September 2021

UNDERGROUND CONDUIT SYSTEMS

for Primary and Secondary Conductors (Rev. 11)

Engineering Standards Policy No. 242

Rocky Mountain Power

Idaho | Utah | Wyoming

This policy and related documents are posted on the web at:
https://www.rockymountainpower.net/working-with-us/builders-contractors/electric-service-requirements.html

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Procedure 242—Underground Conduit Systems for Primary and Secondary Conductors

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Procedure 242—Underground Conduit Systems for Primary and Secondary Conductors

1. General

1.1. Purpose

This manual is intended to guide Rocky Mountain Power customers in the installation of primary and secondary underground conduit systems. This document covers most applications, but cannot address every possible situation. Consult the Power Company for solutions to unique circumstances.

If additional information is required, contact the Power Company at 1−888−221−7070 or via the internet at www.rockymountainpower.net.

1.2. Changes or Conflicts in Requirements

The intent of this manual is to comply with all applicable codes, ordinances, and tariffs, as well as to implement common practices throughout the Power Company's service territory. Common practices are implemented to:

- meet or exceed minimum safety codes and municipal building ordinances
- ensure fair and impartial requirements for all customers
- use safe work procedures by following established Power Company standards
- facilitate the privacy and security of current and future customers and occupants

If a requirement in this manual conflicts with an applicable tariff, code, or ordinance, then other Power Company standards shall be used to design a solution that meets (or exceeds) the minimum requirements of the tariff, code, or ordinance. The Power Company will provide the standards, and should be consulted with questions on the applicability of any item in this manual.

Where this document differs from the Power Company's *Electric Service Requirements* Manual regarding primary and secondary installations this document shall prevail.

1.3. Definitions

1.3.1. Conduit Systems

Closed Conduit Design: A closed conduit design consists of conduit in a trench terminating in a vault. All 600-ampere (A) systems require a closed conduit design. 200 A systems may require closed conduit designs – depending on design requirements.

Open Conduit Design: An open conduit design consists of conduit in a trench terminating in open box pads or flatpads. The Power Company reserves the right to require a closed conduit design in non-typical 200 A applications.

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Equipment Bases: Equipment bases include box pads, padvaults, and flat pads. Equipment bases provide a platform for pad-mounted equipment.

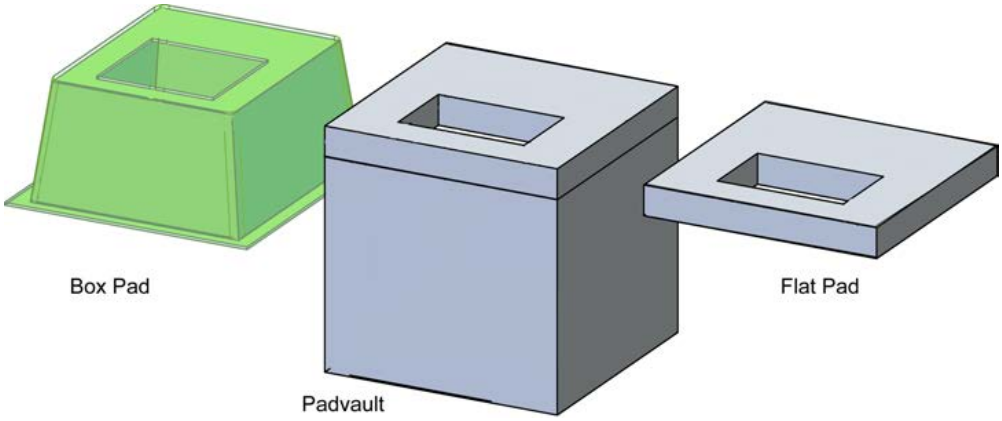

Figure 1—Equipment Bases

1.3.2. Underground System Conductors Figure 2)

Primary Conductors: Underground conductors between the Power Company's substation and the Power Company's distribution transformers. Depending on the area, these conductors are energized between 4,200 volts (V) and 34,500 V.

Secondary Conductors: Underground conductors between the Power Company's distribution transformers and secondary boxes. Depending on the customer's application, these conductors are energized between 120 and 480 V.

Service Entrance Conductors: Underground conductors between the customer's service equipment terminals and the Power Company's source (a distribution transformer or a secondary box). For more information regarding service entrance conductors and conduit please refer to the Power Company's *Electric Service Requirements Manual* at https://www.rockymountainpower.net/working-with-us/builders-contractors/electric-service-requirements.html.

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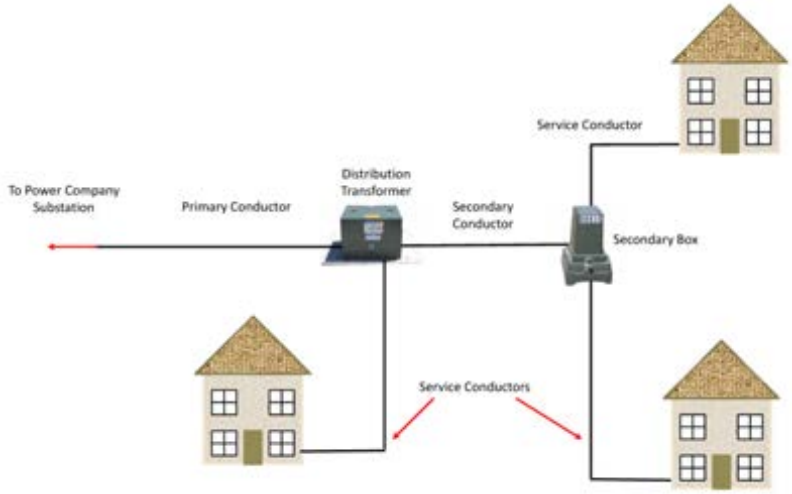

Figure 2—Primary, Secondary, and Service Conductor Schematic

1.3.3. Primary and Secondary Equipment Associated with Conduit Systems

Distribution Transformer: A voltage device that converts power from primary voltage to a secondary voltage. The secondary side of the transformer is used to serve individual customers either directly or via a secondary box. See "Figure 3" below.

Sectionalizing Cabinet: A primary voltage device used as a junction for two or more primary cables. A sectionalizing cabinet cannot be used to serve a customer.

Switchgear: A primary voltage device used as either a switch point or protection point for two or more primary cables. Switchgear cannot be used to serve a customer.

Secondary Box: A secondary voltage device used as a junction for two or more secondary or service cables. A secondary box can be used to serve a customer. See "Figure 3" below.

Figure 3—Typical Primary and Secondary Equipment

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1.4. Customer Responsibilities

The customer shall meet the requirements described in this document to complete construction for underground installations.

The customer is responsible for providing all trenches, backfill, compaction, conduit, and equipment bases, and final grade design. The Power Company may provide some of these services, such as providing and leveling box pads. The customer is responsible for boring if that method is used.

Before installing any primary and/or secondary conduit system, the customer shall enter into a contract with the Power Company and obtain a job sketch from a Power Company representative. The customer is responsible for ensuring that all conduit system installations comply with Power Company requirements and the provided job sketch.

Any conduit system or any part of a conduit system installed before receiving a job sketch from the Power Company will be subject to Power Company rejection.

1.5. Underground Infrastructure Signs and Markers

Above-grade signage, buried radio frequency (RF) markers, and buried caution tapes assist utility location services. Their presence may also provide a supplemental level of protection against service interruptions from dig-ins. General requirements are provided below:

Requirements:

Caution tape shall be installed 12 to 18 inches above all electrical conduits and duct banks, if trenching or other open excavation methods are used.

a. Caution tape shall be red in color with black text "CAUTION BURIED ELECTRIC LINE BELOW," tape shall be a minimum of 6 inches wide by 0.004 inches thick. (3M Scotch #368 or equivalent).

1. Red-dyed concrete shall be used if concrete encasement is used to encase electrical conduits or duct banks.
2. Radio frequency (RF) markers shall be installed above 4- to 8-inch electrical conduits at stub-outs and transition points between bored and trench installations. (3M #1256 Passive Mid-Range Marker Power Encoded or equivalent). If these markers are required, they will be provided by the Power Company with locations specified on the job sketch.
3. Above-grade signage, if required, will be provided by the Power Company with locations specified on the job sketch.
4. Additional signs or markers may be required for unique installations.

2. Trench and Backfill

2.1. Call Before You Dig (8-1-1)

State laws require the customer/excavator call 8-1-1 for underground utility cable locations at least 48 hours prior to any excavation. Excavation shall not start until facilities have been marked by an underground locator service, or until the service confirms that no facilities exist in the area.

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811 Know what's below. Call before you dig.

2.2. Trench and Backfill Requirements

2.2.1. Trenching Requirements

The customer shall provide all trenching. OSHA requires the trench be shored when the combination of trench plus the spoil exceeds five feet (5′). To comply with OSHA rules when not shoring a trench, the customer shall keep the spoil at least two feet away from the open trench.

Figure 4—Spoil

The National Electrical Safety Code (NESC) states in section 321.A, "The bottom of the trench should be undisturbed, tamped, or relatively smooth earth. Where the excavation is in rock, the conduit should be laid on a protective layer of clean tamped backfill."

To the extent possible, trench bottoms shall be level and made of well-tamped earth without sharp rises and drops in elevation. Rock spurs or ridges shall not project into the trench. If trenching is left open overnight, the customer is responsible for cleaning prior to conduit installation. Per NESC 321.A. the Power Company may require the conduit be laid on a protective layer of clean tamped backfill.

When the customer is trenching to existing (energized) equipment, the customer shall stop trenching with mechanical methods and continue hand trenching the final two feet (2′) to the energized equipment unless otherwise requested by the Power Company. Do not trench under/past the base of the energized equipment (see "Figure 5" on the next page).

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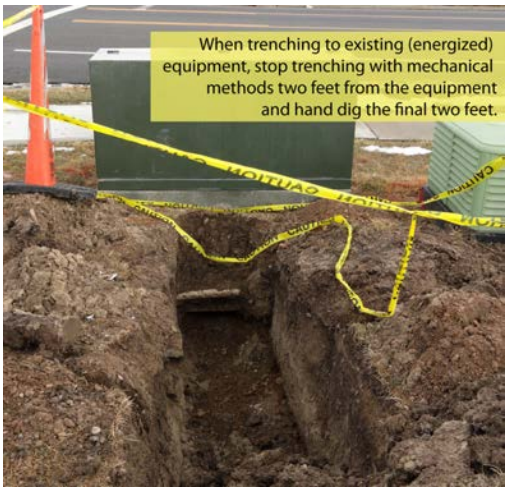

Figure 5—Trench to Energized Equipment

2.2.2. Backfill Requirements

The National Electrical Safety Code states in section 321.B, "All backfill should be free of materials that may damage the conduit system. Backfill material should be adequately compacted to limit settling under the expected surface usage."

The following list of requirements applies to all installations requiring backfill:

1. The customer shall provide trench backfill and site restoration.
2. All backfill shall be free of materials, such as construction waste, large rocks, or sharp rocks, that may damage the conduit system. Where natural backfill poses such a hazard the Power Company will require the backfill within six inches (6″) of the conduit to be 4″ minus or finer (capable of passing through a 4″ sieve).
3. Backfill shall be adequately compacted to prevent future settling.
4. Prior to backfilling over the conduit, the Power Company shall inspect the backfill material and conduit installation.

The Power Company will not energize conductors until the customer completes the backfill to Power Company satisfaction.

Extra caution should be taken when backfilling trenches. The customer is responsible for repairing crushed or damaged conduit, including any costs for crews to return to the job site.

2.3. Trench Types

2.3.1. Primary Conduit Trench

The primary conduit trench is normally in the Public Utility Easement (PUE) or an established right-of-way (ROW). This trench may include both secondary and primary cable. When digging only a primary trench, the customer shall follow the dimensions shown in "Figure 6" on the facing page.

