
PART 3 EXECUTION

3.1 SURFACE PREPARATION

- A. Surfaces for epoxy adhesives may be either moist or dry prior to grouting, but shall be free of standing water.

3.2 HOLE DRILLING AND INSTALLATION PROCEDURES

A. Hole diameter and length

1. Epoxied reinforcing bars: The diameter of the drilled hole in existing concrete shall conform to the instructions of the epoxy product used.
 - a) Where the contract Drawings specify a minimum embedment depth for anchorage, the length of the drilled hole in existing concrete shall be determined based on the specified embedment length, plus any overdrilling length specified on the structural drawings. For overhead installations, an additional length of 2-inches is normally specified on the structural drawings.
 - b) Where no embedment length is indicated on the Contract Drawings, the length of the hole shall be based on the dimensions specified in the manufacturer's ICC approval report, but shall be no less than 12 times the diameter of the bar or rod to be anchored.
2. Expansion anchors: The diameter and length of the drilled hole in existing concrete shall conform to the longest tabulated dimensions specified in the installation procedures prescribed for the size, product, and manufacturer of anchor detailed on the Contract Drawings. Where product installation instructions call for the use of particular drilling devices or drill "bit" diameters, that exact product or drill bit shall be used, with no substitutions.

B. Drilling

1. Hole diameter up to 7/8-inch: Drill holes in sound concrete using either a carbide or star drill bit, or diamond-core holes as described below. Remove debris by vacuum and/or with oil-free compressed air. Scrape sides of hole and repeat removal procedure.
2. Hole diameter larger than 7/8-inch: Holes shall be cored in sound concrete using a diamond-tipped bit. Remove debris by flushing with water. The hole shall be free of standing water before grouting.
3. Holes cut by coring shall be thoroughly roughened by scraping of surfaces and then cleaned to remove all dust and debris.

- C. Where the required depth of hole extends to within 2-inches from the far face of an existing concrete section, preventative measures shall be used to prevent "blowouts" through the far face of the concrete. Such measures might include use of a diamond, rather than impact, drill and/or the use of an indicator or drill stop device to prevent overdrilling.

- D. Interference with existing rebar:

1. Prior to drilling of concrete, efforts shall be made to prelocate and avoid reinforcing bars within the existing concrete. As a minimum, these efforts shall include a review of available drawings to determine the approximate number and types of bars present. Where feasible, or where specified on the drawings, a survey shall also be conducted by the testing laboratory, using either X-ray photography or a pachometer, to locate and pre-mark bar locations before holes are drilled, or chipping the existing cover to expose reinforcing bars. These locations shall then be used to adjust hole locations within the tolerances permitted so as to avoid reinforcing bars if possible.
2. When hole drilling interferes with the existing rebar, one of the following steps shall be taken:
 - a.) A new inclined hole shall be drilled or cored. The maximum inclination from the location shown on the Contract Drawings shall be limited to less than 15 degrees. The rebar shall be bent in the field to suit the new hole configuration.
 - b.) The hole shall be abandoned, dry-packed and a new hole shall be proposed by the Contractor. The new hole shall maintain the required minimum edge distance and shall have the Owner's Representative's approval before drilling.
3. The Owner's Representative shall be consulted to obtain written approval for cutting of particular reinforcing bars or embedded items. This approval, if provided, shall be limited to the cutting of certain types or sizes of bars at a specific location, and shall not be interpreted as an approval to cut any size or type of reinforcing bar or embedded item.

E. Procedure for installation of epoxy-grouted rebar

1. Temperature: Epoxy materials shall not be installed when surface or environmental conditions exceed the recommended application temperature range indicated by the product manufacturer.
2. Poured applications: Pour a measured amount of the specified epoxy adhesive mix into the hole. Insert the bar, displacing the liquid epoxy, then secure the bar in the center of the hole before it hardens. For grouting deep holes pressure injection of epoxy is recommended.
3. Pressure-injection applications
 - a.) Forms shall be adequate to resist injection pressures without blowouts and to provide support for embedments where required. Seal edges with silicon caulking or epoxy "gel" prior to start of pressure-injection.
 - b.) Grouting shall be performed by an experienced grouting Contractor thoroughly familiar with the project conditions.
 - c.) For overhead conditions, plastic caps may be used to prevent run-out of epoxy. The depth of the caps into the hole shall be less than 1-inch, otherwise additional length beyond the 2-inch added embedment specified for overhead installations will be required. Remove any protruding portions of caps prior to concrete placement.

F. Procedure for installation of expansion anchors

1. When expansion anchor bolts are specified on the Contract drawings, they shall be installed in accordance with the installation procedures prescribed in the applicable International Code Council (ICC) report which was prepared for the specified bolt being utilized.
2. Temperature: Epoxy materials shall not be installed when surface or environmental conditions exceed the recommended application temperature range indicated by the product manufacturer.

3.3 CLEANUP

- A. Mixed epoxy and grouting materials are much easier to clean up before they harden.
- B. Consult epoxy product manufacturer's instructions for cleanup recommendations. Where specific manufacturer's instructions conflict with these instructions, consult the Owner's Representative.
- C. Commercial epoxy/paint stripper solvents are recommended for hardened epoxy. consult solvent manufacturers usage recommendations.
- D. Fill with Dry-Pack all abandoned holes.
- E. Leave finished work and work area in a neat, clean condition without evidence of spillovers.

3.4 TESTING

- A. Special inspection in accordance with CBC 2013 shall be provided for all anchor installations and testing.
- B. Epoxy Adhesive anchor system (installation in concrete).
 1. Unless noted otherwise on the drawings, test 100% of the installed anchors in structural applications per CBC 2013 requirements.
 2. Failed fasteners shall be replaced. Tests shall be in accordance with the requirements shown on the structural drawings.
 3. Hooked bars that cannot be tested when bent may be installed straight and bent after testing.
- C. Expansion type anchor bolts
 1. Test 100% of the installed anchors in structural applications per CBC 2013 requirements.
 2. Concrete anchor bolts of the expansion type (loaded in either pullout or shear) shall be tested in accordance with the requirements shown on the structural drawings. Bolts must have ICC approval and be installed in accordance with the requirements of the CBC 2013.

3. Failure/acceptance criteria: The anchor should have no observable movement at the applicable test load. For wedge type anchors, a practical way to determine observable movement is that the washer under the nut becomes loose.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

Division 1 requirements apply to this section.

1.1 SUMMARY

- A. Section includes:
 - 1. Load and non-load bearing formed steel interior and exterior wall stud.
 - 2. Formed metal furring systems.
 - 3. Framing accessories.

1.2 REFERENCES

- A. Federal Specification (FS); TT-P-645A Primer, Paint, Zinc-Chromate, Alkyd Type.
- B. ASTM A 1011: Structural Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
- C. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
- D. ASTM A 924: Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- E. ASTM C 645: Specification for Nonstructural Steel Framing Members.
- F. AISI: Specification for the Design of Cold Formed Steel Structural Members.
- G. AWS D1.3: Structural Welding Code – Sheet Steel.
- H. AWS D5.1: Specification for Carbon Steel Electrodes for Shielded Arc Welding.
- I. ICBO Evaluation Service Research Report No. 4943P, current edition.
- J. ICBO Evaluation Service Research Report No. 4782, current edition.

1.3 SUBMITTALS

- A. Submit product data and shop drawings under provisions of Division 1.
- B. PRODUCT DATA:
 - 1. Submit a complete list of all materials proposed to be furnished and installed under this portion of the work.
 - 2. Provide current ICC ESR report.

3. Provide framing member materials, dimensions, structural properties and finishes.

C. SHOP DRAWINGS:

1. Show special components and installations not fully dimensioned or detailed in manufacturer's product data. Include placing drawings for framing members showing size and gauge designations, number, type, location and spacing. Show supplemental trapping, bracing, splices, bridges, accessories and details.
2. Provide stud and ceiling joist layout.

1.4 FIELD MEASUREMENTS

- A. Verify field measurements as shown on shop drawings.

1.5 QUALITY ASSURANCE

- A. Fabricate formed steel framing members in accordance with AISC-Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

1.6 QUALIFICATIONS

- A. Manufacturer: Use manufacturers with a demonstrated history of producing the specified products for a period of five (5) years prior to beginning work of this section, and with the capability to produce the specified products to the delivery and quantity criteria of the project.
- B. Fabricator/Installer: Use only thoroughly trained and experienced personnel, who have installed similar applications of the specified products within one (1) year prior to beginning work of this section, and who are completely familiar with the manufacturer's recommended methods of installation as well as the requirements of this work.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store on site under the provisions provided within the specifications.
- B. Store materials above ground, protected from dirt, grease, corrosion and other damage.
- C. Store all other materials in a waterproof manner.
- D. Provide original packaged welding electrodes, clearly marked as to type and rating.
- E. Do not store materials on structure in a manner causing potential distortion or damage to members, surfaces, or supporting structures.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Basis of Design: Characteristics of specific products manufactured by Cemco are indicated to establish required level of quality and performance. The Owners Representative will consider comparable products by alternate manufacturers listed in this Section, and requests for substitutions.

1. Approved Manufacturers: Cemco, American Studco, Dietrich Industries Inc., Unimast, Inc., Western Metal Lath & Steel Framing, or approved equal.

2.2 MATERIALS/DESIGN CRITERIA

- A. Base Metal Thickness Criteria: All metal framing materials provided as work of this Section shall comply with the following minimum thickness criteria for uncoated sheet steel. Thicknesses indicated are the minimum acceptable thickness for materials delivered to jobsite.

1. Members designated as 20 gauge: 0.0359 inch.
2. Members designated as 16 gauge: 0.0598 inch.
3. Members designated as 14 gauge: 0.0747 inch.

2.3 WALL/VERTICAL SURFACE FRAMING MATERIALS

- A. Type: Punched "C" studs, screwable, ASTM C 645.

- B. Series:

1. Members (within the hospital) designated as 16 gauge: Cemco 400CS16 or 362CS16 depending on the existing partition wall thickness to be matched, unless noted otherwise.

- C. Characteristics:

1. Size: Depth as shown on drawings, 1 5/8 inch flange with 9/16 inch return, unless noted otherwise.
2. Base Metal:
 - a) 16 gauge members: ASTM A 570 Grade 50 sheet steel, $F_y = 50,000$ psi, galvanized to G60 coating class per ASTM A 653.
3. Top/Bottom Track: Same gauge and material as wall framing, 16 gauge, whichever is more restrictive, unpunched deep-leg runner tracks, width to suit stud width.
4. Bracing: 16 gauge unpunched, unless otherwise indicated.

2.4 WALL FURRING MATERIALS

- A. Type: Hat channel, screwable, ASTM C 645
- B. Series:
 - 1. 20 gauge: Cemco FHC.
- C. Characteristics:
 - 1. Size: 7/8 inch depth, 1 1/2 inch nominal screw face width
- D. Base Metal:
 - 1. ASTM A 570 Grade 33 sheet steel, $F_y = 33,000$ psi, galvanized to G60 coating class per ASTM A 653.

2.5 HORIZONTAL FRAMING MATERIALS

- A. Type: "C" Joist, screwable.
- B. Series:
 - 1. Members designated as 20 gauge: Cemco 400CS20P, unless noted otherwise.
 - 2. Members designated as 16 gauge: Cemco 400CS16P, unless noted otherwise.
- C. Characteristics:
 - 1. Size: Depth as shown on drawings, 1 5/8 inch flange with 9/16 inch return.
 - 2. Base Metal:
 - a) 20 gauge members: ASTM A 570 Grade 33 sheet steel, $F_y = 33,000$ psi, galvanized to G60 coating class per ASTM A 653.
 - b) 16 gauge members: ASTM A 570 Grade 50 sheet steel, $F_y = 50,000$ psi, galvanized to G60 coating class per ASTM A 653.

2.6 PERMINANT STUD WALL FORMS

- A. Type: "C" Joist, screwable.
- B. Series:
 - 1. Members designated as 14 gauge: Cemco 400XCS14P, unless noted otherwise.
- C. Characteristics:
 - 1. Size: Depth as shown on drawings, 2 inch flange with 3/4 inch return.
 - 2. Base Metal:

- a) 14 gauge members: ASTM A 570 Grade 50 sheet steel, $F_y = 50,000$ psi, galvanized to G60 coating class per ASTM A 653.

2.7 PERMINANT STUD FRAMED MECHANICAL OPENINGS

- A. Type: "C" Joist, screwable.
- B. Series:
 - 1. Members designated as 14 gauge: Cemco 600XXC14P, 800XXC14P or 1000XXC14P as required.
- C. Characteristics:
 - 1. Size: Depth as shown on drawings, 2-1/2 inch flange with 3/4 inch return.
 - 2. Base Metal:
 - a) 14 gauge members: ASTM A 570 Grade 50 sheet steel, $F_y = 50,000$ psi, galvanized to G60 coating class per ASTM A 653.

2.8 ACCESSORIES

- A. Self drilling Screws, Bolts, Nuts and Washers: ASTM A 90, hot dip galvanized.
- B. Anchorage Devices:
 - 1. Wedge Anchors: Galvanized steel; size as indicated on drawings.
- C. Primer: FS TT – P – 645, for touch-up of galvanized surfaces.

2.9 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.10 SOURCE QUALITY CONTROL AND TESTS

- A. Sample and test as required per the drawings.
- B. Studs and track: Chapter 22, Part 2, Title 24, CCR.

2.11 OTHER MATERIALS

- A. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Owners Representative.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. INSPECTION

1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.
2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
3. In the event of discrepancy, immediately notify the Owners Representative.
4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 ERECTION OF STUDS

- A. Align and secure top and bottom wall tracks.
- B. Fit tracks under and above openings; secure intermediate studs at spacing of wall studs.
- C. Refer to drawings for locations of partitions extending to ceiling only, and partitions extending through ceiling to structure above.
- D. Connect studs to tracks using method called for on the drawings.
- E. Stud splicing NOT permissible.
- F. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, in accordance with manufacturer's instructions and requirements in this Section.
 1. Cut framing members by sawing or shearing; do not torch cut.
- G. Construct corners using a minimum of three studs.
- H. Provide multiple studs at wall openings as indicated.
- I. Brace stud framing system and make rigid.
- J. Coordinate erection of studs with requirements of door and window frame supports and attachments.
- K. Install intermediate studs above and below openings to match wall stud spacing.
- L. Align stud web openings.
- M. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

- N. Coordinate installation of ducks, anchors, blocking, and backing plates with architectural, electrical, and mechanical work to be placed in or behind stud framing.
- O. Provide deflection allowance in stud track, directly below horizontal building framing for non-load bearing framing.
- P. Attach cross studs to studs for attachment of fixtures anchored to walls.
- Q. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- R. Blocking and backing: Install blocking and backing plates for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and equipment. Backing plates shall be continuous across not less than three studs. Notch channels at studs. Unless otherwise indicated, provide the following:
 - 1. For loads less than 100 pounds per foot: 6-inch x 1-5/8-inch, 16-gauge track channel attached to each stud with three No. 10 flat-head sheet metal screws.
 - 2. For loads of 101 to 250 pounds per foot: 1-inch-wide, 14-gauge steel plate with 4-inch x 1-5/8-inch, 16 gauge track channel stiffeners welded to back, attached to each stud with not less than one No. 10 flat-head sheet metal screw.
- S. Maintain clearance under structural building members to avoid deflection transfer to studs.
- T. Coordinate placement of insulation in multiple stud spaces made inaccessible after stud framing erection.
- U. Mechanically Fastened Connections: Connect members with mechanical fasteners as shown on drawings, with screws penetrating joined members by not less than three (3) exposed screw threads. Wire tying of framing members is NOT permitted.
- V. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

3.3 ERECTION OF JOISTS

- A. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, in accordance with manufacturer's instructions and requirements in this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
- D. Complete framing ready to receive ceiling.

