

# ELECTRIC LINE EXTENSION HANDBOOK

## Information and Guidelines for Underground Construction



# **PRIMARY LINE EXTENSIONS**

## **CUSTOMER INSTALLED FACILITIES INFORMATION PACKET**

*Single Residences – Short Plats - Subdivisions*

If your new residence or new meter location is not located close to existing primary electrical facilities, a primary line extension is required to place a transformer close to your structure. Chelan County PUD standards for installation of underground primary power facilities, including trenching, conduit, termination cabinets and transformers are included in this packet. Please review this information and the attached drawings thoroughly.

A Chelan County PUD inspector and/or Engineer will oversee the trenching, equipment placement, installation and backfilling for your project. If you have questions regarding the standards in this packet, please contact Engineering *before* commencing work.

### **CUSTOMER RESPONSIBILITIES**

#### **DESIGN, ESTIMATING AND PAYMENT**

- Contact Chelan County PUD Customer Service Engineering for a primary line extension design and estimated costs. Engineering & primary line extension fees must be paid before Chelan PUD can issue materials for construction to customers.

#### **OBTAINING MATERIAL FOR INSTALLATION**

- All electrical conduit is supplied and installed by the customer. All conduit must meet the specifications described in this pamphlet
- Fiber optic conduit, vaults and handholes are supplied by Chelan PUD. Fiber conduit shall be installed in all electrical trenches as specified by Engineering.
- Fiberglass sleeves for transformers and termination cabinets are supplied by Chelan PUD.
- Material supplied by Chelan PUD may be picked up at Chelan PUD Hawley Street Warehouse. Customers must contact Customer Service Engineering at least 24 hours in advance of picking up material to coordinate material pickup.
- It is the responsibility of the customer or customers contractor to contact telephone and cable TV companies to coordinate installation of these utilities for a shared trench.

#### **COORDINATING INSPECTIONS**

- All work is subject to the inspection and approval of Chelan County PUD
- No work shall be backfilled until it has been inspected and approved by a Chelan County PUD inspector. Inspection requirements are included in this pamphlet.

### **CHELAN P.U.D. RESPONSIBILITIES**

- Provide inspections by a PUD representative in a timely fashion
- Coordinate material acquisition with customer and Chelan PUD warehouse
- Supply customer with work sketch with locations for conduits, termination cabinets, and transformers and stake the equipment locations as necessary.

# INSPECTION REQUIREMENTS

All customer/contractor installed facilities require a visual inspection performed by a PUD representative before backfilling. No facilities will transfer ownership from the contractor to the District without prior inspections and final approval. Customer shall call at least 24 hours in advance for all inspections. A District inspector will respond on site within (2) working days.

Inspection services can be arranged by calling **Chelan County PUD Trench Inspection Line at (509)661-8011**

The following items will be inspected and are discussed in further detail in this pamphlet:

1. All conduits shall be arranged in accordance with District Standards.
2. Conduit depth must be a minimum 36" from final grade for primary power conduits and 30" from final grade for secondary service conduits
3. Minimum of 1' separation shall be maintained between PUD electric conduits and phone/cable conduits. Other separation requirements are described on Page 6.
1. All conduit sweeps must be 36" minimum radius for entrance into sleeves. All horizontal bends must be 60" minimum radius.
2. Conduits must be labeled with phase designation at terminations in cabinets, transformers and where conduits turn, and at intervals as designated by the Engineer.
3. Transformer and termination cabinet grounding shall be installed by a licensed electrician
4. Transformer sleeves, electric and fiber hand holes and termination cabinets must be backfilled to the finish grade of the corresponding lots. In instances where the grade of the sidewalk is higher or lower than the grade of the lot, the electric and fiber optic facilities shall be set at a grade so that they will not be either buried or uncovered in the future. The surrounding grade of the lots after backfilling should leave approximately 2-4" of transformer pad or hand hole exposed above grade.
5. Transformer sleeves and hand holes must be level and ground compacted such that no settling will occur.
6. Transformer sleeves and electric hand holes shall be parallel with the curb/sidewalk. The fiber optic hand hole located beside the transformer or hand hole and shall be parallel with the transformer pad/electric hand hole.
7. No more than (4) 90deg sweeps may be used in any one run of primary (2") conduit.
8. No more than (3) 90deg sweeps may be used in any one run of secondary (3") conduit.
9. String must be blown through conduits to proof pipe and to allow PUD crews to pull rope through pipe. The PUD inspector may require the use of a mandrel to proof pipe.
10. Conduits must be cut off to 6-8" above grade inside of termination cabinets, transformer pads, and 3-4" above grade inside of handholes.
11. Fiber Optic conduit supplied by Chelan PUD shall be installed in the electrical trench per Engineered plans, corresponding fiber termination points will be installed near electric facilities.
12. Transformer pads, termination cabinet sleeves, electric and fiber optic handholes shall not be cut or otherwise modified by the installer.

**Customers & Developers will be held responsible for installations during and following the installation of electrical facilities by Chelan PUD crews. The costs for repairs or modification required of the facilities in the future will be borne by the customer**

# CONDUIT TRENCHING

*Adopted from CCPUD Standard Practice 761.000*

## CUSTOMER RESPONSIBILITIES

Provide the trenching for conduit runs and backfill in accordance with Chelan County PUD standards. Coordinate all existing utility locates prior to excavation activities.

## EXCAVATION

- **Trenches containing primary electrical conduit shall have a minimum depth of 36 inches from final grade to the top of the conduit.** Trenches containing only secondary service conduit shall have a minimum depth of 30 inches to the top of the conduit.
- **Trench shall be as straight as possible between equipment locations.** (1) 90deg conduit sweep is required at the beginning of the run (from pole or pad-mounted equipment) and (1) 90deg sweep is required into the new equipment. This leaves (2) possible 90deg sweeps between these two points. A gentle curve of the trench and bending the duct in the trench is the preferred method.
- **Trench width will be, as necessary to contain all conduits** (power, fiber, TV, telephone) at the required depth and maintain required conduit spacing.
- **The trench bottom will generally be smooth, flat and will be free from rocks and sharp objects.**
- **Any excavated materials not suitable as backfill, as determined by the PUD inspector, will be disposed of.**

## BACKFILL

- **Proper spacing and alignment of all facilities shall be maintained during the backfilling process.** Select bedding (sand) will be used as bedding and conduit cover. A minimum of three inches beneath and over the top of the conduits is required.
- **Excavated materials that are free from rocks and foreign objects that could damage the conduit may be used as backfill.** Do not use backfill with rocks, vegetation, trash, and scrap conduit or other non-native debris
- **PUD supplied warning tape shall be installed 12" below finished grade during the backfill process.**

## ROAD CROSSINGS

- **Only licensed and bonded contractors may perform work in City, County and State Rights of Way.**
- **It is the responsibility of the contractor to obtain Right of Way work permits from the appropriate agency.** All excavation and backfill for road crossings shall comply with the city, county or state requirements
- **The road surface shall be repaired so as to match the existing surface.** All restored surfaces must be approved and accepted by the owner/agency.

# CONDUIT INSTALLATION

*Adopted from CCPUD Standard Practice 760.000*

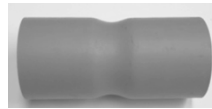
## CUSTOMER RESPONSIBILITIES

Provide electrical conduit, and installation of electrical and fiber optic conduit in accordance with Chelan County PUD standards.

