SPECIFICATIONS

DRY CREEK ES
MODULAR RELOCATION
PHASE 3

1230 G STREET
RIO LINDA, CA 95673

DSA A#02-119476

Technical Requirements

Twin Rivers Unified School District
General Services – Purchasing
3222 Winona Way, Suite 200
North Highlands, CA 95660

DSA Backcheck

PROJECT MANUAL AND SPECIFICATIONS
FOR
Twin Rivers Unified School District
Dry Creek Elementary School
Portable Relocation Phase 3
Harrington Design Associates Project # 2131.00

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 02-119476 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 10/19/2021

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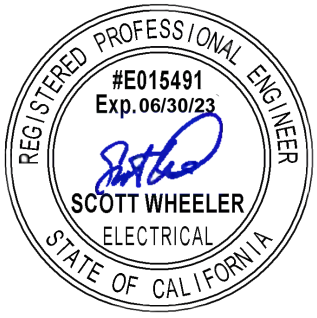

Scott Wheeler — California Registration #E015491

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Technical Requirements

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EROSION CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. General: Provide all materials, equipment and labor necessary to furnish and install BMPs and required maintenance.

B. The Contractor shall provide erosion and sediment control measures to the following activities, but not limited to:
1. Cut and fill operations.
2. Temporary stockpiles.
3. Vehicle and equipment storage, maintenance and fueling operations.
4. Concrete, plaster, mortar and paint disposal.
5. Dust control.
6. Tracking of dirt, mud on off-site streets.
7. Pipe flushing.
8. Appropriate Erosion Controls

1.02 QUALITY ASSURANCE

A. General: Comply with governing codes and regulations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Straw Wattles: Shall be new manufactured straw roles in compliance with state requirements for sediment control.

B. Filter Bag: Shall be as required by local jurisdiction.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Straw Wattles: Shall be installed as required.

B. Filter Bags: Shall be installed as required by manufactures requirements.

3.02 MAINTENANCE AND REMOVAL

A. General: Maintain and repair existing and new erosion control facilities throughout the construction period. Remove silt build up at straw wattles and/or silt fences as needed. Repair damage to earth slopes and banks. Erosion control measures shall be left in place until final paving and landscaping are complete.

B. Monitoring: Contractor shall provide all site monitoring and recommendations to meet current NPDES requirements during construction.

C. Cleaning: Keep area clean of debris.

D. Remove erosion control measures prior to placing finish landscaping.

END OF SECTION [01 57 13]

SECTION 02 41 00

SITE DEMOLITION

PART 1 – GENERAL

1.01 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01500, Construction Facilities and Temporary Controls.

B. Section 015713, Erosion Control

C. Section 310000, Earthwork.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.

B. Coordinate clearing Work with utility companies.

C. Maintain emergency access ways at all times.

D. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.04 SUBMITTALS:

A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.

B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.

1.05 EXISTING CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

1.06 PROTECTION

A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

C. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

D. Safety Precautions Prevent damage to existing elements identified to remain or to be salvaged, and prevent injury to the public and workmen engaged on site. Demolish roofs, walls and other building elements in such manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate on site. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends.

E. Protect existing items which are not indicated to be altered.
1. Protect utilities designated to remain from damage.
2. Protect trees, plant growth, and features designated to remain as final landscaping as shown on drawings.
3. Protect bench marks from damage or displacement.

F. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

G. Fire Safety: The contractor shall conform to chapter 33 of the California Fire Code (CFC), "Fire Safety During Construction and Demolition", at all times during the construction process. A copy of this chapter can be provided.

H. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

I. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

J. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

K. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine conditions of work in place before beginning work; report defects.

B. Report existence of hazardous materials or unsafe structural conditions.

3.02 PREPARATION

A. Scheduling:
1. General: Coordinate and schedule demolition work as required by the Owner and as necessary to facilitate construction progress.

B. Hazardous Materials:
   1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
   2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact the Owner. Do not proceed with demolition until directed by Owner.

C. Utility and Service Termination
   1. Locate and identify existing utility, service and irrigation system components affected by work of this contract. Review existing record drawings, conduct site investigations, contact Underground Service Alert and other qualified cable/pipe/line locator services, and implement all other means necessary to define the location of underground systems.
   2. Prior to beginning any demolition, properly disconnect all water, gas and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.
   3. Prior to demolition or disconnect, obtain Owners approval that such system does not impact facilities or systems beyond the extent of this contract.
   4. Mark location of disconnected systems. Identify and indicate stub-out locations on Project Record Documents.

D. Verify that existing plant life and features designated to remain are tagged or identified.

   1. The Architect will mark the features, trees, and shrubs to remain within the construction area. Contractor shall not commence clearing and grubbing operations until authorized by the Owner and all protective measures are in place.

E. Coordinate the time and duration of all system disconnects with Owner.

3.03 DEMOLITION

A. General Requirements
   1. Clear areas required for access to site and execution of Work, including pavements, structures, foundations, vegetation, trash and debris.
   2. Coordinate with Owner the time of day and route to remove demolished materials from premises.
   3. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
   4. Remove all buried debris, rubble, trash, or other material not deemed suitable by the Geotechnical Engineer.
   5. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with specified fill material.

B. Fixture and Equipment Removal:
   1. Remove existing fixtures and equipment as identified and shown on drawings and required by Architect.
   2. Verify all service connections to fixtures and equipment designated for removal have been properly disconnected.
   3. Remove all conductors from conduit at all abandoned circuits.

3.04 UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

A. Where crossing paths and potential points of interference with existing utility services are shown or can be reasonably inferred from surface conditions or evidence of subsurface systems, such as meter boxes, vaults, relief vents, cleanouts and similar components.

1. Review all contract documents showing crossing paths and potential points of interference.
2. Pot-hole or determine by other means the accurate depth and location of such utilities.
3. Incorporate all costs required to complete work under this contract, including additional trenching, re-routing of existing and new utilities, and all means necessary to construct work under this contract.
4. No additional cost to the Owner will be allowed for work necessary to accommodate utility conflicts where such crossing paths are shown on contract drawings or can be reasonably inferred from surface conditions or components.

B. Remove all conductors from conduit at all abandoned electrical circuits.

C. Seal off ends of all piping, drains and other components as directed by Architect and serving utility.

D. Where necessary to maintain service to existing utility and building systems, relocate or redirect all conduit and conductors, piping, drains, and associated system components.
1. Re-circuit all electrical as required.
2. Re-circuit all landscape irrigation valving and control systems as required.
3. Temporarily terminate landscape system components in approved boxes or with approved caps, suitable for re-connection or extension.
4. Extend or otherwise modify all site drainage systems, including catch basins, drain inlets and piping. Fine grade to maintain proper drainage flow pattern to drains.

E. Demolish structure in an orderly and careful manner.
1. Use of explosives prohibited.

3.05 SITE PAVEMENT REMOVAL

A. Remove sidewalk and curb where required for new construction as specified and as indicated on the Drawings.
1. Remove all paving by saw-cutting.
2. Remove concrete paving and curbing at locations shown on drawings. Locate closest adjacent expansion or weakened plane joint to define start of removal or saw-cutting.

B. Remove asphalt concrete paving areas where required for new construction as specified and as indicated on the Drawings.
1. Remove all paving by saw-cutting.
2. Remove paving assembly as required to expose subgrade.

3.06 LANDSCAPE AND IRRIGATION SYSTEMS DEMOLITION AND RENOVATION

A. Clearing, grubbing, and planting demolition.
1. Remove grass and grass roots to a minimum depth of two inches below existing grade.
2. Remove all shrubs, plants and other vegetation within the area of the work unless designated to remain. Grub and remove all roots of all vegetation to a depth of 24 inches below existing grade.
3. Remove only those trees which are specifically designated for removal, or as shown on the drawings, within the construction area. Remove all stumps. Remove root ball and root systems larger than 1 inch in diameter to a depth of two feet below existing or finished grades, whichever is lower and a minimum of five feet beyond the edge of paving, structure, wall or walkway.

4. Hand cut existing tree roots over 1 inch in diameter as necessary for trenching or other new construction, apply multiple coats of emulsified asphalt sealant especially made for horticultural use on cut or damaged plant tissues to cut faces and adjacent surfaces. Cover exposed roots with wet burlap to prevent roots from dying out until backfilling is complete.
5. Disking and mixing of vegetation, trash, debris, and other deleterious materials with surface soils prior to grading is not permitted.
6. Remove all buried debris, organic material, rubble, trash, or other material not deemed suitable by the Geotechnical Engineer.
7. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with fill material in compliance with Section 310000.
8. Selected equipment of such sizes and capacities that the existing environment is disturbed as little as possible, and to afford ease of mobility within limited and relatively confined work areas. Make every effort to preserve the topography in its natural state.
9. Keep drains, catch basins, surface drainage courses and related drainage system components clear of debris and construction materials.
10. Remove irrigation piping and appurtenances as necessary within area of work, unless noted otherwise to remain. Replace irrigation piping and appurtenances to irrigate new and/or existing landscaping. Contractor shall be responsible for temporary landscape irrigation until such time that irrigation system is restored and operational.

3.07 DISPOSAL

Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.

A. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.

B. It is recommended that all materials that are of a recyclable nature, be transported to a suitable legal recycling facility instead of a dump or refuse facility (unless they are one-in-the same).

C. Burning and Burying of Materials: NOT ALLOWED.

D. Haul Routes:
1. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance; post flagmen for the safety of the public and workmen.
2. Keep streets free of mud, rubbish, etc.; assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.

E. Remove demolished materials and debris from site on a daily basis.

3.08 CLEANING

A. Upon completion of work of this Section promptly remove from the working area all scraps, debris.

B. Clean excess material from surface of all remaining paved surfaces and utility structures.

C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION [02 41 00]

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Description of requirements for materials, fabrications and installation of rough carpentry and associated items (except that which is specified elsewhere) indicated on Drawings and necessary to complete the work (**per A# 02-45723**). Items include, but are not necessarily limited to, the following:
   1. Blocking, Backing, Stripping, Furring, and Nailers.
   2. Rough Hardware.
   3. Wood Framing.
   4. Plywood Sheathing.
   5. Preservative Treatment.
   6. Metal Fabrications.

1.02 RELATED SECTIONS

A. Section 00 72 00: General Conditions

B. Section 07 90 00: Joint Sealers

1.03 QUALITY ASSURANCE

A. Manufacturer data: Submit product data for all materials specified under this section and as applicable to each site.

B. Coordinate the work of all trades to ensure proper placement of all materials, anchors, etc., as well as providing for openings and anchors for the installation of surface mounted materials and equipment.

C. Qualifications of Workmen: Provide sufficient skilled workmen and supervisors who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of construction involved and the materials and techniques specified.

D. Rejection: In the acceptance or rejection of rough carpentry, no allowance will be made for lack of skill on the part of the workmen.

E. Requirements of Regulatory Agencies:
   1. California Building Code Standard, No. 23-1, "Classification, Definition and Methods in California of Grading all Species of Lumber":
      a. No. 23-2 - "Construction and Industrial Plywood".
   2. California Building Code (CBC), 2019 edition.

F. References and Standards: Provide materials graded under latest Edition of the pertinent following Agencies:
   1. American Society for Testing and Materials (ASTM).
   2. Lumber: West Coast Lumber Inspection Bureau (WCLIB), Rule 17, Standard Grading Rules for West Coast Lumber.
   3. Lumber: Western Wood Products Association (WWPA); Western Lumber Grading Rules.
   4. Plywood: American Plywood Association (APA); Plywood Specifications and Grades.
   5. Wood Preservative: American Wood Protection Association (AWPA), Standard U1.
   6. California Building Code, 2019 edition.

G. Design Criteria: Pressure treatment shall not adversely affect application, permanence, or appearance of finish paint system.

1.04 SUBMITTALS

A. Submit under provisions of Section 00 72 00.

B. Product Data.

C. Certification:
1. Pressure Treated Wood: Certification for water-borne preservative that moisture content was reduced to 19% maximum, after treatment.
2. Pressure Treated Wood: Submit certification by treating plant stating the chemicals and process used, net amount of salts retained, and conformance with applicable standards.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protection, General: Protect wood from moisture while being stored and while work is in progress.

B. Protection:
1. After delivery, store all materials in such a manner as to ensure proper ventilation and drainage and to protect against damage and the weather.
2. Keep all material clearly identified with all grade marks legible; keep all damaged material clearly identified as damaged, and separately store to prevent its inadvertent use. Do not allow installation of damaged or otherwise non-complying material.
3. Use all means necessary to protect the installed work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.06 JOB CONDITIONS

A. Environmental Requirements: Maintain uniform moisture content of lumber at 19 percent or less prior to close-in.

B. Sequencing: Coordinate details with other work supporting, adjoining, or fastening to rough carpentry work.

PART 2 – PRODUCTS

2.01 MATERIALS (also see **A#02-101199 Drawings**)

A. Wood:
1. Lumber (Blocking, Backing, Stripping, Furring, and Nailers): WCLIB Construction.
2. Lumber (Wood Framing): Meet requirements of following minimum grades:

Item	Species	Grade	Reference
Studs	D.F.	No. 1 2 x 4 Light Framing	WCLIB 124b
Studs	D.F.	No. 1	WCLIB 121
Plates	D.F.	No. 1	WCLIB 123b
Beams	D.F.	No. 1	WCLIB 130b
Joists	D.F.	No. 1	WCLIB 123b
Posts	D.F.	No. 1	WCLIB 131b

3. 4X and larger lumber shall be free of heart center.
4. 2x6 T & G Douglas Fir No. 1.

B. Plywood:
   1. Roof and Wall Structural Sheathing: PS-1-95 Structural 1, CDX APA with exterior glue.
   2. Thickness and type shall be as indicated on Drawings (**or A# 02-45723)**

C. Pressure-Treated Lumber:
   1. Douglas Fir pressure-treated, or RIS foundation grade Redwood.
      a. Required for cast-in-nailers, sills or anywhere wood is in contact with ground, concrete, masonry or grout.

D. Building Paper: Fed. Spec. UU-B-790a, Type I, Grade B (15 lb. min.).

E. Preservative Treatment
   1. Furnish pressure treated Douglas Fir in accordance with AWPA, Standard U1. Each piece is required to bear AWPA stamp.
   2. Field treat cut edges and holes frilled in factory treated lumber with an approved AWPA Standard U1 preservative product.
   3. For fastener requirements, see Paragraph 2.01-F-8.

F. Rough Hardware Fastenings and Connections: All types including bolts, lag screws, nails, spikes, screws, washers, framing devices and other rough hardware, or kinds that may be purchased and that require no further fabrication, shall be furnished and installed for all finish and rough carpentry. All exterior hardware shall be hot-dipped galvanized per ASTM A123 / A123M-09 Standards.
   1. Nails:
      a. Common wire nails or spikes; box nails not permitted.
   2. Bolts: ASTM A307-07b, Grade A, hexagonal heads, unless noted otherwise.
   3. Washers: Washers for bearing against wood shall be provided under all bolt heads and nuts. Washers shall be as indicated on Drawings.
   4. Powder Driven Fasteners: Tempered steel pins with special corrosive-resistant plating or coating. Pins shall have guide washers to accurately control penetration, minimum 1-1/8 inch. Fastening shall be accomplished by low-velocity pistol-driven powder activated tool. Pins and tool shall be as manufactured by Hilti Fastening Systems; Impex Tool Corporation; or approved equal. ICC approved.
   5. Expansion Bolts: ICC approved, ITW Ramset/Redhead Fastening Systems, or substitutions under provisions of Section 00 72 00.
   6. Fabricated Sheet Metal Timber Framing Connectors: CBC approved. Fabricate from hot-dipped galvanized steel. Connectors shall be at least 18 gauge minimum material (1/8" plate materials where welded, unless otherwise noted), punched for nailing. Nails and Nailing shall conform to the manufacturer's instructions with a nail provided for each punched hole. Types as noted on Drawings, manufactured by Simpson Co. or approved substitute. All framing connectors shall be stamped with manufacturer's logo, and model designation.
   7. Lag Screws: Conform to ASTM A307-07b. Dimensions and installation shall conform to requirements described in the National Design Specification (NDS), 1991 edition.
   8. All fasteners into preservative-treated and fire-retardant-treated wood shall be of hot dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153. Fasteners other than nails, timber rivets, wood screws and lag screws shall be permitted to be of zinc coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum.

G. Exterior Trim and Fascias: RIS Grade Stamped, Redwood, B Heart, Vertical Grain, Kiln Dried, surfaced sizes as indicated on the drawings (or **A# 02-45723)**

2.02 FABRICATION

A. Lumber:

1. Air- or kiln-dry to maximum 19 percent moisture content, prior to installation. Lumber must be 19 percent moisture content prior to close-in and finish.
2. Furnish S4S unless otherwise noted.
3. Size to conform with rules of governing standard. Sizes shown are nominal unless otherwise noted.

2.03 SOURCE QUALITY CONTROL

A. Grade Mark each piece of lumber. Marking must be done by recognized agency. Lumber Manufacturer's Association Certificates may be accepted in lieu of such grade and trademarks.
1. Douglas Fir shall bear WCLIB grade stamp.

B. Plywood Sheathing: Each panel shall be legibly identified as to type, grade and specie by APA grade. If plies are spliced, the slope of the scarf shall not be steeper than 1:8. White pockets will not be permitted in face plies.

C. Each piece of preservative treated lumber shall bear AWPA stamp.

2.04 WOOD PRESERVATIVE TREATMENT

A. Preservative treatment: Comply with applicable requirements of AWPA standards C2 for lumber and C9 for plywood. After treatment, kiln dry lumber to a maximum moisture content of 19 percent, and plywood to 15 percent.

1. Pressure treat members connected with roofing, flashing and weatherproofing; including but not limited to cants, nailers, curbs, equipment supports and blocking.

2. Pressure treat members that are concealed and in contact with masonry or concrete, including, but not limited to, sills, nailers, blocking, furring and studs.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. 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 properly proceed.

2. Verify that rough carpentry may be performed in strict accordance with the original design and all pertinent codes and regulations.

B. Selection of Lumber Pieces: Carefully select all members. Select individual pieces so that knot and obvious defects will not interfere with placing bolts or proper nailing or making proper connections. Cut out and discard all defects which will render a piece unable to serve its intended function.

C. Lumber may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting. No load carrying member shall be exposed to earthen materials.

D. Shimming: Do not shim any framing component.

3.02 FASTENING

A. Nailing: Except as otherwise indicated on Drawings or specified, all nailing shall be as scheduled on Drawings:

1. Nails or Spikes shall be common wire unless noted otherwise. Penetration of nails or spikes shall be one-half the length of the nail or spike into the piece receiving the point. However, to connect pieces 2 inches in thickness, 16d nails shall be used unless noted otherwise.

a. Bore holes for nails wherever necessary to prevent splitting.

b. Use finish or casing nails for finish work.

c. Use of nailing guns is as limited by CBC, and must be approved by Architect and DSA. Submittal of guns and nails is required.

B. Bolts: Bolts shall be of sizes indicated. Drive fit with washers under nuts. Tighten all bolts and screws before closing in.

C. Framing Devices: As specified under Products, sizes as indicated. Use half-length nails where required.

D. Lag Screws: Pre-Bore lead holes and install per CBC 2019 edition, Chapter 23.

3.03 FRAMING AND ROUGH CARPENTRY

A. Sills: Shall be in long lengths of sizes shown, fastened with anchor bolts at exterior walls and with powder driven fasteners at interior walls as indicated, a minimum of two (2) fasteners per piece and a bolt within 9" but not nearer than 6" from end of piece. Place malleable iron or steel plate washers (but not cut washers) under nuts bearing on wood. Set sills level and true and bed exterior wall sills and interior bearing wall sills on 1/2 inch dry-pack or non-shrink grout.

B. Studs, Posts and Columns: Shall be full length. Corners shall be as detailed. Partitions or walls containing plumbing, heating or other piping shall be so formed as to give proper clearance for materials. Cut members as required to provide full bearing at ends. Connect to structure as indicated.

C. Plates: Shall be in long lengths and spliced as shown.

D. Blocking: Shall be same thickness and width of studs or joists unless shown otherwise. Blocking shall not be spaced over 8'-0" o.c. Install fire blocking in accordance with CBC 2019 edition, Section 717. Install blocking at all plywood joints unless otherwise noted on the drawings. Install blocking for fastening all surface applied items.

E. Joists and Beams: Shall be in long lengths and spliced over bearings unless shown otherwise. Install with crown side up. Beams or headers indicated to be built up of two or more joists shall be fabricated on the job using full length members. For two piece members, stitch nail pieces together with 16d common nails spaced not over 12" o.c. and staggered. Clinch nails protruding through members.
1. Provide double joists and headers at all openings through floors and roofs unless otherwise shown on Drawings.
2. Provide typical headers at all openings through walls where one or more studs are required to be cut. For penetration through walls narrower than stud spacing, provide solid backing on all sides for fastening finish materials.

F. Plywood Structural Sheathing: Install to pattern indicated and provide blocking at joints where noted on the drawings. Center all joints over bearing supports. Nail to framing as indicated. Install plywood with face plies perpendicular to joists or studs unless indicated otherwise.

G. Wood Furring, Stripping and Grounds: Install as shown or required to provide nailing of materials or passage of pipes, conduits, etc., not otherwise accommodated. Strips used for furring gypsum board wall finishes shall be in widths as wide as existing wood studs. Thickness of strips shall be field verified by Contractor as needed to obtain needed wall finish location.

H. Bridging: Space not over 8'-0" o.c. for spans over 16'-0". Spans over 8'-0" and under 16'-0" shall have bridging placed at midspan. Bridging shall be two 2 x 3's or solid blocking as indicated. Joists 8" or less in depth shall not require bridging unless specifically indicated.

I. Backing: Shall be provided for all wall and ceiling finishes and for supporting of fixtures and equipment for all trades, including toilet partitions, toilet room accessories, frames, case work, mirrors, trim, applied wall finishes, etc. Coordinate placement of backing and supports with manufacturer or supplier of mounted items.

J. Building Paper: Install two layers in all exterior locations. Install with weather lap edges a minimum of 2 inch horizontal and 6 inch vertical laps. Continue building paper minimum 6 inches around inside and outside corners. Fasten in place with appropriate staples.

K. Cuts or holes in preservative treated wood shall be treated in accordance with AWPB standard M4 in the field.

3.04 MISCELLANEOUS HARDWARE

A. Finish hardware is specified in Section 08 71 00. All other hardware indicated or required but not specified elsewhere shall be furnished and installed hereunder, including appropriate screws or other fastening devices.

3.05 MISCELLANEOUS CARPENTRY WORK

A. Miscellaneous Carpentry Work not included under other sections shall be furnished and installed hereunder as indicated. Carefully locate and securely anchor such items to structure.

B. Drypack: Drypack shall consist of 1 part high early strength Portland cement to not more than 3 parts of sand by volume. Add only a minimum amount of water to hold the mixture in shape while packing and to provide hydration. Solidly ram drypack into place to provide uniform bearing and cure with moist sacks or cloths for a period of at least three (3) days.

C. Plywood Backing for electrical, telephone, and similar types of wall mounted equipment shall be provided hereunder where required. Plywood shall be 3/4" thick exterior A-C plywood with 'A' face exposed.

D. Shoring and Bracing: Shore or brace for temporary support of all work as required during the construction period except any shoring and bracing specified and included under other sections of these specifications.

E. Temporary Enclosures: Provide and maintain all barricades and enclosures required to protect the work in progress.

F. Protect all work in progress and all work installed, as well as the work of all other trades. Any work damaged as a result of the work under this section shall be corrected to its original condition or replaced if directed by the Architect and at no increase in cost to the Owner.

G. Protection Devices: Pedestrian walkways, barricades, lights, shoring and other protective structures and devices necessary for the protection of pedestrians shall conform in all respects to the requirements of CBC 2019 edition, Section 3303, Title 24 and to the requirements of the Department of Public Works.

3.06 FRAMING TOLERANCES

A. Maximum variation from true flatness: 1/4 inch in ten feet in any direction.

3.07 CLEAN-UP

A. Upon completion of the work of this Section, remove all surplus materials, rubbish and debris from the premises.

[END OF SECTION 06 10 00]

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Flashings **per A# 02-45723**

1.02 RELATED SECTIONS

A. Section 00 72 00: General Conditions.

B. Section 07 71 23: Gutters and Related Flashings.

C. Section 07 90 00: Joint Sealers.

D. Section 09 90 00: Painting: Prime and Finish Painting.

1.03 REFERENCES

A. ASTM A924 / A924M-09a - General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.

B. ASTM B32-08 - Solder Metal.

C. FS SS-C-153 - Cement, Bituminous, Plastic.

D. NRCA (National Roofing Contractors Association) - Roofing Manual.

E. SMACNA - Architectural Sheet Metal Manual.

1.04 SYSTEM DESCRIPTION

A. Work of this Section is to physically protect roofing and exterior from damage that would permit water leakage to building interior.

1.05 QUALITY ASSURANCE

A. Applicator: Company specializing in sheet metal flashing work with five years minimum experience.

1.06 SUBMITTALS

A. Submit shop drawings and manufacturer’s product data, installation instructions and general recommendations for each required material and product under provisions of Section 00 72 00.

B. Describe material profile, jointing pattern, jointing details, fastening methods, and installation details.

C. Samples: Only as directed by Architect.

1.07 STORAGE AND HANDLING

A. Store products under provisions of Section 00 72 00.

B. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation.

C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

PART 2 – PRODUCTS

2.01 SHEET MATERIALS

A. Galvanized Steel: ASTM A924 / A924M-09a, G90; **per A# 02-45723**

2.02 ACCESSORIES

A. Fastener: Galvanized steel or Stainless steel with soft neoprene washers at exposed fasteners. Finish exposed fasteners same as flashing metal.

B. Protective Backing Paint: FS TT-C-494A. Bituminous.

C. Sealant: Type specified in Section 07 90 00.

D. Solder: ASTM B32-08; 95-5 Tin Antimony type.

E. Flux: As recommended by sheet metal manufacturer.

F. Self-Adhered Flashing: Vycor Plus Self-Adhered Flashing as manufactured by Grace Construction Products, or equal. Product shall be 25 mil thickness, composed of durable, cross-laminated, high-density polyethylene sheet, backed by an aggressive, pressure-sensitive rubberized asphalt adhesive. Width and length as required for complete installation.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

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

C. Form pieces in longest practical lengths.

D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

E. Form material with flat lock seam.

F. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.

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

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

I. Expansion-contraction of sheet metal runs: Provide flat, loose locking slip joint at maximum of ten (10) foot intervals.

J. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contract, with bituminous coating or other permanent separation as recommended by manufacturer or fabricator.

2.04 FINISH

A. Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

B. Touch-up Paint: Section 09 90 00: Painting

PART 3 – EXECUTION

3.01 INSPECTION

A. Verify shapes and dimensions of surfaces to be covered.

B. Verify substrates are clean, dry, smooth and free of defects to the extent needed for sheet metal work.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Field measure site conditions prior to fabricating work.

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

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

D. Lock and seal all joints.

E. Apply plastic cement compound between metal flashings and felt flashings.

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

G. Solder metal joints watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

H. Seal metal joints watertight.

3.03 INSTALLATION

A. Install VYCORner and Self-Adhered Flashings(SAF) per manufacturer’s guidelines as shown Grace’s Installation Guidelines: Installation Before Weather-Resistive Barrier(WRB), and as shown on drawings. Contractor shall further reference the Grace Contractor’s Guide for complete details. Provide VYCORner at all window and door sill conditions securely anchored in place. Additionally wrap SAF over YVCORner and complete sill extending up each jamb to completely cover all wood surfaces and seal area from moisture and wind.

B. Conform to drawing details included in SMACNA and NRCA manual.

C. Insure that items are installed in true and accurate alignment with other items and related work; that joints are accurately fitted; that exposed surfaces are free from dents; that corners are reinforced; that seams are watertight.

D. All work shall be left free of oil, grease, or acid residue, ready to receive painter's finish.

E. Wherever possible, all fasteners shall be concealed. All exposed fasteners shall have neoprene

gaskets and be capped with a bead of sealant.

3.04 TOUCH-UP

A. Where galvanized finish is damaged by fabrication or installation, repair with specified touch-up material, applying in accordance with manufacturer's printed instructions.

[END OF SECTION 07 62 00]

SECTION 07 71 23

GUTTERS AND RELATED FLASHINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel gutters, downspouts **per A# 02-45723** and related flashing.

1.02 RELATED SECTIONS

A. Section 00 72 00: General Conditions.

B. Section 07 62 00: Sheet Metal Flashing and Trim.

C. Section 07 90 00: Joint Sealers

D. Section 09 90 00: Painting: Field painting of gutters & downspouts

1.03 REFERENCES

A. ASTM A924 / A924M-09a - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

B. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

C. SMACNA - Architectural Sheet Metal Manual, current edition.

D. AWS - American Welding Society.

1.04 SUBMITTALS

A. Submit under provisions of Section 00 72 00.

B. Shop Drawings: Indicate locations, configurations, jointing methods, welding methods, fastening methods, expansion joint layouts, downspout layout and installation details.

C. Samples: Submit two samples, 12 inches long illustrating component design, finish, color, and configuration.

1.05 QUALITY ASSURANCE

A. Conform to SMACNA Manual for architectural sheet metal flashing and installation details.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 00 72 00.

B. Stack pre-formed 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.

1.07 COORDINATION

A. Coordinate painting portions prior to installation and the work with downspout discharge pipe inlet.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Galvanized Steel: ASTM A924 / A924M-09a, Grade A, G90 zinc coating; **Per A# 02-45723**

B. Downspouts: **Per A# 02-45723**

2.02 COMPONENTS

A. Gutters: Size and shape **per A# 02-45723**

B. Downspouts: Size and shape **per A# 02-45723**

2.03 ACCESSORIES

A. Anchorage Devices: SMACNA requirements

B. Gutter Supports: Size and shape **per A# 02-45723**

C. Fasteners: Galvanized steel or stainless steel. Finish exposed fasteners same as flashing metal.

D. Touch-up Primer: Cold applied zinc-rich type.

E. Protective Back Coating: FS TT-C-494, bituminous.

F. Sealant: Type as specified under Section 07 90 00.

G. Strainers: Provide and install strainers (bee hive type) a downspouts per SMACNA manual, latest edition.

2.04 FABRICATION

A. Form gutters of profiles and size indicated, to SMACNA requirements.

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 all exposed edges of metal.

E. Welding process shall be Metallic Inert Gas (MIG).

F. Weld all shop formed metal joints. Grind exposed joints flush with adjacent surfaces and apply touch-up primer as specified.

G. Butt weld all field assembled gutter sections. Grind exposed joints flush with adjacent surfaces and apply touch-up primer as specified.

H. Fabricate gutter sections with SMACNA butt type expansion joints at 40ft. maximum with a minimum of one(1) downspout being centered in each 40' section. Provide additional downspouts as necessary to accommodate expansion joint locations.

I. All joints shall be water tight per SMACNA standards.

2.05 FINISHES

A. Field paint gutters under provisions of Section 09 90 00.

B. Apply bituminous protective backing on surfaces in contact with dissimilar materials.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

A. Install gutters and downspouts as shown on **A# 02-45723** . Install expansion joints, additional downspouts and accessories **per** .**A# 02-45723**

B. Field assemble (weld) gutter sections at "ground level" wherever possible and lift into place as one unit.

C. Install gutters level and straight in line with building. Shim horizontally and vertically as required to level. Installed gutter to have no ponding water more than ¼" deep.

D. Water test all gutters and downspouts for leaks and ponding in presence of IOR.

E. Flash and seal gutters to downspouts and accessories.

[END OF SECTION 07 71 23]

SECTION 07 90 00

JOINT SEALERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Preparing sealant substrate surfaces.

B. Concrete Joint Sealants.

C. Sealant and backing.

D. Fireproof Firestopping and firesafing materials and accessories.

1.02 RELATED SECTIONS

A. Section 00 72 00: General Conditions.

B. Section 07 62 00: Sheet Metal Flashings and Trim: Sealants used in conjunction with metal flashings.

C. Section 07 71 23: Gutters and Related Flashings.

D. Division 26: Electrical.

1.03 REFERENCES

A. ASTM C834-10 - Latex Sealants.

B. ASTM C920-05 - Elastomeric Joint Sealants.

C. ASTM E84-10 - Test Method for Surface Burning Characteristics of Building Materials.

D. ASTM E119-07a - Method for Fire Tests of Building Construction and Materials.

E. ASTM E814-02 - Test Method for Fire Tests of Through Penetration Firestops.

F. FM (Factory Mutual) - Fire Hazard Classifications.

G. UL - Fire Hazard Classifications.

H. UL 263 - Fire Tests of Building Construction and Materials.

I. UL 723 - Test for Surface Burning Characteristics of Building Materials.

J. UL 1479 - Fire Tests of Through-Penetration Firestops.

K. FS TT-S-00227 - Sealing Compound: Elastomeric Type, Multi-Component.

L. FS TT-S-00230 - Sealing Compound: Elastomeric Type, Single Component.

M. FS TT-S-001543 - Sealing Compound, Silicone Rubber Base.

1.04 SUBMITTALS

A. Submit manufacturer’s product data under provisions of Section 00 72 00 for each product required.

B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, and color availability.

C. Submit samples under provisions of Section 00 72 00.

D. Submit standard color ranges of exposed materials for Architect selection.

E. Submit manufacturer's installation instructions under provisions of Section 00 72 00.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years experience.

B. Applicator: Company specializing in applying the work of this section with minimum three years experience, with projects of a similar size and type.

C. Conform to Sealant Waterproofering and Restoration Institute requirements for materials and installation.

D. Prior to installation of joint sealants, field test adhesion to joint substrates.
1. Install joint sealants in 5-foot joint lengths. Allow to cure before testing. Test adhesion by pulling sealant out of joint.
2. Perform field tests for each type of elastomeric sealant and joint substrate.
3. Arrange for tests to take place with joint sealant manufacturer’s technical representative present.
4. Report whether or not sealant in joint connected to pulled out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
5. Sealants not evidencing adhesive failure from testing, in absence of other indications of non-compliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrate during testing.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent curing sealants in enclosed building spaces.

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

C. Do not install sealants under adverse weather conditions or when temperatures are above or below manufacturer's recommended limitations for installation.

D. Deliver materials in the unopened, original containers or unopened packages with manufacturer’s name, labels, product identification, color, expiration period, curing time and mixing instructions for multi-component materials.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with all Sections referencing this Section.

1.08 WARRANTY

A. Provide two year warranty for materials and workmanship under provisions of Section 00 72 00.

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

PART 2 – PRODUCTS

2.01 SEALANTS

A. Silicone Sealant: Silicone Sealant (use at concrete, masonry, or glazing applications): FS TT-S-01543, Class A, low modulus type; Spectrum I as manufactured by Tremco, Inc.

B. Interior Building Sealant: Acrylic-emulsion; one-part, nonsag, mildew-resistant. Complying with ASTM C834-10, formulated to be paintable; Pecora Corp. “AC-20”, Sonneborn “Sonolac”, Tremco Inc. “Tremco Acrylic Latex 834” or approved equal.

C. Sanitary Sealant: One-part mildew-resistant silicone; ASTM C920 Type S; Grade NS Class 25; Uses NT, G, A and O; formulated with fungicide for sealing interior joints with nonporous substrates around ceramic file, showers, sinks and plumbing fixtures; Dow Corning Corp. “786 Mildew Resistant”, or approved equal.

D. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound; Pecora Corp. “BA-98”, Tremco Inc. “Tremco Acoustical Sealant” or approved equal.

E. Acoustical Sealant for Exposed Joints: Nonoxidizing, skinnable, paintanle, gunnable sealant recommended for sealing interior exposed joints to reduce transmission of airborne sound; Pecora Corp. “AC-20”, USG “Sheetrock Acoustical Sealant” or approved equal.

F. Concrete Expansion Joints: Joint sealing material shall be a two-component, self-leveling, polyurethane elastomeric sealant. Product shall be Sikaflex 2cSL as manufactured Sika Corporation, or equal. Color shall be shall be chosen from the full range of manufacturer’s standard colors.

G. Sheet Metal Flashings, Trims, Gutters, & Joints: Joint sealing material shall be a two-component, self-leveling, polyurethane elastomeric sealant. Product shall be Sikaflex 2cSL as manufactured Sika Corporation, or equal. Color shall be shall be chosen from the full range of manufacturer’s standard colors. Provide Sikaflex 260 Primer at all stainless steel and/or galvanized substrate location for proper adhesion of Sikaflex 2cSL.

H. Substitutions: Under provisions of Section 00 72 00.

I. Color of sealant shall be as selected by Architect.

2.02 FIRESTOPPING SEALANTS

A. Firestopping Material: One-Piece insert conforming to the following:
   1. All fire stopping shall be one part, two stage intumescent sealants and puttys.
   2. All fire stopping sealants shall be capable of maintain an effective barrier against flame, heat, and smoke in compliance with the requirements of ASTM E814-09, UL 1479, ASTM E119-09c, UL 723, ASTM E84-10 and UL 263.
   3. Fire stopping materials shall be classified in the Underwriters Laboratories (UL) Fire Resistance Directory or listed in the Warnock Hersey International Directory.

4. Fire stopping materials shall be paintable or capable of receiving finish materials in those areas which are exposed to view and which are scheduled to receive finishes.
5. Acceptable Manufacturers: Hilti Firestop Systems, International Protective Coating Corporation “Flamesafe” Systems, 3M Fire Protection Products or approved equal.
6. Substitutions: Under provisions of Section 00 72 00.

2.03 ACCESSORIES

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

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

C. Joint Backing: Non-staining; compatible with sealant and primer; such as round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width. Materials impregnated with oil, bitumen or similar materials shall not be used. Sealant shall not adhere to back-up material.

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

E. Solvents; cleaning agents or other accessory materials shall be as recommended by the sealant manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing surfaces.

3.02 PREPARATION

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

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

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

D. Perform preparation in accordance with sealant manufacturer's recommendations.

E. Protect elements surrounding the work of this Section from damage or disfiguration.

F. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or acid washing to produce a clean, sound substrate. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints.

G. Clean metal, glass, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealants.

3.03 INSTALLATION

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

B. Caulk all exterior joints and openings in the building envelope that are observable sources of air infiltration.

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

D. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width. Roll the material into the joint to avoid lengthwise stretching. Do not twist or braid rod stock.

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

F. Prime surfaces to receive joint sealant with primer recommended by sealant manufacturer.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges. Apply masking tape where required to protect adjacent surfaces from sealant application.

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

I. Tool joints concave.

J. At all surface mounted light fixtures mounted on gypsum board ceilings, contractor shall caulk light fixture body to ceiling finish to eliminate gap between metal body and fixture. Coordinate locations with drawings.

K. Firestopping:
1. Apply materials in exact accordance with manufacturer's latest published instructions, requirements, specifications, details and approved submittals.
2. Installation shall be in accordance with the appropriate UL Fire Resistance Directory or Listing with the appropriate Warnock Hersey International Listing.
3. Seal holes or voids made by penetrating items to ensure an effective fire and smoke barrier.
4. Seal intersections and penetrations of floors, ceilings, walls and columns.
5. Seal around cutouts for lights, cabinets, pipes, plumbing, HVAC ducts and electrical boxes, etc.
6. Where floor openings are four inches or more in width and subject to traffic or loading, install cover plate systems capable of supporting same loading as floor.
7. Interface with Other Projects: Coordinate and cooperate with adjacent, contiguous and related materials trades, (such as concrete, drywall, plumbing, conduit, electrical wiring, communication systems) to ensure a proper and timely installation.
8. Seal steel deck flute openings.

3.04 CLEANING AND REPAIRING

A. Clean work under provisions of Section 00 72 00.

B. Clean adjacent soiled surfaces. Use a solvent or cleaning agent as recommended by the sealant manufacturer.

C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Section 00 72 00.

B. Protect sealants until cured.

C. Do not paint sealants until sealant is fully cured.

D. Do not paint silicone sealant.

[END OF SECTION 07 90 00]

SECTION 09 53 00

SUSPENDED ACOUSTICAL CEILINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Acoustical panels.

B. Non-fire rated assembly

1.02 RELATED SECTIONS

A. Section 00 72 00: General Conditions.

1.03 REFERENCES

A. ASTM C635 / C635M-07 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636 / C636M-08 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

C. ASTM E580 / E580M-09a - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

D. ASTM E1264-08 - Classification of Acoustical Ceiling Products.

E. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.

F. UL - Fire Resistance Directory and Building Material Directory.

G. Division of the State Architect - Interpretations of Regulations, IR 25-2.13 - Metal Suspension Systems for Lay-in Panel Ceilings, 12 GA wire ASTM A641 Class 1.

1.04 SYSTEM DESCRIPTION

A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with a maximum deflection of 1/360.

1.05 SUBMITTALS

A. Submit under provisions of Section 00 72 00.

B. Product Data: Provide data on main grid system components and acoustical units.

C. Samples: Submit two samples 6 x 12 inch in size illustrating material and finish of acoustic units.

1.06 QUALIFICATIONS

A. Acoustical Unit Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.07 SEQUENCING

A. Sequence work to ensure acoustical 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.

B. Install acoustic units after interior wet work is dry.

1.08 EXTRA MATERIALS

A. Furnish under provisions of Section 00 72 00.

B. Provide 2 percent extra panels to District (Owner).

PART 2 – PRODUCTS

2.01 MANUFACTURERS - ACOUSTIC UNITS

A. USG Interiors, Inc.

B. Armstrong Contract Interiors.

C. Chicago Metallic.

D. Substitutions: Under provisions of Section 00 72 00.

2.02 MANUFACTURERS - ACOUSTICAL UNITS

A. Armstrong, Product: Georgian Square Lay-In.

B. USG Interiors, Inc.

C. Substitutions: Under provisions of Section 00 72 00.

2.03 ACOUSTIC UNIT MATERIALS

A. Acoustic Panels: Conforming to the following:
1. Size: 24 x 48 inches.
2. Thickness: 5/8 inches.
3. Composition: Wet-formed Mineral Fiber.
4. Light Reflectance: 0.86.
5. NRC: 0.55.
6. CAC: 33 minimum.
7. Flame Spread: 25 minimum, Class A.
8. Smoke Developed Index: 50 minimum.
9. Edge: Square cut.
10. Surface Color: White.
11. Surface Finish: "Georgian", No. 763(Armstrong).
12. Exposed Grid Surface Width: 15/16 inches.

2.04 ACCESSORIES

A. Touch-up Paint: Type and color to match acoustical units.

B. Edge Trim at Acoustical Tiles: PVC channel, manufacturer's standard. Color to match grid.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that layout of hangers will not interfere with other work, either new or existing.

3.02 RE-INSTALLATION – (E) LAY-IN GRID SUSPENSION SYSTEM

A. Install system in accordance with ASTM C636 / C636M-08, DSA IR 25-2.13 and as supplemented in this section **(as applicable for re-installation)**.

B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.

C. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

D. Locate system on room axis according to reflected ceiling plan. At infill areas within existing grid, layout as identified on the reflected ceiling plan.

E. Hang suspension system impendent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, 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.

G. 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 4ft. light fixtures must have slack safety wires at each corner.

H. All flush or recessed light fixtures and air terminals or services weighing 56 pounds or more must be independently supported by not less than four taught 12 ga. wires each attached to the fixture and to the structure above regardless of the type of ceiling grid system used.

I. The four taught 12 ga. wires including their attachment to the structure above must be capable of supporting four times the weight of the unit.

J. Do not eccentrically load system or produce rotation of runners.

K. Install edge molding at intersection of ceiling and vertical surfaces using longest practical lengths without splices. Miter all corners. Provide edge molding at all junctions with other interruptions.

L. Attach all light fixtures and ceiling mounted air terminals or services to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures.

M. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduits, etc. It is acceptable to attach lightweight items such as single electrical conduit not exceeding 3/4 inches nominal diameter to hanger wires using connectors acceptable to DSA.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

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

C. Lay direction patterned units one way with pattern parallel to the longest room axis. Fit border trim neatly against abutting surfaces.

D. Install units after above ceiling work is complete and accepted.

E. Install acoustical units level, in a uniform plane, and free from twists, warps and dents.

F. Cut panels to neatly fit irregular grid and perimeter edge trim.

G. Install hold-down clips to retain panels tight to grid system within 10 feet of an exterior door.

3.04 ERECTION TOLERANCES

A. Maximum variation from flat and level surface: 1/8 inch in 10 feet.

B. Variation from plumb of grid members caused by eccentric loads: Two degrees maximum.

[END OF SECTION 09 53 00]

SECTION 09 68 00

CARPETING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Carpet tile.

B. Carpet accessories.

C. Substrate preparation for carpet and accessories.

1.2 RELATED SECTIONS

A. Section 00 72 00: General Conditions.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. Shop Drawings: Show the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Seam locations, types, and methods.
4. Type of subfloor.
5. Type of installation.
6. Pattern type, repeat size, location, direction, and starting point.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Sheet Carpet: 12-inch- square Sample.
   a. Carpet Seam: 6-inch Sample.
2. Carpet Tile: Full-size Sample.
3. Exposed Edge, Transition, and other Accessory Stripping: 12-inch-long Samples.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. Sample Warranties: For special warranties.

F. Maintenance Data: For carpet to include in maintenance manuals specified in Division 01. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

A. Carpeting Standard: Comply with the Carpet and Rug Institute's "CRI Carpet Installation Standard," 2011 edition, formerly CRI 104 "Standard For Installation Specification Of Commercial Carpet."

B. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

C. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

D. Mockups: Before installing carpet, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI Carpet Installation Standard, Section 5, "Storage and Handling."

B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.6 PROJECT CONDITIONS

A. General: Comply with CRI Carpet Installation Standard, Section 7, "Site Conditions."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

D. Where demountable partitions, equipment, or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of

substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

1. Warranty Period: Ten years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet: Full-width rolls and tiles equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Carpet (Vinyl Cushioned Tufted Textile) and integrated walk-off mats:
   1. **Tandus Centiva**, a Tarkett Company or approved equal.
      a. Powerbond cushion RS vinyl backing system – "**Aftermath II**" series with fully solvent welded seams. Color: **03026 Lapis / Marine 23517**
      b. "**Abrasive Action II**" walk-off system at all exterior doors in relocated classrooms. Color: **Charcoal 19100**
      c. Minimum Critical Radiant Flux: not less than Class II

B. Rubber Wall Base: Cove style, conforming to ASTM F 1861 or FS-SS-W-40, Type 1. 4" high and 1/8 inch (3.2mm) gauge. No manufactured corners.
   1. Burke Industries or approved equal. Color: **Black 100**

C. Resilient Edge and Adapter/Transition Strips: 1/8 inch thick, tapered or bullnose, minimum of 1 inch wide.
   1. Roppe
   2. Johnsonite
   3. Flexco Floors
   4. Approved equal.

A. Leveling and Patching Compounds:
   1. White premix latex; type recommended by carpet manufacturer. Install as recommended by manufacturer for specific application.

B. Primer: C&A C-36 primer.

C. Adhesives: Low VOC, waterproof, and as recommended by product manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. Examine carpet for type, color, pattern, and potential defects.

C. Concrete Subfloors: Comply with CRI Carpet Installation Standard, Section 9, “Testing Concrete Substrates.” Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer.
   2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI Carpet Installation Standard, Section 7.3, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
   3. Moisture Vapor Emission Testing:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.
   4. Relative Humidity Testing:
      a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
   5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.

C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Carpet Sheet, Direct-Glue-Down Installation: Comply with CRI Carpet Installation Standard, Section 13, "Direct Glue-Down Installation."
   1. Carpet Sheet, Stair Installation: Comply with CRI Carpet Installation Standard, Section 17, "Carpet on Stairs" for glue-down installation.
   2. Comply with carpet sheet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

B. Carpet Tile: Comply with CRI Carpet Installation Standard, Section 18, "Modular Carpet," and with carpet tile manufacturer's written installation instructions.

1. Installation Method, for Adhesive: Partial glue down; install periodic tiles with releasable, pressure-sensitive adhesive.
2. Installation Method, for Adhesive Film: Free lay; apply adhesive film squares at corners of tiles.
   a. Do not install tiles with adhesive film at stair and ramp locations.
   b. Do not install tiles with adhesive film over existing carpets.
3. Carpet Tile Pattern: As directed by Architect.
4. Maintain dye lot integrity. Do not mix dye lots in same area.

C. Install pattern parallel to walls and borders.

D. Do not bridge building expansion joints with carpet.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:
1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element and HEPA filter.

B. Protect installed carpet to comply with CRI Carpet Installation Standard, Section 20, "Protecting Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

[END OF SECTION 09 68 00]

SECTION 09 72 16

VINYL-COATED FABRIC WALL COVERINGS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Section specifies vinyl coated fabric wall covering and installation.

1.02 RELATED WORK:

B. Section 09 90 00: Painting

1.03 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:
1. Each type and pattern.
2. Size: Full width of mill run not less than 450 mm (18 inches) in length.

D. Manufacturer's Certificates:
1. Compliance with WA W-101.
2. Wall covering manufacturer's approval of adhesive.

E. Manufacturer's Literature and Data:
1. Wall covering primer and adhesive.
2. Installation instructions.
3. Maintenance instructions, including recommended materials and methods for maintaining wall covering with precautions in use of cleaning material.
4. Adhesive for edge guard.

F. Tests: Substrate moisture.

1.04 DELIVERY, STORAGE AND HANDLING:

A. Deliver in original unopened containers bearing the manufacturer's name, brand name, and product designation.

B. Store in accordance with manufacturer's instructions.

C. Handle to prevent damage to material.

1.05 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):
E84-14.....Surface Burning Characteristics of Building Materials
G21-13 .....Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Code of Federal Regulation (CFR):
40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

D. Wallcovering Association (WA):
W-101-13.....Quality Standard Polymer Coated Fabric Wallcoverings

PART 2 - PRODUCTS

2.01 VINYL COATED FABRIC WALL COVERING:

A. Comply with WA W-101 **(match existing).**

B. Fungi Resistance: ASTM G21, rating of zero (0).

C. Factory-applied clear delustered polyvinyl-fluoride (PVF) coating:
1. Minimum 0.0125 mm (1/2 mil) thickness.
2. Do not include PVF coating weight in minimum total weight.

D. Flame Spread Index: Class A or I, Flame spread Index 25 or less

2. 2 PRIMER AND ADHESIVE:

A. Vermin, mildew resistant and germicidal inhibiting type recommended by wall covering manufacturer for use on substrate to receive wall covering.

2.03 WALL LINER:

A. Provide a non-woven polyester cellulose blend having a minimum weight of 0.125 Kg/square meter (3.7 ounces per square yard) and a total minimum thickness of 0.325 mm (0.013 inches). Wall liner is to have a flame spread rating of 0-20 and smoke development rating of 0-25 when tested in accordance with ASTM E84.

