

CITY OF LOS ANGELES  
DEPARTMENT OF WATER AND POWER  
POWER DISTRIBUTION DIVISION

UNDERGROUND CONDUIT AND SUBSTRUCTURES

SPECIFICATIONS No. 104

\* (Revised 09-20-2013)

CONTENTS

<b>SECTION “A”</b> .....	GENERAL PROVISIONS	2
<b>SECTION “B”</b> .....	TRENCH EXCAVATION	8
<b>SECTION “C”</b> .....	SUBSTRUCTURES	11
<b>SECTION “D”</b> .....	SUBSTRUCTURE VENT INSTALLATION	17
<b>SECTION “E”</b> .....	MAINLINE AND SERVICE CONDUIT	19
<b>SECTION “F”</b> .....	STREET LIGHT CONDUIT	26
<b>SECTION “G”</b> .....	SUBSTRUCTURE BACKFILL (VLTS., M.H.’S AND H.H.’S)	27
<b>SECTION “H”</b> .....	CONDUIT TRENCH BACKFILL	30
<b>SECTION “I”</b> .....	SURVEY REQUIREMENTS	33
<b>SECTION “J”</b> .....	CONTRACTOR’S RESPONSIBILITIES	34
<b>APPENDIX -I</b> .....	CONDUIT INSTALLATION	36
<b>APPENDIX-II</b> .....	REFERENCE TABLES	47

**A. GENERAL PROVISIONS**

1(a). All underground substructures and conduits, in which the Department of Water and Power (Department) installs and maintains cables, and any other associated distribution system components shall be constructed in accordance with:

**a. For installation on private property:** The Department's Electrical Service Requirements (ESR) and the Los Angeles Department of Building and Safety (LADBS) where applicable.

**\*b. For installation on public property:** Section 62.00-62.05 of the Los Angeles Municipal Code and the Standard Specifications for Public Works Construction (SSPWC), latest edition.

All construction shall also comply with the Department's Construction Standards, the Department's Standard Drawing H-168 as last revised where applicable and all the requirements specified herein.

\*1(b). All underground substructures and conduits placed in known methane gas areas (as identified by the Department of Building and Safety or the developer), shall also satisfy the requirements of the Department's Standard Drawing(s) H-242 and 1-802.2, latest revisions.

\*2(a). **On site inspection:** The Department shall be notified within two (2) full business days prior to the start of construction. On site inspections performed by the Department Representative will be made between the hours of 10:00 am and 2:00 pm Monday through Friday.

\*2(b). **Special inspection:** Special inspection, outside the normal business days and/or hours may be arranged by notifying the Department at least five (5) full business days in advance of the date the inspection will be required. The Contractor shall pay any premium time charges

that may be incurred by the Department representative. The premium time paid may include travel time.

2(c). **Emergency inspection:** Only in case of an emergency, the contractor may request special inspection, if available, without advance notification. The contractor will be required to sign a written agreement obligating them to pay for any premium time charges incurred as a result of the requested special inspection. Final acceptance of the project may be delayed if the Department does not receive reimbursement for the premium charged.

\*2(d). **Inspection offices:** Contact the Department at the following telephone number: (213) 367-2697 or as otherwise noted on the construction drawings or marked plot plan.

3(a). All conduits shall be as specified on the construction drawings.

\*3(b). Any conduit or conduit duct-bank (a group of two or more conduits) that will **only** house cables intended to carry loads of less than 600 volts shall not be encased in concrete, unless requested by the Department Representative or as otherwise noted on the construction drawing(s). **Any conduit or conduit duct-bank that will house at least one (1) 600 volts or higher voltage cables shall be encased in concrete (330-C-1700 or equal).** For residential tracts and private properties only, any conduit or group of conduits belonging to another utility and sharing the same trench (Joint Trench) with LADWP conduit(s) shall not be encased in concrete and shall comply with subsection E-4 for Joint Trench.

3(c). All PVC conduits shall be type EB-35 or better for concrete encased applications and type DB-120 or better for direct-buried applications. All PVC bends shall be type DB-120 or better and shall be encased whenever they are used in conjunction with encased buried (EB-35) conduits. The specified PVC conduit types represent the minimum requirements; they can be replaced with stronger conduit when approved by the Department Representative (see subsection 3(h) herein).

3(d). All PVC conduits shall be made available for visual inspection and approval by the Department representative prior to installation. The Department representative may also request laboratory testing of any PVC conduit in addition to the visual inspection. In such a case, the contractor shall submit one 7'-0" long or two 4'-0" long pvc conduit samples with the same run numbers and one coupling or bell end attached, to:

Los Angeles Dept. of Water and Power  
Electrical Conduit And Material Testing  
1630 North Main St. Bldg. #7  
Los Angeles, Ca. 90012

Please allow five days for test results. Where the conduit fails to meet the visual requirements or the ASTM F512 test specifications, the Contractor shall be responsible for the replacement of the substandard conduit with acceptable conduit.

3(e). All PVC conduit used for above ground construction shall be schedule 40, 80 or metallic conduit as specified.

3(f). All metallic conduits shall be hot-dipped galvanized rigid steel conduit (GRC). GRC may be used for all low-voltage service conditions. GRC shall be used where low-voltage service conduit will remain exposed or may be subject to damage. Use of GRC conduit will also be required if requested by the Department representative or if such use is called out on the construction drawings. Hot-dipped galvanized intermediate metallic conduit (IMC) may be used as an alternate to GRC, except where exposed to traffic. Running-thread type connections are not permitted. All metallic conduits shall be grounded.

3(g). Fiberglass conduit may be used for mainline or service conduit only if specified in the construction drawings or if requested by the Department representative. All fiberglass conduits shall be heavy wall with U.V. protection and shall use gasket or epoxy sealed joints.

\*3(h). Smooth wall coilable high-density schedule 40 or 80 Polyethylene conduit shall be used for Horizontal Directional Drilling (HDD) if such use is approved by the Department Representative (See subsection E-21 for HDD requirements).

3(i). All the conduit types used in any continuous run shall be of uniform type and size. Exception to this provision will be made for PVC bends which will always be min. DB-120, and when a run crosses steeply sloping terrain or non-compacted fill areas. Exception will also be made if the conduit configuration is shown otherwise in the construction drawings, or if requested by the Department representative. See Subsection E-8 for non-compacted fill and Subsection E-9 (a) for sloping terrain conduit type requirements.

4. All excavations and backfill shall be done in accordance with Sections "B", "G" and "H" of this Specification and:

**\*a. For installation on private property:** The Department of Water and Power Underground Construction Standard Drawing H-168, latest revision.

**b. For installation in public property:** The Los Angeles Municipal Code 62.00-62.05, the SSPWC, Section 306 as modified herein.

5. When concrete encased or direct buried conduit is specified, concrete encasement and/or backfill shall not be made until the conduit has been inspected and approved by the Department representative. **If the conduit is encased or the trench is backfilled before the conduit has been inspected and approved by the Department, the contractor shall be required to re-expose the conduit for inspection if backfilled or remove and replace the conduit if encased.**

\*6(a). All pre-cast concrete substructures shall comply with the Department's Standard Specification P-178, as last revised. In addition, all pre-cast and poured-in-place substructures placed in public property shall be

subject to approval by the Department of Public Works and all concrete substructures placed in private property shall be approved by the Department of Building and Safety. Certificates of approval and/or a building permit may be required from the Contractor for any pre-cast or poured-in-place concrete substructure.