## MATERIALS

All PVC conduits shall meet the following requirements:

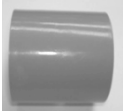
- PVC Electrical Grade Schedule 40 (EPC-40) meeting NEMA Standard TC-2
- All conduit pipe, sweeps and fittings shall be grey in color
- Do not mix fiber optic conduit with electrical or other conduit
- Fiber optic conduit shall be used only for CCPUD Fiber Optic installation
- Conduit shall be in diameters of 2", 3", or 4" or as specified by the PUD
- All conduit shall be in either 10' or 20' sections with one extended coupling
- Conduit bends shall be 2" 90deg, 45deg, or 22 1/2deg long radius factory bends of 36", or 60" for horizontal bends with one bell end. – Heated and bent conduit is not acceptable
- All couplings shall be the "extended" type
- Flexible conduit is not acceptable



*Extended Coupling*



*Bell End  
(Pulling Collar)*



*Short Coupling  
(not acceptable)*

## CONDUIT ASSEMBLY PROCEDURE

- Apply a liberal and uniform coat of PVC cement to the conduit and bell end. Assemble the pieces while the surfaces are wet and fluid. Slip the conduit straight into the coupling, while lightly twisting, until it bottoms. Hold the joint for 15 seconds so the conduit will not "push out"
- Let conduit joints cure completely before placing conduit in permanent position
- Plug all exposed conduit ends during work breaks and upon completion with tape or conduit plug to keep dirt, mud and water out of the conduits
- When joining schedule 40 & schedule 80 conduits, bevel the inside edge of the thicker conduit (schedule 80) to prevent scraping of the cable during installation

## CONDUIT PLACEMENT AND INSTALLATION

- All conduits (primary power, secondary service power & communications) shall be placed at the same depth in a common trench
- All power conduits shall be placed on the field side of the trench
- A minimum of 12" separation is required between any Chelan PUD conduit and other utility conduits occupying the same trench.
- A minimum of 2" separation is required between all adjacent conduits. A 2" separation is also required between any conduit and trench wall
- Keep the number of 90-degree bends in a primary conduit run to a minimum. **No more than (4) four bends will be allowed in any single run**

- All conduit bends will be made with manufactured 90 or 45 degree, 36" or 60" radius elbows
- For conduit stubs in transformer sleeves, termination cabinets and handholes, 90 or 45 degree, 36" or 60" radius elbows.
- A mandrel or missile of suitable diameter with respect to pipe size shall be pulled or blown through conduit to ensure pipe is clean of debris and has not been crushed.
- A nylon pull string or tape shall be installed in all conduits and destinations and phasing marked. Conduit shall be plugged with a standard conduit plug of the appropriate size.

**CONDUIT BANKS**

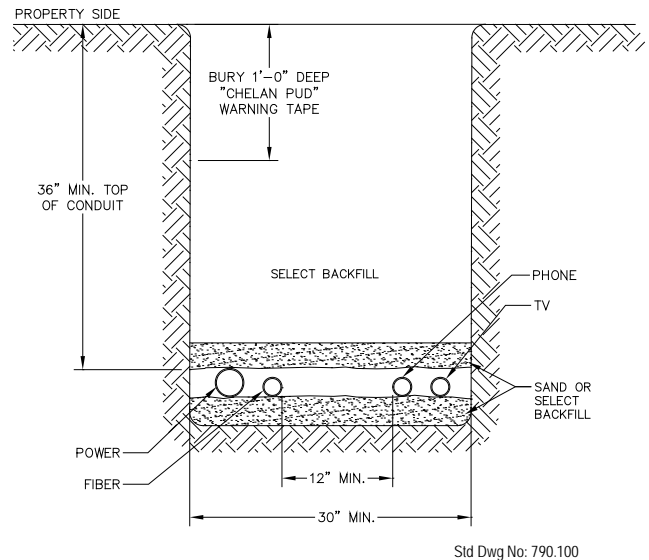
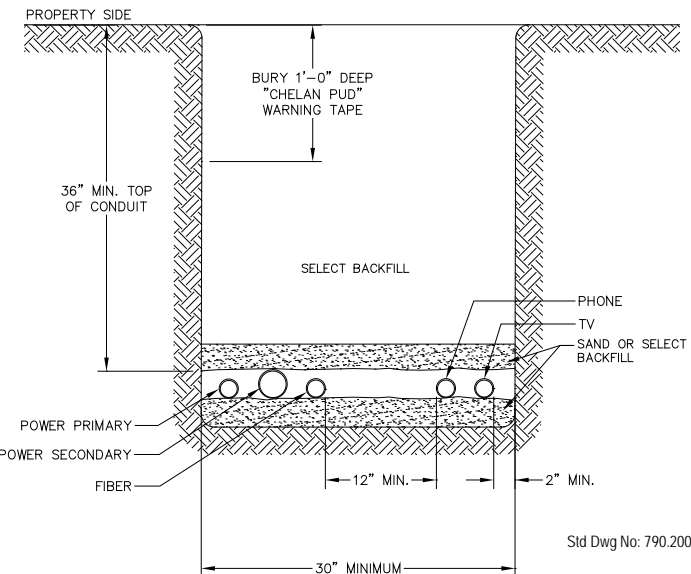
- When conduit banks are required, check with Chelan PUD engineering for conduit size and bank configuration
- Place conduit banks directly on sand-bedded trench bottom
- Use conduit base spacers for the bottom row of conduit. Place spacers at 5-foot intervals
- Use conduit "intermediate" spacers for additional layers of conduit. Place spacers at 5-foot intervals.
- Stagger bell ends between layers to facilitate bank assembly
- If a slurry mix is required for backfill, the bank must be tied down to prevent "floating" during the backfilling process. The Chelan PUD representative, prior to backfilling, must approve the method used to secure the bank

**JOINT TRENCH SECONDARY SERVICE & COMMUNICATION CONDUITS**

**Figure 1**

**JOINT TRENCH PRIMARY POWER & COMMUNICATION CONDUITS**

**Figure 2**



**MINIMUM CLEARANCES TO OTHER UTILITIES:**

Water Lines	2' horizontal AND 6" vertical
Irrigation	12" horizontal OR vertical
Telephone & Cable TV	12" horizontal
Gas	24" horizontal
Sewer	12" vertical at crossings/as per jurisdiction
Storm Drain	12" vertical at crossings/as per jurisdiction

# GROUNDING STANDARD

## For Vaults, Transformers and Termination Cabinets

### CCPUD Standard Practice 430.000

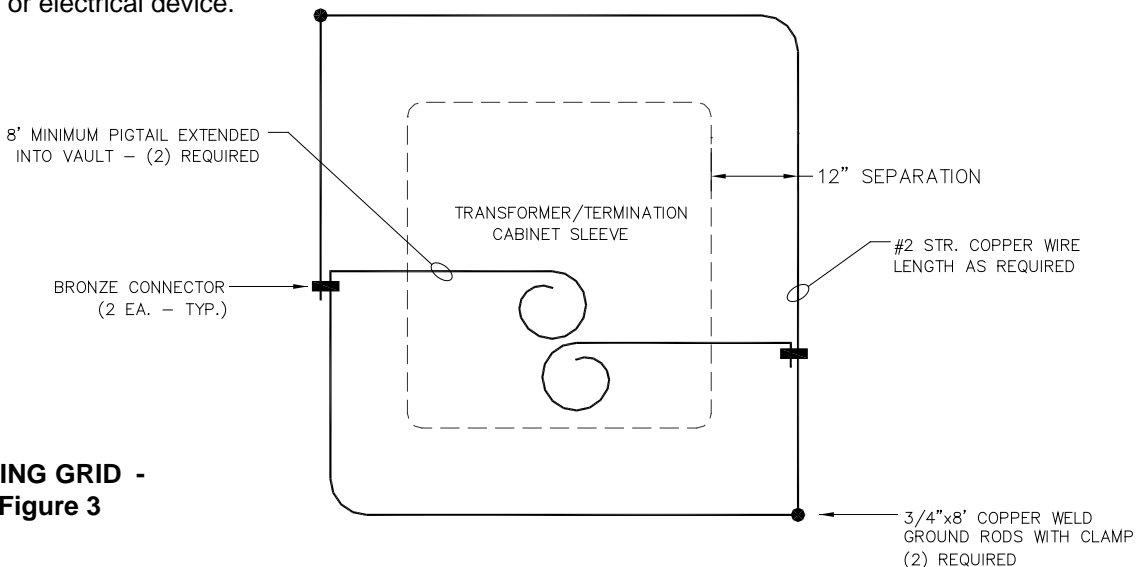
#### MATERIAL

All Chelan PUD concrete vaults, transformers, and termination cabinets shall be installed with the Chelan PUD standard grounding system, unless otherwise directed by a Chelan PUD representative. A licensed electrical contractor shall install the grounding grid, make connections, and the grid shall be inspected by a Chelan PUD representative before backfilling. Each system shall include the following materials:

