

STOWE ELECTRIC DEPARTMENT  
Stowe, Vermont

INSTALLATION PRACTICES AND SPECIFICATIONS FOR  
UNDERGROUND ELECTRIC DISTRIBUTION

I. GENERAL

These installation practices and specifications provide for the construction and installation of underground distribution power facilities by the Stowe Electric Department (SED).

All construction work must be done, between the months of May 1 and November 1 or at SED's discretion, in a thorough and workmanlike manner in accordance with the staking sheets, plans, specifications, and construction drawings.

The current edition of the National Electrical Safety Code (ANSI C2-1984 or current revision) shall be followed, except where local regulations or the practices and specifications contained herein are more stringent, in which case local regulations or these practices and specifications shall govern.

II. INSTALLATION PRACTICE

SED acknowledges that circumstances may occur where exceptions to these practices may occur. SED reserves the right to allow exceptions to the standards.

- A. All underground primary cable must be installed in a conduit system. At all pad-mounted equipment locations, the conduit must terminate in a fiberglass box pad or a concrete vault.
- B. Any telephone or cable TV pedestals must be at least **fifteen (15) feet** from any fiberglass box pad or concrete vault.
- C. **After SED has designed the conduit system location, all stages of trench preparation and conduit installation must be inspected by SED.**

1. Conduit

- a. Underground (buried) conduit must be electrical grade schedule 40 PVC. Where it crosses underneath a stream, driveway or road, it must be in schedule 80 PVC and enclosed in a six (6) inch or larger culvert to avoid possible damage.
- b. The minimum size buried conduit for primary underground must be three (3) inches. Metering conductor, as used to locate metering remotely from current transformers installed in pad-mounted transformer, may be installed in one and one-half (1 ½) inch conduit.

- c. All ends, joints, and internal finish of the conduit shall be free of sharp edges or burrs which could damage the cable.
- d. The maximum length of a conduit including no more than two (2) bends, between pulling locations may be limited to approximately 500 feet per judgement of SED. In this case a box pad or a concrete vault will be placed with a sectionalizing cabinet.
- e. All buried joints shall be glued with cement as recommended by the conduit manufacturer.
- f. All conduit must be inspected in the open trench by SED before covering.

2. Location of Conduit

- a. Conduit systems should be subject to the least disturbance practical. Conduit systems extending parallel to other subsurface structures should not be located directly over or under other subsurface structures.
- b. Longitudinal runs of conduit should not be located directly over or under other underground facilities such as gas, water, or sewer pipes. Whenever possible the horizontal distance between these facilities should be a minimum of twelve (12) feet to permit access and maintenance of either facility without damage to the other.
- c. Conduit should be installed as far as is practical from a water main in order to protect it from being undermined if the main breaks.
- d. Where a conduit run crosses a water main or sewer, it must be encased in a four (4) inch envelope of concrete six (6) feet each side of the water main, sewer, or gas lines to prevent transferring any direct load onto the pipe.
- e. Underground conduit systems are normally installed in the center of a thirty (30) foot wide right-of-way and must not be installed within fifteen (15) feet of any building, swimming pool, septic tank, etc. The conduit to the service entrance should be at right angles to the building.
- f. The conduit should be installed in as straight and direct line as possible. When bends are required, the minimum radius shall be sufficiently large as to prevent damage to cable being installed in the conduit. The maximum change of direction in any plane between lengths of straight rigid conduit without the use of bends shall be limited to five (5) degrees. All changes in direction between lengths of straight rigid conduit greater than five (5) degrees must be made in electrical sweeps having an inside bending radius of at least five (5) times the diameter of the conduit.