\*6(b). Any pre-cast concrete manufacturer (Contractor) interested in providing pre-cast concrete products to the Department shall have their pre-cast concrete manufacturing plant, fabrication procedures and all their products to be used for the Department facilities inspected and approved prior to the manufacturer and/or Distributer participates in any Department pre-cast concrete substructure(s) bid.

\*6(c). The design, calculations and shop drawings of any pre-cast concrete substructure shall be approved by the Department prior to fabrication. All materials used for the fabrication of pre-cast concrete substructures shall be reviewed, tested and approved by the Department.

\*7(a). Concrete used for poured-in-place structures shall conform to the Department mix design Number DWP 3000-1.0 as defined in Department's Standard Drawing **C702-50** (See Appendix II, TABLE 1).

\*7(b). Concrete used for conduit encasement shall meet the requirements of Mix Design 330-C-1700 as defined in SSPWC, Section 201 (See Appendix II, TABLE 1). The first number "330" is the weight of portland cement conforming to 201-1.2.1 in pounds per cubic yard, the letter "C" is the combined aggregate gradation conforming to 201-1.3.2, and the last number "1700" is the required compressive strength at 28 days in pounds per square inch (psi).

8. The total elapsed time between the initial addition of water to concrete at the batch plant and discharging the concrete at the job site shall not exceed 90 minutes, unless approved by the engineer. Under conditions contributing to quick setting of the concrete, the engineer may reduce the total elapsed time permitted.

9. The contractor shall notify the Department of Public Works, Bureau of Contract Administration, before excavation and prior to backfilling and compacting fills for any excavations done on public property.

\*10. All conduit and substructure installation in public property shall meet the requirements of SSPWC, Subsection 7-9 for Protection and Restoration of Existing Improvements and the "Brown Book", City of Los Angeles Department of Public Works (formerly Standard Plan S-610), latest revision.

**\*Deleted item 11.**

**B. TRENCH EXCAVATION**

\*1(a). **General:** The contractor shall notify Dig-Alert at 811, at least two (2) full working days prior to start of any excavation.

\*1(b). The Contractor shall perform trench excavation to the lines and grades shown on the drawings and as specified herein. If deviations from the drawing alignment are found to be necessary, they must be approved by the Department.

2. **Trench excavation:** Trench excavation shall meet the requirements of Section 306-1.1 of the SSPWC, except as modified herein and except that Subsections 306-1.1.3 and 306-1.1.5 are deleted.

3(a). **Exploration:** The contractor shall explore for the location and depth of all existing underground infrastructures and mainline utilities such as sewers, storm drains, gas, telephone, water, other electric facilities, etc.

3(b). Underground utility service connections are not shown on the Department's construction drawings. The Contractor shall assume that every property parcel is being served by a utility service connection for, but not limited to, telephone, water, gas, sewer, cable television, and electric power.

3(c). The Contractor, at the Contractor's expense, shall determine the location and actual depth of all known utilities, including service connections and other substructures shown on the construction drawings far enough in advance of the actual conduit construction to facilitate decisions concerning the necessity for conduit to go either over or under these substructures in accordance with SUBSECTION 3.4 of Appendix I.

3(d). The Contractor should expect abnormal substructure depths at all roadway intersections.



\*4(a). **Underground Utilities or Substructures:** Underground utilities or substructures encountered during the trench excavation shall be temporarily or permanently supported as shown on the drawings or as required by the owner of the substructures. Damage to underground utilities or substructures shall be repaired at the contractor's expense.

\*4(b). Interfering portions of abandoned pipes, culverts, and conduits shall be cut, removed, and disposed of in accordance with the applicable regulations. Open ends of such pipes, culverts or conduits shall be securely closed by a plug or wall of 2000 psi concrete (See Appendix II, Table 1, ITEM 9) not less than 6 inches thick.

5. **Trench width for conduit construction:** The trench width shall be a maximum of 30 inches unless otherwise specified on the drawings or as approved by the Department representative.

6. **Removal of Surface Improvements:** Bituminous pavement, concrete pavement, curbs, sidewalks, or driveways removed in or adjacent to public streets in connection with construction, shall be removed in accordance with SSPWC, Subsection 300-1.3, except as modified herein.

- a. Pavement shall first be saw cut before removing.
- b. Sidewalk shall be cut at scoring lines.
- c. The Contractor shall place and maintain temporary resurfacing and striping on all excavations in paved streets and sidewalks. The maintenance of temporary resurfacing shall continue until permanent resurfacing is placed.

7. **Classification:** All excavated materials of whatever nature shall be considered unclassified.

\*8. **Unsuitable Soil:** Where soft, spongy, unstable, or other similar unsuitable sub-grade material is encountered upon trenching operations for installation of conduit or for placement of pre-cast concrete substructures, the contractor shall remove the unsuitable sub-grade material to a depth as ordered by the Engineer. Any void thus created shall be refilled with crushed rock, meeting the gradation requirements of SSPWC, Subsection 200-1.2, for 3/4-inch crushed aggregate. After placement, the rock shall be tamped or vibrated as needed to achieve a minimum 90% compaction. The contractor may be required to provide compaction report(s) prepared by a certified testing laboratory. The material compaction test(s) shall be in accordance with ASTM D1556 and ASTM D1557.

9. **Bracing Excavations:** Excavations shall be braced in accordance with SSPWC, Section 306-1.1.6.

**C. VAULTS, MAINTENANCE HOLES, SUBSURFACE TRANSFORMER ENCLOSURES, HANDHOLES, AND TRANSFORMER PADS**

1(a). All pre-cast concrete substructures (vaults, maintenance holes, hand-holes and transformer pads) shall comply with the Department's specifications and standards and shall be subject to inspection by the Department representative prior to, during, and after placement operations.

1(b). Unless other prior arrangements have been made with the Department representative, pre-cast concrete substructures shall not be placed until they have been inspected and approved by the Department representative.

1(c). Each pre-cast concrete substructure delivered to a construction site shall have a quality assurance repair report from the manufacturer. This report will be provided to the Department representative at their request.

1(d). Pre-cast concrete substructures may be rejected at any time prior to the final installation of cables or equipment and/or final acceptance of the project for non-compliance regardless of any prior approvals.

2. All pre-cast concrete structures shall be installed not less than 7 calendar days after the date the concrete, of which they are constructed, is poured.

\*3. All pre-cast concrete sections of substructures shall have paint markings stenciled on the inside and outside of each section. The stenciled markings shall indicate the manufacturer's name, identification number, date of pour and the designation "DWP/FA-CN" (FA= Fly Ash, CN= Calcium Nitrate) or "DWP/F-CN-SC" (F= Fly Ash, CN= Calcium Nitrate, SC= Self-Consolidating Concrete). Also, the manufacturer's name, the year, and the designation "FA-CN" or "F-CN-SC" shall be cast inside of each piece of the substructure. All markings shall be clear, legible, and durable.

\*4(a). All walls and the roof section of poured-in-place vaults and maintenance holes must be constructed with one continuous monolithic pour and must be waterproof. The floor may be poured separately and must be waterproof. Poured-in-place vaults and maintenance holes shall rest on 6" of compacted crushed 1" rock, type A, meeting the requirements of SSPWC, Subsections 200-1.2 and 200-1.4 and shall have the sump sealed.

4(b). All poured-in-place vaults, maintenance holes, hand-holes, and pad construction shall be inspected and approved during the different stages of construction and before concrete is ordered. The extra engineering and inspection work, over and above that required for pre-cast products, shall be paid for (in advance) by the contractor.

\*5. Pre-cast concrete vaults, maintenance holes, Underground Transformer Silos (Silos) and hand-holes shall be set on well compacted soil with 6 inch minimum depth of tamped crushed aggregate base, meeting the requirements of SSPWC, Subsection 200-2.2 and all sumps and floor knockouts (other than those which facilitate the installation of ground rods) shall be left sealed.