PART 3 - EXECUTION

3.01 JOB CONDITIONS:

A. Temperatures:
1. Do not perform work until surfaces and materials have been maintained at minimum of 16 degrees C (60 degrees F) for three (3) days before work begins.
2. Maintain minimum temperatures of 16 degrees C (60 degrees F) until adhesives are dried or cured.

B. Lighting:
1. Do not proceed unless a minimum lighting level of 15 candela per 0.09 square meter (15 candela per square foot) is provided.
2. Measure light level at mid-height of wall.

B. Ventilation: Provide continuous ventilation as required to rid the spaces in which the wall coverings are being installed of volatile compounds given off by the wall coverings, sealers and adhesives and as recommended by the product manufacturer for full drying or curing.

C. Protect other surfaces from damage resulting from installation of wall coverings. Provide drop cloths, shields and protective equipment to prevent primers, adhesives or wall covering from fouling adjacent surfaces and in particular, storage and preparation areas.

D. Store flammable rubbish, waste, cloths and materials which may constitute a fire hazard, in closed metal containers. Daily remove and properly dispose of flammable wastes from the site.

3.02 SURFACE CONDITION AND PREPARATION:

A. Inspect surfaces to receive wall coverings to assure that:
1. Patches and repairs to substrates are completed.
2. Surfaces are clean, smooth and prime painted.
3. Masonry and concrete walls are to have flush joints. Coat these walls with cement plaster or wall/liner as substrate preparation.

C. Surfaces to receive wall covering are to be dry. Test moisture content of plaster, concrete, and masonry walls with an electric moisture meter. The moisture content is not permitted to be more than 5 percent. Submit test results.

D. Do not proceed until discovered defects have been corrected by other trades and surfaces are ready to receive wall covering.

D. Carefully remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings, prior to starting work and store items for reinstallation.

3.03 APPLICATION OF ADHESIVE:

A. Mix and apply adhesives in accordance with manufacturer's directions.

B. Prevent adhesive from getting on face of wall covering.

C. Apply adhesive to wall covering back.

3.04 INSTALLATION:

A. Use wall covering of same batch or run in each area. Use fabric rolls in consecutive numerical sequence of manufacture.

B. Install material completely adhered, smooth, clean, without wrinkles, air pockets, gaps or overlaps.

C. Extend wall covering continuous behind non-built-in casework and other items which are not bolted to the walls.

D. Install wall covering before installation of resilient base. Extend wall covering not more than 6 mm (1/4 inch) below top of resilient base.

E. Install wall covering panels consecutively in order in which they are cut from the roll including filling spaces above or below windows, doors, or similar penetrations.

F. Do not install horizontal seams.

G. Except on match patterns, hang fabric by reversing alternate strips, except as recommended by the manufacturer.

H. Cutting:
   1. Cut on a work table with a straight edge.
   2. Joints or seams that are not cut clean are unacceptable.
   3. Trim additional selvage to achieve a color and pattern match at seams. Overlapped seams are not allowed.
   4. Do not double cut seams on wall unless specified.
   5. If double cutting on the wall is necessary, place a three inch strip of Type I wall covering under pasted edge.
      a. Do not cut into wall surface.
      b. After cutting, remove strip and excess adhesive from seam before proceeding to next seam.
      c. Smooth down seam in adhesive for tight bond and joint.

H. Trim strip-matched patterns which are not factory pre-trimmed.

J. Inside Corners:
   1. Wrap wall covering around corners.
   2. Do not seam within 50 mm (2 inches) of inside corners.
   3. Double cut seams.

K. Outside Corners:
   1. Wrap wall covering around corners.
   2. Do not seam within 152 mm (6 inches) of outside corners.
   3. Double cut seams.

3.05 PATCHING:

A. Replace surface damaged wall covering in a space as specified for new work:
   1. Replace full height of surface.
   2. Replace from break in plane to break in plane when same batch or run is not used.
   3. Double cut seams.
   4. Adjoining differential colors from separate batches or runs is not acceptable.

B. Correct loose or raised seams with adhesives to lay flat with tight bonded joint as specified for new work.

3.06 CLEANING AND INSTALLING TEMPORARY REMOVED ITEMS:

A. Remove adhesive from wall covering as work proceeds.

B. Remove adhesives where spilled, splashed or splattered on wall coverings or adjacent surfaces in a manner not to damage surface from which it is removed.

B. Upon completion of work, leave wall covering free of dirt or soil.

D. Remove all debris associated with wall covering installation.

D. Reinstall previously removed electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings.

[End of Section 9 72 16]

SECTION 09 90 00

PAINTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Exhibit A: Requirements for Disturbance of Lead.

1.2 SUMMARY

A. This Section includes the following:
   1. Surface Preparation.
   2. Field application of paints, stains, varnishes, and other coatings.

1.3 SUBMITTALS

A. Product data - Submit product data sheets for each product.

B. Samples:
   1. Submit two painted samples, illustrating selected colors and textures for each color and systems selected with specified coats cascaded.
   2. Submit on suitable backing, 8x10 inch size.

1.4 QUALITY CONTROL

C. Use Professional-grade paint selections that include Manufacturer's warranty forcommercial applications whenever possible.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's 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.

1.7 WARRANTY

A. Installer Warranty: 1 year.

1.8 EXTRA STOCK

A. Provide following:
   1. Minimum 1 gallon each product in original or new 1 gallon cans or 2% of the quantity used, whichever is greater.
      a. Color spot each lid.
      b. Identify with formula, location, product and date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Paints: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Kelly Moore. (District Standard)
   2. Or equal.

2.2 PAINTS AND COATINGS

A. Ready mixed, except field-catalyzed coatings.

B. Prepare pigments:
   1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogenous coating.
   2. For good flow and brushing properties.
   3. Capable of drying or curing free of streaks or sags.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application. Do not proceed unless substrate is suitable.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent
   3. Interior Wood: 15 percent, measured in accordance with ASTMD4442.
   4. Exterior Wood: 15 percent, measured in accordance with ASTMD4442.

3.2 PREPARATION OF SURFACE

A. General:
   1. Clean all exterior walls and surfaces of loose and scaly paint, dirt, dust, chalk, and other foreign matter by water-blasting using care not to damage substrate followed by hand scraping, sanding or wire brushing after surfaces are dry. Mildew must be treated with household bleach solution and rinsed thoroughly.
   2. Patch, caulk, set protruding nails and repair all surfaces and cracks where necessary with suitable patching materials and smooth off to match adjacent surfaces.
   3. Sand Glossy surfaces to dull surface and remove residue.
   4. Remove mildew from affected surfaces with a solution of Tri-Sodium Phosphate and bleach. Rinse with clean water and allow to dry completely.
   5. Existing surfaces to be recoated shall be thoroughly cleaned and de-glossed by sanding or other means prior to priming and painting. Patched and bare areas shall be spot primed with the same primer as specified for new work.
   6. Rusty metal: Scrape, sand or wire wheel, feathering edges to sound coating. Dust surfaces. Topcoat.

7. Remove soil and body oils completely from surfaces, including handrails, door edges and posts. Treat with Liquid Sandpaper or Dull-N-Bond.
8. Remove hardware, accessories, plates, fixtures and similar items not to be finished. Reinstall at completion.
9. Paint edges of sink cut-outs.
10. Remove all signage / murals, clean and paint surface behind per specifications, and reinstall signage.

B. Concrete Surfaces:
   1. Concrete surfaces shall be dry, clean and free from efflorescence, encrustations and other foreign matter. Any glazed surface shall be slightly roughened or etched. Curing compounds, bond breakers, release agents and other coatings shall be removed with a light sandblast or high pressure power wash.

C. CMU Surfaces:
   1. Remove dirt, loose mortar, scale, powder and other foreign matter from concrete block surfaces which are to be painted.
   2. Unpainted CMU surfaces shall be cleaned with TSP. Rinse thoroughly. Surface shall be tested for adhesion. Prime as listed in materials section; allow to cure, then perform adhesion test with duct tape.

D. Galvanized Surfaces: Remove all oils and contamination from galvanized surfaces scheduled to be painted by washing with a compliant solvent wash.

E. Ferrous Metal: Remove grease, rust, scale, dirt and dust from ferrous metal surfaces. Primer coat shall be applied not less than 30 minutes, nor more than 3 hours after preparation of surface.

F. Primed Metal: Sand and scrape shop primed metal to remove loose primer and rust. Touch-up bare, abraded and damaged areas with metal primer. Feather edges to make touch-up patches inconspicuous.

G. Wood Surfaces:
   1. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot prime knots, pitch streaks and sappy sections with a stain blocking primer where surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs after patching material has fully cured.
   2. Wood surfaces with peeling areas are to have edges of broken paint film sanded to a feather edge.
   3. Back prime wood trim. Paint tops, bottoms, edges and cut-outs of doors.

H. Plaster Surfaces:
   1. Plaster surfaces shall be dry and free from efflorescence, encrustations and foreign matter. Fill cracks, holes and imperfections, smoothing repairs to match adjacent texture. Allow repairs to fully cure before priming.
   2. Prime plaster surfaces with specified primer. Caulk all cracks.

I. Gypsum Board: Gypsum board shall be dusted clean and free from encrustations and other foreign matter.

J. Preparation of other surfaces shall be performed following specific recommendations of the coating manufacturer.

3.3 PREVIOUSLY COATED SURFACES

A. Maintenance painting will frequently not permit or require complete removal of all old coatings prior to repainting. However, all surface contamination such as oil, grease, loose paint, mill scale dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers must be removed to assure sound bonding to the tightly adhering old paint. Glossy surfaces of old paint films must be clean and dull before

repainting. Thorough washing with an abrasive cleanser will clean and dull in one operation, or, wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system. Check for compatibility by applying a test patch of the recommended coating system, covering at least 2 to 3 square feet. Allow to dry one week before testing adhesion per ASTM D3359. If the coating system is incompatible, complete removal is required per ASTM D4259.

3.4 APPLICATION

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

B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

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

E. Sand wood surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust particles just prior to applying next coat.

G. Stipple all edges and corners to conceal brush marks.

H. Paint entire trim element with like color. Painting of faces only is unacceptable. Trim surfaces must be wrapped with the trim color and not "faced off" or "Hollywooded".

I. Doors: Paint entire door unless otherwise noted, including door top and bottom edge surfaces.

J. Tinting: Tint each primer a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint primer to match the color of the finish coat, but provide sufficient differences in shade of primer to distinguish each separate coat.

3.5 PROTECTION

A. Protect work of other trades and items not intended to receive paint. Install "wet paint" signs to protect newly painted surfaces.

3.6 CLEANING

A. Protection - Carefully protect areas where work is in progress from damage.
   1. Provide and spread clean drop cloths when and where required to provide the necessary protection.
   2. Immediately clean-up all accidental spatter, spillage, misplaced paint and restore the affected surface to its original condition.

B. Clean-up:
   1. Clean up debris daily per OSHA requirements.
   2. At completion of work, remove all materials, supplies, debris and rubbish and leave each area in a clean, acceptable condition.
   3. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.7 SURFACES TO BE FINISHED

A. Paint all new work and areas affected by new work, unless noted otherwise.

B. Do not paint or finish the following items:
   1. Items fully factory-finished unless specifically noted.
   2. Fire rating labels, equipment serial number and capacity labels.

C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
   1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
   2. Paint shop primed items occurring in finished areas.
   3. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint.
   4. Paint dampers exposed behind louvers, grilles and convector and baseboard cabinets to match face panels.

3.8 PAINT SYSTEMS - EXTERIOR

A. Portland Cement Plaster:
   1. Flat – 100% Acrylic:
      a. First Coat: 247 Acry-Shield 100% Acrylic Masonry Primer
      b. Two Coats: 1245 Acry-Shield 100% Acrylic Exterior Low Sheen

B. Ferrous Metal:
   1. Semi-Gloss – Alkyd / 100% Acrylic:
      a. First Coat: CV740 – Rust Preventative White Primer.
      b. Two Coats: 1250 Acry-Shield 100% Acrylic Exterior Semi-Gloss.

C. Galvanized Metal:
   1. Semi-Gloss – Epoxy / 100% Acrylic:
      a. Pretreatment: Jasco Metal Etch.
      b. First Coat: 5725 DTM Acrylic/Primer Finish.
      c. Second Coat: 1250 Acry-Shield 100% Acrylic Exterior Semi-Gloss.
      d. Third Coat: 1250 Acry-Shield 100% Acrylic Exterior Semi-Gloss.

D. Wood Substrates-Including architectural woodwork-Latex System:
   1. Semi-Gloss-100% Acrylic:
      a. First Coat: 255 Acry-Shield 100% Acrylic Exterior Wood Primer.
      b. Second Coat: 1250 Acry-Shield 100% Acrylic Exterior Semi-Gloss Enamel.
      c. Third Coat: 1250 Acry-Shield 100% Acrylic Exterior Semi-Gloss Enamel.

E. Wood decks be painted with an anti-skid paint:
   1. Two Coats of Monochem Dex-Coat Non-Skid Deck Coating. For applications on elevated (second story) decks, use Ultra Prime and Monochem 300 waterproofing membrane prior to applying Dex-Coat.

F. Metal roofing be painted:
   1. Primer: Mathys Pegalink Primer.
   2. Top Coat- Rust-Oleum 5200 System DTM Acrylic Comes in different sheens. Flat, Semi-Gloss and Gloss to match existing as approved by Architect.

3.9 PAINT SYSTEMS -INTERIOR

A. Gypsum Board
   1. Flat – Acrylic Copolymer:
      a. First Coat: 971 Acry-Plex Interior PVA Primer Sealer.
      b. Two Coasts: 550 Acry-Plex Interior Acrylic Flat Wall Paint.
   2. Low Sheen – Acrylic Copolymer:
      a. First Coat: 971 Acry-Plex Interior PVA Primer Sealer.
      b. Two Coats: 1507 Enviro-Coat Zero VOC 100% Acrylic Interior Low Sheen.
   3. Eggshell – Acrylic Copolymer / 100% Acrylic:
      a. First Coat: 971 Acry-Plex Interior PVA Primer Sealer.
      b. Two Coats: 1610 Acry-Plex 100% Acrylic Interior Eggshell Enamel
   4. Semi-Gloss - Acrylic Copolymer / 100% Acrylic:
      a. First Coat: 971 Acry-Plex Interior PVA Primer Sealer.
      b. Two Coats: 1650 Acry-Plex 100% Acrylic Interior Semi-Gloss.
   5. Gloss – Acrylic Copolymer / 100% Acrylic:
      a. First Coat: 971 Acry-Plex 100% Acrylic PVA Primer Sealer.
      b. Two Coats: 1680 Dura –Poxy+ 100% Acrylic Gloss.

B. Ferrous Metal:
   1. Semi-Gloss – Alkyd / 100% Acrylic:
      a. First Coat: CV740 Red Primer.
      b. Two Coats: 1685 Dura-Poxy+ 100% Acrylic Semi-Gloss.

C. Wood Substrates Including architectural woodwork Painted finish:
   1. Semi-Gloss Finish
      a. First Coat: 973 Acry-Plex Zero VOC Interior Wall Primer & Undercoat.
      b. Second Coat: 1685 Dura-Poxy+ 100% Acrylic Semi-Gloss.
      c. Third Coat: 1685 Dura-Poxy+ 100% Acrylic Semi-Gloss.

D. Tackboard to be painted:
   1. Primer: Bin Shellac Primer.
   2. Top Coat- 1610 Eggshell Enamel. (Test system prior to use). As always please follow all manufactures product data and label instructions.

3.10 COLORS

A. To be selected by Architect from manufacturer’s full range of colors.

[END OF SECTION 09 90 00]

TWIN RIVERS UNIFIED SCHOOL DISTRICT

EXHIBIT A

REQUIREMENTS FOR DISTURBANCE OF LEAD

PART 1 – GENERAL REQUIREMENTS

1.1 INTRODUCTION

These specifications are designed to minimize and control potential lead hazards during the disturbance of materials that contain lead. These procedures and precautions apply to the disturbance of lead that may result from the drilling into, cutting into, or removal of building components containing or covered with lead, or the demolition of buildings and/or structures that contain lead either in or on their surfaces.

The primary focus of these specifications is to address the work practices and procedures that the Contractor and/or other subcontractors must follow when conducting activities that may disturb lead in paint or other coatings or lead in ceramic tile glaze.

All paint on structures in California must be treated as "presumed lead-based paint" unless the paint is on a home built after 1978 or a school built after 1992. **THEREFORE THE PAINT IN ALL SCHOOLS COVERED BY THIS PROJECT THAT WERE CONSTRUCTED BEFORE 1993 MUST BE TREATED AS LEAD-BASED PAINT UNLESS TESTED AND PROVED OTHERWISE.**

The Owner has conducted bulk sampling of paints found on the buildings included in this project in the past. The results indicated multiple colors of paints present with lead in various amounts to include amounts requiring several paints be classified as lead based. As a result, all paints associated with the buildings to be impacted are considered lead based and these specifications and lead related work practices apply.

Owner/Owner's Representative anticipates enforcing Cal/OSHA and Department of Public Health (CDPH) regulations regarding the training of workers disturbing lead and the containment and work practices utilized during that disturbance. The training requirements for workers and supervisors on this project are summarized in Part 1.5. Lead Training Requirements. The Contractor and other subcontractors disturbing lead must be familiar with the CDPH requirements regarding containment of lead debris and the Cal/OSHA lead in construction standard. Those requirements are summarized below in Part 1.3 Regulatory Compliance.

In summary, the Contractor and subcontractors shall utilize engineering controls to limit the release of lead dust or debris. These engineering controls may include, but are not limited to, using wet methods, using tools with vacuum recovery systems with High Efficiency Air Particulate (HEPA) filtration, using vacuums with HEPA filtration, using negative air pressure differential systems, and by the prompt clean up of any lead-containing debris that the work might produce. Dry scraping, sanding, grinding, or abrading lead-containing materials is not permitted. All work that disturbs lead will require a containment. The containment may be as simple as plastic sheeting on the floor or ground when drilling minor penetrations or scraping paint on exterior surfaces. Or, for the demolition of ceramic tile and any painted wall systems, it is likely to require the Contractor construct a full containment for the area and utilize a negative air pressure differential system. The requirements for work practices and containment are described in Part 3.5 Work Site Preparation & Containment Requirements.

The requirements of this specification apply to all employers who have employees who may reasonably be exposed to lead on this project. This includes the Contractor, who will normally be an environmental contractor such as an asbestos abatement contractor, or a painting contractor utilizing California Department of Public Health (CDPH) lead certified workers and supervisors. In addition, this specification applies to all subcontractors conducting work on this project who have employees who may disturb lead by drilling, cutting, scraping, or demolishing materials containing lead.

No Contractor shall begin work which will disturb known or suspect lead-containing surfaces or materials in a manner that may expose a worker to lead containing dust, create a potential for building contamination, or create possible lead containing waste, until all required pre-construction documentation

has been reviewed and written approval has been received from the Owner and/or Project Monitor.

Activities expected to disturb lead-containing materials include, but are not limited to, painting preparation work such as scraping or sanding, penetration of painted surfaces through drilling or cutting, demolition of painted surfaces, removal of painted building components, and removal, drilling, or cutting of ceramic wall tiles. If the Contractor or subcontractors are observed conducting such activities without having written approval from the Owner and/or Project Monitor, they will be instructed to stop work. Work will not be allowed to resume until the Owner and/or Project Monitor provides approval for the work to begin.

1.2 DEFINITIONS

Action Level - Airborne exposure to lead at or above 30 □g/m^3 over an eight-hour-time-weighted average as discussed in 8 CCR 1532.1. Typically, when employees are exposed over the Action Level, the employer must provide blood testing, training in compliance with 8 CCR 1532, and air sampling.

Air Filtration Unit - A portable exhaust system equipped with HEPA filtration and capable of maintaining a constant low velocity air flow into contaminated areas from adjacent uncontaminated areas. At a minimum, the air intake for the air filtration device must have a pre-filter on it which can be changed within the containment area. In most cases, air filtration devices will need to pass challenge testing by DOP before they are allowed to be used on site.

Airlock - A system for permitting ingress and egress with minimum air movement between a contaminated area and an uncontaminated area, typically consisting of two curtained doorways separated by a distance of at least three feet such that one passes through one doorway into the airlock, allowing the doorway sheeting to overlap and close off the opening before proceeding through the second doorway, thereby preventing flow-through contamination.
Air Monitoring - The process of measuring the content of a known volume of air collected during a specific period of time.

Blood Testing - Blood testing for lead and zinc protoporphyrin in compliance with the requirements for medical surveillance as listed in 8 CCR 1532.1.

Cal/OSHA - California Division of Occupational Safety and Health. A California agency that implements and enforces numerous health and safety standards regarding lead.

Certified Lead Supervisor and Worker - Supervisors and workers currently certified by the California Department of Public Health (CDPH).

Challenge Testing - Process used to verify that HEPA-filtered equipment does not leak or exhaust asbestos, lead, or other particulate. This testing must be done by a testing company, not affiliated with the Contractor, and approved by the Owner and Project Monitor. Challenge testing normally uses an oil mist as the challenge agent and measures how much, if any, of the agent is exhausted from the machine being tested.

Clean Room - An uncontaminated area or room which is a part of the worker decontamination enclosure system with provisions for storage of workers' street clothes and clean protective equipment. The term also includes the uncontaminated area or room of a Waste Transfer Airlock.

Containment - Isolation of the work area from the rest of the building to prevent escape of lead in dust, debris or in the air.

Contractor - The Contractor is the person or entity identified as such in the Contract Documents as being responsible for the environmental work as done in response to and in accordance with this document. References to the "Contractor" include the Contractor’s authorized representatives. The Contractor may be a sub-contractor to the Primary Contractor. The Contractor normally will be responsible for paint preparation work that disturbs lead, paint scraping done prior to the demolition of structures, or the demolition of ceramic tile. The Contractor will typically need to use CDPH certified lead workers and supervisors to conduct their work that disturbs lead. Those employers disturbing smaller amounts of lead

such as through drilling, cutting, or small component removal are typically known as a subcontractor for the purposes of this specification.

Critical Barrier - Critical Barriers are used to restrict water and airflow. Critical Barriers are the barriers placed over openings in the walls and ceilings of a work area in order to ensure that lead dust cannot escape the work area via these openings. Unless otherwise specified in these Specifications, critical barriers shall be constructed of at least one layer of six-mil thick poly.

Curtained Doorway - A device to allow ingress or egress from one room to another while permitting minimal air movement between the rooms. These are typically constructed by placing two overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. Other effective designs are permissible as long as they are approved by the Project Monitor.

Decontamination Enclosure System - A series of connected rooms, separated from the work area and from each other by air locks, for the decontamination of workers, containers, and equipment. This unit shall be constructed with at least two layers of six mil poly for the floors, walls, and ceiling. The floor of the dirty room shall consist of two layers of six mil poly plus a third layer of poly, four mil or thicker, to be used as a removable drop layer. Drop layer is to be removed as needed, but at least daily.

CDPH - California Department of Public Health. State agency that regulates the disturbance of lead in public buildings and on all structures in California. This agency and relevant regulations are primarily concerned with preventing childhood lead poisoning.

DOP - Dioctylphthalate particles, a testing agent for the efficiency of HEPA filters.

DOT - Department of Transportation, a Federal agency which has regulations and labeling requirements for the transportation of hazardous waste.

DTSC - Department of Toxic Substances Control, a department within the California Environmental Protection Agency charged with implementing and enforcing hazardous waste regulations.

Dust or Debris - Any visible dust or debris remaining in work area will be considered lead-containing residue.

EPA - U.S. Environmental Protection Agency, a Federal agency that developed and enforces various asbestos and lead regulations.

HVAC - Heating, ventilation and air conditioning system.

HEPA Filter - A high efficiency particulate air filter capable of removing particles 0.3 microns in diameter from an air stream with 99.97% efficiency.

HEPA-Filtered-Vacuum Recovery System - This is a mechanical tool that has a shroud or covering over the area of a surface disturbed by a mechanical system in order to eliminate or significantly reduce the amount of dust released to the ambient air by the mechanical process. The shroud must be attached to a working vacuum with HEPA filtration.

HEPA Vacuum - A vacuum system equipped with HEPA filtration. Typically these units will need to be challenge tested before being allowed to be used inside of buildings on this project.

Lead-Based Paint - Materials meeting the definition of lead-based paint as defined by the California Department of Public Health and the United States Environmental Projection Agency. Currently defined as containing lead in concentrations equal to or greater than 1 mg/cm^2, 5000 ppm, or 0.5% by weight.

Lead-Containing Material - Materials that contain measurable, quantifiable amounts of lead. The disturbance of these materials is regulated by Cal/OSHA.

Lead-Containing Hazardous Waste - Materials required by the State of California to be packaged, labeled, transported, and disposed of as a lead hazardous waste.

Lead-Containing Waste Material - Lead-containing waster material that does not need to be treated as a lead-containing hazardous waste.

Lead Project Management or Monitoring Firm – The firm hired by Owner to provide third-party oversight of the disturbance of lead performed on the Owner's property by the Contractor or subcontractors.

Mil - An abbreviation for millimeter. Generally used when referring to the thickness of plastic (poly) sheeting used to contain the regulated area.

Movable Object - An unattached piece of equipment or furniture in the work area which can be removed from the work area.

Negative Air Machines - See Air Filtration Units.

NIOSH - The National Institute for Occupational Safety and Health. All respirators used on this project must be approved by NIOSH.

Outside Air - The air outside buildings and structures.

Owner - Property owner where the disturbance of lead will take place. For example, this may be a private building owner or manager, a government body such as a city or county agency, a military base, or a school district. This includes the Owner's authorized representatives and employees.

PEL - Permissible Exposure Limit (as used in 8 CCR 1532.1)

Permissible Exposure Limit (PEL) - Airborne exposure to lead above 50 □g^3 over an eight-hour, time-weighted average as discussed in 8 CCR 1532.1. Typically, when employees are exposed over the PEL, the employer must provide blood testing, respirators, protective clothing, shower decontamination, CDPH certification, regulated areas, and air sampling.

Poly - Flame-retardant polyethylene sheeting used to seal critical barriers, create cleaning barriers and drop layers, and to protect surfaces from damage or contamination.

Primary Contractor - The Contractor may not work directly for the Owner but instead subcontract with another contractor such as a general contractor or demolition contractor. The Primary Contractor is the entity responsible for hiring the Contractor if it is not the Owner.

Pre-start Meeting - Meeting held before the beginning of the project in which final details of the project are discussed and Contractor provides project monitor with pre-job submittal packet.

Project Monitor - An individual qualified by virtue of experience and education, designated as the Owner's representative and responsible for overseeing the work that disturbs lead on this project.

Project Monitoring - Activities undertaken by the Project Monitoring Firm for the purpose of monitoring the work done by the Contractor on this project in regards to the disturbance of lead.

Regulated Area - Term used by Cal/OSHA in 8 CCR 1532.1 to indicate a work area where exposure to airborne lead might exceed the Permissible Exposure Limit or where "Trigger Activities" may be performed. The area must be demarcated with signs and barriers designed to keep unauthorized people out of the area. Additionally "Regulated Area" means any measure used to restrict access to an area where personnel impacting lead-containing materials are required to wear respiratory protection and/or protective clothing by the project specifications regardless of airborne concentration of lead.

Shower Room - A room between the clean room and the equipment room in the decontamination enclosure with hot and cold or warm running water controllable at the tap and suitably arranged for complete showering during decontamination. Unless specified elsewhere in these specifications, or determined otherwise by the program monitor, the shower shall be on a metal pan to contain water splashed, leaked or spilled out of the shower unit.

Specifications - These written requirements describing procedures the Contractor must follow for this project.

Subcontractor - Contractors working for the Primary (General) Contractor but who are not primarily responsible for environmental work. For example, they may be responsible for, demolition, electrical, plumbing, general construction, minor painting, or other special trades.

Submittals - Pre-construction, interim construction, and post construction documents submitted by the contractor to the Owner as indicated in General Requirements and Bidding Requirements.

Trigger Task - Term commonly used to describe the tasks described by Cal/OSHA in 8 CCR 1532.1 (d)(2). These are tasks or activities that Cal/OSHA believes are expected to result in airborne exposures over the PEL until air monitoring proves otherwise. In brief, trigger tasks include manual demolition, scraping, sanding, using HEPA-attached equipment, using heat guns to remove lead paint, welding, torch cutting, and using other more aggressive techniques. (This is a summary list and does not list all tasks that are considered trigger tasks.) In addition, trigger tasks include any activity reasonably expected to result in airborne exposures to lead above the Permissible Exposure Limit.

View Ports - Clear windows into the regulated work area that allow authorized persons to view work activities inside the regulated area without entering the area. The view ports must be of sufficient number, constructed of materials of sufficient clarity, and be located in areas determined and/or approved of by the Project Monitor. All regulated work areas including mini-enclosures will require view ports unless specifically determined not to be feasible by the Project Monitor.

Visible Emissions - Any emissions containing particulate material that are visually detectable without the aid of instruments. For example, dust, debris, and water leaks are considered visible emissions.

Waste Load-out/Transfer System - A decontamination system utilized for transferring containerized waste from inside to outside of the work area. A series of connected rooms used for the load-out of lead-containing materials that have been properly containerized.

Waste Bags - Waste bags for lead-containing waste must be a minimum of six-mil thickness. In general, double bagging will be required.

Waste Containers - Waste containers are the containers into which lead-containing waste is placed. They may be bags of at least six-mil thickness, metal or fiber barrels, or other containers such as cardboard boxes approved by the Project Monitor. The Contractor is responsible for assuring that the type of container chosen is acceptable to the waste landfill to which the waste will be transported. Waste containers must be labeled according to the requirements of the California Department of Occupational Safety and Health (Cal/OSHA), Department of Toxic Substances Control (DTSC), Department of Transportation (DOT), and the Environmental Protection Agency (EPA).

Waste Transfer Airlock - A decontamination system utilized for transferring containerized waste from inside to outside of the work area.

Wet Cleaning - The process of eliminating lead contamination from building surfaces and objects by using cloths, mops, or other utensils which have been dampened with water and afterwards thoroughly decontaminated or disposed of as lead-contaminated waste.

Work Area - Designated rooms, spaces, or areas of the project in which the disturbance of lead is to be undertaken or which may become contaminated as a result of such action. A contained work area is a work area which has been sealed off from adjacent areas.

Work Plan - Contractor's written plan describing how the Contractor will perform the work in compliance with these specifications. The work plan shall include information on preparation of the work area, personal protective equipment, employee experience, training and assigned responsibilities during the project. It will also list decontamination procedures for personnel, work area and equipment, removal methods and procedures, required air monitoring program, procedures for handling and disposing of waste materials and procedures for final decontamination and cleanup.

Worker - A person who successfully meets the training requirements for the disturbance of lead as described in these specifications.

8 CCR 1532.1 - Chapter 8 of the Labor Code, California Code of Regulations, Section 1532.1: Lead (Known as the Lead Standard for the Construction Industry)

8 CCR 1544 - Chapter 8 of the Labor Code, California Code of Regulations, Section 1544: Respiratory Protection Standard.

1.3 REGULATORY COMPLIANCE

Various agencies regulate work that disturbs lead-containing materials. The following is a summary of the most important agencies and regulations that apply during the disturbance of lead during construction work. This list is not to be considered comprehensive. The Contractor is responsible for complying with all applicable federal, state, and local regulations that may apply to the specific work they are conducting.

1.3.1 ENVIRONMENTAL PROTECTION AGENCY (EPA)

Lead: Identification of Dangerous Levels of Lead; Final Rule (40 CFR Part 745 Subpart D)

The EPA defines lead-based paint as paint and coatings that contain lead in concentrations equal to or more than one milligram per square centimeter (1 mg/cm^2), 5000 parts per million (5000 ppm), or one half of one percent (0.5%) by weight. EPA regulations apply to all housing and child-occupied facilities built before 1978. When the term "lead-based paint" is used in the context of these specifications, the term is used only to refer to paint that contains lead in concentrations equal to or greater than that defined by the EPA as lead-based paint. (This is to differentiate lead-based paint from the term "lead-containing paint" as used for compliance with Cal/OSHA.)

1.3.2 HOUSING AND URBAN DEVELOPMENT (HUD)

Requirements for Notification, Evaluation and Reduction of Lead-Based Paint Hazards in Federally Owned Residential Property and Housing Receiving Federal Assistance (24 CFR Part 35)

The HUD Rule for Federal Housing (shortened name) applies to all residential properties built before 1978 that receive Federal financial assistance. This regulation uses the same definition of lead-based paint as the EPA. The work practices and procedures described in these specifications are designed to comply with occupant and worker protection regulations as mandated by OSHA and Cal/OSHA regulations for work that disturbs lead and **are not** designed to comply with all the requirements of 24 CFR Part 35. Should this project be covered by this regulation, the Owner may require additional practices and procedures in the scope of work for activities conducted in properties covered by the HUD Rule for Federal Housing.

1.3.3 CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

Accreditation, Certification, and Work Practices For Lead-Based Paint And Lead Hazards (Title 17, CCR, Division 1, Chapter 8, Sections 35000-361000)

This regulation primarily applies to residential and public buildings located in California. The definition of a public building is one that is "generally accessible to the public." Some aspects of this regulation, particularly those that pertain to the definition of "presumed lead-based paint" and

the containment requirements for disturbing lead-based paint **apply to all structures** in California.

This CDPH regulation definition of lead-based paint is identical to the EPA/HUD definition of 1 mg/cm^2, 5000 ppm, and 0.5% by weight. In addition, this regulation requires all paint on structures in California to be treated as "presumed lead-based paint" unless the paint is on a home built after 1978 or a school built after 1992. **THEREFORE THE PAINT IN ALL SCHOOLS COVERED BY THIS PROJECT THAT WERE CONSTRUCTED BEFORE 1993 MUST BE TREATED AS LEAD-BASED PAINT UNLESS TESTED AND PROVED OTHERWISE AS DESCRIBED ELSEWHERE IN THESE SPECIFICATIONS**.

The CDPH regulation differentiates between work that disturbs lead as part of renovation or maintenance work and work that disturbs lead as part of "abatement" work as defined in Title 17. The work practices and procedures described in these specifications are designed to comply with occupant and worker protection regulations as mandated by Cal/OSHA regulations for work that disturbs lead as part of renovation, demolition, and maintenance work. These specifications **are not** designed to comply with the requirements for abatement as defined in the CDPH Title 17 regulation. Unless stated specifically otherwise in these specifications, the Owner does not anticipate any work being done as part of this project that meets the definition of abatement as used in Title 17. **Therefore, unless specifically directed otherwise by this specification or by the direction of the Owner and/or Project Monitor, the Contractor and/or subcontractors shall NOT submit Form 8551, "ABATEMENT OF LEAD HAZARDS," to the CDPH since that form provides inappropriate notice for the work done on this project**. The Contractor may be required to complete and submit this form should the scope of the work or the work practices change.

This regulation has significant penalties associated with the creation of "lead hazards." Lead hazards are defined as: "...disturbing lead based paint or presumed lead-based paint **without containment**, or any other nuisance which may result in persistent and quantifiable lead exposure." The requirements discussed in Part 3.5 Work Site Preparation & Containment Requirements are designed to meet CDPH requirements. Should a Contractor and/or subcontractor conduct work without a containment or release lead-contaminated dust or debris outside of the containment, they are in violation of this regulation. The Project Monitor will stop all work, consider the Contractor and/or subcontractor to be in violation of these specifications and the contract documents. Work will not be allowed to begin again until the Contractor and/or subcontractor takes adequate steps to correct their violation and convinces the Owner and/or Project Monitor that the violation will not occur again.

1.3.4 CALIFORNIA OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (CAL/OSHA)

Lead Standard for the Construction Industry (8 CCR 1532.1)

This standard regulates work done by employees who may disturb lead as part of demolition, construction, renovation or maintenance work. Painting activities that may disturb lead are covered by this standard. General construction work that disturbs lead is covered, as is the demolition of building components or entire structures.

Cal/OSHA regulates lead whenever lead is determined to exist in a material. When the term "lead-containing paint" is used in the context of these specifications, the term is used to refer to paint that contains lead in an amount equal to or above the reporting limit for the laboratory analysis or that detected by an X-ray Fluorescent Analyzer (XRF).

In addition, Cal/OSHA uses the EPA/HUD/CDPH definition of lead-based paint (1 mg/cm^2, 5000 ppm, or 0.5% by weight) for their pre-job notification requirements discussed in Part 1.4 Lead-Work Pre-Job Notification Requirements.

The following information summarizes the significant requirements in the Cal/OSHA standard. This summary is not meant to substitute for the Contractor reading and being familiar with the Cal/OSHA requirements.

a. The Cal/OSHA lead standard is very complex. Cal/OSHA regulates lead in materials when a laboratory can quantify the amount of lead. This means materials are regulated even when they contain very small amounts of lead. The standard sets an "Action Level" for airborne lead at or above 30 □g/m^3 over an eight-hour-time-weighted average. Typically, if employees are expected to be exposed to this airborne lead level, the employer must conduct air sampling, provide blood lead testing, and provide specialized training. The standard sets a "Permissible Exposure Limit" or "PEL" for airborne lead at or above 50 □g/m^3 over an eight-hour-time-weighted average. The employer must continue the requirements needed at the Action Level but must now provide respirators, protective clothing, a shower decontamination system, and a written compliance program.

b. In 8 CCR 1532.1 (p), employers are required to notify Cal/OSHA before employees conduct a trigger task that will disturb more than 100 square or linear feet of material that contains lead in concentrations equal to or above 1 mg/cm^2, 5000 ppm, or 0.5% by weight. The notification also applies to welding or torch cutting that takes more than one hour in a shift. Trigger tasks are described in 8 CCR 1532.1 (d)(2). In brief, they include manual demolition, scraping, sanding, using HEPA-attached equipment, using heat guns to remove lead paint, welding, torch cutting, and using other more aggressive techniques. This is a summary list and does not list all task that are considered trigger tasks.

c. The California standard defines lead-containing paint at the Consumer Product Safety Commission's (CPSC) level of 0.06% by weight or 600 ppm for non-trigger tasks. The lead standard would not apply if the paint contains less than 600 ppm and the employees do not conduct trigger tasks. However if the employees do conduct trigger tasks, the entire standard applies.

d. Cal/OSHA **requires CDPH lead training and certification** for any supervisors or workers who are "shown to be exposed" to airborne lead levels above the PEL in residential or public buildings. The Owner and Project Monitor believe that there is a reasonable expectation that those workers scraping paint prior to repainting, and those demolishing ceramic tile are likely to be exposed over the PEL. Therefore, on this project, that work must be done by CDPH certified workers and supervisors.

e. Cal/OSHA requires the supervisor to establish a "regulated area" whenever employees may be exposed to airborne lead over the PEL or if they will perform trigger tasks as defined in 8 CCR 1532.1 (d)(2). The establishment of regulated areas is discussed in Part 3.5 Work Site Preparation & Containment Requirements.

1.4 LEAD-WORK PRE-JOB NOTIFICATION REQUIREMENTS

The Contractor is responsible for complying with the Lead-Work Pre-Job Notification as specified in 8 CCR 1532.1 (p). If notification is required for this project, the Contractor must provide the notification to Cal/OSHA and provide a copy of this notification to the Owner and/or Project Monitor as part of the Contractor's pre-work submittal package.

Unless the material is tested as described elsewhere in these specifications, the Contractor and subcontractors must anticipate notifying Cal/OSHA if they plan to manually demolish or perform another type of trigger task (such as paint scraping or sanding) on any painted surface or ceramic wall surface on this project if the amount of material to be disturbed equals or is greater than 100 square feet.

Notification to Cal/OSHA is not required if the paint on the painted surface is primarily intact (not loose and peeling) and the painted material is removed in a manner that does not disturb the paint. For example, door or window frames may be removed without providing the notification if the paint or coating on the frames is intact and the building components can be removed without significantly disturbing the coating.

Unless stated otherwise in these specifications, or directed otherwise by the Project Monitor, the Contractor and/or subcontractors shall NOT submit Form 8551, "ABATEMENT OF LEAD HAZARDS," to the CDPH since that form provides inappropriate notice for the work done on this project since no lead "abatement" as defined by CDPH will be conducted as part of this project.

1.5 LEAD TRAINING REQUIREMENTS

At a minimum, the Contractor and subcontractors must meet the lead training requirements as specified by 8 CCR 1532.1. This will include training all employees who drill, cut, scrape, abrade, remove, clean up debris, or in any other way are exposed to lead from painted surfaces or ceramic tile found on the buildings or structures covered by this project. The different types of training are summarized below for the typical types of work that are expected to disturb lead on this project.

1.5.1 MINIMAL TRAINING REQUIRED FOR ALL WORKERS EXPOSED TO LEAD

This training will be sufficient for those who disturb lead in only minor ways. Those disturbing lead in more significant amounts will need to meet the training requirements stated in Part 1.5.2 or 1.5.3.

For example, this training applies to those workers who, for a total of less than one hour in an eight-hour shift, will drill or cut through painted surfaces, remove painted components (when the paint is intact), or remove ceramic tile significantly intact. *(This time frame is guidance and not an official Cal/OSHA time frame. This time frame is suggested because it is thought that these tasks, done for such a short time frame, do not pose a realistic chance that workers will be exposed over the Action Level based on an eight-hour time-weighted average.)* In some cases, however, depending on the surface and type of work being conducted, the Project Monitor may determine that more training is needed even if the worker disturbs lead for less than an hour. **In general, workers with this training conducting this type of minimal disturbance of lead will not need to wear respirators while conducting this work**.

The training must comply with the training requirements as listed 8 CCR 1532.1(l)(1)(A). In summary, this training must comply with Hazard Communication Training for lead as discussed in 8 CCR 5194. This training is also known as "hazard communication," or "lead awareness" training and is usually done in less than hour depending on the work the employee will conduct.

The Contractor and subcontractors will need to provide the Owner and/or Project Monitor written proof that this training has been provided before workers will be allowed to conduct work that disturbs lead even in minimal amounts. Owner/Owner's Representative can provide this training for the Contractor and/or subcontractors or they can obtain this training from any source the employer believes is qualified.

Proof of this training is not required if the employees are trained to the levels listed in Part 1.5.2 and/or 1.5.3.

1.5.2 REQUIRED TRAINING FOR THOSE EXPOSED OVER THE ACTION LEVEL OR WHO CONDUCT TRIGGER TASKS

This training must be done for all those workers who conduct trigger tasks or are expected to be exposed above the Action Level. Typically, this training will be required for workers who conduct a trigger task such as paint scraping or manual demolition of painted components and the work will take more than one hour in an eight-hour shift. *(This is a guidance and not an Cal/OSHA time frame.)* The Project Monitor may determine that this training is needed for some workers who conduct tasks for even less than an hour.

The training must comply with the training requirements as listed 8 CCR 1532.1 (l)(1)(B) and (l)(2)(A-H). In summary, the standard requires the worker to be trained in series of subjects. The length of training depends on the experience and previous training of the worker, the type of work they will conduct, and whether or not they already have been trained and approved to wear

respirators. **Workers receiving this training and conducting this type of work will typically need to wear respirators and protective clothing while they conduct the work.**
An environmental contractor, or a contractor with environmental work experience, previous training, and a written respiratory protection program generally conducts this type of work. The Owner and Project Monitor do not recommend subcontractors attempt this type of work. However, subcontractors will be allowed to conduct this type of work on this project if they can demonstrate proof of training and carry out the work according to these specifications.

The Contractor and subcontractors will need to provide the Owner and/or Project Monitor written proof that this training has been provided all workers conducting the tasks that require this training. Owner/Owner's Representative can provide this training for the Contractor and/or subcontractors or they can obtain this training from any source the employer deems is qualified.

This training is not required if the employees are trained to the levels listed in Part 1.5.3.

1.5.3 REQUIRED TRAINING FOR THOSE WHO ARE REASONABLY EXPECTED TO BE EXPOSED OVER THE PEL AND/OR CONDUCT TRIGGER TASKS ON OVER 100 SQUARE FEET OF MATERIAL

Workers and supervisors must be CDPH Certified Lead-Related Construction Workers or Supervisors if they will conduct trigger tasks or other work reasonably expected to exceed the PEL and/or conduct this work on over 100 square feet of material. *(This is a guidance amount and not a Cal/OSHA regulatory requirement. However this amount of material and type of work is reasonably expected to potentially release airborne exposures over the PEL and thus trigger the CDPH certification requirement.)* This includes work such as the manual demolition of painted surfaces, ceramic walls, paint preparation work (sanding and scraping), and other tasks as described in 8 CCR 1532.1 (d)(2). Proof of training will be a currently valid CDPH certification card. Workers who can show a completed course completion form and a completed application form for certification will be allowed to work pending their being fully certified.

Exception: Licensed asbestos contractors performing paint scraping work on the outside of buildings only for the purpose of removing loose and peeling paint prior to the demolition of the building, or the demolition of a structure, will not be required to have the workers or on-site supervisor be CDPH certified. They must, however, show proof of training in compliance with 8 CCR 1532.1 (l)(2) for employees who may be exposed above the Action Level. In summary they must meet the training requirements of this specification as stated in Part 1.5.2. In addition, however, the Contractor must have a CDPH certified supervisor approve the containment setup at the start of each shift that will disturb lead, approve the work practices and personal protective equipment worn by the workers, verify that proper air monitoring is being collected, must be able to return to the site within two hours if requested by the Project Monitor, and must approve the final cleanup of the work area prior to a visual inspection of the work area being conducted by the Project Monitor. The certified supervisor will always be required to approve the initial set up of the containment, personal protection, and work practices at the start of the job, but then depending on the quality of the work demonstrated, the Project Monitor may not require the certified supervisor to inspect the work site at the start of each shift. **This exemption will be revoked should air sampling on this project demonstrate airborne lead levels above the Action Level on workers or supervisors**.

1.6 REQUIRED SUBMITTAL DOCUMENTS

While additional documents may be required by the scope of work for this project, at a minimum, the Contractor will be required to provide the Owner and/or Project Monitor with the following documents regarding the Contractor's ability to safely disturb lead-containing materials.

1.6.1 SUBMITTALS PRIOR TO THE START OF WORK

All Contractors and subcontractors who will have employees disturb lead on this project must, at a minimum, provide proof of item number 1.6.1.e.1., lead hazard communication training in

compliance with 8 CCR 1532.1 (l)(A)(1). **This is the only submittal that must be provided by these employers as long as they do not disturb conduct more disturbance of lead than is described in Part 1.5.1**.

The following submittals must be provided by all Contractors and subcontractors who will, at a minimum, have employees who will conduct trigger tasks for more than one hour per shift, will potentially be exposed above the Action Level, or will conduct other activities as determined by the Project Monitor that may result in significant exposure to lead.

a. A written lead compliance plan in compliance with 8 CCR 1532.1 must be provided that includes the following:

   1. A description of equipment and materials, controls, crew size, job responsibilities, and operations and maintenance procedures for each activity in which lead is disturbed and potentially emitted;

   2. A description of specific control methods (wet methods, engineering controls, etc.) that will be used to ensure workers are not exposed above the PEL;

   3. Technology considered in meeting the Cal/OSHA permissible exposure level (PEL);

   4. Air monitoring data documenting sources of lead emissions;

   5. A detailed implementation schedule for the compliance plan, including the schedule for inspections by a competent person;

   6. A description of the lead work practice program which will be used to control worker exposures. This includes the use of protective work clothing, equipment, hygiene facilities and practices, and housekeeping practices;

   7. A description of the steps the Contractor or subcontractor will take to minimize the generation of hazardous waste produced on this project. This includes, but is not necessarily limited to how the contractor will separate waste streams. For example, how will the Contractor or subcontractor keep potentially hazardous waste such as paint chips and dust from being disposed of with other potentially non-hazardous construction materials and debris?

   Note: If a Contractor or subcontractor is found conducting lead-related work not specifically mentioned and described in the compliance plan, the work will be stopped until a compliance plan including that work is submitted, reviewed, and approved by the Owner and/or Project Monitor.

b. Copy of the Contractor or subcontractor's written respirator program in accordance with the requirements of 8 CCR 1544.

c. Proof that all employees expected to wear respirators on this project have medical approval to wear a respirator.

d. Copies of respiratory fit-tests for all workers expected to wear a respirator on this project. Fit testing must be done as required by and in accordance with 8 CCR 1544.

e. Proof of training required by Part 1.5 for type of work employee will do.

   1. Proof of Hazard Communication Training for Lead done within the last calendar year for those exposed to lead or who will perform trigger tasks for less than one hour. *(Proof may be a certificate or written statement stating training was completed and a list of names of those individuals who were trained. Proof of*

this training is not needed if employee provides proof of training required by items e. 2, or e 3.)

2. Proof of training in compliance with 8 CCR 1532.1 (l)(2) done within the last calendar year for all employees who will conduct trigger tasks as defined in 8 CCR 1532.1 (d)(2) for more than one hour or who will reasonably be expected to be exposed to lead above the Action Level. *(Proof may be a certificate or written statement stating training was completed and a list of names of those individuals who were trained.)*

3. Proof of CDPH lead certification for those workers who will conduct trigger tasks as defined in 8 CCR 1532.1 (d)(2) or will reasonably be expected to be exposed to airborne levels of lead above the PEL on projects that will disturb more than 100 square feet of lead-containing material. *(Proof of certification will be a currently valid CDPH certification card as a worker or supervisor. Workers who can show proof of a valid course completion form and application being submitted to CDPH, will be allowed to work while awaiting full certification from CDPH.)*

4. Proof of current CDPH certification as a lead supervisor for the on-site competent person for projects involving the conduction of trigger tasks or other activities reasonably expected to exceed the PEL on all projects that will disturb more than 100 square feet of lead-containing material. *(Proof of valid certification will be a currently valid CDPH certification card a worker.)*

5. If exception to requirement for CDPH certified supervisor listed in Part 1.5.3 is requested, then provide proof of CDPH certified supervisor who will verify containment, personal protection and work practices, and will be able to respond to the project within two hours of request by the Project Monitor.

f. Copies of all current MSDS for chemicals used on this project.

g. Manufacturers' certifications that high efficiency particulate air (HEPA) vacuums, pressure differential units and other local exhaust ventilation equipment conform to ANSI Z9.2-79 for all HEPA-filtered equipment that will be used on this project. *(This is proof that the equipment is actually HEPA filtered. This is separate from the challenge testing requirement needed for equipment used in interior spaces.)*

h. Name and contact information of independent testing company who will challenge test all vacuums and air filtration devices used on this project (in interior spaces).

