PALOS VERDES PENINSULA UNIFIED SCHOOL DISTRICT
FACILITIES CONSTRUCTION PROGRAM

PROJECT MANUAL

Volume 2 of 2

Technical Specifications
for
RS063 – Palos Verdes High School 10 Classroom Building

600 Cloyden Road
Palos Verdes Estates, CA 90274

Bid No. RS063-06.28.12
Project No. RS063

Palos Verdes Peninsula Unified School District
375 Via Almar
Palos Verdes Estates, CA 90274

Construction Manager:
VANIR Construction Management Inc.
38 Crest Road West
Rolling Hills, CA 90274

Architect:
PBWS Architects
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Pasadena, CA 91101

Mandatory Pre-Bid Job Walk:
Tuesday, May 1, 2012 at 10:00 a.m.
Bid Opening:
Thursday, May 31, 2012 at 11:00 a.m

May 2012

04-114031

Construction Specifications for

Palos Verdes High School Classroom Building 3

Palos Verdes Peninsula School District

600 Cloyden Road

Palos Verdes Estates
California
90274

DSA Submittal
July 22, 2011

SCANNED

PBWS

1040 Lincoln Avenue Suite 200, Pasadena, California 91103

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Construction Specifications for

Palos Verdes High School Classroom Building 3

Palos Verdes Peninsula School District

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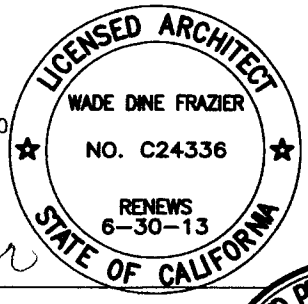

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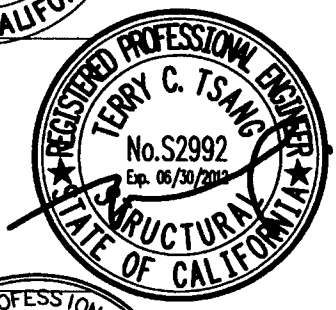

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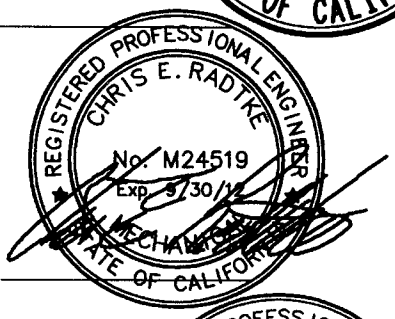

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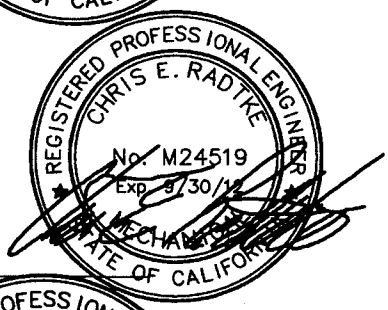

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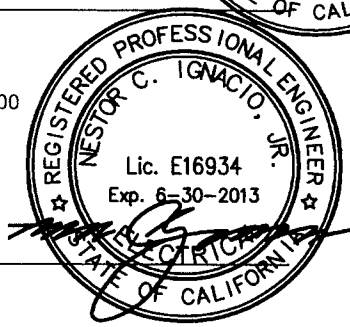

IDENTIFICATION STAMP
DIV. OF ARCHITECT
AP03 114081
AC N.V. PLS SS 17
3/22/2012
SS P. FISCHER.

Construction Specifications for

Palos Verdes High School Classroom Building 3

Palos Verdes Peninsula School District

General Note:

1. Title 24 Parts 1-5 must be kept on site during construction.
2. All addenda must be signed by the Architect and approved by DSA. (Section 4-338, Part 1).
3. All substitutions affecting ACS, FLS, and SS shall be considered as a Change Order or Addenda, and shall be approved by DSA prior to fabrication and installation (Section 4-338, Part 1).
4. Change Orders must be signed by all the following: A/E of record; Owner, Structural Engineer; DSA.
5. Project Inspector must be employed by the Owner and approved by all of the following: A/E of record; Structural Engineer; DSA.

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SECTION 02 41 13

SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes partial and complete demolition of designated site improvements; demolition of foundations and slabs-on-grade; disconnecting and capping and demolition of identified utilities; and demolition of underground piping; removing demolished materials from site; protection of items to remain as indicated on the Drawings, salvage items as indicated to be retained by the District.

B. Related Sections

1. Section 01 11 00: Summary of Work - for work sequence
2. Section 01 31 19: Project Meetings
3. Section 01 50 00: Temporary Facilities
4. Section 01 73 29: Cutting and Patching
5. Section 01 77 19: Closeout Requirements
6. Section 31 10 00: Site Clearing

1.2 PROJECT SITE CONDITIONS

A. The Drawings may not indicate in detail all demolition work to be carried out. Contractor shall carefully examine all existing work to determine the full extent of demolition for the completed Work to conform to the Drawings and Specifications.

B. Existing work damaged during and by demolition operations shall be repaired or replaced to the satisfaction of the Architect and at no cost to the District.

C. Contractor shall be solely responsible for damage resulting from inadequate or improper construction, shoring, bracing or support procedures.

D. Notify Architect immediately for further instructions, should materials, systems or conditions differ from those indicated on the Drawings.

1.3 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of capped utilities, subsurface and obstructions.

1.4 QUALIFICATIONS

A. Demolition Firm: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

1.5 REGULATORY REQUIREMENTS

A. Perform all work in strict accordance with applicable government Codes and Regulations, especially meeting all safety standards and requirements of CAL/OSHA and City of Pasadena. Provide additional measures, added materials and devices as may be needed as directed by the State at no added cost to the State.

B. Comply strictly to Rule 1404, South Coast Air Quality Management District.

C. Obtain required permits from authorities.

D. Notify affected utility companies before starting work and comply with their requirements.

E. Do not close or obstruct roadways, sidewalks or hydrants without permits.

F. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

G. Test soils around buried tanks for contamination.

1.6 SEQUENCING

A. Sequence work under the provisions of Section 01 11 00.

1.7 SCHEDULING

A. Schedule work under the provisions of the General Conditions.

B. Schedule Work to precede site excavation work.

C. Describe demolition removal procedures and schedule.

D. Perform work between the hours approved by the Architect/Engineer.

1.8 COORDINATION

A. Prior to commencement of Work of this Section, contact the District to confirm that all items identified as District property have been removed or clearly marked.

B. Coordinate demolition with other trades and/or contractors to ensure correct sequence, limits, and methods of proposed demolition. Schedule work to create the least possible inconvenience to the operation of the facility.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Use fill materials free of foreign materials, vegetable growths, sod, expansive soils and all debris.

B. Type S1 fill. Fill Materials shall conform to requirements of Section 31 23 00.

C. Fill materials shall be placed in accordance with Section 31 23 23.

2.2 HANDLING OF MATERIALS

A. All existing items to be reused or retained by the District shall be removed by use of proper tools to insure against damage.

B. Salvaged items to be retained by the District and not incorporated into the Work shall be delivered to the District, cleaned, packaged and labeled, unless otherwise instructed by the District.

C. Items to be reused on site shall be stored on site and protected from damage, soiling, and theft/vandalism.

PART 3 EXECUTION

3.1 PREPARATION

A. Erect and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, District, Contractor's employees and existing improvements to remain prior to any demolition.

B. Protect existing landscaping materials, trees, structures and other materials not indicated to be demolished.

1. All trees indicated to remain shall be properly tagged.

2. Trees shall not be allowed to deteriorate and shall be maintained in a healthy and vigorous condition during the construction and maintenance period.

C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.

D. Mark location of utilities.

E. Provide all safeguards, including warning lights, signs, chain link fence barricades, etc., for the protection of staff and the public during demolition.

3.2 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent structures and occupancies.

B. Cease operations immediately when adjacent structures appear to be in danger. Notify Architect. Do not resume operations until directed.

C. Conduct operations with minimum interference to public or private accesses. Maintain protected egress and access from adjacent structures at all times.

D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

E. Sprinkle work with water to minimize dust. Provide hoses and water connections required for this purpose. Do not allow ponding of water.

3.3 DEMOLITION

A. Do not throw materials from heights. Use ramps or chutes.

B. Disconnect, remove and cap, and identify designated utilities within demolition areas.

C. Remove foundation walls and footings to minimum of three (3) feet below finished grade, beyond area of new construction and within area of new construction.

D. Remove concrete slabs on grade.

E. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect in accordance with requirements of Section 01 66 00.

F. Backfill areas excavated including open pits and holes resulting from demolition, in accordance with Article 2 of this section.

G. Rough grade and compact areas affected by demolition to maintain site grades and contours.

H. Continuously clean-up and remove demolished materials from site. Do not allow materials to be scavenged, or accumulate on site.

I. Remove and dispose of all materials in a manner allowed by Local, State and Federal law and regulation.

J. Do not burn or bury materials on site. Leave site in clean condition.

K. Remove temporary work.

L. If demolition exceeds the limits shown on the drawings, contractor shall patch and/or repair the demolished work at no additional cost to the District.

3.4 CUTTING EXISTING CONCRETE

A. Cutting of existing concrete shall be done by experienced workers familiar with the requirements and space necessary for placing concrete. All cutting shall be done under the direct supervision of the Contractor. In general, cutting of concrete shall be done with concrete cutting wheels and hand chisels. Care shall be taken so as to not shatter concrete that is to remain.

B. Extent of cutting of concrete shall be determined by figured dimensions on drawings. Any concrete removed in excess of amount indicated, specified, or required shall be replaced with concrete as directed by the Architect at the expense of the Contractor.

C. Prior to cutting or coring of concrete, locate utilities that are concealed by the concrete and take necessary precautions to protect them.

3.5 REMOVAL OF EXISTING PLUMBING AND ELECTRICAL EQUIPMENT

A. Contractor shall remove from designated building(s) and designated portion(s) of the site all existing plumbing and electrical equipment, fixtures and services not reserved for reuse and not necessary for completion of Work.

3.6 CLEANING

A. Clean all existing materials to remain, using skilled and experienced workers under continual supervision, using appropriate materials and tools.

B. Protect all adjacent materials and equipment during cleaning function.

C. Refer to other specifications sections for further cleaning requirements.

3.7 PATCHING

A. Patch materials that are to remain when damaged by work. Finish material and appearance of patch or repair work shall match existing contiguous materials and finishes in all respects, per the Architect.

3.8 CLEAN-UP/DISPOSAL

A. The parking of trucks at the building shall be coordinated with the District.

B. Debris shall be conveyed by trucks designed to transport rubbish and debris. Trucks shall be covered during transport.

C. Contractor to pay all dump/disposal fees.

D. Contractor to dispose of all debris in a manner allowed by Local, State and Federal regulations/requirements.

E. Debris shall be dampened by fog water spray when it is transported from its location to truck. Amount of water shall be controlled to insure against water ponding at the area of debris pick-up.

F. The debris pick-up area shall be kept broom-clean and shall be flushed with clean water when necessary to remove soil.

G. Debris, waste, and removed materials, other than items to be salvaged, are Contractor's property for legal disposal off the site. Continuously clean-up and remove these items and do not allow to accumulate in the building(s) and on the site.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

E. Related Sections
1. Section 03 20 00 Concrete Reinforcement.
2. Section 03 30 00 Cast-In Place Concrete.

1.02 REFERENCES

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 347R -05 Guide for Shoring/Reshoring of Concrete Multistory Buildings.

C. PS-1 - Construction and Industrial Plywood.

D. California Code of Regulations, Title 8 Subchapter 4. Construction Safety Orders, Article 29, Erection and Construction, Section 1717.

E. Americans with Disabilities Act of 1990 (ADA)
1. ADA Standards – ADA Title III Regulations and DOJ Standards for Accessible Design.
2. ADA/UFAS – ADA Title II Regulations and Uniform Federal Accessibility Standards.

F. CACRM - California Access Compliance Reference Manual, updated July 1, 2008, based on the 2010 California Building Code.

G. Chapter 19A, 2010 California Building Code.

H. APA - American Plywood Association Design and Construction Guide.

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

J. Local AQMD - Air Quality Management District.

1.03 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to Section 1906A, California Building Code. Resultant concrete to conform to required shape, line and dimension. Design of formwork is Contractor's responsibility.

B. The formwork shall be designed for the loads and lateral pressures outlined in Chapter 2 of ACI 347R, and lateral forces as specified by the CBC.

C. Forms shall be designed by a professional Civil (Structural) engineer registered in the State of California.

D. Foundation concrete may be placed directly into neat excavations, provided foundation trench walls are stable as determined by Architect, subject to approval of DSA, OSHPD and Architect. In such case, minimum formwork indicated on drawings is mandatory to insure clean excavations immediately prior to and during placing of concrete.

1.04 COORDINATION

A. Coordinate this Section with other Sections of work that require attachment of components to formwork.

B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

1.05 SUBMITTALS

A. Structural engineering calculations and drawings signed by California Licensed Structural Engineer. Shoring design shall account for all imposed shoring loads on the structure and measures shall be taken to not overload any element of the structure. ****DSA may require Structural Engineer NOT Civil Engineer for elevated floor conc. slabs and other complex elevated conc. construction******

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Plywood: APA - MDO (Medium Density Overlay) Plyform, Group 1, Exterior, PS-1, for exposed surfaces. APA - BB (No-overlay) Plyform, Class 1, Exterior, PS-1 for unexposed surfaces APA - HDO (High Density Overlay) Plyform, Class 1, Exterior, PS-1 for smoothest glossy concrete finish.

B. Tubular Column Forms: fiber-reinforced, spirally wound, paperboard forms with integral form-release liner, seamless, Sonotube by Sonoco, Hartsville, SC, or equal, approved in accordance with Division 01, General Requirements, for substitutions.

C. Lumber: Douglas Fir species; construction grade with grade stamp clearly visible.

D. Form Ties: Removable metal of adjustable length, cone ends.

2.02 FORMWORK ACCESSORIES

A. Form Release Agent: Colorless non-staining liquid chemical agent, free of wax or oils which will not absorb water. Material shall comply with AQMD, Local Regulations.

B. Corners: Chamfered type; maximum possible lengths.

C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.02 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements in accordance with requirements of Section 1906A, California Building Code 2010.
   1. Calculations Required: Provide shoring required to protect all earth banks which cannot be sloped back, due to adjacent structures, walks, streets or property lines. Provide engineering calculations and drawings necessary to perform Work. Calculations to be sealed and signed by licensed California Structural Engineer.
   2. Where public areas such as sidewalks and streets are to be shored, drawings and calculations are to be submitted by Contractor to the city or governing agency for approval prior to beginning of any work.
   3. Contractor and/or his engineer assume and accept all responsibility for construction and safety of shoring.
   4. Upon completion of Work, shoring materials are to be removed from site at expense of Contractor. Certain steel and/or concrete materials may be left in place with written approval of Architect.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shoring. Conform to Title 8, Subchapter 4, Construction Safety Orders, CCR.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on Drawings.

F. Provide chamfer strips on external corners.

G. Surface irregularities, ACI 347R Class A, gradual or abrupt irregularities of 1/8 inch for exposed to view concrete. Class B, 1/4 inch for plaster cement finish.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work. No openings or embedded items permitted in structural slabs within 18 inches of columns. Conform to Section 1906A, California Building Code.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors and other inserts, whether indicated on the structural drawings or not.

D. Install accessories in accordance with manufacturer's instructions, straight, level and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117.

3.08 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design and that supports, fastenings, wedges, ties and items are secure.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads. Conform to Section 1906A.2, California Building Code.
   1. Minimum stripping time for walls and columns: 5 days.
   2. Minimum stripping time for beams and structural slabs: 21 days.

B. Loosen forms carefully. Do not wedge pry bars, hammers or tools against finish concrete surfaces scheduled for exposure to view. Do not break-off corners.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms. Re-shoring permitted only after 10 days and prior to stripping.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fabricating and setting reinforcing steel and accessories for cast-in-place concrete.

B. Related Sections:
1. Section 03 10 00, Concrete Formwork
2. Section 03 30 00, Cast-in-Place Concrete

1.02 REFERENCES

A. ACI 315 - Details and Detailing of Concrete Reinforcing.

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

C. ASTM A615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. ASTM A706 - Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

E. AWS D1.4 - Structural Welding Code for Reinforcing Steel.

F. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.

G. Chapter 19A, 2010 California Building Code.

1.03 SUBMITTALS

A. Shop Drawings, indicating bar sizes, spacings, locations and quantities of reinforcing steel bending and cutting schedules and supporting and spacing devices.

1.04 QUALITY ASSURANCE

A. Provide Testing Laboratory with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

B. Comply with the requirements of Division 01 General Requirements.

1.05 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 - PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, deformed billet steel bars, in grades as follows, and conforming to CBC-19, Section 1903A.
   1. For No.4 and larger bars, use 60 ksi yield grade.
   2. For ties and stirrups, and No. 3 and smaller bars, use 40 ksi yield grade.
   3. For welded bars, use ASTM A706 60 ksi yield grade.

B. Epoxy-Coated Reinforcing Bars: ASTM A615/A 615M, Grade 60, deformed bars, ASTM A775/A 775M, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

C. Welded Wire Reinforcement: Plain type, ASTM A185; in flat sheets; uncoated finish, 6 x 6 - W4.0 x W4.0 unless otherwise noted on drawings

D. Welding Electrodes: Low Hydrogen grade E70XX for Grade 40, E90XX for Grade 60.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gauge black annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

D. Concrete Blocks: Approximately 3 inches dimension each side.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice and ACI 315 and ACI 318. Wherever possible, make bends to shape in fabricator's shop.
   1. Bars reduced in section will not be accepted.
   2. Bars with kinks are unacceptable.
   3. Bars shall not be heated to facilitate bending or for any other purpose.
   4. Bars with bends not indicated on drawings will not be accepted. Perform no forming in a manner which will damage bars.
   5. Rebending of bars prohibited.

B. Weld reinforcement in accordance with AWS D1.4.

C. Locate reinforcing splices not indicated on Drawings at point of minimum stress.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Install concrete blocks to support reinforcement over grade. Rocks not permitted.

B. Do not displace or damage vapor barrier where vapor barrier is specified or indicated on drawings.

C. Accommodate placement of formed openings.

D. Prior to placing, thoroughly clean reinforcement of all rust, dirt, dust, oil or any other material deleterious to bonding of concrete.

E. Accurately place and securely tie reinforcement at all intersections and splices with black annealed wire and securely hold in position during placing of concrete by means of precast concrete block supports. Point wire tie ends away from the form. Unless otherwise indicated, the number, type, and spacing of supports shall conform to the ACI 315.

F. During placing of structural concrete slabs, provide a full-time reinforcing steel placer to repair and replace reinforcing to its proper location. Provide additional chairs of the proper size available to place under bars displaced during the concrete pouring operation.

G. Dowels for Walls: Securely tie in place prior to placing of concrete. Do not place dowels in concrete after pour.

H. Conform to Section 1907A, California Building Code for concrete cover over reinforcement.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete.

B. Concrete curbs for walls, floors and slabs on grade, footings.

C. Control, expansion and contraction joint devices associated with concrete work including joint sealants.

D. Concrete fill for steel pan stairs and landings, installation of safety nosings.

E. Concrete for curbs, gutter, sidewalks, stairs and ramps and other site-related concrete is specified in Section 32 13 13.

F. Related Sections:
1. Section 03 10 00, Concrete Formwork
2. Section 03 20 00, Concrete Reinforcement
3. Section 03 39 00, Concrete Curing

1.02 REFERENCES

A. CBC - 2010 California Building Code
1. CBC-19 – CBC Chapter 19A, Concrete (for DSA)

B. Americans with Disabilities Act of 1990 (ADA)
1. ADA Standards – ADA Title III Regulations and DOJ Standards for Accessible Design.

C. CACRM - California Access Compliance Reference Manual, updated July 1, 2008, based on the 2010 California Building Code.

D. ACI 301 - Structural Concrete for Buildings.

E. ACI 318-08 - Building Code Requirements for Structural Concrete and Commentary - DSA.

F. ASTM C33 - Concrete Aggregate.

G. ASTM C150 - Portland Cement.

H. ASTM C171 - Sheet Materials for Curing Concrete.

I. ASTM C 311 – Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

J. ASTM C618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete.

K. IR 19-3 Interpretation of Regulations, Fly Ash and Natural Pozzolans Used in Concrete.

L. ASTM C856 - Petrographic Examination of Hardened Concrete.

M. ASTM C1107 - Packaged Dry, Hydraulic - Cement Grout (Nonshrink).

N. ASTM C567 – Unit Weight of Structural Lightweight Concrete.

O. ASTM C1116 – Specification for Fiber-Reinforced Concrete.

P. ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Bituminous Type).

Q. ASTM E96 - Water Vapor Transmission of Materials.

R. ASTM F1869 - Test Method for Measuring Moisture Vapor Emission.

S. ASTM F2170 – Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes.

T. CSS - Caltrans Standard Specifications, Latest Edition.

1.03 SUBMITTALS

A. Placement Schedule: Submit for approval details and/or sketches showing location of each proposed construction joint. Do not deviate from locations of horizontal joints indicated on drawings.

B. Product data for each type of manufactured material and product included.

C. Design mix for each concrete mix.

D. Steel reinforcement shop drawings, including material, grade bar schedules, spacing, bent bar diagrams, arrangement and supports.

E. Submit contraction (crack control) joint, expansion, isolation and construction joint layout to Architect for approval.

1.04 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of embedded utilities and components that are concealed from view.

B. Maintain an accurate record showing date and time of concrete placement in each portion of structure. Correlate placing record for test cylinders made by testing laboratory. Maintain a separate record giving date of removal of forms, shoring, including first and second halves and reshoring, if used. Keep records available for inspection at site. Upon completion, deliver two copies of each to Architect in approved form.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with Section 1905A, California Building Code, and ACI 318.

B. Maintain one copy of all records.

C. Acquire cement and aggregate from same source for all work.

D. Conform to Section 1905A.13, California Building Code, when concreting during hot weather. No concrete placement permitted above 90 degrees Fahrenheit.

E. Conform to Section 1905A.12, California Building Code, when concreting during cold weather. No concrete placement permitted below 50 degrees Fahrenheit.

F. Concrete Stain Installer Qualifications: Minimum 5 years experience with installing stain and color products specified, certified and approved by the manufacturer.

1.06 COORDINATION

A. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150, Type II. Portland Cement Type, conforming to Section 1903A, California Building Code.

B. Aggregates:
   1. Aggregate for Stone Concrete: ASTM C33.
   2. Aggregate for Lightweight Concrete: ASTM C330.

C. Conform to requirements specified herein for maximum size of aggregate permitted in individual applications.

D. Water: Clear, from potable source, and not detrimental to concrete.

E. Fly ash: may be used at 15 % maximum replacement of the Portland cement, at a 1:1 replacement ratio by weight. The fly ash shall meet the requirements of ASTM C 618 with the exception that the Loss on Ignition (LOI is a measure of the loss in mass of a fly ash sample when placed in a 750 degrees C oven) shall not exceed 1.0%. Only Class F material is permitted, CBC Section 1903A.4.

F. When fly ash is used the quantity of water shall be determined on a water-cement plus fly ash basis.

G. Comply with requirements of DSA IR 19-3.

2.02 ACCESSORIES

A. Bonding Agent: ASTM C631, Polyvinyl Acetate Latex emulsion; HIBOND, manufactured by Lambert Corporation, Orlando FL, LOCK BOND NO. 906, manufactured by Macklanburg-Duncan Co., City of Industry, CA, or equal as approved in accordance with Division 01, General Requirements for Substitutions.

B. Curing Film: ASTM C171; 10 mil thick, clear polyethylene film, single sheet, manufactured from virgin resin with no scrap or additives, free of visible defects, uniform in appearance, conforming to the following:
1. Moisture Loss: 0.055 g per sq. cm.
2. Tensile Strength: 1700 psi longitudinal, 1200 psi transverse.
3. Elongation: 225 percent longitudinal, 350 percent transverse.

C. Non-Shrink Grout: ASTM C1107, Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 5,000 psi in 24 hours and 8,000 psi in 7 days; of consistency suitable for application and a 30 minute working time.

D. Vapor Barrier: ASTM D4397, 15 mils thick polyethylene with maximum Water Vapor Transmission Rate (WVTR) of 0.0142 grains/sq.ft x hr. ASTM E 96 and Permeance of 0.014 per ASTM E154. Performance exceeding Class B, ASTM E1745.
1. Stegowrap, Stego Industries LLC, San Juan Capistrano, CA.
2. Moiststop Ultra 15, Fortifiber Building Systems, Los Angeles, CA.
3. Perminator 15, W. R. Meadows.
4. Or equal.

E. Safety Nosings: Style B-41A, 4 inches wide manufactured by Barrycraft Pattern and Foundry, Inc., Birmingham, AL, or equal as approved in accordance with Division 01, General Requirements for Substitutions. Provide contrasting colors at top and bottom treads. Interior treads, black.
1. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions

F. Reinforcement: In accordance with Section 03 20 00.

G. Concrete Formwork: In accordance with Section 03 10 00.

H. Vapor Emission Treatment Systems: In accordance with Section 07 25 00.

I. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8" and that can be feathered at edges to match adjacent floor elevations. Products by Tile-Tex by Flintkote Co., Webtex #60 or Fixallatex by Dowman Products Co or equal.

J. Combination Hardener, and Sealer: ASHFORD FORMULA by Curecrete Chemical Co., Springville, UT; SHUR-SEAL by Paul M. Wolff Co., Orange, CA; Chemprobe CT

Densifier 201 by Tnemec Company; LIQUI-HARD by W.R, Meadows, or equal. ****Hardeners cannot be applied over curing compounds without removing compound****

K. Rigid Insulation Under Floor Slab and Perimeter Foundation Insulation: Styrofoam by the Dow Chemical Company, ASTM C578 Type VI.

L. Interior/Exterior Compound: ARDEX TILT WALL PATCH or equal as approved in accordance with Division 01 for substitutions., cementitious surface treatment for filling and smoothing interior and exterior vertical concrete surfaces prior to sealing or painting.

M. Waterstops: Flexible PVC type, factory-installed metal eyelets for embedding in concrete to prevent passage of fluids through joints, factory-fabricated corners, intersections and directional changes. Flat, dumbbell without [with] center bulb for moving joints, 6 inches, 1/4 inch thick. By BoMetals Inc. Powder Springs, GA or equal.

2.03 JOINT DEVICES AND FILLER MATERIALS

A. Expansion Joint Filler - ASTM D1751: Close cell bituminous saturated fiberboard, 1/2 inch thick; Fiber Expansion Joint manufactured by American Highway Technology, Kankakee, IL, W. R. Meadows, or approved equal.

B. Expansion Joint Top: Integral extruded polystyrene plastic; 1/2 inch thick, with removable top strip exposing sealant trough, JOINT CAPS manufactured by The Burke Company, or equal as approved in accordance with Division 01, General Requirements for substitutions.

C. Joint Backing: ASTM C1330, Cylindrical, Type C, closed cell, polyethylene backer rod; oversized 30 to 50 percent larger than joint width. Green Rod by Nomaco Inc. or equal.

D. Sealant: Polyurethane multi-component type, non-sagging or self leveling at flatwork, as specified in Section 07 92 00.

E. Primer: As recommended by sealant manufacturer.

F. Saw-Cut Joint Filler: Two-component epoxy resin, gray color, non-hardening, self-leveling, SIKADUR 51 (SL), by Sikacorp., Lyndhurst, NJ, or equal as approved in accordance with Division 01 General Requirements for Substitutions.

2.04 CONCRETE MIX

A. Mix and deliver concrete in accordance with Section 1905A, California Building Code 2010. Deliver concrete in transit mixers only. Discharge loads in less than 1-1/2 hours after water is first added.
   1. Design Mix: Section 1905A.3, ingredients and proportions for design mix selected by a DSA approved Testing Laboratory certified by a registered civil engineer licensed in California.
   2. Do not exceed 0.50 water-cement ratio by weight for floor slabs and for other concrete.

B. Select proportions by volume for concrete in accordance with the approved design mix.
   1. Required Strength: As noted on the structural drawings and below.
   2. Grout Mix: 1:3:2 Portland Cement, to sand, to pea gravel, minimum 3000 psi at 28 days.

C. Provide concrete to the following criteria:

Element	Min 28 Day Strength PSI	Max Slump	Max Size Aggregate Type
Grade Beams and Foundations	3,000	4 inch	1-1/2 inch Normal wt Concrete
Floor Slabs on Grade	3,000	4 inch	1 inch Normal wt. Concrete
Other	3,000	4 inch	3/4 inch Normal wt. Concrete

D. Miscellaneous Sitework Concrete: Specified in Section 32 13 13, Sitework Concrete.

E. Do not use admixtures containing chlorides.

2.05 GRANULAR FILL

A. Crushed Aggregate Base (capillary break): 3/4 inch maximum grading, crushed rock and rock dust conforming to requirements of Section 200-2.2, SSPWC, with 3/8 inch sieve requirement waived, or Class 2 Aggregate Base as defined in Section 26, CSS.

B. Granular fill for under slab: compactable manufactured sand from rock-crushing operations with particle sizes ranging from No. 4 through the No. 200 sieve, reference ACI 302.1R.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely and will not cause hardship in placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with sandblasting to remove laitance and expose clean aggregate.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. When approved by the Architect, clean previously placed concrete with steel brush and apply bonding agent in accordance with manufacturer's instructions.

D. Under Interior Slabs on Grade: Sub-base refer to soil report.

E. Install steel reinforcing per Section 03 20 00. Place concrete slab as scheduled.

3.03 PLACING CONCRETE

A. Place concrete in accordance with Section 1905A, California Building Code. Remove loose dirt from excavations.

B. Notify Architect minimum 24 hours prior to commencement of operations. All excavations, forms and reinforcing shall be inspected and approved by the Architect prior to placement.

C. Ensure reinforcement, inserts, embedded parts, formed joint fillers, joint devices and accessories are not disturbed during concrete placement.

D. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

E. When detailed on the drawings, separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.

F. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface using two-component polyurethane sealant as specified in Section 07 92 00.

G. Install joint devices in accordance with manufacturer's instructions as detailed.

H. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

I. Maintain joint device in correct position to allow joint cover flush with finish.

J. Install joint covers in longest practical length.

K. Place concrete continuously between predetermined expansion, control and construction joints.
   1. Install expansion joints at vertical concrete walls at 24 feet on center unless noted otherwise on drawings.
   2. Retaining Walls at Buildings: install waterstops in expansion joints to form a continuous waterproofed wall surface condition. Support and protect exposed waterstops during progress of the Work.

L. Do not interrupt successive placement; do not permit cold joints to occur.

M. Avoid segregation of materials. Perform vibrating so as to produce a dense, smooth application free of rock pockets and voids. Do not use vibrators to move concrete horizontally.

N. Provide special mix prepared by the Testing Laboratory and approved by the Architect utilizing smaller aggregates in areas of reinforcing congestion to prevent the formation of rock pockets.

O. The unconfined vertical drop of concrete shall not be greater than 5 feet. Do not allow concrete to fall free from any height that will cause materials to segregate. Maximum height of free fall permitted in any case: 5 feet. Utilize trunks or additional chutes where doubt occurs. Conform to requirements of CBC Section 1905A.10.

P. Construction Joints: Wash surface of each joint shortly after pouring to expose clean, sound aggregate. Sandblast surface to remove laitance remaining or loose aggregate as approved by the Architect. Conform to Section 1906A, CBC. Apply bonding agent in accordance with manufacturer's instructions. Locate joints within the middle third of spans of slabs, beams and girders. Coincide construction joints with contraction, isolation, or expansion joints when possible. Locate where they lease affect the structural integrity of the element under consideration and are compatible with building's appearance.

Q. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/8 inch in 10 ft. Slope floors for drains.

R. Contraction Joints: Grooved joints; form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch, place joints 12 feet on centers each way. Remove groover tool marks on concrete surfaces.

S. Isolation Joints: preformed joint filler depth of slab, fill top 1/2 inch with elastomeric sealant per Section 07 92 00. Locations: at columns, footings, and as noted on drawings.

T. Saw cut slabs only when indicated on drawings or as approved by Architect at 15 ft. on center, maximum 225 square feet, within 24 hours after placing concrete. Saw cut joints with power saws equipped with shatterproof abrasive re diamond-rimmed blades, cut 1/8" wide joint into concrete when cutting action will not tear, abrade, or otherwise damage surface. Cut no deeper than 1/4 depth of slab thickness. Fill cuts with non-hardening epoxy. Completely fill cut to surface of slab.

U. Steel Pan Stairs: Install safety nosings at each tread, all steel pan stairs.

3.04 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels, maximum dimension not to exceed 20 ft.

E. Screed toppings level, maintaining surface flatness of maximum 1/8 inch in 10 ft.

3.05 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed with smooth rubbed finish.

B. Install Vapor Emission Treatment Systems in accordance with Section 07 25 00 if tests reveal presence of more than acceptable moisture level in accordance with Test Method ASTM F1869 or ASTM F2170.

3.06 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury.

B. Maintain concrete with minimal moisture loss at above 50 degrees F temperature for period necessary for hydration of cement and hardening of concrete. Dusting with dry cement to absorb excess water is prohibited.

C. Cure floor surfaces only as specified herein and in accordance with Section 1905A.11, California Building Code. Membrane curing compound method not permitted for interior cast-in-place concrete slabs.

D. Moisture Retaining Coverings: spread polyethylene film over floor slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for minimum of seven (7) day unless noted otherwise on the drawings. Do not permit traffic over floor slabs during the curing period.

E. Vertical Surfaces: Spray water over surfaces and maintain wet for 10 days.

F. Quality Control: Proper curing of concrete surfaces shall be the responsibility of the Contractor under this section.

3.07 FIELD QUALITY CONTROL

A. Provide free access to Work and cooperate with Testing Laboratory.

B. Measure floor and slab flatness and levelness according to ASTM E1155 (ASTM E 1155M) within 72 hours of finishing.

C. Proposed mix design of each class of concrete shall conform to Section 1905A, California Building Code and shall be approved by the Architect prior to commencement of work.

3.08 PATCHING

A. Architect will inspect concrete surfaces and determine imperfections, if any.

B. Patch imperfections as approved and in accordance with ACI 301.
   1. Clean all exposed concrete surfaces and all adjoining work stained by leakage of concrete. Remove all fins, butts and projections by grinding. Patch voids, rock pockets, holes, cracks and similar imperfections by chipping loose concrete and exposing clean, sound aggregate.
   2. Fill cone form tie recesses with portland cement mortar flush to finish surface.

3.09 DEFECTIVE CONCRETE

A. Defective Concrete: Remove concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect.

C. Do not patch, fill, touch-up, repair or replace exposed concrete except upon express approval of Architect for each individual area.

3.10 MOISTURE TEST FOR CONCRETE FLOORS

D. It shall be the Contractor's responsibility to provide a concrete floor slab meeting the maximum moisture vapor emissions here-in specified and the Contractor shall exercise care in all aspects of mixing, placing, and curing the concrete floor slabs so that a minimum of mitigation treatment will be required.

E. Prior to ordering adhesives applied floor covering materials or coatings, conduct Calcium-Chloride Test Method in accordance with ASTM F1869 or ASTM F2170 to verify that concrete floor slabs are dry with maximum moisture vapor emissions of 3 pounds per 1,000 square feet in 24 hours and that slabs exhibit negative alkalinity, carbonation or dusting. Apply the moisture test in four (4) different areas of each floor location, with at least one test for each 1,000 square feet of floor area.

F. Prior to ordering adhesive-applied floor covering materials or coatings, conduct Relative Humidity Test Method in accordance with ASTM F1869 or ASTM F 2170 to verify relative humidity and surface pH of concrete floor slabs, the method
   1. Requires drilling holes at diameter not to exceed outside diameter of probe by more than 0.04 inch to depth equal to 40 percent of slab's thickness (elevated structural slab shall be tested at depth equal to 20 percent of slab thickness).
   2. Place probe to full depth of test hole, place cap over probe.
   3. Permit test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
   4. Remove cap and press button on the probe to obtain reading.
   5. Relative humidity readings for substrates receiving non-permeable flooring are 75% or lower.
   6. Testing shall require 3 tests in first 1,000 square feet, with one additional test per each additional 1,000 square feet of concrete slab surface.

G. Alkalinity Testing: Concrete floors shall be tested for alkalinity prior to the installation of adhesive-applied floor covering materials or coating. Levels of pH shall not exceed the written recommendations of the flooring covering manufacturer or the adhesive manufacturer, or both.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.
   1. Galvanized at exterior exposed structural steel.
   2. Shop-primed at concealed and at painted steel.

B. Architecturally Exposed Structural Steel (AESS).

C. Related Sections
   1. Section 09 91 00, Painting

1.02 REFERENCES

A. AISC - American Institute of Steel Construction
   1. AISC Manual – AISC Manual of Steel Construction, 13th Edition
   2. AISC S323 - Quality Criteria and Inspection Standards

B. ASTM - American Society for Testing and Materials
   1. ASTM A36 - Structural Steel
   2. ASTM A53 - Hot Dipped, Zinc-Coated Welded and Seamless Steel Pipe
   3. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality
   4. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
   5. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware
   6. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners
   7. ASTM A325 - High Strength Bolts for Structural Steel Joints
   8. ASTM A500 - Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
   9. ASTM A572 - Grade 50 - Structural Steel
   10. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
   11. ASTM C1107 - Packaged Dry, Hydraulic Cement Grout (Non-Shrink)

C. AWS - American Welding Society
   1. AWS A2.4 - Standard Symbols for Welding, Brazing and Non Destructive Examination
   2. AWS A5.1 – Carbon Steel Electrodes for Shielded Metal Arc-Welding
   3. AWS A5.5 – Low Alloy Steel Electrodes for Shielded Metal Arc-Welding
   4. AWS B2.1 – Welding Procedure and Performance Qualification
   5. AWS D1.1 – Structural Welding Code, Steel
   6. AWS D1.2 – Structural Welding Code, Aluminum
   7. AWS D1.3 – Structural Welding Code, Sheet Steel
   8. AWS D1.6 - Structural Welding Code, Stainless Steel
   9. AWS D1.8 – Structural Welding Code, Seismic Supplement

D. SSPC - Steel Structures Painting Council.

E. CBC - California Building Code 2010, Chapter 22A.

~~F. CBC 2010, Chapter 22A, Division III - Design Standard for Structural Steel Buildings Allowable Stress Design and Plastic Design and Division V Seismic Provisions for Structural Steel Buildings for Use with Allowable Stress Design.~~

G. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold-Finish, Standard Quality.

H. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.

I. AISC – American Institute of Steel Construction, Code of Standard Practice for Steel Buildings and Bridges, for Architecturally Exposed Structural Steel (AESS).

J. ASTM A992 - Steel for Structural Shapes For Use in Building Framing

K. ASTM F1554 - Standard Specification for Anchor Bolts.

L. ASTM F1554 - Standard Specifications for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.03 SUBMITTALS

A. Shop Drawings:
   1. Indicate profiles, sizes, spacing and locations of structural members, connections, openings, attachments and fasteners.
   2. Indicate cambers.
   3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

B. Shop Drawings detailing fabrication of AESS components.
   1. Provide erection drawings clearly indicating which members are considered as AESS members.
   2. Include details that clearly identify all of the requirements listed in Part 3, sub-paragraph entitled "Architecturally Exposed Structural Steel". Provide connections for exposed AESS consistent with concepts shown on the structural drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined herein.
   4. Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections. Indicate which direction bolt heads should be oriented.
   5. Clearly indicate which surfaces or edges are exposed and what class of surface preparation is being used.
   6. Indicate special tolerances and erection requirements as noted on the drawings or defined herein.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Mill Test Reports: showing structural strength, destructive and non-destructive test analysis and identification.

E. All certified welders employed on the work have been AWS qualified within the previous 12 months, in accordance with AWS-WHB-1.

F. Fabricator's and erector's qualifications.

G. Submit written welding procedures to Owner's testing agency for all welding on project. Procedures shall be in accordance with AWS pre-qualified welds. For welds not pre-qualified by AWS, provide project-specific procedures qualified by testing in accordance with AWS D1.1 to match actual materials, conditions, and orientations.

1.04 QUALITY ASSURANCE

A. Qualifications
1. Fabricator: Company specializing in performing structural steel work minimum five years experience. Qualified fabricator who participates in the AISC Quality Certification Program and its designation as AISC-Certified Plant, Category Sbd Conventional steel building structures or Category Cbd for complex steel building structures.
2. Erector: Company specializing in performing structural steel work with minimum five years experience.
3. Erector: AISC Certified Erectors for Category for steel and erection required.
4. AWS Certified welders.

B. Fabricate structural steel members and perform work in accordance with AISC-M015L.

C. Perform welding in accordance with AWS D1.1 and AWS D1.8 and California Building Code Section 2204A.

D. Galvanized Structural Steel Coating applicator: Company specializing in hot-dip galvanizing after fabrication and following the procedures in the *Quality Assurance Manual* of the American Galvanizers Association.

E. Erect mock-up panel of fabricated structural steel meeting Architectural Exposed Structural Steel tolerances for exposed areas. Approval by Architect is required. Mock-up to remain for comparison but may not be left as part of the work.
1. Mockup will have finished surface including surface preparation and paint system as specified in Section 09 90 00.

1.05 FIELD MEASUREMENTS

A. Verify field measurements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel Members: W-Shape Sections use ASTM A992 or ASTM A572 Grade 50 steel, as indicated on Structural Drawings.

B. Channels, Angles, Plates, Bars, M-Shapes and S-Shapes: ASTM A36.

C. Structural Tubing; ASTM A500, Grade B.

D. Pipe: ASTM A53, Type E or S, Grade B, Schedule 40.

E. Shear Stud Connectors: ASTM A108, Grade 1015 forged steel, headed, uncoated, granular flux filled shear connector or anchor studs by Nelson Stud Welding Division of TRW, Lorain, OH, or equal as approved in accordance with Division 01 for substitutions.

F. Bolts, Nuts and Washers: ASTM A307 galvanized to ASTM A153 for galvanized members, American National Course Threaded Series.

G. Anchor Bolts, Pins and Rods: ASTM F1554.

H. Anchor Bolts: ASTM A354 Grade BC anchor bolts

I. High Strength Bolts: ASTM A325 Slip-Critical, tension set high strength bolts, by Bristol Machine Co., Walnut, CA, or equal as approved in accordance with Division 01 for substitutions.

J. Welding Materials: AWS A5.1, E70XX, type and procedures required by electrode manufacturer for materials being welded.

K. Non-Shrink Grout: ASTM C1107, high performance, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 5,000 psi in 24 hours and 8,000 psi in 7 days; of consistency suitable for application and a 30 minute working time.

L. In-Shop Primer: Series L69 Hi Build Epoxoline II, Red color Low VOC epoxy, air dried, by Tnemec or equal as approved in accordance with Division 01 for Substitutions. Manufacturer's standard primer for unpainted steel permanently enclosed in walls and above finished ceilings.

M. Touch-Up Material for Galvanized Steel: ASTM D520 Type III High Purity Grade zinc dust, ready mixed, zinc-rich galvanizing compound 95% metallic zinc. Galvilite by ZRC Products Company, Marshfield, MA. Zinc Rich Galvanize 1141 for Primer and Brite Galvanize 1142 for exposed, by Aervoe-Pacific Company, Inc. *****65% zinc content only**** or equal as approved in accordance with Division 01 for substitutions.

2.02 SHEAR STUD CONNECTORS

A. Space shear stud connectors as indicated on the drawings.

B. Completely fuse end of stud to plate. Allow no porosity in weld.

C. Allowable decrease in length of stud during welding:
   1. 1/8 inch for 5/8 inch diameter and smaller.
   2. 3/16 inch for more than 5/8 inch diameter.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP-3 Power Tool Cleaning for embedded steel and SSPC-SP 6 Commercial Blast Cleaning for exposed steel and AESS. Apply primer by brush or spray, minimum dry film thickness 3.0 mils.

B. Shop prime structural steel members. DO NOT prime surfaces that will be fireproofed, field welded, in contact with concrete or high strength bolted.
   1. Clean surfaces to be primed, remove mill scale, grease, dirt and foreign matter. Two coats required for parts in contact but inaccessible for painting after erection.
   2. Apply primer by brush or spray, minimum dry film thickness 3.0 mils. Thoroughly work into joints, angles and open spaces. Allow primer to dry and harden prior to handling for delivery to the site.
   3. Clean contact surfaces immediately prior to assembly, leave unpainted.
   4. Coat machined surfaces with approved removable coating to prevent corrosion.
   5. After erection, clean field welds, field bolts and abraded portions and apply one additional brush spot coat using same paint material.
   6. All surfaces scheduled to receive sprayed-applied fireproofing shall be free of lubricants, oils, paint or other matter that will impair adhesion of fireproofing.

C. Galvanize exposed exterior structural steel members per Section 05 05 14 where indicated to minimum Coating Grade 80 (1.9 oz/sq. ft.) in accordance with ASTM A123.

D. All exterior steel exposed to weather conditions shall be shop galvanized or primed painted. Field painted in accordance with Section 09 90 00 Painting, High Performance Coatings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.
   1. Report discrepancies between drawings and field dimensions to Architect before commencing work.

B. Beginning of installation means erector accepts existing conditions and surfaces underlying or adjacent to work of this section.

3.02 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

B. Camber structural steel members where indicated.

C. Identify high-strength structural steel according to ASTM A6 and maintain markings until steel has been erected.

D. Mark and match-mark materials for field assembly.

E. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.

F. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.

G. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

H. Architecturally Exposed Structural Steel
   1. Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the Architect. Detail AESS assemblies to minimize field handling and expedite erection.
   2. Fabricate AESS with exposed surfaces smooth, square and of surface quality consistent with the approved mock up. Use special care in handling and shipping of AESS both before and after shop painting.
   3. In addition to special care used to handle and fabricate AESS, employ the following fabrication techniques.
      a. Fabrication Tolerance: Fabricate steel to one half the normal tolerance as specified in the Code of Standard Practice section 10.
      b. Welds ground smooth: Fabricator shall grind welds of AESS smooth. For groove welds, the weld shall be made flush to the surfaces each side and be within + 1/16", -0" of plate thickness.
      c. Contouring and blending of welds: Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required and grind to provide a smooth transition and match profile on approved mock-up.
      d. Continuous Welds: Where welding is noted on the drawings, provide continuous welds of a uniform size and profile.
      e. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
      f. Coping and Blocking Tolerance: Maintain a uniform gap of 1/8" ± 1/32at all copes and blocks.
      g. Joint Gap Tolerance: Maintain a uniform gap of 1/8" ± 1/32

h. Piece Marks Hidden: Fabricate such that piece marks are fully hidden in the final structure or made with such media to permit full removal after erection.

i. Mill Mark Removal: Fabricator shall deliver steel with no mill marks (stenciled, stamped, raised etc) in exposed locations. Mill marks shall be omitted by cutting of mill material to appropriate lengths where possible. Where not possible, the fabricator may fill and/or grind to a surface finish consistent with the approved mock up.

j. Grinding of sheared edges: Fabricator shall grind all edges of sheared, punched or flame cut steel to match approved mockup.

k. Rolled Members: Member specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem and of outstanding flanges or legs of angles shall be visibly acceptable to the Architect from a distance of 20 [ ] feet under any lighting condition determined by the Architect. Tolerances for the vertical and horizontal walls of rectangular HSS members after rolling shall be the specified dimension +/- 1/2 inch.

l. Seal Welds: Seal weld open ends of round and rectangular hollow structural section with 3/8" closure plates. Provide continuous, sealed welds at angle to gusset plate connections and similar locations where AESS is exposed to weather.

3.03 ERECTION

A. Allow for erection loads and stresses, and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection and installation of permanent bracing. Provide bracing for dead and live loads and wind loads. Keep bracing in place until required to maintain safe conditions.

B. Contractor shall be responsible for correcting detailing and fabrication errors and for correct fitting of all members and components.

C. Field weld components and shear studs indicated on structural drawings.

D. Do not field cut or alter structural members without approval of Architect.

E. When approved, perform cutting, punching, drilling and tapping to accommodate work. Obtain accurate data as indicated on shop and erection drawings.

F. After erection, prime welds, abrasions and surfaces not shop primed except surfaces to be in contact with concrete.

G. Grout under base plates with the specified non-shrink grout.

H. Provide anchor bolts with templates and diagrams. Contractor shall be responsible for proper location and installation of bolts. Correct deficiencies or errors.

I. Architecturally Exposed Structural Steel: use special care in unloading, handling and erecting the steel to avoid marking or distorting the steel members. Minimize damage to any shop paint. When temporary braces or erection clips are used. Avoid unsightly surfaces upon removal. Tack welds: Ground smooth and holes filled with weld metal or body solder and smoothed by grinding or filing. Plan and execute all operations in such a manner that the close fit and neat appearance of the structure will not be impaired.

3.04 ERECTION TOLERANCES

A. Conform to AISC S325.

B. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

C. Members and components, plumbed, leveled and aligned to a tolerance not to exceed one-half the amount permitted for structural steel. Contractor to provide adjustable connections between AESS and the structural steel frame or the masonry or concrete supports, in order to provide the erector with means for adjustment.

3.05 HIGH STRENGTH BOLTS

A. Allowable hole sizes: 1/16 inch larger than bolt size.

B. Use friction type connection with standard hardened steel circular, square or rectangular washer under bolt nut.

C. Thoroughly clean area under bolt head, nut and washer. Remove all paint, lacquer, oil or other coatings except organic zinc-rich paints in accordance with SSPC, SP-2.

D. Tighten bolts by power torque wrench or hand wrench until twist-off.

3.06 PUNCHING AND DRILLING

A. Punch material 1/16 inch larger than nominal diameter of bolt, wherever thickness of metal is equal to or less than the diameter of the bolt plus 1/8 inch.

B. Drill or sub-punch and ream where metal is equal to or more than the diameter of the bolt plus 1/8 inch. Make diameter for sub-punched and sub-drilled holes 1/16 inch larger than nominal diameter of bolt.

C. Precisely locate holes to ensure passage of bolt through assembled materials without drifting. Enlarge holes when necessary to receive bolts by reaming, flame cutting to enlarge holes is not acceptable. Poorly matched holes will be rejected.

D. Punch and ream holes to receive high strength bolts.

3.07 WELDING

A. Conform to AWS D1.1 & D1.8 and CBC Chapter 22A, Section 2204A.

1. Architecturally Exposed Structural Steel: Verify that weld sizes, fabrication sequence, and equipment used for Architecturally Exposed Structural Steel will limit distortions to allowable tolerances. Prevent surface bleeding of backside welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13mm) and larger. Grind flush butt welds. Dress exposed welds.

B. Perform welding by direct electric arc process. Use operators certified within preceeding 12 month period as per AWS "Standard Qualification Procedure."

C. Chip welds to remove slag. Use wire brush to demonstrate uniformity of section, smoothness of welded metal, freedom from undercuts, overlays or feather edges and freedom from porosity and clinkers.

D. Visually inspect edges and ends of fillets and butt joint welds for indication of good fusion and penetration into base metal. Grind smooth all exposed welds.

E. Use of cutting torch will be allowed where metal being cut does not carry stress during the operations, and provided no stresses will be transmitted through a flame-cut surface. Make gas cuts smooth and regular in contour.

F. To determine effective width of members subjected to gas cutting, deduct 1/8 inch from width of gas cut edges. Make radius of gas cut fillets as large as practicable, but in no case less than one inch. Gas cutting to align bolt is not permitted.

G. Remove erection bolts on welded, Architecturally Exposed Structural Steel; fill holes with plug welds; and grind smooth at exposed surfaces.

H. Verify that weld sizes, fabrication sequence, and equipment used for Architecturally Exposed Structural Steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13mm) and larger. Grind flush butt welds. Dress exposed welds.

3.08 CLEANING AND STRAIGHTENING

A. Before fabrication, thoroughly wire-brush material clean of scale and rust. Straighten by methods that will not injure materials.

B. After punching or working, remove twists or bends before parts are assembled. Make finished members free from twists, bends and open joints when erected.

C. Touch-Up Material for Galvanized Steel: Ready mixed, zinc-rich galvanizing compound, ASTM A780 - A2. Repair Using Paints Containing Zinc Dust, minimum thickness 5 mils.

D. Repair of galvanized surfaces: No flux is required. Repair surfaces in conformance with ASTM A 780 - A1 Repair Using Zinc-Based Alloys. Apply Gal-Viz while metal is still hot. Tin surface with Gal-Viz with wire brush. Do not direct flame on alloy. Minimum thickness 5 mils.

3.09 FITTING

A. Closely fit members, finished true to line and in precise position required to allow accurate erection and proper joining in the field.

B. Drilling to enlarge unfair holes will not be allowed. Light drifting to draw parts together will be permitted. Do not heat rolled sections, except for minor details.

3.10 QUALITY CONTROL

C. Required testing shall be performed under provisions of Division 01 and California Building Code Section 2212A and Sections 1704A.3, 1704A.3.1.

D. All complete penetration welds shall be subject to Ultrasonic Testing, as per AWS D1.1. All defective welds shall be repaired and retested with ultrasonic equipment at the Contractor's expense.

3.11 HANDLING

E. Both in shop and in field, transport, handle and erect to preclude damage or overstressing of any component.

3.12 FINISH

F. For exposed steel, field paint per Section 09 90 00 Painting with High Performance Coatings.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes supply and installation of all metal fabrications not included elsewhere in the specifications.

B. Related sections:

1. Section 05 12 00: Structural Steel

1.2 REFERENCES

A. AA DAF-45 (Aluminum Association) - Designation System for Aluminum Finishes.

B. AAMA 603.8 9 (American Architectural Manufactures Association) - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.

C. AAMA 605.2 (American Architectural Manufactures Association) - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

D. AAMA 606.1 (American Architectural Manufactures Association) - Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.

E. AAMA 607.1 (American Architectural Manufactures Association) - Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

F. AAMA 608.1 (American Architectural Manufactures Association) - Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

G. ANSI A14.3 - Ladders, Fixed, Safety Requirements.

H. ASTM A36/A36M - Carbon Structural Steel.

I. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

J. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

K. ASTM A153/A153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

L. ASTM A283/A283M - Low and Intermediate Tensile Strength Carbon Steel Plates.

M. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

N. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

O. ASTM A325M - Standard Specification for High-Strength Bolts for Structural Steel Joints (Metric).

P. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

Q. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

R. ASTM B26/B26M - Aluminum-Alloy Sand Castings.

S. ASTM B85 - Aluminum-Alloy Die Castings.

T. ASTM B177 - Chromium Electroplating on Steel for Engineering Use.

U. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

V. ASTM B209M - Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

W. ASTM B210 - Aluminum and Aluminum-Alloy Drawn Seamless Tubes.

X. ASTM B210M - Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric).

Y. ASTM B211 - Aluminum and Aluminum-Alloy Bar, Rod, and Wire.

Z. ASTM B211M - Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric).

AA. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

BB. ASTM B221M - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube (Metric).

CC. AWS A2.4 (American Welding Society) - Symbols for Welding, Brazing, and Nondestructive Examination.

DD. AWS D1.1 (American Welding Society) - Structural Welding Code.

EE. SSPC (Steel Structures Painting Council) - Painting Manual.

FF. California Building Code (CBC) Title 24, Part 2.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

2. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.4 QUALIFICATIONS

A. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of California.

B. Welders Certificates: Submit under provisions of Section 01 45 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

C. Fabricator's/Installer's Qualifications: A firm with at least five years of successful fabrication/installation experience on projects with work similar to that required for this Project.

1.5 REGULATORY REQUIREMENTS

A. Perform Work in accordance with California Building Code (CBC) Title 24, Part 2.

B. Design, fabricate and erect miscellaneous metals in accordance with AISC'S Design, Fabrication and Erection of Structural Steel for Buildings.

C. Conform to AWS D-1.0 Code - Welding in Building Construction.

D. Inspection of Welding: See Section 01 45 23.

E. Welding: See Section 01 45 00.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Shapes: Conform to ASTM A36.

B. Steel Pipe:

1. Steel pipe for pipe columns, and other structural purposes shall conform to "Standard Specification for Welded and Seamless Steel Pipe," ASTM A53, Type E or S, Grade A or B, as required.

2. Steel pipe other than pipe used for structural purposes shall conform to "Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded And Seamless Pipe for Ordinary Uses," ASTM A120 or ASTM A53.

C. Square and Rectangular Steel Tubing:

1. Steel tubing for structural purposes shall be carbon steel conforming to "Standard Specification for Cold-Formed Welded and Seamless Carbon Structural Tubing in Rounds and Shapes," ASTM A500 or A36 steel.

2. Steel tubing other than tubing used for structural purposes shall be hot or cold rolled carbon steel electric welded tubing.

D. Cast Steel: "Standard Specification for Mild-to-Medium Strength Carbon-Steel Castings for General Application," ASTM A27, Grade 65-35.

E. Bolts, Nuts and Washers

1. Bolts: ASTM A307, hex head.

2. Nuts: ASTM A563, hex head.

3. Washers: FS FF-W-92, helical spring.

4. Plain Washers, ANSI B27.2, Type A.

5. Beveled Washers, ANSI B27.4.

6. High strength bolts, ASTM A325, Type I.

7. Lag screws and lag bolts: ANSI B18.2.1; hex head.

8. Galvanizing for bolts and nuts: ASTM A153; galvanizing required for exterior applications.

9. Nelson Studs: Use header anchors sized as shown on the drawings.

F. Rolled steel plates and shapes: Shapes and plates shall conform to ASTM A36, except for plates to be bent or cold-formed. Plates to be bent or cold-formed shall conform to ASTM A283, Grade C.

G. Cosmetic patching at weld joints: Bondo automotive repair compound, or equal.

H. All steel items exposed to the exterior environment shall be galvanized.

2.2 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221.

B. Sheet Aluminum: ASTM B209.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210.

D. Finishes:

1. Finish coatings to conform AAMA A41 anodized, prepared with a mechanical M12 - chemical C22 pre-treatment, anodized to clear color.

2. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.3 FABRICATION

A. General:

1. For the fabrication of items which will be exposed to view, use only materials which are smooth and free of blemishes. Remove blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc-coatings.

2. Form exposed work true to line and level with accurate angles and surfaces, and straight sharp edges.

3. Ease exposed edges to a radius of approximately 1/32", unless otherwise

indicated or specified.

4. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

5. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible.

6. Remove loose rust, mill scale, cutting and punching burrs.

7. Fabricate items in as large sections as practical to minimize field jointing. Fabricate assemblies to be hot-dipped galvanized in as large sections as practical for single-dip or double-dip coating in a minimum 42-foot long tank.

8. In galvanized assemblies, provide relief holes in pipe and tube sections to prevent trapped air spaces. At items to be painted, patch holes after galvanizing with automotive repair compound.

9. At items which will be exposed to view and painted, fill voids and gaps in welded joints left after continuous or tack welding with automotive repair compound, and grind and sand smooth and flush to match and blend with adjoining surfaces.

B. Miscellaneous Framing and Supports:

1. Provide miscellaneous steel framing and supports which are not a part of the structural steel framework, as required to complete the work.

2. Fabricate miscellaneous units to the sizes, shapes and profiles indicated or, if not indicated, of the dimensions to receive adjacent work to be retained by the framing.

3. Except as otherwise indicated, space anchors 2' on center, and provide minimum anchor units of 1¼" x ¼" x 8" steel straps.

4. Shelf angles for exterior construction shall be galvanized steel of the sizes indicated.

C. Fabricated Rough Hardware:

1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6.

2. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

D. Welding: All welding shall be inspected by a certified welding inspector.

1. Weld all shop connections and all field connections unless indicated or specified otherwise.

2. Weld corners and seams continuously.

3. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

E. Galvanizing: Comply with "Standard Specification for Zinc (Hot-galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip," ASTM A123. All steel exposed to the weather, and items indicated on the Drawings or specified shall be hot-dip galvanized.

F. Shop Primer shall be Tnemec Series 10, Dunn-Edwards 43-4, or equal, unless otherwise specified.

1. All miscellaneous metal fabrications, except galvanized items, which will be exposed when the building is completed, shall receive a coat of primer.

2. The primer specified shall be spray applied, filling all joints and corners and covering all surfaces with a smooth unbroken film. The minimum dry film thickness of the primer shall be 2.0 mils.

3. Preparation for Painting: All miscellaneous ferrous metal, except items specified galvanized or shop primed, shall be thoroughly cleaned of a mill scale, grease, dirt or rust, by scraping, wirebrushing, or sandblasting and shall be delivered to the job unpainted, but in proper condition for painting. Shipping oil or other protective coatings shall be removed.

2.4. EXPANSION ANCHORS

A. KWIK BOLT TZ, 3/8 to 1 inch diameter, ICC ESR 1917, by Hilti Corp., Tulsa, OK.

~~B. Sleeve Type: Hilti HSL-3, M8-M24, ICC ESR-1545, by Hilti Corp., Tulsa, OK.~~

~~C. Shell Type: MULTI-SET II, 1/4 to 3/4 inch diameter, SERIES HDI, 1/4 to 1 inch diameter, ICC ER-2895, by Hilti Corp., Tulsa, CA.~~

D. Maximum Values: The maximum allowable shear and tension values shall be determined in one of the following ways:

1. An allowable load equal to but not more than eighty percent of the allowable load listed in the ICC Evaluation Report recommendation for a specific anchor in the same configuration as tested.

E. Expansion anchors installed in the tension zone (underside) of structural members (beams and slabs) shall have allowable load values modified beyond that defined herein, unless data is submitted indicating that the specific anchor is not adversely affected by the cracking of concrete in the tension zone. From qualification test a factor of safety equal to eight shall be used on those anchors. If loads are determined from an ICC Evaluation Report, the allowable loads shall be based on bolts installed without special inspection.

F. Embedment, Spacing and Edge Distance: The minimum spacing between anchors shall be as defined in the ICC Report. The minimum edge distance for drilled-in anchors shall be ten bolt diameters unless test data is submitted indicating full anchor strength at a

closer edge distance. For edge distances closer than ten bolt diameters, with the load directed toward the free edge, the allowable shear load shall be reduced per, unless a qualification tests are submitted to substantiate a higher value.

G. All expansion anchors shall meet the minimum depth of embedment criteria established by the ICC Evaluation Report and/or manufacturer. The minimum slab thickness established in the manufacturers technical guide for the specified anchor shall also be adhered to.

H. Testing: Comply with Section 01 45 23.

2.5 POWDER ACTUATED FASTENERS

A. Use of Powder actuated fasteners for tension loads is limited to support of minor loads such as suspended acoustical ceilings, ductwork and conduit.

B. Allowable Loads: Limited to less than 100 lbs.

C. Permissible Loads:

1. Stone Aggregate Concrete: Minimum 0.177 inch diameter, minimum penetration 1-7/16 inch. Required Allowable Loads: 100 lbs. or 80 percent of values listed in ICC Report whichever is less: ICC ESR 1663.

a. 3300 SERIES, by ITW Ramset, City of Commerce, CA, ICC No. 1639 and 1147.

b. Type DS, by Hilti Fastening Systems, Inc., Tulsa, OK.

D. Testing: Comply with Section 01 45 23.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal and aluminum where site welding is required.

B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

A. Install fabrications in accordance with approved shop drawings. Miscellaneous metal items shall be securely fastened to the structure, plumb and true to lines and levels indicated.

B. Masonry anchorage devices shall be set in masonry or concrete-in-place construction in accordance with the anchorage device manufacturer's printed instructions. Holes

shall be of the recommended depth and diameter and shall be drilled as recommended by the manufacturer of the particular anchorage device used.

C. Field Welding: Field welding shall be inspected by a certified welding inspector. Exposed welds shall be ground smooth.

3.4 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.5 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of surfaces. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Repair of Damaged Galvanized Surfaces: Galvanized finish which has been damaged or burned off in welding shall be repaired by coating surface with "Galvalloy" or "Galvabar" or approved equal. Clean surface of all foreign matter, heat to approximately 600°F and rub the alloy bar over the heated surface, allowing a small amount to flow. Wire brush briskly, spreading the material evenly over the area covered. Apply one coat of silver-colored paint over repaired area.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Rough carpentry.

B. Heavy Timber Construction.

1.02 REFERENCES

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

B. Chapters 7 and 23A, CBC.

C. PS 1-95 - Department of Commerce Product Standard, U. S. Product Standard for Construction and Industrial Plywood

D. Lumber Standards: DOC PS 20

E. PS 2-92 - Department of Commerce Product Standard, U. S. Product Standard for Construction, Performance Standard for Wood-Based Structural-Use Panels.

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

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

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

I. AQMD - Local Air Quality Management District Regulations.

J. AWPA C1, C2, C3, C9, C20, C27 - American Wood Preservers Association - Manual of Recommended Practice.

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

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

M. Title 8 – California Code of Regulations, Construction Safety Orders.

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

O. FSC – Forest Stewardship council Principles and Criteria.

1.03 SUBMITTALS

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

1.04 QUALITY ASSURANCE

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

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

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

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

E. Plywood: No added urea-formaldehyde binders.

1.05 DELIVERY, STORAGE AND HANDLING

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

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

C. Certified wood shall be kept separate from non-certified wood. Auditing process as mandated by certifiers shall be complied with.

1.06 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 ROUGH CARPENTRY MATERIALS

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

B. Plywood: Section 2304.7, CBC, Douglas Fir 1 Group Species, PS 1-95, APA Structural I Rated Sheathing. Durability Classification: Exterior, A-C Panel Grade, sanded 2 sides. Thickness as indicated, span rating sized for spacing. For natural finished plywood use Panel Grade N veneer and B on other side.

C. Roof Plywood Decking: requiring FM 1-90 Wind and Fire Classification, minimum 1/2" (15/32") thick. Section 2304.7, CBC, Douglas Fir 1 Group Species, PS 1-95, APA Structural I Rated Sheathing. Durability Classification: Exposure 1, B-C Panel Grade, sanded 1 side. Thickness as indicated, span rating sized for spacing.

D. Oriented Strand Board (OSB): PS 2-92, APA PRP-108, 15/32" through 3/4" APA Rated Sheathing and Structural 1 Rated Sheathing, Exposure 1, meeting NES "Oriented Strand Board Roof and Wall Sheathing, Combination Subfloor/Underlayment OSB Lap and Panel Siding (NER-124)". Needs to comply with DSA IR-23-11.

E. Texture Plywood: APA T1-11 texture exterior-grade plywood APA A-C, 5/8 inches thick with 1/4 inch deep grooves 3/8 inches wide spaced at 6 [8] inches on center, shiplapped edges, rough texture. Finish in accordance with Section 09 90 00 Painting

F. Nails, Spikes and Staples: Sections 2303.6 and 2304.9, CBC Galvanized for exterior applications, high humidity locations and treated wood; plain finish for other interior locations; size and type to suit application. Comply with Table 2304.9.1, CBC. Use common nails only.

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

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

I. Stock Framing Connectors: Section 2304.9.3, CBC types indicated on Drawings, galvanized, with nails fully driven in all holes in each face of connector. Conform to the following.
   1. Manufacturers: Simpson Strong Tie Co., Inc., San Leandro, CA, United Steel Products, Montgomery, MN. or equal as approved in accordance with Division 01 General Requirements for Substitutions.
   2. ICC Listed.

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

K. Preservative (Pressure) Treated Lumber: Section 2303, CBC Conform to AWPA Manual of Recommended Practice, kiln dry after treatment. Use preservative complying with AWPA C2 lumber and C9 plywood, latest edition. Products NOT containing arsenic or chromium. Conform to AQMD, Local Regulations.
   1. Douglas Fir Larch, used as required by Section 2303, CBC, shall conform to the following:
      a. Lumber shall be WWPA or WCLIB grade stamped.

b. Lumber shall be No. 1 grade or better unless indicated otherwise on Drawings.

L. Waterproof Membrane: ASTM D4601; Type II, asphalt saturated glass felt.

M. Fire-Retardant Wood:
1. Fire-Retardant Douglas Fir Lumber: Chemically treated and pressure impregnated, as defined in Section 703 CBC. Lumber shall be grade stamped by an approved agency at the factory, and shall bear identification indicating the fire performance rating thereof, Flame Spread Less than 25, ASTM E84. Lumber: AWPA C20.
2. Fire-Retardant Treated Douglas Fir Plywood: AWPA Standard C-27, NFPA 703, ASTM D-5516, ASTM E-84, Section 2304A.5, CBC, PS 1-95, APA structural rated sheathing, Exposure 1, 5/8 thick. Plywood shall comply with the following Maximum Flame Spread Classifications in the following locations:
3. Horizontal Exitways: All Occup. Groups: Class II, except Occup. Group I: Class I.
4. Rooms/Areas: All Occup. Groups: Class III, except Occupancy Groups A and I: Class II.
5. Other Locations: As indicated on drawings.

N. Heavy timber: DOC PS 20, Species: Douglas-fir larch, Grade; Select Structural.

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

PART 3 - EXECUTION

3.01 FRAMING, FURRING AND STRIPPING

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

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

C. Construct and erect required headers and lintels.

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

E. Provide double joist headers at joist ends and around openings unless otherwise indicated on Drawings. Bridge joists and rafters to conform with Section 2308.9.9 and 2308.8.3 CBC and as noted on plans. For pre-manufactured joists, provide bridging in accordance with manufacturer's recommendations.

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

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

H. Install 3 studs at corners.

I. Conform to Section 2308.9.8, CBC, where pipes penetrate sills or plates.

J. Cutting and Notching: Conform to Section 2308.9.10, CBC and details on plan.

K. Bored Holes: Conform to Section 2308.9.11, CBC and details on plan.

L. Conform to Section 708, California Building Code for fire blocks and draft stops. Fire blocks and stops at 10'-0" intervals and at ceiling level.

3.02 SUBFLOORING

A. Place floor sheathing with end joints staggered. Secure sheets over firm bearing. Maintain minimum 1/16 inch and maximum 1/8 inch spacing between joints of sheets. Place perpendicular to framing members of rafters or joists.

B. Maintain surface flatness of maximum 1/8 inch in 10 ft.

C. Secure with glue and screw nails.

3.03 PLYWOOD SHEATHING

A. Thickness as indicated on the Drawings, minimum thickness 1/2 inch.

B. Boundary Nailing: Not less than 3/8 inch from edge, spaced not more than 6 inches on center, unless noted otherwise on Drawings.

C. Blocking: Panel edges shall bear on framing members or solid blocking.

D. Minimum Size Vertical Panel: 16 inches wide.

E. Minimum Size Horizontal Panel: 24 inches wide.

F. Oriented Strand Board not permitted.

3.04 FOUNDATION FRAMING, PLATES, SILLS AND SLEEPERS

A. Preservative treated wood required. Set wood sills on a bead of continuous butyl sealant on both sides of sill.

B. Under-Floor Clearance for Joist: 18 inches minimum.

C. Under-Floor Clearance for Girders: 12 inches minimum.

D. End Clearance for Lumber Entering Concrete: 1/2 inch minimum.

3.05 HORIZONTAL FRAMING

A. Bearing: 1-1/2 inch minimum on wood or metal, 3 inches on masonry. Lay framing members with crown up. Members with knots at bottom not permitted.

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

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

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

E. Provide ties, purlins and blocking in conformance with Section 2306, CBC.

3.06 BACKING

A. Provide backing as indicated on Drawings to support electrical fixtures, fixed equipment, cabinets, grab bars, door stops and plates. Fasten securely to framing.

END OF SECTION

SECTION 06 18 13

GLUE LAMINATED BEAMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Glue laminated wood beams.

1.02 REFERENCES

A. ANSI/AITC - American Institute of Timber Construction - A190.1 - Structural Glued Laminated Timber and AITC 117 Standard Specification for Structural Glued Laminated Timber Softwood Species.

B. AITC - American Institute of Timber Construction AITC 109 Standard Specification for Preservative Treatment of Structural Glued Laminated Timber.

C. ASTM D3737 - Establishing Stresses for Structural Glued Laminated Timber.

D. AWPA C28 – American Wood Preservers' Association, Standard for Preservative Treatment by Pressure Process of Glue Laminated Members and Laminations before Gluing.

E. Chapter 23 California Building Code, National Design Specifications Part V and CBC 2010 Code Section 2303.1.3.1.

1.03 SUBMITTALS

A. Shop drawings indicating framing sizes and cambers.

B. Product data.

C. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance of structural glued-laminated timber.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of glue laminated structural units with five years minimum experience, and certified by the AITC. [and approved by Division of State Architect].

B. Mock-up: field finishes
   1. Provide finished sample of glue-laminated beam units for approval.
   2. Units will establish a minimum standard of quality for this Work.
   3. Approved units may be used as part of the Work.

C. Glue laminated beams shall be free of urea-formaldehyde binders and adhesives.

D. Gluelam beams shall be FSC certified. SFI and other sustainable forestry certifications will not be accepted in lieu of FSC.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and protect members in accordance with AITC requirements for load wrapped material.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Standard Structures, Inc., Santa Rosa, CA.

B. American Laminators, Drain, OR.

C. Calvert Co., Inc., Vancouver, WA.

2.02 MATERIALS

A. Materials, Manufacture and Quality Control: Conform to Product Standard PS 56, "Structural Glued Laminated Timber".

B. Lumber: Conform to Standard Grading rules for Western Lumber, March 1998, published by Western Wood Products Association and West Coast Lumber Inspection Bureau.
   1. Species: Douglas Fir-Larch.
   2. Lay-up: either balanced or unbalanced.

C. Adhesives: wet-use type, melamine, phenol, resorcinol or phenol-resorcinol types.

D. Laminating Combinations: Meet the requirements of Product Standard PS 56; provide allowable stress values of 2400 psi in bending (Fb) either face, (24F-V8).

E. Service Temperature Maximum: Less than 150 degrees F maximum.

F. Laminated Veneer Lumber: manufactured to Trus Joist standards, on file at DSA. Framing members shall be Grade AA compressed, made of Alternating C and D Grade Coast Region Douglas Fir Veneers 1/10 inch in thickness.
   1. Sizes: As noted in the Structural Drawings.
   2. Structural Properties:
      a. MOE: 2.2×10^6 psi.
      b. F_b : 2,900 psi.
      c. F_v : 290 psi.
      d. F_C perp: 750 psi.
   3. Face Veneers: C Grade; fully glued with phenolic resin glue complying with ASTM D2559. Provide B Grade faces where exposed to view.
   4. Grain of all Veneers shall be oriented in the direction parallel to span.
   5. Veneer Laps. Required laps in veneer shall be at least 2-inch minimum lap joints occurring at any section. Any 2 laps shall have at least seven continuous piles between them. Lap joints in adjacent veneers shall be at least 12 inches center to center.
   6. Acceptable Product: Trus Joist MacMillan, Paralam, or equal as approved in accordance with Division 01, General Requirements for substitutions.

G. Waterproof Sealer:
   1. Exceeds federal specification TT-C-555B for resistance to wind-driven rain and ASTM D-4446 for waterproofing wood.
   2. Acceptable products or equal.
      a. Thompson's WaterSeal Clear Multi-Surface Waterproofer

2.03 FABRICATION

A. AITC A190.1, ASTM D3737, Section 2303.1.3, 2010 California Building Code, and the following requirements:
   1. End joints in adjacent laminations: Separated by a minimum of 6 inches. Plain scarf end joints: Slope not steeper than 1:10. Strength reducing defects such as wane not be permitted in an end joint. Finger Joints: Cut in wood which is free of knots and local grain deviation. The sum of the sizes of all knots which appear in the beveled surface of a scarf shall not exceed 1/4 the nominal width of lamination when laminations are 1-1/2 inches in thickness, and shall be reduced in proportion to the thickness of laminations to 1/8" the width of laminations when laminations are 5/8 inch or less in thickness.
   2. The moisture content of lumber in a single package of laminations at the time of gluing: Less than 16 percent. The range of moisture content of various laminations assembled into a single member shall not exceed 5 percentage points if any piece in the assembly exceeds 12 percent.
   3. Adhesive: "Wet-Use" type only.
   4. Preservative Treatment: For Architectural and Premium Grade, not affecting appearance, oil borne Type C, AITC 109, Table 1. Oxine copper in a light petroleum solvent or similar products approved by the glue-lam manufacturer, listed in AWAP C28, EPA approved and California VOC compliant.

B. Workmanship
   1. Fabrication: In accordance with the best practices with adequate plant and equipment and under supervision of properly qualified personnel.
   2. Gluing surfaces of laminations including edge and end joints: Plane surfaces, machine-surfaced smooth, and except for minor local occurrences, free of raised grain, torn grain, skips, burns, glazing, or other deviations from the plane of the surface that might interfere with the contact of sound wood fiber in mating surfaces of the laminations. Gluing surfaces, whether treated or untreated shall at the time of gluing be free from dust or other foreign matter, including any exudation or surface damage which would be detrimental to satisfactory gluing.
   3. At the time of gluing, variations in thickness across the width or along the length of any lamination shall not exceed plus or minus 0.008 inch and cup should not exceed 1/32 inch for each inch of width for lumber nominal 1 inch and less in thickness, and should not exceed 1/164 inch for each inch of width for lumber over nominal 1-inch thickness, but in no event shall cup and warp exceed that which will be straightened out by pressure in gluing.
   4. Clamping Methods: Such that the pressure is as uniform as practical over the whole area. Nailing in lieu of clamping for pressure is not permitted. Clamping may start at any point but shall progress to an end or ends. Gluing Pressure: Such as to assure close contact of the surfaces and provide a uniformly thin glue line, but not less than 100 lbs. psi. Maintain pressure until the adhesive has set. Clamping time and curing process shall be in accordance with adhesive manufacturer's recommendations.

Finishing: Seal all end grain at place of fabrication after ends have been finally trimmed.

a. Immediately after end cutting each member to final length, and after wood preservative treatment, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.

b. After fabrication and sanding of each unit, and after end cut sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.

2.04 COMBINATION AND APPEARANCE GRADE

A. Combination 24F-V8 DF/DF Cantilever span and 24F-V8 DF/DF Simple span in conformance with AITC 117-2004.

B. Appearance of Members: Architectural Grade, Premium Grade all sides were exposed, Industrial Grade surfaced where concealed.

C. Units shall be fabricated for wet use.

2.05 INSPECTION AND TESTING

A. Glu-Lam beams shall be continuously inspected. Inspection and test procedures to be used in the production of structural glued laminated timber shall conform with Section 2303.1.3.1 California Building Code.

B. Conform to Structural Test and Inspection in accordance with Division 01, General Requirements.

2.06 FACTORY FINISH

A. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer: oven dried and resistant to mildew and fungus.
1. Provide color selected by Architect from manufacturer's full range.
2. Provide color matching Architect's sample.

B. Clear Finish: Manufacturer's two-coat, clear conversion varnish finish; oven dried and resistant to mildew and fungus.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that supports are ready to receive glue-laminated beams.

B. Verify sufficient end bearing area.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Coordinate placement of bearing and support items.

3.03 ERECTION

A. Set structural members level and plumb in correct positions.

B. Provide temporary bracing and anchorage to hold members in place until permanently secured.

C. Fit members together accurately without trimming, cutting, or any other unauthorized modification.

D. Where beams penetrates through exterior walls apply waterproof sealer as recommended by manufacturer.

3.04 FIELD FINISHES

A. Stain and Seal finish per Section 09 90 00 Painting.

3.05 TOLERANCES

A. Framing Members: 1/2 inch maximum from true position.

END OF SECTION

SECTION 07 21 00

THERMAL AND SOUND INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermal and sound insulation as indicated on the Drawings and as specified. Provide the sound transmission class indicated.

B. Related Sections:

1. Section 07 92 00: Joint Sealants

1.2 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 33 00, manufacturer's product literature and installation instructions for each type of insulation required.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide batt or blanket products by one of the following manufacturers:

1. Owens-Corning Fiberglas Corporation.

2. Johns Manville.

3. USG Interiors, Inc., USG Corp.

4. CertainTeed Corporation.

2.2 THERMAL INSULATION - BATT OR BLANKET TYPE

A. Insulation shall be installed on the exterior envelope of the building, shall conform to ASTM C665 for Type II, Class C, Category 1, and shall be fiberglass kraft-faced batts at unrated construction and foil-faced batts at rated construction. R-value and/or thickness shall be a minimum of R-19 at walls and R-30 at roofs, and as required to entirely fill depth of wall cavity.

2.3 SOUND INSULATION

A. Sound insulation shall be installed in interior partitions as follows:

1. At all interior walls and partitions.

2. At walls separating toilet rooms from adjacent occupied rooms.

3. To achieve STC 45 in compliance with California Department of Health Services "Catalog of STC and IIC Ratings for Wall and Floor/Ceiling Assemblies."

4. Where suspended acoustical tile ceilings abut interior walls and partitions that do not fully extend to the underside of floor or roof above, and where interior walls and partitions terminate at the suspended acoustical ceiling, sound insulation batts shall be installed immediately above the ceiling extending 4 feet minimum on each side of wall or partition.

B. Sound insulation shall be fiberglass, unfaced, sound control batts, thickness as required to entirely fill depth of wall cavity but not less than 4" thick.

C. Provide accessories to mitigate the passage of sound. Adhesives, duct tape, tie wires and other accessories shall be as recommended by the insulation manufacturer.

D. Provide acoustical sealant at all walls and partitions to receive sound insulation. Acoustic sealant shall be a one component elastomeric sealant as specified in Section 07 92 00.

2.4 FASTENING MATERIALS

A. Nails shall be zinc-coated steel, common style, of the size required to suit the application, conforming to FS FF-N-105, Type II, Style 10.

B. Staples shall be galvanized steel, flat top crown, of the size required to suit the application, conforming to FS FF-N-105, Type II, Style 3.

2.5 OUTLET BOX PADS

A. Outlet box pads shall be polybutene-butyl sheets, Lowry's Electrical Box Pads as manufactured by Lowry & Associates, Inc. (818) 768-4661, or approved equal. Cover electrical boxes with pads.

PART 3 EXECUTION

3.1 INSPECTION AND PREPARATION

A. Require Installer to examine substrates and conditions under which insulation work is to be performed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

B. Extend insulation full thickness over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

C. Apply a single layer of insulation of required thickness, unless multiple layers are required to attain required STC.

D. In walls, erect insulation vertically and hold in place with z-furring members spaced 24" on center. Install sound attenuation blankets prior to gypsum board unless it is readily installed after board has been installed.

E. Where sound-rated drywall construction work is indicated, seal construction at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C919 and manufacturer's recommendations for location of edge trim, and close off sound-flanking paths around or through construction including sealing of partitions above acoustical ceilings.

F. Stuff loose glass fiber insulation into hollow metal door frames, and miscellaneous voids and cavity spaces that would impair the sound attenuation of the assembly. Compact insulation to produce a solidly filled void.

G. Protect installed insulation from harmful weather exposures and from possible physical abuses.

END OF SECTION

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SECTION 07 26 13

TOPICAL CONCRETE MOISTURE CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Liquid applied, concrete additive and floor treatment system for preparing substrates to receive flooring systems.

a. Apply during concrete placement.

b. Install on existing substrates to receive new flooring.

B. Related Sections:

1. Section 01 45 24: Concrete Moisture Vapor Emission and pH Testing

2. Division 9: Flooring materials.

1.2 REFERENCES

A. ASTM American Society for Testing Materials

1. ASTM E96 Water Vapor Transmission Testing

2. ASTM D1308 Acid & Alkali Testing

3. ASTM D4541 Concrete Adhesion Testing

4. ASTM F1869 Calcium Chloride Testing

5. ASTM F710 Preparing Concrete Floors to Receive Resilient Flooring

6. ASTM F2170 Relative Humidity in Concrete Slabs Using in situ Probes

1.3 SUBMITTALS

A. Make submittals in compliance with Section 01 33 00.

B. Product Data: Detailed installation requirements, spread rates, joint and crack treatment and final barrier surfaces for floor coverings.

C. Installer: Factory certified installer certificate.

D. Laboratory Reports: Testing results for compliance with specified criteria.

F. Warranty Certificate: Sample of warranty certificate as issued to District.

G. Insurance Certificate: Certificate adding District as additionally insured to manufacturer's product liability policy.

I. Field Documents: Manufacturer shall provide written acceptance of on site conditions including concrete mix design, admixtures, sub slab vapor barrier, and concrete surface quality.

1. 4 SCHEDULING

A. Scope Meeting: Prior to installations District's Representative, Architect, Contractor and installer shall review application schedule, required temperature, humidity and site conditions.

B. Safety Meeting: Installer shall report ventilation requirements, site protection and material data safety information to disclose product limitations and precautions prior to application. Information is to prevent site contamination and safety issues with other trades.

1.5 WARRANTY

A. Warranty: Written fifteen (15) year warranty for the repair and replacement of flooring systems components damaged by concrete originated substrate water vapor emission, alkalinity and relative humidity rates within specified performance.

1. Flooring replacement shall include re-application of moisture control, flooring coverings, adhesives, patching compounds and labor.

B. Warranty shall not be limited to materials purchased for project or exclude or become void due to non-conformance to ACI-318 or ACI 201 parameters, dew point, foreign salts, admixtures, resin and silicate surface treatments or cohesive substrate failure in the concrete surface due to normal concrete movement.

1. Warranty may exclude unforeseen Alkali-silica reaction or Alkali-aggregate conditions as outlined by ACI-212, ASTM C33 or seismic action. Moisture control manufacturer is responsible for complete review of concrete mix designs, admixtures, sub-slab vapor retarder installed and curing methods for written acceptance prior to installations.

C. Insurance Certificate: Manufacturer shall maintain product liability insurance in the amount of $6 million per occurrence. District shall be added as additionally insured and provided as a close out submittal.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide one of the following barriers: Diamond Stone Products (888) 817-8663 www.DiamondStoneProducts.com, Synthetics Intl. (866) 646-0356 www.SyntheticsIntl.com.

2.2 MATERIAL

A. Description: Two-part water-based epoxy used to chemically and mechanically restrict water vapor emission transfer.

B. Use: Product shall be capable of being mixed-trowel finished into concrete and roller applied to existing substrates.

C. Water vapor transmission properties (ASTM E96, wet method) of less than 2.4 grams

D. Volatile organic compounds (VOC's) of less than 40 g/liter for compliance with LEED EQ 4.1 Low-Emitting Sealant

E. Tolerance to concrete originated 100% relative humidity, 14pH alkalinity and vapor emission rates up to 15 pounds.

F. Single component silicate, acrylic, latex and specialty flooring adhesives do not meet the intent of this section.

2.3 ACCESSORIES

A. Concrete Moisture Tests: Comply with Section 01 45 24

1. Anhydrous Calcium chloride – ASTM F 1869

2. In-situ Relative Humidity – ASTM F 2170

3. Digital pH-Alkalinity – ASTM F 710

B. Cement Toping: Portland cement (non-gypsum) based patching or self-leveling product as approved by control manufacturer.

1. Non-porous primer required to secure cement products.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions are acceptable for a warranty application.

B. New concrete pouring to include the following:

1. Under slab vapor barrier meeting ASTM E1745 class A

2. Pour concrete directly into barrier (no sand layer)

3. Concrete water to cement ratio not to exceed 0.45

4. Minimum of 15% pozzlan content per ASTM C618

5. Report unsatisfactory conditions in writing prior to application.

C. Existing slab on grade substrates shall be tested per ASTM F1869 for moisture, relative humidity per ASTM F2170 and alkalinity per ASTM F 710. Provide moisture control in all areas above the following results at no additional costs to District:

1. ASTM F1869 – Not to exceed 3.0 lbs.

2. ASTM F2170 – Not to exceed 75%

3. ASTM F710 – Not to exceed 9.0pH

3.2 PREPARATION

A. General: Coordinate work with work specified under other sections to ensure proper and adequate interface of work. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work.

B. New Concrete Substrates: Apply during the final mechanical finishing process during concrete placement.

C. Existing Substrates: Scarify concrete surfaces using #390 shot to expose an absorbent concrete profile, ICRI #4. Diamond grind near wall base, columns and edges.

3.3 APPLICATION

A. General: Apply product components in accordance with manufacturer's data and on-site requirements.

B. Application:

1. New Concrete: Use electric sprayer to form a white coated surface.

2. Existing: Apply using a 10-mil notched squeegee to coat substrate, cracks and joints.

C. Cracks, Joints & Penetrations: Re-apply control mixture over entire substrate to securely seal penetrations and imperfections. Allow to cure.

D. Cement Topcoat: Apply manufacturer's approved non-porous primer and cement topcoat at a nominal 1/8 inch thickness on new and existing substrates.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform concrete moisture testing per ASTM F1869 at a minimum of 10 locations to verify acceptable moisture vapor transmission rates for specified floor coverings at a minimum of 45 days prior to flooring installation. Apply tests directly to moisture control surface without scarification.

B. Meeting: Schedule a meeting to confirm results of floor covering bond tests and moisture results. Confirm acceptable patching compounds and cleaning methods are being utilized.

END OF SECTION

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SECTION 07 26 16

UNDER-SLAB VAPOR BARRIER

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Vapor barrier, seam tape, and mastic for installation under concrete slabs.

B. Related sections:

1. Section 03 30 00 Cast-in-Place Concrete

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E1745-09 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

2. ASTM E154-99 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

3. ASTM E96-05 Standard Test Methods for Water Vapor Transmission of Materials.

4. ASTM F1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

5. ASTM E1643-09 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

A. Quality control/assurance:

1. Summary of test results as per paragraph 8.3 of ASTM E1745.

2. Manufacturer's samples, literature.

3. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Vapor barrier must have all of the following qualities:

1. Permeance of less than 0.01 Perms as tested in accordance with ASTM E1745 Section 7.

2. Other performance criteria:

a. Strength: ASTM E1745 Class A.

B. Vapor barrier products:

1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

2. Other acceptable products:

b. Or equal products that meet all of the specified performance criteria in paragraph A.

2.2 ACCESSORIES

A. Seam tape:

1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Vapor-proofing mastic:

1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Pipe Boots

1. Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 EXECUTION

3.1 PREPARATION

A. Ensure that base material is approved by Geotechnical Engineer.

1. Level and compact base material.

3.2 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.

2. Lap vapor barrier over footings and/or seal to foundation walls.

3. Overlap joints 6 inches and seal with manufacturer's tape.

4. Seal all penetrations (including pipes) per manufacturer's instructions.

5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.

6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

END OF SECTION

[illegible]

SECTION 07 27 19

PLASTIC SHEET AIR BARRIERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Sheet applied weather barrier and related accessories for wall air/moisture barrier system.

B. Related Sections:

1. Section 06 10 00: Rough Carpentry

2. Section 07 21 00: Thermal and Sound Insulation

1.2 REFERENCES

A. The American Association of Textile Chemists and Colorists (AATCC) 127 - Water Resistance: Hydrostatic Pressure Test.

B. American Society for Testing and Materials (ASTM) E96 - Standard Test Methods for Water Vapor Transmission of Materials.

C. American Society for Testing and Materials (ASTM) D1117 - Standard Guide for Evaluating Nonwoven Fabrics.

D. American Society for Testing and Materials (ASTM) D3330 - Standard Test Method for Peel Adhesion of Pressure-Sensitive Tape1.

E. American Society for Testing and Materials (ASTM) D3759 - Standard Test Method for Tensile Strength and Elongation of Pressure-Sensitive Tapes.

F. PSTC-1 - Peel Adhesion of Single Coated Pressure-Sensitive Tapes at 180 Degree Angle.

G. TAPPI T-460 - Porosity - Gurley.

1.3 SYSTEM DESCRIPTION

A. The airtight components and secondary moisture protection of the building enclosure and the joints, junctures and transitions between materials, products, and assemblies forming the air-tightness and moisture barrier of the building enclosure are called "the air/moisture barrier system." Services include coordination between the trades, the proper scheduling and sequencing of the work, preconstruction meetings, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by the Architect.

B. Air Barrier Penetrations: All penetrations of the air/moisture barrier and paths of air infiltration / exfiltration through the air/moisture barrier system shall be made air-tight.

C. Moisture Barrier Penetrations: All penetrations of the air/moisture barrier and paths of water migration through the air/moisture barrier system shall be made water shedding.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation and sealing techniques and application workmanship.

1. Finish areas designated by Architect.

2. Do not proceed with remaining work until workmanship is approved by Architect.

3. Repair mock-up area as required to produce acceptable work.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Do not store in direct sunlight. Weather barrier shall be stored in a covered area. Do not expose to building site chemicals.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Anticipate environmental conditions and schedule installation when conditions are within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Product Warranty: Limited product warranty against manufacturing defects.

1. HardieWrap Weather Barrier and related products for 10 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: James Hardie Building Products, Inc., (866) 274-3464.

B. Requests for approval of equal substitutions will be considered in accordance with provisions of Section 01 25 00.

2.2 WEATHER BARRIER SYSTEM

A. Moisture Air Barrier Sheet:

1. Product: HardieWrap Weather Barrier as manufactured by James Hardie Building Systems.

2. Composition: Non-woven, non-perforated polyolefin.

3. Film: MicroTech Coating with micropores to balance water holdout and breathability.

4. Thickness: 11 mil.

5. UV Stability: Up to 180 days.

6. Water Holdout (AATCC127): 128 inches.

7. Breathability/Water Vapor Permeance (ASTM E-96A): 15 perms.

8. Air Resistance (TAPPI T-460): >1800 sec/100 cc.

9. Tear Strength (ASTM D1117): 15 to 18 lb.

10. Basis Weight: 19.4 lbs/1000 sf.

11. Sizes: 3 feet by 195 feet, 9 feet by 100 feet, 9 feet by 150 feet, 10 feet by 100 feet, 10 feet by 150 feet.

B. Self-adhering Flashing: Designed for peel and stick application.

1. Product: HardieWrap Flashing as manufactured by James Hardie Building Systems.

2. Composition: Butyl rubber adhesive non-woven polyolefin backing; coated Kraft paper release.

3. Total Thickness: 25 mil.

4. UV Stability: Up to 180 days.

5. Application Temperature: 30 degree F to 180 degree F.

6. Operating Temperature: -30 degree F to 200 degree F.

7. Packaging: Individually shrink-wrapped.

8. Roll Weight: 4 inch = 4.6 lb/roll, 6 inches = 6.9 lb /roll, 9 inches = 9.9 lb/roll.

9. Provide Width for Application Required: 4 inches by 100 feet (2x4 construction), 6 inches by 100 feet (2x4 construction), 9 inches by 100 feet (2x6 construction).

C. Flexible Flashing:

1. Product: HardieWrap Flex Flashing as manufactured by James Hardie Building Systems.

2. Composition: Butyl rubber adhesive; creped cross-laminated polyolefin backing; polyethylene film release.

3. Total Thickness: 60 mil.

4. Tensile Strength (ASTM D3759): 18 lb/inch.

5. UV Stability: Up to 180 days.

6. Water Vapor Transfer Rate (ASTM E96-94): <.2g/100 square inches/24hrs.

7. Application Temperature: 30 degree F to 180 degree F.

8. Operating Temperature: -30 degree F to 200 degree F.

9. Packaging: Each roll is packed in a convenient dispenser box.

10. Roll Weight: 6 inches = 22.2 lb/roll, 9 inches = 33.3 lb/roll.

11. Provide Width for Application Required: 6 inches by 75 feet (2x4 construction), 9 inches by 75 feet (2x6 construction).

D. Seam Tape:

1. HardieWrap Seam Tape as manufactured by James Hardie Building Systems.

   Composition: Polypropylene film coated with acrylic adhesive Total Thickness: 3.0 mil.

2. Adhesion Peel to HardieWrap (PSTC-1): 22 oz/inch.

3. Tensile Strength (ASTM D3759): 32 lb/in.

4. Elongation: 136 percent.

5. UV Stability: Up to 90 days.

6. Application Temperature: 30 degree F to 180 degree F.

7. Operating Temperature: -30 degree F to 200 degree F.

8. Packaging: Individually shrink-wrapped.

9. Roll Weight: 1 lb/roll.

10. Roll Size: 1-7/8 inches by 165 feet.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Weather barrier shall be installed before window and door installation. Do not install on saturated sheathing. Weather barrier can become slippery and should not be used in any application where it may be walked on.

D. Weather barrier shall be installed on vertical wall applications only.

E. Manufacturer warrants weather barrier sheet only when covered within 180 days of its installation.

3.3 INSTALLATION

A. Moisture Air Barrier Sheet:

1. Weather barrier shall be installed before window and door installation. Do not install on saturated sheathing. Weather barrier can become slippery and should not be used in any application where it may be walked on.

2. Begin by affixing weather barrier extending at least 6 inches around a building corner. Unroll horizontally (with print side facing out) around the building covering rough window and door openings.

3. Fasten to studs or nailable sheathing material with galvanized construction grade staples a maximum of 18 inches in the vertical and horizontal direction.

4. Attach weather barrier so that it is taut and flat. The vertical overlap shall have a minimum of 6 inches and the vertical seam shall be taped.

5. Assure that the bottom edge of the weather barrier extends over the sill plate and foundation interface by at least 1 inch.

6. Overlap upper layers of weather barrier (in shingle lap fashion) by a minimum of 6 inches below the horizontal edge, and tape the horizontal seam line.

7. At roof to wall intersection (or wall to deck), affix wrap to the wall such that it overlaps any step flashing already in place on the wall by at least 2 inches.

B. Flexible Flashing:

1. Windows and Doors: Weather barrier is not designed nor guaranteed as a flashing material to prevent moisture or air from intruding behind weather barrier. Verify that flashing has previously been installed around all windows and door openings. Install flexible flashing per manufacturer's instructions.

a. Use the inverted "Y" cut method at rough window and door openings. Do not place fasteners within 9 inches of the rough opening, door or window heads. This area shall not be fastened to allow for proper head flashing installation. At the top corners of the rough opening, cut the weather barrier at 45 degree to extend 9 inches past the joint.

b. Fold the top flap up and out of the way and fasten temporarily.

c. Fold the remaining three flaps in through the opening fastening them inside the opening with staples.

2. Rough Electrical and Plumbing Penetrations: Seal with a double layer of flashing. Install the top flashing piece over the bottom flashing piece overlapping flashing layers to cover flashing cut-out necessary for placement around penetration.

C. Repairs: For minor punctures or tears, less than 3 inches, cover and completely seal with seam tape. For larger holes, greater than 3 inches, use slit flashing technique.

1. Slit flashing requires making a horizontal slit above the damaged area and placing a cut piece of weather barrier into the slit, covering the damaged area. Tape the perimeter of the patched area.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 32 16

CONCRETE ROOFING TILES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed concrete roofing tiles.

B. Underlayment, eave, valley and ridge protection.

C. Associated metal flashings.

1.02 RELATED SECTIONS

A. Section 061000 - Rough Carpentry.

B. Section 072100 – Thermal and Sound Insulation.

C. Section 076000 - Flashing and Sheet Metal Trim.

D. Section 077123 – Gutters and Downspouts.

1.03 REFERENCES

A. ASTM A641: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

B. ASTM D226: Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

C. ASTM D4869: Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.

D. Steep Roofing Manual, The NRCA Roofing and Waterproofing Manual - Fifth Edition.

E. Chapter 15, California Building Code.

F. IR 15-1 - California State Structural Safety Interpretation of Regulation, Division of the State Architect (DSA).

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in forming concrete roof tiles with minimum five years experience.

B. Installer Qualifications: Company specializing in forming concrete roof tiles with minimum five years experience.

C. Fire Hazard Classification: Minimum Class B as required by Table 15-A, California Building Code.

D. Conform to Section 1507.3, Table 1507.3.7 California Building Code except where exceeded by this specification.

E. Conform to DSA IR 15-1.

F. Installation: Refer to the Tile Roofing Institute Installation Manual for Moderate Climate Regions ICC-ES ESR 2015P.

G. Compliance Reports for Eagle Roofing Products:
1. ICC-ES ESR 1900.
2. City of Los Angeles Research Report #25021.

H. Product Requirements:
1. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for five years.

I. Mock-Up:
1. Provide mock-up as required to demonstrate quality of workmanship.
2. Provide mock-up test panel at least 4 feet square exactly duplicating each different job site condition including tile, attachment, underlayment, sheathing, framing and slope.
3. Mock-up may not remain as part of completed structure.
4. Do not proceed with remaining work until material and workmanship are approved by Architect.
5. Modify mock-up area as required to produce acceptable work.

1.05 SUBMITTALS

A. Product Data:
1. Submit manufacturer's product data for each material and product used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

B. Selection Samples: For each finish product specified, submit samples indicating manufacturer's full range of available colors and patterns.