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- F. Locate joist and bearing directly over load-bearing studs or provide load distributing member to top of stud track.

3.3 TOLERANCES

- A. Maximum Variation From True Position: $\frac{1}{4}$ inch.
B. Maximum Variation of any Member from Plane: $\frac{1}{8}$ inch.

3.4 FIELD QUALITY CONTROL

- A. Perform filed inspection and testing.
1. Wedge Anchors: Pullout testing; Refer to testing schedule on Drawings.

END OF SECTION

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Penetrations in fire-resistance-rated walls.
 2. Penetrations in horizontal assemblies.
 3. Penetrations in smoke barriers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- D. Product test reports.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.
- C. Preinstallation Conference: Conduct conference at Project site: 26520 Cactus Avenue, Moreno Valley, CA 92555

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Grace Construction Products.
 2. Hilti, Inc.
 3. 3M Fire Protection Products.
 4. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- D. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.3 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

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- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 84 13

SECTION 07 84 46 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

1.2 SUBMITTALS

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

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

D. Product test reports.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases,

and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

- B. Joints in or between Fire-Resistance-Rated Construction: Ratings determined per ASTM E 1966 or UL 2079:
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. 3M Fire Protection Products.
 - d. USG Corporation.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa) or ASTM E 2307.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. 3M Fire Protection Products.
 - d. USG Corporation.
- D. Joints in Smoke Barriers: Ratings determined per UL 2079.
 - 1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. 3M Fire Protection Products.
 - d. USG Corporation.
- E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Provide fire-resistive joint systems that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- D. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.3 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

-
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 84 46

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Silicone joint sealants.
 2. Urethane joint sealants.
 3. Latex joint sealants.
 4. Preformed joint sealants.

1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers samples of materials that will contact or affect joint sealants. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.
- D. Product test reports.
- E. Preconstruction compatibility and adhesion test reports.
- F. Preconstruction field-adhesion test reports.
- G. Field-adhesion test reports.
- H. Warranties.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

- B. Preinstallation Conference: Conduct conference at **Project site:** 26520 Cactus Avenue, Moreno Valley, California 92555.

1.5 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 SILICONE JOINT SEALANTS

- A. Silicone Joint Sealant: ASTM C 920.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Dow Corning Corporation.
 - c. GE Advanced Materials - Silicones.
 - d. May National Associates, Inc.

- e. Pecora Corporation.
- f. Polymeric Systems, Inc.
- g. Schnee-Morehead, Inc.
- h. Sika Corporation; Construction Products Division.
- i. Tremco Incorporated.
- 2. Type: Single component (S) or multicomponent (M).
- 3. Grade: Pourable (P) or nonsag (NS).
- 4. Class: 100/50 50 and 25.
- 5. Uses Related to Exposure: Traffic (T) Nontraffic (NT).

2.3 URETHANE JOINT SEALANTS

- A. Urethane Joint Sealant: ASTM C 920.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Lyntal, International, Inc.
 - d. May National Associates, Inc.
 - e. Pacific Polymers International, Inc.
 - f. Pecora Corporation.
 - g. Polymeric Systems, Inc.
 - h. Schnee-Morehead, Inc.
 - i. Sika Corporation; Construction Products Division.
 - j. Tremco Incorporated.
 - 2. Type: Single component (S) or multicomponent (M).
 - 3. Grade: Pourable (P) or nonsag (NS).
 - 4. Class: 100/50 50 and 25.
 - 5. Uses Related to Exposure: Traffic (T) Nontraffic (NT).

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant : Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. May National Associates, Inc.
 - d. Pecora Corporation.
 - e. Schnee-Morehead, Inc.
 - f. Tremco Incorporated.

2.5 PREFORMED JOINT SEALANTS

- A. Preformed Foam Joint Sealant : Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in

precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Superior Specialty Chemicals.
 - b. EMSEAL Joint Systems, Ltd.
 - c. Sandell Manufacturing Co.
 - d. Schul International, Inc.
 - e. Willseal USA, LLC.

2.6 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
 1. Remove laitance and form-release agents from concrete.
 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- F. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform **10** tests for the first **1000 feet (300 m)** of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each **1000 feet (300 m)** of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

END OF SECTION 079200

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal stud wall framing.
- B. Metal channel ceiling framing.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.

1.02 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2012.1.
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2012.1.
- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002 (Reapproved 2007).
- D. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2009)e1.
- E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2011a.
- F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.
- H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2011.
- I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2011.
- J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.
- K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2010a.
- L. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2008.
- M. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a (Reapproved 2011).
- N. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing; 2012.
- O. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets; 1999 (Reapproved 2010).
- P. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets; 2008b.
- Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2011.
- R. ASTM C1629/C1629 - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2006.

- S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- T. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- U. ASTM E413 - Classification for Rating Sound Insulation; 2010.
- V. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2010.
- W. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.
- X. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2009.
- Y. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.
- Z. United States Gypsum Co. (USG) Specification and Technical Bulletins No. SA 923, No. SA 924, and No. SA 925, as applicable for materials location, installation and condition of construction.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
 - 1. Indicate tested assembly number and testing agency.
 - 2. Indicate methods of framing, type and size of framing members, location of expansion and control joints and proposed methods of securing gypsum board to these members.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
 - 1. Joint Treatment Materials: Submit manufacturer's product data, indicating VOC content.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Application Procedures: Submit a general written description of procedures to be followed where fire-rated work is being done and where alternative assemblies are proposed.
- F. Test Reports: For all stud framing products that do not comply with ASTM C645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
- G. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches in size, illustrating finish color and texture.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum five years of documented experience.
- B. Regulatory Requirements: Conform to California Building Code (CBC), Title 24, Part 2, Chapter 7 and Chapter 25, as amended and adopted by authorities having jurisdiction.
- C. Fire Resistance Rating: Certain partition constructions gypsum wallboard systems are required to meet fire resistive requirements of ASTM E119 and applicable building Codes. Construction which forms component parts of such assemblies shall be constructed to afford the fire resistance required by Code for the location and condition of construction indicated. See required ratings and designs on Drawings. Construction shall conform to requirements of these tested assemblies.
- D. Fire Resistive Gypsum Board: Material shall bear the Underwriters' Laboratories, Inc. (UL) label or label of other testing organization acceptable to the State Fire Marshal.
- E. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver gypsum board and accessories in manufacturer's original unopened containers, bundles or rolls bearing manufacturer's identification.
- B. Store materials inside the building or in other dry weather tight enclosure. Stack gypsum board flat and off the floor. Do not stack long lengths over shorter lengths.
- C. Store flammable adhesives away from fire, sparks and smoking areas.
- D. Handle gypsum board to prevent damage to edges, ends, and surfaces.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Interior Partitions Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.
 - 1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly; as indicated on Drawings.
 - 2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly; as indicated on Drawings.
 - 3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory; as indicated on Drawings.

2.02 METAL FRAMING MATERIALS

- A. Interior Non-Loadbearing Studs and Furring for Application of Gypsum Board: As specified in Section 09 22 16.
- B. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 40 00.
- C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

2.03 BOARD MATERIALS

- A. General: Gypsum board, joint treatment and finishing materials shall be manufactured from asbestos-free materials.
- B. Manufacturers - Gypsum-Based Board:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Domtar Gypsum:
 - 3. Georgia-Pacific Gypsum: www.gpgypsum.com.
 - 4. National Gypsum Company: www.nationalgypsum.com.
 - 5. USG Corporation: www.usg.com.
- C. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.

- a. Provide abuse-resistance gypsum panels typical at corridors, and stair enclosures, unless noted otherwise.
- 2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
- 4. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- 5. Paper-Faced Products:
 - a. CertainTeed Corporation; ProRoc Brand Gypsum Board.
 - b. CertainTeed Corporation; ProRoc Brand Abuse Resistant Gypsum Board.
 - c. Georgia-Pacific Gypsum; ToughRock, ToughRock Fireguard, and ToughRock FireGuard C Gypsum Wallboard.
 - d. National Gypsum Company; Gold Bond Brand Gypsum Wallboard.
 - e. USG Corporation; Sheetrock Brand Gypsum Panels.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Ceiling Board: Special sag-resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Ceilings, unless otherwise indicated.
 - 2. Thickness: 1/2 inch.
 - 3. Edges: Tapered.
 - 4. Products:
 - a. CertainTeed Corporation; ProRoc Interior Ceiling.
 - b. Georgia-Pacific Gypsum; ToughRock CD Ceiling Board.
 - c. National Gypsum Company; High Strength Brand Ceiling Board.
 - d. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Types: Type X, in locations indicated.
 - 4. Type X Thickness: 5/8 inch.
 - 5. Edges: Tapered.
 - 6. Products:
 - a. CertainTeed Corporation; ProRoc Brand Exterior Soffit Board.
 - b. Georgia-Pacific Gypsum; ToughRock Soffit Board.
 - c. National Gypsum Company; Gold Bond Brand Exterior Soffit Board.
 - d. USG Corporation; Sheetrock Exterior Gypsum Ceiling Board.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

- A. Finishing Accessories: ASTM C 1047, galvanized steel or rolled zinc, paper-faced, unless otherwise indicated. Product shall have 30 year guarantee against edge cracking.
 - 1. Types: As detailed or required for finished appearance.
 - a. Cornerbead: USG Sheetrock B1 XW EL, or equal.
 - b. L Trim: USG Paper-faced "L" trim, B4 or equal.
 - c. Control Joint: CEMCO No. 093 or equal.
 - d. J-Trim: USG Sheetrock paper faced "J" trim, B9, or equal.
 - e. J-Trim Casings: CEMCO No. 400, no finishing compound.
 - 2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.
 - 3. Manufacturers - Finishing Accessories:
 - a. Same manufacturer as framing materials.
 - b. Phillips Manufacturing Co: www.phillipsmfg.com.
 - c. CEMCO Products, Inc; www.cemco.com.
 - d. USG Corporation: www.usg.com

- e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 3. Ready-mixed vinyl-based joint compound.
 - 4. Chemical hardening type compound not affected by humidity at water and mold resistive applications:
 - a. USG Easy Sand, Durabond 45 or 90 joint compound, or equal as approved by Architect.
- C. Gypsum Board Primer: USG Sheetrock First Coat.
- D. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C 954, Type W; steel drill screws for application of gypsum board to loadbearing steel studs.
- E. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.
- B. Coordinate gypsum board Work with Work specified in other Sections to properly locate framing members and to provide additional framing and backing as necessary for recessed and built-in components. Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board. Maintain a uniform temperature of 55 to 70 degrees F during installation and finishing of gypsum board.
- C. Examine substrates which gypsum board wall or shaft wall construction attaches to or abuts, including the following.
 - 1. Preset hollow metal frames
 - 2. Elevator hoistway door frames
 - 3. Cast-in-anchors.
 - 4. Structural framing, including sprayed fireproofing.
 - 5. Steel stairs.
 - 6. Piping.
 - 7. Conduit.
 - 8. Ductwork.
- D. Beginning of installation means acceptance of substrate.
- E. Maintain temperature range between 55 degrees F and 70 degrees F for a period extending from 24 hours before installation until the permanent heating system is in operation. Provide ventilation during the following adhesive and joint treatment application. Use temporary air circulators in enclosed areas lacking natural ventilation.
- F. Delivery and Storage: Arrange for an adequate supply of materials on the jobsite so that progress of Work will be uninterrupted.
- G. Provide fixtures, anchors, sleeves, inserts and miscellaneous items, and provide openings and chases as necessary. Prior to closing in and finishing of drywall Work, ascertain that piping, conduit, ductwork and fixtures which are to be concealed and which penetrate gypsum boards are in place, tested and approved.

- H. Scaffolding: Construct, erect and maintain in conformance with applicable laws and ordinances.
- I. Fire Protection: Where required, the Work shall comply with the requirements for the protection rating indicated in the governing building code.
- J. Fire Sprinkler System: In areas where sprinkler heads occur, exercise care when installing drywall work. Do not damage or obstruct the heads in any way.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
 - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs as permitted by standard.
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 - 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
 - 1. Orientation: Vertical.
 - 2. Spacing: As indicated.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
- G. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.
- H. Blocking: Install mechanically fastened steel sheet blocking (backing) for support of:
 - 1. Framed openings.
 - 2. Wall mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet partitions.
 - 5. Toilet accessories.
 - 6. Wall mounted door hardware.
 - 7. Wall mounted equipment
 - 8. Wall mounted handrails
 - 9. Where sheet steel blocking(backing) is used on a wall with level 5 surface finish, provide shims between stud face and gypsum board panel to maintain a visually smooth level surface.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
 - 1. Comply with USG Specification and Technical Bulletins No. SA 923, No. SA 924, and No. SA 925, as applicable for materials location, installation and condition of construction.
- B. Regulatory Requirements: Install gypsum board products in accordance with applicable Code requirements and requirements of listed assemblies shown on Drawings.

- C. Single-Layer Non-Rated: Install gypsum board in most economical direction, with staggered ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- D. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- E. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
 - 1. Single Layer: Install and fasten gypsum board in accordance with CBC Title 24, Part 2, Table 7-B for steel or wood construction. Install gypsum board vertically, with edges and ends occurring over firm bearing.
 - 2. Double Layer: Install and fasten gypsum board in accordance with CBC Title 24, Part 2, Table 7B. Install base layer horizontally with ends occurring over firm bearing. Install face layer vertically with ends and edges occurring over firm bearing. Stagger joints 24 inches each side and opposite sides. Attach with required screws.
- F. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
- J. Fastener Spacing: Space fasteners in accordance with reference standards and fire rating requirements of wall, partition, floor and ceiling assembly. Maximum spacing of 1-inch screws 8 inches on centers at vertical edges and 12 inches on centers in field and at top and bottom.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Use longest practical lengths. Place corner beads at external corners. Place edge trim when gypsum board abuts dissimilar materials. Surfaces indicated to receive non-textured finish and semi-gloss enamels.
- B. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
 - 2. At exterior soffits, not more than 30 feet apart in both directions.
- C. Corner Beads: Install at external corners, using longest practical lengths.
- D. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.05 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive textured finish, light textured flat paint finish or wall coverings, unless otherwise indicated.
 - a. At joints and angles, embed tape in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads, and flanges of trim accessories. Panel surfaces and joint compound must be smooth and free of tool marks and ridges.
 - b. Provide one uniform coat of drywall primer over the entire surface.
- D. Tape, fill, and sand all exposed joints, edges, and corners, including inside corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Tape shall be set over joint and seated into joint compound, leaving sufficient adhesive under tape to provide proper bond.

