

DUCT AND CONCRETE INSTALLATION



DUCT INSTALLATION

Duct shall be installed per the manufacturer's recommendations and shall be properly connected with couplings and/or cement and aligned such that there are no sharp edges on the inside to damage the cable.

- Install 2 1/2 inch and 4 inch duct, as applicable, in accordance with SR-209, SR-215, SR-308, SR-308A, SR-309, SR-310 or SR-312.
- Install 6 inch duct in accordance with SR-215.
- Install proper duct plugs at each end of duct and on each duct.
- Installation of duct at Company equipment such as risers, box pads, transformers, pull boxes, etc. shall be done in accordance to the applicable SR Standard.

DUCT RADIUS

- Horizontal and vertical direction changes in the duct at the coupling shall not exceed 5°.
- The minimum radius of bends depends on duct size and type of installation and shall be as specified in SR-215, SR-308 or SR-312.
- The total of all deflections at couplings and bends shall not exceed 360° in any continuous duct run between Company equipment.

INSPECTION

All duct systems shall be installed by the customer and the following inspections completed, as applicable, by Service Provider Design Services.

- Duct - Inspection completed after duct installation and prior to concrete encasement or trench backfill.
- Concrete Encasement - Inspection completed after duct inspection approval and upon completion of concrete encasement prior to any backfill.
- Backfill - After duct and/or concrete inspection and in accordance with SR-207.
- Mandrel - Customer shall install a polypropylene pull rope with a 5/16 inch minimum diameter in the duct system in preparation to pull a steel mandrel no more than 1/2 inch smaller than the inside diameter of the duct.

Design Services will be on-site during mandrel to observe mandrel pull performed by the customer.



- TEP will provide an appropriate length of footage calibrated mule tape to attach to the mandrel that must be pulled through the duct.
- UES Santa Cruz, the customer is required to provide an appropriate length of footage calibrated mule tape to attach to the mandrel that must be pulled through the duct.

The installed mule tape will be used by The Company for subsequent cable installation.

Failure to have required inspections at the proper time will result in a delay until the duct is uncovered for inspection and the mandrel is pulled in the presence of the Service Provider's inspector. The Company reserves the right to require the installation of locatable "Tone Tape" (ARNCO " Tone -Tape" Part Number WP 25 LC) in place of a polypropylene pull rope.

Only Service Provider personnel and authorized contractors working for The Company are permitted entry into company owned pad-mounted equipment. If access is required into pad-mounted equipment the customer must arrange to have qualified Service Provider employee on site while the work is performed.

Arrangements must be made by calling 520-918-8300 (TEP) or 520-761-7951 (UES), a minimum of five working days in advance.

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APPROVED DUCT TYPES (CONDUIT TO BE PROVIDED BY CUSTOMER)

2 1/2" PVC CONDUIT (REQUIRES A CONCRETE CAP, SEE SR-209 AND SR-215)

Grey Polyvinyl Chloride (PVC) electrical grade, Schedule 40 conduit for direct burial installation.

- Conduit to be manufactured to NEMA TC-2 specification.
- Conduit shall be rated for direct burial and use with 90°C conductors
- All bends and sweeps shall be factory bent and meet the following:
 - a) 36" x 90° or 36" x 45° for vertical
 - b) 12 1/2' x 45° for horizontal



2 1/2" HDPE CONDUIT-"WAVE-RIB" OR "DURA LINE-SMOOTH OUT/RIBBED IN" FLEXIBLE CONTINUOUS CONDUIT (COILED/ REELED)

- Conduit shall be Schedule 40, solid red color on the interior and exterior, and have a ribbed interior.
- Conduit shall be rated for direct burial and use with 90°C conductors

2 1/2" DB-120 CONDUIT

Service Installation ONLY Exception - DB-120 conduit will be allowed for STRAIGHT runs in service laterals, from transformer or pedestal to the meter, as long as the following requirements are met:

- Service length is 250' or less
- Total bends in the conduit run are 270° or less
- Connectors and sweeps are Grey PVC, Electrical Grade, Schedule 40 for direct burial installation and use with 90°C conductors.
- Meter panel is on the same side of the building as the Company transformer or pedestal, as specified by Design Services.

DB-120 conduit CAN NOT be utilized in a cross trench installation, refer to SR-304 for details.

4" & 6" PVC CONDUIT

Grey Polyvinyl Chloride (PVC) electrical grade, Schedule 40 for direct burial installation.