3/4" copperweld ground rods, 8' or 10' long	2 Each
3/4" ground rod clamps	2 Each
#2 awg direct-bury, bronze connectors	3 Each
#2 awg stranded (7) bare, copper wire	42' (min., as req'd)

#### INSTALLATION

- This grounding system shall be placed around the base of each vault, pad or sleeve after the unit has been installed.
- The grounding rods shall be placed at opposite diagonal corner of the excavated pit (never closer than six feet measured between them) and driven vertically to within 6" of their entire length.
- The copper wire shall be placed on the ground, encircling the vault, pad or sleeve and shall be attached to the protruding top of the rods using the ground rod clamps.
- The grid shall maintain 12" separation from all vaults, pads and sleeves – maintain original shape during backfill process.
- The #2 wire shall be continuous, with the wire ends being reattached to one another using the connectors.
- Two separate grounding wire leads, placed on opposite sides or ends of the vault, pad or sleeve, shall be attached to the grounding loop and extend into the vault, pad or sleeve. They shall be a minimum 8' in length, and left inside of the unit to attach to the interior grounding grid of the transformer or electrical device.



**GROUNDING GRID -  
Figure 3**

NOTES

- ALL FITTINGS MUST BE BRONZE, ALUMINUM IS NOT ACCEPTABLE
- COPPER WIRE MUST BE #2 STRANDED
- GROUND RODS MUST BE COPPER WELD

**PRE-CAST FIBERGLASS VAULT SLEEVES  
(SINGLE PHASE AND THREE PHASE TERMINATION CABINETS,  
TRANSFORMERS)**

*Adopted from CCPUD Standard Practice 784.000*

**EXCAVATION**

- All pad locations shall be identified and approved prior to excavating.
- Sleeve shall be placed in an outward position and with minimum of 10' of clearance for PUD crews to conduct work.
- No sleeve shall be placed on an existing utility.
- The excavation bottom shall be level and free from rock.
- All excavation boundaries shall be as required to allow the sleeve to be square with the adjacent roads, property lines, sidewalks or structures.

**SUBGRADE PREPARATION**

- Each sleeve shall be placed on a minimum three inch base of sand

**INSTALLATION:**

- All sleeves shall be placed according to District standards.
- They shall be square with adjacent roads, property lines, sidewalks or structures unless otherwise directed by the Districts representative.
- The tops of all sleeves shall be level with surrounding finish grade with 3-6" inches extending above the finished grade.
- Conduit placement inside the sleeve shall be as shown on the attached drawings. The top of the duct 4-8" above grade inside the sleeve.
- For Safety, all openings shall be covered with 5/8" plywood secured to the top of the sleeve.

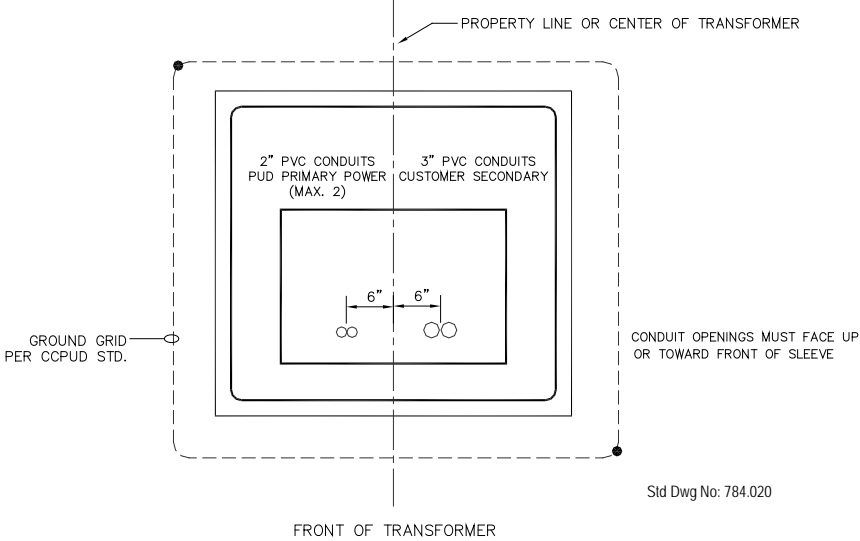
**SYSTEM GROUNDING:**

- A grounding mat shall be installed around the base of the sleeve in accordance with the Districts standard grounding practices (see page 7) Two separate ground wire tails shall enter the sleeve with a minimum of 8 feet of wire on each tail extending into the vault.

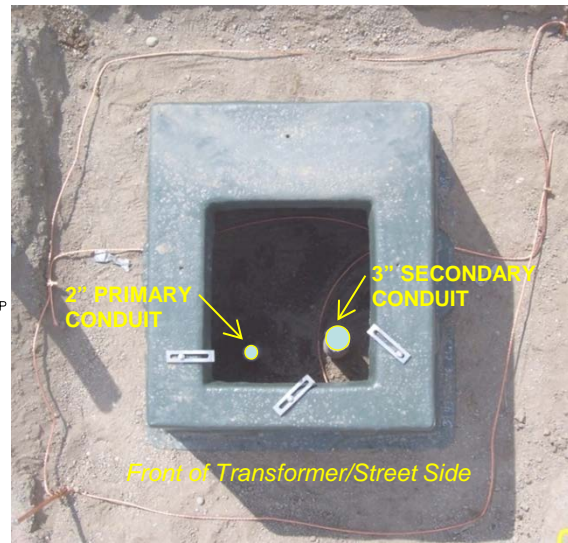
**BACKFILL:**

- Prior to initiating the backfill process, the customer shall receive approval from Districts representative of all sleeve installations.
- Select backfill (sand) will be used as bedding and cover for all conduits. Excavated materials free from rocks, vegetation and foreign objects may be used as backfill.
- Care shall be taken during the backfill procedure in not "overloading" the side wall pressures of the fiberglass sleeves, causing them to bow inward.
- Backfill shall be placed around the tops of each unit and sloped away for drainage purposes.