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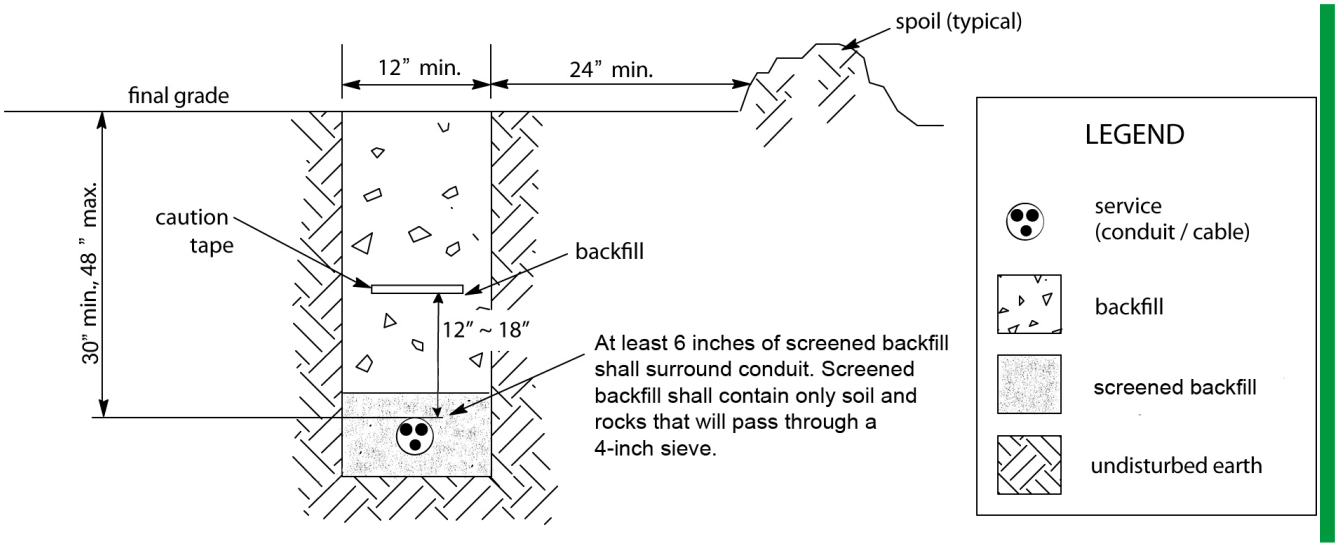

Figure 6—Primary Trench

2.3.2. Secondary Trench

When installing only secondary conduit in a trench, follow the dimensions and requirements in "Figure 7" below. Where the secondary conduit approaches a box pad, the trench will need to be deeper to allow the conduit and sweep to be installed under the box pad. Do not reduce the integrity of the box pad by putting holes in it.

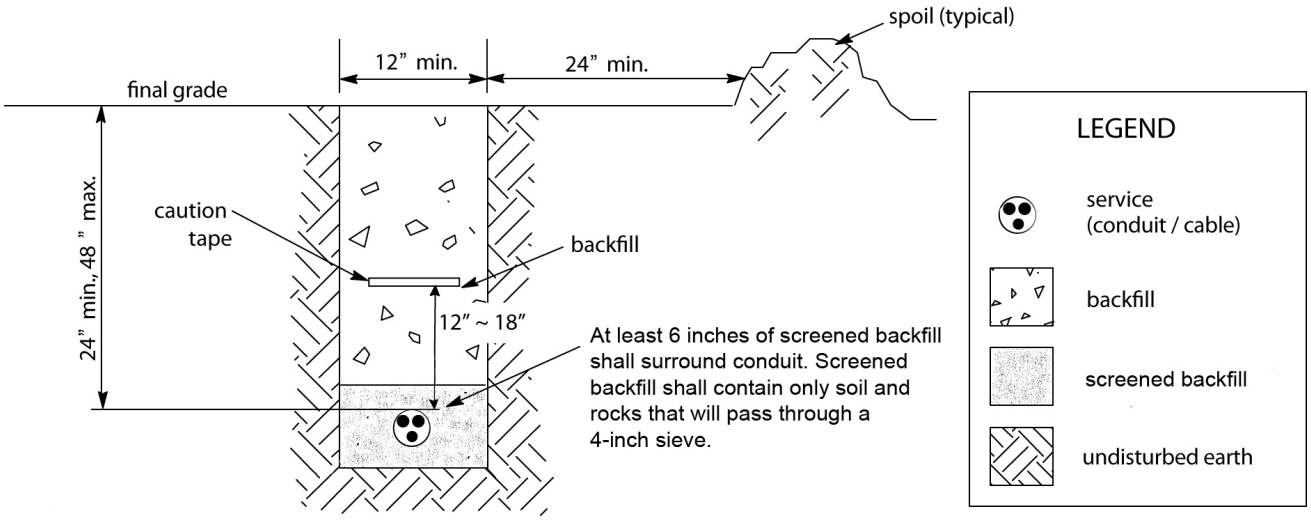

Figure 7—Secondary Trench

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2.3.3. Joint Use Trench

Joint use trenching requirements may vary by area; consult the Power Company for requirements before installation. The customer may be allowed to place communication, signal, and other electrical supply conductors in the same trench as Power Company conductors, provided that the installation meets Power Company policy, and all concerned parties agree on the placement.

Communications: A minimum horizontal distance of 12 inches (12″) shall exist between the electrical conduit and other utility lines, unless superseded by the requirements of other utilities involved (and/or unless local requirements differ).

Gas: The minimum horizontal distance between the electrical conduit and gas lines must be greater than 12 inches (12″) unless both the Power Company and the joint use gas utility have reached a separate operational agreement requiring a greater distance.

Other electric utilities: PacifiCorp requires that other electric utilities be located in different trenches that have a minimum separation of 72″; however, the Power Company may allow a joint trench agreement with another electric utility.

Water, sewer, and drainage: The Power Company will not install electrical conductors in a common trench with main water lines, sewer lines, or other drainage lines. Conduit should be installed as far as practical in order to protect it from being undermined if the water main breaks.

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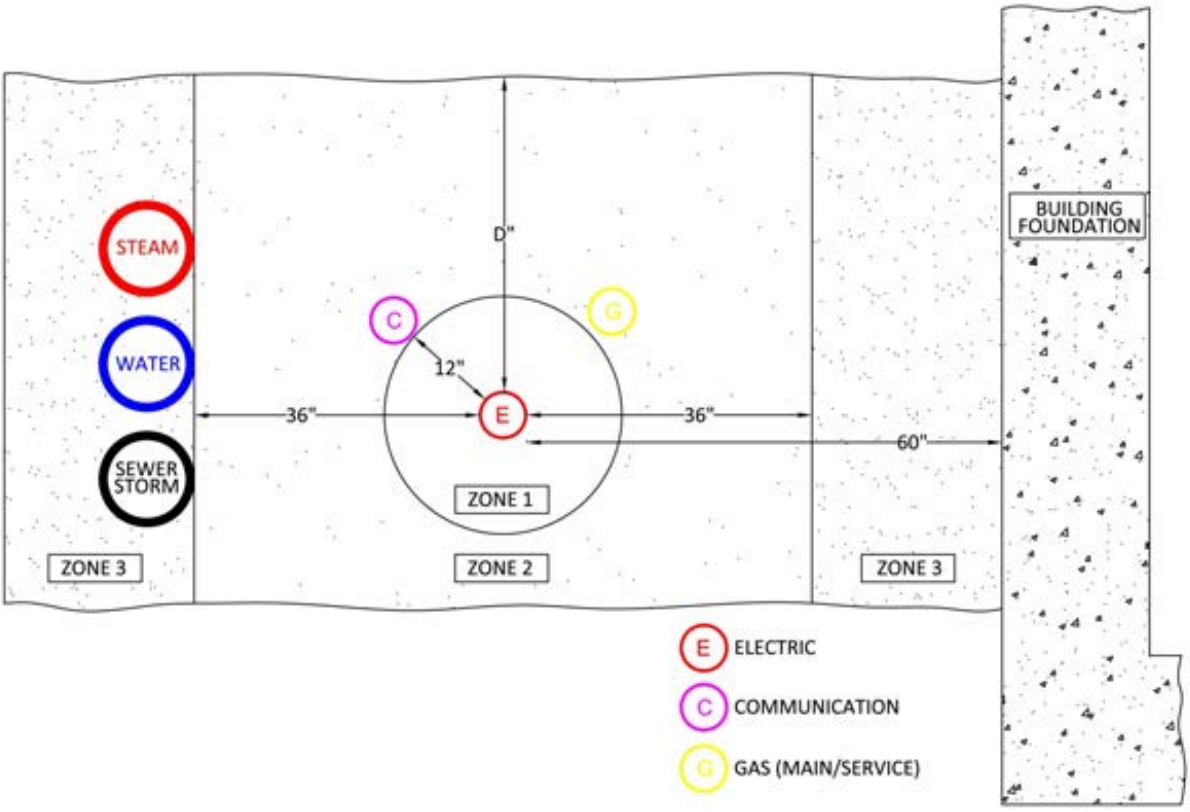

Figure 8—Separation of Paralleling Lines and Structures

Note: Distance exceptions may be granted on a case-by-case basis by the Power Company.

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Table 1 —Radial Separation from Foreign Utilities and Structures

Location	Foreign Utility or Structures Permitted	Minimum Separation	
		Paralleling	Crossing
Zone 1	No foreign lines or structures allowed	N/A	N/A
Zone 2	Communication (telephone, fiber, cable)	12″ (Radial)	12″ (Radial)
	Streetlights		
	Minor structures (vaults, manholes, poles foundations, fence footings)		
	Gas (mains and services)		
Zone 3[a]	Water lines (pressurized)	36″ (Horizontal)	12″ (Radial)
	Sewer (sanitary and sewer)		
	Steam and cryogenic		
—	Building foundations and retaining walls	60" (Horizontal)	Engineering required
—	Gas transmission	Engineering required	Engineering required
	Other lines transporting flammable materials		
	Railroads		

[a] Lines shall not be parallel directly above or below electric supply lines.

Joint trench examples can be seen in "Figure 9" below through "Figure 11" on the facing page.

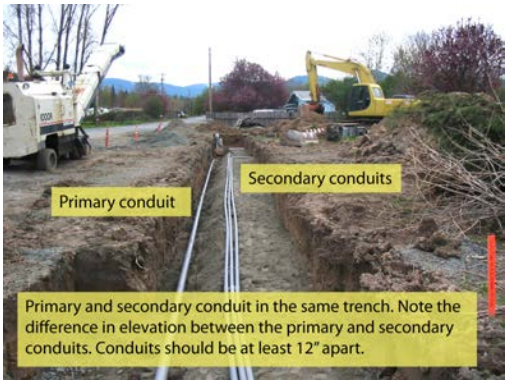

Figure 9—Primary and Secondary Conduits in Trench

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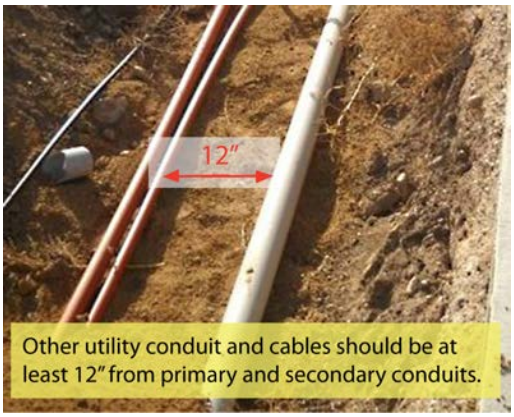

Figure 10—Joint Trench

When installing secondary conduit in a joint use trench, follow the dimensions in "Figure 11" below. When installing primary conduit in a joint use trench, follow the dimensions in "Figure 12" on the next page. "Figure 12" on the next page shows the secondary and joint use installed in a horizontal configuration. This is the preferred configuration. When easements are limited or crowded, the secondary conduit can be placed above the primary conduit. Please contact the Power Company for details.