I. Statement regarding compliance with all Cal/OSHA exposure monitoring required for this project.

j. Name and contact information for laboratory who will analyze air samples or waste samples and documentation of their certification to conduct such analysis.

k. Name of Waste Transporter who will transport hazardous waste on this project and documentation that the Transporter is allowed to transport lead hazardous waste.

l. Name of Waste Landfill to which lead hazardous waste will be sent and documentation that such landfill is allowed to accept such waste.

m. Should waste water filtration be required on this project, submit manufactures documentation pertaining to the capability of waste water filters to filter particles of, at a minimum, five micrometers in size.

n. List of all rented equipment to be used within a lead regulated area, or a statement that

no rental equipment will be used on this project.

1. If rental equipment is to be used, submit written statements from each rental company indicating the rental company's acknowledgment that the equipment is provided for and may be used in areas where airborne levels of asbestos and/or lead may be present.

o. Submit emergency plans. At a minimum submit the following:

1. Submit non-emergency telephone numbers, other then 911, for the appropriate Police, Sheriff, and Fire Departments.

2. Name, pager or cell phone numbers of the on-site supervisor and his immediate company supervisor.

3. Submit detailed written directions from the project site to the medical facility to be used in case of an emergency. Also include a map which sufficiently shows the route to be taken from the site to the designated medical facility.

4. Submit written emergency procedures pertinent to the work to be performed and which can be implemented by site personnel if the need arises.

p. Local sanitation district Wastewater Discharge Permit for Surface Washers (if required).

The above listed documents must be provided prior to the start of work that will disturb lead. Under no circumstances will workers or supervisors be allowed to work on this project prior to the receipt, review, and acceptance of this documentation by the Owner and/or Project Monitor. In addition, documentation for rental equipment must be provided before the equipment may be used in a lead regulated area. All delays resulting from the failure of the Contractor and/or subcontractors to provide this information in the required time frame is solely the responsibility of the Contractor and/or subcontractor.

The Contractor must use the Pre-Work Submittal Checklist provided at the end of these specifications to provide the Owner and/or Project Monitor these submittals. Failure to use the form will likely lead to the rejection of the submittal package and a delay in the project that will be the sole responsibility of the Contractor and/or subcontractor.

The Contractor is responsible for maintaining current documents and resubmitting copies to the Owner and/or Project Monitor for any worker whose documents expire during the project. Any worker observed on a job site who either is not approved to conduct work by the Owner and/or Project Monitor or has been approved but documentation pertaining to training, medical evaluation, or respiratory fit testing has expired, will be instructed to stop work until these documents are received by the Owner and/or Project Monitor and the worker is approved to perform work that disturbs lead.

1.6.2 SUBMITTALS PROVIDED DURING THE WORK OR FOLLOWING COMPLETION OF THE WORK IF APPLICABLE

Depending on the document, these documents must be provided the Owner and/or Project Monitor on an ongoing basis during the work, or if appropriate following completion of the physical activities associated with the project. The documents must be received and approved by the Owner and/or Project Monitor before the work is considered complete. (Failure to provide these documents means the work is not complete, even though the physical activities may be completed.)

a. Daily sign-in sheet for each worker entering a lead regulated area.

b. The Contractor must provide the results of exposure sampling done to comply with the

requirements of 8 CCR 1532.1 (d) and the requirements of this specification.

c. The Contractor must provide blood sampling and analysis results of lead (BLL) and zinc protoporphyrin (ZPP) levels for all workers who are represented by air monitoring results that exceed the Action Level. Typically, the Project Monitor will require blood lead sampling for all workers on a work shift if one or more air sampling results for that shift is above the Action Level.

The written results of the blood sampling analysis must be provided the Owner and/or Project Monitor within 21 days of the exposure over the Action Level or within 12 days of the completion of the project, whichever comes first.

d. Copies of job progress reports and project documentation. This must include the names of all employees onsite, the hours worked and a brief description of the work completed at the site(s).

e. The Contractor must provide all waste disposal documentation.

1.7 THIRD-PARTY OVERSIGHT

The Owner is utilizing an independent third-party consultant to provide oversight of all work that disturbs lead on this project. The Contractor shall treat this third-party consultant as a designated representative of the Owner. The third-party consultant for this project is known as the Project Monitor. The Project Monitor is expected to perform some or all of the following activities on this project, but may also conduct other activities as needed:

a. Visually monitor the work practices of the Contractor's employees to determine that the work is being done in compliance with these specifications. The Project Monitor may conduct this activity on a continual basis or may make unannounced random visits to the project site to check on the Contractor's performance.

b. Visually inspect for the presence of visible emissions suspected to contain lead.

c. Conduct personal and area air monitoring in accordance with accepted methods.

d. Collect bulk samples of relevant materials to determine the presence or absence of lead.

e. Visually inspect the work area for cleanliness after completion of the work.

1.8 AIR SAMPLING BY THE OWNER AND/OR PROJECT MONITOR

The Owner and/or Project Monitor may determine it appropriate to collect air samples to evaluate the effectiveness of the Contractor's engineering controls and work practices. The Contractor and/or subcontractors shall allow the Project Monitor to attach and collect personal air samples on the workers and shall instruct the workers to comply with the directions for that sampling as given by the Project Monitor.

Air sampling may also be used to verify the effectiveness of the Contractor's containment system. The Project Monitor may choose to collect area air samples within the work area. These samples results may be used to generate an eight-hour, time-weighted average. The result of area samples in a lead work area should normally be far below what the workers are breathing. Therefore should the Project Monitor collect area air samples within the work area that result in exposures above half the Action Level (15 □g/m^3), the Project Monitor will require the Contractor and/or subcontractors to re-evaluate their work practices, engineering controls, and containment system.

The Project Monitor may also choose to collect area samples downwind, outside of the regulated work area. These sample results will be compared to background air samples upwind or samples collected prior to the beginning of work. Sample results indicating airborne lead emissions at or above 5 □g/m^3 above background levels will be interpreted to mean that the Contractor and/or subcontractors

containment or engineering controls are inadequate. This may result in the temporary stoppage of work until the Project Monitor is assured that airborne lead levels will significantly diminish by the change in work practices or engineering controls.

1.9 NOTIFICATION OF EMPLOYERS OF EMPLOYEES IN ADJACENT AREAS

The Contractor and subcontractors who will disturb lead are responsible for ensuring that employers of employees in areas adjacent to the work being conducted have been notified that work disturbing lead will take place.

Typically this notification is in addition to the posting of lead regulated area signs. In summary, this notice shall be provided to all other contractors and subcontractors in areas adjacent to the work. Those employers must be notified in advance of any upcoming work that will disturb or impact lead in a manner that may generate airborne levels of lead that could present a potential exposure to workers at or above the Permissible Exposure Limit (PEL) as defined in 8 CCR 1532.1©). This notice shall also provide information on the control measures being implemented and a warning that the employer's employees are to remain outside of the posted regulated areas. The Contractor and/or subcontractors anticipating the need for such notification shall coordinate this notification with the Owner and/or Primary Contractor.

1.10 SUSPENSION OF WORK

The Owner and/or Project Monitor may suspend all work that disturbs lead if any controls (such as barriers) fail, if debris known or suspected to contain lead is detected outside the containment, or if work is on the exterior of a structure and wind speeds are more than fifteen miles per hour, or if in the judgement of the Project Monitor, other factors exist that determine the work must be stopped because of the potential for the creation of lead hazards. For example, the Project monitor may conduct perimeter monitoring and discover that lead is being released in concentrations above 5 □g/m^3 above background levels or work area air monitoring that is above half the Action Level. In either case, the Owner and/or Project Monitor may suspend work until more effective containment, work practices, and engineering controls are utilized.

1.11 PRE-START MEETING

The Project Monitor typically recommends that there be a pre-start meeting with the Contractor or subcontractor's representative and the Project Monitor approximately five days prior to the expected start of work. The Contractor will be expected to provide the majority of pre-work submittals described in Part 1.6.1 at that meeting. This meeting is designed to answer questions about the project and address issues of concern of either the Contractor, subcontractor, or Project Monitor. Should this meeting be determined not to be necessary, the submittals must be delivered to the Owner and/or Project Monitor no later than five working days in advance of the work.

1.12 TESTING FOR LEAD IN PAINTS, COATINGS, CERAMIC TILE, AND OTHER MATERIALS

The Owner has already investigated the paints present in and on the building associated with this project and does not anticipate paying for additional testing.

PART 2.0 MATERIALS AND EQUIPMENT

2.1 FIRE RESISTANT PLASTIC SHEETING (POLY)

All plastic sheeting used on this project must be fire resistant whether used inside or outside of buildings.

2.2 CHALLENGE TESTING OF HEPA FILTRATION SYSTEMS

All HEPA-equipped vacuums and air filtration units to be used on this project in interior spaces during operations that may disturb lead must be challenge tested and meet ANSI requirements using DOP or an equivalent testing agent. Except for HEPA air filtration units used to create negative pressure differentials for the demolition of ceramic tile, this testing must take place within ten calendar days prior to their use

and after replacement of any HEPA filter removed from previously tested equipment. Air filtration units used in conjunction with the demolition of ceramic walls must be challenge tested on site. They do not need to be retested as long as they remain on site. They will need to be retested if they are moved off site. Copies of all testing certifications must be provided to the Owner and Project Monitor prior to use of the equipment.

Exception: Subcontractors using HEPA vacuums for incidental cleanup of lead dust resulting from the minimal disturbance of lead as discussed in Part 1.5.1 are exempt from the challenge testing requirement unless, in the judgement of the Project Monitor, there is a reasonable expectation that the subcontractor's HEPA vacuums are leaking.

2.3 VACUUM-ASSISTED TOOLS

When using power tools to disturb lead, the Contractor shall only use tools that have a HEPA-filtered-vacuum recovery system.

2.4 POWER WASHING

NOT APPLICABLE TO THIS PROJECT

2.5 PERSONAL PROTECTIVE EQUIPMENT

The Contractor shall use respirators and personal protective equipment as required by 8 CCR 1532.1 and as appropriate based on personal air monitoring results. All respirators must be approved by NIOSH.

Respirator fit test records and the respiratory protection program shall be retained on site as part of the project documentation if respiratory protection is used on this project. Disposable dust/mist respirators shall not be used.

At a minimum, half-face respirators with P-100 (HEPA) cartridges will be required during surface preparation where there is manual scraping or sanding that will take more than one hour to complete. Dry scraping or sanding, mechanical scraping, abrading, sanding, or similar actions will trigger the need for respirators regardless of the duration of the activity.

Regardless of the duration of the work, all workers scraping lead-containing paint or removing or demolishing ceramic tile must wear disposable protective clothing over their wear home clothes. Workers demolishing surfaces that contain ceramic tile must wear full body protective clothing including hoods and gloves.

At a minimum, the Contractor and subcontractors must ensure that no lead dust or debris is tracked out of the contained, regulated area. The Contractor and subcontractors must ensure that all those allowed into the regulated area wear adequate foot coverings that ensure that they will not track contaminated material out of the area when the leave.

2.6 RENTAL EQUIPMENT

Any equipment rented for the purpose of disturbing lead or used within a lead regulated area must be accompanied with documentation verifying that the rental agency has been notified, and acknowledges receipt of notification that the equipment being rented will be used for work inside a lead regulated area. This documentation must be submitted to the Project Monitor prior to the equipment being used on the job site.

PART 3.0 EXECUTION

3.1 SUMMARY

Contractors and subcontractors conducting lead related construction work will be evaluated on a performance standard which includes, but is not limited to, cleanliness of work area, work practices as

verified by exposure monitoring, containment set up, and ultimately, the clean up of paint chips, dust, and debris.

Any work practice that creates paint chips, dust, glazed ceramic or painted debris must be conducted within a regulated area as defined in 8 CCR 1532.1 and within a containment at least as stringent as required by Title 17 and/or described in these specifications.

The containment system shall be designed and constructed to prevent visible dust or debris from escaping the work area as well as the escape of airborne lead emissions at or above 10 □g/m^3 above background levels. Should dust or debris generated by the work be found outside the containment, or the airborne lead outside the containment exceed background levels, the Project Monitor will determine that the containment is inadequate, in violation of Title 17 requirements, and work will be stopped until the Contractor and/or subcontractors redesign the containment to be more effective.

3.2 COMPLIANCE WITH REQUIREMENTS FOR THE PEL AND ACTION LEVEL

Contractors and subcontractors strictly adhering to the requirements listed in these specifications who conduct minimal disturbance of lead such as by the conduction of trigger task work amounting to less than one hour, may begin work assuming the Cal/OSHA Permissible Exposure Limit (PEL) will not be exceeded.

Contractors and subcontractors **not strictly conforming to suggested work practices must start work assuming the PEL will be exceeded**. This means they must comply with all OSHA requirements specified for work that results in exposures over the PEL. This will include, but is not limited to, complying with requirements for training, personal protection, regulated area development, blood testing, personal air monitoring, the development of a written compliance plan, and the notification of employers in adjacent areas.

Contractors and subcontractors must assume the PEL will be exceeded each time they conduct trigger activities that will exceed one hour in duration. This will trigger the need to wear respirators and protective clothing, meet the training requirements specified earlier in these specifications, conduct personal air sampling, develop a written compliance plan and all other actions described as necessary by 8 CCR 1532.1 and these specifications.

3.2.1 PERSONAL AIR SAMPLING

The Contractor and subcontractors are responsible for conducting personal air monitoring during disturbance of lead in compliance with the requirements of 8 CCR 1532.1. At a minimum, Contractors and subcontractors shall conduct representative exposure monitoring on workers on a daily basis whenever those workers will conduct trigger task activities that will take longer than one hour to complete in an eight-hour shift. In addition, air sampling must be done for any work for which the Project Monitor believes has a reasonable potential for generating airborne lead at or above the Action Level. The Project Monitor will not allow work to proceed if the Contractor is not prepared to conduct the necessary air monitoring.

Sample information must include (but is not restricted to) the name of the individuals wearing the samples, the individuals' Social Security Number or Company ID number, the date the samples were collected, identification by unique method of the area where the work is being performed, and identification of the work being performed. EXAMPLE: James Black, 000-11-222, 06/25/03, Bill Jackson Elementary School, Building H, Classroom 5, East covered walkway, paint surface preparation work.

Laboratory results shall be provided to the Owner and/or Project Monitor within 72 hours of sample collection. Paper copies must be received within 14 days of the Contractor receiving the results from the laboratory. Contractor and/or subcontractor must submit proof that laboratory has the required licenses to analyze air samples for lead.

Should they wish to make use of the exceptions to air sampling stated in 8 CCR 1532.1 (d)(3)©)

& (D), the Contractor and/or subcontractors must submit the required information to the Owner and/or Project Monitor and receive written approval from the Owner and/or Project Monitor prior to reducing the personal protection, containment, or engineering controls stated in this specification. In general, air sampling results that are intended for use to reduce personal protection requirements must be collected on this project. Air sampling results from other projects will not be allowed to create a negative exposure assessment for use on this project.

Contractor and/or subcontractors must submit a signed statement that they will conduct personal air sampling according to Cal/OSHA requirements for all work where that sampling is required by these specifications. Typically sampling will be required whenever the Contractor and/or subcontractor conduct a trigger task for more than one hour in an eight or more hour shift.

3.3 WORK INVOLVING WHOLE COMPONENT REMOVAL OR DEMOLITION OF ENTIRE STRUCTURES

Intact lead-containing paint on construction debris is generally not considered a hazardous waste in California. However, loose and peeling paint on structures may result in all construction debris from that site being considered a hazardous waste.

Therefore prior to the demolition or removal of painted material and the disposal of that material, all loose, peeling or flaking paint must be removed. This includes objects such as fences, built-in furniture or cabinets, other similar structures, as well as entire structures being demolished.

Any paint debris generated during this work must be separated into appropriate waste streams and handled as a hazardous waste, or as deemed appropriate as discussed in Part 3.11 Lead Waste Management.

The manual demolition or removal of painted components involving over 100 square feet of material does not trigger the Cal/OSHA pre-work notification as stated in 8 CCR 1532.1 (p) **if the paint is intact and will largely remain undisturbed by the removal or demolition process.** For example, if door or window frames with intact paint are removed, and the amount of material is over 100 square feet, the Cal/OSHA notification does not need to be provided if the paint is intact and won't be disturbed by the removal process.

3.4 PROHIBITED WORK PRACTICES

The following work activities are prohibited on the project:

a. Open-flame burning or torching.

b Machine sanding or grinding of lead materials or surfaces coated with lead unless the machine is equipped with a HEPA-filtered-vacuum recovery system.

c. Un-contained hydro-blasting or high-pressure washing.

d. The use of power washing to remove loose and peeling paint.

e. Abrasive blasting or sandblasting without a HEPA-filtered-vacuum recovery system or done outside of a negative pressure enclosure.

f. Heat guns operating above 1,100 □F.

g. Dry scraping, except for limited areas where electrical hazards create a higher risk than lead or unless specifically approved by the Project Monitor.

h. Use of methylene chloride based paint strippers.

3.5 COMPETENT PERSON

The Contractor and/or subcontractors disturbing lead shall have a competent person (as defined by Cal/OSHA for construction activities) onsite at all times to supervise and oversee all activities which may disturb materials containing lead. This person must be a CDPH Certified Lead Supervisor for all work that involves the conduction of trigger tasks on more than 100 square feet of lead-containing material.

The above requirement is not required for environmental contractors conducting work limited to the removal of loose and peeling paint on structures scheduled for demolition. In those situations, the on-site supervisor must meet the lead training requirements as stated in Part 1.5.2 Required Training For Those Exposed Over the Action Level Or Who Conduct Trigger Tasks. In addition, the Contractor must have a CDPH certified supervisor approve the containment setup at the start of each shift that will disturb lead, approve the work practices and personal protective equipment worn by the workers, verify that proper air monitoring is being collected, be able to return to the site within two hours if requested by the Project Monitor, and approve the final cleanup of the work area prior to a visual inspection of the work area being conducted by the Project Monitor. *The certified supervisor will always be required to approve the initial set up of the containment, personal protection, and work practices at the start of the job, but then depending on the quality of the work demonstrated, the Project Monitor may not require the certified supervisor to inspect the work site at the start of each shift.* This exemption will be revoked should air sampling on this project demonstrate airborne lead exposures to workers or supervisors are above the Action Level.

3.6 WORK SITE PREPARATION & CONTAINMENT REQUIREMENTS

The Contractor and/or subcontractor is required to contain the disturbance of lead in a manner that prevents lead-contaminated dust, debris, water, or air from leaving the regulated work area in an uncontrolled fashion. The containment must be developed in compliance with the requirements of Title 17 and these specifications. The presence of lead dust, debris, or air above background levels will indicate that the containment is inadequate. Work will be stopped and the Contractor and/or subcontractor must adjust work practices, engineering controls, or the containment in a manner that convinces the Project Monitor that the material will no longer be able to escape the regulated work area.

3.6.1 EXTERIOR WORK SITE PREPARATION & CONTAINMENT

NOT APPLICABLE TO THIS PROJECT

3.6.2 INTERIOR SITE PREPARATION & CONTAINMENT

NOT APPLICABLE TO THIS PROJECT

3.6.3 ADDITIONAL CONTAINMENT REQUIREMENTS FOR DEMOLITION OF CERAMIC TILE AND/OR MECHANICAL DISTURBANCE OR BLASTING OF LEAD-CONTAINING MATERIALS WITHOUT A HEPA-FILTERED-VACUUM RECOVERY SYSTEM

NOT APPLICABLE TO THIS PROJECT

3.6.4 DECONTAMINATION PROCEDURES

Decontamination procedures shall be established by the Contractor and subcontractor depending upon the airborne concentrations of lead as well as the amount of dust and debris created by the work. At a minimum, the decontamination procedures shall be in compliance with 8 CCR 1532.1 (I)(1-5). As stated in 8 1532.1 (I)(1-5), the Contractor shall assure that these decontamination facilities are used by the supervisor and workers.

For work that does not exceed the PEL, and/or does not include the disturbance of more than 100 square feet of material, the Contractor and/or subcontractor must assure that a hand-washing station is available and used by the supervisor and workers. For work that exceeds the PEL, or involves the breakage of ceramic tile in amounts over 100 square feet, the Contractor must ensure that workers shower, at a minimum at the end of the work shift as required by 8 CCR

1532.1.

3.6.5 AVOIDING CONTAMINATION OF ADJACENT AREAS BY PROPER DECONTAMINATION

Should the Owner and/or Project Monitor discover that an occupant of the regulated area left the regulated area without properly decontaminating, the Contractor will be required to clean the adjacent areas that in the opinion of Project Monitor may have been exposed to lead dust or debris from this action. Failure to properly decontaminate is demonstrated by wearing protective clothing outside the regulated area that was previously worn in the area or by wearing footwear outside the regulated area that was not properly covered and/or decontaminated. The failure to adequately decontaminate will trigger the following cleaning. In all areas determined necessary by Project Monitor, the Contractor will be required to HEPA vacuum, then wet wash, then HEPA vacuum again all potentially contaminated areas and items to the satisfaction of the Project Monitor. The Project Monitor will not need to demonstrate the need for this cleaning by the presence of visible dust and will not need to collect settled dust samples in order to require the Contractor to implement the cleaning routine.

3.6.6 APPROVAL PRIOR TO START OF WORK

The Project Monitor shall visually inspect any regulated area for compliance with this specification before the contractor and/or subcontractor may begin work that may disturb lead. The contractor and/or subcontractors may not begin work disturbing lead without approval from the Project Monitor. The contractor and/or subcontractor must contact the Project Monitor sufficiently in advance of needing the visual inspection and coordinate with the Project Monitor in order to minimize any delays resulting from the need for this visual inspection.

Typically, once the Project Monitor has reviewed the contractor and/or subcontractors regulated work area set up, the work site supervisor will be told that they may start work at future regulated work areas without prior authorization from the Project Monitor as long as they assure the Project Monitor that the containment and work practices will be implemented as approved by the Project Monitor.

3.7 WET WORK PRACTICES

Unless determined infeasible by the Project Monitor, all disturbance of lead-containing materials must utilize wet methods for dust suppression.

3.8 PROMPT CLEANUP OF DEBRIS

Removed lead-containing material shall be kept wet and promptly placed in the type of waste containers required by this specification. The Contractor and subcontractors are encouraged to place debris in containers shortly after it has been removed. However, at a minimum, all bulk debris must be containerized before any work stoppages such as for breaks, lunch, or the end of a shift. Bulk debris must be kept adequately wet until it is containerized. The Contractor must plan only to disturb amounts of material that can be cleaned up and containerized before the next work stoppage. Delays and additional costs incurred by the Contractor for failing to adequately calculate the amount of time needed to clean up debris will be the sole responsibility of the Contractor. For example, if a crew must work overtime to containerize debris before ending the shift, those additional costs are the sole responsibility of the Contractor.

The Contractor and/or subcontractor must not allow excessive amounts of dust and debris to gather on the floor containment barriers. If in the opinion of the Project Monitor, too much debris is being allowed to gather on the floor poly, the Project Monitor will require the Contractor or subcontractor to either assign a worker to conduct continual cleanup, or the workers scraping paint or conducting other work disturbing lead will have to contain the debris before it falls to the ground. Typically this is done by scraping paint directly into a cardboard box held by the worker as he or she scrapes off the loose and peeling paint.

3.9 FINAL CLEANUP OF THE WORK AREA

3.9.1 EXTERIOR WORK AREAS

The Contractor and/or subcontractor must HEPA vacuum up all visible dust and debris off containment barriers. Then gently roll and/or fold poly barriers in on themselves in order to avoid releasing any remaining dust to adjacent areas during this process.

The final step will be to vacuum up any visible dust or debris in the work area or regulated area that is suspected to contain lead. The area must be visually clean of all lead-related dust and debris, and all poly barriers must be removed before the workers leave the job site. The regulated area barrier tape and/or signs must be taken down. Critical barriers erected on windows and HVAC systems may be left in place if work will take place in those same areas during the next work shift. Otherwise those barriers must also be removed before the workers leave at the end of the shift.

3.9.2 CLEANUP OF INTERIOR WORK AREAS

NOT APPLICABLE TO THIS PROJECT

3.10 FINAL INSPECTION OF THE WORK AREA

The Project Monitor will inspect work areas for visual signs of dust and debris related to the disturbance of lead. The Project Monitor will not inspect or evaluate the quality of paint preparation work such as paint scraping. The contractor who will be painting the prepared surfaces is responsible for the quality and workmanship of the surface preparation. However, if the work involves the removal of loose and peeling paint prior to the demolition of a structure, the Project Monitor will evaluate the completeness of that work.

For exterior work, the Project Monitor will visually inspect the work area to determine that there is no visible dust or debris still in the area that is reasonably expected to have been generated by the work. All poly barriers (except for on critical barriers in areas needed for the next shift) and barrier tape and signs must be removed.

Until told otherwise by the Project Monitor, the supervisor must notify the Project Monitor in advance of the end of the shift in order for the Project Monitor to visually inspect the work area prior to the workers leaving for the day. Typically this will not be required after the workers demonstrate that they consistently properly clean the work area before leaving.

For interior work, the Project Monitor will conduct a thorough visual inspection for dust and debris that may be related to the disturbance of lead. All surface areas must be clean. Residue dust will be assumed to contain lead and must be cleaned.

Until told otherwise by the Project Monitor, the supervisor shall notify the Project Monitor when the supervisor believes the work is complete and ready for a visual inspection. Prior to calling the Project Monitor for the visual inspection, the supervisor must personally inspect the area and determine that it is clean and ready for a final inspection.

The Project Monitor typically will not collect dust wipe samples to verify the cleanliness of an area unless specifically stated otherwise elsewhere in these specifications. However, dust wipes may be collected in either of the following circumstances. In both cases the supervisor will be told of the possibility of the collection of dust wipes and encouraged to conduct extra cleaning of the areas.

a. Ceramic Tile Removal Closely Adjacent To Kindergarten Classrooms, Daycare Facilities, or Food Preparation Areas Including Kitchens and Eating Areas.

   The Project Monitor is likely to conduct dust wipe sampling on the floor in the area between the decontamination unit and occupied areas of the property where children under the age of six routinely may be present. The supervisor will be told in advance that

this testing will take place and is encouraged to clean the area between the decontamination area and where the sample will be collected. This sample will be collected within 20 feet of the decontamination chambers unless the Project Monitor believes that poor work practices or decontamination procedures have contaminated the area as discussed below.

b. Failure To Comply With Work Practices, Engineering Controls, Or Decontamination Procedures

If in the judgement of the Project Monitor, the Contractor and/or subcontractor has not followed the requirements of this specification regarding work practices, engineering controls, and decontamination procedures, the Project Monitor will collect dust wipe samples in areas believed contaminated by the Contractor or subcontractors' actions. The supervisor of the project will be told in advance if such testing will be conducted and given time to clean those areas. For example, Part 3.6.5. describes actions that will lead to additional cleaning by the Contractor.

Should dust wipe sampling be necessary, the Project Monitor will conduct such testing with the specified intent of verifying whether the containment process and decontamination processes used by the Contractor and/or subcontractor were adequate in preventing the release of lead dust from the work area. The samples will be collected according to the procedures required in Title 17. The containment will be judged appropriate if the results of the samples do not indicate a dust lead hazard for floors as specified in Title 17.

3.11 POWER WASHING OF EXTERIOR BUILDING SURFACES

NOT APPLICABLE TO THIS PROJECT

3.12 LEAD WASTE MANAGEMENT

Proper testing and disposal of all waste material is the responsibility of the Contractor.

The Contractor must plan the work in order to minimize the generation of hazardous waste during the disturbance of lead-containing materials. The Contractor must create separate waste streams as necessary. This particularly includes the separation of any loose paint chips or flakes or ceramic tile debris from other construction debris. All waste streams must be identified by the Contractor before the work begins and separated during the course of the project to minimize costs of disposal.

The Contractor is responsible for all costs associated with the testing, removal, packing, loading, shipping, and disposal of lead containing waste generated during this project. This does not include waste water testing done to determine if power washing is permitted. The cost of that testing will be covered by the Owner.

The Contractor is required to comply with all regulations in Title 8 Section 1532.1 Lead in Construction and Cal/EPA Title 22 for waste classification and disposal.

3.12.1 LEAD WASTE TESTING

The Contractor must conduct appropriate waste stream characterization testing and/or filtering prior to disposal of waste products such as water, sand, paint chips, vacuum debris, and filters generated during surface preparation activities. Once completed, the test analysis results must be submitted to the Owner and/or Project Monitor for review. The Contractor is responsible for all costs associated with waste stream testing. Contractors may choose to avoid some waste testing by presuming that the waste is a lead hazardous waste. Waste must be tested if the Contractor wishes to treat it as a non-hazardous waste.

The Contractor may not remove or dispose of the identified materials from the job site until this

review has been completed and the Contractor has been informed by the Owner and/or Project Monitor of their concurrence that the materials have been properly tested and meet the requirements allowing the materials to be classified as non-hazardous.

3.12.2 HAZARDOUS WASTE MANIFESTS

For all hazardous waste that requires an EPA manifest, the Contractor must coordinate with the Owner for signature of the manifest. In general, the Contractor must notify the Owner a minimum of 24 hours in advance of the need for a signature. Hazardous waste cannot be transported without an authorized signature so it is the responsibility of the Contractor to coordinate with the Owner the time waste transporters will need the signature. Delays resulting from the failure of the Contractor to obtain an authorized signature from the Owner will be the sole responsibility of the Contractor, unless the Owner was provided 24 hour in advance notice and the transporter arrived on time during the regular work hours of the Owner.

3.12.3 WASTE CONTAINERS

All debris generated in the regulated work area shall be placed in containers approved by the Project Monitor. The containers shall be leak tight and meet the requirements as stated in these specifications. Bags and other containers shall not be overfilled.

If in the judgement of the Project Monitor, the Contractor's method of containerizing debris is inadequate and either results in the release of dust or debris or is reasonably expected to result in such a release, the Contractor will be forbidden to continue waste containerization or load out until the containers meet the approval of the Project Monitor. This may result in the Contractor being required to change from one type of container to another. It must be understood that the Contractor is responsible for proper containerization of waste and therefore, will be required to provide for adequate and appropriate containers regardless of cost incurred due to failure of one system of containerization being required over another.

When utilizing bags to contain lead hazardous waste, two bags at least six-mil in thickness must be used. The inner bag may be sealed with adequate amounts of tape necessary to secure the opening of the bag. Only the second or final bag must be gooseneck sealed.

Regardless of the wastes characterization or designation as construction debris or hazardous waste, all waste containers shall be stored in designated and secure areas separate from the work area prior to testing and/or disposal.

The Contractor is responsible for proper storage and labeling of all hazardous waste containers while they are being used as storage and before they leave the job site according to the requirements of DTSC and DOT.

Building components such as wood with loose and flaking paint must, at a minimum, be wrapped in one layer of six-mil poly and adequately sealed with tape to secure the containerized material.

Concentrated lead waste such as sludge from paint stripping operations, lead containing paint chips and/or dust, HEPA vacuum contents and filters must be assumed to be hazardous waste until properly tested and must, at a minimum, be placed in poly lined, DOT approved steel drums.

Hard edged materials such as floor tile, gypsum board, plaster, stucco, ceramic tile, and other materials that may tear bags must be assumed to be hazardous waste until properly tested and must, at a minimum, be placed in poly lined, ridged-walled containers such as fiber drums or cardboard boxes as the final container.

Sharp edged components with peeling, blistering or flaking paint (e.g., nails, screws, metal lath, tin sheeting, door frames, etc.) must, at a minimum, be wrapped in one layer of six-mil

poly sheeting, or a single six-mil thick bag and adequately sealed with tape to secure the containerized material.

3.13 ALTERNATIVE WORK PLANS

The Contractor and/or subcontractors may submit alternate work plans to the suggested work practices and containment strategies as stated in these specifications. These alternate work plans or containment strategies must be approved by Owner and/or Project Monitor prior to their implementation.

This specification was developed by:

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PART 4.0 DOCUMENTATION SUBMITTAL REQUIREMENTS

Pre-Start Submittal Form

This form must be completed, signed, and submitted with the Contractor and/or subcontractors' documents required prior to the start of work. This form and these documents must be submitted to the Owner and/or Project Monitor in the time specified in the project documents prior to the start of work disturbing lead.

Please attach submittals in the order listed below. Please check off each item that is submitted. Write NA in spaces for which you believe the requirement is Not Applicable.

All Contractors and subcontractors who will have employees disturb lead on this project must, at a minimum provide proof of item number 1.6.1.e.1., lead hazard communication training in compliance with 8 CCR 1532.1 (L)(A)(1). **This is the only submittal that must be provided by these employers as long as they do not disturb more lead than is described in Part 1.5.1**.

The following submittals must be provided by all Contractors and subcontractors who will, at a minimum, have employees who will conduct trigger tasks for more than one hour per shift, will potentially be exposed above the Action Level, or will conduct other activities as determined by the Project Monitor that may result in significant exposure to lead.

a. ____ A written lead compliance plan in compliance with 8 CCR 1532.1 must be provided that includes the following:

1. ____ A description of equipment and materials, controls, crew size, job responsibilities, and operations and maintenance procedures for each activity in which lead is disturbed and potentially emitted;

2. ____ A description of specific control methods (wet methods, engineering controls, etc.) that will be used to ensure workers are not exposed above the PEL;

3. ____ Technology considered in meeting the Cal/OSHA permissible exposure level (PEL);

4. ____ Air monitoring data documenting sources of lead emissions;

5. ____ A detailed implementation schedule for the compliance plan, including the schedule for inspections by a competent person;

6. ____ A description of the lead work practice program which will be used to control worker exposures. This includes the use of protective work clothing, equipment, hygiene facilities and practices, and housekeeping practices;

7. ____ A description of the steps the Contractor or subcontractor will take to minimize the generation of hazardous waste produced on this project. This includes, but is not necessarily limited to how the contractor will separate waste streams. For example, how will the Contractor or subcontractor will keep potentially hazardous waste such as paint chips and dust from being disposed of with other potentially non-hazardous construction materials and debris.

b. ____ Copy of the Contractor or subcontractor's written respirator program in accordance with the requirements of 8 CCR 1544.

c. ____ Proof that all employees expected to wear respirators on this project have medical approval to wear a respirator.

d. ____ Copies of respiratory fit-tests for all workers expected to wear a respirator on this project. Fit testing must be done as required by and in accordance with 8 CCR 1544.

e. Proof of training required by Part 1.5 for type of work employee will do.

1. ____ Proof of Hazard Communication Training for Lead for those exposed to lead or who will perform trigger tasks for less than one hour. *(Proof may be a certificate or written statement stating training was completed and a list of names of those individuals who were trained. Proof of this training is not needed if employee provides proof of training required by items e. 2, or e. 3.)*

2. ____ Proof of training in compliance with 8 CCR 1532.1 (l)(2) for all employees who will conduct trigger tasks as defined in 8 CCR 1532.1 (d)(2) for more than one hour or who will reasonably be expected to be exposed to lead above the Action Level. *(Proof may be a certificate or written statement stating training was completed and a list of names of those individuals who were trained.) Not required if providing proof of training required in item e.3 and/or item e.4.*

3. ____ Proof of CDPH lead certification for those workers who will conduct trigger tasks as defined in 8 CCR 1532.1 (d)(2) or will reasonably be expected to be exposed to airborne levels of lead above the PEL. This is required for this work on all projects that will disturb more than 100 square feet of lead-containing material. *(Proof of certification will be a currently valid CDPH certification card as a worker or supervisor. Workers who can show proof of a valid course completion form and application being submitted to CDPH, will be allowed to work while awaiting full certification from CDPH.)*

4. ____ Proof of current CDPH certification as a lead supervisor for the on-site competent person for projects involving the conduction of trigger tasks or other activities reasonably expected to exceed the PEL. This is required for this work on all projects that will disturb more than 100 square feet of lead-containing material. *Proof of valid certification will be a currently valid CDPH certification card a worker.)*

5. ____ If exception to requirement for CDPH certified supervisor listed in Part 1.5.3 is requested, then provide proof of CDPH certified supervisor who will verify containment, personal protection and work practices, and will be able to respond to the project within two hours of request by the Project Monitor. *(Only applicable for paint scraping work done prior to the demolition of buildings or structures.)*

f. ____ Copies of all current MSDS for chemicals used on this project.

g. ____ Manufacturers' certifications that high efficiency particulate air (HEPA) vacuums, pressure differential units and other local exhaust ventilation equipment conform to ANSI Z9.2-79 for all HEPA-filtered equipment that will be used on this project. *(This is proof that the equipment is actually HEPA filtered. This is separate from the challenge testing requirement needed for equipment used in interior spaces.)*

h. ____ Name and contact information of independent testing company who will challenge test all vacuums and air filtration devices used on this project (in interior spaces).

I. ____ Statement regarding compliance with all Cal/OSHA exposure monitoring required for this project.

j. ____ Name and contact information for laboratory who will analyze air samples or waste samples and documentation of their certification to conduct such analysis.

k. ____ Name of Waste Transporter who will transport hazardous waste on this project and documentation that the Transporter is allowed to transport lead hazardous waste.

l. ____ Name of Waste Landfill to which lead hazardous waste will be sent and documentation that such landfill is allowed to accept such waste.

m. ____ Should waste water filtration be required on this project, submit manufactures documentation pertaining to the capability of waste water filters to filter particles of, at a minimum, five micrometers in size.

n. ____ List of all rented equipment to be used within a lead regulated area, or a statement that no rental equipment will be used on this project.

1. ____ If rental equipment is to be used, submit written statements from each rental company indicating the rental company's acknowledgment that the equipment is provided for and may be used in areas where airborne levels of asbestos and/or lead may be present.

o. ____ Submit emergency plans. At a minimum submit the following:

1. ____ Submit non-emergency telephone numbers, other then 911, for the appropriate Police, Sheriff, and Fire Departments.

2. ____ Name, pager or cell phone numbers of the on-site supervisor and his immediate company supervisor.

3. ____ Submit detailed written directions from the project site to the medical facility to be used in case of an emergency. Also include a map which sufficiently shows the route to be taken from the site to the designated medical facility.

4. ____ Submit written emergency procedures pertinent to the work to be performed and which can be implemented by site personnel if the need arises.

p. ____ Local sanitation district Wastewater Discharge Permit for Surface Washers (if required).

The above listed documents must be provided in the time specified in the project documents prior to the start of work that will disturb lead. Under no circumstances will workers or supervisors be allowed to work on this project prior to the receipt of this documentation by the Owner and/or Project Monitor. In addition, documentation regarding rental equipment, but must be provided before the equipment may be used in a

lead regulated area. All delays resulting from the failure of the Contractor and/or subcontractors to provide this information in the required time frame is solely the responsibility of the Contractor and/or subcontractor.

Name, Signature, and Contact Information of Contractor's Personnel Completing Pre-Start Submittal Package

NAME:
(Print or Type)

SIGNATURE:

Telephone:

Fax:

Mailing Address:

The following information is reprinted from earlier in these specifications in order to assist the Contractor and/or subcontractors in providing the necessary submittals during and following the work.

1.6.2 Submittals Provided During The Work (Or Following Completion Of The Work If Applicable)

The following documents must be provided the Owner and/or Project Monitor following completion of the physical activities associated with the project. The following documents must be received and approved by the Owner and/or Project Monitor before the work is considered complete. (Failure to provide these documents means the work is not complete, even though the physical activities may be completed.)

a. Daily sign-in sheet for each worker entering a lead regulated area.

b. The Contractor must provide the results of exposure sampling done to comply with the requirements of 8 CCR 1532.1 (d) and the requirements of this specification.

c. The Contractor must provide blood sampling and analysis results of lead (BLL) and zinc protoporphyrin (ZPP) levels for all workers who are represented by air monitoring results that exceed the Action Level. Typically, the Project Monitor will require blood lead sampling for all workers on a work shift if one or more air sampling results for that shift is above the Action Level.

   The written results of the blood sampling analysis must be provided the Owner and/or Project Monitor within 21 days of the exposure over the Action Level or within 12 days of the completion of the project, whichever comes first.

d. Copies of job progress reports and project documentation. This must include the names of all employees onsite, the hours worked and a brief description of the work completed at the site(s).

e. The Contractor must provide all waste disposal documentation.

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.01 APPLICABLE REQUIREMENTS

A. The requirements of Divisions 00 & 01 apply to all work of this Section.

1.02 SCOPE

1 Fixed dry marker writing surfaces.

2 Trim, chalk rail and accessories.

2.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 06 10 00: Rough Carpentry. Substrate construction behind markerboards, including blocking/backing.

B. Section 09 72 16: Vinyl-Coated Fabric Wall Coverings

1.04 REFERENCES:

A. AA (Aluminum Association) – Designation System for Aluminum Finishes.

B. AHA A135.4 (American Hardboard Association) – Basic Hardboard.

C. ANSI A208.1 – Wood Particleboard.

D. ANSI/ASTM B221 – Aluminum-Alloy Extruded Bars, Rods, Wires, Shapes and Tubes.

E. ASTM A424 – Standard Specifications for Steel Sheets for Porcelain Enameling.

F. ASTM A653/A653M – Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.

G. ASTM B209 – Standard Specifications for Aluminum – Alloy Sheet and Plate.

H. FS LLL-B-810 – Building Board, (Hardboard) Hard Pressed, Vegetable Fiber.

I. Porcelain Enamel Institute – Performance Specifications for Porcelain Enamel Chalkboards.

1.05 QUALITY ASSURANCE:

A. Single Source Responsibility: Provide specified items from one manufacturer.

B. Catalog Standards:
1. Manufacturer's catalog numbers may be shown on Drawings for convenience in identifying specified items. Unless modified by notation on Drawings or specified, catalog description for indicated number constitutes requirements for the item specified.
2. The use of catalog numbers and specific requirements set forth in Drawings and Specifications does not preclude use of any other manufacturer's products or

procedures which may be equivalent. Such numbers and requirements establish standards of design and quality for materials, construction, and workmanship.

1.06 SUBMITTALS:

A. Refer to Section 00 72 00 for submitting the following items:
1. Product Data.
2. Installation Instructions and Drawings.
3. Samples of dry marker board surface and colors.
4. Cleaning and maintenance instructions, 6 sets. Furnish to Section 00 72 00 for incorporation into Operation and Maintenance Manuals.
5. Samples of vinyl surface for color selection.

1.07 DELIVERY, STORAGE AND HANDLING:

A. Deliver undamaged products to site in manufacturer's sealed containers or wrappings with legends intact. Store on site secure from weather, soil and physical damage.

1.08 WARRANTY:

A. Provide marker board manufacturer's "Life of Building" guarantee against material failure and faulty workmanship, and including guarantee that surfacing will not discolor, peel or become glossy if used and maintained in accordance with manufacturer's recommendations. Submit in form found in Section 00 72 00.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Claridge Products and Equipment, Inc. (Specified).

B. Nelson Adams.

C. Greensteel, Division of Polyvision Corp.

D. Approved equal.

2.03 FIXED MARKER BOARDS:

A. Dry marker boards shall be Claridge LCS Dry-Erase Boards (sizes as indicated on Drawings), PolyVision / Greensteel DMB Dry Marker Boards, or approved equal. Boards shall be trimmed out in an aluminum frame with a continuous marker trough on the bottom edge and continuous map rail on the top edge. Provide one (1) LCS eraser, twelve (12) assorted LCS markers and (1) flag holder at each board. Colors as selected by Architect from the manufacturer's full range of standard colors.

B. Marker trough shall be equal to Claridge No. 264.

C. Map rail shall be equal to Claridge No. 51, with cork insert, size to match marker board thickness with (1)51FH, (1)pair 51M and (1)pair 51RB.

D. Perimeter trim shall be equal to Claridge No. 170, size to match marker board thickness.

E. Provide all miscellaneous and incidental accessories as required for a complete and proper installation.

2.06 FABRICATION:

A. Marker boards and tack boards shall be in one piece without splices. Sizes as indicated on the Drawings.

B. All perimeter edges shall be trimmed with continuous moldings as specified for each location, or as indicated on Drawings.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Prior to installation, carefully inspect and verify that the installed work of all other trades is complete to the point where this installation may properly commence.

B. Verify that specified items may be installed in accordance with the approved design.

C. In the event of discrepancy, immediately notify Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 INSTALLATION:

A. Install items where indicated on the Drawings and in full accord with all pertinent regulations and the manufacturer's recommendations, anchoring all components firmly in place for long life under hard use.

B. Secure marker boards and tack boards to solid backing by hanging from continuous mounting bars or by attaching to top steel hanger clips attached with screws through edge of top edge molding. At bottom edges attach with steel hanger clips secured to solid backing and fastened to boards with screws through edge of bottom molding or through edge of marker tray. Countersink screw heads into continuous mounting bars and hanger clips at wall surfaces. Screws shall be of sufficient length to penetrate wood framing not less than one inch and as required to provide firm anchorage into metal framing.
   1. Screws at top and bottom edges of marker boards and tack boards: Phillips style oval head, not less than No. 8 size, spaced not more than 12 inches on centers at continuous mounting bars and 24 inches on center at steel hanger clips.
   2. Exposed screws shall be aluminum or stainless steel.
   3. Steel hanger clips shall be spaced at 24 inches on center maximum spacing and within 6 inches of each end. Minimum two hangers per edge.

C. Unless otherwise indicated on Drawings, install tack board frame tight to edge of marker board frame.

3.03 PROTECTION:

A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

B. In the event of damage, make all repairs and replacements necessary to the satisfaction of the Architect at no additional cost to the Owner.

[END OF SECTION 10 11 00]

SECTION 10 14 00

SIGNAGE

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Provision and installation of interior and exterior room identification signs, and interior and exterior directional and informational signs including signs for accessible features and regulatory signs.

1.02 RELATED SECTIONS (List is for the Contractor's Convenience and May Not Be Complete.)

A. Section 00 72 00: General Conditions

B. Section 06 10 00: Rough Carpentry

C. Section 09 90 00: Painting.

1.03 RELATED CODES AND STANDARDS

A. Accessible signs shall conform with the following requirements as indicated:
1. California Building Code (CBC) Title 24, 2019 Edition.
2. ADA Accessibility Guidelines (ADAAG, latest adopted edition).
3. Contracted Grade 2 Braille shall be used whenever Braille symbols are specifically required (CBC Section 11B-703.3 Braille).
4. Means of Egress Identification: CBC 11B-216.1 &11B-703.1.
5. Tactile Exit Signs: CBC 1011.4.
6. Restroom Identification Symbols: CBC 11B-216.8 &11B-703.7.2.6.
7. Signs and Identification: CBC 11B-216.1 &11B-703.1.
8. International Symbol of Accessibility: CBC 11B-703.7.2.1.
9. Identification Signs: CBC 11B-213.2.
10. Direction and Information Signs: CBC 11B-703.1.
11. Symbols of Accessibility: CBC 11B-703.7.
12. Finish and Contrast: CBC 11B-703.5.1.
13. Character Proportions: CBC 11B-703.2.4.
14. Character Height: CBC 11B-703.2.5.
15. Raised Characters and Pictorial Symbol Signs: CBC 11B-703.2 & 11B-703.6.
16. Braille: CBC 11B-703.3.
17. Mounting Height and Location: CBC 11B-703.4.1 & 11B-703.4.2.
18. Symbols of Accessibility: CBC 11B-703.7.2.
19. Color of Symbol: CBC 11B-703.7.2.1.
20. Entrance Signs: CBC 11B-216.6.

1.04 SUBMITTALS

A. Submit manufacturer's technical data and installation for each type of sign required.

B. Submit shop drawings listing sign size, type style and letter heights and construction detail.

C. Submit samples of background colors and character colors. Indicate which type styles shall be used for required tactile characters and for required visual characters.

D. Submit proposed sign schedule to comply with scoping requirements above. Architect to provide text for Room ID Signage.

E. Submit under provisions of Section 00 72 00.

F. All signage shall be designed and constructed to comply with signage specifications and drawings.

1.05 QUALITY ASSURANCE, MATERIALS AND FABRICATION TECHNIQUES

A. QUALITY ASSURANCE
1. Manufacturers shall submit 3 references showing products for projects completed within the last 6 years. Both tactile and non-tactile signage shall be included in the work.
2. Manufacture's Two-Year Warranties.
3. Contractor shall provide labor and materials to repair or replace defective signs as directed by Owner. Defects shall include:
a. Tactile characters and/or Braille dots which come off or are removed.
b. Discoloration, wear and scratching off of the surface color.
c. All signs and sign components, except for damage by mishandling by Owner, including installation by Owner, or vandalism.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver to project site in manufacturer's original, unopened and undamaged packaging. Store in original packaging under protective cover and protect from damage. Handle materials in such a manner as to prevent damage to products or finishes.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sign Material
1. See 2.08, SIGN TYPES below.

B. Fasteners:
1. See 2.08, SIGN TYPES below.

C. No substitution of material or design shall be permitted.

2.02 SUBSTRATE

A. Interior plaques shall have eased or rounded edges and corners.

B. Exterior plaques shall have eased or rounded edges.

2.03 GENERAL

A. Non-glare (non-reflective) materials shall be used for all signs which identify, direct to, or give information about facilities and their use.
1. Exception: Parking, traffic signs, and exterior safety signs may use reflective materials. Identification signs for accessible parking spaces shall use reflective materials for graphics.

B. Characters shall have a minimum of 70 percent contrast with their backgrounds on all signs which identify, direct to, or give information about facilities and their use.

C. Characters on all signs which identify, direct to, or give information about facilities and their use shall comply with CBC 11B-703.2.4 & 11B-703.2.6.

D. Type styles of characters on all signs which identify, direct to, or give information about facilities

and their use shall not be italic, oblique, or decorative in style.

E. Non-tactile characters (letters, numbers and symbols) shall be Helvetica Regular
1. Characters shall be uppercase unless otherwise shown on Drawings.
2. Upper case letters shall be 1 inch high (unless otherwise shown on Drawings, maximum 1 1/4 inch high).
3. Height of lower case letters (where shown on Drawings) shall be proportional to height of upper case letter.

2.04 TACTILE CHARACTERS

A. Characters required to be tactile shall be San Serif.
1. Characters shall be raised 1/32 inch minimum and a maximum of 1/16 inch from the background.
2. Characters shall be uppercase unless otherwise shown on Drawings. Signs shall have tactile characters where shown on Drawings.
3. Upper case tactile letters shall be 1 inch high (unless otherwise shown on Drawings, maximum 1-1/4 inch high).
4. Height of lower case letters (where shown on Drawings) shall be proportional to height of upper case letter.
5. Exception: Characters required by code to exceed 1 1/4 inches, such as elevator hoistway characters, shall not exceed 2 inches in height. Characters on elevator control panels shall not be less than 5/8 inches high.