3. Internal angles, both horizontal and vertical, shall be reinforced and with tape folded to form straight and true angle.
4. Metal external corners shall be cemented in place.
5. Joints shall be allowed to dry according to Gypsum Association Standards based on temperature and humidity. Allow for at least 24 hours between each application of joint compound.
6. The final application of compound and sanding shall leave all surfaces uniformly smooth and in condition to receive specified finish.
7. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
8. Taping, filling and sanding is not required at base layer of double layer applications.

3.06 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.07 REPAIR, CLEAN-UP AND PROTECTION

- A. Repair fastener pops by driving a new fastener approximately 1-1/2 inches from the fastener pop and reset the popped fastener. When face paper is punctured, install a new fastener approximately 1-1/2 inches from the defective fastener. Fill damaged surfaces with compound.
- B. Upon completion of the work, remove from adjacent surfaces, overspray, splatter and daubs of taping and finish compound and textured finishes. Remove tools, equipment, unused material and cuttings and leave the work in a clean orderly manner.

END OF SECTION

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical units.

1.02 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010.
- B. ASTM A 641/A 641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a.
- C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.
- D. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2010.
- E. ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.
- F. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2007.
- G. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2008.
- H. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.
- I. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2011.
- J. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2008e1.
- K. ASTM E 1414 - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum; 2006.
- L. ASTM E 1477 - Standard Test Method for Luminance Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers; 1998a (Reapproved 2008).
- M. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2011.
- N. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- O. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. See General Conditions for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
 - 1. Shop drawings shall show: reflected ceiling plans; location of acoustical ceilings and suspension systems; location of light fixtures, diffusers, speakers and other exposed to view items; list of materials; dimensions, jointing, method of hanger attachment, fastenings and other pertinent information.
 - a. Reflected ceiling plans;
 - b. Location of acoustical ceilings and suspension systems;

- c. Location of light fixtures, diffusers, speakers and other exposed to view items;
 - d. List of materials;
 - e. Dimensions, jointing, method of hanger attachment, fastenings and other pertinent information.
 - f. Shop drawings may be in the form of revised copies of the Architect's reflected ceiling plan showing any proposed changes from the layout indicated.
- C. Product Data: Provide data on suspension system components.
- 1. Submit manufacturer's catalog cuts, specifications, and other data for each component of the acoustical ceiling systems as necessary to demonstrate compliance with these specifications.
 - 2. Submit copies of the suspension system manufacturer's current ICC Evaluation Service Report.
- D. Samples: Submit six samples 6 x 6 inch in size illustrating material and finish of acoustical units.
- E. Samples: Submit six samples each, 6 inches long, of suspension system main runner.
- F. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 QUALITY ASSURANCE

- A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL for the fire resistance indicated.
- 1. Identify ceiling components with appropriate markings of applicable testing and inspecting organization.
 - a. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
 - 1) Flame Spread: 25 or less
 - b. HPVA (Hardwood Plywood and Veneer Association) certification and audit program per ASTM E-84 tunnel test.
- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the project in original unopened packages bearing the manufacturer's name, brand designation, and label verifying compliance with these specifications. Store materials in properly protected and dry storage area.
- B. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed.

1.06 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Flame Spread Rating: Provide acoustical ceiling units bearing the label of Underwriters' Laboratories, or other testing agency acceptable to the State Fire Marshal, indicating that the units provide the specified flame spread rating.
- B. Seismic Requirements: Furnish and install suspension systems in accordance with the suspension system manufacturer's current ICC Evaluation Service Report; the California Building Code (CBC).

2.02 ACOUSTICAL UNITS

- A. Manufacturers:
 - 1. Armstrong World Industries, Inc: www.armstrong.com; local contacts Dai-Nee Tan (949) 275-8169.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. Hunter Douglas Contract: www.hunterdouglascontract.com.
 - 4. USG: www.usg.com.
- B. Acoustical Units - General: ASTM E1264, Class A.
- C. Glass Fiber Acoustical Panels Type ACT-08: Acoustically transparent factory applied latex paint faced glass fiber, ASTM E 1264 Type XII, with the following characteristics:
 - 1. Technical Panels: The Technical Zone accommodates recessed fixtures, linear air diffusers, sprinkler heads, and other components.
 - a. Match existing, adjacent panels.
 - 2. Size: 24 x 24 & 48 inches .
 - 3. Thickness: .75 inches.
 - 4. Density: 0.42 lb/sq.ft..
 - 5. Light Reflectance: 0.90 percent, determined as specified in ASTM E1264.
 - 6. NRC Range: 0.90 to 0.90, determined as specified in ASTM E1264.
 - 7. Articulation Class (AC): 190, determined as specified in ASTM E1264.
 - 8. Fire Rating: Class A
 - a. Flame Spread and Smoke Developed Ratings: 0-25 flame spread and 0-50 smoke developed in accordance with ASTM E84.
 - 9. Edge: Match existing.
 - 10. Surface Color: White.
 - 11. Surface Pattern: Fiberglass with acoustically transparent membrane to match existing.

2.03 SUSPENSION SYSTEM(S)

- A. Manufacturers:
 - 1. Basis-of-Design: Armstrong World Industries, Inc: www.armstrong.com.
- B. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
 - 1. Main runners, cross runners, splices, expansion devices, intersection connectors shall be designed to carry a mean ultimate test load of not less than 180 lbs. in compression and tension per ASTM E580 Section 5.1.2.

2.04 ACCESSORIES

- A. Accessories are to be compliant with seismic requirements indicated in the ESR approval documents.

- B. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
 - 1. Suspension wires shall be #12 gage (0.106 inch diameter), soft annealed, and galvanized steel wires with Class 1 coating.
- C. Perimeter Moldings: Same material and finish as grid.
 - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
 - a. Cold rolled steel, hemmed edge, protective coating.
 - b. Product: Silhouette No. 7807 (2-inch wide) by Armstrong World Industries
 - 2. Provide 8 inch wide drapery pocket compatible with the suspension system; where indicated on Drawings.
- D. Clips:
 - 1. BERC2 (Armstrong) – 2 inch Beam End Retaining Clip, 0.034 inch thick, hot-dipped galvanized cold-rolled steel per ASTM A568 – used to join main beam or cross tee to wall molding.
 - 2. SJCG (Armstrong) – Seismic Joint Clip, 5 inches x 1-1/2 inch, hot-dipped galvanized cold-rolled steel per ASTM A568. The two piece unit is designed to accommodate a seismic separation joint. The clip is compatible with 15/16 inch and 9/16 inch grid systems including Prelude, Suprafine, and Silhouette The SJCG is not suitable for use with Vector panel installations.
- E. Acoustical Insulation: Specified in Section 07 21 00. Provide where indicated on Drawings.
 - 1. Thickness: 2 inch.
 - 2. Size: To fit acoustical suspension system.
- F. Gypsum Board: Fire rated type; 5/8 inch thick, ends and edges square, paper faced.
- G. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
- H. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.
- I. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.
- C. Wet operations such as plastering and concrete work shall be completed and dry before installation of acoustical ceilings. Mechanical, electrical and other work above the ceiling line shall be completed and approved before start of acoustical ceiling installation.
- D. Examine surfaces and conditions affecting proper installation of the materials, and report defects in materials or surfaces to which acoustical tile is applied. Do not start work until deficiencies have been corrected. Start of work of this section constitutes acceptance of the surfaces.

3.02 INSTALLATION - GENERAL

- A. Place units as indicated on the shop drawings. Install with joints true and straight and junctures with ceilings, walls and openings neat and tight. Completed work shall present a smooth plane and level surface, free from unevenness, edge or corner offsets, cupping, scratches and other imperfections.

- B. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.04 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
- F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Lateral Bracing System: In all rooms and spaces exceeding 96 square feet in area, provide sets of 4 splayed wires located a maximum of 6 feet from walls and with intermediate sets spaced to form a 8'-0" by 12'-0" pattern. Install the 4 splayed wires at 90 degrees to each other and at an angle not to exceed 45 degrees from the plane of the ceiling. Provide each bracing wire in one piece without splices. Anchor each wire to the structure above by a connection device capable of carrying 200 pounds or the actual design load, whichever is greater with a safety factor of 2. Bend bracing wires directly across the bulb of the main runner and tight against the connection device at supporting construction, then wrap the wire around itself in 4 tight wraps within 1-1/2 inches.
- K. Exposed Suspension System:
 - 1. Install main tee runners 48 inches on center supported by 12 gage wire attached to the hanger tabs along the length of the main runner. Locate hanger wires within 8 inches of the end of each main runner at walls, partitions and vertical offsets in the ceiling and spaced not to exceed 48 inches on center between end wires.
 - 2. Install cross tees perpendicular to main tees at 48 inches on center to form a 2'-0" by 4'-0" exposed grid system. Provide hanger wires within 8 inches of the free end of cross runners at walls, partitions and vertical offsets in the ceiling.
- L. Do not eccentrically load system or induce rotation of runners.
- M. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Install in bed of acoustical sealant.
 - 2. Use longest practical lengths.
 - 3. Miter corners.
 - 4. Install wall molding at the perimeter of the defined areas. Attach wall moldings to the wall at not more than 16 inches on center. On two adjacent walls attach each runner to the wall molding with a pop rivet. At opposite walls, provide metal struts or 16 gage wire with mechanical connection to the runner to prevent runners from spreading.

- N. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.05 INSTALLATION - ACOUSTICAL UNITS

- A. Install in coordination with suspension system.
- B. Install acoustical units in accordance with manufacturer's instructions.
- C. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- D. Fit border trim neatly against abutting surfaces.
- E. Install units after above-ceiling work is complete.
- F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- G. Cutting Acoustical Units:
 - 1. Perform all cutting required for fixtures, pipes and other work passing through acoustical tile and panels. Neatly and tightly fit units to such work and adjoining work. Fit border units neatly and tightly against abutting surfaces.
 - 2. Scribe and cut panels to fit accurately at borders and at penetrations.
 - 3. Cut to fit irregular grid and perimeter edge trim.
 - 4. Make field cut edges of same profile as factory edges.
 - 5. Double cut and field paint exposed reveal edges.
 - 6. Edges shall be concealed by support of suspension members.
- H. Where round obstructions occur, provide preformed closures to match perimeter molding.
- I. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.
- J. Install hold-down clips on each panel to retain panels tight to grid system in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer.; comply with fire rating requirements.
- K. Install hold-down clips on panels within 20 ft of an exterior door.

3.06 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.07 ADJUSTING AND CLEANING

- A. Replace loose and damaged tile and panels when directed.
- B. Touch-up all damaged finish.
- C. Leave all surfaces clean and free from markings and other disfigurements.
- D. Remove all debris resulting from the work of this section.

END OF SECTION

SECTION 26 01 00 BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

- A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The work required under this division is not limited to the electrical specifications and drawings. Refer to all bid documents including Landscape and Musco documents which may designate Work to be accomplished. The intent of the Specifications is to provide a complete and operable electrical system, which shall include all documents that are a part of the entire Project Contract.

1. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this division complete as shown or noted on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Refer to all sections in the general contract conditions, Contract Requirements and Division 1, General Requirements.

C. Work Installed but Furnished by Others:

1. The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify installation details. Foundations for apparatus and equipment will be furnished by others unless otherwise noted or detailed.

1.2 GENERAL REQUIREMENTS

A. Guarantee See General Conditions:

1. Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guarantee period, from date of final completion. Guarantee all work against defective workmanship, material, and improper installation. Upon notification of failure, correct deficiency immediately and without additional cost to the Owner.
2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, through the Landscape Architect, printed manufacturer's warranties complete with material included and expiration dates, upon completion of project. Conform to Division 01.

- B. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized

testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety.

C. Codes and Regulations:

1. Design, manufacturer, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:
 - a. Institute of Electrical and Electronic Engineers - IEEE
 - b. National Electrical Manufacturers' Association - NEMA
 - c. Underwriters' Laboratories, Inc. - UL
 - d. National Fire Protection Association - NFPA
 - e. American Society for Testing and Materials - ASTM
 - f. American National Standards Institute - ANSI
 - g. California Electrical Code - CEC, Title 24, Part 3
 - h. California Code of Regulations, Title 8, Subchapter 5
 - i. California Building Code-CBC, Title 24 Parts 1 & 2
 - j. State & Municipal Codes in Force in the Specific Project Area
 - k. Occupational Safety & Health Administration - OSHA
 - l. California State Fire Marshal
 - m. California Fire Code- CFC, Title 24 Part 9
 - n. National Electrical Testing Association - NETA
2. The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.

D. Requirements of Regulatory Agencies:

1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply. The most stringent condition shall be as interpreted by the Engineer.
 - a. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the Contractor at his expense shall obtain the Work, unless otherwise specified.

E. Shop Drawings:

1. See Division 01 for additional requirements.
2. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.
3. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.
4. Submit a complete list of materials and equipment proposed for the job, including manufacturers names and catalog numbers.

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5. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or switchgear). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the (equipment) (material) shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals without review.
- a. Bind catalog cuts, plate numbers, descriptive bulletins and drawings, 11" x 17" (275 mm x 435 mm) or smaller, in sets with covers neatly showing titles.
 - b. The Contractor shall verify dimensions of equipment and be satisfied as to Code compliance for fit prior to submitting shop drawings for approval.
 - c. Include complete catalog information such as construction, ratings, insulation systems, as applicable.
 - d. For any material specified to meet UL or trade standards, furnish the manufacturers or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.
 - e. Reference listings to the specifications' Sections and Article to which each is applicable.
 - f. Equipment Floor Plans: After approval of material is secured prepare a floor plan of each electrical equipment space, room or yard, drawn to scale at 1/2 inch equals 1 foot and submit for approval in the same manner as for shop drawings. The layout drawings shall be exact scale. Indicate mounting and anchorage details.
6. Contractor shall prepare coordinated drawings when required by Division 01 or where noted otherwise.
- F. Interpretations: The Contractor through the Landscape Architect must make Requests for interpretations of drawings and specifications. Any such requests made by equipment manufacturers or suppliers will be referred to the Contractor.
- G. Standard of Quality
- 1. The contract Drawings and Specifications establish the "MINIMUM STANDARD OF QUALITY" each product and/or system must meet to be considered acceptable. Products of other manufactures will be considered if the product and/or system meet or exceed the "MINIMUM STANDARD OF QUALITY" established by this Contract Document.
- H. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:
- 1. General Requirements:
 - a. Conduits
 - b. Conductors
 - c. Fuses and Circuit Breakers
 - d. Pullboxes
 - e. Manholes
 - f. Sump Pumps
 - g. Pedestal Enclosure
 - h. Cabinets and enclosures. Include all cabinet dimensions.