- g. Routes through unstable soils, such as mud, shifting soils, etc. should be avoided. If construction is required in these soils, the conduit should be constructed in such a manner as to minimize movement.
- h. The installation of conduit systems longitudinally under traveled surfaces of streets, roads, and parking areas, should be avoided whenever possible. Normally the conduit should be located at least three (3) feet behind ditch lines. (See trench spec.)
- i. The installation of conduit systems under bridges or in tunnels must be located so as to minimize the possibility of damage by traffic. It should be located to provide safe access for inspection or maintenance of both the structure and the conduit system.
- j. When crossing beneath railroad tracks, the top of the conduit system should be located a minimum of fifty (50) inches below the top of the rails. Where unusual conditions exist, or where proposed construction would interfere with existing installations, a greater depth than specified above may be required. Where this is impractical, or for other reasons, this clearance may be reduced by agreement between the parties concerned. In no case, however, shall the top of the conduit or any conduit protection extend higher than the bottom of the ballast section which is subject to working or cleaning.

### III. INSTALLATION OF CONDUIT

The customer will install the underground conduit system unless otherwise arranged with SED.

- A. All conduit must be installed in accordance with SED specification UR1, Trenches for Underground Conduit Systems. Where the underground extension might serve two (2) or more transformers, a loop feed conduit system must be installed at the customer's cost.

The minimum depth of burial, the distance between the top of the conduit, and the surface under which it is installed, may be reduced by mutual agreement under special circumstances, such as when solid ledge is encountered, by encasing the conduit in a minimum of four (4) inches of concrete around the conduit.

In areas where frost conditions could damage the conduit system, greater burial depths than indicated may be desirable.

Where the surface is not to final grade, under which the conduit system is to be installed, the conduit should be placed so as to meet or exceed the requirements indicated above, both at the time of installation and subsequent thereto.

- B. Excavation: The bottom of the trench shall be forty-eight (48) inches from finished grade and be undisturbed, tamped, or relatively smooth earth. The conduit shall be laid on a six (6) inch protective layer of sand – see trench specifications.

All box pads or concrete vaults and the grounding mat arrangement must be installed with sufficient drainage with crushed stone under box pads and concrete vaults including crushed stone under and around drain pipe.

- C. All conduit, including terminations and bends, should be suitably restrained by backfill, concrete envelope, or other approved means to maintain its design position under stress of installation procedures, cable pulling operations, and other conditions such as settling and hydraulic or frost uplift.
- D. In trenches for primary cable, when electric cables are installed in separate conduits but in the same trench with communication cables, the conduits shall have a separation or twelve (12) inches.
- E. Backfill. All backfill must be free of materials that may damage the conduit system. Backfill on top of the conduit must be six (6) inches of sand and free of solid material greater than one-half (1/2) inch in diameter or with sharp edges likely to damage it. The balance of backfill must be free of solid material greater than three (3) inches in diameter. Backfilling must be completed in such a manner that voids will be minimized. Backfill material shall be adequately compacted. Customer is responsible for backfilling around pole, box pad, and concrete vault.
- F. The customer must install a pulling twine in each conduit. The pulling twine must have minimum breaking strength of 500 pounds or must be of polypropylene or equivalent material.
- G. Warning tape, clearly marked must be installed twelve (12) inches below final grade and directly over the conduit system.
- H. The ends of the conduits must be terminated as follows:

At pole locations, the conduit shall terminate five (5) inches away from the pole at the premarked area. All backfill within the twelve (12) inches of the pole must be sand or equivalent. This should allow for future pole replacement without splicing the cable, etc.

The conduit will run in the side knockouts of the concrete vaults and box pads. At meter locations, the conduit must terminate at the meter socket in accordance with applicable SED meter installation specifications. If the meter socket is at a lower grade than the pad-mounted equipment vault or part of the underground conduit system, provisions shall be made, as necessary, so that the conduit will not fill with water and run into the meter socket.

- I. All exposed ends of the conduit must be plugged during construction to prevent the entrance of foreign matter and moisture into the conduit.

- J. All conduit joints must form a sufficiently continuous smooth-interior surface between joining duct sections so that the cable will not be damaged when pulling past the joint.
- K. Bridges: Conduit installed in bridges must include the capability to allow for expansion and contraction of the bridge. Conduits passing through a bridge abutment should be installed so as to avoid or resist any shear due to soil settlement. Conduit of conductive material installed on bridges must be effectively grounded.
- L. The customer shall be responsible for having the conduit system ready prior to SED personnel installing the cable. Any changes, repairs, or other work required to the underground conduit system in order for SED personnel to pull the cable into the conduit shall be the responsibility of the customer.