B. A minimum of 1/8” space between the top surfaces of adjacent characters measuring between the two closest points shall be provided.

C. Drawing Coordination: Sign size, text, mounting locations requirements and other requirements shall be as stipulated in this Specification Section unless other shown on Drawings.

2.05 BRAILLE

A. Braille text shall comply with CBC 11B-703.3.

B. Braille on metal signs shall be embossed domed California Contracted Grade 2 Braille. All Braille shall be fabricated by a method which produces a rounded or domed dot shape. All Braille dots shall be solid or filled from behind so they cannot be crushed or indented.

C. Braille dot, cell spacing and dot height shall follow specifications as per CBC 11B-703.3 & 11B-703.3.1.

D. There shall be no Braille indication of capital letters except for proper names, individual letters or acronyms, or beginnings of sentences.

E. Braille shall be centered directly below raised print characters.

F. Braille shall be located on the sign 3/8 inch below the corresponding tactile characters, flush left or centered to the characters depending on the sign layout. (CBC 11B-703.2.9 & 11B-703.3.2)

G. Spacing between Braille and raised characters shall be between 3/8” to 1/2”.

2.06 NON-TACTILE GRAPHICS AND TEXT

A. Non-tactile graphics/pictogram and text shall screen printed on the surface and complying with Paragraph 2.01.A.1.a of this Specification Section.

B. Identifying pictograms shall be located above the tactile text in a clear, six inch high field.

C. Non-tactile text shall be upper case and one inch high (unless otherwise shown on Drawings), and shall comply with CBC 11B-703.2.4, 11B-703.2.6, 11B-703.5.1, 11B-703.5.4, 11B-703.5.5, & 11B-703.6.2.

2.07 MISCELLANEOUS

A. Furnish all items required for the proper installation of all signage including but not limited to tamper resistant fasteners, adhesives, sealants, metal sleeve spacers, etc.

2.08 SIGN TYPES:
Note: At all references to Braille text in the sign types listed below, Braille text shall comply with 2019 edition, CBC 11B-703.3 as follows:

Braille text shall be Contracted Grade 2 Braille and shall be used wherever Braille symbols are specifically required. Dots shall be 1/10 inch on centers in each cell with 3/10 inch space between corresponding dots centers in adjacent cells. Dots height above background surface shall be raised a minimum of 0.025" to maximum of 0.037".

A. **Sign Type S-5**: Room Identification Signs and blank sign panel where occurs (See Drawings for locations).
1. Signs shall be plaque type signs with subsurface screen printed numbers and/or letters with corresponding Grade 2 Contracted Braille below text.
2. Characters shall be subsurface screen printed.
3. Signs shall be 3" high x 6" wide (or wider as required for text length) with 3/4" radius corners.
4. Signage and text shall be 1/16" subsurface screen printed matte finish acrylic with 1/4" thick acrylic base plate backing and 1/16" raised acrylic graphics. All signs have text which shall be number, letter or number-letter combinations, centered and normally spaced with approximately ten (10) characters per sign.
5. Text schedule shall be provided by the Owner during submittal review process.
6. Character Style:
   a. Number style shall be 1" high Optima Semi-Bold.
   b. Letter style shall be 1" high Optima Semi-Bold, upper case.
7. Mounting:
   a. Screw countersunk mounted on wall at strike side of door with sign at 5'-0" maximum to baseline of highest raised character above finish floor. Where side wall mounting is not possible, mount sign on door with sign at 5'-0" maximum to baseline of highest raised character above finish floor. Confirm with Architect prior to installation at location other than strike side of door.
   b. Provide security head type fasteners, typical.
   c. Where sign type S5 occurs at location of glass side light adjacent to door, install sign to glass with continuous double-sided adhesive tape on all 4 sides of sign. Provide blank sign panel (no text) of same color as sign panel for installation on inside face of glass to conceal view of sign panel through glass. Align blank panel with sign panel and fasten with continuous double-sided adhesive tape on all 4 sides of blank panel.
8. Color selections of the characters and subsurface background shall be made by Architect from the full range of the manufacturer's standard colors.
9. Provide and install up to ten (10) additional signs of up to 15 characters each. Text and locations shall be provided by the Architect during the submittal process.

F. **Sign Type S-6**: N/A

G. **Sign Type S-7**: Assistive Listening Signs where occurs (See Drawings for locations).
1. Signs shall be plaque type signs with subsurface screen printed numbers and/or letters.
2. Characters shall be subsurface screen printed.

3. Signs shall be 6" high x 9" wide with 3/4" radius corners.
4. Signage and text shall be 1/16" subsurface screen printed matte finish acrylic with 1/4" thick acrylic base plate backing and 1/16" raised acrylic graphics.

H. **Sign Type S-8**: N/A

D. **Sign Type S-9**: N/A

PART 3 – EXECUTION

3.01 GENERAL

A. Signs shall be installed with edges horizontal and vertical and face plumb.

B. Install signs with tamper resistant screws and anchors at all wall conditions except glass.

C. Screw length shall be sufficient for minimum 1 inch embedment.

D. Signs mounted onto glass:
1. Sign shall be attached to glass with clear silicone adhesive designed to secure sign material to glass (double stick tape with cushion is not permitted). Contractor shall apply sealant around perimeter of sign.
2. Where interior and exterior signs are to be mounted, signs shall be the same size (the larger sign size shall dictate the size of the smaller sign) and located “back-to-back”.
3. Where only an interior or exterior sign is mounted, a “blank sign” (the same size as the sign) shall be installed and located “back-to-back”.

E. The Contractor is solely responsible for the identification of the material onto which signs are to be mounted. The Contractor shall furnish and install all materials necessary for the proper installation of each sign.

F. Contractor shall notify the Architect of any conflicts between the Drawings, Specifications and the requirements of the CBC and ADA prior to the submission of the Bid Form. No increase of the Contract Sum and no extension of the Contract Time shall be granted for the resolution of CBC, ADA and Contract Documents conflicts.

G. Permanent identification signs for rooms or spaces shall be installed on the wall adjacent to the latch side of the door.

3.02 ADJUST AND CLEAN

A. Clean and Touch-up: Remove all packing and protection blemishes and thoroughly clean and polish all finish surfaces. Restore any marred or abraded surfaces to their original condition by touching up in accordance with the manufacturer’s recommendations. Touch-up shall not be obvious.

B. Defective Work: Remove and replace all defective work which cannot be properly repaired, cleaned or touched-up with no additional cost to the owner.

C. Protect installed work during the construction period to prevent abuse and damage.

3.03 CLEAN-UP

A. Upon completion of the work of this section, remove all surplus materials, rubbish and debris from the premises.

[END OF SECTION 10 14 00]

SECTION 12 06 20

WINDOW TREATMENTS

PART 1 - GENERAL

1.01 APPLICABLE REQUIREMENTS:

A. The requirements of Divisions 0 & 1 apply to all Work of this Section.

1.02 SCOPE:

A. Provide all labor materials and equipment necessary for the complete and proper installation of horizontal mini blinds and hardware accessories, as indicated on the Drawings and specified herein.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 06 10 00: Rough Carpentry

B. Section 09 72 16: Vinyl-Coated Fabric Wall Coverings

1.05 QUALITY ASSURANCE:

A. Qualifications of manufacturer: The proposed manufacturer shall have been successfully engaged in the manufacture of horizontal blinds for at least two years immediately prior to the start of this work and shall have a record of installations acceptable to the Architect.

B. Qualifications of installers: For actual installation of horizontal blinds, use only personnel who are thoroughly trained and experienced in the skills required and who are completely familiar with the requirements of this work.

C. The approved manufacturer's recommended installation procedures will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.

D. Catalog Standards:
1. Manufacturer's catalog numbers may be shown on Drawings for convenience in identifying specified items. Unless modified by notation on Drawings or specified, catalog description for indicated number constitutes requirements for the item specified.
2. The use of catalog numbers and specific requirements set forth in Drawings and Specifications does not preclude use of any other manufacturer's products or procedures which may be equivalent. Such numbers and requirements establish standards of design and quality for materials, construction, and workmanship.

E. Single Source Responsibility: Provide specified items from one manufacturer or from manufacturers as recommended by primary material or system manufacturer.

1.06 SUBMITTALS:

A. Submit shop drawings, product data, samples and manufacturer’s installation instructions under provisions of Section 00 72 00.

B. Submit shop drawings indicating opening sizes, tolerances required, and installation of blind at window opening, method of attachment, clearances and operation.

C. Submit product data indicating physical and dimensional characteristics and operating features.

D. Submit two samples 6” long illustrating slat materials, finish and colors.

E. Submit color samples from manufacturer's full range of standard colors.

1.07 DELIVERY, STORAGE AND HANDLING:

A. Deliver undamaged products to site in manufacturer’s sealed containers or wrappings with all sides intact. Store on site secure from weather, soil and physical damage.

B. Store in strict accordance with manufacturer’s recommendations.

1.08 PROJECT CONDITIONS:

A. Products shall be available at project when required for installation so as not to delay job progress. Installer for these products shall cooperate with installers performing work under other Sections involved to effect proper installation.

PART 2 - PRODUCTS

2.01 HORIZONTAL MINI BLINDS:

A. Horizontal Blinds: Provide 1 inch aluminum horizontal blinds equal to "Levolor - Riviera One", “Hunter Douglas – Modern Precious Metals”, or approved equal, with hold down brackets and top locking cord lock. Install on face of hollow metal fame or door and anchor as per manufacturer's instructions. Submit color samples from manufacturer's full range of standard colors.

2.03 OTHER MATERIALS:

A. Provide all other materials and accessories required for a complete and proper installation of blinds.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Prior to installation of the work of this Section, carefully inspect and verify that the installed work of all other trades is complete to the point where this installation may properly commence.

B. Verify that specified items may be installed in accordance with the approved design.

C. In the event of discrepancy, immediately notify Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

D. Do not commence fabrication until field measurements are confirmed.

E. Ensure structural supports are correctly placed.

F. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION:

A. Install blinds in accordance with manufacturer's instructions.

B. Place controls for most accessible location.

C. All lift cords and tilt wands shall be of sufficient length to be accessible from a maximum of 48" above the finished floor.

D. Secure in place with concealed fasteners.

3.03 TOLERANCES:

A. Maximum Variation of Gap at Window Opening perimeter: 1/4".

B. Maximum Offset From Level: 1/8".

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean work under provisions of Division 01.

B. Clean blinds using products recommended by the manufacturer.

3.06 PROTECTION OF WORK AND TESTING:

A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

B. In the event of damage, make all repairs and replacements necessary to the satisfaction of the Architect at no additional cost to the Owner.

C. Test operation of drapery hardware before and after installation of drapery and curtains. Operation shall be smooth and uniform.

[END OF SECTION 12 06 20]

SECTION 260010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Table of Contents, Division 26 - Electrical:

SECTION NO.	SECTION TITLE
260010	BASIC ELECTRICAL REQUIREMENTS
260519	BUILDING WIRE AND CABLE
260526	GROUNDING AND BONDING
260529	ELECTRICAL HANGERS AND SUPPORTS
260531	CONDUIT
260533	BOXES
260543	UNDERGROUND DUCTS AND STRUCTURES
260553	ELECTRICAL IDENTIFICATION
262716	CABINETS AND ENCLOSURES
262816	OVERCURRENT PROTECTIVE DEVICES
266113	FIRE ALARM/LIFE SAFETY SYSTEM
266516	SECURITY ALARM MONITORING SYSTEM
267113	TELECOMMUNICATION CABLING SYSTEM
267613	SCHOOL COMMUNICATION SYSTEM

B. Work included: This Section includes general administrative and procedural requirements for Division 26. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 01.
1. Quality assurance.
2. Definition of terms.
3. Submittals.
4. Coordination.
5. Record documents.
6. Operation and maintenance manuals.
7. Rough-in.
8. Electrical installation.
9. Cutting, patching, painting and sealing.
10. Field quality control.
11. Cleaning.
12. Project closeout.

C. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete and operable installation.
1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26 Sections.
2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, lighting pole foundations, etc. Refer to Division 31, Earthwork.

3. Selective demolition: Nondestructive removal of materials and equipment for reuse or salvage as indicated. Also dismantling electrical materials and equipment made obsolete by these installations. Refer to Division 02, Selective Demolition.
4. Concrete Work: Include forming, steel bar reinforcing, cast-in- place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, housekeeping pads, etc. Also includes setting of floor boxes in existing concrete slabs, saw-cutting of existing slabs and grouting of conduits in saw-cut. Refer to Division 03, Concrete.
5. Miscellaneous metal Work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor control centers, etc. Refer to Division 05, Miscellaneous Metals.
6. Miscellaneous lumber and framing Work: Include wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment. Refer to Division 06, Rough Carpentry.
7. Moisture protection and smoke barrier penetrations: Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vaportight. Refer to Division 07, Thermal and Moisture Protection.
8. Access panels and doors: Required in walls, ceilings and floors to provide access to electrical devices and equipment. Refer to Division 08, Access Doors also, Division 05, Metals.
9. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 09, Painting.
10. Lighting fixture supports: Provide slack fixture support wire for lighting fixtures installed in acoustical tile or lay-in suspended ceilings. Refer to Division 09, Acoustical Treatment.

D. Work furnished and installed under another Division requiring connections under this Division includes but is not limited to:
1. Electric motors.
2. Package mechanical equipment: fans, fan coil units, pumps, boilers, compressors, etc.
3. Flow switches and valve monitors for sprinkler system.
4. Pre-wired electrified partition furniture.
5. Temperature control panel(s). (Line voltage only)
6. Irrigation controller(s). (Line voltage only)
7. FM-200 control panel. (Line voltage only)
8. Kitchen equipment and appliances.
9. Electric signage.
10. Electric door locks.
11. Door hold-open/release devices.
12. Variable frequency drive units.
13. Motorized roll down/sliding doors and grills.
14. Projection screens.

E. Items furnished under another Division, but installed and connected under this Division includes but is not limited to:
1. Wall mounted control stations for motorized roll down and sliding doors.
2. Electric fire sprinkler water flow bells.
3. Speed control switches for ceiling exhaust fans.

1.02 QUALITY ASSURANCE

A. Reference to Codes, Standards, Specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow Work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements or extent of the Contract Documents. The Contract Documents address the minimum requirements for construction.

C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
1. California Electric Code (CEC).
2. California Building Code (CBC).
3. California Fire Code (CFC).
4. California Mechanical Code (CMC).

D. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
CBM	Certified Ballast Manufacturers
ETL	Electrical Testing Laboratories
FS	Federal Specification
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IPCEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturer's Association
UL	Underwriters' Laboratories

E. Independent Testing Agency qualifications:
1. Testing Agency shall be an independent testing organization that will function as an unbiased authority, professionally independent of Manufacturer, Supplier and Contractor, furnishing and installing equipment or system evaluated by Testing Agency.
2. Testing Agency shall be regularly engaged in the testing of electrical equipment, devices, installations and systems.
3. Testing Agency shall meet Federal Occupational Safety and Health Administration (OSHA) requirements for accreditation of independent testing laboratories, Title 9, Part 1907.
4. On-site technical personnel shall be currently certified by the International Electrical Testing Association in electrical power distribution system testing.
5. Testing Agency shall use technicians who are regularly employed by the firm for testing services.
6. Contractor shall submit proof of above Testing Agency qualifications with bid documentation upon request.

F. All base material shall be ASTM and/or ANSI standards.

G. All electrical apparatus furnished under this Section shall conform to NEMA standards and the NEC and bear the UL label where such label is applicable.

H. Certify that each welder performing Work has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.03 DEFINITION OF TERMS

A. The following list of terms as used in the Division 26 documents shall be defined as follows:
   1. "Provide": Shall mean furnish, install and connect unless otherwise indicated.
   2. "Furnish": Shall mean purchase and deliver to Project site.
   3. "Install": Shall mean to physically install the items in-place.
   4. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.
   5. "As directed": Shall be as directed by the Owner or their authorized Representative.
   6. "Utility Companies": Shall mean the company providing electrical, telephone or cable television services to the Project.

1.04 SUBMITTALS

A. Format: Furnish submittal data neatly bound in an 8-1/2" x 11" folder or binder for each Specification Section with a table of contents listing materials by Section and paragraph number.

B. Submittals shall consist of detailed Shop Drawings, Specifications, block wiring diagrams, "catalog cuts" and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication and material finish. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories which are included and those which are excluded. Furnish quantities of each submittal as noted in Division 01.

C. Each submittal shall be labeled with the Specification Section Number and shall be accompanied by a cover letter or shall bear a stamp stating that the submittal has been thoroughly reviewed by the Contractor and is in full compliance with the requirements of the Contract Documents. Cover letters shall list in full the items and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.

D. The Contractor shall submit detailed Drawings of all electrical equipment rooms and closets if the proposed installation layout differs from the construction documents. Physical size of electrical equipment indicated on the Drawings shall match those of the electrical equipment that is being submitted for review, i.e.: switchboards, panelboards, transformers, control panels, etc. Minimum scale: 1/4" = 1'- 0". Revised electrical equipment layouts must be approved prior to release of order for equipment and prior to installation.

E. As part of the equipment and fixture submittals, the Contractor shall provide anchorage calculations for floor and wall mounted electrical equipment and fixtures, distribution conduits and raceways, in conformance with the 2019 California Building Code (CBC) and ASCE 7-05. Use the Occupancy Category, Ground Accelerations, Site Class, Seismic Design Category, and Seismic Importance Factor as noted in the structural drawings. For components required for Life Safety or containing hazardous materials use Ip=1.5. Structural Calculations shall be prepared, stamped and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

F. The Manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights and approximate centers of gravity.

G. The Manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights and approximate centers of gravity.

H. All resubmittals shall include a cover letter that lists the action taken and revisions made to each Drawing and equipment data sheet in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

I. Shop Drawings for the following systems must be prepared via a computer aided drafting (CAD) system for submission by the Contractor. The Engineer can provide files of the electrical Contract Documents to the Contractor.
   1. Fire alarm/life safety system, Section 266116.
   2. Security alarm monitoring system, Section 266516.

J. Independent Testing Agency report:
   1. Testing Agency shall provide 3 copies of the complete testing report.
   2. Test report shall include the following:
      a. Summary of Project.
      b. Description of equipment.
      c. Equipment used to conduct the test.
         1) Type.
         2) Manufacturer.
         3) Model number.
         4) Serial number.
         5) Date of last calibration.
         6) Documentation of calibration leading to NIST standards.
      d. Description of test.
      e. Test results, as compared to Manufacturers or industry accepted standards and tolerances.
      f. Conclusion and recommendation.
      g. Signature of responsible test organization authority.
   3. Furnish completed test report to Engineer no later than 30 days after completion of testing, unless otherwise directed.

K. Substitutions:
   1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.
   2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor must submit to the Engineer all pertinent test data, catalog cuts and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.
   3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility and appearance. Materials, processes or equipment, which in the opinion of the Engineer is equal in quality, utility and appearance, will be approved as substitutions to that specified.
   4. Whenever any material, process or equipment is specified in accordance with a Federal specification, an ASTM standard, an ANSI specification, UL rating or other association standard, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, support test data to substantiate compliance shall be submitted by the Contractor at no additional cost.
   5. Substitutions shall be equal, in the opinion of the Architect/Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the Architect/Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted article or material to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the Work or from any provisions of the Specifications.
   6. The Contractor shall be responsible for all expenses in connection with the substitution materials, processes and equipment, including the effect of the substitution on the Contractor, Subcontractor's or other Contractor's Work. No substitution of material, processes or equipment shall be permitted without written authorization of the Architect/Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

1.05 COORDINATION

A. Discrepancies:
1. In the event of discrepancies within the Contract Documents, the Engineer shall be so notified, within sufficient time, as delineated in Division 01, prior to the Bid Opening to allow the issuance of an Addendum.
2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The Drawings govern in matters of quantity and the Specifications govern in matters of quality. In the event of conflict within the Drawings involving quantities or within the Specifications involving quantities or within the Specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Contractor's Bid. No additional allowances will be made because of errors, ambiguities or omissions that reasonably should have been discovered during the preparation of the Bid.

B. Project conditions:
1. Examination of Project site: The Contractor shall visit the Project site and thoroughly review the locale, working conditions, conflicting utilities and the conditions in which the Electrical Work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the Project site and to notify the Engineer of any discrepancies between Contract Documents and actual Project site conditions.
2. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.
3. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the Work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

C. Preparation:
1. Drawings:
a. Layout: General layout indicated on the Drawings shall be followed except where other Work may conflict with the Drawings.
b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.
2. Design-Build systems approach: The Drawings do not fully represent the entire installation for the systems indicated below. The Contractor is required to complete the design for these systems as specified herein and as indicated on the Drawings. CAD Shop Drawings shall be submitted for review prior to installation:
a. Security system: Drawings indicate the layout and location of control console(s) components, as well as location of all security devices, i.e. CCTV cameras, card readers, door locks and contacts, intercom stations, duress stations, personal security system receivers, etc. conduits, wire and cabling between all system components, equipment, devices, etc. are not indicated

1.06 RECORD DOCUMENTS

A. Provide Project Record Drawings as described herein:
1. Drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit and wire sizing as well as routing, revised fixture schedule listing Manufacturers and products actually installed and revised panel schedules. Contractor shall record all changes in the Work during the course of construction on blue or black line prints. These prints shall be

made subject of monthly review by the Owner's Representative to ascertain that they are current. If not current monthly payments may be withheld.

2. Record Drawings shall be the transfer of information on these prints to the Revit Model.
3. Record drawing submissions shall be provided to the Engineer to review upon the completion of the following phases of Work:
   a. Final electrical installation.
4. Include in the record drawing submission the following shop drawing submission with all updated installation information:
   a. Fire alarm/life safety system.
   b. Security alarm monitoring system.
   c. Telecommunication cabling system
   d. School communication system.
5. A single set of half size prints of the Record Drawings shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made and the Contractor shall provide the following:

a. Printed drawing sets and digital files as defined in Division 1.
b. Updated electrical Revit model with all field changes, redlines, shop drawings, and updated installation information completed by the Contractor.

B. Panel schedules:

1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms matching those in the construction documents and inserted in the pocket of the inner door of each panelboard. See Section 262416: Panelboards for requirements.
2. The contractor shall update the Revit model panel schedules at project completion.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Prior to Project closeout furnish to the Owner, six (6) hard back 3-ring binders containing all bulletins, operation and maintenance instructions, part lists, service telephone numbers and other pertinent information as noted in each Section all equipment furnished under Division 26. Binders shall be indexed into Division Sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 ROUGH-IN

A. Contractor shall verify lines, levels and dimensions indicated on the Drawings and shall be responsible for the accuracy of the setting out of Work and for its strict conformance with existing conditions at the Project site.

B. Verify final locations for rough-ins with field measurements and with the requirements for the actual equipment to be connected.

C. Refer to equipment specification in Divisions 22 through 33 for rough-in requirements.

3.02 ELECTRICAL INSTALLATION

A. Preparation, sequencing, handling and installation shall be in accordance with Manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:
   1. Shop Drawings prepared by Manufacturer.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installations.

4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting height is not detailed or dimensioned, contact the Architect for direction prior to proceeding with rough-in.
7. Install systems, materials and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are indicated only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
10. Coordinate electrical systems, equipment and materials installations with other building components.
11. Provide access panel or doors where devices or equipment are concealed behind finished surfaces. Furnish and install access doors per the requirements of Division 08.
12. Install systems, materials and equipment giving right-of-way priority to other systems that are required to maintain a specified slope.
13. Conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

3.03 CUTTING, PATCHING, PAINTING AND SEALING

A. Structural members shall in no case be drilled, bored or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Architect and Structural Engineer.

B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

C. Application of joint sealers:
1. General: Comply with joint sealer Manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
2. Installation of fire-stopping sealant: Install sealant, including forming, packing and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops and fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.04 FIELD QUALITY CONTROL

A. General testing requirements:
1. The purpose of testing is to ensure that all tested electrical equipment, both Contractor and Owner supplied, is operational and within industry and Manufacturer’s tolerances and is installed in accordance with design Specifications.
2. Tests and inspections shall determine suitability for energization.
3. Perform tests in presence of the Owner's Representative and furnish test equipment, facilities and technical personnel required to perform tests.
4. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.

B. Tests: In addition to specific system test described elsewhere, tests shall include:

1. Equipment operations: Test motors for correct operation and rotation.
2. Lighting control circuits: Test lighting circuits for correct operation through their control devices.
3. Alarm and interlock systems: Produce malfunction symptoms in operating systems to test alarm and interlock systems. In addition, all specific tests described in the fire alarm/life safety system shall be performed.
4. Circuit numbering verification: Select on a random basis various circuit breakers in the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.
5. Voltage check:
    a. At completion of job, check voltage at several points of utilization on the system that has been installed under this Contract. During test, energize all installed loads.
    b. Adjust taps on transformers to give proper voltage, which is 118 to 122 volts for 120 volt nominal systems and proportionately equivalent for higher voltage systems. If proper voltage cannot be obtained, inform the Owner and the serving Utility Company.

C. Contractor shall provide test power required when testing equipment before service energization and coordinate availability of test power with General Contractor after service energization. The Contractor shall provide any specialized test power as needed or specified herein.

D. Testing safety and precautions:
1. Safety practices shall include the following requirements:
    a. Applicable State and Local safety operating procedures.
    b. OSHA.
    c. NSC.
    d. NFPA 70E.
2. All tests shall be performed with apparatus de-energized and grounded except where otherwise specifically required ungrounded by test procedure.

E. Calibration of test equipment:
1. Testing Agency shall have calibration program that assures test instruments are maintained within rated accuracy.
2. Instruments shall be calibrated in accordance with the following frequency schedule:
    a. Field instruments: Analog, 6 month maximum; Digital, 12 months maximum.
    b. Laboratory instruments: 12 months.
    c. Leased specialty equipment: 12 months where accuracy is guaranteed by lessor.
3. Dated calibration labels shall be visible on test equipment.
4. Records, which show date and results of instruments calibrated or tested, must be kept up-to-date.
5. Up-to-date instrument calibration instructions and procedures shall be maintained for test instrument.
6. Calibration standards shall be of higher accuracy than instrument tested.
7. Equipment used for field testing shall be more accurate than instrument being tested.

F. Coordinate with General Contractor regarding testing schedule and availability of equipment ready for testing.

G. Notify Owner and Engineer one week in advance of any testing.

H. Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired or corrected as prescribed by the Owner's Representative at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.

I. Testing Agency shall maintain written record of tests and shall assemble and certify final test report.

J. Include all test results in the maintenance manuals.

3.05 CLEANING

A. Prior to energizing of electrical equipment, the Contractor shall thoroughly clean the interior of enclosures from construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project, prior to final acceptance, the Contractor shall thoroughly clean both the interior and exterior of all electrical equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.06 PROJECT CLOSEOUT

A. Training: At the time of completion, a period of not less than 4 hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. This 4 hours training is in addition to any instruction time called out in the Specifications for specific systems, i.e., Fire Alarm, etc. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with Manufacturer’s Representative. The equipment Manufacturer shall be requested to provide product literature and application guides for the users' reference. Costs, if any, for the above services shall be paid by the Contractor.

B. Special tools: Provide one of each tool required for proper operation and maintenance of the equipment provided under this Section. All tools shall be delivered to the Owner at the Project completion.

C. Keying: Provide two keys for each lock furnished under this Section and turn over to Owner.

END OF SECTION [26 00 10]

SECTION 260519

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Building wire.
2. Cable.
3. Wiring connections and terminations.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. Federal Specifications (FS):
FS J-C-30A; Cable and Wire, Electrical (Power, Fixed Installation).
FS W-S-610C; Splice Conductor.
FS HH-I-595C; Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic.
2. Underwriters Laboratories, Inc. (UL):
UL 4; Armored Cable.
UL 44; Thermoset-Insulated Wires and Cables.
UL 62; Flexible Cord and Fixture Wire.
UL 83; Thermoplastic-Insulated Wires and Cables.
UL 183; Manufactured Wiring Systems.
UL 310; Electrical Quick-Connect Terminals.
UL 486A & B; Wire Connectors.
UL 486C; Splicing Wire Connectors.
UL 486D; Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
UL 493; Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.
UL 510; Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
UL 854; Service-Entrance Cables.
UL 1569; Metal-Clad Cables.
UL 1581; Reference Standard for Electrical Wires, Cables and Flexible Cords.
3. National Electrical Manufacturer Association (NEMA):
NEMA WC-5; Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
NEMA WC-7; Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
4. Institute of Electrical and Electronic Engineers (IEEE):
IEEE 82; Test Procedure for Impulse Voltage Tests on Insulated Conductors.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.
4. Final test results.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

C. Independent Testing Agency qualifications: Refer to Section 260010: Basic Electrical Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Building wire:
   a. Cerrowire
   b. General Cable
   c. Southwire Company
   d. Stabiloy (aluminum only)
   e. United Wire and Cable
2. Metal-CladArmored Cable:
   a. AFC Cable Systems
   b. AFC Cable Systems – MC Luminary Cable (0-10V)
   c. Southwire Company
3. Flexible Cords and Cables:
   a. Carol Cable Company
   b. Cerrowire
   c. PWC Corp
4. Wiring connectors and terminations:
   a. 3M Company.
   b. Ideal.
   c. Blackburn-Holub.
   d. Burndy.
   e. Thomas & Betts Corp.
   f. Beau Barrier.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 BUILDING WIRE

A. Conductor material:
1. Provide annealed copper for all wire, conductor and cable, unless otherwise indicated.
2. Copper wire AWG #8 and larger shall be stranded, unless otherwise indicated.
3. Copper wire AWG #10 and smaller may be solid or stranded as best suited for the installation.

B. Insulation material:

1. All insulated wire, conductor and cable shall be 600 volt rated unless otherwise noted on the Drawings.
2. Thermoplastic-insulated building wire: NEMA WC 5.
3. Rubber-insulated building wire: NEMA WC 3.
4. Copper feeders and branch circuits larger than #6 AWG: Type THW, XHHW or dual rated THHN/THWN.
5. Copper feeders and branch circuits #6 AWG and smaller: Type TW, THW, XHHW or dual rated THHN/THWN.
6. Feeders and branch circuits for direct-current (DC) in wet locations: Type XHHW-2
7. Service Entrance: Type RHW or THWN.
8. Control Circuits: Type THW or dual rated THHN/THWN.
9. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation.

2.03 METAL-CLAD CABLE (MC)

A. MC cable shall be an armored assembly of two or more dual rated THHN annealed copper conductors with a full sized green insulated ground wire.

B. MC cable sheath shall be fabricated in continuous lengths from galvanized steel or aluminum strips, spirally wound and formed to provide an interlocking design.

C. Conductors shall be color-coded for the correct phase and voltage as specified herein.

D. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Fittings shall be UL listed for use with MC cable type specified.

E. MC cable used for 0-10V signal wiring shall have the 0-10V wires twisted at a different twist ratio than that of the current carrying conductors.

2.04 FLEXIBLE CORDS AND CABLES (TYPE'S')

A. Provide flexible cords and cables of size, type and arrangement as indicated on the Drawings.

B. Type 'S' flexible cords and cables shall be manufactured in accordance with NEC Article 400 and composed of two or more conductors and a full size green insulated ground wire with an outer jacket of rubber or neoprene as noted.

C. Flexible cords and cables shall be fitted with wire mesh strain relief grips either as a integral component of the connector or as an independently supported unit.

D. Suspended flexible cords and cables shall incorporate safety spring(s) unless otherwise noted.

2.05 WIRING CONNECTIONS AND TERMINATIONS

A. Bolted pressure connectors: Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.

B. Electrical spring wire connectors:
1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.
2. Self-striping pigtail and tap U-contact connectors shall not be used.

C. Push-in wire connectors:

1. Multi-port push-in wire connectors for a maximum of 8-wires, as required for specific application. Connectors are manufactured to accommodate a wide range of sizes with either solid or stranded conductors, up to a maximum wire size of #10 AWG. Low insertion force required for ease of installation.
2. Housing shall be 105 degrees C and transparent for visual connection verification.
3. 600 volt maximum rating with copper contacts.
4. UL Listed to 486C and UL 467 Listed for grounding and bonding applications.

D. Compression type terminating lugs:
1. Provide tin-plated copper high-compression type lugs for installation with hand or hydraulically operated circumference-crimping tools and dies as stipulated by the lug Manufacturer or as indicated on Drawings. Notch or single point type crimping is NOT acceptable.
2. Two hole, long barrel lugs shall be provided for size (4/0) and larger wire where terminated to bus bars. Use minimum of three crimps per lug, on sizes where possible.

E. Splicing and insulating tape: Provide black, ultraviolet proof, self-extinguishing, 7 mil thick vinyl general purpose electrical tape with a dielectric strength of 10,000 volts suitable for temperatures from minus 18 degrees C to 105 degrees C. Federal Spec. HH-I-595, Scotch 33+ or equal minimum.

F. Insulating putty:
1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.
2. Use putty suitable for temperatures from minus 17.8 degrees C to 37.8 degrees C with a dielectric strength of 570-volts/mil minimum.

G. Insulating resin:
1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. Scotchcast 4 or equal for wet or underground vaults, boxes, etc. splices or terminations.
2. Use resin with a set up time of approximately 30 minutes at 21.1 degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.

H. Terminal strips:
1. Provide box type terminal strips in the required quantity plus 25% spare. Install in continuous rows in terminal cabinets.
2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.
3. Identify all terminals with numbering sequence being used for a particular system.

I. Crimp type connectors:
1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support
2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector Manufacturer.
3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support.
4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support.

J. Cable ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by Manufacturer of ties.

K. Wire lubricating compound:
1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.

2. Shall not be used on wire for isolated type electrical power systems.

L. Bolt termination hardware:
1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE grade 5; or silicon bronze alloy ASTM B-9954 Type B.
2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.
3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, confirming to ANSI B27.2. SAE or narrow series shall not be used.
4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.
5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:
   a. 1/4" bolt - 125 amps
   b. 5/16" bolt - 175 amps
   c. 3/8" bolt - 225 amps
   d. 1/2" bolt - 300 amps
   e. 5/8" bolt - 375 amps
   f. 3/4" bolt - 450 amps

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wire and cable installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

A. All wire, conductor and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient condition.

B. Feeders and branch circuits in wet locations shall be rated 75 degree C.

C. Feeders and branch circuits in dry locations shall be rated 90 degree C.

D. Minimum conductor size:
1. Provide minimum AWG #12 for all power and lighting branch circuits.
2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.

E. Color coding:
1. For 120/208 volt, 3 phase, 4 wire systems:
   a. Phase A - Black
   b. Phase B - Red
   c. Phase C - Blue
   d. Neutral - White
   e. Ground - Green
2. For 277/480 volt, 3 phase, 4 wire systems:
   a. Phase A - Brown
   b. Phase B - Orange
   c. Phase C - Yellow
   d. Neutral - Gray
   e. Ground - Green
3. Switch leg individually installed shall be the same color as the branch circuit to which they are connected, unless otherwise noted.

4. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.03 WIRING METHODS

A. Install wires and cables in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Install all single conductors in raceway system, unless otherwise noted.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.

D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

E. 20 amp power and lighting branch circuit containing no more than four (4) current carrying conductors (phases and neutrals). Use #10 AWG conductor for 120/208 volt circuits located outside a 75 foot radius of panel source and for 277 volt branch circuits located outside a 200 foot radius of panel source, unless otherwise noted.

F. 20 amp power and lighting branch circuits containing no more than eight (8) current carrying conductors (phases and neutrals). Use #10 AWG conductors for 120/208 volt circuits located outside a 65 foot radius of panel source and for 277/480 volt circuits located outside a 150 foot radius of panel source.

G. Provide #10 AWG pig tails on all 20A and 30A wiring devices served by #8 AWG conductors and larger.

H. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes or handholes. Group and bundle with tie wrap each neutral with it's associated phase conductor where more then one neutral is present in a conduit.

I. Install cable supports for all vertical feeders in accordance with the NEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.

J. Neatly form, train and tie the cables in individual circuits. For panelboards, cabinets, wireways, switches and equipment assemblies.

K. Seal cable or wire, entering a building from underground or exiting walk-in cold box or freezer, between the wire or cable and conduit, where it exits the conduit, with a non-hardening approved compound, i.e. duct seal or equal.

L. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.

M. Stranded wire shall be terminated using fitting, lugs or devices listed for the application. However, in no case shall stranded wire be terminated solely by wrapping it around a screw or bolt.

N. Flexible cords and cables supplied, as part of a pre-manufacturer fixture or unit assembly shall be installed according to Manufacturers published installation instructions.

3.04 WIRING INSTALLATION IN RACEWAYS

A. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical Work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

B. Completely mandrel all underground or concrete encased conduits prior to installing conductors.

C. Completely and thoroughly swab raceway system before installing conductors.

D. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors of size smaller than AWG #1.

E. Wire pulling:
1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
2. Use rope made of nonmetallic material for pulling feeders.
3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. Pull in together multiple conductors or cables in a single conduit.

F. Install and test all cables in accordance with Manufacturer's instructions and warranty.

3.05 MC CABLE INSTALLATION

A. The Drawings indicate above suspended ceiling power distribution junction boxes for conversion from hardwire to MC cable wiring system. Install these boxes such that they are accessible from below. MC cable shall be run to each device as described in documents. MC cable runs have not been indicated. Refer to Shop Drawings for installation.

B. Install MC cable in accordance with Manufacturers instructions and in strict accordance with NEC Article 334. Follow Manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over-tightened. Connector shall be firmly attached to the metal boxes.

C. Support cables every 6 feet and within 12 inches of boxes, per NEC Article 334, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Cables shall not be bundled together.

D. Provide separate drop wire above accessible ceiling, to support MC cables. Suspended ceiling drop wire may not be used to directly support MC cables.

E. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.

F. Bend the cable per NEC Article 334.

G. Provide separate sleeves and/or fire barriers where cable penetrated firewalls, unless cable is UL listed for the application.

H. MC Cable may be used for 20A and 30A branch circuiting, under the following conditions.
1. Above accessible ceiling space.
2. In rooms with accessible ceiling space, MC cable may be routed to each individual device in the room. Do not route MC Cable horizontally in the walls from device to device.
3. Do not use MC Cable for branch circuit home-runs.

3.06 WIRE SPLICES, JOINTS AND TERMINATION

A. Join and terminate wire, conductors and cables in accordance with UL 486A, C, NEC and Manufacturer's instructions.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Splices and terminations shall be made mechanically and electrically secure.

E. Where it's determined that unsatisfactory splice or terminations have been installed, remove the devices and install approved devices at no addition cost.

F. Terminate wires in Terminal Cabinets, relay and contactor panels, etc. using terminal strip connectors.

G. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.

H. Install cable ties and maintain harnessing.

I. Encapsulate splices in exterior outlets, pullboxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.

J. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least six (6) inches of tail and neatly packed in box after splice is made up.

K. Branch circuits (#10 AWG and smaller):
   1. Connectors: Solderless, screw-on, reusable spring pressure cable type, 600 volt, 105-degree C. with integral insulation, approved for copper conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped wires.
   3. The number, size and combination of conductors as listed on the Manufacturers packaging shall be strictly complied with.

L. Feeder circuits: (#6 to 750 MCM)
   1. Join or tap conductors from #6 AWG to 750 MCM using bolted pressure connectors or insulate mechanical compression (hi-press) taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.
   2. Terminate conductors from size #6 AWG to 750 MCM copper using bolted pressure or mechanical compression lugs in accordance with Manufacturer recommendation or as specified elsewhere.
   3. Field installed compression connectors for cable sizes 250 MCM and larger shall have not less than two clamping elements or compression indents per wire.
   4. Insulate splices and joints with materials approved for the particular use, location, voltage and temperature. Insulate with not less than that of the conductor level that is being joined.

M. Termination hardware assemblies:
   1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer and nut.
   2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.
   3. The crown of Belleville washers shall be under the nut.
   4. Bolt assemblies shall be torque to Manufacturer recommendation. Where manufacture recommendation are not obtainable, the following values shall be used:

a. 1/4" - 20 bolt at 80-inch pounds torque.
b. 5/16" - 18 bolt at 180-inch pounds torque.
c. 3/8" - 16 bolt at 20-foot pounds torque.
d. 1/2" - 13 bolt at 40-foot pounds torque.
e. 5/8" - 11 bolt at 55-foot pounds torque.
f. 3/4" - 10 bolt at 158-foot pounds torque.

3.07 IDENTIFICATION

A. Refer to Section 260553: Electrical Identification for additional requirements.

B. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.

C. Color code conductors size #8 and larger using specified phase color markers and identification tags.

D. Provide all terminal strips with each individual terminal identified using specified vinyl markers.

E. In manholes, pullboxes and handholes, provide tags of the embossed brass type and also show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.08 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein. Independent Testing Agency shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements.

B. Prefunctional testing:
1. Visual and mechanical inspection:
a. Compare cable data with Contract Documents.
b. Inspect exposed sections of wires and cables for physical damage and proper connections.
c. Verify tightness of accessible bolted connections with calibrated torque wrench in accordance with Manufacturer’s published data.
d. Inspect compression applied connectors for correct cable match and indention.
e. Verify visible cable bend meet or exceed ICEA and Manufacturer’s minimum allowable bending radius.
f. If cables are terminated through window type current transformers, make an inspection to verify neutral and ground conductors are correctly placed for operation of protective devices.
g. Ensure wire and cable identification has been installed as specified herein.
2. Electrical testing:
a. Contractor shall perform feeder and branch circuit insulation test after installation and prior to connection to utilization devices such as fixtures, motors or appliances. Testing shall be as follows:
1) 100% of all feeders 100 amp rated and above.
2) 50% of all feeders smaller than 100 amps.
3) 10% of all branch circuits at each individual panelboard.
b. Perform insulation-resistance test using megohm meter with applied potential of 1000V DC for a continuous duration of 60 seconds. Test conductors phase-to-phase and phase-to-ground. Conductors shall test free from short-circuit and ground faults.

c. Perform continuity test of all feeder and branch circuits to ensure correct cable connections. Test all neutrals for improper grounds.
d. Contractor shall furnish instruments, materials and labor for these tests.

3. Test values: Investigate resistance values less than 50 megohms.
4. Furnish test results in typewritten report form for review and inclusion in the operation and maintenance manuals.

END OF SECTION [26 05 19]

SECTION 260526

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Power system grounding.
   2. Site lighting grounding.
   3. Telecommunication system grounding.
   4. Electrical equipment and raceway grounding and bonding.
   5. Safety ground grid and/or mat.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 05: Building Steel.
   2. Division 22: Cold Water Piping.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Underwriters Laboratories, Inc. (UL):
      UL 467; Grounding and Bonding Equipment.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      IEEE No. 142; Recommended Practice for Grounding of industrial and Commercial Power Systems.
      IEEE No. 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.03 SYSTEM DESCRIPTION

A. Ground the electrical service system neutral at service entrance equipment as described herein and indicated on Drawings.

B. Ground each separately derived system neutral as described herein and indicated on Drawings.

C. Provide telecommunications system grounding conductor as described herein and indicate on Drawings.

D. Provide a safety ground grid and/or mat beneath all electrical switchgear operating at 1000 volts and above, and at emergency generator. Grid/mat shall be poured in the concrete floor slab and constructed as specified herein.

E. Except as otherwise indicated, the complete electrical installation including the neutral conductor, metallic conduits and raceways, cable trays, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically indicated or specified.

F. Resistance:
   1. Resistance from the main switchboard ground bus through the ground electrode to earth shall not exceed 5 OHMS unless otherwise noted.

2. Resistance from the farthest panelboard, switchboard, etc. ground bus through the ground electrode to earth shall not exceed 20 OHMS

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Ground Rods:
a. Weaver.
b. Erico "Cadweld" Products, Inc.
2. Ground Wells:
a. Christy Concrete Products, Inc.
b. Forni Corp.
3. Ground Bushings, Connectors, Jumpers and Bus:
a. O-Z/Gedney.
b. Thomas & Betts Corp.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GROUND CONDUCTORS

A. Refer to Specification Section 260519: Building Wire and Cable for conductor specifications.

B. General purpose insulated:
1. UL approved and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green.
2. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with NEC/CEC.

C. Bare conductors in direct contact with earth or encased in concrete: #2/0 AWG copper minimum, U.O.N.

D. Bonding pigtails: Insulated copper conductor, identified green, sized per code and provide with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.

2.03 DRIVEN (GROUND) RODS

A. Copper clad steel, minimum 3/4-inch diameter by 8 feet long, unless otherwise noted.

2.04 GROUND WELL BOXES FOR GROUND RODS

A. Precast concrete box nominal 9" throat diameter x 14" deep with light duty concrete cover for non-traffic areas or steel plate for traffic areas. Cover shall be embossed or engraved with "GROUND ROD".

2.05 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron or steel body with 150 degree Centigrade molded plastic insulating throat and lay-in grounding lug.

2.06 CONNECTIONS TO PIPE

A. For cable to pipe: UL and NEC/CEC approved bolted connection.

2.07 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPLICES

A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high pressure compression type connectors.
   1. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld or equal. Each particular type of weld shall use a kit unique to that type of weld.
   2. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections.

2.08 EXTRA FLEXIBLE, FLAT BONDING JUMPERS

A. Where required by Code, indicated on the Drawing, and specified herein.

2.09 BUILDING GROUND BUS REQUIREMENTS

A. Main building power system ground bus:
   1. Provide one 24" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in main electrical room utilizing insulating stand-offs at 18" above finished floor.
   2. Furnish complete with cast copper alloy body lugs for connecting grounding system conductors. Attach lugs to bus with appropriate size cadmium bronze bolt, flat washer and Belleville washer. Torque all lug connections.
   3. All holes shall be drilled and tapped for single-hole lugs. Provide 6 spare lugs and lug spaces.

B. Building power system reference ground bus:
   1. The reference ground bus is furnished as part of the main electrical switchboard for the building, along with neutral disconnect and bus, and is in addition to the main building power system ground bus outlined above. The building grounding electrode shall make a direct connection to the building referenced ground bus in the main switchboard.
   2. Provide a #2/0 AWG copper ground conductor connection between the building reference ground bus in switchboard and the main building ground bus wall mounted in main electrical room.

C. Telecommunication system ground bus requirements:

1. Main telecommunication system ground bus: Provide one 18" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in MDF room utilizing insulating stand-offs at 18" above finished floor.
2. Telecommunication system ground bus: Provide one 12" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in the IDF room utilizing insulating stand-offs at 18" above finished floor.
3. Furnish complete with cast copper alloy body lugs for connecting grounding system conductors. Attach lugs to bus with appropriate size cadmium bronze bolt, flat washer and Belleville washer. Torque all lug connections.
4. All holes shall be drilled and tapped for single-hole lugs. Provide 3 spare lugs and lug spaces.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of grounding system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Grounding electrodes:
1. Metal underground water pipe: Cold water metal piping system: Where the underground cold water service line is metal, indirect contact with the earth for 10 feet or more, the Contractor shall install a grounding electrode conductor from the main incoming cold water line ahead of the meter and extend to the main building reference ground bus in the main electrical room. The electrode shall be sized per NEC/CEC Article 250. Electrode connection should be accessible.
2. Concrete encased grounding electrode (UFER ground): Provide a #2/0 AWG minimum bare copper conductor encased along the bottom of concrete foundation or footings which are in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. The electrode shall extend through a horizontal length of 30 feet minimum and shall be encased in not less than 2 or more than 5 inches of concrete separating it from surrounding soils. The electrode shall emerge from the concrete slab through a protective non-metallic sleeve and shall be extended to the main building reference ground bus.
3. Supplementary grounding electrode (ground ring, grid and driven rods): Provide, as indicated on the Drawings, driven ground rod(s) installed in listed ground well box(s) and filled with gravel after connection is made. Interconnect ground rod with structural steel and adjacent rods with minimum #4 AWG bare copper conductor. Ground rod shall not be less than 10 foot from any other electrode of another electrical system or from adjacent ground rod(s).

B. Grounding electrode conductor: Provide grounding electrode conductor as indicated on the Drawings or sized per NEC/CEC Article 250, whichever is greater.

C. Power system grounding:
1. Provide, unless otherwise indicated, a main building power system ground bus mounted on the wall in the main electrical room. Connect the following items using NEC/CEC sized copper grounding conductors to lugs on the main building ground bus:
   a. Grounding conductor from building reference ground bus in main service switchboard.
   b. Bonding conductor to metallic cold water piping system.
   c. Bonding conductor to building structural steel.
   d. Separately derived system grounding conductors in same room.

2. At the building power system reference ground bus in the main service switchboard, connect the grounding electrode conductor from concrete encased UFER ground or other grounding electrode systems as indicated on the Drawing or herein.

D. Separately derived electrical system grounding:
1. Ground each separately derived system per requirements in NEC/CEC Article 250 as a minimum, unless greater requirements are required elsewhere in the Contract Documents.
2. Transformers: Provide a dual rated four or six-barrel grounding lug with a 5/8"-11 threaded hole. Drill enclosure with 11/16" bit and attach lug to enclosure utilizing a torque bolt and a dragon tooth transition washer or equal. Connect the following when present:
   a. Grounding electrode conductor from supplemental ground rods.
   b. Building steel.
   c. Cold water pipe.
   d. Primary feeder ground.
   e. Secondary feeder ground.
   f. Main bond jumper.
   g. Isolated ground conductor.

E. Equipment bonding/grounding:
1. Provide a NEC/CEC sized insulated copper ground conductor in all 120VAC through 600 VAC feeder and branch circuit distribution conduits and cables.
2. Provide a separate grounding bus at panelboards, and switchboards. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35 volts above ground.
3. Conduit terminating in concentric, eccentric or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.
4. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold water piping system.
5. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.
6. Provide external ground wire wrapped around flexible conduit and terminate to connectors designed for the purpose.

F. Site lighting grounding: Bond all metallic light poles and bollards. Provide ground rods where indicated on the Drawings.

G. Telecommunication system grounding:
1. In addition to grounding noted on the Drawings for the power systems, provide a telecommunication system ground riser for interconnecting the MDF and the IDF rooms.
2. Riser shall consist of the following:
   a. Provide a main telecommunication system ground bus wall mounted in the MDF room at the ground floor of building.
   b. Provide telecommunication system ground bus wall mounted in each IDF room and at MPOE room.
   c. From the main telecommunication system ground bus provide one #1/0 THHN in 1-1/4" conduit to the main electrical room and terminate conductor at the main building power system ground bus.
   d. At the IDF room, provide one #1/0 THHN in 1-1/4” conduit from the telecommunication system ground bus to the main telecommunication system ground bus in the MDF room.