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- I. Record Drawings: Refer to Division 01, Contract Closeout.
- J. Work Responsibilities:
1. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, junction boxes and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of his work. Where conflicts occur in plans and/or specifications, the most stringent application shall apply and shall be part of the base bid.
 2. In the event minor changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or rearrangement of furnishings or equipment or due to interference with other trades, such changes shall be made without extra cost.
 3. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the furnished equipment will fit into the spaces provided without violation of applicable Codes.
 4. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Landscape Architect.
 5. Contractor shall be responsible for coordination of coordinated drawings when required by the Landscape Architect.
 6. Replace or repair, without additional compensation any work which does not comply with or which is installed in violation of any of these requirements.
- K. Installation General: For special requirements, refer to specific equipment under these requirements.
1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.
 2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Landscape Architect. Furnish all access panels to make all boxes, connections and devices accessible as required by CEC.
 3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.
 4. Contractor shall be responsible for cutting and patching which may be required for the proper installation of the electrical work.
 5. Protect work, materials and equipment cause whatever and provide adequate and proper storage facilities during the progress of the work. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all damaged or defective work, materials and equipment before requesting final acceptance.
 6. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior. All underground conduits shall be mandrelled prior to pulling wire.
 7. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from
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- conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.
8. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.
 9. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish on a weekly basis. Vacuum out all cabinets, and panels and junction boxes prior to pulling any conductors.
 10. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation. All outdoor screw-type fasteners shall be vandal-resistant spanner type; include tool.

L. Excavation, Cutting and Patching:

1. Excavating, trenching and backfilling required for the work of this Division shall be coordinated with existing site conditions. Excavating and backfilling connected with electrical work, repaving cuts and providing and maintaining protective measures for the electrical work excavation required by the governing authorities having jurisdiction shall be performed as a part of the work of this Division. Trenches shall be plated over at the end of each work day. Concrete sidewalks shall have a complete section removed in lieu of saw cutting and remove a partial section. Repair all damaged utility and irrigation systems. Restore all paving and landscaping to match existing. Drawings show a suggested underground pathway. The contractor shall determine exact pathway in the field.
2. Provide a sub grade survey of the entire pathway way of the proposed electrical duct bank installation. The survey shall use both ground penetrating radar and electromagnetic utility locating equipment. The contractor shall also obtain record or as built drawings from owner and coordinate with respective utility companies. The survey shall include the area of the trench plus 4' on each side of trench.

M. Tests

1. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.
2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.
3. Upon completion of the work and adjustment of all equipment, conduct an operating test. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.
4. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.
5. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.

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- N. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.
- O. Cleaning Up:
1. Upon completion of the work and at various time during the progress of the work, remove from the buildings and site all surplus materials, rubbish and debris resulting from the work of this Division.
 2. Thoroughly clean electrical equipment including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.
 3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.
 4. Leave the entire installation in a clean condition.
- P. Completion:
1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.
 2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.
- Q. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for operation and maintenance of electrical equipment, including replacement parts lists. As specified in Division 01.
- R. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.
- S. Final Completion of Electrical Systems:
1. Prior to Final Completion of operating electrical systems, the Contractor shall:
 - a. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.
 - b. Deliver to the Landscape Architect, all Record Documents per 1.3 of this section.
 - c. Furnish the required Operating and Maintenance Data/Manuals.
 - d. Clean up of the project pertaining to this Division of the work.
 - e. After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Architect that systems are complete and operating in conformance with Contract Documents.
 - f. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.
 - g. Submission of warranties and guarantees.
-

2. Final Completion of Work Shall be Contingent On:

- a. Contractor replacing defective materials and workmanship.
- b. Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Architect directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.
- c. Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours shall be a minimum of four (4) hours for each system or days as required under separate Sections of these Specifications. Complete operation and maintenance manuals shall be provided at least two (2) weeks prior to training.
- d. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.

- T. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of all equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating personnel shall receive the number of days instruction as indicated in other sections.

1.3 PROJECT RECORD DOCUMENTS

- A. Record Drawings: CAD: Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. Acceptable CAD systems shall be capable of producing files in AutoCAD Version 2000 compatible DWG or DXF format.
- B. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies, a complete separate, clean, undamaged set of the latest stamped, actioned submittals. As work progresses, maintain records of "as installed" conditions on this set in suitable ink or chemical fluid. Update the set daily. After successful completion of Project Site testing specified herein, and after completion of Punch List corrections, copy all records of "as installed" conditions on to originals.
- C. As- built drawing requirements:

As-built drawings are the final set of drawings produced at the completion of a construction project. They include all the changes that have been made to the original construction drawings, including notes, modifications, revisions and any other information that should be included. As-built drawings should not change the design intent but should depict the actual as-built conditions of the completed construction. While the original drawings are typically produced using computer aided design (CAD) software, the as-built drawings should contain handwritten notes, sketches, and changes. When the construction phases of the project / contract are finished a complete set of marked-up redlined drawings will be turned over to EDA Design & Construction for review and approval. All markings shall be on a previous approved set of drawings, signed and stamped by the EOR and Jurisdiction Enforcement Agency. No additional PE seal or signature is required on the as-built drawings. These drawings shall have AS-BUILT DRAWINGS indicated on the title sheet in the title block and on each sheet of

submitted as-built drawings along with initial of responsible individual. The as-built drawings are part of the permanent facility records for maintenance, operations and modification activities, in addition to systemization and operation activities. All accepted drawings by the jurisdiction will be logged into county archives.

- D. Content: All drawings required under "Field and Shop Drawings". Show "as installed" condition. Where room designations according to Project permanent signage differ from construction designations in the Contract Documents, show both designations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 260100

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN or XHHW.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems, Inc.
 2. Hubbell Power Systems, Inc.

3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

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

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Type THHN-THWN or XHHW, single conductors in raceway
- B. Class 1 and 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and below grade, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- G. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.4 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated wall assemblies to restore original fire-resistance rating of assembly.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
1. After installing conductors and cables and before electrical circuitry has been energized, test all conductors for compliance with requirements.
 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 3. Infrared Scanning: Perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductor Terminations and Connections:
 - 1. Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors.
 - 3. Connections to Ground Rods: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors in all raceways, enclosures, wireways and lighting poles in addition to those required by NFPA 70:

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.
- B. Report measured ground resistances that exceed 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, install up to 6 additional ground rods per location at no additional cost to the owner.

END OF SECTION 26 05 26

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Boxes, enclosures, and cabinets.

1.2 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. IMC: Comply with ANSI C80.6 and UL 1242.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

- a. Material: Steel
- b. Type: Compression. Set screw fittings shall not be used.

2. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

F. Joint Compound for IMC, or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, with gasketed cover.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, with gasketed cover.
- F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- G. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets:
 - 1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Indoors: Apply raceway products as specified below unless otherwise indicated.
 - 1. Exposed, Not Subject to Physical Damage: EMT.

- 2. Exposed and Subject to Severe Physical Damage: GRC or IMC.
- B. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- E. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- D. Install no more than the equivalent of three 90-degree bends in any conduit run. A. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- E. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- F. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- G. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- H. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

J. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

K. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

L. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where an underground service raceway enters a building or structure.
2. Where otherwise required by NFPA 70.

M. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.4 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for slurry-encased duct banks and in slurry-encased single duct runs.
2. Handholes and pull boxes.

1.2 ACTION SUBMITTALS

A. Product Data: For accessories, handholes, and boxes.

B. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.
4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

- B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line detectable warning tape specified in Division 26 Section "Identification for Electrical Systems."

2.3 HANDHOLES AND PULL BOXES

- A. Description: Comply with SCTE 77.

1. Color: Gray.
2. Configuration: Units shall be designed for flush burial and have closed bottom. Refer to drawings for installation detail.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural traffic load rating.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes and pull boxes shall have cable racks and pulling-in irons installed before slurry is poured in duct bank.
8. Provide a comparable product by one of the following or approved equal:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- B. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- C. Cut and patch existing pavement in the path of underground ducts and utility structures.

3.2 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward handholes & pull boxes and away from buildings and equipment.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1220 mm), both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for ducts.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition.
- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.
- H. Slurry-Encased Ducts: Support ducts on duct separators.
 - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly

together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

2. Pouring Slurry: Spade slurry carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of slurry to fall directly onto ducts. Use a plank to direct slurry down sides of bank assembly to trench bottom. Allow slurry to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
3. Reinforcement: Reinforce slurry-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
4. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and slurry envelope can be poured without soil inclusions; otherwise, use forms.
5. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
6. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade unless otherwise indicated.
7. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend slurry encasement throughout the length of the elbow.
8. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of slurry.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
9. Warning Tape: Bury detectable warning tape approximately 12 inches (300 mm) above all slurry-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.3 INSTALLATION OF HANDHOLES AND PULL BOXES

- A. Install hand holes and pull boxes below finished grade as detailed on drawings and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, (bottom and four sides as detailed on drawings) compacted to same density as adjacent undisturbed earth.
- C. Elevation: Set so cover surface to be 1" above finished grade as detailed on drawings.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

- E. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.4 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 3. Test grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.6 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 05 43

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identification for conductors.
 - 2. Underground-line detectable warning tape.
 - 3. Warning labels and signs.
 - 4. Equipment identification labels.
 - 5. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 UNDERGROUND-LINE DETECTABLE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: **ELECTRIC LINE.**

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Workspace Clearance Warning: **"WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."**

2.4 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. Underground-Line Detectable Warning Tape: During backfilling of trenches install continuous underground-line detectable warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, pull boxes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded Feeder and branch-circuit conductors.
 - a. Color shall be factory applied[or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit].
 - b. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- C. Conductors to Be Extended in the Future: Attach write-on tags marker tape to conductors and list source.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line detectable warning tape for power, lighting, communication, and control wiring.
- F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated.

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- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
- H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label] Stenciled legend 4 inches (100 mm) high]
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 26 05 53

SECTION 32 13 13 - CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete sidewalks, integral curbs, and gutters.
- B. Integrally colored and color-hardened Portland cement concrete paving with imprinted pattern and stain/sealer treatments.

1.02 RELATED REQUIREMENTS

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 20 00 - Concrete Reinforcement.
- C. Section 03 30 00 - Cast-in-Place Concrete.
- D. Section 03 30 50 - Concrete Testing and Inspection
- E. Section 03 31 10 - Anchorage to Existing Concrete

- D. Section 07 90 05 - Joint Sealants: Sealant for joints.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).
- D. ACI 303R - Guide to Cast-in-Place Architectural Concrete Practice; 2004.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
- G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
- H. ACI 503 - Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.
- I. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- J. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2012.
- K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2011a is current; use 2003 as indicated in 2010 CBC Referenced Standards.
- L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2012a.
- M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2012 is current; use 2007 as indicated in 2010 CBC Referenced Standards.
- N. ASTM C150/C150M - Standard Specification for Portland Cement; 2012 is current; use 2007 as indicated in 2010 CBC Referenced Standards.

- O. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2012.
- P. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- Q. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2012.
- R. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012 is current; use 2008a as indicated in 2010 CBC Referenced Standards.
- S. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2011.
- T. ASTM C 881/C 881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2002.
- U. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete; 2005.
- V. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 1999 (Reapproved 2008).
- W. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2009.
- X. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2008).
- Y. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2008).
- Z. Standard Specifications for Public Works Construction ("Green Book"), by Joint Cooperative Committee of the Southern California Chapter of the American Public Works Association and the Southern California Districts of the Associated General Contractors of California. Standard Specifications is published by and available from Building News, Division of BNI Publications, Inc., Los Angeles, CA, (213) 202-7775.

1.04 SUBMITTALS

- A. See General Conditions, for submittal procedures.
- B. Mix Design: Design mixes for each concrete mix.
- C. Product Data: Provide data on joint filler, admixtures, and curing compound.
 - 1. Material Certificates signed by manufacturers for each of the following:
 - a. Cementitious materials and aggregates.
 - b. Steel reinforcement and reinforcement accessories.
 - c. Admixtures.
 - d. Curing compounds.
 - e. Joint fillers.
 - 2. Colored concrete product data and color selections.
- D. Samples: Submit 6 sample panels, 6 x 6 inch in size illustrating each finish.
 - 1. Samples can be of sufficient size for color selection and/or verification.
- E. Shop drawings: For pattern layout and verification.

1.05 QUALITY ASSURANCE

- A. Industry Standard: Perform concrete paving Work in accordance with ACI 301.
- B. Regulatory Requirements: Where reference is made to Standard Specifications, the following shall apply.
 - 1. Where reference is made to Standard Specifications, the following shall apply:

- a. Perform off-site Work in public rights-of-way as indicated on the Contract Drawings and in accordance with requirements of authorities having jurisdiction, including Standard Specifications for Public Works Construction, as amended and adopted those authorities. For conditions not indicated otherwise on Contract Drawings, conform to Standard Details adopted by authorities having jurisdiction, including Standard Details for Public Works Construction, as amended and adopted those authorities.
 - b. Perform on-site Work as indicated and referenced on the Contract Drawings and as specified herein.
- 2. Conform to California Department of Transportation (CalTRANS) standard specifications.
- 3. Conform to Standard Specifications for Public Works Construction.
- 4. Conform to California Code of Regulations (CCR), Volume 2, Part 2, Chapters 18, 18A, 19 and 19A.
- 5. Conform to California Building Code (CBC), Chapter 11B and ADAAG for accessibility requirements.
 - a. Concrete paving and concrete finishes along accessible routes of travel shall be at least as slip-resistant as that described as a medium salted finish for slopes of less than 6%, and slip resistant at slopes of 6% or greater; CBC 1133B.7.1
- 6. Comply with OSHA and Cal-OSHA requirements.
- 7. Continuous surfaces, including walks and sidewalks, shall have a continuous common surface, not interrupted by steps or by abrupt changes in level exceeding 1/2-inch and shall have a minimum width of 48 inches.
- 8. Surface cross slopes shall not exceed 2 percent on any accessible path of travel.
- C. Source Quality Control: Obtain like materials from one source throughout.
- D. Lines and Levels: Established by State of California licensed Surveyor or registered Civil Engineer. Costs of surveying services shall be included in the Contract Sum.
- E. Installer Qualifications for stamped or imprinted concrete:
 - 1. The Installer shall provide a qualified foreman or supervisor who has a minimum of three years experience with imprinted and textured concrete, and who has successfully completed at least five stamped or imprinted concrete installations of high quality and similar in scope to that required.
 - 2. The concrete is cast in place, on the job site, by trained and experienced workmen who shall be employed by a firm that is a licensed and Manufacturer certified Contractor.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Delivery, Storage and Handling: Comply with requirements specified for regular concrete in Section 03 30 00 - Cast in Place Concrete.

PART 2 PRODUCTS

2.01 BASE MATERIAL

- A. Sub-Base and Aggregate Base Material under Portland Cement Concrete Paving: For pavement subject to vehicular traffic, provide sub-base and aggregate base material as specified in Section 32 11 23 - Aggregate Base Courses and as indicated on the Drawings. Aggregate base is not required under portland cement concrete paving subject only to pedestrian traffic in normal use.