ALL ASPECTS OF INSTALLATION MUST BE INSPECTED BY SED

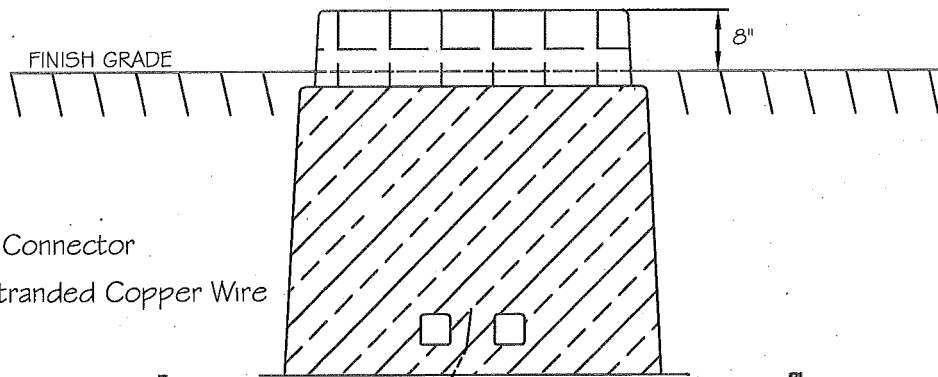
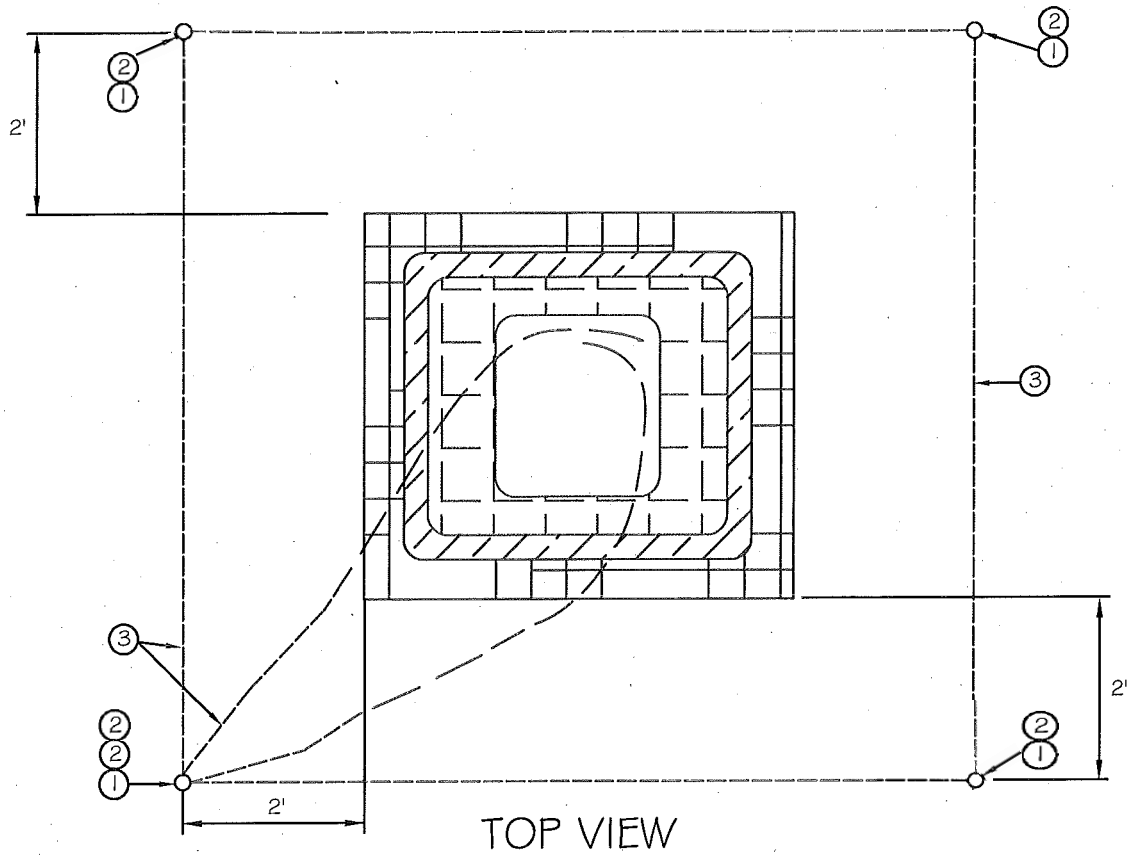
Steps For Installation of Primary Underground