3.03 FIELD QUALITY CONTROL

A. Independent Testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein.

B. Prefunctional testing:
   1. Provide Testing Agency with Contract Documents for their review prior to the commencement of ground testing.
   2. Visual and mechanical inspection:
      a. The Testing Agency shall inspect the grounding electrode and connections prior to concrete encasement, burial or concealment.
      b. Check tightness and welds of all ground conductor terminations.
      c. Verify installation complies with the intent of the Contract Documents
   3. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required complying with resistance limits specified under this Section of the Specification.
   4. A typewritten record of measured resistance values shall be submitted for review and included with the operation and maintenance manual furnished to the Owner at the time of Project closeout and before certificate of final payment is issued.

END OF SECTION [26 05 26]

SECTION 260529

ELECTRICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Conduit supports.
   2. Equipment supports.
   3. Fastening hardware.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 09: Ceiling suspension systems. Slack fixture support wires.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Underwriters Laboratories, Inc. (UL):
      UL 2239; Hardware for the Supports of Conduit, Tubing and Cable.

1.03 SYSTEM DESCRIPTION

A. Provide devices specified in this Section and related Sections for support of electrical equipment furnished and installed under Division 26.

B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Concrete fasteners:
   a. Hilti Kwik Bolt TZ
   b. Phillips "Red-Head".
   c. Remington.
   d. Ramset.
   2. Concrete inserts and construction channel:
   a. Unistrut Corp.
   b. GS Metals "Globe Strut."
   c. Thomas & Betts "Kindorf" Corp.
   3. Conduit straps:
   a. O-Z/Gedney.
   b. Erico "Caddy" Fastening Products.
   c. Thomas & Betts "Kindorf" Corp.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CONCRETE FASTENERS

A. Provide expansion-shield type concrete anchors.

B. Provide powder driven concrete fasteners with washers. Obtain approval by Architect and Structural Engineer prior to use.

2.03 CONCRETE INSERTS

A. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

2.04 THREADED ROD

A. Provide steel threaded rod, sized for the load unless otherwise noted on the Drawings or in the Specifications.

2.05 CONSTRUCTION CHANNEL

A. Provide 1-1/2 inch by 1-1/2 inch, 12 gauge galvanized steel channel with 17/32-inch diameter bolt holes and 1-1/2 inch on center in the base of the channel.

2.06 CONDUIT STRAPS

A. One hole strap, steel or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.
   1. Use malleable strap with spacers for exterior and wet locations.
   2. Use steel strap without spacers for interior locations.

B. Steel channel conduit strap for support from construction channel.

C. Steel conduit hanger for pendant support with threaded rod

D. Steel wire conduit support strap for support from independent #12 gauge hanger wires.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of supporting device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Coordinate size, shape and location of concrete pads with Division 03, Cast-in-place concrete.

B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.

C. Where indicated on the Contract Documents, install freestanding electrical equipment on concrete pads.

3.03 INSTALLATION

A. Furnish and install supporting devices as noted throughout Division 26.

B. Electrical device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.

C. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using precast inserts, expansion anchors, preset inserts or beam clamps.

D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.

E. Use expansion anchors or preset inserts in solid masonry walls.

F. Use self-drilling anchors, expansion anchor or preset inserts on concrete surfaces.

G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.

H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit or acoustical ceiling suspension wires.

I. Do not drill structural steel members unless first approved in writing by the Architect or Structural Engineer.

J. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

K. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.

L. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.04 ERECTION OF METAL SUPPORTS

A. Cut, fit and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.05 WOOD SUPPORTS

A. Cut, fit and place wood grounds, nailers, blocking and anchorage accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

3.06 ANCHORAGE

A. All floor mounted, free standing electrical equipment such as transformers, etc. shall be securely fastened to the floor structure.

B. Anchorage of electrical equipment shall comply with the seismic requirements as outlined in Section 260010: Basic Electrical Requirements.

END OF SECTION [26 05 29]

SECTION 260531

CONDUIT

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Rigid steel conduit and fittings.
2. PVC insulated rigid steel conduit and fittings.
3. Intermediate metal conduit and fittings.
4. Electrical metallic tubing and fittings.
5. Flexible metallic conduit and fittings.
6. Liquidtight flexible metallic conduit and fittings.
7. Miscellaneous conduit fittings and products.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
1. Division 07: Sheet metal flashing and trim.
2. Division 09: Painting. Exposed conduit and other devices.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. Federal Specifications (FS):
FS WW-C-563; Electrical Metallic Tubing.
FS WW-C-566; Specification for Flexible Metal Conduit.
FS WW-C-581; Specification for Galvanized Rigid Conduit.
FS W-C-1094A; Conduit and Conduit Fittings Plastic, Rigid.
2. American National Standards Institute, Inc. (ANSI):
ANSI C80.1; Rigid Steel Conduit, Zinc-Coated.
ANSI C80.3; Electrical Metallic Tubing, Zinc Coated.
3. Underwriters Laboratories, Inc. (UL):
UL 1; Flexible Metal Conduit.
UL 6; Rigid Metal Conduit.
UL 360; Liquid-Tight Flexible Steel Conduit.
UL 514B; Conduit, Tubing and Cable Fittings.
UL 635; Insulating Bushings.
UL 797; Electrical Metallic Tubing - Steel.
UL 1242; Intermediate Metal Conduit - Steel.
4. National Electrical Manufacturer Association (NEMA):
NEMA RN1; PVC Externally coated Galvanized Rigid Steel Conduit.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instruction. Provide written instructions for raceway products requiring glues, special tools or specific installation techniques.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Metal conduit:
      a. Allied Tube and Conduit Co.
      b. Triangle PWC, Inc.
      c. Western Tube and Conduit Corp.
      d. Spring City Electrical Manufacturing Co.
      e. Occidental Coating Co. (OCAL).
      f. Alflex Corp.
      g. American Flexible Metal Conduit Co.
      h. Anaconda.
   2. Fittings:
      a. Appleton Electric Co.
      b. OZ/Gedney.
      c. Thomas & Betts Corp.
      d. Spring City Electrical Manufacturing Co.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GALVANIZED RIGID STEEL CONDUIT (GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.

B. Standard threaded couplings, locknuts, bushings and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.

C. Three piece couplings: Electroplated, cast malleable iron.

D. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150 degree C minimum.

E. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.

F. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150 degrees C.

G. All fittings and connectors shall be threaded.

2.03 PVC INSULATED GALVANIZED RIGID STEEL CONDUIT (PVC GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.

B. Fittings: Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Conduit: Hot dip galvanized steel meeting the requirements of NEC Article 345 and conforming to ANSI C80.6 and UL 1242.

B. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.

B. Set screw type couplings: Electroplated, steel or cast malleable iron, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

C. Set screw type connectors: Electroplated steel or cast malleable iron UL listed concrete tight with male hub and insulated plastic throat, 150 degree C temperature rated. Setscrew shall be same as for couplings.

D. Raintight couplings: Electroplate steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.

E. Raintight connectors: Electroplated steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.

2.06 FLEXIBLE METALLIC CONDUIT (FMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1.

B. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for fixture connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

2.07 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.

B. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.08 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

B. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.

C. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

D. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate .75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless steel jacket clamps. Unit shall comply with UL467 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF or equal.

E. Fire rated penetration seals:
1. UL building materials directory classified.
2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.
3. The fire rated sealant material shall be the product best suited for each type of penetration and may be a caulk, putty, composite sheet or wrap/strip.

F. Standard products not herein specified:
1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.
2. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
3. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of conduit system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

A. Galvanized rigid steel conduit (GRS) shall be used in the following applications:
1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks or in hazardous locations in accordance with NEC and local Codes.
2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.

B. PVC insulated galvanized rigid steel conduit shall be used in the following applications:
1. Use 40-mil coating for feeders and branch circuits in damp or wet locations.
2. Use 20 or 40 mil for feeders and branch circuits concealed in concrete walls or slabs in contact with earth.
3. Use 20 or 40-mil for runs beneath floor slabs on grade.

4. Use 40-mil for all below grade penetrations through floor slabs on grade or exterior walls.

C. Intermediate metal conduit (IMC): Shall be used for the same application as galvanized rigid steel conduit as specified herein.

D. Electrical metallic tubing (EMT): Shall be used exposed or concealed for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension distribution system where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces. EMT shall not be installed exposed below 6 feet above the finish floor except within electrical, communication or signal rooms or closets.

E. Flexible metallic conduit (FMC): Shall be used only in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices and to lighting fixtures installed in suspended ceilings, minimum sizes shall be 3/8" for lighting fixtures and control wiring and 1/2" for motor and transformer connections. U.O.N.

F. Liquidtight flexible metallic conduit (LFMC): Shall be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc. Minimum sizes shall be 1/2".

3.03 PREPARATION

A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.

C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.

D. Conduits shall not be placed closer than 12 inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

E. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.

F. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center of concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.

G. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150 feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.

H. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated or specified in the Contract Documents or not.

I. Connect recessed lighting fixtures to conduit runs with maximum six feet of flexible metal conduit.

3.04 INSTALLATION

A. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Minimum Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1/2" for interior applications and 3/4" for exterior and underground applications.

C. All conduit sizes indicated on the Drawings are sized for copper conductors with THHN/THWN insulation. If conductor type or size is changed the Contractor shall be responsible for resizing conduits upward to meet Code.

D. In general, all conduit work shall be concealed where possible. Exceptions shall be electrical, communication and mechanical rooms, exposed ceiling areas, and parking garages.

E. Conduit connections to motors and surface cabinets shall be concealed, with the exception of electrical, communication and mechanical rooms, or unless exposed Work is clearly called for on the Drawings.

F. Install conduits in complete runs before pulling in cables or wires.

G. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.

H. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.

I. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading. Coat all field-threaded joints with UL approved conductive type compound to ensure low resistance ground continuity through conduit and to prevent seizing and corrosion.

J. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.

K. In all empty conduits or ducts, install a “True Tape” conduit measuring tape line to provide overall conduit length for determining length of cables/conductors for future use.

L. Conduit systems shall be mechanically and electrically continuous throughout. Install code size, insulated, copper, green-grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not indicated on the Drawings. Refer to Section 260526: Grounding and Bonding.

M. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).

N. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.

O. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360 degrees, total).

P. Emergency power raceway system: Install entirely independent of other raceway systems, except where specifically allowed by NEC Article 517.

3.05 PENETRATIONS

A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:

1. Where indicated on the Structural Drawings.
2. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size and position of each penetration.

B. Cutting or holes:
1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
2. Provide sleeves or “can outs” for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.
3. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.
4. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.

C. Sealing:
1. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.
2. Fire stop: Where conduits, wireways and other electrical raceways pass through fire rated partitions, walls, smoke partitions or floor; install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.

D. Waterproofing: At floor, exterior wall and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 07: Sealants and Caulking.
1. Install specified watertight conduit entrance seals at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be PVC coated rigid galvanized steel.
2. For roof penetrations furnish and install roof flashing, counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the Specifications.
3. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.
4. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

3.06 CONCEALED IN CONCRETE

A. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the conduits.

B. Installation of conduit in structural concrete that is less than three inches thick is prohibited. Topping slabs, maintenance pads and curbs are exempted.

C. Tie conduits to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.

D. Where nonmetallic conduit or tubing is used, raceways must be converted to PVC coated rigid steel conduit before rising above floor.

E. Make couplings and connections watertight.

F. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

3.07 TERMINATIONS AND JOINTS

A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.

B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.

C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

D. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.

E. Stub-up connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver operated threaded flush plugs with floor.

F. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets or gutters inside the building. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.

G. Raceway seal: Inject into wire filled raceways, a pre-formulated rigid 2 lbs. density polyurethane foam which expands a minimum 35 times it's original bulk. Foam shall have the physical properties of water vapor transmission of 1.2 to 3.0 perms; water absorption less than 2% by volume, fungus and bacterial resistant. Foam shall permanent seal against water, moisture, insects and rodents. Install raceway sealing foam at the following points:
   1. Where conduits pass from warm locations to cold locations to prevent passage of water vapor (such as refrigerated spaces, constant temperature rooms, air-conditioned spaces, etc.).
   2. Where conduits enter buildings from below grade.

H. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:
   1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.
   2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.

I. Use short length (maximum of 6ft) of the appropriate FMC or LFMC conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped

quarters or noise transmission. Provide liquidtight flexible metal conduit for installation in exterior locations, moisture or humidity-laden atmosphere, corrosive atmosphere, water hose or spray wash-down operations and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with FMC or LFMC conduit.

3.08 SUPPORTS

A. Provide supports for raceways as specified in Section 260529: Electrical Hangers and Supports.

B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the NEC.

C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.

D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.

E. Individual 1/2" and 3/4" conduits installed above suspended ceilings may be attached to the ceiling's hanger wire using spring steel support clips provided that not more than two conduits are attached to any single support wire.

F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.

G. Fasteners and supports in solid masonry and concrete:
   1. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
   2. After concrete installation:
      a. Steel expansion anchors not less than ¼ inch bolt size and not less than 1-1/8 inch embedment.
      b. Power set fasteners not less than ¼ inch diameter with depth of penetration not less than three inches.
      c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

H. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.

I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

END OF SECTION [26 05 31]

SECTION 260533

BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Wall and ceiling outlet boxes.
   2. Pull and junction boxes.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. American National Standards Institute/National Electrical Manufacturer Association:
      ANSI/NEMA OS-1; Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
      ANSI/NEMA OS-2; Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
      NEMA 250; Enclosures for Electrical Equipment (1000 volts maximum).
   2. Underwriters Laboratories (UL):
      UL 50; Enclosures for Electrical Equipment.
      UL 514A; Metallic Outlet Boxes.
      UL 1773; Termination Boxes.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Submit Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

a. Outlet boxes:
b. Bowers
c. Hubbel

2. Weatherproof Outlet Boxes and Box Extension Adapters:
   a. Bell
   b. Red Dot
   c. Carlon
3. Floor boxes:
   a. Legrand.
   b. Hubbell Inc.
   c. Steel City
4. Junction and Pullboxes:
   a. Circle AW Products.
   b. Hoffman Engineering Co.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 OUTLET BOXES

A. Standard outlet box:
   1. Provide galvanized, one-piece die formed or drawn steel, knockout type box of size and configuration best suited to the application indicated on the Drawings.
   2. 4-inch square by 1-1/2 inch deep shall be minimum box size.
   3. ANSI/NEMA OS 1.

B. Concrete box:
   1. Provide galvanized steel, 4-inch octagon rings with mounting lugs, backplate and adapter ring as required.
   2. Select height as necessary to position knockouts above concrete reinforcing steel.
   3. ANSI/NEMA OS 1.

C. Tile box:
   1. Provide outlet boxes for installation in tile or concrete block walls.
   2. Standard outlet boxes with raised, square corners and device covers are acceptable.
   3. ANSI/NEMA OS 1.

D. Cast metal outlet body:
   1. Provide four inch round, galvanized cast iron alloy with threaded hubs and mounting lugs as required.
   2. Provide boxes with cast cover plates of the same material as the box and neoprene cover gaskets.

E. Conduit outlet body: Provide Cadmium plated cast iron alloy, oblong conduit outlet bodies with threaded conduit hubs and neoprene gasket, cast iron covers.

2.03 PULL AND JUNCTION BOXES

A. Sheet metal pull and junction box:
   1. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16 gauge galvanized sheet metal, NEMA 1 boxes, sized to Code requirements with covers secured by cadmium plated machine screws located 6 inches on centers.
   2. ANSI/NEMA OS 1.

B. Cast metal pull and junction box: Provide standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets.

C. Flush mounted pullboxes and junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

2.04 FLOOR BOXES

A. Refer to Section 262726: Wiring Devices for floor mounted service boxes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of box installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Install all outlet boxes flush with building walls, ceilings and floors except where boxes are installed in mechanical and electrical rooms, in cabinetry, above accessible ceilings or where exposed Work is called for on the Drawings.

B. Locate pullboxes and junction boxes in concealed locations above removable ceilings or exposed in electrical rooms, utility rooms or storage areas.

C. Install outlet boxes at the locations and elevations indicated on the Drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.

D. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.

E. Locate outlet boxes above hung ceilings having concealed suspension systems, adjacent to openings for removable recessed lighting fixtures.

F. Do not install outlet boxes back-to-back, separate boxes by at least 6". In fire rated walls separate boxes by at least 24" and wall stud.

G. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

3.03 INSTALLATION

A. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Locate electrical boxes as indicated on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.

C. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.

D. Install raised covers (plaster rings) on all outlet boxes in stud walls or in furred, suspended or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.

E. Leave no unused openings in any box. Install close-up plugs as required to seal openings.

F. Provide cast metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.

G. Provide precast concrete boxes in exterior planting areas, walkways, roads etc.

H. Provide an access panel in permanent ceiling or wall where boxes are installed and will be inaccessible.

I. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.

J. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.

K. Use conduit outlet bodies to facilitate pulling of conductors or to make changes in conduit direction only. Do not make splices in conduit outlet bodies.

L. Add additional sheet rock as necessary to maintain original fire rating of walls where boxes are installed.

M. Install galvanized steel coverplates on boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.

3.04 SUPPORTS

A. Provide boxes installed in metal stud walls with brackets designed for attaching directly to the studs or mount boxes on specified box supports.

B. Mount boxes, installed in suspended ceilings of gypsum board or lath and plaster construction, to 16 gauge metal channel bars attached to main ceiling runners.

C. Support boxes independently of conduit system.

D. Support boxes, installed in suspended ceilings supporting acoustical tiles or panels, directly from the structure above wherever pendant mounted lighting fixtures are to be installed from the box.

E. Support boxes, mounted above suspended acoustical tile ceilings, directly from the structure above.

END OF SECTION [26 05 33]

SECTION 260543

UNDERGROUND DUCTS AND STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Underground conduits and ducts.
2. Handhole and pullboxes.
3. Excavation, trenching and backfill.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
1. Division 31 - Earthwork: General requirements for Excavation and Backfill and related items for ducts, manholes, pullboxes and handholes.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. Federal Specifications (FS):
FS W-C-1094A; Conduit and Conduit Fittings Plastic, Rigid.
2. American Concrete Institute (ACI):
ACI 318; Building Code Requirements for Structural Concrete
3. American National Standards Institute, Inc. (ANSI):
ANSI C80.1; Rigid Steel Conduit, Zinc-Coated.
4. American Society for Testing And Materials (ASTM):
ASTM C31; Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39; Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C172; Standard Practice for Sampling Freshly Mixed Concrete
ASTM C192; Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231; Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C478; Specification for Precast Reinforced Concrete Manhole Sections
ASTM C805; Test Method for Rebound Number of Hardened Concrete
ASTM C857; Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C858; Specification for Underground Precast Concrete Utility Structures
ASTM C877; Specification for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections
ASTM C891; Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C990; Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C1037; Practice for Inspection of Underground Precast Concrete Utility Structures
ASTM C1064; Standard Test Method for Temperature of Freshly Mixed Concrete
ASTM C1231; Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinder
ASTM C1611; Standard Test Method for Slump Flow of Self-Consolidating Concrete

5. Underwriters Laboratories, Inc. (UL):
   - UL 6; Rigid Metal Conduit.
   - UL 651; Schedule 40 and 80 Rigid PVC Conduit.
   - UL 651A; Type EB and A Rigid PVC Conduit and HDPE Conduit.
6. National Electrical Manufacturer Association (NEMA):
   - NEMA RN1; PVC Externally-coated Galvanized Rigid Steel Conduit.
   - NEMA TC 2; Electrical Plastic Tubing and Conduit.
   - NEMA TC 3; PVC Fittings for use with Rigid PVC Conduit.
   - NEMA TC6; PVC Plastic Utilities Duct (EB and BD Type).

1.03 DEFINITIONS

A. Duct: Electrical conduit and other raceway, either metallic or nonmetallic, used underground embedded in earth.

B. Duct bank: Two or more conduits or other raceway installed underground in same trench.

C. Handhole: An underground junction box in a duct or duct bank.

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Shop Drawings showing details and design calculations for precast handholes, including reinforced steel. Stamp Drawings with seal of registered professional Structural Engineer.
   4. Submit Manufacturer's installation instructions.
   5. Complete bill of material listing all components.
   6. Certificate for concrete and steel used in underground precast concrete utility structures, according to ASTM C858.
   7. Inspection report for factory inspections, according to ASTM C1037.
   8. Coordination Drawings showing duct profiles and coordination with other utilities and underground structures. Include plans and section drawn to accurate scale.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

C. Precast concrete vaults shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete units similar to that indicated in the project specifications or drawings for at least 10 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Underground precast concrete utility structures:
   a. Oldcastle Enclosure Solutions.
   b. Jensen Precast.
2. Conduits, ducts and fittings:
   a. Prime Conduit.
   b. JM Eagle.
   c. Cantex.
   d. Occidental Coating Company (OCAL).

B. Substitution: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CONDUIT AND DUCT

A. Refer to 260531: Conduit.

B. PVC insulated galvanized rigid steel conduit (PVC GRS):
1. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
2. Fittings: Conduit couplings and connectors shall be steel or malleable iron as required with factory PVC coating and insulated jacket equivalent to that of the coated material.

C. Rigid non-metallic conduit (PVC):
1. Conduit:
   a. Rigid polyvinylchloride, schedule 40 or 80 conforming to NEMA TC2 and UL 651. UL listed for exposed and direct-burial applications and for 90 degrees C conductor insulation. Conduit shall include an integral bell fitting at one end.
   b. Rigid polyvinylchloride, type EB or DB conforming to NEMA TC 6 and UL 651. UL listed for concrete encased burial and direct burial applications and for 90 degree C conductor insulation. Conduit shall include an integral bell fitting at one end.
2. Fittings: Couplings, adaptors, transition fittings, bell ends, etc., shall be molded PVC, slip on and solvent weld type. Schedule 40 or 80 conforming to NEMA TC 3 and type EB or DB conforming to NEMA TC 9.
3. Factory elbows: Minimum radius bends shall be 36 inches.

D. Duct supports: Rigid PVC spacers selected to provide minimum duct spacing and concrete cover depths, while supporting ducts during concrete pour.

E. Duct sealing compound: Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 degree F, withstands temperature of 300 degrees F without slump and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, cable sheaths and jackets, etc.

2.03 PULLBOXES AND HANDHOLES

A. Construction: High densities precast reinforced concrete box, extension, base and cover. Furnish box with end and side knockouts and non-settling shoulders. Cover shall have hold-down bolts and two lifting eyes.

B. Size: As indicated on the Drawings.

C. Cover markings: Covers shall read "ELECTRICAL" or "SIGNAL" as appropriate.

D. Rated covers: Use cast iron lid with H20 traffic rating when subject to vehicular traffic.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of duct and manhole installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 EARTHWORK

A. Excavation and backfill: Conform to Division 31, Earthwork.

B. Excavation for underground electrical structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation or services, other construction and for inspection.
   1. Excavate, by hand, areas within drip-line of large trees. Protect the root system for damage and dry-out. Maintain moist conditions for root system and over exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
   2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

C. Trenching: Excavate trenches for electrical installation as follows:
   1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearances on both sides of raceways and equipment.
   2. Excavate trenches to depth indicated or required.
   3. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
   4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.

D. Backfilling and filling: Place soil materials in layers to required sub-grade elevations for each area classification, using materials and methods specified in Division 31: Earthwork.
   1. Under building slabs, use drainage fill materials.

3.03 CONDUIT AND DUCT INSTALLATION

A. Install duct lines in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Application:
   1. Direct burial ducts: Schedule 40, minimum 24-inches below finished grade.
   2. Below building slab-on-grade: Schedule 40, minimum 4-inches below bottom of slab except that bends and penetrates through floor slab shall be PVC coated galvanized rigid steel.
   3. Penetrations of building and equipment slabs: PVC insulated rigid steel.

C. Slope duct to drain towards handholes and away from building and equipment entrances. Pitch not less than 4-inches per 100-feet. Curved sections in duct lines shall consist of long sweep bends with a minimum radius of 25-feet in the horizontal and vertical directions. The use of manufactured bends is limited to building entrances and equipment stub-ups.

D. Underground conduit stub-ups to inside of building and exterior equipment shall be PVC insulated rigid steel.

E. Make joints in ducts and fittings watertight according to Manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

F. Terminate duct lines at handholes with end bells spaced 10-inches on center for 5-inch ducts and varied proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10-feet from the end bell without reducing duct line slope and without forming trap in the line.

G. Separation between direct buried duct lines shall be 3-inches minimum for like systems and 12 inches minimum between power and signal ducts.

H. For direct burial installations install continuous warning strip of heavy gage plastic imprinted "electrical ducts below", approximately 12-inch wide at 12-inches above ducts.

I. Mandrel all ducts upon completion of installation and prior to pulling cables.

3.04 HANDHOLE AND PULL BOX INSTALLATION

A. Install handholes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Handholes shall be installed flush with finished grade or surface. Install on a level 6-inch bed of well-tamped gravel or crushed stone.

C. Orientation of handholes shall be coordinated in advance with Landscape Architect and arranged to minimize connecting duct bends and deflections.

3.05 FIELD QUALITY CONTROL

A. Testing: Demonstrate capability and compliance with requirements upon completion of installation of underground duct and structures.
   1. Duct integrity: Rod ducts with a mandrel 1/4-inch smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove the obstructions and retest.

3.06 CLEANING

A. Pull brush through full length of ducts. Use round bristle brush with a diameter 1/2-inch greater than internal diameter of duct.

B. Clean internal surfaces of handholes. Remove foreign material.

END OF SECTION [26 05 43]

SECTION 260553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Electrical equipment nameplates.
   2. Panelboard directories.
   3. Wire and cable identification.
   4. Buried electrical line warnings.
   5. Junction box identification.
   6. Inscribed device coverplates.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 09: Painting.

1.02 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein.
   2. Schedules for nameplates to be furnished.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Conduit and wire markers:
      a. Thomas & Betts Corp.
      b. Brady.
      c. Griffolyn.
   2. Inscription Tape:
      a. Kroy.
      b. Merlin.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 NAMEPLATES

A. Type NP: Engraved, plastic laminated labels, Signs and Instruction Plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20 square inches or 8 inches in length; 1/8 inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.

B. Color and letter height as specified in Part 3: Execution.

2.03 LEGEND PLATES

A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.

B. Stamped characters to be paint filled.

2.04 BRASS TAGS

A. Type BT: Metal tags with die-stamped legend, punched for fastener.

B. Dimensions: 2" diameter 19 gauge.

2.05 PANELBOARD DIRECTORIES (400 AMP OR LESS)

A. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.

B. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left hand side and even numbered circuits down the right hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126).

2.06 WIRE AND TERMINAL MARKERS

A. Provide self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips. Blank markers shall be inscribed using the printer or pen recommended by Manufacturer for this purpose.

2.07 CONDUCTOR PHASE MARKERS

A. Colored vinyl plastic electrical tape, 3/4" wide, for identification of phase conductors. Scotch 35 Brand Tape or equal.

2.08 UNDERGROUND CONDUIT MARKER

A. 6-inch wide, yellow polyethylene tape, with continuous black imprinting reading "Caution - Buried Electric Line Below".

2.09 INSCRIBED DEVICE COVERPLATES

A. Coverplate material shall be as specified in Section 262726: Wiring Devices.

B. Methods of inscription: (Unless otherwise noted)
   1. Type-on-tape:
      a. Imprinted or thermal transfer characters onto tape lettering system.
      b. Tape trimmer.
      c. Matte finish spray-on clear coating.
   2. Engraving:
      a. 1/8" high letters.
      b. Paint filled letters finished in black.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 NAMEPLATES

A. Installation:
1. Degrease and clean surfaces to receive nameplates.
2. Install nameplates parallel to equipment lines.
3. Secure nameplates to equipment fronts using machine screws.

B. Provide type 'NP' color coded nameplates that present, as applicable, the following information:
1. Equipment or device designation:
2. Amperage, KVA or horsepower rating, where applicable.
3. Voltage or signal system name.
4. Source of power or control.

C. Nameplates for power system distribution equipment and devices are to be black.

D. Nameplates for signal systems equipment and devices are to be black except as follows:
1. Fire alarm and life safety - Red.

E. Minimum letter height shall be as follows:
1. For Switchboards, panelboards, etc.: ½ inch letters to identify equipment designation. Use ¼ inch letters to identify voltage, phase, wires, etc.
2. For individual circuit breakers, switches and motor starters in Switchboards, Distribution panelboards, use 3/8-inch letters to identify equipment designation. Use 1/8-inch letters to identify all other.
3. For individual mounted circuit breakers, disconnect switches, enclosed switches and motor starters use 3/8-inch letters to identify equipment designation. Use 1/8" letters to identify all other.
4. For transformers use 1/2 inch letters to identify equipment designation. Use ¼ inch letters to identify primary and secondary voltages, etc.
5. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8-inch letters to identify equipment designation.

3.03 LEGEND PLATES

A. Provide panel-mounted operators devices such as pilot lights, reset buttons, “HAND-OFF-AUTO” switches, etc.

3.04 BRASS TAGS

A. Provide type BT tags for individual ground conductors to exposed ground bus indicating connection i.e. "UFER", "Cold water bond", etc.

B. Provide tags for all feeder cables in underground vaults and pull boxes.

C. Provide tags for empty conduits in underground vault, pull boxes and stubs.

3.05 PANELBOARD DIRECTORIES (400 AMP OR LESS)

A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.

B. Verify room numbers or area designation with Project Manager.

C. Mount panelboard directories in a minimum 6" x 8" metal frame under clear plastic cover inside every panelboard.

3.06 WIRE AND CABLE IDENTIFICATION

A. Provide wire markers on each conductor in panelboards, pull boxes, outlet and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment Manufacturer's Shop Drawings for control wiring.

B. Provide colored phase markers for conductors as noted in Section 260519: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

3.07 UNDERGROUND CONDUIT MARKERS

A. During trench backfilling, for exterior underground power, signal and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

3.08 JUNCTION BOX IDENTIFICATION

A. The cover of junction, pull and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

3.09 INSCRIBED DEVICE COVERPLATE

A. General:
   1. Lettering type: Helvetica, 12 point or 1/8" high.
   2. Color of characters shall be black.
   3. Locate the top of the inscription ½” below the top edge of the coverplate.
   4. Inscription shall be centered and square with coverplate.

B. Application:
   1. Provide inscribed coverplates for devices as outlined below:
      a. Outlets in surface raceways.
      b. Network Lighting Control Switches and Dimmers
      c. Special purpose switches, i.e. projection screens, shades, exhaust fans, etc.
   2. Type-on-tape inscriptions shall be provided for the following devices:
      a. Receptacles.
      b. Outlets in surface raceways.
      c. Telecommunication outlets.
   3. Type-on-tape installation:
      a. Tape shall be trimmed to the height of the letters.
      b. Trim tape length to 1/4 inch back from each edge of coverplate.
      c. Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.

END OF SECTION [26 05 53]

SECTION 262716

CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Hinged cover enclosures.
   2. Cabinets.
   3. Terminal blocks and accessories.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. National Electrical Manufacturer's Association (NEMA):
      NEMA 250; Enclosures for Electrical Equipment.
      NEMA ICS 1; Industrial Control and Systems.
      NEMA ICS 4; Terminal Blocks and Industrial use.
      NEMA ICS 6; Enclosures for Industrial Controls and Systems.
   2. Underwriters Laboratories (UL):
      UL 50; Enclosures for Electrical Equipment.
      UL 65; Standards for Wired Cabinets.
      UL 1059; Terminal Blocks.
      UL 1773; Termination Boxes.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe Project construction, material, finish and any specific features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Submit Manufacturer's installation instructions.
   5. Shop Drawings: Indicating wiring diagrams and equipment arrangement within cabinets.
   6. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Hoffman Engineering Co.
   2. Circle AW Products.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CABINETS AND ENCLOSURES

A. Construction: Shall be code gauge galvanized steel with standard concentric knockouts for conduit terminations. Size shall be as indicated on Drawings. Cabinet shall be NEMA 250 Type 1.

B. Finish: Manufacturer's standard gray baked enamel finish.

C. Covers: Continuous hinged steel door, lockable and keyed to match panelboard locks.

D. Mounting:
   1. Flush cabinets shall be furnished with concealed trim clamps and shall be not less than 4 inches deep.
   2. Surface cabinets shall be furnished with screw cover trim, flush hinged door and shall not be less than 6 inches deep.

2.03 BACKBOARDS

A. Furnish cabinet with 3/4-inch fire retardant plywood mounting backboard on interior unless otherwise indicated on Drawings.

2.04 TERMINAL BLOCKS AND ACCESSORIES

A. Terminal blocks: NEMA ICS 4; UL listed.

B. Power terminals: Unit construction type, closed-back with tubular pressure screw connections, rated 600 volts.

C. Signal and control terminals: See terminal strips in Section 260519: Building Wire and Cable.

D. Identification: Identify terminal strips with permanent numbers.

E. Wiring diagram: Provide wiring diagram in protective pocket on inside front cover of cabinet. Diagram shall indicate control wiring, connections and layout of components within enclosure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of cabinets and enclosures installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Set cabinets and enclosures plumb and symmetrical with building lines. Furnish and install all construction channel bolts, angles, etc. required to mount all equipment furnished under this Section of the Specifications.

B. Cabinets and enclosures shall be anchored and braced to withstand seismic forces calculated in accordance with that referenced in Section 260010: Basic Electrical Requirement.

C. "Train" interior wiring, bundle and clamp using specified plastic wire wraps.

D. Replace doors or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.

E. Terminate conduit in cabinet with lock nut and grounding bushing.

F. Terminate wiring on terminal blocks and identify each with heat shrink tags.

3.03 CLEANING

A. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

B. Vacuum clean cabinet on completion of installation.

END OF SECTION [26 27 16]

SECTION 262816

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Fuses.
   2. Molded case circuit breakers.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Federal Specification (FS):
      FS W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service.
   2. Underwriters Laboratories, Inc. (UL):
      UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
   3. National Electrical Manufacturer Association (NEMA):
      NEMA AB 1; Molded Case Circuit Breakers.
   4. Pacific Gas & Electric (PG&E) – Section G2 – Protection and Control Requirements for Generation Entities - Power Generation Interconnection Handbook:
      Paragraph G2.14; Emergency Generator Requirements
      Table G2-5; Section G2 – Protection and Control Requirements for Generation Entities document.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe product operation, equipment and dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.
   5. Provide current let-through and melting time information for each type and rating of fuses.
   6. Submit Manufacturer's installation instructions.
   7. Complete bill of material listing all components.
   8. Warranty.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
   1. A detailed explanation of the operation of the system.

2. Instructions for routine maintenance.
3. Parts list and part numbers.
4. Telephone numbers for authorized parts and service distributors.
5. Final testing reports.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Overcurrent Protective Device components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Fuses:
   a. Bussmann Division, Cooper Industries.
   b. Gould Shawmut Co.
2. Circuit breakers:
   a. General Electric.
   b. Square D.
   c. Eaton Electrical/Cutler-Hammer.
   d. Siemens/I-T-E.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 FUSES

A. General: All power fuses shall be time-delay, high interrupting (300 K AIC), current limiting type, unless otherwise noted on the Drawings. All fuses shall be the product of a single Manufacturer and shall be selectively coordinated when applied in 2:1 ratios. Types of fuses shall be as follows:

1. Motor branch circuit fuses (0-600 amperes): UL Class J dual element, time delay type fuse. Motor branch circuit fuses shall be sized for Type 2 coordination for the motor controller and back-up motor overload protection and shall be coordinated with motor starter overload relay heaters. See Section 262900: Motor Controls.

B. Control and instrument fuses shall be suitable for installing in blocks or fuseholders. Exact type and rating shall be as recommended by the Manufacturer of the equipment being protected.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Branch and feeder circuit breakers shall be molded case, bolt on and trip indicating.

B. Where stationary molded case circuit breakers are indicated on the Drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.

C. Circuit breakers shall have interrupting capacity not less than that indicated on the Drawings or if not indicated, not less than 14,000 RMS symmetrical amps for 480 volt systems and 10,000 RMS symmetrical amps for 208 volt systems.

D. Covers shall be sealed on non-interchangeable breakers and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.

E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.

F. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided inside the breaker to prevent any phase-to-phase flashover. Each pole of the breaker shall have means for Arc extinguishing.

G. All terminals shall be rated for aluminum or copper wire.

H. Circuit breakers with trip ratings 100 amp and smaller shall be ambient temperature compensated, thermal magnetic type unless otherwise noted. Breakers shall be of full size, 1" per pole type. Panels with more than one branch breaker larger than 100 amps shall be installed in distribution type panels.

I. Circuit breakers with trip ratings 101 amps through 400 amps shall have solid state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, adjustable instantaneous and short time be rated as indicated on Drawings at the voltage indicated.

J. Circuit breakers with trip ratings 401 amps through 1200 amps shall have electronic trips with the following characteristics:
1. Electronic true RMS sensing trip, adjustable via current plug.
2. Adjustable long time setting and delay.
3. Adjustable short time pick-up and delay.
4. Adjustable instantaneous pick-up.
5. Mechanical targets on overload, ground fault and short circuit.

K. Accessories: Provide accessories as noted on the Drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.

L. Spaces in the boards shall be able to accept any combination of 1, 2 or 3 pole circuit breakers as indicated. Provide all necessary bus, device supports and mounting hardware sized for frame, not trip rating.

M. Series rated breakers are not acceptable unless specifically noted on the Drawings.

N. Refer to the Drawings for breakers requiring ground fault protection. See Section 262413: Switchboards for requirements of ground fault protection system.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of overcurrent protective device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Install overcurrent protective devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.

C. Install overcurrent protective devices and accessories in accordance with Manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable NEC and NEMA standards for installation.

D. Circuit breakers serving "Fire Alarm Control Panel(s)" shall be red in color.

3.03 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
   1. Assure overcurrent protective device installation conforms to specified requirements and operates within specified tolerances.
   2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
   3. Prepare final test report including results, observations, failures, adjustments and remedies.
   4. Verify ratings and settings and make final adjustments.

B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.

D. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.

E. Prefunctional testing:
   1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
   2. Visual and mechanical inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
      c. Compare nameplate information and connections to Contract Documents.
      d. Check tightness of all control and power connections.
      e. Check that all covers, barriers and doors are secure.
   3. Electrical tests:
      a. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
      b. Determine that circuit breaker will trip under overcurrent condition, with tripping time in conformance with NEMA AB 1 requirements.
      c. Test all circuit breakers with frame size 225 amps and larger and 10 percent of all circuit breakers with frame sizes less than 225 amps in each panelboard, distribution board, switchboard, etc. unless otherwise noted.

F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 ADJUSTING

A. Adjust circuit breaker trip settings based on recommendations of Section 260060: Power System Study.

B. Adjust circuit breaker trip settings for coordination with other overcurrent protective devices in system.

C. Adjust circuit breaker trip settings for adequate protection from overcurrent and fault currents.

3.05 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean overcurrent protective devices per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt and debris.

3.06 TRAINING

A. Factory authorized service representative shall conduct a 4 hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment with both classroom training and hands-on instruction.

B. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION [26 28 16]

SECTION 266113

FIRE ALARM/LIFE SAFETY SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Fire alarm control panel(s) 'FACP'
2. Fire alarm annunciators
3. Fire alarm terminal cabinets 'FATC'
4. Initiating devices
5. Notification appliances
6. Auxiliary equipment control and supervision
7. Voice communication system
8. Fireman's phone system
9. Smoke control system
10. Record Drawings
11. Pretesting and final testing

B. Work furnish and installed under another Section, but connected under this Section:
1. Fire sprinkler alarm system flow switches, valve monitors and post indicating valves

C. Work furnished and connected to alarm system under this Section, but installed and connected to HVAC system under another Section:
1. Duct mounted smoke detectors at supply air HVAC equipment 2000 cfm and larger.

D. Work furnished and installed under another Section: HVAC shutdown wiring via dry contacts in remote mounted programmable relays.

E. Related work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. American National Standards Institute, Inc. (ANSI):
ANSI C62.41; Guide for Surge Voltage in Low-Voltage AC Power Circuits
ANSI/ASME A17.1; Safety Code for Elevators and Escalators
2. National Fire Protection Association (NFPA):
NFPA 13; Standards for the Installation of Fire Sprinkler Systems
NFPA 72; National Fire Alarm Code
NFPA 90A; Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 101; Life Safety Code
3. Underwriters Laboratories, Inc. (UL):
UL 38; Manually Activated Signaling Boxes
UL 268; Smoke Detectors for Fire Protective Signaling Systems
UL 268A; Smoke Detectors for Duct Applications
UL 464; Audible Signal Appliances
UL 497B; Protectors for Data Communications and Fire Alarm Circuits
UL 521; Heat Detectors for Fire Protective Signaling Systems
UL 864; Control Units for Fire-Protective Signaling Systems
UL 1424; Cables for Power-Limited Fire-Alarm Circuits

UL 1480; Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
UL 1481; Power Supplies for Fire-Protective Signaling Systems
UL 1638 Visual Signaling Appliances Standard
UL 1971 Signal Devices for the Hearing Impaired

4. Factory Mutual System (FM):
FM P7825 Approval Guide

1.03 DEFINITIONS

A. Addressable device: A fire alarm system initiating, control or monitoring device module component on a signaling line circuit (SLC) with discrete digital identification that can have its status individually identified or that is used to individually control other functions, using site-specific programming at the fire alarm control panel.

B. Alarm signal: A signal indicating an emergency that requires immediate action, such as a signal indicative of fire.

C. Annunciator: A unit containing one or more indicator lamps, alphanumeric displays or other equivalent means in which each indication provides status information about a circuit, condition or location.

D. Circuits and pathways:
1. Class B: Performance that does not include a redundant pathway and will not be capable of operation past a single open or ground fault condition, but does include monitoring and annunciation of a trouble signal when either condition occurs. Any conditions that affect the intended operation of the path are annunciated as a trouble signal.

E. Initiating device: A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box or supervisory switch.

F. Initiating device circuit: A circuit to which automatic or manual initiating devices are connected where the signal received does not identify the individual device operated.

G. Notification appliances: A fire alarm system component such as a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs or any combination thereof.

H. Notification appliance circuit: A circuit or path directly connected to a notification appliance(s).

I. Signaling line circuit: A circuit or path between any combination of circuit interfaces, control units or transmitters over which multiple system input signals or output signals or both, are carried.

J. Supervisory signal: A signal indicating the need for action in connection with the supervision of guard tours, the fire suppression systems or equipment or the maintenance features of related systems.

K. Trouble signal: A signal initiated by the fire alarm system or device indicative of a fault in a monitoring circuit or component.

1.04 SYSTEM DESCRIPTION

A. The fire alarm system shall be a microprocessor-based direct wired, multi-priority, peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this Specification. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer.

B. It shall be 24Vdc closed circuit, electronically supervised, common signaling, device indicating, and automatic alarm type. The system shall include all wiring, raceways, pullboxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm and supervisory signal initiating devices, alarm notification appliances and all other accessories required for a complete operating system.

C. Provide system with the following circuit and pathway performance:
1. Initiating devices circuits (IDCs): Class B
2. Signaling line circuits (SLCs): Class B
3. Notification appliance circuits (NACs): Class B
4. Additionally, all notification and communication circuits for partial evacuation systems (EVACS) shall comply with the survivability requirements of NFPA 72, Chapter 12, Level 2 and Level 3.

D. Standby power: The standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for twenty four (24) hours and capable of operating the system for fifteen (15) minutes of evacuation alarm on all devices, operating at maximum load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

E. Voltage drop:
1. Under all operating conditions, the voltage on the NAC must be sufficient to operate all the notification appliances so that they deliver the proper signal intensity. The worst case operating condition shall be calculated from when the control unit primary power supply has failed and the battery capacity is at its lowest point. An end of useful battery life starting value of 20.4 Volts shall be used at the starting voltage unless the manufacturer's instructions indicate that a higher or lower value should be used. The current draw of an appliance at the minimum listed operating voltage (16 Volts) should be used.
2. The point-to-point Ohm's Law voltage drop calculations of all alarm system circuits shall not exceed

F. Spare capacity: The system shall be engineered to accommodate 20% spare capacity on each individual loop, and 20% spare on system power supplies.

G. Auxiliary equipment requiring control and monitoring:
1. Flow switches, tamper switches and PIV monitoring
2. Elevator recall and monitoring
3. Interface and provide fan shutdown control for all supply fans over 2000cfm
4. Interface and provide fire/smoke damper (FSD) control and monitoring
5. Door hold/open release device power and control

1.05 SEQUENCE OF OPERATION

A. For system description of output controls and monitoring, based on input signals, refer to Sequence of Operation Matrix on the Drawings.

B. General alarm operation: Upon alarm activation of any area smoke detector, duct smoke detector, heat detector, manual pull station, sprinkler waterflow, etc., the following functions shall automatically occur:
1. The internal audible device shall sound at the control panel and annunciator.
2. The LCD Display shall indicate all applicable information associated with the alarm condition including zone, device type, device location and time/date.
3. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.
4. The following notification signals and actions shall occur simultaneously:
   a. Speakers shall sound throughout the building.
   b. Activate visual strobes throughout the building.
5. Transmit signal to the central station with point identification.
6. Activate automatic smoke control sequences.

7. All self-closing fire/smoke doors held open shall be released.
8. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

C. Elevator lobby/equipment room detectors: Upon alarm activation of any elevator lobby smoke detector or equipment/control room detectors, the following functions shall automatically occur:
1. Perform general alarm sequence above.
2. Activation of elevator lobby smoke detectors (other than primary floor) shall recall the elevators to primary floor.
3. Activation of elevator lobby smoke detectors located on the primary recall floor shall recall the elevator the alternate floor.
4. Activation of equipment/control room smoke detectors shall recall the elevator to the primary floor.
5. Activation of the equipment room heat detector shall initiate the shunt-trip of service power to the associated elevator equipment.

D. Supervisory operation: Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, etc., the following functions shall automatically occur:
1. The internal audible device shall sound at the control panel and annunciator.
2. The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.
3. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
4. Transmit signal to the central station with point identification.

E. Trouble operation: Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:
1. The internal audible device shall sound at the control panel and annunciator.
2. The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.
3. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
4. Transmit signal to the central station with point identification.

F. Monitor activation: Upon activation of any device connected to a monitor circuit (fire pump, emergency generator status, etc.), the following functions shall automatically occur:
1. The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.
2. Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

G. In addition to the above sequence of operation, the FACP shall perform the following functions:
1. Identify every addressable device by location, priority and device type.
2. Read and display at FACP the sensitivity of addressable smoke and heat detection devices.
3. Remain 100% operational and capable of responding to an alarm condition while in the routine maintenance mode.
4. Be capable of supporting non-addressable as well as addressable devices.
5. Allow individual programmable control of each connected remote or panel-mounted relay.
6. Provide the user with the field programmability to add or change addressable device types and custom messages on-site .
7. Display up to 127 alarms and/or up to 127 trouble indications, one at a time, as a list on the system printer/terminal.
8. Change the status of configured circuits (arming or disarming) and change status of relays.
9. Generate an addressable detector sensitivity report providing a chamber voltage listing (device testing) for each detector.

1.06 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe system operation, equipment and dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Shop Drawings. A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:
      a. All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, address, date including revisions, and preparer's and reviewer's initials.
      b. Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.
      c. A riser diagram that individually depicts all control panels, annunciators, addressable devices and notification appliances. Field addressable devices and notification appliances may be grouped together by specific type per loop or circuit.
      d. Complete 1/8" = 1'-0 scale floor plan drawing locating all system devices and elevation of all equipment. Floor plans shall indicate accurate locations for all control and peripheral devices as well as raceway size and routing, junction boxes, and conductor size, and quantity in each raceway. All notification appliances shall be provided with a candela rating and circuit address that corresponds to that depicted on the Riser Diagram. If individual floors need to be segmented to accommodate the 1/8” scale requirements, KEY PLANS and BREAK-LINES shall be provided on the plans in an orderly and professional manner. End-of-line resistors (and values) shall be depicted.
      e. Control panel wiring and interconnection schematics. The drawing(s) shall depict internal component placement and all internal and field termination points. Drawing shall provide a detail indicating where conduit penetrations shall be made, so as to avoid conflicts with internally mounted batteries. For each additional data-gathering panel, a separate control panel drawing shall be provided, which clearly indicated the designation, service and location of the control enclosure.
      f. Complete calculations shall clearly indicate the quantity of devices, the device part numbers, the supervisory current draw, the alarm current draw, totals for all categories, and the calculated battery requirements. Battery calculations shall also reflect all control panel component, remote annunciator, and auxiliary relay current draws.
      g. System (Load & Battery) calculations shall be provided for each system power supply, each notification appliance circuit and each auxiliary control circuit that draws power from any system power supply.
      h. Additionally, Drawings shall include:
         1) Symbols legend.
         2) Equipment list showing quantity, make, model and CSFM listing number for each device.
         3) Wire and cable schedule.
         4) Scope of Work with overall system description.
         5) Sequence of operation matrix with system inputs signals and output functions.
         6) Code summary and Building type.
         7) Assignment of Class and/or Style designation for device circuits.
         8) Elevation indicating mounting heights for manual pull stations, audible and visual devices and combination audible/visual devices.

9) Rated penetration details.
10) Typical wiring diagram details of field devices.
11) Detector mounting details at HVAC ducts.
12) Voltage drop calculations for system wiring circuits.

5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
6. Submit Manufacturer's installation instructions.
7. Complete bill of materials listing all components.
8. Installer's NICET 3 Certification
9. Letter or Certificate from the fire alarm manufacturer stating that the fire alarm contractor is an authorized Strategic Partner of the specified product.
10. Warranty.

B. Contractor shall submit approved Shop Drawings for review by State Local Fire Marshal prior to the purchase and installation of equipment. Provide quantities of Drawing sets as required by jurisdiction. Drawings shall be wet stamped and signed by a registered professional Engineer.

C. Record Drawings:
1. Furnish Record Drawings as described in Section 260010: Basic Electrical Requirements, utilizing Shop-Drawing submissions with updated field conditions. These Drawings shall include but not be limited to the following:
a. Plot plans and building floor plans, showing point-to-point wiring location of and conduit routing to all devices.
b. Block Diagram/Riser Diagram showing the FACP, system components and all conduit and wire type/sizes between each.
2. Drawings shall be incorporated into the Record Drawing submission.
3. Final acceptance will not be made until the Engineer has approved the Record Drawings.

1.07 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and part numbers.
4. Schematic Drawings of wiring system, including all initiation and annunciation devices, control panel, annunciators, etc.
5. Telephone numbers for the authorized parts and service distributors.
6. Final testing reports.