C. Verification Samples: Submit three representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

D. Manufacturer's storage and installation instructions.

E. Warranty: Submit manufacturer's standard warranty.

F. ICC-ES approval number.

G. Certification that minimum breaking load for tiles shall exceed 350 pounds.

H. Closeout Submittals:

1. Product Documentation.
2. Installation Guide.
3. Warning Labels.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store materials in accordance with manufacturer's instructions. Refer to roof loading guide MC-09 of the Tile Roofing Institute Installation Manual for Moderate Climate Regions ICC-ES ESR 2015P.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Anticipate environmental conditions (temperature, humidity, and ventilation) to schedule work within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. Manufacturer shall warrant the products against manufacturing defects and shall include material and labor to repair or replace defective materials as specified in manufacturer's warranty.
B. Warranty Period - Concrete Roof Tile: Lifetime transferable limited product warranty for concrete roof tile.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer:

1. Eagle Roofing Products - Rialto 2352 N. Locust Ave., Rialto, CA 92377. ASD. Tel: (800) 300-3245. Fax: (909) 854-7181. Web: http://www.eagleroofing.com.

   a. Product: Capistrano "S" Tile

2. Or equal as approved in accordance with Division 01, General Requirements for subsititutions.

B. Roofing Materials:

1. Concrete "S" Tile: Portland Cement, standard weight sand, proprietary additives and mineral oxides, manufacturer's nominal size of 12-3/8 x 17 inches, special sizes to suit valley, ridge, eave and other conditions, colors and premium

custom-blends:

a. The blend is 30% #3521; 30% #3645; 30% SMC8404; and 10% SMC8822.
b. Color blend shall be mixed on the pallets, by the manufacturer, prior to delivery at the site.

C. Decking:

1. Sheathing shall be structured to support the loads required, but not less than nominal 1 inch (25 mm) thick lumber or nominal 15/32 inch (12 mm) thick plywood or other decking material recognized in a code evaluation report or by the local building official.

D. Underlayment:

1. Nominal: One layer of No. 30 asphalt-saturated felt complying with ASTM D-226 Type 11 or ASTM D4869 Type IV, unless noted otherwise.
2. Upgraded Underlayment: Versashield by GAF Corp.
3. Weather Barrier: Composite 60 mil HDPE and rubberized asphalt self adhering weather barrier sheet.
4. Comply with the Tile Roofing Institute Moderate Climate Installation Guide's Table 1A and Table 1B for specific requirements according to roof pitch.

E. Battens:

1. Wood Battens and Nailers: Pressure Treated No. 2 or better, Douglas Fir. Pressure treat in accordance with American Wood Preservers Association Manual of Recommended Practice, "Standard for Preservative Treatment by Pressure Process, All Timber product, C1-61." Comply with "Standard for Water-Borne Preservatives PS-60." Battens may be pressure treated with C2-C per AWPA PS-86, to a minimum retention of 0.45 pounds per cubic foot by assay, per AWPA Standards C2-84.

F. Eave Closure/Riser/Bird Stop: Terracotta color.

G. Flashing Materials:

1. Steel Flashings: ASTM A653/A653M-98; 24 gauge with 1.25 ounces per square feet galvanized coating.

2. Bituminous Paint: Acid and alkali resistant type; black color.

H. Flashing Fabrication:

1. Form sheet metal flashings to profiles required, and to protect roof assembly and shed water.

a. Provide sheet metal valleys, base flashing, counterflashings, vent pipe jacks and crickets.

2. Form sections square, true, and accurate to profile, in maximum possible lengths, free from distortion and other defects detrimental to appearance or performance.

3. Hem exposed edges of flshings minimum ¼ inch on underside.

4. Apply bituminous primer on concealed surfaces of flashings.

I. Tile Fasteners:

1. Corrosive resistant fastener meeting ASTM A641 Class I or approved equal. Number 11 gauge diameter and of sufficient length to penetrate 3/4 inch (19 mm) into or through the thickness of the deck or the batten. Comply with Tile Roofing Institute Moderate Climate Installation Guide Table 1A and 1B.
2. Wind Clips: Galvanized steel 18 gauge by ½ inch, size to suit type of tile.

J. Adhesive/Sealant: One component polyurethane as specified in Section 07 92 00.

K. Mortar Cement: Portland cement, sand, and water to a 1 to 4 mix, pigmented with non-fading mineral oxide to match tile color.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify that roof deck surfaces are dry, sound, flat, and of sufficient thickness to accept fasteners.

B. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

A. Seal roof deck joints wider than 1/16 inch with deck tape.

B. Coordinate installation of roof mounted components, or work projecting or penetrating through roof. Verify roof openings are prepared prior to installing work of this Section.

3.3 INSTALLATION

A. Install according to Tile Roofing Institute Moderate Climate Installation Guide ICC-ES ESR 2015P (TRI Guide).

B. Preparation
1. Seal roof deck joints wider than 1/16 inch with deck tape.
2. Coordinate installation of roof mounted components, or work projecting or penetrating through roof. Verify roof openings are prepared prior to installing work of this Section.

C. Roof Layout: Layout according to TRI Guide MC 07, MC 08, MC 08A, MC 09.

D. Battens: Install according to TRI Guide Table 1, Table 2, Table 3, MC 04 or MC-05, MC 06, MC 06A.

E. Underlayment: Install according to TRI Guide MC 01A, MC 01B and manufacturer's instructions.
1. Apply 4 inch wide band of plastic cement over deck flange of eave edge flashings, and embed an 18 inch wide strip of underlayment. Place underlayment with eave edge flush with face of flashings. Secure in place. Lap ends minimum 6 inches.

2. Apply lap cement at a rate of approximately 1-1/4 gal/square on underlayment starter strip
3. Apply underlayment per NRCA. Starting from eave edge of starter strip, lay additional 36 inch wide strips of underlayment in lap cement, to produce a two ply membrane. Weather lap plies mimimum 19 inches and nail in place. Lap ends minimum 6 inches. Stagger end joints of each consecutive ply.
4. Extend membrane over full area of roof deck.
5. Apply extra layer of underlayment, 36 inches wide, at valleys.

F. Vent Pipes: Install according to TRI Guide MC 02.

G. Eave/Gable: Install according to MC 10, MC 10A, MC 10B, MC 20, MC 20A.

H. Venting: Install according to TRI Guide MC 21, manufacturer's instructions and local code requirements.

I. Hip and Ridge: Install according to TRI Guide MC 18, MC 18A, MC 18B.

J. Rake: Install according to TRI Guide MC 19, MC 19A, MC 19B.

K. Side Wall Flashing: Install according to TRI Guide MC 12, MC 12A, MC 13, MC 13A.

L. Head and Apron Flashing: Install according to TRI Guide MC 11, MC 11A.

M. Gutters: Install according to TRI Guide MC 23.

3.5 TESTING

A. Testing shall conform to Division 01, General Requirements.

END OF SECTION

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes modified bituminous roofing system - hot applied.

1. Scope of Work

a. Attach one Red Rosin and Viking Type II base sheet. Install in hot asphalt StressPly Base Sheet 80. Install StressPly Plus Mineral (LEED) for recycled content in hot asphalt.

b. Install 22 ga Garland 20 year edge and coping metal.

c. Allow for a flash off period and prime roof with All Knight Primer.

d. Apply White Star polyurea Title 24 coating in white gravel (LEED for Reducing Urban Heat Island).

e. Contractors shall submit with their bid proposal ASCE 7-5 wind up lift calculations, building and geographic specific, via a licensed engineer.

f. Complete all roofing field assembly work each day. Phased construction will not be accepted. Blisters, mole runs, moisture or other imperfections in the cap sheet as a result of phased roofing will be repaired during the 5 year contractor warranty.

g. Contractor shall be able to bond for a 5 year labor and materials warranty. Manufacturer will supply Garland 20 leak warranty.

B. Related Sections:

1. Section 06 10 00: Rough Carpentry

2. Section 07 27 19: Plastic Sheet Air Barriers

3. Section 07 41 13: Metal Roof Panels

4. Section 07 60 00: Flashing and Sheet Metal

5. Section 08 45 13: Structured-Polycarbonate-Panel Roof Assembly

1.2 REFERENCES

A. American Society of Civil Engineers (ASCE):

1. ASCE 7-05, Minimum Design Loads for Buildings and Other Structures.

B. American Society for Testing and Materials (ASTM):

1. ASTM D41 Standard Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.

2. ASTM D312 Standard Specification for Asphalt Used in Roofing.

3. ASTM D451 Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.

4. ASTM D1079 Standard Terminology Relating to Roofing, Waterproofing and Bituminous Materials.

5. ASTM D1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

6. ASTM D1863 Standard Specification for Mineral Aggregate Used as a Protective Coating for Roofing.

7. ASTM D2178 Standard Specification for Asphalt Glass Felt Used as a Protective Coating for Roofing.

8. ASTM D2822 Standard Specification for Asphalt Roof Cement.

9. ASTM D2824 Standard Specification for Aluminum-Pigmented Asphalt Roof Coating.

10. ASTM D4601 Standard Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing.

11. ASTM D5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.

12. ASTM D6162 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.

13. ASTM D6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.

14. ASTM E108 Standard Test Methods for Fire Test of Roof Coverings.

C. Factory Mutual Research (FM):

1. Roof Assembly Classifications.

D. National Roofing Contractors Association (NRCA):

1. Roofing and Waterproofing Manual.

E. Underwriters Laboratories, Inc. (UL):

1. Fire Hazard Classifications.

F. Warnock Hersey (WH):

1. Fire Hazard Classifications.

1.3 SUBMITTALS FOR REVIEW

A. Product Data: Provide manufacturer's technical product data for each type of roofing product specified. Include data substantiating that materials comply with specified requirements.

B. Samples: Submit two (2) samples of the following:

1. 1 lb. sample of roofing aggregate for review.

C. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the District.

1.5 SUBMITTALS FOR INFORMATION

A. Manufacturer's Installation Instructions: Submit installation instructions and recommendations indicating special precautions required for installing the membrane.

B. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey or approved third party testing facility in accordance with ASTM E108, Class A for external fire and meets local or nationally recognized building codes.

C. Manufacturer's Certificate: Certify that the roof system is adhered properly to meet or exceed the requirements of FM [1-90].

D. Manufacturer's Certificate: Certify that the roof system furnished is approved or accepted by Factory Mutual Approval Standard 4470.

E. Manufacturer's Certificate: Certify that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.

F. Manufacturer's Certificate: Submit a certified copy of the roofing manufacturer's ISO 9001 compliance certificate.

G. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147.

H. Written certification from the roofing system manufacturer certifying the applicator is currently authorized for the installation of the specified roof system.

I. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-05, Method 2 for Components and Cladding, sealed by a registered professional engineer employed by the system manufacturer as a full-time staff engineer. In no case shall the design loads be taken to be less than those detailed in Design and Performance Criteria article of this specification.

J. Qualification data for firms and individuals identified in Quality Assurance Article below.

1.6 CONTRACT CLOSEOUT SUBMITTALS

A. General: Comply with Requirements of Section 01 77 19.

B. Special Project Warranty: Provide specified warranty for the Project, executed by the authorized agent of the Manufacturer.

C. Roofing Maintenance Instructions. Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.

D. Insurance Certification: Assist District in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

E. Demonstration and Training Schedule: Provide a schedule of proposed dates and times for instruction of District's personnel in the maintenance requirements for completed roofing work. Refer to Part 3 for additional requirements.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with not less than [12] years documented experience [and have ISO 9001 certification].

B. Installer Qualifications: Company specializing in modified bituminous roofing installation with not less than [5] years experience and authorized by roofing system manufacturer as qualified to install manufacturer's roofing materials.

C. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress. Maintain proper supervision of workmen.

D. Maintain a copy of the Contract Documents in the possession of the

Supervisor/Foreman and on the roof at all times.

E. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer.

F. Upon request of the Architect or District, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.

G. Source Quality Control: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001.

1.8 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Roofing Conference: Convene a pre-roofing conference approximately two (2) weeks before scheduled commencement of modified bituminous roofing system installation and associated work.

B. Require attendance of installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing that shall precede or follow roofing work (including mechanical work if any), Architect, District, roofing system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) District's insurers, testing agencies and governing authorities. Objectives of conference include:

1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.

2. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.

3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.

4. Review roofing system requirements (drawings, specifications and other contract documents).

5. Review required submittals both completed and yet to be completed.

6. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

7. Review required inspection, testing, certifying and material usage accounting procedures.

8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not mandatory requirement).

9. Record discussion of conference including decisions and agreements (or disagreements) reached and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

10. Review notification procedures for weather or non-working days.

C. The District's Representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.

D. The intent of the conference is to resolve issues affecting the installation and performance of roofing work. Do not proceed with roofing work until such issues are resolved to the satisfaction of the District and Architect of Record. This shall not be construed as interference with the progress of Work on the part of the District or Architect of Record.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.

B. Store and handle roofing sheets in a dry, well-ventilated, weather-tight place to prevent moisture exposure. Store rolls of felt and other sheet materials on pallets or other raised surface. Stand all roll materials on end. Cover roll goods with a canvas tarpaulin or other breathable material (not polyethylene).

C. Do not leave unused materials on the roof overnight or when roofing work is not in progress unless protected from weather and other moisture sources.

D. Secure all material and equipment on the job site. If any material or equipment is stored on the roof, assure that the integrity of the deck is not compromised at any time. Damage to the deck caused by the Contractor's actions will be the sole responsibility of the Contractor, and the deck will be repaired or replaced at his expense.

1.10 MANUFACTURER'S INSPECTIONS

A. When the Project is in progress, the roofing system manufacturer will provide the following:

1. Report progress and quality of the work as observed.

2. Provide daily job site inspections.

3. Report to the District in writing any failure or refusal of the Contractor to correct

unacceptable practices called to the Contractor's attention.

4. Confirm after completion that manufacturer has observed no application procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.11 PROJECT CONDITIONS

A. Proceed with roofing work only when existing and forecasted weather conditions will permit a unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.

B. Do not apply roofing insulation or membrane to damp deck surface.

C. Do not expose materials subject to water or solar damage in quantities greater than can be weatherproofed during same day.

D. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank one (1) inch cap nails, or screws and plates at a rate of one (1) fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 ft o.c. for slopes less than 3:12 and four (4) ft o.c. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install four (4) additional fasteners at the upper edge of the membrane when strapping the plies.

1.12 SEQUENCING AND SCHEDULING

A. Sequence installation of roofing with related units of work specified in other Sections to ensure that roof assemblies, including roof accessories, flashing, trim and joint sealers, are protected against damage from effects of weather, corrosion and adjacent construction activity.

B. Complete all roofing field assembly work each day. Phased construction will not be accepted. Blisters, mole runs, moisture or other imperfections in the cap sheet as a result of phased roofing will be repaired during the 5 year contractor warranty.

1.13 WARRANTY

A. Upon completion of installation, and acceptance by the District and Architect, the Manufacturer will supply to the District the a twenty year leak warranty.

B. Installer will submit a 5 year warranty to the membrane manufacturer with a copy directly to District.

1.14 DESIGN AND PERFORMANCE CRITERIA

A. Uniform Wind Uplift Load Capacity: per completed ASCE 7-5 Wind up lift calculations.

PART 2 PRODUCTS

2.1 PRODUCTS, GENERAL

A. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

2.2 ACCEPTABLE MANUFACTURERS

A. The design is based upon roofing systems engineered and manufactured by The Garland Company, or Pasadena Unified School District approved equal.

The Garland Company
3800 East 91st Street
Cleveland, Ohio 44105
Col. Sean Magee
Telephone: (310) 420-0713
Email: smagee@garlandind.com

2.3 DESCRIPTION

A. Modified bituminous roofing work including but not limited to:

1. One ply of Garland StressBase 80 base sheet bonded to the prepared substrate with bitumen.

2. Hot Bitumen: ASTM D312, Type IV special steep asphalt having the following characteristics:

   a. Softening Point 210°F - 225°F

   b. Flash Point 500°F

   c. Penetration @ 77°F 15-25 units

   d. Ductility @ 77°F 1.5 cm

3. Base Flashing Ply: One (1) ply of 80 mil Stress Base SBS base flashing ply covered by an additional layer of modified bitumen membrane and set in bitumen.

4. Modified Membrane: STRESSPLY PLUS FR MINERAL - Environmentally Friendly; 145 mil SBS (Styrene-Butylene-Styrene) mineral surfaced, rubber modified roofing membrane incorporating recycled rubber, fire retardant characteristics and reinforced with a fiberglass and polyester composite scrim.

5. White Star single component aliphatic polyurea and 3/8 white aggregate

6. Hot Surfacing Bitumen: ASTM D312, Type IV special steep asphalt having the following characteristics:

   a. Softening Point 210°F - 225°F

   b. Flash Point 500°F

   c. Penetration @ 77°F 15-25 units

   d. Ductility @ 77°F 1.5 cm

2.4 BITUMINOUS MATERIALS

A. Asphalt Primer: Garla Prime Water Based and All Knight Primer V.O.C. compliant, ASTM D41.

B. Asphalt Roofing Mastic: Green Lock Flashing Adhesive V.O.C. free.

C. Interply Adhesive: ASTM D312, Type IV Hot Asphalt.

2.5 SHEET MATERIALS

A. Base Ply (Viking Type II Base Sheet) and (StressBase 80 Sheet): Fiberglass scrim with the following minimum performance requirements according to ASTM D5147. Properties (Finished Membrane):

1. Tensile Strength (ASTM D2523)

   a. 2 in/min. @ 73.4 ± 3.6°F MD 100 lbf/in CMD 100 lbf/in

   b. 50mm/min. @ 23 ± 3°C MD 39 kN/m CMD 39 kN/m

2. Tear Strength (ASTM D4073)

   a. 2 in/min. @ 73.4 ± 3.6°F MD 110 lbf CMD 110 lbf

   b. 50mm/min. @ 23 ± 3°C MD 1335 N CMD 1335 N

3. Elongation at Maximum Tensile (ASTM D2523)

   a. 2 in/min. @ 73.4 ± 3.6°F MD 2.5 % CMD 2.5 %

   b. 50mm/min@ 23 ± 3°C MD 2.5 % CMD 2.5 %

B. Base Flashing Ply (StressBase 80 Sheet): Fiberglass scrim with the following minimum performance requirements according to ASTM D5147. Properties (Finished Membrane):

1. Tensile Strength (ASTM D2523)

    a. 2 in/min. @ 73.4 ± 3.6°F MD 100 lbf/in CMD 100 lbf/in

    b. 50mm/min. @ 23 ± 3°C MD 39 kN/m CMD 39 kN/m

2. Tear Strength (ASTM D4073)

    a. 2 in/min. @ 73.4 ± 3.6°F MD 110 lbf CMD 110 lbf

    b. 50mm/min. @ 23 ± 3°C MD 1335 N CMD 1335 N

3. Elongation at Maximum Tensile (ASTM D2523)

    a. 2 in/min. @ 73.4 ± 3.6°F MD 2.5 % CMD 2.5 %

    b. 50mm/min@ 23 ± 3°C MD 2.5 % CMD 2.5 %

C. Modified Flashing Ply:

1. STRESSPLY PLUS FR MINERAL

D. Modified Membrane Properties (Finished Membranes): STRESSPLY PLUS FR MINERAL; ASTM D6163, Type III Grade G

1. Tensile Strength (ASTM D5147)

    a. 2 in/min. @ 73.4 ± 3.6°F MD 310 lbf/in CMD 310 lbf/in

    b. 50 mm/min. @ 23 ± 3°C MD 54.2 kN/m CMD 54.2 kN/m

2. Tear Strength (ASTM D5147)

    a. 2 in/min. @ 73.4 ± 3.6°F MD 500 lbf CMD 500 lbf

    b. 50 mm/min. @ 23 ± 3°C MD 2224 N CMD 2224 N

3. Elongation at Maximum Tensile (ASTM D5147)

    a. 2 in/min. @ 73.4 ± 3.6°F MD 3.5% CMD 3.5%

    b. 50 mm/min. @ 23 ± 3°C MD 3.5% CMD 3.5%

4. Low Temperature Flexibility (ASTM D5147): Passes -30°F (-34°C)

E. Modified Membrane Properties (Finished Membranes): BIFLEX; ASTM D6163, Type I Grade S

1. Tensile Strength (ASTM D2523)

a. 2 in/min. @ 73.4 ± 3.6°F MD 100 lbf/in CMD 100 lbf/in

b. 50mm/min. @ 23 ± 3°C MD 39 kN/m CMD 39 kN/m

2. Tear Strength (ASTM D4073)

a. 2 in/min. @ 73.4 ± 3.6°F MD 110 lbf CMD 110 lbf

b. 50mm/min. @ 23 ± 3°C MD 1335 N CMD 1335 N

3. Elongation at Maximum Tensile (ASTM D2523)

a. 2 in/min. @ 73.4 ± 3.6°F MD 2.5 % CMD 2.5 %

b. 50mm/min@ 23 ± 3°C MD 2.5 % CMD 2.5 %

4. Low Temperature Flexibility (ASTM D5147): Passes -20 °F (-28.8 °C)

2.6 SURFACINGS

A. White Star single component polyurea;

1. Flash Point 120°F min.

2. SRI 112

3. Roofing Aggregate: 3/8 inch aggregate.

a. White

2.7 RELATED MATERIALS

A. Roof Insulation: In accordance with Section 07 21 00.

B. Roof Insulation Fasteners: In accordance with Section 07 21 00.

C. Base Sheet: ASTM D4601, Garland Viking Type II;

D. Nails and Fasteners: Non-ferrous metal or galvanized steel, except that hard copper nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel. Fasteners shall be self-clinching type of penetrating type as recommended by the manufacturer of the deck material. Nails and fasteners shall be flush-driven through flat metal discs of not less than one (1) inch diameter. Omit metal discs when one-piece composite nails or fasteners with heads not less than one (1) inch diameter are used.

E. Metal Discs: Flat discs or caps of zinc-coated sheet metal not lighter than twenty eight (28) gauge and not less than one (1) inch in diameter. Form discs to prevent dishing.

Bell or cup shaped caps are not acceptable.

F. Walkway Pads: Factory formed recycled rubber, nonporous, with a slip-resisting surface texture, manufactured specifically for adhering to modified bituminous membrane roofing as a protection course for foot traffic, of the following thickness:

1. ¾" thick for use in high traffic areas

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

a. Supplied by membrane manufacturer.

G. Walkway Pad Adhesive: Adhesive used to adhere approved walk way pads as recommended and furnished by the membrane manufacturer

H. Rust Inhibitive Paint: As recommended and furnished by the membrane manufacturer for mechanical units and other metal surfaces to control and prevent surface rust.

I. Sealant: Green Lock Structural Adhesive Single component, 100% solids structural adhesive as furnished and recommended by the membrane manufacturer.

1. Elongation (ASTM D412) 300%

2. Hardness, Shore A (ASTM C920) 50

3. Shear Strength (ASTM D1002) 300 psi

J. Butyl Tape: 100% solids, asbestos free and compressive tape designed to seal as recommended and furnished by the membrane manufacturer.

K. Glass Fiber Cant: Continuous triangular cross Section made of inorganic fibrous glass used as a cant strip as recommended and furnished by the membrane manufacturer.

L. Flashing Boot: Neoprene pipe boot for sealing single or multiple pipe penetrations adhered in approved adhesives as recommended and furnished by the membrane manufacturer.

M. Vents and Breathers: Heavy gauge aluminum and fully insulated vent that allows moisture and air to escape but not enter the roof system as recommended and furnished by the membrane manufacturer.

N. Roof Drains: Drain system as recommended and furnished by the membrane manufacturer.

O. Sky Light Protection System: Compression mounted skylight protection system that meets OSHA requirements for skylights as recommended and furnished by the membrane manufacturer.

P. Drain Flashings should be 4lb (1.8kg) sheet lead formed and rolled

Q. Plumbing stacks should be 4lb (1.8kg) sheet lead formed and rolled.

PART 3 EXECUTION

3.1 NOT USED

3.2 EXAMINATION

A. Verify that deck surfaces and project conditions are ready to receive work of this Section.

B. Verify that deck is supported and secured to structural members.

C. Verify that deck is clean and smooth, free of depressions, projections or ripples, and is properly sloped to drains, valleys, or eaves.

D. Verify that adjacent roof substrate components do not vary more than [¼] inch in height.

E. Verify that deck surfaces are dry.

F. Verify that insulation is attached per ASCE 7-5 wind up lift calculations.

G. Confirm that moisture content does not exceed [twelve (12)] percent by moisture meter tests. On concrete deck pour hot asphalt on to deck if it bubbles / foams and once cooled does not adhere to the substrate, the moisture levels are too high.

H. Verify that openings, curbs, pipes, conduit, sleeves, ducts, and other items which penetrate the roof are set solidly, and that [wood cant strips] [wood nailing strips] [and reglets] are set in place.

3.3 NOT USED

3.4 GENERAL INSTALLATION REQUIREMENTS

A. Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing the roof system.

B. Insurance/Code Compliance: Where required by code, install and test the roofing system to comply with governing regulation and specified insurance requirements.

C. Protect other work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of the coal tar modified bituminous roofing system.

D. Coordinate installation of roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight. Provide cut-offs at end of each day's work to cover exposed ply sheets and insulation with two (2) plies of #15 organic roofing felt set in full moppings of bitumen and with joints and edges sealed with

roofing cement. Remove cut-offs immediately before resuming work.

E. Asphalt Bitumen Heating: Heat and apply bitumen in accordance with the Equiviscous Temperature (EVT) Method as recommended by National Roofing Contractors Association (NRCA). Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 5°F at point of application) more than one (1) hour prior to time of application. Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either from information by manufacturer or by suitable test. Do not exceed recommended temperature limits during bitumen heating. Do not heat to a temperature higher than twenty five degrees (25°F) below flash point. Discard bitumen that has been held at temperature exceeding Finishing Blowing Temperature (FBT) for more than three (3) hours. Keep kettle lid closed except when adding bitumen.

F. Asphalt Bitumen Mopping Rate:

1. Interply Mopping: Apply bitumen at the rate of approximately twenty five (25) lb.(11.3kg) of bitumen per roof square.

2. Modified Membrane Mopping: Apply bitumen at the rate of approximately thirty (30) lb (13.6kg). of bitumen per roof square.

3. Flood Coat: Apply bitumen at the rate of approximately sixty (60) to seventy (70) lb.(27-31kg) of bitumen per square (plus or minus twenty five (25) percent on a total job average basis).

G. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

H. Apply roofing materials as specified by manufacturer's instructions.

1. Keep roofing materials dry before and during application.

2. Do not permit phased construction.

3. Complete application of roofing plies, modified sheet and flashing in a continuous operation.

4. Begin and apply only as much roofing in one day as can be completed that same day.

I. Cut-Offs (Waterstops): At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and insulation. Provide temporary covering of two (2) plies of #15 organic roofing felt set in full moppings of bitumen with joints and edges sealed.

J. Broadcast minerals into the bleed out of bitumen while bitumen is at its recommended EVT temperature to achieve uniform color throughout.

3.5 NOT USED

3.6 NOT USED

3.7 BASE PLY INSTALLATION

A. Fiberglass/Polyester Plies: Install (1) Viking Bases Sheet Fiberglass/Polyester/Fiberglass base sheets in twenty five (25) lbs (11.3kg) per square of bitumen shingled uniformly to achieve one ply over the entire prepared substrate. Shingle in direction of slope of roof to shed water on each area of roof. Do not step on base rolls until asphalt has cooled, fish mouths should be cut and patched.

B. Lap ply sheet ends eight (8) inches (203mm). Stagger end laps twelve (12) inches (304mm) minimum

C. Extend plies two (2) inches (50mm) beyond top edges of cants at wall and roof projections and equipment bases.

D. Install base flashing ply to all perimeter and projection details after membrane application.

3.8 MODIFIED MEMBRANE APPLICATION

A. Solidly bond the modified membrane to the base layers with specified asphalt at the rate of twenty five (25) to thirty (30) lbs. (11-13kg) per 100 square feet.

B. The modified membrane roll shall push a puddle of asphalt in front of it with asphalt slightly visible at all side laps. Exercise care during application to eliminate air entrapment under the membrane.

C. Apply pressure to all seams to ensure that the laps are solidly bonded to substrate.

D. Install subsequent rolls of modified membrane across the roof as above with a minimum of four (4) inch (101mm) side laps and eight (8) inch (203mm) end laps. Stagger the end laps. Apply the modified membrane in the same direction as the previous layers but stagger the laps so they do not coincide with the laps of the base layers.

E. Apply asphalt no more than five (5) feet (1.5m) ahead of each roll being embedded.

F. Extend membrane two (2) inches (50mm) beyond top edge of all cants in full moppings of the specified asphalt [as shown on the drawings].

3.9 FLASHING MEMBRANE INSTALLATION

A. Seal all curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.

B. Prepare all walls, penetrations, expansion joints [and where shown on the drawings] to be flashed with asphalt primer at the rate of one hundred (100) square feet per gallon.

Allow primer to dry tack free.

C. Use the modified membrane as the flashing membrane. Adhere to the underlying base flashing ply with specified asphalt unless otherwise noted in these specifications. Nail off at a minimum of eight (8) inches o.c. from the finished roof at all vertical surfaces.

D. Solidly adhere the entire sheet of flashing membrane to the substrate.

E. Seal all vertical laps of flashing membrane with a three-course application of trowel-grade mastic and fiberglass mesh.

F. Coordinate counter flashing, cap flashings, expansion joints, and similar work with modified bitumen roofing work [as specified in other Sections].

G. Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work [as specified in other Sections].

H. Metal Edge [Detail No. MBH-10]:

1. Inspect the nailer to assure proper attachment and configuration.

2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at eight (8) inches o.c.

3. Install continuous cleat and fasten at six (6) inches o.c.

4. Install new metal edge hooked to continuous cleat and set in bed of roof cement. Fasten flange to wood nailer every three (3) inches o.c. staggered.

5. Prime metal edge at a rate of one hundred (100) square feet per gallon and allow to dry.

6. Strip in flange with base flashing ply covering entire flange in bitumen with six (6) inches on to the field of roof. Assure ply laps do not coincide with metal laps.

7. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof.

I. Raised Metal Edge [Detail No. MBH-11]:

1. Inspect the nailer to assure proper attachment and configuration.

2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at eight (8) inches o.c.

3. Install continuous cleat and fasten at six (6) inches o.c.

4. Install new metal edge hooked to continuous cleat and set in bed of roof cement.

Fasten flange to wood nailer every three (3) inches o.c. staggered.

5. Prime metal edge at a rate of one hundred (100) square feet per gallon and allow to dry.

6. Strip in flange with base flashing ply covering entire flange in bitumen with six (6) inches on to the field of roof. Assure ply laps do not coincide with metal laps.

7. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof.

J. Raised Metal Edge Cap [Detail No. MBH-12]:

1. Inspect the nailer to assure proper attachment and configuration.

2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at eight (8) inches o.c.

3. Install continuous cleat and fasten at six (6) inches o.c.

4. Strip in cant dam with base flashing ply covering entire vertical area in bitumen with six (6) inches on to the field of the roof. Assure ply laps do not coincide with metal laps.

5. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof.

6. Install new metal edge hooked to continuous cleat and set in bed of roof cement.

7. Attach metal edge with approved fasteners and neoprene washers at eight (8) o.c.

K. Roof Edge With Gutter [Detail No. MBH-13]:

1. Inspect the nailer to assure proper attachment and configuration. Increase slope at metal edge by additional degree of slope in first board.

2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at eight (8) inches o.c.

3. Install gutter and strapping.

4. Install continuous cleat and fasten at six (6) inches o.c.

5. Install new metal edge hooked to continuous cleat and set in bed of roof cement. Fasten flange to wood nailer every three (3) inches o.c. staggered.

6. Prime metal edge at a rate of one hundred (100) square feet per gallon and allow to dry.

7. Strip in flange with base flashing ply covering entire flange in bitumen with six (6) inches onto the field of the roof. Assure ply laps do not coincide with metal laps.

8. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof.

L. Scupper Through Roof Edge [Detail No. MBH-14]:

1. Inspect the nailer to assure proper attachment and configuration.

2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at eight (8) inches o.c.

3. Install a scupper box in a ¼ inch (6mm) bed of mastic. Assure all box seams are soldered and have a minimum four (4) inch flange. Make sure all corners are closed and soldered. Prime scupper at a rate of one hundred (100) square feet per gallon and allow to dry.

4. Fasten flange of scupper box to nailer every three (3) inches o.c. staggered.

5. Strip in edge with base flashing ply covering entire area in bitumen with six (6) inches on to the field of the roof.

6. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all seams.

M. Scupper Through Wall [Detail No. MBH-15]:

1. Inspect the nailer to assure proper attachment and configuration.

2. Run one ply over nailer, into scupper hole and up flashing as in typical wall flashing detail. Assure coverage of all wood nailers.

3. Install a scupper box in a ¼ inch (6mm) bed of mastic. Assure all box seams are soldered and have a minimum four (4) inch flange. Make sure all corners are closed and soldered. Prime scupper at a rate of one hundred (100) square feet per gallon and allow to dry.

4. Fasten flange of scupper box every three (3) inches o.c. staggered.

5. Strip in flange of scupper box with base flashing ply covering entire area with six (6) inch overlap on to the field of the roof and wall flashing.

6. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all seams.

N. Scupper Through Wall (Overflow) [Detail No. MBH-16]:

1. Inspect the nailer to assure proper attachment and configuration.

2. Run one ply over nailer up the overflow, into the scupper hole and up flashing as in typical wall flashing detail. Assure coverage of all wood nailers.

3. Install scupper box in a ¼ inch (6mm) bed of mastic. Assure all box seams are soldered and have a minimum four (4) inch flange. Make sure all corners are closed and soldered. Prime scupper at a rate of one hundred (100) square feet per gallon and allow to dry.

4. Fasten flange of scupper box every three (3) inches o.c. staggered.

5. Strip in flange scupper box with base flashing ply covering entire area with six (6) inch overlap on to the field of the roof and wall flashing.

6. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all seams.

O. Coping Cap [Detail No. MBH-20]:

1. Minimum flashing height is eight (8) inches. Maximum flashing height is twenty four (24) inches. Prime vertical wall at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Attach tapered board to top of wall.

4. Install base flashing ply covering entire wall and wrapped over top of wall and down face with six (6) inches on to field of roof and set in hot asphalt. Nail membrane at eight (8) inches o.c.

5. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all seams and allow to cure and aluminize.

6. Install continuous cleat and fasten at six (6) inches o.c. to outside wall.

7. Install new metal coping cap hooked to continuous cleat.

8. Fasten inside cap twenty four (24) inches o.c. with approved fasteners and neoprene washers through slotted holes which allow for expansion and contraction.

P. Surface Mounted Counterflashing/Coping Cap [Detail No. MBH-21]:

1. Minimum flashing height is eight (8) inches. Prime vertical wall at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering wall set in bitumen with six (6) inches on to field of roof.

4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all seams and allow to cure and aluminize.

5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall.

6. Secure counterflashing set on butyl tape above flashing. Fasten eight (8) inches o.c. and caulk top of counterflashing.

7. Attach tapered board to top of wall (minimum slope ¼ -12)(Do not use organic fiberboard or perlite).

8. Cover tapered board and all exposed wood with base flashing ply. Fasten inside and out at eight (8) inches o.c.

9. Install continuous cleat and fasten at six (6) inches o.c. to outside wall.

10. Install new metal coping cap hooked to continuous cleat.

11. Fasten inside of cap twenty four (24) inches o.c. with approved fasteners and neoprene washers.

Q. Surface Mounted Counterflashing [Detail No. MBH-22]:

1. Minimum flashing height is eight (8) inches. Maximum flashing height is twenty four (24) inches. Prime vertical wall at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering wall set in bitumen with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall.

6. Secure counterflashing set on butyl tape above flashing at eight (8) inches o.c. and caulk top of counterflashing.

R. Reglet Mounted Counterflashing [Detail No. MBH-23]:

1. Minimum flashing height is eight (8) inches. Maximum flashing height is twenty four (24) inches. Prime vertical wall at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering wall set in bitumen with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall.

6. Cut reglet in masonry one joint above flashing.

7. Secure reglet counterflashing with expansion fasteners and caulk reglet opening.

S. Through Wall Counterflashing [Detail No. MBH-24]:

1. Minimum flashing height is eight (8) inches. Prime vertical wall at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering wall with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall at eight (8) inches o.c.

6. Install counterflashing in through wall reglet.

T. Base Flashing For Non-Supported Deck [Detail No. MBH-25]:

1. Inspect the nailer to assure proper attachment and configuration. The wood cant strip should be mechanically attached to the vertical and horizontal wood nailers.

2. Install compressible insulation in neoprene cradle between wall and vertical

wood nailer.

3. Prime vertical wall at a rate of one hundred (100) square feet per gallon and allow to dry.

4. Install base flashing ply covering entire wall and wrapped to top of wood nailer with six (6) inches on to field of the roof. Nail membrane at eight (8) inches o.c.

5. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

6. Attach counterflashing through wall flashing at a spacing of twenty four (24) inches o.c.

U. Expansion Joint [Detail No. MBH-30]:

1. Minimum curb height is eight (8) inches. Chamfer top of curb. Prime vertical curb at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Mechanically attach wood cant to expansion joint nailers. Run all field plies over cant a minimum of two (2) inches.

3. Install compressible insulation in neoprene cradle.

4. Install base flashing ply covering curb set in bitumen with six (6) inches on to field of the roof.

5. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Attach top of membrane to top of curb and nail at eight (8) inches o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

6. Install pre-manufactured expansion joint cover. Fasten sides at twelve (12) inches o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between metal covers.

V. Area Divider [Detail No. MBH-31]:

1. Minimum curb height is eight (8) inches. Prime vertical curb at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over a cant a minimum of two (2) inches.

3. Install base flashing ply covering curb set in bitumen with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Attach top of membrane to top of curb

and nail at eight (8) inches o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

5. Install pre-manufactured cover. Fasten sides at twenty four (24) inches o.c. with fasteners and neoprene washers through slotted holes. Furnish all joint cover laps with butyl tape between metal covers.

W. Equipment Support [Detail No. MBH-32]:

1. Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering curb set in bitumen with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Attach top of membrane to top of curb and nail at eight (8) inches o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

5. Install pre-manufactured cover. Fasten sides at twenty four (24) inches o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between metal covers.

6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

X. Curb Detail/Air Handling Station [Detail No. MBH-33]:

1. Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering curb set in bitumen with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

5. Install pre-manufactured counterflashing with fasteners and neoprene washers or per manufacturer's recommendations.

6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

Y. Skylight [Detail No. MBH-34]:

1. Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering curb set in bitumen with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Attach top of membrane to top of wood nailer and apply a three-course application of mastic and mesh. Allow to cure and aluminize.

5. Install pre-manufactured lens and fasten flashing sides at eight (8) inches o.c. with fasteners and neoprene washers.

Z. Skylight With Protection Screen [Detail No. MBH-34b]:

1. Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering curb set in bitumen with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Attach top of membrane to top of wood nailer and apply a three-course application of mastic and mesh. Allow to cure and aluminize.

5. Install pre-manufactured lens and fasten flashing sides at eight (8) inches o.c. with fasteners and neoprene washers.

6. Install OSHA compliant, compression mounted skylight protection screen per membranes manufacturer's written instructions.

AA. Pre-manufactured Curb For Equipment Support [Detail No. MBH-35]:

1. Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Run all field plies over cant of the pre-manufactured equipment support a minimum of two (2) inches.

3. Install base flashing ply covering pre-manufactured curb with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply installed over the base flashing ply, nine (9) inches on to field of the roof. Attach top of membrane to top of wood curb and nail at eight (8) inches o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

5. Install pre-manufactured cover. Fasten sides at twenty four (24) inches o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between metal covers.

6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

BB. Exhaust Fan [Detail No. MBH-36]:

1. Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering curb with six (6) inches on to field of the roof.

4. Install a second ply of modified flashing ply installed over the base flashing ply, nine (9) inches on to field of the roof. Attach top of membrane to top of wood curb and nail at eight (8) inches o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

5. Install metal exhaust fan over the wood nailers and flashing to act as counterflashing. Fasten per manufacturer's recommendation.

CC. Passive Vent/Air Intake [Detail No. MBH-37]:

1. Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

2. Set cant in bitumen. Run all plies over cant a minimum of two (2) inches.

3. Install base flashing ply covering curb with six (6) inches on to the field of the roof.

4. Install a second ply of modified flashing ply installed over the base flashing ply, nine (9) inches on to field of the roof. Attach top of membrane to top of wood curb and nail at eight (8) inches o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

5. Install passive vent/air intake over the wood nailers and flashing to act as counterflashing. Fasten per manufacturers recommendations.

DD. Roof Drain [Detail No. MBH-40]:

1. Plug drain to prevent debris from entering plumbing.

2. Taper insulation to drain minimum of twenty four (24) inches from center of drain.

3. Run roof system plies over drain. Cut out plies inside drain bowl.

4. Set lead/copper flashing (thirty (30) inch square minimum) in (¼) inch bed of mastic. Run lead/copper into drain a minimum of two (2) inches. Prime lead/copper at a rate of one hundred (100) square feet per gallon and allow to dry.

5. Install base flashing ply (forty (40) inch square minimum) in bitumen.

6. Install modified membrane (forty eight (48) inch square minimum) in bitumen.

7. Install clamping ring and assure that all plies are under the clamping ring.

8. Remove drain plug and install strainer.

EE. Plumbing Stack [Detail No. MBH-50]:

1. Minimum stack height is twelve (12) inches.

2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.

3. Prime flange of new sleeve. Install properly sized sleeves set in (¼) inch bed of roof cement.

4. Install base flashing ply in bitumen.

5. Install membrane in bitumen.

6. Caulk the intersection of the membrane with elastomeric sealant.

7. Turn sleeve a minimum of one (1) inch down inside of stack.

FF. Heat Stack [Detail No. MBH-51]:

1. Minimum stack height is twelve (12) inches.

2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.

3. Prime flange of new sleeve. Install properly sized sleeves set in (¼) inch bed of roof cement.

4. Install base flashing ply in bitumen.

5. Install modified membrane in bitumen.

6. Caulk the intersection of the membrane with elastomeric sealant.

7. Install new collar over cape. Weld collar or install stainless steel draw brand.

3.10 APPLICATION OF SURFACING

A. Aggregate Surfacing:

1. Apply surfacing materials in the quantities specified (two hundred (200) lbs. per square for aggregate. Follow White Star data sheet instructions to ensure proper application.

B. Reflective Coating:

1. Follow manufactures instructions and data sheets for application of White Star. Application rate is approximately 2 gallons per square.

3.11 FIELD QUALITY CONTROL

A. Perform field inspection and [and testing] as required.

B. Correct defects or irregularities discovered during field inspection.

C. Require attendance of roofing [and insulation] materials manufacturers' representatives at site during installation of the roofing system. A copy of the specification should also be on site at all times.

3.12 CLEANING

A. Remove bitumen adhesive drippings from all walls, windows, floors, ladders and finished surfaces.

B. In areas where finished surfaces are soiled by asphalt or any other sources of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning instructions and conform to their instructions.

C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.13 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during roofing procedures. Comply with requirements of authorities having jurisdiction.

3.14 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with Contractor,

Architect, installer, installer of associated work, District, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

C. The roofing system manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the [Roofing] Contractor.

D. If core cuts verify the presence of damp or wet materials, the [Roofing] Contractor shall be required to replace the damaged areas at his own expense.

E. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

F. Notify the Architect and District upon completion of corrections.

G. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

H. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty four (24) hours, the District will exercise rights to correct the Work under the terms of the Conditions of the Contract.

3.15 DEMONSTRATION AND TRAINING

A. At a time and date agreed to by the District, instruct the District's facility manager, or other representative designated by the District, on the following procedures:

1. Roof troubleshooting procedures.

2. Notification procedures for reporting leaks or other apparent roofing problems.

3. Roofing maintenance.

4. The District's obligations for maintaining the roofing warranty in effect and force.

5. The Manufacturer's obligations for maintaining the roofing warranty in effect and force.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flashings and sheet metal associated with roofing not specifically described in other sections, but required to prevent penetration of water through exterior shell of the building.

2. Garland R-mer Edge Coping, flashing, Fascia, and Termination system or Tremco TremLock System.

   a. Comply with code and testing requirements for ANSI/SPRI ES1 for installation.

   b. Provide all labor, equipment, and materials to fabricate and install the following.

      1. Edge strip and flashing.

      2. Fascia and trim.

      3. Coping cap at parapets.

      4. Fascia and edge metal.

      5. Gutters and down spouts.

B. Related Sections:

1. Section 06 10 00: Rough Carpentry

2. Section 07 32 16: Concrete Roofing Tiles

3. Section 07 92 00: Joint Sealants

1.2 QUALITY ASSURANCE

A. Materials shall conform to the following:

1. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

2. ASTM A361 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Roofing and Siding.

3. ASTM A446 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

4. ASTM A 653 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

5. ASTM A792 Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process.

6. ASTM B32 - Standard Specification for Solder Metal.

7. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

8. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

9. ASTM B 370 - Copper Sheet and Strip for Building Construction.

10. ASTM B 749 - Lead and Lead Alloy Sheet, Strip and Plate Products.

11. "Architectural Sheet Metal Manual," published by SMACNA.

12. American National Standards Institute and Single Ply Roofing Institute (ANSI/SPRI)

    a. ANSI/SPRI ES-1 Testing and Certification Listing of Shop Fabricated Edge Metal

13. Warnock Hersey International, Inc., Middleton, WI (WH)

14. Factory Mutual Research Corporation (FMRC)

15. Underwriters Laboratories (UL)

16. National Roofing Contractors Association (NRCA)

    a. Roofing and Waterproofing Manual

17. American Society of Civil Engineers (ASCE)

    a. ASCE 7-05 Minimum Design Loads for Buildings and Other Structures.

B. Installer's Qualifications: At least five years of successful experience on projects with work similar to that required for this project.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with Section 01 33 00.

B. Shop Drawings: Submit shop drawings showing the configuration, thickness of the materials, methods of joining, reinforcement and anchorage features of all sheet metal work, and details showing the Work of this Section incorporated into the construction.

1. Provide complete details of concealed joints.

2. Provide isometric details of corners, end conditions and coping intersections.

C. Edge Coping, flashing, Fascia, and Termination System

1. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the District.

D. Design Loads: Any material submitted as equal to the specified material must be accompanied by a report signed and sealed by a professional engineer licensed in the state in which the installation is to take place. This report shall show that the submitted equal meets the wind uplift and perimeter attachment requirements according to ASCE 7-05 and ANSI/SPRI ES-1. Substitution requests submitted without licensed engineer approval will be rejected for non-conformance.

E. A letter from an officer of the manufacturing company certifying that the materials furnished for this project are the same as represented in tests and supporting data.

F. Mill production reports certifying that the steel thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.

G. Certification of work progress inspection. Refer to Article 3.5.

H. Certifications:

1. Submit roof manufacturer's certification that metal fasteners furnished are acceptable to roof manufacturer.

2. Submit roof manufacturer's certification that metal furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

1.4 DESIGN REQUIREMENTS

A. Sheet Metal Flashings: Conform to the criteria of SMACNA "Architectural Sheet Metal Manual."

B. Edge Coping, flashing, Fascia, and Termination System

1. Thermal expansion and contraction:

a. Completed metal edge flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

2. ANSI/SPRI ES1

a. Termination and flashing system installed per ANSI/SPRI ES1 testing and code requirements.

1.5 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01 66 00.

B. Protect sheet metal materials before, during and after installation.

C. Protect the installed work of other trades. Do not install bent or damaged materials.

1.5 COORDINATION

A. Comply with provisions of Section 01 31 19.

B. The Work under this Section to be built into or connected with roofing work shall be coordinated so that all connections, flashings and like items will provide a watertight installation.

1.6 GUARANTEE

A. Materials and workmanship shall be guaranteed in accordance with the requirements of the General Conditions, for a period of two (2) years.

1.7 WARRANTIES: EDGE COPING, FLASHING, FASCIA, AND TERMINATION SYSTEM

A. District shall receive one (1) warranty from manufacturer of roofing materials covering all of the following criteria. Multiple warranties are not acceptable.

1. Pre-finished metal material shall require a written twenty (20)-year non-prorated warranty covering fade, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D2244 or chalking excess of 8 units per ASTM D659. If either occurs material shall be replaced per warranty, at no cost to the District.

2. Changes: Changes or alterations in the edge metal system without prior written consent from the manufacturer shall render the system unacceptable for a warranty.

3. Warranty shall commence on date of substantial completion or final payment, whichever is agreed by contract.

4. The Contractor shall provide the District with a written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of five years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop, and make good any damage to other work or equipment caused by such leaks or the repairs thereof.

5. Installing roofing contractor shall be responsible for the installation of the edge metal system in general accordance with the membrane manufacturer's recommendations.

6. Installing contractor shall certify that the edge metal system has been installed per the manufacturer's printed details and specifications.

7. One manufacturer shall provide a single warranty for all accessory metal for flashings, metal edges and copings, along with the warranty for metal roof areas, membrane roof areas, and any transitions between two different material types.

PART 2 PRODUCTS

2.1 MATERIALS

A. Galvanized Sheet Steel: ASTM A653, regular coating, designation G90, not lighter than 20 gage. The galvanized coating shall be 1.25 oz. per square foot "commercial."

B. Sheet lead: Federal Specification QQ-L-201 F (2) Grade B, except that the bismuth content shall be 0.025% maximum.

C. Fastenings shall be the same or a metal compatible with the material joined.

1. Galvanized Steel: Nails rivets, and other fastenings used in connection with galvanized sheet steel work shall be steel with rust resistive coating. Rivets shall be tinned, nails and other fastenings shall be zinc-coated.

D. Soldering Flux: Raw muriatic acid for galvanized steel.

E. Solder Metal: ASTM B32, Grade 50A. The name of manufacturer and grade designation shall be stamped or cast on each bar.

F. Primer: Zinc molybdate type.

G. Protective Backing Paint: Zinc molybdate alkyd.

H. Sealant: Type specified in Section 07 92 00.

2.2 FABRICATION

A. General:

1. Accurately form sheet metal work to dimensions and shapes detailed. Finish molded and broken shapes with true, straight, sharp lines and angles and, where intersecting each other, cope to a precise fit. All exposed edges of sheet metal shall have a ½" minimum hemmed edge.

2. Fabricate cleats of same material as sheet, interlocking with sheet.

3. Form pieces in longest possible lengths.

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

5. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

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

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

8. Soldering of sheet steel shall be done slowly with well-heated soldering torch, joints full-flowing, to be made neat and thin. Thoroughly clean materials at

joints before soldering. Exposed soldering on finished surfaces shall be scraped smooth. Lock seam work shall be made flat and true to line and soldered along its entire length. Acid fluxed work shall be washed thoroughly with soap, soda and water solution after soldering.

9. Form and install sheet metal work to provide proper allowances for expansion and contraction without causing undue stresses in any part of the completed work. Installation shall be water and weather tight throughout.

10. Galvanize items after fabrication in largest sections possible.

B. Miscellaneous Flashing: Unless otherwise indicated, all miscellaneous flashing shall be fabricated of galvanized steel.

2.3 EDGE COPING, FLASHING, FASCIA, AND TERMINATION SYSTEM

A. Acceptable Manufacturers

1. The Garland Company. Contact: Sean Magee, (310) 420-0713.

2. Tremco Inc. Contact: Regan Espindola, (800) 732-4189.

2. Substitutions: Comply with provisions of Section 01 25 00.

B. Materials

1. General: Product designations for the materials used in this section shall be based on performance characteristics of the R-MER Edge System manufactured by the Garland Company, Cleveland, OH, or the TremLock System manufactured by Tremco Inc., and shall form the basis of the contract documents.

2. Materials:

a. Exposed base metal material:

1. Aluminum-zinc alloy (galvalume) coated steel, ASTM A792, coating designation AZ-50, in thickness of .0217 nom./24 gauge or .0336 nom./22 gauge or 0.157 nom; 36" to 48" by coil length, chemically treated, commercial or lock-forming quality.

b. Unexposed base metal material:

1. Zinc-coated steel, ASTM A653, coating designation G-90, in thickness of 0.0299 nom./ 22 gauge, 36" to 48" by coil length, chemically treated, commercial or lock-forming quality.

c. Minimum gauge of steel or thickness of Aluminum to be specified in accordance with Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractor's National Association, Inc. recommendations.

3. Finishes:

a. Exposed surfaces for coated panels:

1. Steel Finishes: fluorocarbon finish. Epoxy primer baked both sides, .2-.25 mils thickness as approved by finish coat manufacturer.

Weathering finish as referred by National Coil Coaters Association (NCCA).

PROPERTY	TEST METHOD	FLUOROCARBON*
Pencil Hardness	ASTM D3363 NCCA II-2	HB-H
Bend	ASTM D-4145 NCCA II-19	O-T
Cross-Hatch Adhesion	ASTM D3359	no loss of adhesion
Gloss (60° angle)	ASTM D523	25+/-5%
Reverse Impact	ASTM D2794	no cracking or loss of adhesion
Nominal Thickness	ASTM D1005	
Primer		0.2 mils
Topcoat		0.8 mils
TOTAL		1.0 mils

* Subject to minimum quantity requirements

2. Color shall be as selected by Architect from manufacturer's full standard range.

b. Exposed and unexposed surfaces for mill finish flashing, fascia, and coping cap, shall be as shipped from the mill.

c. Exposed and unexposed surfaces for anodized aluminum flashing, fascia, and coping cap, shall be as shipped from mill.

C. Related Materials and Accessories

1. Metal Primer: Zinc chromate type.

2. Plastic Cement: ASTM D 4586

3. Sealant: Specified in Section 07 92 00.

4. Underlayment: ASTM D2178, HPR Fire Tite Base Sheet.

5. Slip Sheet: Rosin sized building paper.

6. Fasteners:

   a. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.

   b. Fastening shall conform to Factory Mutual requirements or as stated on section details, whichever is more stringent.

7. Gutter and Downspout Anchorage Devices: Material as specified for system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work: Comply with provisions of Section 01 31 19.

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

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

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

C. Paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 5 mil.

D. Concrete and masonry materials in contact with sheet metal shall be painted with alkali resistant coating, such as heavy-bodied bituminous paint. Wood in contact with sheet metal shall be painted with 2 coats of aluminum paint or one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

A. Install as indicated on the Drawings and conforming to the "Architectural Sheet Metal Manual," published by SMACNA.

B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

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

E. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

F. Unless otherwise indicated, miscellaneous flashing shall be fabricated of galvanized steel. Exterior doors and windows, unless covered by overhangs shall be flashed with #22 gage galvanized steel as detailed. At wood construction, nail flashing to framing before paper backed lath is installed.

3.4 FIELD QUALITY CONTROL

A. Comply with provisions of Section 01 45 00.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

C. Upon request of District Representative, demonstrate by means of a hose or standing water, that all flashing and sheet metal is completely watertight.

END OF SECTION

SECTION 07 71 23

GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes copper gutters and downspouts as set forth by Architectural Sheet Metal Manual, 2003 Edition, by SMACNA.

1. Reference Table 1-5 Recommended Minimum Gages for Gutters.
2. Table 1-6 Maximum Distance Between Expansion Joint and Downspout.
3. Table 1-8 Sizes Recommended for Brackets and Straps.
4. Table 1-9 Minimum Gages for Downspouts.

B. Related Sections:

1. Section 07 60 00 - Flashing and Sheet Metal
2. Section 07 92 00 - Joint Sealants
3. Section 09 91 00 - Painting
4. Section 33 40 00 - Storm Drainage Utilities: Connection of downspouts to storm sewer.

1.2 REFERENCES

A. ASTM A167 - Standard Specification for Stainless and Heat-Resisting, Chromium-Nickel Steel Plate.

B. ASTM A361 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Roofing and Siding.

C. ASTM A446 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

D. ASTM A526 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

E. ASTM B32 - Standard Specification for Solder Metal.

F. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

G. ASTM Specification B-370 – Sheet Copper.

1.3 DESIGN REQUIREMENTS

A. Conform to the City of Sierra Madre Building Code for size and method of rain water discharge.

B. Maintain one copy of document on site.

1.4 SUBMITTALS FOR REVIEW

A. Section 01 33 00 - Submittals: Procedures for submittals.

B. Shop Drawings: Indicate profiles to match existing and locations, configurations, jointing methods, fastening methods, locations, and installation details.

C. Product Data: Provide data on prefabricated components.

D. Samples: Submit two samples, 6 inch long illustrating component design, finish, color, and configuration.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 76 00 - Material and Equipment: Transport, handle, store, and protect.

B. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

C. Prevent contact with materials during storage which may cause discoloration, staining, or damage. Prevent physical contact with surface of material during handling and storage. Use soft cotton gloves when handling to prevent finger prints, staining, discoloration, or surface damage.

1.6 PROJECT CONDITIONS

A. Section 01 31 19 – Project Meetings: Coordination and Meetings.

B. Coordinate the work with downspout discharge pipe inlet.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Contractor performing on-site work must also provide fabrication of metal necessary to complete work. No subcontracting will be allowed.

2.2 MATERIALS

A. Copper conforming to Federal Specification QQ-C-5766. Copper to be Commercially Pure Alloy 110.

B. Solder: ASTM B32; 50/50 type.

2.3 COMPONENTS

A. Gutters: Profile as indicated to match existing gutters.

B. Downspouts: Profile as indicated to match existing downspouts.

C. Anchors and Supports: Profiled to suit gutters and downspouts to match existing.

1. Anchoring Devices: Type recommended by SMACNA.

2. Gutter Supports: Brackets.

3. Downspout Supports: Straps.

2.4 FABRICATION

A. Form gutters and downspouts of profiles and sizes indicated to match existing profiles.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Tin edges of copper sheet to be soldered. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.

F. Fabricate gutter and downspout accessories; solder watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 19 – Project Meetings: Coordination and Meetings. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.2 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with SMACNA instructions.

B. Sheet Metal: Join lengths with formed seams soldered watertight. Flash and solder gutters to downspouts and accessories.

C. Slope gutters 1/16 inch per foot minimum.

D. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

E. Connect downspouts at 12 inches above grade.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Sealants and caulking as indicated on the Drawings and as specified, including the following:

1. Preparing sealant substrate surfaces.

2. Sealant and backing.

B. Related Sections

1. Section 09 29 00: Gypsum Board

1.2 REFERENCES

A. ASTM C834 - Latex Sealing Compounds.

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

C. ASTM C920 - Elastomeric Joint Sealants.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants.

E. ASTM D695 - Compressive Properties of Rigid Plastics.

F. ASTM D732 - Aging Effects of Artificial Weathering on Latex Sealing Compounds.

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

1.3 QUALITY ASSURANCE

A. For each type of material specified, use products of a single manufacturer, unless otherwise directed by the Architect.

B. Field adhesion tests, as specified in this Section, shall be reviewed and approved by an authorized sealant manufacturer's representative prior to commencing installation.

C. A pre-installation conference shall be convened to review testing results, application procedures and warranty requirements. The contractor, the manufacturer's representative, the applicator, the Architect and the District shall be present.

1. The Contractor shall record discussion, including agreement or disagreement on matters of significance; furnish copy of recorded discussions to each participant. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

D. Conform to SWRI (Sealant, Waterproofing and Restoration Institute) requirements for materials and installation.

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

1.4 SUBMITTALS

A. Make submittals in compliance with Section 01 33 00.

B. Manufacturer's product data for each type of sealant/caulking required.

C. Samples: Submit physical samples of the standard colors available for each sealant material intended for installation in an exposed location.

D. Certificates: Submit certificate that the materials specified and proposed for use are suitable for intended application, and that the materials comply with local VOC regulations.

E. Manufacturer's installation instructions.

1.5 FIELD SAMPLES

A. Sample joint: Prepare a sample joint for Architect's approval, for each type of caulked or sealed joint indicated.

1. Locate field samples as directed by the Architect.

2. The approved sample joint will be used as the standard of quality for the workmanship required.

3. Accepted sample may remain as part of the Work.

B. Field Adhesion Tests: Perform field adhesion tests on all substrate types using the same materials and methods to be used on the project. Field adhesion tests shall be performed in accordance with manufacturer's recommendations. Allow 7 days to cure before testing.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.

B. Applicator: Applicators shall be thoroughly trained and experienced in the necessary skills and be thoroughly familiar with the specified requirements and shall have a minimum of 5 years experience installing caulking and sealants.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 66 00.

B. Deliver materials in the unopened, original containers or unopened packages with manufacturer's name labels, product identification, and lot numbers where appropriate.

C. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturer.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of sealants/caulking under the following conditions:

1. When ambient and substrate temperature exceed limits permitted by the sealant/caulking manufacturer.

2. When joint substrates are wet or retaining moisture.

1.9 COORDINATION

A. Coordination requirements: Comply with Section 01 31 19.

B. Coordinate the work with all sections referencing this section.

1.10 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, watertight seal, and exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 SEALANTS

A. Type A Sealant: Multiple component, self-leveling polyurethane based sealant conforming to ASTM C920, Type M, Grade P, Class 25.

B. Type B Sealant: Single or multiple component, non-sag, polyurethane-based sealant conforming to ASTM C920, Type S or M, Grade NS, Class 25.

C. Type C Sealant: Butyl rubber based sealant conforming to ASTM C920, Type S, Grade NS, Class 7.5.

D. Type D Sealant: Latex acrylic based sealant conforming to ASTM C834.

E. Type E Sealant: Low-modulus silicone sealant conforming to ASTM C920, Type S, Grade NS, Class 50.

F. Type F (Acoustical) Sealant:

1. Tape: Polyvinylchloride foam tape with pressure sensitive adhesive on one side, ¾" wide by the thickness required to accommodate unevenness of substrate and completely fill openings between partition framing and building floors and concrete or masonry walls.

2. Compound: Permanently resilient type manufactured specifically for acoustical applications.

2.2 MISCELLANEOUS MATERIALS

A. Backer Rod

1. Material: Closed-cell foam, nonstaining, resilient material such as neoprene, butyl, or polyurethane, compatible with sealant to be used.

2. Sized and shaped to control depth of sealant and to provide 20% to 50% compression upon insertion.

3. At joints in floors and walks subject to foot traffic, use 9 pound density backer rod. Backer rod shall contact surface at bottom of joint. If distance to bottom of joint makes it infeasible for backer rod to make contact with a surface, install epoxy ledge on side(s) of joint substrate to support backer rod.

B. Joint Cleaner

1. For metal and glass: Xylol, xylene, toluol, or toluene.

2. For removing lacquer coatings: Lacquer thinner.

C. Primer: As recommended by sealant manufacturer for use intended.

D. Masking Tape: Pressure-sensitive adhesive paper type.

E. Bond Breaker: Pressure-sensitive adhesive polyethylene tape.

F. Clean silica sand.

2.3 SEALANT COLORS

A. Sealant color for use in exposed locations shall match the color of adjacent materials as closely as possible and shall be approved by the Architect prior to installation.

B. Wherever sealants are not exposed to view, provide manufacturer's standard color which has the best overall performance characteristics for the application indicated.

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect joints to be sealed to determine if conditions are satisfactory for the proper installation of joint sealants.

B. If unsatisfactory conditions exist, do not commence Work until such conditions have been corrected.

3.2 GENERAL

A. The extent of joint sealant Work is not necessarily fully described as specified herein, nor necessarily fully described as indicated on the Drawings.

B. Provide sealants wherever required to prevent light leakage as well as moisture leakage; and at exposed joints around plumbing fixtures, door frames, at roof conditions, and at other locations as required to facilitate cleaning and sanitation, even when not specifically indicated on the Drawings.

C. Consult the Architect if in doubt as to whether sealant is required at a given location.

3.3 PREPARATION

A. Cleaning: Clean joint surfaces, using joint cleaner as necessary, of dust, dirt, oil, grease, rust, lacquers, laitance, release agents, moisture, and other matter which could adversely affect adhesion of sealants.

B. Masking: Mask areas adjacent to joints.

C. Priming: Apply primer, if required, following manufacturer's printed instructions.

D. Joints shall enclose sealant on three sides.

1. Where adequate joints for sealants have not been provided, suitable joints shall be cleaned out to the depth required, or as indicated, and ground to a minimum width of ¼" without damage to the adjoining Work, unless otherwise specified or indicated.

2. No grinding shall be performed on metal surfaces.

3.4 APPLICATION

A. Install sealant and backing materials in accordance with manufacturer's instructions.

B. Install backing materials in joints using blunt instrument to avoid puncturing.

1. Do not twist backing while installing.

2. Install backing so that joint depth is 50% of joint width, minimum ¼" deep.

C. Apply sealants in joints using pressure gun with nozzle cut to fit joint width.

D. Place sealants in uniform, continuous beads without gaps or air pockets.

E. Tool joints to required configuration within 10 minutes of sealant application.

F. If masking materials are used, remove immediately after tooling.

G. Seal joints adjacent to painted Work before the final coat of paint is applied.

H. At joints subject to foot traffic, evenly sprinkle silica sand on uncured surface of sealant/caulking. After curing, sweep away excess unadhered sand.

3.5 CLEANING

A. Remove spilled and excess materials adjacent to joints without damaging adjacent surfaces.

B. Leave finished Work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

3.6 SCHEDULE

A. Type A

1. Joints in concrete and floors and paved surfaces subject to foot traffic.

B. Type B

1. Exterior and interior vertical joints in concrete, except as otherwise specified.

2. Exterior joints in masonry.

3. Around metal frames penetrating exterior concrete and masonry surfaces.

4. Do not use single component sealants when excessive movement is expected within the curing time of the sealant.

C. Type C

1. Interior wall penetrations for pipe and conduit that will be concealed by escutcheons and other trim and plate, and for lap joints in sheet metal.

D. Type D

1. Joints, voids and penetrations not otherwise specified for interior surfaces exposed to view and requiring painting.

2. Bedding of fixtures, partitions, equipment and accessories fastened to walls and floors, flanges and escutcheons of items penetrating surfaces in Toilet Rooms, and other areas requiring sanitary conditions to eliminate any open joints between contact surfaces.

E. Type E

1. Exterior and interior joints in contact with organically-coated aluminum.

F. Type F

1. Perimeter joints around sound-retardant partitions and electrical boxes and other penetrations in such partitions.

G. Conflicts

1. In the event of conflict between the above Schedule and sealant type indicated on Drawings, notify Architect.

2. Architect will determine sealant type to be installed in location in question.

3. Install sealant type directed by Architect, complete with all necessary joint preparation and accessories.

END OF SECTION

SECTION 08 12 13

STANDARD HOLLOW METAL FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire rated, non-rated and thermally insulated steel frames.

1. Provide frames for interior and exterior glazed lights.

B. Related Sections:

1. Section 08 13 13: Standard Hollow Metal Doors.

2. Section 08 71 00: Door Hardware, for silencers and weatherstripping.

1.2 REFERENCES

A. ADA - American with Disabilities Act.

B. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

C. ASTM E152 - Methods of Fire Tests of Door Assemblies.

D. CBC - California Building Code, Part 2, Title 24.

E. DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

F. MIL-P-24441 - Paint, Epoxy-Polyamide, General Specification For.

G. SDI-100 - Standard Steel Doors and Frames.

H. SSPC-PS 13.01 - Epoxy-Polyamide Painting System.

I. UL 10B - Fire Tests of Door Assemblies.

1.3 SUBMITTALS FOR REVIEW

A. Submit under provisions of Section 01 33 00.

B. Product Data: Indicate frame configuration and finishes.

C. Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacings, location of cut-outs for hardware, and finish.

1.4 QUALITY ASSURANCE

A. Conform to requirements of SDI-100.

B. Manufacturer: Company specializing in manufacturing the Products specified in this

Section with minimum three years documented experience

C. Manufacture all labeled frames in accordance with the specifications of Underwriter's Laboratory, (UL). Frames shall have UL listing and label when delivered to the job site.

D. Quality Standards: SDI-100 - Standard Steel Doors and Frames.

1.5 REGULATORY REQUIREMENTS

A. Fire Rated Frame Construction: Conform to California Building Code, Title 24, Part 2.

B. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.

C. Conform to the more restrictive provisions of the American with Disabilities Act or the California Building Code, Title 24, Part 2.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 66 00: Transport, handle, store, and protect products.

B. Accept frames on site in manufacturer's packaging. Inspect for damage.

1.7 PROJECT CONDITIONS

A. Section 01 31 19 - Project Meetings and Procedures.

B. Coordinate the work with frame opening construction, door, and hardware installation.

C. Sequence installation to ensure wire connections are achieved in an orderly and expeditious manner.

PART 2 PRODUCTS

2.1 FRAME MANUFACTURERS

A. Ceco Door Products

B. Elco Manufacturing, Inc.

C. Republic Builders Products.

D. Substitutions: Refer to Section 01 25 00.

2.2 FRAMES

A. Exterior Frames: 14 gage thick material, core thickness; to suit SDI-100 Grade and Model of door specified in Section 08 13 13.

B. Interior Frames: 16 gage thick material, core thickness; to suit door specified in Section 08 13 13.

C. Formed metal cap: 16 gage thick material as specified on drawings. See Frame type C.

2.3 ACCESSORIES

A. Bituminous Coating: Fibered asphalt emulsion.

B. Primer: Epoxy Polyamide in accordance with SSPC-PS 13.01 and with MIL-P-24441, Formula 150.

C. Silencers: Specified in Section 08 71 00.

D. Weatherstripping: Specified in Section 08 71 00.

E. Head and Jamb Seals: Specified in Section 8 71 00.

2.4 FABRICATION

A. Fabricate frames as welded unit for interior gypsum board slip on type, for exterior cement plaster and as indicated.

B. Fabricate frames with hardware reinforcement plates welded in place. Provide cement plaster guard boxes for exterior frames located in cement plaster.

C. Provide miter cut at joint of jamb to head. All frames to be knock down type.

D. Prepare frames for silencers. Provide three single silencers for single doors. Provide two single silencers on frame head at double doors without mullions.

E. Configure exterior frames with special profile to receive recessed weatherstripping.

F. Attach fire rated label to each fire rated door unit.

2.5 FINISH

A. Steel Sheet: Galvanized to ASTM A525 A60.

B. Primer: Epoxy-Polyamide in accordance with SSPC-PS 13.01 and with MIL-P-24441, Formula 150.

C. Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 19: Verification of existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install frames in accordance with SDI-100 and DHI and set steel frames accurately in location, in perfect alignment, plumb, straight and true. Brace frames to prevent displacement.

B. Anchor frames in concrete with galvanized anchor bolts; 3/8" diameter, F.H., countersunk at 24" o.c. at head and jamb.

C. Provide adjustable floor clips for all frames.

D. Anchor frames in steel stud frame partitions with suitable manufacturer recommended anchors.

E. Coordinate installation of frames with installation of hardware specified in Section 08 71 00 and doors in Section 08 13 13.

F. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.3 SETTING FRAMES

A. Set frames in accordance with these standards:

1. Squareness: +/- 0.0625" measured on a line from jamb perpendicular to frame head.

2. Plumbness: +/- 0.0625" measured at jambs on a perpendicular line from the head to the floor.

3. Alignment: +/- 0.0625" measured at jambs on a horizontal line parallel to the plane of the face.

4. Twist: +/- 0.0625" measured at opposite face corners of jambs on parallel lines, perpendicular to the plane of the door rabbet.

B. Set welded frames in place prior to construction of adjacent partition work. Properly brace frame until permanent anchors are set.

C. Place wood or styrofoam blocking at surface-mounted hardware locations prior to setting frames scheduled to be filled with concrete or grout.

D. Leave only hairline seam at corner joints.

E. Install fire rated frames in accordance with NFPA 80.

3.4 DOOR INSTALLATION

A. Clearances:

1. 1/8 inch between door and frame at head and jambs.

2. 1/8 inch at meeting edges of pairs.

3. 1/8 inch at transom panels, without transom bar.

4. 3/4 inch above finish floor at sills without threshold.

5. 1/4 inch at sill with threshold.

3.5 ADJUSTMENT AND CLEANING

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

B. Adjust moving parts for smooth operation. Use shims as required.

C. Fill dents, holes, etc. with metal filler and sand smooth and flush with adjacent surfaces. Paint filler and bare metal with rust-resistant primer and finish paint to match adjacent surface.

3.6 SCHEDULE

A. Refer to Door and Frame Schedule indicated on Drawings.

END OF SECTION

SECTION 08 13 13

STANDARD STEEL DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes non-rated, fire rated, thermally insulated and acoustic steel doors and panels.

1. Provide door louvers.

B. Related Sections:

1. Section 08 12 13: Standard Hollow Metal Frames
2. Section 08 71 00: Door Hardware
3. Section 08 81 00: Glass Glazing
4. Section 09 91 00: Painting

1.2 REFERENCES

A. ADA - the American with Disabilities Act.

B. California Building Code, Part 2, Title 24.

C. ASTM A525: Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

D. DHI (Door Hardware Institute): The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware

E. MIL-P-24441: Paint, Epoxy-Polyamide, General Specification.

F. SDI-100: Standard Steel Doors and Frames.

G. SSPC-PS 13.01: Epoxy-Polyamide Painting System.

H. UL 10B: Fire Tests of Door Assemblies.

1.3 SUBMITTALS FOR REVIEW

A. Submit under provisions of Section 01 33 00.

B. Product Data: Indicate door configurations, location of cut-outs for hardware reinforcement.

C. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for louvers, and finishes.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience

B. Manufacture all labeled doors in accordance with the specifications of Underwriter's Laboratory, (UL). Doors shall have UL listing and label when delivered to the job site.

C. Quality Standards: SDI-100 - Standard Steel Doors and Frames.

1.5 REGULATORY REQUIREMENTS

A. Fire Rated Construction: Conform to California Building Code, Title 24, Part 2.

B. Conform to the more restrictive provisions of the American with Disabilities Act or the California Building Code, Title 24, Part 2.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 66 00: Transport, handle, store, and protect products.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Break seal on site to permit ventilation.

1.7 PROJECT CONDITIONS

A. Comply with requirements of Section 01 31 19.

B. Coordinate frame installation with size, location, and installation of service utilities.

C. Coordinate the work with door opening construction, door frame, and door hardware installation.

D. Sequence installation to ensure wire connections are achieved in an orderly and expeditious manner.

PART 2 PRODUCTS

2.1 DOOR MANUFACTURERS

A. Elco Manufacturing, Inc.

B. Republic Builders Products.

C. Steelcraft Manufacturing Co.

D. Ceco Door Products.

E. Substitutions: Refer to Section 01 25 00.

2.2 DOORS

A. Exterior Doors (Thermally Isolated): SDI-100 Grade III, Model 3, 1 3/4 inches thick.

B. Interior Doors (Non-rated): SDI-100 Grade II Model 3, 1 3/4 inches thick.

C. Interior Doors (Fire Rated): SDI-100 Grade II Model 3, 1 3/4 inches thick.

2.3 DOOR CONSTRUCTION

A. Face: Steel sheet in accordance with SDI-100, 14 gage for exterior doors and 16 gage for interior doors.

B. End Closure: Channel, 0.047 inches thick, flush.

C. Core: Cardboard honeycomb or vertical steel stiffeners with Thermal Insulated insulation placed full height between stiffeners.

D. Thermal Insulated Door: Total insulation R value of 2.4, measured in accordance with ASTM C236.

E. Sound Rating: Minimum STC of 29, measured in accordance with ASTM E413, unless noted otherwise.

2.4 ACCESSORIES

A. Glass: In accordance with Section 08 81 00.

B. Removable Stops: Rolled steel minimum 0.0359 inch thick shape, mitered corners; prepared for countersink style tamper proof screw.

C. Metal Door Louvers: Anemostat PLSL louver with security grille two sides, non-vision inverted split Y; factory grey primer finish at interior doors, hot dipped galvanized finish at exterior doors; 12 gauge frame and security grille face plate with 13/16" square holes on 1" centers, 18 gauge louver blades, thru bolt installation, 50% free area.

2.5 FABRICATION

A. Fabricate doors with hardware reinforcement welded in place.

B. Attach fire rated label to each fire rated door unit.

C. Configure exterior doors with special profile to receive recessed weatherstripping.

D. Door face sheet edges shall have continuously welded seams.

2.6 FINISH

A. Steel Sheet: Galvanized to ASTM A525 A60.

B. Primer: Epoxy-Polyamide in accordance with SSPC-PS 13.01 and with MIL-P-24441, Formula 150.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 19: Verification of existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install steel doors in accordance with manufacturer's instructions and as indicated on Drawings and in accordance with SDI-100 and DHI.

B. Coordinate installation of doors with installation of frames specified in Section 08 12 13 and hardware specified in Section 08 71 00.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust door for smooth and balanced door movement.

3.5 TESTING

A. Section 01 45 00: Field inspection and testing.

B. Test 2 doors or not less than 10 percent of all doors under the direction of the District Representative for quality control.

3.6 SCHEDULE

A. Refer to Door Schedule indicated on Drawings.

END OF SECTION

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SECTION 08 51 23

STEEL WINDOWS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Furnish all labor and materials to complete the fabrication of windows as shown on the Drawings and as specified herein. All work shall include, but not be limited to, the following:

a. Steel frames.

b. All window anchors, and trim.

c. Factory applied finish.

d. Field-fabricated exterior window casings.

B. Related Sections:

1. Section 05 50 00: Metal Fabrications.

2. Section 07 92 00: Joint Sealants.

1.2 QUALITY ASSURANCE

A. Manufacturer shall have not less than (5) years experience in the fabrication of custom formed steel windows.

B. Installation of windows shall be done by experienced window installers.

C. Allowable tolerances: Size dimensions + 1/16 inch.

D. Source quality control:

1. Air infiltration test

a. Meets or exceeds ASTM E283.

b. Maximum air infiltration 0.37 CFM/Ft. of crack length with differential pressure across window unit of 6.24 PSF (50 m.p.h.).

2. Water penetration test

a. Meets or exceeds ASTM E331.

b. No water penetration for 15 minutes when window is subjected to a rate of flow of 5 gal./hr./sq. ft. with differential pressure across window unit of 6.24 PSF (50 m.p.h.).

3. Structural test

a. Meets or exceeds ASTM E330.

b. No damage at 60 psf.

4. Hinge test for casement ventilators

a. Meets or exceeds ANSI A156.1.

b. Hinge play test – Maximum 0.015 inches.

c. Vertical wear test – 0.105 inches.

d. Lateral wear test – 0.062 inches.

e. Overload test – 0.062 inches.

5. Quality of e-coat/top-coat combination shall meet or exceed the following ASTM designations: ASTM D714 - Paint Blistering Test, ASTM D4585 – Humidity Test, ASTM B117 – Salt Spray (Fog) Test, ASTM D1654 – Painted Products in Corrosive Environments, ASTM G85 – Cyclic Fog/Dry Test (Prohesion), ASTM D5894 – Salt Fog/UV Painted Metal, ASTM D4541 – Pull Off Strength of Coating Test.

6. Upon request, the window manufacturer shall provide a test report from a qualified independent U.S. testing laboratory regularly engaged in testing windows to verify that his products conform to these test requirements.

1.3 SUBMITTALS

A. Samples:

1. Typical window corner with glazing beads.

2. Color sample of finish.

b. Shop drawings and manufacturer's literature:

1. Submit shop drawings showing window and installation details, including anchorage, fastening and recommended sealing methods.

2. Dimensioned elevations showing window opening and window sizes.

3. The manufacturer shall not commence any work until shop drawings have been approved.

4. Color charts for finishes.

1.4 PRODUCT, STORAGE AND HANDLING

A. Comply with requirements of Section 01 66 00.

B. Store in designated areas in an upright position on wood slats or on a dry floor in a

manner that will prevent damage. Ventilate canvas or plastic coverings to prevent humidity buildup.

1.5 WARRANTY

A. Provide Hope's® standard 10-year Limited Warranty.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturer: All windows covered by this specification shall be fabricated by Hope's Windows, Inc., Jamestown, New York, whose name and products are used to establish the standard of workmanship and quality construction required for this project.

1. Landmark 175™ Series.

B. All windows shall be domestically manufactured in the U.S.A.

C. Windows shall be manufactured from solid hot rolled steel shapes.

1. Sections made from new billet steel with flanges rolled integrally at the mill.

2. Perimeter frames shall have glazing rebates providing an unobstructed glazing surface of at least 5/8".

3. Glazing rebate surfaces must be perpendicular to the web or stem of the section. Applied glazing rebate extensions and rebate surfaces that are tapered will not be acceptable.

4. Frame section shall not weigh less than 1.80 pounds per lineal foot.

D. Glazing beads shall be extruded aluminum Alloy 6063-T5 with a minimum thickness of .062 inches.

E. All screws that are furnished by Hope's, for hardware, trim, covers, anchoring, weatherbars, water dams, screens, etc. shall be non-ferrous brass or stainless steel. Glazing bead retainer screws are plated steel.

F. Paint: Factory-applied Hope's finish.

1. Pre-treatment.

2. Primer - E-Coat (Electrodeposited epoxy primer).

3. Finish coat – Factory applied polyurethane.

4. Finish Color: As selected by Architect from manufacturer's full standard range of 64,000 colors minimum, or custom color at no additional charge.

2.2 FABRICATION

A. Fabricate steel windows in accordance with approved shop drawings. All metal frames shall be formed from the gauge and to the profile shown.

B. Prior to fabrication, all hot rolled steel sections shall be cleaned by shot blasting.

C. Corners of frame and ventilator shall be mitered or coped then solidly welded. Exposed and contact surfaces shall be finished smooth flush with the adjacent surfaces.

D. Glazing

1. All windows shall be designed for inside glazing.

2. Provide replaceable continuous snap-in glazing beads to suit the glass as specified.

3. Glazing beads shall be cut and shop fitted to each glass lite prior to shipment.

E. Factory Finishing

1. Shot Blasting

a. Before any machining or welding is performed, all hot-rolled steel sections shall be cleaned by shot blasting to remove any loose scale.

2. Bonderizing

a. After fabrication, windows, mullions, covers, and trim shall be subjected to a 10 stage bonderizing pre-treatment process that produces a non-metallic phosphate coating on the surface of the steel in preparation for e-coat priming system.

3. E-Coat Prime Painting

a. Following the pretreatment, windows and accessories are e-coated with a cathodic epoxy primer of PPG Powercron® 8000 or equivalent to insure all surfaces are evenly covered. Spray or dip primers shall not be acceptable.

b. Immersed in a rinse of ultra-filtered RO water for 3 min to remove all the excess paint and removing any runs.

c. A spray of ultra-filtered RO water repeats the above process to further improve surface conditions.

d. The primer is oven baked to 335 degrees F for 15 minutes to a dry film thickness of 0.7 - 1.0 mil.

e. The material is then cooled in preparation for the finish coat.

4. Ultrathane Finish Painting

a. Following the prime coat, all windows and accessories are given a spray coat of acrylic polyurethane and oven baked at 225 degrees F for 15 minutes to dry film thickness of 1.5 to 2.0 mils.

b. The combined overall dry film thickness of the prime coat and finish coat shall be 2.2 - 3.0 mils.

c. The architect shall choose from an unlimited color selection. Provide color matching upon request, along with clear coats.

5. E-Coat/top coat combination shall provide full documented compliance with all ASTM designations as outlined in Quality Assurance portion of the specifications.

PART 3 EXECUTION

3.1 INSPECTION

A. Window openings shall conform with details, dimensions and tolerances shown on the window manufacturer's approved shop drawings.

B. Conditions which may adversely affect the window installation must be corrected before installation commences.

C. The wash down of the adjacent masonry must be completed before erection commences to prevent damage to the finish by the cleaning materials.

3.2 INSTALLATION

A. Windows specified under this section shall be installed by experienced personnel.

B. Install windows in openings in strict accordance with approved shop drawings.

1. Set units plumb, level and true to line, without warp or rack of frames.

2. Anchor units securely to surrounding construction with approved fasteners.

3. The exterior joints between the windows, trim and mullions shall be properly sealed watertight with an approved sealant and neatly pointed.

C. Repair any abraded areas of the factory finish.

3.3 CLEANING

A. Window installer shall leave window surfaces clean after installation and ready to receive glass and glazing. The window installer will not be responsible for final cleaning.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes hardware for wood, steel and aluminum doors.

1. Provide door gaskets, including weather-stripping and seals, and thresholds.

B. Related Sections:

1. Section 08 12 13 - Standard Hollow Metal Frames

2. Section 08 13 13 - Standard Hollow Metal Doors

3. Section 10 14 00 - Signage

4. Section 28 31 00 - Fire Detection and Alarm

1.02 REFERENCES

A. BHMA (Builders Hardware Manufacturers Association) - A156 series.

B. CAR - The California Accessibility Regulations,, Part 2, Title 24 of the California Code of Regulations, 2010 California Building Code with State Amendments.

C. DHI (Door and Hardware Institute) - A115 series.

D. DHI (Door and Hardware Institute) - WDHS.3 - Architectural Hardware for Wood Flush Doors.

E. NFPA 80 - Fire Doors and Windows.

F. NFPA 101 - Life Safety Code.

G. NFPA 252 - Fire Tests of Door Assemblies.

H. UL 10C - Safety Fire Tests of Door Assemblies.

1.03 SUBMITTALS FOR REVIEW

A. Section 01 33 00 - Submittals: Procedures for submittals.

B. Finish Hardware Schedule: Submit 7 copies of schedule: Include manufacturers name, catalog number, location of item in work, and door index. Hardware shall be listed by "Headings" in following manner:

LIST OF DOOR HARDWARE

1. HARDWARE NO. 1

a. DOOR NO. (Room and Number) from/to(Room and Number)

b. DOOR NO. (Room and Number) from/to(Room and Number)

c. List the product names and numbers

2. HARDWARE NO. 2

ETC.

C. Samples:

1. Submit 1 sample of hinge, latchset, lockset and closer, illustrating style, color, and finish.

2. Samples will be incorporated into the work.

D. Construction Schedule: Provide estimated times and dates that will be required to process submittals, to furnish templates, to deliver hardware to the District for installation by the Contractor, and to perform other work associated with furnishing door hardware for purposes of including this data in the construction schedule. Comply with this schedule.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with the following requirements:

1. BHMA A156 series.

2. DHI - A115 series.

3. DHI - WDHS.3.

4. NFPA 80.

5. NFPA 101.

6. NFPA 252.

7. UL 10B.

8. ANSI.

9. BHMA.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with 3 years documented experience approved by manufacturers.

D. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section. Alternatively, provide the name of the consultant

retained by the supplier and the person's qualifications to perform the necessary door hardware detailing required to prepare the submittal.

1.05 REGULATORY REQUIREMENTS

A. Accessibility: Conform to the more restrictive provisions of the American with Disabilities Act Accessibility Standards or the CCR, Title 24, Part 2, California Accessibility Regulations, 2010 California Building Code with State Amendments.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

C. Mounting height of latching hardware shall be 30" to 40" A.F.F. per CBC Section 1133B.2.5.2.

D. Pressure to operate doors shall not exceed: 5 lbs for exterior doors, and 5 lbs for interior doors. When fire doors are required, the maximum effort to operate the doors shall not exceed 5 lbs, except that, when approved by the appropriate administrative authority, the maximum effort required to operate the doors may be increased not to exceed 15 lbs. CBC Sections 1008.1.3 and 1133B.2.5 / ADAAG 4.13.11.

E. Door closers, when provided, shall have sweep period adjusted so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3" from the strike. CBC Section 1133B2.5.1.

F. All hardware shall meet the requirements of CBC Section 1008.1.9.

G. Thresholds shall comply with CBC Sections 1008.1.7 and 1133B.2.4.1.

H. Floor stops shall not be located in the path of travel and 4" maximum from walls. DSA Policy 99-08.

I. Exit Devices:

a. Panic hardware shall comply with CBC Section 1008.1.9. Panic bar shall be mounted at 36" to 44" above finished floor. (Consider that if the device is mounted lower than 36" AFF, the clear opening may be restricted to less than the 32" required clear opening).
b. The unlatching force shall not exceed 15 lbs, applied in the direction of travel.
c. Panic hardware shall not be provided with "Night Latch" (NL) function that requires the exit unlatching with tight grasping, pinching or twisting of the wrist to operate (CBC Section 1008.1.9.1), or with more than one operation (1008.1.9.5).

1.06 COORDINATION

A. TEMPLATES: Deliver templates or physical samples of finish hardware items to manufacturer of interfacing items, such as doors and frames, in a timely manner to insure orderly progress of work.

B. Coordinate hardware with other work in respect to both fabrication and installation. Furnish the District for Contractor installation, templates and deliver hardware to the District or to the District's approved location.

1.07 PRODUCT HANDLING

A. Section 01 76 00 – Furnished / Installed Materials and Equipment: Transport, handle, store, and protect products.

B. Package each item of hardware and each lockset individually, complete with necessary installation instructions, screws and fastenings, and installation templates; marked with item number corresponding to number on approved Door Hardware Materials List.

C. Packaging of door hardware is responsibility of the supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in the same container.

D. Inventory door hardware jointly with representatives of hardware supplier, the Construction Manager, Architect, District, or authorities having jurisdiction and the Contractor's hardware installer until each is satisfied that the count is correct.

E. Deliver individually packaged door hardware items promptly to the District or District Representative approved place of installation.

1.08 PROJECT CONDITIONS

A. Section 01 31 19 - Project Meetings

B. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.

C. Contractor shall sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.09 EXTRA MATERIALS

A. Furnish the following items extra items and turn it over to the Construction Manager, Architect, District, or authorities having jurisdiction:

1. Locksets: One (1) of representative function.

2. Door Closers: Two (2) closer cylinders.

3. Hinges: Two (2) of each type.

1.10 WARRANTY

A. All Warranties shall be for a minimum of 2 years except as follows;

1. Those items which incorporate longer term warranties as part of normal purchase agreement.

2. Door closers, which shall have a minimum 10 years warranty.

B. Warranties shall start from either date of occupancy or date of final inspection by the District Representative.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

ITEM	MANUFACTURER	ACCEPTABLE SUB
Hinges	(BOM) Bommer	Hager, McKinney
Continuous Hinges	(ROT) Roton	Hager, Zero, Pemco, Markar
Key System	(SCH) Schlage	Owner's Standard
Locks	(SCH) Schlage	Owner's Standard
Exit Devices	(VON) Von Duprin	Owner's Standard
Closers	(LCN) LCN	Owner's Standard
Auto Flush Bolts	(IVE) Ives	DCI
Coordinators	(IVE) Ives	DCIr
Silencers	(IVE) Ives	Trimco, Rockwood
Push & Pull Plates	(IVE) Ives	Trimco, Rockwood
Kickplates	(IVE) Ives	Trimco, Rockwood
Stops & Holders	(TRI) Trimco	Trimco, Rockwood
Overhead Stops	(GLY) Glynn-Johnson	None Available
Thresholds	(PEM) Pemko	Zero, Reese, NGP
Seals & Bottoms	(PEM) Pemko	Zero, Reese
Key Cabinets	(LUN) Lund	TelKee

2.02 FINISH

A. Hardware finish shall be stainless steel (630) or dull chrome-plated (626) per B.H.M.A. Standards except as otherwise listed in the individual headings.

Standard: Comply with BHMA A156.18.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. BHMA Designations: Comply with base material and finish requirements indicated by the following:

ANSI	US	Description	Base Metal
600	USP	PRIMED FOR PAINTING	STEEL
625	US26	BRIGHT CHROMIUM PLATED OVER NICKEL	BRASS, BRONZE
626	US26D	SATIN CHROMIUM PLATED OVER NICKEL	BRASS, BRONZE
628	US28	SATIN ALUMINUM, CLEAR ANODIZED	ALUMINUM
630	US32D	SATIN STAINLESS STEEL	STAIN. STEEL 300 SER
652	US26D	SATIN CHROMIUM PLATED OVER NICKEL	STEEL
689	US28	ALUMINUM POWDER COAT	ANY METAL
719	US27	MILL FINISH ALUMINUM UNCOATED	ALUMINUM
BLK		BLACK	ANY MATERIAL
GRY		GREY	ANY MATERIAL
WHT		WHITE	ANY MATERIAL

2.03 KEYING

A. General: Meet with Owner to finalize keying requirements and obtains final instructions in writing.

B. All cylinder locks shall be keyed as directed by the District lockshop. The existing system is Schlage small-format interchangeable core (SFIC), Everest B restricted keyway, as structured by District lockshop. Turn over cylinders and keys to District's lockshop via secured signature-required delivery upon delivery of hardware to the project.

C. Furnish keys as follows: Each cylinder lock- 2 keys.

D. Keying System: Provide a grand master key system with new master keys, department master keys and individual change keys.

D. Key Material: Provide keys of nickel silver only.

2.04 FASTENER

A. Screws for strikes, face plates and similar items shall be Phillips head, flathead, countersunk type; machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be phillips head, flathead, countersunk type; machine screws for metal and standard wood screws for wood.

C. Fastening of closer bases or closer shoes to doors shall be by means of through bolts and grommets, spray painted to match closer finish.

D. Provide ICBO approved expansion anchors for attaching hardware items to concrete or masonry.

2.05 BUTT HINGES

A. Standards: Comply with the following:

1. Butts and Hinges: BHMA A156.1.
2. Template Hinge Dimensions: BHMA A156.7.

B. Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches.
2. Three Hinges: For doors with heights 61 to 90 inches.
3. Four Hinges: For doors with heights 91 to 120 inches.
4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

C. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (inches)	Hinge Height (inches)	Metal Thickness (inches)	
		Standard Weight	Heavy Weight
32 by 84 by 1-3/8	3-1/2	0.123	-
36 by 84 by 1-3/8	4	0.130	-

36 by 84 by 1-3/4	4-1/2	0.134	0.180
42 by 90 by 1-3/4	4-1/2	0.134	0.180
48 by 120 by 1-3/4	5	0.146	0.190

D. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

E. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavyweight hinges ball bearing.
2. Interior Doors: Standard-weight hinges ball bearing.

F. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Conventional butt hinges, stainless steel.
2. Interior Hinges: Steel, with steel pin.
3. Hinges for Fire Rated Assemblies: Steel, with steel pin.

G. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

1. Provide Non-removable Pins for all doors: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
2. Corners: Square.

H. Continuous-Pin and Barrel Hinges for all exterior doors with the exception of aluminum & glass storefront type doors: Minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches, fabricated to full height of door and frame. Finish components after milling and drilling are complete. Fabricate hinges to symmetrical template screw locations.

I. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.06 LOCKS

A. Comply with: BHMA/ANSI 156.13 Series 1000, Grade 1.

B. Provide Mortise locks as Marks LA118 Design 2-3/4" in. backset.

2.07 DOOR CLOSERS

A. Surface mounted closers shall have fully hydraulic, full rack and pinion type with pressure cast aluminum body.

1. Provide drop brackets, mortise shoes, long arms and low profile arms as required. Parallel, regular arm, and top jamb closers shall be capable of 180 swing.

2. Provide non-handed door closers with non-sized springs adjustable, size 1 thru 6, with separate adjustable valves for latch, sweep speed, back check and delayed action.

3. Template and adjust closers per manufacturer's recommendations and to meet barrier free requirements.

4. Closers shall have full spring power adjustment, 2 thru 6 spring adjustment on exterior and fire doors, 1 thru 4 adjustment on interior doors.

5. Mount surface closers on side of door away from corridor, inside rooms or in stairs. Provide parallel, mount closers as required.

B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with the Part 2, Title 24, CCR and the Americans with Disabilities Acts Architectural Guidelines

1. Adjust closer operating effort to conform to Section 1004, Part 2 T-24CCR.
   - Interior and Exterior Doors: 5.0 poundsforce.
   - Fire Rated Doors: minimum required to assure positive latching, up to maximum of 15.0 poundsforce.

2. Adjust closer delay and operating speeds to comply with requirements of chapter 11B, Part 2 Title-24 CCR and the American with Disabilities Act Architectural Guidelines, Article 4.13.10.
   - Closer Certification: Provide written certification, signed by door closer representative, staring all closers were inspected and installed in accordance with specified opening force and delay requirements.

3. Install closers on push side of door with sex bolts.

4. Install closers with parallel arm, when possible.

2.08 THRESHOLD

A. Maximum height of threshold shall be 1/2 inch.

B. Install exterior thresholds in full bed of sealant at front and side edges.

2.09 EXIT DOORS

A. Provide exit door locks and panic exit devices of such construction that when locked, the door may be opened from the inside by turning the Lever or by depressing the cross-bar, without the use of a key or any special knowledge or effort.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 19- Project Meetings: Coordination; Verification of existing conditions before starting work.

B. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may proper commence.

C. Verify that work of this Section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

D. In the event of discrepancy, immediately notify the Architect.

E. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved. Commencement of installation for a given opening denotes acceptance of that opening's condition.

3.02 SETTING FINISH HARDWARE

A. Secure finishes hardware with manufacturer provided fasteners of the same material and finish as the item being attached.

B. After fitting hardware to doors, remove all finish hardware except butt hinges, carefully replace in properly marked boxes, and place in storage until painting is completed. After painting is completed, permanently install finish hardware.

3.03 TYPICAL HARDWARE LOCATIONS

A. Butt Hinges: 5 in. from head of opening to top of top butt. 10 in. from floor to bottom of bottom butt. Intermediate butt (or butts) equally spaced between top and bottom butts center line. For pre-finished, pre-fitted frames, use manufacturer's standard locations for hinges.

B. Lock: 38 in. above floor to centerline of lever.

D. Push-Pulls: 44 in. above floor to centerline.

E. Closers: Refer to manufacturer's templates.

F. Panic Devices: 36 to 40 inches above floor. Verify manufacturer's template with door design.

3.04 INSTALLATION

A. For metal doors, install hardware without marking or defacing hardware of finish work and in accordance with the manufacturers printed instructions before proceeding with painting. Remove finish hardware, (except prime-coated butts), and store to original cartons. After finish painting has been completed, reset finish hardware.

B. Protect finish hardware with suitable coverings until completion of the building.

C. On completion, doors shall be freely but not loosely operating, without sticking or binding, and with all hardware adjusted and functioning properly.

3.05 ADJUSTING AND CLEANING

A. At final completion, hardware shall be left clean and free from disfigurement. Where hardware is found or replace or otherwise correct as directed.

B. Clean adjacent surfaces soiled by hardware installation.

3.06 INSPECTION

A. Upon completion of installation, verify correct application of hardware, according to approved hardware schedule and keying schedule. Verify that finish hardware is in optimum working condition.

3.07 PROTECTION

A. Contractor shall protect all finish hardware items until acceptance by the District Representative.

3.08 SCHEDULE OF HARDWARE

HW SET: 01 Classroom Door

1	EA	HINGE	780-110HD	630	ROT
1	EA	EXIT DEVICE	CD99NL-OP X L/TRIM	626	VON
1	EA	I.C.MORTISE CYLINDER	30-008T FOR DOGGING	626	SCH
1	EA	I.C. RIM CYLINDER	20-057T	626	SCH
2	EA	PERMANENT CORE	SUPPLIED BY OWNER	626	SCH
1	EA	SECURITY PULL	VR910NL	630	IVE
1	EA	SURFACE CLOSER	4041 FP Super Smoothee H EDA	ALUM	LCN
1	EA	KICKPLATE	8400 10" X 2" LDW	626	IVE
1	EA	FLR STOP + BASE ANCHOR	1214CK + 1268CK	626	TRI
1	EA	HEAD SEAL	290ANB	720	PEM
2	EA	JAMB SEAL	290ANB	720	PEM
1	EA	BOTTOM SEAL	345AV	720	PEM
1	EA	DOOR CAP	B344	720	PEM
1	EA	THRESHOLD	253A	720	PEM

HW SET: 02 Mechanical Closet Door

3	EA	HINGE	BT-LB8000 4.5 X 4.5	630	BOM
1	EA	STOREROOM LOCK	L9080T 06N	626	SCH
1	EA	PERMANENT CORE	SUPPLIED BY OWNER	626	SCH
1	EA	FLOOR STOP	FS441	626	IVE
1	SET	ADJSTBLE SOUND SEAL	379AS HEAD & JAMBS	720	PEM
1	EA	AUX SOUND SEAL	S88D HEAD & JAMBS	BRN	PEM
1	EA	BOTTOM SEAL	315CN	720	PEM
1	EA	THRESHOLD	151A	720	PEM

END OF SECTION

SECTION 08 91 19

FIXED LOUVERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes galvanized wall louvers as indicated on the drawings and specified.