6. Pre-cast transformer pad hand-holes shall be set on 6" of compacted crushed 1" rock, type A or concrete aggregate No.3, type B base, meeting the requirements of SSPWC, Subsections 200-1.2 and 200-1.4.

\*7. All vaults, maintenance holes, hand-holes, and Silos shall be placed in areas where the substructures are not subjected to surcharges other than backfill around the substructure. Adjacent retaining walls, foundations, or footings must be designed such that their loading does not affect the structural integrity of the Department's substructures. Designs likely to create additional surcharge must be approved by the Department of Building and Safety and shall require acceptance by the Department.

8. Chipping or core drilling of any pre-cast concrete substructure, except at designated knockout locations, shall not be allowed unless the Contractor has the approval of the Department's Substructure Standards Engineer.

\*9. No foreign substructure or utility line shall enter any part of any Department substructure.

10. All substructures, except transformer pads and hand-holes, shall be designed and fabricated to provide a dry and watertight installation. Any through-holes used for lifting shall be filled with non-shrink grout capable of reaching a minimum strength of 4500 psi in 28 days, except that the lifting holes in the removable cover shall be plugged with an appropriate diameter neoprene plug. Mastic tape is not required on transformer pad and hand-hole installations.

11. When pre-cast concrete substructures are located in high water table areas, the Department representative may require that two layers of mastic tape be placed at all the joints and gaps between the pre-cast substructure panels or sections. Pre-cast concrete substructures, if required, shall be water proofed with "zebron No. 386" coating or equivalent. Coating shall be applied by the coating manufacturer to the outside surface of the substructure at the precast manufacturer's plant and to the joints during field installation. All waterproofing shall be applied in accordance with the waterproofing manufacturer's recommendations for the field conditions present.

12(a). Substructures shall not be set in an area where excess surface or landscaping water accumulates. Use of electric sump pumps to drain the excess water is not allowed.

12(b). The grading around all substructures shall be configured in such a way that all surface water will be drained away from the substructures.

12(c). The landscaping and grading plans around the substructures shall be checked and approved by the Department engineer for acceptable drainage and avoidance of potential water collection areas prior to the start of construction.

\*13. The required clearance for vaults, maintenance holes, hand-holes and Silos away from any building, building projection, or overhang (such as a

balcony), shall be a minimum of 2 feet from the vertical projection of the closest wall of the substructure. Adequate clearances shall remain in place to facilitate future maintenance, repairs and the replacement of the substructure. For the clearance requirements around transformer pads see the Department's Standard Drawing No. C-721-01(01 thru 08).

14(a). All substructures located on private property shall be accessible to the Department's trucks by means of a clear and unobstructed path from the street to the structure with a minimum width of 12 feet. Minimum vertical clearance above the path shall be 14 feet. The path paving must be capable of withstanding truck weights of 24 tons.

14(b). If the path requires any turns by the Department trucks, the minimum required clearances might be increased to allow for adequate curve radiuses and clear areas for the trucks to make the turn. Consult the Department engineer when such a situation is anticipated.

\*14(c). Plantings such as trees, plants and shrubs on or around the Department substructures shall allow access to the substructure for maintenance. Trees shall be planted at least five (5) feet clear to all sides of the substructure. Trees and plants shall be planted so that their growth does not apply unintended pressure causing possible damage to the Department substructure. Any planting area that is not in compliance with these requirements is to be removed without notice at the owner's expense.

15. Head castings, Silos, hand-hole covers and transformer pads shall be set to final or required level by the contractor prior to completing the final grading of adjacent unpaved areas.

16. In public property, final grade of the substructure shall meet the approval of the City of Los Angeles Department of Public Works, Bureau of Contract Administration, construction inspector, and must also be acceptable to the Department.

\*17. Vault and maintenance hole castings shall be adjusted to grade in accordance with the Department's Standard Drawings 1-802 and 1-802.1, latest revision.

\*18. All vaults and maintenance holes shall have a minimum of 18 inches of cover below gutter grade of city streets, 42 inches of cover below the finished grade of state streets or highways and a maximum of 4'-0" of cover below any finished grade (See Appendix II, TABLE 2). Any variance from these limits will require the approval of the Department Substructure Standards Engineer unless otherwise noted on the construction drawings.

\*19. A maximum of one 12 inch or smaller adjustment ring is allowed for adjusting each hand-hole to grade. Any variance from this limit will require the approval of the Department Substructure Standards Engineer.

\*20(a). All substructure frames and covers located in parking areas shall be adjusted to match required grade. The grade shall be set such that the surrounding surface, immediately adjacent to the structure and for a distance of three feet minimum (measured perpendicular to the edge of the structure), can be sloped away at a rate of 1/2 inch per 10 feet of run. The contractor shall set the structure to the required grade prior to completing the final paving.

\*20(b). All substructure frames and covers located in areas where sidewalk will be constructed or parkway areas which will be paved shall be adjusted to the level of a string line extending from the top of the curb to surface level at the property line. Any area less than 18 inches wide which occurs between any top surface edge of the substructure frames and covers in planted parkway areas and any adjacent paved surface shall be filled in with a 3 inch thick layer of concrete. The concrete used shall be a sidewalk mix proportioned in accordance with the SSPWC.

\*20(c). All substructure frames and covers located in planter areas (not accessible to pedestrian traffic) shall be adjusted such that their top surface is 2 inches above final grade of the surrounding ground.

\*20(d). Silos and hand-holes installed in unpaved and planter areas shall have a concrete collar constructed as shown on the Department's Standard Drawing H-168, latest revision.

\*21. All water and debris must be removed from completed vaults, maintenance holes, Silos, hand-holes, and transformer pad hand-holes prior to final acceptance.

22. All gaps exceeding 1/8 inch between ends of conduits, which have been glued into place, and the abutment step in plastic terminators cast into substructure end and sidewalls, shall be filled with body putty (Bondo) or equivalent, and made smooth to the satisfaction of the Department representative. Construction grout is not an acceptable substitute for Bondo.

\*23. The contractor shall install 5/8-inch diameter by 8 foot long, 304 Stainless Steel clad grounding rods in each substructure. The number and location of grounding rods shall be as shown on the Department standard drawings or as requested by the Department representative.

\*24. Any existing substructure owned by, or in which the Department maintains cables and/or equipment, shall not be opened unless specifically authorized by and in the presence of the Department representative. The Contractor shall follow all federal, state and local safety regulations when entering any structure.



**D. SUBSTRUCTURE VENT INSTALLATION**

\*1. All vent pipes and accessories shall be 12-inch diameter PVC sewer pipe in accordance with ASTM D3034, latest revision.

2. There shall not be more than one 90-degree bend in any vent pipe installation, unless approved by the Department Representative.

3. Vent outlets shall be located in the closest sidewalk or planter area to the substructure. Piping for single vent should not exceed 30 feet in length, unless approved by the Department Representative.

4. Vent outlet covers shall be installed with a minimum separation of 4'-0" from center to center.

\*5. All vent outlet covers located in pedestrian sidewalks, planter areas or unimproved areas shall be the architectural standpipe type in accordance with the Department's Standard Drawing No. C730-10, latest revision.

\*6. In the event that the standpipe type cover can only be installed next to the curb face and there is a possibility of damage due to vehicular traffic, the Department's Representative may require flush mount traffic type vent covers to be installed in accordance with the Department's Standard Drawing No. C730-09, latest revision.