1. Trench
  2. Sand
  3. Conduit
  4. Sand
  5. Backfill
  6. Warning Tape
  7. Backfill
  8. Pull String
1. Excavation of Trench – See Spec
    - a. The trench must be a minimum of 48” in depth with the bottom of the trench undisturbed, tamped or relatively smooth earth.
    - b. If ledge is present, blasting may be required to acquire the 48” depth (consult with SED).
    - c. Must have drain to disperse all water.
    - d. The trench must be straight as possible (as staked by SED).
  2. Installation of Sand
    - a. Place 6” of sand evenly distributed and graded in the bottom of the trench with no rocks larger than 1/2” diameter.
  3. Installation of Conduit
    - a. Place electrical grade schedule 40 PVC in trench on top of sand. All ends, joints and internal finish of the conduit must be free of sharp edges or burrs which could damage the cable. All joints must be glued with cement as recommended by conduit manufacturer. Conduit must be free of all debris and moisture.
  4. Installation of Sand
    - a. Place 6” of sand evenly distributed and graded on top of the 3” conduit.
  5. Backfill
    - a. Place 20” backfill distributed and graded on top of the sand.
  6. Warning Tape

- a. Place warning tape approximately 12” below grade and directly over the conduit system to clearly mark the conduit system.
7. Backfill
- a. Complete backfilling the trench with no larger than 3” diameter rocks in backfill which must mound up trench to allow for settling.
8. Pull String.
- a. Must install a pull rope in conduit system. The pull rope must have a minimum breaking strength of 500 pounds and must be of polypropylene or equivalent material.

INSTALLATION OF VAULT – SEE SPECS

# GROUNDING MAT ARRANGEMENT FOR BOXPAD OR VAULT



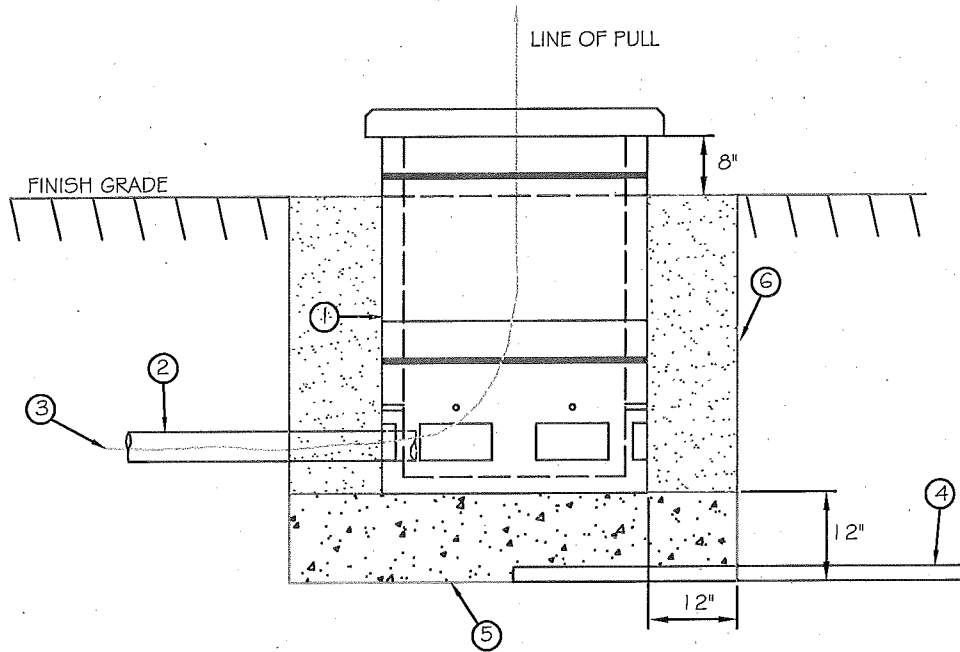
## LEGEND

- ① (4) Ground Rod
- ② (5) Ground Rod Connector
- ③ (80') #4 Bare Stranded Copper Wire