1.2 SUBMITTALS

A. All submittals shall be made in accordance with Section 01 33 00.

B. Shop Drawings: Submit shop drawings showing the louver construction, thickness of the materials, methods of joining, reinforcement and anchorage features of all sheet metal work. Provide complete information regarding concealed joints.

1.3 PRODUCT HANDLING

A. Comply with requirements of Section 01 66 00.

B. Protect sheet metal materials before, during and after installation. Protect the installed work of other trades. Do not install bent or damaged materials.

1.4 COORDINATION

A. The work under this Section shall be coordinated so that all flashings and like items will provide a water and weathertight installation.

PART 2 PRODUCTS

2.1 GALVANIZED STEEL

A. Conform to ASTM A526 or ASTM A527, galvanized in accordance with ASTM A525, coating designation G90.

2.2 WALL LOUVERS

A. Louvers shall be fixed or 45-minute fire-rated with fusible link type as indicated, of size and design shown. Heads, sills and jamb sections shall have formed caulking slots or be designed to retain caulking. Head sections shall have exterior drip lip, and sill sections an integral water stops. Furnish louvers with sill extension or separate sill as shown. Frame shall be of welded construction with welds dressed smooth and flush. Louvers shall be secured in opening as shown. Provide bird screens on inside of all exterior louvers.

2.3 FRAMED BIRD SCREENS

A. For galvanized steel louvers, provide 1/4-inch square mesh, 16-gauge zinc-coated steel or copper bird screening.

B. Miter corners and join by concealed corner clips or locks extending about 2-1/4 inches

into rails and stiles.

C. Fasten frames to inside of louvers with galvanized or stainless steel devices designed to allow removal and replacement without damage to the louver.

2.4 SHOP PRIMING

A. Shop prime galvanized steel with baked-on or oven dried shop prime coat material as standard with the louver fabricator.

B. Surfaces of steel work shall be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication. Paint all contact surfaces of assembled work with an additional shop coat of similar paint.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install using stops or moldings, flanges, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations. Fasten frames to louvers with screws or bolts.

B. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

END OF SECTION

SECTION 09 24 00

PORTLAND CEMENT PLASTERING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Metal lath and lathing accessories.

2. Special, proprietary, integrally-colored, fine sand textured, acrylic modified Portland cement plaster.

B. Related Sections:

1. Section 06 10 00: Rough Carpentry

2. Section 07 27 19: Plastic Sheet Air Barrier

1.2 REFERENCES

A. ASTM C150 - Standard Specification for Portland Cement.

B. ASTM C206 - Standard Specification for Finishing Hydrated Lime.

C. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters.

D. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster.

E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.3 SUBMITTALS

A. Submit manufacturer's data for lath and accessories in compliance with the requirements of Section 01 33 00.

B. Mock-up panels:

1. Section 01 45 00: Requirements for mock-ups.

2. Provide at the Project site, where directed by the Architect, size as specified herein, sample panel with each type of condition with finished corners at each end, representative of the plaster quality of execution to be expected on the Project, mounted on lath/gypsum base/wood studs,

complete with trim, for the Architect's evaluation.

3. Demonstrate patching which will be required for a typical scaffolding tie on one side of the panel.

4. Construct mock-ups, 4 feet wide by 4 feet high, illustrating surface finish. Provide separate mock-up for each specified surface finish.

5. Repeat sample panel(s) until Architect's approval is obtained.

6. Protect approved panels, which will be used as a standard for the Project, until its removal is authorized by the Architect.

7. Mock-ups may not remain as part of the Work.

1.4 QUALITY ASSURANCE

A. Pre-installation meeting: Prior to start of installation, arrange a pre-installation meeting with the Architect, the Contractor, and the plastering subcontractor, including plastering subcontractor key personnel, in conformance with Section 01 31 19.

1. Review the Specifications, the sample panel and mock-ups, if in place.

2. Questions, comments and objections shall be recorded by the Contractor and distributed to all concerned within 3 days of the meeting.

B. Applicator shall have a minimum of 3 years experience applying plaster and be certified by the finish manufacturer.

C. Perform Work in accordance with ASTM C926. Maintain one copy on site.

1.5 HANDLING

A. Comply with the requirements of Section 01 66 00.

B. Store aggregates on clean platforms and cover with plastic sheeting to exclude dirt and other foreign materials which would adversely affect the plaster.

C. Store sealed containers or bags of materials covered and above ground. Do not allow liquids to freeze.

D. Keep metal lath and accessories dry and off the ground.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 76 00 - Material and Equipment: Environmental conditions affecting products on site.

B. Do not apply plaster when substrate or ambient air temperature is less than 40 degrees F nor more than 100 degrees F.

C. Maintain minimum ambient temperature of 40 degrees F during installation of plaster and until cured.

PART 2 PRODUCTS

2.1 MATERIALS

A. Paper-backed metal lath: Where required by Building Code provide paper backing with a flame spread rating of 25 or less. Lath shall be provided separately from paper backing.

1. Paper: As specified in Section 07 27 19.

2. Lath:

a. Expanded diamond mesh lath weighing 3.4 lbs./sq. yd. made from uncoated or zinc-coated (galvanized) steel sheet to produce lath complying with ASTM C847, with uncoated steel sheet painted after fabrication, by Western Metal Lath, Amico West, or Cemco.

b. For ceiling and soffit applications, use expanded metal rib lath fabricated from uncoated or zinc-coated (galvanized) steel sheet, ASTM C 847, 3/8 in. depth, weighing 3.4 lbs./sq. ft. with uncoated steel sheet painted after fabrication, by Western Metal Lath, Amico West, or Cemco.

c. On solid surfaces use self-furred lath.

B. Flexible Flashings: Laminated glass fiber reinforced high strength waterproof paper complying with FS UU-B-790a, for Type I, 76 hours, Grade A (vapor permeable), Style 4. Fortifiber® Moistop® Flashing, or approved equal.

C. Air/Vapor Barrier: Where indicated on drawings, provide air & vapor barrier membrane.

D. Lathing accessories:

1. Formed from minimum 26 gage hot-dip, G 60 galvanized steel furnished in longest possible single length.

a. Control joints expanded flange: Western Metal Lath No. XJ15-3.

b. Casing bead expanded flange: Western Metal Lath No. 66.

c. Corner reinforcement: Western Metal Lath Stucco-Lok.

d. Base and soffit screed: Superior Metal Products No. 5.

e. Ventilating Screeds: Fry Reglet PCS 75-V-600.

f. Drip Screed: Form shape CLPCA, Chapter Two, Detail No. 24 or similar to Pacific Products No. 2 plaster drip stop.

g. Weep Screed: Form shape CLPCA, Chapter Two, Detail No. 24A, .029" minimum, corrosion resistant galvanized.

h. Strip Reinforcement: 6" wide strip of galvanized steel expanded metal lath; minimum 1.75 lbs. per square yard.

E. Fasteners for lath to wood framing: Nails per CBC, Table 2507.2 and CBC 2304. 9.1.1.

F. Tie-wire: 18 gage galvanized, annealed steel wire for accessories-to-lath.

G. Plastering materials:

1. Portland cement: ASTM C150, Type I or II. Use only one brand throughout this work. Color: White.

2. Hydrated lime: ASTM C206, Type S.

3. Sand: ASTM C897, graded as follows, except for finish coat.

Sieve Size	Percentage retained on each sieve	
	Max.	Min.
No. 4	0	0
No. 8	10	0
No. 16	40	10
No. 30	65	30
No. 50	90	70
No. 100	100	90
No. 200	100	97

4. Water: Potable, fresh from domestic source.

5. Integrally Colored Stucco Finish, color(s) as indicated on the drawings, or if not indicated, one color to be selected by Architect from manufacturer's full standard range.

a. Manufacturer: LaHabra Stucco.

H. Plaster Mix Reinforcement: Purpose made glass fibers, chopped to 1/2 inch nominal length, alkali resistant.

2.2 PLASTER MIXES

A. Scratch coat (by volume): One part Portland cement, maximum one part dry hydrated lime, maximum 4 parts loose sand aggregate of the total volume of cement/lime.

B. Brown coat (by volume): Same as specified for scratch coat except that sand may be increased to 4-1/2 parts of the total volume of cement/lime.

C. Mix as accurately as possible. Measurement of cementitious materials shall be based on full bag of cement increments only.

D. Add ingredients to the mixer from calibrated containers. Do not use materials which are caked, lumpy, dirty or contaminated by foreign materials.

1. If calibrated container supply interferes with progress of Work, shovels may be used provided they are measuredto determine the accuracy of the volume of aggregate they carry, in accordance with manufacturer's printed instructions.

E. Add plaster mix reinforcement as recommended by manufacturer.

PART 3 EXECUTION

3.1 INSPECTION/PREPARATION

A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

B. Verify that waterproofing membrane, to be installed under plaster, has been installed, inspected and approved before proceeding with installation.

C. Before plastering begins, insure that adjacent finish work iswell protected with waterproof covers securely taped in place.

D. Before enclosing stud walls, thoroughly clean space of debris.

3.2 LATHING ON PLYWOOD SHEATHING AND OPEN FRAMING

A. Comply with ASTM C 1063, except as specified below, and where Code requirements are more stringent.

B. Install paper backing over plywood sheathing and open framing, and as specified in Section 07250.

C. Apply lath taut, with long dimension at right angle to supports.

D. Apply first course at bottom and work up.

1. Locate ends of lath over supports. Install additional stud where stress relief (control) joints will occur to support the separate lath ends; coordinate this requirement with Section 06100.

2. Stagger vertical joints.

3. Lap longitudinal joints 1/2 in. and vertical joints 1 in. minimum.

4. Wire tie intermediate horizontal joints at 6 in. o.c. maximum directly to framing or supporting members where no paper backing occurs (soffits).

E. Attach lath to supports at 6 in. o.c.

F. At control joints, cut lath but continue paper backing uninterrupted behind lath.

G. Hold lath 1/4 in. clear of electrical boxes, columns and similar items projecting through the plaster.

3.3 PLASTER ACCESSORIES

A. Wire tie at no more than 24 in. o.c. to metal lath or studs.

B. Use single length wherever length of run does not exceed longest standard stock length available. Miter or cope at corners with hairline joints, and seal with sealant specified in Section 07920.

C. Set accessories level, plumb and true to line with a tolerance of not more than 1/8 in. in 10 ft. Shim as required and align joints with concealed splice or tie plates.

D. Install corner reinforcement at external corners.

E. At plaster terminations, provide casing beads at the following locations:

1. Where plaster termination abuts other finishes, isolate casing bead from contact with adjacent finishes with 1/4 in. thick tape sealant specified in Section 07920.

2. Where plaster termination is not covered by another finish or applied trim, provide cased opening by installing casing bead around perimeter of opening as detailed.

3. At locations as indicated and detailed in the Drawings.

4. Casing beads at bottom of plaster panels shall be provided with weep holes, and shall not be blocked by sealant.

F. Control joints: Install plumb, level and in one piece at the spacing indicated. Follow manufacturer's directions for their installation. Plaster panels shall not exceed 100 sq. ft. in size, with no span exceeding 18 ft. or as indicated on Drawings, whichever is less.

1. Proposed joint locations, different than those indicated, are subject to Architect's approval.

3.4 PLASTERING

A. General: Comply with ASTM926, except as specified below, and where Code requirements are more stringent.

B. Plaster types:

1. 3-coat work on metal lath. Minimum thickness 1 in.

2. Soffits shall receive the same plaster type as the adjacent walls.

C. Where plaster is applied directly to concrete, coat with bonding agent in compliance with the bonding agent manufacturer's instructions.

D. Sequencing: Provide sufficient manpower and equipment to ensure a continuous operation free of cold joints, scaffold lines, texture variations, and other objectionable conditions.

E. Application: Plaster surfaces in one operation once the application of any coat has begun. Stop plaster at control joints or bead, edges or corners only. Plaster in one operation, full height and width between control joints.

1. Scratch coat: Apply with sufficient material and pressure to form good full keys, and to cover well.

a. Minimum thickness of scratch coat shall be 3/8 in. when measured from backing to crest of scored plaster.

b. Scratch horizontally before plaster hardens to provide sufficient mechanical key for brown coat. Moist cure continuously for a minimum of 48 hours, including weekends and holidays.

c. Scratch coat shall be thick enough to provide a good bond with the metal lath and shall fully embed the lath. Avoid excessive troweling during hand application.

d. Resulting surface shall be a rodded plane with vertical surfaces scored horizontally with shallow scoring approximately 1/8 in. to 3/16 in. deep.

2. Brown coat:

   a. Apply brown coat no sooner than 48 hours after application of the scratch coat.

   b. Under very dry weather conditions, lightly dampen scratch coat before application of the brown coat.

   c. Apply the brown coat approximately 3/8 in. thick with enough force to key into the scratch coat. Bring to a true, even surface by rodding and floating and leave slightly rough to receive the finish coat.

   d. Begin floating only after hydration of the cement has commenced and sufficient moisture has evaporated, so that surface sheen has disappeared, but before plaster has become too rigid to be moved under the float.

   e. On very hot days, and days with high wind or low humidity, 5% water measured in relation to the mixing liquid may be added to extend the plasticity of the brown coat.

3. Primer: Apply in manner and rate per manufacturer's recommendations.

4. Finish coat: Terminate finish coat only at a reveal, at an outside corner, or at an inside angle, as necessary to control and achieve the required color and texture.

   a. Apply finish coat to an entire building elevation when primer has dried to the touch. Overlaps and cold joints are unacceptable.

   b. After finish coat is applied, remove the first plank of scaffolding quickly to avoid shadow lines and staining.

   c. Finish coat to a total minimum thickness of 1/8 in. over the entire panel.

   d. Trowel smooth, without leaving directional lines, to a flat uniform surface leaving a fine sand finish. Allow to firm up and allow the water sheen to leave the surface.

   e. Use long trowel strokes to avoid a choppy appearance.

   f. Cross-out directional patterns. Patterns of arcs and swirls are not acceptable.

   g. Do not water trowel. Excessive sheen and burning of finish or water marks are is not acceptable.

h. There must be a sufficient number of plasterers on each wall to maintain a wet leading edge. Cold joints are not acceptable.

i. "Smooth" refers to the fact that there will be no variation in the surface.

j. Take whatever steps are necessary (such as shielding walls with netting or tarps, or performing finish work at appropriate times of the day) to avoid working walls that are too "hot" or that will dry too rapidly.

k. Protect plaster from water and air-cure under acceptable covering until plaster cures to hydration level of no more than 15% as measured with a moisture meter. Plaster with a hydration level of less than 15% should require no special protection.

l. Stucco Finish Coat: The finish coat of plaster shall match adjacent existing plaster finishes. Existing finishes are generally described as Medium Dash, as depicted on the Technical Services Information Bureau (TSIB) website (www.tsib.org/plaster.shtml). Verify in field with Architect the applicable locations of specified finishes.

6. Concealed plaster:

a. Where plaster will be concealed above suspended ceilings and similar locations, the finish coat may be omitted.

b. Where assembly is fire-rated, the plaster, regardless of whether a finish coat is applied shall meet Building Code requirements for thickness.

7. Allowable tolerances for plaster surfaces and accessories: Maximum deviation from true planes of finish plaster shall not exceed 1/8 in. in 10 ft. when measured with a straightedge placed at any point on plaster surfaces.

F. Do not use materials which are caked, lumpy, dirty or contaminated by foreign materials.

G. Plaster finish coat flush with metal frames and other built-in metal items or accessories which act as plaster grounds.

H. Where permanent grounds are too far apart to serve as guides for rodding, provide supplemental plaster screeds as required.

1. Establish true surfaces with rods before setting the screeds.

2. Keep grounds clean and free of plaster.

3. Finish plaster in a true, plumb or level plane flush with grounds.

3.5 FIELD QUALITY CONTROL

A. The specified curing periods shall be considered as minimum requirements. Be responsible for determining the most effective procedure(s) for curing and time lapse between application of coats based on climatic and job conditions and the acrylic manufacturer printed instructions.

B. Completed plaster shall match approved sample panels and mock-ups, be within the tolerances specified, be uniform in thickness, texture and color, free of blisters, pits, checks and other defects.

C. Repair, or remove and replace, as determined by the Architect, lath/plaster that does not meet these requirements, with materials satisfactory to the Architect, at no cost to the Owner.

3.6 REPAIRING/CLEANING/PROTECTING

A. Cut, patch, repair and point-up defective plaster as demonstrated on approved mock-ups.

1. Repair cracks and indented surfaces by moistening plaster and filling with new material, troweled and tamped to match adjoining surfaces.

2. Point-up finish plaster surfaces around items which are built into or penetrate plaster.

B. Promptly remove plaster spatter and droppings from adjacent surfaces. Repair surfaces which have been stained, marred or otherwise damaged during plastering.

C. Protect in-place plaster against damage and stains with impermeable covers securely taped in place when work is performed adjacent to finished plaster surfaces. Do not perform work next to plastered surfaces without proper protection.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 GENERAL

1.1 SUMMARY

~~A. Section includes gypsum board and joint treatment; gypsum sheathing; and textured finish.~~

B. Related Sections:

1. Section 06 10 00: Rough Carpentry

2. Section 07 21 00: Thermal and Sound Insulation

1.2 REFERENCES

A. ASTM C1396 - Standard Specification for Gypsum Board.

B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

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

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

E. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on gypsum board and joint tape.

D. Samples: Submit 12-inch x 12-inch sample of drywall texturing for acceptance, when requested by the District Representative.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C840.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

C. Reference specifications and standards:

1. "Recommended Specifications for the Application and Finishing of Gypsum Board", Gypsum Association GA-216.

2. In case of conflict between these Specifications, applicable legal requirements and the ANSI Standards, the more restrictive requirement shall prevail.

D. Gypsum wallboard finish shall conform to requirements of "Recommended Specification for Levels of Gypsum Board Finish" of the Painting and Decorating Contractors of America, the Association of Wall and Ceiling Industries International, the Gypsum Association, and the Ceilings & Interior Systems Construction Association. Levels are described as follows:

Level 5: All joints and interior angles shall have tape embedded in joint compound and three separate coats of joint compound applied over all joints angles, fastener heads, and accessories. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.

1.5 REGULATORY REQUIREMENTS

A. Comply with California Building Code, Title 24, Part 2.

B. In addition to compliance with applicable legal requirements comply with following:

1. Underwriters Laboratories for fire-rated materials and products classification.

2. NFPA for fire-rated assemblies.

3. ASTM C1396, C840, C1002, and C1047.

C. Scaffolding: In accordance with Federal, State, County, and City of Pasadena Safety Rules and Regulations and CAL/OSHA.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

1.7 MOCK-UP

A. Section 01 45 00 - Quality Control: Mock-up requirements.

B. Provide mock-up of interior wall and ceiling system.

C. Construct mock-up, 8 feet long by 96 inch wide, illustrating surface finish.

D. Locate where directed by District Representative.

E. If approved by Architect and District Representative, the mock-up may remain as part of the Work.

1.8 PRE-INSTALLATION MEETING

A. Comply with Section 01 31 19.

B. Convene minimum one week prior to commencing Work of this section.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. United States Gypsum Corporation.

B. Domtar Gypsum, Inc.

C. Georgia Pacific Corporation

D. Gold Bond - National Gypsum Corporation.

2.2 MATERIALS

A. Standard Gypsum Board: ASTM C1396; 5/8 inch thick unless otherwise indicated, Type "X," maximum available length in place; ends square cut, tapered and beveled edges.

B. Moisture and Mold Resistant Gypsum Board: ASTM C1396 (Section 5); 5/8 inch thick, regular type except where Type X fire-resistant type is indicated on the Drawings or required to meet UL, maximum available length in place; wrapped long edges.

1. Provide for exposed and concealed locations at toilet rooms, janitor rooms, kitchens, and other "wet" areas except where otherwise indicated on the drawings or otherwise specified.

2.3 ACCESSORIES

A. Corner Beads: Metal.

B. Edge Trim: GA-201 and GA-216; Type LC bead.

C. Joint Materials: GA-201 and GA-216; reinforcing tape, joint compound, adhesive, and

water.

D. Fasteners: ASTM C1002, Type S12.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 19: Verification of existing conditions before starting work.

B. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with GA-201, GA-216 and manufacturer's instructions.

B. Erect single layer board in horizontal, with ends and edges occurring over firm bearing.

C. Use screws when fastening gypsum board to wood furring or framing.

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

E. Place control joints consistent with lines of building spaces as indicated.

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

G. Install backing board over gypsum board in accordance with manufacturer's written instructions.

3.3 JOINT TREATMENT

A. Exposed Surfaces: All internal and external corners and angles and joints between panels shall be reinforced with perforated tape and joint compound and finished as follows:

1. Taping: Fill all corners and recesses between gypsum board panels with sufficient thickness of joint compound to completely hide board at all joints. Center tape on joint and press tightly to 2 panels using suitable tool. Lay excess compound squeezed from beneath tape smoothly on top of tape.

2. Second Coat: When first coat is dry, spread a second coat application of joint compound evenly over entire joint to beyond shoulder of recess or tape.

3. Third Coat: When second coat is dry, apply sufficient joint compound to even up all surfaces of joint.

4. Screw Depressions: Apply at least 2 coats of joint compound to fill depressions even and flush with surface of panel.

5. At trim flanges apply joint compound in 3 coats, full thickness at bead nose and feather out at least 10".

6. Sanding: Between applications of compound, rough spots or areas shall be sanded smooth where necessary. When dry, finish coat shall be sanded as required to leave joints and screw spots flat, flush and smooth, and ready for painting or finishing.

3.4 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

B. Shim Work as required to comply with specified tolerances.

C. Do not exceed 1/16" offset between planes of abutting sheets at edges or ends.

3.5 REPAIR RECOMMENDATIONS FOR DAMAGED DRYWALL

A. Reset all nails which are protruding or loose.

B. For each nail in a fractured area or a protruding nail, add a nail similar to existing, in an undamaged area of drywall near the loose nail into the framing.

C. Remove loose gypsum, paper, and joint compound.

D. Refinish to match existing texture.

E. Paint entire wall plane, color to match existing.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes suspended metal grid ceiling system and perimeter trim; acoustic panels and supplementary acoustic insulation over system units.

B. Related Sections:

1. Section 07 21 00: Thermal and Sound Insulation

2. Section 07 92 00: Joint Sealants

4. Division 23: Heating, Ventilating, and Air Conditioning - for Air Outlets and Inlets.

5. Division 26: Electrical - for Fire Alarm System.

6. Division 26: Electrical - for Interior Luminaries.

1.2 REFERENCES

A. ASTM C635 - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

C. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

D. ASTM E580 - Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

E. ASTM E1264 - Classification of Acoustical Ceiling Products.

F. CISCA (Ceilings and Interior Systems Contractors Association) - Acoustical Ceilings: Use and Practice.

G. UL - Fire Resistance Directory.

1.3 SYSTEM DESCRIPTION

A. Suspension System: Rigidly secure acoustic ceiling system including integral

mechanical and electrical components with maximum deflection not to exceed the allowable deflection per requirements of adopted applicable current code.

B. Noise Reduction Coefficient: 0.70 minimum.

C. Ceiling Attenuation Class: 35 minimum.

1.4 SUBMITTALS FOR REVIEW

A. Make submittals in accordance with Section 01 33 00.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.

C. Product Data: Provide data on metal grid system components, acoustic units.

D. Samples: Submit two full size samples illustrating material and finish of acoustic units.

E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner and perimeter molding.

1.5 QUALITY ASSURANCE

A. Conform to CISCA requirements.

B. Grid Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Acoustic Unit Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Design of ceiling suspension system, including related components, shall meet or exceed minimum requirements of California Building Code, Title 24, Part 2.

B. Quality Standards: ASTM C636.

C. Provide panels that demonstrate the following performance when tested in accordance with ASTM E84:

1. Flame spread: 25 maximum.

2. Smoke density: 25 maximum.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 66 00: Environmental conditions affecting products on site.

B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

1.8 PROJECT CONDITIONS

A. Section 01 31 19 - Project Meetings.

B. Sequence work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

C. Install acoustic units after interior wet work is dry.

1.9 EXTRA MATERIALS

A. Provide 5 percent of total acoustic unit area of extra tile to the District.

PART 2 PRODUCTS

2.1 SUSPENSION SYSTEM MATERIALS

A. Manufacturers:

1. USG Interiors, Inc.

2. Armstrong World Industries, Inc.

3. Chicago Metallic

B. Non-fire Rated Grid (For Lay-in Acoustic Units):

1. ASTM C635, heavy duty, exposed fineline with 9/16 inch wide face, and similar to Model No. "Fineline DXF" manufactured by Donn Suspension Systems (USG Interiors, Inc.), or equal.

a. Length For Heavy Duty Class: 12'-0".

b. Height: 1-25/32".

c. Allowable load for 4'-0" spacing: 12.3 lbs./linear foot.

d. Color: Factory White.

C. Suspension Trim:

1. ASTM C635, 2¼ inch high face, equal and similar to Model No. "Compasso Suspension Trim" manufactured by USG Interiors, Inc. or equal.

a. Length For Heavy Duty Class: Manufacturer's standard.

b. Height: 2¼".

c. Color: Factory White.

D. Wall Angle and Trim:

1. ASTM C635, listed by UL for use in an assembly indicated, with 9/6 inch exposed face, M9 (M7A for gypsum lay-in panels) wall angle manufactured by Donn Suspension Systems, USG Interiors, Inc. or equal.

a. Length: 12'-0".

b. Edges: Hemmed flat

c. Color: Factory White.

E. Suspension Materials and Fastenings:

1. Wire: 12-gauge galvanized steel, pre-straightened.

2. Wire Connections to Overhead Structure: ¼ inch eye screw at wood framing with 1¼ inch minimum penetration at angle of wire.

3. Uplift Stiffeners: ½ inch EMT conduit or as indicated.

4. Clamps for Hanging Threaded Rods: Malleable iron C-Clamps, Model No. 3048T21 manufactured by McMaster-Carr.

F. Accessories: Stabilizer bars, clips, splices, and hold down clips required for suspended grid system shall be ceiling manufacturer's standard to fit system furnished.

G. Grid Finish: Factory applied matte white to match ceiling panel.

2.02 ACOUSTIC UNIT MATERIALS - TYPE 1, NON-FIRE RATED

A. Manufacturers:

1. Armstrong

2. Or equal.

3. Substitutions: Refer to Section 01 25 00:

B. Acoustical Panels Item #1811, School Zone™ FINE FISSURED™ Lay-In, manufactured by Armstrong, conforming to the following:

1. Size: 24 x 48 inches.

2. Thickness: ¾ inches.

3. Surface finish: Factory-applied latex paint.

4. Composition: Wet-formed mineral fiber.

5. Light Reflectance: 0.85 percent per ASTM E1477.

6. NRC Range: 0.70.

7. Fire Hazard Classification: Class A (Flame Spread 25 or under), UL Label.

8. Surface Color: White.

9. Sag Resistance: HumiGuard® Plus.

2.3 ACCESSORIES

A. Acoustic Sealant For Perimeter Moldings: Specified in Section 07 92 00 - Joint Sealants.

B. Touch-up Paint: Type and color to match acoustic and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 19: Verification of existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636, manufacturer's instructions, California Building Code, Title 24, Part 2.

B. Install system in accordance with ASTM E580.

C. Install system capable of supporting imposed loads to a deflection of 1:360 maximum.

D. Locate system on room axis according to reflected plan.

E. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

F. Secure hanger wires to structure above as indicated. Space hanger wires 48" on centers along main runner tees and install all other wire supports as indicated. Provide a support wire at each of 4 corners of each recessed light fixture. (Hanger wire shall be not more than 1 in 6 out of plumb)

G. Space main runner tees 4'- 0" apart with cross tees placed to produce 24" by 48" modules, as indicated. Main and cross tees shall be mechanically locked in place to form a rigid grid system, complete with wall angles and accessories. Suspend ceiling flat and level to within 1/8" in 10'-0" in all directions except where sloped ceilings occur. Bottom flange joints shall be tight and flush.

H. Provide trapeze or other supplementary support members at obstructions to main hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 in 6 out of

plumb are to have counter-sloping wires.

I. Ceiling grid members may be attached to not more than 2 adjacent walls; ceiling grid members should be at least ½ inch free of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free and a minimum of ½ inch clear of wall.

J. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

K. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.

L. Do not eccentrically load system, or produce rotation of runners.

M. Perimeter Molding:

1. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal strut or a 16 gage wire with a positive mechanical connection to the runner may be used. Where the perpendicular distance from the wall to the first parallel runner is 12 inches or less, this interlock is not required.

2. Install concealed edge molding at intersection of ceiling and vertical surfaces into bed of acoustic sealant.

3. Use longest practical lengths.

4. Miter and rivet corners.

5. Provide concealed at junctions with other interruptions.

N. Form expansion joints in accordance with manufacturer's instructions. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

O. Provide sets of four 12 ga. splayed bracing wires oriented 90 degrees from each other at the following spacing:

1. For school buildings, place sets of bracing wires at a spacing not more than 12 feet by 12 feet on center.

2. Provide bracing wires at locations not more than ½ the spacing given in (A) above from each perimeter wall and at the edge of vertical ceiling offsets.

P. Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns. Make all tight turns within a distance of 1½ inches. Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.

Note: Wire turns made by machine where both strands have been deformed or bent

in wrapping can waive the 1½" requirement, but the number of turns should be maintained, and be as tight as possible.

Q. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit, etc. It is acceptable to attach lightweight items, such as single electrical conduit not exceeding ¾" nominal diameter, to hanger wires using connectors acceptable to OSA/SSS OR OSHPD.

R. When drilled-in concrete anchors or shot-in anchors are used in reinforced concrete for hanger wires, 1 out of 10 must be field tested for 200 pounds of tension. When drilled-in concrete anchors are used for bracing wires, 1 out of 2 must be field tested for 440 pounds in tension. Shot-in-anchors in concrete are not permitted for bracing wires. If any shot-in or drilled-in anchor fails, see Section 2624 (d) Title 24.

Note: Drilled-in or shot-in anchors require special DSA/SSS approval when used in prestressed concrete.

S. Attach all light fixtures to the ceiling grid runners to resist a horizontal force to the weight of the fixtures.

T. Flush or recessed light fixtures and air terminals or services weighing less than 56 pounds may be supported directly on the runners of a heavy duty grid system but, in addition, they must have a minimum of two 12 ga. slack safety wires attached to the fixture at diagonal corners and anchored to the structure above. All 4 ft. x 4 ft. light fixtures must have slack safety wires at each corner.

U. All flush or recessed light fixtures and air terminals or services weighing 56 pounds or more must be independently supported by not less than 4 taut 12 ga. wires each attached to the fixture and to the structure above regardless of the type of ceiling grid system used.

V. The 4 taut 12 ga. wires including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.

W. All fixtures and air terminals or services supported on intermediate duty grid systems must be independently supported by not less than 4 taut 12 ga. wires each attached to the fixture or terminal and to the structure above.

X. Support surface mounted light fixtures by at least two positive devices which surround the ceiling runner and which are each supported from the structure above by 12 ga. wire. Spring clips of clamps that connect only to the runner are not.

Y. Provide additional supports when light fixtures are 8 feet or longer.

Z. Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting 4 times the weight of the fixture. Special details are necessary for this condition at the ceiling grid.

3.3 INSTALLATION - ACOUSTIC UNITS

A. Install acoustic units in accordance with manufacturer's instructions.

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

C. Lay directional patterned units one way with pattern parallel to longest room axis. Fit border trim neatly against abutting surfaces.

D. Install units after above ceiling work is complete.

E. Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustic Units:

1. Cut to fit irregular grid and perimeter edge trim.

2. Cut bevel edges to field cut units.

3. Double cut and field paint exposed edges of regular units.

G. Where occurs, provide preformed closures to match perimeter molding.

H. Lay acoustic insulation for a distance of 48 inches either side of acoustic partitions.

I. Install hold-down clips to retain panels tight to grid system within 20 feet of an exterior door.

3.4 ERECTION TOLERANCES

A. Section 01 45 00: Tolerances.

B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.5 CLEANUP

A. After installation of acoustical material, clean all surfaces of the material, removing any dirt, or discolorations. Abraded spots and cut edges shall be touched up with the same paint as was used for factory applied finish of the acoustical materials. Replace badly abraded materials.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes resilient tile flooring and resilient base.

B. Related Sections:

1. Section 01 45 24: Concrete Moisture Vapor Emission and pH Testing.

2. Section 03 30 00: Cast-in-Place Concrete

3. Section 07 26 13: Vapor Emission Control

1.2 REFERENCES

A. ADA - American with Disabilities Act.

B. CBC - California Building Code, Part 2, Title 24.

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

D. ASTM E648 Class 1 and ASTM D-2859 - Fire Resistance.

E. UPEC "UPEC Classification".

F. Federal Test Method Standard 501-a - Indentation Resistance.

G. NFPA 258 - Smoke Density.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples: Submit 3 pieces of resilient flooring and base products, 12" long.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.4 REGULATORY REQUIREMENTS

A. Conform to the California Building Code, Title 24, Part 2.

B. Conform to the more restrictive provisions of the American with Disabilities Act or

the California Building Code, Title 24, Part 2.

C. Resilient Flooring demonstrating a coefficient of friction of at least 0.6 per ASTM D2047 will be accepted as meeting the intent of slip resistance. CBC 1124B.1 / ADA Standards 4.5.1.

1.5 PRODUCT HANDLING

A. Deliver materials to jobsite in original, unopened packages or containers with manufacturer's labels intact and legible. Store materials in building at least 24 hours prior to installation. Run or batch numbers shall be clearly stamped on each carton or container.

PART 2 PRODUCTS

2.1 TILE FLOORING

A. Manufacturers - Tile Flooring:

1. Tile listed is manufactured by Armstrong World Industries, Inc., Fullerton, CA.

2. Or equal

3. Substitutions: Refer to Section 01 25 00.

B. Vinyl Composition Tile: Standard Excelon Imperial Texture, ASTM F1066, Class 2, homogeneous composition tile, pattern uniformly dispersed throughout thickness of material.

1. Size: 12 x 12 inch.

2. Thickness: 1/8 inch

3. Pattern and Color: As selected by Architect from the following list.

a. Field Color: 51928 Pebble Tan (85%)

b. Accent Color: 51903 Blue Gray (10%)

c. Accent Color: 51910 Black (5%)

4. Subfloor Leveler System: Johnsonite LS-40, pieces to fit transition condition. Install per manufacture's specifications.

2.2 BASE

A. Manufacturers - Base:

1. Roppe Corp.

2. Armstrong World Industries, Inc.

3. Burke Flooring Products

4. Substitutions: Refer to Section 01 25 00.

B. Base: Rubber top set coved for use with sheet flooring and vinyl composition tile, toeless for use with carpet, premolded external corners.

1. Height: 4 inch.

2. Thickness: 1/8 inch.

3. Color to be selected by Architect from the following, based on Burke:

a. 502 – P-Brown

b. 506 – Tahoe

c. 253 – Dark Teal

d. 660 – Slate

e. 206 – Light Beige

2.3 ACCESSORIES

A. Subfloor Filler: Type recommended by adhesive material manufacturer.

B. Primers and Adhesives: Waterproof, types recommended by flooring manufacturer.

C. Moldings, Edge Strips and Reducer Strips: Same material as flooring.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate with other trades to provide level, smooth and clean finish surfaces to receive resilient flooring and topset base.

3.2 PREPARATION

A. Moisture vapor transmission shall not exceed 3 lbs/1000 sq. ft ./24 hours per RMA Calcium Chloride Test. As a general rule, a 4 inch thick slab will require a month drying time before moisture test are performed.

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Subfloors shall be dry, and cleaned of grease, oil, dirt and foreign material and swept clean. Grind of high spots and fill low spots. Surfaces to receive resilient tactile warning

tile shall be wire brushed.

D. Prohibit traffic until filler is cured.

E. Clean substrate by vacuuming or blowing with compressed air.

F. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION - TILE FLOORING

A. Install in accordance with manufacturer's instructions.

B. Mix tile from container to ensure shade variations are consistent when tile is placed.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place, press with heavy roller to attain full adhesion.

E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

F. Scribe flooring to walls, columns, floor outlets, and other appurtenances to produce tight joints. Install flooring underneath all base cabinets and other fixed equipment where indicated.

G. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

H. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Secure metal strips before installation of flooring with stainless steel screws.

I. Install feature strips and floor markings where indicated. Fit joints tightly.

3.4 INSTALLATION – BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

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

B. Clean, seal, and wax resilient flooring products in accordance with 's instructions.

3.6 PROTECTION OF FINISHED WORK

A. Prohibit traffic on resilient flooring for 48 hours after installation.

3.7 CLEANING

A. Comply with provisions of Section 01 74 00 for final cleaning.

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

C. Clean, seal, and maintain resilient flooring products.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Use all means necessary to protect resilient flooring, resilient tactile warning tile and base surfaces before, during and after installation. In event of damage, immediately contact the District.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.

B. Related Sections:

1. Section 05 50 00: Metal Fabrications: Shop primed items.

3. Division 23: Mechanical Identification.

4. Division 26: Basic Electrical Materials and Methods.

5. Section 32 17 23: Pavement Markings.

1.2 REFERENCES

A. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.

B. PDCA - Architectural Specifications Manual; Painting and Decorating Contractors of America.

C. SSPC - Steel Structures Painting Manual; Steel Structures Painting Council.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

1. Submit a complete list of all materials to be furnished stating supplier and distributor's names.

2. Submit standard color samples, OR CUSTOM COLOR SAMPLES TO MATCH selected colors as indicated on Drawings, for each type of paint specified. Once colors have been selected by the Architect, submit 3 samples of each color selected for each type of paint, on standard 8-1/2" x 11" spray-out panel.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated

surfaces.

1.6 QUALITY ASSURANCE

A. Certification of Materials: With every delivery of paint materials, certify that materials comply with requirements of this Section.

B. The District Representative will measure thickness of paint on metal with magnetic dry mil thickness gage to verify that designated thickness has been attained.

1.7 REGULATORY REQUIREMENTS

A. Conform to the California Building Code, Title 24, Part 2.

B. Paint materials shall comply with applicable requirements of the Food and Drug Administration's (F.D.A.) Lead Law and the SCAQMD.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 66 00: Transport, handle, store, and protect products.

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

C. Container Label: Include name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 66 00: Environmental conditions affecting products on site.

B. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product .

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product .

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

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

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.10 PROJECT CONDITIONS

A. Section 01 31 19: Project Meetings and Procedures.

B. Sequence application to the following:

1. Do not apply finish coats until paintable sealant is applied.

2. Back prime wood trim before installation of trim.

1.11 EXTRA MATERIALS

A. Supply 3 gallons of each color, type, and surface texture; store where directed.

B. Label each container with color, type, texture and room/area location.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

A. Paint, Transparent Finishes, Stain and Primer Sealers listed are manufactured by Dunn-Edwards Corp.

B. Other manufacturers offering equal products:

1. Benjamin Moore & Co.

2. Sherwin – Williams Co.

3. Or equal.

2.2 MATERIALS

A. Coatings: Ready mixed, except field catalyzed coatings. Prepare pigments:

1. To a soft paste of consistently, capable of being readily and uniformly dispersed to a homogeneous coating.

2. For good flow and brushing properties.

3. Capable of drying or curing free of streaks or sags.

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

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler.

2.3 FINISHES

A. Refer to schedule at end of section for surface finish. Colors to be selected by Architect.

2.4 FOLLOWING ITEMS NOT TO BE PAINTED

A. Brass valves, chromium or nickel-plated piping and fittings.

B. Boiler control panels and control systems.

C. Fabric connections to fans.

D. Flexible conduit connections to equipment, miscellaneous nameplates, stamping and instruction labels and manufacturer's data.

E. Mechanical and electrical utility lines, piping and heating and ventilation ductwork. in tunnels, underfloor excavated areas or crawl spaces, attic spaces and enclosed utility spaces.

F. Products and equipment having a complete factory finish.

G. Flag, floodlight, parking light poles and loudspeaker poles furnished with a galvanized finish.

H. Structural and miscellaneous, steel, open web steel joints and metal floor decking which will not be exposed in final construction, shall have no finish other than one coat of shop primer.

I. Hardboard covering on tops and backs of counters and benches.

J. Items specified with galvanized finish unless otherwise indicated.

K. Brass, bronze, aluminum, lead, stainless steel, and chrome or nickel-plated surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 19: Verification of existing conditions before starting work.

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

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop applied primer for compatibility with subsequent cover materials.

E. 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. Concrete: 12 percent.

3. Concrete Floors: 8 percent.

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

5. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION FOR NEW WORK

A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Surfaces: Correct defects and clean surfaces which affect work of this section.

C. Marks: Seal with shellac those which may bleed through surface finishes.

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

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

F. Creosote Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

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 Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Passivation is not acceptable. Apply coat of primer.

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

K. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, 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. Passivation is not acceptable. Spot prime paint after repairs.

L. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

M. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

N. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: 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.

O. Interior Wood Items Scheduled to Receive Paint Finish: 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.

P. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

Q. Existing Steel, Metal and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, rust and paint. 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. Passivation is not acceptable. Spot prime paint after repairs.

3.3 PREPARATION OF EXISTING PAINTED SURFACES

A. Examine surfaces to receive paint finish. Surfaces which are not properly prepared, and cleaned or which are not in condition to receive the finish specified, shall be corrected before paint is applied. No painting shall be done on existing painted surfaces until surfaces are approved by the District Representative.

B. Existing painted surfaces indicated to be painted, shall be prepared as follows:

1. Wood, plaster and metal surfaces shall be washed with TSP (trisodium phosphate), to remove dirt, grease and other foreign materials and rinsed with clean water and then sandpapered and dusted off. Surfaces shall have wax completely removed before washing.

2. Checked, cracked, blistered, scaled, loose and alligatored paint on wood and metal surfaces shall have the paint removed down to original finished surface, then hand sanded and dusted clean.

3. Existing metal ceiling panels indicated to be painted, shall be prepared as follows:

a. Surface shall have paint completely removed by bead blasting with the smallest possible beads. Wash as indicated in Paragraph B.1.

b. Metal ceiling panels shall be shop painted for a quality finish.

4. Surfaces shall then be considered as new work.

3.4 PREPARATION OF EXISTING PLASTER SURFACES

A. The following procedures are to repair interior plaster cracks prior to painting:

1. Hairline Cracks: Two coats of elastomeric coating will bridge hairline cracks.

2. Small to Large Cracks: The elastomeric coating will fill and span cracks up to 1/32". A credit card thickness or greater (1/8") needs to be filled with an elastomeric sealant (recommended by the Paint Manufacturer) prior to applying 2 coats of elastomeric coating.

3. Large Cracks: Cracks 1/4" to 1/2" need to be"raked out," the crack(s) to be 1/4" minimum wide, then filled with an elastomeric sealant prior to application

of 2 coats of elastomeric coating.

4. The following applies to Paragraphs A-1, A-2, and A-3 above: Apply a primer coat over the elastomeric coating to change absorbency to be similar to adjacent wall surface.

3.5 APPLICATION

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

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

D. Sand wood, metal and existing metal surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

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

G. Prime concealed surfaces of interior and exterior woodwork with primer paint.

H. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.

3.6 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Division 23 for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.

B. Paint shop primed equipment.

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

D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports except where items are shop finished and where indicated on Drawings not to be painted.

E. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces. Paint dampers exposed behind louvers, grilles, to match face panels.

F. Paint exposed conduit and electrical equipment occurring in finished areas.

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

H. Color code equipment, piping, conduit, and exposed duct work in accordance with color schedule.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.7 FIELD QUALITY CONTROL

A. Section 01 45 00: Quality Control.

B. Inspect questionable coated areas.

3.8 CLEANING

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

3.9 SCHEDULES

A. Interior:

1. Woodwork, Painted: 3 coats.

~~a. First: One coat of primer: Super U-365 - Interior Alkyd Enamel Undercoat manufactured by Dunn-Edwards Corp., or equal.~~

b. Second and Third: Syn-Lustro Semi-Gloss - Industrial Maintenance Semi-Gloss Enamel (9 Series) manufactured by Dunn-Edwards Corp., or equal, or Syn-Lustro Gloss - Industrial Maintenance Gloss Enamel (10 Series) manufactured by Dunn-Edwards Corp., or equal to be selected by the District Representative.

2. Miscellaneous Woodwork: 4 coats. Wood items including but not limited to: Wood base and shoe, chair rails, counter tops and walking surfaces.

a. First: One coat of primer: Synseal - Interior Brushing Sanding Sealer manufactured by Dunn-Edwards Corp. (V106A), or equal.

b. Second, Third and Fourth: Syngloss II Interior Gloss Varnish (V197) manufactured by Dunn-Edwards Corp., or equal.

3. Casework: Interior surfaces of casework (except plastic laminate faced casework) including top, edges, and underside of shelving, poles, surfaces of drawers except fronts, the interior surfaces of mailbox pigeonholes, and particle board.

a. First: One coat of primer: Stainseal - Semi-Transparent Wood Stain manufactured by Dunn-Edwards Corp. (V 108), or equal.

b. Second and Third: Interior Alkyd Semi-Gloss Varnish (V199) manufactured by Dunn-Edwards Corp., or equal.

4. Gypsum Board: 3 coats.

   a. First: One coat of primer: Vinylastic - Interior Pigmented Sealer manufactured by Dunn-Edwards Corp. (W101), or equal.

   b. Second and Third: Syn-Lustro Semi-Gloss - Industrial Maintenance Semi-Gloss Enamel (9 Series) manufactured by Dunn-Edwards Corp., or equal, or Syn-Lustro Gloss - Industrial Maintenance Gloss Enamel (10 Series) manufactured by Dunn-Edwards Corp., or equal to be selected by the District Representative.

5. Plaster and Stucco: 2 coats.

   a. First: One coat of primer: Acri-Flat - Exterior Flat Finish manufactured by Dunn-Edwards Corp. (W704), or equal.

   b. Second: One coat of primer: Acri-Flat - Exterior Flat Finish manufactured by Dunn-Edwards Corp. (W704), or equal.

6. Concrete: 3 coats

   a. First: One coat of primer: EFF-Stop - Acrylic Masonry Sealer manufactured by Dunn-Edwards Corp. (W709), or equal.

   b. Second and Third: One coat of primer: Acri-Flat - Exterior Flat Finish manufactured by Dunn-Edwards Corp. (W704), or equal.

7. Metal to Include Existing Metal: Shall be cleaned, pre-treated with one coat of Galv-Etch - Galvanized Metal Etching Solution manufactured by Dunn-Edwards Corp. (GE123), or equal, and painted with 3 coats.

   a. Items to be painted include but are not limited to: exposed structural and miscellaneous steel, metal doors and frames, ladders and other miscellaneous metal items as directed by the District Representative.

   b. First: One coat of primer: Corrobar - White Corrosion Primer manufactured by Dunn-Edwards Corp. (43-5), or equal.

B. Second and Third: Syn-Lustro Semi-Gloss - Industrial Maintenance Semi-Gloss Enamel (9 Series) manufactured by Dunn-Edwards Corp., or equal, or Syn-Lustro Gloss - Industrial Maintenance Gloss Enamel (10 Series) manufactured by Dunn-Edwards Corp., or equal to be selected by the District Representative.

C. Exterior:

1. Woodwork: 3 coats.

   a. First: One coat of primer: Compo - Exterior Primer/Undercoat manufactured by Dunn-Edwards Corp. (42-1), or equal.

   b. Second and Third: Rancho - Quick-Dry Alkyd Gloss Enamel (QD60) manufactured by Dunn-Edwards Corp., or equal.

2. Plaster and Stucco: 2 coats.

   a. First: One coat of primer: Acri-Flat - Exterior Flat Finish manufactured by Dunn-Edwards Corp. (W704), or equal.

   b. Second: One coat of primer: Acri-Flat - Exterior Flat Finish manufactured by Dunn-Edwards Corp. (W704), or equal.

3. Concrete: 3 coats

   a. First: One coat of primer: EFF-Stop - Acrylic Masonry Sealer manufactured by Dunn-Edwards Corp. (W709), or equal.

   b. Second and Third: One coat of primer: Acri-Flat - Exterior Flat Finish manufactured by Dunn-Edwards Corp. (W704), or equal.

4. Concrete Block: 3 coats.

   a. First: One coat of primer: Blocfil Smooth - Acrylic Block Filler manufactured by Dunn-Edwards Corp. (W305), or equal.

   b. Second and Third: One coat of primer: Acri-Flat - Exterior Flat Finish manufactured by Dunn-Edwards Corp. (W704), or equal.

5. Metal: Shall be cleaned, pre-treated and painted with 3 coats.

   Items to be painted include, but are not limited to, steel columns and miscellaneous steel items, gravel stops, metal doors and frames, decking and flashings.

   a. First: One coat of primer: High Build Industrial Epoxy Primer manufactured by Dunn-Edwards Corp. (IP714), or equal.

   b. Second and Third: One coat of: Acrylic Alphatic Urethane Enamel - Pigmented manufactured by Dunn-Edwards Corp. (IP640), or equal.

6. Existing Metal: Shall be cleaned, pre-treated and painted with 3 coats.

   Items to be painted include, but are not limited to, existing steel columns and existing miscellaneous steel items, existing gravel stops, existing metal doors and frames, existing metal deck ceilings and existing flashings.

   a. First: One coat of primer: High Build Industrial Epoxy Primer manufactured by Dunn-Edwards Corp. (IP714), or equal.

   b. Second and Third: One coat of: Acrylic Alphatic Urethane Enamel - Pigmented manufactured by Dunn-Edwards Corp. (IP640), or equal.

D. Mechanical and Electrical Work:

1. Except where interior mechanical and electrical work to be painted is specified to received another paint finish, work occurring in finished rooms and spaces shall be cleaned, pre-treated and painted with 3 coats. Items to be painted include, but are not limited to: steel and copper piping, pipes, vents, fittings, ducts, plenums, miscellaneous supports and hangers, electrical conduit, fittings, pull boxes, outlet boxes, unfinished surfaces of plumbing fixtures, miscellaneous metal cabinets, panels and access doors and panels.

   a. First: One coat of primer: Corrobar - White Corrosion Primer manufactured by Dunn-Edwards Corp. (43-5),or equal

   b. Second and Third: Syn-Lustro Semi-Gloss - Industrial Maintenance Semi-Gloss Enamel (9 Series) manufactured by Dunn-Edwards Corp., or equal, or Syn-Lustro Gloss - Industrial Maintenance Gloss Enamel (10 Series) manufactured by Dunn-Edwards Corp., or equal to be selected by the District Representative.

2. Insulation and Taping On Pipes and Ducts: 3 coats.

   a. Finished Rooms:

      (1) First: One coat of primer: Multi-Purpose Primer manufactured by Dunn-Edwards Corp. (W713), or equal.

      (2) Second and Third: Syn-Lustro Semi-Gloss - Industrial Maintenance Semi-Gloss Enamel (9 Series) manufactured by Dunn-Edwards Corp., or equal, or Syn-Lustro Gloss - Industrial Maintenance Gloss Enamel (10 Series) manufactured by Dunn-Edwards Corp., or equal, to be selected by the District Representative.

   b. On Building Exterior:

      (1) First: One coat of primer: High Build Industrial Epoxy Primer manufactured by Dunn-Edwards Corp. (IP714), or equal.

      (2) Second and Third: One coat of: Acrylic Alphatic Urethane Enamel - Pigmented manufactured by Dunn-Edwards Corp. IP640), or equal.

3. Inside surfaces of ducts, vents, dampers and louvers as far back as visible from room in which they open shall be painted with 2 coats of flat black paint.

E. Miscellaneous:

1. Lettering: Where lettering and signs are indicated to be painted, lettering shall be done by an experienced sign painter. Unless otherwise indicated, characters shall be 4" high, 3/4" wide stroke, black.

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes markerboards.

B. Related Sections:

1. Section 06 10 00: Rough Carpentry

1.2 REFERENCES

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

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate wall elevations, dimensions, joint locations and special anchor details.

C. Samples: Submit four samples 6 x 6 inch in size illustrating materials and finish, color and texture of tackboard, and tackboard surfacing.

1.4 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include data on regular cleaning and stain removal.

1.5 REGULATORY REQUIREMENTS

A. Conform to the California Building Code, Title 24, Part 2.

B. Conform to the more restrictive provisions of the American with Disabilities Act or the California Building Code, Title 24, Part 2.

1.6 QUALIFICATIONS

A. Acceptable Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products listed are made by Claridge Products & Equipment, Inc., or equal.

2.2 MARKERBOARD MATERIAL

A. Markerboards, with vertical sliding panels, shall consist of #22 gage facing sheet, with porcelain enamel surface, laminated to 7/8" honeycomb core, with 0.015 aluminum backing sheet. Color shall be selected by the Architect from manufacturer's full standard range. Chalkrail and metal trim shall be extruded aluminum alloy, matching configuration indicated on Drawings.

B. Standard continuous aluminum maprail and maphooks. Provide 2 map hooks for each 4 feet of map rail.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01 31 19.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for frameless adhesive applied type.

3.2 INSTALLATION

A. Install markerboards in accordance with acceptable manufacturer's instructions.

B. Secure units level and plumb.

C. Install panels after finish painting of wall surfaces has been completed and paint is thoroughly dry. Set panels level, plumb and neatly assembled. At the completion of the work, trim shall be completely cleaned of dirt, fingermarks, or other foreign material. Adjust sliding panels for smooth operation.

3.3 CLEANING

A. Cover markerboard surfaces with protective cover, taped to frame.

B. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes interior signs.

B. Related Sections:

1. Section 08 12 13: Standard Hollow Metal Doors.

2. Section 09 29 00: Gypsum Board.

1.2 REFERENCES

A. ADA - American with Disabilities Act.

B. CBC - California Building Code, Part 2, Title 24.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.

C. Samples: Submit two sample signs, 4 x 6 inch in size illustrating type, style, letter font, and colors specified; method of attachment.

D. Manufacturer's Installation Instructions: Include installation template and attachment devices.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.5 REGULATORY REQUIREMENTS

A. Conform to the more restrictive provisions of the American with Disabilities Act or California Building Code, Part 2, Title 24.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01 66 00.

B. Package signs, labeled in name groups.

C. Store adhesive attachment tape at ambient room temperatures.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install signs when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ASI Sign Systems, Inc.

B. Nelson-Harkins Industries, Inc.

C. Seton Name Plate Co.

D. Substitutions: Under provisions of Section 01 25 00.

2.2 A. Tactile character type: Tactile characters on signs shall be raised 1/32 inch (0.794 mm) minimum and shall be sans serif uppercase characters accompanied by Contracted Grade 2 Braille (see note below). CBC Section 1117B.5.5.1.

B. Tactile character size: Raised characters shall be minimum of 5/8 inch (15.9 mm) and a maximum of 2 inches (51 mm) high. CBC Section 1117B.5.5.2.

C. Finish and contrast: Contrast between character, symbols and their background must be 70% minimum and have a non-glare finish. CBC Section 1117B.5.2.

D. Proportions: Characters on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width-to-height ratio of between 1:5 and 1:10. CBC Section 1117B.5.3. All letters measured must be uppercase. After choosing a typestyle to test, begin by printing whichever is narrower. If the character is not wider than 1 inch, nor narrower than the 3:5 rectangle, the proportions are correct. Use the 1:5 rectangle to determine if the stroke of the I is too broad, and the 1:10 rectangle to see if it is too narrow. If all the tests are passed, the typestyle is compliant with proportion requirement.

E. Braille: California (Contracted) Grade 2 Braille shall be used wherever Braille is required in other portions of these standards. Dots shall be 1/10 inch on center in each cell with 2/10 inch (5.09 mm) space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised a minimum of 1/40 inch (0.635 mm) above the background. Braille dots shall be domed or rounded. CBC Section 1117B.5.6.

F. Mounting location shall be determined so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of the door. CBC Section 1117B.5.7.

2.3 ROOM NUMBERING SIGNS

A. Materials: Non-glare photopolymer face, bonded to 1/8 inch thick acrylic backing plate.

1. Color as selected by Architect from manufacturer's full standard range.

2. Corners: Radius corners as indicated on the Drawings.

3. Edges: Ease all exposed edges to eliminate sharp edges.

B. Size: As indicated on the Drawings, or if not indicated, 4" x 8".

C. Provide room signage at each corridor door

D. Provide 25 additional signs as directed by District. Minimum size 4 inches x 2 feet with 1½ inch high characters.

C. Lettering Type: Helvetica Medium.

2.3 ACCESSIBILITY SIGNS

A. Accessibility Signs:

1. Tedlar coated faces.

2. Colors: Face color blue; graphics and letter color white.

3. Sign size: 8 inches by 8 inches.

4. Graphics: International symbols as indicated on the Drawings.

2.4 OCCUPANCY SIGNS

A. Material: Satin matte finish opaque acrylic plastic with integral color:

1. Thickness: 1/4 inch

2. Face Color: To be selected by Architect from manufacturer's full standard range.

B. Character Style:

1. Text: To be selected by Architect from manufacturer's full standard range.

2. Size: 4 inches high; length as required;

3. Lettering Type: 3 inches high Helvetica Medium.

2.5 EXIT, STAIR, AND STAIRWELL IDENTIFICATION SIGNS

A. Exit and Exit Stairs which are required to be identified as such by the Fire Marshal shall also be identified by a sign with raised characters and Braille which conforms to ANSI 117.1 (703.2 or 703.3). A sign shall identify enclosed stairways with raised characters and

Braille. The following designations shall be provided:

1. EXIT (For an unlocked exit door without an alarm, leading to the exterior of the building.)

2. STAIR (For an enclosed stairway door on the ground floor, or for an enclosed stairway door on any other floor which does not lead to an exit.

3. EXIT STAIR (For an enclosed stairway door above or below the ground floor which leads to an exit.)

4. EXIT WITH ALARM (For an exit or exit stair door with an alarm.)

5. EXIT ONLY or EXIT STAIR ONLY (For an exit door or exit stair door which locks from the outside and does not allow a return.)

B. Enclosed stairwells shall be identified by a raised and Braille numeral or letter or combination identifying the level of the floor. This sign shall be located adjacent to the door leading from the stairwell into the corridor. The ground floor shall, in addition to its numeral or letter identification, be identified by a raised, five pointed star. The sign shall conform to ANSI 117.1 (703.2 or 703.3).

C. Enclosed stairwells in buildings four stories or more, including parking garages or basements, shall have signs identifying the stairwell by number, whether or not it has roof access, the level, and the floors accessed by that stairwell. Signs shall comply with CBC and with the requirements of ANSI 117.1 and CBC 1117B.5 for non-glare and high contrast.

2. EXTERIOR BUILDING SIGN

A. Building sign, indicating facility name and address, shall be furnished with cast aluminum letters as manufactured by ASI Sign Systems, Inc., or equal.

B. Style: As selected by Architect from manufacturer's full standard range.

C. Material: 0.064 inch aluminum construction, unless indicated otherwise.

D. Letter Size: Name shall be 10 inches high and address shall be 4 inches high, unless indicated otherwise.

E. Letter Copy and Design: As indicated on Drawings.

F. Finish: Finish shall be selected by Architect from manufacturer's full standard range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install signs with aluminum storefront glazing in locations as directed.

C. Clean and polish.

END OF SECTION

SECTION 10 22 26

OPERABLE PARTITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes paired panel partitions, 3 inch (76 mm) thick panels.

B. Related Sections:

1. Section 03 30 00: Cast-In-Place Concrete
2. Section 05 50 00: Metal Fabrications
3. Section 06 10 00: Rough Carpentry

1.2 REFERENCES

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

D. ASTM E557 - Standard Practice for the Installation of Operable Partitions.

1.3 SUBMITTALS

A. Comply with provisions of Section 01 33 00.

B. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

C. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by Contractor.

D. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

E. Samples: Color samples demonstrating full range of finishes available to Architect. Verification samples shall be available in same thickness and material indicated for the work.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in accordance with ASTM E 90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of Opening: Conform to ASTM E 557.

1.5 REGULATORY REQUIREMENT

A. Conform to applicable code for flame/smoke rating for covered panels in accordance with ASTM E84.

B. Design for seismic loading shall meet or exceed minimum requirements of Chapter 16A, California Building Code.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's instructions and as required to prevent damage.

1.7 WARRANTY

A. Provide operable partition manufacturer's written warranty agreeing to repair or replace components with manufacturing defects for a period of two years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Modernfold

B. Hufcor

C. Panelfold

2.2 PAIRED PANEL PARTITIONS, THREE INCH (76 MM) THICK PANELS

A. Product: Acousti-Seal 932 Operable Partition by Modernfold, Inc., manually operated paired flat panels, top supported with operable floor seals.

B. Panel Construction and STC Rating: Nominal 3 inch (76 mm) thick in manufacturer's standard 48 inch (1220 mm) width by height required, with horizontal and vertical framing elements fabricated from 18 gage formed steel with overlapped and welded corners; reinforced top channel to support suspension system components; frame with concealed formed steel at vertical edges.

1. Panel Skin: 1/2 inch (13 mm) tackable gypsum board, class A rated single material or composite layers continuously bonded to panel frame with minimum STC as follows:

a. STC 41.

2. Hinges for Closure Panels, Pass Doors and Pocket Doors: Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Hinges mounted into panel edge or vertical astragal are not acceptable.

3. Panel Trim: No vertical trim required or allowed on vertical edges of panels; minimal groove appearance at panel joints.

4. Panel Weight: As standard with manufacturer for STC selected, 6.5 to 11 pounds per sq ft.

C. Panel Finish and Exposed Trim: Factory applied as follows:

1. Panel Finish: Reinforced vinyl with woven backing weighing not less than 21 ounces per lineal yard.

2. Exposed Panel Trim Color: As selected by Architect from manufacturer's full standard range.

D. Sound Seals and Bottom Seals:

1. Vertical Interlocking Sound Seals Between Panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.

2. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.

3. Horizontal Bottom Floor Seals: Modernfold IA2 Bottom Seal. Automatic operable seals providing nominal 2 inches (51 mm) operating clearance with an operating range of plus 1/2 inch (13 mm) to minus 1-1/2 inches (38 mm) which automatically drop as panels are positioned without the need for tools or cranks.

E. Suspension System and Soffits:

1. Suspension System: Modernfold No. 30 Suspension System:

a. Track: Heat-treated extruded aluminum supported by adjustable steel hanger brackets connected to structural support by pairs of 3/8 inch (10 mm) diameter threaded rods.

b. Exposed Track Soffit: Aluminum, integral to the track with white powder coated finish.

c. Carriers: Trolley wheel minimum 3 inches (76.2 mm) diameter glass reinforced nylon with all-steel precision-ground bearings, attached to panels with 1/2 inch (12.7 mm) diameter pendent bolt mounted to welded steel mounting plate.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until supports and substrates have been properly prepared, in strict accordance with manufacturer's instructions.

B. Notify Architect in writing of unsatisfactory preparation prior to installation. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and ASTM E557 installation procedures. Test for proper operation and make necessary adjustments until satisfactory results are obtained.

B. The complete installation of the accordion wall system shall be by an authorized factory-trained installer and be in strict accordance with the approved shop drawings and manufacturer's standard printed specifications, instructions, and recommendations.

3.3 ADJUSTING

A. Adjust installed work in compliance with provisions of Section 01 77 19.

B. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

C. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

3.4 CLEANING AND PROTECTION

A. Comply with provisions of Section 01 74 00.

B. All track and door surfaces shall be wiped clean and free of handprints, grease, and soil.

C. Cartoning and other installation debris shall be removed to onsite waste collection area, provided by others.

D. Protect installed products until completion of project.

E. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 DEMONSTRATION AND INSTRUCTION

A. Demonstrate installed work in compliance with provisions of Section 01 77 19.

B. Distributor shall demonstrate proper operation and maintenance procedures to District's representative.

C. Owners manuals shall be provided to District's representative.

END OF SECTION

SECTION 10 44 13

FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire extinguishers; fire blankets; fire extinguisher cabinets; and brackets for wall mounting.

1.2 REFERENCES

A. ADA - American with Disabilities Act.

B. CBC - California Building Code, Part 2, Title 24.

C. NFPA 10 - Standard for Portable Fire Extinguishers.

D. UL - Fire Protection Equipment Directory.

1.3 SUBMITTALS FOR REVIEW

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate physical dimensions of cabinet and adjacent plate, rough-in details, measurements for mounting, attachment methods, and hardware. Show relationship to wall opening.

C. Product Data: Provide extinguisher operational features, color, finish and anchorage.

D. Test Data: Indicate hardware operating effort to not exceed 5 lbf. to break glass on extinguisher cabinet door.

1.4 CLOSEOUT SUBMITTALS

A. Comply with Section 01 77 19.

B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Comply with Section 01 66 00 for environmental conditions affecting products on site.

B. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.6 REGULATORY REQUIREMENTS

A. Conform to the more restrictive provisions of the American with Disabilities Act or the California Building Code, Part 2, Title 24.

B. Conform to Title 19, CCR Chapter 3.

C. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

B A. Manufacturers:
C

1. J. L. Industries
2. Kidde Fire Extinguisher Co.
3. Larsen's Manufacturing Co.
4. Potter Roemer
5. Substitutions: Under provisions of Section 01 25 00.

B. Fire Extinguishers: Dry chemical type, cast steel tank, UL-rated 2A:10-BC, 5 lbs. UL rated 4A:40-BC. Model shall be Cosmic by J.L. Industries, or accepted substitution.

C. Extinguisher Finish: Stainless steel tank.

2.2 FIRE EXTINGUISHER CABINETS

A. Cabinet shall be Academy 2025 by J.L. Industries, or accepted substitution.

B. Metal: #180 aluminum, clear anodized.

C. Configuration: semi-recessed type, sized to accommodate accessories.

D. Trim Type: Flat trim.

E. Door: 18 gauge thick, reinforced for flatness and rigidity; lock with break glass access.

1. Hardware shall not require twisting, pinching, or grasping to operate. Operating effort shall not exceed 5 lbf.

F. Door Glazing: Manufacturer's standard scored acrylic sheet.

PART 3 EXECUTION

3.1 EXAMINATION

A. Comply with Section 01 31 19 for verification of existing conditions before starting work.

3.2 INSTALLATION

A. Fabricate and coordinate the assembly of cabinet and adjacent plate so that installation into wall opening is provided.

B. Provide applicable fire rated wall assembly at back side of wall opening.

C. Install in accordance with manufacturer's instructions.

D. Install brackets plumb and level on wall, 48" maximum height from finished floor, as indicated on Drawings, conforming to California Building Code.

E. Secure rigidly in place.

F. Place extinguishers and accessories in cabinets.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.

2. Hanger rods.

3. Flashing.

B. Related Sections:

1. Section 03 10 00 - Concrete Forming and Accessories: Execution requirements for placement of sleeves in concrete forms specified by this section.

2. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.

3. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.

4. Section 07 90 00 - Joint Protection: Product requirements for sealant materials for placement by this section.

5. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this section.

6. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 – Building Services Piping.

B. ASTM International:

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

2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.

3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.

4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. Underwriters Laboratories Inc.:

1. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods and calculations sealed by a Registered Professional Engineer.

E. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Maintain one copy of each document on site.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Carpenter & Paterson Inc.
2. Creative Systems Inc.
3. Flex-Weld, Inc.
4. Glope Pipe Hanger Products Inc.
5. Michigan Hanger Co.
6. Superior Valve Co.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Furnish materials in accordance with State and Municipality of Palos Verdes standards.

C. Plumbing Piping - Gas:

1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

5. Vertical Support: Steel riser clamp.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 MANUFACTURERS – SEISMIC BRACING

A. Systems: Products of B-Line, Inc., Oakland, CA, are the standard of quality required and specified herein. Similar products of other manufacturers meeting the same standards of performance and approved by OSHPD or ORS/DSA may be submitted for approval.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 PREPARATION

A. Do not drill or cut structural members.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

G. Support riser piping independently of connected horizontal piping.

H. Design hangers for pipe movement without disengagement of supported pipe.

I. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tags.

2. Stencils.

3. Pipe markers.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 TAGS

A. Metal Tags:

1. Manufacturers:

a. Safety Sign Co.

b. Seton

c. Brady

d. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

B. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.2 STENCILS

A. Manufacturers:

1. Safety Sign Co.

2. Seton.

3. Brady.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.

2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.

3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.

4. Ductwork and Equipment: 1-3/4 inches high letters.

C. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.3 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers:

a. Safety Sign Co.

b. Seton

c. Brady

d. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Section 09 90 00.

B. Install identifying devices after completion of coverings and painting.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Identify valves in main and branch piping with tags.

F. Identify piping, concealed or exposed, with plastic pipe markers plastic tape pipe markers stenciled painting. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Flashing.
4. Sleeves.
5. Mechanical sleeve seals.
6. Formed steel channel.

B. Related Sections:

1. Division 07 - Joint Protection: Product requirements for sealant materials for placement by this section.
2. Division 07 - Installation requirements for roof flashing installation.
3. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
4. Division 23 – HVAC Ducts and Casings: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

4. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, pipe hanger and support locations including attachment methods, and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Perform Work in accordance with applicable authority and AWS D1.1 for welding hanger and support attachments to building structure.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three (3) years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Provide ventilation in areas to receive solvent cured materials.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Fee and Mason Manufacturing Co.
2. Tolco.
3. Cooper B-Line Systems, Inc.
4. Carpenter & Paterson Inc.
5. Anvil International Inc.
6. Flex-Weld Inc
7. Globe Pipe Hanger Products
8. Michigan Hanger Co.

9. Substitutions: Division 01 - Product Requirements.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 FLASHING

A. Metal Flashing: 24 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb/sq. ft sheet lead.

2. Soundproofing: 1 lb/sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.4 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel.

E. Sealant: Acrylic or polyurethane, two-component type; refer to Division 07.

2.5 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.

2. NMP Corporation

3. Substitutions: Division 01 - Product Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FORMED STEEL CHANNEL

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. B-Line Systems

3. Unistrut Corp.

4. Midland Ross Corp.

5. Substitutions: Division 01 - Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Remove incompatible materials affecting bond.

B. Powder-actuated anchors are not allowed.

C. Install backing or damming materials to arrest liquid material leakage.

D. Do not drill or cut structural members.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Pipe and conduits shall be supported and braced per "B-line Seismic Restraint System" or equal.

B. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69 and MSS SP 89.

C. Support horizontal piping as scheduled in Section 3.10.

D. Arrange hangers to prevent transmission of vibration from piping to building structure and allow for expansion and construction to hangers and supports.

E. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

F. Place hangers within 12 inches of each horizontal elbow.

G. Use hangers with 1-1/2 inch minimum vertical adjustment.

H. Support vertical piping at every floor.

I. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

J. Support riser piping independently of connected horizontal piping.

K. Provide copper plated hangers and supports for uninsulated copper piping.

L. Design hangers for pipe movement without disengagement of supported pipe.

M. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

N. Provide clearance in hangers and from structure and other equipment for installation of specified insulation without cutting pipeline or fitting covering. Refer to Division 22.

3.4 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs. For pipes through outside walls, turn flanges back into wall and caulk, metal counterflash and seal.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

C. Flash and counter-flash roof curbs with sheet metal; seal watertight. Attach counterflashing to equipment and lap base flashing on roof curbs. Fasten and solder joints.

D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.5 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Install stainless steel escutcheons at finished surfaces.

3.6 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

3.7 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

3.8 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.9 SCHEDULES

A. The maximum support spacing for vertical and horizontal pipes shall be as required by the California Plumbing Code, Chapter 3, but not less than that indicated in the table below for horizontal piping.

B. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	6	7	3/8	3/8
3/4	6	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	6	7	3/8	3/8
1-1/2	6	10	3/8	3/8
2	6	10	3/8	3/8

C. Refer to manufacturer's recommendations for grooved end piping systems.

D. Note 1: Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC AND PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical Identification Materials
2. Plastic Pipe Markers
3. Plastic Duct Markers
4. Plastic Tape
5. Lettering and Graphics
6. Ceiling Tacks

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

D. Samples: Submit two tags, labels and pipe markers size used on project.

E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Division 01 - Execution and Closeout Requirements: Closeout procedures.

1.4 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.6 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers:

1. Craftmark Identification Systems

2. Brady (W.H.) Co.; Signmark Div.

3. Industrial Safety Supply Co., Inc.

4. Seaton Identification Products

5. Safety Sign Co.

6. Substitutions: Division 01 - Product Requirements

2.2 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.3 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 21, 22 and 23 sections. Where more than single type is specified for application, selection is installer's option but provide single selection for each product category.

2.4 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, preformed to fit around pipe or pipe covering, complying with ANSI A13.1. Larger sizes may have maximum sheet size with spring fastener.

B. Pressure Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers, complying with ANSI A13.1.

C. Insulation: Furnish 1 inch thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on un-insulated pipes subject to fluid temperature of 125 degree F or greater. Cut length to extend 2 inches beyond each end of plastic pipe marker.

D. Small Pipes: For external diameters less than 6 inch (including insulation if any), provide full band pipe markers, extending 360 degree around pipe at each location, fastened by one of the following methods:

1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

2. Adhesive lap joint in pipe marker overlap.

3. Laminated or bonded application of pipe marker to pipe (or insulation).

4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 inch wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inch.

E. Lettering: Manufacturer's standard pre-printed nomenclature that best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.

1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

2.5 PLASTIC DUCT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color-coded duct markers. Conform to the following color code:

1. Green: Cold air

2. Yellow: Hot air

3. Yellow/Green: Supply air

4. Blue: Exhaust, outside, return, and mixed air

5. For hazardous exhausts use colors and designs recommended by ANSI A13.1.

B. Nomenclature: Include the following:

1. Direction of airflow.

2. Duct service (supply, return, exhaust, etc.)

2.6 PLASTIC TAPE

A. General: Provide manufacturer's standard color-coded pressure sensitive (self adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2 inch wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6 inch, 2-1/2 inch wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.7 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated, below or as required for proper identification and operation/maintenance of mechanical systems and equipment.

System	Letters
Gravity Condensate	G.C.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

2.8 CEILING TACKS

A. Steel with 3/4 inch diameter color coded head.

B. Color code as follows:

1. Yellow: HVAC equipment.

2. Red: Fire dampers/smoke dampers.

3. Green: Plumbing valves.

4. Blue: Heating/cooling valves.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceiling and similar removable concealment.

3.2 DUCTWORK IDENTIFICATION

A. General: Identify air supply, return, exhaust, intake and relief ductwork with duct markers; showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).

B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground, or similar concealment) and at 50 foot spacing along exposed runs.

C. Access Doors: Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

3.3 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

1. Near each valve and control device.

2. Near each branch, excluding short take offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floor/s ceilings, or enter non-accessible to enclosures.

4. At access doors, manholes similar access points which permit view or concealed piping.

5. Near major equipment items and other pints of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

7. On piping above removable acoustical ceilings, except omit intermediately spaced marks.

3.4 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.

2. Meters, gages, thermometers and similar units.

3. Fuel burning units including make-up air units, boilers, furnaces, heaters, stills, absorption units.

4. Heat exchangers, coils, evaporators, cooling towers, heat recovering units and similar equipment.

5. Fans, blowers, primary balancing dampers and mixing boxes.

B. Lettering Size: Minimum 1/4 inch high lettering for name of unit where viewing distance is less than 2'-0", 1/2 inch high for distance up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.

C. Test of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC AND PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, adjusting, and balancing of air systems.

2. Measurement of final operating condition of HVAC systems.

3. Sound measurement of equipment operating conditions.

4. Vibration measurement of equipment operating conditions.

B. Related Sections:

1. Division 23 - Direct-Digital Control System for HVAC: Requirements for coordination between DDC system and testing, adjusting, and balancing work.

1.2 REFERENCES

A. Associated Air Balance Council:

1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Prior to commencing work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms containing information indicated in schedules.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guarantee.

F. Submit draft copies of report for review prior to final acceptance of Project.

G. Furnish reports in soft cover, letter size, 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

H. Preliminary Submittals: Within 30 days after receipt of above preliminary information and data, the Agency shall submit the following through Contractor:

1. Agenda: Submit 3 sets of complete Agenda including drawings of the entire HVAC system to be balanced. Agenda shall represent final Total System Balance Report as per Chapter 29 of AABC National Standards, 1982, less field test data. Areas of intended field test inputs shall be represented by fully labeled blank spaces.

2. Pre-construction Plan Check and Construction Review Reports: Submit 3 sets of defined in AABC National Standards, 1982 (Chapter 25) including reports:

a. Demonstrating complete understanding of the design intent by the Test and Balance Agency.

b. Identifying potential problems for performing the Total System Balance and suggesting possible changes to allow most effective Total System Balance.

3. Total System Balance Schedule: Submit 3 sets of this schedule based on critical-path-network-analysis method and furnishing the Contractor and Owner's representative with a planning tool to include the testing and balancing into overall project schedule. Schedule shall consist of graphical and columnar reports and shall be updated periodically to reflect total project schedule.

I. Guarantee: Submit three (3) sets of AABC National Project Performance Guaranty.

J. Certifications: Submit the certificates from mechanical Subcontractor as specified hereinafter.

K. Reports, Test Reports, and Information: Submit six (6) sets as specified herein and Division 01.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flow measuring stations, balancing valves and rough setting.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 WORK BY MECHANICAL SUBCONTRACTOR

A. Mechanical subcontractor shall certify in writing that the system, as scheduled for balancing, is operational and complete. Completeness shall include not only the physical installation, but mechanical subcontractor's certification that prime movers, fans, pumps, refrigeration machines, boilers, etc., are installed in good working order, and full load

performance has been preliminarily tested under certification of mechanical subcontractor. Before any testing and balancing is started, a complete report shall be sent to the Agency.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance.

B. Maintain one copy of each document on site.

C. Prior to commencing work, calibrate each instrument to be used and list in the testing and air balance report showing date of calibration. Upon completing work, recalibrate each instrument to assure reliability.

1.7 QUALIFICATIONS

A. Qualifications of Agency: Total systems balance shall be performed by an independent Agency certified by the Associated Air Balance Council (AABC), which specializes in and whose business is dedicated to the testing, adjusting, and verification of HVAC system performance. Work of this section shall conform to AABC Specifications referred to in Chapters 17 through 26 of the AABC National Standards and other criteria as set forth in this Section.

B. Information furnished to the air balance agency: Agency shall be furnished with the following information and data:

1. Preliminary: Within 30 days after selection and approval:

a. Drawings of the work.

b. Specifications covering all work to be tested and balanced.

c. Written consent.

2. Exceptions: Following shall be furnished as submittals are approved and the work progresses:

a. Change orders affecting work to be tested and balanced.

b. Copies of approved submittals for work to be tested and balanced, including approved Shop Drawings, equipment submittals and the approved temperature control drawings.

c. Project schedule

d. Completely operable systems.

1.8 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 SEQUENCING

A. Division 01 - Summary: Work sequence.

B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.10 SCHEDULING

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Schedule and provide assistance in final adjustment and test of life safety, smoke evacuation and smoke control system with Fire Authority.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.

5. Duct systems are clean of debris.

6. Fans are rotating correctly.

7. Fire and volume dampers are in place and open.

8. Air coil fins are cleaned and combed.

9. Access doors are closed and duct end caps are in place.

10. Air outlets are installed and connected.

11. Duct system leakage is minimized.

12. Proper strainer baskets are clean and in place or in normal position.

13. Service and balancing valves are open.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 3 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

H. Check and adjust systems approximately six (6) months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities at site altitude. Provide labor at no additional cost to the Owner to change sheaves and belts as required to accomplish specified fan performance. Mechanical Contractor to provide material as required.

B. Make air quantity measurements in main ducts by pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust supply air devices to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Adjust volume control by using volume dampers located in branch ducts. Make drive changes, install additional dampers, etc. as may be required on the job at no additional cost to the Owner.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries.

L. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 DUCT PRESSURE TESTING

A. General

1. High, medium, and low pressure ductwork systems tested during construction prior to insulation. Test ducts lengths a maximum of 100 feet at time for risers and 150 feet for horizontal ducts. All ductwork tested and approved prior to installation of insulation.

2. Riser branches shall be isolated with seals, plugs, or caps. Riser installed in shafts shall be tested in sections to allow erection of shaft wall and duct insulation as approved by Architect.

3. Tests shall be performed in presence of the Architect who must verify recorded test data for test pressure and air leakage for tested duct length.

4. Test equipment: Rotary blower, calibrated orifice section, and gauge board.

5. Pressure test procedure:

a. Check and alert the Mechanical Contractor of any required seals of all openings in duct and plenum section to be tested.

b. Connect the test apparatus to test section using a flexible duct connection or hose.

c. Close damper on blower suction side, to prevent excessive build-up of pressure.

d. Start blower and gradually open damper on suction side of blower.

e. Build-up pressure on test section to required limit.

f. Determine amount of air leakage by make-up air flow measurements and make repairs as required.

g. Total allowable leakage shall not exceed 1% per minute based upon the total operating CFM of the system being tested. Total leakage is determined by summation of leakage for each section of system tested.

h. All negative pressure ducts, including return and exhaust system shall be tested by same procedure as positive pressure supply ducts.

i. Report final results of duct testing.

B. Main Supply Ductwork Systems: Extending from the discharge of supply fans to the inlet of air terminal units.

1. Test pressures: 2 inch WG, 4 inch WG (vertical risers).

2. The allowable leak measured in CFM varies depending upon the length of duct tested and as follows:

a. Main duct maximum 1/2% of 1% of the designed CFM on the total length and proportioned to the duct being tested.

b. Branch duct or risers maximum 1/2% of 1% of the designed CFM on the total length and proportioned to the duct being tested.

C. Branch Ductwork Systems: Extending from the air terminal to diffuser, return and exhaust air ducts.

1. Test pressures: 2 inch WG.

2. The allowable leak measured in CFM varies depending upon the length of duct tested and as follows:

a. Main duct maximum 1/2% of the designed CFM on the total length and proportioned to the duct being tested.

b. Branch duct or risers maximum 1/2% of the designed CFM on the total length and proportioned to the duct being tested.

3. The allowable leakage shall not exceed 1% per minute based upon the total peak operating CFM of system being tested. Total leakage is determined by summation of leakage for each section of the system tested.

D. Leak tests shall be performed and recorded separately for each system for:

1. Main duct.

2. Branch duct or risers.

3. Complete system.

E. Test Failures: Notify General Contractor to repair duct system if test pressure and leakage is not attained. Repairs and sealing to be done with sheet metal and sealant by Mechanical Contractor.

3.7 SOUND TEST PROCEDURES

A. Test Conditions: Any deem necessary, sound level measurements shall be taken at times when the building is unoccupied, or when activity in surrounding areas and background noise levels in areas tested are at a minimum and are relatively free from sudden changes in noise levels. Measurements shall be taken with all equipment secured, except that being tested. Test conditions shall be as directed by the Engineer.

B. Measurements: Required sound levels shall be measured at any point within a room not less than 6 feet from an air terminal or room unit and no closer than 3 feet from any floor, wall, or ceiling surface.

C. Test Instrument: Measure surface levels with General Radio Model 19829720 Sound Analysis System 30-140 DB Octave Banck Analyzer; "A" scale shall be used to measure overall sound levels. Specified octave banks levels shall be determined with above sound level meter set on "A."

3.8 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:

1. Fans.

2. Air Filters.

3. Air Inlets and Outlets.

B. Report Forms

1. Title Page:

a. Name of Testing, Adjusting, and Balancing Agency

b. Address of Testing, Adjusting, and Balancing Agency

c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency

d. Project name

e. Project location

f. Project Architect

g. Project Engineer

h. Project Contractor

i. Project altitude

j. Report date

2. Summary Comments:

   a. Design versus final performance

   b. Notable characteristics of system

   c. Description of systems operation sequence

   d. Summary of outdoor and exhaust flows to indicate building pressurization

   e. Nomenclature used throughout report

   f. Test conditions

3. Instrument List:

   a. Instrument

   b. Manufacturer

   c. Model number

   d. Serial number

   e. Range

   f. Calibration date

4. Electric Motors:

   a. Manufacturer

   b. Model/Frame

   c. HP/BHP and kW

   d. Phase, voltage, amperage; nameplate, actual, no load

   e. RPM

   f. Service factor

   g. Starter size, rating, heater elements

   h. Sheave Make/Size/Bore

5. V-Belt Drive:

   a. Identification/location

   b. Required driven RPM

   c. Driven sheave, diameter and RPM

d. Belt, size and quantity

e. Motor sheave diameter and RPM

f. Center to center distance, maximum, minimum, and actual

6. Combustion Test:

a. Manufacturer

b. Model number

c. Serial number

d. Firing rate

e. Overfire draft

f. Gas meter timing dial size

g. Gas meter time per revolution

h. Gas pressure at meter outlet

i. Gas flow rate

j. Heat input

k. Burner manifold gas pressure

l. Percent carbon monoxide (CO)

m. Percent carbon dioxide (CO2).

n. Percent oxygen (O2)

o. Percent excess air

p. Flue gas temperature at outlet

q. Ambient temperature

r. Net stack temperature

s. Percent stack loss

t. Percent combustion efficiency

u. Heat output

7. Air Moving Equipment:

a. Location

b. Manufacturer

c. Model number

d. Serial number

e. Arrangement/Class/Discharge

f. Air flow, specified and actual

g. Return air flow, specified and actual

h. Outside air flow, specified and actual

i. Total static pressure (total external), specified and actual

j. Inlet pressure

k. Discharge pressure

l. Sheave Make/Size/Bore

m. Number of Belts/Make/Size

n. Fan RPM

8. Return Air/Outside Air Data:

a. Identification/location

b. Design air flow

c. Actual air flow

d. Design return air flow

e. Actual return air flow

f. Design outside air flow

g. Actual outside air flow

h. Return air temperature

i. Outside air temperature

j. Required mixed air temperature

k. Actual mixed air temperature

l. Design outside/return air ratio

m. Actual outside/return air ratio

9. Duct Traverse:

a. System zone/branch

b. Duct size

c. Area

d. Design velocity

e. Design air flow

f. Test velocity

g. Test air flow

h. Duct static pressure

i. Air temperature

j. Air correction factor

10. Duct Leak Test:

a. Description of ductwork under test

b. Duct design operating pressure

c. Duct design test static pressure

d. Duct capacity, air flow

e. Maximum allowable leakage duct capacity times leak factor

f. Test apparatus

1) Blower

2) Orifice, tube size

3) Orifice size

4) Calibrated

g. Test static pressure

h. Test orifice differential pressure

i. Leakage

11. Air Distribution Test Sheet:

a. Air terminal number

b. Room number/location

c. Terminal type

d. Terminal size

e. Area factor

f. Design velocity

g. Design air flow

h. Test (final) velocity

i. Test (final) air flow

j. Percent of design air flow

12. Sound Level Report:

a. Location

b. Octave bands - equipment off

c. Octave bands - equipment on

d. RC level - equipment on

13. Vibration Test:

a. Location of points:

1) Fan bearing, drive end

2) Fan bearing, opposite end

3) Motor bearing, center (when applicable)

4) Motor bearing, drive end

5) Motor bearing, opposite end

6) Casing (bottom or top)

7) Casing (side)

8) Duct after flexible connection (supply air)

9) Duct after flexible connection (exhaust/return air)

b. Test readings:

1) Horizontal, velocity and displacement

2) Vertical, velocity and displacement

3) Axial, velocity and displacement

c. Normally acceptable readings, velocity and acceleration

d. Unusual conditions at time of test

e. Vibration source (when non-complying)

3.9 TOTAL SYSTEM PERFORMANCE VERIFICATION

A. Immediately on completion of the system testing and balancing, the Agency shall conduct a 7-day continuous total system performance and capacity test; the Contractor shall supply all energy and consumables and/or materials required for the test.

B. General: Outdoor DB and WB air temperatures and actual operating data for this test shall be taken simultaneously and hourly on all energy consuming equipment of cooling and heating plants and on any air and/or water distribution equipment which deviates more than 10% from design specifications.

C. Date Conversion and Reports: The data collected during this test shall be converted to KWH per ton for cooling equipment and KWH per MBH for the heating equipment and shall cover a minimum of four points on the equipment operating curve. These points shall be at 25%, 50%, 75% and 100% of full load test. Reports shall be prepared and submitted for all data and conversion.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. HVAC insulation, jackets and accessories.

2. HVAC ductwork insulation, jackets, and accessories.

3. Insulation accessories including vapor retarders and accessories.

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

2. Division 23 – Hangers and Supports for HVAC and Plumbing Piping and Equipment: Product and Execution requirements for inserts at hanger locations.

3. Division 23 – Identification for HVAC and Plumbing Piping and Equipment: Product requirements for HVAC piping and equipment identification.

1.2 REFERENCES

A. ASTM International:

1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

4. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

5. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.

6. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

7. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

8. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

9. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

10. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

11. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

12. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

13. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).

14. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

15. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

16. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

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

18. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

19. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors':

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible, latest edition.

C. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

2. UL 1978 - Standard for Safety for Grease Ducts.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials, R value, finished accessories and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing work of this section with minimum three years documented experience.

1.5 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, UL 723, and NFPA 255.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame spread index of 25 or less, and smoke developed index of 50 or less, in accordance with UBC standard No. 42-1 except where more stringent requirements are noted.

E. Insulation materials shall be tested by Underwriters Laboratories, Inc. (UL). Tests shall include insulation, jackets, fittings, adhesives, coatings and accessories. Composite products shall meet the fire hazard requirements of NFPA 90A.

F. Furnish affidavit from manufacturer that products delivered to project meet requirements specified

G. Maintain one (1) copy of each document on site.

1.6 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five (5) year manufacturer warranty for manmade fiber.

PART 2 PRODUCTS

2.1 MANUFACTURER

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

1. Owens-Corning.

2. Armstrong World Industries, Inc.

3. CertainTeed.

4. Knauf.

5. Rubatex Corp.

6. Johns Manville.

7. Substitutions: Division 01 - Product Requirements

2.2 PIPE INSULATION

A. Fiberglass (Mineral Fiber) Piping Insulation: ASTM C547, Class 1 unless otherwise indicated. Owens Corning "Fiberglass Evolution", ASJ, Johns Manville Products Corp. "Micro-Lok", or equivalent.

B. Jackets for Piping Insulation: ASTM C921, Type I (Vapor Barrier) for piping with temperatures below ambient.

1. Encase pipe fittings insulation with one-piece remolded PVC fitting covers, fastened per manufacturer's recommendations.

2. Encase exterior piping insulation with aluminum or stainless steel jacket with moisture barrier. Secure in accordance with manufacturer's recommendations. Joints shall be applied so they will shed water and shall be sealed completely.

C. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

D. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.3 DUCTWORK INSULATION MATERIALS

A. Rigid Fiberglass Ductwork Insulation: ASTM C612, Class 1, 3-5 lbs/ft3.

B. Flexible Fiberglass Ductwork Insulation: ASTM C1290, with ASTM C1136 Type II vapor barrier jacket. Owens-Corning Fiberglass All Service Wrap Insulation, Type 75 or equivalent R-value:

1. R8 minimum installed insulation for all supply and return ducts. Applies to ducts located in unconditioned spaces, such as outdoors, spaces between roof and insulated ceiling, space directly under roof, unconditioned crawl space. Not required for ductwork exposed in space being served (i.e. gym).

2. R4.2 minimum installed insulation for all supply ducts for all "other" spaces not listed above (i.e., conditioned space). Not required for ductwork exposed in space being served (i.e. gym).

3. Density of 0.75 pcf (Type 75) and nominal thicknesses below shall be used to provide installed R-value as follows:

a. Type 75 1-1/2" Thick R = 4.2

b. Type 75 3 " Thick R = 8.3

C. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

D. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

2.4 PIPE INSULATION JACKETS

A. Aluminum Pipe Jacket:

1. ASTM B209.

2. Thickness: 0.025 inch thick sheet.

3. Finish: Embossed.

4. Joining: Longitudinal slip joints and 2 inch laps.

5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

B. Stainless Steel Pipe Jacket:

1. ASTM A167 Type 302, 304 or 316 stainless steel.

2. Thickness: 0.016 inch thick.

3. Finish: Corrugated.

4. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

C. Field Applied Jacket System:

1. ASTM C 921, Type 1.

2. Aluminum Jacket: Stucco-embossed finish sheets manufactured from aluminum alloy complying with ASTM B 209, and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness shall be 0.024" for outdoor applications.

a. Moisture Barrier: 3-mil- thick, heat-bonded polyethylene or Kraft paper.

3. Stainless Steel Jacket: Deep corrugated sheets of stainless steel complying with ASTM A666, Type 304 or 316, 0.016 inch thick, and roll stock ready for shop or field cutting and forming to indicated sizes.

a. Moisture Barrier: 3 mil thick, heat bonded polyethylene and kraft paper.

b. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.

2.5 INSULATING CEMENTS (DUCTWORK AND EQUIPMENT)

A. Mineral Fiber Insulating Cement: Comply with ASTM C 195.

1. Manufacturers:

a. Insulco, Division of MFS, Inc.: Triple I.

b. Ramco. Insulation, Inc.: Super-Stik

c. Substitutions: Division 01 - Product Requirements.

B. Mineral Fiber Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Manufacturers:

a. Insulco, Division of MFS, Inc.: SmoothKote.

b. Ramco Insulation, Inc.: P.K. No. 127 and Quick-Cote

c. Rock Wool Manufacturing Co.; Delta One Shot

d. Substitutions: Division 01 - Product Requirements.

2.6 ADHESIVES (DUCTWORK)

A. Manufacturers:

1. Childers Products, Division of ITW; CP-82.

2. Foster Products Corporation, H. B. Fuller Company; 85-20.

3. ITW TACC, Division of Illinois Tool Works; S-90/80

4. Marathon Industries, Inc.; 225

5. Mon-Eco Industries, Inc.; 22-25

a. Substitutions: Division 01 - Product Requirements.

B. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

2.7 MASTICS (DUCTWORK)

A. Manufacturers:

1. Childers Products, Division of ITW; CP-35.

2. Foster Products Corporation, H. B. Fuller Company; 30-90.

3. ITW TACC, Division of Illinois Tool Works; CB-50

4. Marathon Industries, Inc.; 590

5. Mon-Eco Industries, Inc.; 55-40

6. Vimasco Corp.; 749

7. Or equal

B. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

D. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

E. Service Temperature Range: Minus 20 to plus 180 degrees F.

F. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

G. Color: White.

2.8 SEALANTS

A. FSK and Metal Jacket:

1. Manufacturers:

a. Childers Products, Division of ITW; CP-76-8

b. Foster Products Corp. H.B. Fuller Co.; 95-44

c. Marathon Industries, Inc., 405

d. Mon-Eco Industries, Inc.; 44-05

e. Vimasco Corp; 750

f. Or equal.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: Aluminum.

B. ASJ Flashing Sealants (Ductwork):

1. Manufacturer: Childers Products, Division of TTW; CP-76

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire and water resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 degrees F.

5. Color: White

2.9 ACCESSORIES AND ATTACHMENTS

A. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

1. Welded Pin Holding Capacity: 20 lb for direct pull perpendicular to the attached surface.

B. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated. May be used for heating and hot water systems.

1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 20 lb for direct pull perpendicular to the adhered surface.

C. Wire: 0.080 inch, nickel copper alloy, 0.062 inch soft annealed stainless steel, or 0.062 inch soft annealed galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Examine areas and conditions which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

C. Verify piping, equipment and ductwork has been tested before applying insulation materials.

D. Verify surfaces are clean and dry, with foreign material removed.

3.2 HVAC PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on hot unions, flanges, strainers, flexible connections and expansion joints.

B. Refrigerant Piping:

1. Application Requirements: Insulate the cold HVAC piping systems for HVAC chilled water supply and return piping.

2. Insulate each piping system specified above with fiberglass with wicking technology, 1 inch.

3.3 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Butt piping insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For chilled water piping apply insulation with wicking technology with 3 inch wide paperless tape over the butt joints.

I. Pipe exposed to weather: Encase exterior piping with aluminum jacket with weather proof construction.

J. Pipes in mechanical rooms and equipment room. Use pipe insulation with paperless polymer jacketing or encase piping with PVC cover.

K. Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation. Provide high density insulation of same thickness where saddles or protection shields all located. In case where insulation with wicking technology is used, cover evaporation grid holes with paperless tape under length of saddles or shields.

3.4 DUCTWORK SYSTEM INSULATION:

A. Insulation Omitted: Do not insulate lined ductwork.

B. Hot/Cold Ductwork:

1. Application Requirements: Insulate the following ductwork:

a. Outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet, insulate to R-8,

b. HVAC supply ductwork, unconditioned space R-8, above ceiling grid indirectly conditioned space R-4.2.

c. HVAC return ductwork, unconditioned space R-8, above ceiling grid indirectly conditioned space R-4.2.

d. HVAC plenums and unit housings not pre-insulated at factory to geographical R-value requirements based on California Title 24, R-4.2, R-6 or R-8.

2. Insulate each ductwork system specified above with one of the following types and thickness of insulation as indicated:

a. Rigid Fiberglass: 2 inch thick, (Owens Corning 703 FRK R-8), in machine, fan and equipment rooms.

b. Flexible Fiberglass: Type 75 (0.75 pcf), 1-1/2 inch thick in conditioned space (R4.2) or 3 inch thick in unconditioned space (R-8), , application limited to concealed locations.

3.5 INSTALLATION OF DUCTWORK INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor barrier on ductwork insulation, and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

F. Lined ductwork: Except as otherwise indicated, omit external insulation on ductwork where internal insulation or sound absorbing linings have been installed.

G. Ductwork Exposed to Weather: Cover exposed to weather duct insulation with 26 gauge galvanized sheet metal, sides, top and bottom with standing seams. Pitch for drainage.

H. Ductwork and sheet metal plenums exposed to view (Ductwork in the mechanical rooms): Insulate to California Title 24 requirements. If space is unconditioned provide 3 inch thick, 3/4 pounds per cubic foot density FRK faced glass fiber blanket. If space is indirectly conditioned, provide 1-1/2 inch thick 3/4 pounds per cubic foot density FRK faced glass fiber blanket. Tightly butt joints. Secure with 18 gauge tie wire. Corner angles shall overlap at least two sheet metal screws at each side.

3.6 PROTECTION AND REPLACEMENT

A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damaged and deterioration.

END OF SECTION

SECTION 23 11 23

FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Natural gas piping buried.
2. Natural gas piping above grade.
3. Unions and flanges.
4. Valves.
5. Pipe hangers and supports.

B. Related Sections:

1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
2. Section 08 31 13 - Access Doors and Frames: Access doors for concealed valves and accessories.
3. Section 09 90 00 - Painting and Coating: Product requirements for painting for placement by this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.

B. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
3. ASME B31.9 - Building Services Piping.
4. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

3. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.

4. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

3. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.

4. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

5. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

F. National Fire Protection Association:

1. NFPA 54 - National Fuel Gas Code.

G. Underwriters Laboratories Inc.:

1. UL 842 - Valves for Flammable Fluids.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.

C. Provide pipe hangers and supports in accordance with ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

D. Use plug or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

3. Hangers and Supports: Submit manufacturers catalog information including load capacity.

4. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:

a. Natural gas pressure regulators.

C. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Test Reports: Indicate results of piping system pressure test.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves, piping system, and system components.

C. Operation and Maintenance Data: Submit for valves installation instructions, spare parts lists.

1.6 QUALITY ASSURANCE

A. Perform natural gas Work in accordance with NFPA 54.

B. Perform work in accordance with California Plumbing Code (CPC).

C. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

D. Perform Work in accordance applicable code AWS D1.1 for welding hanger and support attachments to building structure.

E. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.

F. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

C. Design hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate trenching, excavating, bedding, backfilling of buried piping systems.

1.13 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for valves excluding packing.

1.14 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two packing kits for each type and size valve.

PART 2 PRODUCTS

2.1 NATURAL GAS PIPING, BURIED BELOW GRADE

A. Polyethylene Pipe: ASTM D2513, SDR 11.5. Fittings: ASTM D2683 or ASTM D2513 socket type. Joints: Fusion welded; plastic to steel connections with ASTM D2513 transition fittings or risers. Pipe shall be buried 30 inches deep and backfill with sand, including identification tape and #14 insulated copper tracer wire.

B. Transition riser from below grade polyethylene pipe to above grade steel pipe; ASTM D2513, Schedule 40 steel epoxy coated casing weld or threaded end, the polyethylene end shall be fusion welded, as manufactured by "Central" or equal.

2.2 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.

2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

2.3 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Copper Piping: Class 150, bronze unions with soldered.

3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.