2.02 PAVING ASSEMBLIES

- A. Comply with applicable requirements of ACI 301.
- B. Concrete Sidewalks and Median Barrier: 3,000 psi 28 day concrete, 4 inches thick, buff color Portland cement, exposed aggregate finish.

2.03 FORM MATERIALS

- A. Form Materials: As specified in Section 03 10 00.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751) or sponge rubber or cork (ASTM D 1752).

2.04 REINFORCEMENT

- A. General: As indicated on Drawings and specified following. Reinforcement for portland cement concrete paving in public rights-of-way shall comply with all applicable requirements in the Standard Specifications for Public Works Construction and Standard Details, as adopted by local authorities having jurisdiction.
- B. Reinforcing Steel and Welded Wire Reinforcement: Types specified in Section 03 20 00.
- C. Welded Wire Mesh: ASTM A185, welded plain cold-drawn steel wire fabric, minimum 6 x 6 / 1.9 x 1.9 or as noted on Drawings or required by reference standards and details. Furnish reinforcement in flat sheets, not rolls.
- D. Tie Wires: 18 gage minimum, black annealed steel.
- E. Dowels: ASTM A615/A615M Grade 60 (420); deformed billet steel bars; unfinished finish.

2.05 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Cement: ASTM C 150 Air Entraining - Type IIA or Type V portland type, grey color. Unless sulfate resistance is determined unnecessary by sulfate content tests. Refer to soils report referenced in Document 02 3200 - Geotechnical Data.
- C. Fine and Coarse Mix Aggregates: ASTM C33.
- D. Fly Ash: ASTM C618, Class C or F.
- E. Calcined Pozzolan: ASTM C618, Class N.
- F. Silica Fume: ACI 211.1
- G. Water: Clean, and not detrimental to concrete.
- H. Chemical Admixtures: ASTM C494/C494M, Type A - Water Reducing, Type B - Retarding, Type D - Water Reducing and Retarding, Type F - Water Reducing, High Range, and Type G - Water Reducing, High Range and Retarding.
 - 1. Do not use chemicals that result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.07 ACCESSORIES

- A. Liquid Curing Compound: ASTM C 309, Type 1, Class A. Comply with all applicable air pollution requirements.
- B. Liquid Surface Sealer: Flor-Guard, Outdoor manufactured by Diamatic USA, LLC division of Blastrac / Diamatic Global: www.diamaticusa.com.
- C. Tactile Warning Surfaces: See Section 32 17 26.
- D. Joint Sealer: Type as specified in Section 07 90 05.
- E. Color Additive:
 - 1. Color Admixture and Hardener: Dry Shake color hardener, suitable for both normal set and retarded set forms; containing no calcium chloride; pure mineral oxide pigments; each package containing enough dosage for one entire yard of concrete; and complying with the following:
 - a. Paragraph 407 of ACI 318-632.
 - b. ASTM C494, Type A for normal set and Type D for retarded set.
 - c. ASTM C979 for pigment.

- d. Manufacturer and Product: Lithochrome color hardener as manufactured by L.M. Scofield Company (800/800-9900), or approved equal.
- e. Curing Compound for Integrally Colored Concrete Paving: Color-matched, heavy duty, curing and finishing compound complying with the following.
 - 1) ASTM C309.
 - 2) Include colored concrete where indicated, include 5 pounds of coloring pigment per sack of cement.
 - 3) Manufacturer and Product: Lithochrome Colorwax as manufactured by L.M. Scofield Company, or approved equal.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Comply with requirements specified in Section 03 30 00 - Cast in Place Concrete.
- C. Concrete Mix for Pedestrian (Sidewalk) Pavements, Natural Color, unless indicated otherwise: Standard Specification for Public Works Construction, Section 201-1.1.2 - Class 520-B-2500, with minimum slump of 4-inches, except concrete paving in public rights of way shall be as required authorities having jurisdiction.
- D. Concrete Mix for Exterior Slabs on Grade: ASTM C94 - Ready-Mixed Concrete, Alternative No. 2, minimum 28 day compressive strength as indicated on Drawings or, if not indicated, 3000 psi.
- E. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
 - 1. Use accelerating admixtures in cold weather or set retarding admixtures in hot weather only when approved by Architect/Engineer. Do not use calcium chloride.
- F. Concrete Properties:
 - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 psi.
 - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 - 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
 - 4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
 - 5. Water-Cement Ratio: Maximum 40 percent by weight.
 - 6. Maximum Slump: 3 inches.

2.09 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.

2.10 ACCESSORY MATERIALS

- A. Soil Sterilant: As specified in Standard Specifications for Public Works Construction. Soil sterilant shall comply with all applicable environmental protection and hazardous materials laws and regulations. See Section 32 1313 - Aggregate Base Course for product.
- B. Headers and Stakes: Pressure preservative treated douglas fir, 2x6 nominal size except at curves provide laminated 1x6. Use hot dipped galvanized nails only.
- C. Expansion Joint Filler: ASTM D1751, premolded, compressible 1/2-inch thick non-extruding bituminous type resilient filler, compatible with joint backing and sealing products.
- D. Joint Backing and Sealer: As specified in Section 07 9005 - Joint Sealers.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads. As indicated on Drawings and/or Project Manual.

- B. Fine grading, checking, shaping, and compacting of subgrade shall be complete before start of concrete paving Work.
- C. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. See Section 32 11 23 Aggregate Base Course for construction of base course for work of this Section.

3.03 PREPARATION

- A. Project Conditions:
 - 1. Water and Dust Control: Maintain control of concrete dust and water at all times. Do not allow adjacent planting areas to be contaminated.
 - 2. Do not place pavement when base surface or ambient temperature is less than 40 degrees F (4 degrees C) or if base surface is wet or frozen.
 - 3. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Moisten base to minimize absorption of water from fresh concrete. Do not place concrete on standing water.
- C. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.
- D. Notify Architect minimum 24 hours prior to commencement of concreting operations.
- E. Curbs and Gutters: Schedule portland cement concrete curbs and gutters to be in place and cured prior to start of adjoining asphaltic concrete and portland cement concrete paving Work.

3.04 COORDINATION WITH EXISTING CONSTRUCTION

- A. Connection to Existing Construction: Where new concrete is doweled to existing construction, drill holes in existing concrete, insert steel dowels and pack with non-shrinking grout.
- B. Preparation of Existing Concrete: Prepare previously placed concrete by cleaning with steel brush and apply bonding agent in accordance with manufacturer's instructions.

3.05 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
 - 1. Surfaces and Edges: Except where special finishes and tooled edges are indicated, provide all exposed finish surfaces of dense concrete with sharp arises and outside corners.
 - 2. Recesses and Openings: As indicated on Drawings or as directed.
- B. Concrete Formwork:
 - 1. Construct formwork accurately and to configurations and dimensions indicated for finish concrete Work.
 - 2. Formwork shall be substantial, mortar-tight and braced to maintain position and shape during placement of reinforcing and concrete.
 - 3. Hold forms rigidly in place by stakes, clamps, spreaders and braces where required to ensure rigidity.
 - 4. Construct curb forms with smooth side placed next to exposed concrete face.
 - 5. Curb forms shall have true, smooth upper edge.
 - 6. Depth of curb forms at back of curbs shall be equal to full depth of curb.
 - 7. Depth of face forms shall be equal to full face height of curb.
 - 8. Benders or thin plank forms may be used to form curves and at grade changes and curb returns.
 - 9. Back forms for curb returns may be made of 1/2-inch thick benders cleated together for full depth of the curb.

10. Formwork shall not deviate more than 1/4-inch maximum from required positions and levels.
 11. Verify formwork alignment and levels as Work proceeds, promptly making adjustments and adding bracing as necessary.
- C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
1. Remove the form on the front of curbs in not less than one hour nor more than 6 hours after the concrete has been placed.
 2. Remove side forms for sidewalks, gutter depressions, island paving and driveways, not less than 12 hours after the finishing has been completed.
- D. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.06 REINFORCEMENT

- A. Place reinforcement at midheight of slabs-on-grade.
- B. Reinforcement Placement, General: Locate reinforcement as indicated on Drawings or in Standard Specifications, whichever is more stringent.
1. Locate reinforcement to provide required cover by concrete. If not otherwise indicated on Drawings or in Standard Specifications, provide concrete cover in compliance with ACI 318, Table 3.3.2.3.
 2. Place, support and secure reinforcement against displacement.
- C. Reinforcement Spacing: Space reinforcement as indicated on Drawings or in Standard Specifications, whichever is more stringent. If not indicated, maintain clear spacing of two times bar diameter but not less than 1-1/2 inches nor less than 1-1/3 times maximum size aggregate.
- D. Coordination: Locate reinforcement to accommodate embedded products and formed openings and recesses.
- E. Reinforcement Supports: Provide load bearing pads under supports or provide precast concrete block bar supports.
- F. Wire Fabric Placement: Place fabric in sheets as long as practicable, lapping adjoining pieces at least one full mesh and lace splices with 16 gage wire. Offset end laps in adjacent widths to prevent continuous laps. Extend fabric to within 1-inch of edge at slabs on grade. Cut mesh at expansion joints and full depth control joints.
- G. Interrupt reinforcement at contraction and expansion joints.
- H. Place dowels to achieve pavement and curb alignment as detailed.
1. Secure tie dowels in place before depositing concrete. Provide No. 3 bars for securing dowels where no other reinforcement is provided.

3.07 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.08 PLACING CONCRETE

- A. Mixing: If batch plant is within travel time not exceeding maximum limits, transit mix concrete in accordance with ASTM C94. If travel time exceeds limits, provide alternative means for mixing and submit for review and approval.
- B. Place concrete in accordance with ACI 304R.
- C. Do not place concrete when base surface is wet.
- D. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

- E. Concrete Conveying and Placement: Convey and place concrete in accordance with ACI 301 and requirements specified in Section 03 3000 - Cast in Place Concrete.
- F. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- G. Place concrete to pattern indicated.
- H. Apply surface retarder only to surfaces indicated in accordance with manufacturer's instructions.
- I. Natural Color Concrete Paving and Other Exterior Concrete: Provide natural color concrete typically, including at trash enclosure and loading door areas (exterior slabs on grade).

3.09 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Place 1/2 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated. Place in all concrete walks, other exterior flatwork and concrete curbs and gutters. If expansion joints are not indicated, comply with standard details and specifications of authorities having jurisdiction, including Standard Details for Public Works Construction and Standard Specification for Public Works Construction, as applicable.
 - 1. Place expansion control filler to correct elevation and profile. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
 - 2. Secure to resist movement by wet concrete.
 - 3. Coordinate locations to align expansion joints in adjoining concrete walks, curbs, gutters and other exterior flatwork.
 - 4. Provide expansion joints also at beginning and end of all curved segments.
 - 5. Provide expansion joints also at intersections of concrete curbs and gutters and building footing.
 - 6. Provide expansion joints also at intersections of concrete paving and building footing.
 - 7. Lay out expansion joint locations to occur where possible at penetrations such as handrail posts and columns.
 - 8. Place expansion control filler to correct elevation and profile.
 - 9. Align curb, gutter, and sidewalk expansion joints.
- C. Provide scored joints:
 - 1. As indicated on Drawings. If not indicated, locate joints in compliance with Standard Details.
 - 2. Evenly spaced at maximum 5 feet intervals.
 - 3. Between sidewalks and curbs.
 - 4. Between curbs and pavement.
 - 5. Lay out control joint locations to occur at penetrations such as handrail posts and columns and where shown on Drawings.
 - 6. Refer to Architectural, Landscape and Civil Drawings for additional information and joint locations.
- D. Provide keyed joints as indicated.
- E. Saw cut contraction joints 1/8 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.10 FINISHING

- A. Concrete Paving Finish: ACI 301, two-step trowel finish, followed after surface has achieved initial set by flooding of surface and light rubbing with bristle brush so that concrete fines are exposed slightly.
 - 1. Finish surface less than 6 percent shall receive medium broom finish resembling medium grit sandpaper. CBC 1133B.7
 - 2. Finish surface greater than 6 percent shall receive heavy broom finish. CBC 1133B.7

3. Surfaces shall have static coefficients of friction of 1.3 to 1.6 (dry) and 1.2 to 1.4 (wet) when field tested in accordance with ASTM C1028.
- B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/8 inch radius.
 1. Broomed: Pull broom across freshly floated concrete to produce medium texture in straight lines perpendicular to main line of traffic. Do not dampen brooms.
 2. Tooled Joints: 1-inch deep by 3/16-inch wide tooled joints with 1/8-inch radius corners.
- C. Curbs and Gutters: Comply with Standard Specifications.
- D. Specific Finishes:
 1. Trowel: Precautions should be taken to ensure that the surface is uniformly troweled so that it is not slippery. Do not over-trowel or burnish the surface.
- E. Curing and Sealing:
 1. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
 2. Curing, Concrete Curbs and Gutters: Apply curing compound as specified in Section 03 30 00 - Cast In Place Concrete, immediately after finishing. Apply compound in accordance with manufacturer's instructions.
 3. Precautions shall be taken in hot weather to prevent plastic cracking resulting from excessively rapid drying at surface as described in CIP 5 Plastic Shrinkage Cracking published by the National Ready Mixed Concrete Association.
 4. Do not cover concrete with plastic sheeting.

3.11 JOINT SEALING

- A. See Section 07 90 05 for joint sealer requirements.

3.12 TOLERANCES

- A. ACI 301, Class B, except paving in public rights-of-way shall comply with the Standard Specifications.
- B. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- C. Maximum Variation From True Position: 1/4 inch.

3.13 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
 2. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 75 cu yd or less of each class of concrete placed each day.
 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 2. Perform one slump test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.14 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

- B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.
- C. Provide lumber ramping and plywood covering where curbs and gutters are subject to vehicular and equipment traffic during construction.
- D. Provide protection of colored concrete in accordance with colored concrete manufacturer's instructions and recommendations.

END OF SECTION

SECTION 32 84 23 - LANDSCAPE IRRIGATION SYSTEM

1.00 GENERAL

1.01 SECTION INCLUDES

- A. Furnish all labor, materials, equipment, appliances and necessary incidentals for the complete installation of all landscape irrigation system as shown on the drawings and as specified herein.

1.02 RELATED WORK IN OTHER SECTIONS

- A. Landscape finish grading
- B. Landscape planting
- C. Cast-in-place concrete

1.03 QUALITY ASSURANCE AND REQUIREMENTS

- A. Permits and fees: The Contractor shall obtain and pay for any and all permits and all observations as required.
- B. Manufacturer's directions: Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the drawings and specifications.
- C. Ordinances and regulations: All local, municipal and state laws, and rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations or requirements of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.
- D. Explanation of drawings:
 - 1. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and Landscape Architectural features.
 - 2. The word Landscape Architect as used herein shall refer to the Owner's authorized representative.

3. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications.
4. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Owner's authorized representative. In the event this notification is not performed, the irrigation Contractor shall assume full responsibility for any revision necessary.