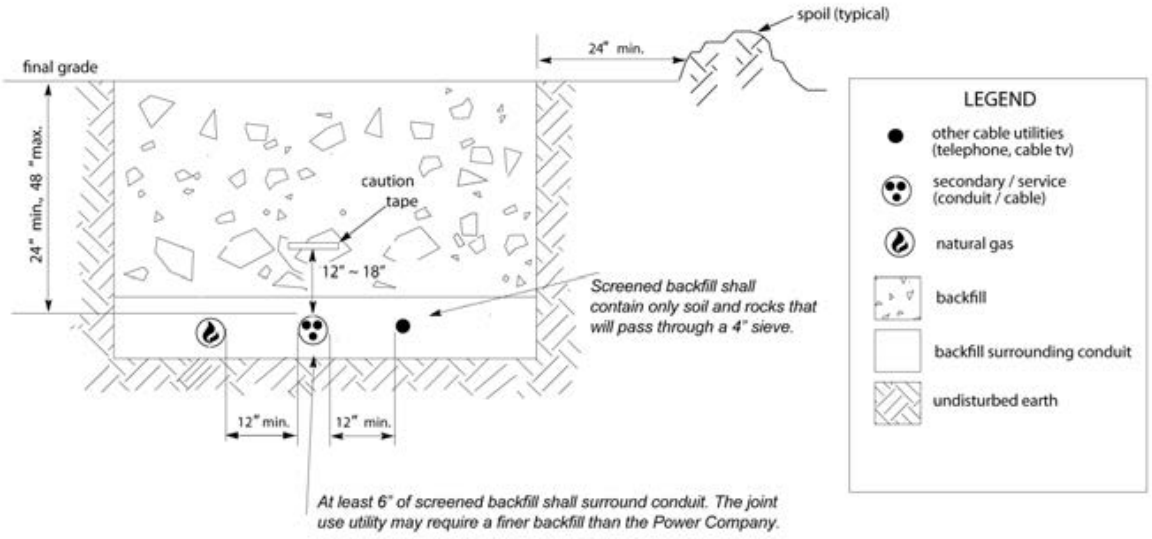

Figure 11—Joint Use Secondary Trench

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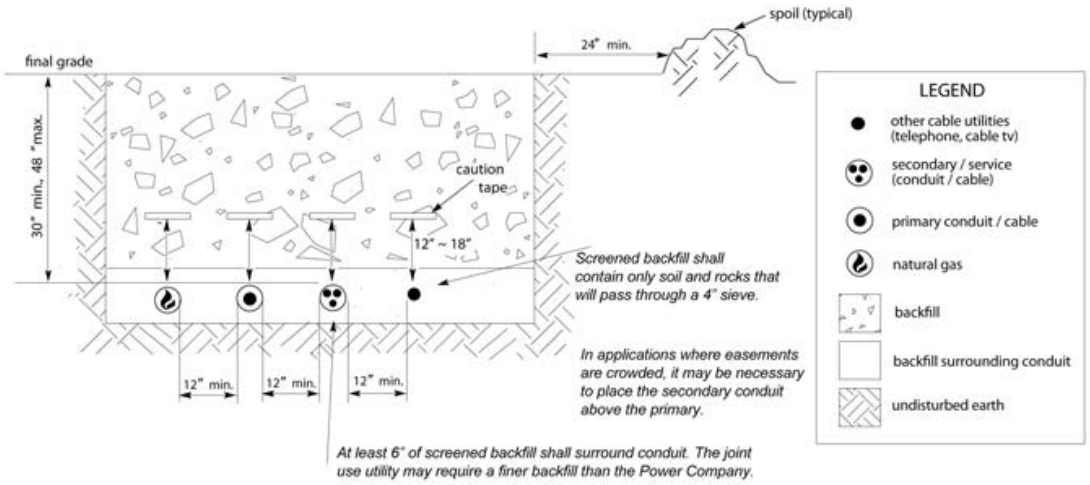

Figure 12—Joint Use Primary Trench

2.4. Trench and Backfill Installation

The customer is responsible for providing all trenches, boring, backfill, compaction, conduit, and equipment foundations. The customer shall meet the requirements described in this procedure to complete construction for underground installation.

Before installing any conduit system, the customer shall enter into a contract with the Power Company and obtain a job sketch from a Power Company representative. The customer is responsible for ensuring that all conduit system installations comply with Power Company requirements and with the provided job sketch. Any conduit system or any part of a conduit system installed before receiving a job sketch from the Power Company may be subject to rejection or revision.

During development/construction, the customer is responsible for ensuring that all subsequent contractors working in the vicinity of Power Company facilities exercise care to maintain the integrity of the conduit system (conduit and equipment bases). If the Power Company is required to return to the site to repair the conduit system, the customer will be held liable.

Winter conditions may not allow a customer to adequately build to company specifications regarding compaction. The customer shall be responsible for the cost if the Power Company is required to return later to correct settling issues.

Figure 13—Typical Primary Conductor Trench

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Figure 14—Typical Conductor Trench

2.5. Backfill

For trenching requirements see Section 2.2, *Trench and Backfill Requirements*

Figure 15—Acceptable Backfill

Figure 16—Unacceptable Backfill

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3. Conduits

3.1. Conduit Installation Requirements

The following list of requirements applies to all primary and secondary conduit installations. Sections 6 through 9 of this document clarify many of these requirements and provide photographs of typical installations.

3.1.1. Location

The customer shall ensure that conduit is located away from (and never underneath) buildings, building foundations, or other structures.

Conduit shall not be run in a parallel direction under a retaining wall. Conduit may be run at a right angle under a retaining wall. If the retaining wall is greater than 3′ in height a steel sleeve shall be used to protect the conduit.

3.1.2. Water Flow

The customer is responsible for recognizing potential surface and subgrade water flows and coordinating with the Power Company to minimize potential runoff problems. Potential surface and subgrade water flows are relevant where water infiltration is problematic because of proximate river flooding, the presence of a high water table, or the lay of the land.

3.1.3. Dirt and Debris

The customer shall keep the inside of the conduit free of dirt and debris during installation. Once the conduit is installed, it shall be temporarily sealed (plugged or capped) to prevent infiltration of water and dirt. An unglued conduit cap or plug is required for keeping the conduit free of debris. The customer is responsible for clearing accumulated debris.

3.1.4. Pull Rope

The customer shall provide a flat pull line or poly rope rated to withstand 1,000 lbs. of tension, installed with 72″ of extra line extending from each end of the conduit. The pull line shall be secured inside the ends of the conduit and both conduit ends shall be capped.

3.2. Conduit and Sweeps – Material

Table 2 and Table 3 identify the appropriate types of conduit and sweeps to be used. Table 4 specifies the sweep specifications. Field bends are not permitted.

The company accepts electrical grade schedule 40 PVC (or better), fiberglass (ZG 033), and High-density polyethylene (HDPE) (ZG 031) conduit materials. Table 2 shows the preferred, conduit materials for below-grade applications. Table 3 shows the preferred, conduit materials for risers. HDPE is only accepted for below-grade applications when installed by directional boring or cable plowing.

Rocky Mountain Power shall provide prior approval for the use of rigid metal conduit (RMC), which is only to be used in above-grade special applications.

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3.2.1. Final Grade

Final grade design must be established and a physical measure confirmed by the presence of curb, gutter, and grading stakes placement.

Table 2—Below-Ground Conduit Applications

Application	Type of Conduit[1]	Sweep Material[1]
Three-phase primary	Fiberglass, PVC, HDPE	Fiberglass [2]
Single-phase primary	Fiberglass, PVC, HDPE	Fiberglass or PVC[2, 3]
Secondary	Fiberglass, PVC, HDPE	Fiberglass or PVC[2, 3]

1. Steel conduit, casings, and sweeps may be required for special applications.
2. Fiberglass can tolerate higher sidewall pressures than PVC.
3. Longer conduit runs or conduit with multiple sweeps may require fiberglass.

Table 3—Riser Applications

Application	Type of Conduit[1]	Sweep Material[1]
Three-phase primary	Fiberglass or PVC	Fiberglass[2]
Single-phase primary	Fiberglass or PVC	Fiberglass or PVC[2, 3]
Secondary	Fiberglass or PVC	Fiberglass or PVC[2, 3]

1. Steel conduit, casings, and sweeps may be required for special applications
2. Fiberglass can tolerate higher sidewall pressures than PVC.
3. Longer conduit runs or conduit with multiple sweeps may require fiberglass.

Table 4—Sweep Specifications

Acceptable Elbow Sweeps[1]				When PVC is Used[1]	When Fiberglass is Used[1]
Conduit Diameter (in.)	Secondary Conductor Conduit (in.)	Primary Conductor Conduit (in.)		PVC Schedule	Minimum Fiberglass Wall Thickness (in.)
		In Trench	Riser		
2″	Note 2	36″	36″	40	n/a
3″	36″	36″	36″	40	0.09″
	48″	48″			
4″	36″	36″	36″	40	0.09″
	48″	48″			
6″	n/a	48″	48″	40	0.11″
		60″			

[1] Long radii sweep elbow sizes are based on cable sidewall pressure-bearing limitations. Depending on pulling calculations, the Power Company may require a larger radius sweep or specify which material the sweep should be made of.

[2] Two-inch (2”) conduit is prohibited for secondary use unless prior approval from the Power Company is granted.

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Figure 17—Fiberglass Conduit

Figure 18—Electrical Grade PVC

Figure 19—Fiberglass Sweeps

Additional conduit and sweep requirements:

- PVC shall be electrical grade Schedule 40 or better
- Fiberglass conduit shall meet or exceed the Power Company's material specification ZG 033, *Fiberglass Conduit*
- Each fiberglass sweep requires two factory-attached PVC, extra-deep, fabricated, expanded bell-ends as shown in "Figure 20" on the facing page.
- Fiberglass sweeps must be certified by a Nationally Recognized Testing Laboratory (NRTL)

  HDPE conduit may be used upon approval of the Power Company. HDPE conduit can be installed by plowing and short-directional boring methods. Primary and secondary conductors can be pulled into this type of conduit. HDPE conduit shall meet the Power Company's specification ZG 031, *High-Density Polyethylene (HDPE) Conduit*, which can be found at https://www.rockymountainpower.net/working-with-us/builders-contractors/electric-service-requirements.html.

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3.3. Conduit and Sweeps – Installation

The customer is responsible for providing all conduit and sweeps. The customer shall meet the requirements described in this procedure to complete construction for underground installation. The customer is responsible for ensuring that all conduit system installations comply with Power Company requirements.

During development/construction, the customer is responsible for ensuring that all subsequent contractors in the vicinity of Power Company facilities exercise care to maintain the integrity of the conduit system (conduit and equipment bases). If the Power Company is required to return to the site to repair the conduit system, the customer will be held liable.

1. The customer shall provide and install conduit, including long-radius sweeps.
2. All PVC joints shall be glued and compressed to the depth of the coupling system.
3. All fiberglass joints shall be glueless, using an interference and gasketed joint (see "Figure 20" below), and shall be compressed to the depth of the coupling system. Where straight ends and bell ends are joined, the straight end shall be beveled so as not to become an obstacle to mandrels or pulled cable.
4. Manufactured sweeps shall not be altered. Field form sweeps are not permitted

Figure 20—Fiberglass End Connections

Figure 21—Field Altered Sweep – Damaged PVC

3.4. Conduit Proofing

3.4.1. Conduit Proofing Requirements

All installed underground conduit shall be proofed with a mandrel to remove obstructions, and to confirm at least 80 percent of the nominal conduit diameter. When requested by the Power Company, the customer shall perform a Power Company-witnessed proofing of

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conduit systems. See Table 5, *Required Mandrel Sizes for Conduit Proofing* and "Figure 22" below.

Table 5—Required Mandrel Sizes for Conduit Proofing

Conduit Nominal Diameter (in.)	Mandrel Diameter (in.)	Minimum Mandrel Length (in.)	Maximum Mandrel Length (in.)	Proof (%)
2″	1.62″	2.4″	6″	81%
3″	2.5″	3.25″	8″	83%
4″	3.5″	4.25″	8″	87%
6″	5.5″	6.25″	10″	92%

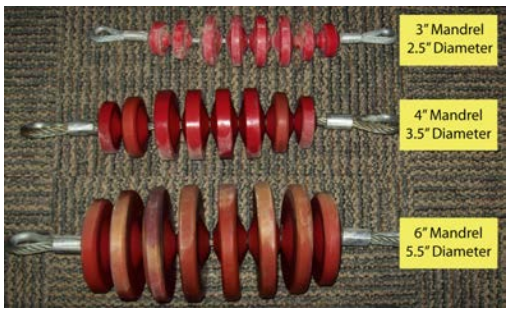

Figure 22—Typical Mandrels

3.5. Change in Conduit Size

No change in conduit size within a conduit run is allowed.