\*7. All vent outlet covers to be located in driveways or subject to vehicular traffic shall be flush mount traffic type in accordance with the Department's Standard Drawing No. C730-09. They shall also meet the location requirements of the Department's Standard Drawing No. 1-824. **Flush mount traffic type vent outlet covers shall be used only when the standpipe type vent cover has to be placed at a distance of more than 30 feet from the structure or an excessive number of bends would be required to locate the vent outlet cover in a non-traffic location.**

8. All flush mount type vent outlet covers if allowed by the Department Representative, shall be placed

**Sect. "D"**

away from any water runoff and if they are located in planter or unimproved areas, they shall be placed two inches above the surrounding finished grade.

**E. MAIN LINE AND SERVICE CONDUIT**

1. Electric conduits shall be of the size and type (or approved equivalent) noted on construction drawings.

2. All cut or damaged ends of duct shall be cut perpendicular to the longitudinal axis of the pipe and shall be chamfered and smoothed before being used.

3. **For installations on residential property:**

a. All main line conduits shall be placed 2 feet outside the front property line unless otherwise specified.

b. Service conduits shall be extended 1 foot inside of the front property line and 3 feet inside from the side property line. The open end of the conduit shall be closed with a plug or cap in accordance with SUBSECTION 11.3 of Appendix I unless otherwise specified.

\*4(a). **Joint Trench:** Joint Trenches with telephone, communication and cable TV companies are allowed in residential tracts and on private properties only if approved by the Engineer. A joint trench is not to be allowed whenever a Department conduit or conduit duct-bank is intended to carry at least one (1) 34,500 volts cable.

\*4(b). Joint Trench shall be constructed in accordance with the Department's Standard Drawing H-168, latest revision.

\*4(c). There shall be a minimum clearance of 12 inches vertically and/or horizontally between the Department conduit in direct buried or the Department conduit concrete encasement in encased buried construction and other joint utilities. Other users of a joint trench may require additional depth for cover and/or separation. **Joint**

utilities cannot be in the same Department conduit(s) concrete encasement.

\*5. Trench bottom shall be smooth, level and free from debris.

\*6. Minimum radius of curves shall be as follows (See also, Appendix II, TABLE 3):

**a. For installation on private property:**

Pipe size	Minimum radius
3 and 4 inch dia.	3 feet (for residential or commercial properties)
5 and 6 inch dia.	4 feet minimum

**b. For installation on public property:** 12.5 feet for main line conduit, 5 feet for pole risers in primary and mainline conduits and 3 feet for service conduits, unless otherwise specified on the construction drawings.

7. No field bends shall be made without the approval of the Department representative unless shown on the construction drawings. All field bends shall be made in accordance with Appendix I, SUBSECTION 3.4.

8. Non-metallic conduit shall not be placed in a non-compacted fill area unless encased in concrete with rebar reinforcement. Four No.4 continuous rebar, grade 60 Ksi, shall be placed, one in each corner of the concrete envelope, parallel to the conduit run with a minimum concrete cover over rebar of 1-1/2 inches.

9. In sloping terrain where any 40-foot section of the conduit run exceeds 30-degrees from horizontal:

- a. In Direct Buried installations, the conduit for the entire sloped portion and a minimum of 10-feet beyond that at the top of the slope shall be metallic conduit. Baffle boards may be required to retain backfill.
  
- \*b. In Encased Buried installations, the conduit for the entire sloped portion and a minimum of 10-feet beyond that at the top of the slope shall be concrete encased metallic conduit or PVC conduit encased in concrete with rebar reinforcement (check with Standards Engineer for reinforcement detail). Baffle Boards are required to place the concrete in sloped trenches in accordance with Department's Standard No. 1-225.

\*10. Minimum cover over conduit in Direct Buried or over the concrete encasement in Encased Buried conduit shall be as follows (See also, Appendix II, TABLE 2, as applicable):

**a. For installation on private property and new residential tract housing:**

Primary: (600 volts and over)	30 inches (paved areas)
	36 inches (landscaped)
Secondary: (Under 600 volts)	24 inches

**b. For installation on public property:**

Road surface area (paved or unpaved) or Parkway area: Provide 30 inches below gutter grade in city paved streets, 36 inches below finished surface in city unpaved or parkway areas and 42 inches

below finished surface in paved or unpaved state highways.

Railroad tracks: 42 inches below the base of the lowest rail or as otherwise noted on the construction drawings.

11(a). **Crossing existing utilities:** Conduit section(s) as shown on the construction drawings shall be constructed under existing crossing underground utilities and substructures, unless by constructing over the existing utilities the minimum cover requirements as specified in Subsection 10(a) and 10(b) above are met, or as otherwise noted on the construction drawings.

11(b). Provide a minimum clearance of 6 inches between the conduits in direct buried, or the conduit concrete encasement in encased buried construction, and other existing crossing utilities.

11(c). When paralleling other existing utilities there shall be a minimum clearance of 12 inches between the conduit and the existing utility in direct buried, or the conduit concrete encasement and the existing utility in encased buried construction.

11(d). All conduit sections crossing under or over existing underground utilities and substructures shall be constructed without the aid of segments or bends unless their use is approved by the Department representative prior to construction.

\*11(e). Plantings such as trees, plants and shrubs near the Department conduit(s) in direct buried or encased buried shall be at a minimum clearance of five (5) feet. Trees and plants shall be planted so that their growth does not apply unintended pressure causing possible damage to the Department conduit(s). Any planting area that is not in compliance with these requirements is to be removed without notice at the owner's expense.

12(a). **Joining to Existing Dead-End Conduits:** The dimensions shown on the construction drawings for the

locations and depths of existing dead-end conduits, which are to be joined, are approximate.

12(b). Where new conduit is required to be joined to an existing conduit, the Contractor shall determine in advance of construction, the actual location and depth of the joining ends of all conduits. The Contractor, at the Contractor's expense, shall attempt to locate the existing dead ends within a search area delineated by a circle of 6 feet radius centered on the dead-end location indicated on the plans. If the indicated dead-ends cannot be located within the prescribed search area, the Department representative should be consulted for further direction.

12(c). The Contractor shall chamfer and de-burr the existing conduit dead ends. Prior to the joining of the conduits, the Contractor shall clean and swab that portion of the existing conduits located between the joining end and the closest existing substructure. All cleaning, swabbing, and joining operations shall be performed in presence of the Department representative, unless otherwise approved by the representative. See SUBSECTION 20(c) herein for pulling tape requirements.

\*13. All conduits that are required to be dead-ended for future connections shall be constructed in accordance with Department's Standard Drawing No. 1-120.1, latest revision.

\*14. To reduce segregation, metal or rubber tremies shall be used to deposit concrete, 330-C-1700 (See Appendix II, TABLE 1), for conduit encasement where the free fall to the bottom of the trench exceeds eight feet.

\*15. All types of direct buried conduit tie-ins entering substructure walls shall be grouted into the walls and concrete encased for a minimum distance of 18 inches, outside of the substructure walls.

\*16. Prior to final resurfacing over the conduit duct-bank a cylindrical mandrel as specified in Department's Standard Drawing No. 2-210 shall be drawn by hand through each completed duct (**in both directions**) **without any mechanical assistance**. The Contractor shall be responsible

for removing any obstacles found or replacing any duct section through which the mandrel will not pass. Replaced or repaired conduit shall be made available for inspection before encasement in concrete, shading with sand, or backfilling and shall be re-mandrelled after encasement or backfilling.

17. All conduits shall be free of water. The contractor, to the satisfaction of the Department representative, shall repair any leakage through conduit. Replaced or repaired conduit shall be made available for inspection before encasement in concrete, shading with sand, or backfilling.