1.04 SUBMITTALS

A. Material List:

1. The Contractor shall furnish the articles, equipment, materials, or processes specified by name in the drawings and specifications. No substitution will be allowed without prior written approval by the Landscape Architect.
2. Complete material list shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used.
3. Equipment or materials installed or furnished without prior approval of the Landscape Architect may be rejected and the Contractor required to remove such materials from the site at his own expense.
4. Approval of any item, alternate or substitute indicates only that the product or products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted.
5. Manufacturer's warranties shall not relieve the Contractor of his liability under the warranty. Such warranties shall only supplement the warranty.

B. Record ("As-Built") Drawings:

1. Submit in accordance with Division 01.
2. The Contractor shall provide and keep up to date a complete 'as-built' record set of black line prints which shall be corrected daily and show every change from the original drawings and specifications and the exact 'as-built' locations, sizes, and kinds of equipment. Prints for this purpose may be obtained from the Landscape Architect with the Owners approval at cost. This set of drawings shall be kept on the site and shall be used only as a record set.
3. These drawings shall also serve as work progress sheets and shall be the basis for measurement and payment for work completed. The Contractor shall make neat and legible annotations thereon daily as the work proceeds, showing the work as actually installed. These drawings shall be available at all times for observation and shall be kept in a location designated by the Landscape Architect.

4. Before the date of the final observation, the Contractor shall transfer all information from the 'as-built' prints to a sepia mylar, procured from the Landscape Architect with Owner's approval at cost. All work shall be neat, in ink, and subject to the approval of the Landscape Architect.
5. The Contractor shall dimension from two (2) permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:
 - a. Connection to existing water lines.
 - b. Connection to existing electrical power.
 - c. Gate valves.
 - d. Routing of irrigation pressure lines (dimension max. 100 ft. along routing).
 - e. Irrigation control valves.
 - f. Routing of control wiring.
 - g. Quick coupling valves.
 - h. Other related equipment as directed by the Landscape Architect.
5. On or before the date of the final observation, the Contractor shall deliver the corrected and completed sepias to the Landscape Architect. Delivery of the Record Drawings will not relieve the Contractor of the responsibility of furnishing required information that may be omitted from the prints.

C. Controller Charts:

1. As-built drawings shall be approved by the Landscape Architect before controller charts are prepared.
2. Provide one controller chart for each controller supplied.
3. The chart shall show the area controlled by the automatic controller.
4. The chart is to be a 50% reduced drawing of the actual as-built system. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
5. The chart shall be a blackline print and a different color shall be used to indicate the area of coverage for each station.
6. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum of 10 mils.
7. These charts shall be completed and approved prior to final observation of the

irrigation system.

- D. Operation and Maintenance Manuals: Prepare and deliver to the Landscape Architect within ten calendar days prior to completion of construction, two hard cover binders with three rings containing the following information:
1. Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representative.
 2. Catalog and parts sheets on every material and equipment installed under this contract.
 3. Warranty statement.
 4. Complete operating and maintenance instruction on all major equipment.
 5. In addition to the above mentioned maintenance manuals, provide the Owner's maintenance personnel with instructions for major equipment and show evidence in writing to the Landscape Architect at the conclusion of the project that this service has been rendered.
- E. Equipment to be furnished
1. Supply as a part of this contract the following tools:
 - a. Two (2) sets of special tools required for removing, disassembling and adjusting each type of irrigation and valve supplied on this project.
 - b. Two (2) five ft. long valve keys for operation of gate valves.
 - c. Two (2) keys for each automatic controller.
 - d. Six (6) quick coupler keys and matching hose swivels for each type of quick coupling valve installed.
 2. The above mentioned equipment shall be turned over to the Owner at the conclusion of the project. Before final observation can occur, evidence that the Owner has received material must be shown to the Landscape Architect.

1.05 JOB CONDITIONS

- A. Verification of Existing Conditions
1. Visit the site to determine existing conditions, including access to the site and the nature and extent of existing improvements upon adjacent public and private property. Nature of materials to be encountered and other factors that may affect the work of this section.
 2. Additional compensation resulting from the alleged ignorance of local conditions, and their effect upon the cost of the work will not subsequently be approved.
- B. Protection
1. Protect the Owner's property from injury or loss. All damage to existing property

(buildings, utilities, etc.) or planting (trees, shrubs, lawn or ground cover) caused by the Contractor during his operation or as a result of malfunction of installed work during the warranty period shall be repaired at Contractor's expense.

2. Cause minimum interference with workmen, materials, or other equipment of other trades on the project.
- C. Irrigation work shall not begin until all construction adjacent to the areas has been completed unless otherwise directed.
- D. Contractor shall apply for and secure all required permits.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handling of PVC Pipe and Fittings: The Contractor is cautioned to exercise care in handling, loading, unloading, and storing of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded and, if installed, shall be replaced with new piping.

1.07 WARRANTY

- A. The warranty for the irrigation system shall be made in accordance with the attached form. The general conditions and supplementary conditions of these specifications shall be filed with the Owner or his representative prior to acceptance of the irrigation system.
- B. A copy of the warranty form shall be included in the operations and maintenance manual.
- C. The warranty form shall be re-typed onto the Contractor's letterhead and contain the following information:

WARRANTY FOR IRRIGATION SYSTEM

We hereby warranty that the irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defects in material or workmanship which may develop during the period of one year from date of acceptance and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project
Location
Signed
Address
Phone
Date of Acceptance

2.00 PRODUCTS

2.01 GENERAL

- A. Use only new materials or brands and types noted on drawings, specified herein, or approved equals.

2.02 PRESSURE MAIN LINE PIPE AND FITTINGS

- A. Pressure main line piping for sizes 2 in. and larger, shall be PVC Class 315.
- B. Pipe shall be made from an NSF approved type I, grade I, PVC compound conforming to ASTM resin specification D1784. All pipe must meet requirements as set forth in Federal Specification PS-22-70, with an appropriate standard dimension (S.D.R.). (Solvent weld pipe)
- C. Pressure main line piping for sizes 1 ½ in. and smaller shall be PVC schedule 40 with solvent-weld joints.
- D. Pipe shall be made from NSF approved type I, grade I, PVC compound conforming to ASTM resin specification D1785. All pipe must meet requirements as set forth in Federal Specification PS-21-70. (solvent-weld pipe).
- E. PVC solvent-weld fittings shall be schedule 40, 1-2, II-1 NSF approved conforming to ASTM test procedure D2466.
- F. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation methods prescribed by the manufacturer.
- G. All PVC pipe must bear the following markings:
 - 1. Manufacturer's name.
 - 2. Nominal pipe size.
 - 3. Schedule or class.
 - 4. Pressure rating in P.S.I.
 - 5. NSF (National Sanitation Foundation) approval.
 - 6. Date of extrusion.

- H. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable I.P.S. schedule and NSF seal of approval.

2.03 PVC NON-PRESSURE LATERAL LINE PIPING

- A. Non-pressure buried lateral line piping shall be PVC class 200 with solvent-weld joints.
- B. Pipe shall be made from NSF approved, type I, grade II PVC compound conforming to ASTM resin specification D1784. All pipe must meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.
- C. Except as noted in paragraph A and B of Section 2.03, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure mainline pipe and fittings as set forth in section 2.02 of these specifications.

2.04 BRASS PIPE AND FITTINGS

- A. Where indicated on the drawings, use red brass screwed pipe conforming to Federal Specification #WW-P-351.
- B. Fittings shall be red brass conforming to Federal Specifications #WW-P-460.

2.05 GALVANIZED PIPE FITTINGS

- A. Where indicated on the drawings, use galvanized steel pipe ASA schedule 40 mild steel screwed pipe.
- B. Fittings shall be medium galvanized screwed beaded malleable iron. Galvanized couplings may be merchant coupling.
- C. All galvanized pipe and fittings installed below grade shall be painted with two (2) coats of Koppers #50 Bitumastic.

2.06 QUICK COUPLING VALVES

- A. Quick coupling valves shall have a brass one or two piece body designed for working pressure of 150 P.S.I. operable with quick coupler. Key size and type shall be as shown on plans.
- B. Quick coupling valves shall be installed from 6 in. to 12 in. from nearest adjacent paved area.

2.07 GATE VALVES - 3" AND SMALLER

- A. Shall be 125 lb. SWP bronze gate valve with screw-in bonnet, non-rising stem and solid wedge disc.
- B. Shall have threaded ends and shall be equipped with a bronze handwheel.

- C. Shall be similar to those manufactured by Nibco or approved equal.
- D. All gate valves shall be installed per installation detail.

2.08 CONTROL WIRING

- A. Connections between the automatic controllers and the electric control valves shall be made with direct burial copper wire AWG-UF 600 volt. Pilot wires shall be a different color wire for each automatic controller. Common wires shall be white with a different color stripe for each automatic controller. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14.
- B. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.
- C. Where more than one (1) wire is placed in a trench, the wiring shall be taped together at intervals of ten (10) feet.
- D. An expansion curl shall be provided within three (3) feet of each wire connection. Expansion curl shall be of sufficient length at each splice connection at each electric control, so that in case of repair, the valve bonnet may be brought to the surface without disconnection of the control wires. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.
- E. All splices shall be made with Scotch-Lok #3576 connector sealing packs, Rainbird Snap-Tite wire connector, or approved equal. Use one splice per connector sealing pack.
- F. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of the Landscape Architect.

2.09 CHECK VALVES

- A. Swing check valves 2 in. and smaller shall be 200 lb. W.O.G. bronze construction with replaceable composition, neoprene or rubber disc and shall meet or exceed Federal Specification WW-V-51D, Class A, Type IV. Install when required to prevent any low head drainage.
- B. Anti-drain valves shall be of heavy duty virgin PVC construction with F.I.P thread inlet and outlet. Internal parts shall be stainless steel and neoprene. Anti-drain valve shall be field adjustable against drawout from 5 to 40 feet of head. Anti-drain valve shall be similar to the Valcon 'ADV' or approved equal. Install when required to prevent any low head drainage.

2.10 TRICKLE DRIP EMITTERS AND EMITTER TUBING

- A. Emitter body shall be manufactured of 20% glass-filled polypropylene and have an inlet barb. Flow shall be regulated through a silicone flapped diaphragm with a flow path of 1/4 in. The emitter shall pressure compensate for rated flow $\pm 10\%$ over a pressure variant of 10 to 50 PSI. It shall be similar to those manufactured by Global Water Systems, Inc., 7341 Whittier Blvd, Whittier, California. (213) 945-2287. Refer to irrigation drawings for

emitter size and type.

- B. Tubing for emitter systems shall be virgin polyethylene extruded from Union Carbide Bakelite resin #60-80 or #75-10. The ½ in. tubing shall have an I.D. of .580 inches and an O.D. of .690 inches. The 1/8 in. tubing shall have an I.D. of .125 inches and an O.D. of .195 inches. Tubing shall be similar to that manufactured by Global Water Systems, Inc.
- C. Fittings for emitter tubing shall be molded from specially formulated ultra high heat resistant polypropylene plastic material. Fitting for emitter tubing shall be similar to Agricultural Products, Inc. 'compression line fittings'. Use AG Products #CA adapter and #CAA adhesive when connecting emitter tubing to ½ in. PVC slip socket fittings.

2.11 AUTOMATIC CONTROLLERS

- A. Automatic controllers shall be of size and type shown on the plans.
- B. Final location of automatic controllers shall be approved by the Landscape Architect.
- C. Unless otherwise stated on the plans, the 120 volt electrical power to the automatic controller location shall be furnished by others. The final electrical hook-up shall be the responsibility of the irrigation Contractor.

2.12 ELECTRIC CONTROL VALVES

- A. All electric control valves shall have a manual flow adjustment.
- B. Provide and install one control valve box for each electric control valve.

2.13 BACKFLOW PREVENTION UNITS

- A. Backflow prevention units shall be of size and type indicated on the irrigation drawings. Install backflow prevention units in accordance with irrigation construction details.
- B. Wye strainers at backflow prevention units shall have a 125 lb flanged cast iron with 30 mesh monel screen and shall be similar to Bailey #100A or approved equal.

2.14 CONTROL VALVE BOXES

- A. Use 10 in. x 10 1/4" round valve box with extension and bolt down cover for all gate valves, Carson Industries 910-12B or approved equal. Extension sleeve shall be PVC - 6" minimum size.
- B. Use 9-1/2 in. x 16 in. x 11 in. rectangular box for all electrical control valves, Carson Industries 1419-12B with green bolt down cover or approved equal.
- C. All electric control valve boxes shall have controller and valve station numbers embossed on top of cover.

2.15 IRRIGATION HEADS

- A. All irrigation heads shall be of the same size, type, and deliver the same rate of precipitation with the diameter (or radius) of throw, pressure, and discharge as shown on the plans and/or specified in these special provisions.
- B. Spray heads shall have a screw adjustment.
- C. Riser units shall be fabricated in accordance with the details shown on the plans.
- D. Riser nipples for all sprinkler heads shall be the same size as the riser opening in the sprinkler body.
- E. All irrigation heads of the same type shall be of the same manufacturer.

3.00 EXECUTION

3.01 OBSERVATION

- A. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions and receive Landscape Architect's approval prior to proceeding with work under this section.
- B. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by his operations or neglect. Check existing utilities drawings for existing utility locations.
- C. Coordinate installation of irrigation materials, including pipe, so there shall be no interference with utilities or other construction or difficulty in planting trees, shrubs, vines, and ground cover.
- D. The Contractor shall carefully check all grades to satisfy himself that he may safely proceed before starting work in the irrigation system.

3.02 PREPARATION

- A. Physical Layout:
 - 1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of irrigation heads.
 - 2. All layout shall be approved by Landscape Architect prior to installation.
- B. Water Supply:
 - 1. Irrigation system shall be connected to water supply points of connection as indicated on the drawings.

2. Connections shall be made at approximate locations as shown on drawings. Contractor is responsible for minor changes caused by actual site conditions.

C. Electrical Supply:

1. Electrical connections for automatic controller shall be made to electrical points of connection as indicated on the drawings.
2. Connections shall be made at approximate locations as shown on drawings. Contractor is responsible for minor changes caused by actual site conditions.

3.03 INSTALLATION

A. Trenching:

1. Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout indicated on drawings and as noted.
2. Provide for a minimum cover of twenty four (24) inches for all pressure main line piping 4 in. and larger and for a minimum cover of eighteen (18) inches for all pressure main line piping 3 in. and smaller
3. Provide for a minimum cover of twelve (12) inches for all non-pressure lines.
4. Provide for a minimum cover of eighteen (18) inches for all control wiring.

B. Backfilling:

1. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
2. A fine granular material backfill will be initially placed on all lines. No foreign matter larger than ½ in. in size will be permitted in the initial backfill.
3. Flooding of trenches will be permitted only with approval of Landscape Architect.
4. If settlement occurs and subsequent adjustments in pipe, valves, irrigation heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the Owner.