3.6. Conduit to Existing Equipment

When the customer is installing conduit to existing (energized) equipment, the customer shall stop installation of the conduit two feet from the Power Company facility, unless otherwise requested by the Power Company. The customer shall provide a sweep and extra conduit for use by Power Company employees.

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Figure 23—Installing Conduit to Existing (Energized) Equipment

3.7. Conduit to New Equipment Bases

Customer installation of conduit to new box pads, padvaults, flat pads, secondary boxes, or secondary pedestals shall be done according to Sections 6 – 9 of this document.

3.8. Conduit through Pavement

When conduit extends vertically through a paved or concrete surface, a sleeve or permanent opening shall be placed around the conduit to prevent direct contact with the pavement to help prevent damage to conductors caused by soil settling.

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Figure 24—Installing Conduit through Concrete

3.9. Easements

The customer must ensure all conduits, bases, vaults, and equipment are placed within the Public Utility Easement (PUE) or within the limits of the granted right-of-way for Rocky Mountain Power.

3.10. Gluing and Sealing PVC Conduit

"Figure 25" below and "Figure 26" on the facing page illustrate the process of gluing and sealing PVC conduit. As described in these two figures: To glue PVC conduit together, apply glue to both the outside (male) and inside (female) ends of the conduit. If you are installing pull rope a conduit section at a time, use caution to ensure that the rope doesn't dry in any residual glue. Push conduits together until they are seated.

3.10.1. Gluing and Sealing PVC Conduit

Figure 25—Applying Glue to Conduit

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Figure 26—Seating the Conduit

3.11. Pull Line, Proofing, and Sealing the Conduit

For conduit sealing and pull line requirements, see sections 3.1.3., *Dirt and Debris* and 3.1.4., *Pull Rope*. For conduit proofing requirements, see Section 3.4. , *Conduit Proofing*.

Figure 27—Conduit Plug and Pull Line

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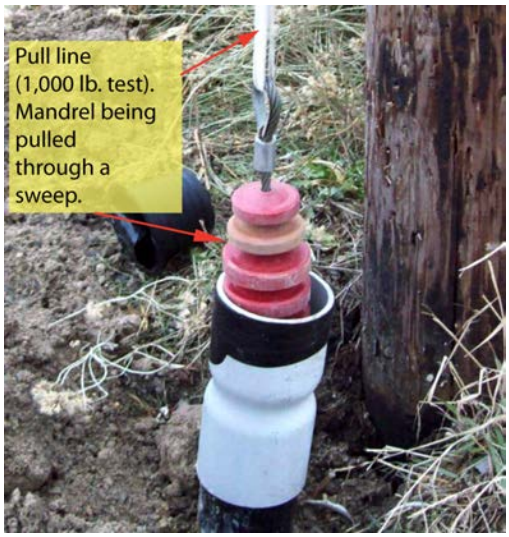

Figure 28—Conduit Proofing

Figure 29—Plugging the Conduit

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3.11.1. Transition from Overhead to Underground

When transitioning from overhead conductors to underground conductors, the Power Company will identify the appropriate location where the conduit riser shall be, relative to the pole. The nearest edge of the conduit sweep should be 7.5″ from the pole. If a riser already exists on the pole, the new riser shall be attached such that the new riser is parallel to the existing riser.

Figure 30—Riser 7.5″ from Pole

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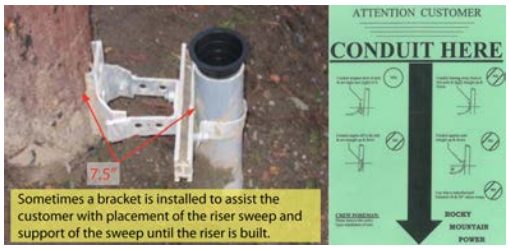

Figure 31—Riser 7.5″ from Pole, Bracket and Power Company Template

Figure 32—Riser/Sweep Too Close to Pole

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4. Clearances, Firewalls, and Enclosed Spaces

4.1. Working Clearances

The Power Company needs working clearances to maintain equipment once it is installed. The customer shall comply with the distances shown in "Figure 33" below. and Table 6.

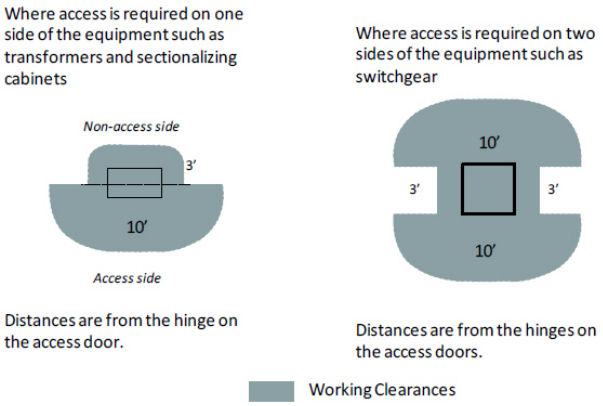

Figure 33—Working Clearances to Pad-Mounted Equipment

Notes on Figure 33:

1. Depending on the base the customer may not know exactly where the equipment will sit on the equipment base. As a rule of thumb assume the clearances will be from the edge of the equipment base. If these rule of thumb clearances cannot be achieved, contact the Power Company. Distances are from the edge of the equipment pad.
2. No vegetation over six inches (6″) in height shall be present in the clear workspace.
3. Trip hazards such as gutters, spigots, etc., shall not exist within the clear workspace.
4. Curbs may be acceptable in the clear workspace; contact the Power Company during site scoping.

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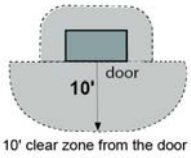
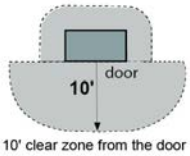
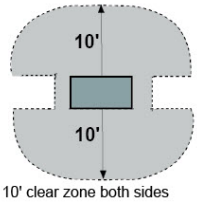
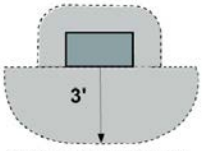
Table 6—Working Clearances

Symbol	Size	Equipment	Working Clearance
Δ	single-phase	transformer	
E	single-phase/ three-phase	sectionalizing cabinet	
S	three-phase	switchgear	
■	single-phase	pedestal	

4.2. National Code Clearances

National codes require minimum clearances to equipment. The clearances shown in "Figure 34" below and Table 7 are required for all pad-mounted equipment.

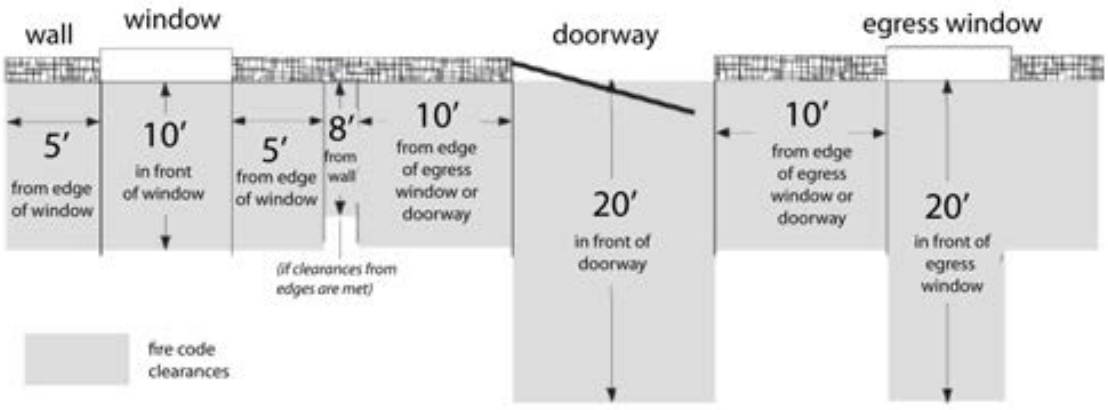


Figure 34—Clearances Between Equipment and Structures

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Table 7—Clearances between Equipment and Structures

Clearance from	Clearance in Front of (ft.)	Clearance to Side of (ft.)	Vertical Clearance from (ft.)
Fire escape	20	10	n/a
Doorway	20	10	n/a
Window that can be opened	20	10	n/a
Window that cannot be opened	10	5	10
Air vent intake	20	10	25
Air vent exhaust	10	10	25
Combustible surface	8	n/a	n/a
Non-combustible surface	3	n/a	n/a
Fire hydrant (non-metallic equipment)	4	4	n/a
Fire hydrant (metallic equipment)	6	6	n/a

Notes on "Figure 34" on the previous page and Table 7:

1. Distances are from the equipment.
2. If the building has a combustible overhang, the distance is measured from the outside edge of the overhang.
3. Edge of equipment is measured from the overhang.
4. Outside walkways or stairs attached to the building are considered part of the building. Minimum clearances must also be maintained from walkways used for exiting to a place of safety.
5. Distances less than those specified in Table 7 (but not less than the required working space) may be allowed if approved by the appropriate code enforcement authority. This may require alternate means of fire protection per NEC Section 450.27 and NESC Section 152(A) (2), including fire barriers, fire-rated walls, sprinkler systems, oil-containment means, or other measures. Use of alternate means of fire protection must be approved by the local code enforcement authority.
6. The final grade at the location of the transformer should provide oil drainage away from the building. Otherwise, an adequate oil containment means is required
7. The customer shall conform to all local building codes, insurance regulations, and/or ordinances affecting the equipment location.
8. Combustible/non-combustible construction types are defined by respective state building codes.

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4.3. Conduit Clearances to Foundations

There shall be a minimum 60″ horizontal distance between the building foundation and conduit. When the conduit is installed before the foundation it is recommended that the clearance be 120″ from the planned foundation, see "Figure 8" on page 9

4.4. Firewalls (Blast Walls)

For oil-filled equipment at locations where the required clearance cannot be met, a firewall may be constructed. The firewall shall be constructed such that the heat and flame from a dynamic event are deflected away from a combustible surface or a storage tank.

The firewall shall be approved by the authority having jurisdiction. Consult the Power Company for information on firewalls. Also see ESR White Paper 4—*Firewalls* at https://www.rockymountainpower.net/working-with-us/builders-contractors/electric-service-requirements.html.

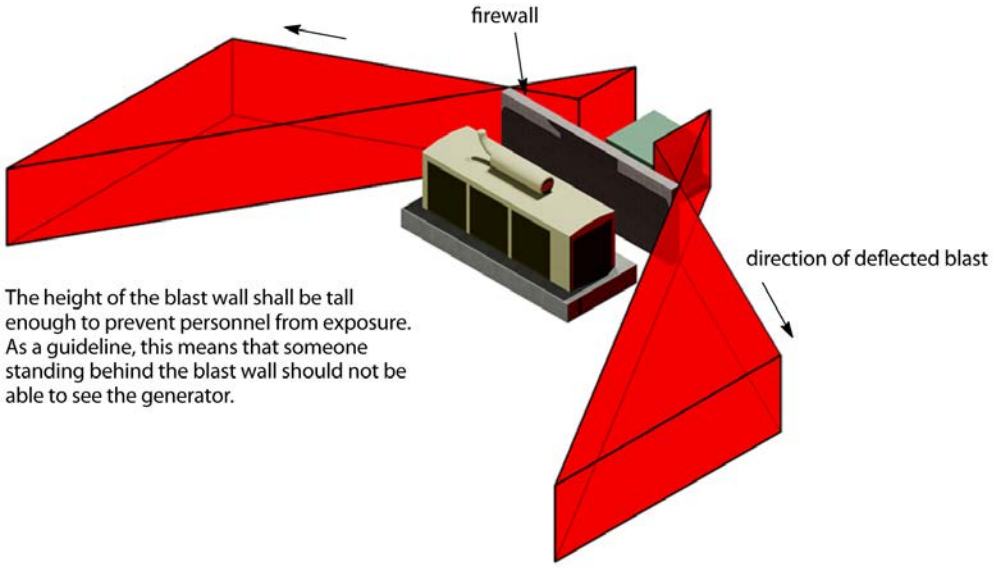

Figure 35—Typical Firewall

4.5. Power Company Equipment in Enclosed Spaces

The Power Company requires 24-hour access to equipment in gated and enclosed spaces. If a single- or three-phase transformer, pad-mounted piece of equipment, or pedestal is to be placed in a gated or enclosed space, the Power Company shall be granted proper access prior to installation. For more information, see ESR White Paper 4, *Gated and Enclosed Spaces* at https://www.rockymountainpower.net/working-with-us/builders-contractors/electric-service-requirements.html.