# VAULT PROFILE



## LEGEND

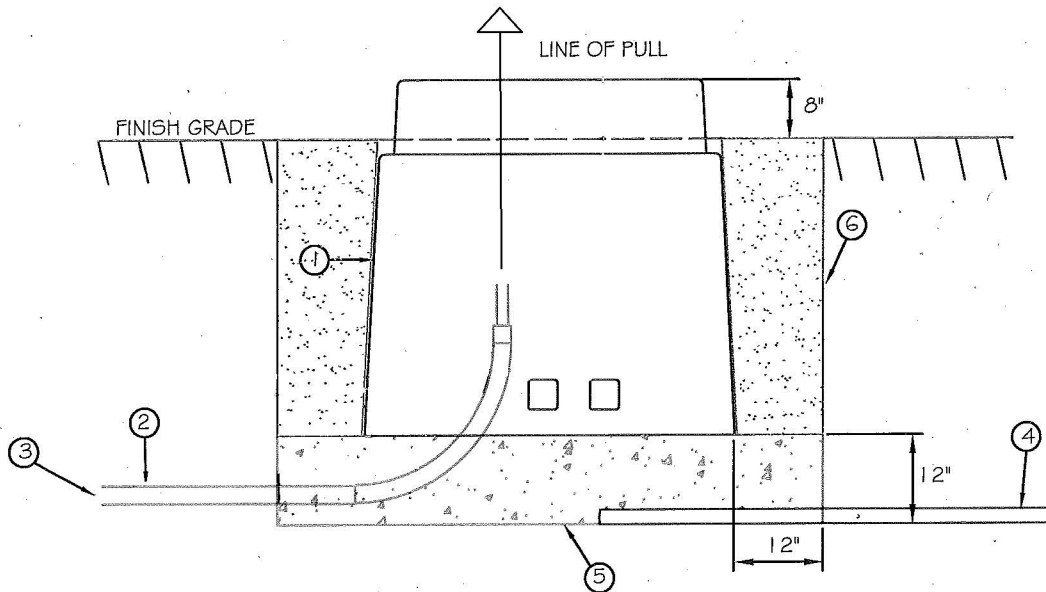
- ① Concrete Vault
- ② 3" SCH 40 Electrical Grade PVC
- ③ Pull Twine
- ④ 2" Drain Pipe
- ⑤ Crushed Stone
- ⑥ Sand will be used as backfill around entire area of vault

## NOTES:

- 1) A pull string rated at 500 pounds must be installed in conduit to assist in pulling the cables.
- 2) Must provide a 2", or greater, drain pipe to drain any excess water.
- 3) Vault must extend 8" - 10" above finish grade.
- 4) Crushed stone must extend 12" beyond each side of vault with a 12" depth.
- 5) Vault protection may be required (Consult with SED).
- 6) Vault must have a Grounding Mat Arrangement.
- 7) The location of the vault must be accessible by a Digger or Bucket truck year round.