- Conduit to be manufactured to NEMA TC-2 standards.
- Conduit shall be rated for direct burial and use with 90°C conductors

4" & 6" CONDUIT FOR DIRECTIONAL BORING

Conduit approved for directional Boring when crossing under a road and a street cut is not permitted or desired. Bore-Gard Trenchless Raceway is approved for use on road crossings and for extended length (distances greater than road crossings) boring installations. The Company reserves the right to require the customer to provide a boring profile.



Arcco or Dura-line (HDPE) SDR-13.5 (ASTM D-3035) (Standard lead time of 12 weeks, if conduit is not in stock Border States Electric).

- Conduit must have solid red interior and exterior



Bore-Gard Trenchless Raceway from Prime Conduit Inc. (Standard lead time of 6-8 weeks, if conduit is not in stock at Border States Electric).

- Manufacturer Part Number - BG440SP-020 (4") and BG640SP-020 (6"), grey in color.

4" & 6" CONDUIT SWEEPS

Vertical Installation into Company Equipment

- Grey Polyvinyl Chloride (PVC) electrical grade, Schedule 40 for direct burial installation
 - o 4" x 36" x 90° sweep
 - o 6" x 48" x 90° sweep
 - o 6" x 48" x 45° sweep

Power Pole Attachment (Riser Installation)

- Steel
 - o 4" x 36" x 90° sweep or 6" x 48" x 90° sweep

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4" & 6" CONDUIT SWEEPS (Continued)

46kV Power Pole Attachment (Riser Installation)

- Rigid Aluminum
 - o 6" x 48" x 90° sweep

NOTES:

1. Service Provider reserves the right to reject any of the above ducts which show signs of environmental damage.
2. Solvent cemented joints shall be made according to the manufacturer's recommendations, using cements meeting the requirements of ASTM D2564 for PVC duct.

CONCRETE STRUCTURES

All concrete for structures shall meet the following requirements.

- Mixture shall be such that it will work readily without segregation and will provide a minimum strength of 3000 lbs. per square inch at 28-day test.
- Concrete shall conform to proper slump tests of not less than 2 inches nor more than 4 inches, using a standard 12 inch cone.
- Service Provider may request a copy of the concrete delivery invoice to verify the ordered formula strength of the concrete mix.
- The customer or his contractor shall furnish test cylinders as requested by Service Provider for the purpose of materials testing.
- Test cylinders must reach 75 percent of the 3000 lbs. PSI rating or equivalent 21-day curing period before any equipment will be installed.
- Concrete shall be reinforced with deformed billet steel conforming to ASTM A615, Grade 60 as shown on the appropriate SR drawing and shall be thoroughly worked around reinforcing steel and into corners of forms.
- Concrete surfaces or inner faces of structures shall be clean and smooth.
- Finished floor surfaces shall be steel troweled smooth and level.
- Edges must be chamfered.

CONCRETE DUCT ENCASEMENT and CAPPING

All concrete for duct coverage and protection shall meet the following requirements.

- Mixture shall be such that it will work readily without segregation and will provide a minimum strength of 2000 lbs. per square inch at 28-day test.
- The customer or his contractor shall furnish documentation at request from the Service Provider for the purpose of material verification.



NOTES:

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 1. All 46kV circuits (pole riser and pullbox to pullbox) require (4) four, 6 inch ducts per circuit and will require red dyed concrete encasement and locatable tracer wire the entire underground run. For tracer wire requirements refer to SR-206.
 2. Duct encased in concrete shall have a 3 inch minimum and 5 inch maximum encasement and/or cap as shown in the appropriate SR drawing.

SPARE DUCTS

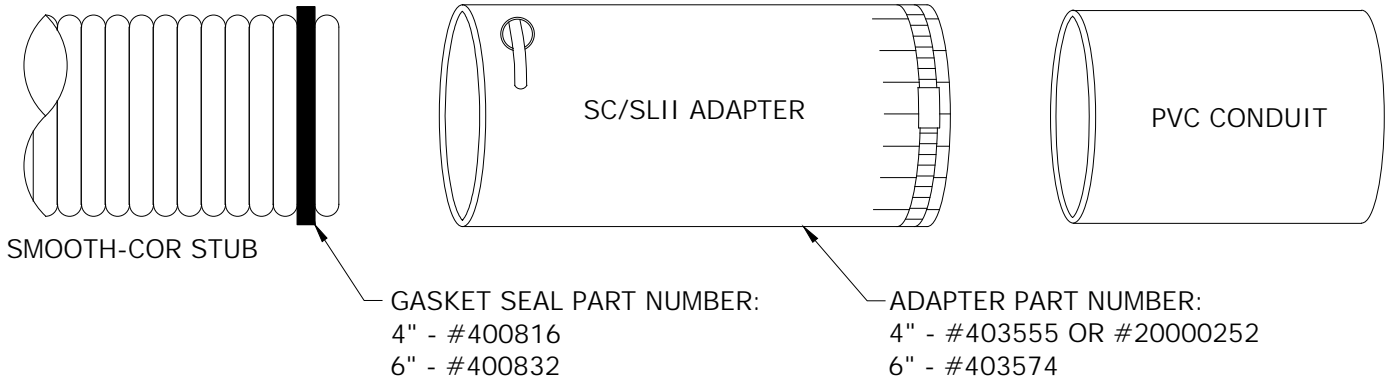
The Company will not guarantee the condition of, or the responsibility for, any ducts installed by any contractor for future use in the installation of an underground distribution system. Service Provider will assist in locating ducts stubbed for future use and will accept responsibility and ownership at such time as cable has been installed in the conduit system and energized. For information pertaining to sleeves refer to SR-210.