2. Copper Piping: Class 150, slip-on bronze flanges.

3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.4 BALL VALVES

A. Manufacturers:

1. Crane Valve, North America.

2. Hammond Valve.

3. Milwaukee Valve Company.

4. NIBCO, Inc.

5. Stockham Valves & Fittings.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. 1/4 inch to 1 inch: MSS SP 110, Class 125, two-piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port.

C. 1-1/4 inch to 3 inch: MSS SP 110, Class 125, two-piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, conventional port.

2.5 PLUG VALVES

A. Manufacturers:

1. DeZURIK, Unit of SPX Corp.

2. Flow Control Equipment, Inc.

3. Homestead Valve.

4. Conbraco Model 50.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. 2 inches and Smaller: MSS SP 78, Class 300, construction, round port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 300, construction, round port, full pipe area, pressure lubricated, teflon packing, flanged ends. Furnish wrench-operated.

2.6 GAS SEISMIC VALVES

A. Provide a valve consisting of a swing check valve arrangement with an acceleration-sensitive triggering mechanism. The trip mechanism shall consist of a steel ball resting on a tapered cup-shaped support. The trip mechanism shall be factory set and sealed. A sight glass is provided so that the Open or Closed indicator can be seen, and the trip mechanism status of the valve can be easily determined. The valve assembly shall be certified by the California State Architect's Office, approved by the local authority, meet the requirements of ANSI Z21.70 and ASCE 25-97. See drawings for model numbers.

2.7 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Flex-Hose Co., Inc.

2. Flex-Weld, Inc./Keflex.

3. The Metraflex Company.

4. Twin City Hose, Inc.

5. USHose Corp.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. 2 inches and Smaller: Corrugated stainless steel hose with single layer of stainless steel exterior braiding, copper tubing ends; maximum working pressure 170 psig, threaded or soldered connections.

C. 2-1/2 inches and Larger: Corrugated stainless steel hose with single layer of stainless steel exterior braiding, Class 150 flanged ends; maximum working pressure 190 psig.

2.8 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Carpenter & Paterson Inc.

2. Creative Systems Inc.

3. Flex-Weld, Inc.

4. Glope Pipe Hanger Products Inc.

5. Michigan Hanger Co.

6. Superior Valve Co.

7. Substitutions: Section 01 60 00 - Product Requirements.

B. Conform to NFPA 54, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.

D. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.

G. Vertical Support: Steel riser clamp.

H. Floor Support: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

2.9 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon: Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.1 EXAMINATION

A. 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with ASME B31.9, ASTM F708 and MSS SP 89.

B. Support horizontal piping hangers as scheduled.

C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Install hangers to allow 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

G. Prime coat exposed steel hangers and supports in accordance with Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

C. Establish elevations of buried piping with not less than 2 ft of cover.

D. Establish minimum separation of 12" from other services piping in accordance with State of California code.

E. Remove scale and dirt on inside of piping before assembly.

F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent maximum density.

G. Install pipe on prepared bedding.

H. Route pipe in straight line.

I. Install pipe to allow for expansion and contraction without stressing pipe or joints.

J. Install plastic ribbon tape continuous buried 6 inches above pipe line.

K. Install trace wire continuous around pipe.

L. Pipe Cover and Backfilling:

1. Backfill trench.

2. Maintain optimum moisture content of fill material to attain required compaction density.

3. After test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.

4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.

5. Do not use wheeled or tracked vehicles for tamping.

3.5 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Sleeve pipe passing through partitions, walls and floors.

H. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 07 84 00.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 13.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.

L. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting. Refer to Section 09 90 00.

M. Install valves with stems upright or horizontal, not inverted.

N. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Pressure test natural gas piping in accordance with NFPA 54.

C. Inspect, test and purge gas piping in accordance with applicable code.

D. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

3.7 SCHEDULES

A. Pipe Hanger Spacing:

Pipe Size Inches	Copper Tubing Maximum Hanger Spacing Feet	Steel Pipe Maximum Hanger Spacing Feet	Copper Tubing Minimum Hanger Rod Diameter Inches	Steel Pipe Minimum Hanger Rod Diameter Inches
½	4	6	3/8	3/8
3/4	6	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	8	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2	8	10	1/2	1/2
3	8	10	1/2	1/2
4	8	10	1/2	5/8
5	8	10	1/2	5/8
6	8	10	5/8	3/4
8	8	10	3/4	3/4

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Duct Materials.
2. Insulated flexible ducts.
3. Single wall spiral round ducts.
4. Single wall spiral flat oval ducts.
5. Transverse duct connection system.
6. Ductwork fabrication.
7. Duct cleaning.

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.
2. Division 23 - Hangers and Supports for HVAC and Plumbing Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
3. Division 23 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
4. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

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

B. California Mechanical Code

1. CMC – State of California Mechanical Code

C. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

D. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - Fibrous Glass Duct Construction Standards.

2. SMACNA - HVAC Air Duct Leakage Test Manual.

3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible, latest edition.

E. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts, if it is not shown on the drawings.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:

1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.

2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.

3. Fittings.

4. Reinforcing details and spacing.

5. Seam and joint construction details.

6. Penetrations through fire rated and other walls.

7. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

8. Equipment service clearance, access panels and door swings.

C. Product Data: Submit data for duct materials, duct liner and duct connectors.

D. Test Reports: Indicate pressure tests performed. Include date; section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A and NFPA 90B standards.

C. Maintain one (1) copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum three (3) weeks prior to commencing work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures during and after installation of duct sealant.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90/A90M.

B. Steel Ducts: ASTM A1008/A1008M, ASTM A1011/A1011M, ASTM A568/A568M.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 INSULATED FLEXIBLE DUCTS

A. Manufacturers:

1. Casco

2. Atco

3. Thermaflex

4. Substitutions: Division 01 - Product Requirements.

B. Product Description: Flexible duct shall consist of an exterior reinforced laminated vapor barrier, 1-1/2 inch thick fiberglass insulation (K = .25 @ 75 degrees F), encapsulated spring steel wire helix and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars. Flexible fiberglass duct shall meet the requirements of NFPA No. 90A and UL 181.

1. Pressure Rating: 2 inches wg positive and 0.5 inches wg negative.

2. Maximum Velocity: 4000 fpm.

3. Temperature Range: -0 degrees F to 200 degrees F.

4. Furnish each flexible duct section with integral clamping devices for connection to round or oval fittings.

5. Join each flexible duct section to main trunk duct through sheet metal fittings. Construct fittings of galvanized steel and equip with factory installed volume damper having positive locking regulator. Provide fittings installed in lined ductwork with insulation guard.

6. Flexible ducts shall be supported at or near mid-length with 2 inch wide, 28 gage steel hanger collar, attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets. The maximum length connecting to terminal outlets shall be 7 feet and minimum length of 5 feet.

2.3 SINGLE WALL SPIRAL ROUND DUCTS

A. Manufacturers:

1. McGill Airflow Corporation

2. Semco Incorporated

3. Omni Duct

4. Spiral Mfg. Co., Inc.

5. Substitutions: Division 01 - Product Requirements.

B. Product Description: UL 181, Class 1; round spiral lock seam duct constructed of galvanized steel.

C. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

D. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.4 SINGLE WALL SPIRAL FLAT OVAL DUCTS

A. Manufacturers:

1. McGill Air Flow Corporation
2. Semco Incorporated
3. Omni Duct
4. Spiral Mfg. Co., Inc.
5. Substitutions: Division 01 - Product Requirements.

B. Product Description: Machine made from round spiral lock seam duct constructed of galvanized steel; rated for 4 inches wg pressure.

C. Joints: Either fully welded or bolted flange with gasket material in accordance with manufacturer's recommendations.

D. Construct duct with the following minimum gauges:

Major Axis Dimension	Gauge
7 inches to 24 inches	24
25 inches to 48 inches	22
50 inches to 70 inches	20
72 inches to 82 inches	18
84 inches and larger	16

E. Construct fittings with the following minimum gauges:

Major Axis Fitting Dimension	Gauge
7 inches to 36 inches	20
37 inches to 60 inches	18
62 inches and larger	16

2.5 RECTANGULAR DUCTWORK FABRICATION

A. Low Pressure Duct Construction Schedule: (2 inch" S.P. and below). Include all return, exhaust, supply branches and ductwork downstream of terminal units.

Duct Dimension (Inches)	Material Gauges	Construction of Transverse Joints, Bracing and Reinforcing
0 to 12	26	Hemmed S slip spaced not more than 10' apart
13 to 30	24	Ductmate 25**, or 1" G lock spaced not more than 10' apart
31 to 42	22	Ductmate 25**, spaced not more than 5' apart
43 to 54	22	Ductmate 35**, spaced not more than 4' apart
55 to 60	20	Ductmate 35**, spaced not more than 4' apart
61 to 84	20	Ductmate 35**, spaced not more than 4' apart

Duct Dimension (Inches)	Material Gauges	Construction of Transverse Joints, Bracing and Reinforcing
85 and up	18	Ductmate 45**, spaced not more than 4' apart. Provide intermediate bracing for low pressure ductwork 85" and larger

Note: * Based on maximum of 2.0" WG.
**The Lockformer Company TDC or approved equal

1. All ducts over 18 inches in either dimension shall be stiffened with beads on 24 through 20 gage. Cross break on 18 and 16 gauge. Longitudinal seams shall be Pittsburgh locks Snap-Lock shall be limited to 12 inch maximum width of ducts.

B. Strap hanger shall be a minimum of 1 inch, #18 gauge galvanized steel attached to the bottom of ducts at 8'- 0" OC and as required by CMC/UMC and SMACNA guidelines.

C. Elbows shall be square throat with vanes, type RE 2 or radius, Type RE 1 in the SMACNA manual. Mitered elbows with turning vanes and other types shall not be used. Construct vanes per Chapter 4 of the SMACNA manual, 3rd edition.

D. Divided flow branches shall be per SMACNA manual, 3rd edition, figure 4-5.

E. Branch connections per SMACNA manual, 3rd edition, figure 4-6; 45-degree entry shall only be used where airflow in branch is less than 25% of total airflow in main duct.

F. Offsets shall be SMACNA manual, 3rd edition, figure 4-7.

G. Eccentric transitions with maximum 30" divergence shall be used on connections to air handling units and plenums.

H. Provide Ductmate 25, 35 or 45, per table above, with all required material including metal cleats, corner bolts and nuts, angles, clips and gaskets, all installed in accordance with manufacturer's recommendations and supervision.

I. Quadrant volume damper blades in fittings shall be two gauges heavier than the fittings.

J. Longitudinal Seams: Pittsburgh lock sealed with non-curing polymer sealant. Button punch snap lock seams are not acceptable and shall not be used.

K. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations.

L. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of non-braced panel area unless ducts are lined.

M. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

N. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

2.6 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards-Metal and Flexible."

C. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards-Metal and Flexible." Fabricate ducts larger than 72 inches in diameter with butt-welded longitudinal seams.

D. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.

2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.

3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards-Metal and Flexible," Chapter 3.

4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

2. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.

3. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.

4. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.

5. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction. Fabricate 90 degrees elbows with minimum of 5 pieces.

6. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.

7. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick (20 ga) with 2-piece welded construction.

8. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.

9. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.

10. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch, 26 gage.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, as required in this section.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Use beaded sleeve couplings for joining round duct and flexible ducts.

D. Install duct hangers and supports in accordance with approved structural and mechanical drawings.

E. Use double nuts and lock washers on threaded rod supports.

F. Set plenum doors 6 to 12 inches above floor. Arrange door swing so fan static pressure holds door in closed position.

3.3 INSTALLATION OF METAL DUCTWORK

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3 inch and under; 1% for systems rated over 3 inch) and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with a minimum number of joints. Align ductwork

accurately at connections, within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.

B. Field Fabrication: Complete fabrication of work at project as necessary to match shop fabricated work and accommodate installation requirements. The fabrication of field dog-leg offsets shall be prohibited.

C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, column, and other structural and permanent enclosure elements of building. Limit clearance to 1/2 inch where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1 inch clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

D. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

E. Tape the clips, snaplock seams and joints or connections of the metal supply, return and exhaust ducts and the grilled and diffuser connections with 4 inch strips of 6 oz. canvas attached with approved adhesive. Tape the filter frames the same as ducts. Coat all canvas exposed to the weather with Tuff Bond #12. Taping of Pittsburgh seams is required.

F. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

G. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

H. Round ducts shall be used to the maximum extent possible. As duct size increases, flat oval shall be considered. Rectangular ducts shall be limited to areas of space restriction with a maximum aspect ratio of 2:1. If due to a structural clearance constraint, duct aspect ratio can be increased and/or duct cross section reduced if upstream transition has included angles of 60 degrees or less and downstream transition has included angles of 30 degrees or less.

I. Ducts exposed outside to elements shall only be of round construction to shed rainwater. If conditions do not allow round ducts, provisions shall be provided to slope the flat top of rectangular ductwork so rainwater will not stand on top of duct.

J. Except for connection of terminal discharge duct to air outlets, 90 degree taps shall not be used unless space prohibits the use of low loss fittings. Takeoff feeding terminals shall be conical branch; 45 wye, conical branch; low loss tee; bell mouth, or branch with a loss coefficient equivalent to that for the conical branch. The slopes of transitions shall be approximately one to five, and no abrupt changes or offsets of any kind in the duct system shall be permitted.

K. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

L. Install ducts with fewest possible joints.

M. Install fabricated fittings for changes in directions, size, and shape and for connections.

N. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

O. Install ducts vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs in ducts that would be over 12 feet in length.

P. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

Q. Install ducts with a clearance of 2 inch on each side, plus allowance for insulation thickness.

R. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

S. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

T. Seal all joints and seams. Apply approved sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

U. Install heavy volume dampers at all main supply, return and exhaust duct branch connections or as indicated on the drawings. Heavy volume dampers shall be Pottorff Series 400 AF with handle, or approved equal.

V. Duct hangers shall be attached to horizontal slabs with steel angle clips secured with inserts, strapped to vertical walls, bolted to beams and joists, as per SMACNA guidelines, or as approved by the Architect.

W. All ducts and equipment shall be blown out prior to operating.

X. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures and telephone equipment rooms.

Y. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

Z. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by California building codes.

AA. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

BB. Do not paint interiors of metal ducts. Ductwork exposed to view (i.e. Gym) shall have clean finished and sealed joints. Ductwork may be required to be painted per Architect. Coordinate final finish requirements with Architect.

CC. Protect duct openings from damage and prevent entrance of foreign materials.

3.4 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum length: For any duct run using flexible ductwork, do not exceed 5'- 0" extended length.

B. Installation: Install in accordance with Chapter 3 of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible", latest edition.

C. Bends in flexible ducts shall have a radius of not less than 1.5 times the internal diameters.

3.5 EQUIPMENT CONNECTIONS

A. General: Connect metal ductwork to equipment as indicated. Provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotary machinery. Provide access doors as indicated.

3.6 HANGING AND SUPPORTING

A. Support horizontal ducts at 8'-0" o.c. and within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum one-story intervals not to exceed 16 feet.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load. Wire and friction clamps shall not be used.

3.7 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 to 7 feet maximum length of flexible duct held in place with strap or clamp except as otherwise shown on the drawings. Do not use flexible duct on moisture laden air systems.

3.8 CLEANING NEW SYSTEM

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

C. Use service openings, as required, for physical and mechanical entry and for inspection.

D. Create other openings to comply with duct standards.

E. Disconnect flexible ducts as needed for cleaning and inspection.

F. Remove and reinstall ceiling sections to gain access during the cleaning process.

G. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

H. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

I. Cleaning Requirements:

1. Interior surfaces of all supply ductwork shall be cleaned of dust and dirt at the fabrication shop during fabrication.

2. Supply Ductwork shall be sealed to protect interior surfaces prior to being shipped and handled.

3. Seals and wrapping shall be removed on job site at time of installation.

4. Seal open duct ends during at the end of each day.

J. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

K. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.

2. Where contaminants are discovered, re-clean and re-inspect ducts.

3.9 SCHEDULES

A. Static-Pressure Classes: Construct ducts according to the following:

1. Supply Ducts: 2-inch wg.

2. Return Ducts (Negative Pressure): 2-inch wg.

3. General Exhaust Ducts (Negative Pressure): 2-inch wg.

4. Vertical risers shall be constructed to a minimum of 4-inch wg, regardless of type.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Back-draft dampers.
2. Duct access doors.
3. Volume control dampers.
4. Flexible duct connections.
5. Duct test holes.

B. Related Sections:

1. Division 23 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.
2. Division 26 - Equipment Wiring Connections: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

D. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible, latest edition.

E. Underwriters Laboratories Inc.:

1. UL 555 - Standard for Safety for Fire Dampers.

2. UL 555C - Standard for Safety for Ceiling Dampers.

3. UL 555S - Standard for Safety for Smoke Dampers.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

C. Product Data: Submit data for shop fabricated assemblies and hardware used.

D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.

1. Backdraft dampers.

2. Flexible duct connections.

3. Volume control dampers.

4. Duct access doors.

5. Duct test holes.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of access doors and test holes.

1.5 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

C. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

1.7 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum three (3) weeks prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect dampers from damage to operating linkages and blades.

C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

D. Storage: Store materials in a dry area indoor, protected from damage.

E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work where appropriate with building control Work.

1.11 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.12 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 BACK-DRAFT DAMPERS

A. Manufacturers:

1. Pottorff

2. Ruskin

3. Greenheck

B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, extruded aluminum. Blades, maximum 6 inch width, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment counter balance weight to permit setting for varying differential static pressure. Back draft damper shall be capable of adjusting to 0.025 inches of w.g.

2.2 DUCT ACCESS DOORS

A. Manufacturers:

1. Air Balance, Inc.

2. Duro Dyne Corp.

3. Register & Grille Mfg. Co., Inc.

4. Ruskin Mfg. Co.

5. Ventfabrics, Inc.

6. Zurn Industries, Inc.; Air Systems Div.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged other side with one handle type latch for doors 12 inch high and smaller, 2 handle type latches for larger doors.

2.3 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Ventfabrics, Inc.

2. Young Regulator Co.

3. Duro Dyne Corp.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axle's full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple-opposed-blade design, standard leakage rating, with linkage outside air stream, and suitable for horizontal or vertical applications. Single blade design may be used for duct sizes 12" and smaller.

1. Steel Frames: Hat-shaped, galvanized (provide stainless in outside air system) sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.

2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized (provide stainless in outside air system) sheet steel.

3. Blade Axles: Stainless steel.

4. Bearings: Stainless-steel sleeve.

5. Tie Bars and Brackets: Galvanized steel.

D. Jamb Seals: Cambered stainless steel Jack shaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 MOTORIZED CONTROL DAMPERS

A. Manufacturers:

1. Pottorff.

2. Ruskin Company.

B. General duty control dampers: AMCA-rated, opposed-blade design, air foil shape; minimum of 0.1084-inch- thick (12 ga), galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch- thick (16 ga), galvanized-steel damper blades with maximum blade width of 8 inches and stainless steel jamb seals.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.

2. Operating Temperature Range: From minus 40 to plus 200 deg F.

3. Provide opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 CFM per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is being held by torque of 50 in. x lbf; when tested according to AMCA 500D.

4. Maximum pressure drop shall be 0.07 inches WG for a 24-inch by 24-inch duct-mounted damper handling 8,000 CFM.

C. Fan isolation control dampers: AMCA rated, opposed blade design, airfoil shape, for fan isolation under dynamic conditions. Dampers shall be low leakage industrial grade control dampers that meet the following minimum construction standards.

1. Frame shall be 8 inches deep by 2-inch flanged 12 gage galvanized steel channel. Blades shall be double skin airfoil, maximum 8" wide and minimum 14 gage galvanized steel. Axles shall be minimum ¾" diameter plated steel rod. Provide dampers with neoprene blade seals and stainless steel jamb seals.

2. Ball bearings shall be mounted outboard external of frame. Oil impregnated bronze, stainless sleeve or synthetic bearings are not acceptable.

3. Linkage shall be located out of air stream and constructed of minimum 10 gage steel clevis arms with 3/16" x ¾" plated steel tie bars pivoting on 3/8" diameter stainless steel pivot pins with lock type retainers. Standard construction shall include crank lever for motor operation. Face linkage in air stream is not acceptable. Each damper panel shall have separate drive actuator.

4. Submittal data must include published leakage, pressure drop, and maximum pressure data for full range of damper sizes based on AMCA standard 500 testing. Data from one size sample test is not acceptable. Performance data for 48" x 48" damper at 1" wg. is 0.12% of maximum flow or 4.3 CFM per square foot.

5. Dampers shall be Ruskin model CD80AF3 or equal.

D. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:

1. Duro Dyne Corp.

2. Ventfabrics, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick (24 ga), galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz. /sq. yd.

2. Tensile Strength: 480 lbf/inch in the warp and 360 lb/inch in the filling.

3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric insulated double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz. /sq. yd.

2. Insulation: Fiberglass.

3. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

4. Service Temperature: Minus 50 to plus 250 deg F.

F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz. /sq. yd.

2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.

3. Service Temperature: Minus 67 to plus 500 deg F.

G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz. /sq. yd.

2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.

3. Service Temperature: Minus 67 to plus 500 deg F.

2.6 SCREENS

A. Screens shall be 1/4 inch mesh, 12 gauge stainless steel wire set in 1 inch galvanized channel frames for all openings.

2.7 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:

1. Test holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.

2. Quadrant locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12 inch. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Manufacturer: Subject to compliance with requirements, provided duct hardware of one of the following:

1. Ventfabrics, Inc.

2. Young Regulator Co.

3. Duro Dyne

2.8 ACCESS DOORS

A. Manufacturers:

1. American Warming and Ventilating.

2. Ductmate Industries, Inc.

3. Greenheck.

4. McGill Air Flow Corporation.

5. Ruskin Company

6. Or equal

B. Pressure Relief Access Door: Double wall and duct mounting; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.

C. Frame: Galvanized sheet steel, with bend-over tabs and neoprene gaskets.

D. Provide negative pressure and positive pressure relief doors design to open automatically to prevent exploding or imploding ductwork in the event dampers close or some other event may occur while the fan is still operating. The door shall automatically close and reset when the pressure is equalized or the system shuts down. Ruskin models PRD18, NRD18 or ADHP-3. Provide insulated doors in supply air systems, stainless steel construction for hazardous air exhaust systems and construction shall be appropriate for the pressure class.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify ducts and equipment installation is ready for accessories.

C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

A. Install in accordance with NFPA 90A & 90B, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide a volume control damper for each grille and diffuser and in all other locations necessary to properly balance the system.

C. Quadrants on insulated ducts shall be mounted on sheet metal brackets, set flush with the insulation.

D. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings. Back-draft dampers are not required for the fans with continuous operation and kitchen exhaust fans.

E. Access Doors: Install access doors at the following:

1. Spaced every 50 feet of straight duct.

2. Adjacent to each duct mounted filter.

3. Adjacent to each duct mounted coil.

4. Before and after each duct mounted fan.

F. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Review locations prior to fabrication.

G. Install the following sizes for duct-mounting, round access doors:

1. 8 inches in diameter for up to 12-inch diameter duct size.

2. 12 inches in diameter for 13-inch to 19 inch duct sizes.

3. 18 inches in diameter for 20-inch to 25 inch duct sizes.

4. 24 inches in diameter for larger duct sizes than listed above.

H. Label access doors according to Section 23 05 53.

I. Install temporary duct test holes required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

J. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

K. Connect flexible ducts to metal ducts with approved adhesive and draw bands.

L. Provide instrument test holes in ductwork at fan inlets and outlets and elsewhere as required by Testing, Adjusting and Balancing Contractor for testing and balancing purposes.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Diffusers.

2. Registers/Grilles.

B. Related Sections:

1. Division 08 - Louvers: Wall Louvers.

2. Division 09 - Painting and Coating: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.

3. Section 23 33 00 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Test Reports: Rating of air outlet and inlet performance.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70 and ADC 1062 "Certification, Rating and Test Manual".

B. Test and rate louver performance in accordance with AMCA 500.

C. NFPA Compliance: Install air outlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilation Systems".

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

1.7 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.9 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 EXHAUST AND RETURN CEILING GRILLES (CR)

A. Acceptable Manufacturer: Metal-Aire RH or approved equal.

B. Material: Aluminum or Steel.

C. Finish: Baked enamel. Coordinate color per Architect.

D. Face Arrangement: Fixed deflection blades set at 45° and 2/3" o.c.

E. Frame: 1 ¼" wide

F. Mounting: Flush surface mounted or T-bar lay-in.

G. Provide filler panel when installed in 24" X 24" T-bar ceiling. Panel to match ceiling construction. For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to provide 24" x 24" space. Where full 24" x 24" grid module is not available, surface mount the outlet in center cut to fit ceiling tile.

2.2 CEILING SUPPLY DIFFUSERS (CD)

A. Acceptable Manufacturer: Metal-Aire 9000, or approved equal.

B. Material: Aluminum or Steel.

C. Finish: Baked enamel. Coordinate color per Architect.

D. Face Arrangement: Fixed louver blades with four (4) removable core modules for adjustable throw pattern.

E. Pattern: Adjustable from 1-4 way throw.

F. Mounting: Beveled surface mounted or T-bar lay-in. Verify prior to ordering.

G. Provide filler panel when installed in 24" X 24" T-bar ceiling. Panel to match ceiling construction. For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to provide 24" x 24" space. Where full 24" x 24" grid module is not available, surface mount the outlet in center cut to fit ceiling tile.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify inlet and outlet locations.

C. Verify ceiling and wall systems are ready for installation.

3.2 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Division 23, Air Duct Accessories.

C. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Division 09.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Verify final location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 54 00

FURNACES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gas Fired Furnaces.

2. Thermostats.

B. Related Sections:

1. Section 23 11 23 - Facility Natural-Gas Piping: Execution requirements for natural gas piping specified in this section.

2. Section 23 11 26 - Facility Liquid-Petroleum Gas Piping: Execution requirements for LP gas piping specified in this section.

3. Section 23 31 00 - HVAC Ducts and Casings: Execution requirements for ductwork and duct liner specified by this section.

4. Section 23 33 00 - Air Duct Accessories: Execution requirements for flexible duct connections specified by this section.

5. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.47 - Gas-Fired Central Furnaces.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

2. ASHRAE 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces.

C. International Code Council:

1. ICC IFGC - International Fuel Gas Code.

D. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.

E. National Fire Protection Association:

1. NFPA 54 - National Fuel Gas Code.

2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

3. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

4. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances.

F. Underwriters Laboratories Inc.:

1. UL 727 - Oil-Fired Central Furnaces.

2. UL 729 - UL Standard for Safety for Oil-Fired Floor Furnaces.

G. United States Department of Energy:

1. DOE 10 CFR - Uniform Test Method for Measuring the Energy Consumption of Furnaces.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittals procedures.

B. Product Data: Submit rated capacities, efficiencies, weights, required clearances, and location and size of field connections, accessories, electrical nameplate data, and wiring diagrams.

C. Manufacturer's Installation Instructions: Submit rigging, assembly, and installation instructions.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and connections.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, service instructions, installation instructions, maintenance and repair data, and parts listing.

1.5 QUALITY ASSURANCE

A. Furnace Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with ANSI Z21.47.

B. Perform Work in accordance with DSA standard.

C. Maintain one copy of document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept furnaces, and thermostats on site in factory packaging. Inspect for damage.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer's warranty for heat exchangers.

C. Furnish five year manufacturers warranty for solid state ignition modules.

1.11 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.

B. Furnish service and maintenance of furnace and accessories for one year from Date of Substantial Completion.

C. Include systematic examination, adjustment, and lubrication. Repair or replace parts whenever required. Use parts produced by manufacturer of original equipment.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two filters for each furnace.

PART 2 PRODUCTS

2.1 GAS FIRED FURNACES

A. Manufacturers:

1. Carrier Corp.

2. The Trane Company.

3. Lennox.

B. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter and accessories; wired for single power connection with control transformer.

1. Air Flow Configuration: Upflow.

2. Fuel: Natural gas fired.

3. Accessories: Roof termination kit.

C. Provide equipment that is UL listed as suitable for clearance space available in installed location.

D. Cabinet: Steel with baked enamel finish, easily removed and secured access panels insulation.

E. Supply Fan: Centrifugal type rubber mounted with direct or belt drive.

F. Motor: Direct drive, variable speed, constant airflow, permanently lubricated.

G. Heat Exchanger: Aluminized steel, crimped or welded construction.

H. Gas Burner:

1. Atmospheric type with adjustable combustion air supply.

2. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety ignition system, manual On-Off valve, pilot filtration, automatic electric valves.

3. Electronic or pilot ignition, with hot surface igniter.

4. Corrosion resistant combustion air blower with permanently lubricated motor.

I. Gas Burner Safety Controls:

1. Ignition and flame- sensing safety controls to prove adequate combustion air supply and stop gas flow on ignition failure.

2. Flame rollout switch: Installed on burner box and prevents unsafe operation.

J. Operating Controls:

1. Room Thermostat: Cycles furnace system on and off to maintain room temperature setting.

2. Supply Fan Control: Energize from outlet air temperature or timer device independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation. Provide continuous low or high speed fan operation.

K. Air Filters: 1 inch thick glass fiber, disposable type arranged for easy replacement.

2.2 THERMOSTATS

A. Manufacturers:

1. Carrier Corp.

2. The Trane Company.

3. Lennox.

B. Adjustable Room Thermostat: Low voltage, to control heater stages in sequence with delay between stages and supply fan to maintain temperature setting. Include system selector switch (heat-off-cool) and fan control switch (auto-on).

C. Electric solid state microcomputer based room thermostat with remote sensor:

1. Automatic switching from heating to cooling.

2. Preferential rate control to minimize overshoot and deviation from setpoint.

3. Set-up for four separate temperatures for each day.

4. Instant override of setpoint for continuous or timed period from one hour to 31 days.

5. Short cycle protection.

6. Programming based on every day of week.

7. Selection features including degree F or degree C display, 12 or 24-hour clock, remote sensor, fan on-auto.

8. Battery replacement without program loss.

9. Thermostat display:

a. Time of day.

b. Actual room temperature.

c. Programmed temperature.

d. Programmed time.

e. Duration of timed override.

f. Day of week.

g. System mode indication: heating, cooling, auto, off, fan auto, fan on.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify building is ready for installation of units and openings are as indicated on Drawings.

3.2 INSTALLATION

A. Install Work in accordance with DSA standards.

B. Install gas fired furnaces in accordance with NFPA 54.

C. Install vent connections in accordance with NFPA 211 and NFPA 54.

D. Installation - Natural Gas Piping:

1. Connect natural gas piping in accordance with NFPA 54.

2. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

3. Install the following piping accessories on natural gas piping connections. Refer to Section 23 11 23.

a. Strainer.

b. Pressure gage.

c. Shutoff valve.

d. Pressure reducing valve.

E. Connect units to electric supply and connect controls remote from units.

F. Install control components supplied with equipment and provide control wiring.

G. Install control wiring between thermostat, indoor unit.

END OF SECTION

SECTION 26 01 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The work required under this division is not limited to the Electrical Drawings. Refer to Site, Architectural, Structural, and Mechanical Drawings which may designate Work to be accomplished. The intent of the Specifications is to provide a complete electrical system which include all documents which are a part of the Contract.

1. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this section complete as shown or noted on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Refer to all sections in Division 0, Contract Requirements and Division 1, General Requirements.

C. Work Installed but Furnished by Others:

1. The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify installation details. Foundations for apparatus and equipment will be furnished by others unless otherwise noted or detailed.

1.2 GENERAL REQUIREMENTS

A. Guaranty See General Conditions and Section 01 70 00:

1. Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guaranty period, from date of Substantial Completion against defective workmanship and material, and improper installation. Upon notification of failure, correct deficiency immediately and without cost to the Owner.

2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, through the Architect, printed manufacturer's warranties complete with material included and expiration dates, upon completion of project. Conform to Section 01 70 00.

B. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its

safety. Provide signage at all electrical rooms and on each exterior electrical enclosure access door or gate. Sign shall read "DANGER-HIGH VOLTAGE". Provide signage on each door or removable access panel on electrical equipment rated 600 volts and over. Sign shall read "DANGER-HIGH VOLTAGE".

C. Codes and Regulations:

1. Design, manufacture, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:
Institute of Electrical and Electronic Engineers - IEEE
National Electrical Manufacturers' Association - NEMA
Underwriters' Laboratories, Inc. - UL
National Fire Protection Association - NFPA
American Society for Testing and Materials - ASTM
American National Standards Institute - ANSI
California Electrical Code - CEC
California Code of Regulations, Title 8, Subchapter 5
California Building Code
State & Municipal Codes in Force in the Specific Project Area
Occupational Safety & Health Administration - OSHA
California State Fire Marshal - CSFM

2. The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.

D. Requirements of Regulatory Agencies:

1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.

a. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the work shall be obtained by the Contractor at his expense, unless otherwise specified.

b. Comply with the requirements of the applicable utility companies serving the Project. Make all arrangements with the utility companies for proper coordination of the Work.

E. Shop Drawings:

1. See Section 01 33 00 for additional requirements.

2. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.

3. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.

4. Submit a complete list of materials and equipment proposed for the job, including manufacturer's names and catalog numbers.

5. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or panelboards). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the equipment and material shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals to be reviewed.

   a. Bind catalog cuts, plate numbers, descriptive bulletins and drawings, 11" x 17" or smaller, in sets with covers neatly showing titles.

   b. The Contractor shall verify dimensions of equipment and be satisfied as to Code compliance for fit prior to submitting shop drawings for approval.

   c. Where current limiting devices are specified, submit technical data to substantiate adequate protection of equipment cascaded downstream. Submittals shall not be reviewed unless supporting calculations and data are submitted therewith.

   d. Include complete catalog information such as construction, ratings and insulation systems, as applicable.

   e. For any material specified to meet UL or trade standards, furnish the manufacturer or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.

   f. Reference listings to the specifications' Sections and Article to which each is applicable.

   g. Equipment Floor Plans: After approval of material is secured, prepare a floor plan of each electrical communication, and voice/data equipment room, drawn to scale at 1/2 inch equals 1 foot and submit for approval prior to rough-in in the same manner as for shop drawings. The layout drawings shall be exact scale. Equipment dimensions shall not exceed those indicated on the drawings. If proposed equipment exceeds these dimensions, it shall be the responsibility of the contractor to coordinate all equipment arrangement within the room with all affected trades to provide all code clearances and proper arrangements prior to rough-in. Equipment that grossly exceeds the space allocated and would require an increase in room size is not acceptable.

6. Contractor shall prepare coordinated drawings when required by Section 01 33 00.

F. Interpretations: Requests for interpretations of drawings and specifications must be made by the Contractor through the Architect. Any such requests made by equipment manufacturers or suppliers will be referred to the Contractor.

G. Substitutions: Refer to General Conditions.

H. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:

1. General Requirements:

a. Panelboards.

b. Conduits

c. Conductors, include selected insulation type.

d. Fuses

e. Disconnect switches.

f. Pullboxes, manholes and handholes.

g. Standard lighting fixtures, specially fabricated fixtures, ballasts and lamps, with samples and sample of standard finish available (where requested).

h. Integrated electronic system.

i. Control devices, standard and special receptacles, switches, plug strips and finish device plates.

j. Cabinets for signal and telephone system, special terminals and cabinets.

k. Access panels.

l. Fire alarm system.

m. Security system.

n. Telephone/data network system.

o. Master antenna television.

p. Autonomous Public Address System.

I. Utility Service:

1. Contractor shall verify the locations shown on the drawings and shall include extensions of lines to service locations which are acceptable to the utility companies costs levied by the serving utility must be borne by the Contractor.

2. Verify electrical, civil, architectural and structural, dimensional and other requirements with the serving utility companies.

3. Should any major modifications to the work indicated be necessary to comply with the utility requirements, notify the Architect.

4. Within five days after award of Contract, notify serving utilities that the project is under construction and furnish them the dates on which the various services will be required.

J. Record Drawings: Refer to Section 01 70 00, Execution Requirements.

K. Work Responsibilities:

1. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of his work.

2. Locations shown on architectural plan or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify the Architect before installing any rough-in conduit underground or above ground.

3. In the event changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without extra cost.

4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.

5. Lighting fixtures in mechanical spaces and elevator machine rooms are shown in their approximate locations only. Do not install light outlets or fixtures until mechanical piping and ductwork are installed; then lights shall be installed in locations best suited for equipment arrangement as directed by the Architect. Verify locations of fixtures in elevator machine rooms with the elevator company before installation.

6. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the equipment will fit into the spaces provided without violation of applicable Codes.

7. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect.

8. Be responsible for coordination of coordinated drawings.

9. Replace or repair, without additional compensation, any work which does not comply with these requirements.

L. Installation General: For special requirements, refer to specific equipment under these requirements.

1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.

2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Architect. Furnish access panels as required.

3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.

4. Type of Sleeves: Sleeves shall be steel pipe or galvanized sheet steel.

5. Finish Around Sleeves: Rough edges shall be finished smooth. Space between conduit and sleeves where conduit passes through exterior walls shall be sealed to permit movement of conduit, but prevent entrance of water. Space between conduit and sleeves where conduit passes through fire rated interior walls and slabs shall be sealed with approved materials to provide a fire barrier conforming to the requirements of the governing authorities having jurisdiction, using UL Approved Firestopping Systems.

6. Wherever conduit extends through roof, install flashings in accordance with drawings and details.

7. Be responsible for cutting and patching which may be required for the proper installation of the electrical work.

8. Protect work, materials and equipment cause whatever and provide adequate and proper storage facilities during the progress of the work. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all damaged or defective work, materials and equipment before requesting final acceptance.

9. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior

10. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.

11. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.

12. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish.

13. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation in accordance with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.

M. Excavation, Cutting and Patching:

1. Excavating, trenching and backfilling required for the work of this Division in accordance with the applicable requirements of Division 2. Excavating and backfilling connected with electrical work, repaving cuts and providing and maintaining protective measures for the electrical work excavation required by the governing authorities having jurisdiction shall be performed as a part of the work of this Division.

2. Verify openings indicated on the drawings. Additional cutting, patching and reinforcement of the construction of the building as required.

N. Tests:

1. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.

2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.

3. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.

4. Measure the three-phase voltage at no load and at maximum load conditions and submit to the report showing the results of these measurements.

5. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an authorized representative of the Architect. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.

6. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.

7. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.

8. Submit a report showing test voltage of line to neutral on the secondaries of transformers.

9. Measure voltage on secondary side of transformers with full load connected and adjust taps to provide rated secondary voltage.

10. Refer to Section 01 40 00 for other testing requirements.

O. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.

P. Cleaning Up:

1. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.

2. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.

3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.

4. Leave the entire installation in a clean condition.

Q. Completion:

1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.

2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.

3. Refer to Section 01 40 00 for other system starting requirements.

R. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for operation and maintenance of electrical equipment, including replacement parts lists. As specified in Section 01 70 00.

S. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.

T. Substantial Completion of Electrical Systems:

1. Prior to Substantial Completion of operating electrical systems, the Contractor shall:

a. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.

b. Deliver to the Architect, the Record Drawings.

c. Furnish the required Operating and Maintenance Data/Manuals.

d. Clean up of the project pertaining to this Division of the work.

e. After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Architect that systems are complete and operating in conformance with Contract Documents.

f. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.

g. Submission of warranties and guarantees.

2. Substantial Completion of Work Shall be Contingent On:

a. Contractor replacing defective materials and workmanship.

b. Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Architect directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.

c. Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours or days as required under separate Sections of these Specifications.

d. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.

U. Submittals for Change Orders: When changes are made during the construction phase, deletions and additions shall be presented in a manner that will indicate the cost of each item of material and corresponding labor. Markup shall be then added in accordance with the requirements of the General Conditions as modified by the Supplementary Conditions.

1. Unit pricing shall apply in event of changes, additions and deletions to the base Contract, as follows:

a. Submit a unit cost, covering one hour of labor, including all applicable supervision, nonproductive labor, burdens, benefits, insurance's, taxes, direct and indirect job expenses including drawings, engineering temporary power, warehouse, tools, equipment, clean-up, bonds, overhead and profit, charged for labor. Unit cost of labor shall be applicable for duration through completion of the project.

b. Material unit costs shall be based on the latest edition of "Electrical Trade Book," published by Trade Service Publications, Inc., Unit cost shall be taken from extreme right-hand column.

2. Labor unit quantities, for specific items as required by unit pricing and for equipment not covered by unit pricing shall be those listed in the third column from the National Electrical Contractors' Association, Inc., "NECA Manual of Labor Units."

3. For material not covered by the Unit Pricing, use the latest edition of "Electrical Trade Book, extreme right hand column. This materials cost shall remain for the duration of the contract and shall apply to all phases of construction.

V. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of the equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating personnel shall receive the number of days instruction as indicated in other sections.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 26 05 03

EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

B. Related Sections:

1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.

2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Submittal procedures.

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 CORD AND PLUGS

A. Manufacturers:

1. Hubbell.
2. Pass & Seymour.
3. General Electric.
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Attachment Plug Construction: Conform to NEMA WD 1.

C. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

D. Cord Construction: Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

E. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.

B. Related Sections:

1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.

2. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.

3. Section 31 23 23 - Fill: Requirements for backfill to be placed by this section.

1.2 REFERENCES

A. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:

1. Solid conductor for feeders and branch circuits 10 AWG and smaller.

2. Stranded conductor for feeders and branch circuits * AWG and larger.

3. Stranded conductors for control circuits.

4. Conductor not smaller than 12 AWG for power and lighting circuits.

5. Conductor not smaller than 16 AWG for control circuits.

6. 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

7. 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.

B. Wiring Methods: Provide the following wiring methods:

1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN insulation, in raceway.

4. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

5. Exterior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

6. Underground Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper. Aluminum conductors are not permitted.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers:

1. Rome Cable.

2. Superior Essex.

3. Southwire.

4. General Cable.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper.

D. Insulation: CEC; Type THHN/THWN 600 V insulation rated 75 degrees C for feeders and branch circuits larger than 2 AWG; Type THHN/THWN 600 V insulation rated 75 degrees C for feeders and branch circuits 1 AWG and smaller].

2.2 WIRING CONNECTORS

A. Split Bolt Connectors:

1. ILSCO Model SK.

2. Burndy Model KSU.

3. Blackburn Model HPS.

4. Substitutions: Substitutions: Section 01 60 00 - Product Requirements.

B. Solderless Pressure Connectors:

1. ILSCO Model SLUH.

2. Burndy Model KA-U.

3. Panduit Model LAM.

4. Substitutions: Substitutions: Section 01 60 00 - Product Requirements.

C. Compression Connectors:

1. ILSCO Model CRL.

2. Burndy Model HYLUG/HYLINK.

3. Blackburn Model ATL.

4. Substitutions: Substitutions: Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Wire in Raceway:

1. Pull conductors into raceway at same time.

2. Install building wire 4 AWG and larger with pulling equipment:

E. Special Techniques - Cable:

1. Protect exposed cable from damage.

2. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.

3. Use suitable cable fittings and connectors.

F. Special Techniques - Wiring Connections:

1. Clean conductor surfaces before installing lugs and connectors.

2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.

4. Install split bolt connectors for conductor splices and taps, 6 AWG and larger.

5. Install solderless pressure connectors with insulating covers for conductor splices and taps, 8 AWG and smaller.

G. Install solid conductor for feeders and branch circuits 10 AWG and smaller.

H. Install stranded conductors for branch circuits 10 AWG and smaller. However, when stranded conductors are used in lieu of solid, then install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

3.4 WIRE COLOR

A. General

1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:

a. Black, red, and blue for circuits at 120/208 volts single or three phase.

b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:

a. Black, red, and blue for circuits at 120/208 volts single or three phase.

b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:

1. For 6 AWG and smaller: Green.

2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rod electrodes.

2. Wire.

3. Grounding well components.

B. Related Sections:

1. Section 03 20 00 - Concrete Reinforcing: Bonding or welding bars when reinforcing steel is used for electrodes.

2. Section 33 79 00 - Site Grounding: Site related grounding components for buildings and facilities.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

2. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Metal underground water pipe.

2. Metal building frame.

3. Concrete-encased electrode.

4. Ground ring specified in Section 33 79 00.

5. Rod electrode.

6. Plate electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on grounding electrodes and connections.

C. Manufacturer's Installation Instructions: Submit for active electrodes.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Perform Work in accordance with CEC.

C. Maintain 2 copies of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Product Description:

1. Material: Copper-clad steel.

2. Diameter: 3/4 inch.

3. Length: 10 feet.

B: Connector: Connector for exothermic welded connection.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 4 AWG or as noted.

C. Grounding Electrode Conductor: Copper conductor bare, size to meet CEC requirements.

D. Bonding Conductor: Copper conductor bare.

2.3 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches NPS by 24 inches long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint at connection points.

3.3 INSTALLATION

A. Install rod electrodes at locations as indicated on Drawings. Install additional rod electrodes to achieve specified resistance to ground.

B. Install grounding and bonding conductors concealed from view.

C. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

D. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings.

E. Bond together metal siding not attached to grounded structure; bond to ground.

F. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

G. Connect to site grounding system. Refer to Section 33 79 00.

H. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

I. Permanently ground entire light and power system in accordance with CEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

J. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with CEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

K. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with CEC.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground resistance testing in accordance with IEEE 142.

E. Perform leakage current tests in accordance with NFPA 99.

F. Perform continuity testing in accordance with IEEE 142.

G. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Sleeves.
4. Firestopping relating to electrical work.
5. Firestopping accessories.
6. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 27 05 29 - Hangers and Supports for Communications Systems.
3. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. California Electrical Code:

1. CEC - California Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Firestopping Materials: ASTM E119, UL 1479, to achieve fire ratings of adjacent construction in accordance with UL Design Numbers noted on Drawings.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to CSFM and UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: L 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Maintain two copies of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. Electroline Manufacturing Company.

3. O-Z Gedney Co.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. B-Line Systems.

3. Midland Ross Corporation, Electrical Products Division.

4. Unistrut Corp.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

2.4 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.

2. Fire Trak Corp.

3. Hilti Corp.

4. International Protective Coating Corp.

5. 3M fire Protection Products.

6. Specified Technology, Inc.

7. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.

2. Foam Firestopping Compounds: Multiple component foam compound.

3. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

C. Color: As selected from manufacturer's full range of colors.

2.5 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Sheet metal.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products or products tested by independent testing laboratory.

2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.

2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Do not use powder actuated anchors.

E. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide expansion anchors.

2. Steel Structural Elements: Provide beam clamps.

3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.

5. Sheet Metal: Provide sheet metal screws.

6. Wood Elements: Provide wood screws.

B. Inserts:

1. Install inserts for placement in concrete forms.

2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

C. Install conduit and raceway support and spacing in accordance with CEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

2. Install surface mounted cabinets and panelboards with minimum of four anchors.

3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating to uniform density and texture.

D. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling and roof as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Pack void with backing material.

d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

2. Where cable tray, conduit, and wireway, penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment as indicated on drawings. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves.

E. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install stainless steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Related Sections:

1. Section 26 05 03 - Equipment Wiring Connections.
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
4. Section 26 05 34 - Floor Boxes for Electrical Systems.
5. Section 26 05 53 - Identification for Electrical Systems.
6. Section 26 27 16 - Electrical Cabinets and Enclosures.
7. Section 26 27 26 - Wiring Devices.
8. Section 27 05 33 - Conduits and Backboxes for Communications Systems.
9. Section 27 05 36 - Cable Trays for Communications Systems.
10. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.
11. Section 33 71 19 - Electrical Underground Ducts and Manholes.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground More than 5 feet outside Foundation Wall: Provide thickwall nonmetallic conduit. Provide cast metal boxes.

C. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit. Provide cast metal boxes.

D. Under Slab on Grade: Provide rigid steel conduit. Provide cast metal boxes.

E. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.

F. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

G. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

H. Exposed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for the following:

1. Flexible metal conduit.

2. Liquidtight flexible metal conduit.

3. Nonmetallic conduit.

4. Flexible nonmetallic conduit.

5. Nonmetallic tubing.

6. Raceway fittings.

7. Conduit bodies.

8. Surface raceway.

9. Wireway.

10. Pull and junction boxes.

11. Handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents:

1. Record actual routing of conduits larger than 2 inches.

2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Rigid Steel Conduit: ANSI C80.1.

C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.2 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Interlocked aluminum construction.

C. Fittings: NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Interlocked aluminum construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel compression type.

2.5 NONMETALLIC CONDUIT

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA TC 2; Schedule 40.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 OUTLET BOXES

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.

2. Concrete Ceiling Boxes: Concrete type.

C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.7 PULL AND JUNCTION BOXES

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 27 16.

D. Surface Mounted Cast Metal Box: NEMA 250, Type 4X; flat-flanged, surface mounted junction box:

1. Material: Galvanized cast iron.

2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

E. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1. Material: Galvanized cast iron.

2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.

3. Cover Legend: "POWER" or "SIGNAL".

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 26 05 29.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit in and under slab from point-to-point.

K. Maintain clearance between raceway and piping for maintenance purposes.

L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.

R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

S. Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.

T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

3.4 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights oeas indicated on Drawings.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Wire markers.
3. Conduit markers.
4. Stencils.
5. Underground Warning Tape.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating: Execution requirements for painting specified by this section.
2. Section 27 05 53 - Identification for Communications Systems.
3. Section 28 05 53 - Identification for Electronic Safety and Security.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Submit manufacturer's catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Install nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.6 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

B. Letter Size:

1. 1/8 inch high letters for identifying individual equipment and loads.

2. 1/4 inch high letters for identifying grouped equipment and loads.

C. Minimum nameplate thickness: 1/8 inch.

2.2 WIRE MARKERS

A. Description: Split sleeve type wire markers.

B. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.

2. Low Voltage Circuits: Wire number as indicated on shop drawings.

2.3 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 EXISTING WORK

A. Install identification on all equipment.

B. Replace lost nameplates.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.

2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.

3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.

4. Secure nameplate to equipment front using adhesive.

5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.

6. Install nameplates for the following:

a. Existing relocated distribution board.

b. Panelboards.

c. Transformers.

d. Disconnects.

C. Underground Warning Tape Installation:

1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 26 05 72

ACCEPTANCE TESTING

PART 1 GENERAL

1.1 SCOPE OF WORK

It is the intent of these acceptance tests to assure that all Contractor supplied equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with designed specifications.

A. The acceptance tests and inspections shall determine suitability for energization of switchgear and cables.

B. Items that shall be checked, inspected, and tested include, but are not limited to, the following:

1. Power/Lighting panel boards.

2. 600V rated cable.

1.2 APPLICABLE CODES

A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.

1. California Electrical Code - CEC 2010 Edition.

2. National Electrical Manufacturer's Association - NEMA.

3. American Society for Testing and Materials - ASTM.

4. Institute of Electrical and Electronic Engineers - IEEE.

5. National Electrical Testing Association - NET A.

6. American National Standards Institute - ANSI:

a. C2, National Electrical Safety Code

b. Z244-1, American National Standard for Personnel Protection

7. State Codes and Ordinances.

8. Insulated Cable Engineers Association - ICEA.

9. Association of Edison Illuminating Companies - AEIC.

10. Occupational Safety and Health Administration:

a. Part 1910, Subpart S, 1910.30S

b. Part 1926, Subpart V, 1926.950 through 1926.960

11. National Fire Protection Association - NFPA:

    a. ANSI/CECB, Electrical Equipment Maintenance

    b. CECE, Electrical Safety Requirements for Employee Workplaces

    c. ANSI/CEC, California Electrical Code 2010 Edition

    d. ANSI/NFPA 7S, Lightning Protection Code

    e. ANSI/NFPA 101, Life Safety Code

12. All inspections and tests shall utilize the following references:

    a. Project Design Specification.

    b. Project Design Drawings.

    c. Manufacturer's instruction manuals applicable to each particular apparatus.

1.3 QUALIFICATIONS OF TESTING AGENCY

A. The testing firm shall be an independent testing organization, which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.

B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

C. The testing firm and all the testing personnel shall have been engaged in such practices for a minimum of ten years.

D. The testing firm shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Parts 1907, 1910, and 1936. Full membership in the National Electrical Testing Association constitutes proof of such criteria.

E. The lead, on site, technical person shall be currently certified by the National Electrical Testing Associate (NETA) in Electrical Power Distribution System Testing.

F. Testing firm shall utilize only full-time technicians who are regularly employed by the firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians may assist, but may not perform testing and/or inspection services.

G. The testing firm shall submit proof of the above qualifications.

H. The testing firm shall be an independent organization as defined by OSHA Title 29, Part 1936 and the National Electrical Testing Association.

I. All instruments used by the testing firm to evaluate electrical performance shall meet NETA's Specifications for Test Instruments. (See Section 1.7 of this specification).

J. The terms used herewith such as Test Agency, Testing Laboratory, or Contractor Test Company, shall be construed to mean testing firm.

1.4 RESPONSIBILITIES

A. The Contractor shall notify the Owners Representative prior to commercement of any testing.

B. Any system, material or workmanship, which is found defective on the basis of acceptance tests, shall be reported.

C. The testing firm shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.

D. A stable source of 60 hertz power shall be provided for testing purposes by the Contractor. Owners Representative shall witness all tests and a minimum of 14 days notice shall be provided.

1.5 TEST EQUIPMENT

A. Test Instrument Calibration

B. The testing firm shall have a calibration program that assures that all applicable test instrumentation is maintained within rated accuracy.

C. The accuracy shall be directly traceable to the National Bureau of Standards.

D. Instruments shall be calibrated in accordance with the following frequency schedule:

1. Field instruments: Analog - 6 months maximum
   Digital - 12 months maximum

2. Laboratory Instruments - 2 months

3. Leased specialty equipment - 12 months (where accuracy is guaranteed by lessor)

E. Dated calibration labels shall be visible on all test equipment.

F. Records must be kept up-to-date which show date and results of instruments calibrated or tested.

G. An up-to-date instrument calibration instruction and procedure will be maintained for each test instrument.

H. Calibrating standard shall be of higher accuracy than that of the instrument tested.

1.6 TEST REPORTS

A. The test report shall include the following:

1. Summary of project.

2. Description of equipment/device tested.

3. Description of test, including date, time, and duration of test.

4. Test results.

5. Conclusions and recommendations.

6. Appendix, including appropriate test forms.

7. Identification' of test equipment used.

8. Signature of responsible test organization authority.

9. Signature of the person witnessing the tests.

10. Furnish five copies of the complete report to the Owners Representative no later than thirty (30) days after completion of project unless otherwise directed.

1.7 SAFETY AND PRECAUTIONS

A. Safety practices shall include, but are not limited to, the following requirements:

1. Occupational Safety and Health Act of 1970 - OSHA.

2. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.

3. Applicable State safety operating procedures.

4. NETA Safety/Accident Prevention Program.

5. District's safety practices.

6. National Fire Protection Association - CECE.

7. ANSI Z244.1 American National Standards for Personnel Protection.

B. All tests shall be performed with apparatus de-energized except where otherwise specifically required.

C. The testing firm shall have a designated safety representative on the project to supervise operations with respect to safety.

PART 2 PRODUCTS

2.1 PROTECTIVE DEVICE COORDINATION STUDY

A. A protective coordination study shall be performed using SKM's Dapper or equal software to select or check the selection of power fuse ratings, protective relay characteristics and settings, ratios, and characteristics of associated voltage breaker trip characteristics and settings.

B. The coordination study shall include all voltage classes of equipment indicated on the single line diagram drawings. The entire electrical system shall be included in the coordination study. Verify characteristics and settings of existing devices in the field and from the manufacturer.

C. The time-current characteristics of the specified protective devices shall be plotted on the appropriate log-log paper. The plots shall include complete titles, representative one-line diagrams of both buildings and legends, associated relays or fuse characteristics,

significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves, and fuse curves. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, cable damage curves, symmetrical and asymmetrical fault currents. All requirements of the current California Electrical Code shall be adhered to. Reasonable coordination intervals and separation of characteristic curves shall be maintained. Separate coordination plots for phase and ground protective devices shall be provided on a system basis. Separate curves shall be used to clearly indicate the coordination achieved for feeder breakers with downstream fuses and circuit breakers in switchgear and substations. There shall be a maximum of six protective devices per plot.

D. The selection and setting of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. Discrepancies, problem areas, or inadequacies shall be promptly brought to the project Owners Representative's attention.

E. Five copies of coordination curves and tabulated data indicating selection and settings of protective devices shall be submitted to the Owners Representative for approval.

PART 3 EXECUTION

3.1 EQUIPMENT VERIFICATIONS, TESTS AND CALIBRATIONS GENERAL

A. As part of the contract, the Contractor shall perform tests of installed work as herein specified and specified in other Sections of these Specifications.

B. The Contractor shall provide all materials, equipment, labor and technical supervision to perform such tests and inspections.

C. All tests shall be performed in compliance with the recommendations and requirements of the National Electrical Testing Association, Inc. (NET A), and applicable codes and standards.

D. Upon completion of the tests and inspections noted in these Specifications, a label shall be attached to all serviced devices. These labels shall indicate date serviced and the service company responsible.

E. The test and inspections shall determine suitability for continued reliable operation.

F. All tests shall be conducted in the presence of the Owners Representative. Provide a minimum of two weeks notice to the Owners Representative.

G. Furnish the necessary equipment and personnel to perform all required tests of all wiring and connections for continuity, short circuit, and improper grounds. Included, but not limited to, the following systems: substations, air interrupting switches, low voltage main and feeder circuit breakers, interlocking controls, panelboards, distribution transformers, branch circuits.

3.2 DISTRIBUTION BOARDS AND PANELBOARDS GENERAL

A. Visual and Mechanical Inspection:

1. Inspect for physical damage and code violations.

2. Clean interior and exterior surfaces.

3. Inspect for proper alignment, anchorage, and grounding.

4. Check tightness of accessible bolted bus joints by torque wrench method. Tighten connections in accordance with industry standard torque levels.

5. Make closure attempt on locked open devices. Make opening attempt on locked closed devices.

6. Make exchange with devices operated in off-normal positions.

B. Electrical tests:

1. Measure insulation resistance of each bus section phase-to-phase and phase-to-ground.

2. Inspect all accessible bus joints and cable connections by infrared scanner to detect loose or high-resistance connections and other circuit anomalies.

3. Inspect correctness of control wiring.

3.3 LOW VOLTAGE CIRCUIT BREAKERS

A. Visual and Mechanical Inspection:

1. Inspect for physical condition.

2. Inspect alignment and grounding.

3. Perform mechanical operator and contact alignment tests on the breaker and its operating mechanism in accordance with manufacturer's instructions.

4. Perform insulation resistance test on control wiring.

5. Clean mechanism, insulating surfaces and contacts.

B. Electrical Tests:

1. Measure contact resistance.

2. Trip overcurrent protective device by operation of each protective device.

3. Perform an insulation resistance test phase-to-ground, phase-to-phase and across open contacts.

4. Perform insulation resistance test in accordance with Doble procedure.

5. Perform timing test with Travel Analyzer to insure proper contact overtravel and pressure.

3.4 CABLES, LOW VOLTAGE (600 VOLTS AND LESS)

A. Visual and Mechanical Inspections:

1. Inspect cables for physical damage and proper connection.

2. Torque test cable connection. Tighten connections in accordance with industry standards.

3. Perform infrared scan of all connections under loaded conditions.

B. Electrical Tests: Perform insulation resistance test of each cable with respect to ground and adjacent cables.

3.5 GROUNDING SYSTEMS

A. Visual and mechanical inspection: Inspect ground system connections for completeness and adequacy.

B. Electrical tests: Perform fall-of-the-potential test per IEEE No. 81, Section 9.03 to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral and/or *derived* neutral points.

C. Infrared Inspection:

1. All doors and *cover* shall be *removed* and upon completion of test be reinstalled by testing agency technicians.

2. A load bank shall be furnished to circulate low *voltage* currents of 400A magnitude through each bus, main breaker and feeder breaker. After two hours infrared scans shall be made of all bus joints. Problem area shall be photographed before and after corrections. After corrections, another current test of two hours duration shall be made. Again an infrared scan shall be made to confirm correct operation.

3. Upon completion of infrared scans, all *covers* and doors shall be reinstalled.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes distribution and branch circuit panelboards.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

2. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:

1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

2. NEMA FU 1 - Low Voltage Cartridge Fuses.

3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.

5. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

6. NEMA PB 1 - Panelboards.

7. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. California Electrical Code (CEC):

1. CEC - California Electrical Code.

E. Underwriters Laboratories Inc.:

1. UL 67 - Safety for Panelboards.

2. UL 1283 - Electromagnetic Interference Filters.

3. UL 1449 - Transient Voltage Surge Suppressors.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Product Data: Submit catalog data showing specified features of standard products.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance products.

B. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.1 DISTRIBUTION PANELBOARDS (EXISTING)

A. Furnish circuit breaker type panelboard to match existing manufacturer, and AIC ratings.

B. Minimum integrated short circuit rating: 22,000 amperes rms symmetrical for 208 volt panelboards; 42,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.

C. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

D. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated on Drawings.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Manufacturers:

1. Square D.

2. Substitutions: None.

B. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

C. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

D. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000, 65,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.

E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.

F. Enclosure: NEMA PB 1, Type 1 or Type 3R as indicated on drawings.

G. Cabinet Box: 6 inches deep, 20 inches wide.

H. Cabinet Front: Flush or Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb.

C. Install recessed panelboards flush with wall finishes.

D. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

E. Install filler plates for unused spaces in panelboards.

F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.

G. Install engraved plastic nameplates in accordance with Section 26 05 53.

H. Install spare conduits out of each recessed panelboard to accessible location above ceiling. Minimum spare conduits: 5 empty, 3/4 inch. Identify each as SPARE.

I. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with CEC.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.

E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 26 27 16

ELECTRICAL CABINETS AND ENCLOSURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes hinged cover enclosures, cabinets, terminal blocks, and accessories.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

3. Section 27 05 33 - Conduits and Backboxes for Communications Systems.

4. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.5 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two of each key.

PART 2 PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Manufacturers:

1. Appleton.

2. Circle AW.

3. Reliance Electric.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Construction: NEMA 250, Type 1 or 3R steel enclosure.

C. Covers: Continuous hinge, held closed by flush latch operable by key.

D. Furnish interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.

E. Enclosure Finish: Manufacturer's standard enamel.

2.2 CABINETS

A. Manufacturers:

1. Appleton.

2. Circle AW.

3. Reliance Electric.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Boxes: Galvanized steel.

C. Box Size: 24 inches wide x 30 inches high x 6 inches deep.

D. Backboard: Furnish 3/4 inch thick plywood backboard for mounting terminal blocks. Paint matte white.

E. Fronts: Steel, flush or surface type with door with concealed hinge, and flush lock. Finish with gray baked enamel.

F. Furnish metal barriers to form separate compartments wiring of different systems and voltages.

G. Furnish accessory feet for free-standing equipment.

2.3 TERMINAL BLOCKS

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Reliance Electric.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Terminal Blocks: NEMA ICS 4.

C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

E. Furnish ground bus terminal block, with each connector bonded to enclosure.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 26 05 29.

B. Install cabinet fronts plumb.

3.2 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean electrical parts to remove conductive and harmful materials.

C. Remove dirt and debris from enclosure.

D. Clean finishes and touch up damage.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; receptacles; and device plates and decorative box covers.

B. Related Sections:

1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.

2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

C. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish fifty of each style, size, and finish wall plate.

PART 2 PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:

1. Leviton.

2.2 WALL SWITCHES

A. Product Description: NEMA WD 1, General-Duty, AC only general-use snap switch.

B. Body and Handle: Ivory plastic with toggle handle.

C. Indicator Light: Lighted handle type switch.

D. Locator Light: Lighted handle type switch.

E. Ratings:

1. Voltage: 120-277 volts, AC.

F. Ratings: Match branch circuit and load characteristics.

2.3 WALL DIMMERS

A. Manufacturers:

1. Leviton.

B. Product Description: NEMA WD 1, Type 1 semiconductor dimmer for incandescent or fluorescent lamps.

C. Body and Handle: Ivory plastic with linear slide.

D. Voltage: 120-277 volts.

E. Power Rating: Match load shown on drawings; 600 watts minimum.

F. Accessory Wall Switch: Match dimmer appearance.

2.4 RECEPTACLES

A. Manufacturers:

1. Leviton.

B. Product Description: NEMA WD 1, Heavy-duty general use receptacle.

C. Device Body: Ivory nylon.

D. Configuration: NEMA WD 6, type as indicated on Drawings.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.5 WALL PLATES

A. Manufacturers:

1. Leviton.

B. Coverplate: 0.035 inch thick, satin-finished stainless steel.

C. Weatherproof Cover Plate: Gasketed cast metal plate with threaded and gasketed device cover.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on top.

F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

G. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

H. Use jumbo size plates for outlets installed in masonry walls.

I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified and as indicated on drawings.

B. Install wall switch 48 inches above finished floor from top of device.

C. Install convenience receptacle 18 inches minimum.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fuses.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 DESIGN REQUIREMENTS

A. Select fuses to provide appropriate levels of short circuit and overcurrent protection for the following components: wire, cable, bus structures, and other equipment. Design system to maintain component damage within acceptable levels during faults.

B. Select fuses to coordinate with time current characteristics of other overcurrent protective elements, including other fuses, circuit breakers, and protective relays. Design system to maintain operation of device closest to fault operates.

1.4 FUSE PERFORMANCE REQUIREMENTS

A. Motor Load Feeder Switches: Class RK1 (time delay).

B. General Purpose Branch Circuits: Class RK1 (time delay).

C. Motor Branch Circuits: Class RK1 (time delay).

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual sizes, ratings, and locations of fuses.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two fuse pullers.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish fifteen spare fuses of each Class, size, and rating installed.

PART 2 PRODUCTS

2.1 FUSES

A. Manufacturers:

1. Bussman.

2. Gould Shawmut.

3. Reliance.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.2 CLASS RK1 (TIME DELAY) FUSES

A. Manufacturers:

1. Bussman.

2. Gould Shawmut.

3. Reliance.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Dimensions and Performance: NEMA FU 1.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fuse with label oriented so manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 28 19

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fusible and nonfusible switches.

B. Related Sections:

1. Section 26 28 13 - Fuses.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.

2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:

1. Square D.

2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray.

1. Interior Dry Locations: Type 1.

2. Exterior Locations: Type 3R.

E. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:

1. Square D.

2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position]enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray.

1. Interior Dry Locations: Type 1.

2. Exterior Locations: Type 3R.

D. Furnish switches with entirely copper current carrying parts.

2.3 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes when used with or protected by Class R.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

B. Height:5 feet to operating handle.

C. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

D. Install engraved plastic nameplates in accordance with Section 26 05 53.

E. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes interior luminaires, lamps, ballasts, and accessories.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

3. Section 26 52 00 - Emergency Lighting.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.

2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.

C. Product Data: Submit dimensions, ratings, and performance data.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.6 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish twenty of each plastic lens type.

C. Furnish one replacement lamps for each lamp installed.

D. Furnish twenty of each ballast type.

PART 2 PRODUCTS

2.1 INTERIOR LUMINAIRES

A. Product Description: Complete interior luminaire assemblies, with features, options, and accessories as scheduled.

B. Refer to Section 01 60 00 - Product Requirements for product options. Substitutions are not permitted.

2.2 FLUORESCENT BALLASTS

A. Manufacturers:

1. General Electric Co.
2. Hubbell Lighting.
3. Magnetek Inc.
4. Philips Electronic North America.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Electronic ballast, suitable for lamps specified, with voltage to match luminaire voltage. Ballast shall be rapid start type only.

2.3 FLUORESCENT LAMPS

A. Manufacturers:

1. General Electric Co.
2. Hubbell Inc.
3. Philips Electronics.
4. Substitutions: Section 01 60 00 - Product Requirements.

2.4 OCCUPANCY SENSOR

A. Shall be Leviton Multi-tech OSC20-MOW ceiling mounted.

2.5 TIME CLOCK

A. Intermatic mechanical type 7-day with ON/OFF auto switches.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.

B. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.

C. Locate recessed ceiling luminaires as indicated on Drawings.

D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Exposed Grid Ceilings: Support surface-mounted luminaires on grid ceiling directly from building structure. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.

F. Install recessed luminaires to permit removal from below.

G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Install clips to secure recessed grid-supported luminaires in place.

I. Install wall-mounted luminaires at height as indicated on Drawings as scheduled.

J. Install accessories furnished with each luminaire.

K. Connect luminaires to branch circuit outlets provided under Section 26 05 33.

L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

M. Install specified lamps in each luminaire.

N. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Aim and adjust luminaires as indicated on Drawings.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.5 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Relamp luminaires having failed lamps at Substantial Completion.

END OF SECTION

SECTION 26 52 00

EMERGENCY LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes emergency lighting units and exit signs.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

3. Section 26 51 00 - Interior Lighting: Exit signs.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SYSTEM DESCRIPTION

A. Emergency lighting to comply with requirements.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit dimensions, ratings, and performance data.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish twelve replacement battery for each battery type and size.

PART 2 PRODUCTS

2.1 EXIT SIGNS

A. Product Description: Exit sign fixture suitable for use as emergency lighting unit.

B. Directional Arrows: As indicated on Drawings.

C. Mounting: As indicated on Drawings.

D. Battery: 12 volt, nickel-cadmium type, with 1.5 hour capacity.

E. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.

F. Input Voltage: 120-277 volts.

G. Lamp: As indicated on drawings.

2.2 FLUORESCENT LAMP EMERGENCY POWER SUPPLY

A. Manufacturers:

1. Bodine.

2. Cooper.

3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.

C. Lamp Ratings: One F32CW lamp providing 1200 lumens, minimum.

D. Battery: Sealed lead calcium or nickel cadmium type, rated for 10 year life.

E. Include TEST switch and AC ON indicator light, installed to be operable and visible from outside of assembled luminaire.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install suspended exit signs using pendants supported from swivel hangers. Install pendant length required to suspend sign at indicated height.

B. Install surface-mounted emergency lighting units and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

C. Install wall-mounted emergency lighting units and exit signs at height as indicated on Drawings.

D. Install accessories furnished with each emergency lighting unit and exit sign.

E. Connect emergency lighting units and exit signs to branch circuit outlets provided in Section 26 05 33.

F. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within unit.

G. Install specified lamps in each emergency lighting unit and exit sign.

H. Ground and bond emergency lighting units and exit signs in accordance with Section 26 05 26.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Operate each unit after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements:Testing, adjusting, and balancing.

B. Aim and adjust lamp fixtures.

C. Position exit sign directional arrows as indicated on Drawings.

3.4 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Relamp emergency lighting units and exit signs having failed lamps at Substantial Completion.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes exterior luminaries, poles, and accessories.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.

2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

3. ANSI O5.1 - Wood Poles, Specifications and Dimensions.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.

C. Product Data: Submit dimensions, ratings, and performance data.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store and handle solid wood poles in accordance with ANSI O5.1.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.7 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish twelve of each lamp installed.

C. Furnish two ballasts of each lamp type installed.

PART 2 PRODUCTS

2.1 LUMINARIES

A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories as scheduled.

B. Refer to Section 01 60 00 - Product Requirements for product options.

2.2 FLUORESCENT BALLASTS

A. Manufacturers:

1. Cooper Industries Inc.

2. General Electric Co.

3. Hubbell Lighting

4. Magnetek Inc.

5. Pass & Seymour.

6. Philips Electronic North America.

7. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: High-power-factor type electromagnetic ballast certified by Certified Ballast Manufacturers, Inc. to comply with ANSI C82.1, suitable for lamps and environmental conditions specified, with voltage to match luminaire voltage.

2.3 HIGH INTENSITY DISCHARGE (HID) BALLASTS

A. Manufacturers:

1. General Electric Co.

2. Philips Electronic North America.

3. Radiant Lamp Co.

4. Siemens Corp.

5. Venture Lighting International Inc..

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: ANSI C82.4, metal halide lamp ballast, suitable for lamp and environmental conditions specified, with voltage to match luminaire voltage.

2.4 FLUORESCENT LAMPS

A. Manufacturers:

1. General Electric Co.

2. Hubbell Lighting

3. Philips Electronic North America.

4. Siemens Corp.

5. Substitutions: Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and Project conditions.

B. Verify foundations are ready to receive fixtures.

3.2 INSTALLATION

A. Install concrete bases for lighting poles at locations as indicated on Drawings, in accordance with Section 03 30 00.

B. Install poles plumb. Install double nuts to adjust plumb. Grout around each base.

C. Install lamps in each luminaire.

D. Bond and ground luminaries, metal accessories and metal poles in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

C. Measure illumination levels to verify conformance with performance requirements.

D. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Aim and adjust luminaries to provide illumination levels and distribution.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Relamp luminaries having failed lamps at Substantial Completion.

END OF SECTION

SECTION 27 05 23

TELEVISION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes television antennas; television distribution equipment.

B. Related Sections:

1. Section 27 05 26 - Grounding and Bonding for Communications Systems.

1.2 SYSTEM DESCRIPTION

A. Service entrance from local cable utility.

B. Premises wiring for broadband distribution of television signal, including individual outlets.

1.3 PERFORMANCE REQUIREMENTS

A. Signal at each outlet: 3 dBmV across 75 ohms, minimum, plus 5 dB, minus 0 dB.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Show installation details, cable routing, and system configuration.

C. Product Data: Submit catalog data showing electrical characteristics and connection requirements for each component.

D. Test Reports: Indicate procedures and results for specified field testing and inspection.

E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of outlets, devices, and cable routing.

C. Operation and Maintenance Data: Submit instructions for setting and tuning channels, and for basic trouble-shooting procedures.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience and with service facilities within 100 miles of project.

B. Installer: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.8 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.

1.9 COORDINATION

A. Contact utility company regarding charges related to service installation. Include utility charges in this contract.

PART 2 PRODUCTS

2.1 VHF ANTENNA

A. Product Description: Single channel antenna for each channel required.

B. Impedance: 75 ohm, gamma match.

C. Antenna Type: 5 element Yagi type.

D. Gain: 13 dB over tuned dipole.

E. Front-to-Back Ratio: 20 dB, minimum.

F. Beam Width: 52 degrees vertical x 63 degrees horizontal or 38 degrees vertical x 48 degrees horizontal, minus 3 dB.

G. Return Loss: 17 dB, minimum over entire channel.

H. Construction: Tubular metal elements.

I. Mounting Hardware: Suitable for stacking; minimum separation, 1/2 wavelength.

J. Wind Resistance: Withstand 100 mph wind.

2.2 VHF PREAMPLIFIER

A. Product Description: Single channel pre-amplifier for each required channel.

B. Impedance: 75 ohm.

C. Bandpass: 6 MHz, plus or minus 0.25 dB.

D. Gain: 24 dB, minimum.

E. Signal-to-Noise Ratio: 3 db maximum.

F. Power Supply: Remote, impedance matched for 22 dB return loss, 0.2 dB through loss. Furnish 120 volt, single phase input.

2.3 CONVERTER

A. Product Description: Solid-state, crystal-controlled converter for each UHF channel required, set to convert to VHF channel scheduled.

B. Gain: 10 dB.

C. Minimum Input Signal: minus 1.0 dBmV.

D. Maximum Signal Without Distortion: 35 dBmV.

E. Signal-to-Noise Ratio: 8 dB, minimum.

F. Bandpass Flatness: 0.5 dB over channel.

G. Power Supply: Furnish 120 volt, single phase input.

2.4 VHF AMPLIFIER

A. Product Description: One single channel VHF amplifier with automatic gain control for each required channel, including converted UHF channels.

B. Impedance: 75 ohm.

C. Input Match: 11 dB return loss.

D. Output Match: 13 dB return loss.

E. Bandpass Flatness at Full Gain: plus or minus 1.5 dB.

F. Gain: Adjustable, 35 to 55 dB.

G. Output: 69.5 dBmV, maximum, for 0.5 dB synch compression.

H. Noise at Maximum Gain: 7 db maximum.

I. AGC Range: 40 dB, minimum.

J. Power Supply: Furnish 120 volt, single phase input.

2.5 BANDPASS FILTER

A. Product Description: One bandpass filter for each required channel when adjacent to another required channel.

B. Impedance: 75 ohm.

C. Insertion Loss: 3.5 dB, maximum.

D. Bandpass Flatness: 1.5 dB.

E. Selectivity: minus 55 dB at 9 MHz.

2.6 ATTENUATOR PADS

A. Product Description: 75 ohm impedance attenuator pad, with bandwidth of 6 MHz., plus or minus 0.5 dB.

2.7 TAP

A. Product Description: All-channel, back-matched tap.

B. Recessed, suitable for mounting with standard duplex receptacle wall plate.

C. Through Loss: 0.7 dB, maximum.

D. Return Loss: 20 dB, maximum.

E. Isolation: 12 dB. At each tap to meet specified performance.

F. Connector: F type coaxial connector.

2.8 SPLITTER

A. Product Description: In-line, channel, back-matched splitter.

B. Through Loss: 3.5 dB for two-way; 6.7 dB for four-way.

C. Isolation: 16 dB, minimum.

2.9 ANTENNA CABLE

A. Product Description: RG 59/F.

2.10 DISTRIBUTION CABLE

A. Main Distribution Cable: .500

B. Branch Distribution Cable: RG 59/F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Connect cable television service in accordance with Cable Utility instructions.

B. Install grounding of television system components and wiring in accordance with Section 27 05 26.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Measure signal level at each outlet.

3.3 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturer's field services.

B. Supervise final adjustments and tuning of system.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust each antenna using field strength meter to orient for acceptable signal reception on all channels.

C. Adjust amplifier gain and make other system adjustments to achieve specified output levels at each outlet.

D. Adjust traps to eliminate spurious interference.

END OF SECTION

SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wire.

2. Mechanical connectors.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

1.2 REFERENCES

A. Building Industry Consulting Service International, Inc.

1. BICSI TDM Manual - Telecommunications Distribution Methods Manual.

B. California Electrical Code:

1. CEC - California Electrical Code.

C. Telecommunication Industry Association/Electronic Industries Alliance:

1. TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.3 SYSTEM DESCRIPTION

A. Communications grounding systems use the following elements as grounding electrodes:

1. Building grounding electrode.

B. Do not use the following elements as grounding electrodes:

1. Building plumbing system.

2. Building gas system.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms maximum.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground.

D. Manufacturer's Installation Instructions: Submit for active electrodes.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding, surge protection and lightning protection of telecommunications system in accordance with latest version of Grounding, Bonding and Electrical Protection chapter of the BICSI TDM Manual, TIA/EIA 607, and CEC.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.1 WIRE

A. Material: Stranded copper.

B. Grounding Conductor: Copper conductor bare.

C. Bonding Conductor: Copper conductor bare.

2.2 MECHANICAL CONNECTORS

A. Manufacturers:

1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc.
4. ILSCO Corporation.
5. O-Z Gedney Co.
6. Thomas & Betts, Electrical.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove paint at connection points.

3.2 INSTALLATION

A. Install in accordance with BICSI TDM Manual, TIA/EIA 607, and CEC.

B. Install grounding and bonding conductors concealed from view.

C. Install grounding for each rack using 6 AWG THHN, rated for 90 degrees C, insulated, copper stranded conductor to copper communication grounding bus bar located in main telecommunications room.

D. Bond main telecommunications grounding system to building grounding electrode system at main electrical service entrance location with 6 AWG THHN, rated for 90 degrees C, insulated, copper stranded conductor.

E. Install routing for grounding conductor as short and direct as practical.

F. Install routing of bonding conductors with minimum number of bends and splices. Use sweeping bends.

G. Install bonding connections with listed bolts, crimp pressure connectors, clamps, or lugs.

H. Between each telecommunications/signal room, install multiple busbars directly bonded with 6 AWG copper conductor.

I. Position busbars near associated equipment and insulate from supports.

J. Construct busbars of copper, 4 inches x 8 inches by 1/4 inch thick with pilot holes for ground lug.

K. Bond backbone cabling at each sheath opening.

L. Ground data cabinets, racks, cable trays, and mounting hardware located in MDF Room and IDF Rooms.

M. Install ground from each piece of equipment to MDF Room grounding bar via an insulated cable no smaller than 6 AWG stranded copper wire. Install proper grounding lug on cable where connecting to racks and grounding bar.

N. Label grounding conductors and grounding bus bars in accordance with Section 27 05 53.

O. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Visually inspect from each bus bar to main grounding electrode service location.

C. Test in accordance with BICSI TDM Manual, TIA/EIA 607, and CEC.

D. When improper grounding is found, check entire project and correct. Perform retest.

END OF SECTION

SECTION 27 05 29

HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Sleeves.
4. Mechanical sleeve seals.
5. Firestopping relating to electrical work.
6. Firestopping accessories.
7. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
3. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. California Electrical Code:

1. CEC - California Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to FM and UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. Electroline Manufacturing Company.

3. O-Z Gedney Co.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. B-Line Systems.

3. Midland Ross Corporation, Electrical Products Division.

4. Unistrut Corp.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

C. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.

2. NMP Corporation.

3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.5 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.

2. Fire Trak Corp.

3. Hilti Corp.

4. International Protective Coating Corp.

5. 3M fire Protection Products.

6. Specified Technology, Inc.

7. Substitutions: Section 01 60 00 - Product Requirements.

2.6 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Sheet metal.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products or products tested by independent testing laboratory.

2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.

2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide precast inserts, expansion anchors.

2. Steel Structural Elements: Provide beam clamps.

3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts.

5. Sheet Metal: Provide sheet metal screws.

6. Wood Elements: Provide wood screws.

B. Inserts:

1. Install inserts for placement in concrete forms.

2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

C. Install conduit and raceway support and spacing in accordance with CEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

2. Install surface mounted cabinets and panelboards with minimum of four anchors.

3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

3.5 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install chrome plated steel escutcheons at finished surfaces.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 27 05 29

HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Sleeves.
4. Mechanical sleeve seals.
5. Firestopping relating to electrical work.
6. Firestopping accessories.
7. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
3. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. California Electrical Code:

1. CEC - California Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to FM and UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. Electroline Manufacturing Company.

3. O-Z Gedney Co.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. B-Line Systems.

3. Midland Ross Corporation, Electrical Products Division.

4. Unistrut Corp.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

C. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.

2. NMP Corporation.

3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.5 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.

2. Fire Trak Corp.

3. Hilti Corp.

4. International Protective Coating Corp.

5. 3M fire Protection Products.

6. Specified Technology, Inc.

7. Substitutions: Section 01 60 00 - Product Requirements.

2.6 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Sheet metal.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products or products tested by independent testing laboratory.

2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.

2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide precast inserts, expansion anchors.

2. Steel Structural Elements: Provide beam clamps.

3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts.

5. Sheet Metal: Provide sheet metal screws.

6. Wood Elements: Provide wood screws.

B. Inserts:

1. Install inserts for placement in concrete forms.

2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

C. Install conduit and raceway support and spacing in accordance with CEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

2. Install surface mounted cabinets and panelboards with minimum of four anchors.

3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

3.5 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install chrome plated steel escutcheons at finished surfaces.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 27 05 33

CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Related Sections:

1. Section 26 05 03 - Equipment Wiring Connections.

2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

3. Section 26 27 16 - Electrical Cabinets and Enclosures.

4. Section 26 27 26 - Wiring Devices.

5. Section 27 05 26 - Grounding and Bonding for Communications Systems.

6. Section 27 05 29 - Hangers and Supports for Communications Systems.

7. Section 27 05 53 - Identification for Communications Systems.

8. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.

3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground More than 5 feet outside Foundation Wall: Provide thickwall nonmetallic conduit. Provide cast metal boxes or nonmetallic handhole.

C. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit. Provide cast metal or nonmetallic boxes.

D. Outdoor Locations, Above Grade: Provide rigid conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.

E. Wet and Damp Locations: Provide rigid steel. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

F. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

G. Exposed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents:

1. Record actual routing of conduits larger than 2 inches.

2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:

1. Allied Tube.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Rigid Steel Conduit: ANSI C80.1.

C. Rigid Aluminum Conduit: ANSI C80.5.

D. Intermediate Metal Conduit (IMC): Rigid steel.

E. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.2 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Interlocked aluminum construction.

C. Fittings: NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Interlocked aluminum construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube.

2. Wheatland Tube Co.

3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel compression type.

2.5 NONMETALLIC CONDUIT

A. Manufacturers:

1. Carlon Electrical Products.

2. Cantex.

3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA TC 2; Schedule 80 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 OUTLET BOXES

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.

2. Concrete Ceiling Boxes: Concrete type.

C. Nonmetallic Outlet Boxes: NEMA OS 2.

D. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer.

E. Wall Plates for Finished Areas: As specified in Section 26 27 26.

F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.7 PULL AND JUNCTION BOXES

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 27 16.

D. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:

1. Material: Galvanized cast iron.

2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

E. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1. Material: Galvanized cast iron.

2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.

3. Cover Legend: "ELECTRIC".

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29 provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 26 05 29.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit in and under slab from point-to-point.

K. Maintain clearance between raceway and piping for maintenance purposes.

L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

P. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations to cast boxes.

Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.

R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

S. Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.

T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

3.4 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 27 05 53

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Wire markers.
3. Conduit markers.
4. Stencils.
5. Underground Warning Tape.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating: Execution requirements for painting specified by this section.
2. Section 27 05 53 - Identification for Communications Systems.
3. Section 28 05 53 - Identification for Electronic Safety and Security.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Submit manufacturer's catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Install nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.6 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

B. Letter Size:

1. 1/8 inch high letters for identifying individual equipment and loads.

2. 1/4 inch high letters for identifying grouped equipment and loads.

C. Minimum nameplate thickness: 1/8 inch.

2.2 WIRE MARKERS

A. Description: Split sleeve type wire markers.

B. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.

2. Low Voltage Circuits: Wire number as indicated on shop drawings.

2.3 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 EXISTING WORK

A. Install identification on all equipment.

B. Replace lost nameplates.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.

2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.

3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.

4. Secure nameplate to equipment front using screws or rivets.

5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.

6. Install nameplates for the following:

a. Cabinets.

b. Panelboards.

C. Underground Warning Tape Installation:

1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.

2. Backboards.

3. Telecommunications equipment racks and cabinets.

4. Telecommunications service entrance pathways.

5. Grounding.

B. Related Sections:

1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

2. Division 27 Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

3. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. LAN: Local area network.

D. RCDD: Registered Communications Distribution Designer.

E. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.

F. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.

3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Seismic Qualification Certificates: For floor-mounted cabinets, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

4. A diagram of all network closets depicting the layout of equipment racks, fiber optic enclosures, patch panels, wire management and electronics hardware will be required in a Visio format.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.8 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with CEC and UL 2043 for fire-resistant and low-smoke-producing characteristics.

2. Support brackets with cable tie slots for fastening cable ties to brackets.

3. Lacing bars, spools, J-hooks, and D-rings.

4. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, and coated with the appropriate type and quantity of fire resistive paint, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.3 EQUIPMENT FRAMES

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

1. APC Data Enclosures: Enclosures shall be 4 posts with square holes and labeled U's on the front of the race posts.

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.

2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (panel mounting.

3. Finish: Manufacturer's standard, baked-polyester powder coat.

4. Wall mounted IDF's shall be built on shallow uni-strut that is attached to no less than three (3) studs on the wall by lag bolts. Lag bolts shall penetrate the studs by no less than 3 inches. IDF cabinet shall be attached to the mounted uni-struts with 3/8ths spring nuts and bolts.

5. Furnish and install required bonding material (racks and runway) and hardware, and bond to nearest TMGBB. Refer to ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications.

C. Floor-Mounted Racks: Modular-type, steel construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.

2. Baked-polyester powder coat finish.

3. Racks must have square mounting holes.

D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. Rack-mounted, 550-cfm fan with filter.
8. Power strip.
9. Baked-polyester powder coat finish.
10. All cabinets keyed alike (Key 415).
11. Front doors will be smoked plexiglass

E. Modular Wall Cabinets:

1. Wall mounting.
2. Steel construction.
3. Treated to resist corrosion.
4. Lockable front and rear doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. Rack-mounted, 250-cfm fan.
9. Power strip.
10. All cabinets keyed alike (Key 415).

F. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.

3. Vertical cable management panels shall have front and rear channels, with covers.

4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

G. IDF appropriate sized UPS (Rack Mountable):

1. APC 1500 (3-U) UPS for IDFs or APC3000 110V with standard 3-prong outlet (if a Cisco 4000 or greater switch is in the IDF rack).

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Rack mounting.

2. Six, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.

3. LED indicator lights for power and protection status.

4. LED indicator lights for reverse polarity and open outlet ground.

5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.

6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.

7. Cord connected with 15-foot line cord.

8. Rocker-type on-off switch, illuminated when in on position.

9. Peak Single-Impulse Surge Current Rating: 13 kA per phase.

10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.5 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.

3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers. Labeling shall be computer generated (P-touch).

PART 3 EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

C. Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems "INSTALLATION.

D. Comply with NECA 1.

E. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

F. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

G. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.3 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for level of administration including optional identification requirements of this standard.

C. Labels shall be preprinted or computer-printed type.

PART 4 REFERENCE PVPUSD CABLING STANDARDS

4.1 GENERAL

A. The power meter test results shall be recorded and printed using the software provided with the test equipment. Provide a hard and soft copy of the fiber optics and copper test results to Palos Verde Peninsula USD IT Department including a copy of the test equipment software. Hard copy test result must be provided in an 8-1/2" x 11" binder including a cover sheet.

B. A diagram of all network closets depicting the layout of equipment racks, fiber optic enclosures, patch panels, wire management and electronics hardware will be required in a Visio format.

C. All network closets (IDFs) shall use the same key (key-415) to open the front door as well as the back locks. All IDFs shall come with fans installed for ventilation and the cabinets shall have air vents in the side if the cabinets.

D. Use APC Data Products. All racks must be 4 posts with square holes and labeled U's on the front of the race posts.

E. Split A/C shall be installed in all IDF rooms, if applicable.

4.2 DATA CLOSET(S)-IDF & MDF

A. Labeling shall be computer generated (P-Touch).

B. All workstation faceplates, data patch panels must be permanently labeled on both ends (P-Touch).

C. All fiber optic cables and cable pairs must be permanently labeled on both ends at the Fiber patch panel and all junction boxes with their IDF or MDF destination using (P-Touch) labeling. (i.e. To MDF)

D. All fiber optic and copper cables shall be installed with adequate slack and 10' service loops.

E. Fiber optic cabling shall consist of a minimum of (6) individual strands 50/125 multi-mode cables for each IDF "home run" to the MDF.

F. Fiber optic cables are to be installed in Contractor provided UL rated inner duct.

G. All fibers are to be terminated on both ends with SC connectors on the inside of the fiber patch panels and SC on the outside of the fiber patch panels and fiber shielding is to be secured to the stress relief in the fiber patch panel.

H. All fiber optic rack mount enclosures will be installed at the top of wall mount and freestanding equipment racks.

I. Pinning configuration for all data jacks shall be in accordance to the EIA/TIA T568A Standard.

J. All plywood must be fire resistant and coated with the appropriate type and quantity of fire resistive paint.

K. Distribution Frames:

1. All distribution frames shall be built on shallow uni-strut that is attached to no less than three (3) studs on the wall by lag bolts. Lag bolts shall penetrate the studs by no less than 3 inches. IDF/MDF cabinet shall be attached to the mounted uni-struts with 3/8ths spring nuts and bolts.

2. All distribution frames shall be permanently grounded both the main unit as well as the door if plastic hinges are used.

L. Jumper wire management above and below the patch panels are provided and installed by the Contractor.

M. MDF to IDF, IDF to IDF Category 6A or better and able to meet 1 GB standards. Tie cables shall be terminated on contractor supplied (24) or (48) port patch panel frames with the appropriate number of RJ45 category 6A or better data inserts with a 10 foot service loop in IDF/MDF.

N. Conduit Sleeves:

1. Contractor shall provide and install EMT conduit sleeves as required through any intervening walls/fire-walls to properly route the station cabling to the required locations.

2. Additionally, any conduit sleeves provided by Contractor, or existing sleeves utilized by Contractor, to properly route station cabling from the station to the appropriate MDF, IDF, shall be properly fire-caulked by Contractor.

O. All exposed conduit ends and sleeves shall be properly protected with plastic bushings. Pull strings must be left in all conduits and sleeves exceeding four (4) feet in length.

P. Data Backbone Cables:

Cable Type: (6) strand 50micron/125 multi-mode indoor/outdoor
Outer Sheath Color: Different than existing station wiring (NOT RED)
Outer Sheath NAPA Rating: CM or CMP

Q. Data Station Cables:

Cable Type: Stranded Category 6A or higher, four (4) pair, 24 awg copper UTP
Outer Sheath Color: "Blue" Different than existing wiring and backbone (Not Red)
Outer Sheath NAPA Rating: CM or CMP

R. Each equipment cabinet or rack shall be equipped with horizontal cable managers. (CM) as required if one patch panel+ 2 CM's; two patch panels +3 CM's, three-patch panel's +4 CM's, etc.). Horizontal cable managers shall be Panduit # WMPHF2 (or equal) for (48) port panel installations and Panduit # WMPFS (or equal) for (24) port panel installations. Where 19" x 7' free standing equipment racks are installed. Panduit # WMPvsf20 (or equal) should be supplied and installed for vertical cable management.

S. PVPUSD contractor will provide appropriate length and quantity, plus five percent (5%), Category 6A straight through serialized data patch cables (blue). (Three (3) foot for racks and ten (10) foot patch cables for wall jack to station).

T. All wire (copper, fiber, and ground) will enter and or exit equipment closets by passing through contractor provided and installed EMT conduit fastened where needed by uni-strut.

U. A minimum of insulated #6 AWG copper conductor(s) wire will be provided and installed by the contractor and grounded in IDF or MDF.

V. Layout of the IDF or MDF Cabinet shall be installed as follows from the top of cabinet working down: Fiber patch panel, 24-48 port patch panel(s) (2Us), Wire management (1U), 2U space left open for equipment i.e. switches, 24-48 port patch panel(s) (2Us), Wire management (1U), 2U space left open for equipment i.e. switches, this pattern should be repeated to the bottom of the cabinet and into the second cabinet if needed. The bottom 8Us in each cabinet are to be left open for a rack mount UPS.

W. All Floor Mount racks will have a vertical 14 outlets Power Distribution Unit mounted internally in the back of the rack. Not blocking any electronics that may be mounted in the rack using the back mounting posts.

X. APC smart 5000 UPS 220V 30 amp twist lock plug with optional battery pack and PDU in MDF (with APC 4 post enclosures) and Administration IDFs. (These are to be mounted in the bottom of the racks).

Y. Where Multiple Racks are installed in MDF/IDF they will be secured together with Baying Kits.

Z. Any wall mount IDF's require a rack mount APC 3000 110V with standard 3 prong outlet.

AA. All floor mount Racks are to be installed with Seismic kits (Ladder racks and floor brackets bolted to the floor).

BB. All racks with square holes will come with no less that 200 cage nuts and 200 screws per rack.

4.3 WORKSTATION JACKS

A. Labeling shall be computer generated (P-Touch).

B. All workstation faceplates, data patch panels must be permanently labeled on both ends (P-Touch). (See Appendix A)

C. If flush mounting is not reasonably feasible, surface mounting with a back-box will be accepted.

D. Depending on the number of required outlets faceplates should be able to accommodate future cables. All un-jacked positions shall have a minimum of two blank inserts installed.

E. Faceplate: = almond/electric ivory
Category 6A data jacks (RJ-45) = blue
Blank Inserts = almond/electric ivory

F. Pinning configuration for all data jacks shall be in accordance to the EIA/TIA T568A Standard.

G. Data Station Jack Specification:

Rating:	Category 6A
Jack Type:	RJ-45
Pinning Config:	EIA/TIA T568A
Jack Color:	Blue

H. Faceplate Specifications:

Size:	Single Gang USO Bezel
Ports:	Two (2) four (4) or six (6)
Color:	Almond/Electric Ivory
Insert Color:	Blue

I. All surface mounted raceway, back boxes, junction boxes, etc. (other than electrical conduit where called for) shall be from the Panduit Corporation or equal product line. Contractor will be required to provide all manufacturer specified devices for corners, turns, transitions, dead ends, etc. to provide a complete and workmanlike installation according to recommended methods and procedures. Mechanical fastening methods will be required in all cases (double sided tape or foam is not acceptable).

4.4 WALLS & CEILING

A. Fiber optic cables are to be installed in Contractor provided UL rated inner duct.

B. Station cables are to be suspended on an independent hanger system supplied by the Contractor. The preferred suspension method will utilize an assembly of pencil rod or hanger wire, caddy clips and bridal rings. Any suspension system must meet all applicable standards for building and seismic requirements. Cable hanger shall be placed no more than four-foot (4') apart. (Use of ceiling grid system suspension wire is not acceptable).

C. Conduit Sleeves:

1. Contractor shall provide and install EMT conduit sleeves as required through any intervening walls/fire-walls to properly route the station cabling to the required locations.

2. Additionally, any conduit sleeves provided by Contractor, or existing sleeves utilized by Contractor, to properly route station cabling from the station to the appropriate MDF, IDF, shall be properly fire-caulked by Contractor.

D. All exposed conduit ends and sleeves shall be properly protected with plastic bushings. Pull strings must be left in all conduits and sleeves exceeding four (4) feet in length.

E. All conduits in the walls shall stub out in the open drop ceiling.

Appendix A:

Labeling of all wall jacks are to use the following format:

<MDF # or IDF #>.<JACK #>

i.e. If the MDF or IDF was **#7** and the patch panel number was **23** then the label on the wall jack would have the following label: **7.023** **(Letters for IDFs and/or MDFs are NOT admissible).**

If the patch panel is factory labeled with a set of redundant numbers i.e. 1-24, then the patch panel would have to be labeled to show the new set of numbers. For example **IDF #7** already has a patch panel with the numbers **1-24** and a second patch panel is installed, it must be relabeled with the numbers **25-48**. The wall jack label would look like this 7.035

Appendix B:

The following are codes and standards that apply to this installation:

TIA/EIA-568B - Commercial BLDG telecommunication wiring standard

TIA/EIA-569 - Commercial BDLG standards for telecommunications pathways and spaces

TIA/EIA-606 - Administration standard for the telecommunications infrastructure of commercial Buildings

TIA/EIA-607 - Commercial building grounding and bonding requirements for telecommunications

TIA/EIA-67 - Transmission performance spec's for field testing of "UTP" cabling systems

NEC - National Electrical Code

ISO/IEC 8802-3 - ANSI/IEEE 802.3 series standards

Appendix C:

APC Netshelter for all 7 foot and above floor mount racks

Southwest Data Products for the IDF wall mount cabinets

Levington for all Patch Panels, Fiber Panels, Work Station inserts and face plates.

All MDF and IDF will have the appropriate sized APC UPS (rack mountable). APC 5000 (3-U) UPS for MDFs with a 30 AMP twist lock receptor (LG-30) and APC 1500 (3-U) UPS for IDFs or APC 3000 (if a Cisco 4000 or greater switch is in the IDF rack). If an APC 5000 is needed a 30AMP twist lock receptor (LG-30) will need to be installed by the contractor as well.

DATA COMM:

Part #:	Description	Mfg.
530529TP-00	CAT-6A DATA CABLE - PVC	BERTEK
6110G – R*6	CAT-E RJ-45 - BLUE	LEVITON
41080-XXP	FACE PLATE	LEVITON
5G596-U12	CAT-6A PATCH PANEL-12 PORT	LEVITON
5G596-U24	CAT-6A PATCH PANEL-24 PORT	LEVITON
5G596-U48	CAT-6A PATCH PANEL-48 PORT	LEVITON
WMPH2E	2-U WIRE MANAGEMENT PANEL	PANDUIT

FIBER MATERIAL:

Part #:	Description	Mfg.
DX06-055D-W3SB/OFNR	6 STRAND M/M IN/OUT FIBER CABLE	OPTICAL CABLE
95-100-16	S/C MULTIMODE ANAEROBIC CONN.	SIECOR
5F100-3SC	3 PACK DUPLEX S/C INSERTS	LEVITON
5R130-OON **IDF**	1-24 PORT RACK MOUNT PANEL	LEVITON
5R460-OON **MDF**	1-72 PORT RACK MOUNT PANEL	LEVITON

DATA CABINETS:

Part #:	Description	Mfg.
SWE-4000-12UD	24HX24WX24D	SOUTHWEST DATA
SWE-4000-18UD	36HX24WX24D	SWDP
SWE-4000-26UD	48HX24WX24D	SWDP
CH-415	Front & REAR LOCK KIT (key-415)	SWDP

DATA CABINETS:

Part #:	Description	Mfg.
AR3307	APC NETSHELTER SX 48U	APC
AP9567	14 outlet PDU (1 for each rack)	APC
AR8112BLK	Seismic Kit (1 for each rack)	APC
AR7600	Baying kit (to bond multiple racks 1 per 2 racks)	APC

END OF SECTION

SECTION 27 13 00

COMMUNICATIONS BACKBONE CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pathways.