# BOXPAD PROFILE



## LEGEND

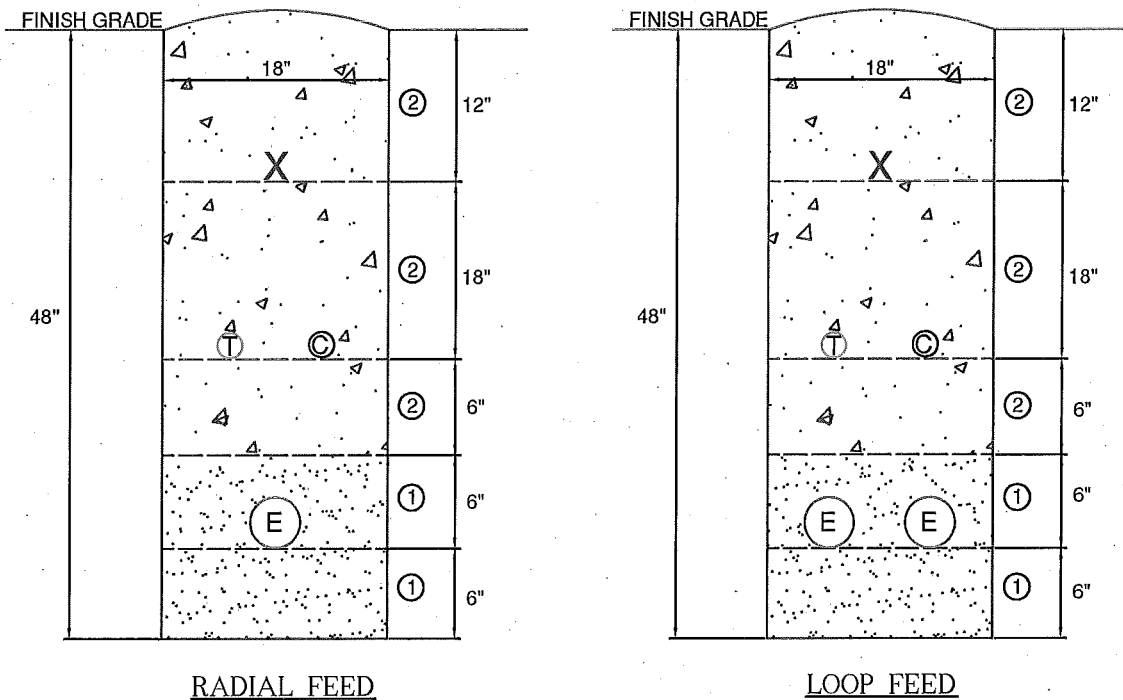
- ① Fiberglass Box Pad
- ② 3" SCH 40 Electrical Grade PVC
- ③ Pull Twine
- ④ 2" Drain Pipe
- ⑤ Crushed Stone
- ⑥ Sand will be used as backfill around entire area of vault

## NOTES:

- 1) A pull string rated at 500 pounds must be installed in conduit to assist in pulling the cables.
- 2) Must provide a 2", or greater, drain pipe to drain any excess water.
- 3) Box pad must extend 8" - 10" above finish grade.
- 4) Crushed stone must extend 12" beyond each side of box pad with a 12" depth.
- 5) Box pad protection may be required (consult with WEC Engineer).
- 6) Box pads must have a Grounding Mat Arrangement.
- 7) The location of the box pad must be accessible by a Digger or Bucket truck year round.



# TYPICAL TRENCH CROSS-SECTION FOR PRIMARY U.G.



## LEGEND

- |   |                                    |   |   |
|---|------------------------------------|---|---|
| ⓔ | Conduit(s) for Electrical Cable    | Ⓛ | Sand, no rocks larger than 1/2" diameter                  |
| Ⓣ | Conduit for Telephone Cable        | Ⓜ | Well Compacted Backfill, no rocks larger than 3" diameter |
| ⓐ | Conduit for Television Cable       |   |   |
| X | U.G. Electrical Cable Marking Tape |   |   |