1.08 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

C. All work in this Section shall be performed (furnished, installed, connected, programmed and tested) by a qualified fire alarm contractor. The fire alarm contractor shall provide the following documentation to show compliance with the contractor qualifications.
1. Contractor’s License: A copy of the contractor’s valid State License. The contractor must be licensed in the State where project is located and have been in business in that State for a minimum of 5 years.
2. Proof of Experience: Proof that the fire alarm contractor has successfully installed similar fire alarm systems on a previous project of comparable size and complexity. Provide a statement summarizing any pending litigation involving an officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates

to this work in the worst case scenario. Non-disclosure of this item, if later discovered, may result, at the Owner's discretion, in termination of this contract with the contractor bearing all associated costs.

3. Insurance Certificates: Copy of fire alarm contractor's current liability insurance and state industrial insurance certificates in conformance with the contract document.
4. Service Capability: The fire alarm contractor shall have in-house Engineering, installation and service personnel with a maintenance office within 50 miles of the project location
5. Authorization Letters: Letters from the fire alarm equipment manufacturer stating that the fire alarm contractor is a Factory Authorized Distributor and is trained and certified for the equipment proposed on this project and is licensed to purchase and install the software required to provide the specified functions.
6. Certifications:
   a. Provide a copy of the National Institute for Certification in Technologies (NICET) Technician Level 3 Certificate for the employee actively involved in this project.
   b. Documentation that the fire alarm contractor has on staff personnel factory-trained and certified for the equipment proposed for this project.

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Fire alarm system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.10 WARRANTY

A. Units and components offered under this Section shall be covered by a ***1*** year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

B. The warranty package shall include, but not be limited to the following:
   1. Emergency maintenance service.
   2. Service by factory trained service representative of system Manufacturer.
   3. Replacement of any defective components.

1.11 SYSTEM START-UP

A. Upon completion of installation, a factory trained dealer service representative shall perform initial start-up of the fire alarm system. Sufficient time shall be allowed to properly check the system out and perform required minor adjustments before the Engineer's witnessed test shall begin.

1.12 MAINTENANCE

A. Extra Material:
   1. Provide the following fire alarm system components as extra materials, matching the products installed and packaged for storing.
      a. Manual pull station: Furnish a quantity equal to 10 percent of the number installed.
      b. Detectors: Furnish a quantity equal to 10 percent, for each type of the number installed.

c. Speaker/strobes, strobe's: Furnish a quantity equal to 10 percent of the number installed.
d. Speakers: Furnish a quantity equal to 10 percent of the number installed.

B. Maintenance Service:
1. For a period of one year following acceptance the equipment Supplier shall have a person(s) familiar with this Project attend four quarterly meetings with the Owner's Representative to review system performance, operation and any system problems. That person shall provide a written summary of the items discussed in each meeting and a schedule of when the system problems will be corrected. The report is due within 7 working days after each meeting.
2. During the eleventh month following system acceptance, on a weekend day, the equipment Supplier shall perform a complete test of the system, in a manner similar to the acceptance test. A written report shall be submitted to the Owner certifying that each initiating device has been tested. A copy of these test forms shall be submitted to the Engineer for review and acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Silent Knight

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CONTROL PANEL 'FACP'

A. General:
1. The control panel shall comply with applicable requirements of UL864 and shall provide power, annunciation, supervision and control for the complete fire alarm system. The panel shall be installed in a mounted steel cabinet, containing all modules necessary to operate as indicated herein. The operating controls shall be located behind hinged, locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified.
2. The panel shall be supervised, site programmable, and of modular design supporting up to 64 network nodes. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, and annunciation nodes. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes. When utilizing a network and multiple wiring faults occur, the network shall re-configure into many sub-networks and continue to respond to alarm events from every panel that can transmit and receive network messages.
3. The panel module shall control and monitor all local or remote peripherals. It shall support a large 168 character LCD, power supply, remote LCD and zone display annunciators, etc.
4. The programmer shall be able to download all network applications from the configuration computer to all the network panels from a single location on the system.
5. The panels shall have the ability to add an operator interface control/display at each node that shall annunciate, command and control system functions.
6. The system shall store all basic system functionality and job specific data in non-volatile memory. All site specific and operating data shall survive a complete power failure intact.
7. The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.

8. All addressable devices shall be individually identified by the system and any quantity of addressable devices may be in alarm at any time up to the total number connected to the system.
9. Dynamic supervision of system electronics, wiring, initiating devices and software shall be provided by the control system. Failure of system hardware or wiring shall be indicated by type and location on the alphanumeric annunciator. Software and processor operation shall be monitored by an independent hardware watchdog, which will indicate their failure. The panel shall provide failsafe operation, i.e. all incoming alarms shall override all other modes of operation.
10. Provide a service mode to permit the arming and disarming of individual initiating or output devices as well as manually operating output devices. Status of these devices shall be displayed upon command from the control panel. The panel shall automatically return to the normal mode in the event the panel remains unattended in the service mode.
11. The panel shall be capable of measuring and adjusting the sensitivity of addressable detectors upon request. An alphanumeric display shall be provided to display custom messages and give readings of detector sensitivity detector by detector. Each device on an addressable initiating circuit shall be checked continuously to include the following:
    a. Sensitivity.
    b. Response.
    c. Opens.
    d. Shorts.
    e. Ground faults.
    f. Functionality.
    g. Status.
12. The panel shall monitor the addressable smoke detectors in such a manner that if the detectors become dirty and reach and maintain 80% of alarm threshold for five (5) consecutive hours, a trouble condition indicating exactly which device needs service shall be automatically annunciated. If the device becomes too insensitive for a period of 10 seconds, the trouble indication will read: "Input device response too low".
13. The panel shall report, by specific device number, any device removed from an addressable initiating circuit and all other devices shall continue to function.
14. The panel shall automatically indicate the total quantity of alarms and troubles, which have occurred prior to reset at the control unit.
15. No alarm or trouble indication shall be resettable until it has been acknowledged. It shall not be possible to reset the system until all alarms have been acknowledged.
16. The panel shall be capable of:
    a. Counting the number of addressable devices within a designated area or "zone" which are in alarm.
    b. Counting "zones" which are in alarm.
    c. Counting the number of addressable devices, which are in alarm on the system.
    d. Differentiating among types of addressable devices such as smoke detectors, manual stations, waterflow switches, heat detectors, etc.
    e. Assigning priorities to types of devices, zones or groups of devices.
    f. Cross-Zoning.
17. Each addressable device shall report its condition to the panel control unit every three (3) seconds in a manner such that failure of the connections to or internal electronics of the device will result in a trouble signal that identifies the specific device involved.

B. Signaling line circuits (SLC):
1. The control panel shall be supervised, site programmable, and of modular design supporting up to 125 detectors and 125 remote modules per addressable SLC. The panel shall support up to 10 SLC's per panel for a total system capacity of 2500 intelligent addressable points. The system shall be designed with peer-to-peer networking capability for enhanced survivability, with support for up to 64 nodes, each with up to 2500 points and an overall capacity of 160,000 points.
2. The system shall provide electronic addressing of analog/addressable devices.

3. The system shall have built-in automatic system programming to automatically address and map all system devices attached to the main controller.
4. The system shall use full digital communications to supervise all addressable loop devices for placement, correct location, and operation. It shall allow swapping of “same type” devices without the need of addressing and impose the “location” parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.
5. The system shall have a UL Listed detector sensitivity test feature, which will be a function of the smoke detectors and performed automatically every 4 hours.

C. Integrated Fireman's Phone System
1. The two-way voice communications control unit shall provide two-way communications between remotely located phones and the command center.
2. The control unit shall provide the ability to individually select and display each two-way voice communication circuit support up to five (5) remote telephones in simultaneous two-way voice communications.
3. The Fire Fighters’ Telephone System shall include an 8-line LCD to show the operator the identity and location of up to 20 waiting calls.
4. The LCD will display call-in information in full language, without the need for individual LEDs and switches per telephone station.

D. Digital alarm communicator transmitter (DACT):
1. The system shall provide DACT for off premise communications capability, transmitting system events to single or multiple Central Monitoring Station (CMS) receivers.
2. The system shall capable of providing the CMS with point identification of system events using Contact ID or SIA DCS protocols.
3. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

E. Internal Modular Power Supply:
1. System power supply(s) shall provide multiple power limited 24 VDC output circuits as required by the panel.
2. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions.
3. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.
4. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciate as battery trouble and identify the specific power supply affected.
5. All system power supplies shall be capable of recharging up to 260AH batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.
6. Power supply shall be adequate to supply all system components of the fire alarm system, including FACP modules, initiating devices, notification appliances, remote control and monitoring devices, annunciators, etc. All power connections whether AC or DC shall be separately fused within panel.

F. Storage batteries: Shall be provided and shall be the sealed, lead-calciumlead-acidnickel-cadmium types. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 24 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm annunciating devices in the total alarm mode for a period of 15 minutes. Batteries shall be sized to deliver 50 percent more ampere/hours than required for the calculated capacities. Battery cabinet shall be a separate compartment within the control panelcabinet**.**

G. Battery charger: Shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 8 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state

of the battery charge. Pilot light shall indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel battery cabinet.

H. Reports:
1. The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD and shall be capable of being printed on any system printer.
2. The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any particular detector.
3. The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.
4. The system shall provide a report to determine the carbon monoxide detectors end-of-life.
5. The system shall provide a report that gives a chronological listing of up to the last 1740 system events.
6. The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.

2.03 ANNUNCIATORS

A. Main control and annunciator panel:
1. Main annunciator shall be located with the FACP.
2. The main display shall be a large 168 character LCD with normal, alarm, trouble, supervisory, disabled point and ground fault indicators.
3. The main display shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never inter-mixed to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.
4. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.
5. The internal audible signal shall have different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.
6. The annunciator shall contain the following controls:
   a. System reset switch with indicator
   b. System alarm silence switch with indicator
   c. System panel silence switch with indicator
   d. Programmable switch with indicator
   e. Details switch
   f. System message queue scroll switches.
   g. 10-Digit keypad to enable/disable system and functions.
7. An authorized operator shall have the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
8. An authorized operator shall be capable of performing test functions within the installed system.

B. Fireman’s remote annunciator panel (FRAP):
1. Remote LCD network alphanumeric annunciators shall display each and every point in the system.
2. Network alphanumeric annunciators shall be located as indicated on the plans. This annunciator shall be an integral part of the peer to peer network for survivability.

3. Annunciator shall contain a supervised, back-lit, liquid crystal display with a minimum of 8 lines and 21 characters per line. The annunciator shall support full ability to serve as the operating interface to the system and shall include the following features;
   a. Matched appearance with other system displays
   b. LCD display shall be configurable to show the status of any or all of the following functions anywhere in the system:
      1) Alarm
      2) Supervisory
      3) Trouble
      4) Monitor
4. Annunciator must be capable of supporting custom messages as well as system event annunciation. It must be possible to filter unwanted annunciation of trouble, alarm or supervisory functions on a by point or by geographic area. The annunciators shall be mounted in stand-alone enclosures at location as indicated on the plans.

2.04 INTELLIGENT ADDRESSABLE DETECTORS

A. General:
1. Each detector device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Devices shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.
2. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location. Setting a device's address by physical means shall not be necessary.
3. The intelligent detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.
4. Each detector shall be capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller. Maximum total analog loop response time for detectors changing state shall be 0.75 seconds. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data.
5. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging and humidity.
6. Each detector shall have a separate means of displaying communication and alarm status. A green/red LED shall flash to confirm communication with the analog loop controller and display alarm status.
7. The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.
8. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings.
9. Each device microprocessor shall contain an environmental compensation algorithm, which identifies and sets ambient "Environmental Thresholds" approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall

employ digital compensation to adapt the detector to both 24 hour long-term and 4 hour short-term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the "learned" base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

B. Photoelectric smoke detector:
   1. Provide intelligent analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings.
   2. Each unit shall have a field-replaceable smoke chamber.
   3. The photo detector shall be rated for ceiling installation at a minimum of 30 ft centers and be suitable for wall mount applications.
   4. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft high and 3 ft wide with air velocities up to 5,000 ft/minimum.
   5. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photoelectric detector shall be suitable for operation in the following environment:
      a. Temperature: 32°F to 120°F (0°C to 49°C)
      b. Humidity: 0-93% RH, non-condensing
      c. Installation attitude: no limit

C. Fixed temperature/rate-of-rise heat detector:
   1. Provide intelligent combination fixed temperature/rate-of-rise heat detectors with low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.
   2. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data.
   3. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute.
   4. The heat detector shall be rated for ceiling installation at a minimum of 50 ft centers and be suitable for wall mount applications.

D. Multi-sensor photoelectric/heat detector:
   1. Provide intelligent combination photoelectric smoke and heat detectors with analog photoelectric detector that utilizes a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air to process an alarm.
   2. Each unit shall have a field-replaceable smoke chamber
   3. Each unit shall provide split sensor programming such that the combination device shall only require one software address, while still providing two distinct inputs. This capability will allow for separate actions to be initiated independently from the two separate elements (smoke & heat) without requiring a separate software address on the loop.
   4. The multi-sensor shall be rated for ceiling installation at a minimum of 30 ft centers and be suitable for wall mount applications.
   5. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute.
   6. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photoelectric detector shall be suitable for operation in the following environment:
      a. Temperature: 32°F to 120°F (0°C to 49°C)
      b. Humidity: 0-93% RH, non-condensing
      c. Installation Attitude: no limit

E. Photoelectric smoke/carbon monoxide detector:

1. Provide intelligent photoelectric smoke and carbon monoxide detectors with analog photoelectric detector that utilizes a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral electrochemical carbon monoxide cell shall be provided.
2. Each unit shall have a field-replaceable smoke chamber
3. Each unit shall be provided with a field-replaceable carbon monoxide sensor module.
4. The carbon monoxide sensor module shall have a end of life at six years. End of life status shall be continuously monitored and reported by the control panel.
5. Each unit shall provide split sensor programming such that the combination device shall only require one software address while still providing two distinct inputs. This capability will allow for separate actions to be initiated independently from the two separate elements (smoke & CO) without requiring a separate software address on the loop.
6. The photoelectric detector shall be rated for ceiling installation at a minimum of 30 ft centers and be suitable for wall mount applications.
7. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photoelectric detector shall be suitable for operation in the following environment:
   a. Temperature: 32°F to 120°F (0°C to 49°C)
   b. Humidity: 0-93% RH, non-condensing
   c. Installation Attitude: no limit

F. Standard detector bases:
1. Provide standard detector mounting bases suitable for mounting on a standard 4” octagon or square box. The base shall contain no electronics and support all intelligent detector types.
2. Removal of the respective detector shall not affect communications with other detectors.
3. Terminal connections shall be made on the room side of the base.

G. Relay detector bases:
1. Provide standard detector mounting bases suitable for mounting on a standard 4” octagon or square box. The base shall support all intelligent detector types.
2. Removal of the respective detector shall not affect communications with other detectors.
3. Terminal connections shall be made on the room side of the base. Bases, which must be removed to gain access to the terminals, shall not be acceptable.
4. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
5. The position of the contact shall be supervised.
6. The relay shall automatically de-energize when a detector is removed.
7. The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.
8. Form "C" relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for pilot duty.

H. Duct detector:
1. Provide intelligent addressable analog photoelectric duct smoke detectors that utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging and humidity.
2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 0.79% to 2.46%. The duct detector shall be suitable for operation in the following environment:
   a. Temperature: -20°F to 158°F (-29°C to 70°C)
   b. Humidity: 0-93% RH, non-condensing
   c. Air velocity: 100 to 4000 ft/min

3. Provide an air exhaust tube and an air sampling inlet tube, which extends into the duct air stream up to ten feet. The sampling tube can be installed with or without the cover in place and can be rotated in 45 degree increments to ensure proper alignment with the duct airflow.
4. Status LEDs shall remain visible through a clear assembly cover.
5. The unit shall contain a magnet-activated test switch.
6. One integral Form C auxiliary alarm relay shall be provided. The relay contact shall be capable of being individually programmed from the control panel. The contact shall be rated for 2.0A at 30VDC.

I. Projected beam smoke detector (conventional, non-addressable device):
1. The unit shall be listed to UL 268 and shall consist of an integrated transmitter and receiver.
2. The detector shall operate between a range of 15 and 330 ft.
3. The temperature range of the beam shall be -22°F to 131°F.
4. The beam detector shall feature automatic gain control, which will compensate for gradual signal deterioration caused by dirt accumulation on the lenses.
5. Transmitter produces a crystal controlled, infrared beam which is monitored by the receiver to determine smoke obscuration. If receiver measures beam intensity below a preset, selectable threshold, an alarm output is generated.
6. Alarm initiation shall have a delay of 30 seconds as a standard setting, but should include an option for fast acting delay of 5 seconds. Complete beam blockage and dust accumulation that reduces signal by 50% will initiate a trouble signal output.
7. Include addressable monitoring modules connected to the addressable initiating circuit to monitor alarm and trouble conditions of detectors.
8. The unit shall include a wall mounting bracket.
9. Testing shall be carried out using a calibrated test filter.
10. Provide wall mounted test station at ground level. Test stations shall include power and alarm LEDs with a key activated test switch on a single gang plate.

2.05 INTELLIGENT ADDRESSABLE MODULES

A. General:
1. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Devices shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.
2. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location.
3. The module shall be suitable for operation in the following environment:
   a. Temperature: 32°F to 120°F (0°C to 49°C)
   b. Humidity: 0-93% RH, non condensing

B. Single input module:
1. Provide intelligent signal input modules for monitoring of PIV's, tamper switches, flow switches, fan & damper status, generator status, fire pump status, preaction system alarm or trouble or any other sets of dry contacts required to be monitored.
2. The single input module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 1-gang ring.
4. The single input module shall support the following circuit types:
   a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
   b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
   c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)

d. Normally-Open Active Latching (Supervisory, Tamper Switches)

C. Dual input module:
1. Provide intelligent dual input modules for monitoring of sets of PIV's, tamper switches, flow switches, fan & damper status, generator status, fire pump status, preaction system alarm or trouble or any other sets of dry contacts required to be monitored.
2. The dual input module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 1-gang ring.
4. The dual input module shall support the following circuit types:
   a. Normally-open alarm latching
   b. Normally-open alarm delayed latching
   c. Normally-open active non-latching
   d. Normally-open active latching

D. Signal module:
1. Provide intelligent single input signal modules for activation of booster power supplies, audible/visual circuits, speaker circuits.
2. The single input signal module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 2-gang ring.
4. The single input signal module shall support audible/visible signal power selector (polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 watts of audio)

E. Synchronized signal module:
1. Provide intelligent single input signal modules for activation of booster power supplies and/or audible/visual circuits that require synchronization.
2. The single input signal module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 2-gang ring.
4. The single input signal module shall support audible/visible signal power selector (polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 watts of audio)
5. Provides UL1971 auto-sync output for synchronizing multiple notification appliance circuits

F. Control relay module:
1. Provide intelligent control relay modules for activation and/or shutdown of fans, dampers, door holder circuits, door locks, shunt trip, elevator recall or any other fail safe system requiring control or activation.
2. The control relay module shall provide one Form R dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown.
3. The control relay shall be rated for pilot duty and releasing systems.
4. The control relay module shall be suitable for mounting on a standard 4" square box with 1-gang ring.

G. Manual pull station:
1. Provide intelligent single action, single stage fire alarm pull stations. The fire alarm pull station shall be of metal construction with an internal toggle switch. Provide a locked test feature. Finish the station in red with silver "PULL IN CASE OF FIRE" lettering.
2. The manual station shall be suitable for mounting on a standard 4" square box with 1-gang ring.
3. Provide compatible surface mount red box at all surface mount locations.

2.06 NOTIFICATION APPLIANCES

A. Speakers:

1. Speakers shall be a low profile design, finished in red with white lettering and shall not protrude more than 1" off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Speakers shall be provided with a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), and 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL 464.
3. Wattage setting shall be visible with the cover installed.
4. The moisture-repellent, fire-retardant speakers shall be selectable for 25-volt circuits or 70-volt circuits.
5. Speakers shall be suitable for wall mounting and shall mount in a standard 4" square x 2 1/8" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
6. Speakers shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 2 1/8" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
7. Where surface mounted speakers are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

B. Strobe lights:
1. Strobes shall be a low profile design, finished in **red** with **white** lettering and shall not protrude more than 1" off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Strobes shall provide synchronized flash outputs at maximum pulse duration of 0.2 seconds. The light output shall be an even pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
3. The strobe shall have selectable 15, 30, 75 or 110 cd settings for wall or standard ceiling height *mounting*.
4. The strobe shall have selectable 95, 115, 150 or 177 cd settings for high ceilings.
5. It shall be possible to change the strobe setting without removing the device from the wall or ceiling**.**
6. Strobes shall be suitable for wall mounting and shall mount in a standard 4" square x 1 ½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
7. Strobes shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 1 ½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
8. Where surface mounted strobe lights are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

C. Combination horn/strobe lights:
1. Strobes shall provide synchronized flash outputs at maximum pulse duration of 0.2 seconds. The light output shall be an even pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
2. It shall be possible to flash the strobe at a temporal flash rate to match the horn.
3. The strobe shall have selectable 15, 30, 75 or 110 cd settings for wall or standard ceiling height mounting.
4. The strobe shall have selectable 95, 115, 150 or 177 cd settings for high ceilings.
5. It shall be possible to change the strobe setting without removing the device from the wall or ceiling**.**
6. Horn/strobes shall be suitable for wall mounting and shall mount in a standard 4" square x 1 ½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.

7. Speaker/strobes shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 1 ½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
8. Where surface mounted horn/strobe lights are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

D. Combination speaker/strobe lights:
1. Speaker/strobes shall be a low profile design, finished in **red** with **white** lettering and shall not protrude more than 1" off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Speakers shall be provided with a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), and 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL 464.
3. Wattage setting shall be visible with the cover installed.
4. The moisture-repellent, fire-retardant speakers shall be selectable for 25-volt circuits or 70-volt circuits.
5. Strobes shall provide synchronized flash outputs. The light output shall be an even "FullLight" pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
6. It shall be possible to flash the strobe at a temporal flash rate to match the speaker.
7. The strobe shall have selectable 15, 30, 75 or 110 cd settings for wall or standard ceiling height mounting.
8. The strobe shall have selectable 95, 115, 150 or 177 cd settings for high ceilings.
9. It shall be possible to change the strobe setting without removing the device from the wall or ceiling**.**
10. Speaker/strobes shall be suitable for wall mounting and shall mount in a standard 4" square x 1 ½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
11. Speaker/strobes shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 1 ½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
12. Where surface mounted speaker/strobe lights are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

E. Weatherproof speakers and strobes and/or combination appliances:
1. Appliances shall be a semi-flush design, finished in red with white lettering. In-out screw terminals shall be provided for wiring.
2. Horns shall be provided with a switch selectable audible output of at least three decibel levels of 99, 95, and 90dBA.
3. Horns shall have two selectable tone options of temporal or non-temporal continuous pattern.
4. Speakers shall be weatherproof re-entrant type with field selectable taps for 1/8W to 8W operation for either 25V or 70V. Speakers shall incorporate a sealed back construction for extra protection and improved audibility.
5. Speakers shall provide a 94dBA sound output over a frequency range of 400-4000 Hz when measured in reverberation room per UL-1480.
6. Strobes shall provide synchronized flash outputs at maximum pulse duration of 0.2 seconds. The light output shall be an even pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
7. The strobe shall have a 75 cd setting for wall or standard ceiling height mounting.
8. Strobe shall operate over an extended temperature range of -31°F to 150°F. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring.
9. Appliance backbox shall be weatherproof and vandal resistant.

F. Remote booster power supplies:
1. Unit shall be a self contained with 24Vdc power supply and batteries housed in its own locked enclosure. Keys provided shall be identical to the keys provided for all other fire alarm equipment provided.
2. Power supply shall be available in both 10 Amp or 6.5 Amp models and 120Vac.
3. On board LED indicators for each NAC, battery supervision, ground fault and AC power.
4. The power supply shall provide four (4) independent 3Amp NACs. Each circuit can be configurable as an auxiliary output.
5. Configurable for any one of three signaling rates: 120SPM; 3-3-3 temporal; or, continuous.
6. Two independent and configurable inputs switch selectable to allow correlation of the two (2) inputs and the four (4) outputs.
7. NACs shall be configurable for either four Class B or two Class A circuits.
8. The unit shall be compatible with SIGA-CC1S for synchronization of multiple power supplies without inter-connect wiring.
9. Brackets shall be provided inside the enclosure to allow mounting the signaling modules. All signaling modules shall be listed to be located inside the booster power supply enclosure.
10. A selectable dip switch shall enable built in synchronization for horns and strobes which may be used to synchronize downstream devices, as well as other boosters and their connected devices.

2.07 AUXILIARY EQUIPMENT CONTROL AND SUPERVISION

A. Fire sprinkler system components: Include single or dual input modules at waterflow and/or tamper switch on each floor of building, fire pump room, etc., for monitoring status:
1. Each waterflow switch will initiate an alarm signal.
2. Each tamper switch will initiate a trouble signal.
3. Each post indicating valve (PIV) will initiate a trouble signal.

B. Elevator interface: Include the following in each elevator machine/control room or electrical room for interface with the elevator system:
1. Addressable control relay in each machine/control room for elevator recall purposes to ground floor.
2. Addressable control relay in each machine/control room for elevator recall purposes to an alternate floor, designated by fire marshal. Alternate floor will activate if ground floor lobby smoke detector is in alarm.
3. Single or dual input modules in machine/control rooms to monitor auxiliary contacts of elevator disconnect switches for power availability.

C. Supply fan/air handlers shutdown: All supply air fan, 2000cfm and greater, shall be furnished with a duct-mounted smoke detector and addressable control relay for shutdown purposes. Upon smoke detection, the fan shall be automatically controlled to the “OFF” position.

D. Fire/smoke dampers (FSDs):
1. FSDs for return air systems: Include spot smoke detector(s) over the openings of all return air FSDs for “OPEN/CLOSE” control upon detection of smoke. Provide one detector if open is 36” wide or less, two if opening is 72” wide or less and three if opening is 108” wide or less.
2. FSDs for supply air systems: Include in-duct smoke detector(s) within ducts adjacent to supply air FSDs for “OPEN/CLOSE” control upon detection of smoke. Provide one detector if open is 36” wide or less, two if opening is 72” wide or less and three if opening is 108” wide or less.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of fire alarm system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. General:
1. Install fire alarm system in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
2. The 120volt, 2-wire, 60 cycles AC two-20A circuit supply required to power the system shall be connected as indicated on the Drawings. Connect to red colored circuit breaker(s) in panelboard. Identify circuit as "Fire Alarm Circuit Control."

B. Conductors:
1. Refer to Section 260519: Building Wire and Cable.
2. All circuits shall be rated power limited in accordance with CEC Article 760.
3. All system conductors shall be of the type(s) specified herein.
   a. All initiating circuit, signaling line circuit, AC power conductors, shield drain conductors and grounding conductors, shall be solid copper, stranded or bunch tinned (bonded) stranded copper.
   b. All wiring shall be color-coded throughout.
   c. Signaling line circuits: Shall be 18 AWG minimum multi-conductor jacketed twisted cable or as per manufacturer's requirements.
   d. Initiating device circuits: 24Vdc circuits shall be 18 AWG minimum or per manufacturer's requirements.
   e. Notification appliance circuits:
      1) Speaker: Twisted pair, not less than No. 16 AWG or as recommended by the manufacturer.
      2) Horn-strobe or strobe: Non-twisted pair, not less than 14 AWG or as recommended by the manufacturer.
   f. 120Vac circuits:
      1) Minimum 10 AWG for panel power circuits.
      2) Minimum 12 AWG for all other circuits.
      3) Each circuit shall have its own dedicated neutral conductor.
   g. Fiber optic cable:
      1) Only glass filament cable permitted. Plastic filament fiber optic cables are not acceptable.
      2) Multimode shall be 62.5/125 micron fiber optic cables with ST connectors used at all equipment terminations
      3) Single Mode shall be 8.3 micron fiber micron fiber optic cables with Duplex SC connectors used at all equipment terminations

C. Conduit raceway:
1. All system components listed to UL864 Control Units for Fire Protective Signaling Systems maybe installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
2. All system conduits shall be EMT, 1/2 -inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 1/2-inch diameter, minimum.
3. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.
4. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or by fire damage, and so as not to interfere with other building systems, facilities or equipment, and to facilitate service and minimize maintenance.
5. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures and device back boxes shall be readily accessible for inspection, testing, service and maintenance.

6. All penetration of floor slabs and firewalls shall be sleeved (1" conduit minimum) fire stopped in accordance with all local fire codes.
7. All junction box covers shall be painted red.

D. Equipment:
1. All devices and appliances shall be mounted to flush mounted boxes where areas are finished. Exceptions being above suspended ceiling, exposed ceiling areas, or equipment rooms to facilitate connections to other equipment.
2. All pull stations shall be mounted 48 inches above the finished floor, as measured on handle.
3. All audio/visual devices shall be mounted at a minimum of 80 inches and no more than 96 inches above the finished floor, as measured on strobe center. Devices shall be mounted no less than 6 inches from the ceiling.
4. No area smoke detectors shall be mounted within 36 inches of any HVAC supply, return air register or lighting fixture.
5. No area smoke or heat detector shall be mounted within 12 inches of any wall.
6. All fire alarm devices shall be accessible for periodic maintenance.
7. End-of-line resistors shall be furnished as required for mounting as directed by the manufacturer. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled so removal of the device is not required to identify the EOL device.
8. All addressable modules shall be mounted within 36 inches of the monitored or controlled point of termination. This shall include, but is not necessarily limited to, fan shutdown, elevator recall, shunt trip, sprinkler status points, or door release. Label all addressable modules as to their function.
9. Power-limited/non-power-limited CEC wiring standards shall be observed.
10. Relays shall be appropriately labeled on the exterior to indicate "FIRE ALARM SYSTEM" and their specific function (i.e. FAN SHUTDOWN).

3.03 FIELD QUALITY CONTROL

A. Refer to Specification Section 260800: Electrical Commissioning.

B. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the fire alarm system.

C. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
1. Assure fire alarm system installation conforms to specified requirements and operates within specified tolerances.
2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
3. Prepare final test report including results, observations, failures, adjustments and remedies.
4. Apply label on fire alarm system control panel upon satisfactory completion of tests and results.
5. Verify settings and make final adjustments.

D. Engineer witnessed testing: Allow a period of 8 hours for Engineer review and final check.

E. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

F. Prefunctional testing:

1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
2. Visual and mechanical inspection:
   a. Inspect for physical damage, defects alignment and fit.
   b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
   c. Compare nameplate information and connections to Contract Documents.
   d. Check tightness of all control and power connections.
   e. Check that all covers, barriers and doors are secure.
3. Electrical tests:
   a. The system shall be completely tested prior to final acceptance testing. All points shall be tested from point of initiation to the final point or points of annunciation. All circuits shall be tested for continuity and ability to transmit the required signal correctly to the FACP. Any problem due to wrong wire type, wire twist, impedance, mismatches, noise filtering or shielding shall be completely corrected during pretesting and prior to any final acceptance tests.
   b. Testing shall include each and every device in the system. Coordinate with other trades as necessary for testing.
      1) Sprinkler flow switches: Record time delay from water flow to alarm and adjust as necessary for a 30-50 second delay.
      2) Tamper switches: Verify "trouble "signal is received and alarmed on closing of each valve.
      3) Smoke detectors , in-duct smoke detectors and duct mounted smoke detectors: Test with actual or approved artificial smoke. Verify that reset does not occur when devices are cleared of smoke. Verify supervisory circuit function.
      4) Door release: Verify that proper alarm activates every held-open door, roll-down doors and shutters, that doors close completely to the closed position.
      5) Elevator recall: Verify that elevators recall to designated floor by testing elevator lobby detectors with smoke. This is necessary on the ground floor and one other only.
      6) Audible/visual notification: Activate by means of an alarm-initiating device that audible and visual devices are clearly audible and/or visual throughout.
      7) Central station notification: Verify that one set of conductors in the terminal cabinet becomes a short circuit on any "trouble" condition and that the other set becomes a short circuit on any "alarm" condition. Verify that the conductor groups are labeled properly.
   c. Test report:
      1) Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
      2) Submit two typed copies of the test report in a neatly bound folder for review and approval. Failure to comply with this will result in a delay of final testing and acceptance.

G. Functional performance testing:
1. Refer to Specification Section 260800: Electrical Commissioning for requirements of system wide functional performance testing.
2. After the approval of the test report, provide a schedule of final testing to be done in the presence of the Owner's Representative. The schedule must be received by the Engineer a minimum of 2 weeks prior to the Final Test Date and must list the dates and time slots in which the various systems can be tested.
3. Coordination of the Final Test dates with all parties (General Contractor, Mechanical Contractor, Elevator Contractor, Engineer, Owner and others) shall be the sole responsibility of the Contractor. If a party is required to be present during any phase of

testing to activate a device, ensure that the party or a qualified representative of the party is present throughout that phase of the testing.

H. In the event that the system fails to function properly during the testing, as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.

I. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

J. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 TRAINING

A. Refer to Specification Section 260800: Electrical Commissioning.

B. Factory authorized service representative shall conduct a 8 hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment with both classroom training and hands-on instruction.

C. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION [26 61 13]

SECTION 26 6516

SECURITY ALARM MONITORING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Main controller/communicator panel.
2. Passive infrared detector “PIR.”
3. Door position contact switches.
4. Digital keypad arming/disarming stations.
5. Remote terminal cabinets.
6. System printer.

B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. Underwriters Laboratories, Inc. (UL):
UL 13; Power-Limited Circuit Cables.
UL 294; Access Control System Units.
UL 603; Power Supplies for Use with Burglar-Alarm Systems.
UL 639; Intrusion-Detection Units.
UL 1076: Proprietary Burglar Alarm Units and Systems.
2. Electronics Industries Alliance (EIA):
EIA: Testing standards.

1.03 SYSTEM DESCRIPTION

A. General requirements:
1. Provide a complete security alarm monitoring/keypad access control system as described herein.
2. The system shall comprise all necessary supervision, processing, display and printout circuitry and/or devices.
3. The system shall comprise redundant circuitry to ensure that no single independent failure of any component or component group shall cause consequential failure of the system.

B. System overview:
1. Passive infrared detectors shall be installed in all interior spaces indicated on the Drawings.
2. Flush mounted magnetic contact switches will be provided on all exterior doors to monitor and annunciate “open,” “closed,” ‘forced,” and “held” positions.
3. Both passive infrared detectors and door position switches shall transmit an alarm condition when the buildings are "armed" and system is violated.
4. Keypads shall be installed at each common building to provide individual zone control of a building. Keypads shall allow access to programmed zones via a 1 to 5 digit access code. They shall be capable of "disarming" or "arming" functions. A delay feature shall be built into the system to provide personnel sufficient time to disarm system upon entering a building prior to activation of an alarm sequence.

5. The monitoring and control panel shall include a programmable microprocessor and related circuitry capable of interpreting signals from the detection circuits and initiating appropriate alarms.
6. Activation of an intrusion alarm sensor shall cause a signal to be transmitted to a Central Station via telephone lines. A built-in dialer unit shall initiate signal transmission. In addition to alarm reporting, system shall report trouble, low battery and shunted zone indications.

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe system operation, equipment and dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Shop Drawings:
      a. Plot plans and building floor plans, showing location of and conduit routing to all devices.
      b. Point-to-point wiring diagram in block or riser formats showing all components, conduit and wire types and sizes with cable legend.
      c. Include elevations of control panel and remote terminal cabinet(s).
   5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
   6. Submit Manufacturer's installation instructions.
   7. Complete bill of materials listing all components.
   8. Warranty.

1.05 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
   1. A detailed explanation of the operation of the system.
   2. Instructions for routine maintenance.
   3. Pictorial parts list and part numbers.
   4. Schematic Drawings of wiring system, including all devices, control panel, terminal cabinets, etc.
   5. Telephone numbers for the authorized parts and service distributors.
   6. Final testing reports.

1.06 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Security monitoring and control system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.08 WARRANTY

A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Bosch

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 MAIN CONTROLLER/COMMUNICATOR PANEL

A. Control Panel: Control Panel shall be surface mounted, NEMA 1 enclosure, having a key operated locking, hinged door. Opening the main door shall expose all components for inspection or adjustment without further dismantling of the cabinet, control units or wiring. Unit shall be complete with the following features:

B. Sixty (60) alarm zones, hardwired to devices including zone expander modules.
1. All functions keypad programmable. One hundred (100) user codes, 1 - 5 digits.
2. 12 Volt, 6 amp/hour emergency back-up battery.
3. System shall be programmable remotely using an IBM PC compatible computer with standard modem.
4. System shall have programmable auto-arm feature at a preset time of day.
5. System shall be capable of custom arming configurations.
6. Automatic zone verification.
7. 96 event history and reporting.
8. Programmable exit and entrance delay times.
9. Digital communicator:
   a. Transmit all major formats.
   b. DPDT line seizure.
   c. Pulse or touch-tone dialing.
   d. Anti-jam feature.
   e. Hexadecimal reporting.
   f. Dial two (2) different 30 digit telephone numbers for reporting.
   g. Report by zone.
   h. Expanded or single line reporting.
   i. Open and close reports by user code.
   j. Exception opening report.
   k. Restore reporting.
   l. Cancel reporting.
   m. Trouble reporting.
   n. Low battery reporting.
   o. Stunted-zone reporting.

C. EEPROM (non-volatile) memory. Will not lose programmed features during total loss of power.
   1. Restore to previous arm/disarm status after total loss of power.
   2. Lightning/transient protection.
   3. Heavy-duty 1.5 amp power supply:
      a. Regulated 10.2 - 14.0 volts DC.
      b. 2 amps available for powering auxiliary devices.
      c. Battery float-charge circuit.

D. 12 volt 6 AH sealed lead-acid batteries.
   1. One (1) general-purpose 2 amp SPDT relays.
   2. Operating temperature range of 32 to 120 degrees F. (0 to +48.8 degrees C.)
   3. Install one keypad in panel door.
   4. Provide additional power supplies and batteries to power quantity of infrared detectors as required.
   5. Include system printer to document all system activities.

E. Remote station signal transmitter: Furnish with auto-dialer/modem device capable of transmitting alarm signals over telephone lines to remote monitoring station receiver.

2.03 PASSIVE INFRARED DETECTOR “PIR”

A. Wall mounted wide-angle infrared detector with dual element pyro-electric sensor and directional pulse count.

B. Tamper switch shall protect against removal of front cover or unit from wall and shall alarm upon loss of power.

2.04 DIGITAL KEYPAD

A. Wall mounted keypad to interface with controller to remotely "arm" and "disarm" designated alarm zones of the security monitoring system.

2.05 DOOR POSITION CONTACT SWITCH

A. Concealed, flush mounting, magnetic contact switch, with self-locking housing, six-inch wire leads and single-pole/double-throw contacts. Sentrol Model #1706 series.

2.06 TERMINAL CABINETS

A. Provide 18" X 18" X 6" deep hinged door lockable terminal cabinet in NEMA 1 enclosure. All conduits for security system shall terminate in these boxes. Provide engraved nameplate on each box marked "Security System Wiring".

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of the security system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 COORDINATION

A. Coordinate all installation requirements for door contacts with other trades prior to ordering of doors and frames.

B. Install contacts, boxes, conduits and connections to doors and frames for complete operating installation. All connections shall be concealed.

3.03 INSTALLATION REQUIREMENTS

A. Alarm circuits shall be terminated on screw terminals. Terminal blocks shall be Allen-Bradley with 600 volt screw terminals for #22 to #10 conductors, mounted to type M22 channel or approved equal. Submittal shall show internal elevation of terminal cabinets with equipment laid out.

B. All cables shall be run through fanning strip to terminals on terminal blocks.

C. All cables entering terminal cabinet shall be identified with Brady or E-Z code wire markers. Upon completion of installation, six (6) copies of one-line "as-built" wiring diagram shall be furnished to the Owner.

D. Each cable run on wiring diagram shall be identified with exact wire marker code (numerical or alphabetical) as appears in terminal cabinets.

E. Station locations shall be identified by architectural room numbers and in all ways one-line wiring diagram shall relate as closely as possible to architectural Drawings.

F. No splices shall occur in underground pullboxes. System wiring shall be continuous, without splices, from terminal cabinet to terminal cabinet and control panel to devices. All interior junction boxes shall be accessible and locations shall be recorded or "As-Built" Drawings.

G. Door contacts shall be located 6" from hinge side of door and both the switch and magnet shall be epoxy in place.

H. After all equipment is installed and operational, Contractor shall set angle settings, sensitivity settings, etc., of each detector to ensure optimum performance and minimal false alarms. Mask out areas, of each detector, to remove sources of false alarms (windows, heaters, air diffusers, etc.), from detection zones.

3.04 WIRING

A. Wiring from devices in building to terminal block at the same building shall be West Penn #241 or approved equal.

B. Wiring from each building terminal block to the control panel shall be West Penn #244 or approved equal.

C. Wiring from each keypad to the control panel shall be West Penn #244 or approved equal.

D. Low voltage AC Power wiring shall not run close to or parallel to fluorescent lighting fixtures. If necessary run conduit perpendicular to the lighting conduit with as much separation as possible.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the security system.

B. Pretesting objectives shall be to:
   1. Assure security system installation conforms to specified requirements and operates within specified tolerances.
   2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.

3. Prepare final test report including results, observations, failures, adjustments and remedies.
4. Apply label on security system control panel upon satisfactory completion of tests and results.
5. Verify settings and make final adjustments.

C. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

D. Prefunctional testing:
1. Visual and mechanical inspection:
   a. Inspect for physical damage, defects alignment and fit.
   b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
   c. Compare nameplate information and connections to Contract Documents.
   d. Check tightness of all control and power connections.
   e. Check that all covers, barriers and doors are secure.
2. Electrical tests:
   a. The system shall be completely tested prior to final acceptance testing. All points shall be tested from point of initiation to the final point or points of annunciation. All circuits shall be tested for continuity and ability to transmit the required signal correctly to the controller. Any problem due to wrong wire type, wire twist, impedance, mismatches, noise filtering or shielding shall be completely corrected during pretesting and prior to any final acceptance tests.
   b. Testing shall include each and every device in the system. Coordinate with other trades as necessary for testing.
      1) Door contact switches: Verify alarm signal received and annunciated at control panel.
      2) PIR detection devices: Adjust device sensitivity as required for coverage and location. Verify alarm signal received and annunciated at control panel.
      3) Keypads: Ensure that keypads function properly to “arm” and “disarm” the system.
      4) Remote station monitoring: Verify that the alarm condition is transmitted via telephone lines to remote monitoring station from auto-dialer/modem device within the control panel.
   c. Test report:
      1) Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
      2) Submit two typed copies of the test report in a neatly bound folder for review and approval. Failure to comply with this will result in a delay of final testing and acceptance.

E. In the event that the system fails to function properly during the testing, as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.

F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.06 TRAINING

A. Factory authorized service representative shall conduct a 4 hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment with both classroom training and hands-on instruction.

B. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION [26 6516]

SECTION 26 7113

TELECOMMUNICATION CABLING SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Equipment rooms.
2. Equipment bonding.
3. Backbone fiber optic cabling.
4. Backbone twisted pair cabling.
5. Horizontal twisted pair cabling.
6. Telecommunication testing.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. Federal Communications Commission (FCC) Regulations:
FCC Part 15; Radio Frequency Devices & Radiation Limits.
FCC Part 68; Connection of Terminal Equipment to the Telephone Network.
2. Electronics Industries Alliance (EIA):
EIA; Testing Standards.
American National Standards Institute, Inc. (ANSI) / Telecommunications Industry Association (TIA) / Electronics Industries Alliance (EIA):
ANSI/TIA/EIA-568-B; Commercial Building Telecommunications Cabling Standards, including the following:
• Part 1: General Requirements.
• Part 2: Balanced Twisted-Pair Cabling Components.
• TIA SP 3-4426 (12/28/06 or latest version): Transmission Performance Specifications for 4-Pair 100 Ohm Augmented Category 6 Cable (to be published as TIA-568-C.2-10).
• Part 3: Optical Fiber Cabling Components Standard.
ANSI/TIA/EIA-569-A; Commercial Building Standard for Telecommunications Pathways and Spaces, including the following:
• TIA/EIA-569-A-1: Perimeter Pathway Addendum.
• TIA/EIA-569-A-2: Furniture Pathway Fill Addendum.
ANSI/TIA/EIA-598-B; Optical Fiber Cable Color Coding.
ANSI/TIA/EIA-606-A; Administration Standard for Commercial Telecommunications Infrastructure.
ANSI/J-STD-607-A; Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
ANSI/TIA/EIA-758; Customer-Owner Outside Plant Telecommunications Cabling Standard (TIA/EIA-758-1: Addendum No. 1).
TIA TSB-155; Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBase-T.
3. Building Industry Consulting Service International, Inc. (BICSI):
BICSI (TDMM); Telecommunication Distribution Methods Manual.
BICSI; Customer-Owner Outside Plant Design Manual.
BICSI (NDRM); Network Design Reference Manual.
4. Insulated Cable Engineers Association (ICEA):
ICEA S-80-576-2002; Category 1 & 2 Individually Unshielded Twisted Pair Indoor Cables for Use in Communications Wiring Systems.
ICEA S-83-596-1994; Fiber Optic Premises Distribution Cable.

ICEA S-87-640-1999; Fiber Optic Outside Plant Communications Cable.
ICEA S-90-661-2002; Category 3, 5 & 5e Individually Unshielded Twisted Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems.
ICEA S-104-696-2001; Standard for Indoor-Outdoor Optical Cable.

5. Underwriters Laboratories, Inc. (UL):
   UL 444; Communication Cables.
   UL 497; Protectors for Paired-Conductor Communication Circuits.
   UL 1651; Optical Fiber Cable.
   UL 1690; Data-Processing Cable.
   UL 1963; Communications-Circuit Accessories.
   UL 2024A; Optical Fiber Cable Routing Assemblies.

1.03 DEFINITIONS

A. Adapter: Shall mean a connecting device joining two fiber connectors, either like or unlike.

B. Cabling: A system comprised of cables, wires, cords, and connecting hardware.

C. Channel: End-to-end transmission path, i.e. the entire portion of the horizontal cabling to each outlet consisting of the Permanent Link, line cord (at the workstation), patch cord, and, if a full crossconnection is implemented, the crossconnect termination/connecting apparatus and equipment cord.

D. Connect: To install required patch cords, equipment cords, cross-connect wires, etc. to complete an electrical or optical circuit.

E. Cord: Shall mean length of cordage having connectors at each end. The term “cord” is synonymous with the term “jumper” and “lead.”

F. Identifier: A unique code assigned to an element of the telecommunication infrastructure that links it to its corresponding record.

G. Passive link segment: Shall mean the cable, connectors, couplings, and splices between two fiber optic termination units.

H. Permanent link: Test configuration for a horizontal cabling link excluding test cords, connections at the ends of the test cords, patch cords, equipment cords, line cords, etc. The “permanent” portion of the horizontal cabling to each outlet consisting of cable, consolidation point (if used), termination/connecting apparatus in equipment rooms, and the connectors at outlets.

I. Abbreviations:
   1. BEP: Building Entrance Protection, for termination of OSP twisted pair cabling.
   2. CAT: Category, used when identifying the performance characteristics of twisted pair cabling.
   3. CMP: Communication Media Plenum, rating applied to ISP twisted pair cable.
   4. CMR: Communication Media Riser, rating applied to ISP twisted pair cable.
   5. IDF: Intermediate Distribution Facilities, telecommunication equipment rooms housing network equipment and containing termination fields for backbone cabling from MDF and horizontal cabling from outlet devices.
   6. ISP: Inside Plant, cable installation within building.
   7. MDF: Main Distribution Facilities, telecommunication equipment room housing possible service entrance facilities for interbuilding backbone cabling, network equipment, house voice system equipment headend, backbone cabling distribution headend, termination fields for backbone and horizontal cabling.
   8. MM: Multimode, fiber cable.

9. MPOE: Minimum Point of Entry, for serving telecommunications utility terminations. House's service provider's termination field(s) and interfaces between utility's facilities and premises facilities.
10. NAM: Network Access Module, workstations.
11. OFN: Optical Fiber Non-conductive, general purpose indoor non-plenum rated.
12. OFNP: Optical Fiber Non-conductive Plenum, plenum rated cable.
13. OFNR: Optical Fiber Non-conductive Riser, non-plenum rated riser cable.
14. OSP: Outside Plant, cable installation outside of building.
15. PIC: Plastic Insulated Conductors.
16. PVC: Polyvinyl Chloride.
17. SM: Singlemode, fiber cable.
18. UTP: Unshielded Twisted Pair, copper cable type.

1.04 SYSTEM DESCRIPTION

A. Provide a complete telecommunication cabling system installation as specified herein, as shown on the Drawings, and meeting all requirements of the Twin Rivers Unified School District Low Voltage Standards Section 16700, dated June 2017 (available upon request). In general, system shall include, but not be limited to, the following:

1. OSP backbone fiber optic cabling (existing):
    a. Backbone fiber optic cable shall route underground between each buildings main distribution facility (MDF), in a star topology, and shall consist of one 12-strand singlemode, OSP, fiber optic cable(s).
    b. OSP backbone fiber optic cables shall terminate on rack in existing MDF room for cable interface with ISP backbone fiber optic cables. Terminate cables on backside of rack mounted 24-port patch panels at each IDF.
    c. Existing rack(s) at MDF room for fiber termination with 96-port patch panels as required and patch cord management placed above and below each patch panel.
    d. OSP backbone fiber optic patch panel field shall interface with ISP backbone fiber optic patch panel field at MDF via fiber patch cords between modular connectors on front side of patch panels.
    e. Fiber optic cable connector standard shall be Type LC. Connectors shall be duplex type.
2. OSP backbone twisted pair cabling (existing):
    a. Backbone twisted pair cable shall route underground between each buildings main distribution facility (MDF), in a star topology, and shall consist of one multi-conductor 25-pair, Category 3, UTP, OSP, filled copper cable.
    b. Terminate backbone twisted pair cables on Category 3, wall-mounted, 110 style, BEP blocks at each MDF. BEP shall include a splice chamber.
3. Horizontal twisted pair cabling:
    a. Horizontal twisted pair cables shall route between MDF or IDF's and workstation outlets, and shall consists of two Category 6A, 4-pair, UTP, plenum rated copper cables.
    b. Horizontal twisted pair cables shall terminate on back of rack mounted, Category 6A, 48-port, 19" wide patch panels with modular 8-pin connector front for interface with Owner furnished routers/switches or voice patch panel field via Category 6A patch cords. Patch panels shall have 110 type terminations at rear for horizontal cable terminations.
    c. Wire management shall be provided above and below, 2 RU, for each 48-port patch panel.
    d. Copper jack standard is Category 6A, RJ-45 connectors at patch panels and workstation outlets.
4. Patch cords:
    a. Patch cords shall match the physical and performance criteria of the specified horizontal twisted pair cable and be terminated at each end with 8-position modular plugs.
    b. Patch cords shall be furnished in varying lengths as required.

c. For every terminated cable installed, provide a patch cord for the IDF room, and a patch cord for the workstation.