2. UTP cable.

3. 50/125-micrometer, optical fiber cabling.

4. Coaxial cable.

5. Cable connecting hardware, patch panels, and cross-connects.

6. Cabling identification products.

B. Related Sections:

1. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

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

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.

b. Minimum bending radius.

c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.

3. Cabling administration drawings and printouts.

4. Wiring diagrams to show typical wiring schematics including the following:

a. Cross-connects.

b. Patch panels.

c. Patch cords.

5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For splices and connectors to include in maintenance manuals.

G. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

4. Testing Agency Qualifications: An NRTL.

5. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 50 or less.

3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use or optical loss test set.

2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

3. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.11 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.12 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: two of each type.

2. Connecting Blocks: two of each type.

PART 2 PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.

2. Lacing bars, spools, J-hooks, and D-rings.

3. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

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

1. Belden CDT Inc.; Electronics Division.

2. CommScope, Inc.

3. Mohawk; a division of Belden CDT.

4. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, 100-pair UTP, formed into 25-pair binder groups covered with a thermoplastic jacket and overall metallic shield.

1. Comply with ICEA S-90-661 for mechanical properties.

2. Comply with TIA/EIA-568-B.1 for performance specifications.

3. Comply with TIA/EIA-568-B.2, Category 6A.

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and CEC for the following types:

a. Communications, General Purpose: Type CMR

b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

c. Communications, Riser Rated: Type CMR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

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

1. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

E. Number of Terminals per Field: One for each conductor in assigned cables.

F. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

G. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

H. Patch Cords: Factory-made, 4-pair cables in 36-inch lengths; terminated with 8-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6A performance. Patch cords shall have latch guards to protect against snagging.

2. Patch cords shall have color-coded boots for circuit identification.

2.5 OPTICAL FIBER CABLE

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

1. Optical Connectivity Solutions Division; Emerson Network Power.

B. Description: One (1) 12 strand MM, one (1) 6 strand SM, 50/125-micrometer, tight buffer, optical fiber cable. Outer Sheath Color: Different than existing station wiring (not Red). Outer Sheath NAPA Rating: CM or CMP.

1. Comply with ICEA S-83-596 for mechanical properties.

2. Comply with TIA/EIA-568-B.3 for performance specifications.

3. Comply with TIA/EIA-492AAAA-B for detailed specifications.

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and CEC for the following types:

a. General Purpose, Nonconductive: Type OFN or OFNG.

b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.

c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.

d. General Purpose, Conductive: Type OFC or OFCG.

e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.

f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.

5. Conductive cable shall be aluminum armored type.

6. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.

7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: Orange for 50/125-micrometer cable.

2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.

3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.6 OPTICAL FIBER CABLE HARDWARE

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

1. Leviton

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.

3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.8 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

2. Install cable trays to route cables if conduits cannot be located in these positions.

3. Secure conduits to backboard when entering room from overhead.

4. Extend conduits 3 inches above finished floor.

5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

10. In the communications equipment room, install with a 10-foot- minimum service at the MDF/IDF cabinets and each workstation..

11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

12. Fiber optic cable shall be permanently labeled on both ends at the fiber patch panel and all junction boxes with their IDF or MDF destination using (P-touch) labeling, (i.e. to MDF).

13. Fiber optic cables shall be terminated on both ends with SC style connections.

14. Fiber optic rack mount enclosures will be installed at the top of wall mount and freestanding equipment rack.

15. Fiber optic cables are to be installed by Contractor, provided UL rated inner duct where conduit pathways are not provided.

16. All wire (copper, fiber and ground) will enter and or exit equipment closets by passing through Contractor provided and installed EMT conduit fastened where needed by uni-strut.

17. A minimum of insulated #6 AWG copper conductor(s) wire will be provided and installed by the Contractor and grounded in MDF/IDF.

C. UTP Cable Installation:

1. Comply with TIA/EIA-T568-A.

2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-T568-A.

2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 CODES AND STANDARDS

A. The Following are codes and standards that apply to this installation:

1. TIA/EIA-568B- Commercial BLDG telecommunication wiring standard.

2. TIA/EIA-569- Commercial BLDG standards for telecommunications pathways and spaces.

3. TIA/EIA-606- Administration standard for the telecommunications infrastructure of commercial Buildings.

4. TIA/EIA-607- Commercial building grounding and bonding requirements for telecommunications

5. TIA/EIA-67- Transmission performance spec's for field testing of "UTP" cabling systems

6. ISO.IEC 8802-3- ANSI/IEEE 802.3 series standards.

3.6 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.8 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Administration Class: 2.

2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration including optional identification requirements of this standard.

D. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.

E. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

G. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.

4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

   a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.

   b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-T568A.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-T568A. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical Fiber Cable Tests:

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-T568A. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

   b. Link End-to-End Attenuation Tests:

      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.

      2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-T568A.

D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. The power meter test results shall be recorded and printed using the software provided with the test equipment. Provide a hard and soft copy of the fiber optics test results to Palos Verdes Peninsula USD IT Department including a copy of the test equipment software. Hard copy test result must be provided in an 8-1/2" x 11" binder including a cover sheet.

PART 4 REFERENCE PVPUSD CABLING STANDARDS

4.1 GENERAL

A. The power meter test results shall be recorded and printed using the software provided with the test equipment. Provide a hard and soft copy of the fiber optics and copper test results to Palos Verdes Peninsula USD IT Department including a copy of the test equipment software. Hard copy test result must be provided in an 8-1/2" x 11" binder including a cover sheet.

B. A diagram of all network closets depicting the layout of equipment racks, fiber optic enclosures, patch panels, wire management and electronics hardware will be required in a Visio format.

C. All network closets (MDFs & IDFs) shall use the same key (key-415) to open the front door as well as the back locks. All MDFs and IDFs shall come with fans installed for ventilation and the cabinets shall have air vents in the side if the cabinets.

D. Use APC Data Products. All racks must be 4 posts with square holes and labeled U's on the front of the race posts.

E. Split A/C shall be installed in all IDF and MDF rooms.

4.2 DATA CLOSET(S)-IDF & MDF

A. Labeling shall be computer generated (P-Touch).

B. All workstation faceplates, data patch panels must be permanently labeled on both ends (P-Touch).

C. All fiber optic cables and cable pairs must be permanently labeled on both ends at the Fiber patch panel and all junction boxes with their IDF or MDF destination using (P-Touch) labeling. (i.e. To MDF)

D. All fiber optic and copper cables shall be installed with adequate slack and 10' service loops.

E. Fiber optic cabling shall consist of a minimum of (6) individual strands 50/125 multi-mode cables for each IDF "home run" to the MDF.

F. Fiber optic cables are to be installed in Contractor provided UL rated inner duct.

G. All fibers are to be terminated on both ends with SC connectors on the inside of the fiber patch panels and SC on the outside of the fiber patch panels and fiber shielding is to be secured to the stress relief in the fiber patch panel.

H. All fiber optic rack mount enclosures will be installed at the top of wall mount and freestanding equipment racks.

I. Pinning configuration for all data jacks shall be in accordance to the EIA/TIA T568A Standard.

J. All plywood must be fire resistant and coated with the appropriate type and quantity of fire resistive paint.

K. Distribution Frames:

1. All distribution frames shall be built on shallow uni-strut that is attached to no less than three (3) studs on the wall by lag bolts. Lag bolts shall penetrate the studs by no less than 3 inches. IDF/MDF cabinet shall be attached to the mounted uni-struts with 3/8ths spring nuts and bolts.

2. All distribution frames shall be permanently grounded both the main unit as well as the door if plastic hinges are used.

L. Jumper wire management above and below the patch panels are provided and installed by the Contractor.

M. MDF to IDF, IDF to IDF Category 6A or better and able to meet 1 GB standards. Tie cables shall be terminated on contractor supplied (24) or (48) port patch panel frames with the appropriate number of RJ45 category 6A or better data inserts with a 10 foot service loop in IDF/MDF.

N. Conduit Sleeves:

1. Contractor shall provide and install EMT conduit sleeves as required through any intervening walls/fire-walls to properly route the station cabling to the required locations.

2. Additionally, any conduit sleeves provided by Contractor, or existing sleeves utilized by Contractor, to properly route station cabling from the station to the appropriate MDF, IDF, shall be properly fire-caulked by Contractor.

O. All exposed conduit ends and sleeves shall be properly protected with plastic bushings. Pull strings must be left in all conduits and sleeves exceeding four (4) feet in length.

P. Data Backbone Cables:

Cable Type: (6) strand 50micron/125 multi-mode indoor/outdoor
Outer Sheath Color: Different than existing station wiring (NOT RED)
Outer Sheath NAPA Rating: CM or CMP

Q. Data Station Cables:

Cable Type: Stranded Category 6A or higher, four (4) pair, 24 awg copper UTP
Outer Sheath Color: "Blue" Different than existing wiring and backbone (Not Red)
Outer Sheath NAPA Rating: CM or CMP

R. Each equipment cabinet or rack shall be equipped with horizontal cable managers. (CM) as required if one patch panel+ 2 CM's; two patch panels +3 CM's, three-patch panel's +4 CM's, etc.). Horizontal cable managers shall be Panduit # WMPHF2 (or equal) for (48) port panel installations and Panduit # WMPFS (or equal) for (24) port panel installations. Where 19" x 7' free standing equipment racks are installed. Panduit # WMPvsf20 (or equal) should be supplied and installed for vertical cable management.

S. AUSD contractor will provide appropriate length and quantity, plus five percent (5%), Category 6A straight through serialized data patch cables (blue). (Three (3) foot for racks and ten (10) foot patch cables for wall jack to station).

T. All wire (copper, fiber, and ground) will enter and or exit equipment closets by passing through contractor provided and installed EMT conduit fastened where needed by uni-strut.

U. A minimum of insulated #6 AWG copper conductor(s) wire will be provided and installed by the contractor and grounded in IDF or MDF.

V. Layout of the IDF or MDF Cabinet shall be installed as follows from the top of cabinet working down: Fiber patch panel, 24-48 port patch panel(s) (2Us), Wire management (1U), 2U space left open for equipment i.e. switches, 24-48 port patch panel(s) (2Us), Wire management (1U), 2U space left open for equipment i.e. switches, this pattern should be repeated to the bottom of the cabinet and into the second cabinet if needed. The bottom 8Us in each cabinet are to be left open for a rack mount UPS.

W. All Floor Mount racks will have a vertical 14 outlets Power Distribution Unit mounted internally in the back of the rack. Not blocking any electronics that may be mounted in the rack using the back mounting posts.

X. APC smart 5000 UPS 220V 30 amp twist lock plug with optional battery pack and PDU in MDF (with APC 4 post enclosures) and Administration IDFs. (These are to be mounted in the bottom of the racks).

Y. Where Multiple Racks are installed in MDF/IDF they will be secured together with Baying Kits.

Z. Any wall mount IDF's require a rack mount APC 3000 110V with standard 3 prong outlet.

AA. All floor mount Racks are to be installed with Seismic kits (Ladder racks and floor brackets bolted to the floor).

BB. All racks with square holes will come with no less that 200 cage nuts and 200 screws per rack.

4.3 WORKSTATION JACKS

A. Labeling shall be computer generated (P-Touch).

B. All workstation faceplates, data patch panels must be permanently labeled on both ends (P-Touch). (See Appendix A)

C. If flush mounting is not reasonably feasible, surface mounting with a back-box will be accepted.

D. Depending on the number of required outlets faceplates should be able to accommodate future cables. All un-jacked positions shall have a minimum of two blank inserts installed.

E. Faceplate: = almond/electric ivory
Category 6A data jacks (RJ-45) = blue
Blank Inserts = almond/electric ivory

F. Pinning configuration for all data jacks shall be in accordance to the EIA/TIA T568A Standard.

G. Data Station Jack Specification:

Rating:	Category 6A
Jack Type:	RJ-45
Pinning Config:	EIA/TIA T568A
Jack Color:	Blue

H. Faceplate Specifications:

Size:	Single Gang USO Bezel
Ports:	Two (2) four (4) or six (6)
Color:	Almond/Electric Ivory
Insert Color:	Blue

I. All surface mounted raceway, back boxes, junction boxes, etc. (other than electrical conduit where called for) shall be from the Panduit Corporation or equal product line. Contractor will be required to provide all manufacturer specified devices for corners, turns, transitions, dead ends, etc. to provide a complete and workmanlike installation according to recommended methods and procedures. Mechanical fastening methods will be required in all cases (double sided tape or foam is not acceptable).

4.4 WALLS & CEILING

A. Fiber optic cables are to be installed in Contractor provided UL rated inner duct.

B. Station cables are to be suspended on an independent hanger system supplied by the Contractor. The preferred suspension method will utilize an assembly of pencil rod or hanger wire, caddy clips and bridal rings. Any suspension system must meet all applicable standards for building and seismic requirements. Cable hanger shall be placed no more than four-foot (4') apart. (Use of ceiling grid system suspension wire is not acceptable).

C. Conduit Sleeves:

1. Contractor shall provide and install EMT conduit sleeves as required through any intervening walls/fire-walls to properly route the station cabling to the required locations.

2. Additionally, any conduit sleeves provided by Contractor, or existing sleeves utilized by Contractor, to properly route station cabling from the station to the appropriate MDF, IDF, shall be properly fire-caulked by Contractor.

D. All exposed conduit ends and sleeves shall be properly protected with plastic bushings. Pull strings must be left in all conduits and sleeves exceeding four (4) feet in length.

E. All conduits in the walls shall stub out in the open drop ceiling.

Appendix A:

Labeling of all wall jacks are to use the following format:

<MDF # or IDF #>.<JACK #>

i.e. If the MDF or IDF was **#7** and the patch panel number was **23** then the label on the wall jack would have the following label: **7.023** **(Letters for IDFs and/or MDFs are NOT admissible).**

If the patch panel is factory labeled with a set of redundant numbers i.e. 1-24, then the patch panel would have to be labeled to show the new set of numbers. For example **IDF #7** already has a patch panel with the numbers **1-24** and a second patch panel is installed, it must be relabeled with the numbers **25-48**. The wall jack label would look like this 7.035

Appendix B:

The following are codes and standards that apply to this installation:

TIA/EIA-568B - Commercial BLDG telecommunication wiring standard

TIA/EIA-569 - Commercial BDLG standards for telecommunications pathways and spaces

TIA/EIA-606 - Administration standard for the telecommunications infrastructure of commercial Buildings

TIA/EIA-607 - Commercial building grounding and bonding requirements for telecommunications

TIA/EIA-67 - Transmission performance spec's for field testing of "UTP" cabling systems

NEC - National Electrical Code

ISO/IEC 8802-3 - ANSI/IEEE 802.3 series standards

Appendix C:

APC Netshelter for all 7 foot and above floor mount racks

Southwest Data Products for the IDF wall mount cabinets

Levington for all Patch Panels, Fiber Panels, Work Station inserts and face plates.

All MDF and IDF will have the appropriate sized APC UPS (rack mountable). APC 5000 (3-U) UPS for MDFs with a 30 AMP twist lock receptor (LG-30) and APC 1500 (3-U) UPS for IDFs or APC 3000 (if a Cisco 4000 or greater switch is in the IDF rack). If an APC 5000 is needed a 30AMP twist lock receptor (LG-30) will need to be installed by the contractor as well.

DATA COMM:

Part #:	Description	Mfg.
530529TP-00	CAT-6A DATA CABLE - PVC	BERTEK
5G108-RL5	CAT-E RJ-45 - BLUE	LEVITON
41080-XXP	FACE PLATE	LEVITON
5G596-U12	CAT-6A PATCH PANEL-12 PORT	LEVITON
5G596-U24	CAT-6A PATCH PANEL-24 PORT	LEVITON
5G596-U48	CAT-6A PATCH PANEL-48 PORT	LEVITON
WMPH2E	2-U WIRE MANAGEMENT PANEL	PANDUIT

FIBER MATERIAL:

Part #:	Description	Mfg.
DX06-055D-W3SB/OFNR	6 STRAND M/M IN/OUT FIBER CABLE	OPTICAL CABLE
95-100-16	S/C MULTIMODE ANAEROBIC CONN.	SIECOR
5F100-3SC	3 PACK DUPLEX S/C INSERTS	LEVITON
5R130-OON **IDF**	1-24 PORT RACK MOUNT PANEL	LEVITON
5R460-OON **MDF**	1-72 PORT RACK MOUNT PANEL	LEVITON

DATA CABINETS:

Part #:	Description	Mfg.
SWE-4000-12UD	24HX24WX24D	SOUTHWEST DATA
SWE-4000-18UD	36HX24WX24D	SWDP
SWE-4000-26UD	48HX24WX24D	SWDP
CH-415	Front & REAR LOCK KIT (key-415)	SWDP

DATA CABINETS:

Part #:	Description	Mfg.
AR3307	APC NETSHELTER SX 48U	APC
AP9567	14 outlet PDU (1 for each rack)	APC
AR8112BLK	Seismic Kit (1 for each rack)	APC
AR7600	Baying kit (to bond multiple racks 1 per 2 racks)	APC

END OF SECTION

SECTION 27 13 43

COMMUNICATIONS SERVICES CABLING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes arrangement with Telecommunications Utility Company for telecommunication service.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating: Painting backboards.

2. Section 26 05 34 - Floor Boxes for Electrical Systems.

3. Section 26 27 26 - Wiring Devices: Wall plates.

4. Section 27 05 26 - Grounding and Bonding for Communications Systems.

5. Section 27 05 33 - Conduits and Backboxes for Communications Systems.

6. Section 27 05 53 - Identification for Communications Systems.

7. Section 33 71 19 - Electrical Underground Ducts and Manholes.

1.2 REFERENCES

A. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. Telecommunications Industry Association/Electronic Industries Alliance:

1. TIA/EIA 568 - Commercial Building Telecommunications Cabling Standard.

2. TIA/EIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.

1.3 SYSTEM DESCRIPTION

A. Service entrance from Telecommunications Utility Company.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog data for each termination device, cable, and outlet device.

C. Test Reports: Indicate procedures and results for specified field testing and inspection.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations and sizes of pathways and outlets.

PART 2 PRODUCTS

2.1 TELEPHONE TERMINATION BACKBOARDS

A. Material: Fire retardant Plywood.

B. Size: 4 x 8, 3/4 inch thick.

2.2 PATCH PANEL

A. Manufacturers:

1. Leviton, Part Number 6910G-U24 or 6910G-U48.

2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: TIA/EIA 568, rack-mounted assembly of terminals and accessory patch cords, with adequate capacity for active and spare circuits.

2.3 TELEPHONE OUTLET JACKS

A. Manufacturers:

1. Leviton, Part Number 6110G-RX6 or equal.

2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Conform to TIA/EIA 568 requirements for cable connectors for specific cable types.

2.4 UNSHIELDED BACKBONE CABLE

A. Manufacturers:

1. Bertek, Part Number 530529TP-00..

2. Superior Essex, Part Number 6A-272-XA or 6a-272-XB.

3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: TIA/EIA 568, 100-ohm, unshielded twisted pair multipair cable 24 AWG copper conductor.

2.5 OPTICAL FIBER BACKBONE CABLE

A. Manufacturers:

1. Optical Cable, Part Number DX06-055D-W3SB/OFNR

2. Superior Essex, Part Number W300669G01 (indoor/outdoor riser rated) or 110066G01 (OSP rated).

3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: TIA/EIA 568, 62.5/125 um optical fiber cable.

2.6 UNSHIELDED HORIZONTAL CABLE

A. Manufacturers:

1. Bertek, Part Number 530529TP-00.

2. Superior Essex, Part Number 6A-272-XA or 6A-272-XB.

3. Uniprise.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: TIA/EIA 568, 100-ohm, unshielded twisted pair plenum rated cable with 4 pairs, 24 AWG copper conductor.

2.7 OPTICAL FIBER HORIZONTAL CABLE

A. Manufacturers:

1. Optical Cable, Part Number DX06-055D-W3SB/OFNR.

2. Superior Essex, Part Number W30066G01.

3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: TIA/EIA 568, 62.5/125 um optical fiber cable.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install pathways in accordance with TIA/EIA 569.

B. Install wire and cable in accordance with TIA/EIA 568.

C. Install termination backboards and cabinets plumb, and attach securely to building wall at each corner.

D. Install recessed cabinets flush with wall finishes, and stub 5 empty 1 inch conduits to accessible location above ceiling at each location.

E. Install pull wire in each empty telephone conduit over 10 feet in length or containing bends.

F. Install engraved plastic nameplates in accordance with Section 27 05 53. Mark backboards and cabinets with legend "TELEPHONE."

G. Ground and bond pathways, cable shields, and equipment in accordance with Section 27 05 26.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test optical fiber cables in accordance with NETA ATS, except Section 4. Perform inspections and tests listed in NETA ATS, Section 7.25.

C. Inspect and test copper cables and terminations in accordance with TIA/EIA 568.

END OF SECTION

SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pathways.

2. UTP cabling.

3. Multiuser telecommunications outlet assemblies.

4. Cable connecting hardware, patch panels, and cross-connects.

5. Telecommunications outlet/connectors.

6. Cabling system identification products.

7. Cable management system.

B. Related Sections:

1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

2. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

G. LAN: Local area network.

H. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.

I. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

J. RCDD: Registered Communications Distribution Designer.

K. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.

L. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.

M. UTP: Unshielded twisted pair.

1.4 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.

2. Horizontal cabling shall contain no more that one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.

3. Bridged taps and splices shall not be installed in the horizontal cabling.

4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 250 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

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

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.

b. Minimum bending radius.

c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.

3. Cabling administration drawings and printouts.

4. Wiring diagrams to show typical wiring schematics, including the following:

5. Cross-connects.

6. Patch panels.

7. Patch cords.

8. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

9. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

a. Vertical and horizontal offsets and transitions.

b. Clearances for access above and to side of cable trays.

c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.

d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Samples: For workstation outlets, jacks, jack assemblies, and faceplates for color selection and evaluation of technical features.

D. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

E. Source quality-control reports.

F. Field quality-control reports.

G. Maintenance Data: For splices and connectors to include in maintenance manuals.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 50 or less.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

F. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cables to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.

2. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.

3. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.11 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.12 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: One of each type.

2. Connecting Blocks: One of each type.

3. Device Plates: One of each type.

4. Multiuser Telecommunications Outlet Assemblies: One of each type.

PART 2 PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6A cabling; designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.

2. Lacing bars, spools, J-hooks, and D-rings.

3. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

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

1. Belden CDT Inc.; Electronics Division.

2. West Penn

3. CommScope, Inc.

4. Mohawk; a division of Belden CDT.

5. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

6. Superior Essex.

B. Description: Category 6A, four (4) pair, 24 AWG copper UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.

2. Comply with TIA/EIA-568-B.1 for performance specifications.

3. Comply with TIA/EIA-568-B.2, Category 6A.

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and CEC for the following types:

a. Communications, General Purpose: Type

b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

c. Communications, Riser Rated: Type CMR, complying with UL 1666.

5. Superior Essex Part Number: 6A-272-XA (CMR), 6A-272-XB (CMP).

2.4 UTP CABLE HARDWARE

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

B. Leviton or equal.

C. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

D. Connecting Blocks: 110-style IDC for Category 6A. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

1. Leviton Part Number: 41AB6-1F4 or 41AB6-3F4.

E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

F. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

2. Leviton Part Number: 69586-U24 or 695860U48.

G. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

1. Category 6A rating, RJ-45 jack type, EIA/TIA 568B pinning configuration, blue jack color.

2. Leviton Part Number: 6910G-RX6.

H. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6A performance. Patch cords shall have latch guards to protect against snagging.

2. Patch cords shall have color-coded boots for circuit identification.

3. Leviton Part Number: 6210G-03X.

2.5 OPTICAL FIBER CABLE HARDWARE

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

1. Levtion

2. Siecor

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

2. Leviton Part Number: 5XX30-00N.

3. Leviton Part Number: 5F100-XX.

C. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

2. Quick-connect, simplex and duplex, Type SC connectors by Siecor. Insertion loss not more than 0.75 dB.

3. Leviton Part Number: 49990-MSC or 49990-SSC.

2.6 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

1. Leviton Part Number: 6910G-RX6.

B. Workstation Outlets: Two or Six-port-connector assemblies mounted in single faceplate.

1. Plastic Faceplate: Stainless steel to match power wiring device faceplates.

2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.

a. Flush mounting jacks, positioning the cord at a 45-degree angle.

b. Leviton Part Number: 42080-2AS or 42080-6AS.

3. All workstation faceplate, data patch panels my be permanently labeled on both ends (P-Touch) see below:

a. Labeling of all wall jackets are to use the following format:

b. <MDF# or IDF#>.<JACK#>

c. i.e. If the MDF or IDF was #7 and the patch panel number was 23 then the label on the wall jack would have the following label 7.023 (Letters for IDF's and/or MDF's are NOT admissible).

d. If the patch panel is factory labeled with a set of redundant numbers i.e. 1-24, then the patch panel would have to be labeled to show the new set of numbers. For example IDF #7 already has a patch panel with the numbers 1-24 and a second patch panel is installed, it must be relabeled with the numbers 25-48. The wall jack label would look like this 7.035.

e. Faceplates must accommodate (2) spare ports for future cables. Future cable ports shall be filled with blank inserts.

2.7 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.8 CABLE MANAGEMENT SYSTEM

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide Panduit #WMPHF2(or equal) for (48) port panel installation and Panduit #WMPFS (or equal) for 24 port panel installation where 19" x 7' freestanding equipment rack are installed. Panduit #WWPVSF20 (or equal) should be supplied and installed for vertical cable management.

C. Description: Computer-based cable management system, with integrated database capabilities.

D. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.

E. Information shall be presented in database view technical drawings.

1. AutoCAD drawing software shall be used as drawing and schematic plans software.

F. System shall interface with the following testing and recording devices:

1. Direct upload tests from circuit testing instrument into the personal computer.

2. Direct download circuit labeling into labeling printer.

G. Equipment cabinet or rack shall be equipped with horizontal cable managers: (CM) as required if one patch panel + 2 CM's; two patch panels + 3 CM's, three patch panel's + 4 CM's, etc. Horizontal cable managers shall be Leviton #491RU-HFO for (24) port patch panel and Leviton #492RU-HFO for (48) port patch panel installations. Provide Leviton #4980L-VFR vertical (CM) if open relay rack is specified.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

PART 3 EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

2. Install cable trays to route cables if conduits cannot be located in these positions.

3. Secure conduits to backboard when entering room from overhead.

4. Extend conduits 3 inches above finished floor.

5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

H. Contractor to provide Category 6A plenum rated cable to meet 1 GB standards. Cables shall be terminated on Contractor supplied (24) or (48) port patch panels at the MDF/IDF with the appropriate number of RJ45 Category 6A data inserts at workstations.

I. Contractor shall provide and install EMT conduit sleeves as required through any intervening walls/fire-walls to properly route the station cabling to the required locations. Additionally, any conduit sleeves provided by Contractor, or existing sleeves utilized by Contractor, shall be properly fire-caulked by Contractor.

J. All conduit sleeve shall be properly protected with plastic bushings. Pull strings must be left in all conduits and sleeves exceeding four (4) feet in length.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.

4. MUTOA shall not be used as a cross-connect point.

5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:

   a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.

   b. Locate consolidation points for UTP at least 49 feet from communications equipment room.

6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

12. In the communications equipment room, install with a 10-foot long minimum service loop at the MDF/IDF cabinets and each workstation.

13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

14. All cable pairs shall be permanently labeled on both ends at the patch panel and all junction boxes with their IDF or MDF destination using (P-touch) labeling (i.e. to MDF).

15. PVPUSD Contactor will provide appropriate length and quantity, plus five percent (5%), Category 6A straight through data patch cords (blue). Three (3) foot for MDF/IDF's and ten (1) foot path cables for workstations.

16. All wire (copper, fiber, ground) will enter and or exit equipment closets by passing through Contractor provided and installed EMT conduit fastened where needed by uni-strut.

17. A minimum of insulated #6 AWG copper conductor(s) wire will be provided and installed by the Contractor and grounded in MDF/IDF.

18. All surface mounted raceway, back boxes, junction boxes, etc. (other than electrical conduit where called for) shall be from the Panduit Corporation or equal product line. Contractor will be required to provide all manufacturer specified devices for corners, turns, transitions, dead ends, etc. to provide a complete and workmanlike installation according to recommended methods and procedures. Mechanical fastening methods will be required in all cases (double sided tape or foam is not acceptable).

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.

2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.

2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

3. All fiber optic cables shall be installed with adequate slack and 10' of service loops.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.

2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.

   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 CODES AND STANDARDS

A. The Following are codes and standards that apply to this installation:

1. TIA/EIA-568B- Commercial BLDG telecommunication wiring standard

2. TIA/EIA-569- Commercial BLDG standards for telecommunications pathways and spaces.

3. TIA/EIA-606- Administration standard for the telecommunications infrastructure of commercial Buildings.

4. TIA/EIA-607- Commercial building grounding and bonding requirements for telecommunications

5. TIA/EIA-67- Transmission performance spec's for field testing of "UTP" cabling systems

6. ISO.IEC 8802-3- ANSI/IEEE 802.3 series standards.

3.6 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.8 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Administration Class: 2.

2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.

C. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A.

E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

G. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.

4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

   a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.

   b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.

2. Visually confirm Category 6A, marking of outlets, cover plates, outlet/connectors, and patch panels.

3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. Optical Fiber Cable Tests:

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

   b. Link End-to-End Attenuation Tests:

      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.

      2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

6. UTP Performance Tests:

   a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

      1) Wire map.

      2) Length (physical vs. electrical, and length requirements).

      3) Insertion loss.

      4) Near-end crosstalk (NEXT) loss.

      5) Power sum near-end crosstalk (PSNEXT) loss.

      6) Equal-level far-end crosstalk (ELFEXT).

      7) Power sum equal-level far-end crosstalk (PSELFEXT).

      8) Return loss.

9) Propagation delay.

10) Delay skew.

7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.

8. Coaxial Cable Tests: Conduct tests according to Division 27 Section "Master Antenna Television System."

9. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.

a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.

b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. The power meter test results shall be recorded and printed using the software provided with the test equipment. Provide a hard and soft copy of the copper test results to Palos Verdes Peninsula USD IT Department including a copy of the test equipment software. Hard copy test result must be provided in an 8-1/2" x 11" binder including a cover sheet.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Include training in cabling administration software.

PART 4 Reference PVPUSD CABLING STANDARDS

4.1 GENERAL

A. The power meter test results shall be recorded and printed using the software provided with the test equipment. Provide a hard and soft copy of the fiber optics and copper test results to Palos Verdes Peninsula USD IT Department including a copy of the test equipment software. Hard copy test result must be provided in an 8-1/2" x 11" binder including a cover sheet.

B. A diagram of all network closets depicting the layout of equipment racks, fiber optic enclosures, patch panels, wire management and electronics hardware will be required in a Visio format.

C. All network closets (MDFs & IDFs) shall use the same key (key-415) to open the front door as well as the back locks. All MDFs and IDFs shall come with fans installed for ventilation and the cabinets shall have air vents in the side if the cabinets.

D. Use APC Data Products. All racks must be 4 posts with square holes and labeled U's on the front of the race posts.

E. Split A/C shall be installed in all IDF and MDF rooms.

4.2 DATA CLOSET(S)-IDF & MDF

A. Labeling shall be computer generated (P-Touch).

B. All workstation faceplates, data patch panels must be permanently labeled on both ends (P-Touch).

C. All fiber optic cables and cable pairs must be permanently labeled on both ends at the Fiber patch panel and all junction boxes with their IDF or MDF destination using (P-Touch) labeling. (i.e. To MDF)

D. All fiber optic and copper cables shall be installed with adequate slack and 10' service loops.

E. Fiber optic cabling shall consist of a minimum of (6) individual strands 50/125 multi-mode cables for each IDF "home run" to the MDF.

F. Fiber optic cables are to be installed in Contractor provided UL rated inner duct.

G. All fibers are to be terminated on both ends with SC connectors on the inside of the fiber patch panels and SC on the outside of the fiber patch panels and fiber shielding is to be secured to the stress relief in the fiber patch panel.

H. All fiber optic rack mount enclosures will be installed at the top of wall mount and freestanding equipment racks.

I. Pinning configuration for all data jacks shall be in accordance to the EIA/TIA 568B Standard.

J. All plywood must be fire resistant and coated with the appropriate type and quantity of fire resistive paint.

K. Distribution Frames:

1. All distribution frames shall be built on shallow uni-strut that is attached to no less than three (3) studs on the wall by lag bolts. Lag bolts shall penetrate the studs by no less than 3 inches. IDF/MDF cabinet shall be attached to the mounted uni-struts with 3/8ths spring nuts and bolts.

2. All distribution frames shall be permanently grounded both the main unit as well as the door if plastic hinges are used.

L. Jumper wire management above and below the patch panels are provided and installed by the Contractor.

M. MDF to IDF, IDF to IDF Category 6A or better and able to meet 1 GB standards. Tie cables shall be terminated on contractor supplied (24) or (48) port patch panel frames with the appropriate number of RJ45 category 6A or better data inserts with a 10 foot service loop in IDF/MDF.

N. Conduit Sleeves:

1. Contractor shall provide and install EMT conduit sleeves as required through any intervening walls/fire-walls to properly route the station cabling to the required locations.

2. Additionally, any conduit sleeves provided by Contractor, or existing sleeves utilized by Contractor, to properly route station cabling from the station to the appropriate MDF, IDF, shall be properly fire-caulked by Contractor.

O. All exposed conduit ends and sleeves shall be properly protected with plastic bushings. Pull strings must be left in all conduits and sleeves exceeding four (4) feet in length.

P. Data Backbone Cables:

Cable Type: (6) strand 50micron/125 multi-mode indoor/outdoor
Outer Sheath Color: Different than existing station wiring (NOT RED)
Outer Sheath NAPA Rating: CM or CMP

Q. Data Station Cables:

Cable Type: Stranded Category 6A or higher, four (4) pair, 24 awg copper UTP
Outer Sheath Color: "Blue" Different than existing wiring and backbone (Not Red)
Outer Sheath NAPA Rating: CM or CMP

R. Each equipment cabinet or rack shall be equipped with horizontal cable managers. (CM) as required if one patch panel+ 2 CM's; two patch panels +3 CM's, three-patch panel's +4 CM's, etc.). Horizontal cable managers shall be Panduit # WMPHF2 (or equal) for (48) port panel installations and Panduit # WMPFS (or equal) for (24) port panel installations. Where 19" x 7' free standing equipment racks are installed. Panduit # WMPvsf20 (or equal) should be supplied and installed for vertical cable management.

S. PVPUSD contractor will provide appropriate length and quantity, plus five percent (5%), Category 6A straight through serialized data patch cables (blue). (Three (3) foot for racks and ten (10) foot patch cables for wall jack to station).

T. All wire (copper, fiber, and ground) will enter and or exit equipment closets by passing through contractor provided and installed EMT conduit fastened where needed by uni-strut.

U. A minimum of insulated #6 AWG copper conductor(s) wire will be provided and installed by the contractor and grounded in IDF or MDF.

V. Layout of the IDF or MDF Cabinet shall be installed as follows from the top of cabinet working down: Fiber patch panel, 24-48 port patch panel(s) (2Us), Wire management (1U), 2U space left open for equipment i.e. switches, 24-48 port patch panel(s) (2Us),

Wire management (1U), 2U space left open for equipment i.e. switches, this pattern should be repeated to the bottom of the cabinet and into the second cabinet if needed. The bottom 8Us in each cabinet are to be left open for a rack mount UPS.

W. All Floor Mount racks will have a vertical 14 outlets Power Distribution Unit mounted internally in the back of the rack. Not blocking any electronics that may be mounted in the rack using the back mounting posts.

X. APC smart 5000 UPS 220V 30 amp twist lock plug with optional battery pack and PDU in MDF (with APC 4 post enclosures) and Administration IDFs. (These are to be mounted in the bottom of the racks).

Y. Where Multiple Racks are installed in MDF/IDF they will be secured together with Baying Kits.

Z. Any wall mount IDF's require a rack mount APC 3000 110V with standard 3 prong outlet.

AA. All floor mount Racks are to be installed with Seismic kits (Ladder racks and floor brackets bolted to the floor).

BB. All racks with square holes will come with no less that 200 cage nuts and 200 screws per rack.

4.3 WORKSTATION JACKS

A. Labeling shall be computer generated (P-Touch).

B. All workstation faceplates, data patch panels must be permanently labeled on both ends (P-Touch). (See Appendix A)

C. If flush mounting is not reasonably feasible, surface mounting with a back-box will be accepted.

D. Depending on the number of required outlets faceplates should be able to accommodate future cables. All un-jacked positions shall have a minimum of two blank inserts installed.

E. Faceplate: = almond/electric ivory
Category 6A data jacks (RJ-45) = blue
Blank Inserts = almond/electric ivory

F. Pinning configuration for all data jacks shall be in accordance to the EIA/TIA 568B Standard.

G. Data Station Jack Specification:

Rating:	Category 6A
Jack Type:	RJ-45
Pinning Config:	EIA/TIA 568B
Jack Color:	Blue

H. Faceplate Specifications:

Size:	Single Gang USO Bezel
Ports:	Two (2) four (4) or six (6)

Color: Almond/Electric Ivory
Insert Color: Blue

I. All surface mounted raceway, back boxes, junction boxes, etc. (other than electrical conduit where called for) shall be from the Panduit Corporation or equal product line. Contractor will be required to provide all manufacturer specified devices for corners, turns, transitions, dead ends, etc. to provide a complete and workmanlike installation according to recommended methods and procedures. Mechanical fastening methods will be required in all cases (double sided tape or foam is not acceptable).

4.4 WALLS & CEILING

A. Fiber optic cables are to be installed in Contractor provided UL rated inner duct.

B. Station cables are to be suspended on an independent hanger system supplied by the Contractor. The preferred suspension method will utilize an assembly of pencil rod or hanger wire, caddy clips and bridal rings. Any suspension system must meet all applicable standards for building and seismic requirements. Cable hanger shall be placed no more than four-foot (4') apart. (Use of ceiling grid system suspension wire is not acceptable).

C. Conduit Sleeves:

1. Contractor shall provide and install EMT conduit sleeves as required through any intervening walls/fire-walls to properly route the station cabling to the required locations.

2. Additionally, any conduit sleeves provided by Contractor, or existing sleeves utilized by Contractor, to properly route station cabling from the station to the appropriate MDF, IDF, shall be properly fire-caulked by Contractor.

D. All exposed conduit ends and sleeves shall be properly protected with plastic bushings. Pull strings must be left in all conduits and sleeves exceeding four (4) feet in length.

E. All conduits in the walls shall stub out in the open drop ceiling.

Appendix A:

Labeling of all wall jacks are to use the following format:

<MDF # or IDF #>.<JACK #>

i.e. If the MDF or IDF was **#7** and the patch panel number was **23** then the label on the wall jack would have the following label: **7.023** **(Letters for IDFs and/or MDFs are NOT admissible).**

If the patch panel is factory labeled with a set of redundant numbers i.e. 1-24, then the patch panel would have to be labeled to show the new set of numbers. For example **IDF #7** already has a patch panel with the numbers **1-24** and a second patch panel is installed, it must be relabeled with the numbers **25-48**. The wall jack label would look like this 7.035

Appendix B:

The following are codes and standards that apply to this installation:

TIA/EIA-568B - Commercial BLDG telecommunication wiring standard

TIA/EIA-569 - Commercial BDLG standards for telecommunications pathways and spaces

TIA/EIA-606 - Administration standard for the telecommunications infrastructure of commercial Buildings

TIA/EIA-607 - Commercial building grounding and bonding requirements for telecommunications

TIA/EIA-67 - Transmission performance spec's for field testing of "UTP" cabling systems

NEC - National Electrical Code

ISO/IEC 8802-3 - ANSI/IEEE 802.3 series standards

Appendix C:

APC Netshelter for all 7 foot and above floor mount racks

Southwest Data Products for the IDF wall mount cabinets

Levington for all Patch Panels, Fiber Panels, Work Station inserts and face plates.

All MDF and IDF will have the appropriate sized APC UPS (rack mountable). APC 5000 (3-U) UPS for MDFs with a 30 AMP twist lock receptor (LG-30) and APC 1500 (3-U) UPS for IDFs or APC 3000 (if a Cisco 4000 or greater switch is in the IDF rack). If an APC 5000 is needed a 30AMP twist lock receptor (LG-30) will need to be installed by the contractor as well.

DATA COMM:

Part #:	Description	Mfg.
530529TP-00	CAT-6A DATA CABLE - PVC	BERTEK
5G108-RL5	CAT-E RJ-45 - BLUE	LEVITON
41080-XXP	FACE PLATE	LEVITON
5G596-U12	CAT-6A PATCH PANEL-12 PORT	LEVITON
5G596-U24	CAT-6A PATCH PANEL-24 PORT	LEVITON
5G596-U48	CAT-6A PATCH PANEL-48 PORT	LEVITON
WMPH2E	2-U WIRE MANAGEMENT PANEL	PANDUIT

FIBER MATERIAL:

Part #:	Description	Mfg.
DX06-055D-W3SB/OFNR	6 STRAND M/M IN/OUT FIBER CABLE	OPTICAL CABLE
95-100-16	S/C MULTIMODE ANAEROBIC CONN.	SIECOR
5F100-3SC	3 PACK DUPLEX S/C INSERTS	LEVITON
5R130-OON **IDF**	1-24 PORT RACK MOUNT PANEL	LEVITON
5R460-OON **MDF**	1-72 PORT RACK MOUNT PANEL	LEVITON

DATA CABINETS:

Part #:	Description	Mfg.
SWE-4000-12UD	24HX24WX24D	SOUTHWEST DATA
SWE-4000-18UD	36HX24WX24D	SWDP
SWE-4000-26UD	48HX24WX24D	SWDP
CH-415	Front & REAR LOCK KIT (key-415)	SWDP

DATA CABINETS:

Part #:	Description	Mfg.
AR3307	APC NETSHELTER SX 48U	APC
AP9567	14 outlet PDU (1 for each rack)	APC
AR8112BLK	Seismic Kit (1 for each rack)	APC
AR7600	Baying kit (to bond multiple racks 1 per 2 racks)	APC

END OF SECTION

SECTION 27 51 23

INTEGRATED COMMUNICATION SYSTEM

PART 1 GENERAL

1.1 SCOPE OF WORK

A. All applicable portions of Section 16000 shall apply to this section as though written herein completely.

B. The work under this section includes all labor, materials, equipment, and accessories required to furnish and install a complete Integrated Communication System extension to the existing as indicated on the drawings and as specified herein. The System shall contain the following Subsystems: Telephone Interface, Intercommunication, Master Clock, Emergency and Zone Paging Systems.

1.2 RELATED WORK

Document affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of Divisions 1 and 16 of these specifications.

A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems. This shall include interfacing new system to existing main head end unit. It shall be the installing contractor's responsibility to field verify existing unit and provide necessary hardware and program for the entire system to be fully operable and functional.

B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets and backboards are furnished and installed by others and not part of this section. The wiring, cables, equipment, devices, etc., shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Communications Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the National Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year after final acceptance under this section shall be the responsibility of the communications contractor.

C. The Installing Communications Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.

1.3 GENERAL REQUIREMENTS

A. The Installing Communications Contractor shall hold a valid State of California C-10 License, shall have completed at least 20 projects of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least five years, and capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.

B. The Installing Communications Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work. Such as Alarm Company and Agent licenses.

C. The Installing Communications Contractor shall be a factory authorized distributor and warrantee station for the brand of equipment specified and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Installing Communication Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.

1.4 QUALITY ASSURANCE

A. In order to match the District's Standard, establish quality and standards of performance the specified equipment for the communication systems is that of Rauland Borg Corporation. All mechanical, electrical and general information set forth on the respective data sheets for each specified item shall be considered to be part of these specifications and binding herein.

B. All of the Electronic Systems Equipment 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 Communication Contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

C. All communication systems supplied shall be listed by Underwriters Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

D. The material in this section will be covered by the Rauland factory five year material warranty policy.

1.5 SUBMITTAL AND MANUALS

A. Comply with all requirements of the General Conditions, Supplementary Conditions and applicable sections of Divisions 1 and 16 of these specifications.

B. Additional requirements of this section are:

1. Within thirty-five (35) calendar days after the date of award of the Contract, the Contractor shall submit to the Architect for review, eight copies of a complete submission.

2. The submission shall consist of five major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.

3. The first section shall be the "Index" which shall include the project title and address, name of the firm submitting the proposal and name of the Architect.

4. The second section shall include a copy of the Installing Communication Contractors valid C-10 California State Contractors License, letters of factory

authorization and guaranteed service, list of 20 projects of equal scope and list of proposed instrumentation to be used by the Contractor.

5. The third section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished next to all of the specified equipment's features and functions as stated in the specifications and data sheets.

6. The fourth section shall contain an original factory data sheet for every piece of equipment in the specifications.

7. The fifth section shall contain a wiring designation schedule for each circuit leaving each piece of equipment and drawings showing system wiring plans.

C. The Contractor shall provide two copies of an "Operating and Servicing Manual" for the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following: Instructions necessary for the proper operation and servicing of the system; complete as-built installation drawings of the system; a wiring destination schedule for each circuit leaving for each piece of equipment; a schematic diagram of major components with all transistor and IC complements and replacement number.

PART 2 PRODUCTS

2.1 ICS SYSTEM REQUIREMENTS

A. The system shall provide the state of the art in technology for all telephone interface and intercom communications, emergency call-in notification, life safety paging and evacuation tones, secondary clock corrections, and bell schedule. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features. The system shall be interfaced with the existing telephone system provided by others.

B. Provide complete and satisfactorily operating Integrated Intercom/Communications System as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturer's standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

C. Features offered by this system shall be implemented and controlled by software programs that can be changed and expanded as customer needs evolve.

D. The system shall allow system monitoring and administration from a local Windows XP or Windows 7 PC or remote Windows XP or Windows 7 PC via a modem.

E. The system shall be an electronic system consisting of one or two amplified intercom channels, (classroom) speakers, call switches, and/or telephones, digital readout for display of call origination, and solid state logic and sensing. Provide one channel for this project.

F. Ability to provide multiple zone program distribution which is not interrupted by intercom communications.

G. Ability to initiate life-safety paging announcements, evacuation tones, take cover tones to any location within the facility.

H. Ability to selectively communicate or monitor individual classrooms in emergency situations; all communication within the classroom shall be hands free and will not require any interaction by the end-user to answer.

I. The system shall lend itself to expansion by simple addition of modules.

J. The central switching system shall provide for switching of the intercom talk path to a telephone mode, during the course of a call.

K. The system shall be equipped with voice prompting to identify the calling station and respective call priority.

L. Two-way telephonic communication capability from any classroom phone to any administrative phone.

M. Two-way communication between any telephone and any room speaker.

N. Room speakers and call switches shall be programmable and may be assigned any three, four or five digit number. Any room number may be reassigned at any time, and it shall not be dependent on wiring or circuit numbers.

O. Sixteen (16) separate paging zones shall be provided; each location shall be programmed in software to belong to any combination of software zones.

P. Each dialing administrative telephone in the system shall be programmable for the following options:

1. Allow zone paging.
2. Allow All-Page announcements.
3. Allow Executive Override.
4. Allow Emergency paging.
5. Allow activation of Time Zone tones.
6. Set the priority level and target display of "normal" calls.
7. Set the priority level and target display of "emergency" calls.
8. Assignment of architectural number.
9. Class of Service.
10. Assignment of associated speaker to paging zone.
11. Automatic Call-Back-Busy.
12. Call Forward-No Answer.
13. Call Forward-Busy.

14. Allow activation of security monitoring functions on a per room and per zone basis.

15. Allow activation of remote cameras upon call-in placement.

16. Allow unlocking of remote doors.

17. Security monitoring of doors and windows.

Q. Amplified two-way voice communication shall be available from any dial phone in the system, through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active.

R. The administrative phones shall be located in the office and where indicated on the plans; these phones instruments shall be used for public and inter-school communication.

S. The system shall allow room or area security monitoring features. This will include the ability to support motion detectors, door/window contacts or any normally open alarm input.

T. The system shall be UL listed to the UL 1950 Third Edition standard.

2.2 EQUIPMENT AND MATERIALS

A. Central Controller Unit: The Integrated Electronic Communications Network shall have the following capabilities:

1. Facilities for multiple operations simultaneously without interference with an established pattern of priorities for all administrator/classroom communication capabilities.

2. Facilities for centralized attendant answering.

3. The system shall provide Personal Identification Numbers for selected administrators. By dialing their PIN at any system telephone, the administrator shall have access to the same intercom/paging capabilities assigned to their office telephone, regardless of the restrictions on the phone they are currently using.

4. Provide multiple attendant positions for answering outside lines and internal intercom calls.

5. Facilities for the central control unit to store information and give reports on features, system activity, etc. upon request either on site or remotely.

6. Facilities for automatically sounding a warning tone signal over any loudspeaker selected for two-way communications to alert the station attendant (classroom teacher) to the call and prevent unauthorized monitoring.

7. Facilities for access to any single loudspeaker unit, zone loudspeaker unit, or all loudspeaker units. The warning tone signal shall sound as soon as the station is selected and shall be automatically repeated at regular intervals for the duration of the call if the voice circuit is not activated.

8. Direct Dialing, two-way amplified voice intercom between all locations equipped with administrative telephones and staff station speakers without the use of a press-to-talk or talk-listen switch.

9. The Central Controller Unit shall provide an RS-232 port for the connection of on-site or off-site diagnostics by distributor or factory-trained personnel.

10. This port shall be usable for the programming and saving of all programmed data for each system with the utilization of an on-site or off-site computer.

11. This port shall provide the capability of logging of various activities within the system.

12. Facilities for executive override permitting an assigned telephone to "override" on-going intercom conversation(s) in the system.

13. Facilities for the instantaneous distribution of emergency announcements simultaneously, by a single button access, to all locations equipped with speakers.

14. Emergency announcements originating from any assigned administrative telephone shall have priority over all regular system functions.

15. Facilities for the distribution of alarm signals to all areas equipped with speakers by single button access.

16. Up to nine (9) separate distinct alarm signals shall be provided. Each of the distinct alarm signals can be activated by a designated single button.

17. Capability for assigning speaker locations to any one or more of the sixteen (16) zones for zone paging, up to sixteen (16) zones for program distribution, eight (8) zones for class change "bells", and up to eight (8) security zones. All of these zones may be configured to be independent of the other zones.

18. Facilities for the origination of both "normal" and "emergency" calls from any staff location. Calls may originate from either a separate call switch or by going off hook on the Staff Phone.

19. Facilities for the origination of "alarm" calls from any location equipped with door/window contacts or motion detectors.

20. It shall be possible to review all calls stored in memory in the order received.

21. Facilities for answering calls registered in the digital read-out display merely by pressing a single response button. This capability shall not prevent other calls from being placed or answered by dialing their numbers.

22. Facilities to cancel all staff station originated calls from any administrative telephone.

23. Facilities for assigning or changing classroom numbers by architectural or any desired numbering system; either three-digit, four-digit, or five-digit numbers may be assigned.

24. Facilities for multiple loudspeaker or telephone conversations to take place and not prevent announcements, educational, or music programs from being distributed to other areas of the building.

25. Facilities to automatically send incoming calls to an alternate phone or if they remain unanswered for a predetermined amount of time.

26. A facility to notify a user that the intercom path called earlier is now available. If a busy signal is obtained, user shall dial callback feature code and hang up. System shall automatically call back user when intercom path is available and complete an intercom call to speaker.

27. Facilities for universal wiring for all data network, telephones, intercom speakers, and call switches using Category 6a cable. Systems requiring a custom cable plant dedicated to just the intercom system will not be acceptable.

28. Facilities to provide automatic emergency instructions to be broadcast to the entire school when an alarm is tripped. The emergency instructions are preprogrammed and require no user intervention.

29. Facilities to provide redundant fire alarm annunciation when interfaced with the primary fire alarm system. The redundant annunciation will announce via tones and/or a voice prompt of the nature of the emergency.

30. Facilities to provide redundant security annunciation when interfaced with the primary security system. The redundant annunciation will announce via tones and/or a voice prompt of the nature of the emergency.

31. Facilities to automatically activate remote cameras upon placement of a call-in and unlock doors with single button access.

32. Facilities for single button access to allow page announcements into speaker zones without interrupting others performing simultaneous functions.

33. Facilities to page one or more area-wide pocket pagers when a call is placed of a specific call priority or all call priorities. The pocket pager will display the calling room number and a numeric call priority.

34. Facilities to automatically alter a call switch's class of service by time of day and day of week as directed by the owner.

35. It shall be possible to initiate Class of Service changes either manually or automatically on a per station basis using internal clock set.

36. A minimum of four independent program memory sets shall be provided.

37. Choice of time of service change and active memory set selected shall be completely programmable.

38. Class of Service Changes shall be programmable by time of day and day of week.

39. A minimum of 64 unique classes of service shall be available.

40. Capability for assigning speaker locations to any one or more of the zones for zone paging or time signal reception; this assignment to be a programmable function.

41. Time signal tones shall be generated on a manual or automatic basis.

42. Emergency tones shall be distributed from designated Administrative Telephones.

43. Power amplifiers shall meet all specifications exactly as specified herein, including power capacity and count.

B. Administrative Telephone (If Shown): Administrative Telephones indicated on the drawings shall provide functions as scheduled below:

1. One button dialing of most commonly dialed number or numbers.

2. Facilities for multiple operations simultaneously without interference with an established pattern of priorities for all administrator/classroom communication capabilities.

3. Complete station software assignment including class of service, speed call numbers, and any other features assigned without any wiring changes being required.

4. Facilities to permit the distribution throughout the facility of emergency announcements, all-page announcements, zone-page announcements and emergency/evacuation alert if authorized through class of service.

5. Facilities to unlock remote doors.

6. Facilities to arm/disarm security features, such as door/window contact monitoring and motion detectors.

7. Facilities to enable use of features without the use of "hook switching".

8. Facilities for 2 line, 48 character LCD module to display room number dialed, room station call, program distribution, and paging zones.

9. Facilities for receiving staff station and/or emergency calls with single button response.

10. Provide saved number redial function.

C. Emergency/Normal Call Switch (If Shown): Emergency/Normal Call Switches indicated on the drawings shall provide functions as scheduled below:

1. Provide one (1) "Emergency" call switch that shall activate a distinctive "EMER" level call from a single button activation. Button shall be clearly marked "EMER" and shall route call to any one or more Administrative Telephones and/or Displays for quick and easy response from an Administrative Telephone. In accordance with the Americans with Disabilities Act (ADA), the "Emergency" call will provide a flashing call assurance LED confirming that the call has been placed in the system.

2. Provide one (1) "Normal" call switch that shall activate a distinctive "NORM" level call from a single button activation. Button shall be clearly marked "NORM" and shall route call to any one or more Administrative Telephones and/or Displays for quick and easy response from an Administrative Telephone. In accordance with the Americans with Disabilities Act (ADA), the "Normal" call will provide a steady call assurance LED confirming that the call has been placed in the system.

D. Normal Call Switch (If Shown): Normal Call Switches indicated on the drawings shall provide functions as scheduled below:

1. Provide one (1) "Normal" call switch that shall activate a distinctive "NORM" level call from a single button activation. Button shall be clearly marked "NORM" and shall route call to any one or more Administrative Telephones and/or Displays for quick and easy response from an Administrative Telephone. Ability to upgrade the "NORM" call to an "EMER" call by pressing the button a second time. In accordance with the Americans with Disabilities Act (ADA), the call will provide a steady call assurance LED (which will be upgraded to flashing for "emergency" calls) confirming that the call has been placed in the system.

E. Switch Panel:

1. Program distribution shall be controlled by both dial-up or switch panel selection for individual speakers or program distribution zones. Systems not providing for both switch panel AND dial-up program distribution will not be acceptable.

2. Speaker stations may be manually accessed by rack-mounted switch-panels specifically designed for individual and/or group station selection.

3. Remote cameras may be manually activated by rack-mount switch-panels.

4. Remote doors may be unlocked by rack-mount switch-panels.

5. Provide one 12 position switch panel to be programmed as per District requirements.

F. Program Distribution System:

1. The system shall provide facilities to distribute program material (i.e. DVD, CD, radio broadcasts) in the following manner:

2. The media operator shall cue remotely located music source or select radio station.

3. The media operator shall then "direct select" room(s) or areas to send the program via a switch panel.

AND/OR

The media operator shall dial from an Administrative Telephone to select the room(s) or areas to distribute program.

4. Both means of switch panel and dial-up program distribution shall be accessible from the system.

5. Power amplifiers shall meet all specifications exactly as specified herein, including power capacity and count, provide a minimum of ½ watt power to all intercom speaker locations plus 15 watts power to all horn type speaker locations.

6. Furnish and install a Marantz PMD357 Cassette/CD player and necessary hardware.

7. Furnish and install one ICSPMI remote program and microphone interface jack as directed by the district. Provide 1295 microphone.

G. Time Programming: The master time controller shall provide the following functions:

1. Non-volatile memory capacity for storing 550 events and up to 100 Calendar dates for schedule changes.

2. Ability to review, edit and delete events via a Windows 95/98 PC running the configuration program.

3. Review events from any entered time of day.

4. Events shall be programmable to any or all of (8) zone circuits.

5. Selection of any of (8) schedules to allow flexibility due to seasonal changes or special events.

6. Fully automatic Calendar execution.

7. User programmable Automatic Daylight Savings Time Change.

8. Programmable Music-on-Class-Change. This feature shall be programmable from 1 to 3600 seconds (60 minutes).

9. Separate bell-tone selection and separate bell duration for each event.

10. Latched operation of zones to control lighting or other devices.

11. Interface with most types of secondary slave clocks whether synchronous wired or electronic.

12. User-programmable custom slave clock correction. Output relays rated at 5 amperes shall be provided on all zone circuits as necessary.

13. Lithium battery will provide not less than 5 years battery back-up for timekeeping function.

H. Classroom Security and Supervision Interface:

1. Each classroom connected to the intercom system shall offer the ability to interface to a security motion detector, door switch, or window switch.

2. All field wiring shall be individually supervised for opens or shorts to call stations and security devices.

3. No other wiring or equipment shall be needed to secure a classroom.

4. Arming and disarming functions shall be performed by dial-up via the Administrative Telephone(s).

5. Security alarms may be programmed to automatically trigger pre-recorded emergency announcements and/or emergency tones to sound when the alarm is activated

6. Security alarms may be programmed to dial-out to emergency personnel's telephone extension or cell phone. When answered the system will announce the calling room and type of emergency/security call-in.

7. Security alarms may be programmed to dial-out to emergency personnel's pocket pager with the calling room number and call priority.

8. Easy interface shall be provided to the main security and/or fire alarm system. Emergency tones and/or announcements can be triggered, via the primary security and/or fire alarm system, to provide redundant annunciation via the classroom and corridor speakers.

9. Any systems not providing inherent security functions in the classrooms shall not be acceptable.

I. Data Logging:

1. System wide events. The System Log shall contain all events that occurred in the system for which event logging has been enabled to diagnose or document system usage.

2. Schedule parameters: Shows for each day-of-the-week the times-of-day when system configuration modes change.

3. System logging: The System Log Dump report shall list all events that occurred in the system for which event logging has been enabled to diagnose or document system usage.

4. System shall be self-monitoring. System shall include a background process dedicated to self-monitoring.

J. Telecenter System Rack Equipment: To fulfill the above requirements, the following control equipment shall be provided:

1. Rauland Microprocessor based central switching assembly with auto modem. Equip system for number of stations required plus one station line group card but no less than 20% spare.

2. Power amplifiers - Power and number of amplifiers shall be as required by load plus 50% reserve.

3. All equipment shall be mounted in a Rauland equipment racks.

4. Furnish a Sola or equal 1.3KVA UPS system.

5. Equipment racks shall be located in a climate-controlled area/room as shown on drawings. Equipment racks shall be:

a. Self-contained, specifically engineered racks with provisions for all present and future components as described and recommended by the manufacturer within this specification.

b. Racks shall be accessible from front and rear.

c. All program, zone, and time circuitry, data, linkage, power, telecommunications components, and circuitry to be located in racks configured as approved by the Engineer.

6. Atomic Clock Synchronizer Module TCAMCS.

K. Accessory Equipment:

1. Classroom loudspeakers (or if not designated) - Interior flush mounted wall or ceiling shall be Rauland USO188 mounted in Rauland ACC1004 baffle and ACC1100 back box. Use ACC1102 back box for surface installations.

2. Exterior flush wall shall be ACC1411 and ACC1412 for surface mounting requirements. Use vandal-proof hardware.

3. Exterior long throw surface mounted horn loudspeaker shall be Rauland 3609/3610. Provide Vandal proof cage to protect horn. Submit drawing for approval prior to installation.

4. Clocks shall be as shown on the plans. Rauland TCCKAN 12" (12VDC) Series if shown to be analog, Rauland 2522 if shown digital or Westclock 710 if shown to be battery type. Rauland TCCKANEN. Power Supply Rauland PS12

L. Cable:

1. Telephone site cable shall be Thompson 393B22GR Cable "A" or equal, 25 pair 24 AWG filled foam skin alpeth cable RUS PE-89 with a black jacket color.

2. Telephone cable shall be Thompson 393O5EYW Cable "O" or equal, 24 AWG 4 UTP Certified TIA/EIA-568B Category 6a (UL) CMR/MPR with a yellow jacket color.

3. Paging and Intercom site cable shall be Thompson 393B22GR Cable "B" or equal, 15 ind. Sh. Pair 22 AWG solid (UL) CM/CL3 Sun Res Water Block with a gray jacket color.

4. Paging and Intercom cable shall be Thompson 393F22VI Cable "F" or equal, 2 conductor 22 AWG solid shielded (UL) CMR/CL3R with a violet jacket color.

5. Outside loudspeaker and site loudspeaker cable shall be Thompson 393D18GN Cable "D" or equal, 2 conductor 18 AWG shielded (UL) CM/FPL/VNTC Sun res. Water Block with a green jacket color.

6. Loudspeaker cable shall be Thompson 393G16GR Cable "G" or equal, 2 conductor 16 AWG shielded (UL) CMR/CL3 with a gray jacket color.

7. Microphone cable shall be Thompson 393E22WH Cable "E" or equal, 2 conductor 22 AWG stranded shielded (UL) CMR/CL3 with a white jacket color.

8. System loudspeaker cable shall be Thompson 393H12RE Cable "H" or equal, 2 conductor 12 AWG stranded shielded (UL) CL3R with a red jacket color.

9. Clock (120Vac) cable shall be three (3) 12awg THHN or as required.

10. Clock (low voltage) cable shall be West Penn 220 Cable, 2 conductor 22 AWG stranded shielded (UL) CL3R with a beige jacket color.

11. Media Network cable shall be Thompson 393N5EPK Cable "N" or equal, 24 AWG 4 UTP certified TIA/EIA-568B Cat. 6a (UL) CMR/MPR with a pink jacket color.

12. All cable installed in underground conduit shall be Water Block type.

13. All cable must be of the type approved for the environment they are installed.

14. Provide all necessary site and distribution cable plus 10% spares as required for a complete and working system.

PART 3 EXECUTION

3.1 INSTALLATION

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 architect before making any changes. It shall be the responsibility of the factory authorized distributor of the specified 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. 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 and architect to engage in the installation and service of this system. The systems shall be installed in accordance with NFPA 70 and other applicable codes.

D. Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.

E. Control Circuit Wiring:

1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

2. The contractor shall mount a main distribution frame as shown on the plans. All wires shall be laid down on terminal punch blocks and identified by the actual room location it serves. All the communications points shall be wired into this main distribution frame, laid down in sequence, and identified by which line it is on and the point position it serves. Provide separate termination blocks for field and equipment. Crossconnect circuits for proper operation.

3. The contractor shall provide necessary transient protection on the AC power feed, all station lines leaving or entering the building, and all central office trunks.

All protection shall be as recommended by the equipment supplier and referenced to earth ground.

F. Wiring Within Enclosures:

1. Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars. The cables within the rack or cabinets shall be carefully cabled and laced with no. 12 Cord waxed linen lacing twine or ty-raps. All cables shall be numbered for identification.

2. Provide physical isolation from each other for speaker-microphone, line-level, speaker-level, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones and adjacent parallel power and telephone wiring. Provide physical separation as recommended by equipment manufacturer for other Integrated Electronic Communications Network system conductors.

3. Splices, Taps, and Terminations: Make splices, taps and terminations on numbered terminal punch blocks in junction, pull, and outlet boxes, terminal cabinets and equipment enclosures. Splices of conductors in underground pull boxes is not permitted.

4. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

G. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

H. Grounding:

1. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

2. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3. The contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.

4. The contractor shall note in his system drawings, the type and location of these protection devices as well as all wiring information.

5. The contractor shall furnish and install a dedicated, isolated earth ground from the central equipment rack and bond to the incoming electrical service ground buss bar.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing:

1. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.

2. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3. The owner reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject any or all of the equipment on the basis of the results thereby obtained.

3.3 CLEANING AND PROTECTION

A. 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.

3.4 COMMISSIONING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. Provide a minimum of 8 hours training. Operators Manuals and Users Guides shall be provided at the time of this training.

B. Schedule training with Owner through the Architect, with at least seven days advance notice. This instruction time shall be divided as directed by the Owner.

3.5 WARRANTY

A. The entire system shall be warranted free of mechanical or electrical defects for a period of one (1) year after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the purchaser.

B. 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.

C. A typewritten notice shall be posted at the equipment rack which 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.

END OF SECTION

SECTION 28 05 29

HANGERS AND SUPPORTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Sleeves.
4. Firestopping relating to electrical work.
5. Firestopping accessories.
6. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 27 05 29 - Hangers and Supports for Communications Systems.
3. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. California Electrical Code:

1. CEC - California Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Firestopping Materials: ASTM E119, UL 1479, to achieve fire ratings of adjacent construction in accordance with UL Design Numbers noted on Drawings.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to CSFM and UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: L 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Maintain two copies of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. Electroline Manufacturing Company.

3. O-Z Gedney Co.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. self-locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. B-Line Systems.

3. Midland Ross Corporation, Electrical Products Division.

4. Unistrut Corp.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Galvanized 12 gage) thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

2.4 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.

2. Fire Trak Corp.

3. Hilti Corp.

4. International Protective Coating Corp.

5. 3M fire Protection Products.

6. Specified Technology, Inc.

7. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.

2. Foam Firestopping Compounds: Multiple component foam compound.

3. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

C. Color: As selected from manufacturer's full range of colors.

2.5 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Sheet metal.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products or products tested by independent testing laboratory.

2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.

2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Do not use powder actuated anchors.

E. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide expansion anchors.

2. Steel Structural Elements: Provide beam clamps.

3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.

5. Sheet Metal: Provide sheet metal screws.

6. Wood Elements: Provide wood screws.

B. Inserts:

1. Install inserts for placement in concrete forms.

2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

C. Install conduit and raceway support and spacing in accordance with CEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

2. Install surface mounted cabinets and panelboards with minimum of four anchors.

3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating to uniform density and texture.

D. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling and roof as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Pack void with backing material.

d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

2. Where cable tray, conduit, and wireway, penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment as indicated on drawings. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves.

E. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install stainless steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 28 05 33

CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Related Sections:

1. Section 26 05 03 - Equipment Wiring Connections.
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
4. Section 26 05 34 - Floor Boxes for Electrical Systems.
5. Section 26 05 53 - Identification for Electrical Systems.
6. Section 26 27 16 - Electrical Cabinets and Enclosures.
7. Section 26 27 26 - Wiring Devices.
8. Section 27 05 33 - Conduits and Backboxes for Communications Systems.
9. Section 27 05 36 - Cable Trays for Communications Systems.
10. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.
11. Section 33 71 19 - Electrical Underground Ducts and Manholes.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground More than 5 feet outside Foundation Wall: Provide thick wall nonmetallic conduit. Provide cast metal boxes.

C. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit. Provide cast metal boxes.

D. Under Slab on Grade: Provide rigid steel conduit. Provide cast metal boxes.

E. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.

F. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

G. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

H. Exposed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for the following:

1. Flexible metal conduit.

2. Liquidtight flexible metal conduit.

3. Nonmetallic conduit.

4. Flexible nonmetallic conduit.

5. Nonmetallic tubing.

6. Raceway fittings.

7. Conduit bodies.

8. Surface raceway.

9. Wireway.

10. Pull and junction boxes.

11. Handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents:

1. Record actual routing of conduits larger than 2 inches.

2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Rigid Steel Conduit: ANSI C80.1.

C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit, all steel fittings.

2.2 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Interlocked aluminum construction.

C. Fittings: NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Interlocked aluminum construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel compression type.

2.5 NONMETALLIC CONDUIT

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA TC 2; Schedule 40.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 OUTLET BOXES

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.

2. Concrete Ceiling Boxes: Concrete type.

C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.7 PULL AND JUNCTION BOXES

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices.

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co.

6. Substitutions: Section 01 60 00 - Product Requirements.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 27 16.

D. Surface Mounted Cast Metal Box: NEMA 250, Type 4X; flat-flanged, surface mounted junction box:

1. Material: Galvanized cast iron.

2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

E. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1. Material: Galvanized cast iron.

2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.

3. Cover Legend: "POWER" or "SIGNAL".

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 26 05 29.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit in and under slab from point-to-point.

K. Maintain clearance between raceway and piping for maintenance purposes.

L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.

R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

S. Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.

T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

3.4 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 28 05 53

IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Stencils.
6. Underground Warning Tape.
7. Lockout Devices.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating: Execution requirements for painting specified by this section.
2. Section 26 05 53 - Identification for Electrical Systems.
3. Section 27 05 53 - Identification for Communications Systems.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Submit manufacturer's catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Samples:

1. Submit two tags, actual size.
2. Submit two labels, actual size.
3. Submit two nameplates, 4 x 4 inch in size illustrating materials and engraving quality.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State and District standards.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.8 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish two containers of spray-on adhesive.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

B. Letter Size:

1. 1/8 inch high letters for identifying individual equipment and loads.

2. 1/4 inch high letters for identifying grouped equipment and loads.

C. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

A. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

2.3 WIRE MARKERS

A. Description: Cloth tape, split sleeve, or tubing type wire markers.

B. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.

2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams, shop drawings and Drawings.

2.4 CONDUIT AND RACEWAY MARKERS

A. Description: Nameplate fastened with adhesive. Labels fastened with adhesive.

B. Color:

1. Fire Alarm System: Red lettering on white background.

C. Legend:

1. Fire Alarm System: FIRE ALARM.

2.5 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.

2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to the following:

1. Black lettering on white background.

2. White lettering on gray background.

3. Red lettering on white background.

4. Blue lettering on white background.

2.6 UNDERGROUND WARNING TAPE

A. Description: 6 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

2.7 LOCKOUT DEVICES

A. Lockout Hasps:

1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

B. Install identification on unmarked existing equipment.

C. Replace lost nameplates, labels and markers.

D. Re-stencil existing equipment.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.

2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.

3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.

4. Secure nameplate to equipment front using screws, rivets or adhesive.

5. Secure nameplate to inside surface of door on recessed panels or cabinets in finished locations.

6. Install nameplates for the following:

   a. Panels.

   b. Cabinets.

C. Label Installation:

1. Install label parallel to equipment lines.

2. Install label for identification of individual control device stations, and junction boxes.

3. Install labels for permanent adhesion and seal with clear lacquer.

D. Wire Marker Installation:

1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.

3. Install labels at data outlets identifying patch panel and port designation [as indicated on Drawings].

E. Conduit and Raceway Marker Installation:

1. Install conduit and raceway marker for each conduit or raceway longer than 6 feet.

2. Conduit or Raceway Marker Spacing: 20 feet on center.

3. Raceway Painting: Identify conduit using field painting in accordance with Section 09 90 00.

   a. Paint colored band on] each conduit longer than 6 feet.

   b. Paint bands 20 feet on center.

   c. Color:

      1) Fire Alarm System: Red.

      2) 208V System: Black.

F. Stencil Installation:

1. Apply stencil painting in accordance with Section 09 90 00.

G. Underground Warning Tape Installation:

1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire alarm control panels, manual fire alarm stations, automatic smoke and heat detectors, fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.

B. Related Sections:

1. Section 21 13 13 - Wet-Pipe Sprinkler Systems: Flow detection and alarm devices.

2. Section 23 33 00 - Air Duct Accessories: Smoke dampers.

3. Section 25 50 00 - Integrated Automation Facility Controls.

4. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

5. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

6. Section 28 05 53 - Identification for Electronic Safety and Security.

1.2 REFERENCES

A. National Fire Protection Association:

1. NFPA 72 - National Fire Alarm Code.

2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

1.3 SYSTEM DESCRIPTION

A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to monitoring central station.

B. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:

1. Local fire alarm signaling devices sound and display with march time signal.

2. Non-coded/Zone-coded signal transmits to remote station equipment. central station.

3. Location of alarm zone indicates on fire alarm control panel and on remote annunciator panel.

4. Signal transmits by zone to building smoke removal system.

5. Signal transmits to building mechanical controls, shutting down fans and operating dampers.

6. Signal transmits by zone to release door hold-open devices.

7. Signal releases magnetic door hold opens.

8. Signal releases electric door locks.

C. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.

D. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:

1. Visual and audible trouble alarm indicates by zone at fire alarm control panel.

2. Visual and audible trouble alarm indicates at remote annunciator panel.

3. Trouble signal transmits to remote station.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate annunciator layout, and design calculations.

C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.

D. Test Reports: Indicate procedures and results for specified field testing and inspection.

E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of fire alarm equipment.

C. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Perform Work in accordance with State and Municipality of Palos Verdes standards.

C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.

B. Installer: Certified fire alarm installer with service facilities within 100 miles of Project.

C. Design fire alarm under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.

1.8 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.

B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

1.9 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish ten manual station break-glass rods.

C. Furnish six keys of each type.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish three of each type of automatic smoke detector without base.

PART 2 PRODUCTS

2.1 CONTROL PANEL

A. Manufacturers:

1. Notifier Model 320 and Silent Knight.

2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Modular fire alarm control panel with flush wall-mounted enclosure.

C. Power supply: Adequate to serve control panel modules, remote detectors, remote annunciators, smoke dampers, relays and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.

D. System Supervision: Component or power supply failure places system in trouble mode.

E. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from initiating alarm.

F. Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from signaling alarm.

G. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.

H. Auxiliary Relays: Sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.

2.2 MANUAL FIRE ALARM STATIONS

A. Product Description: Manual single-action station with break-glass rod.

B. Mounting: Semi-Flush.

C. Type: Coded.

D. Backbox: Manufacturer's standard.

2.3 CEILING SMOKE DETECTOR

A. Product Description: NFPA 72,photoelectric type ceiling smoke detector with the following features:

1. Adjustable sensitivity.

2. Plug-in base.

3. Auxiliary relay contact.

4. Integral thermal element rated 135 degrees F.

5. Visual indication of detector actuation.

B. Mounting: 4 inch outlet box.

C. Furnish two-wire detector with common power supply and signal circuits.

2.4 DUCT-MOUNTED SMOKE DETECTOR

A. Product Description: NFPA 72, photoelectric type with the following features:

1. Auxiliary SPDT relay contact.

2. Key-operated normal-reset-test switch.

3. Duct sampling tubes extending width of duct.

4. Visual indication of detector actuation.

5. Duct-mounted housing.

B. Furnish two-wire detector with common power supply and signal circuits.

2.5 ALARM BELLS

A. Product Description: NFPA 72, vibrating, electric bell with the following features:

1. Operating mechanism behind dome.

2. Integral strobe lamp and flasher with red lettered "FIRE" on white lens.

3. Size: 10 inch.

4. Sound Rating: 81 dB at 10 feet.

2.6 ALARM LIGHTS

A. Product Description: NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens.

2.7 ALARM HORN

A. Product Description: NFPA 72, flush projector type fire alarm horn with the following features:

1. Sound Rating: 87 dB at 10 feet.

2. Integral strobe lamp and flasher with red lettered "FIRE" on white lens.

B. Product Description: Exterior mounted horn with the following features:

1. Sound Rating: 15 dB above ambient noise in all areas.

2.8 WIRE AND CABLE

A. Product Description: Non-power limited fire-protective signaling cable, copper conductor, 150 volt insulation rated 60 degrees C. Power limited fire-protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C.

B. Cable Located Exposed in Plenums: Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.

C. Fire alarm circuit conductors have insulation color or code as follows:

1. Power Branch Circuit Conductors: Black, red, white.

2. Initiating Device Circuit: Black, red.

3. Detector Power Supply: Violet, brown.

4. Signal Device Circuit: Blue (positive), white (negative).

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify products and systems receiving devices are ready for installation.

3.2 EXISTING WORK

A. Remove exposed abandoned fire alarm wiring, including abandoned wiring above accessible ceiling finishes. Cut cable flush with walls and floors, and patch surfaces.

B. Disconnect and remove abandoned fire alarm equipment.

C. Maintain access to existing fire alarm equipment and other installations remaining active and requiring access. Modify installation or provide access panel.

D. Extend existing fire alarm installations using materials and methods compatible with existing installations, or as specified.

E. Clean and repair existing fire alarm equipment to remain or to be reinstalled.

3.3 INSTALLATION

A. Install manual station with operating handle 4 feet 6 inches feet above floor.

B. Install audible and visual signal devices 7 feet 6 inches feet above floor.

C. Install 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors in conduit.

D. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.

F. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, and duct smoke detectors.

G. Automatic Detector Installation: Conform to NFPA 72.

H. Install engraved plastic nameplates in accordance with Section 28 05 53.

I. Ground and bond fire alarm equipment and circuits in accordance with Section 26 05 26.

J. All systems installed shall include a copy of the system software and a system device file disk. Contractor will also provide 6 devices of each type.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test in accordance with NFPA 72 and local fire department requirements.

3.5 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturer's field services.

B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.6 DEMONSTRATION AND TRAINING

A. Furnish eight hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes removal of surface debris; removal of paving and curbs; removal of trees, shrubs, and other plant life; removal of underground storage tanks; removal of abandoned utilities; topsoil excavation; and repair of damaged vegetation and/or irrigation systems/system components.

B. Related Sections:

1. Section 01 50 00: Construction Facilities and Temporary Controls
2. Section 02 41 00: Demolition
3. Section 31 22 13: Rough Grading
4. Section 32 80 00: Irrigation

1.2 REGULATORY REQUIREMENTS

A. Perform all work of this Section in strict accordance with applicable Government Codes and Regulations especially meeting all safety standards and requirements of CAL/OSHA, County of Los Angeles and the City of Palos Verdes Estates. Provide additional measures, added materials and devices as may be needed as directed by the District Representative at no added cost to the District.

B. Comply strictly to Rule 1404, South Coast Air Quality Management District.

C. Coordinate clearing Work with utility companies.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials not specifically described but required for completion of the work of this Section, as selected by the Contractor subject to the approval of the District Representative.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified.

B. Identify a waste area for placing removed materials.

3.2 PROTECTION

A. Protect existing structures and site improvements indicated to remain, from damage by approved methods and/or as authorized by the District Representative. Removal of all protections shall be when work of this Section is completed or when so authorized by the District Representative.

B. Protect Existing Utilities indicated or made known to remain traversing the job-site and serving existing adjacent facilities.

C. Protect Existing Trees and Shrubs indicated to remain by providing temporary surrounding fencing so located a sufficient distance away so that trees and shrubs will not be damaged by site-clearing operations.

1. Protection Barrier: A protection barrier shall be installed around the shrubs or trees to be preserved. The barrier shall be constructed of a durable fencing material, such as plastic construction fencing, snow fence, or chain link. The barrier shall be placed at or beyond the drip line. "Drip line" as referred to herein means a line which may be drawn on the ground around the tree directly under its outermost branch tips and which identifies that location where rainwater tends to drip from the tree. Placement of barrier to be approved by District Representative (Grounds Supervisor). If barrier is placed inside the drip line, then 3/4 inch plywood must be placed over the root zone up to the drip line. The fencing shall be maintained in good repair throughout the duration of the project, and shall not be removed, relocated, or encroached upon without permission of the District Representative (Grounds Supervisor).

2. Storage of Materials: There shall be NO storage of materials or supplies of any kind within the area of the protection barriers. Concrete, cement, asphalt materials, block, stone, sand and soil shall not be placed within the drip line of the tree(s).

3. Fuel Storage: Fuel storage shall NOT be permitted within 150 feet of any tree to be preserved. Refueling, servicing and maintenance of equipment and machinery shall NOT be permitted within 150 feet of protected trees.

4. Vehicles/equipment: NO parking or driving of vehicles or storage of equipment shall be permitted within the drip line of any tree to be preserved.

5. Debris and Waste Materials: Debris and waste from construction or other activities shall NOT be permitted within protected areas. Wash down of Concrete, cement or asphalt handling equipment, in particular shall NOT be permitted within 150 feet of protected areas.

6. Grade Changes: Grade changes can be particularly damaging to trees. Any grade changes should be approved by the District Representative (Grounds Supervisor) before construction begins and precautions taken to mitigate potential injuries.

7. Damages: Any damages or injuries to the preserved trees (including pruning or cutting of such trees not in conformity with the International Society of Arboricultural Pruning Guidelines and ANSI A300 Pruning Standards) shall be reported immediately to the District Representative (Grounds Supervisor). Severed roots shall be pruned cleanly to healthy tissue, using proper pruning tools. Broken branches/limbs shall be pruned according to International Society of Arboricultural Pruning Guidelines and ANSI A300 Pruning

Standards. In the event that any damage, injury, improper pruning or cutting of a protected tree is deemed to be so substantial as to require its replacement (such determination to be made in the sole discretion of the District Representative), Contractor shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.

8. Removal of Existing Tree or Shrub: Prior to removing or cutting any trees designated for removal, the contractor shall coordinate with the District's Ground Supervisor. In the event that Contractor, a Subcontractor, Sub-Subcontractor, material supplier or anyone else performing the Work of the Contract willfully, negligently or mistakenly removes any tree or shrub not designated for removal, Contractor shall immediately report such removal to the District Representative (Grounds Supervisor). Contractor shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.

9. Unauthorized Tree Removal or Injury: Criminal Penalties: Reference is made to California Penal Code §384a which provides that any person who willfully or negligently cuts, destroys, mutilates or removes any tree or shrub or portion thereof growing on public land without a written permit from the owner of said public land is guilty of a misdemeanor, subject to a fine of up to $1,000, imprisonment in county jail for up to 6 months, or both. Contractor is advised that, in addition to all remedies provided herein and in the Contract Documents, the District shall cooperate with appropriate authorities in prosecuting and enforcing Penal Code §384a and other criminal sanctions as appropriate concerning trees and shrubs located on District property.

10. Preventive Measures: Before construction begins, fertilization of the affected areas to be applied at a rate to be determined by the District Representative (Grounds Supervisor).

D. Protect bench marks, survey control points, and existing structures from damage or displacement.

E. Protection of Persons and Property (existing structures and site improvements):

1. Provide barricades, warning signs at open depressions and holes on adjacent property and public accesses.

2. Provide operating warning lights during hours from dusk to dawn each day or as otherwise required.

3. Protect existing remaining structures, utilities, sidewalks, pavements other facilities from damage as caused by settlement, undermining, washout or other hazards created by site-clearing operations of this Section.

F. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors and to others performing work on or near the job-site.

G. Maintain access to the job-site at all times.

3.3 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove all rubbish and debris existing and resulting from work operations of this Section as soon as possible, do not allow to pile up. Do not burn rubbish and debris on the job-site.

C. Where active utility lines need to be capped or plugged, perform such work in accordance with requirements of the Utility Company.

3.4 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Excavate and remove associated plumbing piping.

C. Prior to demolition work, the Contractor shall notify the District Representative to identify the existing items for salvage purposes. The materials identified for salvage shall be returned to the District in a timely manner agreed upon by the District Representative.

3.5 REPAIRS

A. During demolition and construction, ensure that trees, shrubs and other plant material and vegetation are protected inside and outside of the work zone and that the vegetation is being watered, maintaining the proper moisture content according to the season. Failed vegetation due to lack of water, and/or plant material destroyed during work are to be replaced to equal or better size and condition.

B. If the irrigation system is damaged or modified during construction, it shall be repaired to the Districts standards, and shall be in equal or better condition than prior to damage or modification. All repairs shall be made so as to ensure proper operation prior to the close of the contract.

C. Controller Wires: If damaged/cut or removed, repair by splicing, soldering and silicone sealing. To ensure proper operation, reconnect the tubes to the valve in the existing station.

D. Hydraulic Tubes: If damaged/cut or removed, repair by replacing the tubing using equal or better material.

E. Valves: If damaged, repair/replace with equal or better material. All valves are to be flushed/cleaned thoroughly.

F. Mainlines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.

G. Lateral Lines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.

H. Irrigation Heads: If damaged, repair/replace with equal or better material. All heads are to be flushed and filters cleaned thoroughly.

I. Controllers: If damaged repair/replace with equal or better material.

J. Backflow Prevention Devices: If damaged, repair/replace with equal or better material.

K. Gate/Ball Valves: If damaged repair/replace with equal or better material.

L. Valve Boxes: If damaged, repair/replace with equal or better material. Concrete boxes and concrete lids with the appropriate markings for identification shall be used. The top of the box shall be buried below finish grade, equal to existing depth or deeper. The top of the valve stems shall be 6" below the underside of the top of the box.

M. Construction in grass areas: Sod shall be removed by sod cutting at a soil depth of 2", stored on site, and watered on a daily basis. Upon completion of work, stored sod shall be reinstalled over the trenched area. An option may be to bypass cutting the sod, however at the completion of the project, installation of new Hybrid Bermuda sod over the finished trenched area shall be required.

3.6 EXCESS MATERIALS DISPOSAL

A. Legally dispose of off-site materials removed and not to be reused. Adjacent areas shall be left clean.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes removal of topsoil and subsoil; and cutting, grading, filling, rough contouring, compacting, and the site for site structures and building pads.

B. Related Sections:

1. Section 32 11 10: Aggregate
2. Section 02 41 00: Demolition
3. Section 31 10 00: Site Clearing
4. Section 31 23 00: Excavation and Fill
5. Section 31 23 23: Backfill
6. Section 31 23 16: Trenching
7. Section 32 91 19: Landscape Grading

1.2 REFERENCES

A. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 inch Drop.

1.3 REGULATORY REQUIREMENTS

A. Perform all work in strict accordance with applicable government Codes and Regulations, especially meeting all safety standards and requirements of CAL/OSHA and the State of California. Provide additional measures, added materials and devices as may be needed as directed by the District Representative at no added cost to the District.

B. Comply strictly to Rule 1404, South Coast Air Quality Management District.

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: Type S2 as specified in Section 32 05 13.

B. Subsoil Fill: Type S1 as specified in Section 32 05 13.

C. Structural Fill: Type A1 as specified in Section 32 11 10.

D. Granular Fill: Type A1 as specified in Section 32 11 10.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01 33 00.

B. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect utilities that remain, from damage.

D. Protect above and below grade utilities that remain.

E. Protect plant life, lawns, and other features remaining as a portion of final landscaping as specified in Section 31 10 00.

F. Protect bench marks, survey control point, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 FIELD QUALITY CONTROL

A. Section 01 45 00: Field inspection and testing.

B. Testing: In accordance with ASTM D1557.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

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SECTION 31 23 16

TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes excavating trenches for utilities from 5 feet outside building to municipal utilities; compacted fill from top of utility bedding to subgrade elevations; and backfilling and compaction.

B. Related Sections:

1. Section 01 45 23: Testing and Inspection
2. Section 01 50 00: Construction Facilities and Temporary Controls
3. Section 03 30 00: Cast-in-Place Concrete
4. Division 26: Electrical - for Raceways and Boxes
5. Section 31 23 00: Excavation and Fill
6. Section 31 23 23: Backfill
7. Section 32 05 13: Soils for Exterior Improvements
8. Section 32 11 10: Aggregate

1.2 REFERENCES

A. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18 inch Drop.

B. Public Contract Code, Section 7104 - Contracts for Digging Trenches or Excavations; Notice on Discovery of Hazardous Waste or Other Unusual Conditions; Investigations; Change Orders; Effect on Contracts.

C. Conform to the requirements of the California Occupational Safety and Health Regulations (CAL/OSHA).

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 FIELD MEASUREMENTS

A. Verify that survey bench mark, control point, and intended elevations for the Work are as shown on drawings.

1.5 WORK COORDINATION

A. The Contractor shall fully coordinate the work operations of this Section with that of other trades involved and with the District Representative.

B. Coordinate the Work in the public right-of-way with the City of Pasadena and coordinate the Work within the site with the California Plumbing Code.

1.6 PROTECTIONS

A. Comply with provisions of DIVISION 1 - GENERAL REQUIREMENTS. Protect and guard all excavations against damage to life, limb and property.

B. Provide and install signs, lights and barricades at danger points on and off the job-site to guard against accidents, etc.

C. Protect against damage resulting from Contractor's operations. Repair or replace damaged items to the full satisfactions of the District Representative at no added cost to the District.

D. Divert or pump out of all excavations until concrete and other items are placed therein, forms removed and backfilling is completed.

1.7 INSPECTION

A. All trenches will be inspected by the District Representative before filling, backfilling and/or other subsequent work is placed therein.

1.8 DISPOSAL OF EXCESS MATERIALS

A. Remove from the job-site all excess excavated and imported materials not used for fill or backfill and all waste and debris.

1.9 COORDINATION

A. Coordinate work under provisions of Section 01 45 00.

B. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Fill Type S2: As specified in Section 32 05 13.

B. Structural Fill Type A1: As specified in Section 32 11 10.

C. Concrete: Structural concrete conforming to Section 03 30 00 with a compressive strength of 3,500 psi.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Maintain and protect above and below grade utilities which are to remain.

E. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill and compact to density equal to or greater than requirements for subsequent backfill material.

F. Trenches, ditches, pits, and similar items which are outside the barricaded working area shall be barricaded to conform to Cal OSHA standards.

G. Trenches over 5'-0" in depth shall conform to the Construction Safety Orders of the California Division of Industrial Safety.

3.2 EXCAVATING

A. Excavate trenches for utilities, pipes, and concrete encased electrical conduits, to required depth, as indicated on Drawings. Grade bottom of trenches to a uniform surface to prevent pockets. Remove all loose soil from the excavation before placing 6" layer of sand bedding, compacted to 90% of the maximum density. Use clean, fine-grained sand of such size that not less than 90 % shall pass through a 1/4" screen and not more than 25 % through a number 50 screen. Sand, meeting the Specifications for fine aggregate for concrete work, may be used. Place pipes, encased conduits and other utilities on a uniformly bearing sand bed.

B. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Keep excavations free of water during installation work. Dispose of water in such a manner as not to endanger public or private property or public health. Remove accumulated water in excavations by pumping, or other approved means. Any contaminated water shall be stockpiled on site per direction by the District Representative. The District shall be responsible for any offsite disposal of contaminated water.

E. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd, measured by volume.

F. Correct areas over excavated in accordance with Section 31 23 00.

G. Where portions of existing structures, walks, paving, etc. must be removed or cut for pipe or conduit installation, replace the material with equal quality, finished to match adjacent work.

H. Stockpile excavated material in area designated on site and remove excess material not being used, from site. Any contaminated soils shall be stockpiled on site per direction of the District Representative. The District shall be responsible for any offsite disposal of contaminated soil.

3.3 BACKFILLING

A. Do not place backfill until the work installed has been inspected, tested and approved by the District Representative. Remove excavated rocky material unsuitable for backfill from the site.

B. Backfill trenches to contours and elevations with unfrozen fill materials.

C. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

D. Trenches for electrical installation outside of the barricaded working area, shall be backfilled within 72 hours after approval of electrical installation by the District Representative.

E. Backfill shall be placed in layers not exceeding 4" in thickness and compacted to 90% of the maximum density.

F. Employ a placement method that does not disturb or damage foundation perimeter drainage and utilities in trench.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Remove surplus fill materials from site.

I. Leave fill material stockpile areas completely free of excess fill materials.

3.4 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Comply with provisions of Section 01 45 00.

B. The District Representative will inspect all subgrades and excavations prior to placing backfill materials.

C. Compaction testing will be performed in accordance with ASTM D1557, method "C".

D. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 76 00.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.7 EXCESS MATERIAL DISPOSAL

A. Remove all excess excavated and imported material not used for fill or backfill and all waste and debris from job-site. Grade site surface to prevent free standing surface water.

END OF SECTION

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SECTION 31 23 23

BACKFILL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building perimeter and site structure backfilling to subgrade elevations; site filling and backfilling; fill under slabs-on-grade and paving; fill under paving fill for over-excavation; and consolidation and compaction as scheduled.

B. Related Sections:

1. Document: Geotechnical report; bore hole locations and findings of subsurface materials.

2. Section 03 30 00: Cast-in-Place Concrete

3. Section 31 23 00: Excavation and Fill

4. Section 31 23 16: Trenching: Backfilling of utility trenches

5. Section 32 11 10: Aggregate

6. Section 32 91 19: Landscape Grading

7. Section 33 10 00: Water Distribution Utilities

8. Section 33 46 13: Foundation Drainage Piping - for filter aggregate and filter fabric

9. Section 33 51 00: Natural Gas Distribution

1.2 REFERENCES

A. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 inch Drop.

1.3 SOILS INFORMATION

A. Information on Drawings does not constitute a guarantee of uniformity of soil conditions over entire construction site.

B. Field conditions may require deviations from information indicated on Drawings, and recommendations made in soils report. Such changes in the work shall be covered by a change order, indicating an increase or decrease in the Contract sum.

1.4 IMPORT AND EXPORT OF EARTH MATERIALS

A. Fees: Pay as required by the City of Palos Verdes Estates.

B. Bonds: Post as required by the City of Palos Verdes Estates.

C. Hauling Routes and Restrictions: Comply with requirements of the City of Palos Verdes Estates.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Fill Type S1: As specified in Section 32 05 13.

B. Structural Fill Type A1: As specified in Section 32 11 10.

C. Concrete: Structural concrete conforming to Section 03 33 00 with a minimum compressive strength as indicated on the Drawings, or if not indicated, a minimum compressive strength of 2,500 psi.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify subdrainage, dampproofing or waterproofing installation has been inspected to include utility boxes.

B. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify and compact subgrade surface to a depth of not less than 6" inch to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 PROTECTION

A. Protect and guard all excavations against danger to life, limb, and property as required by CAL/OSHA.

B. Protect adjacent existing improvements against damage by Contractor's operations. Repair or replace damaged items to full satisfaction of the District at expense of Contractor.

3.4 BACKFILLING

A. Fill or backfill materials shall be placed in horizontal layers of 6". Each layer shall be evenly spread and moistened or aerated as necessary. Unless otherwise approved by the District Representative, each layer of fill material shall cover length and width of area to be filled before next higher layer of material is placed.

B. Employ a placement method that does not disturb or damage other work.

C. Maintain optimum moisture content of backfill materials to attain required compaction density.

D. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise.

E. Remove surplus backfill materials from site.

F. Leave fill material stockpile areas free of excess fill materials.

3.5 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.6 COMPACTING

A. Each layer of fill material shall be compacted by approved tamping or other mechanical means acceptable to the District Representative, to such extent as will produce specified relative compaction. At locations where it would be impractical, because of inaccessibility, to use motorized compacting equipment, fill layers shall be compacted to specified requirements by hand-directed compaction equipment.

B. Unless otherwise specified, each layer of earth fill shall be compacted to a relative compaction of at least 90 percent.

3.7 FIELD QUALITY CONTROL

A. Comply with provisions of Section 01 45 00.

B. Compaction testing will be performed in accordance with ASTM D1557.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. A Soils Engineer, who will be responsible to and will be paid by the District, will inspect and test excavation of existing fills, reworking of natural soils and compaction of all required fills.

E. Place all such backfill under the supervision of the District Representative.

F. The District Representative will inspect all subgrades and excavations prior to placing of fill materials.

G. The District Representative will inspect all foundation excavations when they are completed and ready for forms, and again after forms are in place and prior to first pour of concrete.

3.8 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 45 00.

B. Reshape and re-compact fills subjected to vehicular traffic.

3.9 EXCESS MATERIAL DISPOSAL

A. Remove all excess excavated and imported material not used for fill or backfill and all waste and debris from job-site. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil treatment with termiticide.

B. Related Sections:

1. Section 06 10 00: Rough Carpentry

2. Section 07 60 00: Flashing and Sheet Metal

1.2 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

1.3 SUBMITTALS

A. Product Data: For termiticide.

1. Include the EPA-Registered Label for termiticide products.

B. Product Certificates: For termite control products, signed by product manufacturer.

C. Qualification Data: For Installer of termite control products.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for District's record information, including the following:

1. Date and time of application.

2. Moisture content of soil before application.

3. Brand name and manufacturer of termiticide.

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes, and rates of application used.

6. Areas of application.

7. Water source for application.

E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from a single manufacturer for each product.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Substantial Completion, provide 12 months continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, and terms for agreement period; and terms for future renewal options.

PART 2 PRODUCTS

2.1 SOIL TREATMENT

A. Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

B. Subject to compliance with specified requirements, provide of the following

products:

1. BASF "Termidor."

2. Bayer Corporation "Premise 75."

3. FMC Corporation, Agricultural Products Group "Prevail FT."

4. Syngenta "Demon TC."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 32 05 13

SOILS FOR EXTERIOR IMPROVEMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes subsoil materials and topsoil materials.

B. Related Sections:

1. Document: Geotechnical report; bore hole locations and findings of subsurface materials
2. Section 31 22 13: Rough Grading
3. Section 31 23 16: Trenching
4. Section 31 23 23: Backfill
5. Section 32 11 10: Aggregate
6. Section 32 93 00: Plants
7. Section 32 91 19: Landscape Grading
8. Section 33 46 13: Foundation Drainage Piping

1.2 REFERENCES

A. ASTM D1557 - Test Methods for Moisture-Density Relations

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Samples: Submit, in airtight containers, 10-lb. sample of each type of fill to testing laboratory.

1.4 REGULATORY REQUIREMENTS

A. Coordinate the Work with the California Code of Regulations, Title 24, Part 1; and the California Building Code.

1.5 IMPORT AND EXPORT OF EARTH MATERIALS

A. Fees: Pay as required by the City of Palos Verdes Estates.

B. Bonds: Post as required by the City of Palos Verdes Estates.

C. Hauling Routes and Restrictions: Comply with requirements of the City of Palos Verdes Estates.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Subsoil Type S1:

1. Imported fill.

2. Graded.

3. All imported earth shall be of a regular nature with sufficient binder to form a firm and stable unyielding surged and shall not have more than 60% of fines passing 200-mesh sieve. Material shall have a coefficient of expansion of not more than 2% from air-dry to optimum moisture content and not more than 6% from air-dry to saturation. Imported material shall be clean and free from all rubbish and debris. Adobe or clay soils are not acceptable.

4. Conform to the California Building Code (CBC), Title 24, Parts 1 and 2.

B. Subsoil Type S2:

1. Structural.

2. Graded.

3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris. Conforming to ASTM D2487 Group Symbol CL.

C. Topsoil Type S3:

Topsoil from site is to be excavated and stored on site designated by the District's Representative. Native topsoil to be reused at site.

1. Excavated native soil and reused material from stockpile on site.

2. Graded.

3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.

4. Conforming to ASTM D2487 Group Symbol OH.

2.2 SOURCE QUALITY CONTROL

A. Comply with provisions of Section 01 45 23 for testing and analysis of soil material.

B. Testing and Analysis of Subsoil Material: Perform in accordance with DSA requirements and ASTM D-1557-91.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials from same source throughout the Work.