18. All completed ducts shall be swabbed to remove all foreign material.

19. All ducts shall be capped or plugged at both ends immediately after the completion of installation and again after swabbing and mandrelling, in accordance with Appendix I, SUBSECTION 11.3.

20(a). Install flat, woven multi-fiber polyester ribbon, minimum 3/8-inch nominal width and 1250 pound minimum tensile strength pulling tape in all ducts. The pulling tape shall be printed with the rated tensile strength and sequential footage markings with legible and stable print (no rub off). Fasten each tape to plugs on each end with 5'-0" minimum slack.

20(b). The tape shall be in one continuous length through each duct with no cuts, splice or ties allowed.

20(c). Where the conduit is required to be joined to an existing duct-bank, the Contractor shall extend and install the tape into the existing duct-bank. **A Department representative shall be present prior to opening or entering any in service substructure. The Contractor shall follow all federal, state and local safety regulations.**

21. When Horizontal Directional Drilling (HDD) for direct buried conduit installation is specified on the construction drawings or, under special conditions, is



approved by the Department representative, the HDD shall be completed in accordance with the City of Los Angeles HDD policy Special Order No. 015-1102. The contractor shall obtain City of Los Angeles approval for all HDD installations made in public streets (Special City permit may be required).

**\*Deleted item 22.**

**F. STREET LIGHT CONDUIT**

1. Contractor shall confirm the street light service points with the Bureau of Street Light Inspector before street light conduit is installed.

2. Street light service conduits (not including mainline street light) shall be placed in the same trench with other electric conduits where practical.

3. When street light conduit is in a separate trench, cover over conduit shall be in accordance to Appendix II, TABLE 2, as applicable.

4(a). Street light conduit shall be terminated 12 inches behind curb face.

4(b). For installation in residential areas: Street light service conduit should be located under proposed sidewalks and will normally be placed 2 feet from the front property lines.

**G. VAULTS, MAINTENANCE HOLES, AND HANDHOLES BACKFILL REQUIREMENT**

\*This section covers the backfill requirements for vaults, maintenance holes and hand-holes, which will be herein referred to as structures. For transformer pad backfill requirements refer to the Department's standard drawings No.UB721 series.

Backfill around new and existing structures shall be considered structure backfill in accordance with the requirements of SSPWC, Subsection 300-3 (Subsections 300-3.2 and 300-3.6 are deleted), except as modified herein:

\*1. When a structure is to be located in a dedicated city street whether it is subject to vehicular traffic or not, structure backfill shall be slurry concrete class 100-E-100 (See Appendix II, [TABLE 1](#)), in accordance with SSPWC, Subsection 201-1 for Trench Backfill.

\*2. When a structure is to be located in public property but is not in a dedicated city street and is not subject to vehicular traffic, structure backfill shall be pervious backfill (consist of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations thereof, with 100% passing the 3/4 inch size sieve), meeting the requirements of the SSPWC, subsection 300-3.5.2 and also:

- a. Jetting shall be used to densify the backfill material in accordance with the requirements of the SSPWC, Subsection 306-1.3.
- b. Backfill materials shall be placed evenly in two (2) foot maximum depth horizontal layers.
- c. The contractor shall provide compaction report(s) taken at every compacted layer, and as directed by the Department representative, prepared by a certified testing laboratory. The soil compaction

test(s) shall be in accordance with ASTM D 1556 and ASTM D 1557.

\*3. When a structure is to be located in the State of California Right-of-Way, whether it is subject to vehicular traffic or not, structure backfill shall be a Caltrans approved mix for 1½-sack cement slurry (See Appendix II, TABLE 1).

\*4. When a structure is to be located under an existing paved roadway, parking lot or new or existing driveway in private property or in an easement area and subject to vehicular traffic, structure backfill shall be slurry concrete class 100-E-100 (See Appendix II, TABLE 1), in accordance with SSPWC, Subsection 201-1 for Trench Backfill.

5. When a structure is to be located under a new roadway or parking lot, in public or private property, and subject to vehicular traffic, and the entire roadway or parking lot including the area over the structure will be compacted and paved in accordance with SSPWC as part of the same construction project, the structure backfill shall meet the requirements of ARTICLE G-2 of this Division.

6. When a structure is to be located in an unimproved area in private or public property and will be subject to vehicular traffic, structure backfill shall meet the requirements of SSPWC, Subsection 306-1.3, for Backfill and Densification, and also:

- a. Sand meeting the requirements of SSPWC, Subsection 200-1.5.5, for Mortar, shall be used to backfill the excavated area.
- b. Jetting shall be used to densify the sand after the placement of the structure. Jetting shall be in accordance with the requirements of SSPWC, Subsection 306-1.3.3.
- c. Sand shall be placed evenly in two-foot maximum thick horizontal layer.

- d. Contractor shall provide compaction report(s) providing results of test taken at every other compacted layer, or as directed by the Department representative. The report shall be prepared by a certified testing laboratory. The soil compaction test(s) shall be in accordance with ASTM D 1556 and ASTM D 1557.
  
- e. Where jetting is not allowed by governing agencies (such as Los Angeles Department of Public Works or State Department of Transportation), backfill shall meet the requirements of ARTICLE G-1 or G-3 of this Division.

\*7. When a structure is to be located in private property or in an easement area and not subject to vehicular traffic, structure backfill shall meet the requirements of ARTICLE G-2 of this Division.

\*8. When the whole or any portion of structure is to be located in a planter area, structure backfill shall be as specified in Article above except the upper 12 inches of backfill, within the planter area, shall meet the requirements of SSPWC, Subsection 212-1 for Landscape Materials.

**H. CONDUIT TRENCH BACKFILL REQUIREMENT**

\*1. The Backfill as specified herein shall not be placed until at least two (2) hours after placement of concrete encasement in encased buried conduit, unless otherwise approved by the Department representative.

\*2. When a trench is to be located in a dedicated city street and resurfacing is required whether it is subject to vehicular traffic or not, backfill shall be slurry concrete class 100-E-100 (See Appendix II, [TABLE 1](#)) in accordance with the Standard Specifications for Public Works Construction (SSPWC), Subsection 201-1 for Trench Backfilling.

\*3. When a trench is to be located in an unimproved area in public property, backfill shall meet the requirements of SSPWC, Subsection 306-1.3 for Backfill and Densification, except as modified herein:

- a. Backfill shall be sand or sand cement slurry up to a minimum of 4 inches above any direct buried conduit.
- b. In no case shall the remainder of backfill over the direct buried conduit installation have rock or particles greater than 1/2 inch in diameter. Screening or other suitable means may be required at the discretion of the Department representative
- c. Suitable native backfill materials shall be placed evenly in 8-inch thick horizontal layers and shall be moistened and compacted.
- d. Backfill over the top of concrete encased conduit shall not be mechanically compacted by means of tamping rollers, sheepsfoot rollers, pneumatic tire roller, vibrating rollers, or other mechanical

tampers until a minimum of 10 calendar days after encasement.

- e. Sand backfill shall meet the requirements of SSPWC, Subsection 200-1.5.5, for Mortar, and shall be placed evenly in two-foot thick maximum horizontal layers. Jetting can be used to densify the sand after concrete encasement.
- f. Jetting shall be in accordance with the requirements of SSPWC, Subsection 306-1.3.3.
- g. The Contractor shall provide compaction report(s) for test taken at every 50-foot linear interval for each compacted layer, and/or as directed by the Department representative. A certified testing laboratory shall prepare the report. The soil compaction test(s) shall be in accordance with ASTM D1556 and ASTM D1557.