B. Workstation outlets:
1. Standard telecommunication outlets shall consist of the following, unless otherwise noted on the Drawings:
   a. Two horizontal twisted pair cable(s) per outlet.
   b. Single-gang coverplate with 4-ports.
   c. Two RJ-45 connector jacks for twisted pair terminations.
2. Telecommunication outlets denoted for Wireless Access Points shall consist of the following, unless otherwise noted on the Drawings:
   a. Two horizontal twisted pair cable(s) per outlet.
   b. Single-gang coverplate with 4-ports.
   c. Two RJ-45 connector jacks for twisted pair terminations.
3. Wall mounted telephone outlets shall consist of the following, unless otherwise noted on the Drawings:
   a. One horizontal twisted pair cable per outlet.
   b. Single-gang metal coverplate with 1-port and two support studs.
   c. One RJ-45 connector jack for twisted pair terminations.

C. Required System Colors
   a. Cat 6A Horizontal Cable Color: Green
   b. CAT 6A Patch Cord Color: Green
   c. Cat 6A Jack Colors (Rack and Workstation)
      1) IP Cameras: Black
      2) All Other: Green

D. Refer to Drawings for complete documentation of above requirements and all additional requirements.

1.05 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Describe system operation, equipment, dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Shop Drawings prepare in AutoCAD Release 2012 or later, to include the following:
   a. Building floor plans showing location of all outlets, raceways, cable trays, conduits and cable routing to each device at same scale as construction documents.
   b. Riser diagram(s) indicating all major components of system with required cable interties and backbone cable identification labels.
   c. Provide 1/4" scale plans of equipment layout in MPOE, MDF and IDF rooms.
   d. Provide wall elevations of MPOE, MDF and IDF rooms at ½” scale.
   e. Provide equipment rack elevations at 1” scale.
   f. Use identical symbols as those used in construction documents.
   g. Text shall be a minimum of 3/32” high when plotted at full scale.
   h. Screen all background information.
5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
6. Complete bill of materials listing all components.
7. Warranty.

B. Installer's qualifications: Furnish satisfactory proof of required experience specified herein for system installer.

C. Record Drawings:
   1. Furnish Record Drawings as described in Section 260010: Basic Electrical Requirements, utilizing Shop-Drawing submissions with updated field conditions. These Drawings shall include but not be limited to the following:
      a. Plot plans and building floor plans, showing point-to-point wiring location of all devices.
      b. Block Diagram/Riser Diagram showing the system components and all conduit and wire type/sizes between each.
   2. Drawings shall be incorporated into the Record Drawing submission.
   3. Final acceptance will not be made until the Engineer has approved the Record Drawings.

1.06 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
   1. A detailed explanation of the operation of the system.
   2. Pictorial parts list and part numbers.
   3. Schematic wiring diagrams.
   4. Telephone numbers for the authorized parts and service distributor.
   5. Final testing reports.

1.07 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this section may be used on the Project unless otherwise submitted.

C. Manufacturer qualifications: Manufacturer must have a minimum 5 continuous years of experience in design and manufacturing of the materials and equipment specified herein.

D. Installer's qualifications:
   1. Installer must have a minimum 5 continuous years of experience in satisfactory completion for Projects similar in scope and cost. Provide backup information on 5 such Projects.
   2. Installer shall possess a current, active and valid C7 or C10 California State Contractors License.
   3. The installer shall be the Manufacturer's certified reseller/installer of the telecommunication equipment provided. Provide evidence of this certification.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Telecommunication system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipping shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal components damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.09 WARRANTY

A. The warranty shall commence from the date of final written acceptance by the Owner.

B. All conditions for obtaining the manufacturer's Performance Warranty shall be the sole responsibility of the contractor.

C. Upon successful completion of the installation and subsequent inspection, the Owner's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

D. Contractor shall warrant the installation and that all approved cabling components meet or exceed the requirements of TIA/EIA-568A, TIA/EIA-568A-A5, and ISO/IEC 11801.

E. 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.

F. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

G. Extended Product Warranty and Application Assurance:
   1. The 25 Year Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA 568A and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of TIA/EIA TSB 155 and ISO/IEC IS 11801 for cabling links/channels, that the installation will exceed the loss and bandwidth requirements of TIA/EIA TSB 155 and ISO/IEC IS 11801 for fiber links/channels, for a twenty (20) year period. The warranty shall apply to all passive SCS components. The 20 Year Extended Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for a twenty (20) year period.

H. Contractor will provide a minimum of a fifteen (15) year written warranty from the manufacturer(s) for both UTP basic link and fiber optic cable systems. This may require the contractor to certify their installers to the manufacturer's guidelines before the project begins.

I. The permanent link cabling system shall be warranted for a period of at least 25 years.

   1. The 25 Year Application Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future, up to 10,000 Mbps parallel transmission schemes, by recognized standards or user forums that use the TIA/EIA-568A or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty (20) year period.

J. The contractor will provide a two (2) year written warranty covering workmanship and materials in compliance with Twin Rivers Unified School District specifications. All repairs shall be made at no cost to Twin Rivers Unified School District during the warranty period.

K. Contractor will provide to the Twin Rivers Unified School District warranty information covering parts and materials used by the contractor.

L. Upon hookup of system and system start-up by Twin Rivers Unified School District, if system troubles should indicate problems with the cables or terminations, it shall be the responsibility of the cable installation contractor to repair any such problems free of charge to the Twin Rivers Unified School District. The contractor shall start this repair work within 48-hours from the initial notification by Twin Rivers Unified School District.

M. One-Year Maintenance Service shall be provided as follows:
   1. Emergency Response: Contractor must respond by utilizing remote diagnostics capabilities (as applicable) within thirty minutes of notification. If necessary, Contractor must dispatch at least one certified technician for arrival on-site within two hours of notification.
   2. Non-Emergency Response: Contractor shall respond by utilizing remote diagnostics capabilities and or cause dispatch of at least one certified technician for arrival on-site within one business day of notification.
   3. Definition of "Emergency": For maintenance purposes, "emergency" shall be defined as one or more of the following conditions:
      a. Defects of any riser pairs and/or components involving at least ten percent (10%) of any riser cable's capacity.
      b. Defects of station cable pairs and/or components involving at least ten percent (10%) of any department or group of analog and/or data stations.
      c. Defects significantly impairing any single attendant console.
      d. Defects of any fiber optic cable and/or components involving at least ten percent (10%) of any departments or groups fiber-based systems and/or stations.
      e. Any pre-defined failure as submitted by Owner and agreed to by Contractor.
   4. Contractor shall provide extra service upon request on a 24 hour-a-day, 365 day-a-Year basis. Pricing for such service shall be described in the "Cable Book" Documentation.

1.10 MAINTENANCE

A. Maintenance services:
   1. Distributor of the major system components shall maintain a replacement parts department and provide testing equipment when needed. A complete parts department shall be located close enough to supply replacement parts within a 4 hour period.
   2. Service must be rendered within 4 hours of system failure notification.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Horizontal twisted pair and modular patch cord cable:
      a. Belden
      b. Superior Essex
   2. Horizontal twisted pair and modular patch cord terminations:
      a. Belden
      b. Superior Essex
   3. Patch Panels
      a. Panduit
   4. Innerduct and duct plugs:
      a. TVC Communications.
      b. Tyco "Allied Electrical Group."
      c. MaxCell
   5. Test equipment:
      a. Corning Cable Systems
      b. Fluke Networks.
      c. Agilent Technologies WireScope 350 Test Set.
      d. Laser Precision.
      e. Tektronix.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 HORIZONTAL TWISTED PAIR CABLING

A. Horizontal cables:
   1. Application:
      a. Suitable for indoor installations, exposed within equipment rooms, above suspended ceilings and below raised floors in cable trays, hangers or on deck, or within walls. If space is used as an air plenum, cable shall either be plenum rated or installed in EMT conduit.
      b. Each cable run shall be continuous single cable, homogenous in nature, without splices.
      c. Cables shall meet CAT6A performance criteria.
      d. Cables shall be plenum rated.
   2. Conductors:
      a. Insulated conductors: Eight #23 AWG, solid copper wire insulated with fluorinated-ethylene-propylene (FEP) for plenum rated applications.
      b. Twisted pairs: Two insulated conductors twisted together to form a pair and four such paired cables to form a unit with individually color-coded pairs to conform to industry standards (ANSI/ICEA Publication S-80-576-1994 and EIA-230).
   3. Cable sheath:
      a. Outer jacket: Seamless outer jacket, flame-retardant PVC (low smoke for plenum application), applied to and completely covering the internal components (twisted pairs).
      b. Flame rating: CMP according to NEC Article 800, tested to NFPA 262 and UL Listed as such.
   4. District Standards:
      a. Only virgin materials shall be used in the construction of cabling.
      b. Installation of a new Category 6A UTP as required by the drawings or the scope of work. Category 6A terminations will be EIA/TIA standard 568B wiring configuration into 8-position, 8-wire/4 pair universal RJ45 jacks.
      c. All cables shall be installed with service loops at ground boxes (Christy box/Vault) and MDF/IDF locations only.
      d. Category 6A cable shall be Belden 10GXS Small diameter cable or Superior Essex 10Gain XP 23 AWG Solid annealed copper, or approved district equivalent. All cables shall test to 10Gbps at 100 meters.
      e. All cables installed in an underground conduit shall be Category 6A UTP rated for indoor and outdoor use, GenSPEED 10 UTP Indoor/Outdoor or approved district equivalent. All cables shall test to 10Gbps at 100 meters.
      f. Data/VOIP/Access Control: Cable shall be a 4-pair 23 AWG Category 6A, green in color and shall test at 10Gbps. All jacks shall be Category 6A, Panduit and green in color (p/n CJ6X88TGGR).
      g. Wireless Access Point: Cable shall be a 4-pair 23 AWG Category 6A, green in color and shall test at 10Gbps. All jacks shall be Category 6A, Panduit and green in color (p/n CJ6X88TGGR)
      h. IP Cameras: Cable shall be 4-pair 23 AWG Category 6A cable, green in color and shall test at 10Gbps. All jacks shall be Category 6A, Panduit and black in color (p/n CJ6X88TGBL).
      i. Category 6A patch panels shall be Panduit Modular Patch Panel (p/n CPPL48WBLY). Jacks shall be Panduit CJ6X88TGGR, CJ6X88TGBL, CJ6X88TYL or CJ5E88TGYL as required.
      j. All terminations into patch panel for connection to switches using contractor supplied patch cords. For each data cable installed, the contractor shall supply one (1) 1' Category 6A patch cord for the patch panel location using matching color. Contractor to install patch cords from patch-panel to switches.

B. Modular patch cords:
   1. Application: Suitable for indoor installations within equipment rooms or workstation environments.
   2. Cords assembled from a single, continuous length of cordage, homogenous in nature and terminated at both ends via 8-position modular plugs. Splices are not permitted anywhere.

3. Cordage:
   a. Insulated conductors: Eight solid copper wire insulated with thermoplastic polyethylene or high-density polyolefin for non-plenum rated applications.
   b. Twisted pairs: Two insulated conductors twisted together to form a pair and four such paired cables to form a unit with individually color-coded pairs to conform to industry standards (ANSI/ICEA Publication S-80-576-1994 and EIA-230).
4. Cable sheath:
   a. Outer jacket: Seamless outer jacket, flame-retardant PVC, applied to and completely covering the internal components (twisted pairs).
   b. Flame rating: CM according to NEC Article 800, tested to UL listed as such.
5. Electrical performance: Meet or exceed TIA/EIA-568-C.2-10 Augmented and ISO 11801 Edition 2.1 Class E specifications for CAT6A UTP cabling.

C. Crossconnect wires:
1. Crossconnect wires shall be suitable for installation within equipment rooms and fully compatible with the termination apparatus specified within this Section.
2. Crossconnect wires shall be manufactured from a single, continuous length of insulated wire, homogenous in nature. Splices are not permitted anywhere.
3. Conductors:
   a. Insulated conductors: #24 AWG, solid copper wire insulated with thermoplastic polyethylene or high-density polyolefin for non-plenum rated applications.
   b. Twisted pairs: Two insulated conductors twisted together to form a pair with individually color-coded pairs to conform to industry standards (ANSI/ICEA Publication S-80-576-1994 and EIA-230).

D. Modular patch panels:
1. Application:
   a. Modular patch panels shall be suitable for installation within a equipment room for the terminations of horizontal cables specified within this Section.
   b. Patch panels shall be horizontally oriented for rack-mounted configuration within a 19” rack.
   c. Patch panels shall be capable of supporting, organizing, labeling and patching/crossconnecting between the horizontal termination field and the equipment termination field.
2. Modular patch panels shall have 110-type terminations on back for horizontal cabling.
3. Patch panels shall have 24 or 48 ports on front and each port shall be an 8-position modular jack, mathing the criteria of the cable and shall becompliant to TIA/EIA 568-C.2 Chapter 5.
4. Each port shall be T568B wired.
5. Also, include 24 or 48 port modular patch panels with pre-wired RJ-21C (50 Pin) connectors. Panels shall conform to all above requirements, except performance shall meet TIA/EIA-568-B.2 for CAT3 UTP cabling.

E. Modular connectors:
1. Modular connectors shall be 8-position jacks, compliant to TIA/EIA-568-C.2, and shall be compatible with the specified cable within this Section, both electrically and physically
2. Modular connectors shall be T568B wired.

F. Outlets:
1. Application:
   a. Outlet faceplates and mounting frames shall be suitable for indoor installations to standard single or double-gang flush wall mounted outlet box plaster rings, furniture partition outlets and floor boxes.
   b. Refer to Specification Section 262726: Wiring Devices for device coverplate finish.
2. Standard wall mounted faceplates:
   a. Modular faceplates shall have 4-ports and shall include required accessories, such as icons, blank inserts, label windows and labels.
   b. Faceplates shall be single-ganged.

c. Faceplates shall be flush mounted.
d. Faceplates shall be single-gang decora-style to match power wiring devices.

3. Modular outlet frame:
   a. Modular outlet frame shall have 234-ports and shall include required accessories, such as icons, blank inserts, label windows and labels.
   b. Outlet frame shall be decora-style.
   c. Outlet frame shall attach like a duplex receptacle strap attaches to a box.
4. Wall mounted phone faceplates:
   a. Faceplate shall be single-gang, flush mounted with 1 port and shall include required accessories.
   b. Faceplate shall include two mounting studs for standard wall phone instrument.
   c. Faceplate shall be stainless steel.
5. Surface mounted outlets:
   a. Surface outlets shall be fully compatible with the specified modular connector/jacks.
   b. Surface outlets shall have 4-ports.
6. WAP telecommunication outlets shall consist of the following, unless otherwise noted on the Drawings:
   a. Two horizontal twisted pair category 6A cable(s) per outlet.
   b. Surface mount box with 2-ports when above accessible ceiling.
   c. Two RJ-45 connector jack, for twisted pair terminations.
   d. Blanks as required.
   e. Faceplates shall be single-gang type with 2-ports and shall include required accessories, such as icons, blank inserts, label windows and labels.
   f. Wireless Access Points are to be installed in the center of the room unless otherwise specified.
7. Camera telecommunication outlets shall consist of the following, unless otherwise noted on the Drawings:
   a. All IP Camera installations shall use tamper resistant, vandal resistant security screws on all IP Camera dedicated junction boxes, mounting hardware, and camera domes. One screwdriver used for the each type/size of the tamper resistant, vandal resistant screwdriver is to be provided to the owner.
   b. All parapet mounts shall be mounted so as to swing onto the roof for maintenance unless otherwise specified by the District.
   c. All cables shall be run to the IDF or MDF cabinet specified in the scope of work. All cables shall be terminated into existing RJ45 patch panels. All cables shall be installed with service loops at both ends.
   d. The system shall pass video signals without noticeable degradation of the picture quality.
   e. The system as installed shall be rated and capable of continuous 24-hour operation.
   f. If a shielded version of Category 6A cable is used it shall comply with the performance requirements of the applicable cabling.

G. Labels:
1. Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer or hand-held printer.
2. Labels for horizontal cables:
   a. Adhesive backed labels and self-laminating feature.
   b. Fit the horizontal cables specified herein by fully wrapping around the cable jacket.
   c. Size: 2” x .05” printable area, minimum.
   d. Color: White.

H. Miscellaneous components:
1. Velcro cable ties:
   a. Width: 0.75”.
   b. Color: Velcro cable ties the same color as the cable to which it is applied.
2. Plenum cable ties:
   a. Suitable for use in plenums or air handling spaces.
   b. Color: Maroon or other distinctive non-white color.

c.

2.03 LOW VOLTAGE ENCLOSURES AND PATHWAYS

A. Single channel surface raceway will be Wiremold 2300 series depending on fill ratio, off white in color. All fittings made for an intended purpose of installation by the manufacturer shall be included as part of this material.

B. Multichannel surface raceway will be Wiremold 2300D, 5400, or 5500 series depending on fill ratio, off white in color. All fittings made for an intended purpose of installation by the manufacturer shall be included as part of this material.

C. Wiremold 5500 Series Raceway fittings will be;
1. Wiremold 5511FO Bend Radius Control Full Capacity Flat Elbow
2. Wiremold 5517FO Bend Radius Control Full Capacity Internal Elbow
3. Wiremold 5518FO Bend Radius Control Full Capacity External Elbow

D. Wiremold 2300 Series Raceway fittings will be;
1. Wiremold 2310DFO Bend Radius Control Full Capacity Entrance End Fitting
2. Wiremold 2311DFO Bend Radius Control Full Capacity Flat Elbow
3. Wiremold 2317DFO Bend Radius Control Full Capacity Internal Elbow
4. Wiremold 2318DFO Bend Radius Control Full Capacity External Elbow

E. Faceplates for 5500 will be CM-ARA Angled Raceway Adapter utilizing 5507AD series faceplate openings and Panduit module frame mount (CFG2IW) off white in color.

F. Faceplates for 2300 will be Panduit Mini-Com 2 Position Vertical Sloped (CFPSL2IWY) off white in color.

G. Faceplates for modular furniture will be Panduit Ultimate IDF Faceplates (UICFFP4BL)

H. Surface Mount Boxes for single channel raceway will be Wiremold 2344 or 2344-2. Surface mount boxes for 2300D series dual channel raceway will be 2300SD-2A, off white in color.

I. Cover plates will be Panduit with 2 ports unless otherwise specified.

J. Mounting hardware and anchors recommended by the Manufacturer of any material that shall be mounted to the building or structure.

K. Sheetrock/drywall/wall board: Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.

L. Concrete/cinder block/solid masonry: expanding compression type lag, expanding compression type bolt, expanding compression type all tread with nuts, or approved equal.

M. Tile/Stucco/hollow masonry: toggle bolts or approved equal.

N. Wood: lags, wood screws, or approved equal.

O. Metal: clamp, or approved equal.

P. Power and Communication poles will be Panduit (p/n PCPAxxR20EI), where xx=height with the following power accessories included:

Q. (2) Standard Faceplate Bracket for low voltage (p/n T70SDB-X)

R. Wall mounted cabinets shall be a Hubbell RE4X with Sound Dampening Kit REKS, REKF Fan Kit, REKFF Fan Filter Kit, door and vents, computer white in color. Extra package of Phillips mounting screws are to be provided with cabinet.

S. Wall mounted Hubbell RE4X cabinets are to be mounted with the base 18 inches above the ground unless otherwise specified.

T. Wall mount racks shall be Chatsworth stacker swing-gate rack, minimum of 24” deep, 24” tall (p/n 13602-725), or 36” tall (p/n 13604-725), or approved equal.

U. Outdoor mounted enclosures shall be NEMA rated 12” tall, 12” wide and 4 inches deep weatherproof and lockable.

V. Floor mount racks shall be Chatsworth 19”W x 7’H standard equipment rack (p/n 55053-503) with Quantity 4 Panduit vertical wire managers (p/n WMPVHC45E) and appropriate ladder racking with mounting hardware for structural support.

W. Definitions:

a. A rack is defined as a side less, bottomless, topless open-rammed support structure for equipment. A rack may be mounted to a wall, ceiling, or to a floor depending on type, size, and District requirements.

b. A cabinet is defined as an enclosed equipment support structure. A cabinet may be mounted to a wall, or to a floor depending on type, size, and District requirements.

c. All cabinets and swing able racks must be able to open fully with no cable tension, or obstructions.

X. Nomenclature:

1. IDF cabinets are cabinets/racks specified for intermediate distribution frames, typically at the head of a wing and feed one or more classrooms. Typically a Hubbell RE4X
2. MDF cabinets are cabinets/racks specified for main distribution frames. Typically 84” high.
3. All equipment shall be mounted with Phillips screws, unless otherwise specified by the District.
4. Wire management will be Panduit Horizontal Cable Management System (p/n NCMH2).

2.04 CABLE TESTING EQUIPMENT

A. Twisted pair cabling:

1. Backbone cable tester: Areas of test measurement shall be Wire Map for continuity, opens, shorts, crossed pairs and split pairs, as a minimum.
2. Horizontal cable tester:
   a. Equipment shall meet TIA/EIA-568B.2 Addendum 1 requirements for Level III accuracy, as applicable for cable type specified herein.
   b. Test standards: ISO/IEC 11801 Class C and D; ISO/IEC 11801-2000 Class C and D, 1000Base-Y, 100Base-TX; IEEE 802.3 10Base-T; ANSI TP-PMD; IEEE 802.5.
   c. Areas of test measurement (minimum):
      1) Wire Map.
      2) Length.
      3) Insertion Loss.
      4) The following at both master unit and remote unit:
         a) Near End Crosstalk (NEXT) loss.
         b) Power Sum NEXT (PSNEXT) loss.
         c) Equal Level Far End Crosstalk (ELFEXT).
         d) Power Sum ELFEXT.
         e) Return Loss (RL).
         f) Attenuation-to-Crosstalk Ratio (ACR).

g) Power Sum ACR (PSACR).
5) Propagation Delay and Delay Skew.
6) Characteristic Impedance.
7) DC Loop Resistance.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of the telecommunication cabling system installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

B. Verify that pathways and supporting devices are properly and completely installed prior to cable installation.

C. Verify dimensions of pathways to include length, i.e. “true tape” conduit runs.

D. Prior to installation, verify that equipment rooms are ready to accept cables and terminations.

3.02 INSTALLATION

A. General:
1. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer’s wiring diagrams. Should any variations in these requirements occur the contractor shall notify the Owner’s Representative before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
2. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.
3. Splices of conductors in underground pull boxes are not permitted.
4. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the Owner’s Representative to engage in the installation and service of this system.
5. 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.
6. The system must meet all local and other prevailing codes.
7. All cabling installations shall be performed by qualified technicians.
8. All cabling shall be splice free.
9. In order to ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a special tool.
10. The use of lubricants (i.e. Yellow 77) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed.
11. Under no circumstance are “channel locks” or other pliers to be used.
12. Plenum rated cable may be run exposed above ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The cable shall not be laid directly on the ceiling panels. The use of cable ties shall be done in accordance with the cable manufacturer’s requirements. The cable jacket composition must meet local and all other prevailing fire and safety codes.

13. All firewalls penetrated by structured cabling shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of national Fire Protection Association (NFPA) and the National Electric Code (NEC) or other prevailing code. The contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wire ways or conduits.
14. Site Cleaning. Throughout the progress of the plant construction, the contractor shall keep the working area free from debris of all types and remove from the premises all rubbish resulting from any work done by Contractor. On a daily basis and at the completion of its work the Contractor shall, to the extent possible, leave the premises in a clean and finished condition.
15. Conduits. All backbone cabling will run through dedicated conduits. All new conduits are to be supplied with a pull string. Contractor shall supply pull string and pull rope for the installation of all cables in existing conduits. For all conduits left with available capacity, Contractor shall replace pull strings with ¼-inch pull rope during the course of his work. Contractor must seal all conduits with an approved sealing compound.
16. Cabling and Termination Identifications. All new cabling shall be of the type specified herein. Any conflicts between cabling types specified and code or design requirements shall be submitted to Owner's Representative for review and final disposition. All cabling shall be neatly laced, dressed and adequately supported. Cabling must be concealed to the fullest extent possible. In addition, a numbering and marking scheme must be used to identify all cable and cabling terminations. All cables, regardless of length, shall be marked and/or numbered at both ends. Marking codes and methodologies shall correspond to the instructions in this specification.
17. Seismic Requirements. Contractor will install all equipment racks, equipment cabinet enclosures, cable runways, etc. according to the local, state and/or federal code. Contractor will notify Owner's Representative of such requirements and shall provide such bracing as required.
18. Safety Requirements. Contractor will utilize appropriate personnel and display warning signs, signals, flags and/or barricades at the work site to ensure adherence to safety regulations and as prudence requires.
19. Owner or Owner's Representative may view work or testing in progress.

B. Cable Routing:
1. The cables will be routed to their respective Main Distribution Frame (MDF) or Intermediate Distribution Frame (IDF) or to service drop utilizing the shortest path possible.
2. Cable shall not be exposed at any point in the cable path. Contractor is to use appropriate pathway for the situation (i.e. inside wall, conduit, or non metallic surface raceway). EXCEPTION: In MDF ROOM ONLY cables may be exposed and routed in contractor supplied D-rings every 4 feet.
3. Cables shall be protected and sleeved with a conduit in locations where cables need to pass through walls, floors, or hard ceilings. Contractor shall install threaded IMC or rigid conduit with large fender washers, lock rings, and screw on protective bushings on both ends. The fire rating of the wall must be maintained during and after installation.
4. At solid wall location such as plaster, brick, concrete, cinder block, tile, reinforced concrete, Contractor will provide and install surface mounted non-metallic raceways or equivalent. The use of different series raceways is required at locations where cable fill capacities are exceeded.
5. Terminations on block walls will be accomplished with District approved surface mount boxes.
6. Cables will be run vertically inside the wall and into the ceiling space. Terminations on stud walls will be accomplished with cut-in type electrical boxes with a 1" conduit (flex or EMT) extended from the box within the wall to ceiling access space.
7. Cables shall be run in corridors wherever possible in order to avoid furniture and work areas so that access to the cables is unencumbered.
8. The cables are to be as accessible as possible, placed above all other items in the ceiling, including ducts and supports.

9. Do not use pulling means, including fish tape, cable or rope, which can damage the Wiremold raceway.
10. Use pulling compound or lubricant that will not deteriorate cable or conduit.
11. Pulling compound shall be a water base pulling lubricant that will not deteriorate cable or conduit.
12. Cables shall not be pulled across sharp edges. If sharp edges are present a small sleeve, insulation or grommet shall be installed to protect the cable.
13. Cables shall be pulled free of sharp bends or kinks.
14. Cables shall not be forced or jammed between metal parts, assemblies, etc.
15. Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems shall be maintained.
16. Manufacturer's specifications for pulling stress and minimum bend radius shall not be exceeded on any cable.
17. Do not use staples or drive rings.

C. Service loops:
1. Fiber:
   a. Shall be a minimum of 10' at all MDF and IDF.
   b. Shall be a minimum of 6' at all ground box locations that allow for the minimum bend radius specified by the manufacturer.
2. Category 6A and 5E:
   a. Shall be a minimum of 6' at all MDF and IDF.
   b. Shall be a minimum of 6' at all ground box locations that allow for the minimum bend radius specified by the manufacturer.

D. Horizontal twisted pair cabling:
1. Horizontal cable installation and routing:
   a. Cable runs shall have continuous sheath continuity, homogenous in nature with no splicing.
   b. No cabling shall exceed a cable length of 295' (90m) from the termination point at the equipment room to the termination at the workstation outlet, including service slack, when measured using test equipment.
   c. Place cables within the designated pathways, such as cable tray or basket tray, cable runway, cable hangers, etc. Do not fasten, support or attach cables to other building infrastructures (i.e. ducts, pipes, conduits, etc.), other systems (i.e. ceiling support wires, wall studs, etc.), or to the outside of conduits, cable trays and non0approved pathway systems.
   d. Place and suspend cables during installation and termination in a manner to protect them from physical damage or interference. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation or termination at no additional cost.
   e. Route cables at 90º angles, allowing for bending radius.
   f. Do not exceed pulling tension of 25 lbs.
   g. Do not use cable-pulling compounds.
   h. Do not exceed a minimum bend radius of 6 times the cable diameter during and after installation.
   i. Route cables beneath other building infrastructures (i.e. ducts, pipes, conduits, etc.) in above ceiling applications. Do not route cables over building infrastructures. The installation shall result in easy accessibility to the cables in the future.
   j. Place cables 6" minimum away from power sources to reduce interference from EMI.
   k. Do not set 360º service loops in place for slack storage. Instead, set slack as forward-and-back or as figure eights.
   l. Place a pull string along with cables where run in conduits and spare capacity in conduit remains. Tie off ends of the pull string to prevent the string from falling onto the conduit.
   m. When exiting the primary pathway, such as cable or basket tray, to the workstation outlets, exit via the top of the pathway. Secure the cables to the pathway using an approved cable tie.

2. Cable routing and dressing within equipment rooms:
   a. Within equipment rooms, only use Velcro type straps.
   b. Place cables within the overhead cable support system. When routing vertically on walls, fasten the cables onto vertical supports every 24" on center.
   c. Provide 12" minimum sheath cable slack, length not to exceed permanent link maximum length requirement. Place the slack in the overhead cable support system.
   d. At the rack bay, route and neatly dress cables from the overhead cable support system into the back of the vertical management sections. Divide the cables equally between both sides of an equipment rack such that a cable does not travel past the midpoint of the rack prior to termination. Fasten the cables to the cable support bar at the back of the patch panel using approved ties.
3. Termination in the equipment rooms:
   a. Provide termination apparatus and accessories required for a complete installation. Install and assemble termination apparatus, accessories and associated management apparatus according to the manufacturer's instructions.
   b. Properly relieve strain from the cables to and at termination points per manufacturer's instructions. Provide a strain relief bar at the back of the modular patch panels for proper strain relief.
   c. Terminate cables and twisted pairs in accordance with manufacturer's latest installation requirements and TIA/EIA-568-B standard installation practices. Terminate cable pairs onto the termination apparatus compliant to T568B wiring.
   d. Modular patch panels and horizontal management panels:
      1) Provide quantity of modular patch panels to support the terminations of cables served from respective IDF. Provide quantity of horizontal management panels based on the quantity of patch panels.
      2) Install and assemble modular patch panels and horizontal management panels according to the manufacturer's instructions.
      3) Install the patch panels and the horizontal management panels as shown on the Drawings.
      4) Terminate cables in sequential order using the link's identifier starting at the top left and completing a panel before moving to the next panel below.
4. Cable routing and dressing at workstations:
   a. Provide 12" to 18" cable slack at each workstation outlet, length not to exceed permanent link maximum length requirement. Place the slack within ceiling space neatly on a cable hanger or other approved cable support device.
   b. Route to partition furniture mounted faceplates:
      1) Route cables from primary or secondary pathway within ceiling through the furniture partition feed pathway (stub from wall or floor box) into opening at bottom of furniture system. Exercise caution to prevent scraping, cutting or other damage to cable jacket.
      2) Provide spiral wrap around cables from furniture-feed pathway to point where cables enter furniture.
5. Termination at the workstation outlets:
   a. Provide device components, connectors, and accessories required for a complete installation. Install and assemble connectors, jacks, adapters, termination apparatus, accessories and associated management apparatus according to the manufacturer's instructions.
   b. Connector color shall match the faceplate.
   c. Provide "fog white" connectors for data links and "dark blue" connectors for voice links.
   d. Wall mounted standard devices:
      1) Install devices at heights indicated on drawings.
      2) Mount faceplates plumb, square and at the same level as adjacent power receptacles.
      3) Patch gaps around faceplates so that faceplate covers the entire wall opening.
   e. Partition furniture mounted devices:

1) Coordinate installation of the faceplate adapters with the furniture contractor, including color.
2) Mount faceplate adapters into the designated openings for horizontal cables.

f. Terminate cables and twisted pairs in accordance with the manufacturer's latest installation requirements and TIA/EIA-568-B standard installation practices. Terminate cable pairs onto the connector compliant to T568A wiring.

6. Patching and crossconnecting:
   a. In equipment rooms, provide one modular patch cord for the first data connector in each workstation outlet. Install from the horizontal termination field to the network switches/equipment. Neatly dress patch cords within the horizontal and vertical cable management components.
   b. In equipment rooms, provide one modular patch cord for the first voice connector in each workstation outlet. Install from the horizontal termination field to the voice field. Neatly dress patch cords within the horizontal and vertical cable management components.
   c. Provide one 1-pair crossconnect for each workstation outlet. Install from backbone twisted pair 110 terminal blocks to the pre-wired 110 terminal blocks. Neatly dress patch cords within the horizontal and vertical cable management components.

3.03 LABELING

A. All cable plant labeling and administration documentation shall conform to ANSI/TIA/EIA 606-A Administration Standard.

B. The cables within the rack or cabinets shall be numbered for identification.

C. Label media shall be black typeface on white tape. Tape material shall be ½" wide.

D. Components shall be marked where they are administrated (label at all punch down points, panels, blocks, outlets, etc.).

E. Industry standard color fields should be used where applicable as described in the Standards.

F. Patch Panels shall be identified with the IDF Number and an alphabetical identifier, beginning with the letter A for the first patch panel, B for the second, etc.

G. All pathways labeled (conduit, trays, etc.).

H. Contractor will provide tags, straps and adhesive labels. These tags, straps and adhesive labels shall be of high quality that will endure over time.

I. Hand written labels are not acceptable.

J. Each drop shall have a unique label throughout the site. This would allow a cable management system to track each cable pair.

K. UTP Labeling:
   d. Wiring termination locations shall be labeled to corresponding pairs at the MDF/IDF and at each workstation end.
   e. Cables shall be labeled no more than 3" back from each end of the termination point with a cable label that matches the faceplate labeling.

L. Labeling Scheme:
   1. Workstation Labeling:
      a. The labeled is to contain the IDF Number, the Patch Panel Alphabetical Identification and the port in the patch panel that the drop is located in, separated by a period.

1) Example 1.1A.01 for port one in the patch panel or 1.1A.4-8 for multiple locations on a single faceplate indicating ports 4 through 8 on the Patch Panel A.
2) The label shall be placed under the clear plastic window on the faceplate.

2. Closet Labeling:
   a. The District shall provide the IDF number for each IDF location.
   b. Patch panel shall be labeled with the Room # the cable terminates in.
      1) Example K01, RM3, etc.
      2) The label shall be placed under the clear plastic window on the patch panel.
3. Fiber Optics Labeling:
   a. Fiber termination locations shall be labeled to corresponding fiber strands pairs at the MDF or IDF.
   b. Cables shall be labeled approximately 12 inches back from the point where the cable enters the fiber enclosure with a cable label that identifies the origin and destination of the cable.
   c. Closet labeling; each connection shall be labeled denoting each strands color, origin and destination IDF numbers.
   d. The type (single-mode or multi-mode) of fiber optic cable used shall be clearly labeled on the fiber patch panel per drawn details.
   e. Color-coding shall conform to EIA/TIA specifications.
4. IP CAMERA labeling:
   a. The same unique identifier shall be used at the camera, jack, patch panel, breaker box, etc. (i.e. RTJ01, CCE02, etc.) The camera identifier(s) will be provided in the scope of work.
   b. Label each patch panel and port with the same identifier on both sides of the termination.
   c. Label each horizontal cable within one foot of the end with the same identifier.

3.04 FIELD QUALITY CONTROL AND TESTING

A. Contractor is responsible for supplying all of the required test equipment used to conduct acceptance tests.
District reserves the right to be present during any or all of testing.
All cabling not tested strictly in accordance with these procedures shall be re-tested at no additional cost to the District.
100% of the installed cabling must be tested. All tests must pass acceptance.
Test equipment shall be fully charged prior to each day's testing.

B. Test reports must be submitted in hardcopy and electronic format. Hand-written test reports are not acceptable.

C. Electronic reports with hardcopy summaries are preferred. Hardcopy summary reports shall contain the following information on each row of the report: circuit ID, test specification used, length, date of test, and pass/fail result.

D. Electronic reports are to be submitted on CD/DVD format. If proprietary software is used, CD shall contain any necessary software required to view test results. If the results are delivered in a standard format like Excel, Access, CSV files, etc. then software to read these files are not provided. Electronic reports must be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate must reference traceable circuit numbers that match the electronic record.

E. Test reports shall include the following information for each cabling element tested:
1. Wire map results that indicate the cabling has no shorts, opens, miswires, split, reversed, or crossed pairs, and end to end connectivity is achieved.

2. For Category 6A/5E cabling: Attenuation, NEXT, PSNEXT, Return Loss, ELFEXT, and PSELFEXT data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions when required by the appropriate standards. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
3. Length (in meters), propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
4. Cable manufacturer, cable model number/type, and NVP
5. Tester manufacturer, model, serial number, hardware version, and software version
6. Circuit ID number and project name
7. Auto-test specification used
8. Overall pass/fail indication
9. Date of test
10. Test reports shall be submitted within 7 business days of completion of testing.

F. TEST EQUIPMENT

1. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years experience in producing field test equipment. Manufacturers must be ISO 9001 certified.
2. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.
3. Test adapter cables must be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.
4. Baseline accuracy of the test equipment must exceed TIA Level III, as indicated by independent laboratory testing.
5. Test equipment must be capable of certifying Category 6A and 5E links.
6. Test equipment must have a dynamic range of at least 100 dB to minimize measurement uncertainty.
7. Test equipment must be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
8. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
9. Test equipment must be capable of running individual NEXT, return loss, etc measurements in addition to auto-tests. Individual tests increase productivity when diagnosing faults.
10. Test equipment must include a library of cable types, sorted by major manufacturer.
11. Test equipment must store at least 1000 Category 6A or 5E auto-tests in internal memory.
12. Test equipment must be able to internally group auto-tests and cables in project folders for good records management.
13. Test equipment must include DSP technology for support of advanced measurements.
14. Test equipment must make swept frequency measurements in compliance with TIA standards.
15. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector.
16. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

3.05 INSPECTION AND ADJUSTMENTS

A. Contractor shall inspect all installed Work in conjunction with the General Contractor and develop a "punchlist" for all items needing correction. Provide punchlist to the Engineer prior to their final walk of Project.

B. Punchlist work and the required remediation shall be performed prior to system final acceptance.

C. Replace or repair work completed by others that was defaced or destroyed during the installation of the telecommunication cabling system by this contractor.

D. Make changes to adjust the system to optimum operation for final use. Contractor is responsible for making changes to the system such that any defects in workmanship are correct and all cables and the associated termination hardware passes the minimum test requirements.

3.06 FINAL ACCEPTANCE

A. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.

B. The Owner or Owner's representative will conduct a final job review once the contractor has finished the job. The review will take place within one week after the contractor notifies the owner.

C. Two copies of all certification data and drawings for all identifications shall be provided to the Owner before the Owner's review.

D. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.

E. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the contractor.

F. In the event that repairs or adjustments are necessary, the contractor shall make these repairs at his own expense. All repairs shall be completed within 10 days from the time they are discovered.

3.07 CLEANING

A. Remove all unused, excess and left over products, to include debris, spills, and installation equipment.

B. Leave finished work and adjacent surfaces in neat, clean conditions with no evidence of damage.

C. Legally dispose of debris.

D. Clean installed products in accordance with manufacturer's instructions prior to final punchlist.

3.08 TRAINING

A. At the completion of all Work, a period of not less than 16 hours shall be allocated by the Contractor for instruction and training for the Owner Representative. The Cabling Contractor will need to describe how the cable from each coverplate is separated between different patch panels, how cross-connects are made and other basic cable plant management skills.

B. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION [26 71 13]

SECTION 26 76 13

SCHOOL COMMUNICATION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Provide mew public address and wireless clock components compatible with existing campus systems. Match District Standards, refer to campus-wide system upgrade plans.

B. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Existing School Communication System
   2. Interior Speakers
   3. Exterior Speakers
   4. Analog Clocks
   5. Accessories.

C. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Electronic Industries Association (EIA):
      EIA REC 127-49; Power Supplies.
      EIA RS 160-51 Sound Systems.
      EIA RS 299-A; Loudspeakers, Dynamic Magnetic Structures and Impedance.
      EIA RS 310-A; Racks, Panels and Associated Equipment.
      EIA SE 101-A--49; Amplifiers for Sound Equipment.
      EIA SE 103-49; Speakers for Sound Equipment.
      EIA SE 105-A; Microphones for Sound Equipment.
   2. Underwriters Laboratories, Inc. (UL):
      UL 13; Power-Limited Circuit Cables
      UL 50; Enclosures for Electrical Equipment.
      UL 813; Commercial Audio Equipment.

1.03 SYSTEM OVERVIEW AND SCOPE OF WORK

A. The work provided herein consists of furnishing and installing all equipment, cabling and labor required for a complete, operable, new computer based administrative communication and control system as shown on the plans and specifications.

B. The system shall provide a communications path to all classrooms, workrooms, multi-purpose rooms, offices and corridor speaker locations and all exterior speaker locations. The communications path shall be separate from voice processing system allowing simultaneous use of classroom telephone and receipt of intercom pages to the speaker without interruption.

C. The equipment specified herein and shown on the drawings is based upon equipment as manufactured by Three Sixty. The intent is to establish a standard of quality, function, and features. It is the responsibility of the bidder to ensure that the system meets or exceeds all standards set forth in these specifications.

D. The contractor shall provide all support to the District to interface the system to other communication devices.

E. The installation contractor shall be factory authorized to install, program and maintain the voice communication system.

1.04 SUBMITTALS

A. Contractor is to submit the following prior to construction for approval.

B. Contractor will provide, prior to installation, a current letter of recommendation from the manufacturer, addressed to the owner. Letter of recommendation must be given to General Contractor at time of bid. Contractor must be certified with the manufacturer at least twelve (12) months prior to letter of recommendation. Please reference project number.

C. Contractor will provide data of factory certified installers experience and qualifications, which shall include three (3) years on projects of similar complexity. Include names and locations of two (2) projects successfully completed using a Three Sixty Voice Communications & Sound System. Include written certification from users that systems have performed satisfactorily for not less than 18 months.

D. Provide documentation stating you have been in the telecommunication contracting business for a minimum of five (5) years under the same name and are located within a four (4) hour response time of the District.

E. Product Data:
   1. Manufacturer's data, user and installation manuals for all equipment and software programs including computer equipment and any other equipment required for the Voice Communications & Sound System
   2. Preparation instructions and recommendations
   3. Storage and handling requirements and recommendations
   4. Installation methods
   5. Labeling and schematic for cabling and components. Voice Communications & Sound System contractor must coordinate with Electrical contractor for labeling of cable.
   6. Parts list and quantity of each part

F. Shop drawings shall provide details of proposed system and the work to be provided. Include point-to-point drawings of systems and wiring diagrams of individual devices.
   1. Detailed wiring diagrams and system description
   2. System device locations on architectural floor plans
   3. Full Schematic of system, including wiring information for all devices

G. Training Schedule to provide details for the District staff. Include time line with class types and descriptions and amount of people that can attend along with location.

1.05 CLOSE OUT

A. Documentation to be submitted by the Contractor upon completion of system installation:
   1. Upon completion of installation, the Contractor shall prepare "As Builts" drawings of the system. These As Builts shall be 30 inches by 42 inches (76 cm by 107cm) drawings of each floor plan indicating exact device locations, cable routes and wire numbers as tagged on the cable tag.
   2. The contractor shall provide an electronic copy of As Built drawings in auto Cad 2016 or newer and a pdf copies of all floor plans.
   3. As Builts shall be submitted to the owner for approval prior to the system acceptance walk through.

4. Operation and maintenance manuals: three sets of operating manuals shall be provided electronically and in written binder format explaining the operation and maintenance of the system.
5. Maintenance required and maintenance schedule
6. The system contractor shall generate a list of call stations and their associated rooms to be given to the school.

1.06 DELIVERY STORAGE AND HANDLING

A. Deliver materials in manufacturers original new, unopened, undamaged containers; and unharmed original identification labels.

B. Store products in manufacturers unopened packaging until ready for installation

C. Protect and store materials from environmental and temperature conditions following manufacturer's instructions.

D. Handle and operate products and systems according to manufacturer's instructions

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Intercom: CareHawk,

B. Wireless Clock: Sapling

2.02 SYSTEM COMPONENTS

A. Central System Equipment: Existing. Provide a new 16-port speaker card as required.

B. Intercom System Speakers
   1. Interior 24/70V Speakers
      a. The loudspeaker shall be an 8" (203mm) dia., dual cone type with frequency response of 50Hz to 18kHz (±10dB).
      b. Loudspeaker shall include a factory-wired 25/70.7V transformer with power taps of .25, .5, 1, 2, and 4 watts. The baffle shall be treated 14-gauge steel finished in baked white powder epoxy.
      c. The system shall utilize an interior steel security screen between the speaker and baffle opening.
      d. The speaker shall fit over the existing enclosure and shall be approximately 11.6" x 11.6" square.
      e. Speaker Part #: TQS01
   2. Exterior 24/70V Speakers
      a. Unit shall be 8" diameter loudspeaker /transformer combination
      b. The low-frequency reproducer cone shall be a full 8" (203mm) in diameter and the high frequency reproducer cone shall be 3" (76mm) in diameter. The woofer shall have a 10oz. (260g) ceramic magnet; the tweeter shall have a 2.35oz. (67g) ceramic magnet. The two reproducer sections shall be coupled through a built-in crossover network. The crossover frequency shall be at 2800Hz. Frequency response range shall be 70Hz – 15.5kHz, (±5dB). Sensitivity shall be 98dB at 1 Watt/ 1 meter. Voice coil impedance shall be 8Ω.
      c. Low frequency voice coil diameter shall be 1" (25mm) and operate in a magnet field of at least 10,600 gauss.
      d. Transformer primary voltage shall be 25V/70.7V with a frequency response range of 100Hz – 10kHz and power taps at .5, 1, 2, and 4 watts. Insertion loss shall not

exceed 1.5dB. The maximum depth of the loudspeaker shall not exceed 27⁄8" (73mm).

C. Battery powered analog clock:

1. The clock shall require fewer than five (5) minutes to perform a correction of the hand positions.
2. The clock shall have a smooth surface ABS case which can be attached either directly to the wall, or to a standard-sized gang box.
3. The clock case shall be produced in round cases with diameter 12 inches, or square cases with widths of 12 inches. The dial is to be made of durable polystyrene material. The crystal is to be made of shatterproof, side molded polycarbonate.
4. The clock model shall be SAL-4BS-12R-0, provide with all mounting hardware required to install as indicated on the plans.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of the intercom system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Verify exact speaker locations with respect to light fixtures, mechanical diffusers, sprinkler head and fire alarm devices.

B. Review any conflicts with the project manager prior to installation.

3.03 INSTALLATION

A. General:
1. Install the intercom system in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
2. Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Wiring:
1. Building wiring to analog speaker devices shall be re-used.
2. OSP 25-pair cable will be provided between the intercom headend and the building signal termination can (STC).
3. Patching between the headend and site cable.
4. Patching between the building analog speaker cables and clock cables and site cable.
5. Wiring within the headend and interface to distributed cable shall be new.

3.04 GROUNDING

A. Provide equipment-grounding connections for the intercom system. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pick-up, cross talk and other impairments. Provide 5-ohm ground at main equipment location. Measure, record and report ground resistance.

C. Provide a #6 insulated ground wire from the system ground bus in the equipment cabinets and racks to the nearest cold water pipe.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the intercom system.

B. At least three weeks prior to any testing, notify the Engineer so that arrangements can be made for witnessing tests, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

C. Prefunctional testing:
   1. Visual and mechanical inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
      c. Compare nameplate information and connections to Contract Documents.
      d. Check tightness of all connections.
      e. Check that all covers, barriers and doors are secure.
   2. Electrical tests:
      a. Perform complete testing to determine conformance with the requirements of the Contract Documents.
      b. Operational test: Perform an operational test to verify conformance of system performance and conditions to Contract Document within Manufacturer's tolerances. Perform tests that include originating program and page material at microphone outlets, all preamplifier program inputs and all other inputs. Observe sound reproduction for proper volume levels and freedom from noise.
      c. Power output test: Measure the electrical power output of each power amplifier at normal gain setting at 50, 1,000 and 12,000 Hz. The maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
      d. Provide a list of final tap settings of speaker line matching transformers.
   3. Test report:
      a. Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
      b. Submit two typed copies of the test report in a neatly bound folder for review and approval. Failure to comply with this will result in a delay of final testing and acceptance.

D. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and Engineer's hourly rate.

E. Contractor shall replace at no cost to the Owner all devices which are found defective or do not operate within factory specified tolerances.

F. Contractor shall submit the testing final report to the Engineer for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observations, deficiencies and remedies. Include a copy of the test report in the Owner’s operation and maintenance manuals.

3.06 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean the PA system components per Manufacturer's approved methods and materials. Remove all paint splatters spots, dirt and debris.

3.07 TRAINING

A. Factory authorized service representative shall conduct a 2 hour training seminar for Owner's representative upon completion and acceptance of system. Instructions shall include, operation of system, accessing the system from a telephone, safe operation, maintenance and testing of equipment.

B. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION [27 51 23]

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01500, Construction Facilities and Temporary Controls.

B. Section 015713, Erosion Control

C. Section 312333, Trenching and Backfilling.

D. Section 321600, Site Concrete.

1.03 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner’s testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner’s testing lab representatives nor the testing by the Owner’s testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting of inadequate compaction or moisture content is the sole responsibility of the contractor.

D. Tests (See Part 3 for Compaction Testing).

E. Contractor shall be solely responsible for all subgrades built. Failures resulting from inadequate compaction or moisture content are the responsibility of the contractor. Contractor shall be solely responsible for any and all repairs.

1.04 SUBMITTALS

A. Refer to Section 013300.

B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.05 WARRANTY

A. Refer to General Conditions and Section 017836.

1.06 REFERENCES AND STANDARDS

A. General: Site survey, included in the drawings, was prepared by Warren Consulting Engineers,

and is the basis for data regarding current conditions. While the survey is deemed generally accurate, there exists discrepancies and variations due to elapsed time, weather, etc. Existing dirt grades may vary 0.2 ft. from that shown.