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4.6. Road Clearances

Per AASHTO, a minimum clear zone of 10 feet from all obstructions is required on roads and streets without curbs. Where these distances cannot be obtained, protective barrier posts and/or barricades, as designated by the Power Company, shall be installed by the customer. Working clearances as described earlier in Section 4 must be maintained.

Clearances from the protective device to the equipment must be maintained per Section 5.6.

5. Sites and Locations

5.1. Site Selection

The site shall be inspected prior to selecting the equipment base or determining the installation details. The job sketch and associated documents should clearly identify each equipment base and location. The Power Company is responsible for designing the job and determining the location of the equipment; however, input from the customer is valuable. Customer input will be reviewed and, if possible, incorporated into the design prior to the final design. The following items should be included in the inspection and accounted for in the job design:

- **Soil class.** Soil stability shall be determined and recommendations made on shoring or sloping requirements.
- **Water table.** Precautions should be taken to prevent any flooding affecting customer-owned equipment in adjacent structures or properties.
- **Runoff.** Recognize potential surface and subgrade water flows. Consult the Power Company to minimize potential runoff problems.
- **Frost considerations.** Consideration shall be given to local ground and frost conditions such that the installation remains structurally sound.
- **Final grade.** If the final grade has not yet been established, measures shall be made to allow for anticipated grade changes. Where radical changes in grade are anticipated, installation should be delayed until near-final grade has been achieved.
- **Site accessibility.** The site location for any equipment should be within 15 feet (15′) of gravel or paved surfaces. Future access requirements for operation and maintenance of equipment shall be considered when determining equipment location.

5.2. Site Preparation

Excavations should be no deeper than necessary to install conduit and set the equipment base.

Disturbed soil beneath any type of equipment base shall be compacted in six-inch (6″) lifts, and leveled to within a 2% slope prior to setting or pouring at the site.

The customer shall supply:

- a six inch deep base of ¾-inch-minus gravel compacted to 90% of dry density under pad-vaults,
- when required by the Power Company a six-inch base of ¾-inch-minus gravel compacted to 90% of dry density under box pads and secondary boxes

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- an 18-inch deep base of compacted ¾-inch-minus gravel compacted to 90% of dry density under flat pads.

In marshy areas, where an adequate foundation cannot be created through normal methods, pilings may be required.

5.3. Height Above Final Grade

Box pads should be set such that the top surface is approximately three to six inches (3″–6″) above the final grade.

Concrete vaults and flat pads should be set flush with the final grade in pedestrian and traffic areas. Concrete vaults and flat pads should be set three to six inches (3″–6″) above final grade in all other areas.

A retaining wall, approved by the Authority Having Jurisdiction AHJ, shall be installed on the uphill side of any installation when the grade deviates by more than 6″ in an elevation within two feet (2′) of the equipment foundation. The final construction shall accommodate working clearances identified in Section 4.

A retaining wall may also be necessary on the downhill side of the installation to ensure a level working surface is maintained.

Additional easement considerations may be required.

5.4. In Residential Subdivisions

Box pads and secondary boxes in subdivisions should typically be set 24″ behind the sidewalk and near the property line.

Figure 36–Positioning of a Box Pad

5.5. Leveling

All equipment bases should be level, with no more than a 2% grade from edge to edge.

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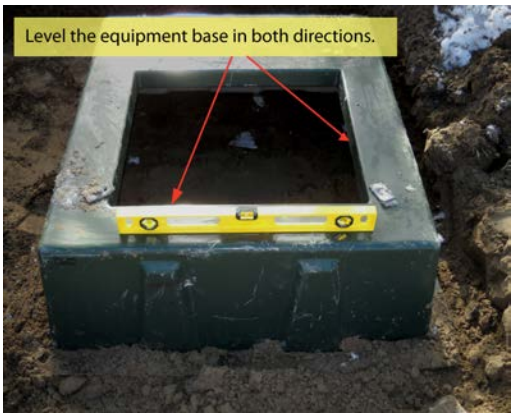

Figure 37–Leveling the Equipment Base

5.6. Equipment Base Location – Barrier Post Protection

Barrier post protection is required by the Power Company in the following situations:

- where equipment is within seven feet (7′) of parking lots or developed travel paths around facilities (paved or unpaved)
- where equipment is within seven to ten feet (7′–10′) of the roadway pavement without curbs
- where equipment within 1.5 feet of roadways with curbs

Six-inch (6″) steel barrier posts shall be painted or galvanized, and should be filled with concrete. Six-inch (6″) concrete barrier posts shall be painted or encased in plastics. The posts shall have a domed top, and shall be free of burrs and sharp edges.

5.6.1. Barrier Post Requirements

Each barrier post shall meet the following requirements:

- Each barrier post shall be set in a concrete foundation at least 12 inches in diameter and 24 inches in depth, below grade, as shown in "Figure 38" on the next page.
- In areas where construction equipment traffic poses a temporary threat to equipment, barrier posts shall be provided by the customer, and shall remain in place until the threat has been eliminated.
- Enough barrier posts shall be installed to adequately protect the pad-mounted equipment from vehicular traffic. If the distance between two posts, or between a post and a non-traffic area, is greater than six feet (6′), an intermediate post shall be installed as shown in "Figure 39" on the next page.
- Barrier posts shall be placed so as not to obstruct the opening of the equipment doors, nor to impede the operation of the equipment. If this is not possible, removable posts shall be used in the obstructive location(s).

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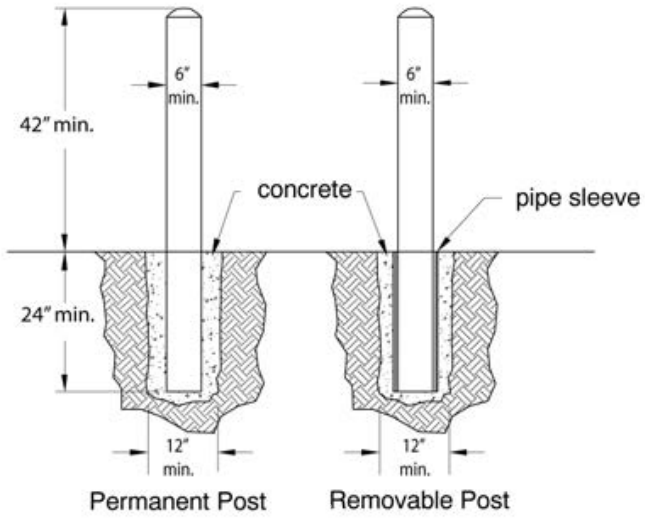

Figure 38–Barrier Post Details

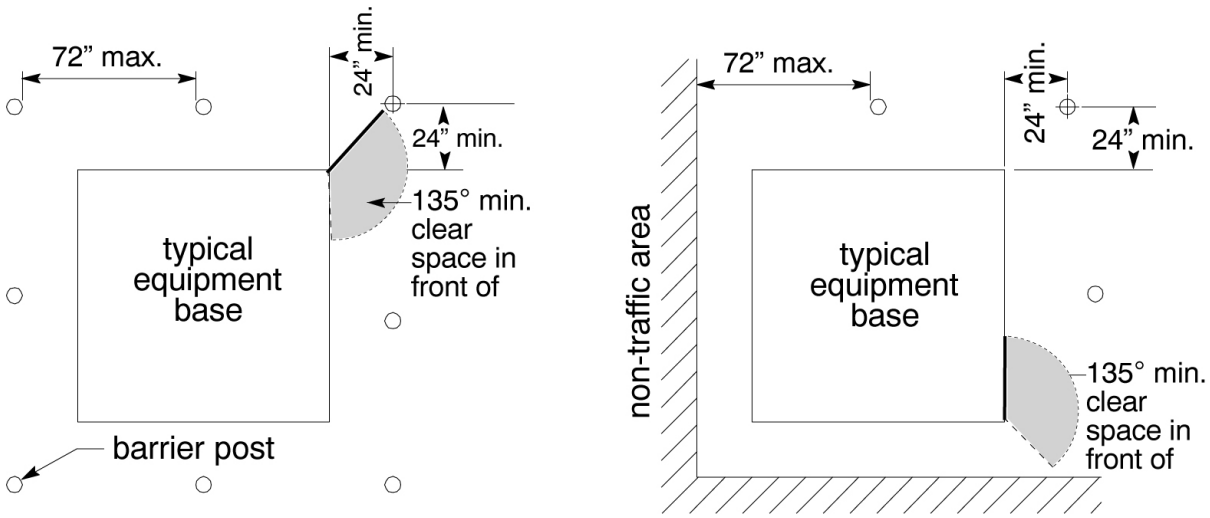

Figure 39–Barrier Post Layout and Clearances

Figure 40–Barrier Posts, Example

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5.7. Joint Use Bonding Wire

Typically, communication enclosures are non-metallic. However, above-ground electric supply and communication enclosures with exterior metallic surfaces shall be bonded if separated by a distance of 72″ or less.

To meet NESC joint use bonding requirements a ten-foot (10′) length of #6 copper wire is required in box pads and flat pads. The bonding wire is used to bond joint use facilities to the Power Company ground.

The customer is responsible to install the bonding wire when installing box pads or flat pads when metallic communication enclosures are used.

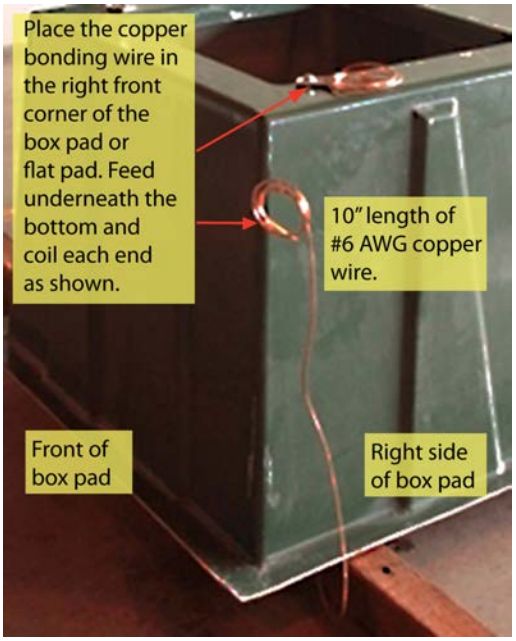

Figure 41–Joint Use Bonding Wire in a Box Pad

6. Equipment Bases—Box Pads

Box pads, shown in "Figure 42" on the next page, support single- and three-phase sectionalizing cabinets, and single-phase transformers. Box pads are used in open conduit designs. The Power Company often provides box pads, but the customer is responsible for the cost.

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Figure 42—24″ Fiberglass Box Pad

A box pad is a fiberglass base for pad-mounted equipment, with sufficient space inside for training cables. The customer may elect to use padvaults in lieu of box pads.

All new construction requires a 24″ box pad. The box pad should be level and installed as shown in "Figure 43" below.

6.1. Single-Phase Sectionalizing Cabinet Box Pads

6.1.1. Equipment Base

The drawings and pictures in this section represent typical installations. "Figure 43" below shows a properly installed single-phase sectionalizing cabinet.