\*4. When the trench is to be located in a State of California Right-of-Way, whether it is subject to vehicular traffic or not, backfill shall be a Caltrans approved mix for 1½ sack cement slurry (See Appendix II, TABLE 1).

\*5. When the trench is to be located in an existing paved roadway or parking lot on private property or in an easement area, which will be subject to vehicular traffic, backfill shall be slurry concrete class 100-E-100 (See Appendix II, TABLE 1) in accordance with the Standard Specifications for Public Works Construction (SSPWC), Subsection 201-1 for Trench Backfilling.

\*6. When the trench is to be located in a new roadway or parking lot on public or private property and subject to vehicular traffic, and the entire roadway or parking lot including the area over the trench will be compacted and paved in accordance with SSPWC as part of the same construction project, the trench backfill shall meet the requirements of ARTICLE H-3 of this Division.

\*7. When the trench is to be located in private property or in an easement area and is not subject to vehicular traffic, backfill shall meet the requirements of ARTICLE H-3 of this Division.

\*8. When any portion of a trench is to be located in a planter area, backfill shall be as specified in Articles above except the upper 12 inches of backfill within the planter area shall meet the requirements of SSPWC, Subsection 212-1 for Landscape Materials.



I. SURVEY REQUIREMENTS

**For installation on public property:**

1. Prior to construction, the contractor shall have the entire construction area and the limits of excavation as specified in the construction drawings laid out by a land surveyor licensed in the State of California.

2. The Contractor shall maintain all survey marks required to complete the construction. The contractor's surveyor shall be required to replace missing or damaged survey marks.

3. The Contractor shall provide a copy of the surveyor's field notes to the Department representative on the first day of construction, unless otherwise approved.

**J . CONTRACTOR'S RESPONSIBILITIES**

\*1(a). The contractor shall be responsible for the construction of the conduit system and installation of the substructures in accordance with this specification, the direction of the Department's representative, Standard Drawing H-168, latest revision, and the conduit construction drawings.

1(b). No underground conduit system and substructure installation is considered approved by the Department until the installation of all cables and equipment as designed by the Department engineer and installed by the Department crews are successfully completed.

2. Final approval will be withheld until sidewalks, required retaining walls, and final paving are completed. Because of extenuating circumstances, the Department may install cable or equipment before final approval, subject to all of the following:

- \*a. The circumstances warrant this sequence of work in the opinion of the Department.
- b. The Developer agrees in writing to pay the Department for any costs incurred to make the installation acceptable after all final paving, sidewalks, and retaining walls are completed.
- c. Adequate precautions are taken to protect the facilities. (Example: Sidewalk around substructure, post barricade, etc.)
- \*d. Final resurfacing shall be inspected and approved by the City of Los Angeles and/or State of California (as jurisdiction applies) and be acceptable to the Department.

3. Prior to the start of construction, the Contractor shall coordinate with the City of Los Angeles or State of California Department of Transportation (as jurisdiction applies) to obtain approval of any and all traffic control measure(s) which will be employed. A copy of such measure(s) and approval(s) shall be submitted to the Department not less than 3 calendar days before the commencement of work.

\*4. The Contractor shall obtain a second permit from the State of California Department Of Transportation, if so required, for construction of an electrical underground distribution system within the state right-of-way.

5. The Contractor shall be responsible for the preservation of Survey Monuments and Bench Marks in accordance with SSPWC, Subsection 2-9 as modified by the "Brown Book" City of Los Angeles Department of Public Works (formerly Standard Plan S-610).

CITY OF LOS ANGELES  
DEPARTMENT OF WATER AND POWER  
POWER DISTRIBUTION DIVISION

**APPENDIX I TO SPECIFICATIONS 104**

Installation Instructions for  
Underground Conduit  
\* (Revised 09-20-2013)

**1. SCOPE**

This standard provides installation instructions for polyvinyl chloride (PVC) and fiberglass conduit and fittings.

**2. GENERAL SPECIFICATIONS**

2.1 All PVC encased buried (EB), or direct buried (DB) conduit used for underground construction shall be manufactured in accordance with ASTM F 512.

2.2 All PVC Schedule 40 or 80 conduit used in the construction shall be manufactured in accordance with UL-651 and/or NEMA TC 2.

2.3 All PVC fittings and accessories (reducers, adapters, caps, etc.) shall be manufactured in accordance with ASTM F 512.

2.4 All PVC expansion joints shall be Schedule 40 with tapered joints which are sealed with either gaskets or o-rings, and must have 12 inch minimum expansion potential. Expansion joints must be belled at both ends.

\*2.5 All fiberglass conduits shall be heavy wall type (HW), reinforced thermosetting resin conduit (RTRC), manufactured in accordance with the latest applicable UL/CSA/NEMA standards, unless otherwise noted or approved by the Department Representative. Conduit joints will be either gasket or epoxy sealed.

\*2.6 All fiberglass expansion joints shall be heavy wall type, manufactured in accordance with the latest applicable UL/CSA/NEMA standards, with gasket or o-ring sealed tapered joints, unless otherwise approved by the Department Representative.

### **3. PVC CONDUIT INSTALLATION**

The contractor shall be responsible for the proper installation of the conduit system. The following provisions apply:

#### **3.1 Preparation:**

- a. The spigot ends of all factory made bends and straight conduit shall be chamfered in accordance with DIAGRAM "A".
- b. The contractor must make certain that all foreign matter has been wiped clean from the joining portions of both pieces to be joined before joints are assembled.
- c. Insertion of conduit (when dry) should not be over 3/4 of the way into the fitting.

#### **3.2 Cutting:**

- a. Use a fine tooth saw to cut conduit. The conduit must be cut square and any burrs incurred must be removed. (Use of a miter box, or other means to ensure square cutting of the conduit is recommended.)

- b. All the conduit cut in the field shall be chamfered and de-burred in accordance with diagram "A":

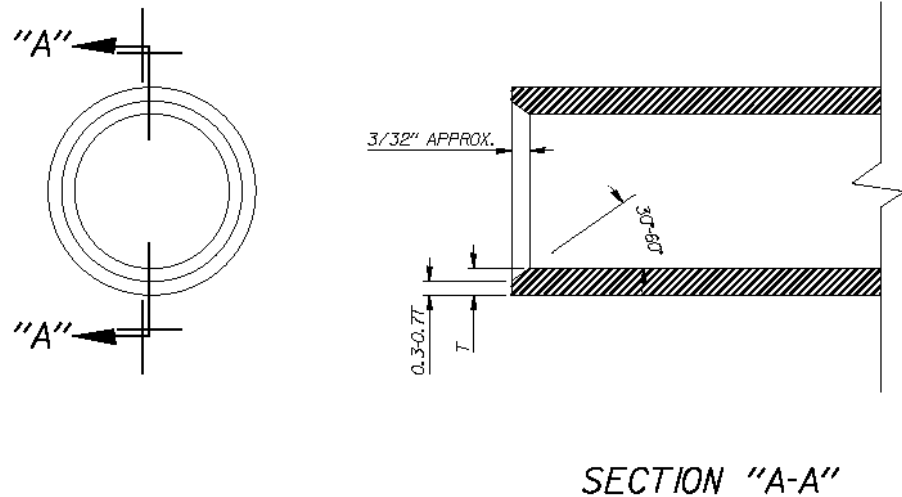


DIAGRAM "A"

### 3.3 Cementing Conduit:

- a. Cementing of conduit shall be in accordance with ASTM D2855 except as modified herein.
- b. Cement and primer shall be applied using a manufacturer's approved roller or swab.
- c. All PVC pipes shall be wiped clean of dirt or water and cut pipe ends shall be chamfered and de-burred, prior to primer application.
- \*d. PVC primer and cement are fast drying products. They shall be applied as quickly as is consistent with the manufacturers' recommendations.