B. Site Visitation: All bidders interfacing with existing conditions shall visit the site prior to bid to verify general conditions of improvements. Discrepancies must be reported prior to the bid for clarification.

C. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

D. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.

E. ANSI/ASTM D1557-02e2 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

F. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).

G. ANSI/ASTM D 422-63(2007) E1 Test Method for Particle Size Analysis of Soil.

H. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

I. CALTRANS Standard Specifications Section 17.

J. CAL-OSHA, Title 8, Section 1590 (e).

K. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.07 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.08 PROJECT CONDITIONS

A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.

B. Excavation dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for excavation dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.09 EXISTING SITE CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.10 ON SITE UTILITY VERIFICATION AND REPAIR PROCEDURES

A. Ground-breaking requirements:
   1. All underground work performed by a Contractor must be authorized by the District's Construction Manager or the Low Voltage Consultant prior to start of construction.
   2. The Contractor is to obtain and keep the original School's construction utility site plans on site during all excavation operations. Contractor can contact the District's Construction Manager, Facilities Manager, or the Low Voltage Consultant to procure the drawings.

B. Underground Utility Locating:
   1. The contractor shall hire an Underground Utility Locating Service to locate existing underground utility pathways in areas affected by the scope of work for excavation.
   2. Contractor must use an underground utility locator service with a minimum of 3 years' experience. The equipment operator must have demonstrated experience. Contact Norcal Underground Locating (800/986-6722) or Precision Locating (800/577-7324)
   3. The Underground Utility Locator Service must have the use of equipment with the ability to locate by means of inductive clamping, induction, inductive metal detection, conductive coupling, or TransOnde (Radio detection) to generate signals, passive locating (free scoping) for "hot" electric, and metal detector.
   4. The Underground Utility Locator Service must be able to locate existing utilities at a depth of at least 72".
   5. The Underground Utility Locator Service must be able to locate but are not limited to locating the following types of utility pathways:
      a) All conduit pathways containing 110 volt or greater 50-60Hz electrical wire.
      b) All conduit pathways containing an active cable TV system.
      c) All conduit pathways containing wire or conductor in which a signal can be attached and generated without damaging or triggering the existing systems.
      d) All empty conduit pathways or pipe in which a signal probe or sonde (miniature transmitter) can be inserted.
      e) All conduit pathways containing non-conductive cables or wires in which a signal probe or sonde (miniature transmitter) can be inserted.
      f) All plastic and other nonconductive water lines in which a TransOnde Radio detection) or other "transmitter" can be applied to create a low frequency pressure waive (signal) without damaging or triggering the existing systems.
      g) All copper or steel waterlines and plastic or steel gas lines
   6. All markings made by the Underground Utility Locator Service or other shall be clear and visible.
   7. The contractor shall maintain all markings made by Underground Utility Locator Service or other throughout the entire length of the project.
   8. The Underground Utility Locator Service shall provide the contractor with two sets of maps showing the location of utilities and average depth. They will be referenced to permanent buildings. Contractor will deliver one copy to the district at no additional charge.
   9. Contractor is responsible to contact Underground Service Alert (U.S.A. 800/227-2600) and receive clearance prior to any excavation operations.
   10. Contractor shall inform the (District's Construction Manager) (Architect) (Owner) no later than five (5) days prior to the date scheduled for the utility locator service to be on site.

1.11 PROTECTION

A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and

property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullying of sides of excavation.

E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

H. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

1.12 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

B. Excessively wet fill material shall be bladed and aerated per section 3.08, B.

1.13 TESTING

A. General: Refer to Section 014500 – Quality Requirements.

B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.
   1. If Contractor elects to process or mine onsite materials for use as Suitable Fill, Aggregate Sub Base, Aggregate Base, Rock, Crushed Rock or sand the cost of all testing of this material shall be paid for by the Contractor.
   2. Testing of import fill for compliance with Department of Toxic Substance Control (DTSC) shall be paid for by the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Engineered Fill Materials: All fill shall be of approved local materials supplemented by imported fill if necessary. "Approved" local materials are defined as local soils tested and approved by Geotechnical Engineer free from debris, and concentrations of clay and organics; and contain rocks no larger than 3-inches in greatest dimension. The soil and rock should be thoroughly blended so that all rock is surrounded by soil. This may require mixing of the soil and rock with a dozer prior to placement and compaction. Clods, rocks, hard lumps or cobbles exceeding 3-inches in final size shall not be allowed in the upper 12 inches of any fill.

B. Imported Engineered Fill Material: Imported fill may be required to complete work. Proposed import fill material shall meet the above requirements; shall be similar to the native soils. Import fill shall meet the above requirements; shall have plasticity index of 15 or less; an Expansion Index of 20 or less; be free of particles greater than three-inch (3") in largest dimension; be free of contaminants and have corrosion characteristics within the acceptable limits. All import fill material shall be tested and approved by Soils Engineer prior to transportation to the site. Proposed fill material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.

1. DTSC TESTING: Site work contractor is to coordinate testing with an analytical lab, hired by the owner, licensed by the State of California for the DTSC testing. The costs associated with the testing will be paid by the contractor.
2. DTSC testing shall include documentation as to the previous land use, location, and history. Soils shall be analyzed for all compounds of concern to ensure the imported soil is uncontaminated and acceptable. Testing shall be performed per the recommendations included in DTSC Imported Fill Advisory http://www.dtsc.ca.gov/Schools/upload/SMP FS Cleanfill-Schools.pdf). Soils shall be tested prior to import to the project site.
3. Lab shall determine geographically which tests and analysis comparison will be appropriate for the testing. (CAM 17 / Title 22); (RWQCB) Regional Water Quality Control Board; or (OEHHA) Office of Environmental Health Hazard Assessment.
4. Frequency of testing shall be conducted in accordance with DTSC's Imported Fill Advisory as follows;

Fill Material Sampling Schedule

Area of Individual Borrow Area	Sampling Requirements
2 Acres or less	Minimum of 4 samples
2 to 4 Acres	Minimum of 1 sample every ½ Acre
4 to 10 Acres	Minimum of 8 Samples
Greater than 10 Acres	Minimum of 8 locations with 4 subsamples per location
Volume of Borrow Area Stockpile	
Up to 1,000 Cubic Yards	1 sample per 250 cubic yards
1,000 to 5,000 Cubic Yards	4 samples for the first 1000 cubic Yards + 1 sample per each additional 500 cubic yards
Greater than 5,000 Cubic Yards	12 samples for the first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

5. Reports/ Documentation
   a. Results of the testing analysis shall be sent to the Owner; Architect; Project Inspector, Project Civil Engineer, DTSC, and DSA. Letter shall reference DSA file and application numbers.

C. Landscape Backfill Material:
1. The top 3" of native topsoil stripped from the site may be used for landscape backfill.

D. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.

E. Aggregate Base: Provide Class 2 3/4" Aggregate Base conforming to standard gradation as

specified in Cal Trans Standard Specifications, Section 26,-1.02A.

PART 3 – EXECUTION

3.01 INSPECTION LAYOUT AND PREPARATION

A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence

B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.

C. Verify that specified items may be installed in accordance with the approved design.

D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 PERFORMANCE

A. GENERAL:
1. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.
2. Archaeological Artifacts: Should any artifacts of possible historic interest be encountered during earthwork operations, halt all work in area of discovery and immediately contact the Architect for notification of appropriate authorities.
3. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density determined by ASTM D1557 Compaction Test method, and such expressed percentage thereof will be minimum acceptable compaction for specified work.
4. Moisture Content: Moisture content shall be as noted below and as called for on the plans. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.03 DEMOLITION, DISPOSAL AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

A. All other obstructions, such as abandoned utility lines, septic tanks, concrete foundations, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials, dish shaped, and widened as necessary to permit access for compaction equipment. Areas exposed by any required over-excavation should be scarified to a depth of 12", moisture-conditioned to near optimum moisture content, and recompacted to at least 90% of the maximum dry density.

3.04 TESTING AND OBSERVATION

A. All grading and earthwork operations shall be observed by the Geotechnical Engineer or his representative, serving as the representative of the Owner.

B. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.

C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer or his representative. The Contractor shall notify the Geotechnical Engineer at least two (2)

working days prior to commencement of any aspect of the site earthwork.

D. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer or Architect/Engineer.

E. After each rain event Geotechnical Engineer shall test fill material for optimum moisture. Do not place any fill material until desired moisture is achieved.

3.05 CLEARING AND GRUBBING

A. Prior to grading, remove all debris off-site. Remove trees and brush including the root systems. Holes resulting from tree and brush removal should be prepared and backfilled in accordance with paragraphs 3.07, 3.08, 3.09, and 3.10. This may require deepening and/or widening the holes to adequately remove disturbed soil and provide room for compaction equipment. Strip the surface of all organics. Stripping's meeting the requirements of Section 329000 may be used in landscape areas only.

3.06 CUTTING

A. Building pads that are located within a cut/fill transition area will have to be overexcavated to provide a semi-uniform fill beneath the building pad. The portions of building pads located in cut areas shall be overexcavated to provide no more than 1 foot difference in fill placed in the same building pad.

B. Do all cutting necessary to bring finish grade to elevations shown on Drawings.

C. When excavation through roots is necessary, cut roots by hand.

D. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.

3.07 STRUCTURAL EXCAVATION

A. General: Excavate to bear on firm material at contract depth shown on Structural Drawings.

B. Footings: All footing excavations shall be of sufficient width for installation of formwork, unless earth will retain its position during concreting. All portions of footings above grade must be formed. In the event that footings are placed against earth, footing widths below grade shall be increased 2 inches from those shown on Drawings and positive protection shall be provided for top corners of trench.

C. Unsuitable Ground: Any errors in structural excavation, soft ground, or clay soils found when excavating shall be reported to Architect. In no case shall work be built on any such soft or clayey unsuitable surface without direction from the Architect. Restore excavations to proper elevation with engineered fill material compacted to 90% of dry density.

3.08 SUBGRADE PREPARATION

A. Grade compact and finish all subgrades within a tolerance of 0.10' of grades as indicated on Drawings and so as not to pool water. Subgrade within building pads and concrete walks shall be within 0.05' of grades indicated.

B. After clearing, grubbing and cutting, subsurface over-excavated to proposed subgrade elevations. Exposed soil shall be static rolled and a geogrid, Tensar BX1100 or approved equal placed per manufacturers requirements. If the existing soils are at a water content higher than specified, the

contractor shall provide multiple daily aerations by ripping, blading, and/or disking to dry the soils to a moisture content where the specified degree of compaction can be achieved. After seven consecutive working days of daily aerations, and the moisture content of the soil remains higher than specified, the contractor shall notify the architect. If the existing soils have a moisture content lower than specified, the contractor shall scarify, rip, water and blade existing soil to achieve specified moisture content. The contractor shall make proper allowance in schedule and methods to complete this work.

C. Subgrade in areas to receive landscaping shall be compacted to (90%).

D. Where Contractor over-excavates building pads through error, resulting excavation shall be recompacted as engineered fill at Contractor's expense.

3.09 PLACING, SPREADING AND COMPACTING FILL MATERIAL IN BUILDING PAD AND PAVEMENT AREAS

A. Selected fill material shall be placed in layers which, when compacted, shall not exceed 8 inches in uncompacted thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity in moisture content.

B. Selected fill material shall be moisture-conditioned to specified moisture content. Selected fill material shall be unfrozen. When moisture content of fill material is below that specified, add water until proper moisture content is achieved. When moisture content is above that specified, aerate by blading or other methods mentioned in 3.08 B until moisture content is satisfactory.

C. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to a minimum of 95% as determined by the ASTM D1557 Compaction Test. Compact each layer over its entire area until desired density has been obtained.

D. Recompaction of Fill in Trenches and Compaction of Fill Adjacent to Walls: Where trenches must be excavated, backfill with material excavated. Place in lifts that when compacted do not exceed 6”, moisture conditioned to 2% above optimum moisture content, and compact to a minimum of 95% relative compaction in building pad and paved areas, and to 90% relative compaction in landscape areas.

E. Jetting of fill materials will not be allowed.

3.10 FINAL SUBGRADE COMPACTION

A. Building Pads and Asphalt: Upper 18" of all final building pad and asphalt subgrades shall consist of 18” Class II aggregate base over a geogrid.

B. Concrete Flatwork Areas: Upper 12" of all final flatwork shall consist of 12” Class II aggregate base over a geogrid.

C. Other Fill and Backfill: Upper 12” of all other final subgrades or finish grades shall be compacted to 90% of maximum dry density.

D. Gravel Fill: Do not place compacted gravel fill until after underground work and foundations are in place. Compact gravel fill with vibratory plate or similar equipment to preclude settlement.

3.11 PLACING, SPREADING, AND COMPACTION OF LANDSCAPE BACKFILL MATERIALS

A. All landscaped areas shall receive topsoil. After subgrade under landscape area has been scarified and brought to 90% maximum dry density, top soil shall be placed evenly to depth of 12" at 85% of maximum dry density.

B. Project Inspector must verify that materials are uniformly spread to minimum depth specified.

3.12 SLOPE CONSTRUCTION

A. Cut slopes shall be constructed to no steeper than 3:1(horizontal:vertical). Fill slopes shall be constructed to no steeper than 2:1 (horizontal:vertical). Prior to placement of fill on an existing slope the existing slope shall be benched. The benches shall be in a ratio of 2 horizontal to 1 vertical. The face of the fill slopes shall be compacted as the fill is placed, or the slope may be overbuilt and then cut back to the design grade. Compaction by track walking will not be allowed.

3.14 FINISH GRADING

A. At completion of project, site shall be finished graded, as indicated on Drawings. Finish grades shall be “flat graded” to grades shown on the drawing. Mounding of finish grades will not be allowed unless otherwise directed on the landscape drawings. Tolerances for finish grades in drainage swales shall be +-0.05’. Tie in new and existing finish grades. Leave all landscaped areas in finish condition for lawn seeding. Landscaped planters shall be graded uniformly from edge of planter to inlets. If sod is used for turf areas the finish grade on which it is placed shall be lowered to allow for sod thickness.

3.15 SURPLUS MATERIAL

A. Excavated material not required for grading or backfill shall be removed from site at contractor’s expense.

3.16 CLEANING

A. Refer to Section 01710.

B. Remove from fill all vegetation, wood, form lumber, casual lumber, and shavings, in contact with ground; buried wood will not be permitted in any fill.

END OF SECTION [31 00 00]

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.01 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The general conditions, supplementary conditions and Division 1 are fully applicable to this section as if repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01500, Construction Facilities and Temporary Controls.

B. Section 310000, Earthwork.

1.03 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. Contractor / Installer shall have been in business for five (5) years providing/finishing similar size projects and complexity.

1.04 SUBMITTALS

A. Refer to Section 01330.

B. Submit Manufacturers data and shop drawings.

1.05 WARRANTY

A. Submit fully executed warranty for work and materials in this section per 01785.

1.06 REFERENCES AND STANDARDS

A. California Building Code current edition.

B. California Plumbing Code current edition.

1.07 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.08 PROJECT CONDITIONS

A. Contractor shall acquaint himself with all existing site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make

Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

B. Field verify that all components, backing, etc. by others are installed correctly to proceed with installation of products as herein specified.

C. Trench dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for trench dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.09 PROTECTION

A. Adequate protection measures shall be provided to protect workers and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations. Repair all trenches in grass areas with new sod (seeding not permitted) and "stake-off" for protection.

B. Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Any construction review of the Contractor's performance conducted by the Architect or Owner is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.

D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullying of sides of excavation.

E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. Keep all excavations free from water during entire progress of work, regardless of cause, source or nature of water.

F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

H. Trees: Carefully protect existing trees which are to remain.

1.10 TRENCH SAFETY PROVISIONS

A. General Contractor shall be solely responsible for safety design, construction and coordination with agencies having jurisdiction. If such plan varies from shoring system standards established by Construction Safety Orders, plan shall be prepared by registered civil or structural engineer.

B. Nothing herein shall be deemed to allow use of shoring, sloping or protective system less effective than that required by Construction Safety Orders of California State Division of Industrial Safety.

C. When trenching through paved surface, provide steel trench plates to cover open trenches daily until trenches are backfilled.

1.11 SEASONAL LIMITS

A. No backfill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, full operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

B. Material above optimum moisture shall be processed per section 310000, 3.08, B.

1.12 TESTING

A. General: Refer to Section 01400 – Quality Requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Backfill materials: Pipeline and conduit trench backfill as shown on the plans and as specified below.
   1. ¾ inch crush rock.
   2. Native Materials: Soil native to Project Site, free of wood, organics, and other deleterious substances. Rocks shall not be greater than 3-inches.
   3. Sand: Fine granular material, free of organic matter, mica, loam or clay.
   4. Lean Mix Concrete/Controlled Density Backfill: 3 sacks of cement per yard plus sand.
   5. Class 2 aggregate base, ¾" rock, per Caltrans section 26-1.02B

B. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.

C. Provide other bedding and backfill materials as described and specified in Section 310000, Section 334000 and Divisions 15 and 16.

PART 3 – EXECUTION

3.01 INSPECTION

A. Verification of Conditions:
   1. Examine areas and conditions under which work is to be performed.
   2. Identify conditions detrimental to proper or timely completion of work and coordinate with General Contractor to rectify.

3.02 COORDINATION

A. General Contractor shall coordinate work as herein specified, in accordance with drawings and as required to complete scope of work with all related trades.

3.03 INSTALLATION

A. Perform work in accordance with pipe manufacturer's recommendations, as herein specified and in accordance with drawings.

3.04 TRENCHING

A. Make all trenches open vertical construction with sufficient width to provide free working space at both sides of trench around installed item as required for caulking, joining, backfilling and compacting; not less than 12 inches wider than pipe or conduit diameter, unless otherwise noted.

B. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.

C. Trench straight and true to line and grade with bottom smooth and free of edges or rock points.

D. Where depths are not shown on the plans, trench to sufficient depth to give minimum fill above top of installed item measured from finish grade above the utility as follows:
   1. Sewer pipe: depth to vary
   2. Storm drain pipe: depth to vary
   3. Water pipe - Fire Supply: 36 inches
   4. Water pipe – Domestic Supply: 30 inches

E. Where trench through existing pavement saw cut existing pavement in straight lines. Grind existing asphalt on each side of trench 3" wide x ½ the depth of the section. Apply tact coat to vertical surfaces before installing new asphalt. Replace asphalt and concrete pavement sections to matched existing conditions. In concrete pavement provide expansion and control joints to match existing joint layout.

3.05 BACKFILL

A. Pipe Trench Backfill is divided into three zones:
   1. Bedding: Layer of material directly under the pipe upon which the pipe is laid.
   2. Pipe Zone: Backfill from the top of the bedding to 6 inches (compacted) over the top of the pipe.
   3. Upper Zone: Backfill between top of Pipe Zone and to surface of subgrade.

B. Bedding: Type of material and degree of compaction for bedding backfill shall be as defined in the Details and Specifications.

C. Pipe Zone and Upper Zone Backfill:
   1. Type of material and degree of compaction Pipe Zone and Upper Zone Backfill shall be as required by Drawings, Details, & Specifications.
   2. Upper Zone Backfill shall not be placed until conformance of Bedding and Pipe Zone Backfill with specified compaction test requirements has been confirmed.
   3. Backfill shall be brought up at substantially the same rate on both sides of the pipe and care shall be taken so that the pipe is not floated or displaced. Material shall not be dropped directly on pipe.

D. Backfill Compaction:
   1. Backfill shall be placed in layers which, when compacted shall not exceed 6 inches in thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity. Do not backfill over, wet, frozen or soft subgrade surfaces. Employ a placement method that does not disturb or damage foundation walls, perimeter drainage, foundation damp-proofing, waterproofing or protective cover.
   2. When moisture content of fill material is below that required to achieve specified density, add water until proper moisture content is achieved. When moisture content is above that required, aerate by blading or other methods until specified moisture content is met, see section 310000, 3.08, B.
   3. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to 90% of maximum dry density while at specified moisture content. Compact each layer over its entire area until desired density has been obtained.
   4. The top 12 inches of subgrade compaction under pavement or building shall be per Earthwork section 310000.
   5. Compaction: All backfill operations shall be observed by the Inspector of Record and/or Geotechnical Engineer. Field density tests shall be made to check compaction of fill material. If densities are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified densities. Notify Inspector and Architect at least 24 hours in advance of any operation.

E. Backfill in Areas Previously Lime or Cement Treated

1. If trenching is necessary in areas that have been previously lime treated the contractor shall backfill the trench with class 2 aggregate base, with minimum section equal to the lime treated section and compacted to 95%.

3.06 TRENCH AND SITE RESTORATION

A. Finished surface of trenches shall be restored to a condition equal to, or better than the condition as existed prior to excavation work.

3.07 PROTECTION

A. Protect existing surfaces, structures, and utilities from damage. Protect work by others from damage. In the event of damage, immediately repair or replace to satisfaction of Owner.

B. Repair existing landscaped areas to as new condition. Replant trees, shrubs or groundcover with existing materials if not damaged or with new materials if required. Replace damaged lawn areas with sod, no seeding will be permitted.

C. Replace damaged pavement with new compatible matching materials. Concrete walks to be removed to nearest expansion joint and entire panel replaced. Asphalt to be cute neatly and replaced with new materials.

D. Any existing materials removed or damaged due to trenching to be returned to new condition.

3.08 SURPLUS MATERIAL

A. Remove excess excavated material, unused materials, damaged or unsuitable materials from site.

3.09 CLEANING

A. Refer to Section 01700.

B. Contractor will keep the work areas in a clean and safe condition so his rubbish, waste, and debris do not interfere with the work of others throughout the project and at the completion of work..

C. After completion of work in this section, remove all equipment, materials, and debris. Leave entire area in a neat, clean, acceptable condition.

END OF SECTION [31 23 33]

SECTION 32 12 00

ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01500, Construction Facilities and Temporary Controls.

B. Section 310000, Earthwork.

C. Section 312333, Trenching and Backfilling.

D. Section 334000, Site Drainage.

1.03 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner’s testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner’s testing lab representatives nor the testing by the Owner’s testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.

D. Contractor shall provide verification that asphalt mix temperature meets the requirements of this specification at time of application.

E. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the contractor.

F. Sieve analysis from testing laboratories identifying rock/sand percentages within the asphalt mix shall have a testing date within 90 days of contract signing.

G. Sieve analysis from a testing laboratory identifying rock/sand percentages within the class 2 aggregate base rock shall have a testing date within 90 days of contract signing.

1.04 SUBMITTALS

A. Refer to Section 01330.

B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.05 WARRANTY

A. Refer to General Conditions and Section 01785.

1.06 REFERENCES AND STANDARDS

A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.

C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).

E. ANSI/ASTM D 422-63 Test Method for Particle Size Analysis of Soil.

F. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

G. CALTRANS Standard Specifications.

H. CAL-OSHA, Title 8, Section 1590 (e).

I. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.07 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Base Course: Do not lay base course on muddy subgrade, during wet weather, or when atmospheric temperature is below 40 degrees F.
   2. Asphalt Surfacing: Do not apply asphaltic surfacing on wet base, during wet weather, or when atmospheric temperature is below 50 degrees F.

1.09 EXISTING SITE CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.10 PROTECTION

A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below

grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Any construction review of the Contractor's performance conducted by the owner's representative is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

D. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

E. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

F. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

1.11 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.12 TESTING

A. General: Refer to Section 01400 – Quality Requirements.

B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and backcharged to Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sterilant: Soil sterilizer shall be CIBA GEIGY's Pramatol 25-E, Treflan EC or Thompson-Hayward Casoron.
1. Soil sterilizer shall be applied in strict accordance with manufacturer's instructions.

B. Base Course Aggregate: State Specifications, Section 26, Class 2 aggregate base (3/4" max.).

C. Asphalt Binder: Steam-refined paving asphalt conforming to State Specifications, Section 92, viscosity grade PG 64-10. Asphalt binder additives for WMA per Caltrans approved list of manufacturer's.

D. Liquid Asphalt Tack Coat: Per CALTRANS section 94.

E. Surface Course Aggregate: Mineral aggregates for Type "B" asphalt concrete, conforming to State Specifications 39-2.02, Type B, ½" maximum, medium grading. 3/8" maximum grading at

Playcourt.

F. Seal Coat: shall be a pre-mixed asphalt emulsion blended with select fillers and fibers such as:
1. "Park-Top No. 302", Western Colloid Products.
2. "OverKote", Reed and Gram.
3. "Drivewalk", Conoco Oil.

G. Wood Headers and Stakes: Pressure treated.

H. Pavement Marking: Colors as directed by Architect. Colors of painted traffic stripes and pavement markings must comply with ASTM D 6628.
1. Waterborne traffic line - colors white, yellow and red, State specification PTWB-01R3.
2. Waterborne traffic line for the international symbol of accessibility and other curb markings – blue, red and green, Federal specification TT-P-1952F.

I. Precast Concrete Bumpers: 3000 psi at 28 day minimum strength; 48" length unless otherwise indicated; provide with steel dowel anchors and concrete epoxy.

J. Pavement Epoxy; K-Lite; Ktepx-590; Ennis Epoxy HPS2 or an approved equal.

K. Crack Filler;
1. Cracks up to ½": QPR model CAR08, 10oz asphalt crack filler; Star STA-FLEX Trowel Grade crack filler or approved equal.
2. Cracks ¼" – 1": "Docal 1100 Viscolastic, distributed by Conoco, Inc., Elk Grove, CA, (916) 685-9253, or approved equal.
3. Cracks greater than 1": Hot Mix, Topeka.

L. Reclaimed Asphalt Paugment (RAP). HMA Type A or Type B may be produced using RAP providing it does not exceed 15% of the aggregate blend.

2.02 MIXES

A. General: Plant mixed conforming to State Specifications, Section 39, Type B, ½" maximum, medium grading. 3/8" maximum grading shall be used at hardcourt.

B. Temperature of Hot Mix Asphalt: Not less than 275 degrees F nor more than 325 degrees F when added to aggregate.

C. Temperature of Hot Mix Aggregate: Not less than 250 degrees F nor more than 325 degrees F when asphalt is added.

D. Temperature of Hot Mix Asphalt Concrete: Asphalt shall be not less than 285 degrees at time of application, nor more than 350 degrees. Asphalt not meeting the required temperature shall not be used.

E. Temperature of Warm Mix Asphalt: Mixing and placement; Per the approved manufactures heat range recommendations for mixing and placement.

PART 3 - EXECUTION

3.01 EXAMINATION OF CONDITIONS

A. Conditions of Work in Place: Subsurfaces which are to receive materials specified under this Section shall be carefully examined before beginning work hereunder, and any defects therein shall be reported, in writing, to the Architect. Work shall not be started until such defects have been corrected. Starting of work shall imply acceptance of conditions as they exist.

3.02 PREPARATION

A. Sub-Grade: Clean, shape and compact to hard surface free from elevations or depressions exceeding 0.05’ in 10' from true plan. Compact per Section 310000. Compaction and moisture content shall be verified immediately prior to placement of aggregate base. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

B. Cleaning: Existing surfaces and new surface shall be clean of all dirt, sand, oil or grease. All cracks shall be cleaned and free of all debris and vegetation. Hose down entire area with a strong jet of water to remove all debris.

3.03 INSTALLATION

A. Headers:
1. General: Install as edging to asphalt paving, except where adjoining existing pavement, concrete curbs, walks or building.
2. Existing Headers: Remove existing headers where new paving will join existing. Saw cut existing asphalt to provide clean edge.
3. Lines and Levels: Install true to line and grade. Cut off tops of stakes 2-inches below top of header so they will not be visible on completion of job.

B. Asphalt Paving:
1. Base Course: Install in accord with State Specifications, Section 26. Compact to relative compaction of not less than 95%, ASTM D1557. The material shall be deposited on the subgrade in such a manner as to provide a uniform section of material within five percent tolerance of the predetermined required depth. Deposition will be by spreader box or bottom dump truck to prevent segregation of the material. The material so deposited on the subgrade shall have sufficient moisture which, in the opinion of the Architect is adequate to prevent excessive segregation. It shall then be immediately spread to its planned grade and cross section. Undue segregation of material, excessive drifting or spotting of material will not be permitted. If in the opinion of the site geotechnical engineer, the material is unsuitably segregated, it shall be removed or completely reworked to provide the desired uniformity of the material.
   a. Moisture content and compaction of base material shall be tested immediately prior to placement of asphalt paving.
2. Sterilant: Apply specified material at manufacturer's recommended rate. Applicator of sterilant material shall be responsible for determining location of all planter areas. Apply specified material over entire base course area just prior to application of asphalt. Follow manufacturer's printed directions.
3. Liquid Asphalt Tack Coat: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed.
4. Asphalt Concrete Surface Course:
   a. Comply with State Specifications, 39-6 except as modified below.
      1) Final gradation shall be smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 95% of the test maximum density determined by California Test Methods #304 and 375. Maximum variation 1/8 inch in 10' when measured with steel straightedge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. In no case shall accessible parking spaces or loading and unloading areas exceed 2% slope in any direction.
      2) Asphalt material shall be delivered to the project site in a covered condition to maintain acceptable temperature. Onsite inspector shall verify temperature of asphalt upon truck arrival to the site.
5. Placement and adjustment of Frames, Covers, Boxes and Grates: The Contractor shall

set and adjust to finish grade all proposed and existing frames, covers, boxes, and grates of all manholes, drop inlets, drain boxes, valves, cleanouts, electrical boxes and other appurtenant structures prior to placement of asphaltic concrete.

6. Water Testing: All paved areas shall be water tested, to check drainage, in the presence of the project inspector prior to placement of seal coat. The surface of asphalt paving shall not vary more than 1/8 inch above or below the grade established on the plans. If variations in grade are present, they will be corrected by overlaying paving and/or pavement removal and replacement as directed by the Architect.
7. Patching: Cut existing paving square and plumb at all edges to be joined by new paving. In trenches; grind existing asphalt on each side of trench 3" wide x ½ the depth of the section. Apply tact coat to vertical surfaces before installing new work. Warp carefully to flush surface, with seal over joints, and feather edge. Sawcut, remove and patch existing paving where cutting is necessary for installation of piping or conduits under Divisions 2, 15 and 16.

C. Pavement Marking: pavement markings shall be done only after the seal coat has thoroughly dried. Existing surfaces to be striped with traffic paint shall be cleaned of dust, dirt, grime, oil, rust or other contaminants which will impair the quality of work or interfere with proper bond of paint coats. Surfaces shall be thoroughly cleaned by whatever means necessary that will satisfactorily accomplish the purpose without damage to asphalt concrete. Provide measured layouts, temporary markings, templates, and other means necessary to provide required marking. Prepare and apply paint in accordance with manufacturer's instructions; paint shall be applied by spray and shall achieve complete coverage free from voids and thin spots. Where indicated on the Drawings, paint parking stall strips, lettering, arrows, accessible symbols, playfield markings, etc. on asphalt concrete paving. Paint strips shall be 4 inches wide (except otherwise indicated) and applied with two (2) coats of herein specified Traffic Line Paint; white (except as otherwise specified or indicated).

1. Paints shall be delivered to the site in unopened containers.
   a. Paint shall not be diluted, or watered down.
   b. Paint shall be applied in 10-12 wet mil thickness (4-6 mil dried). Each coat thickness shall be verified by the project inspector.
2. International Accessible Symbol: Symbol shall be white figures on a blue background. Blue shall be equal to color No. 15090 in Fed. Std. 595c. Lines and symbols shall be accurately formed and true to line and form; lines shall be straight and uniform in width. Painted edges shall be clean cut and free from raggedness, and corners shall be cut sharp and square. Tolerances: Apply striping within a tolerance 1/2 inch in 50 feet. Apply markings and striping to widths indicated with a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.

E. Colors: As directed by Architect

F. Precast Concrete Bumpers: Install in location where shown, using steel rebar dowels, and epoxy.

3.04 DEFECTIVE ASPHALT;

Defective asphalt is as described below.

A. Exposed rock pockets on the finished surface that lack the # 8- #200 fines that is required per the sieve analysis.

B. Asphalt not placed to the design grades.

C. Asphalt that ponds water.

D. Asphalt that was compacted below the minimum required temperature and is cracked.

E. Asphalt that fails to meet the minimum compaction requirements.

F. Asphalt that lacks the minimum thickness required per plan.

G. New asphalt contaminated by a petroleum product, or spilled paint.

H. Asphalt that has depressions, cracks, scored divits from dumpster wheels, heavy equipment use, heavy construction products,

I. Asphalt placed on pumping, unstable sub-grades.

3.05 CLEANING

A. Refer to Section 01710.

B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

C. Clean excess material from surface of all concrete walks and utility structures.

END OF SECTION [32 12 00]

SECTION 32 16 00

SITE CONCRETE

PART 1 - GENERAL

1.01 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 310000, Earthwork.

1.03 QUALITY ASSURANCE

A. Use only new materials and products.

B. Use materials and products of one manufacturer whenever possible.

C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

D. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current project name and project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted

1.04 SUBMITTALS

A. Refer to Section 133300.

B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

C. Materials list: Submit to the Architect a complete list of all materials proposed to be used in this portion of the work. Submitted items should include but are not limited to sand, gravel, admixtures, surface treatments, coloring agents, sealers, fibers, cast-in-place accessories, forming and curing products and concrete mix designs.

D. With concrete submittal, provide documented history of mix design performance.

1.05 WARRANTY

A. Refer to General Conditions and Section 017836.

1.06 REFERENCES AND STANDARDS

A. California Building Code, latest edition.

B. ACI Standards, ACI 211.1-91, ACI 318-19, ACI 302.1R-15, ACI 301-20, ACI 305R-20, ACI 306R-16, ACI 308R-15.

C. ASTM C-94, Specification for Ready-Mixed Concrete.

D. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (latest edition).

E. ASTM – American Society for Testing and Materials.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.

B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.

C. Transport, store and handle in strict accord with the manufacturer's written recommendations.

D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

E. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.

F. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

1.08 TESTING

A. General: Refer to Section 01400 – Quality Requirements.

B. Cement and Reinforcing shall be tested in accordance with CBC Section 1910A. Testing of reinforcing may be waived in accordance with Section 1910A.2 when approved by the Structural Engineer and DSA.

1.09 ADEQUACY AND INSPECTION

A. Design, erect, support, brace and maintain formwork and shoring to safely support all vertical and lateral loads that might be applied until such loads can be carried by concrete.

B. Notify Inspector, Architect and DSA at least 48 hours prior to placing of concrete.

1.10 PROTECTION

A. Finish surfaces shall be protected at all times from concrete pour. Inspect forming against such work and establish tight leak-proof seal before concrete is poured. Finish work damaged, defaced or vandalized during the course of construction shall be replaced by contractor at contractor expense.

1.11 FIELD MEASUREMENTS

A. Make and be responsible for all field dimensions necessary for proper fitting, slopes and completion of work. Report discrepancies to Architect before proceeding.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: Portland cement, ASTM C150, Type II, per ACI 318-14 Section 26.4.

B. Concrete Aggregates: Normal weight aggregates shall conform to ASTM C33, except as modified by this section. Combined grading shall meet limits of ASTM C33. Lightweight aggregate shall conform to ASTM C330, suitably processed, washed and screened, and shall consist of durable particles without adherent coatings.

C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials and per ACI 318-14 Section 26.4.1.3.1.

D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials (Class C is not permitted). Not more than 15% (by mass) may be substituted for portland cement.

E. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio, and ultimate shrinkage may be used. Provide WRDA 64 by Grace Construction Products or approved equal. Admixture shall conform to ASTM C494 and ACI 318-14 Section 26.4.1.4.19(a). Such admixture must receive prior approval by the Architect, Structural Engineer, and the Testing Lab, and shall be included in original design mix.

F. Air-entraining Admixture: Daravair 1000 by Grace Construction Products or approved equal. Admixture must conform to ASTM C260 and ACI 318-14, section 26.4.1.4.

G. Exterior Flatwork Expansion Joint Sealant: 1-part polyurethane sealant, Sikaflex -1c SL or approved equal.

H. Surface Retarder (for exposed aggregate finishes): Rugasol-S by Sika Corporation or approved equal.

I. Form Coating: Material which will leave no residue on concrete surface that will interfere with surface coating, as approved by the Architect.

J. Expansion Joint Material: Preformed 3/8" fiber material, full depth of concrete section, with bituminous binder manufactured for use as concrete expansion joint material, as accepted by the Architect.

K. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615 or ASTM A706; Grade 60. Dowels for installation through expansion joints or construction joints to existing sidewalks or concrete features shall be smooth or shall be sleeved on one end for slippage.

L. Reinforcing supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3’-0” O.C.E.W. Staggered and each support securely fastened to steel reinforcement in place. Bottom bars in footings may be supported with 3” concrete blocks with embedded wire ties. Concrete supports without wire ties will not be allowed.

M. Truncated Domes: Vitrified Polymer Composite (VPC), Cast-In-Place Detectable/Tactile Warning Surface Tiles; “Armor-Tile”, “Access Tile Tactile Systems”, or approved equal. Tiles shall comply with Americans with Disabilities Act and the California Code of Regulations (CCR) Title 24, Part 2, Chapter 11B. Install tiles as recommended by manufacturer.
1. Color: As selected by the Architect.

N. Curing Compound (for exterior slabs only): Burke Aqua Resin Cure by Burke by Edoco, 1100 Clear by W.R. Meadows or accepted equal. Water based membrane-forming concrete curing

compound meeting ASTM C 309 and C1315.

O. Concrete Bonding Agent: Weld-Crete by Larson Products Corp., Daraweld C by Grace Construction Products or accepted equal.

P. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or accepted equal.

Q. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed, non-metallic, no chlorides, non-staining and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C 1107, Grades B and C.

R. Aggregate Base: Class 2 AB per Caltrans specification section 26-1.02A.

S. Joint sealant for expansion joints: Single component silicone sealant, Type S, ASTM D5893

T. Pre- Formed plastic Expansion Joint; W.R. Meadows 3/8" "Snap Cap", Tex-Trude expansion joint cap, or an approved equal.

U. Adhesive Anchoring (Epoxy): Hilty HIT-HY 200 Safe Set, or approved equal.

2.02 CONCRETE DESIGN AND CLASS

A. Class "B": Concrete shall have 1" max. size aggregate, shall have 3000 psi min. at 28 day strength with a maximum water to cementitious ratio no greater than 0.50. Use for exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb & gutter and other concrete of like nature.

B. Slump Limits: Provide concrete, at point of final discharge, of proper consistency determined by Test Method ASTM C143 with a slumps of 4" plus or minus 1".

C. Mix Design: All concrete used in this work will be designed for strength in accordance with provisions of ASI 318-14 Section 26.4. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.

D. Air Entrainment; Per the Local Jurisdiction minimum requirements, or 3% minimum.

2.03 MIXING OF CONCRETE

A. Conform to requirements of CBC, Chapter 19A.

B. All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.

C. Concrete shall be Ready-mixed Concrete: Mix and deliver in accordance with the requirements set forth in ASTM C94 and ACI 301.
   1. Approved Testing Laboratory shall check the first batching at the start of the work and furnish mix proportions to the Licensed Weighmaster.
   2. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
   3. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Project Inspector will not accept load without load ticket identifying mix

and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit two copies of record to DSA.

5. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.
6. Water may be added to the mix only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. In no case shall more than 10 gallons of water shall be added to a full 9 yard load, or 1 gal. per yard on remaining concrete within the drum providing load tag indicates at time of mixing at plant will allow for additional water.

2.04 MATERIALS TESTING

A. Testing of concrete shall be performed per article 3.07 of this specification.

2.05 EQUIPMENT

A. Handling and mixing of concrete: Project Inspector may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

PART 3 - EXECUTION

3.01 APPROVAL OF FORMS AND REINFORCEMENTS

A. Forms and reinforcements are subject to approval by the Project Inspector. Before placing concrete, clean tools, equipment and remove all debris from areas to receive concrete. Clean all reinforcing and other embedded items off all coatings oil, and mud that may impair bond with concrete.

B. All reinforcing steel shall be adequately supported by approved devices on centers close enough to prevent any sagging.

C. All reinforcing bar lap splices shall be staggered a minimum of 5 ft.

D. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames and covers that are located within the concrete placements.
   1. The bars shall be placed so that there will be a minimum of 1 ½” clearance and a maximum of 3” clearance. The reinforcing steel shall be placed mid-depth of concrete slab.

E. At all right angles or intersections of concrete walks, additional 2’x2’ #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2” from concrete forms and supports at mid-depth of slab.

3.02 PROTECTION

A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

B. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

C. Sub-Grade in vehicular concrete paved areas: Subgrade shall be clean, shaped and compact to hard surface free from elevations or depressions exceeding 0.05’ in 10' from true plan. Compact

per Section 310000. Compaction and moisture content shall be verified immediately prior to placement of concrete. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.03 CLEANING

A. Reinforcement and all other embedded items at time of placing concrete to be free of rust, dirt oil or any other coatings that would impair bond to concrete.

B. Remove all wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

3.04 FORMING

A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.

B. Build forms to shapes, lines, grades and dimensions indicated. Construct form work to maintain tolerances required by ACI 301. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.

C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.

D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.

E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of construction joints.

F. Slope tie-wires downward to outside of wall.

G. Brace, anchor and support all cast-in items to prevent displacement or distortion.

H. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.

I. Concrete paving, Curbs, Curb and Gutters, Ramps:
   1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20’ for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant where required. Expansion joints shall not exceed ¼ inch depth measured from finish surface to top of felt or sealant, and ½ inch width.
   2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60’ on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant will be required.
   3. Isolation Joints: 3/8” felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.

4. Exterior Concrete Paving: Install expansion joints at 20’ on center maximum, both directions, unless shown otherwise on plans.
5. Ramps; whether shown or not all ramps shall have control joints and expansion joints.
   a. Control joints on ramps shall be aligned and be placed in between with the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
   b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

3.05 FORM COATING

A. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.

B. Before re-using form material, inspect, clean thoroughly and recoat.

C. Seal all cut edges.

3.06 INSTALLATION

A. General: Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1907A.7 of the CBC. Keep a person on the job to maintain position of reinforcing as concrete is placed. Reinforcement must be in place before concreting is begun. Install dowels as shown on drawings. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences. All expansion and construction joints in concrete shall have dowels of size and spacing as shown, or as approved by Architect.

B. Placing Tolerances:
   1. Per ACI 301 or CRSI/WCRSI Recommended Practice for Placing Reinforcing Bars, unless otherwise shown.
   2. Clear distance between parallel bars in a layer shall be no less than 1”, the maximum bar diameter not 1 ½ times the maximum size of coarse aggregate.

C. Splices:
   1. General: Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports and stagger splices at adjacent splices 5 foot minimum. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
      a. Lap splices in concrete: Lap splice lengths shall not be less than 62 bar diameter for No. 5 bar, 56” minimum for No. 6 bars. No. 4 bar shall have a minimum of 24” splice. 93 bar diameters for No. 7 bars and larger.
      b. All splices shall be staggered at 5 feet minimum.

3.07 INSPECTION

A. Approval of reinforcing steel, after installation, must be received from Inspector.

B. Slope of concrete forms and finish condition shall be checked with a two foot (2’) digital level.

3.08 PLACING OF CONCRETE

A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the concrete pour and finishing shall be replaced at no extra cost to the owner.

B. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of reinforcing steel.

C. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area. Free fall of concrete shall not to exceed 4'-0" in height. If necessary, provide lower openings in forms to inject concrete and to reduce fall height.

D. Remove form spreaders as placing of concrete progresses.

E. Place footings as monolithic and in one continuous pour.

F. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.

G. Compacting: All concrete shall be compacted by mechanical vibrators. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrating shall not be applied to concrete which has already begun to initially set nor shall it be continued so long as to cause segregation of materials.

H. Grout under column bearing plates: Dry pack with specified Non-shrink Grout, as recommended by manufacturer. Use as little water as practicable. Ram grout solid into place.

I. Concrete Flatwork:
   1. All flatwork shall be formed and finished to required line and grades. Flatwork shall be true and flat with a maximum tolerance of 1/8" in 10’ for flatness. Flatwork which is not flat and are outside of the maximum specified tolerances shall be made level by the Contractor at no additional expense to the Owner.
   2. Thoroughly water and soak the exterior slabs, curbs, curb and gutters, footing subgrades with multiple daily waterings for at least three (3) days or as required to achieve required moisture content prior to the concrete pour in order to place the subgrade soils in full expansion. Provide damming as required to keep standing water within the formed area and to allow for proper saturation and full expansion of the subgrade soils. Remove any standing water before concrete placement.

J. Placing in hot weather: Comply with ACI 305R-91. Concrete shall not exceed 85 degrees F at time of placement. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.

K. Placing in cold weather: Comply with ACI 306R-02. Protect from frost or freezing. No antifreeze admixtures are permitted. When deposited concrete during freezing or near-freezing weather, mix shall have temperature of at least 50 degrees F but not more than 90 degrees F. Concrete shall be maintained at temperature of at least 50 degrees F for not less than 72 hours after placing or until it has thoroughly hardened. Provide necessary thermal coverings for any flat work exposed to freezing temperatures.

L. Horizontal construction joint: Keep exposed concrete face of construction joints continuously moist from time of initial set until placing of concrete; thoroughly clean contact surface by chipping entire surface not earlier than 5 days after initial pour to expose clean hard aggregate solidly embedded, or by approved method that will assure equal bond, such as green cutting. If contact surface becomes contaminated with soil, sawdust or other foreign matter, clean entire surface and re-chip entire surface to assure proper adhesion.

3.09 CONCRETE FINISHES

A. Concrete Slab Finishing: Finish slab as required by ACI 302.1R. Use manual screeds, vibrating screeds to place concrete level and smooth. Use “jitterbugs” or other special tools designed for the purpose of forcing the course aggregate below the surface leaving a thick layer of mortar 1 inch in thickness. Surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8" in 10'. Provide final finish as follows:
   1. Flatwork, medium broom finish: Typical finish to be used at all exterior walks, stairs and ramps. Brooming direction shall run perpendicular to slope to form non-slip surface.
   2. Under no circumstances can water be added to the top surface of freshly placed concrete.

B. Curb Finishing: Steel trowel.

C. Joints and Edges: Mark-off exposed joints, where indicated, with ¼” radius x 1” deep jointer or edging tool. Joints to be clean, cut straight, parallel or square with respect to concrete walk edge. Tool all edges of exposed expansion and contraction joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces.
   1. The expansion joints shall be full depth as shown in the plan details. Failure to do so will result in non-compliance and shall be immediately machine cut by the contractor at his expense.

3.10 CURING

A. Cured Concrete in Forms: Keep forms and top on concrete between forms continuously wet until removal of forms, 7 days minimum. Maintain exposed concrete in a continuous wet condition for 14 days following removal of forms.

B. Flatwork/Variable Height Curbs, Curb and gutter, Valley Gutter: Cure utilizing Curing Compound. If applicable, the Contractor shall verify that the approved Curing Compound is compatible with the approved colorant system. Upon completion of job, wash clean per manufacturer’s recommendations.
   1. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor’s expense with no compensation from the owner.

C. No Curing Compound shall be applied to areas scheduled to receive resilient track surface including, curbs, ramps, run ways, etc.

3.11 DEFECTIVE CONCRETE

A. Determination of defective concrete shall be made by the Architect or Engineer. His opinion shall be final in identifying areas to be replaced, repaired or patched.

B. The Owner reserves the right to survey the flatwork, if it is determined to be outside of the maximum tolerance for flatness. If the flatwork is found to be out of tolerance, then the Contractor

will be required to replace concrete. The Contractor will be responsible for reimbursing the Owner for any surveying costs incurred. Determination of flatwork flatness, surveying and any remedial work must be completed far enough in advance so that the project schedule is maintained, delays are avoided and the new flatwork or flatwork repairs are properly cured.

C. As directed by Architect, cut out and replace defective concrete. All defective concrete shall be removed from the site. No patching is to be done until surfaces have been examined by Architect and permission to begin patching has been provided.

D. Permission to patch any area shall not be considered waiver of right, by the Owner, to require removal of defective work, if patching does not, in opinion of Architect, satisfactorily restore quality and appearance of surface.

E. Defective concrete is:
1. Concrete that does not match the approved mix design for the given installation type.
2. Concrete not meeting specified 28-day strength.
3. Concrete which contains rock pockets, voids, spalls, transverse cracks, exposed reinforcing, or other such defects which adversely affect strength, durability or appearance.
4. Concrete which is incorrectly formed, out of alignment or not plumb or level.
5. Concrete containing embedded wood or debris.
6. Concrete having large or excessive patched voids which were not completed under Architect's direction.
7. Concrete not containing required embedded items.
8. Excessive Shrinkage, Traverse cracking, Crazing, Curling; or Defective Finish. Remove and replace if repair to an acceptable condition is not feasible.
9. Concrete that is unsuitable for placement or has set in truck drum for longer than 90 minutes from the time it was batched.
10. Expansion joint felt that is not isolating the full depth of the concrete section, and recessed as required for backer rod and sealant where required.
11. Concrete that is excessively wet or excessively dry and will not meet the minimum or maximum slump required per mix design.
12. Finished concrete with oil stains from equipment use, and or rust spots that cannot be removed.
13. Control joints (weakened planed joints) that do not meet the required minimum depth shown on the drawings.

F. Patching: Install specified Patching Mortar per manufacturer’s recommendations.

3.12 CONCRETE TESTING

A. Comply with CBC Section 1903A, 1905A.1.16, 1910A and 1705A.3 and as specified in B. below. Costs of tests will be borne by the Owner.

B. Four identical cylinder samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. In addition, samples for strength tests for each class of concrete shall be taken for seven-day tests at the beginning of the concrete work or whenever the mix or aggregate is changed.

C. Strength tests will be conducted by the Testing Lab on one cylinder at seven (7) days and two cylinders at twenty-eight (28) days. The fourth remaining cylinder will be available for testing at fifty-six (56) days if the 28-day cylinder test results do not meet the required design strength.

D. On a given project, if the total volume of concrete is such that the frequency of testing required by paragraph B. above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

E. Cost of retests and coring due to low strength or defective concrete will be paid by Owner and back-charged to the Contractor.

F. Each truck shall be tested for slump before concrete is placed.

3.13 REMOVAL OF FORMS

A. Remove without damage to concrete surfaces.

B. Sequence and timing of form removal shall insure complete safety of concrete structure.

C. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
1. Vertical forms of foundations, walls and all other forms not covered below: 5 days.
2. Slab edge screeds or forms: 7 days.
3. Concrete columns and beam soffits: 28 days.

D. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

3.14 CLEANING

A. Refer to Section 01710.

B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

C. Clean excess material from surface of all concrete walks and utility structures.

D. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION [32 16 00]