Figure 43—Single-Phase Sectionalizing Cabinet

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6.1.2. Dimensions

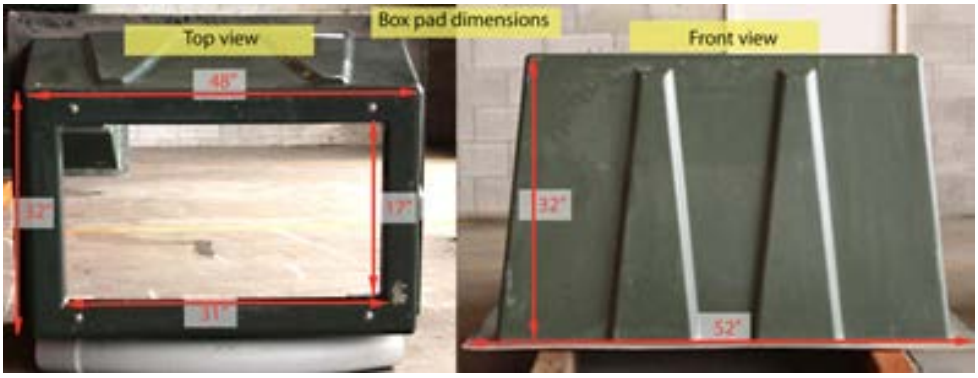

Figure 44—Single-Phase Sectionalizing Cabinet Box Pad Dimensions
(actual dimensions may vary)

6.1.3. Excavation

Excavate the box pad hole to at least 29″ below final grade plus the size of the largest conduit (3″–6″).

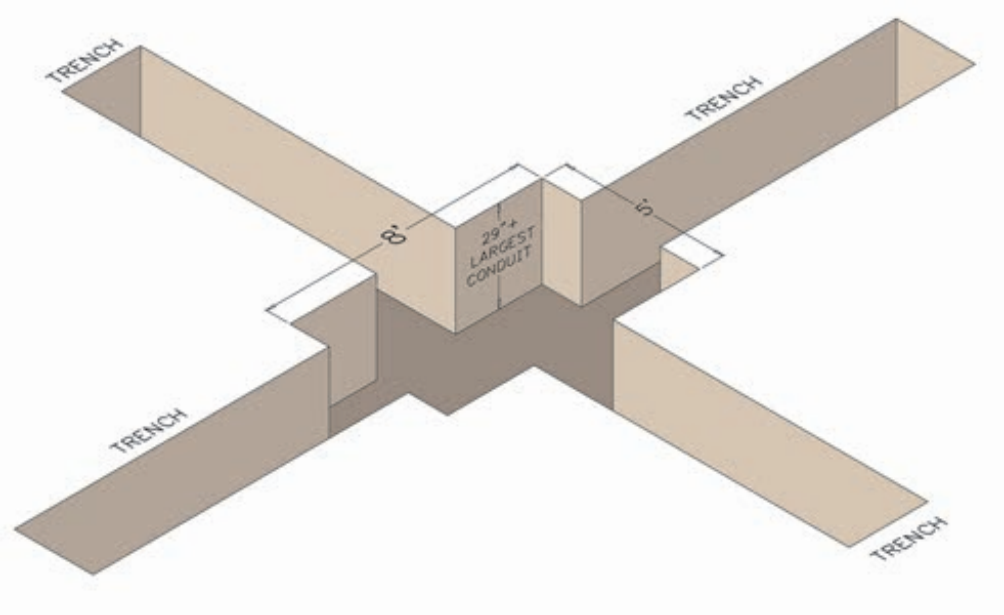

Figure 45—Excavation Dimensions – Single-Phase Sectionalizing Cabinet

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6.1.4. Installation

The box pad and conduits are installed as shown in "Figure 46" below and "Figure 47" below. Note that the number of conduits may vary depending on the infrastructure design.

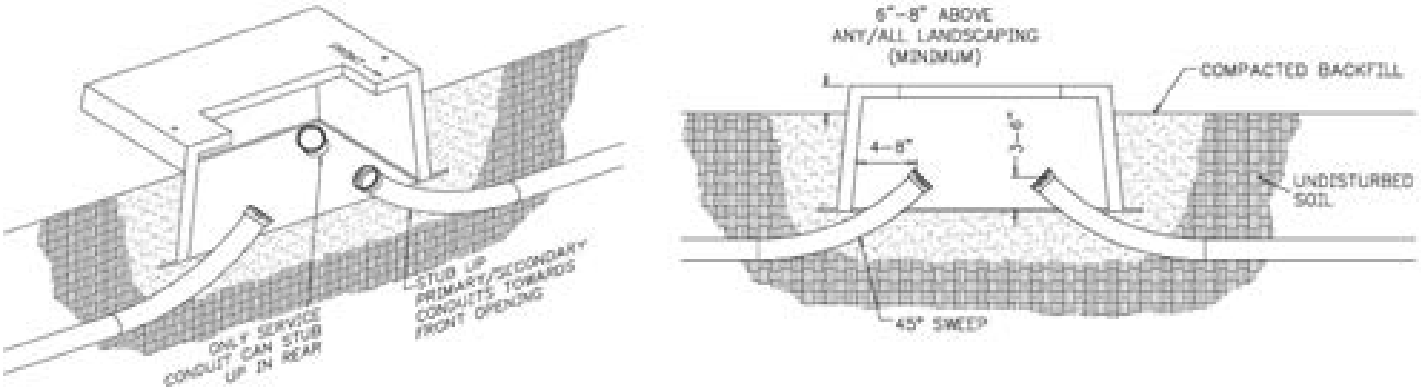

Figure 46—Top View/Side View – Single-Phase Sectionalizing Cabinet Box Pad

Notes:

1. For each conduit run one 45° elbow shall be permanently attached.
2. The box pad base shall be leveled and installed a minimum of 6″ – 8″ above anyand all landscaping
3. The equipment base must be supported by compacted ¾-minus backfill.

6.1.5. Conduit Placement

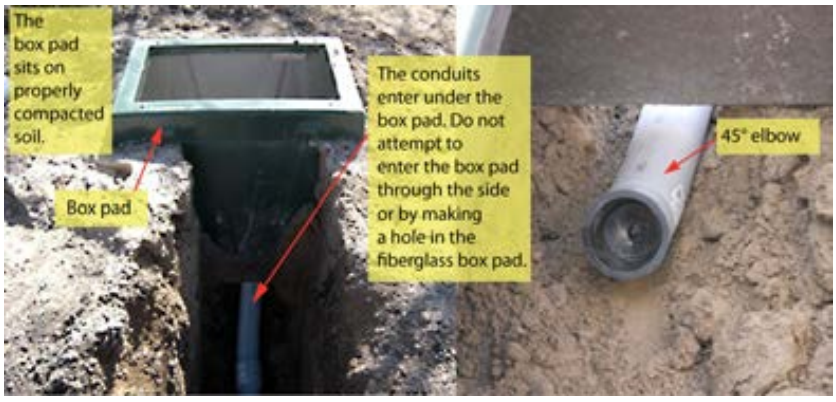

Figure 47—Conduit Placement

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1. The box pad sits on properly compacted soil.
2. The conduits enter under the box pad.
3. Do not attempt to enter the box pad through the side by making a hole in the fiberglass box pad.

The box pad hole is excavated and conduit is installed as shown in "Figure 46" on the previous page.Note that the number of conduits may vary depending on the infrastructure design.

6.2. Three-Phase Sectionalizing Cabinet Box Pads

Equipment Base

The drawings and pictures in this section represent typical installations. "Figure 48" below shows a properly installed three-phase sectionalizing cabinet.

Figure 48—Three-Phase Sectionalizing Cabinet

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6.2.1. Dimensions

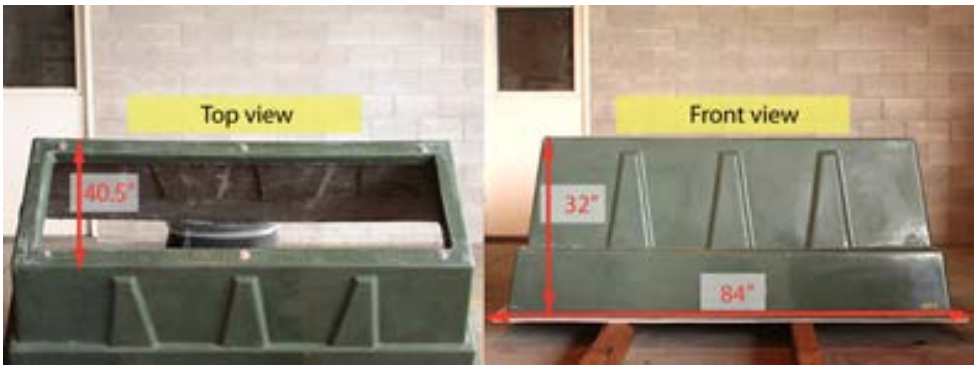

Figure 49—Three-Phase Sectionalizing Cabinet Box Pad Dimensions
(actual dimensions may vary)

6.2.2. Excavation

Excavate a 7′ × 10′ hole to the appropriate depth. An appropriate depth for the box pad hole is at least 29″ below final grade plus the size of the largest conduit (3″–6″).

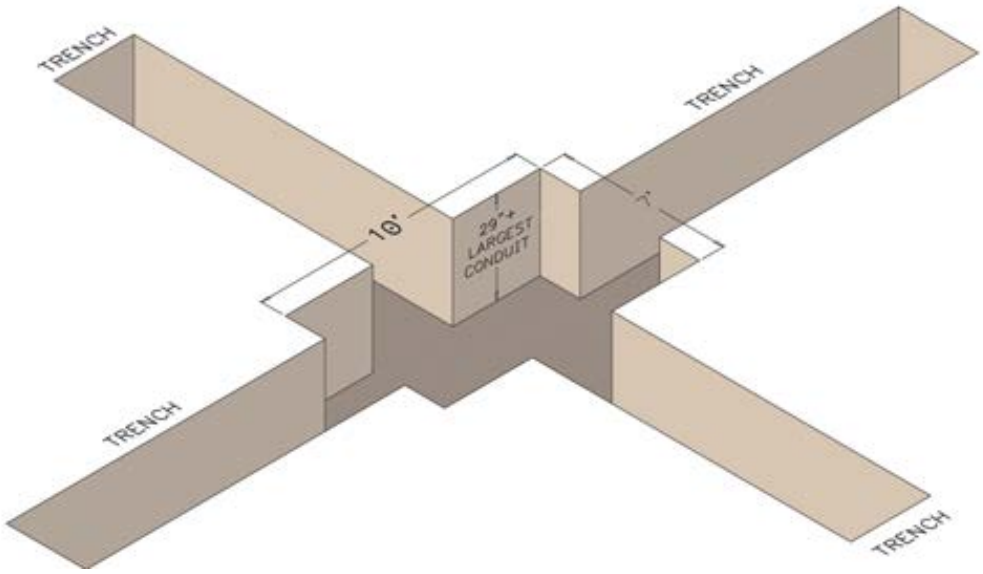

Figure 50—Excavation Dimensions – Three-Phase Sectionalizing Cabinet

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6.2.3. Installation

The customer will install the box pad and conduits as shown in "Figure 51" below and "Figure 52" below. Note that the number of conduits may vary depending on the infrastructure design.

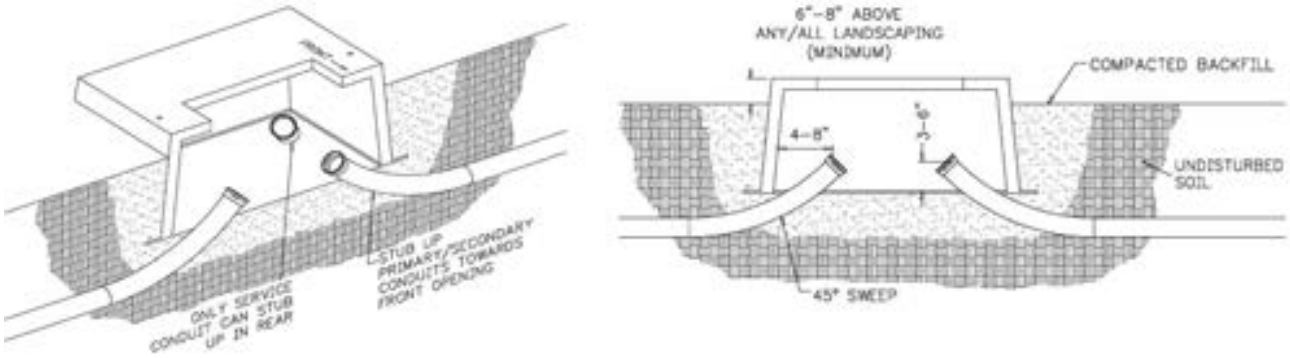

Figure 51—Top View/Side View– Three-Phase Sectionalizing Cabinet Box Pad

Notes:

1. For each conduit run one 45° elbow shall be permanently attached
2. The box pad base shall be leveled and installed a minimum of 6″ – 8″ above any and all landscaping
3. The equipment base must be supported by compacted ¾-minus backfill

6.2.4. Conduit Placement

The box pad sits on properly compacted soil. The conduits enter under the box pad. Do not attempt to enter the box pad through the side by making a hole in the fiberglass.