- e. Apply primer with the applicator once to the inside of the socket, and once to the outside of the spigot end over a length equal to the depth of the socket.
- f. While the primer on the spigot and socket is still wet, apply the cement with the applicator once to the inside of the socket and once to the outside of the spigot end over a length equal to the depth of the socket. The quantity of glue applied should be sufficient to wet the pipe. Excess cement on the socket should be avoided as it is wiped into the joint and tends to weaken the pipe.
- g. If the primer has dried prior to applying the cement or if the cement has dried prior to joining the two pipes, both primer and the cement must be reapplied. The joint must be assembled immediately after the last cement application.
- h. Slip conduit straight into the socket until it bottoms (conduit spigot ends are marked with a line to indicate correct depth of insertion), twist approximately  $\frac{1}{4}$  turn then hold the joint for 15 seconds (One (1) minute in extreme cold weather), so that the conduit does not push out of the fitting.
- i. Do not twist or drive pipe after insertion is complete. No blows by hammer or by any other means shall be used to aid the assembly of the PVC conduit joints.
- j. Another fitting or duct section can be added to the free end of the conduit, within two or three minutes if care is exercised in handling so that strain is not placed on the previously joined assembly.

- k. Under normal circumstances, the newly joined members shall remain undisturbed for at least five minutes before they are handled. In cold or damp weather, this interval should be increased to allow for the slower evaporation of the solvent.
- l. After initial set, care must be exercised in handling the conduit to prevent twisting or pulling the joint.
- m. Wipe off the excess solvent that is left on the outer shoulder of the fitting after the joint is assembled. Plastic bristle brushes should not be used for this purpose.
- n. Keep cement cans covered when not in use and always keep them away from excess heat and flames.
- o. Solvent cement thinner may not be used for thinning cement that has thickened.
- p. All discarded cement and primer cans are to be removed (and properly disposed of) from the open trench prior to conduit encasement and trench backfilling.
- q. All cut bends of PVC conduit shall be assembled in the presence of the Department of Water and Power (Department) representative or otherwise approved by said representative.



3.4 Minimum bend radius for straight conduit that is to be cold bent in the trench is as follows:

<u>Conduit size IPS</u> <u>(Inches)</u>	<u>Minimum Radius</u> <u>(Feet)</u>
2	12-1/2
3 to 6	65

**Hot bending of PVC conduit is not allowed.**

3.5 Mechanical **Damage Prevention Recommendation:**

- a. Conduit should not be left exposed in open trench longer than eight hours.
- b. Provide support for the full length of conduit when transporting long lengths.
- c. Do not permit unsupported overhangs.

#### **4. PVC TEMPERATURE EFFECT PRECAUTIONS**

Due to the expansion and contraction of plastic duct (1-1/2 inches per 100 feet for every 20 degrees Fahrenheit(F) change in temperature), the following precautions should be taken:

4.1 All plastic conduit and fittings to be joined should be exposed to the same temperature conditions for a reasonable length of time before assembly.

4.2 Allow extra conduit footage at each tie-in for contraction when duct temperature is higher than that of the surrounding soil; or extra room for expansion, if the reverse condition exists.

4.3 When pouring concrete over conduit in encased buried or placing backfill in direct buried, the contractor shall allow for temperature induced movement at the free end of the conduit. This can be accomplished by pouring the

concrete or placing the backfill from the center of the run (if both ends of the run are open) or starting from the tie-in point and working towards the free end. This is extremely important for concrete encasement since conduit is subject to temperature rise as concrete cures.

## 5. PVC CEMENT AND PRIMERS

**5.1 Primer:** Use a primer from the below approved list or an equivalent product. The primer shall be purple in color and must meet ASTM F 656 requirements.

### **Approved DWP Primer List**

1. Christy's Purple Primer
2. LSP 670P Primer
3. RectorSeal Jim PR-1L Primer
4. Weld-On P-70 Purple Primer

**5.2 Cement:** Use PVC pipe cement from the below approved list or an equivalent cement (Heavy body, Medium set, clear) meeting ASTM D2564 requirements. **Only clear cement shall be used unless otherwise specified by the Department Standards Engineer.**

### **\*Approved DWP Cement List**

1. Christy's Clear PVC Pipe Cement
2. LSP Solvent Cements 617C PVC Cement
3. RectorSeal Gold 844L Clear PVC Solvent Cement
4. Weld-on 717 Clear PVC cement

## 6. FIBERGLASS CONDUIT WITH EPOXY CONNECTION

6.1(a) Fiberglass Adhesive: All fiberglass conduits that do not use gasket sealed joints shall be installed with epoxy resin adhesive used as the binding medium in the joints.

6.1(b) Epoxy resin adhesive shall have minimum ultimate shear strength of 500 psi and a minimum joint

pullout resistance of 6000 pounds in accordance with ASTM D-2517 and D 2105, respectively.

\*6.1(c) Epoxy resin shall be FRE Composites, Incorporated Adhesive Kit Number 20-0164 or equal. Each kit shall contain the necessary components and instruction sheets, which shall include information regarding cure time, pot life, and other data deemed necessary by the manufacturer.

\*6.1(d) Epoxy shall be applied by using a putty knife or equivalent.

## 6.2 Fiberglass Conduit Assembly:

- a. All bell and spigot ends of the fiberglass conduits shall be sanded and cleaned to remove any transit residues.
- b. \*After sanding, cleaning, and drying the bell and spigot ends of the fiberglass conduits, a liberal and uniform coat of epoxy resin shall be applied to both the interior of the bell and the exterior of the spigot, covering a 4" wide section.
- c. Due to the pot life of the epoxy resin, the joint shall be assembled immediately after the last epoxy application. If the epoxy resin dries before assembly, the bell and spigot ends of the fiberglass conduits must be re-sanded and cleaned before applying any additional epoxy.
- d. Slip the conduit spigot straight into the joining bell with a slight twist until it bottoms. The joint members shall be cured and left undisturbed for 30 minutes or more before they are handled or transferred. After this initial set, care must be exercised in handling to prevent twisting or pulling the joint.

- e. An approved soft paddle may be used to aid the assembly of the fiberglass conduit joints. **Partial mixing of the resin and hardener will not be allowed.**

## **7. DIRECT BURIED CONDUIT INSTALLATION**

7.1 There shall be a minimum of 2-inch spacing maintained between all adjacent conduits. Duct spacers or 2-inch sand layers shall be used if conduits are placed on the top of each other. Refer to [ARTICLE 10](#) of this Appendix for requirements relating to duct spacers.

7.2 The trench must be uniformly graded and the bottom shall be smooth and rock free. In the event of a rocky bottom, a 4-inch bed of sand or sand slurry will be required.

## **8. ENCASEMENT BURIED CONDUIT INSTALLATION**

8.1(a) Maintain a minimum of 2-inch spacing between adjacent conduits.

8.1(b) Maintain a minimum of 3-inch and a maximum of 6-inch concrete cover on top, bottom, and sides of a single conduit or around a group of conduits in a duct-bank. A duct-bank is a group of two or more conduits used as part of a distribution system.

8.1(c) For spacer specifications refer to [ARTICLE 10](#) of this Appendix.

8.2 Tie and fasten all conduits in a multi conduit run with "All-State Nylon Cable Ties", catalog No. 12050, or equivalent to prevent floating.