PART 3 EXECUTION

3.1 SOIL REMOVAL

A. Excavate subsoils from areas designated.

B. Remove soil, boulders, and rock.

C. Stockpile excavated material in area designated by the District Representative on site and remove from site.

3.2 STOCKPILING

A. Stockpile imported fill on site at locations designated by the District Representative.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Direct surfaces water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Remove all excess imported material not used for fill or backfill and all waste and debris from job-site. Grade site surface to prevent freestanding surface water.

END OF SECTION

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SECTION 32 11 10

AGGREGATE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes aggregate materials for fill, drainage, and grading purposes.

B. Related Sections:

1. Document: Geotechnical report; bore hole locations and findings of subsurface materials.

2. Section 31 22 13: Rough Grading

3. Section 31 23 16: Trenching

4. Section 31 23 23: Backfill

5. Section 32 11 23: Aggregate Base Courses

6. Section 33 10 00: Water Distribution Utilities

7. Section 33 30 00: Sanitary Sewer Utilities

8. Section 33 40 00: Storm Drainage Utilities

9. Section 33 46 13: Foundation Drainage Piping - for filter aggregate

10. Section 33 51 00: Natural Gas Distribution

1.2 REFERENCES

A. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12 inch Drop.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Samples: Submit, in air-tight containers, 30 lb. sample of potential import material to Architect at least 96 hours before fill operations. All proposed import materials should be approved by the Geotechnical Consultant and Architect prior to being placed at the site.

1.4 REGULATORY REQUIREMENTS

A. Coordinate the Work with the California Code of Regulations, Title 24, Part 1; and the California Building Code.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Comply with Soil report.

a. Imported materials should contain sufficient fines (binder material) so as to be relatively impermeable and result in a stable subgrade when compacted. The imported materials should also be non-expansive, with an expansion index (EI) less than 30 and free of organic materials, debris, and cobbles larger than 3 inches, with no more than 25 percent of the materials being larger than 2 inches in size and no more than 25% pass #200 sieve.

2.3 SOURCE QUALITY CONTROL

A. Section 01 45 00 - Quality Control: Source testing and analysis of aggregate material.

B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.

C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.

D. If tests indicate materials do not meet specified requirements, change material or material source and retest.

E. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile materials on site at locations designated by the District Representative.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent freestanding surface water.

B. If a borrow area is indicated, leave area in a clean and neat condition. Grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes aggregate base course.

B. Related Sections:

1. Section 31 22 13: Rough Grading - for preparation of site for base course.

2. Section 31 23 16: Trenching - for compacted fill under base course.

3. Section 31 23 23: Backfill - for compacted fill under base course.

4. Section 32 11 10: Aggregate.

5. Section 32 13 13: Concrete Paving - for finish concrete surface course.

6. Section 32 91 19: Landscape Grading - for topsoil fill at areas adjacent to aggregate base course.

1.2 REFERENCES

A. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 inch Drop.

B. Coordinate the Work in the public right-of-way with the City of Palos Verdes Estates.

PART 2 PRODUCTS

2.1 MATERIALS

A. Coarse Aggregate Fill Type A1: As specified in Section 32 11 10.

B. Fine Aggregate (Sand) Fill Type A2: As specified in Section 32 11 10.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Spread, level, moisten, and roll or tamp base material in layers not exceeding 4" in thickness. Use 2 tandem power roller weighing not less than 8 tons. Continue cutting or filling, watering and rolling until the surface is hard and true to grade and cross section; until it is firm and ceases to "creep" in front of roller, and the relative compaction is at least 95%.

B. Grade base course to elevations indicated on Drawings, ready to receive soil treatment and surfacing, in accordance with Section 31 22 13.

3.4 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch, measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation From Design Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Comply with provisions of Section 01 45 00.

B. Compaction testing will be performed in accordance with ASTM D1557.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Hot-mix asphalt paving.

2. Wheel stops.

B. Related Sections:

1. Section 31 20 00: Earthwork, Excavations and Fill

2. Section 32 17 23: Pavement Markings

1.2 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the following standard specifications:

1. Reference Specification: Perform all work in accordance with applicable provisions of "Standard Specifications for Public Works Construction," latest edition. Unless otherwise noted, mention herein of section numbers refers to sections of the Reference Specification. Where Reference Specification refers to "Agency," substitute the word "District." Where Reference Specification refers to "Engineer," substitute the word "Architect." Where Reference Specification is in conflict with these Specifications, these Specifications shall govern.

2. Measurement and payment provisions and safety program submittals included in Reference Specifications do not apply to this Section.

3. The latest edition of the Asphalt Institute's publication "The Asphalt Handbook."

1.3 SUBMITTALS

A. Product Data: For each product specified. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: For each job mix proposed for the Work.

C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.

C. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.

E. Asphalt-Paving Publication: Comply with Asphalt Institute's "The Asphalt Handbook," except where more stringent requirements are indicated.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Section 01 31 19. Review methods and procedures related to asphalt paving including, but not limited to, the following:

1. Review condition of substrate and preparatory work performed by other trades.

2. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

3. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving Installer's personnel, and equipment required to execute the Work without delays.

4. Review inspection and testing requirements, governing regulations, and proposed installation procedures.

5. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.

2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.

4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 PRODUCTS

2.1 ASPHALT PAVEMENT MATERIALS

A. Asphalt Pavement Leveling Course: Conform to Viscosity Grade B-AR-4000 in section 203-1.2 and section 203-6 of the Reference Specification.

B. Asphalt Pavement Wearing (Surface) Course: Conform to Viscosity Grade III C2-AR-4000 in section 203-1.2 and section 400-4 of the Reference Specification.

C. Prime Coat: Grade SC-70 liquid asphalt conforming to section 203-2 of the Reference Specification.

D Tack Coat: Emulsified asphalt grade SS-1h conforming to section 203-3 of the Reference Specification.

E. Asphalt Paint: Conform to ASTM D41 or D43 per section 203-8 of the Reference Specification.

F. Water: Potable.

G. Surface Slurry Seal: Provide one of the following.

Product Name	Manufacturer
Guard-Top	Western Emulsions, Inc.
OverKote® Asphalt Pavement Coating	Reed+Graham, Inc.
Park Top	Western Colloid Products
Ace Seal	Asphalt Coatings Engineering, Inc.

2.2 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.

B. Sand: ASTM D1073, Grade Nos. 2 or 3.

C. Wheel Stops: Pre-cast, air-entrained concrete, 2500-psi minimum compressive strength, approximately 6 inches high, 9 inches wide, and length as shown, reinforced with two No. 3 deformed steel bars. Provide chamfered corners and drainage slots on underside, and provide holes for anchoring to substrate.

1. Dowels: Galvanized steel, diameter 3/4 inch, minimum length 10 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Subgrade and Base:

1. Proof-roll base course using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat when formulated by manufacturer for that purpose.

C. Prime Coat: Comply with section 302-5.3 of the Reference Specification. Apply primer at a rate of between 0.20 and 0.25 gallons per square yard to top surface of base course prior to asphalt placement.

D. Tack Coat: If a leveling course has been used for construction traffic, apply tack coat to all leveling course surfaces in accordance with section 302-5.4 of the Reference Specification at a rate of 0.10 gallons per square yard.

3.3 HOT-MIX ASPHALT PLACING

A. The asphalt pavement shall be completed in phases; the leveling course during construction for temporary construction traffic and storage of materials and; the wearing (surface) course just prior to turnover to District; unless the entire paving operation is completed just prior to turnover to the District. If this method is chosen, then no construction traffic or storage of materials shall be allowed on the finished pavement surface after its completion. Contractor shall schedule final surface course paving operations so that the required waiting period specified in Section 32 17 23 "Pavement Marking" will allow project completion within the specified time.

B. Construct asphalt pavement in accordance with section 302-5 of the Reference Specification and as shown on the Drawings.

C. Two Layer Method: The leveling course shall be installed to elevations which will allow the future placement of a wearing (surface) course no thinner than 1-1/2 inches. Prior to placing the wearing (surface) course, repair all areas damaged during construction use, thoroughly clean the leveling course of all loose material and place a tack coat pursuant to paragraph 3.2.D. herein.

Contractor is further cautioned that the use of this two-layer method will result in construction traffic using pavements which are thinner than designed for the traffic expected for the completed project, and that damage due to wheel loads and materials storage during construction is probable. Any such damage shall be repaired to the satisfaction of the Architect/District/IOR prior to placement of the surface course.

3.4 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat.

2. Offset longitudinal joints in successive courses a minimum of 6 inches.

3. Offset transverse joints in successive courses a minimum of 24 inches.

4. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI's "The Asphalt Handbook."

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and re-rolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D1559, but not less than 94 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

F. Repairs: Remove paved areas that are defective, pond water or are contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt, with a thickness one inch greater than the existing, and to match existing finish surface grades such that no local ponding of water will result. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Leveling Course: Plus or minus 1/2 inch.

2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

3.7 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. Lightly dust areas receiving excess fog seal with a fine sand.

B. Slurry Seals

1. Install seal coat in accordance with manufacturer's written directions and recommendations for new asphalt paving.

2. Install 2 coats of surface seal to new and properly cured asphalt paving. First coat shall be installed before flood testing. Clean surface and allow to dry before installing second coat. Second coat shall be installed after asphalt paving has passed flood test.

3. Where new asphalt paving is installed adjacent to existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing asphalt paving.

3.8 WHEEL STOPS

A. Allow new pavement surfaces to cure for a period of not less than 30 days before installation of wheel stops.

B. Install in the locations shown on the Drawings, and in an even alignment.

C. Install wheel stops over clean and dry surfaces.

D. Securely attach wheel stops into pavement with not less than 2 galvanized steel dowels embedded in precast concrete at one-third points. Firmly bond each dowel to wheel stop and to pavement.

1. Extend upper portion of dowel 5 inches into wheel stop and lower portion a minimum of 5 inches into pavement.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: District will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. Finish Grade: Completed pavement surface shall be tested for proper drainage through flood testing. Contractor shall schedule a flood test to be held in the presence of the Architect/District/IOR to assure that the finished pavement surfaces are consistent with the intent of the Grading Plans with respect to surface drainage, and that drainage devices function properly. It is suggested that a water truck or fire hose be used for the flooding; garden hoses shall not be acceptable. Pavements not deemed acceptable subsequent to this test shall be removed and replaced pursuant to paragraph 3.3 herein. Overlays with thicknesses less than 1-1/2 inches will not be acceptable for these repairs.

F. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D979.

1. Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D1559, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726.

   a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.

   b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes concrete sidewalks, stair steps, integral curbs, gutters, median barriers, parking areas, and roads; and aggregate base course.

B. Related Sections:

1. Section 03 30 00: Cast-in-Place Concrete

2. Section 07 92 00: Joint Sealants

3. Section 31 20 00: Earthwork, Excavations and Fill

4. Section 32 17 23: Pavement Marking

1.2 SYSTEM DESCRIPTION

A. Provide concrete pavement according to the materials, workmanship, and other applicable requirements of the following standard specifications:

1. Reference Specification: Perform all work in accordance with applicable provisions of "Standard Specifications for Public Works Construction," latest edition. Unless otherwise noted, mention herein of section numbers refers to sections of the Reference Specification. Where Reference Specification refers to "Agency," substitute the word "District." Where Reference Specification refers to "Engineer," substitute the word "Architect." Where Reference Specification is in conflict with these Specifications, these Specifications shall govern.

2. Measurement and payment provisions and safety program submittals included in Reference Specifications do not apply to this Section.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Section 01 33 00.

B. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."

2. ACI 318, "Building Code Requirements for Reinforced Concrete."

3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform materials evaluation tests and to design concrete mixes.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Coloring Agent: Color Hardener should be installed when the surface and ambient temperatures are above 40°F and below 120°F. Do not install during inclement weather, when precipitation is occurring or expected within 24 hours.

1.6 STORAGE AND HANDLING

A. Comply with requirements of Section 01 66 00.

B. Coloring Agent: Store Color Hardener out of direct sunlight at temperatures between 40°F and 100°F. Promptly clean tools and equipment with water and mild detergent. Dried material can be removed with mineral spirits. Always wear proper safety equipment, including particle mask, eye protection and gloves when mixing and/or applying these products.

PART 2 PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves of a 100-foot or less radius.

B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Debond Form Coating, L & M Construction Chemicals.

b. Crete-Lease 880 VOC, Cresset Chemical Company.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars and Tie Bars: ASTM A615, Grade 40 for #3 bars and Grade 60 for

bars larger than #3, deformed.

B. Plain, Cold-Drawn Steel Wire: ASTM A82.

C. Joint Dowel Bars: Plain steel bars, ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs.

D. Dowel Sleeves: Speed Dowel, Aztec Concrete Accessories, Inc.

E. Hook Bolts: ASTM A307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

F. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.

1. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type II, low alkali.

1. Use one brand of cement throughout Project. Coordinate with Section 03 30 00.

B. Normal-Weight Aggregates: ASTM C33, Class 4M non-reactive, and as follows. Provide aggregates from a single source.

1. Maximum Aggregate Size: 1-inch.

2. Do not use fine or coarse aggregates that contain substances that cause spalling.

3. Local aggregates not complying with ASTM C33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

C. Water: Potable.

D. Admixtures: Comply with requirements specified in Section 03 30 00.

1. Integral Colored Concrete: Use admixtures only as approved by the color pigment manufacturer. Do not use admixtures that will alter the color of integral colored concrete.

2. Do not use admixtures containing calcium chloride or chloride ions.

E. Concrete to receive coloring agent shall not contain fly ash.

2.4 CURING MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9

oz. per sq. yd., complying with AASHTO M 182, Class 2.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C171.

1. Waterproof paper.

2. Polyethylene film.

3. White burlap-polyethylene sheet.

C. Liquid Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B. Moisture loss not more than 0.55 kg./sq. meter in 72 hours when applied at a rate of 200 sq. ft./gal.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

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

a. L & M Cure R, L & M Construction Chemicals, Inc.

b. 1100-Clear, W.R. Meadows, Inc.

3. Do not use sodium silicate type curing agents.

D. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

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

a. Eucobar; Euclid Chemical Co.

b. E-Con; L&M Construction Chemicals, Inc.

c. Confilm; Master Builders, Inc.

2.5 RELATED MATERIALS

A. Bonding Agent: Acrylic or styrene butadiene, complying with ASTM C1059, Type 2.

B. Epoxy Adhesive: ASTM C881, two-component material suitable for dry or damp surfaces. Provide material type, grade, and class to suit requirements.

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

1. Bonding Agent:

a. SBR Latex; Euclid Chemical Co.

b. Daraweld C; W.R. Grace & Co.

c. Everbond; L&M Construction Chemicals, Inc.

d. Acryl-Set; Master Builders Inc.

2. Epoxy Adhesive:

a. Burke Epoxy M.V., The Burke Co.

b. Concresive Standard Liquid; Master Builders, Inc.

c. Rezi-Weld 1000; W.R. Meadows, Inc.

D. Coloring Agent:

1. Mer-Ko Colored Hardener: Dry-shake material compound mixture of pigment, select aggregates, portland cement and proprietary ingredients.

a. Color: As selected by Architect from manufacturer's full standard range of 20 colors minimum.

E. Concrete Sealer: Water-based, deep penetrating, non-staining, non-darkening silane micro emulsion.

1. Positive chloride-ion screening, prevents water intrusion, minimizes rebar corrosion and potential concrete spalling, and protects against damaging effects of alkalis and other contaminants.

2. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

3. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Pentane WB, L & M Construction Chemicals, Inc. This product is intended to establish the characteristics and level of quality intended for this Project.

2.6 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

1. Do not use the District's field quality-control testing agency as the independent testing agency.

B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:

1. Compressive Strength (28-Day): 3,000 psi.

2. Minimum cement content: shall be 5-1/4 sacks per cubic yard.

3. Maximum concrete slump: shall be 3 inches, plus or minus 1/2 inch, for all walks; and 4 inches, plus or minus 1 inch for all other Portland cement

concrete paving.

4. Water/Cement Ratio: shall be less than or equal to 0.5.

C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

D. Admixtures: Comply with requirements specified in Section 03 30 00.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C94.

1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.8 HERBICIDE TREATMENT

A. Commercial chemical for weed control, registered by Environmental Protection Agency. Provide granular, liquid, or wettable powder form.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

a. Ciba-Geigy Corp.

b. Dow Chemical U.S.A.

c. E.I. Du Pont de Nemours & Co., Inc.

2.9 ACCESSORIES

A. Tread Safety Nosing at Concrete Stair Treads: Single component abrasive stair nosing, Type BF211D as manufactured by American Safety Tread Co., Inc., or equal. Color as selected by Architect from manufacturer's full standard range, to provide visual contrast with tread.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Proof-roll subgrade or base surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

C. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions. Apply to compacted, dry subbase prior to application of prime coat.

D. Coloring Agent Substrate Preparation: The substrate surface must be clean, dry and free of dust and any other contaminants at the time of material application.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in 10 feet.

2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.

1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

2. Make joints, including sawed joints, full depth required and from edge to edge of paving.

B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.

2. Inserts: Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.

1. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.

2. Provide tie bars at sides of paving strips where indicated.

3. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

D. Isolation Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet, unless indicated otherwise.

2. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.

3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

E. Installation of joint fillers and sealants is specified in Section 07 92 00.

F. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.

G. Where spacing is not shown, locate expansion joints at 10-foot maximum spacing.

H. Where plastic "zip strips" are used to construct concrete joints, cut and remove, as a minimum, the top 1/4 inch of these strips after concrete has cured, and coordinate installation of joint filler, if shown on the Drawings, as specified in Section 07 92 00.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit

installation of their work.

B. Do not place concrete on surfaces that are frozen.

C. Moisten subgrade or base to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place. Do not break or interrupt successive pours such that cold joints occur.

F. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

H. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

I. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

J. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

K. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

1. Medium-Textured Broom Finish on surfaces up to 6% slope, CBC Section 1133B.7.1: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform texture finish, equivalent in slip-resistance to that of a medium salted finish.

2. Heavy-Textured Broom Finish on surfaces equal to or greater than 6% slope, CBC Section 1133B.7.1: Provide a slip-resistant heavy broom finish by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3. Do not use troweling machines within 12 inches of electrical junction and outlet boxes which are set to finish flush with concrete slabs. Float and trowel such areas by hand with wood floats and steel trowels, taking care to see that concrete is finished flush with box cover and matches adjacent surfaces.

B. Coloring Agent: Broadcast a heavy layer of Mer-Ko Color Hardener across the entire freshly poured concrete surface thoroughly covering the surface. Completely float the Color Hardener into the top layer of wet concrete and then broadcast an additional lighter-uniform layer of Color Hardener over the entire surface.

C. Finishing formed surfaces:

1. Curb forms shall leave a smooth face.

2. Remove all fins.

D. Provide steel trowel finish on tops of curbs and flow lines of curbs, gutters and integral curb and gutters.

E. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

1. Radius: 1/4 inch.

F. Finish surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.

G. Where concrete finishing occurs adjacent to finished metal or other surfaces, particularly where serrated or indented surfaces occur, remove all traces of cement film before allowing to harden.

H. Apply integral wood float and broom finish to the all concrete pavements and walkways, unless otherwise shown on the Drawings.

1. After screeding and compacting, finish with a wood float using a circular motion to produce a uniform texture and finish throughout.

2. For vehicular traffic areas, the finish shall be coarse enough to provide a non-slip surface with a minimum static friction coefficient of 0.6.

3. For pedestrian traffic areas, finish shall be a non-slip surface with a minimum static coefficient of friction of 0.6.

a. For ramps, the static coefficient of friction shall be a minimum of 0.8. Ramps are defined as any sloping path of travel with a slope in the direction of travel of 5.0%, or greater.

4. Tests for coefficient of friction shall be either ASTM C1028 (field test) or ASTM D2047 (laboratory test).

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure integral colored concrete by curing compound as approved by the manufacturer of the color pigments used in the concrete mix. Cure other concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:

a. Water.

b. Continuous water-fog spray.

c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

E. Spray-apply concrete sealer to all concrete pavement. Comply with sealer manufacturer's application instructions.

3.8 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

B. Maximum Variation From True Position: 1/4 inch.

3.9 FIELD QUALITY CONTROL TESTING

A. The District will employ a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include the following:

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.

a. Slump: ASTM C143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.

b. Air Content: ASTM C231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.

c. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.

d. Compression Test Specimens: ASTM C31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

e. Compressive-Strength Tests: ASTM C39; one set for each day's pour

of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.

4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

B. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

C. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

D. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

E. Manufacturer's Field Service: When placing integral colored concrete, arrange for the services of a qualified technical representative of the color pigment manufacturer, equipped with wet-batch color control test devices to ensure concrete of uniform color and matching approved mock-up.

3.9 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section. Concrete which is not true to line and plane; which is not thoroughly troweled and properly surfaced as required; which varies in excess of 1/4-inch along a 10-foot straight edge; which is scuffed or has a rough top surface, except where required; which contains sawdust shavings, wood or embedded debris; which does not connect properly to adjoining work; which does not slope as required for drainage; or which is not properly cured; will be deemed defective.

1. General: Patch defective areas immediately following form removal. Remove defective concrete to a width and depth necessary for proper patching, but in no case less than 1 inch deep. Make the walls of the cut area perpendicular to the surface and do not feather out the edge. Dampen the patch area and the adjacent area 6 inches around the patch area.

2. Exposed concrete: Prepare a patching mortar of one part Portland cement, adjusted to match the color of the surrounding concrete, and 2-1/2 parts sand with the least water required to produce a workable mass. Re-work this mortar until it is the stiffest consistency that will permit placing. Brush the patch area with a bond of neat cement and water paste and apply patching mortar when the water sheen is off the bond. Strike off the mortar slightly higher than the surrounding surface, let set for 1 hour and finish flush with the surrounding surface.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Parking stripes, pavement and curb markings, and accessibility symbols, as indicated.

B. Related Sections:

1. Section 32 12 16: Asphalt Paving

2. Section 32 13 13: Concrete Paving

1.2 REFERENCES

1. 2010 ADA Standards for Accessible Design.

2. 2010 California Building Code (CBC), Part 2.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00:

1. Manufacturer's product data for all materials to be furnished.

2. Submit manufacturer's standard color samples for each type of paint specified. Once colors have been selected, submit 3 samples of each color selected for each type of paint, on standard 8-1/2" x 11" spray-out panel.

3. Shop drawing layout of all painted striping, signage and symbols required under this Section, including complete parking lot, indicating stalls, lettering, safety zones, directional arrows, fire lane signage and widths of lines and colors.

1.4 REGULATORY REQUIREMENTS

A. Conform to the more restrictive provisions of ADA Standards for Accessible Design or the 2010 California Building Code, Part 2.

B. Pavement markings shall conform to AQMD 1113 and current VOC limits.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 76 00: Environmental conditions affecting products on site.

B. Do not apply pavement markings to surfaces below 40°F or above 95°F unless recommended by the manufacturer.

C. Do not apply pavement markings when rain is predicted within 48 hours or less than 5 days after surface has been wet.

D. Do not apply pavement markings in high or gusty winds.

PART 2 PRODUCTS

2.1 MATERIALS

A. Paint: Water emulsion-based:

1. Dunn-Edwards Corp., "Vin-L-Stripe® Traffic Marking Paint."

2. Frazee Paint, "506 Traffic Paint."

3. Substitutions: Under provisions of Section 01 25 00.

B. Tactile warning devices shall be in conformance with CBC Section 1133B.8.5.

PART 3 EXECUTION

3.1 PAVEMENT MARKINGS

A. Application of Paint:

1. Prior to application of paint, allow the pavement to properly cure. Clean and prepare in accordance with paint manufacturer's written recommendations.

2. Provide mechanical equipment to install paint in a uniform, straight or curved pattern, without holidays and other defects.

3. Do not permit traffic until paint has completely cured.

4. Install 2 coats in thickness recommended by manufacturer.

B. Marking Width and Color: Unless indicated otherwise, marking width and color are as follows:

		Width	Color
1.	Parking stall lines	4 inches	White
2.	Traffic markings	4 inches	Yellow
3.	Striping:		
	a. General	4 inches	Yellow
	b. Disabled	4 inches	Blue
4.	Accessibility emblem	2 inches	White on blue background

5. Letters and Numbers - 2 or 2½ inches White

6. "NO PARKING" curbs Red

7. "LOADING ZONE" curbs Yellow

8. Where 2 different sets of lines overlap, one shall be white and the other yellow.

9. Except as specified or otherwise indicated, use white paint.

10. Painted lines and markings on pavement shall be 3" minimum wide. When blue color is used, it shall be equal to Color No. 15090 per Federal Standard 595B.

11. Parking spaces for the disabled shall be marked according to CBC Sections 1129B.3 and 1129B.4.

3.2 PROTECTION

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

B. Do not permit pedestrian or vehicular traffic over pavement for 2 days minimum after finishing.

3.3 CLEANUP

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

END OF SECTION

SECTION 32 17 26

TACTILE WARNING SURFACING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tactile Warning Surfacing (Truncated Domes).

B. Related Sections:

1. Section 32 12 16: Asphalt Paving

2. Section 32 13 13: Concrete Paving

2. Section 31 17 23: Pavement Markings

1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 00:

1. Manufacturer's literature describing products, installation and maintenance.

2. Submit samples of the tile type proposed for use.

3. Shop drawings are required for products showing fabrication details, tile placement, installation materials and procedure.

4. Material test reports from qualified independent testing laboratory, current within a 24 month period, indicating that materials proposed for use are in compliance with requirements and meet the properties indicated.

5. Maintenance instructions for each type of tile and accessory as required..

1.3 PROJECT CONDITIONS

A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive Tactile Warning Surfacings for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.

B. The use of water for cleaning and dust control shall be contained, not to come into contact with the general public.

1.4 QUALITY ASSURANCE

A. Provide Tactile Warning Surfacings and accessories as produced by a single manufacturer with a minimum of three (3) years experience manufacturing tactile warning surfacings.

B. Engage an experienced Installer certified in writing by manufacturer as qualified for installation.

C. Tactile Warning Surfacings shall comply with the Americans with Disabilities Act.

D. Tactile Warning Surfacings shall comply with the California Building Code (CBC) Title 24, Part 2.

1.5 GUARANTY

A. Tactile Warning Surfacings shall be guaranteed in writing for a period of five years from date of final completion. The guarantee includes defective work, breakage, deformation, and loosening of tiles.

PART 2 PRODUCTS

2.1 MATERIALS

A. Truncated Domes Tactile Warning Surfacing

1. Manufacturer: Specification is based on products manufactured by Engineered Plastics, Inc. Contact: (800) 682-2525.

2. Product/System: Specification is based on "Armor Tile" vitrified polymer composite tactile strip, 36 inches wide.

a. Nominal Face Thickness: 0.1875 +/-5% max.

b. Warpage of Edge: 0.5% max.

c. Water Absorption - ASTM D 570-98 less than 0.05%.

d. Slip Resistance - ASTM C 1028-96 greater than 0.80.

e. Compressive Strength - ASTM D 695-02a greater than 28,000 psi.

f. Tensile Strength - ASTM D 638-03 greater than 19,000 psi.

g. Flexural Strength - ASTM D 790-03 greater than 25,000 psi.

h. Chemical Stain Resistance - ASTM D 543-95 no discoloration or staining.

i. Abrasive Wear - ASTM D 2486-00 less than 0.060 after 1000 cycles.

j. Wear Resistance - ASTM C 501-84 greater than 500.

k. Fire Resistance - ASTM E 84-05 flame spread less than 15.

l. Impact Resistance - ASTM D 5420-04 greater than 550 in. lbf/in.

m. Accelerated Weathering - ASTM G 155-05a for 3000 hrs. $\Delta E < 4.5$ tile color 33538, no fading or chalking.

n. Freeze Thaw - ASTM D 1037-99 no cracking, delamination, or other

defects.

o. Salt Spray - ASTM B 117-03 for 200 hours no deterioration.

p. AASHTO HB-17 single wheel HS20-44 loading no failure @10,400lbs.

3. Color: Federal Standard Color "Yellow" - 33538. Color shall be homogeneous throughout the product.

4. Adhesive: "Armor Bond" adhesive by Engineered Plastics, Inc., or as recommended by manufacturer.

5. Anchors: Color-matched, flat head drive anchors ¼" diameter x 1.5" long, "Armor Drive" anchors by Engineered Plastics, Inc., or as recommended by manufacturer.

6. Perimeter Sealant: "Armor-Seal" by Engineered Plastics, Inc., or as recommended by manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Cast In Place: Pour and float concrete, set tile by tamping down into concrete until all air voids are removed, edge around the perimeter, cut off protective plastic sheet.

3.2 CLEANING AND PROTECTING

A. Protect tiles against damage during construction period to comply with manufacturer's specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tiles by method specified by manufacturer not more than four days prior to date scheduled for inspection.

END OF SECTION

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SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain link fences and gates as indicated.

B. Related Sections:

1. Section 32 12 16: Asphalt Paving

2. Section 32 13 13: Concrete Paving

1.2 REFERENCES

A. ASTM A123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM F567 - Installation of Chain-Link Fence.

D. ASTM F669 - Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.

E. ASTM F1083 - Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

F. Chain Link Fence Manufacturers Institute (CLFMI) - Product Manual.

1.3 SUBMITTALS

A. Shop Drawings:

1. Submit plans and details indicating extent of fences, locations of gates, and details of attachment and footings. Indicate means and methods for surface preparation and finishing.

1.4 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, current edition.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete: Class 500-C-2500 concrete furnished as prescribed in Section 201-1 "Concrete, Mortar and Related Materials" of the Standard Specifications for Public Works Construction or may be provided in the following volumetric proportions:

Portland Cement	1 part
Fine Aggregate	2 parts
Coarse Aggregate (1/4 inch to 1-1/2 inches)	4 parts
Water	7-1/2 gallons, maximum per sack of cement

B. Chain Link Fence Fabric: Conforming to ASTM A392, Class C2 zinc coating, 2.00 ounces minimum per square foot of uncoated wire surface, hot-dipped galvanized after weaving, and top and bottom edges knuckled.

1. Fabric for perimeter fencing and interior fencing shall be 9 gauge woven wire with 2 inch mesh, unless otherwise specified.

2. For perimeter fences 16 feet high, the upper 8 feet of fabric may be 11 gauge.

3. Fences 12 feet high or less shall be furnished with single width fabric.

4. Installed fence fabric shall be free from barbs, icicles, or other projections and installed fence fabric with such defects will be deemed defective Work.

C. Posts, Top Rails, Brace Rails and Gate Frames: Standard weight, galvanized, welded or seamless steel pipe conforming to ASTM A53, with a minimum yield strength of 35,000 psi. Embed posts into footing 6 inches less than the depth of the footing unless noted otherwise on drawings.

D. Schedule of Posts and Footings:

Item	Height	Nominal Pipe Size (inches)	Outside Diameter (inches)	Weight (pounds per foot)	Footings*	
					Diameter(inches)	Depth (inches)
Top Rail, Brace Rails and Transom Rails	Up to 10'-0"	1-1/4	1.660	2.27	N/A	N/A
	10'-1" to 16'-0"	1-1/2	1.900	2.72	N/A	N/A
Line Posts	Up to 6'-0"	2	2.375	2.65	12	24
	6'-1" to 8'-0"	2	2.375	2.65	12	36
	8'-1" to 10'-0"	2-1/2	2.875	5.79	12	36
	10'-1" to 16'-0"	3	3.5	7.58	14	60
Terminal, Corner, Angle & Pull Posts	Up to 8'-0"	2-1/2	2.875	5.79	12	36
	8'-0" to 10'-0"	2-1/2	2.875	5.79	14	42
	10'-1" to 16'-0"	3	3.5	7.58	14	60
Pedestrian Gate Posts	Up to 8'-0"	2-1/2	2.875	5.79	14	36
Gate Frames	Up to 8'-0"	1-1/2	1.900	2.72	N/A	N/A
Driveway Double-Leaf Swing Gate Posts: Opening						
Up to17'-3-1/2"	Up to 8'-0"	3 1/2	4	9.11	16	42
17'-4" to 20'-3-1/2"	Up to 8'-0"	3-1/2	4	9.11	16	42

E. Post Caps: Malleable iron, ASTM A47, Grade 32510, designed to fit snugly over posts with a minimum projection of 1-1/2 inches below top of posts. Post caps shall be manufactured with a curved top.

F. Eye Tops: Malleable iron, ASTM A47, Grade 32510, designed to fit over line posts, and for through passage of top rail.

G. Expansion Sleeve Couplings for Top Rails: Steel, 6 inches long, designed to fit tightly on inside of rail, fitted with raised center.

H. Rail Ends for Top Rails and Brace Rails: Malleable iron, ASTM A47, Grade 32510, with holes to receive 3/8 inch bolts for securing to rail end bands.

I. Tension Bands and Bands for Securing Rail Ends: Mild steel flats, at least 11 gage x one inch, tension bands in gates shall be 11 gage x 1 inch. Bolts for use with tension bands and rail end bands shall be 3/8 inch x 1-1/2 inches.

J. Tension Bars: Mild steel flats at least 3/16 inch x 3/4 inch.

K. Tension Wire for Installation at Bottom of Fabric: 6 gauge steel spring wire, conforming to requirements of AISI Steel Products Manual, Carbon Steel Wire, Section 16, merchant quality, galvanized, soft temper with Type I coating. Wavy type wire is not acceptable.

L. Turnbuckles for installation with Tension Wires: Eye and hook type, drop forged steel, right and left hand threads, at least 3/8 inch screw diameter with at least 4-1/2 inches of take-up.

M. Tie Wire: Aluminum ties 6 gauge for fastening fabric to posts, top rails and brace rails. At bottom tension wire 9 gauge galvanized hog rings shall be installed.

N. Finish of Metal Parts: Post caps, couplings, rail ends, tension bands, tension bars, turnbuckles, rivets, bolts, and other metal parts and fittings shall be hot-dipped galvanized after fabrication, except bolts, which may be galvanized or cadmium-plated. Galvanizing shall conform to ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, and ASTM A47 Standard Specification for Ferritic Malleable Iron Castings.

O. Swinging Gate Hardware:

1. Gate Hinges: Brookfield I-8508 - 5 x 6, 602 finish.

2. Exit Device: Von Duprin CD99EO x 996L, 652 finish.

3. Rim Cylinder: Von Duprin 99NL-OP, 652 finish.

4. Armor Collar: Keedex K-24, 652 finish

5. Kick Plate: As indicated in the drawings. The bottom 10 inches of gates, measured vertically, shall have smooth surface both sides.

6. Balance of hardware by Gate Manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fences to heights indicated on Drawings.

B. Space fence posts at equal intervals between terminal, angle, corner, and gate posts, and not more than 10 feet apart measured from center to center of posts. In curved fence sections having a radius of 50 feet or less, space posts not more than 5 feet - 6 inches apart. Install posts so that top of eye of post caps are level with top of fabric.

C. Install angle or corner posts at each change in direction of 15 degrees or more, at change of 5 percent or more in grade of fencing, and at the beginning and end of curved fence sections.

D. Install terminal posts at ends of runs of fencing. Install gateposts on both sides of driveway and pedestrian gates. For double-leaf gates, net opening between gate posts shall be gate size as indicated on Drawings, plus 3-1/2 inches; for single leaf gates, net opening shall be gate size plus 2-1/2 inches.

E. Where a fence is to be installed on a curb, construct footings with top of footing level with the lower finish grade. Align posts, set plumb and true before placing footings. Remove splattered concrete from exposed pipe surfaces while concrete is still soft. In bituminous surfaced areas, install seal coat on top of concrete footings.

F. Install fences with top rail. Top rail shall pass through eye tops and be secured at ends with rail-end fittings and bands.

G. Install fences over 10 feet in height, in addition to top rail, with a full length horizontal mid-rail set at mid-height of fence and rigidly secured to posts with rail end fittings and bands.

H. In fences higher than 10 feet, install brace rails at angles, corners, and terminals at 1/4 and 3/4 of fence height. Provide one horizontal brace rail in panels adjacent to terminal, angle, corner, and gateposts, install at mid-height of fence and rigidly secured to posts with rail end fittings and bands. Provide horizontal brace rails, as specified, in panels of curved sections having a radius of 50 feet or less. Brace rails are not required in fencing 4 feet or less in height.

I. Provide a transom rail and fabric at top of pedestrian gate openings. Install transom rail 6 feet - 8 inches above high point of grade at gate opening. Ends of transom rails shall be pinned or riveted to rail end fittings with 1/4 inch mild steel rivets. Pin or rivet must go through rail and peen. Welding on rail ends is not permitted.

J. Install bottom tension wire a minimum of 3 inches from grade for fencing, and provide a turnbuckle for each 150 feet of wire or fractional part thereof. Turnbuckles are not required in runs of 15 feet or less. Install ends of tension wires to posts in a manner to prevent slipping or loss of tension. Wrap should start from fence side of post. Turn end of wire around post tightly twisted at least 3 times around wire. At turnbuckles, wire through eye and tightly twist end at least 3 times around wire. Cut tail of bottom wire flush.

K. Install fence fabric on outward facing side of posts. Install fence fabric with top edge projecting above top rail of fence.

L. Install bottom of fence fabric to clear finish grades, except on bituminous surface install 3/4 inch above such surface. Locally shape and trench ground surfaces where

necessary to provide uniform top and bottom alignment of fence.

M. Tightly stretch fabric and at terminal, pull corner, angle, and gateposts, secure with tension bars extending full height of fence. Secure tension bars to posts with bolted tension bands spaced not more than 14 inches apart.

N. Bands and Ties: Install bands and ties in accordance with following schedule:

15 bands on 16 feet fence	16 ties on 16 feet fence
11 bands on 12 feet fence	12 ties on 12 feet fence
7 bands on 8 feet fence	7 ties on 8 feet fence
6 bands on 6 feet fence	6 ties on 6 feet fence
4 bands on 4 feet fence	4 ties on 4 feet fence

O. Fasten fabric to line posts with wire ties spaced not more than 16 inches apart. Where 6 gauge aluminum ties are furnished, hook the tie at both ends. Installation of hooked ties with links is not permitted.

P. Fasten fabric to top rails, mid-rails, brace rails, with wire ties spaced not more than 18 inches apart. Bend back ends of tie wires so as not to be a hazard. At bottom tension wire, install hog rings spaced not more than 18 inches apart. Where 2 fabrics are furnished, lap the fabrics one mesh at mid-rail and tie both fabrics with 9 gauge wire or 6 gauge aluminum ties to midrails.

Q. Grind all field welds smooth, clean off flux and spatter, damaged galvanizing removed, burrs and projections ground off, properly prepared, then heavily coated with "Rust Bullet" as manufactured by Poliflex USA or equal product approved by District's Office of Environmental Health and Safety. Install coating in accordance with written recommendations of manufacturer.

R. Fabrication of Gates:

1. Frames: Fabricate gate frames from steel pipe of size specified, with joints at corners miter cut and continuously welded to sides.

2. Fabric: Install fence fabric to side members with tension bars and tension bands as specified, spaced not more than 14 inches apart. Tension bars shall extend full height of gate. Install fence fabric to top and bottom members and to brace rail with wire ties as specified for top rails, spaced not more than 12 inches apart.

3. Latches: Gate latches and strikes will be furnished by the District. Weld gate latches and strikes to gate posts and frames. Welding shall be performed before gate frames are galvanized, or welds shall be finished as specified for field welds.

4. Hinges: Install and adjust hinges; burr or center punch threads of gate hinge bolts to prevent removal of nuts. Install 3 hinges on each post for swing gates more than 16 feet wide.

5. Grind welds flush and smooth. Hot-dip galvanize fabricated parts after welding, or finish weld as specified for field welds.

3.5 INSTALLATION OF GATES

A. Provide gates of the sizes indicated on Drawings. Allow clearance on gates of 1-1/2 inches at bottom and one inch at top. Construct gates installed in sloping areas to conform to the grade. Provide an opening in each gate for access to locking device or padlock. Knuckle ends of fabric cut for opening to eliminate hazards.

B. Sliding Gates and Swing Barricade Gates: Fabricate and install as indicated on Drawings. Wheel housing must be designed to fit tightly to roll track and prevent gate from rolling over objects. Unsupported cantilever type roll gates are not acceptable. Install gate stops in accordance with the drawings. Both top and track stops are required.

3.6 COMPLETION

A. Completed fencing shall form continuous units between points indicated with required parts, accessories, and fittings provided and installed. Clean exposed metal surfaces of cement, grout and other foreign substances.

B. Fill in holes left by removal of existing fence footings, except in areas where grading Work is indicated or specified, to existing grade with clean earth thoroughly compacted to at least same density as adjoining soil.

3.7 PROTECTION

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

3.8 CLEANUP

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

END OF SECTION

SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes supply and installation of ornamental fences and gates as indicated on the Drawings and as specified.

B. Related Sections:

1. Section 32 13 00: Site Concrete.

2. Section 05 50 00: Metal Fabrications.

3. Section 09 90 00: Painting.

1.2 REFERENCE STANDARDS

A. Standard Specifications for Public Works Construction, current edition.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Submittals shall include manufacturer's product data, and shop drawings.

1.4 REGULATORY REQUIREMENTS

A. Pedestrian gates on an accessible route shall meet all applicable requirements for doors and shall comply with CBC 1133B.1.1.1.4.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete: Class 500-6-2500 concrete prepared as prescribed in Section 201-1 "Concrete, Mortar and Related Materials" of the Standard Specifications for Public Works Construction or at Contractor's option, may be mixed in the following volumetric proportions:

Portland Cement	1 Part
Fine Aggregate	2 Parts
Coarse Aggregate (¼" to 1½")	4 Parts
Water	7½ Gallons, maximum per sack of cement

B. Steel: Comply with requirements of Section 05 50 00.

C. Fences: Height and layout as indicated on the Drawings.

D. Pedestrian Gates:

1. As indicated on the Drawings.

2. Hinges and Hardware: Provide heavy-duty hinges and hardware suitable for gate size, weight and operation.

3. Cane Bolts: Provide cane bolt on each leaf.

4. Locking: Padlock provided by Owner; provide overlapping lock plates on meeting stiles.

5. The bottom 10" of gates shall have a smooth, uninterrupted surface.

E. Provide drainage holes in hollow sections, as required to drain water.

G. Close ends of hollow members.

2.2 FABRICATION

A. Comply with requirements of Section 05 50 00.

B. Field Measurements: Where units are indicated to fit other construction, check actual dimensions of other construction prior to fabrication; record dimensions on shop drawings.

C. Factory assemble. Disassemble if necessary for shipping and handling but minimize need for field splicing or assembly. Clearly mark units for reassembly. Design field connections to maintain the required structural capacity.

D. Prevent galvanic action and other forms of corrosion by separating dissimilar metals and by coating surfaces to be in contact with cementitious materials.

E. Provide finished assemblies that are free from surface blemishes on surfaces exposed to view when installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

A. Coordinate location of anchorage items to be embedded in other work.

B. Clean surfaces thoroughly prior to installation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in manner adequate to achieve required structural capacity.

C. Set assemblies accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

D. Set posts plumb within a tolerance of 1/4 inch in 12 feet.

E. Adjust gates for smooth free operation without binding or scraping.

3.4 PROTECTION AND CLEANING

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products after Substantial Completion so that no evidence remains of correction work.

END OF SECTION

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SECTION 32 80 00

IRRIGATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes

1. Trenching, pipe and fittings, valves, sprinkler heads, and control system.

2. Computer generated joint restraint charts for a job specifying joint restraints with gasketed pipe.

B. Related Sections:

1. Section 01 41 00: Regulatory Requirements

3. Section 01 25 00: Substitution Procedures

3. Section 01 33 00: Submittal Procedures

4. Section 01 77 19: Closeout Requirements

1.2 REFERENCES

A. ASTM B88 - Seamless Copper Water Tube.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. California Electrical Code

D. NEC (National Electric Code)

E. IAPMO (International Association of Plumbing and Mechanical Officials)

1.3 SYSTEM DESCRIPTION

A. Electric solenoid controlled underground irrigation system.

B. Source Power: 120 volt, 3 phase.

C. Low Voltage Controls: 24 volt.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide component, control system and wiring diagrams, and warranties.

C. Samples: Provide one sprinkler head of each type, with housing. Accepted samples may not be used in the Work.

D. Material List: Complete list of all materials to be used on the job before starting job.

1.5 PROJECT RECORD DOCUMENTS

A. Conform to the requirements of Section 01 78 39.

B. Record actual locations of all installed irrigation components, whether concealed or above ground, including piping and system conduit. Turn over "As Builts" to Grounds Supervisor.

1.6 OPERATION AND MAINTENANCE DATA

A. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.

B. Provide irrigation schedule indicating length of run time for each valve, following District direction for length of time scheduled for each valve.

C. Controller Charts:

1. The District Representative must approve record drawings before controller charts are prepared.

2. Provide one control chart for each control installed and one control chart to the ground supervisor.

3. The chart shall show the area controlled by the automatic control.

4. The chart shall be based on a record drawing, reduced to the maximum size that will fit inside controller housing (printed on two sides if required for readability).

5. The chart shall be a black-line print with different colors to indicate areas of coverage for each station, using pastel or transparent colors.

6. When completed and approved, hermetically seal and laminate the chart between two pieces of plastic (thickness of each piece being minimum 20 mils).

7. These charts must be completed and approved prior to final acceptance of the irrigation system.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum 10 years documented experience.

1.8 REGULATORY REQUIREMENTS

A. Perform Work in accordance with the State of California Plumbing Code.

B. Products listed by UL or other agency acceptable to authority having jurisdiction; National Electric Code.

1.9 PRE-CONSTRUCTION CONFERENCE

A. Shall be convened one week prior to the commencement of the Work.

1.10 FIELD MEASUREMENTS

A. Verify all field measurements and easement as indicated on drawings and prepare shop drawings per Section 01 33 00. Notify the District Representative (Grounds Supervisor) immediately of any discrepancies.

1.11 EXTRA MATERIALS

A. Furnish the following extra components:

1. Two sprinkler heads of each type and size specified and installed.

2. Two valve handles for the specified ball valves.

3. Two keys for valve markers.

4. One 1 inch quick coupler key for each quick coupler furnished under this contract.

5. Two adjustment screw drivers for each head type.

6. One remote hand-held Pro-Max radio transmitter and receiver, Model # PROMAX-UA for the new or existing Rain Master Evolution DX 2 control.

7. Two Christy, #LFG 160, 0-160 PSI liquid filled pressure gauges.

1.12 WARRANTY

A. Sprinkler irrigation system warranty shall be according to the following form and in addition to the form found in Section 01 78 36. The general and supplementary conditions of these specifications shall be filed with the District or its representative prior to acceptance of the irrigation system.

B. Manufacturer warranties do not relieve the Contractor of his liability under the warranty. Such warranties only supplement the warranty.

C. Include a copy of the warranty form in the Operations and Maintenance Manual.

D. The following warranty form shall be typed on Contractor's letterhead and shall be submitted in addition to the form found in Section 01 78 36:

WARRANTY FOR IRRIGATION SYSTEM

We hereby warranty that the irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear, unusual

abuse or neglect excepted. We agree to repair or replace any defects in material or workmanship which may develop during or prior of ~~FIVE [5] YEARS~~ from the date of acceptance and also to repair or replace any damage resulting from the repairing or replacing of such defects, at no additional cost to the District. We will perform such repairs or replacements within three days after receipt of written notice. In the event of our failure to perform such repairs or replacement within a reasonable time after receipt of written notice from District, we authorize the District to proceed to complete said repairs or replacements at our expense and we will pay the costs and charges therefore upon demand.

PROJECT:

CONTRACTOR:

ADDRESS:

PHONE NO.:

BY:

DATE OF ACCEPTANCE:

BY:

1.13 TEMPORARY REPAIRS

A. The District reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the District will not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

~~PART 2~~ ~~PRODUCTS~~

2.1 PIPE MATERIALS

A. Manufacturers:

1. Spears Manufacturing (PVC fittings).
2. Harco 80 Series (ductile iron fittings).
3. Harco (ductile iron joint restraints)
4. Pacific Plastics (plastic pipe).
5. PW Eagle (plastic pipe).
6. I.P.S. weld on (solvent weld cement & primer).

B. General Piping: ASTM D2411, schedule 40, solvent welded sockets. Pressure supply line from point of connection to backflow prevention unit as required by Code. Pressure supply line downstream of backflow prevention units: (3/4" through 2") SCH

40 Solvent Weld PVC Pipe (2 ½" through 3") class 315 solvent weld PVC and/or (2 ½" through 6") Class 200 Gasketed PVC Pipe. Non-pressure lines: (3/4" through 2") SCH 40 PVC; (2 ½" – 4") Class 200 PVC.

C. Plastic Pipe Fittings (solvent weld type): Manufactured from virgin polyvinyl chloride compound. Fittings: Standard weight, Schedule 40, injection molded PVC for (3/4" through 2"). Fittings: Standard weight, Schedule 80, injection molded for (2 ½" through 3").

D. Ductile Iron Gasket Fitting: Grade 65-45-12 in accordance with ASTM F-477. The fittings shall be HARCO DEEP BELL as manufactured by the Harrington Corporation of Lynchburg, VA. (2 ½" through 4").

E. PVC Gasketed Coupling: Class 200, SDR 21, ASTM-D-1784. The fittings shall be HARCO as manufactured by the Harrington Corporation of Lynchburg, VA. Note: Only PVC Gasketed Couplings shall be permitted. All other Gasketed Fittings shall be Ductile Iron.

F. Copper Tubing: ASTM B88 Type K. Fittings: Type and style of connection to match pipe. Fittings: Wrought copper, solder joint type.

G. Brass Pipe: Seamless, 85% red brass, iron pipe sized, threaded. Fittings: medium brass 250 psi, screwed, A.S.A. B 16.17 and F S WW-P-460.

H. Joint Cement: I.P.S. Weld-ON.

I. Joint Primer: I.P.S. Weld-ON

J. Main line pipe thread sealant:

1. Plastic to metal fittings: Teflon tape (overlapping wrap on male threads) or 100 % virgin Teflon pipe dope (coat male and female parts).

2. Metal to metal fittings: Permatex 51 D (apply a thick coat to male and female parts).

2.2 OUTLETS

A. Manufacturers:

1. The District standard is Rain Bird, except for artificial turf. The standard for artificial turf is Underhill. No deviations or substitutions are permitted.

a. Sprinklers located on the perimeter of artificial turf areas: pop up Underhill Mirage 125 Series.

b. Sprinklers located in large turf areas: Falcon 6504 Series; pop up Rain Bird Falcon.

c. Sprinklers located in medium turf areas: pop up Rain Bird 5004 Plus Series.

d. Sprinklers located in small turf areas: pop up Rain Bird 1804 Series.

e. Sprinklers located in small shrub areas: 12" pop up Rain Bird 1812 Series.

f. Sprinklers located in medium/large sloped areas: 12" pop up Rain Bird 5012 Series.

2.3 FLOW SENSING WIRING

A. The flow sensor wire shall be a two conductor of ICEA class B, 16 AWG 7 strand, conforming to ASTM B-3 and B-8, aluminum shield with drain wire, and shall have a jacket of 0.50 sunlight and moisture resistant PVC as manufactured by Paige Electric, Inc. (product #P7162D).

B. Flow sensor wire may be extended to a maximum distance of 2,000 feet from the location of the assembly to which it is connected. Wire shall be installed in a 1 1/4" PVC Schedule 40 pipe.

2.4 CONTROL

A. Manufacturers:

1. Rain Master Evolution DX 2. Reference irrigation plan, detail, and legend for station quantity and appropriate model number, including communication board, flow sensing board and Master valve board.

B. Low voltage connections between controller and remote control valves shall be made with direct burial AWG UF copper wire, manufactured by Paige. Reference irrigation plan, detail, and legend for size and appropriate model number for gauge size.

2.5 CONDUCTORS

A. Communication Path

1. Two-Conductors

a. The two conductor communication wire for the irrigation interconnect as required from the Cluster Control Unit(s) (CCU) to the satellite unit(s) shall be a double-jacketed, two conductor cable with conductors tin coated, soft annealed, solid copper with 3/32" thick PVC insulation. The two insulated conductors shall be laid in parallel and encased in polyethylene having minimum wall thickness of 0.45". The two conductors shall be color-coded with one conductor red and the other black. Wire shall be manufactured by Paige Electric, Inc. (product # 7072 - Maxi-cable).

b. The flow sensor wire shall be a two conductor of ICEA class B, 16 AWG 7 strand, conforming to ASTM B-3 and B-8, aluminum shield with drain wire, and shall have a jacket of 0.50 sunlight and moisture resistant PVC as manufactured by Paige Electric, Inc. (product #P7162D).

c. Flow sensor wire may be extended to a maximum distance of 2,000 feet from the location of the assembly to which it is connected. Wire shall be installed in a 1" PVC Schedule 40 pipe.

d. All conductors shall be the same type and shall be of the sizes shown on the drawings as required for proper operation of the systems

2.6 AUTOMATIC CONTROL VALVES

A. Manufacturers:

1. 1" - 2", Rain Bird Sprinkler Manufacturing Corp, Model GB only.

2. 3", Bermad Ltd., 400 series, normally closed 3 way solenoid without diode only.

B. All automatic control valves (electric) shall be globe, electrically controlled, hydraulically operated, single seat, normally closed, brass or cast iron only with spring loaded, packless diaphragm.

C. The automatic control valves shall be actuated by a normally closed solenoid valve operator using 24 volts, 60-cycle alternating current without diode. The wires in the coil of the solenoid shall be embedded in an epoxy resin. The entire solenoid shall be enclosed in a watertight housing. Valves shall automatically close in event of electrical power failure.

D. All automatic control valves shall have a flow control device for manually adjusting the amount of flow of water through the valve (except for Bermad 3 way solenoid valves and pressure reducing valves). The flow control device shall be adjusted so that the pressure at the nozzle of the sprinkler head farthest from the automatic control valve shall be that as specified in the irrigation legend per plan. The pressure at the sprinkler head shall be measured by means of a pito tube pressure gauge while the sprinkler head is operating.

E. Automatic control valves shall be as specified on the plans. Reference irrigation plan, detail, and legend for size and appropriate model number.

F. Valve Box and Cover: Rectangular concrete boxes with concrete covers of type and sizes for all valves indicated on drawings. All boxes are to be buried 8 inches below grade as measured to the top of box/lid.

G. Master Valve & Flow Sensor: Bermad 900 Series Normally Open master valve with "built in" flow meter. Reference irrigation plan, detail, and legend for size and appropriate model number.

2.7 ELECTRICAL (LINE VOLTAGE)

A. All line voltage electrical services required for automatic control and other irrigation system equipment noted on drawing shall be provided under this contract.

B. All connections between electrical services and equipment shall be in rigid galvanized electrical conduit or schedule forty rigid grey electrical PVC conduit (18" minimum cover for PVC conduit), with conduit and wiring sizes as required and specified in the NEC.

2.8 ELECTRICAL (LOW VOLTAGE)

A. All control wire shall be of the Underwriter's Laboratory type UF (underground feeder), single conductor, solid copper, plastic insulated, 600 volt rated, for direct burial applications. Maximum conductor operating temperature, 60 degrees C. for both wet and dry locations. Wire composition is as follows:

1. Conductor - The conductors shall be solid annealed uncoated copper meeting the applicable requirements of the latest revisions of A.S.T.M. B-3.

2. Insulation - The insulation shall be colored plastic which meets the test requirements of I.P.C.E.A. (The Insulated Power Cable Engineer's Association) Pub. No. S-61-402, dated July 1961, Section 3.7 for 60 degrees C. polyvinyl chloride insulation. The insulation shall be flame retardant, resistant to fungus, degree of inherent protections against mechanical abuse.

2.9 BACKFLOW PREVENTER

A. Backflow Prevention Device: Designed to operate on a reduced pressure principle, Febco "880V" for 3" and greater. Febco 825 YA for 2" or less in size.

1. Contractor is responsible to register and provide testing, by a licensed backflow prevention device tester, on any newly installed Backflow Prevention Device, with the local water utility and with the Los Angeles County Cross Connection Department, including a copy of the certified test report to be turned over to the District, at no additional cost to the District.

B. Pressure Regulator: Wilkins 500 YSBR or Wilkins model 70 only.

2.10 AIR & VACUUM RELEASE VALVE

A. Bermad Cast Iron "double purpose" air and vacuum release valve # ARC-02-01.

2.11 STRAINER ASSEMBLY

A. Y strainer: Strainer assembly shall be 125-pound class cast brass with 20 mesh monel screen, unless otherwise noted on drawing. Wilkins/Watts, reference irrigation plan, detail, and legend for size and appropriate model number.

2.12 QUICK COUPLER VALVES

A. Unless otherwise indicated on the plans, all quick coupling valves shall be one inch in size, self-closing, two-piece body, with vandal proof (lockable) top. Valves shall be constructed of bronze, brass and /or stainless steel. Riser opening thread shall be one inch female IPS. Rain Bird 44 LRC shall be furnished as the District approved Manufacturer and Model #.

2.13 VALVE BOXES

A. Required for each remote control valve and stubbed ends of control wires. The valve box shall be Christy rectangular concrete boxes with concrete lids, and identified with letters "RCV" stenciled two inches (2") high on the outside of the lid.

B. Quick coupling valve boxes shall be Christy's rectangular concrete boxes with concrete lids. The lid shall be branded with the letters "QCV," two inches (2") high.

C. Ball valve boxes shall be Christy's Concrete with concrete lid (rectangular). The lid shall be identified with the letters "BV", two inches (2") high stenciled on the outside of the lid.

D. No deviations from this manufacturer shall be permitted.

2.14 COPPER PIPE AND FITTINGS

A. Pipe: Type K, hard tempered.

B. Fittings: Wrought copper, solder joint type.

C. Joints shall be soldered with silver solder, 45% silver, 15% copper, 16% zinc, 24% cadmium, solidus at 1125 Degrees F. and liquid us \ at 1145 Degrees F.

2.15 BRASS PIPE AND FITTINGS

A. Brass pipe shall be 85% red brass, American National Standard Institute (ANSI). Schedule 40 screwed pipe, made in the USA.

B. Fitting shall be medium brass, screwed 125-pound class, made in the USA.

2.16 DUCTILE IRON FITTINGS

A. Threaded ductile iron fittings: Harco ASTM A536, Grade 65-45-12, the words ductile iron shall be cast on the inside of the nipples.

B. Flanged ductile iron fittings: Class 125 AWWA approved.

C. Gasketed ductile iron fittings: Harco series 80.

D. Joint Restraints: Harco Ductile Iron AWWA approved.

E. Artificial Turf Lateral Lines: Harco Ductile Iron "3-way Swing Joint" [(part # 879-15-15B) with male BSPT outlet].

2.17 BALL VALVES

A. 1"- 3", Matco-Norco, 758 full port, FIPT x FIPT, forged brass, Chromed Plated Ball, Teflon Seat, Two Piece Body, Ball Valve, 600 PSI non-shock WOG, 150 PSI SWP. Threaded Ends Comply with ANSI B2.1. Valves shall be installed with the handle on the side, parallel with the ground when in the open position. The handle shall be perpendicular to the ground, pointing upward when in the closed position.

2.18 SWING JOINTS

A. Mainline Quick Coupler: Harco Ductile Iron "3 Way Swing Joint" (# 879-15-10) Swing Joint Assembly kit – parts and order of assembly:

1. 1 ½" D.I "Knuckle" Joint Restraint

2. 1 ½" x 1 ½" D.I. Gasket x Female Swivel Coupling

3. 1 ½" x 1 ½" Gasket x Male Swivel EL

4. 1 ½" D.I "knuckle" joint restraint

5. 1 ½" SCH 40 Bevel x Bevel Nipple

6. 1 ½" "Knuckle" Joint Restrain

7. 1 ½" D.I. Gasket x Male Swivel EL

8. 1 ½" x 1" Female Swivel x MIPT EL

9. Quick Coupler

10. 1" D.I. Anchor (Harco part # 82201)

B. Lateral Line: "3-way Swing Joint" – parts, and order of assembly:

1. Lateral line fitting with FIPT outlet

2. Marlex Street ELL

3. MTBE Schedule 80 Nipple

4. Marlex Street ELL

5. PVC SCH 40 Street ELL

C. Artificial Turf Lateral Lines: "3-way Swing Joint" – parts, and order of assembly:

1. 1 ½" D.I "Knuckle" Joint Restraint

2. 1 ½" x 1 ½" D.I. Gasket x Female Swivel Coupling

3. 1 ½" x 1 ½" Gasket x Male Swivel EL

4. 1 ½" D.I "knuckle" joint restraint

5. 1 ½" SCH 40 Bevel x Bevel Nipple

6. 1 ½" "Knuckle" Joint Restraint

7. 1 ½" D.I. Gasket x Male Swivel EL

8. 1 ½" x 1 ½" Female Swivel x MBSTP EL

9. Rotor Head (Underhill M-125-P)

2.19 PUMP STATIONS

A. Manufacturer: Fountain Supply, Santa Clarita, CA.

1. Skid mount with stainless steel or marine grade aluminum enclosure.

2. Variable Frequency drive with programmable "soft start" and pressure tank for low flows and pressure surge control.

3. Programmable supply pressure for each valve station and pump bypass for valve stations that do not require pressure boost over the city water pressure.

4. Copper, Brass, or Stainless Steel plumbing for all piping on the Pump Station.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions prior to the start of the work.

B. Verify location of existing utilities prior to the start of the work.

C. Verify that required utilities are available, in proper location, and ready for use.

3.2 PREPARATION

A. Piping layout indicated is diagrammatic only. Route piping to avoid trees, plants, ground cover, and structures.

B. Layout and stake locations of system components.

1. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.3 TRENCHING

A. Trenching and backfill in accordance with Part 3.5 & 3.13 and this section.

B. Trench Size:

1. Minimum Width:

a. (3/4" through 2" pipe) six inches (6")

b. (2½" & 3" pipe) eight inches (8")

c. (4" & 6" pipe) sixteen inches (18")

C. Main Line Pipe Cover:

1. (¾" through 2") eighteen inches (18') from finish grade to top of pipe.

2. (2 ½" & 3") twenty four inches (24") from finish grade to top of pipe.

3. (4" & 6") thirty inches (30") from finish grade to top of pipe.

D. Lateral Line Pipe Cover:

1. 12" Minimum cover from finish grade to top of pipe for spray heads.

2. 15" Minimum cover from finish grade to top of pipe for turf rotors.

3. 18" Minimum cover from finish grade to top of pipe for artificial turf "gun" rotors.

E. Trench to accommodate grade changes and slope to drains.

F. Maintain trenches free of debris, material, or obstructions that may damage pipe.

G. Compact to 90% in landscaped areas and 95% under paved areas.

3.4 INSTALLATION

A. All piping or equipment show diagrammatically on drawing outside of planting areas shall be installed inside planting areas whenever possible.

B. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions and as indicated.

C. Line Clearances: Provide not less than 4" clearance between each line and not less than 6" clearance between lines of other trades. Do not install parallel lines directly over any other line.

D. Set the top of remote control boxes 8" minimum below finish grade; Sprinkler heads - located approximately as indicated on Drawings.

E. Provide for thermal movement of components in system.

F. Use threaded nipples for risers to each outlet.

G. Provide 24-inch expansion coil at each valve to which controls are connected, and 20-inch expansion coil at changes in direction. Bury wire beside main line pipe (except where noted on plan). Use a continuous wire between controller and remote control valves. "Loop" common wire on systems which have looped main. Each controller shall be provided with separate ground wire. Mark valves with neoprene valve markers.

H. Unless otherwise indicated, locate quick coupling valves within 12" of hardscape.

I. Valve Boxes: Provide at all locations indicated. Fill area under minimum of 3 cubic feet of 1 to 4 Corona crushed rock before box is installed. Identification – number each remote control valve box in 2" high characters (letters and numbers).

J. Verify with the District Representative the exact future location of the irrigation controller.

K. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

3.5 TRENCHING AND BACKFILL

A. Trenching and backfill in accordance with Part 3.03, 3.13 and this section

1. Minimum trench width shall be:

   a. ¾" – 2" pipe - six inches (6")

   b. 2 ½" – 3" pipe - eight inches (8")

   c. 4" – 6" pipe - eighteen inches (18")

2. Minimum trench bedding below bottom of pipe shall be three inches (3").

3. Minimum cover shall be based on finished grades, unless otherwise noted on Drawings.

B. Main Line Pipe Cover:

1. (¾" through 2") eighteen inches (18') from finish grade to top of pipe.

2. (2 ½" & 3") twenty four inches (24") from finish grade to top of pipe.

3. (4" & 6") thirty inches (30") from finish grade to top of pipe.

4. Pipe and Wire Sleeves minimum cover below traffic areas shall be twenty-four inches (24").

C. Lateral Line Pipe Cover:

1. 12" Minimum cover from finish grade to top of pipe for spray heads.

2. 15" Minimum cover from finish grade to top of pipe for turf rotors.

3. 18" Minimum cover from finish grade to top of pipe for artificial turf "gun" rotors.

4. Pipe and Wire Sleeves minimum cover below traffic areas shall be twenty-four inches (24").

D. Backfill

1. All plastic pipe in landscape areas shall be bedded and encased with approved, clean, fine, granular backfill material free of rocks and clods as indicated in the following table and /or shown on the plans. Plastic pipe in vehicular traffic areas (driveways, parking lots etc.) shall be bedded and encased with plaster sand. Protruding rocks from the trench bottom shall be removed.

2. The balance of backfill material from the top of the protective layer above the pipe to grade shall be

Thickness Under Pipe Minimum	Thickness Above Pipe Minimum	Thickness at Side of Pipe Minimum

Three inches (3")	Six inches (6")	Three inches (3")

3. Provide not less than four inches (4") clearance between each line and not less than six inches (6") clearance between pipe/conduit of other trades, unless otherwise noted.

4. Do not install parallel lines directly over any other line.

5. The balance of backfill material from the top of the protective layer above the pipe to grade shall be approved material with particles no larger than three quarters of one inch (3/4") in size. Unsuitable material, including clods and rocks over three quarters of one inch (3/4") in size, shall be removed from the premises and disposed of legally at no cost to the District.

6. Backfill material shall be sufficiently compacted under and on each side of the pipe to provide support free of voids. Pipe joints shall remain exposed until the completion of pressure and leakage test, unless authorized by the District Representative (Grounds Supervisor). The remainder of the backfill material shall contain no lumps or rocks larger than three quarters of one inch (3/4") nor contain rubbish and debris.

7. Backfill shall be tamped to the dry density of adjacent soil. Backfill with areas of structurally compacted soils shall be returned to the original relative density as before trenching.

3.6 INSTALLATION OF PIPE

A. Unless otherwise specified, the construction of lateral lines and main lines shall include excavation and backfill, the furnishing, installing and testing of pipe, tube, and fittings, the furnishing and installing of anchors, thrust blocks, and wire, the improvements, line flushing and testing, and all work in accordance with the plans and specifications.

B. Polyvinyl chloride pipe shall be installed in such a manner so as to provide for expansion and contraction as recommended by the manufacturer.

C. All polyvinyl chloride pipe, shall lay free in the trench with no induced strain. Where there is evidence of induced pipe strain, the Contractor shall be required to make pipe cuts and install angle fittings as necessary to eliminate the strain.

D. When a connection is plastic to metal, a Schedule 80 (machine cut threads) TOE (thread one end) nipple shall be used. The nipple shall be hand tightened, one to two turns beyond finger tight with a strap wrench. Joint compound shall be IPS weld-on Teflon pipe joint compound or approved equal. (No female PVC threaded fittings on the main line.)

E. The Contractor will be required to remove and replace any fitting which induces a torque strain to the pipe.

F. Polyvinyl chloride pipe shall be cut with PVC pipe cutter, hand saw or hack saw with the assistance of a miter box or in a manner so as to ensure square ends. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained. I.P.S. weld on, deburring tool # DEB-2 is recommended for fast pipe deburring.

G. All plastic to plastic joints shall be solvent-weld joints. Only the IPS WELD-ON solvent & primer shall be used.

H. The solvent-weld joints shall be made in the following manner:

1. Thoroughly clean the mating pipe and fitting with a clean dry cloth.

2. Try the parts for fit. The parts should "dry-mate" between one-third (1/3) and two-third (2/3) the depth of the socket. If adequate insertion is not obtained, or bottoming occurs, try another part until a satisfactory "dry-fit" is obtained.

3. The glue should be fresh and drip freely from the applicator.

4. First apply primer to the pipe end and fitting socket to make joining surfaces soft and semi-fluid.

5. After primer, cement must be applied to fill the gap between pipe and fitting.

6. Assembly of pipe and fittings must be made while the surfaces are still wet and fluid. (Note: it may be necessary to "double coat" male end of pipe with light coat of cement, when working in hot weather with larger diameter pipe, before inserting pipe end into fitting socket.)

7. Give the pipe or fitting a quarter turn to ensure even distribution of the solvents and make sure that the pipe is inserted to the full depth of the fitting socket.

8. Hold in position for at least thirty (30) seconds.

9. Wipe off excess solvent that appears at the outer shoulder of the fitting.

10. Note: All solvent-weld operations should be executed without delay between each procedure. The primer should be "wet" on the pipe when the glue is applied. Tape the primer can to the glue can for fast and accurate work.

I. Pressure supply steel pipe and fittings: Apply Permatex 51 D to male and female threads.

J. Assemble Gasketed PVC pipe in the following manner:

1. Clean the gasket area. Remove sand, dirt, grease, and debris. Do not remove the gasket from the bells – removal could cause improper reinstallation.

2. Check the gasket. Make sure the gasket is seated uniformly in the groove by running your finger around the inner edge of the gasket.

3. Clean the spigot. Use rag to wipe the spigot clean.

4. Lower the pipe into the trench. Lower carefully to avoid getting dirt into the bell or spigot.

5. Lubricate. Apply lubricant to the bevel end of the spigot, approximately mid-way to the stop line. A thin layer of lubricant must be applied to the face of the gasket; but, be careful not to get lubricant behind or under the gasket. WARNING: use only lubricants approved by the pipe manufacturer. The use of

lubricants not approved by the manufacturer may cause deterioration of pipe or gasket.

6. Keep lubricated areas clean. If dirt or sand adhere to the lubricated areas, clean and re-lubricate.

7. Assemble pipe. Insert the spigot end into the pipe until it contacts the gasket uniformly. Straight alignment is essential for ease of assembly. Apply steady pressure by hand or by mechanical means (bar & block, come-along, hydraulic jack) until the spigot slips through the gasket. Insert pipe until the stop line is flush with the bell end. WARNING: Do not use a backhoe, trencher or tractor for assembly – the action of this kind of power equipment can damage bells or dislodge gaskets from raceways.

8. If undue resistance to pipe insertion is encountered or if the pipe can not be inserted to the reference mark, dissemble the joint and check the position of the gasket.

   a. If the gasket has been dislodged from the race, inspect the pipe and gasket for damage, replace damaged items, clean the components, and repeat the assembly steps, assuring **straight** alignment.

9. Cut the pipe square. The pipe can be cut with a handsaw or power saw. To insure a square cut, use a miter box. Bevel the end of the pipe with a plastic pipe beveller tool to form a three quarter inch long 15 degree factory bevel.

K. Thrust Block for mainline gasketted directional fittings.

1. Size as per drawing.

L. Thrust Block for Air and Vacuum Relief Valve.

1. Size as per drawing.

M. Joint Restraints.

1. All joint restraints shall be installed in complete accord with Harco Manufacturing Company's instructions.

2. The linear distance of restrained gasketed pipe on the plan supersedes the joint restraint charts in the Specification Addendum.

3.7 INSTALLATION OF PIPE UNDER EXISTING PAVING

A. Piping under existing pavements may be installed by jacking, boring or by hydraulic driving, except as otherwise specified or directed. When placing piping for sleeves use SDR 35 PVC pipe.

B. All pipes under pavement surface to be installed a minimum 24 inches below A.C.

C. Secure Owner's permission prior to cutting or breaking existing pavements.

D. Make completely clean cuts using power saws at approved locations only.

E. Replace and restore all surfaces to original condition, including grade, landscaping, track surfacing and A. C. paving.

1. Restoration work shall match the original work in every respect, including type, strength, texture and finish.

2. Consult with District for approved methods of patching and/or replacing any damaged track sections as a result form boring, saw cutting or removal.

3.8 INSTALLATION OF CONTROL WIRE

A. Refer to demolition plan for note and reference to existing wire location.

B. Unless otherwise specified, the installation of control wire shall include excavation and backfill, the furnishing, installing and testing of the wires, the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications.

C. Unless otherwise specified all neutral (common ground) wire shall be AWG #12 and all pilot (valve control) wire shall be AWG #14.

3.9 INSTALLATION OF VALVES

A. General: Unless otherwise specified, the installation of the valves shall include excavation and backfill, the furnishing, installing and testing of fittings and valves, the furnishing and installing of valve boxes appurtenances, accessories, the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications.

1. Fill area under valve box with a minimum of three (3) cubic feet 1 to 4 Corona crushed rock before box is installed.

B. Shut-off Ball Valves: Shut-off valves installed underground shall be housed in a suitable valve box, consisting of a concrete valve box and a concrete lid.

C. Quick Coupling Valves: Unless otherwise indicated, locate valves within twelve inches (12") of hardscape. Install in designated valve box.

D. Automatic Control Valves: Automatic control valves shall be set upright and housed in designated valve box, with a concrete top.

3.10 INSTALLATION OF AUTOMATIC CONTROLS

A. Unless otherwise specified, the installation of automatic controllers shall include the test of controllers and connection, and all other work as called for on the plans and/or in the specifications.

3.11 INSTALLATION OF SPRINKLER HEADS

A. Unless otherwise specified, the installation of sprinkler heads shall include excavation and backfill, the furnishing, installing and testing of risers, fittings and heads. The removal and/or restoration of existing improvements and all other work shall be in accordance with the plans and specifications.

B. Flushing: All water lines shall be thoroughly flushed out before heads are installed.

C. Location and arc of heads shall be adjusted, if required to eliminate any dry spots, over water or spillage on adjacent areas.

D. All lawn sprinkler heads to be installed adjacent to existing walks, curbs, or other paved areas, shall be set to the grade of the existing improvements. Sprinkler heads, which are to be installed in areas where the turf has not yet been established, shall be set two inches (2") above the proposed finished grade. The Contractor prior to final acceptance shall lower heads installed in this manner. In established lawn areas the sprinkler heads shall be set to existing grade.

3.12 FIELD QUALITY CONTROL

A. Inspections by District Representative:

1. Material inspection: Inspection at the job site of all materials to be used on the job. The contractor shall store the materials at the job site in a locked container. Note: no work shall start until all the materials to be used on the job are approved by the district representative. NOTE: The District shall not be responsible for the theft or damage of any tools or materials left on site.

2. Irrigation main line and drinking fountain line open trench inspection. Note: the contractor at his discretion may partially back fill the trenches before inspection. All pipe joints must be exposed for inspection.

3. Irrigation main line open trench equipment inspection: remote control valves, quick couplers, air valves etc.

4. Lateral line open trench inspection. Note: the contractor, at his discretion, may partially backfill the trenches before inspection and approval. The pipe joints, swing joints, spray and rotor heads must be exposed for inspection.

5. Coverage test.

6. Final inspection and approval.

7. After each inspection, no work shall start on the next phase until the work to date has been approved in writing and all corrections are completed by the contractor.

B. Pressure Test: Prior to complete backfilling, test all pressure lines for leakage.

1. Test all pressure lines under hydrostatic pressure of 150 pounds per square inch or 50 pounds more than normal static pressure (whichever is greater), and prove watertight for two hours.

a. **Note:** If any of the threaded metal pipe joints assembled with Permatex 51 D pipe joint compound are leaking and causing the system to fail the pressure test, re-test the system for twenty four hours under the required test pressure before disassembling the leaking fittings. Permatex 51 D has self sealing properties under pressure and time.

2. The District Representative may require (at his/her discretion) the pressure testing of the main line prior to installation of electric control valves, quick couplers, saddles or any other equipment that might prevent a proper test from being performed.

3. Test all piping under paved areas under hydrostatic pressure of 150 pounds per square inch for two hours, and prove watertight prior to paving.

4. Sustain pressure in lines for no less than 2 hours. If leaks develop (more than 5 percent), replace joints and repeat test until entire system is proved watertight.

5. All hydrostatic tests shall be conducted only in the presence of the District Representative. Do not completely backfill pipe until it has been inspected, tested and approved in writing.

6. Furnish necessary force pump and all other test equipment.

7. When the sprinkler irrigation system is completed, perform a coverage test in the presence of the District Representative to confirm that water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate without notifying the District Representative. This test shall be accomplished before any planting occurs.

8. Provide handheld walkie-talkie or personnel as necessary to accomplish this task expeditiously.

9. Upon completion of each phase of work, test and adjust entire system to meet site requirements.

10. Test any low voltage wiring more than 50 feet long installed under paving for continuity prior to paving.

C. System is acceptable if no leakage or loss of pressure occurs during test period.

3.13 BACKFILLING

A. Backfill in accordance with Part 3.03, Part 3.05 and this section.

B. In landscaped areas Provide six inches (6") of clean, fine, granular soil on top of the pipe in the and three inches (3") of clean, fine, granular soil under the pipe. In vehicular traffic areas (driveways, parking lots etc.) provide six inches (6") of plaster sand on top of the pipe and three inches (3") of plaster sand under the pipe.

1. Backfill from the top of the protective layer to finish grade shall have no particle larger than three quarters of an inch (3/4"). Backfill trench and compact to sub grade elevation as specified above. Protect piping from displacement with a minimum of 85 % compaction in landscape areas and 90 % compaction in hardscape (paved) areas.

C. After the initial excavation for the mainline trench, if it is found that the soil has too many rocks, making it impractical to remove the rocks from the spoils, notify the District Representative immediately.

1. After all the spoils are removed from the site, the entire main line in the landscaped areas, shall be covered with imported clean fine, granular soil (approved by the District Representative) from the bottom of the trench to the top of finish grade, at no additional cost to the District

2. In vehicular traffic areas, install approved imported soil from the protective sand layer to the top of finish grade.

3. The excess spoils shall be exported from the job site at no additional cost to the District. The allowance referred to in the Supplementary General Conditions shall be used for this work in the event it is needed. If the excavation allowance is not utilized, a credit shall be taken at the conclusion of the project.

3.14 INSTALLER'S FIELD SERVICES

A. Prepare and start systems per manufacturer's guidelines.

B. The entire sprinkler irrigation system shall be operated automatically for a period of seven days prior to any planting.

C. The District Representative reserves the right to waive or shorten the operation period.

D. After the maintenance period, demonstrate in presence of the District Representative that the system is in proper operating order.

3.15 ADJUSTING

A. Adjust work as directed by the District.

B. Adjust control system to achieve time cycles required.

C. Adjust head types for full water coverage as directed.

3.16 DEMONSTRATION

A. Adjust work as directed by the District.

B. Instruct District's personnel in operation and maintenance of system, including adjusting of sprinkler heads and recommended winterization procedures. Provide this training at the District's convenience. Use operation and maintenance manual as basis for demonstration.

3.17 CLEANUP

A. Perform cleanup as each portion of the work progresses. Remove refuse and excess dirt from the site, and sweep or wash down all walks, paving and vegetation. Repair any damage to the work of others and return to the original condition.

3.18 INSPECTIONS

A. The contractor shall give forty eight hours notice to the district representative when each phase of the job will be ready for inspection.

B. Main Line open trench inspection: One inch (1") through four inch (4"), the contractor may partially backfill the trenches before inspection. All saddles, pipe joints, quick couplers, air valve, ball valves, and remote control valves must be exposed for inspection.

C. Drinking Fountain Line open trench inspection. The contractor may partially backfill the trenches before inspection. All pipe joints and the pressure regulator must be exposed for inspection.

D. Main Line pressure test the main line for two hours minimum with the aid of a force pump to a pressure of fifty pounds per square inch over the static pressure or 150 pounds, whichever is greater. Note: thrust blocks or joint restraints (as specified) must be installed on the gasketed main line and the pipe "center loaded" between exposed pipe joints with approved back fill to prevent pipe from shifting.

E. Drinking Fountain Line pressure test. Pressure test drinking fountain line for two hours minimum with the aid of a force pump to a pressure of fifty pounds per square inch over the static pressure or 150 pounds, whichever is greater.

F. Lateral Line open trench inspection. The contractor may partially backfill the trenches before inspection. All pipe joints, swing joints, and rotor heads, must be exposed for inspection.

G. Drinking Fountain drainage system open trench inspection. The contractor may partially backfill the trenches before inspection. All pipe joints and seepage tanks must be exposed for inspection.

H. Coverage test. Coverage test of all rotor heads in the presence of the district representative.

I. Final inspection. Check all subsystems to verify that they are in good working order.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes site storm sewerage drainage piping, fittings and accessories, and bedding; connection of drainage system to municipal sewers and catch basins, plant area drains, cleanouts, paved area drainage, site surface drainage and detention basin.

B. Related Sections:

1. Section 03 30 00: Cast-in-Place Concrete.

2. Section 31 23 16: Trenching.

3. Section 31 23 23: Backfill.

1.2 REFERENCES

A. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 inch Drop.

C. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

D. "Standard Plans and Specifications, Department of Public Works", City of Palos Verdes Estates.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide data indicating pipe and pipe accessories.

1.4 SUBMITTALS AT PROJECT CLOSEOUT

A. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 REGULATORY REQUIREMENTS

A. Perform all work of this Section in strict accordance with applicable Government Codes and Regulations especially meeting all safety standards and requirements of CAL/OSHA, City of Palos Verdes Estates Department of Public Works, and the District, as indicated.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Plastic Pipe: ASTM D2751, SDR 23.5, Acrylonitrile-Butadiene-Styrene (ABS) material; inside nominal diameter as indicated on drawings, bell and spigot style solvent sealed joint end.

2.2 ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Filter Fabric: Non-biodegradable, woven.

D. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Storm Sewer Service" in large letters.

2.3 CLEANOUTS

A. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A1 as specified in Section 32 11 10.

B. Cover: Fill Type A2, as specified in Section 32 11 10.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that trench cut excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with lean concrete.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 00, for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal joints watertight.

B. Place pipe on deep bed of Type A4 filter aggregate.

C. Lay pipe to slope gradients noted on drawings with maximum variation from true slope of 1/8 inch in 10 feet.

D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches, compact to 95 percent.

E. Refer to Section 31 23 16, for trenching requirements. Do not displace or damage pipe when compacting.

F. Connect to municipal storm sewer system, through installed sleeves.

G. Install trace wire continuous over top of pipe, buried 6 inches below finish grade, above pipe line; coordinate with Section 32 11 10.

3.5 INSTALLATION - CATCH BASINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 FIELD QUALITY CONTROL

A. Comply with provisions of Section 01 45 00.

B. Request inspection prior to and immediately after placing aggregate cover over pipe.

C. Compaction testing will be performed in accordance with ASTM D1557.

D. If tests indicate Work does not meet specified requirements, refer to Section 01 45 00.

3.7 PROTECTION

A. Protect finished Work under provisions of Section 01 50 00.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

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SECTION 33 46 13

FOUNDATION DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes retaining wall drainage system; and filter aggregate, fabric and bedding.

B. Related Sections:

1. Section 05 50 00: Metal Fabrications

2. Division 22: Plumbing Fixtures

3. Section 31 23 00: Excavation and Fill

4. Section 33 40 00: Storm Drainage Utilities

1.2 REFERENCES

A. ASTM C4 - Clay Drain Tile.

B. ASTM C412 - Concrete Drain Tile.

C. ASTM D2311 - Perforated, Homogeneous Bituminized Fiber Pipe for General Drainage.

D. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

1.3 SUBMITTALS

A. Comply with provisions of Section 01 33 00.

B. Shop Drawings: Indicate dimensions, layout of piping, high and low points of pipe inverts, gradient of slope between corners and intersections.

C. Product Data: Submit data on pipe drainage products and pipe accessories

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Comply with provisions of Section 01 78 23.

B. Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations.

C. Operation and Maintenance Data: Procedures for submittals.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. Polyvinyl Chloride Pipe: ASTM D2729; plain end, 4 inch inside diameter; with required fittings.

B. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.2 AGGREGATE AND BEDDING

A. Filter Aggregate Materials: Fill Type as specified in Section 32 11 10.

2.3 ACCESSORIES

A. Pipe Coupling: Solid plastic.

B. Sleeve: Cast iron type for foundation wall.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavated base is ready to receive work and excavations, dimensions, and elevations are as indicated on layout Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with lean concrete.

B. Remove large stones or other hard matter which could damage drainage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.

B. Place drainage pipe on compacted impervious fill.

C. Lay pipe to slope gradients noted on Drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Place pipe with perforations facing down. Mechanically join pipe ends.

E. Install pipe couplings.

F. Install aggregate at sides, over joint covers and top of pipe. Provide top cover compacted thickness of 12 inches.

G. Place filter fabric over leveled top surface of aggregate cover prior to subsequent backfilling operations.

H. Place aggregate in maximum 6 inch lifts, consolidating each lift.

I. Refer to Section 31 23 23 for compaction requirements. Do not displace or damage pipe when compacting.

J. Place impervious fill over drainage pipe aggregate cover and compact.

K. Connect to storm sewer system with unperforated pipe, through installed sleeves.

3.4 FIELD QUALITY CONTROL

A. Request inspection prior to and immediately after placing aggregate cover over pipe.

3.5 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

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SECTION 33 71 19

ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rigid steel conduit.
2. Plastic conduit.
3. Plastic duct.
4. Reinforced resin conduit.
5. Precast concrete manholes.
6. Handholes.
7. Underground duct markers.
8. Cast-in-place manhole accessories.

B. Related Sections:

1. Section 03 10 00 - Concrete Forming and Accessories: Product and execution requirements for forms for cast-in-place manholes.
2. Section 03 20 00 - Concrete Reinforcing: Product and execution requirements for reinforcement for cast-in-place manholes.
3. Section 03 30 00 - Cast-In-Place Concrete: Product and execution requirements for concrete for cast-in-place manholes.
4. Section 07 11 00 - Dampproofing: Product and execution requirements for dampproofing of manhole exteriors.
5. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill required by this section.
6. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.
7. Section 31 23 23 - Fill: Requirements for backfill to be placed by this section.
8. Section 33 41 00 - Storm Utility Drainage Piping: Product and execution requirements for drainage from manholes.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Duct bank:

1. Basis of Measurement: By linear foot for each configuration.

2. Basis of Payment: Includes purchase, delivery, and installation of duct, fittings, supports, and accessories; and trenching, concrete encasement, and backfill.

B. Manhole:

1. Basis of Measurement: Each unit and each configuration.

2. Basis of Payment: Includes purchase, delivery, and installation of manhole.

C. Handhole:

1. Basis of Measurement: Each unit and each configuration.

2. Basis of Payment: Includes purchase, delivery, and installation of handhole.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ASTM International:

1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

2. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.

3. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.

4. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.

5. ASTM C1037 - Standard Practice for Inspection of Underground Precast Concrete Utility Structures.

C. Institute of Electrical and Electronics Engineers:

1. IEEE C2 - National Electrical Safety Code.

D. National Electrical Manufacturers Association:

1. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

2. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

3. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

4. NEMA TC 6 - PVC and ABS Plastic Utilities Duct for Underground Installation.

5. NEMA TC 9 - Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.

6. NEMA TC 10 - PVC and ABS Plastic Communications Duct for Underground Installation.

7. NEMA TC 14 - Filament Wound Reinforced Thermosetting Resin Conduit and Fittings.

E. Underwriters Laboratories Inc.:

1. UL 651A - Type EB and A Rigid PVC Conduit and HDPE Conduit.

1.4 SYSTEM DESCRIPTION

A. Interconnected system of encased conduits, ducts, and manholes and handholes to distribute medium-voltage power, low-voltage power, telephone, data communications, and fire alarm systems.

B. Conduit and duct routing and manhole and handhole locations are shown in approximate locations unless dimensions are indicated. Route and locate to complete duct bank system.

C. Medium-voltage: Use rigid plastic conduit.

D. Low-voltage: Use rigid plastic conduit.

E. Telephone: Use rigid plastic conduit.

F. Data communication: Use rigid plastic conduit.

G. Fire Alarm System: Use rigid plastic conduit.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.

C. Product Data: Submit for ducts, manhole, handholes, and accessories.

D. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes and handholes.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with existing underground utilities and structures.

PART 2 PRODUCTS

2.1 PLASTIC CONDUIT

A. Furnish materials in accordance with State of California Public Work's standards.

B. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, with fittings and conduit bodies to NEMA TC 3.

2.2 PRECAST CONCRETE MANHOLES AND HANDHOLES

A. Manufacturers:

1. Jensen.

2. Brooks.

3. Substitutions: Section 01 60 00 - Product Requirements.

2.3 UNDERGROUND DUCT MARKERS

A. Underground Warning Tape: 4 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Verify locations of manholes prior to excavating for installation.

3.2 INSTALLATION

A. Install Work in accordance with State of California Public Work's standards.

3.3 INSTALLATION - DUCT BANK

A. Install duct to locate top of ducts at depths as indicated on Drawings.

B. Install conduit and duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope conduit and duct toward manholes and away from building entrances.

C. Cut conduit and duct square using saw or pipe cutter; de-burr cut ends.

D. Insert conduit and duct to shoulder of fittings; fasten securely.

E. Join nonmetallic conduit and duct using adhesive as recommended by manufacturer.

F. Wipe nonmetallic conduit and duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

G. Install no more than equivalent of three 90-degree bends between pull points.

H. Install fittings to accommodate expansion and deflection.

I. Terminate conduit and duct at manhole entries using end bell.

J. Stagger conduit and duct joints vertically in concrete encasement 6 inches minimum.

K. Use suitable separators and chairs installed not greater than 4 feet on centers. Secure separators and chairs to trench bottom prior to concrete pour.

L. Band conduits and ducts together before backfilling or placing concrete.

M. Securely anchor conduit and duct to prevent movement during concrete placement.

N. Place concrete in accordance with Section 03 30 00.

O. Use mineral pigment to color concrete red as required.

P. Install ducts with minimum 3 inch concrete cover at bottom, top, and sides.

Q. Install two No. 4 steel reinforcing bars in top of bank under paved areas.

R. Connect to existing concrete encasement using dowels.

S. Connect to manhole wall using dowels.

T. Provide suitable pull string in each empty duct except sleeves and nipples.

U. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

V. Backfill trenches in accordance with Section 31 23 17.

W. Interface installation of underground duct markers with backfilling specified in Section 31 23 17. Install 12 inches below finished surface.

3.4 INSTALLATION - PRE-CAST MANHOLE

A. Excavate for manhole installation in accordance with Section 31 23 16.

B. Install and seal precast sections in accordance with ASTM C891.

C. Install manholes plumb.

D. Use precast neck and shaft sections to bring manhole cover to finished elevation.

E. Attach cable racks to inserts after manhole installation is complete.

F. Install drains in manholes and connect to 4 inch (DN100) pipe terminating in 1/2 cu yd crushed gravel bed under provisions of Section 33 41 00.

G. Dampproof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days, in accordance with Section 07 11 00.

H. Backfill manhole excavation in accordance with Section 31 23 23.

3.5 INSTALLATION - PRE-CAST HANDHOLE

A. Excavate for handhole installation in accordance with Section 31 23 16.

B. Install and seal precast sections in accordance with ASTM C891.

C. Install handholes plumb.

D. Backfill handhole excavation in accordance with Section 31 23 23.

END OF SECTION

SECTION 33 79 00

SITE GROUNDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rod electrodes.
2. Active electrodes.
3. Exothermic connections.
4. Mechanical connectors.
5. Wire.
6. Grounding well components.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product and execution requirements for concrete used in concrete wells.
2. Section 26 41 00 - Facility Lightning Protection.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Rod Electrode:

1. Basis of Measurement: By unit.
2. Basis of Payment: Includes purchase, delivery, and installation of rod electrode.

B. Active Electrode:

1. Basis of Measurement: By unit.
2. Basis of Payment: Includes purchase, delivery, and installation of active electrode.

C. Mechanical Connector:

1. Basis of Measurement: By unit.
2. Basis of Payment: Includes purchase, delivery, and installation of mechanical connector.

D. Exothermic Connectors:

1. Basis of Measurement: By unit.

2. Basis of Payment: Includes purchase, delivery, and installation of weld.

E. Conductors:

1. Basis of Measurement: By linear foot.

2. Basis of Payment: Includes purchase, delivery and installation of wire.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 80 - Guide for Safety in AC Substation Grounding.

2. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

3. IEEE C2 - National Electrical Safety Code.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SYSTEM DESCRIPTION

A. Multiple rod electrodes buried in straight line in configuration as indicated on Drawings at intersections of horizontal electrode grid.

B. Multiple horizontal electrodes buried in straight line around perimeter of building foundation.

C. Single rod electrode for local grounding at utility transformer.

1.5 PERFORMANCE REQUIREMENTS

A. Overall Resistance to Ground: 5 ohms.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate layout and installation details of grounding components.

C. Product Data: Submit data for grounding electrodes and connectors.

D. Test Reports: Indicate overall resistance to ground.

E. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and

assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.7 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of electrodes and connections.

1.8 QUALITY ASSURANCE

A. Maintain one copy of each document on site.

B. Conform to IEEE 142.

C. Substation Grounding: Conform to IEEE 80.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:

1. Harger.

2. Erico-Cadweld.

3. Crouse-Hinds.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Copper-clad steel ground rods.

C. Diameter: 3/4 inch.

D. Length: 10 feet.

2.2 ACTIVE ELECTRODES

A. Manufacturers:

1. Harger.

2. Erico-Cadweld.

3. Crouse-Hinds.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Metallic-salt-filled copper tube electrode.

C. Shape: Straight. As indicated on Drawings.

D. Length: 8 feet.

E. Connector: U-bolt pressure plate. Or Suitable for exothermic welded connection.

2.3 EXOTHERMIC CONNECTIONS

A. Manufacturers:

1. Harger.

2. Erico-Cadweld.

3. Crouse-Hinds.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.4 MECHANICAL CONNECTORS

A. Manufacturers:

1. Harger.

2. Erico-Cadweld.

3. Crouse-Hinds.

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.5 WIRE

A. Material: Stranded copper.

B. Horizontal Electrodes: 4/0 AWG, minimum size, unless indicated on drawings.

C. Connections to Electrodes: 4/0 AWG, minimum size, unless indicated on drawings.

D. Bonding Other Objects: 4/0 AWG, minimum size, unless indicated on drawings.

E. Mechanical Connector: Bronze.

F. Grounding Boxes: Bronze.

2.6 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inch diameter by 24 inch long clay tile concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

C. Treatment Well Liner: 8 inch diameter clay tile concrete perforated pipe.

2.7 ACCESSORIES

A. Treatment Chemicals: Use calcium chloride, magnesium sulfate (Epsom salts), copper sulfate (blue vitriol), suitable ion-producing, non-corrosive and non-toxic treating chemicals.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

C. Verify trenching is completed before installing horizontal electrodes.

3.2 EXISTING WORK

A. Remove exposed abandoned grounding components. Cut conductors flush with grade and paving, and patch surfaces.

B. Provide access to existing grounding electrodes, connections, and other installations remaining active and requiring access. Modify installation or install wells as indicated on Drawings.

C. Extend existing site grounding installations using materials and methods compatible with existing installations, or as specified.

D. Clean and repair existing grounding connections remaining.

3.3 INSTALLATION

A. Install rod electrodes [in vertical position with bottom at least 5 feet below frost line.

B. Install interconnecting wire 2 feet below finished grade level.

C. Install grounding wells and grounding boxes as indicated on Drawings.

D. Construct concrete well in accordance with Section 03 30 00.

E. Treatment Wells:

1. Lining: Install to depth of 60 inches.

2. Well Pipe and Cover: Install flush with finished grade.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13. Make final grounding system measurements three or four days after chemical treatment.

3.5 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate location of each accessible grounding connection and each chemical treatment well.

END OF SECTION

FOR REFERENCE ONLY
DOCUMENTS

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NOTIFIER®

August 19, 2004 DN-6971 • A0-110

NOTI•FIRE•NET™

Release 5.0

Section: Network Systems

GENERAL

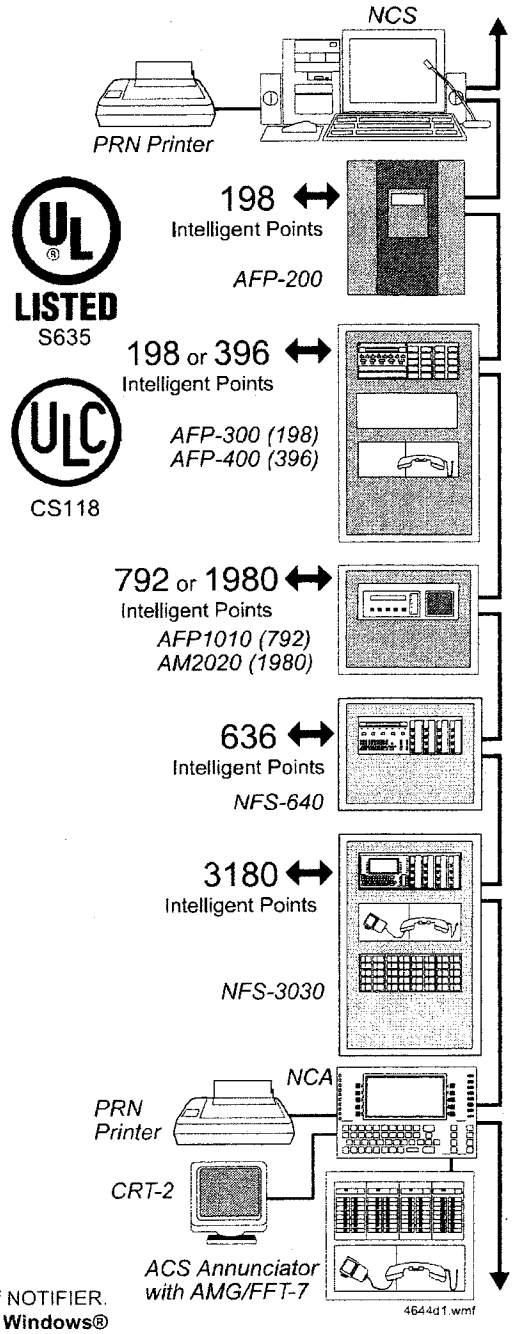
NOTI•FIRE•NET™ is the interface which allows **NOTIFIER** Intelligent Fire Alarm Control Panels to form a network. Each local control panel (network node) maintains its own area of protection, while monitoring and controlling other areas (other network nodes).

Local information is displayed at each network node. In areas such as a security office, where the entire network must be monitored, network annunciators are available.

NOTI•FIRE•NET™ (NFN) is a token-pass style network based on the proven ARCNET® local area network technology, with four million nodes installed worldwide. This computer LAN architecture makes NFN extremely powerful, yet simple to configure and install.

FEATURES

- Fiber optic (multi-mode), wire, or combination wire/fiber communications path.
- NFPA Style 4 or Style 7 network operation.
- Based on proven ARCNET® technology.
- True peer-to-peer communications. Each node stores its own program and communicates equally with all other nodes.
- Token-passing non-collision protocol.
- No "master" polling computer or other central weak link.
- Inherently regenerative system. Each node acts as a repeater to reshape and regenerate data signals. Failure of any node does not affect any other node/communications among surviving nodes.
- High-speed data communications (312,500 BPS) operates several times as fast as competitive networks.
- Simple plug-in module, the SIB-NET, connects AM2020/AFP1010. The NAM-232 connects AFP-200, AFP-300, and AFP-400 panels anywhere on the network. The NCM connects the NFS-3030, NFS-640, NCA, BACnet Gateway, and NWS.
- Multiple Network Control Stations (ONYX® NCS) may be placed anywhere on the network. Additional ONYX® NCS's may be used to provide inherent "hot" backup.
- Multiple Network Control Annunciators (NCA) may be placed anywhere on the network. Version 5.0 does not support the INA.
- ONYX® Series NCS and NCA display all network activity. Unlike competitive systems, the point display capacity is *NOT* held to less than the maximum network capacity.
- Single small-gauge twisted-pair wire (no shield necessary) for data communications path.
- Electrical isolation between nodes.
- Network clock synchronization *(see page 3)*.
- History Buffers on NCA, ONYX® NCS, NFS-3030, NFS-640, AFP1010, AM2020, AFP-200, AFP-300, and AFP-400 Intelligent Fire Control Panels.
- Powerful Cooperative-Control-by-Event allows point(s) on one node to activate point(s) on other nodes. Any input can turn on any output, network-wide.