Figure 52—Conduit Placement – Three-Phase Sectionalizing Cabinet

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Figure 53—Hole through the Side of a Fiberglass Box Pad

Conduit installation is shown in "Procedure 242—Underground Conduit Systems for Primary and Secondary Conductors " on page 1. Note that the number of conduits may vary depending on the infrastructure design.

1. Provide one 45° elbow.
2. Excavation depth should be 29″ plus the size of the largest conduit (3″–6″).
3. The Power Company will cut conduit as needed to install the elbows.

6.3. Single-Phase Transformer Box Pads

6.3.1. Single-Phase Transformer Equipment Base

The drawings and pictures in this section represent typical installations. "Figure 54" below shows a properly installed single-phase transformer.

Figure 54—Single-Phase Transformer

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6.3.2. Dimensions – Single-Phase Transformer

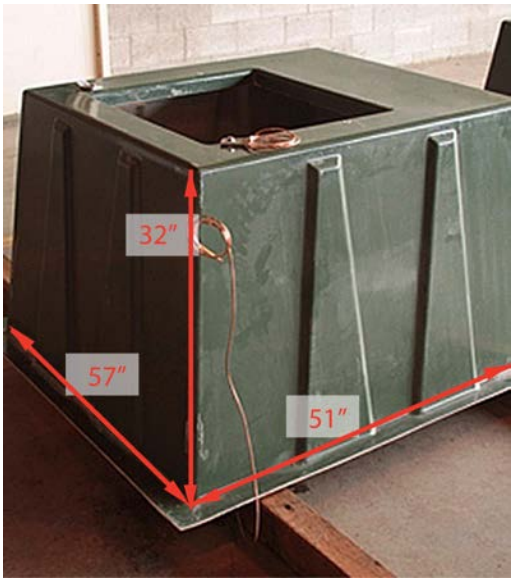

Figure 55—Single-Phase Transformer Box Pad Dimensions
(actual dimensions may vary)

6.3.3. Excavation – Single-Phase Transformer

Excavate a 7′ × 7′ hole to the appropriate depth. An appropriate depth for the box pad hole is at least 29″ below final grade plus the size of the largest conduit (3″–6″).

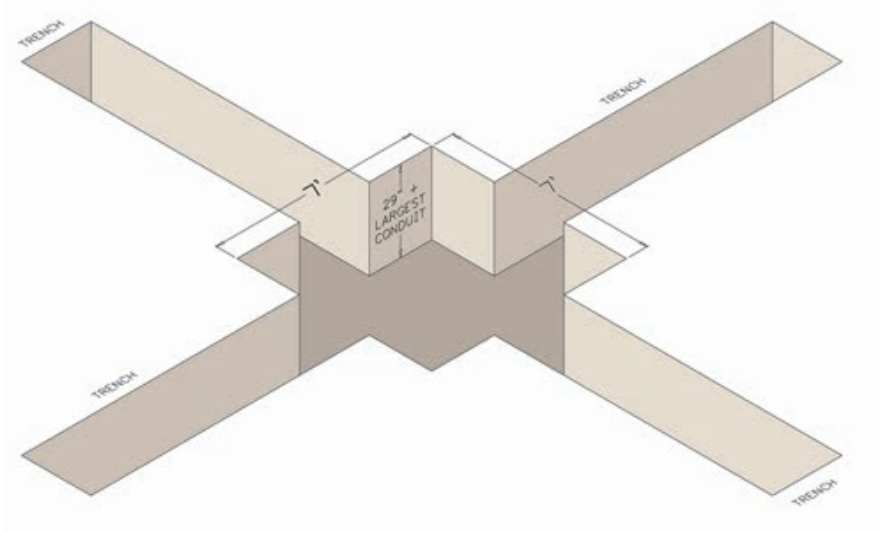

Figure 56—Excavation Dimensions – Single-Phase Transformer

6.3.4. Box Pad Installation–Single-Phase Transformer

The customer will install the box pad and conduits as shown in "Figure 57" on the next page and "Figure 58" on the next page. Note that the number of conduits may vary depending on the infrastructure design.

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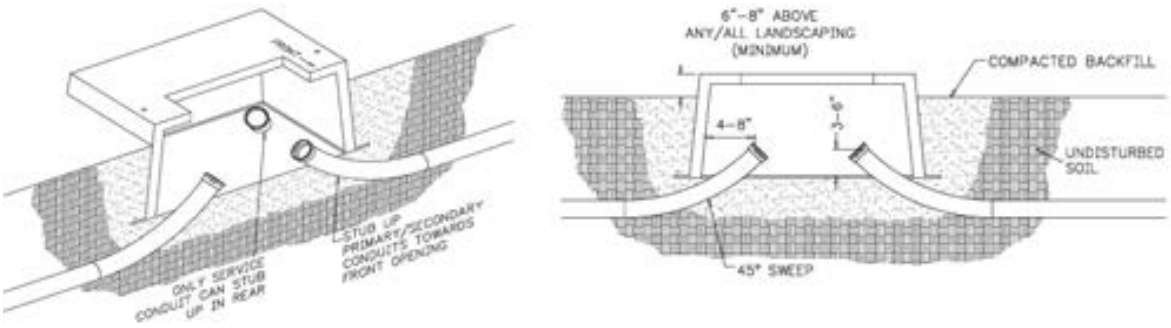

Figure 57—Top View/Side View–Single-Phase Transformer Box Pad

Notes:

1. For each conduit run one 45° elbow shall be permanently attached.
2. The box pad base shall be leveled and installed a minimum of 6″ – 8″ above anyand all landscaping
3. The equipment base must be supported by compacted ¾-minus backfill.

6.3.5. Conduit Placement

The box pad sits on properly compacted soil. The conduits enter under the box pad. Do not attempt to enter the box pad through the side by making a hole in the fiberglass.

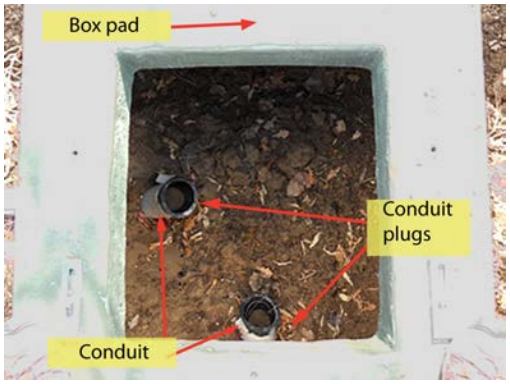

Figure 58—Conduit Placement – Single-Phase Transformer

Conduit is installed as shown in "Figure 59" on the facing page. Note that the number of conduits may vary depending on the infrastructure design.

Notes:

1. For each conduit run: leave 10′ of trench open.
2. Provide one 45° elbow.
3. Excavation depth should be 29″ plus the size of the largest conduit (3″–6″).
4. The Power Company will cut conduit as needed to install the elbows.

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7. Equipment Bases—Flat Pads

Flat pads, shown in "Figure 59" below, are used to support three-phase transformers that have three or fewer secondary or service conduits. The customer may elect to use padvaults in lieu of flat pads. Flat pads may be poured in place or purchased pre-cast by the customer. In both cases, the customer shall follow good construction practices with 18 inches (18″) of soil removed, the remaining soil compacted, and the hole filled and compacted with ¾-inch-minus gravel prior to either pouring the pad or setting the pad. Pads shall be set so they are level with about three inches (3″) of the pad left above final grade. See Figure 61for flat pad specifications.

Figure 59—Three-Phase Transformer on a Flat Pad

7.1. Three-Phase Transformer Flat Pads

7.1.1. Concrete Flat Pads

The drawings and pictures in this section represent typical installations. The left-hand picture in "Figure 60" below shows a properly installed three-phase transformer cabinet. Flat pads are limited to three-phase transformers with no more than three runs of conduit on the secondary side.

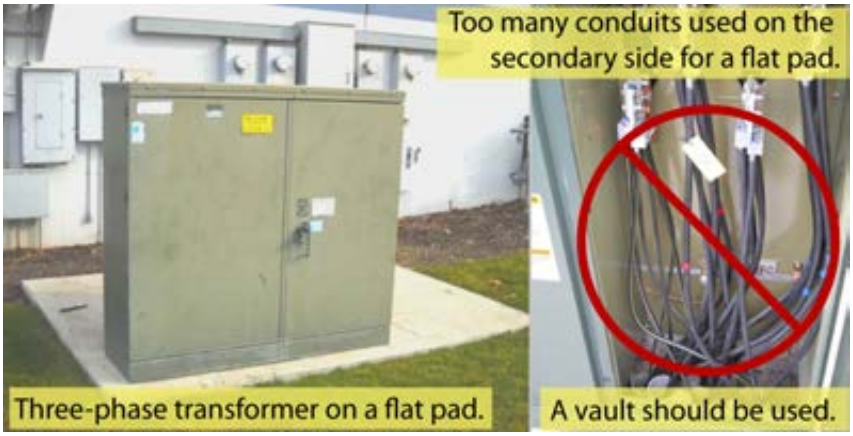

Figure 60—Three-Phase Transformer Flat Pad

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7.1.2. Dimensions and Installation, Three-Phase Transformers

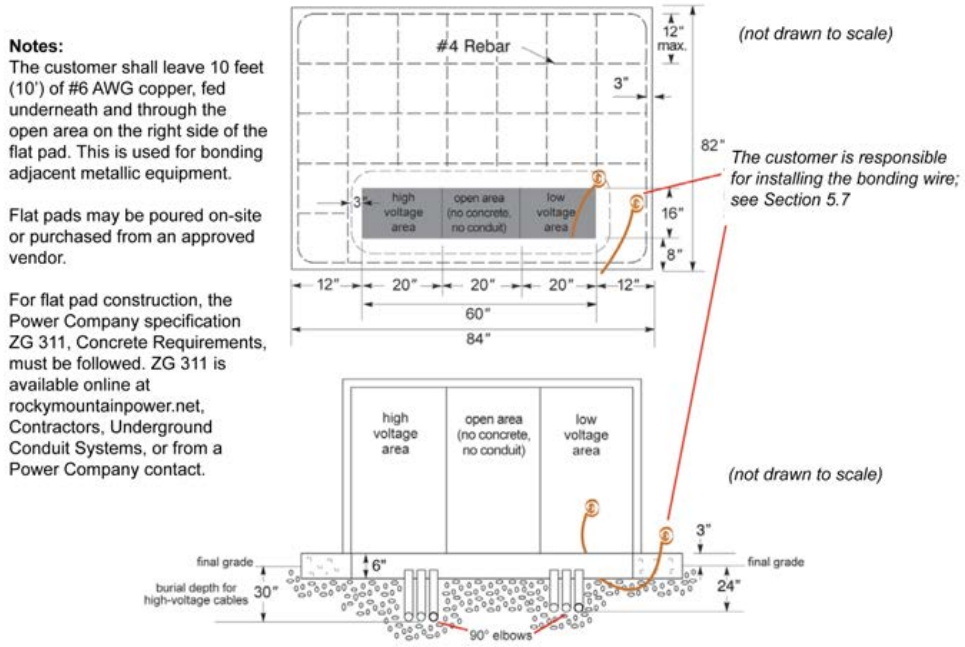

Figure 61—Dimensions and Installation of a Three-Phase Transformer Flat Pad

Notes:

1. For flat pad construction, the Power Company's specification, ZG 311, *Concrete Requirements*, must be followed. ZG 311 is available online (at rockymountainpower.net, Contractors, Underground Conduit Systems) or from a Power Company contact.
2. The customer shall leave 10 feet (10′) of #6 AWG copper, fed underneath and through the open area on the right side of the flat pad. This is used for bonding adjacent metallic equipment.
3. Flat pads may be poured on-site or purchased from an approved vendor.
4. The customer is responsible for installing the bonding wire. See Section 5.7.