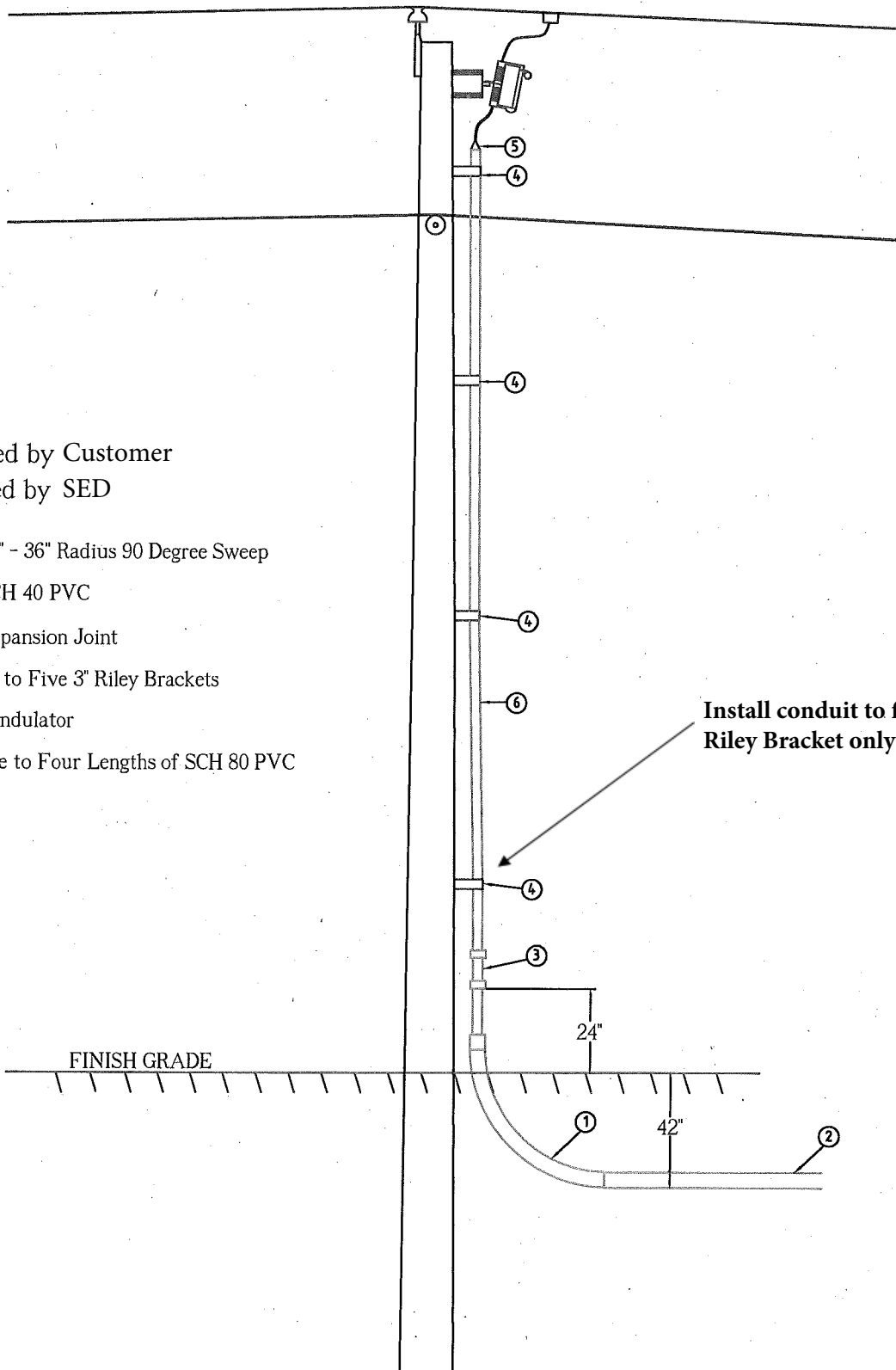
## NOTES:

- 1) All trenches and electrical conduit(s) require approval by SED's inspector before backfilling.
- 2) Trench cross-section shall be identical, with or without telephone or television cable.
- 3) Conduit shall be encased in 4" envelope of concrete under the following conditions:
  - a) 12 ft each side of water, sewer, gas and drain crossings.
  - b) for installations under the travelled portion of the road.
  - c) culvert may be substituted for concrete on road crossings.
  - d) where ledge is encountered depths may be reduced, upon approval by SED Inspector.
- 4) Only telephone and television cables may be located in a common trench with electrical cables. Conduit systems occupied by telephone or television cables must be separated horizontally or vertically by a minimum of 12" of well tamped earth.
- 5) Mounding to gain suitable cable depth is not permitted.
- 6) SED may require the primary underground system to be designed and built as a loop feed system to provide additional reliability. (ex. 3 or more customers or future development potential)