C. Trenching And Backfill Under Paving:

1. Trenches located under areas where paving, turfblock, asphaltic concrete or concrete, will be installed shall be backfilled with sand - a layer 6 in. below the pipe

and 3 in. above the pipe - and compacted in layers to 95% compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm unyielding condition. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, cap and pressure test all piping under paving prior to the paving work.

2. Generally, piping under existing walks is done by jacking, boring or hydraulic driving, but where any cutting or breaking of sidewalks and/or concrete is necessary, it shall be done and replaced by the Contractor as part of the contract cost. Permission to cut or break sidewalks and/or concrete shall be obtained from the Landscape Architect. No hydraulic driving will be permitted under concrete paving.
3. Provide for a minimum cover of eighteen (18) inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

D. Assemblies:

1. Routing of irrigation lines as indicated on the drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with the details per plans.
2. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
3. Install all assemblies specified herein in accordance with respective detail. In absence of detail drawings or specifications pertaining to specific items required to complete work, perform such work in accordance with best standard practice with prior approval of Landscape Architect.
4. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.
5. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon tape or approved equal, shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.

- E. Line Clearance:** All lines shall have a minimum clearance of 6 in. from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.
- F. Automatic Controller:** Install in accordance with manufacturer's instructions. Remote control valves shall be connected to controller in numerical sequence as shown on the drawings.
- G. High Voltage Wiring For Automatic Controller:**

1. 120 volt power connection to the automatic controller shall be provided by the Contractor.
2. All electrical work shall conform to local codes, ordinances, and union authorities having jurisdiction.
- H. Remote Control Valves: Install where shown on drawings and details. When grouped together, allow at least 12 in. between valves. Install each remote control valve in a separate valve box.
- I. Flushing Of System
 1. After all new irrigation pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of irrigation heads, the control valves shall be opened and a full head of water used to flush out the system.
 2. Irrigation heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Landscape Architect.
- J. Irrigation Heads:
 1. Install the irrigation heads as designated on the drawings. Irrigation heads to be installed in this work shall be equivalent in all respects to those itemized.
 2. Spacing of heads shall not exceed the maximum indicated on the drawings. In no case shall the spacing exceed the maximum recommended by the manufacturer.

3.04 TEMPORARY REPAIRS

- A. The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the warranty as herein specified.

3.05 EXISTING TREES

- A. Where it is necessary to excavate adjacent to existing trees, the Contractor shall use all possible care to avoid injury to trees and tree roots. Excavation in areas where two (2) inch and larger roots occur shall be done by hand. All roots two (2) inches and larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap, to prevent scarring or excessive drying. Where a ditching machine is run close to trees having roots smaller than two (2) inches in diameter, the wall of the trench adjacent to the tree shall be hand trimmed, making clean cuts through. Roots one-half (½) inch and larger in diameter shall be painted with two coats of tree seal, or equal. Trenches adjacent to trees should be closed within twenty four (24) hours; and where this is not possible, the side of the trench adjacent to the tree shall be kept shaded with burlap or canvas.

3.06 FIELD QUALITY CONTROL

A. Adjustment of the System:

1. The Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible.
2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.
3. Lowering raised irrigation heads by the Contractor shall be accomplished within ten (10) days after notification by Owner or Landscape Architect.
4. All irrigation heads shall be set perpendicular to finished grades unless otherwise designated on the plans.

B. Testing of Irrigation System:

1. The Contractor shall request the presence of the Landscape Architect in writing at least 48 hours in advance of testing.
2. Test all pressure lines under hydrostatic pressure of 150 lbs. per sq. inch, and prove watertight.
NOTE: Testing of pressure main lines shall occur prior to installation of electric control valves.
3. All piping under paved areas shall be tested under hydrostatic pressure of 150 lbs. per sq. inch, and proved watertight, prior to paving.
4. Sustain pressure in lines for not less than two (2) hours. If leaks develop, replace joints and repeat test until entire system is proven watertight.
5. All hydrostatic tests shall be made only in the presence of the Landscape Architect. No pipe shall be backfilled until it has been observed, tested and approved in writing.
6. Furnish necessary force pump and all other test equipment.
7. When the irrigation system is completed, perform a coverage test in the presence of the Landscape Architect, to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accomplished before any ground cover is planted.
8. Upon completion of each phase of work, entire system shall be tested and adjusted to meet site requirements.

3.07 MAINTENANCE

- A. The entire irrigation system shall be under full automatic operation for a period of seven (7) days prior to any planting and for sixty (60) days after observation to begin maintenance period.
- B. The Landscape Architect reserves the right to waive or shorten the operation period.

3.08 CLEAN-UP

- A. Clean-up shall be made as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to original conditions.

3.09 FINAL OBSERVATION PRIOR TO ACCEPTANCE

- A. The Contractor shall operate each system in its entirety for the Landscape Architect at time of final observation. Any items deemed not acceptable by the observer shall be reworked to the complete satisfaction of the Landscape Architect.
- B. The Contractor shall show evidence to the Landscape Architect that the Owner has received all accessories, charts, record drawings, and equipment as required before final observation can occur.

3.10 OBSERVATION SCHEDULE

- A. Contractor shall be responsible for notifying the Landscape Architect in advance for the following observations, according to the time indicated:
 - 1. Pre-job conference - 7 calendar days.
 - 2. Pressure supply line installation and testing - 48 hours.
 - 3. Lateral line and sprinkler installation - 48 hours.
 - 4. Coverage test - 48 hours.
 - 5. Observation to begin maintenance period - 7 calendar days.
 - 6. Final observation coverage test - 7 days.
- B. When observations have been conducted by other than the Landscape Architect, show evidence of when and by whom these observations were made.
- C. No observations will commence without as-built drawings. In the event the Contractor calls for an observation without as-built drawings, without completing previously noted corrections, or without preparing the system for observation, he shall be responsible for reimbursing the Landscape Architect at the rate of two and one-half times the normal office

hourly rate per hour portal to portal (plus transportation costs) for the inconvenience. No further observations will be scheduled until this charge has been paid.

END OF SECTION 32 84 23

SECTION 32 93 00 - LANDSCAPE PLANTING

1.00 GENERAL

1.01 SECTION INCLUDES

- A. Furnish all labor, materials, equipment, appliances and necessary incidentals for the complete installation of all landscape planting as shown on the drawings and as specified herein. Work includes, but is not limited to, the following:
 - 1. Furnish and install import soil, backfill mix, acid loving plant backfill mix and raised planter mix in planting areas indicated on plans and in specifications.
 - 2. Apply pre-emergent to planting areas as specified herein.
 - 3. Fine grading
 - 4. Soil preparation and fertilization.
 - 5. Furnish shrubs and ground covers.
 - 6. Install shrubs and ground covers.
 - 7. Furnish and install (metal landscape edging)
 - 8. Protect, maintain and warranty as specified.
 - 9. All work of every description mentioned in the specification and/or amendments thereto, and all other satisfactory completion of the work including clean-up of the site.

1.02 RELATED WORK IN OTHER SECTIONS

- A. Landscape irrigation

1.03 QUALITY ASSURANCE

- A. Soils testing for planting areas, if required, shall be performed by RCRMC approved Laboratory.
- B. The testing laboratory for soils analysis shall use the following criteria for soil testing:
 - 1. USDA Agricultural Suitability test per Handbook-60.
 - 2. University of California Soil Fertility test.
 - 3. Interpretation, recommendations, and comments regarding these tests are required.

- D. A soils analysis of import soil, raised planter mix and organic amendment shall be required prior to backfill.
 - 1. One quart of import soil, without specified amendments, shall be submitted for particle size, suitability and fertility analyses. Two quarts of the custom lightweight soil mix shall be submitted for organic analyses. Two quarts each of sphagnum peat moss, organic amendment, and fine sand for backfill mix and on-grade plantings shall be submitted for organic and particle size analyses. Do not mix.
- F. After the completion of planting in the soil preparation areas and on-grade backfill mix areas, soil testing shall be conducted for organic suitability. The Contractor shall submit to the testing laboratory the original amendment specification with all issued bulletins for soil amendments and installation procedures along with 5 random samples of soil preparation areas and 5 random samples of backfill mix areas for analysis. Fertility analyses, recommendations, and interpretation shall be required from the testing laboratory to assure all specified amendments have been provided.
- G. Backfill for acid loving plants shall be sampled after mixing and delivery to the site but prior to backfilling. The Contractor shall submit to the testing laboratory the original acid loving plant backfill mix specifications with all issued bulletins and one quart of backfill mix for every 25 cubic yards of organic and fertility analyses. Fertility analyses, recommendations and interpretation shall be required from the testing laboratory to assure all specified amendments have been provided.
- H. The Contractor shall perform all soil testing of the backfill mix, acid loving plant mix and raised planter mix and submit the soil testing laboratory's findings to the Architect within a minimum of 5 days prior to backfilling.
- I. Samples of materials shall be submitted for observation. Delivery may begin upon approval of samples. Material samples shall include fertilizers and soil conditioners, plants and any other materials indicated herein.
- J. The Contractor shall furnish a certificate of delivery slip with each delivery of material in containers or in bulk. Certificate shall state source, quantity, or weight, type and analysis and date of delivery. Deliver all certificates to the Architect.
- K. No substitutions will be permitted without the approval of the Owner's authorized Representative. Rejected materials shall be removed from the site by the Contractor.
- L. The Contractor shall warranty shrubs and hydroseeded ground covers for a period of six months and trees for one year from date of final acceptance.

1.04 SUBMITTALS

- A. The Contractor shall furnish the articles, equipment, materials, or processes specified by name in the drawings and specifications. No substitution will be allowed without prior written approval by the Architect and/or Client.
- B. Complete material list shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials to be used.

- C. Materials installed or furnished without prior approval of the Architect and/or District may be rejected and the Contractor required to remove such materials from the site at his own expense.
- D. Approval of any item, alternate or substitute indicates only that the product or products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted.
- E. Manufacturer's warranties shall not relieve the Contractor of his liability under the warranty. Such warranties shall only supplement the warranty.

1.05 JOB CONDITIONS

- A. Visit the site to determine existing conditions, including access to the site and the nature and extent of existing improvements upon adjacent public and private property, as well as materials and other factors to be encountered that may affect the work of this section.
- B. Additional compensation resulting from the alleged ignorance of local conditions, and their effect upon the cost of the work will not subsequently be approved.
- C. Protect the Owner's property from injury or loss. All damage to existing property (buildings, utilities, plantings, etc.) caused by the Contractor during his operation or as a result of malfunction of installed work during the warranty period shall be repaired at Contractor's expense.
- D. Cause minimum interference with workmen, materials, or other equipment of other trades on the project.
- E. Landscape work shall not begin until all construction adjacent to the planting areas has been completed and until the irrigation systems have been installed and approved by the Architect and the Client.
- F. Contractor shall apply for and secure all required permits.

2.00 PRODUCTS

2.01 MANUFACTURER: It is the intent of this specification that all materials herein specified and shown on the drawings shall be of the highest quality available and meet the requirements specified.

2.02 SOIL MATERIALS

- A. Import Soil: If needed, furnish all import soil necessary to complete the required planting of on-grade planting areas and for backfill and raised planter mix as indicated:
 - 1. Silt plus clay content of the import soil shall not exceed 15% by weight with a minimum 95% passing the 2.0 millimeter sieve.
 - 2. The sodium absorption ratio (SAR) shall not exceed 6.

3. The electrical conductivity (EC) of the saturation extract of this soil shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade.
4. The boron content of this soil shall be no greater than one part per million as measured on the saturation extract.
5. Samples of the import soil shall be submitted to the soils testing laboratory for analysis, interpretation, and recommendations prior to blending or backfilling.

B. Organic Amendment

1. Humus material shall have an ash content of no less than 8% and no more than 50%.
2. The pH of the material shall be between 6 and 7.5.
3. The salt content shall be less than 10 millimhos/cm @ 25 degrees C. (ECe less than 10) on a saturated paste extract. If the ECe exceeds 10 millimhos/cm, the maximum rate of use shall not exceed 15% by volume.
4. Boron content of the saturated extract shall be less than 1.0 parts per million.
5. Silicon content (acid-insoluble ash) shall be less than 20%.
6. Calcium carbonate shall not be present if to be applied on alkaline soils.
7. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, sludges, peat mosses, etc., low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
8. Composted wood products are conditionally acceptable stable humus must be present. Wood-based products are not acceptable which are based on redwood or cedar.
9. Sludge-based materials are not acceptable if the soil already has a high level (toxic level) of zinc, copper, or other heavy metals based on soil analysis.
10. Carbon: nitrogen ratio is less than 25:1.
11. The compost shall be aerobic without malodorous presence of decomposition products.
12. The maximum particle size shall be 0.5", 80% or more shall pass a No. 4 screen.

Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

Arsenic	20
Mercury	10
Cadmium	15
Molybdenum	60

Chromium	100
Nickel	100
Cobalt	50
Selenium	30
Copper	150
Silver	10
Lead	100
Vanadium	50

13. Samples of the organic amendment shall be submitted to the soils testing laboratory for analysis, interpretation, and recommendations prior to blending or backfilling, as outlined in 1.03 Quality Assurance in this Section. Pending approval from the soils lab, suppliers of acceptable products are:

- a. Earth Works - composted washed steer manure. 310/322-9702.
- b. Auinaga Fertilizer Co. Forest Floor Humus. 949/786-9558.
- c. Foster Farms - compost. 209/394-7901.

- D. Sand: A single sand source shall be used. The sand must pass the following gradation and chemical specifications:

1. Particle size distribution (USDA sand classification) #16 sand.

Sieve No. (US Standard)	Percent Dry Weight Passing
10	100
16	65-100
20	0-20
35	0-5
40	0-2

- 2. Soluble Salts: Maximum 3.0 dS/m at 25 degrees C. as determined in saturation extract.
- 3. Sodium Absorption Ratio (SAR): Maximum 6.0 at 25 degrees C. as determined in saturation extract.
- 4. Boron: Maximum 1 ppm at 25 degrees C as determined in saturation extract.
- 5. Samples of the import sand shall be submitted to the soils testing laboratory for analysis, interpretation, and recommendations prior to blending or backfilling.

- E. Peat:

- 1. Milled Canadian sphagnum peat, light brown and fibrous without excessive sticks. Peat moss shall have a pH of not less than 5, and have an organic content of not less than 90% (L.O.I.)

- F. Vermiculite: Horticultural vermiculite shall be medium sized, clean, odorless, nontoxic and sterile with a pH of 7.0-8.5.

- G. Triple super phosphate (0-45-0) granular commercial grade.
- H. Potassium sulfate (0-0-50) granular commercial grade.
- I. Urea-formaldehyde (38-0-0) commercial grade.
- J. Calcium Carbonate: 95% lime as derived from oyster shells.
- K. Gypsum: Agricultural grade containing minimum 98% calcium sulfate.
- L. Commercial fertilizer: As specified by soils testing laboratory. Deliver in sacks, with a manufacturer's label attached to each sack, which lists weight and analysis.
- M. Soil sulphur shall be agricultural grade, containing a minimum 99% sulphur.
- N. Ferrous iron sulfate shall be first quality commercial grade; ground ferrous sulphate containing a minimum 18.5% iron expressed as metallic.
- O. Root hormone shall be "Super Thrive."
- P. Planting tablets shall be NPK 20-10-5, 21 gram and 5 gram fertilizer tablets.
- Q. Gro-Power materials shall be first quality commercial grade as manufactured by Gro-Power, Inc., 15065 Telephone Avenue, Chino, CA 91710-9614. 800/473-1307 or 909/393-3744. FAX: 909/393-2773.
- R. Soil drain/PAM: As manufactured by Complete Green (310/640-6815) applied in accordance with manufacturer's recommendations.