7.1.3. Excavation, Flat Pad – Three-Phase Transformers

Notes:

1. Level a 9′ × 9′ square and bring conduits up using 90° elbows.
2. Cap the elbows.
3. Follow good construction practices with 18 inches of soil removed, the remaining soil compacted, and the hole filled and compacted with ¾-inch minus gravel.
4. The flat pad is set at three inches above the final grade.

8. Equipment Bases—Padvaults (Vaults)

Padvaults, shown in "Figure 62" on the facing page, are used to support:

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- Switchgear in 600 A applications
- Three-phase transformers with four or more conduits on the secondary side of the transformer
- Single- and three-phase equipment in other select non-typical 200 A applications

A padvault is a two-part concrete box consisting of a pad and an open vault. Padvaults are used with closed conduit designs.

When the vault is delivered, ensure that the eufer ground connections are visible and that the lid is level. Otherwise, the Power Company may reject the vault.

Figure 62—Typical Padvault

8.1. Padvaults

The drawings and pictures in this section represent typical installations."Figure 63" below shows properly installed equipment on padvaults.

Figure 63—Switchgear and Three-Phase Transformer on a Padvault

8.2. Dimensions

The Power Company will provide the stock item number and dimensions with the job estimate.

8.3. Excavation

Padvaults are designed to be set such that the top of the pad is three inches (3″) above the final grade in non-pedestrian areas and flush with the final grade in pedestrian areas. Padvaults should be level and supported by six inches (6″) of ¾-inch-minus gravel backfill, compacted to 90% of dry density, placed over undisturbed earth.

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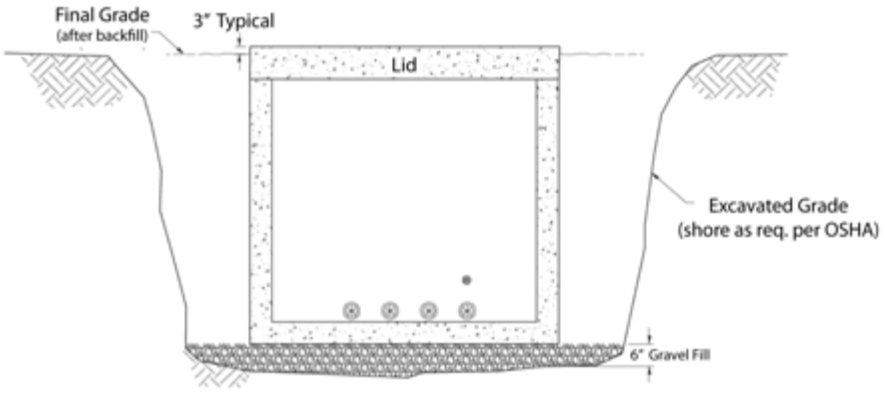

Figure 64—Excavation – Padvault

8.4. Installation and Conduit Placement

Padvault and conduit installation is shown in "Figure 65" below through "Figure 67" on the facing page. Note that the number of conduits may vary depending on the infrastructure design.

8.4.1. Padvault Lids

The top of the padvault lid must be three inches (3″) above final grade, unless installed in a traffic area, where it must be flush with grade.

When the lid extends past the back wall of the vault, backfill of ¾″-minus material must be compacted so as to support the overhanging lid.

All openings in the vault lid must be covered or barricaded to prevent accidents.

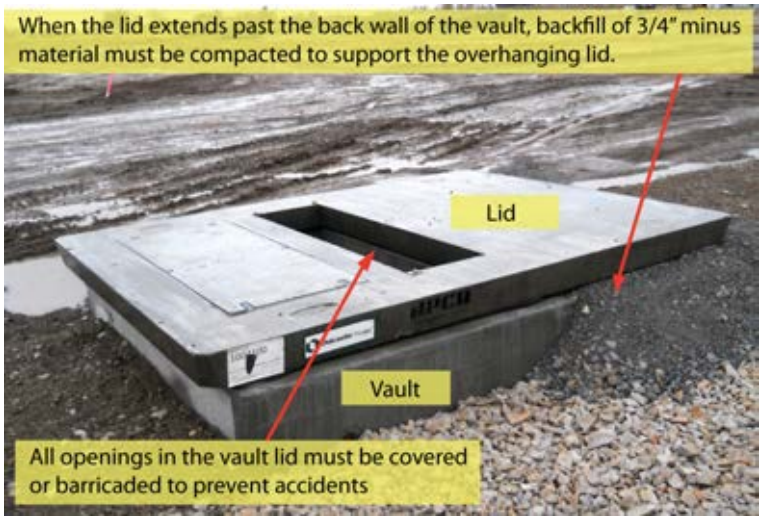

Figure 65—Padvault Lid

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8.4.2. Padvault Elevation

Figure 66—Padvault Not Set at the Proper Elevation

8.4.3. Padvault Conduits

The conduit must either end with a TERM-A-DUCT seal or be grouted.

Figure 67—Conduit Entering the Padvault

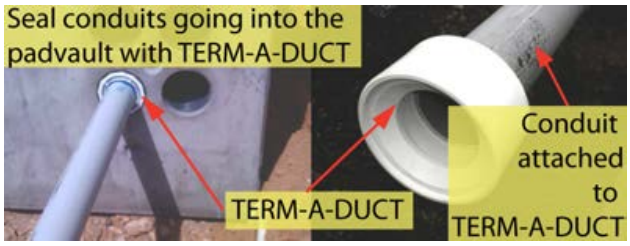

Figure 68—TERM-A-DUCT Used for Conduit Entering the Padvault

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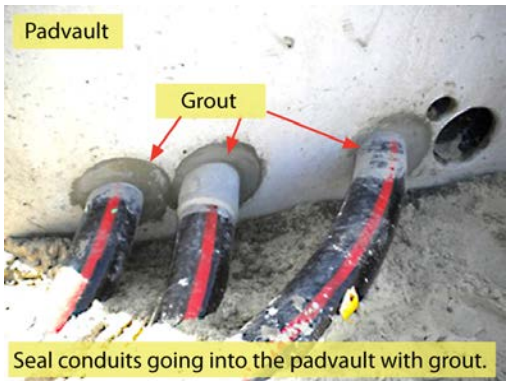

Figure 69—Grout Used for Conduit Entering the Padvault

8.5. Power Company / Padvault Clarification

The Power Company will not install padvaults.

9. Equipment—Secondary Boxes

Secondary boxes are comprised of a base and a pedestal, as shown below, and are used to provide service to multiple customers (typically homes). Secondary boxes should be installed on compacted soil, and the base should be 3″–6″ above final grade.

The Power Company does not allow customers to install secondary boxes.

Figure 70—Installed Secondary Box with Pedestal

9.1. Secondary Box

The drawings and pictures in this section represent typical installations.

The left-hand picture in "Figure 71" on the facing page shows a properly installed secondary box.

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Figure 71—Secondary Boxes

9.2. Dimensions

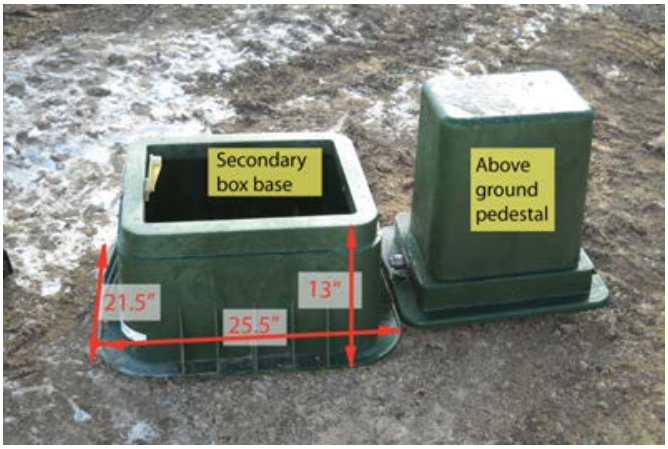

Figure 72—Secondary Box Base Dimensions

9.3. Excavation

Notes

Excavate the secondary box hole to at least 29″ below the final grade plus the size of the largest conduit (3″-4″) .

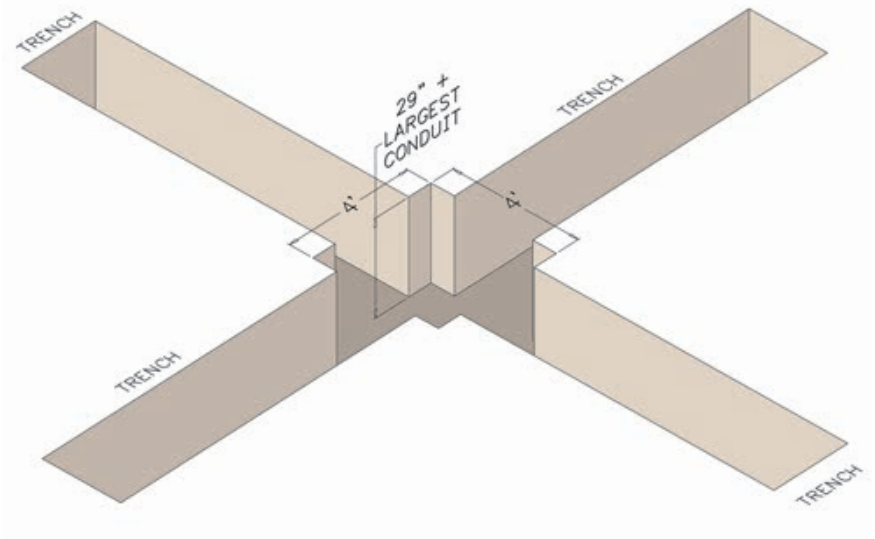

Figure 73—Excavation Dimensions – Secondary Box

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9.4. Conduit Placement

The conduit is installed as shown in "Figure 74" below. Note that the number of conduits may vary depending on the infrastructure design.

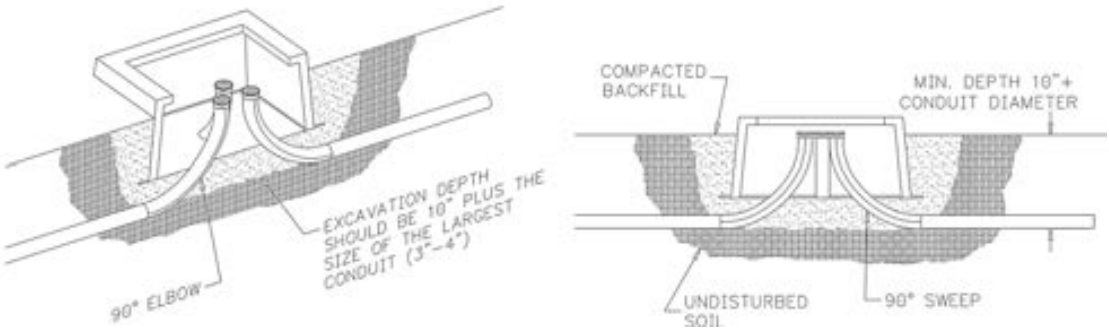

Figure 74—Top View/Side View – Secondary Box

Notes

1. For each conduit run: 2′ of trench left open
2. 90 degree elbow permanently attached to each conduit run.

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Rocky Mountain Power
UG CONDUIT SYSTEMS Rev. 28 September 2021

Engineering Standards Policy No. 242

This policy and related documents are posted on the web at:
https://www.rockymountainpower.net/working-with-us/builders-contractors/electric-service-requirements.html

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