# SINGLE PHASE PRIMARY RISER CONSTRUCTION

7.2 KV



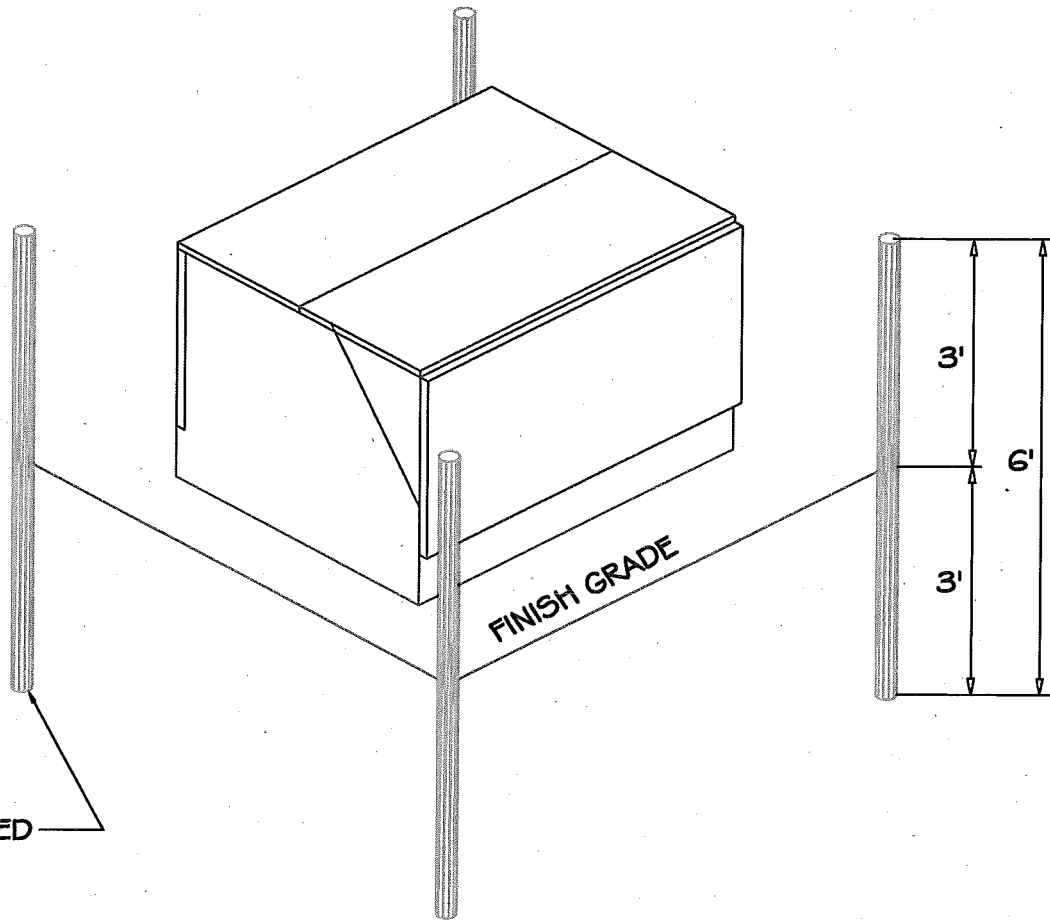
Supplied by Customer  
Installed by SED

- ① (1) 3" - 36" Radius 90 Degree Sweep
- ② 3" SCH 40 PVC
- ③ 3" Expansion Joint
- ④ Four to Five 3" Riley Brackets
- ⑤ 3" Condulator
- ⑥ Three to Four Lengths of SCH 80 PVC

Install conduit to first  
Riley Bracket only.



# PAD / VAULT PROTECTION



6" CONCRETE FILLED  
LOLLY COLUMN.  
3' HIGH TYPICAL

FIBERGLASS PAD EDGE

## NOTES:

Box pad or concrete vault  
protection maybe required.

(Consult with SED)