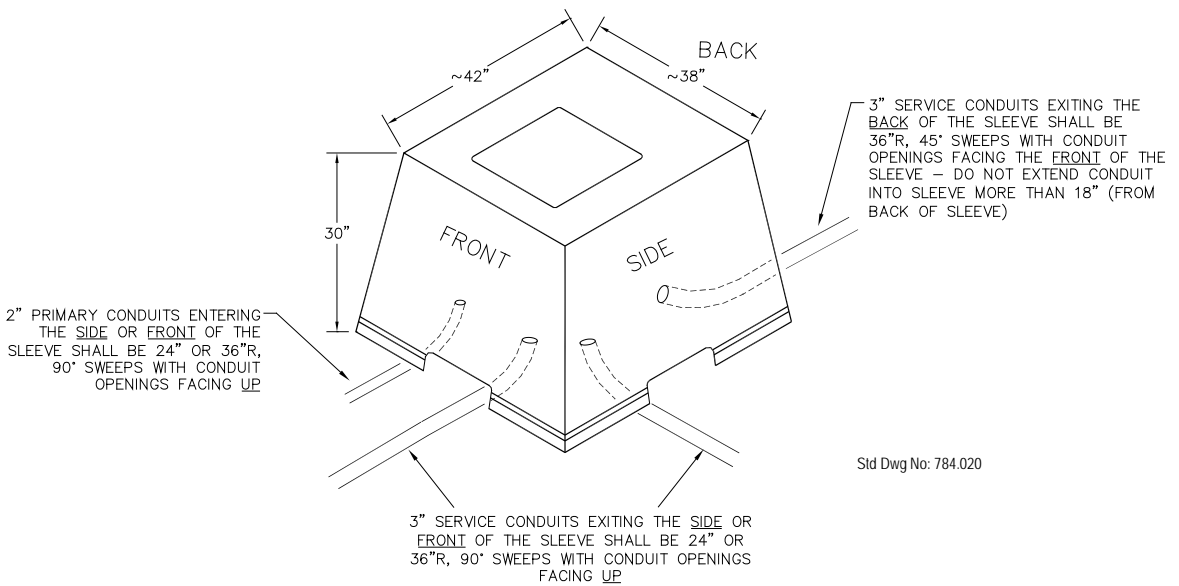




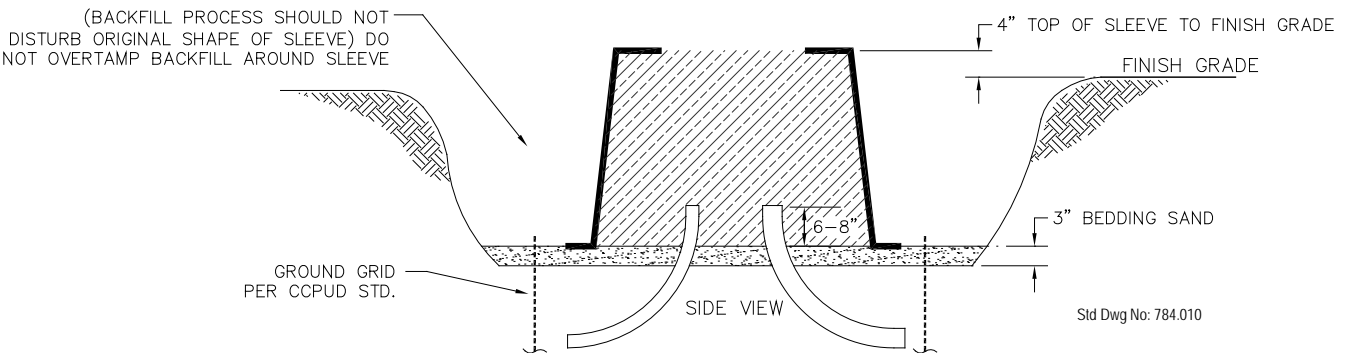
TRANSFORMER LAYOUT – PLAN VIEW  
Figure 4