8.3 Whenever smaller diameter conduits are placed in spacers intended for larger size conduits, all such conduits shall be securely tied to the spacers with "All-States Nylon Cable Ties", Catalog No. 12050, or equivalent. This is to provide lateral stability to the spacers and to avoid floating of the smaller diameter conduits during the concrete encasement process.

8.4 The concrete for encasement shall not be placed until the conduit has been inspected and approved by the Department representative in accordance with ARTICLE A.5 of Specifications 104.

**9. CONDUIT FITTINGS**

9.1 Reducer couplings shall be used when changes in conduit sizes are required.

9.2 Adapter couplings shall be used to convert between different types of conduit.

9.3 Slip couplings shall be used to join conduits of the same diameter coming from opposite directions to the same point.

**10. SPACERS FOR CONDUIT INSTALLATION**

10.1 Duct spacers should be of a type recommended by conduit manufacturers and approved by the Department of Water and Power. The maximum intervals for duct spacers are shown below:

<u>Duct Size (inches)</u>	<u>Spacing (feet)</u>
3	8
4 to 6	6

10.2 All conduit spacers shall be self-supporting and shall not transmit a vertical load to any conduit.

\*10.3 Conduits, when installed inside a bridge cell or suspended under a bridge shall be supported by Reinforced Plastic Mortar (RPM) spacers or hangers. The dimensions and the spacing of the supports shall be in accordance with the applicable Department Standard drawing(s) G-356, H-223 or H-247, latest revisions.

## 11. CONDUIT TERMINATION

\*11.1 All conduit termination in ground (dead ends) shall be constructed in accordance with Department Standard Number 1-120.1, latest revision.

11.2 All Direct Buried (DB) and Encased Buried (EB) conduits shall enter vaults, maintenance holes, and handholes perpendicular to the wall and shall terminate with end bells or duct terminators (end bells or duct terminators are not required for 1, 2 and 3 inch conduits). The end bells or duct terminators shall be flush with the inside face of the knockout, and shall be rounded and smooth. No rough edges will be accepted.

11.3 Cap all free conduit ends at the dead-end points with tapered polyethylene plugs with a nipple. The tapered polyethylene plugs shall be securely taped to the PVC conduit with reinforced tape. Use Jack Moon Company, limited (JMC) Blank Duct Plugs with nipple or equivalent in place of the tapered polyethylene plugs in high water table areas, clayey soil, or as directed by the Department representative.

11.4 Cap all free conduit ends, inside precast concrete pad-mount hand-holes, with plastic plugs with a nipple.

11.5 Cap all end bells or duct terminators, inside pre-cast concrete vaults, maintenance holes and regular hand-hole substructures with JMC Blank Duct Plugs with nipple or equivalent.

CITY OF LOS ANGELES  
DEPARTMENT OF WATER AND POWER  
POWER DISTRIBUTION DIVISION

APPENDIX II TO SPECIFICATIONS 104

Reference Tables  
\* (Revised 09-20-2013)

Item	Application	Mix Type	Specification
	<b>Vaults/ MH/ HH/ TP</b>		
1	Barrier Posts	330-C-1700 or 420-D-1700	C702-50
2	Pour in Place Structure Mix	DWP 3000-1.0	C702-50
3	Concrete Collar Around Structure	DWP 3000-1.0	C702-50
4	Conduit Anchor Next to structure	330-C-1700 or 420-D-1700	C702-50
5	Fill the gap between neck rings>1 ½”	DWP 3000-1.0	C702-50
6	Fill the gap between neck rings<1 ½”	Dry Pack Grout (Non-Shrinkable)	ASTM C-1107
7	High water area. Grout on the joints and unused ground rod locations	Hydraulic Cement (Non-Shrinkable)	ASTM C-1107
	<b>Conduit Construction</b>		
8	Encasement	330-C-1700 or 420-D-1700	C702-50
9	Encasement- Pump Mix	565-E-2000P	SSPWC Sect 201
	<b>Slurry Backfill for</b>		
10	Conduit & Structures in City Streets	100-E-100	SSPWC Sect 201
11	Conduits & Structures in State Highways	1 ½ Sack Cement	State Approved

For Job-Site Concrete Hand-Mix Specifications, See Standard Drawing No. C702-50

**Concrete Ready-Mix Specifications**

**\*Table 1**

Item	Application Description	Below 600V (I)	Over 600V (I)	Vaults & MH	St. Light Conduit
1	Private Property, Landscaped	24 inches min. clear below finished surface	36 inches min. clear below finished surface (III)	18 inches min clear below finished surface (II)	24 inches min clear
2	Private Property, Paved	24 inches min. clear below finished surface	30 inches min. clear below finished surface (III)	18 inches min clear below finished surface (II)	24 inches min clear
3	Property Line Dead Ends	30 inches min. clear below gutter grade	30 inches min. clear below gutter grade	N/A	24 inches min clear
4	Public Property, Paved	30 inches min. clear below gutter grade	30 inches min. clear below gutter grade	18 inches min clear below gutter grade (II)	30 inches min clear (IV)
	Public Property Unpaved or Parkway	30 inches min. clear below finished surface	36 inches min. clear below finished surface	24 inches min clear below finished surface (II)	
5	State Highway Paved or Unpaved	42 inches min. clear below finished surface	42 inches min. clear below finished surface	42 inches min clear below finished surface (II)	42 inches min clear (IV)
6	Railroad Crossings	42 inches min. clear below base of the lowest rail	42 inches min. clear below base of the lowest rail	42 inches min clear below base of the lowest rail (II)	42 inches min clear below base of the lowest rail (IV)

**Notes:** All clearances are to the top of conduit in direct buried or over the concrete encasement in encased buried. All depths shall be as specified herein or as requested by the excavation permit.

- I. Any conduit or conduit duct-bank that will **only** house cables intended to carry loads of less than 600 volts shall not be encased in concrete, unless requested by the Department Representative or as otherwise noted on the construction drawing(s). **Any conduit or conduit duct-bank that will house at least one (1) 600 volts or higher voltage cables shall be encased in concrete (330-C-1700 or equal).** For residential tracts and private properties only, any conduit belonging to another utility and sharing the same trench (Joint Trench) with LADWP conduit(s) shall not be encased in concrete and shall comply with [SUBSECTION E-4](#) of Specifications No. 104.
- II. For substructure installations, all clearances are to the highest point on the roof of the structure and they shall not exceed 48 inches.
- III. This depth requirement applies to any conduit or conduit duct-bank housing 600 volts and higher voltage cables in private property except for any conduit section or conduit duct-bank within 20 feet from the outside wall of the Hand-hole, Transformer Pad or Switchgear Pad not meeting this depth requirement; cover for this section(s) shall be 24 inches minimum clear below finished surface or as otherwise noted.
- IV. This depth requirement is for the service conduit that serves the street light pull box from LADWP main line conduit system, for regular street light conduit installation please check with Bureau of Street Light or the City Inspector.

**Min. Depth Specifications for Conduit and Substructure Installations**

**\*Table 2**



<b>Item</b>	<b>Application/ Description</b>	<b>Conduit Size</b>	<b>Min Radius (1)</b>
1	Main Line in Public Property	All	12.5 ft
2	Service Conduits, Public or Private Property	Up to 4" Dia.	36 inch
3	Service Conduit, Public or Private Property	Over 4" Dia.	48 inch
4	Pole Dip Sweep (Risers), Galvanized or PVC	Up to 4" Dia.	36 inch
5	Pole Dip Sweep (Risers), Galvanized or PVC	Over 4" Dia.	60 inch
6	Field Bends if Required	All	65 ft

(1) Unless otherwise noted on the construction drawings

**Conduit Bend Radius Specifications**

**Table 3**