2.03 PRE-EMERGENT WEED CONTROL

- A. Pre-emergent herbicide shall be as recommended by a licensed pest control advisor and as accepted by the Owner's agricultural testing laboratory.
 - 1. Pre-emergent herbicide products include: Ronstar, Treflan, Eptam, Vegitex or equal.
 - 2. Fungicide/Insecticides include Subdue 2-E and Bayleton.

2.04 PLANT MATERIALS

- A. Plant materials shall be furnished where applicable (except for Owner-supplied trees) by the Contractor in quantities, sizes, and/or spacing as indicated or noted for each location and shall be of species, types, etc., as symbolized and described in the plant list.
- B. Plants shall be protected in transit and after delivery to the project site. Plants in broken containers will not be accepted, and plants with broken branches or injured trunks will be rejected.

- C. Plants that are specified by container size shall be first class material equal to the size of similar material in local retail nurseries.
- D. All plant materials shall be healthy, vigorous, with a good root system, and shall be free from pests or disease. All plant material shall have been observed and released by the County Agricultural Inspector prior to delivery to the job.
- E. Palm trees: Palms shall have a square root ball with a minimum of 18" from trunk to edge of root ball at each side. The intent is to anchor tree with the square root ball. Retain six fronds minimum on head of palm and as accepted by Owner.
- F. All ground cover plants shall be well rooted in flats or containers.
- G. Plant material shall be observed and approved by Architect prior to their placement for planting. Materials not up to specifications will be rejected.
- H. The Contractor shall warranty shrubs and hydroseeded ground covers for a period of six months and trees for one year from date of final acceptance.

2.05 MULCH

- A. Mulch shall be Eco Mulch, 100% recycled above ground tree trimmings, screened and sized from 3" to 3/8". Supplied by Earthwise Products, 2515 Pioneer Avenue, Suite 6, Vista, CA. 760/599-4156.

Note: Mulch shall be certified by manufacturer to be free of weed seed, herbicides, fungus, and other deleterious material.

2.06 METAL LANDSCAPE EDGING

- A. Metal headers shall be constructed of 3/16" x 5-1/2" black ribbed aluminum that is anodized with electrically absorbed dyes as manufactured by: Permaloc Aluminum Edging, 13505 Barry Street, Holland, MI 49424. 616/399-9600 or 800/356-9660.
- B. Stakes: Same material and finish and manufacturer as edging.

3.00 EXECUTION

3.01 SOIL PREPARATION

- A. Soil for planting shall be free of rocks over 1/2" in diameter, and free of foreign debris, refuse, plants or roots, clods, weeds, sticks, solvents, petroleum products, concrete, base rock, or other deleterious or undesirable and unwanted materials. Soil shall be free of soil-borne diseases and capable of sustaining healthy plant life. Materials not meeting such requirements shall be removed, including all temporary road bases or pavement already in place.

- B. All on-grade planting areas with a slope gradient of less than 2-1/2:1 shall be cross-rippled to a depth of 10" to 12" in two directions and receive per 1,000 square feet of area the following:

Ammonium nitrate (34-0-0)	3 lbs.
Potassium sulphate (0-0-50)	6 lbs.
Triple superphosphate (0-45-0)	5 lbs.
Agricultural gypsum	50 lbs.
Organic amendment	3 cu.yds.

Note: Areas to be planted that are densely compacted, 85% to 90%, shall be cross-rippled to 12" depth. Areas over 90% compacted shall be cross-rippled to 24" depth, and all unacceptable materials removed.

- C. Broadcast uniformly and rototill into upper 4-6 inches of soil.
- D. Samples of the native soil shall be submitted to the soils testing laboratory after rough grading and prior to soil preparation. On receipt of a soils analysis and recommendations, an addendum or bulletin to these specifications shall be issued if revision to the soil treatment is necessary. Refer to 1.03 Quality Assurance in this section for soil testing procedure.
- E. Upon completion of soil preparation, an additional soil testing shall be conducted as outlined in 1.03 Quality Assurance in this section.

3.02 ON-GRADE BACKFILL MIX

- A. Backfill mix for plant pits shall be of the following material per ten yards:
- | | |
|--------------------------------|---------------|
| Ammonium nitrate (34-0-0) | 1/4 lb. |
| Potassium sulphate (0-0-50) | 1/3 lb. |
| Triple superphosphate (0-45-0) | 1/4 lb. |
| Agricultural gypsum | 2 lbs. |
| Organic amendment | 15% by volume |
- B. Samples of the native soil shall be submitted to the soils testing laboratory prior to blending of backfill mix. On receipt of a soils analysis and interpretation, and recommendations, an addendum or bulletin to these specifications shall be issued if revisions to the soil treatment are necessary. Refer to 1.03 Quality Assurance in this section for soil testing procedure.
- C. Upon completion of backfill mix blending and prior to installation, an additional soil testing shall be conducted as outlined in 1.03 Quality Assurance in this section.
- D. The above material should be uniformly blended prior to use. Incorporate as specified under "tree, shrub and vine planting" herein.

3.03 BACKFILL MIX FOR ACID LOVING PLANTS

- A. Planters with acid loving plants shall be backfilled with a soil mix consisting of 1/3 sphagnum peat moss, 1/3 nitrogen stabilized fir sawdust, 1/3 fine sand, 1 lb. 12-12-12

commercial fertilizer per each cubic yard of mix, 2 lbs. iron sulfate per cubic yard of mix and 1-1/2 tablespoons of Gro-Power Flower 'N' Bloom 3-12-12 in bottom of each plant pit.

- B. A soils analysis, interpretation, and recommendation of the acid loving plant backfill mix shall be required prior to backfilling as outlined in 1.03 Quality Assurance in this section.

3.04 PRE-PLANT WEED CONTROL

- A. Clear and remove existing weeds by mowing or grubbing to at least 1/4" below the soil surface.
- B. Pre-emergence herbicide shall be applied to all planting areas except lawn and hydroseeded areas. Apply in accordance with manufacturer's recommendation. After this application, apply 1-2" of water.
- C. Contact herbicides shall be applied as per manufacturer's recommendation to areas to receive lawn or hydroseed. Apply in accordance with manufacturer's recommendation. After this application, apply water as if just seeded for period of one month to stimulate weed growth. Reapply contact herbicide and water for period of one week. Remove all remaining weeds manually.

3.05 GENERAL PLANTING

- A. Finish grade shall be as specified in Section 02210.
- B. The Architect shall approve all planting areas prior to the installation of any materials. Placement of plant materials shall be approved before holes are dug. Stake plant locations and secure approval from Architect before excavating pits making necessary adjustments as directed.
- C. Inspect and accept all landscape irrigation work and finish grading prior to start of shrub planting as specified. Trees may be planted in advance of irrigation system installation, provided adequate provision is made for interim watering.
- D. All on-grade plant pits shall be excavated to a minimum of two times the diameter and height of the container to permit handling. Excavate pits with vertical sides for all plants. Scarify sides of plant pit with spade, trowel or other tool so that the sides are pocked and uneven. When hardpan, muck, or unsuitable soil is encountered, break through to clean soil and backfill with prepared backfill as directed.
- E. Plant pits for rooted cuttings or seedlings to be at least 6" x 6" x 6".
- F. In a centralized area, mix all backfill soil to achieve a uniform blend of amendments. The intent is to achieve well-blended soil and not amend each planting hole at the plant pit. Clean up unused excavated soil and dispose of off-site. Protect mix from water until it has been placed in backfill around plants.
- G. All plants shall be planted immediately after containers are cut and containers shall be regularly removed so as not to present a hazard to those persons using the areas.

- H. Planting tablets are to be placed in all planting pits on slope areas 2-1/2" or steeper that are not soil prepped.
1. During backfilling, place NPK 10-10-5, 21 gram fertilizer tablets near, but not in direct contact with, the bottom half of the root balls at the following rates:

One tablet per 1 gallon plant
Two tablets per 5 gallon plant
Three tablets per 15 gallon plant
Five tablets per 24" and larger boxes
Ten tablets per 36" box
Twelve tablets per 42" and larger boxes
 2. For ground cover plants, place one 10-10-5, 5 gram tablet near, but not in contact with, the bottom half of the root ball.
- I. Remove each plant from its container, cut out all broken, frayed or circular root systems. Scarify root ball and place each plant in center of pit and backfill, unless specified otherwise, with prepared soil. Plants to be set in a vertical position in such a manner that when settled, it will bear the same relation to constructed finish grade as it bore to grade in its container or soil surface at place of growth before being transplanted. Remove wire basket 18" below grade if B&B material is used.
- J. Backfill with specified soil mix and tamp firm. No soil in a muddy condition shall be used for backfilling. Water jet plant when hole is two-thirds full to remove all air pockets. After watering, continue to backfill and tamp soil until the surface of the backfill is level with the surrounding grade. No filling shall be permitted around the trunk or stem of the plants.
- K. After backfilling, construct an earthen basin around each plant. Each basin shall be of a depth sufficient to hold at least 4" of water. Basins shall be constructed of amended backfill materials. Remove basin in all turf areas after initial watering and prior to sodding. If erosion occurs, reconstruct water basin until final acceptance.
- L. Water thoroughly immediately following planting. Backfill all voids which develop with additional prepared soil to bring to finish grade.
- M. Upon completion of all planting operations and again as a requirement just prior to final observation, all soil between plants shall be lightly cultivated, weeded, and neatly raked.

3.06 PLANTING TREES or SHRUBS

- A. Prepare tree pits as specified above, with the addition of a 12" round by 10' deep augered hole in the bottom of the plant pit. Remove the excavated soil and fill hole with coarse sand as well as first 6" at bottom of plant pit.
- B. Trees/Shrubs planted in raised planters shall be backfilled to the bottom of the root ball with import soil and thoroughly water-settled. (Do not flood planters.)
- C. Handle each Trees/Shrub in such a manner as not to cause injury or damage to material during digging or planting. Any tree damaged as a result of Contractor's operation shall be rejected and replaced at Contractor's expense.

3.07 PLANTING ANNUALS AND PERENNIALS

- A. Broadcast and thoroughly work into soil bed 2-1/2 lbs. per 100 s.f. of Gro-Power Flower 'N' Bloom 3-12-12.

3.08 GROUND COVER PLANTING

- A. Flat Cuttings:
1. Prepare ground cover areas as specified under "Soil Preparation" except for those slopes which are 2:1 or steeper.
 2. Plant rooted cuttings, pots, or flats in areas and at spacing indicated on plans after mulching.
 3. Smooth soil about plants and leave areas in neat and clean condition. Do not pile soil or mulch around crown of any plants.
 4. For hand-planted ground cover areas which occur on slopes of 2:1 or steeper, Contractor shall install one fertilizer tablet per ground cover cutting.

3.09 MULCHING

- A. All planting areas, that do not exceed a 10% slope, except lawns, shall receive a prepared mulch spread evenly over the surface to a depth of 1".

3.10 FERTILIZING AFTER PLANTING

- A. All planting areas shall receive an application of Gro-Power Hi-Nitrogen 14-4-9 commercial fertilizer at the rate of 7-1/2 lbs. per 1,000 sq. ft. thirty days after planting.
- B. Fertilizer applications shall be repeated at 30-day intervals until the end of maintenance period.
- C. All lightweight soil planting areas that have acid loving plants shall be fertilized with the following mix:

Quantity/1000 gallons:

1. 3 lbs. ammonium nitrate
2. 4-1/2 lbs. potassium
3. 16 fl. oz. phosphoric acid

3.11 PRUNING

- A. Pruning shall be limited to the minimum necessary to remove injured twigs and branches and to shape tree for design intent as directed by Owner to include, but not be limited to: lifting of branch structure, thinning of canopy, and elimination of cross-branching. Pruning may not be done prior to delivery of plants and only as directed by Owner by an experienced and Owner-accepted Arborist. Pruning paint shall not be used.

3.12 MAINTENANCE

- A. Continuously maintain all areas included under this section during the progress of the work, the 90-day maintenance period, and until final acceptance of this work.
- B. If plantings are not acceptable at the completion of this work for entire work, due to defective maintenance, maintenance shall be continued until all work meets specifications and can be approved.
- C. Maintenance shall include continuous operations of watering, weeding, mowing, rolling, trimming, edging, cultivation, fertilizing, spraying insect and pest control, reseeding, replacement and/or any other operations necessary to assure good normal growth. Apply lawn moth control sprays or other materials, as often as may be required to protect lawns and turfs until final acceptance of this work.
- D. All planted areas shall be kept free of debris and shall be cultivated and weeded at no more than 10-day intervals.

Note: Grass shall be cut to not less than 1-1/4" and during the period of maintenance, it will not be allowed to exceed 2" in height.

- E. During installation period and during maintenance period, the Contractor shall be responsible for maintaining adequate protection of all areas. Any damaged plantings shall be repaired at Contractor's expense.
- F. At termination of maintenance period, all plant materials shall be live, healthy, undamaged and free of infestations. Inferior planting shall be replaced and brought to a satisfactory condition before final acceptance of work will be made. All areas shall be neatly raked and free of weeds.
- G. Replacements: Immediately replace any and all plant materials and grass that die or are damaged. Replacements shall be made to the same specifications as required for original plants.
- H. Two observations shall be made that affect the maintenance period. The first after all planting has been completely installed in order to approve the beginning of the maintenance period of not less than 90 calendar days, and the second at the end of the 90-day maintenance period. If plantings are not acceptable at the end of the 90-day period due to defective maintenance, then maintenance shall be continued by the Contractor until all work meets with the specifications and can be approved. Written notice, requesting observations shall be submitted by the Contractor at least 7 calendar days before anticipated date of observation.

3.13 OBSERVATIONS

- A. All observations herein specified shall be made by the Architect. The Contractor shall request observation at least 24 hours in advance of the time observation is required. Observations are required as follows:
 - 1. When fine grading is completed.

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1. When plant material has been delivered to the site.
 2. When plant material has been spotted for planting but before planting pits are excavated.
 3. After planting pits have been excavated but prior to backfill.
 4. During decomposed granite installation.
 5. The Contractor shall be required to have a complete observation and approval of all landscape construction items at the end of the landscape construction period in order to establish the time for beginning of the 90-day maintenance period. Notify Architect at least seven (7) days in advance of observation.
 6. At the completion of the 90-day maintenance period, an observation shall be required by the Contractor to obtain final approval. Notify the Architect at least seven (7) days in advance of observation.

END OF SECTION 32 93 00