TRANSFORMER SLEEVE INSTALLATION  
(Ground mat shown) – Figure 5

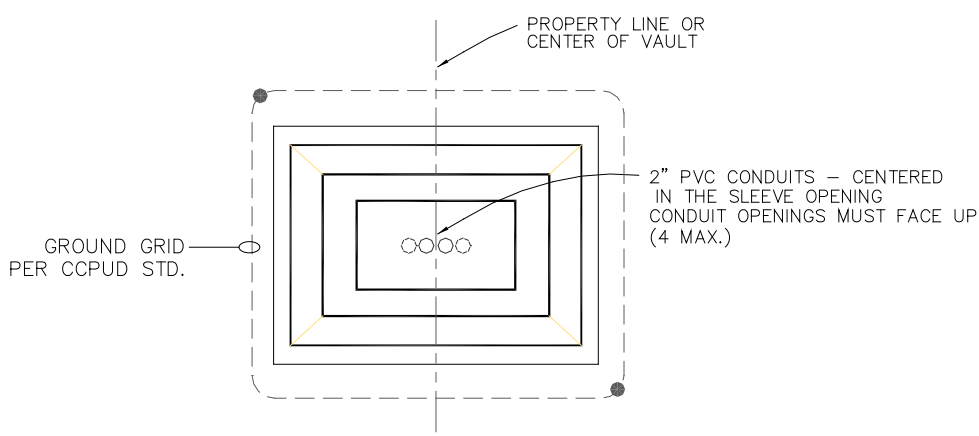


CONDUIT ENTRY -Figure 6

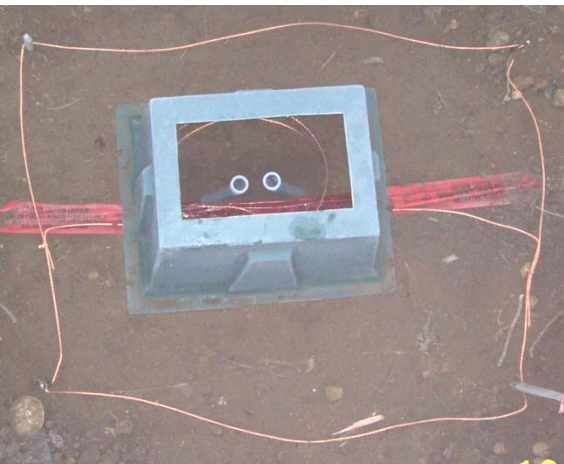


TRANSFORMER – SECTION VIEW  
Figure 7

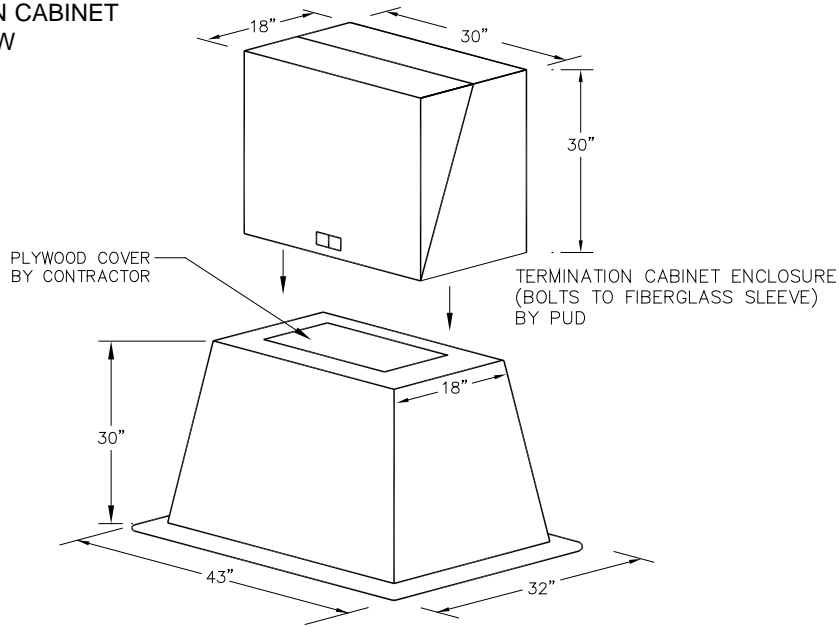
**TRANSFORMER SLEEVE  
GROUND SLEEVE (VAULT) INSTALLATION**



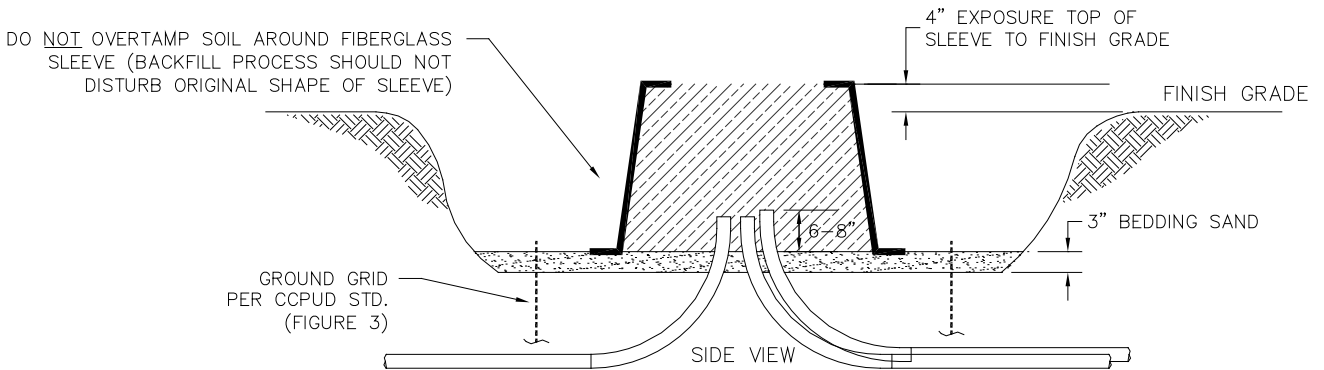
**SINGLE PHASE TERMINATION CABINET  
LAYOUT – PLAN VIEW**  
Figure 8



**SINGLE PHASE TERMINATION CABINET  
INSTALLATION – Figure 9**  
(Ground mat shown, before backfill)

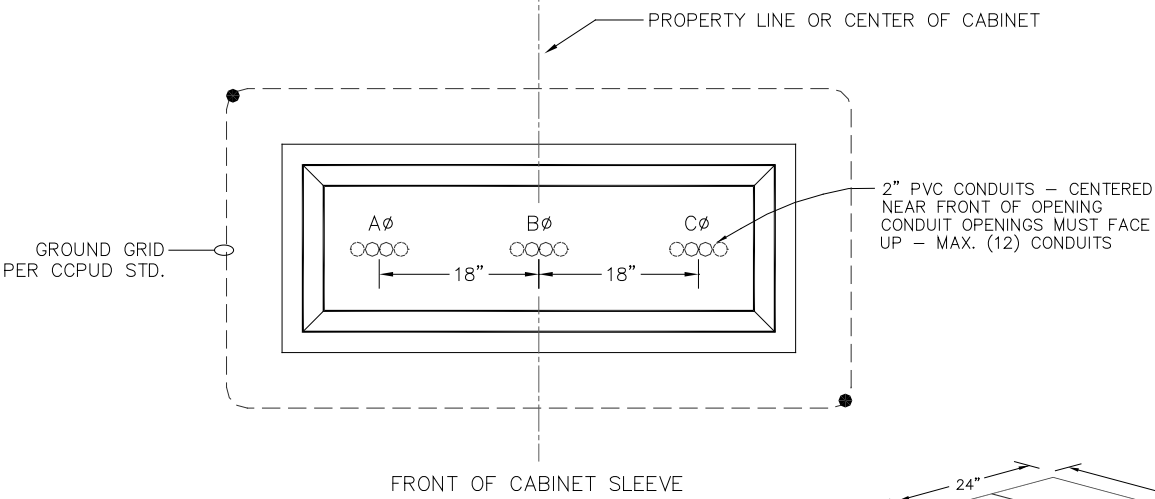


**SINGLE PHASE TERMINATION CABINET  
DIMENSIONS - Figure 10**

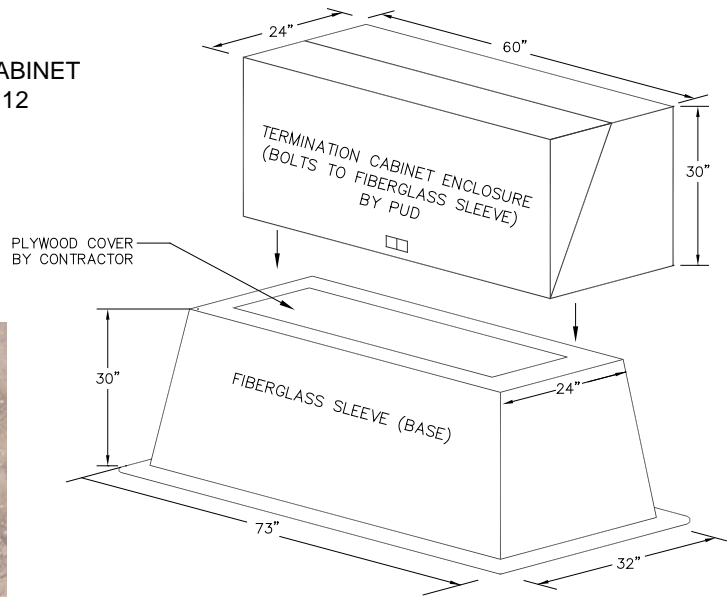


**SINGLE PHASE TERMINATION CABINET  
SECTION VIEW - Figure 11**

**SINGLE PHASE TERMINATION CABINET  
GROUND SLEEVE (VAULT) INSTALLATION**



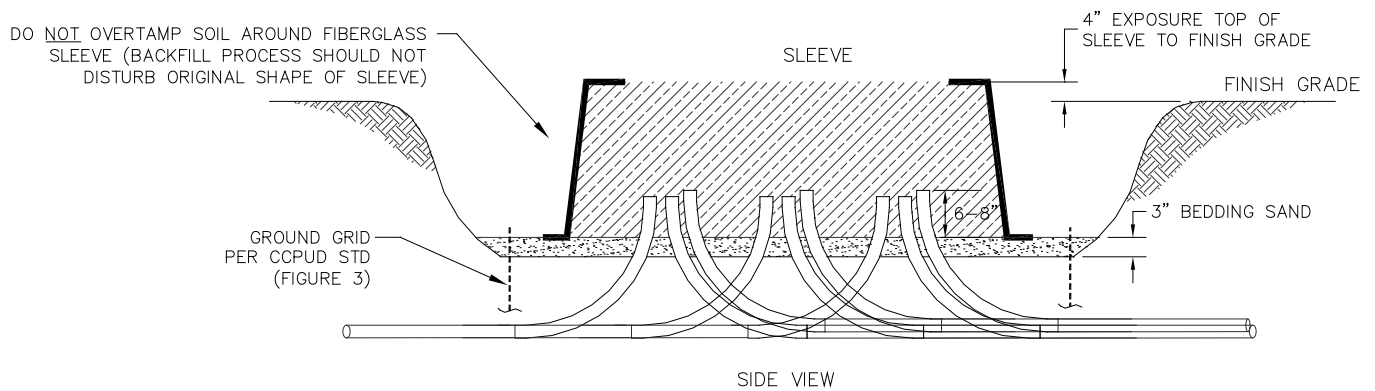
FRONT OF CABINET SLEEVE  
**THREE PHASE TERMINATION CABINET LAYOUT PLAN VIEW - Figure 12**