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NOTIFIER® 12 Clintonville Road, Northford, Connecticut 06472

ISO 9001 CERTIFIED ENGINEERING & MANUFACTURING QUALITY SYSTEMS

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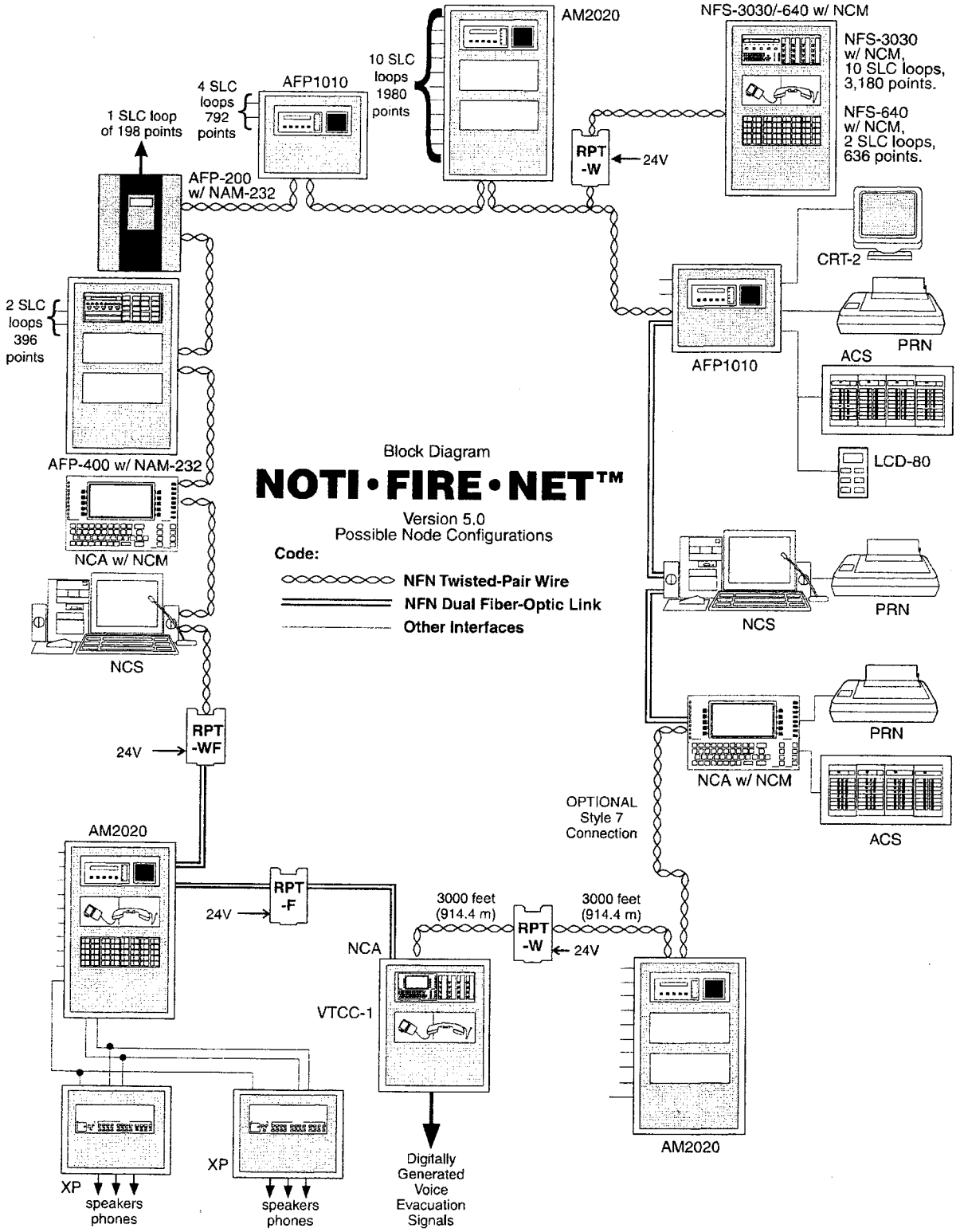

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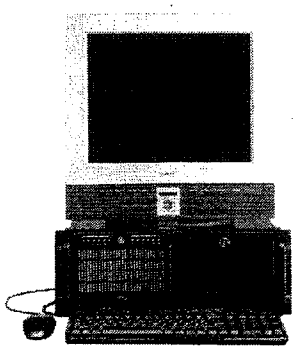
NCS NETWORK CONTROL STATION

The NCS is based on a UL 864-recognized computer. Special hardware and software are added by **NOTIFIER** to make the NCS operate as a Command Center for **NOTI•FIRE•NET™**.

PENTIUM-BASED COMPUTER (ONYX® NCS) features:

- Intel® 2.0 GHz Pentium® IV microprocessor.
- 256 KB cache memory, 256 MB RAM.
- 40 GB hard drive, 1.44 MB floppy drive, 24/10/40X CD-RW drive.
- 17" flat-screen LCD monitor, Windows® 2000 keyboard, P/S 2 mouse, 300 Watt power supply, sound card, microphone, and internal speakers.
- Microsoft® Windows® 2000.



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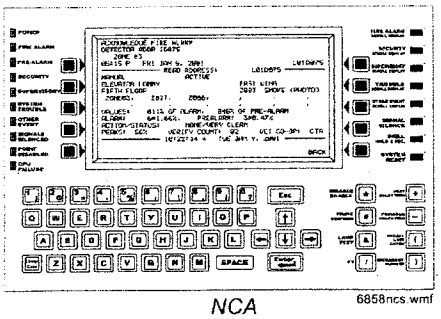
NCA NETWORK CONTROL ANNUNCIATOR

The NCA provides full annunciation of all network signals and may optionally allow system control functions.

- 640-character, backlit LCD display shows all network alarms and troubles.
- LEDs for POWER, FIRE ALARM, PRE-ALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNAL SILENCED, POINT DISABLE, and CPU FAILURE.
- Fixed Function Keys/Switches for FIRE ALARM SCROLL/DISPLAY, SECURITY SCROLL/DISPLAY, SUPERVISORY SCROLL/DISPLAY, TROUBLE SCROLL/DISPLAY, OTHER EVENT SCROLL/DISPLAY, SIGNAL SILENCE, DRILL, AND SYSTEM RESET.
- Special Function Keys for DISABLE/ENABLE, PRINT SCREEN, LAMP TEST, NEXT SELECTION/PREVIOUS SELECTION, and RECALL LAST ENTRY.
- Alphanumeric QWERTY keypad with tactile and audible feedback.
- Nonvolatile real-time clock can be synchronized with network by master node.
- Nonvolatile History Buffer (200 Alarm events, 1,000 System events).
- Two optically-isolated EIA-232 ports for printer and CRT terminal.
- Mounts in ABS-4D surface/semi-flush cabinet with door and key lock.
- Mounts in CAB-3 or CAB-4 Series cabinets, using ADP-4(B) hinged dress panel.
- An NCM is required for every NCA.
- 24 VDC power from remote or local supply (CAB-3/-4 Series cabinet required for local power).



NCA

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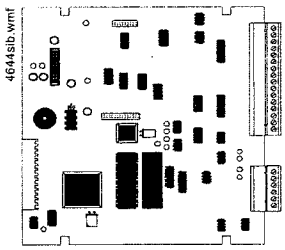
SIB-NET

The SIB-NET is a plug-in board which allows an AM2020 or AFP1010 control panel to connect to **NOTI•FIRE•NET™**. It plugs into the panel ICA-4L Interconnect Chassis Assembly.

- Plug-in module may be retrofitted into existing systems.
- Accepts one MIB series module.
- Two EIA-232 ports for CRT terminals, or EDP listed devices.
- Two EIA-232 ports for PRN printers, or EDP listed devices.
- EIA-485 port for ACS annunciators, LDM Series, LCD-80, AMG, etc.



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SIB-NET

NAM-232

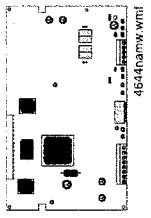
The NAM-232 (NAM-232F for Fiber, NAM-232W for Wire medium) provides the ability to connect the AFP-200, AFP-300 and AFP-400 intelligent control panels to **NOTI•FIRE•NET™**.

AFP-200 Network Interface Features:

- Acknowledge, Signal Silence, System Reset from NCA or NCS.
- Limited CCBE operation. *Cannot participate in clock synchronization.*
- Full network display.

AFP-300/400 Network Interface Features:

- Acknowledge, Signal Silence, System Reset from NCA or NCS.
- Remote Annunciator Control from NCA.
- Read status, control On/Off, and point enable/disable from NCA or NCS.
- Limited CCBE operation. *Cannot serve as a synchronization master clock.*
- Full network display.



NAM-232W

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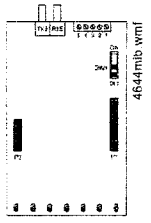
MIB SERIES MEDIA INTERFACE BOARDS

The MIB mounts "piggyback" onto the SIB-NET module. It operates at 312K bits per second and provides full signal regeneration and amplification before passing information on to the next node. In combination with the panel software, it will support NFPA Style 4 or 7 configurations. It is available in three versions: **MIB-W** (wire), **MIB-F** (fiber), and **MIB-WF** (hybrid wire/fiber).



MIB-WF

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RPT SERIES REPEATER MODULES

The RPT repeater is a single PC board that may be used to extend the distance of transmission. It may also be used to change media type between wire and fiber. The RPT may mount in the ABS-8R surface box, or in the CAB-3 or CAB-4 Series using one slot of the CHS-4 or CHS-4L. Available as **RPT-W** (wire), **RPT-F** (fiber), and **RPT-WF** (wire/fiber converter). Requires 24 VDC.

RPT-WF

4644rpt.wmf

SPECIFICATIONS

• ONYX® NCS Network Control Station

See ONYX® NCS data sheet, DN-6869.

• NCA Network Control Annunciator

See NCA data sheet, DN-6858.

• NAM-232 Network Interface Board

See NAM-232 data sheet, DN-5331.

• SIB-NET Serial Interface Board

NFN interface: standard MIB slot.

EIA-232 terminal ports (2): 2,400 baud, isolated.

EIA-232 printer ports (2): 2,400 baud, isolated

EIA-485 ACS port: 20,833 baud, isolated.

Size: 8.0" x 8.0" (203.2 x 203.2 mm).

Compatible panels: AM2020, AFP1010.

• MIB-W Media Interface Board

Data rate (bits per second): 312,500.

Maximum wire distance: 3,000 feet (914.4 meters), two channels.

Wiring type: twisted pair.

Wire size: 14 AWG (2.0 mm^2) to 18 AWG (0.75 mm^2).

Board size: 3.5" (88.9 mm) x 5.0" (127.0 mm).

• MIB-F Media Interface Board

Data rate (bits per second): 312,500.

Fiber distance: 10 dB loss, two channels.

Fiber type: dual, Plenum grade.

Fiber size: 62.5 µm/125 µm; **wavelength:** 850 nM.

Connector type: ST®.

Board size: 3.5" (88.9 mm) x 5.0" (127.0 mm)

• MIB-WF Media Interface Board

Specifications: same as MIB-W plus MIB-F; one channel wire, one channel fiber.

• RPT-W, RPT-F, RPT-WF Repeaters

Wire/fiber specifications: same as MIB-W and MIB-F.

Board size: 4.4" (111.76 mm) x 6.5" (165.1 mm).

• NCM-W Network Communications Module

See NCM-W and NCM-F data sheet, DN-6861.

Compatible panels: NFS-640, NFS-3030.

• NCM-F Network Communications Module

See NCM-W and NCM-F data sheet, DN-6861.

Compatible panels: NFS-640, NFS-3030.

• BACnet Gateway

See BACnet Gateway data sheet, DN-6877.

• NWS NOTI•FIRE•NET™ Web Server

See NWS data sheet, DN-6928.

NOTI•FIRE•NET™ VERSION 5.0 ORDERING/COMPATIBILITY REQUIREMENTS

- The NCS must be version 4.0 or higher. To upgrade NCS version 1.0 to NCS version 4.0 or higher, order **NCSKIT-NCW** (for wire) or **NCSKIT-NCF** (for fiber) and **NCSCDUG-US-4**.
- The NAM-232 (for AFP-200, AFP-300/400) firmware must be version 5.0. To upgrade the NAM-232 for a version 5.0 network, order **NROM-NAM5.0M**.
- The SIB-NET (for AM2020/AFP1010) firmware must be version 5.0. To upgrade the SIB-NET for a version 5.0 network, order **AROM5.0M-SIB**.
- **NOTI•FIRE•NET™** version 5.0 will not support the INA.
- See **NOTI•FIRE•NET™** Ordering Bulletin on **Magni-Fire.com.**

AGENCY LISTINGS AND APPROVALS

All **NOTI•FIRE•NET™** equipment, including the NCS, NCA, MIBs, NAM-232, and RPTs are listed by Underwriters Laboratories in file S635. Listings are for UL category UOJZ (Control Units System) and comply with UL standard 864 (control units for Fire-Protective Signaling Systems) and comply with UL 1076 (Proprietary Burglar alarm units and systems) UL 1610.

Certain software features described in this catalog sheet may not yet be included in this UL listing. Consult factory for latest listing status.

Listings for many other agencies are in process. Consult factory for latest listing status.

ENGINEER/ARCHITECT SPECIFICATIONS

Complete specifications on **NOTI•FIRE•NET™** and **NOTIFIER**'s complete line of fire alarm control and peripheral devices are available from NOTIFIER.

http://www.notifier.com

NFS-320(E)

Intelligent Addressable Fire Alarm System

NOTIFIER® by Honeywell

Intelligent Fire Alarm Control Panels

General

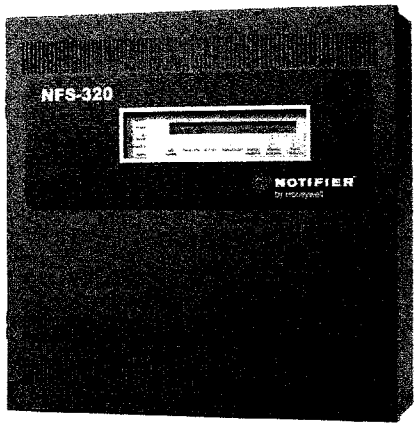
The NFS-320 intelligent Fire Alarm Control Panel is part of the ONYX® Series of Fire Alarm Controls from NOTIFIER.

In stand-alone or network configurations, ONYX Series products meet virtually every application requirement.

Designed with modularity and ease of system planning, the NFS-320 can be configured with just a few devices for small building applications, or for a large campus or high-rise application. Simply add additional peripheral equipment to suit the application. For installations using NFS-320C, an optional ACM Series annunciator can be mounted in the same cabinet (up to 48 zones/points, order separately).

The FireWatch Series internet monitoring modules IPDACT-2 and IPDACT-2UD permit monitoring of alarm signals over the Internet, saving the monthly cost of two dedicated business telephone lines. Although not required, the secondary telephone line may be retained providing backup communication over the public switched telephone line.

NOTE: *Unless called out with a version-specific "R", "C" or "E" at the end of the part number, "NFS-320" refers to models NFS-320, NFS-320R, NFS-320C, and NFS-320E; similarly, "CPU-320" refers to the main circuit board for CPU-320, CPU-320C, and CPU-320E.*



NFS-320

Features

- **Listed to UL Standard 864, 9th edition.**
- One isolated intelligent Signaling Line Circuit (SLC) Style 4, 6 or 7.
- Up to 159 detectors (any mix of ion, photo, thermal, or multi-sensor) and 159 modules (Addressable pull stations, normally open contact devices, two-wire smoke, notification, or relay). 318 devices maximum.
- Standard 80-character display.
- Network options:
  - High-speed network for up to 200 nodes (NFS2-3030, NFS2-640, NFS-320(C), NCA-2, DVC, ONYXWorks, NCS, NFS-3030, NFS-640, and NCA).
  - Standard network for up to 103 nodes (NFS2-3030, NFS2-640, NFS-320(C), NCA-2, DVC, ONYXWorks, NCS, NFS-3030, NFS-640, NCA, AFP-200, AFP-300/400, AFP-1010, and AM2020). Up to 54 nodes when DVC is used in network paging.
- 6.0 amp power supply with four Class A/B built-in Notification Appliance Circuits (NAC). Selectable System Sensor, Wheelock, or Gentex strobe synchronization.
- Built-in Alarm, Trouble, Security, and Supervisory relays.
- VeriFire® Tools online or offline programming utility. Upload/Download, save, store, check, compare, and simulate panel databases. Upgrade panel firmware.
- Autoprogramming and Walk Test reports.
- Optional universal 318-point DACT.
- 80-character remote annunciators (up to 32).
- EIA-485 annunciators, including custom graphics.
- Printer interface (80-column and 40-column printers).
- History file with 800-event capacity in nonvolatile memory, plus separate 200-event alarm-only file.
- Alarm Verification selection per point, with tally.
- Autoprogramming and Walk Test reports.
- Presignal/Positive Alarm Sequence (PAS).
- Silence inhibit and Auto Silence timer options.
- NAC coding functions:
  - March time.
  - Temporal.
  - California two-stage coding.
  - Canadian two-stage.
  - Strobe synchronization.
- Field-programmable on panel or on PC, with VeriFire Tools program check, compare, simulate.
- Full QWERTY keypad.
- Battery charger supports 18 – 200 amp hour batteries
- Non-alarm points for lower priority functions.
- Remote ACK/Signal Silence/System Reset/Drill via monitor modules.
- Automatic time control functions, with holiday exceptions.
- Surface Mount Technology (SMT) electronics.
- Extensive, built-in transient protection.
- Powerful Boolean logic equations.

FLASHSCAN® INTELLIGENT FEATURES:

- Poll up to 318 devices in less than two seconds.
- Activate up to 159 outputs in less than five seconds.
- Multicolor LEDs blink device address during Walk Test.
- Fully digital, high-precision protocol (U.S. Patent 5,539,389).
- Manual sensitivity adjustment — nine levels.
- Pre-alarm ONYX intelligent sensing — nine levels.
- Day/Night automatic sensitivity adjustment.
- Sensitivity windows:
  - **Ion –** 0.5 to 2.5%/foot obscuration.
  - **Photo –** 0.5 to 2.35%/foot obscuration.
  - **Laser (VIEW®) –** 0.02 to 2.0%/foot obscuration.

– **Acclimate Plus™** – 0.5 to 4.0%/foot obscuration.

– **IntelliQuad** – 1.0 to 4.0%/foot obscuration.

- Drift compensation (U.S. Patent 5,764,142).
- Degraded mode — in the unlikely event that the CPU-320 microprocessor fails, FlashScan detectors revert to degraded operation and can activate the CPU-320 NAC circuits and alarm relay. Each of the four built-in panel circuits includes a Disable/Enable switch for this feature.
- Multi-detector algorithm involves nearby detectors in alarm decision (U.S. Patent 5,627,515).
- Automatic detector sensitivity testing (NFPA-72 compliant).
- Maintenance alert (two levels).
- Self-optimizing pre-alarm.

FSC-851 INTELLIQUAD ADVANCED MULTI-CRITERIA DETECTOR

- Detects all four major elements of a fire (smoke, heat, CO, and flame).
- Automatic drift compensation of smoke sensor and CO cell.
- High nuisance-alarm immunity.
- Six sensitivity levels.

FSL-751 VIEW (VERY INTELLIGENT EARLY WARNING) SMOKE DETECTION TECHNOLOGY:

- Revolutionary spot laser design.
- Advanced ONYX intelligent sensing algorithms differentiate between smoke and non-smoke signals (U.S. Patent 5,831,524).
- Addressable operation pinpoints the fire location.
- No moving parts to fail or filters to change.
- Early warning performance comparable to the best aspiration systems at a fraction of the lifetime cost.

FAPT-851 ACCLIMATE PLUS LOW-PROFILE INTELLIGENT MULTI-SENSOR:

- Detector automatically adjusts sensitivity levels without operator intervention or programming. Sensitivity increases with heat.
- Microprocessor-based technology; combination photo and thermal technology.
- FlashScan or classic mode compatible.
- Low-temperature warning signal at 40°F ± 5°F (4.44°C ± 2.77°C).

RELEASING FEATURES:

- Ten independent hazards.
- Sophisticated cross-zone (three options).
- Delay timer and Discharge timers (adjustable).
- Abort (four options).
- Low-pressure CO_2 listed.

HIGH-EFFICIENCY OFFLINE SWITCHING 3.0 AMP POWER SUPPLY (6.0 A IN ALARM):

- 120 VAC (NFS-320/NFS-320C); 240 VAC (NFS-320E).
- Displays battery current/voltage on panel (with display).

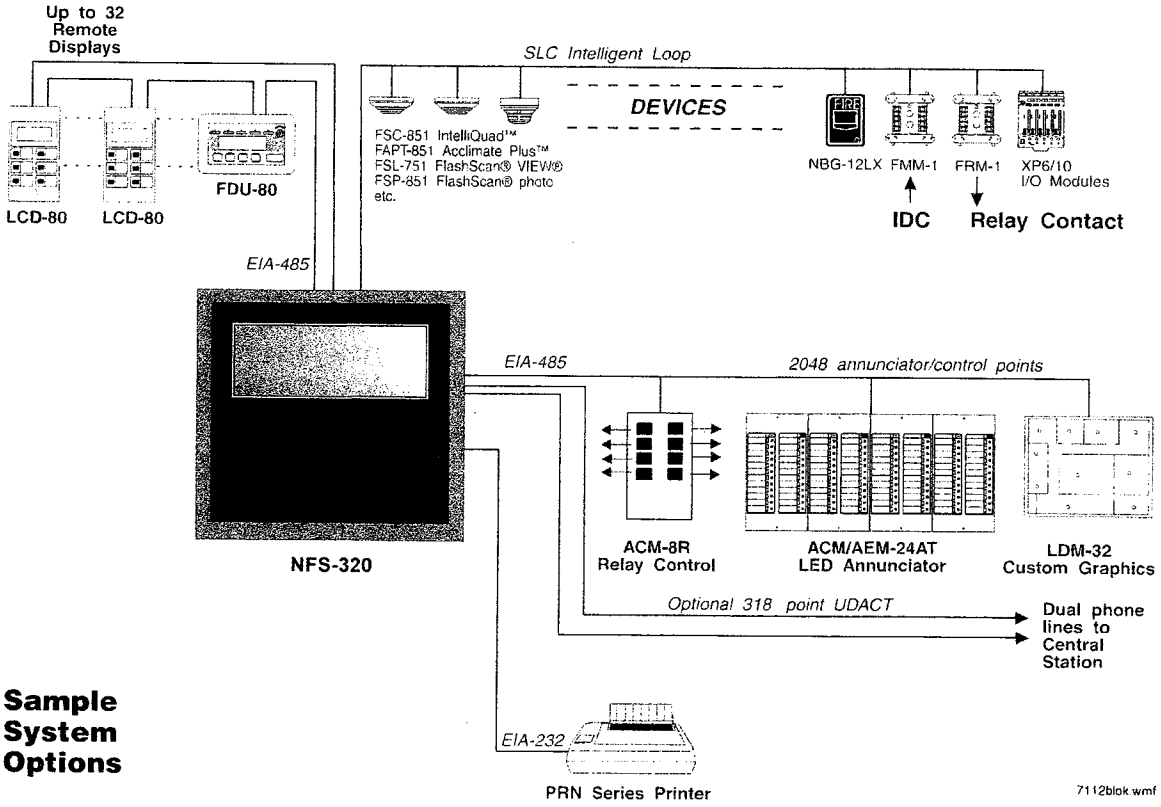
VOICE FEATURES:

- Integrates with FireVoice-25/50 Series *(see DN-7004)*.
- Integrates via serial connection with FireVoice-25/50ZS Series (see DN-7003).

FlashScan, Exclusive World-Leading Detector Protocol

At the heart of the NFS-320 is a set of detection devices and device protocol — FlashScan (U.S. Patent 5,539,389). FlashS-

Sample System Options



can is an all-digital protocol that gives superior precision and high noise immunity.

In addition to providing quick identification of an active input device, this new protocol can also activate many output devices in a fraction of the time required by competitive protocols. This high speed also allows the NFS-320 to have the largest device per loop capacity in the industry — 318 points — yet every input and output device is sampled in less than two seconds. The microprocessor-based FlashScan detectors have bicolor LEDs that can be coded to provide diagnostic information, such as device address during Walk Test.

ONYX Intelligent Sensing

Intelligent sensing is a set of software algorithms that provides the NFS-320 with industry-leading smoke detection capability. These complex algorithms require many calculations on each reading of each detector, and are made possible by the high-speed microcomputer used by the NFS-320.

Drift Compensation and Smoothing: Drift compensation allows the detector to retain its original ability to detect actual smoke, and resist false alarms, even as dirt accumulates. It reduces maintenance requirements by allowing the system to automatically perform the periodic sensitivity measurements required by NFPA 72. Smoothing filters are also provided by software to remove transient noise signals, such as those caused by electrical interference.

Maintenance Warnings: When the drift compensation performed for a detector reaches a certain level, the performance of the detector may be compromised, and special warnings are given. There are three warning levels: (1) Low Chamber value; (2) Maintenance Alert, indicative of dust accumulation that is near but below the allowed limit; (3) Maintenance Urgent, indicative of dust accumulation above the allowed limit.

Sensitivity Adjust: Nine sensitivity levels are provided for alarm detection. These levels can be set manually, or can change automatically between day and night. Nine levels of pre-alarm sensitivity can also be selected, based on predetermined levels of alarm. Pre-alarm operation can be latching or self-restoring, and can be used to activate special control functions.

Self-Optimizing Pre-Alarm: Each detector may be set for "Self-Optimizing" pre-alarm. In this special mode, the detector "learns" its normal environment, measuring the peak analog readings over a long period of time, and setting the pre-alarm level just above these normal peaks.

Cooperating Multi-Detector Sensing: A patented feature of ONYX intelligent sensing is the ability of a smoke sensor to consider readings from nearby sensors in making alarm or pre-alarm decisions. Without statistical sacrifice in the ability to resist false alarms, it allows a sensor to increase its sensitivity to actual smoke by a factor of almost two to one.

Field Programming Options

Autoprogram. This timesaving feature is a special software routine. The FACP "learns" what devices are physically connected and automatically loads them in the program with default values for all parameters. Requiring less than one minute to run, this routine allows the user to have almost immediate fire protection in a new installation, even if only a portion of the detectors are installed.

Keypad Program Edit (with KDM-R2) The NFS-320, like all NOTIFIER intelligent panels, has the exclusive feature of program creation and editing capability from the front panel keypad, ***while continuing to provide fire protection***. The architecture of the NFS-320 software is such that each point entry carries its own program, including control-by-event links to other points. This allows the program to be entered with independent per-point segments, while the NFS-320 simultaneously monitors other (already installed) points for alarm conditions.

VeriFire Tools is an offline programming and test utility that can greatly reduce installation programming time, and increase confidence in the site-specific software. It is Windows®-based and provides technologically advanced capabilities to aid the installer. The installer may create the entire program for the NFS-320 in the comfort of the office, test it, store a backup file, then bring it to the site and download from a laptop into the panel.

Placement of Equipment in Chassis and Cabinet

The following guidelines outline the NFS-320's flexible system design.

Wiring: When designing the cabinet layout, consider separation of power-limited and non-power-limited wiring as discussed in the NFS-320 Installation Manual.

It is critical that all mounting holes of the NFS-320 are secured with a screw or standoff to ensure continuity of Earth Ground.

Networking: If networking two or more control panels, each unit requires a Network Control Module or High-Speed Network Control Module (see "Network Options" on page 5). These modules can be installed in any option board position (see manual), and additional option boards can be mounted in front of them.

KDM-R2 Controls and Indicators

Program Keypad: QWERTY type (keyboard layout).

12 LED Indicators: Power; Fire Alarm; Pre-Alarm; Security; Supervisory; System Trouble; Signals Silenced; Points Disabled; Control Active; Abort; Pre-Discharge; Discharge.

Keypad Switch Controls: Acknowledge/Scroll Display; Signal Silence; Drill; System Reset; Lamp Test.

LCD Display: 80 characters (2 x 40) with long-life LED backlight.

Configuration Guidelines

The NFS-320 system ships assembled; description and some options follow.

Note: Stand-alone and network systems require a main display. On stand-alone systems, the panel's keypad provides the required display. On network systems (two or more networked fire panel nodes), at least one NCA-2, NCS, or ONYXWorks annunciation device is required.

NFS-320: The standard, factory-assembled NFS-320 system includes the following components: one CPU-320 control panel mounted on chassis (120 V operation — ships with grounding cable, battery interconnect cables, and document kit); includes integral power supply mounted to the CPU-320; one primary display KDM-R2 keypad/display; and one cabinet for surface or semi-flush mounting. *Purchase batteries separately. One or two option boards may be mounted inside the NFS-320 cabinet; additional option boards can be utilized in remote cabinets.*

NFS-320R: Same as NFS-320 above, but in red enclosure.

NFS-320C: Based on NFS-320 above. NFS-320C supports installation of an optional ACM-series annunciator in the same cabinet. UL- and ULC-listed.

NOTE: *For additional information on NFS-320C, see DN-60085.*

NFS-320E: Same as NFS-320 above, but with 240 V operation.

TR-320: Trim ring for the NFS-320 cabinet.

Option Modules

FCPS-24S6/-24S8: Remote six-amp and eight-amp power supplies with battery charger. *See DN-6927.*

COMPATIBLE DEVICES, EIA-232 PORTS

PRN-6: 80-column printer. *See DN-6956.*

VS4095/5: Printer, 40-column, 24 V. Mounted in external backbox. *See DN-3260.*

COMPATIBLE DEVICES, EIA-485 PORTS

ACM-24AT: ONYX Series ACS annunciator – up to 96 points of annunciation with Alarm or Active LED, Trouble LED, and switch per circuit. Active/Alarm LEDs can be programmed (by powered-up switch selection) by point to be red, green, or yellow; the Trouble LED is always yellow. *See DN-6862.*

AEM-24AT: Same LED and switch capabilities as ACM-24AT, expands the ACM-24AT to 48, 72, or 96 points. *See DN-6862.*

ACM-48A: ONYX Series ACS annunciator – up to 96 points of annunciation with Alarm or Active LED per circuit. Active/Alarm LEDs can be programmed (by powered-up switch selection) in groups of 24 to be red, green, or yellow. Expandable to 96 points with one AEM-48A. *See DN-6862.*

AEM-48A: Same LED capabilities as ACM-48A, expands the ACM-48A to 96 points. *See DN-6862.*

TM-4: Transmitter Module. Includes three reverse-polarity circuits and one municipal box circuit; mount on NFS-320 chassis or remotely. *See DN-6860.*

LCD-80/FDU-80: 80-character, backlit LCD display. Mounts up to 6,000 ft. (1828.8 m) from panel. Up to 32 per FACP. *See LCD-80/-80TM (DN-3198) and FDU-80 (DN-6820).*

LDM: Lamp Driver Modules LDM-32, LDM-E32, and LDM-R32; remote custom driver modules. *See LDM data sheet, DN-0551.*

ACM-8R: Remote Relay Module with eight Form-C contacts. Can be located up to 6,000 ft. (1828.8 m) from panel on four wires. *See ACM-8R data sheet, DN-3558.*

APS2-6R: Auxiliary Power Supply. Provides up to 6.0 amperes of power for peripheral devices. Includes battery input and transfer relay, and overcurrent protection. Mounts on two of four positions on a CHS-4L or CHS-4 chassis. *See DN-5952.*

SCS: Smoke control stations SCS-8, SCE-8, with lamp drivers SCS-8L, SCE-8L; eight (expandable to 16) circuits. *See SCS data sheet DN-4818.*

UDACT: Universal Digital Alarm Communicator Transmitter, 636 channel. *See DN-4867.*

UZC-256: Programmable Universal Zone Coder provides positive non-interfering successive zone coding. Microprocessor-controlled, field-programmable from IBM®-compatible PCs (requires optional programming kit). Mounts in **BB-UZC**. *See DN-3404.*

COMPATIBLE INTELLIGENT DEVICES

BEAMHK: Heating kit for transmitter/receiver unit of FSB-200(S) below. *See DN-6985.*

BEAMHRK: Heating kit for use with the reflector of FSB-200(S) below. *See DN-6985.*

BEAMLRK: Long-range accessory kit, FSB-200(S) below. *See DN-6985.*

BEAMMRK: Multi-mount kit, FSB-200(S) below. *See DN-6985.*

BEAMSMK: Surface-mount kit, FSB-200(S) below. *See DN-6985.*

FSB-200: Intelligent beam smoke detector. *See DN-6985.*

FSB-200S: Intelligent beam smoke detector with integral sensitivity test. *See DN-6985.*

FSC-851: FlashScan IntelliQuad Advanced Multi-Criteria Detector. *See DN-60412.*

FSI-851: Low-profile FlashScan ionization detector. *See DN-6934.*

FSP-851: Low-profile FlashScan photoelectric detector. *See DN-6935.*

FSP-851T: Low-profile FlashScan photoelectric detector with 135°F (57°C) thermal. *See DN-6935.*

FST-851: FlashScan thermal detector 135°F (57°C). *See DN-6936.*

FST-851R: FlashScan thermal detector 135°F (57°C) with rate-of-rise. *See DN-6936.*

FST-851H: FlashScan 190°F (88°C) high-temperature thermal detector. *See DN-6936.*

DNR: InnovairFlex low-flow non-relay duct-detector housing (order FSP-851 separately). Replaces FSD-751PL/FSD-751RPL. *See DN-60429.*

DNRW: Same as above with NEMA-4 rating, watertight. *See DN-60429.*

FAPT-851: FlashScan Acclimate Plus low-profile multi-sensor detector. *See DN-6937.*

FSL-751: FlashScan VIEW laser photo detector. *See DN-6886.*

B224RB: Low-profile relay base. See DN-60054.

B224BI: Isolator base for low-profile detectors. See DN-60054.

B710LP: Low-profile base. Standard U.S. style. See DN-60054.

B501: European-style, 4" (10.16 cm) base. See DN-60054.

B200S: Intelligent sounder base, capable of producing a variety of tone patterns including ANSI Temporal 3. Compatible with sychronization protocol. See DN-60054.

B200SR: Intelligent sounder base, Temporal 3 or Continuous tone. See DN-60054.

FMM-1: FlashScan monitor module. *See DN-6720.*

FDM-1: FlashScan dual monitor module. *See DN-6720.*

FZM-1: FlashScan two-wire detector monitor module. *See DN-6720.*

FMM-101: FlashScan miniature monitor module. *See DN-6720.*

FCM-1-REL: FlashScan releasing control module. *See DN-60390.*

FCM-1: FlashScan NAC control module. *See DN-6724.*

FRM-1: FlashScan relay module. *See DN-6724.*

NBG-12LX: Manual pull station, addressable. *See DN-6726.*

ISO-X: Isolator module. *See DN-2243.*

XP6-C: FlashScan six-circuit supervised control module. *See DN-6924.*

XP6-MA: FlashScan six-zone interface module; connects intelligent alarm system to two-wire conventional detection zone. *See DN-6925.*

XP6-R: FlashScan six-relay (Form-C) control module. *See DN-6926.*

XP10-M: FlashScan ten-input monitor module. *See DN-6923.*

NETWORK OPTIONS

NCM-W, NCM-F: Standard Network Communications Modules. Wire and multi-mode fiber versions available. *See DN-6861.*

HS-NCM-W/MF/SF/WMF/WSF/MFSF: High-speed network communications modules. Wire, single-mode fiber, multi-mode fiber, and media conversion models are available. *See DN-60454.*

RPT-W, RPT-F, RPT-WF: Standard-network repeater board with wire connection (RPT-W), fiber connection (RPT-F), or allowing a change in media type between wire and fiber (RPT-WF). *See DN-6971.*

ONYXWorks-NW: UL-listed graphics PC workstation for standard NOTI•FIRE•NET with wire media. Includes NFN Gateway wire version (NFN-GW-PC-W) and 19" color flat-screen LCD monitor. Each ONYXWorks workstation consumes one of 103 network addresses. *See DN-7048.*

ONYXWORKS-HNW: UL-listed graphics PC workstation for wire high-speed NOTI•FIRE•NET. Includes high-speed NFN Gateway (NFN-GW-PC-HNW) and 19" color flat-screen LCD monitor. Each ONYXWorks consumes one of up to 200 network addresses. *See DN-7048.*

ONYXWorks-NF: UL-listed graphics PC workstation for standard NOTI•FIRE•NET with fiber media. Includes NFN Gateway wire version (NFN-GW-PC-F) and 19" color flat-screen LCD monitor. Each ONYXWorks workstation consumes one of 103 network addresses. *See DN-7048.*

ONYXWORKS-HNSF: UL-listed graphics PC workstation for single-mode-fiber high-speed NOTI•FIRE•NET. Includes HS-NFN Gateway (NFN-GW-PC-HNSF) and 19" color flat-screen LCD monitor. Each ONYXWorks consumes one of up to 200 network addresses. *See DN-7048.*

ONYXWORKS-HNMF: UL-listed graphics PC workstation for multi-mode-fiber high-speed NOTI•FIRE•NET. Includes HS-NFN Gateway (NFN-GW-PC-HNMF) and 19" color flat-screen LCD monitor. Each ONYXWorks consumes one of up to 200 network addresses. *See DN-7048.*

NFN-GW-EM-3: NFN Gateway, embedded.

OTHER OPTIONS

IPDACT-2/2UD, IPDACT Internet Monitoring Module: Mounts in IPENC enclosure. Connects to primary and secondary DACT telephone output ports for internet communications over customer-provided ethernet connection. Requires compatible Teldat VisorALARM Central Station Receiver. Can use DHCP or static IP. *See DN-60408.*

IPENC: External enclosure for IPDACT, includes IPBRKT mounting bracket; Red. For Black order **IPENC-B**.

IPSPLT: Y-adaptor option allow connection of both panel dialer outputs to one IPDACT-2/2UD cable input.

DPI-232: Direct Panel Interface, specialized modem for extending serial data links to remotely located FACPs and/or peripherals; mount on NFS-320 chassis. *See DN-6870.*

VeriFire-TCD: VeriFire Tools CD-ROM. Contains programming software for the ONYX Series. Includes local panel connection cable. *See DN-6871.*

BAT Series: Batteries. NFS-320 utilizes two 12 volt, 18 to 200 AH batteries. This series of products replaces the previous PS Series. *See DN-6933.*

NFS-LBB: Battery Box (required for batteries larger than 25 AH).

NFS-LBBR: Same as above, but red.

411: Slave Digital Alarm Communicator. *See DN-6619.*

411UDAC: Digital Alarm Communicator. *See DN-6746.*

BB-UZC: Backbox for housing the UZC-256. Required for NFS-320 applications. Black; for red, order BB-UZC-R.

SYSTEM SPECIFICATIONS

System Capacity

- Intelligent Signaling Line Circuits 1
- Intelligent detectors 159
- Addressable monitor/control modules 159
- Programmable internal hardware and output circuits 4
- Programmable software zones 99
- Special programming zones 14
- LCD annunciators per CPU-320/-320E 32
- ACS annunciators per CPU-320/-320E ..... 32 addresses x 64 points

Specifications

- Primary input power, **CPU-320 board:** 120 VAC, 50/60 Hz, 3.0 A. **CPU-320E board:** 220/240 VAC, 50/60 Hz, 1.5 A.
- Total output 24 V power: 6.0 A in alarm.

NOTE: *The power supply has a total of 6.0 A of available power. This is shared by all internal circuits.*

- Standard notification circuits (4): 1.5 A each.
- Resettable regulated 24V power: 1.25 A.
- Two non-resettable regulated 24V power outputs:
  - 1.25 A
  - 0.50 A.
- Non-resettable 5V power: 0.15 A.
- Battery charger range: 18 AH – 200 AH. Use separate cabinet for batteries over 25 AH.
- Float rate: 27.6 V.

Cabinet Specifications

- NFS-320 cabinet dimensions: Backbox: 18.12 in. (46.025 cm) width; 18.12 in. (46.025 cm) height; 5.81 in. (14.76 cm) depth.
- Door: 18.187 in. (46.195 cm) width; 18.40 in. (46.736 cm) height; 0.75 in. (1.905 cm) depth.
- Trim ring: Molding width is 0.905 in. (2.299 cm).

Temperature and Humidity Ranges

This system meets NFPA requirements for operation at 0 – 49°C/32 – 120°F and at a relative humidity 93% ± 2% RH (noncondensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15 – 27°C/60 – 80°F.

Agency Listings and Approvals

The listings and approvals below apply to the basic NFS-320 control panel. In some cases, certain modules may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

- **UL Listed:** file S635
- **ULC Listed:** file S635 (NFS-320C only, excludes IPDACT)
- **CSFM:** 7165-0028:0243
- **FM Approved**
- **MEA:** 128-07-E
- **FDNY COA #6038**
- **City of Chicago**

NOTE: *For additional information on UL- and ULC-listed model NFS-320C, see DN-60085. For information on NFS-320SYS, see DN-60637*

Standards

The NFS-320 complies with the following UL Standards and NFPA 72 Fire Alarm Systems requirements:

- **UL 864** (Fire).
- **UL 1076** (Burglary).
- **LOCAL** (Automatic, Manual, Waterflow and Sprinkler Supervisory).
- **AUXILIARY** (Automatic, Manual and Waterflow) (requires TM-4).
- **REMOTE STATION** (Automatic, Manual, Waterflow and Sprinkler Supervisory) (requires TM-4).
- **PROPRIETARY** (Automatic, Manual, Waterflow and Sprinkler Supervisory). *Not applicable for FM.*
- **CENTRAL STATION** (Automatic, Manual, Waterflow and Sprinkler Supervisory) (requires UDACT).
- **EMERGENCY VOICE/ALARM**.
- **OT, PSDN** (Other Technologies, Packet-switched Data Network)

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ISO 9001 CERTIFIED
ENGINEERING & MANUFACTURING QUALITY SYSTEMS

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We try to keep our product information up-to-date and accurate.
We cannot cover all specific applications or anticipate all requirements.
All specifications are subject to change without notice.

For more information, contact Notifier. Phone: (203) 484-7161, FAX: (203) 484-7118.
www.notifier.com

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7165-0028:0243

CATEGORY: 7165 -- FIRE ALARM CONTROL UNIT (COMMERCIAL)

LISTEE: NotifierOne Fire-Lite Place, Northford, CT 06472-1653
Contact: Vladimir Kireyev (203) 484-6277 Fax (203) 484-7309
Email: vladimir.kireyev@honeywell.com

DESIGN: Models NFS2-640, NFS-320/C (R), and NFS-320SYS fire alarm control units. Local, auxiliary, remote station (PPU), proprietary (PPU), central station (PPU), manual, automatic, waterfowl and sprinkler supervisory services. Also suitable for releasing service, Process Management and Emergency Voice/Alarm communication System (NFS2-640 only). Model numbers may be followed by an "R" suffix representing the enclosure color being red . Refer to listee's data sheet for additional detailed product description and operational considerations. System components:

ACM-8R, -16AT, -32A, -24AT, -48A; Annunciator Control Modules
ACPS-610, AMPS-24; Addressable power supply/charger
ADP-4B, -A4, -1, -2, DP-DISP2; Dress Panel
AEM-16AT, -32A, -24AT, -48A; Annunciator Expander Modules
AFM-16A, -16AT, -32A; Annunciator Fixed Modules
AKS-1B; Annunciator Key Switch
APS2-6R; Power supply
BB-100, -200, NFS-LBB/-LBBR; Battery Boxes
BGRA-SCS, BGRB-SCS; Smoke Control Station
CEF-SCS, RSA-SCS, RSB-SCS; Smoke Control Station
RSC-SCS, RSD-SCS, RSE-SCS; Smoke Control Station
BMP-1; Blank Module
BP-4, BP2-4; Battery Dress Plates
CAB-3/-4 Series; Enclosure
CHS-4, CHS-4N, CHS-4L; Chassis
CPU2-640, CPU-320SYS; CPU Board
CRT-2; Display Terminal
DP-1B; Blank Panel
DPA-1A4/1/2, DP-DISP2; Dress Panel
DPI-232; Panel Interface
DR-A4, DR-A4B, DR-A4BR, DR-A4R; Door Assembly
DR-AA4, DR-AA4B, DR-AA4BR, DR-AA4R; Door Assembly
DR-B3F; Door Assembly
DR-B4, DR-B4B, DR-B4BR, DR-B4R; Door Assembly
DR-C4, DR-C4B, DR-C4BR, DR-C4R; Door Assembly
DR-D4, DR-D4B, DR-D4BR, DR-D4R; Door Assembly

*Rev. 11-29-11 gt

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Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***JASON DEWITT**, Deputy State Fire Marshal*

Fire Engineering Division

EQ Series; Cabinets
EQBB-B4, EQBB-C4, EQBB-D4; Backbox Assembly
EQDR-B4, EQDR-C4, EQDR-D4; Door Assembly
FCM-1, FCM-1-REL; Releasing Control Module
FCPS-24S6, -24S8; Field Charger/Power Supply
FDU-80/-80G; Remote Annunciator
NFV-25/50, NFV-25/50ZS/ZST; Voice Evacuation Control Panels
*NFV-25/50DA, *NFV-25/50DAZS; *Distributed Audio Panels
FIRSTVISION-LCD/ENC; Interactive Firefighters' display/enclosure
FDM-1; Dual Monitor Module
*FDRM-1:*Multiple Module with two Relay Outputs
FRM-1; Relay Module
FTM-1; Control Module
FZM-1, FMM-1, FMM-101; Monitor Modules
HS-NCM-W/-MF/-SF/-WMF/-WSF/-MSSF; High Speed Network Control Modules
NBG-12LRA; Agent Releasing Abort Station
NBG-12LX; Addressable Manual Pull Station
NCA, NCA-2; Network Communication Annunciator
NCM-W, -F; Network Control Module
NCS4-W-ONYX, NCS4-F-ONYX; Network Control Station
NCS5-W-ONYX, NCS5-F-ONYX; Network Control Station
NFS-LBB/NFS-LBBR; Battery Box/Red
NFS-320SYS; Chassis
IPDACT-2/-2UD; IP Fire Alarm Communicator
ISO-X; Isolator Module
KAPS-24, CPS-24; Power Supply
KDM-R2; Keyboard Display Module
LCD-80, -160; Annunciators
LCD-80TM; Annunciator Terminal Module LCD
LCD2-80; Remote Annunciator
LDM-32/-E32/-R32; Lamp Driver Module
LEM-320/ELEM-320; Loop Expander Module
ONYXWorks-EW/-NW-/NF/-HNW/-HNMF/-HNSF/-TS/-EW-TS/-NF-TS/-HW-TS/
-HNMFT/-HNSFT/-HNWT; PC workstation for NOTI•FIRE•NET, Wire/Fiber/
with Touch screen monitors
RKS-S; Remote Security Key Switch
PRN-6; Printer
RPT-W, -485W; Repeater Wire
RPT-F; Repeater Fiber
RPT -485FW; Repeater Fiber/Wire
SBB-A3F; Backbox Assembly
SBB-A4, SBB-A4R, SBB-AA4, SBB-AA4R; Backbox Assembly
SBB-B4, SBB-B4R-L8, SBB-C4, SBB-C4R; Backbox Assembly
SBB-D4, SBB-D4R; Backbox Assembly
SCS-8; Smoke Control Station

*Rev. 11-29-11 gt

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Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***JASON DEWITT**, Deputy State Fire Marshal*

Fire Engineering Division

SCE-8; Smoke Control Expander
SCS-8L; Smoke Control Lamp Driver Station
SCE-8L; Smoke Control Expander Lamp
STS-1; Security Tamper Switch
TM-4; Transmitter Module
TR-A4/-B3N/-B4/-C4/-D3N/-D4; Trim Ring
UDACT, *UDACT-2; Universal DACT
UZC-256; Universal Zone Coder
VP-2B; Dress Panel
XP5-C/-M; Transponder Modules
XPM-8L; Transponder Monitor Modules
XP6-C; Supervised Control Modules
XP6-MA; Six Zone Interface Modules
XP6-R; Six Relay Control Modules
XP10-M(A); Ten Input Monitor Modules

The following models are intended for use on NFS2-640 only:

AA-30, -100, -120; Amplifiers
ACT-1, -2, -4, -25, -70; Audio Coupling Transformer
ADDR-B4/-B4R/-C4/-C4R/-D4/-D4R; Door Assemblies
AMG-E; Audio Message Generator
AVL-1; Audio Voice Link
BDA-25V/-70V; Backup Digital Audio Amplifiers
CHS2-M2, CA-1, CA-2; Chassis
CMIC-1; Microphone Assembly
DAA-5025/-5070; Digital Audio Amplifiers
DAA-5025F/DAA-5025SF; Digital Audio Amplifiers
DAA-5070F/DAA-5070SF; Digital Audio Amplifiers, Fiber Mode
DAA-75 Series; Digital Audio Amplifiers
DAA-7525, DAA-7525F, DAA-7525SF; Digital Audio Amplifiers
DAX-3525/-3570/-5025/-5070; Digital Audio Amplifiers
DAA2-5025/-5070/-7525; Digital Audio AmplifiersDVC; Digital Voice Command
DS-AMP/E; Digital Series Audio Amplifier
DS-BDA; Digital Series Backup Amplifier
DS-DB; Digital Series Distribution Board
DS-FM, DS-RFM, DS-SFM; Digital Series Fiber Module
DVC; Digital Voice Command
DVC-EM/-EMF/-EMSF; Digital Voice Command Extended Memory Module
FFT-7, -7S; Fire Fighter's Telephone
FHS; Fireman's Handset
FPJ; Fireman's Phone Jack
RM-1, RM-1SA; Remote Microphone
TELH-1; Telephone Assembly
XPIQ; Transponder Quad Intelligent Audio

*Rev. 11-29-11 gt

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Authorized By: ***JASON DEWITT**, Deputy State Fire Marshal*

Fire Engineering Division

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, model number, electrical ratings, and UL Label

APPROVAL: Listed as fire alarm control units suitable for use in high-rise applications when used in conjunction with separately listed compatible initiating and indicating devices.This control unit can generate the temporal code pattern fire alarm signal as required per NFPA 72. Refer to manufacturer's Installation Manual for details. This control unit meets the requirements of UL Standard 864, 9th
Edition.

NOTE: 1. For Fire Alarm Verification feature (delay of fire alarm signal), the maximum Retard/Reset/Restart period shall not exceed 30 Seconds.
2. Combined with 7170-028:244

*Rev. 11-29-11 gt

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Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***JASON DEWITT**, Deputy State Fire Marshal*

Fire Engineering Division

FSP-851, FSP-851T, & FSP-851R

Intelligent Plug-In Photoelectric

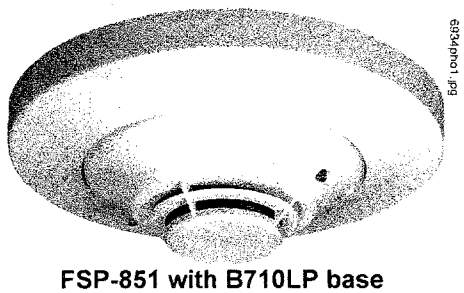
NOTIFIER® by Honeywell

Intelligent/Addressable Devices

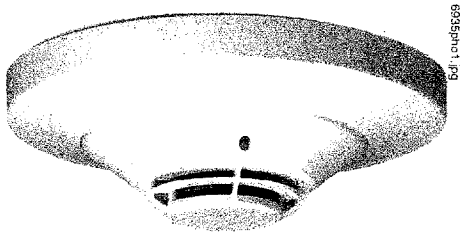
General

Notifier 851 Series intelligent plug-in smoke detectors with integral communication provide features that surpass conventional detectors. Detector sensitivity can be programmed in the control panel software. Sensitivity is continuously monitored and reported to the panel. Point ID capability allows each detector's address to be set with decade address switches, providing exact detector location for selective maintenance when chamber contamination reaches an unacceptable level. The FSP-851 photoelectric detector's unique optical sensing chamber is engineered to sense smoke produced by a wide range of combustion sources. Dual electronic thermistors add 135°F (57°C) fixed-temperature thermal sensing on the FSP-851T. The FSP-851R is a remote test capable detector for use with DNR(W) duct detector housings. FSP-851 series detectors are compatible with all ONYX series Notifier intelligent Fire Alarm Control Panels (FACP).

FlashScan® (U.S. Patent 5,539,389) is a communication protocol developed by Notifier that greatly increases the speed of communication between analog intelligent devices. Intelligent devices communicate in a grouped fashion. If one of the devices in the group has new information, the panel's CPU stops the group poll and concentrates on single points. The net effect is response speed greater than five times that of earlier designs.



FSP-851 with B710LP base



FSP-851T with B710LP base

Features

- Sleek, low-profile design.
- Addressable-analog communication.
- Stable communication technique with noise immunity.
- Low standby current.
- Two-wire SLC connection.
- FlashScan (NFS-320, NFS-640, NFS2-640, NFS-3030, NFS2-3030) and classic CLIP systems (AFP-100, AFP-200, AFP-300, AFP-400, NFS-640, AM2020/AFP1010, NFS-3030) compatible.
- Rotary, decimal addressing (1-99 on CLIP systems, 1-159 on FlashScan systems).
- Optional remote, single-gang LED accessory.
- Dual LED design provides 360° viewing angle.
- Visible bi-color LEDs blink green every time the detector is addressed, and illuminate steady red on alarm *(FlashScan systems only).*
- Remote test feature from the panel.
- Walk test with address display (an address on 121 will blink the detector LED: 12-[pause]-1*(FlashScan systems only).*
- Built-in functional test switch activated by external magnet.
- Built-in tamper-resistant feature.
- Sealed against back pressure.
- Constructed of off-white Bayblend®, designed to commercial standards, and offers an attractive appearance.
- 94-5V plastic flammability rating.
- SEMS screws for wiring of the separate base.
- Optional relay, isolator, and sounder bases.

Specifications

Size: 2.1" (5.3cm) high x 4.1" (10.4cm) diameter installed in B501 base, 6.1" (15.5cm) diameter installed in B710LPbase.

Shipping Weight: 5.2oz. (147g).

Operating Temperature: FSP-851, 0°C to 49°C (32°F to 120°F); FSP-851T, 0°C to 38°C (32°F to 100°F). Low temperature signal for FSP-851T at 45°F +/- 10°F (7.22°C +/- 5.54°C). FSP-851R installed in a DNR(W), -20°C to 70°C (-4°F to 158°F).

UL/ULC Listed Velocity Range: 0-4000 ft/min. (1219.2 m/min.), suitable for installation in ducts.

Relative Humidity: 10%-93% noncondensing.

Thermal Ratings: Fixed-temperature setpoint 135°F (57°C).

DETECTOR SPACING AND APPLICATIONS

Notifier recommends spacing detectors in compliance with NFPA 72. In low airflow applications with smooth ceiling, space detectors 30 feet (9.144m) for ceiling heights 10 feet (3.148m) and higher. For specific information regarding detector spacing, placement, and special applications refer to NFPA 72. *System Smoke Detector Application Guide,* document A05-1003, is available at systemsensor.com

ELECTRICAL SPECIFICATIONS

Voltage Range: 15-32 volts DC peak.

Standby Current (max. avg.): 300µA @ 24VDC (one communication every five seconds with LED enabled).

LED Current (max.): 6.5mA @ 24VDC ('ON').

BASES AVAILABLE

NOTE: *"A" suffix indicates ULC Listed model.*

B710LP(A): 6.1" (15.5cm) diameter.

B501(A): 4.1" (10.4cm) diameter.

B200SR(A): Intelligent sounder base, configurable for temp-3 or steady sound.

B224RB(A) Relay Base: *Screw Terminals*, up to 14AWG ($2.0mm^2$); *Relay Type*, Form-C; *Rating*, 2.0A @ 30VDC resistive, 0.3A @ 110VDC inductive, 1.0A @ 30VDC inductive; *Dimensions*, 6.2" (15.748cm) x 1.2" (3.048cm) x 1.2" (3.048cm).

B224BI(A) Isolator Base: *Dimensions*, 6.2" (15.748cm) x 1.2" (3.048cm) x 1.2" (3.048cm); *Maximum*, 25 devices between isolator bases.

Installation

FSP-851 plug-in detectors use a separate base to simplify installation, service, and maintenance. A special tool allows maintenance personnel to plug in and remove detectors without using a ladder.

Mount base on an electrical backbox which is at least 1.5" (3.81cm) deep. Suitable mounting base boxes include:

- 4.0" (10.16cm) square box.
- 3.5" (8.89cm) or 4.0" (10.16cm) octagonal box.
- Single-gang box (except relay or isolator base).
- With B200SR base, use an appropriate junction box.
- With B224RB or B224BI base, use a 3.5" (8.89cm) octagonal box, or a 4.0" (10.16cm) octagonal or square box.

NOTE: *1) Because of inherent supervision provided by the SLC loop, end-of-line resistors are not required. Wiring "T-taps" or branches are permitted for style 4 (Class "B") wiring. 2) When using relay or sounder bases, consult data sheet DN-2243 (ISO-X) for device limitations between isolator modules and isolator bases.*

Agency Listings and Approvals

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. *Consult factory for latest listing status.*

- **UL Listed:** S1115
- **ULC Listed:** S1115 (FSP-851A, FSP-851TA)
- **MEA Listed:** 225-02-E
- **FM Approved**
- **CSFM:** 7272-0028:206
- **Maryland State Fire Marshal:** Permit # 2122
- **BSMI:** CI313066760036
- **CCCF:** Certif. # 2004081801000017 (FSP-851T)
  Certif. # 2004081801000016 (FSP-851)
- **Lloyd's Register:** 03/60011

Product Line Information

NOTE: *"A or "CDN" suffix indicates ULC listed model.*

FSP-851: Low-profile intelligent photoelectric sensor. Must be mounted to one of the bases listed below.

FSP-851A: Same as FSP-851 but with ULC listing.

FSP-851T: Same as FSP-851 but includes a built-in 135°F (57°C) fixed-temperature thermal device.

FSP-851TA: Same as FSP-851T but with ULC listing.

FSP-851R: Low-profile intelligent photoelectric sensor, remote test capable. For use with DNRW.

FSP-851RA: Same as FSP-851R but with ULC listing.

BASES

B710LP: Standard U.S. low-profile base.

B710LPBP: Standard U.S. low-profile base, pkg. of 10.

B710LPA: Standard U.S. low-profile base, ULC listing.

B501BP: Standard European flangeless base, pkg. of 10.

B501A: Standard European flangeless base, ULC listing.

B200SR(A): Intelligent sounder base, configurable for temp-3 or steady sound.

B224RB(A): Intelligent relay base.

B224BI(A): Intelligent isolator base. Isolates SLC from loop shorts.

ACCESSORIES

F110: Retrofit replacement flange for older style bases. Converts older high profile base for use with FlashScan detectors.

RA100Z(A): Remote LED annunciator. 3-32VDC. Fits U.S. single-gang electrical box. *Supported by* B710LP(A) *and* B501(A) *bases only.*

SMK400E: Surface mounting kit provides for entry of surface wiring conduit. *For use with* B501(A) *base only.*

RMK400: Recessed mounting kit. *For use with* B501(A) *base only.*

SMB600: Surface mounting kit for use with B710LP(A).

BCK-200B: Black detector covers, box of 10. For use with FSP-851 only.

WCK-200B: White detector covers, box of 10. For use with FSP-851 only.

M02-04-00: Test magnet.

M02-09-00: Test magnet with telescope stick.

XR2B: Detector removal tool. Allows installation and/or removal of FlashScan Series detector heads from base in high ceiling installations.

T55-127-010: Detector removal tool without pole.

XP-4: Extension pole for XR2B. Comes in three 5-ft. sections.

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ISO 9001 CERTIFIED
ENGINEERING & MANUFACTURING
QUALITY SYSTEMS

This document is not intended to be used for installation purposes.
We try to keep our product information up-to-date and accurate.
We cannot cover all specific applications or anticipate all requirements.
All specifications are subject to change without notice.

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For more information, contact Notifier. Phone: (203) 484-7161, FAX: (203) 484-7118.
www.notifier.com

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7272-0028:0206

CATEGORY: 7272 -- SMOKE DETECTOR-SYSTEM TYPE-PHOTOELECTRIC

LISTEE: NotifierOne Fire-Lite Place, Northford, CT 06472-1653
Contact: Vladimir Kireyev (203) 484-6277 Fax (203) 484-7309
Email: vladimir.kireyev@honeywell.com

DESIGN: Models FSP-751, HPX-751, FSP-751T, FSH-751, FAPT-751, FAPT-851, FSP-851, FSP-851R* and FSP-851T photoelectric type smoke detectors. Models FSP-751T and FSP-851T employ a 135°F supplement integral heat sensor which only assists in a fire situation. This thermal circuitry is NOT approved for use in lieu of a required heat detector. Refer to listee's data sheet for additional detailed product description and operational considerations.

RATING: 24 VDC

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes & ordinances and in manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, product number, electrical rating and UL label.

APPROVAL: Listed as photoelectric type smoke detector for use with listee's separately listed compatible base and fire alarm control units. Models FSP-751, FSP-751T, FAPT-751, FAPT-851, FSP-851, FSP-851R*, FSP-851T are suitable for open areas and inside duct installation with air velocities between 0-4000 fpm. Model HPX-751 is suitable for open areas with air velocities between 0-300 fpm. Model FSH-751 is suitable for open areas with air velocity between 0-4000 fpm.

NOTE: Combined with 7272-0028:208

The photoelectric type detectors are generally more effective at detecting slow, smoldering fires that smolder for hours before bursting into flame. Sources of these fires may include cigarettes burning in couches or bedding. The ionization type detectors are generally more effective at detecting fast, flaming fires that consume combustible materials rapidly and spread quickly. Sources of these fires may include paper burning in a waste container or a grease fire in the kitchen.

*Rev. 01-07-2009 fm

This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other

Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***FRANCIS MATEO**, Program Coordinator*

Fire Engineering Division

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7300-0028:0173

CATEGORY: 7300 -- FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES

LISTEE: NotifierOne Fire-Lite Place, Northford, CT 06472-1653
Contact: Vladimir Kireyev (203) 484-6277 Fax (203) 484-7309
Email: vladimir.kireyev@honeywell.com

DESIGN: Models BX501, B610LP, B612LP, B614LP, B616LP and B710LP detector bases. Refer to listee's data sheet for additional detailed product description and operational considerations.

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction

MARKING: Listee's name, product designation, electrical rating and UL label.

APPROVAL: Listed as detector bases for use with separately listed compatible detectors.

*Corrected 10-20-08 bh

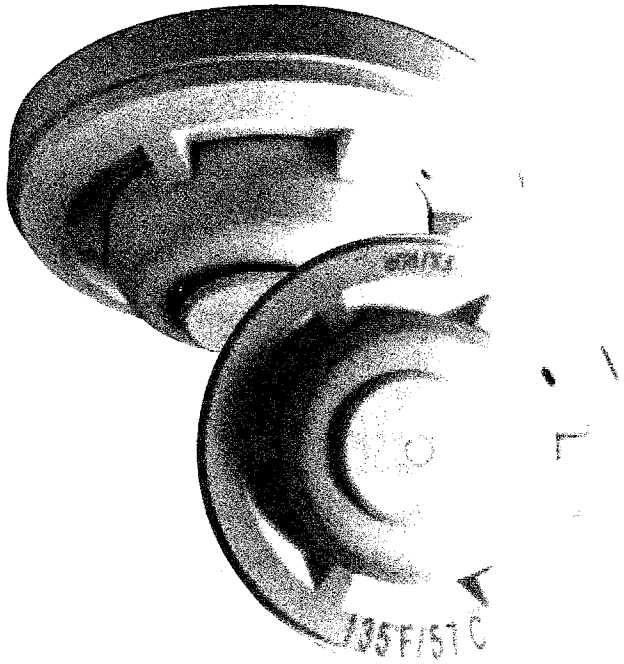
This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other

Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***FRANCIS MATEO**, Program Coordinator*
Fire Engineering Division

SYSTEM SENSOR

5600 Series Mechanical Heat Detectors



System Sensor's 5600 series mechanical heat detectors offer a low-cost means for property protection against fire, and for non-life-safety installations where smoke detectors are inappropriate.

Features

- Multiple configurations for installations:
  - Single- and dual-circuit models
  - Fixed temp and combination fixed- temp/rate-of-rise 135°F or 194°F ratings.
- Plain housing for residential installations (Model 5601P)
- Easy-to-use terminal screws
- A broad range of back box mounting options:
  - Single gang
  - 3.5" and 4" Octagonal
  - 4" square with square to round plaster ring
- Reversible mounting bracket

Multiple configurations. The 5600 series offers a full-line of configurations to accommodate a broad range of applications. Both single- and dual-circuit models are available for low- and high-temperature ratings with either fixed temperature or combination fixed temperature/rate-of-rise (ROR) activation. The ROR element of the fixed/ROR models is restorable to accommodate field-testing.

Installation flexibility. To satisfy a variety of installation needs, the 5600 series easily mounts to single-gang and octagonal back boxes. And these models accommodate four-square back boxes, when used with a square to round plaster ring. The reversible mounting bracket permits both flush- and surface-mount back box installations.

Visual identification. The 5600 series provides clear markings on the exterior of the unit to ensure that the proper detector is being used. Alphanumeric characters identify the activation method, as well as the temperature rating, in Fahrenheit and Celsius degrees. Fixed temperature models are identified FX, while combination fixed/rate-of-rise units are marked FX/ROR. The 5600 series also provides a post-activation indicator in the form of a collector. When the detector is activated, the collector drops from the unit, making it easy to identify the unit in alarm.

Agency Listings

UL LISTED FM APPROVED MEA approved

Specifications

Architectural/Engineering Specifications

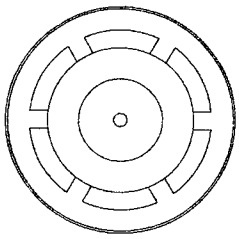
Mechanical heat detector shall be a System Sensor 5600 series model number _____, listed to Underwriters Laboratories UL 521 for Heat Detectors for Fire Protective Signaling Systems. The detector shall be either a single-circuit or a dual-circuit type, normally open. The detector shall be rated for activation at either 135°F (57°C) or 194°F (90°C), and shall activate by means of a fixed temperature thermal sensor, or a combination fixed temperature/rate-of-rise thermal sensor. The rate-of-rise element shall be activated by a rapid rise in temperature, approximately 15°F (8.3°C) per minute. The detector shall include a reversible mounting bracket for mounting to 3½-inch and 4-inch octagonal, single gang, and 4-inch square back boxes with a square to round plaster ring. Wiring connections shall be made by means of SEMS screws that shall accommodate 14–22AWG wire. The detector shall contain alphanumeric markings on the exterior of the housing to identify its temperature rating and activation method. The rate-of-rise element of combination fixed temperature/rate-of-rise models shall be restorable, to allow for field-testing. The detectors shall include an external collector that shall drop upon activation to identify the unit in alarm.

Physical/Operating Specifications

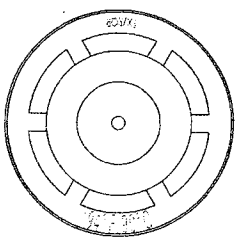
Maximum Installation Temperature	5601P, 5603, 5621, and 5623: 100°F (38°C) 5602, 5604, 5622, and 5624: 150°F (65.6°C)
Operating Humidity Range	5 to 95% RH non-condensing
Dimensions with mounting bracket	Diameter: 4.57 inches (11.6cm) Height: 1.69 inches (4.3cm)
Alarm Temperature	5601P, 5603, 5621, and 5623: 135°F (57°C) 5602, 5604, 5622, and 5624: 194°F (90°C)
Weight	6 oz. (170 grams)
Rate-of-Rise Threshold	15°F (8.3°C) rise per minute (models 5601P, 5602, 5621, and 5622 only)
Mounting	3½-inch octagonal back box 4-inch octagonal back box Single gang back box 4-inch square back box with a square to round plaster ring

Electrical Specifications

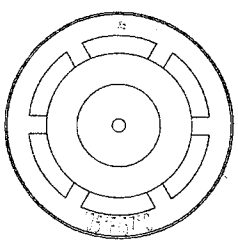
Operating Voltage / Contact Ratings	6–125VAC / 3A 6–28VDC / 1A 125VDC / 0.3A 250VDC / 0.1A
Input Terminals	14–22 AWG



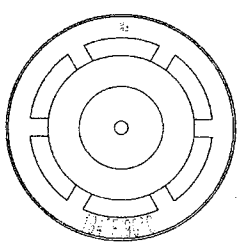
5601P



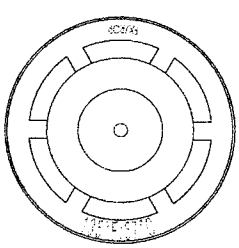
5602, 5622



5603, 5623



5604, 5624



5621

Ordering Information

Model	Circuit	Identification Method on Exterior	Temperature Rating	Activation	UL Protected Spacing – 10 Foot Ceiling*
5601P	Single	None	135°F (57°C)	Fixed Temperature / Rate-of-Rise	50 feet × 50 feet (15.24m × 15.2m)
5602	Single	Lettering	194°F (90°C)	Fixed Temperature / Rate-of-Rise	50 feet × 50 feet (15.24m × 15.2m)
5603	Single	Lettering	135°F (57°C)	Fixed Temperature	25 feet × 25 feet (7.62m × 7.62m)
5604	Single	Lettering	194°F (90°C)	Fixed Temperature	25 feet × 25 feet (7.62m × 7.62m)
5621	Dual	Lettering	135°F (57°C)	Fixed Temperature / Rate-of-Rise	50 feet × 50 feet (15.24m × 15.2m)
5622	Dual	Lettering	194°F (90°C)	Fixed Temperature / Rate-of-Rise	50 feet × 50 feet (15.24m × 15.2m)
5623	Dual	Lettering	135°F (57°C)	Fixed Temperature	25 feet × 25 feet (7.62m × 7.62m)
5624	Dual	Lettering	194°F (90°C)	Fixed Temperature	25 feet × 25 feet (7.62m × 7.62m)

*NOTE: Refer to NFPA72 guidelines for spacing reductions when ceiling heights exceed 10 feet.

SYSTEM SENSOR

3825 Ohio Avenue • St. Charles, IL 60174
Phone: 800-SENSOR2 • Fax: 630-377-6495

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7270-1653:0167

CATEGORY: 7270 -- HEAT DETECTOR

LISTEE: System Sensor, Unincorporated Div of Honeywell Int'l Inc.3825 Ohio Ave, St. Charles, IL 60174
Contact: Trish Linhart (630) 377-6580 Fax (630) 377-7245
Email: trish.linhart@systemsensor.com

DESIGN: Models 5601, 5601P, 5602, 5621, and 5622 combination fixed-temperature and rate-of-rise type and Models 5603, 5604, 5623, and 5624 fixed-temperature mechanical heat detectors. Refer to listee's data sheet for detailed product description and operational considerations.

RATING: Models 5601, 5601P, 5603, 5621, & 5623 have a fixed temperature of 135°F.

Models 5602, 5604, 5622, & 5624 have a fixed temperature of 194°F.

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, model number, temperature/electrical rating, and UL label.

APPROVAL: Listed as heat detectors for use with separately listed compatible fire alarm control units. Refer to listee's Installation Instruction Manual for details and UL directory for dimensions.

NOTE: Formerly 7270-1209:227

06-20-05

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Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***FRANCIS MATEO**, Program Coordinator*

Fire Engineering Division

FMM-1(A), FMM-101(A), FZM-1(A) & FDM-1(A)

Monitor Modules with FlashScan®

NOTIFIER® by Honeywell

Intelligent/Addressable Devices

General

Four different monitor modules are available for Notifier's intelligent control panels for a variety of applications. Monitor modules supervise a circuit of dry-contact input devices, such as conventional heat detectors and pull stations, or monitor and power a circuit of two-wire smoke detectors (FZM-1(A)).

FMM-1(A) is a standard-sized module (typically mounts to a 4" [10.16 cm] square box) that supervises either a Style D (Class A) or Style B (Class B) circuit of dry-contact input devices.

FMM-101(A) is a miniature monitor module a mere 1.3" (3.302 cm) H x 2.75" (6.985 cm) W x 0.5" (1.270 cm) D that supervises a Style B (Class B) circuit of dry-contact input devices. Its compact design allows the FMM-101(A) to be mounted in a single-gang box behind the device it monitors.

FZM-1(A) is a standard-sized module that monitors and supervises compatible two-wire, 24 volt, smoke detectors on a Style D (Class A) or Style B (Class B) circuit.

FDM-1(A) is a standard-sized dual monitor module that monitors and supervises two independent two-wire Style B (Class B) dry-contact initiating device circuits (IDCs) at two separate, consecutive addresses in intelligent, two-wire systems.

FlashScan® (U.S. Patent 5,539,389) is a communication protocol developed by NOTIFIER that greatly increases the speed of communication between analog intelligent devices. Intelligent devices communicate in a grouped fashion. If one of the devices within the group has new information, the panel CPU stops the group poll and concentrates on single points. The net effect is response speed greater than five times that of other designs.

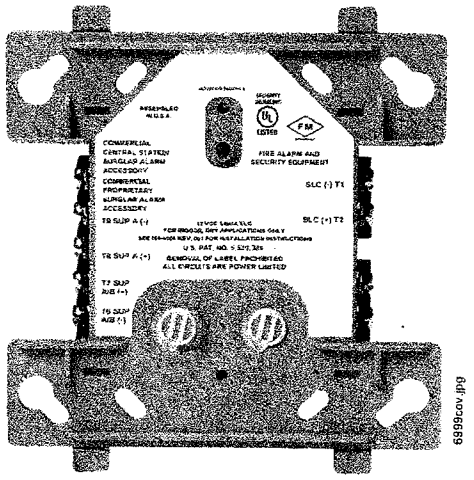
FMM-1(A) Monitor Module

- Built-in type identification automatically identifies this device as a monitor module to the control panel.
- Powered directly by two-wire SLC loop. No additional power required.
- High noise (EMF/RFI) immunity.
- SEMS screws with clamping plates for ease of wiring.
- Direct-dial entry of address: 01 – 159 on FlashScan loops; 01 – 99 on CLIP loops.
- LED flashes green during normal operation (this is a programmable option) and latches on steady red to indicate alarm.

The FMM-1(A) Monitor Module is intended for use in intelligent, two-wire systems, where the individual address of each module is selected using the built-in rotary switches. It provides either a two-wire or four-wire fault-tolerant Initiating Device Circuit (IDC) for normally-open-contact fire alarm and supervisory devices. The module has a panel-controlled LED indicator. The FMM-1(A) can be used to replace MMX-1(A) modules in existing systems.

FMM-1(A) APPLICATIONS

Use to monitor a zone of four-wire smoke detectors, manual fire alarm pull stations, waterflow devices, or other normally-open dry-contact alarm activation devices. May also be used to monitor normally-open supervisory devices with special supervisory indication at the control panel. Monitored circuit may be wired as an NFPA Style B (Class B) or Style D (Class A) Initiating Device Circuit. A 47K ohm End-of-Line Resistor (provided) terminates the Style B circuit. No resistor is required for supervision of the Style D circuit.



FMM-1(A) (Type H)

FMM-1(A) OPERATION

Each FMM-1(A) uses one of the available module addresses on an SLC loop. It responds to regular polls from the control panel and reports its type and the status (open/normal/short) of its Initiating Device Circuit (IDC). A flashing LED indicates that the module is in communication with the control panel. The LED latches steady on alarm (subject to current limitations on the loop).

FMM-1(A) SPECIFICATIONS

Nominal operating voltage: 15 to 32 VDC.

Maximum current draw: 5.0 mA (LED on).

Average operating current: 350 µA (LED flashing), 1 communication every 5 seconds, 47k EOL.

Maximum IDC wiring resistance: 40 ohms.

EOL resistance: 47K ohms.

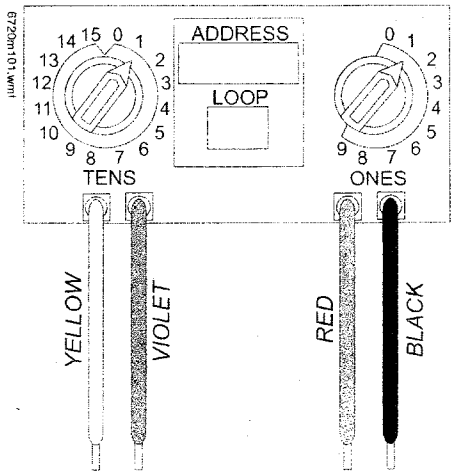
Temperature range: 32°F to 120°F (0°C to 49°C).

Humidity range: 10% to 93% noncondensing.

Dimensions: 4.5" (11.43 cm) high x 4" (10.16 cm) wide x 1.25" (3.175 cm) deep. Mounts to a 4" (10.16 cm) square x 2.125" (5.398 cm) deep box.

FMM-101(A) Mini Monitor Module

- Built-in type identification automatically identifies this device as a monitor module to the panel.
- Powered directly by two-wire SLC loop. No additional power required.
- High noise (EMF/RFI) immunity.
- Tinned, stripped leads for ease of wiring.
- Direct-dial entry of address: 01 – 159 on FlashScan loops; 01 – 99 on CLIP loops.



The FMM-101(A) Mini Monitor Module can be installed in a single-gang junction directly behind the monitored unit. Its small size and light weight allow it to be installed without rigid mounting. The FMM-101(A) is intended for use in intelligent, two-wire systems where the individual address of each module is selected using rotary switches. It provides a two-wire initiating device circuit for normally-open-contact fire alarm and security devices. The FMM-101(A) can be used to replace MMX-101(A) modules in existing systems.

FMM-101(A) APPLICATIONS

Use to monitor a single device or a zone of four-wire smoke detectors, manual fire alarm pull stations, waterflow devices, or other normally-open dry-contact devices. May also be used to monitor normally-open supervisory devices with special supervisory indication at the control panel. Monitored circuit/device is wired as an NFPA Style B (Class B) Initiating Device Circuit. A 47K ohm End-of-Line Resistor (provided) terminates the circuit.

FMM-101(A) OPERATION

Each FMM-101(A) uses one of the available module addresses on an SLC loop. It responds to regular polls from the control panel and reports its type and the status (open/normal/short) of its Initiating Device Circuit (IDC).

FMM-101(A) SPECIFICATIONS

Nominal operating voltage: 15 to 32 VDC.

Average operating current: 350 µA, 1 communication every 5 seconds, 47k EOL; 600 µA Max. (Communicating, IDC Shorted).

Maximum IDC wiring resistance: 40 ohms.

Maximum IDC Voltage: 11 Volts.

Maximum IDC Current: 400 µA.

EOL resistance: 47K ohms.

Temperature range: 32°F to 120°F (0°C to 49°C).

Humidity range: 10% to 93% noncondensing.

Dimensions: 1.3" (3.302 cm) high x 2.75" (6.985 cm) wide x 0.65" (1.651 cm) deep.

Wire length: 6" (15.24 cm) minimum.

FZM-1(A) Interface Module

- Supports compatible two-wire smoke detectors.
- Supervises IDC wiring and connection of external power source.
- High noise (EMF/RFI) immunity.
- SEMS screws with clamping plates for ease of wiring.
- Direct-dial entry of address: 01 – 159 on FlashScan loops, 01 – 99 on CLIP loops.
- LED flashes during normal operation; this is a programmable option.
- LED latches steady to indicate alarm on command from control panel.

The FZM-1(A) Interface Module is intended for use in intelligent, addressable systems, where the individual address of each module is selected using built-in rotary switches. This module allows intelligent panels to interface and monitor two-wire conventional smoke detectors. It transmits the status (normal, open, or alarm) of one full zone of conventional detectors back to the control panel. All two-wire detectors being monitored must be UL compatible with the module. The FZM-1(A) can be used to replace MMX-2(A) modules in existing systems.

FZM-1(A) APPLICATIONS

Use the FZM-1(A) to monitor a zone of two-wire smoke detectors. The monitored circuit may be wired as an NFPA Style B (Class B) or Style D (Class A) Initiating Device Circuit. A 3.9 K ohm End-of-Line Resistor (provided) terminates the end of the Style B or D (class B or A) circuit (maximum IDC loop resistance is 25 ohms). Install ELR across terminals 8 and 9 for Style D application.

FZM-1(A) OPERATION

Each FZM-1(A) uses one of the available module addresses on an SLC loop. It responds to regular polls from the control panel and reports its type and the status (open/normal/short) of its Initiating Device Circuit (IDC). A flashing LED indicates that the module is in communication with the control panel. The LED latches steady on alarm (subject to current limitations on the loop).

FZM-1(A) SPECIFICATIONS

Nominal operating voltage: 15 to 32 VDC.

Maximum current draw: 5.1 mA (LED on).

Maximum IDC wiring resistance: 25 ohms.

Average operating current: 300 µA, 1 communication and 1 LED flash every 5 seconds, 3.9k eol.

EOL resistance: 3.9K ohms.

External supply voltage (between Terminals T3 and T4): DC voltage: 24 volts power limited. Ripple voltage: 0.1 Vrms maximum. Current: 90 mA per module maximum.

Temperature range: 32°F to 120°F (0°C to 49°C).

Humidity range: 10% to 93% noncondensing.

Dimensions: 4.5" (11.43 cm) high x 4" (10.16 cm) wide x 1.25" (3.175 cm) deep. Mounts to a 4" (10.16 cm) square x 2.125" (5.398 cm) deep box.

FDM1(A) Dual Monitor Module

The FDM-1(A) Dual Monitor Module is intended for use in intelligent, two-wire systems. It provides two independent two-wire initiating device circuits (IDCs) at two separate, consecutive addresses. It is capable of monitoring normally open contact fire alarm and supervisory devices; or either normally open or normally closed security devices. The module has a single panel-controlled LED.

NOTE: *The FDM-1(A) provides two Style B (Class B) IDC circuits ONLY. Style D (Class A) IDC circuits are NOT supported in any application.*

FDM-1(A) SPECIFICATIONS

Normal operating voltage range: 15 to 32 VDC.

Maximum current draw: 6.4 mA (LED on).

Average operating current: 750 µA (LED flashing).

Maximum IDC wiring resistance: 1,500 ohms.

Maximum IDC Voltage: 11 Volts.

Maximum IDC Current: 240 µA

EOL resistance: 47K ohms.

Maximum SLC Wiring resistance: 40 Ohms.

Temperature range: 32° to 120°F (0° to 49°C).

Humidity range: 10% to 93% (non-condensing).

Dimensions: 4.5" (11.43 cm) high x 4" (10.16 cm) wide x 2.125" (5.398 cm) deep.

FDM-1(A) AUTOMATIC ADDRESSING

The FDM-1(A) automatically assigns itself to two addressable points, starting with the original address. For example, if the FDM-1(A) is set to address "26", then it will automatically assign itself to addresses "26" and "27".

NOTE: *"Ones" addresses on the FDM-1(A) are 0, 2, 4, 6, or 8 only. Terminals 6 and 7 use the first address, and terminals 8 and 9 use the second address.*

CAUTION:
Avoid duplicating addresses on the system.

Installation

FMM-1(A), FZM-1(A), and FDM-1(A) modules mount directly to a standard 4" (10.16 cm) square, 2.125" (5.398 cm) deep, electrical box. They may also be mounted to the SMB500 surface-mount box. Mounting hardware and installation instructions are provided with each module. All wiring must conform to applicable local codes, ordinances, and regulations. These modules are intended for power-limited wiring only.

The FMM-101(A) module is intended to be wired and mounted without rigid connections inside a standard electrical box. All wiring must conform to applicable local codes, ordinances, and regulations.

Agency Listings and Approvals

In some cases, certain modules may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

- **UL:** S635
- **ULC:** S635
- **FM Approved**
- **CSFM:** 7300-0028:0219
- **MEA:** 457-99-E
- **U.S. Coast Guard:**
  - 161.002/23/3 *(AFP-200: FMM-1/-101, FZM-1)*
  - 161.002/42/1 *(NFS-640: FMM-1/-101)*
- **Lloyd's Register:**
  - 03/60011/E1 *(FMM-1/-101, FZM-1)*
  - 94/60004/E2 *(AFP-200: except FDM-1)*
  - 02/60007 *(NFS-640: FDM-1)*
- **FDNY:** COA #6038 (NFS2-640, NFS-320), COA# 6058 (NFS2-3030)

Product Line Information

NOTE: *"A" suffix indicates ULC-listed model.*

FMM-1(A): Monitor module.

FMM-101(A): Monitor module, miniature.

FZM-1(A): Monitor module, two-wire detectors.

FDM-1(A): Monitor module, dual, two independent Class B circuits.

SMB500: Optional surface-mount backbox.

NOTE: *See installation instructions and refer to the SLC Wiring Manual, PN 51253.*

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ISO 9001 CERTIFIED
ENGINEERING & MANUFACTURING
QUALITY SYSTEMS

This document is not intended to be used for installation purposes.
We try to keep our product information up-to-date and accurate.
We cannot cover all specific applications or anticipate all requirements.
All specifications are subject to change without notice.

Made in the U.S. A.

For more information, contact Notifier. Phone: (203) 484-7161, FAX: (203) 484-7118.
www.notifier.com

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7300-0028:0219

CATEGORY: 7300 – FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES

LISTEE: NotifierOne Fire-Lite Place, Northford, CT 06472-1653
Contact: Vladimir Kireyev (203) 484-6277 Fax (203) 484-7309
Email: vladimir.kireyev@honeywell.com

DESIGN: Models XP6-R relay module, XP6-C, supervising control module, XP10-M input monitor module, XP6-MA six zone interface module, FMM-1, FMM-101, FZM-1, FSM-101, FDM-1, FTM-1 monitor modules, FCM-1, FRM-1 control modules, and *FDRM-1 with 2 input/2 output relay module. All devices are intended to be connected between the signaling line circuit of a compatible fire alarm control panel. Refer to listee's data sheet for additional detailed product description and operational considerations.

RATING: 16-33 VDC Primary

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes & ordinances and in manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, product number and UL label.

APPROVAL: Listed as control unit accessories for use with listee's separately listed compatible fire alarm control units. Model FTM-1 is intended to be used with Notifier Models NFS-640, NFS2-640 (CSFM Listing No. 7165-0028:214), NFS-3030, NFS2-3030 (CSFM Listing No. 7165-0028:224) Fire Alarm Control Units.

NOTE: If an external power supply is used for Model XP6-MA, the negative of the external power supply is referenced to the negative of the auxiliary supply of the compatible control panel. This is done in order to detect ground faults on the initiating circuit.

*Rev. 10-24-11 mt

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Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***MIKE TANAKA**, Program Coordinator*

Fire Engineering Division

SYSTEM SENSOR

Selectable-Output Horns, Strobes, and Horn Strobes

SpectrAlert® Advance selectable-output horns, strobes, and horn strobes are rich with features guaranteed to cut installation times and maximize profits.

SPECTRAlert ADVANCE from System Sensor

Features

- Plug-in design with minimal intrusion into the back box
- Tamper-resistant construction
- Automatic selection of 12- or 24-volt operation at 15 and 15/75 candela
- Field-selectable candela settings on wall and ceiling units: 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, and 185
- Horn rated at 88+ dBA at 16 volts
- Rotary switch for horn tone and three volume selections
- Universal mounting plate for wall and ceiling units
- Mounting plate shorting spring checks wiring continuity before device installation
- Electrically compatible with existing SpectrAlert products
- Compatible with MDL sync module

The SpectrAlert Advance series offers the most versatile and easy-to-use line of horns, strobes, and horn strobes in the industry. With white and red plastic housings, wall and ceiling mounting options, and plain and FIRE-printed devices, SpectrAlert Advance can meet virtually any application requirement.

Like the entire SpectrAlert Advance product line, horns, strobes, and horn strobes include a variety of features that increase their application versatility while simplifying installation. All devices feature plug-in designs with minimal intrusion into the back box, which make installations fast and foolproof while virtually eliminating costly and time-consuming ground faults. Furthermore, a universal mounting plate with an onboard shorting spring tests wiring continuity before the device is installed, protecting devices from damage.

In addition, field-selectable candela settings, automatic selection of 12- or 24-volt operation, and a rotary switch for horn tones with three volume selections enables installers to easily adapt devices to suit a wide range of application requirements.

Agency Listings

SIGNALING UL LISTED

FM APPROVED

MEA approved

SpectrAlert Advance Specifications

Architect/Engineer Specifications

General

SpectrAlert Advance horns, strobes, and horn strobes shall mount to a standard 4 × 4 × 1½-inch back box, 4-inch octagon back box, or double-gang back box. Two-wire products shall also mount to a single-gang 2 × 4 × 1⅞-inch back box. A universal mounting plate shall be used for mounting ceiling and wall products. The notification appliance circuit wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance products, when used with the Sync-Circuit™ Module accessory, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts. When used with the Sync-Circuit Module, 12-volt-rated notification appliance circuit outputs shall operate between 9 and 17.5 volts, 24-volt-rated notification appliance circuit outputs shall operate between 17 and 33 volts. Indoor SpectrAlert Advance products shall operate between 32 and 120 degrees Fahrenheit from a regulated DC or full-wave rectified unfiltered power supply. Strobes and horn strobes shall have field-selectable candela settings including 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, and 185.

Strobe

The strobe shall be a System Sensor SpectrAlert Advance Model _____ listed to UL 1971 and shall be approved for fire protective service. The strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

Horn Strobe Combination

The horn strobe shall be a System Sensor SpectrAlert Advance Model _____ listed to UL 1971 and UL 464 and shall be approved for fire protective service. The horn strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have three audibility options and an option to switch between a temporal three-pattern and a non-temporal (continuous) pattern. These options are set by a multiple position switch. On four-wire products, the strobe shall be powered independently of the sounder. The horn on horn strobe models shall operate on a coded or non-coded power supply.

Synchronization Module

The module shall be a System Sensor Sync-Circuit model MDL listed to UL 464 and shall be approved for fire protective service. The module shall synchronize SpectrAlert strobes at 1 Hz and horns at temporal three. Also, while operating the strobes, the module shall silence the horns on horn strobe models over a single pair of wires. The module shall mount to a 4⅛ × 4⅛ × 2⅛-inch back box. The module shall also control two Style Y (class B) circuits or one Style Z (class A) circuit. The module shall synchronize multiple zones. Daisy chaining two or more synchronization modules together will synchronize all the zones they control. The module shall not operate on a coded power supply.

Physical/Electrical Specifications

Standard Operating Temperature	32°F to 120°F (0°C to 49°C)
Humidity Range	10 to 93% non-condensing
Strobe Flash Rate	1 flash per second
Nominal Voltage	Regulated 12 DC/FWR or regulated 24 DC/FWR[1]
Operating Voltage Range[2]	8 to 17.5 V (12 V nominal) or 16 to 33 V (24 V nominal)
Input Terminal Wire Gauge	12 to 18 AWG
Ceiling-Mount Dimensions (including lens)	6.8" diameter × 2.5" high (173 mm diameter × 64 mm high)
Wall-Mount Dimensions (including lens)	5.6"L × 4.7"W × 2.5"D (142 mm L × 119 mm W × 64 mm D)
Horn Dimensions	5.6"L × 4.7"W × 1.3"D (142 mm L × 119 mm W × 33 mm D)
Wall-Mount Back Box Skirt Dimensions (BBS-2, BBSW-2)	5.9"L × 5.0"W × 2.2"D (151 mm L × 128 mm W × 56 mm D)
Ceiling-Mount Back Box Skirt Dimensions (BBSC-2, BBSCW-2)	7.1" diameter × 2.2" high (180 mm diameter × 57 mm high)
Wall-Mount Trim Ring Dimensions (sold as a 5 pack) (TR-HS, TRW-HS)	5.7"L × 4.8"W × 0.35"D (145 mm L × 122 mm W × 9 mm D)
Ceiling-Mount Trim Ring Dimensions (sold as a 5 pack) (TRC-HS, TRCW-HS)	6.9" diameter × 0.35" high (175 mm diameter × 9 mm high)

Notes:

1. Full Wave Rectified (FWR) voltage is a non-regulated, time-varying power source that is used on some power supply and panel outputs.
2. P, S, PC, and SC products will operate at 12 V nominal only for 15 and 15/75 cd.

UL Current Draw Data

UL Max. Strobe Current Draw (mA RMS)

		8–17.5 Volts		16–33 Volts	
	Candela	DC	FWR	DC	FWR
Standard Candela Range	15	123	128	66	71
	15/75	142	148	77	81
	30	NA	NA	94	96
	75	NA	NA	158	153
	95	NA	NA	181	176
	110	NA	NA	202	195
	115	NA	NA	210	205
High Candela Range	135	NA	NA	228	207
	150	NA	NA	246	220
	177	NA	NA	281	251
	185	NA	NA	286	258

UL Max. Horn Current Draw (mA RMS)

		8–17.5 Volts		16–33 Volts	
Sound Pattern	dB	DC	FWR	DC	FWR
Temporal	High	57	55	69	75
Temporal	Medium	44	49	58	69
Temporal	Low	38	44	44	48
Non-temporal	High	57	56	69	75
Non-temporal	Medium	42	50	60	69
Non-temporal	Low	41	44	50	50
Coded	High	57	55	69	75
Coded	Medium	44	51	56	69
Coded	Low	40	46	52	50

UL Max. Current Draw (mA RMS), 2-Wire Horn Strobe, Standard Candela Range (15–115 cd)

	8–17.5 Volts		16–33 Volts						
DC Input	15	15/75	15	15/75	30	75	95	110	115
Temporal High	137	147	79	90	107	176	194	212	218
Temporal Medium	132	144	69	80	97	157	182	201	210
Temporal Low	132	143	66	77	93	154	179	198	207
Non-Temporal High	141	152	91	100	116	176	201	221	229
Non-Temporal Medium	133	145	75	85	102	163	187	207	216
Non-Temporal Low	131	144	68	79	96	156	182	201	210
FWR Input									
Temporal High	136	155	88	97	112	168	190	210	218
Temporal Medium	129	152	78	88	103	160	184	202	206
Temporal Low	129	151	76	86	101	160	184	194	201
Non-Temporal High	142	161	103	112	126	181	203	221	229
Non-Temporal Medium	134	155	85	95	110	166	189	208	216
Non-Temporal Low	132	154	80	90	105	161	184	202	211

UL Max. Current Draw (mA RMS), 2-Wire Horn Strobe, High Candela Range (135–185 cd)

	16–33 Volts					16–33 Volts			
DC Input	135	150	177	185	FWR Input	135	150	177	185
Temporal High	245	259	290	297	Temporal High	215	231	258	265
Temporal Medium	235	253	288	297	Temporal Medium	209	224	250	258
Temporal Low	232	251	282	292	Temporal Low	207	221	248	256
Non-Temporal High	255	270	303	309	Non-Temporal High	233	248	275	281
Non-Temporal Medium	242	259	293	299	Non-Temporal Medium	219	232	262	267
Non-Temporal Low	238	254	291	295	Non-Temporal Low	214	229	256	262

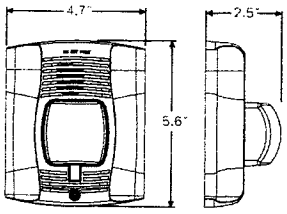
Horn Tones and Sound Output Data

Horn and Horn Strobe Output (dBA)

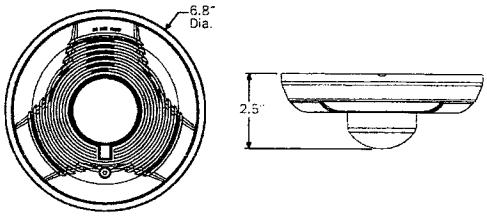
			8–17.5 Volts		16–33 Volts		24-Volt Nominal			
							Reverberant		Anechoic	
Switch Position	Sound Pattern	dB	DC	FWR	DC	FWR	DC	FWR	DC	FWR
1	Temporal	High	78	78	84	84	88	88	99	98
2	Temporal	Medium	74	74	80	80	86	86	96	96
3	Temporal	Low	71	73	76	76	83	80	94	89
4	Non-Temporal	High	82	82	88	88	93	92	100	100
5	Non-Temporal	Medium	78	78	85	85	90	90	98	98
6	Non-Temporal	Low	75	75	81	81	88	84	96	92
7*	Coded	High	82	82	88	88	93	92	101	101
8*	Coded	Medium	78	78	85	85	90	90	97	98
9*	Coded	Low	75	75	81	81	88	85	96	92

*Settings 7, 8, and 9 are not available on 2-wire horn strobe

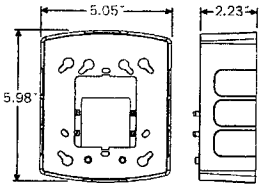
SpectrAlert Advance Dimensions



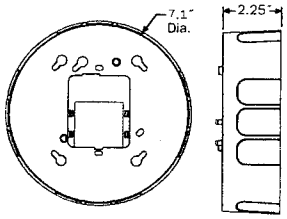
Wall-mount horn strobes



Ceiling-mount horn strobes



Wall back box skirt



Ceiling back box skirt

SpectrAlert Advance Ordering Information

Model	Description
Wall Horn Strobes	
P2R*†	2-Wire Horn Strobe, Standard cd‡, Red
P2RH*	2-Wire Horn Strobe, High cd, Red
P2W*	2-Wire Horn Strobe, Standard cd, White
P2WH*	2-Wire Horn Strobe, High cd, White
P4R*	4-Wire Horn Strobe, Standard cd, Red
P4RH	4-Wire Horn Strobe, High cd, Red
P4W	4-Wire Horn Strobe, Standard cd, White
Wall Strobes	
SR*†	Strobe, Standard cd, Red
SRH*†	Strobe, High cd, Red
SW*	Strobe, Standard cd, White
SWH*	Strobe, High cd, White
Ceiling Horn Strobes	
PC2R*	2-Wire Horn Strobe, Standard cd, Red
PC2RH	2-Wire Horn Strobe, High cd, Red
PC2W*†	2-Wire Horn Strobe, Standard cd, White
PC2WH*	2-Wire Horn Strobe, High cd, White
PC4R	4-Wire Horn Strobe, Standard cd, Red
PC4RH	4-Wire Horn Strobe, High cd, Red
PC4W	4-Wire Horn Strobe, Standard cd, White

Model	Description
Ceiling Strobes	
SCR	Strobe, Standard cd, Red
SCRH	Strobe, High cd, Red
SCW*	Strobe, Standard cd, White
SCWH	Strobe, High cd, White
Horns	
HR	Horn, Red
HW	Horn, White
Accessories	
BBS-2	Back Box Skirt, Wall, Red
BBSW-2	Back Box Skirt, Wall, White
BBSC-2	Back Box Skirt, Ceiling, Red
BBSCW-2	Back Box Skirt, Ceiling, White
TR-HS	Trim Ring, Wall, Red
TRW-HS	Trim Ring, Wall White
TRC-HS	Trim Ring, Ceiling, Red
TRCW-HS	Trim Ring, Ceiling, White

Notes:

* Add "-P" to model number for plain housing (no "FIRE" marking on cover), e.g., P2R-P

† Add "-SP" to model number for "FUEGO" marking on cover, e.g., P2R-SP

‡ "Standard cd" refers to strobes that include 15, 15/75, 30, 75, 95, 110, and 115 candela settings. "High cd" refers to strobes that include 135, 150, 177, and 185 candela settings

SYSTEM SENSOR

3825 Ohio Avenue • St. Charles, IL 60174
Phone: 800-SENSOR2 • Fax: 630 377 6495

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Product specifications subject to change without notice. Visit systemsensor.com for current product information, including the latest version of this data sheet.

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7125-1653:0188

CATEGORY: 7125 – FIRE ALARM DEVICES FOR THE HEARING IMPAIRED

LISTEE: System Sensor, Unincorporated Div of Honeywell Int'l Inc.3825 Ohio Ave, St. Charles, IL 60174
Contact: Trish Linhart (630) 377-6580 Fax (630) 377-7245
Email: trish.linhart@systemsensor.com

DESIGN: Models CHSR and CHSW Chime/Strobes.
Models P2R, P2W, P2RH and P2WH Horn/Strobes two-wire type, rectangular enclosure.
Models PC2R, PC2W, PC2RH and PC2WH Horn/Strobes two-wire type, round enclosure
Models P4R, P4W, P4RH and P4WH Horn/Strobes four-wire type, rectangular enclosure.
Models PC4R, PC4W, PC4RH and PC4WH Horn/Strobes* four-wire type, round enclosure.
All models are intended for indoor use only unless other wise indicated. Models may be followed by the suffix "K" indicating indoor or outdoor use, or may be followed by suffix "P" for plain housing with no lettering. "K" suffix models are suitable for outdoor applications at temperatures from -40°F to +151°F (-40°C to +66°C) and are rated NEMA 4X when used with the System Sensor weather proof back boxes models SA-WBB (Wall), SA-WBBW (Wall), SA-WBBC (Ceiling) and *SA-WBBCW (Ceiling). Refer to listee's data sheet for additional detailed product description and operational considerations.