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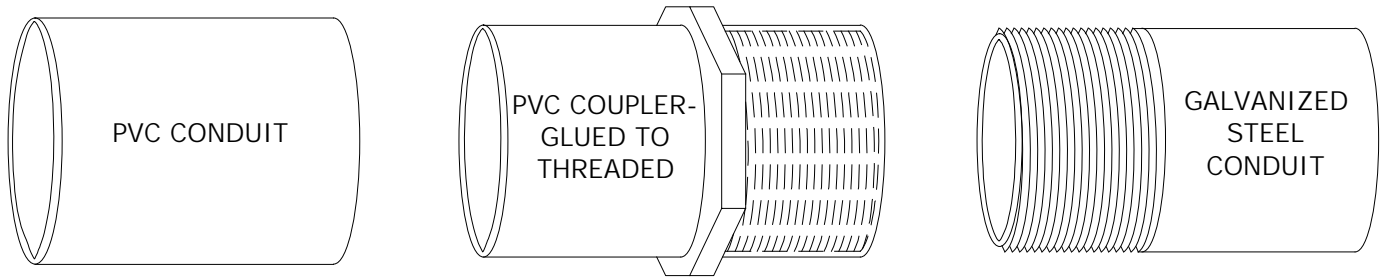
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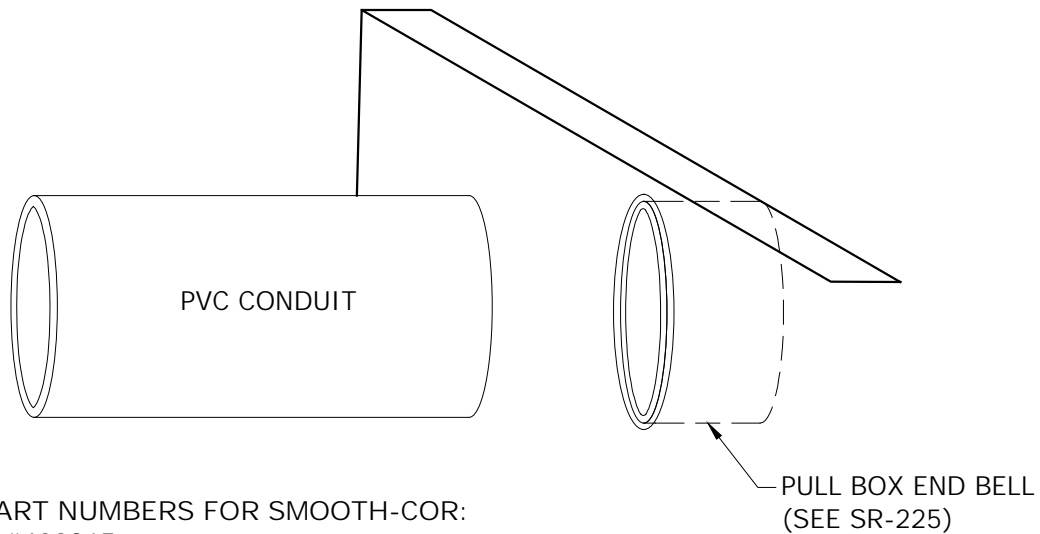
SMOOTH-COR STUB TO PVC



PVC TO GALVANIZED STEEL (POLE RISER)



PVC TO PULL BOX END BELL



ADDITIONAL PART NUMBERS FOR SMOOTH-COR:
4" KEYLOCKS - #400815
6" KEYLOCKS - #400831
GASKET LUBE, QUART - #402813

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