**THREE PHASE TERMINATION CABINET DIMENSIONS - Figure 14**

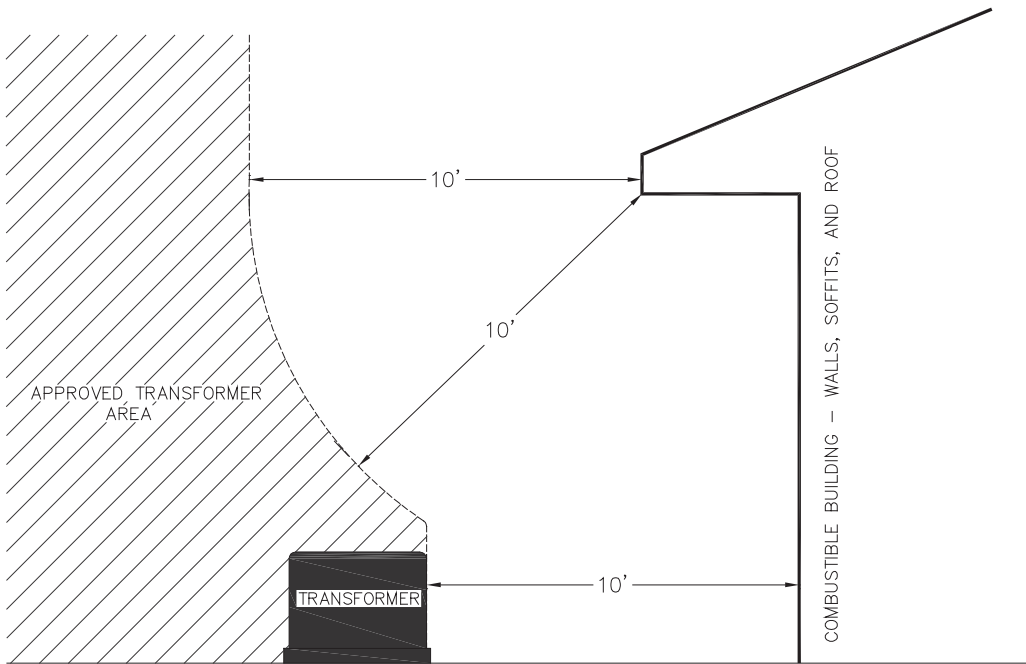


**THREE PHASE TERMINATION CABINET INSTALLATION - Figure 13**  
 (Backfilled, with ground tails into cabinet)



**THREE PHASE TERMINATION CABINET SECTION VIEW - Figure 15**

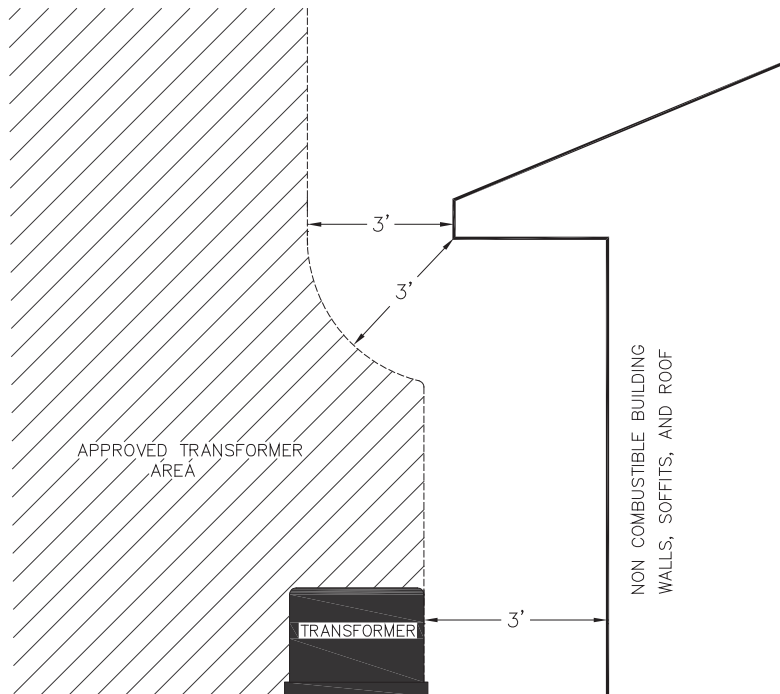
**THREE PHASE TERMINATION CABINET GROUND SLEEVE (VAULT) INSTALLATION**



**Figure 10**  
**Transformer Clearance**  
**Requirements – Combustible**  
**Building**

Std Dwg No: 540.300

**Figure 11**  
**Transformer Clearance**  
**Requirements Non-Combustible**  
**Building**



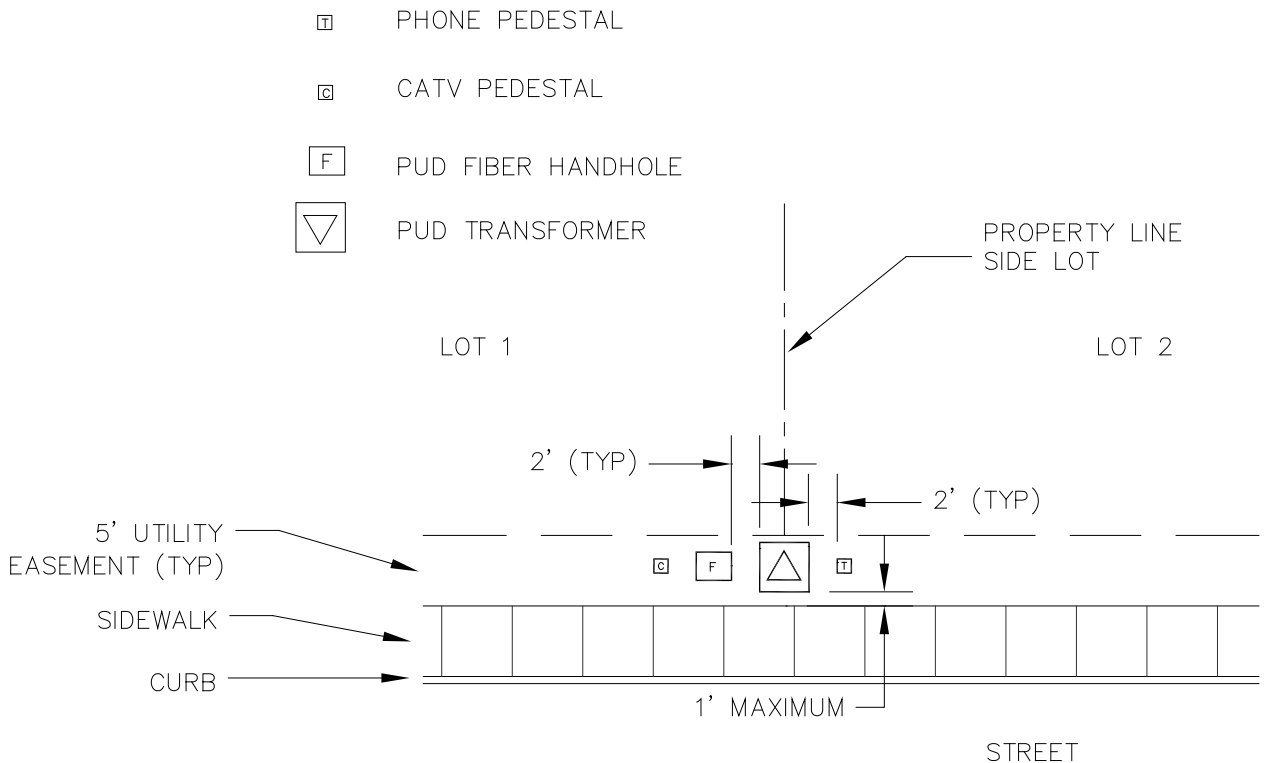
**SECONDARY TERMINAL LIMITS FOR TRANSFORMERS**

Std Dwg No: 540.300

The maximum number of secondary conductors allowed for specific transformer sizes is outlined in CCPUD Construction Standard 780.200 "Padmount Transformer Secondary Terminal Requirements" which is available from a Customer Service Engineer.