RATING: Standard Horn/Strobes and Chime/Strobes 8 - 17.5 or 16-33 VDC/FWR
Hi CD Horn/Strobes 16-33 VDC/FWR

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes and ordinances, and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, model number, electrical rating, and UL label.

APPROVAL: Listed as *horn/strobes or chime/strobes suitable for signaling appliances and equipment for the hearing impaired applications when used with separately listed compatible fire alarm control units. Horn/strobes with -K suffix are suitable for indoor or outdoor use, ceiling or wall mount. Chime section is suitable for private mode and indoor use only.
Horn/Strobes or chime/strobes* can generate the distinctive three-pulse audible Temporal Pattern Fire Alarm Evacuation Signal (for total evacuation) in accordance with NFPA 72, 2010 Edition. Refer to listee's Installation Instruction Manual for details.

*Corrected 12-15-11 bh

This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other

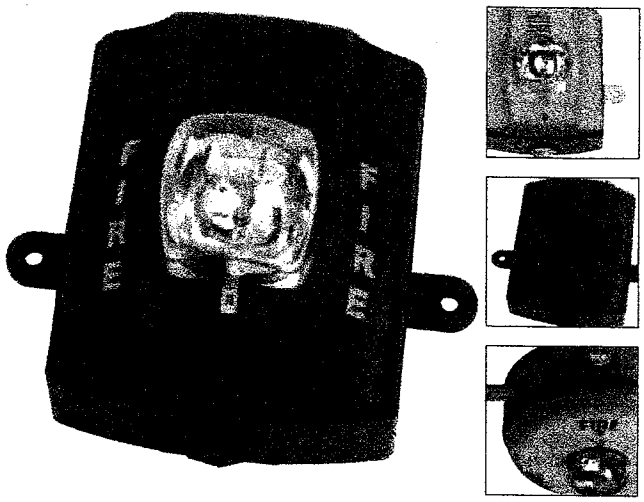
Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***BEN HO**, Division Chief*

Fire Engineering Division

SYSTEM SENSOR

Outdoor Selectable-Output Horns, Strobes, and Horn Strobes



SpectrAlert® Advance outdoor selectable-output horns, strobes, and horn strobes are rich with features that cut installation times and maximize profits.

SPECTRAlert ADVANCE from System Sensor

Features

- Automatic selection of 12- or 24-volt operation at 15 and 15/75 candela
- Field-selectable candela settings on wall and ceiling units: 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, and 185
- Plug-in design with minimal intrusion into the back box
- Tamper-resistant construction
- Universal mounting plate for wall- and ceiling-mount units
- Mounting plate shorting spring tests wiring continuity before devices are installed
- Weatherproof per NEMA 4X, IP56
- Listed to UL 1638 (strobe) and UL 464 (horn)
- Rated from –40°F to 151°F
- Horn rated at 88+ dBA at 16 volts
- Rotary switch for horn tone and three volume selections
- Compatible with System Sensor synchronization protocol and legacy SpectrAlert products

The SpectrAlert Advance series offers the broadest line of outdoor horns, strobes, and horn strobes in the industry. With white and red plastic housings, wall and ceiling mounting options, and plain and FIRE-printed devices, SpectrAlert Advance can meet virtually any application requirement.

SpectrAlert Advance outdoor horns, strobes, and horn strobes can be used indoors or outdoors in wet or dry applications, and can provide reliable operation from –40°F to 151°F.

Like the entire SpectrAlert Advance product line, these devices include a variety of features that increase their application versatility while simplifying installation. All devices feature plug-in designs with minimal intrusion into the back box, which make installations fast and foolproof while virtually eliminating costly and time-consuming ground faults.

All horns, strobes, and horn strobes use a universal mounting plate with an onboard shorting spring that tests wiring continuity before the device is installed, protecting devices from damage. In addition, field-selectable candela settings, automatic selection of 12- or 24-volt operation, and a rotary switch for horn tones with three volume selections enables installers to easily adapt devices to suit a wide range of application requirements.

Agency Listings

SIGNALING UL LISTED

FM APPROVED

MEA approved

SpectrAlert Advance Outdoor Horn, Strobe, and Horn Strobe Specifications

Architect/Engineer Specifications

General

SpectrAlert Advance outdoor horns, strobes and horn strobes shall mount to a weatherproof back box. A universal mounting plate shall be used for mounting ceiling and wall products. The notification appliance circuit wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance products, when used with the Sync-Circuit™ Module accessory, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts. When used with the Sync-Circuit Module, 12-volt-rated notification appliance circuit outputs shall operate between 9 and 17.5 volts; 24-volt-rated notification appliance circuit outputs shall operate between 17 and 33 volts. Outdoor SpectrAlert Advance products shall operate between –40 and 151 degrees Fahrenheit from a regulated DC or full-wave rectified unfiltered power supply. Strobes and horn strobes shall have field-selectable candela settings including 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, and 185.

Strobe

The strobe shall be a System Sensor SpectrAlert Advance Model _____ listed to UL 1971 and shall be approved for fire protective service. The strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The strobe must be installed with its weatherproof back box in order to remain outdoor approved per UL. The strobe shall be suitable for use in wet environments.

Horn Strobe Combination

The horn strobe shall be a System Sensor SpectrAlert Advance Model _____ listed to UL 1971 and UL 464 and shall be approved for fire protective service. The horn strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have three audibility options and an option to switch between a temporal three-pattern and a non-temporal (continuous) pattern. These options shall be set by a multiple position switch. On four-wire products, the strobe shall be powered independently of the sounder. The horn or horn strobe models shall operate on a coded or non-coded power supply. The horn strobe must be installed with its weatherproof back box in order to remain outdoor approved per UL. The horn strobe shall be suitable for use in wet environments.

Physical/Electrical Specifications

Operating Temperature	–40°F to 151°F (–40°C to 66°C)
Strobe Flash Rate	1 flash per second
Nominal Voltage	Regulated 12 DC/FWR or regulated 24 DC/FWR[1]
Operating Voltage Range[2]	8 to 17.5 V (12 V nominal) or 16 to 33 V (24 V nominal)
Input Terminal Wire Gauge	12 to 18 AWG
Ceiling-Mount Dimensions (including lens)	6.8" diameter × 2.5" high (173 mm diameter × 64 mm high)
Wall-Mount Dimensions (including lens)	5.6" L × 4.7" W × 2.5" D (142 mm L × 119 mm W × 64 mm D)
Horn Dimensions	5.6" L × 4.7" W × 1.3" D (142 mm L × 119 mm W × 33 mm D)
Wall-Mount Weatherproof Back Box Dimensions (SA-WBB)	5.7" L × 5.1" W × 2.0" D (145 mm L × 130 mm W × 51 mm D)
Ceiling-Mount Weatherproof Back Box Dimensions (SA-WBBC)	7.1" diameter × 2.0" high (180 mm diameter × 51 mm high)

Notes:

1. Full Wave Rectified (FWR) voltage is a non-regulated, time-varying power source that is used on some power supply and panel outputs.
2. P, S, PC, and SC products will operate at 12 V nominal only for 15 and 15/75 cd.

UL Current Draw Data

UL Max. Strobe Current Draw (mA RMS)

		8–17.5 Volts		16–33 Volts	
	Candela	DC	FWR	DC	FWR
Standard Candela Range	15	123	128	66	71
	15/75	142	148	77	81
	30	NA	NA	94	96
	75	NA	NA	158	153
	95	NA	NA	181	176
	110	NA	NA	202	195
	115	NA	NA	210	205
High Candela Range	135	NA	NA	228	207
	150	NA	NA	246	220
	177	NA	NA	281	251
	185	NA	NA	286	258

UL Max. Horn Current Draw (mA RMS)

		8–17.5 Volts		16–33 Volts	
Sound Pattern	dB	DC	FWR	DC	FWR
Temporal	High	57	55	69	75
Temporal	Medium	44	49	58	69
Temporal	Low	38	44	44	48
Non-Temporal	High	57	56	69	75
Non-Temporal	Medium	42	50	60	69
Non-Temporal	Low	41	44	50	50
Coded	High	57	55	69	75
Coded	Medium	44	51	56	69
Coded	Low	40	46	52	50

UL Max. Current Draw (mA RMS), 2-Wire Horn Strobe, Standard Candela Range (15–115 cd)

	8–17.5 Volts		16–33 Volts						
DC Input	15	15/75	15	15/75	30	75	95	110	115
Temporal High	137	147	79	90	107	176	194	212	218
Temporal Medium	132	144	69	80	97	157	182	201	210
Temporal Low	132	143	66	77	93	154	179	198	207
Non-Temporal High	141	152	91	100	116	176	201	221	229
Non-Temporal Medium	133	145	75	85	102	163	187	207	216
Non-Temporal Low	131	144	68	79	96	156	182	201	210
FWR Input									
Temporal High	136	155	88	97	112	168	190	210	218
Temporal Medium	129	152	78	88	103	160	184	202	206
Temporal Low	129	151	76	86	101	160	184	194	201
Non-Temporal High	142	161	103	112	126	181	203	221	229
Non-Temporal Medium	134	155	85	95	110	166	189	208	216
Non-Temporal Low	132	154	80	90	105	161	184	202	211

UL Max. Current Draw (mA RMS), 2-Wire Horn Strobe, High Candela Range (135–185 cd)

	16–33 Volts					16–33 Volts			
DC Input	135	150	177	185	FWR Input	135	150	177	185
Temporal High	245	259	290	297	Temporal High	215	231	258	265
Temporal Medium	235	253	288	297	Temporal Medium	209	224	250	258
Temporal Low	232	251	282	292	Temporal Low	207	221	248	256
Non-Temporal High	255	270	303	309	Non-Temporal High	233	248	275	281
Non-Temporal Medium	242	259	293	299	Non-Temporal Medium	219	232	262	267
Non-Temporal Low	238	254	291	295	Non-Temporal Low	214	229	256	262

Candela Derating

For K series products used at low temperatures, listed candela ratings must be reduced in accordance with this table.

Strobe Output (cd)

Listed Candela	Candela rating at -40°F
15	Do not use below 32°F
15/75	
30	
75	44
95	70
110	110
115	115
135	135
150	150
177	177
185	185

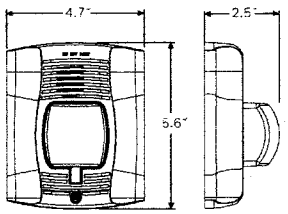
Horn Tones and Sound Output Data

Horn and Horn Strobe Output (dBA)

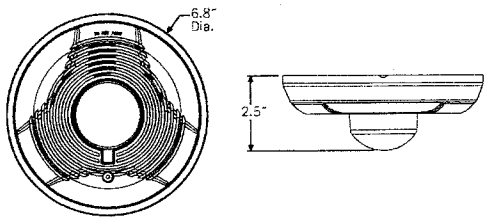
			8–17.5 Volts		16–33 Volts		24-Volt Nominal			
							Reverberant		Anechoic	
Switch Position	Sound Pattern	dB	DC	FWR	DC	FWR	DC	FWR	DC	FWR
1	Temporal	High	78	78	84	84	88	88	99	98
2	Temporal	Medium	74	71	80	80	86	86	96	96
3	Temporal	Low	71	73	76	76	83	80	94	89
4	Non-Temporal	High	82	82	88	88	93	92	100	100
5	Non-Temporal	Medium	78	78	85	85	90	90	98	98
6	Non-Temporal	Low	75	75	81	81	88	84	96	92
7*	Coded	High	82	82	88	88	93	92	101	101
8*	Coded	Medium	78	78	85	85	90	90	97	98
9*	Coded	Low	75	75	81	81	88	85	96	92

*Settings 7, 8, and 9 are not available on 2-wire horn strobe.

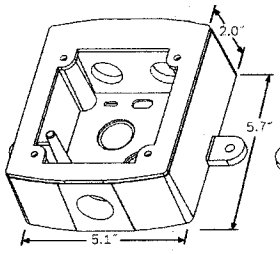
SpectrAlert Advance Dimensions



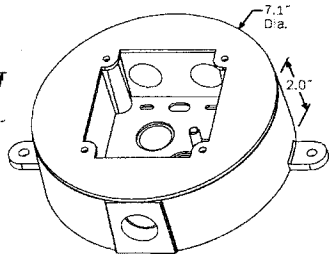
Wall-mount horn strobes



Ceiling-mount horn strobes



Wall weatherproof back box



Ceiling weatherproof back box

SpectrAlert Advance Ordering Information

Model	Description
Wall Horn Strobes	
P2RK*†	2-Wire Horn Strobe, Standard cd, Red, Outdoor
P2RHK*†	2-Wire Horn Strobe, High cd, Red, Outdoor
P2WK*†	2-Wire Horn Strobe, Standard cd, White, Outdoor
P2WHK*†	2-Wire Horn Strobe, High cd, White, Outdoor
P4RK†	4-Wire Horn Strobe, Standard cd, Red, Outdoor
P4WK	4-Wire Horn Strobe, Standard cd, White, Outdoor
P2RHK-120	2-Wire Horn Strobe, High cd, Red, Outdoor, 120 V
Wall Strobes	
SRK*†	Strobe, Standard cd, Red, Outdoor
SRHK*†	Strobe, High cd, Red, Outdoor
SWK*†	Strobe, Standard cd, White, Outdoor
SWHK*†	Strobe, High cd, White, Outdoor

Model	Description
Ceiling Horn Strobes	
PC2RK	2-Wire Horn Strobe, Standard cd, Red, Outdoor
PC2RHK	2-Wire Horn Strobe, High cd, Red, Outdoor
PC2WK	2-Wire, Horn Strobe, Standard cd, White, Outdoor
PC2WHK	2-Wire, Horn Strobe High cd, White, Outdoor
PC4WK	4-Wire, Horn Strobe, Standard cd, White, Outdoor
PC4WHK	4-Wire, Horn Strobe, High cd, White, Outdoor
Ceiling Strobes	
SCRK	Strobe, Standard cd, Red, Outdoor
SCRHK	Strobe, High cd, Red, Outdoor
SCWK	Strobe, Standard cd, White, Outdoor
SCWHK	Strobe, High cd, White, Outdoor
Horns	
HRK	Horn, Red, Outdoor

Notes:

* Add "-P" to model number for plain housing (no "FIRE" marking on cover), e.g., P2RK-P

† Add "-R" to model number for weatherproof replacement device (no back box included), only for use with weatherproof outdoor flush mounting plate, WTP and WTPW.

"Standard cd" refers to strobes that include 15, 15/75, 30, 75, 95, 110, and 115 candela settings. "High cd" refers to strobes that include 135, 150, 177, and 185 candela settings.

When replacing standard outdoor units both the device and back box must be replaced.

SYSTEM SENSOR

3825 Ohio Avenue • St. Charles, IL 60174
Phone: 800-SENSOR2 • Fax: 630-377-6495

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Product specifications subject to change without notice. Visit systemsensor.com for current product information, including the latest version of this data sheet.
A05-0456-002 • 11/09 • #2253

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7135-1653:0189

CATEGORY: 7135 – AUDIBLE DEVICES

LISTEE: System Sensor, Unincorporated Div of Honeywell Int'l Inc.3825 Ohio Ave, St. Charles, IL 60174
Contact: Trish Linhart (630) 377-6580 Fax (630) 377-7245
Email: trish.linhart@systemsensor.com

DESIGN: Models HR, HW Horns and CHR, CHW chimes. Intended for indoor use only unless otherwise indicated. Models may be followed by the suffix "K" indicating indoor or outdoor use. "K" suffice models are suitable for outdoor applications at temperatures from -40°F to +151°F (-40°C to +66°C) and are rated NEMA *4X when used with the System Sensor weather proof back boxes models SA-WBB (Wall), *SA-WBBW (Wall), SA-WBBC (Ceiling) and *SA-WBBCW (Ceiling). Models CHR and CHW are intended for private mode use only. Suitable for wall or ceiling mount.
Refer to listee's data sheet for additional detailed product description and operational considerations.

RATING: 8 - 17.5 or 16-33 VdcAVFWR

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes and ordinances, and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, model number, electrical rating, and UL label.

APPROVAL: Listed as audible devices when used with separately listed compatible fire alarm control units.

Units can generate the distinctive three-pulse Temporal Pattern Fire Alarm Evacuation Signal (for total evacuation) in accordance with NFPA 72, 2002 Edition. Refer to listee's Installation Instruction Manual for details.

*Rev 12-01-08 bh

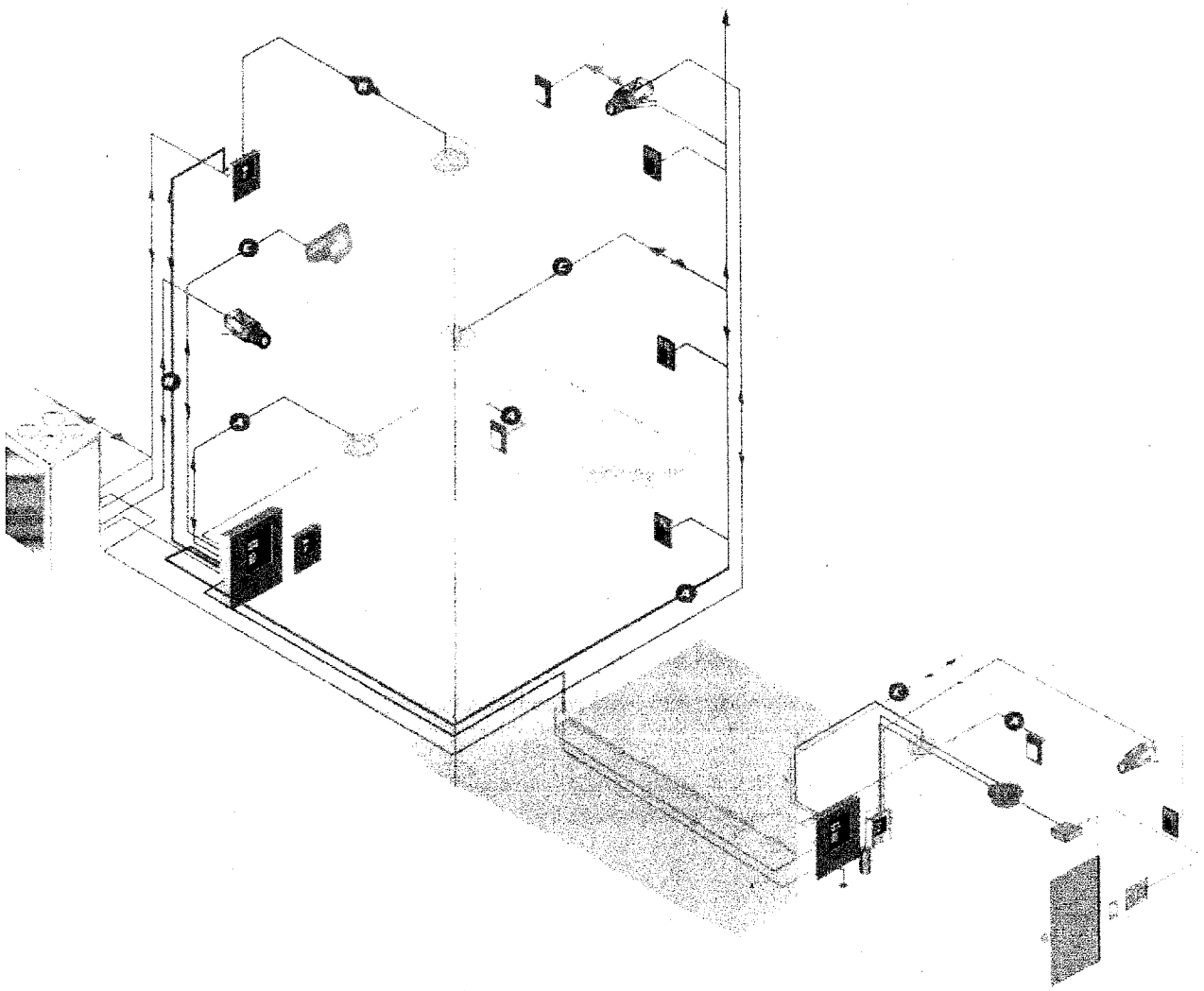
This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other

Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***FRANCIS MATEO**, Program Coordinator*

Fire Engineering Division

FIRE ALARM CABLES



WEST PENN WIRE

800-245-4964

www.westpenn-wpw.com

PRODUCT INDEX:

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Fire Alarm Cables
Power-Limited Multiple Conductor/
Unshielded

Description:

• ASTM bare copper • PVC insulation • Twisted pair or cabled construction • Overall PVC jacket

Rating:

• NEC Type FPLR
• (UL) Listed
• Meets 300V requirements as specified in the NEC
• Flame Rating: UL1666

Applications:

Indoor for:
• Audio Circuits
• Control Circuits
• Initiating Circuits
• Notification Circuits

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
980	1 Pair	18 AWG Solid 6.5 Ω/Mft	PVC .008	None	PVC .017	.146	FPLR	29 pf/ft*	RD, BL, WH, YE
982	4	18 AWG Solid 6.5 Ω/Mft	PVC .008	None	PVC .017	.170	FPLR	29 pf/ft*	RD, BL, WH, YE
990	1 Pair	16 AWG Solid 4.1 Ω/Mft	PVC .008	None	PVC .017	.168	FPLR	32 pf/ft*	RD, BL, WH, YE
992	4	16 AWG Solid 4.1 Ω/Mft	PVC .008	None	PVC .017	.198	FPLR	32 pf/ft*	Red
994	1 Pair	14 AWG Solid 2.6 Ω/Mft	PVC .012	None	PVC .017	.210	FPLR	35 pf/ft*	RD, BL, WH, YE
700	4	14 AWG Solid 2.6 Ω/Mft	PVC .012	None	PVC .017	.246	FPLR	35 pf/ft*	Red
998	1 Pair	12 AWG Solid 1.8 Ω/Mft	PVC .012	None	PVC .017	.244	FPLR	45 pf/ft*	Red

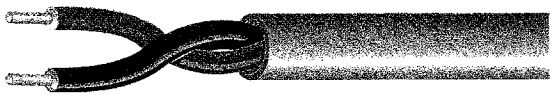
Special Notes:

• Selected Plenum Versions see pages 52
• Selected Indoor/Outdoor Aquaseal Water Resistant® Versions see Aquaseal Section pg.43
• Select Items are Packaged in our Advantage Box
• Orange rip cord under jacket

Tracer Marks:
Available upon Request: Minimum Quantities may apply
Example:- On a Red Jacket only
980T-GN
T- Tracer
GN- Green Tracer

800-245-4964 • www.wes nn-wpw.com

Fire Alarm Cables
Power-Limited/ Unshielded
Plenecon II ® Extra Flexible



Description:

- ASTM bare copper • Polymer alloy insulation
- Twisted pair or cabled construction • Flexible plenum jacket

Applications:

Indoor within ducts,plenums and other spaces used for environmental air:

- Audio Circuits
- Control Circuits
- Initiating Circuits
- Notification Circuits

Rating:

- NEC Type FPLP
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: NFPA-262 Smoke & Flame Test

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
60980B	1 Pair	18 AWG Solid 6.5 Ω/Mft	.008	None	.015	.144	FPLP	29 pf/ft*	Red
60982B	4	18 AWG Solid 6.5 Ω/Mft	.008	None	.015	.166	FPLP	29 pf/ft*	Red
60991B	1 Pair	16 AWG Solid 4.1 Ω/Mft	.008	None	.015	.164	FPLP	32 pf/ft*	RD, BL, OR, WH, YE
60164B	4	16 AWG Solid 4.1 Ω/Mft	.008	None	.015	.191	FPLP	32 pf/ft*	Red
60993B	1 Pair	14 AWG Solid 2.6 Ω/Mft	.010	None	.015	.198	FPLP	35 pf/ft*	RD, BL, YE
60700B	4	14 AWG Solid 2.6 Ω/Mft	.010	None	.015	.236	FPLP	35 pf/ft*	Red
60995B	1 Pair	12 AWG Solid 1.8 Ω/Mft	.010	None	.015	.239	FPLP	45 pf/ft*	Red

* Capacitance between conductors.

Special Notes:

- Plenum Installation precautions see Technical Reference Section pg.196
- Select Items are Packaged in our Advantage Box

Tracer Marks:
Available upon Request: Minimum Quantities may apply
Example:- On a Red Jacket only
60980BT-GN
T- Tracer
GN- Green Tracer

Color Code	
All Cables	1.Black, 2. Red, 3. Brown, 4. Blue
	JACKET: Red RD- Red, BL-Blue, OR-Orange, WH-White, YE- Yellow

Stranded Conductor Fire Alarm Cables
Power-Limited Multiple Conductor/ Unshielded

Description:

• ASTM Stranded bare copper • PVC insulation • Twisted pair or cabled construction • Overall PVC jacket

Rating:

• NEC Type FPLR
• (UL) Listed
• Meets 300V requirements as specified in the NEC
• Flame Rating: UL1666

NEW

Applications:

Indoor for:
• Audio Circuits
• Control Circuits
• Initiating Circuits
• Notification Circuits

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
990S	1 Pair	16 AWG Strd. 4.1 Ω/Mft	PVC .009	None	PVC .017	.182	FPLR	32 pf/ft*	Red
994S	1 Pair	14 AWG Strd. 2.6 Ω/Mft	PVC .010	None	PVC .017	.224	FPLR	35 pf/ft*	Red
998S	1 Pair	12 AWG Strd. 1.8 Ω/Mft	PVC .010	None	PVC .017	.260	FPLR	45 pf/ft*	Red

Stranded Conductor Fire Alarm Cables
Plenum Power-Limited/ Unshielded
Standed Conductors Extra Flexible

Description:

• ASTM Stranded bare copper • Polymer alloy insulation
• Twisted pair or cabled construction • Flexible plenum jacket

Rating:

• NEC Type FPLP
• (UL) Listed
• Meets 300V requirements as specified in the NEC
• Flame Rating: NFPA-262 Smoke & Flame Test

NEW

Applications:

Plenum Indoor for:
• Audio Circuits
• Control Circuits
• Initiating Circuits
• Notification Circuits

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
60991BS	1 Pair	16 AWG Stranded 4.1 Ω/Mft	.008	None	.015	.164	FPLP	32 pf/ft*	Red
60993BS	1 Pair	14 AWG Standed 2.6 Ω/Mft	.010	None	.015	.198	FPLP	35 pf/ft*	Red
60995BS	1 Pair	12 AWG Stranded 1.8 Ω/Mft	.010	None	.015	.239	FPLP	45 pf/ft*	Red

Aquaseal® Water Blocking Cable
Multi-Conductor/ 300 Volts Power-Limited

Applications:

Indoor/Outdoor Use:

- Low Voltage Industrial Process Control
- Power-Limited Circuits
- Power-Limited Fire Alarm Circuits
- Power-Limited Tray Cable PLTC
- Speaker Level

Direct Burial

Description:

- ASTM Bare Copper • PVC insulation with nylon • Twisted pair or cabled construction • Waterblocked Construction • Overall Sunlight/ Moisture Resistant PVC jacket

Rating:

- NEC Type FPL or PLTC or CL3
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Direct Burial
- Flame Rating: UL1685

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
AQ224	1 Pair	18 AWG (7x26) 6.2 Ω/Mft	PVC .015 Nylon .005	None	.035	.270	CL3/FPL PLTC	25 pf/ft*	Black
AQ244	4	18 AWG (7x26) 6.2 Ω/Mft	PVC .015 Nylon .005	None	.040	.327	CL3/FPL PLTC	25 pf/ft*	Black
AQ225	1 Pair	16 AWG (7x24) 4.2 Ω/Mft	PVC .015 Nylon .005	None	.040	.295	CL3/FPL PLTC	28 pf/ft*	Black
AQ245	4	16 AWG (7x24) 4.2 Ω/Mft	PVC .015 Nylon .005	None	.040	.355	CL3/FPL PLTC	28 pf/ft*	Black
AQ226	1 Pair	14 AWG (19x27) 2.7 Ω/Mft	PVC .015 Nylon .005	None	.040	.310	CL3/FPL PLTC	32 pf/ft*	Black
AQ246	4	14 AWG (19x27) 2.7 Ω/Mft	PVC .015 Nylon .005	None	.040	.395	CL3/FPL PLTC	32 pf/ft*	Black
AQ227	1 Pair	12 AWG (19x25) 1.7 Ω/Mft	PVC .015 Nylon .005	None	.040	.340	CL3/FPL PLTC	36 pf/ft*	Black

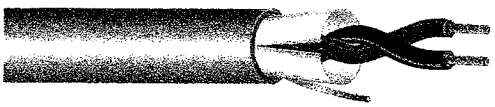
* Capacitance between conductors.

Color Code	
All Cables	1. Black,2. Red, 3. Brown, 4. Blue
	JACKET: Black

Special Notes:

- Orange ripcord under jacket

800-247-764 • www.westpenn-wpw.com



Fire Alarm Cables
Power-Limited Multiple Conductor/ Shielded

Applications:

Indoor for:
- Audio Circuits
- Control Circuits
- Initiating Circuits
- Notification Circuits

Description:

- ASTM bare copper • PVC insulation • Twisted pair or cabled construction • Overall shield 100% coverage of aluminum polyester foil binders as required with 24 AWG TC drain wire
- Overall PVC jacket

Rating:

- NEC Type FPLR
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1666

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thick-ness Inches	Shielding & % Coverage	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
975	1 Pair	18 AWG Solid 6.5 Ω/Mft	PVC .008	Al. Foil 100%	PVC .017	.150	FPLR	73 pf/ft* 133 pf/ft**	RD, BL, WH, YE
977	4	18 AWG Solid 6.5 Ω/Mft	PVC .008	Al. Foil 100%	PVC .017	.180	FPLR	73 pf/ft* 133 pf/ft**	Red
991	1 Pair	16 AWG Solid 4.1 Ω/Mft	PVC .010	Al. Foil 100%	PVC .017	.172	FPLR	82 pf/ft* 148 pf/ft**	RD, BL, WH, YE
993	4	16 AWG Solid 4.1 Ω/Mft	PVC .008	Al. Foil 100%	PVC .017	.200	FPLR	82 pf/ft* 148 pf/ft**	Red
995	1 Pair	14 AWG Solid 2.6 Ω/Mft	PVC .012	Al. Foil 100%	PVC .017	.215	FPLR	84 pf/ft* 151 pf/ft**	Red
999	1 Pair	12 AWG Solid 1.8 Ω/Mft	PVC .012	Al. Foil 100%	PVC .017	.248	FPLR	96 pf/ft* 173 pf/ft**	Red

* Capacitance between conductors.
** Capacitance between one conductor and the other connected to the shield

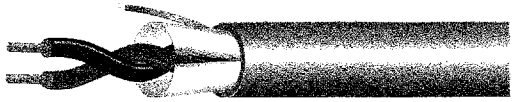
Color Code	
All Cables	1.Black, 2. Red, 3. Brown, 4. Blue
	JACKET: RD-Red, BL-Blue, WH- White, YE-Yellow

Tracer Marks:
Available upon Request: Minimum Quantities may apply
Example:- On a Red Jacket only
975T-GN
T- Tracer
GN- Green Tracer

Special Notes:

- Select Items are Packaged in our Advantage Box.
- Orange rip cord under jacket

Fire Alarm Cables
Power-Limited / Shielded
Plenecon II ® Extra Flexible



Applications:

Indoor within ducts,plenums and other spaces used for environmental air:

- Audio Circuits
- Control Circuits
- Initiating Circuits
- Notification Circuits

Description:

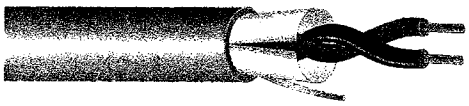
- ASTM bare copper • Polymer Alloy insulation • Twisted pair or cabled construction • Overall shield 100% coverage of aluminum polyester foil with 24 AWG TC drain wire • Flexible plenum jacket

Rating:

- NEC Type FPLP
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: NFPA-262 Smoke & Flame Test

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thick-ness Inches	Shielding & % Coverage	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
60975B	1 Pair	18 AWG Solid 6.5 Ω/Mft	.008	Al. Foil 100%	.015	.148	FPLP	54 pf/ft* 97 pf/ft**	Red
60977B	4	18 AWG Solid 6.5 Ω/Mft	.008	Al. Foil 100%	.015	.170	FPLP	54 pf/ft* 97 pf/ft**	Red
60990B	1 Pair	16 AWG Solid 4.1 Ω/Mft	.008	Al. Foil 100%	.015	.168	FPLP	61 pf/ft* 110 pf/ft**	Red
603164B	4	16 AWG Solid 4.1 Ω/Mft	.008	Al. Foil 100%	.015	.195	FPLP	61 pf/ft* 110 pf/ft**	Red
60992B	1 Pair	14 AWG Solid 2.6 Ω/Mft	.010	Al. Foil 100%	.015	.202	FPLP	84 pf/ft* 151 pf/ft**	Red
60994B	1 Pair	12 AWG Solid 1.8 Ω/Mft	.010	Al. Foil 100%	.015	.243	FPLP	96 pf/ft* 173 pf/ft**	Red



Stranded Conductor Fire Alarm Cables
Power-Limited Multiple Conductor/ Shielded

Description:

- ASTM Stranded bare copper • Polymer Alloy insulation • Twisted pair
- Overall shield 100% coverage of aluminum polyester foil with 24 AWG TC drain wire • Flexible plenum jacket

NEW

Applications:

Indoor for:

- Audio Circuits
- Control Circuits
- Initiating Circuits
- Notification Circuits

Rating:

- NEC Type FPLR
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1666

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
995S	1 Pair	14 AWG Stranded 2.6 Ω/Mft	PVC .012	Al. Foil 100%	PVC .017	.232	FPLR	84 pf/ft* 151 pf/ft**	Red
999S	1 Pair	12 AWG Stranded 1.8 Ω/Mft	PVC .012	Al. Foil 100%	PVC .017	.264	FPLR	96 pf/ft* 173 pf/ft**	Red

Stranded Conductor Fire Alarm Cables
Plenum Power-Limited/ Shielded
Standed Conductors Extra Flexible

Description:

- ASTM Stranded bare copper • Polymer Alloy insulation • Twisted pair
- Overall shield 100% coverage of aluminum polyester foil with 24 AWG TC drain wire • Flexible plenum jacket

NEW

Applications:

Plenum Indoor for:

- Audio Circuits
- Control Circuits
- Initiating Circuits
- Notification Circuits

Rating:

- NEC Type FPLP
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: NFPA-262 Smoke & Flame Test

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
60990BS	1 Pair	16 AWG Stranded 4.1 Ω/Mft	.008	Al. Foil 100%	.015	.174	FPLP	61 pf/ft* 110 pf/ft**	Red
60992BS	1 Pair	14 AWG Stranded 2.6 Ω/Mft	.010	Al. Foil 100%	.015	.210	FPLP	84 pf/ft* 151 pf/ft**	Red
60994BS	1 Pair	12 AWG Stranded 1.8 Ω/Mft	.010	Al. Foil 100%	.015	.249	FPLP	96 pf/ft* 173 pf/ft**	Red

Aquaseal® Water Blocking Cable

Multi-Conductor/ 300 Volts Power-Limited Shielded

Description:

- ASTM Bare Copper • PVC insulation with Nylon • Twisted pair or cabled construction • Overall shield 100% coverage of aluminum polyester foil with drain wire • Waterblocked Construction
- Overall Sunlight/ Moisture Resistant PVC jacket

Rating:

- NEC Type FPL or PLTC or CL3
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Direct Burial
- Flame Rating: UL1685

Applications:

Indoor/Outdoor Use:

- Low Voltage Industrial Process Control
- Power-Limited Circuits
- Power-Limited Fire Alarm Circuits
- Power-Limited Tray Cable PLTC
- Line Level Audio

Direct Burial

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding % Coverage	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
AQ293	1 Pair	18 AWG (7x26) 6.2Ω/Mft	PVC .015 Nylon .005	Al. Foil-100% 24 Strd.	.040	.310	CL3/FPL PLTC	32 pf/ft* 58 pf/ft**	Black
AQ3244	4	18 AWG (7x26) 6.2Ω/Mft	PVC .015 Nylon .005	Al. Foil-100% 24 Strd.	.040	.371	CL3/FPL PLTC	32 pf/ft* 58 pf/ft**	Black
AQ294	1 Pair	16 AWG (7x24) 4.2Ω/Mft	PVC .015 Nylon .005	Al. Foil-100% 24 Strd.	.040	.328	CL3/FPL PLTC	37 pf/ft* 67 pf/ft**	Black
AQ3245	4	16 AWG (7x24) 4.2Ω/Mft	PVC .015 Nylon .005	Al. Foil-100% 24 Strd.	.050	.415	CL3/FPL PLTC	37 pf/ft* 67 pf/ft**	Black
AQ295	1 Pair	14 AWG (19x27) 2.7Ω/Mft	PVC .015 Nylon .005	Al. Foil-100% 24 Strd.	.040	.350	CL3/FPL PLTC	46 pf/ft* 83 pf/ft**	Black
AQ296	2	12 AWG (19x25) 1.7Ω/Mft	PVC .015 Nylon .005	Al. Foil-100% 24 Strd.	.040	.375	CL3/FPL PLTC	54 pf/ft* 97 pf/ft**	Black

* Capacitance between conductors.
** Capacitance between one conductor and the other connected to the shield

Special Notes:

- Aquaseal Water Resistant Cables is a Registered Trademark of West Penn Wire
- Orange ripcord under jacket

Color Code	
All Cables	1. Black, 2. Red, 3. Brown, 4. Blue
	JACKET: Black

Power-Limited / Unshielded Addressable Systems/ Data Cable

Description:

- ASTM bare copper • Polyolefin insulation • Short overall twist lengths • Unshielded construction • Overall PVC jacket

Rating:

- NEC Type FPLR
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1666

Applications:

Indoor data cable for:

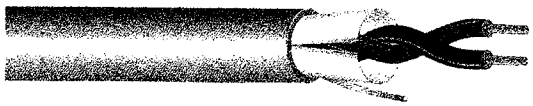
- Data Circuits
- Addressable Systems
- Initiating Circuits
- Notification Circuits

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thick-ness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
D980	1 Pair	18 AWG Solid 6.5 Ω/Mft	Polyolefin .015	None	PVC .030	.182	FPLR	16 pf/ft*	Red
D990	1 Pair	16 AWG Solid 4.1 Ω/Mft	Polyolefin .015	None	PVC .030	.223	FPLR	18 pf/ft*	Red

* Capacitance between conductors.

Power-Limited / Shielded Addressable Systems/ Data Cable



Description:

- ASTM bare copper • Polyolefin insulation • Short overall twist length • Overall shield 100% coverage of aluminum polyester foil with 24 AWG TC drain wire • Overall PVC jacket

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thick-ness Inches	Shielding & % Coverage	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
D975	1 Pair	18 AWG Solid 6.5 Ω/Mft	Polyolefin .015	Al. Foil 100%	PVC .030	.210	FPLR	25 pf/ft* 45 pf/ft**	Red
D991	1 Pair	16 AWG Solid 4.1 Ω/Mft	Polyolefin .015	Al. Foil 100%	PVC .030	.226	FPLR	30 pf/ft* 54 pf/ft**	Red
D995	1 Pair	14 AWG Solid 2.6 Ω/Mft	Polyolefin .020	Al. Foil 100%	PVC .030	.262	FPLR	30 pf/ft* 54 pf/ft**	Red

Color Code	
All Cables	1.Black, 2. Red, 3. Brown, 4. Blue
	JACKET: Red

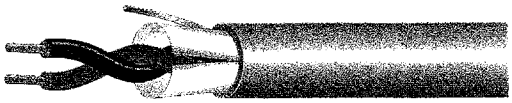
* Capacitance between conductors.
** Capacitance between one conductor and the other connected to the shield

Special Notes:

- Orange rip cord under jacket

800-245-4964 • www.wes nn-wpw.com

Fire Alarm Cables
Power-Limited / Shielded
Plenecon II ® Extra Flexible- Data Cable



Applications:

Indoor within ducts,plenums and other spaces used for environmental air:

- Audio Circuits
- Control Circuits
- Initiating Circuits
- Notification Circuits

Description:

- ASTM bare copper • Polymer Alloy insulation • Twisted pair or cabled construction • Overall shield 100% coverage of aluminum polyester foil with 24 AWG TC drain wire • Flexible plenum jacket

Rating:

- NEC Type FPLP
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: NFPA-262 Smoke & Flame Test

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
D60975 ^	1 Pair	18 AWG Solid 6.5 Ω/Mft	.012	Al. Foil 100%	.015	.165	FPLP	25 pf/ft* 45 pf/ft**	Red
D60990 ^	1 Pair	16 AWG Solid 4.1 Ω/Mft	.012	Al. Foil 100%	.015	.188	FPLP	30 pf/ft* 54 pf/ft**	Red

^ - Data grade versions for addressable systems contain Low Loss Insulation and Overall Flexible Plenum Jacket.

* Capacitance between conductors.
** Capacitance between one conductor and the other connected to the shield

Color Code	
All Cables	1.Black, 2. Red, 3. Brown, 4. Blue
	JACKET: Red

Tracer Marks:
Available upon Request: Minimum Quantities may apply
Example:- On a Red Jacket only
60980BT-GN
T- Tracer
GN- Green Tracer

Fire Alarm Cables
Local Law 5 (LL5) Power-Limited/
Unshielded

Description:

• ASTM bare copper • Fluropolymer • Twisted pair or cabled construction • Unshielded • Fluoropolymer jacket- 150 Deg.

Rating:

Power Limited Fire Alarm Cable also classified for use as Fire Alarm Cable in New York City.

• NEC Type FPLP
• (UL) Listed
• Meets 300V requirements as specified in the NEC
• Flame Rating: NFPA-262 Smoke & Flame Test

NEW

Applications:

Indoor for:
• Audio Circuits
• Control Circuits
• Initiating Circuits
• Notification Circuits

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thick-ness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
LL5182	1 Pair	18 AWG Solid 6.5 Ω/Mft	.016	None	.026	.190	FPLP	29 pf/ft*	Red
LL5184	4	18 AWG Solid 6.5 Ω/Mft	.016	None	.026	.175	FPLP	29 pf/ft*	Red
LL5162	1 Pair	16 AWG Solid 4.1 Ω/Mft	.016	None	.026	.161	FPLP	32 pf/ft*	Red
LL5164	4	16 AWG Solid 4.1 Ω/Mft	.016	None	.026	.220	FPLP	32 pf/ft*	Red
LL5142	1 Pair	14 AWG Solid 2.6 Ω/Mft	.016	None	.026	.191	FPLP	35 pf/ft*	Red
LL5144	4	14 AWG Solid 2.6 Ω/Mft	.016	None	.026	.252	FPLP	35 pf/ft*	Red
LL5122	1 Pair	12 AWG Solid 1.8 Ω/Mft	.016	None	.026	.225	FPLP	45 pf/ft*	Red

Special Notes:

• Orange rip cord under jacket

Color Code	
All Cables	1.Black, 2. Red
	JACKET: Red

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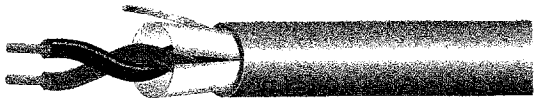
Fire Alarm Cables
Local Law 5 (LL5) Power Limited/
Shielded



Applications:

Indoor for:

- Audio Circuits
- Control Circuits
- Initiating Circuits
- Notification Circuits

Description:

- ASTM bare copper • Fluoropolymer • Twisted pair or cabled construction • Overall shield 100% coverage of aluminum polyester foil with TC drain wire • Fluropolymer jacket

Rating:

Power Limited Fire Alarm Cable also classified for use as Fire Alarm Cable in New York City.

- NEC Type FPLP
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: NFPA-262 Smoke & Flame Test

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding & % Coverage	Jacket Type & Thickness	Nom. O.D.	NEC Type	Nom. Capacitance	Jacket Color
LL5182SH	1 Pair	18 AWG Solid 6.5 Ω/Mft	.016	Al. Foil 100%	.026	.194	FPLP	54 pf/ft* 97 pf/ft**	Red
LL5184SH	4	18 AWG Solid 6.5 Ω/Mft	.016	Al. Foil 100%	.026	.243	FPLP	54 pf/ft* 97 pf/ft**	Red
LL5162SH	1 Pair	16 AWG Solid 4.1 Ω/Mft	.016	Al. Foil 100%	.026	.215	FPLP	61 pf/ft* 110 pf/ft**	Red
LL5164SH	4	16 AWG Solid 4.1 Ω/Mft	.016	Al. Foil 100%	.026	.267	FPLP	61 pf/ft* 110 pf/ft**	Red
LL5142SH	1 Pair	14 AWG Solid 2.6 Ω/Mft	.016	Al. Foil 100%	.026	.242	FPLP	84 pf/ft* 151 pf/ft**	Red
LL5122SH	1 Pair	12 AWG Solid 1.8 Ω/Mft	.016	Al. Foil 100%	.026	.275	FPLP	96 pf/ft* 173 pf/ft**	Red

* Capacitance between conductors.
** Capacitance between one conductor and the other connected to the shield

Color Code	
All Cables	1.Black, 2. Red, 3. Brown, 4. Blue
	JACKET: Red

Special Notes:

- Orange rip cord under jacket

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Fire Alarm Cables
Power-Limited One & Two Conductor/ Parallel

Applications:
Indoor for:
- Power-Limited Protective Circuits

Description:
- ASTM bare copper • PVC insulation
- Two conductor parallel features- PERFECTSTRIPE®

Rating:
- NEC Type FPL
- (UL) Listed
- Flame Rating: UL1685

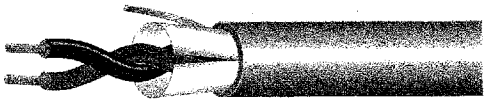
Parallel Construction- Two Conductor

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thick-ness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
970	2	18 AWG Solid 6.5 Ω/Mft	PVC .032	None	--	.104x.204	FPL	--	Red
971	2	16 AWG Solid 4.1 Ω/Mft	PVC .032	None	--	.115x.225	FPL	--	Red
972	2	14 AWG Solid 2.6 Ω/Mft	PVC .032	None	--	.128x.250	FPL	--	Red

Colors	
Jacket Colors	Red

NOTE:
Additional Colored Jackets are available upon request.
Minimum quantity orders may apply.
- Items are Packaged in our Advantage Box

Circuit Integrity in Conduit/ Shielded (CIC) - Riser Rated



Applications:

Indoor for:

- Circuit Integrity
- Fire Alarm Circuit Integrity
- Survivability

Description:

- ASTM bare copper • Ceramifiable Silicon Rubber (CSR) Insulation • Twisted pair or cabled construction • Overall shield 100% coverage of aluminum polyester foil with TC drain wire • Overall FRPE Low-Smoke, Non-Halogen Jacket

Rating:

- NEC Type FPLR
- (UL) Listed
- Meets 300V requirements as specified in the NEC - 105°C
- Flame Rating: UL1666, UL2196 - 2 Hour Flame Test (in conduit only)

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding & % Coverage	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
5200FZ	2	16 AWG 7x24 4.0 Ω/Mft	CSR .035	Al. Foil 100%	FRPE .056	.37	FPLR	22pf/ft*	Red
5220FZ	2	16 AWG Solid 4.0 Ω/Mft	CSR .035	Al. Foil 100%	FRPE .056	.36	FPLR	20pf/ft*	Red
5222FZ	4	16 AWG Solid 4.0 Ω/Mft	CSR .035	Al. Foil 100%	FRPE .056	.41	FPLR	16pf/ft*	Red
5100FZ	2	14 AWG 7x22 2.5 Ω/Mft	CSR .035	Al. Foil 100%	FRPE .056	.41	FPLR	26pf/ft*	Red
5120FZ	2	14 AWG Solid 2.5 Ω/Mft	CSR .035	Al. Foil 100%	FRPE .056	.38	FPLR	23pf/ft*	Red
5000FZ	2	12 AWG 7x20 1.6 Ω/Mft	CSR .035	Al. Foil 100%	FRPE .056	.44	FPLR	27pf/ft*	Red

* Capacitance between conductors.

Color Code	
All Cables	Black, Red- 4 or more are Black and numbered
	JACKET: Red

Special Notes:

- CSR- Ceramifiable Silicon Rubber
- FRPE- Flame Retardant Polyethylene
- CIC Cables have been tested to pass the 2 hour UL2196 Flame test in conduit. CIC cables can not be deployed outside the conduit and mantain a CI rating.

www.westpenn-wpw.com 800-245-4964 •

Circuit Integrity in Conduit/ Unshielded Riser Rated - (CIC)

Description:

- ASTM bare copper • Ceramifiable Silicon Rubber (CSR) Insulation • Twisted pair or cabled construction
- Overall FRPE Low-Smoke, Non-Halogen Jacket

Rating:

- NEC Type FPLR
- (UL) Listed
- Meets 300V requirements as specified in the NEC - 105°C
- Flame Rating: UL 1666, UL2196 - Two Hour Flame Test (in conduit only)

Applications:

Indoor for:

- Circuit Integrity
- Fire Alarm Circuit Integrity
- Survivability

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thick-ness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
5200UZ	2	16 AWG 7x24 4.0 Ω/Mft	CSR .035	None	FRPE .056	.37	FPLR	16pf/ft*	Red
5220UZ	2	16 AWG Solid 4.0 Ω/Mft	CSR .035	None	FRPE .056	.35	FPLR	15pf/ft*	Red
5100UZ	2	14 AWG 7x22 2.5 Ω/Mft	CSR .035	None	FRPE .056	.40	FPLR	18pf/ft*	Red
5120UZ	2	14 AWG Solid 2.5 Ω/Mft	CSR .035	None	FRPE .056	.38	FPLR	17pf/ft*	Red

* Capacitance between conductors.

Special Notes:

- CSR- Ceramifiable Silicon Rubber
- FRPE- Flame Retardant Polyethylene
- CIC Cables have been tested to pass the 2 hour UL2196 Flame test in conduit. CIC cables can not be deployed outside the conduit and maintain a CI rating.

Color Code	
All Cables	Black, Red
	JACKET: Red

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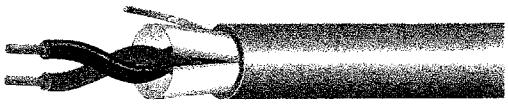
Circuit Integrity/ Shielded (CI) - Riser Rated



Applications:

Indoor for:

- Circuit Integrity
- Fire Alarm Circuit Integrity
- Survivability

Description:

- ASTM bare copper • Ceramifiable Silicon Rubber (CSR) Insulation • Twisted pair or cabled construction
- Overall shield 100% coverage of aluminum polyester foil with TC drain wire • Overall FRPE Low-Smoke, Non Halogen Jacket

Rating:

- NEC Type FPLR-CI
- (UL) Listed
- Meets 300V requirements as specified in the NEC - 105°C
- Flame Rating: UL1666, UL2196 - 2 Hour Flame Test

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding & % Coverag	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
5320FM	2	18 AWG Solid 5.9 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.31	FPLR-CI	27pf/ft*	Red
5322FM	4	18 AWG Solid 5.9 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.36	FPLR-CI	27pf/ft*	Red
5300FM	2	18 AWG 7x26 5.9 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.32	FPLR-CI	27pf/ft*	Red
5302FM	4	18 AWG 7x26 5.9 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.37	FPLR-CI	27pf/ft*	Red
5220FM	2	16 AWG Solid 4.0 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.33	FPLR-CI	31pf/ft*	Red
5222FM	4	16 AWG Solid 4.0 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.38	FPLR-CI	31pf/ft*	Red
5200FM	2	16 AWG 7x24 4.0 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.35	FPLR-CI	31pf/ft*	Red
5120FM	2	14 AWG Solid 2.5 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.36	FPLR-CI	33pf/ft*	Red
5122FM	4	14 AWG Solid 2.5 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.41	FPLR-CI	33pf/ft*	Red
5100FM	2	14 AWG 7x22 2.5 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.38	FPLR-CI	33pf/ft*	Red
5020FM	2	12 AWG Solid 1.6 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.39	FPLR-CI	37pf/ft*	Red
5022FM	4	12 AWG Solid 1.6 Ω/Mft	CSR .034	Al. Foil 100%	FRPE .045	.46	FPLR-CI	37pf/ft*	Red

* Capacitance between conductors.

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Circuit Integrity / Unshielded Riser Rated - (CI)

Description:

- ASTM bare copper • Ceramifiable Silicon Rubber (CSR) Insulation • Twisted pair or cabled construction
- Overall FRPE Low-Smoke, Non-Halogen Jacket

Rating:

- NEC Type FPLR-CI
- (UL) Listed
- Meets 300V requirements as specified in the NEC - 105°C
- Flame Rating: UL 1666, UL2196- Two Hour Flame Test

Applications:

Indoor for:

- Circuit Integrity
- Fire Alarm Circuit Integrity
- Survivability

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thick-ness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
5320UM	2	18 AWG Solid 5.9 Ω/Mft	CSR .034	None	FRPE .045	.31	FPLR-CI	17pf/ft*	Red
5322UM	4	18 AWG Solid 5.9 Ω/Mft	CSR .034	None	FRPE .045	.35	FPLR-CI	17pf/ft*	Red
5220UM	2	16 AWG Solid 4.0 Ω/Mft	CSR .034	None	FRPE .045	.33	FPLR-CI	19pf/ft*	Red
5222UM	4	16 AWG Solid 4.0 Ω/Mft	CSR .034	None	FRPE .045	.38	FPLR-CI	19pf/ft*	Red
5120UM	2	14 AWG Solid 2.5 Ω/Mft	CSR .034	None	FRPE .045	.36	FPLR-CI	21pf/ft*	Red
5122UM	4	14 AWG Solid 2.5 Ω/Mft	CSR .034	None	FRPE .045	.41	FPLR-CI	21pf/ft*	Red
5020UM	2	12 AWG Solid 1.6 Ω/Mft	CSR .034	None	FRPE .045	.39	FPLR-CI	23pf/ft*	Red
5022UM	4	12 AWG Solid 1.6 Ω/Mft	CSR .034	None	FRPE .045	.45	FPLR-CI	23pf/ft*	Red

* Capacitance between conductors.

Special Notes:

- CSR- Ceramifiable Silicon Rubber
- FRPE- Flame Retardant Polyethylene
- CI Cables have been tested to pass the 2 hour UL2196 Flame test not in conduit. CI rated cables can not be deployed in conduit and maintain a CI rating.

Color Code	
All Cables	Black, Red- 4 or more are Black and numbered
	JACKET: Red

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7161-0859:0101

CATEGORY: 7161 – CABLES-FIRE PROTECTIVE SIGNALING

LISTEE: West Penn WireP.O. Box 762, Washington, PA 15301
Contact: Diane Kelley (724) 222-7060 Fax (724) 229-1151
Email: msams@westpenn-cdt.com

DESIGN: Types FPL and FPLP power limited fire protective signaling cable. Refer to listee's data sheet for detailed product description and operational considerations.

RATING:

INSTALLATION: In accordance with listee's printed installation instructions, NEC Article 760, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, type, NEC rating and UL label.

APPROVAL: Listed as power-limited fire protective signaling cable.

NOTE:

*Rev. 05-23-2005

This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other

Date Issued: **July 01, 2011** *Listing Expires* **June 30, 2012**

Authorized By: ***FRANCIS MATEO**, Program Coordinator*

Fire Engineering Division

FIRE ALARM TEST INSPECTION REPORT

ACKNOWLEDGEMENT SHEET

BRANCH	SERVICE - CUSTOMER NUMB	PO #	INSPECTION DATE	INSPECT TYPE	TR ARRIVAL DATE	TR COMP DATE	NON-BILL	SVC CODE	
			12/17/2011	FA					
NAME: Palos Verdes High School			SERVICE CODE	LBR.- REG	TRAV - REG	LBR. - OT	TRAV. OT	MILES	
ADDRESS (OR ATTN OF): 600 Cloyden Drive			WARRANTY START						
ADDRESS:									
CITY: Rancho Palos Verdes	STATE	ZIP	CUSTOMER P O		AND / OR		CUSTOMER NAME		

CONTROL PANEL

MANUFACTURER	MODEL NO.	SERIAL NO	POWER SOURCE	PANEL LOCKED
Notifier	AM 2020		120vac	☑ Y ☐ N

TYPE OF SIGNALING				SIGNALS SOUNDED PER CUSTOMER REQUEST	CENTRAL STATION MONITOR
☑ GENERAL ALARM	☐ CODED	☑ Y ☐ N ☐ NA	CUST INIT	☐ Y ☑ N
☐ SELECTIVE SIGNALS	☐ PRE-SIGNAL			

BATTERIES	BATT MODEL	BATT INSTALL DATE	VOLTS, AMPS	QUANTITY	SIZE (LxWxH)	BATT SUPV BY PANEL Y/N?
		9/1/2010	12vdc/24ah	2		☑ Y ☐ N

CUSTOMER OPERATING INSTRUCTIONS PROVIDED TO:	PHONE NO.:	TECHNICIAN NAME:	
CUSTOMER SIGNATURE:	DATE:	TECHNICIAN SIGNATURE:	DATE:

AUXILIARY FUNCTIONS

ELEVATOR FIRE RECALL	RECALL TO PRIMARY FLOOR:	RECALL TO ALTERNATE FLOOR:
Y/N ☐ ELEVATORS RESTART AUTOMATICALLY	☐ NORMAL NOTE # N/A ☑	☐ NORMAL NOTE # N/A ☑
DOOR HOLDERS	DOOR RELEASE DEVICES INCLUDING CLOSERS AND LATCHES:	**ANNUNCIATOR LOCATION:**
☐ NORMAL	QTY: NOTE # N/A ☑	main office
HVAC SHUTDOWN	AIR HANDLER SHUTDOWN:	ANNUNCIATOR MFGR: / MODEL #:
Y/N ☐ AIR HANDLERS RESTART AUTOMATICALLY	☐ NORMAL NOTE # N/A ☑	

PANEL SUPERVISION RESPONSE TO:			AUX FUNCTIONS		SPECIAL CONSIDERATIONS:
ZONE TROUBLE	☑ NORMAL	NOTE#	RESET	☑	
SIGNAL TROUBLE	☑ NORMAL	NOTE#	ACK	☑	
AC POWER LOSS	☑ NORMAL	NOTE#	DRILL SW	☑	
EARTH GROUND	☑ NORMAL	NOTE#	LAMP TEST	☑	

TYPE	VOLTAGE	# ZONES	# USED

THE NUMBER OF PERIPHERAL DEVICES TESTED ARE:

AUDIO/VISUAL ALARM TESTED						SYSTEM ON TEST		MANUAL PULL STATIONS	TOTAL NO OF DEVICES FOUND	NUMBER TESTED	
SIG TYPE:	(CHECK ALL THAT APPLY)		OPERATION VERIFIED			OUT OF SERVICE	IN SERVICE	AREA SMOKE DETECTOR			
BELLS	☐	Total:		Y ☐	N ☐			DUCT DETECTOR			
HORNS	☑	62		Y ☑	N ☐	MONITORING COMPANY		HEAT DETECTOR			
CHIMES	☐	Total:		Y ☐	N ☐			WATER FLOW SWITCH			
STROBE	☑	117		Y ☑	N ☐	PHONE NO.		TAMPER SWITCH			
SPEAKERS	☐	Total:		Y ☐	N ☐			BEAM DETECTOR			
SPK/STROBR	☐	Total:		Y ☐	N ☐	LINE NO.					
HORN/STROBE	☑	141		Y ☑	N ☐						
SIRENS	☐	Total:		Y ☐	N ☐	ACCOUNT NO.					

FAILURES : SEE DISCREPANCY PAGE ☐ NONE: ☑ AS FOLLOWS (DESCRIBE FULLY):

FIRE ALARM INSPECTION REPORT

General Notes

NOTE NO.	
1	There are 2 Notifier AM2020 and 4 Notifier AM400 all networked together for a campus wide system.

FIRE ALARM INSPECTION REPORT

ACKNOWLEDGEMENT CONTINUATION SHEET

PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		BLDG A						
SD	101	FACP RM	X		X			
SD	102	PRINCIPAL RECEP	X		X			
SD	104	RM 100	X		X			
SD	105	PAPER STORAGE	X		X			
SD	106	STORE RM CLOSET	X		X			
SD	107	DUPLICATION OFFICE	X		X			
SD	108	JANITORS CLOSET	X		X			
SD	109	PRINCIPAL RR	X		X			
SD	118	CONFERENCE RM	X		X			
SD	119	ATHLETIC OFFICE	X		X			
SD	120	PRINCIPAL RM 105	X		X			
SD	121	ADMIN WAITING	X		X			
SD	122	PRINCIPAL CLOSET 2	X		X			
SD	123	ASST PRINCIPAL	X		X			
SD	124	TOILET	X		X			
SD	125	ROOM	X		X			
SD	103	ADMIN KEY STORAGE	X		X			
SD	148	ADMIN PHONE RM	X		X			
SD	110	ATTENDENCE CLOSET	X		X			
SD	111	ATTENDENCE STORE	X		X			
SD	112	COUNSELOR VESTIBULE	X		X			
SD	114	PSYCH OFFICE	X		X			
SD	115	TEACHERS LOUNGE	X		X			
SD	116	TEACHERS LOUNGE CLOSET	X		X			
SD	117	MECH RM	X		X			
SD	126	REST AREA	X		X			
SD	127	WAITING	X		X			
SD	128	TOILET	X		X			
SD	129	DISPENSARY	X		X			
SD	130	DRESSINGS	X		X			
SD	131	NURSE	X		X			
SD	132	REST AREA 2	X		X			
SD	133	WAITING	X		X			
SD	134	COUNSELOR 4	X		X			
SD	135	COUNSELOR 3	X		X			
SD	136	COUNSELOR 2	X		X			
SD	137	COUNSELOR 1	X		X			
SD	138	COUNSELOR 5	X		X			
SD	139	COUNSELOR 6	X		X			
SD	140	COUNSELOR 7	X		X			
SD	141	ASST PRINCIPAL	X		X			
SD	142	COUNSELING RECEP	X		X			
SD	143	COUNSELING RECEP	X		X			
SD	145	WOMENS FACULTY	X		X			

FIRE ALARM INSPECTION REPORT

ACKNOWLEDGEMENT CONTINUATION SHEET

PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		BLDG A CONT.						
SD	147	HALL	X		X			
		BLDG B						
SD	101	STORAGE	X		X			
SD	104	JANITORS CLOSET	X		X			
SD	105	BOYS RR	X		X			
SD	109	213 WORK RM	X		X			
SD	110	212 WORK RM	X		X			
SD	111	MECH RM	X		X			
SD	114	CLASSRM 213	X		X			
SD	116	CLASSRM 212	X		X			
SD	117	CLASSRM 211	X		X			
SD	118	CLASSRM 212	X		X			
SD	119	CLASSRM 213	X		X			
SD	120	GIRLS RR	X		X			
SD	141	MECH RM	X		X			
HD	103	RM 201 WEST	X		X			
HD	102	RM 201 WEST	X		X			
HD	115	KILN RM	X		X			
HD	108	RM 202 EAST	X		X			
HD	106	202 WORK RM	X		X			
HD	107	202 WEST	X		X			
		BLDG 300 [BLDG C]						
SD	101	JANITORS CLOSET	X		X			
SD	102	CLR 307/306 WORKRM	X		X			
SD	103	MECH RM	X		X			
SD	106	CLR 312/313 WORKRM	X		X			
SD	115	MENS TOILET	X		X			
SD	116	CLASSRM 305A	X		X			
SD	117	CLASSRM 305	X		X			
SD	118	CLASSRM 306	X		X			
SD	119	CLASSRM 306	X		X			
SD	120	CLASSRM 307	X		X			
SD	121	CLASSRM 307	X		X			
SD	122	BOYS TOILET	X		X			
SD	123	GIRLS TOILET	X		X			
SD	124	CLASSRM 314	X		X			
SD	125	CLASSRM 314	X		X			
SD	126	CLASSRM 308	X		X			
SD	127	CLASSRM 309	X		X			
SD	128	CLASSRM 311	X		X			
SD	129	CLASSRM 310	X		X			
HD	105	CLASSRM 313 WEST	X		X			
HD	104	CLASSRM 313 EAST	X		X			
HD	107	CLASSRM 312 WEST	X		X			

FIRE ALARM INSPECTION REPORT

ACKNOWLEDGEMENT CONTINUATION SHEET

PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		BLDG 300 [BLDG C] CONT.						
HD	108	CLASSRM 312 EAST	X		X			
SD	207	CLASSRM 318	X		X			
SD	218	WOMENS TOILET	X		X			
SD	219	MENS TOILET	X		X			
SD	217	CLASSRM 315	X		X			
SD	216	CLASSRM 316	X		X			
SD	215	CLASSRM 317	X		X			
SD	213	CLASSRM 301	X		X			
SD	203	MECH RM	X		X			
SD	211	CLASSRM 302	X		X			
SD	210	CLASSRM 303	X		X			
SD	212	CLASSRM 301	X		X			
SD	214	CLASS RM 301	X		X			
SD	205	CLASSRM 304	X		X			
HD	201	ELEC RM	X		X			
SD	209	CLASSRM 305	X		X			
		BLDG D						
SD	201	WORKRM 205	X		X			
SD	204	WORKRM 206	X		X			
SD	205	WORKRM 207	X		X			
SD	209	WORKRM 210	X		X			
SD	217	CLASSRM 204	X		X			
SD	218	CLASSRM 205	X		X			
SD	221	WORKRM 205	X		X			
SD	230	CLASSRM 203	X		X			
SD	251	WORKRM 208	X		X			
HD	203	ROOM 206 EAST	X		X			
HD	202	ROOM 206 WEST	X		X			
HD	207	CLASSRM 207 NORTH	X		X			
HD	206	CLASSRM 207 SOUTH	X		X			
HD	238	208 EAST	X		X			
HD	239	208 WEST	X		X			
HD	213	CLASSRM 209 WEST	X		X			
HD	212	CLASSRM 209 EAST	X		X			
HD	211	CLASSRM 210 EAST	X		X			
HD	210	CLASSRM 210 WEST	X		X			
SD	209	WORKRM 210	X		X			
SD	208	STORAGE RM 210	X		X			
		BLDG F						
SD	101	WORKRM 401	X		X			
SD	102	JANITOR RM	X		X			
SD	104	CLASSRM 401	X		X			
SD	105	CLASSRM 402	X		X			
SD	106	CLASSRM 403	X		X			

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ACKNOWLEDGEMENT CONTINUATION SHEET

PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		BLDG F CONT.						
SD	107	CLASSRM 404	X		X			
SD	108	BOYS TOILET	X		X			
SD	109	GIRLS TOILET	X		X			
SD	110	CLASSRM 415	X		X			
SD	111	415 WORKRM	X		X			
SD	112	CLASSRM 414	X		X			
SD	113	CLASSRM 413	X		X			
SD	114	CLASSRM 412	X		X			
SD	115	PSYCHOLOGIST	X		X			
SD	116	SPEECH THERAPIST	X		X			
SD	117	PSYCH TOILET	X		X			
SD	119	WOMENS RM	X		X			
SD	120	CLASSRM 407	X		X			
SD	121	CLASSRM 407	X		X			
SD	122	CLASSRM 406	X		X			
SD	123	CLASSRM 405	X		X			
SD	124	CLASSRM 411	X		X			
SD	125	CLASSRM 410	X		X			
SD	126	CLASSRM 409	X		X			
SD	127	CLASSRM 408	X		X			
SD	154	SPEECH WORKRM	X		X			
HD	40	SPEECH THERAPIST	X		X			
SD	118	SPEECH THERAPIST RR	X		X			
HD	39	PSYCHOLOGIST	X		X			
		LIBRARY						
PS	201	NORTH EAST	X		X			
PS	202	WEST	X		X			
SD	232	CENTER WEST	X		X			
SD	231	NORTH WEST	X		X			
SD	228	SUPPORT RM	X		X			
SD	229	STORAGE	X		X			
PS	205	ORAL ART EAST	X		X			
SD	203	ORAL ARTS	X		X			
SD	205	STAGE	X		X			
SD	206	TOILET	X		X			
SD	225	OFFICE	X		X			
SD	226	COMP RM CENTER	X		X			
SD	230	COMP RM	X		X			
SD	233	SOUTH WEST	X		X			
SD	234	SOUTH EAST	X		X			
SD	235	CENTER EAST	X		X			
SD	236	NORTH EAST	X		X			
PS	206	ORAL ART	X		X			
PS	221	SUPPORT RM	X		X			

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ACKNOWLEDGEMENT CONTINUATION SHEET

PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		LIBRARY CONT.						
PS	224	NORTH WEST	X		X			
PS	225	NORTH CENTER	X		X			
		NEW BLDG G						
SD	126	ELEC RM	X		X			
SD	127	ELEC RM	X		X			
SD	128	CLASSRM 326	X		X			
SD	129	CLASSRM 326	X		X			
SD	130	CLASSRM 325	X		X			
SD	131	CLASSRM 325	X		X			
SD	132	CLASSRM 324	X		X			
SD	133	CLASSRM 324	X		X			
SD	134	CLASSRM 323	X		X			
SD	135	CLASSRM 323	X		X			
SD	136	CLASSRM 322	X		X			
SD	137	CLASSRM 322	X		X			
SD	138	CLASSRM 327	X		X			
SD	139	CLASSRM 327	X		X			
SD	140	CLASSRM 328	X		X			
SD	141	CLASSRM 328	X		X			
SD	142	CLASSRM 329	X		X			
SD	143	CLASSRM 329	X		X			
SD	144	CLASSRM 330	X		X			
SD	145	CLASSRM 330	X		X			
SD	146	CLASSRM 331	X		X			
SD	147	CLASSRM 331	X		X			
TS	119	TAMPERSWITCH		X	X			
WF	18	WATERFLOW				X		
		GYM & LOCKERS BLDG H						
SD	102	CORRIDOR N GIRLS	X		X			
SD	106	COMM RM H919	X		X			
SD	107	GIRLS FLD EQ RM	X		X			
SD	108	JANITORS CLOSET GIRLS	X		X			
SD	109	GIRLS TOILET	X		X			
SD	110	GIRLS STORAGE	X		X			
SD	112	GIRLS WAITING RM	X		X			
SD	113	GIRLS FIRST AID	X		X			
SD	114	COACH OFFICE GIRLS	X		X			
SD	115	DRESS RM GIRLS	X		X			
SD	116	TOILET RM GIRLS	X		X			
SD	117	FIELD EQ RM GIRLS	X		X			
SD	120	EQUIP STORAGE BOYS	X		X			
SD	125	GIRLS LKR SHOWER	X		X			
SD	127	LOWER DANCE OFFICE	X		X			
SD	128	LOWER DANCE OFFICE GYM	X		X			

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PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		GYM & LOCKERS BLDG H						
SD	129	LOWER DANCE OFFICE GYM	X		X			
SD	130	GYM CLASSRM	X		X			
SD	131	GYM CLASSRM	X		X			
SD	132	GYM CLASSRM	X		X			
SD	135	CORRIDOR CENTER BOYS	X		X			
SD	141	CORR SOUTH BOYS	X		X			
SD	142	BOYS TOILET	X		X			
SD	150	COACH OFFICE BOYS	X		X			
SD	151	WAITING RM BOYS	X		X			
SD	152	FIRST AID BOYS	X		X			
SD	153	COACH STORAGE BOYS	X		X			
SD	155	MECH RM EAST	X		X			
SD	162	TOILET RM BOYS	X		X			
SD	163	CORRIDOR NORTH BOYS	X		X			
SD	167	DRYING AREA BOYS	X		X			
SD	171	DRYING AREA GIRLS	X		X			
SD	174	TOILET GIRLS	X		X			
PS	105	NORTH WEST BOYS	X		X			
PS	106	SOUTH WEST BOYS	X		X			
PS	131	SOUTH EAST GYM	X		X			
PS	132	NORTH EAST GYM	X		X			
SD	244	COACHES OFFICE BOYS	X		X			
SD	124	LOCKER RM STORAGE	X		X			
HD	138	GIRLS SHOWER ATTIC	X		X			
SD	101	GYM FACP RM	X		X			
HD	39	BOYS LOCKER RM	X		X			
HD	45	BOYS LOCKER RM	X		X			
HD	32	BOYS RR	X		X			
HD	36	BOYS RR	X		X			
SD	50	BOYS LOCKER RR	X		X			
		BLDG J						
SD	201	BAND RM 1	X		X			
SD	202	BAND RM 2	X		X			
SD	203	8TH RESTROOM	X		X			
SD	205	STORAGE	X		X			
SD	206	NTH RR	X		X			
HD	210	STORAGE	X		X			
		BLDG K						
SD	106	TRAINING RM 505	X		X			
SD	107	TRAINING RM STORAGE	X		X			
SD	108	OFFICE K126	X		X			
SD	109	TRAINING RM OFFICE	X		X			
SD	110	FOOTBALL STORAGE	X		X			
SD	111	FOOTBALL COACH LOCKER	X		X			

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PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		BLDG K CONT.						
SD	112	FOOTBALL LOCKER RM	X		X			
SD	113	FOOTBALL COACHES OFFICE	X		X			
SD	114	FOOTBALL LOCKER STORAGE	X		X			
SD	115	FOOTBALL LOCKER RM	X		X			
SD	116	501 STORAGE	X		X			
SD	117	CLASSRM 501	X		X			
SD	118	501 STORAGE	X		X			
SD	119	EAST WEIGHT RM	X		X			
SD	120	EAST WEIGHT RM STORAGE	X		X			
SD	121	EAST WEIGHT RM OFFICE	X		X			
SD	122	WEST WEIGHT RM STORAGE	X		X			
SD	123	WEST WEIGHT RM	X		X			
SD	127	ROOM 501 SMOKE 3	X		X			
SD	128	FOOTBALL LOCKER RR	X		X			
SD	131	TRAINERS RR	X		X			
SD	133	WEIGHT RM EAST STORAGE	X		X			
SD	134	WEIGHT RM W STORAGE	X		X			
SD	135	WEIGHT RM WATER HEATER	X		X			
SD	136	WEIGHT RM W 1	X		X			
SD	137	WEIGHT RM W 2	X		X			
SD	142	WEIGHT RM EAST 1						
SD	143	WEIGHT RM EAST 2	X		X			
SD	144	ROOM 501 #1	X		X			
SD	145	ROOM 501 #2	X		X			
SD	16+3	FOOTBALL LOCKER MEZZ	X		X			
SD	164	FOOTBALL LOCKER MEZZ	X		X			
SD	166	ROOM 501 MEZZ 1	X		X			
SD	176	FOOTBALL LOCKER	X		X			
SD	177	FOOTBALL LOCKER	X		X			
SD	178	ROOM 501 MEZZ 2	X		X			
SD	179	ROOM 501 MEZZ 3	X		X			
HD	56	WEIGHT RM	X		X			
HD	59	WEIGHT RM	X		X			
HD	73	501 MEZZ	X		X			
HD	74	501 MEZZ	X		X			
HD	75	501 MEZZ	X		X			
HD	49	TRAINING RM	X		X			
HD	70	MECH RM	X		X			
HD	2	MECH RM	X		X			
		MPR - BLDG L						
SD	101	FACP RM	X		X			
SD	102	JANITORS RM	X		X			
SD	103	CONTROL RM	X		X			
SD	104	GIRLS RM	X		X			

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PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		MPR-BLDG L CONT.						
SD	105	RM 127 STORAGE	X		X			
SD	106	CHAIR RM	X		X			
SD	107	GREEN RM TOILET	X		X			
SD	156	CHAIR STORAGE	X		X			
PS	102	SOUTH WEST	X		X			
PS	104	SOUTH CENTER	X		X			
PS	106	NORTH	X		X			
PS	108	BAND RM 321	X		X			
PS	155	STAGE	X		X			
SD	217	DRESSING RM	X		X			
SD	224	MENS RM HALLWAY	X		X			
SD	245	BOYS RM	X		X			
SD	273	MPR	X		X			
SD	274	MPR	X		X			
SD	275	MPR	X		X			
SD	276	MPR	X		X			
SD	277	MPR	X		X			
SD	278	MPR	X		X			
SD	279	MPR	X		X			
SD	280	MPR	X		X			
SD	281	MPR	X		X			
SD	282	MPR	X		X			
HD	9	FACP RM	X		X			
SD	211	MPR	X		X			
SD	237	BAND RM	X		X			
SD	239	BAND RM	X		X			
SD	240	BAND RM OFFICE	X		X			
SD	242	UPPER DANCE 320	X		X			
SD	244	UPPER DANCE 320	X		X			
SD	247	CHORAL 319	X		X			
SD	249	CHORAL 319	X		X			
SD	283	MPR	X		X			
SD	284	MPR	X		X			
SD	285	MPR	X		X			
SD	286	MPR	X		X			
SD	287	MPR	X		X			
SD	288	MPR	X		X			
SD	289	MPR	X		X			
SD	290	MPR	X		X			
SD	291	MPR	X		X			
SD	292	MPR	X		X			
SD	293	MPR	X		X			
SD	294	STAGE	X		X			
SD	298	STAGE	X		X			

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ACKNOWLEDGEMENT CONTINUATION SHEET

PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		MPR-BLDG L CONT.						
SD	299	STAGE	X		X			
		CAFETERIA						
HD	87	ABOVE HALL	X		X			
HD	49	ABOVE FACULTY DINNING	X		X			
HD	83	ABOVE FACULTY DINNING	X		X			
SD	113	STORAGE L132	X		X			
SD	114	JANITORS RM	X		X			
SD	118	MECH RM 141	X		X			
SD/HD	120	STUDENT STORE ATTIC	X		X			
SD	122	STUDENT STORE OFFICE	X		X			
SD/HD	123	STUDENT STORE	X		X			
SD	158	IEP CONF RM 416 RR	X		X			
SD	159	WORK RM	X		X			
SD	160	IEP ROOM B	X		X			
SD	163	FACULTY DINNING	X		X			
SD	167	FACULTY DINNING	X		X			
SD	169	FACULTY SERVICE	X		X			
SD	171	PASSAGE	X		X			
SD	174	WOMENS DRESSING RR	X		X			
SD	176	WOMENS DRESSING RR	X		X			
SD	179	KITCHEN HALLWAY	X		X			
SD	189	KITCHEN TOILET	X		X			
SD	193	GIRLS TOILET STUDENT STORE	X		X			
PS	101	FACULTY DINNING	X		X			
PS	103	SW HALL	X		X			
PS	114	CAFÉ NE	X		X			
PS	115	CAFÉ NW	X		X			
SD	202	FACULTY TOILET	X		X			
SD	207	WORKRM	X		X			
SD	220	IEP ROOM A	X		X			
HD	81	KITCHEN	X		X			
HD	80	ABOVE KITCHEN	X		X			
HD	85	KITCHEN	X		X			
HD	86	KITCHEN	X		X			
HD	82	CAFÉ SERVING	X		X			
HD	81	CAFÉ SERVING	X		X			
HD	25	STUDENT STORE	X		X			
HD	48	STUDENT STORE	X		X			
HD	55	STUDENT STORE	X		X			
		SCIENCE BLDG						
SD	270	SCIENCE LAB 416	X		X			
SD	273	SCIENCE LAB 416	X		X			
SD	274	SCIENCE LAB WORKRM	X		X			
SD	277	SCIENCE LAB 417	X		X			

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PERIPHERAL FUNCTION TEST

DEVICE TYPE	ZONE #	Location	ALARM	SUPERV	PASS	FAIL	TIME IN SECONDS	NOT TESTED
		SCIENCE BLDG CONT						
SD	278	SCIENCE LAB 417	X		X			
SD	279	SCIENCE LAB 417	X		X			
SD	280	SCIENCE LAB 417	X		X			
WF	201	SCIENCE BLDG	X		X			
		PORTABLES						
SD	226	P12	X		X			
SD	227	P12	X		X			
SD	230	P11	X		X			
SD	231	P11	X		X			
SD	203	P3	X		X			
SD	204	P4	X		X			
SD	205	P5	X		X			
SD	206	P6	X		X			
SD	207	P10	X		X			
SD	208	P9	X		X			
SD	209	P8	X		X			
SD	210	A	X		X			
SD	211	B	X		X			
SD	212	C	X		X			
SD	213	D	X		X			
SD	216	P6	X		X			
SD	219	P5	X		X			
SD	222	P4	X		X			
SD	225	P3	X		X			
SD	234	P1	X		X			
SD	235	P1	X		X			
SD	241	P8	X		X			
SD	246	P13	X		X			
SD	247	P13	X		X			
SD	252	D	X		X			
SD	255	C	X		X			
SD	258	B	X		X			
SD	261	A	X		X			
SD	262	P2	X		X			
SD	263	P2	X		X			
SD	266	P9	X		X			
SD	267	P10	X		X			

FIRE ALARM INSPECTION REPORT

ACKNOWLEDGEMENT CONTINUATION SHEET

NOTE NO.	DISCREPANCIES START WITH NOTE 1 ☐ NONE: ☑ AS FOLLOWS:
1	NO STROBE IN BLDG A
2	ROOM 202 - NO ACCESS TO PANEL
3	WHEN REMOVING DETECTOR HEADS THE ALARM SOUNDS - SHOULD BE TROUBLE CONDITION
4	SUPERVISORY DEVICES ARE SOUNDING THE ALARM
5	WATERFLOWW IN THE MECHANICAL ROOM OF BLDG C IS LABELED SMOKE IN HEATER ROOM
6	SMOKE BEHIND ROOM 404 & 405 DOES NOT FUNCTION
7	ORAL ARTS ROOM PULL STATION IS BLOCKED BY A FILE CABINET
8	WATERFLOW SWITCH IN NEW BLDG G FAILED
9	NO ACCESS TO HALL BEHIND GYM
10	NO ACCESS TO HALL NEXT TO GIRLS LOCKER ROOM
11	PULL STATION IN CAFETERIA PASSAGE HALL NEEDS TO BE FASTENED TO THE WALL
12	NO ACCES TO ELECTRIC ROOM NEXT TO SCIENCE LAB
13	NO ACCESS TO THE LIBRARY FIRE RISER ROOM
14	WEATHERPROOF HORN BEHIND THE WEIGHT ROOM IS BROKEN
15	WEATHERPROOF HORN BEHIND FOOTBALL LOCKER IS HANGING

Underwriters Laboratories Inc.®

Northbrook, IL San Jose, CA
Melville, NY

A not-for-profit organization dedicated to public safety and committed to quality service

Applicant ID No: **257057-001**
Service Center No **1**
Expires: **31-MAR-2012**

CERTIFICATE OF COMPLIANCE

THIS IS TO CERTIFY that the Alarm Service Company indicated below is included by Underwriters Laboratories Inc. (UL) in its Product Directories as eligible to use the UL Listing Mark in connection with Certificated Alarm Systems. The only evidence of compliance with UL's requirements is the issuance of a UL Certificate for the Alarm System and the Certificate is current under UL's Certificate Verification Service. This Certificate does not apply in any way to the communication channel between the protected property and any facility that monitors signals from the protected property unless the use of a UL listed or Classified Alarm Transport Company is specified on the Certificate.

Listed Service From: ALISO VIEJO, CA

Alarm Service Company: (257057-001)

ADVANCED PROTECTION INDUSTRIES INC,
DBA NATIONAL MONITORING CENTER
SUITE 250
26800 ALISO VIEJO PKY
ALISO VIEJO CA 92656

Service Center: (257057-001)

ADVANCED PROTECTION INDUSTRIES INC,
DBA NATIONAL MONITORING CENTER
SUITE 250
26800 ALISO VIEJO PKY
ALISO VIEJO CA 92656

The Alarm Service Company is Listed in the following Certificate Service Categories:

File - Vol No.	CCN	Listing Category
BP10307 - 1	CRZM	Monitoring Stations, National Industrial Security
S8126 - 1	UUFX	[Signal and Fire Alarm Equipment and Services] (Protective Signaling Services) Central Station

*****THIS CERTIFICATE EXPIRES ON 31-MAR-2012 *****

"LOOK FOR THE UL ALARM SYSTEM CERTIFICATE"

Engineering Manager
31-MAR-2011

© 2008 UL Form CS-CC

California Water Service Company
Fire Flow Test

Test Date: 2/29/2012 | Test Time: 15:30 | Approved Date:
District: PALOS VERDES | Zone: | Plat:
General Location:
Address: PV High School
Cross Street:
Requested By: Thomas Norico
Purpose Of Test:
Conducted By: Matt Kang
Witnessed By C.W.S. Co:
Others:

Outlet No.	Size Outlet	PITOT	Observed	Static Pressure	Residual Pressure	Flow Observed	Flow Avail.@20
Location 1	Hydrant #:	Address: Hydrant 1					
1	2.5	70	1404	118	70	1404	2064
2	0	0	0				
3	0	0	0				
4	0	0	0				
Location 2	Hydrant #:	Address: Hydrant 2					
1	2.5	35	993			993	1459
2	0	0	0				
3	0	0	0				
4	0	0	0				
			Total Flow Observed Available @20:			2397	3524

Remarks:
Static/Residual Location:

Note:
Regardless of the results of this test, California Water Service Company assumes no liability beyond that stated in the following excerpt from the P.U.C. Tariff Schedule: 'The utility (California Water Service Company) will supply only such water at such pressure as may be available from time to time as a result of its normal operation of the system.'

California Water Service Company
Fire Flow Test

Test Date: 2/29/2012 | Test Time: 15:45 | Approved Date:

District: PALOS VERDES | Zone: | Plat:

General Location:

Address: Via Pacheco

Cross Street:

Requested By: Thomas Norcio

Purpose Of Test:

Conducted By: Matt Kang

Witnessed By C.W.S. Co:

Others:

Outlet No.	Size Outlet	PITOT	Observed	Static Pressure	Residual Pressure	Flow Observed	Flow Avail.@20
Location 1	Hydrant #: 561	Address: 2124 Via Pacheco					
1	2.5	25	839	116	90	839	1699
2	0	0	0				
3	0	0	0				
4	0	0	0				
			Total Flow Observed Available @20:			839	1699

Remarks:

Static/Residual Location: 2137 Via Pacheco non regulated hose bib

Note:

Regardless of the results of this test, California Water Service Company assumes no liability beyond that stated in the following excerpt from the P.U.C. Tariff Schedule: 'The utility (California Water Service Company) will supply only such water at such pressure as may be available from time to time as a result of its normal operation of the system.'

LOCAL FIRE AUTHORITY REVIEW

Local Fire Authority to initial the items as applicable to this project and sign below

YES	NO	N/A		DSA Application #: _____
☐	☐	☐	Elevators	Where an Elevator does not meet medical emergency service cab size, per 2010 California Building Code (CBC), the Local Fire Authority approves the use of stairways for emergency rescue and patient transport.
☐	☐	☐	Access Roads	Access Roads and Gate Entrances are in accordance with Title 19, Calif. Code of Regulations & 2010 California Fire Code (CFC) Chapter 5. (Explain in comments section any "NO" answer)
☐	☐		Fire Flow	The Hydrant location and distribution are in accordance with 2010 CFC or Local Fire Authority, means for providing fire flow may vary from 2010 CFC with an approval signature of the School District Superintendent or Facilities Director. (See OSA Policy 09-01) (Explain in comments section any "NO" answer)
☐	☐	☐	Hazard Severity Zone Area?	(2010 CBC Chapter 7A)
☐	☐	☐	Automatic Fire Sprinkler Systems (AFSS)	The location(s) of the pressure Post Indicator Valve (PIV) and Fire Dept. Connection (FDC) meet the requirements of this jurisdiction.
☐	☐	☐		The location(s) of the Detector Check Valve Assembly (DCVA) meet the requirements of this jurisdiction.
☐	☐	☐		The fire pump accessway/backflow preventer and other valves meet the requirements of this jurisdiction.

LOCAL FIRE AUTHORITY INFORMATION:
School Superintendent or Facilities Director Signature when required above.

AGENCY NAME (Print): LA COUNTY FIRE DEPARTMENT

ADDRESS (Print): 4475 W. El Segundo Bl.

CITY/STATE/ZIP (Print): HAWTHORNE, CA 90250

PHONE NUMBER (Print): 310-363-2732 DATE: _____

APPROVAL ISSUED BY: _____

NAME/TITLE (Print): _____

SCHOOL REPRESENTATIVE SIGNATURE: _____

COMMENTS (Print): _____

Initials and a signature above signify that the Local Fire Authority has reviewed the Exhibit Items and was consulted regarding their placement and design. The current configuration shown on this site plan, as of this date, meets with their current standards. Local Stamps w/signature indicates all items above have been reviewed.

AREA ANALYSIS:

CLASSROOM BUILDING 3

A. USE	OCCUPANCY	AREA
CLASSROOMS + WALKWAYS	E	12,216 SQ. FT.
CLASSROOM 101 + 102 + 103 = 2,868 SQ. FT.		
CLASSROOM 104 + 105 = 1,833 SQ. FT.		
CLASSROOM 106 + 107 = 1,833 SQ. FT.		
CLASSROOM 108 + 109 + 110 = 2,858 SQ. FT.		
WALKWAY = 2,554 SQ. FT.		
TOTAL = 12,216 SQ. FT.		

B. CONSTRUCTION TYPE V-B

C. BUILDING AREA MODIFICATIONS

AREA INCREASE DUE TO FRONTAGE = ((564/534 - .25)30) / 30
AREA INCREASE DUE TO FRONTAGE = 0.56

ALLOWABLE BUILDING AREA PER STORY = 9,500 + (9,500 X 0.56)

ALLOWABLE BUILDING AREA PER STORY = 14,725 SQ. FT.

D. ALLOWABLE FLOOR AREAS

ALLOWABLE AREA PER C, V-B	9,500 SQ. FT
ALLOWABLE AREA AFTER AREA MODIFICATION	14,725 SQ. FT.
ACTUAL FLOOR AREA =	12,216 SQ. FT. : OK

KEYNOTES - (E) CONSTRUCTION

(A) ACCESSIBLE DRINKING FOUNTAIN, A# 111573
(B) ACCESSIBLE BOY'S TOILETS, A# 111573
(C) ACCESSIBLE GIRL'S TOILETS, A# 111573
(D) ACCESSIBLE WOMEN'S TOILETS, A# 111573
(E) ACCESSIBLE MEN'S TOILETS, A# 111573

KEYNOTES - NEW WORK

(01) FIRE LANE SIGNAGE — 10 / A121
(02) TOW AWAY SIGNAGE — 10 / A121
(03) ACCESSIBLE SIGNAGE (TOTAL OF 5) — 3 / A121

NOTES:

PATH OF TRAVEL- PATH OF TRAVEL (P.O.T.) AS INDICATED IS A BARRIER FREE ACCESS THAT IS AT LEAST 48 INCHES WIDE WITHOUT ANY ABRUPT VERTICAL CHANGES EXCEEDING 1/2" AT 1:2 MAXIMUM SLOPE, EXCEPT THAT LEVEL CHANGES DO NOT EXCEED 1/4" VERTICAL, MAXIMUM CROSS-SLOPE 2% TYPICAL AND MAXIMUM SLOPE IN THE DIRECTION IS 5%, UNLESS OTHERWISE NOTED. THE ARCHITECT SHALL VERIFY THAT ALL BARRIERS ON THE DEDICATED PATH OF TRAVEL HAVE BEEN REMOVED. P.O.T. SHALL BE MAINTAINED FREE OF OVERHEAD OBSTRUCTION TO 80" MINIMUM (CBC 11338.2) AND SIDE OBJECTS PROTRUDING GREATER THAN 4" INTO P.O.T. BETWEEN 27 AND 80 INCHES ABOVE THE FINISHED FLOOR (CBC 11338.6).

FIRE RATINGS OF EXISTING CONSTRUCTION AND ALL EMERGENCY EGRESS FEATURES INCLUDING PANIC HARDWARE, ILLUMINATED EXIT SIGNS, AND SITE LIGHTING ALONG EGRESS ROUTE SHALL BE MAINTAINED UNLESS NOTED TO BE REPLACED IN THE DRAWINGS.

THIS DRAWING IS PRIMARILY INTENDED TO DEMONSTRATE CODE COMPLIANCE; SEE CIVIL, PLUMBING, & ELECTRICAL DRAWINGS FOR ADDITIONAL SITE CONSTRUCTION.

CONTRACTOR SHALL COORDINATE EXACT TYPE, LOCATION & ORIENTATION OF SIGNAGE IN FIELD WITH ARCHITECT

PARKING RATIO CALCULATIONS

TOTAL NUMBER OF PARKING SPACES: 71

MINIMUM NUMBER OF REQUIRED ACCESSIBLE PARKING SPACES: 3

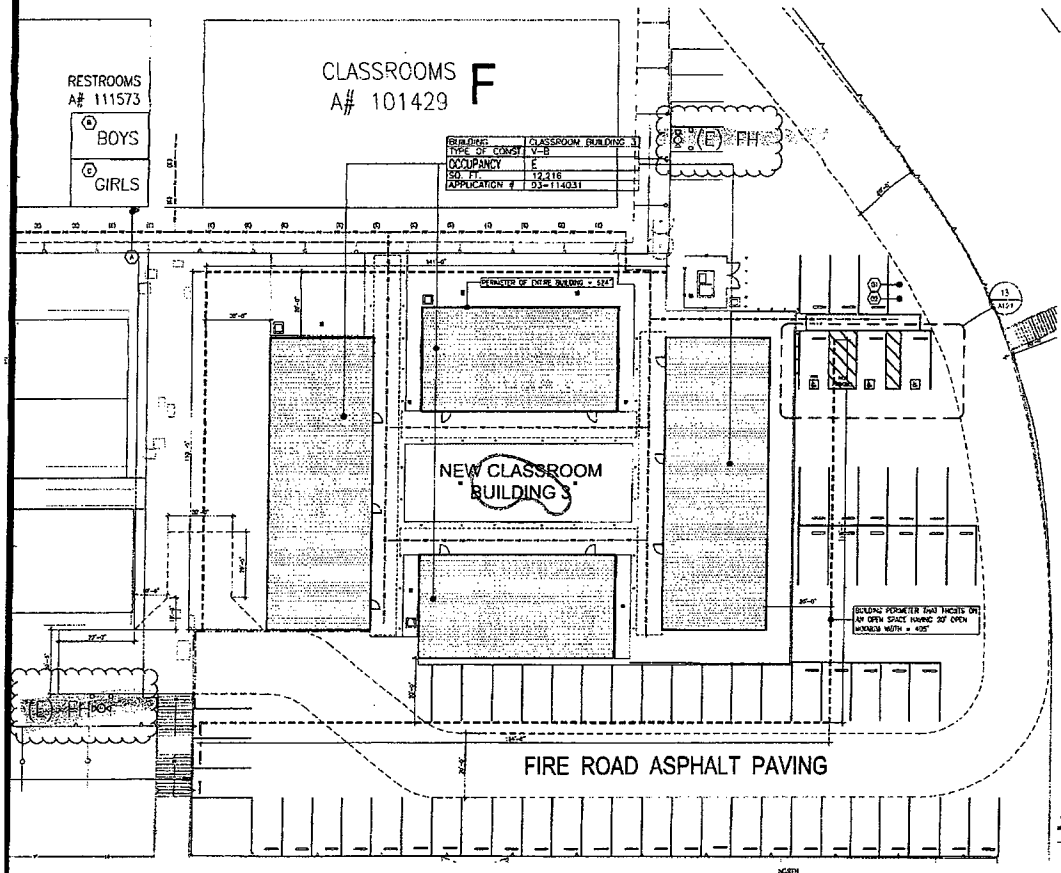
TOTAL NUMBER OF ACCESSIBLE PARKING SPACES PROVIDED: 3

MINIMUM NUMBER OF REQUIRED VAN ACCESSIBLE PARKING SPACES: 1

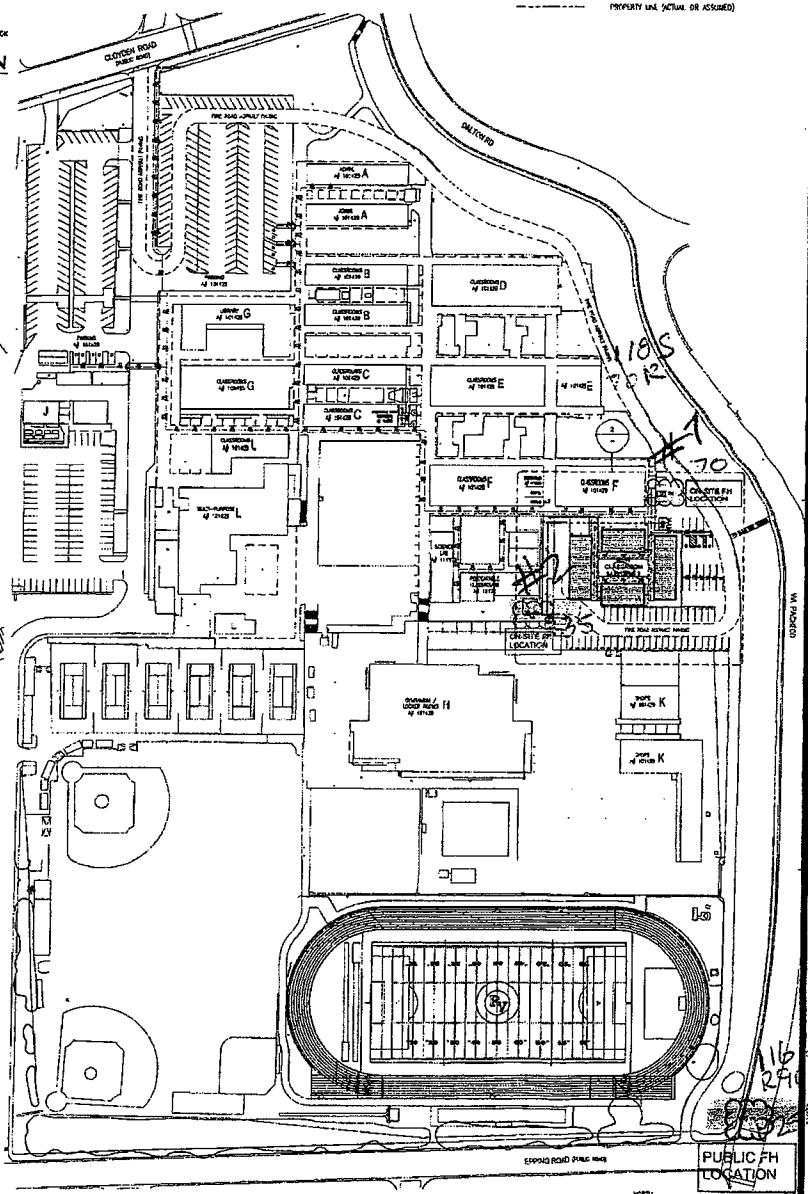
TOTAL NUMBER OF VAN ACCESSIBLE PARKING SPACES PROVIDED: 1

LEGEND

NEW BUILDING
(E) ACCESSIBLE PATH OF TRAVEL SEE NOTE 1
NEW ACCESSIBLE PATH OF TRAVEL SEE NOTE 1
PROPERTY LINE (ACTUAL OR ASSUMED)



2 ENLARGED CAMPUS PLAN
1/16" = 1'-0"



1 OVERALL CAMPUS PLAN
1" = 60'-0"

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Consultant:

Project Title:

Palos Verdes HS
CLASSROOM BUILDING 3
600 Cloyden Road
Palos Verdes Estates
California 90274

KEY PLAN

DSA SUBMITTAL	07.22.11
50% CD	05.31.11
DESIGN DEVELOPMENT	03.17.11

Mark Date Description
Issues/Revisions

Approvals:

DSA IDENTIFICATION STAMP
NO. OF STATE ARCHITECT
OFFICE OF REGIONAL SERVICES
APPL. 03-114031
DATE

Project No.:	1102.00
CAD Dwg. File:	
Drawn By:	
Checked By:	

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Sheet Title:
CODE ANALYSIS
FIRE DEPT. ACCESS PLAN
PATH OF TRAVEL PLAN

Sheet Number:
G101