## PLAT DEVELOPMENT – UTILITY PLACEMENT

- Only CATV, phone and fiber optic facilities are to be placed at transformer locations. Avoid placing street lights and water chambers on the same property corners where transformers are located. Water chambers may be placed on the same property corners as secondary handholes if proper clearance is maintained (2')
- All utilities must maintain a 2' minimum clearance from transformers
- Transformers, vaults and handholes shall be set level, parallel to and within 1' of sidewalk and centered on the property line.
- Grade for vaults and transformer sleeves is 2" above reference feature, typically back of sidewalk.
- Electrical construction drawings provided by PUD engineering in general show the basic plan, scaled distances, routing and location of various units of electrical equipment. Allowances must be made for clarity due to scale, for example, ducts shown projecting an exaggerated distance into property and wire and conduit shown out of easements or into the road right of way. If any doubt arises as to the location, grade elevation, routing etc, of any electrical conduits or equipment, contact the engineer to resolve the situation.
- The contractor shall provide clear as-built information on spare drawings used specifically for that purpose, noting as built information as the work progresses.

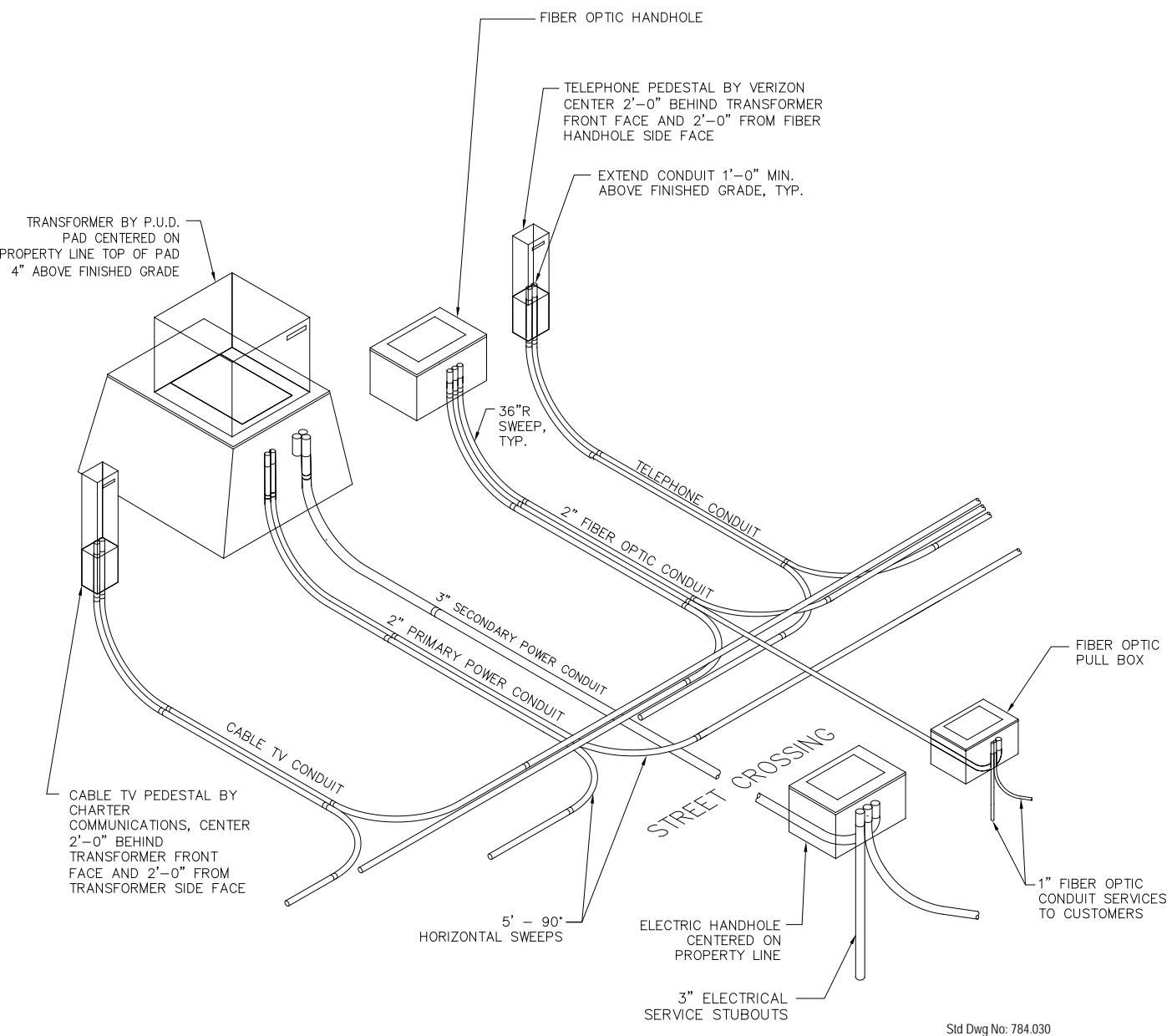


UTILITY LAYOUT PLAN

Figure 16

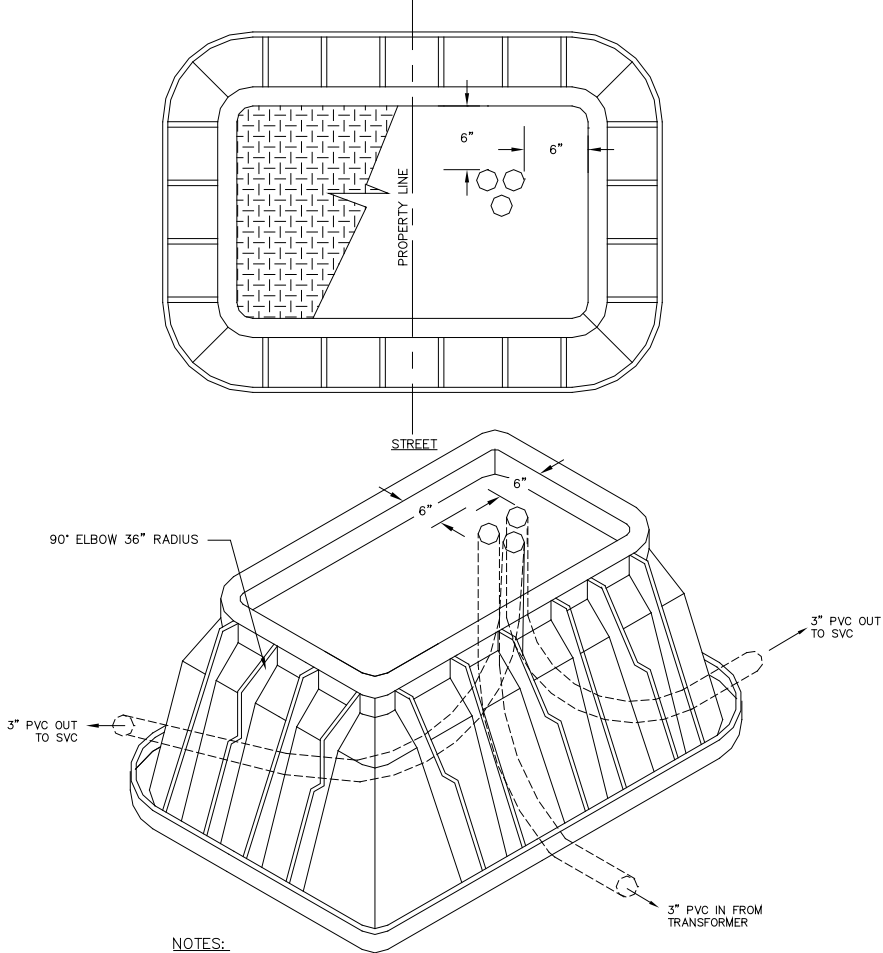
Std Dwg No: 784.030

## UTILITY LOCATIONS LOT LINE OR STAND-ALONE



Std Dwg No: 784.030

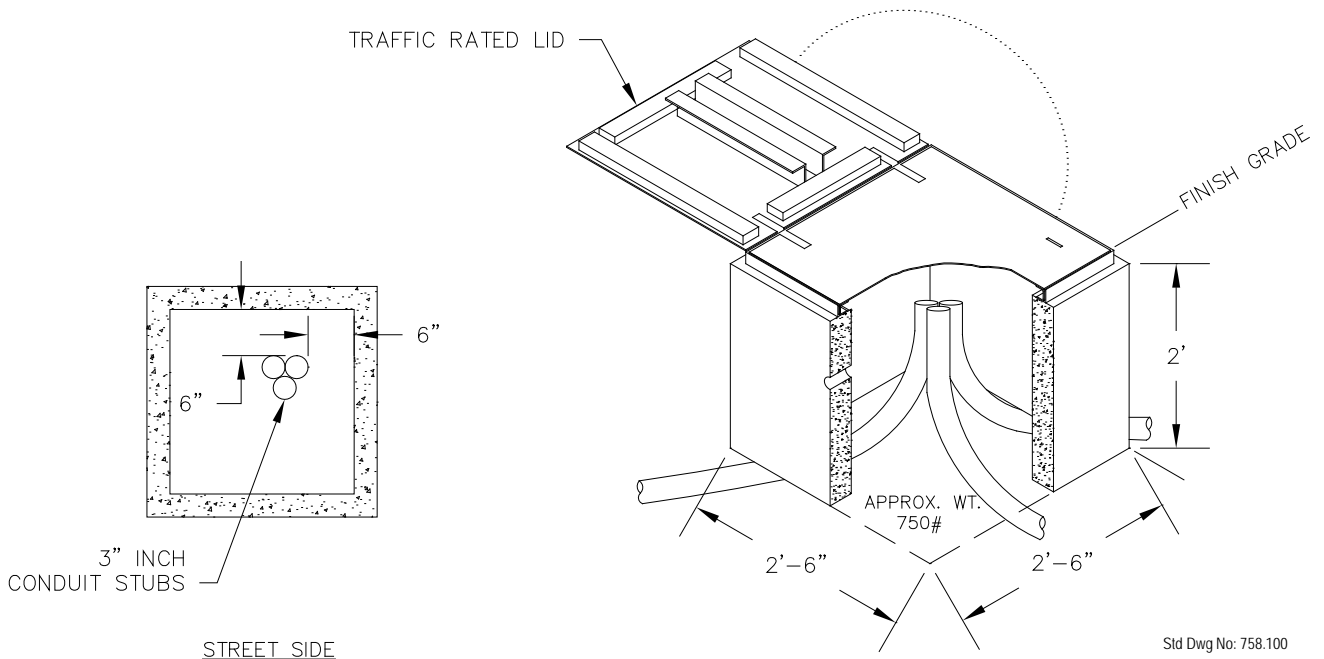
Figure 17  
**UTILITY LOCATIONS  
 LOT LINE OR STAND-ALONE**



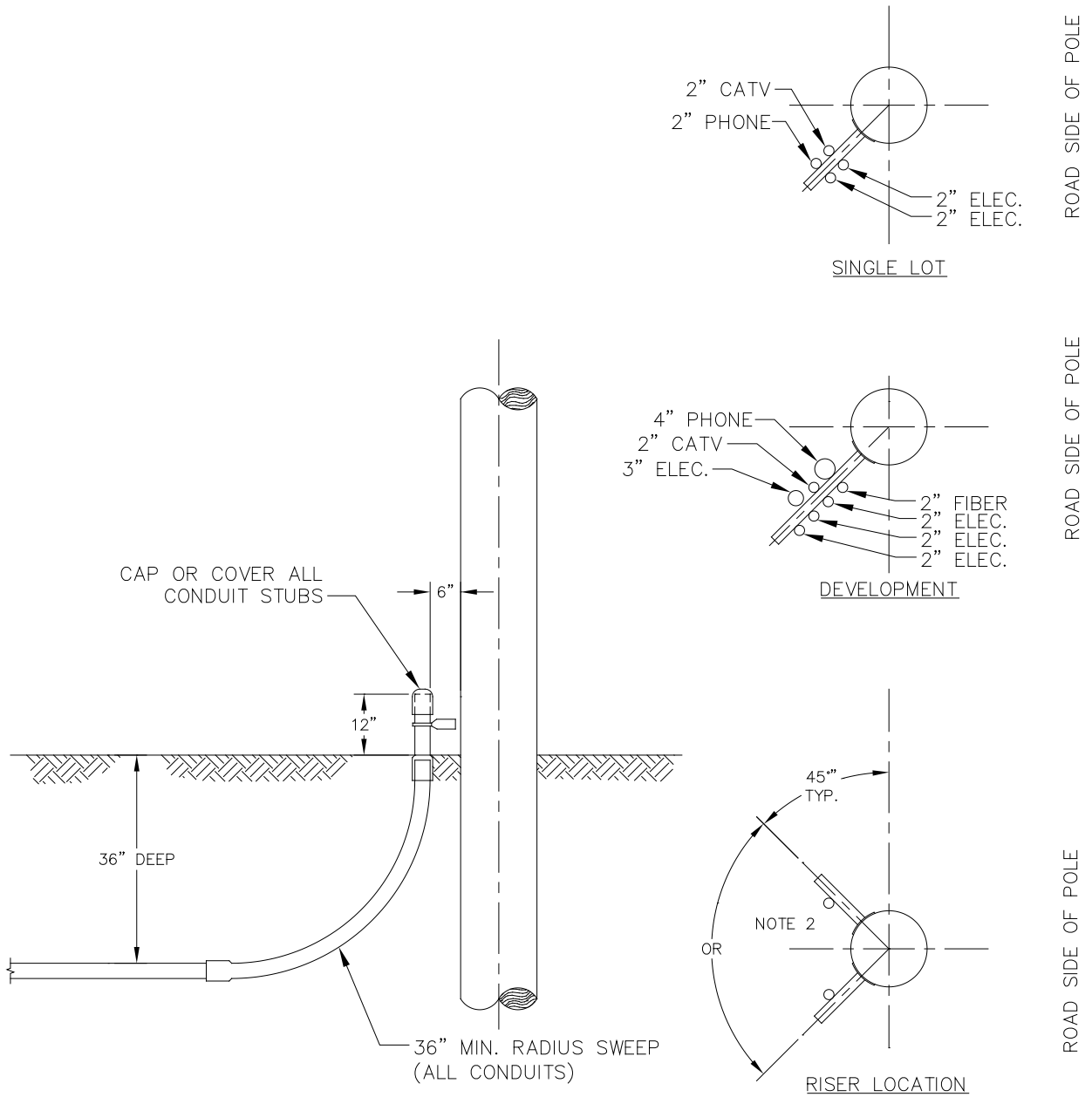
**NOTES:**

1. ALL CONDUIT TO BE GROUPED IN BACK RIGHT CORNER FROM STREET & CAP 4" ABOVE GRADE IN VAULT BOTTOM.
2. KEEP ALL CONDUIT 6" FROM HAND HOLE SIDES AND PLUMB VERTICAL.
3. DO NOT PLUMB CONDUITS IN MIDDLE OF HANDHOLE.
4. REFER TO CHELAN PUD STANDARDS FOR EXCAVATION, INSTALLATION & BACKFILL.

**FIBERGLASS HANDHOLE INSTALLATION – Figure 18**



**CONCRETE/LOAD BEARING LID HANDHOLE INSTALLATION – Figure 19**



**NOTES:**

If riser brackets exist at the pole, stub conduit at the existing riser bracket.

If riser brackets do not exist, verify proper quadrant for conduit placement with the PUD trench inspector.

Std Dwg No: 790.700

Figure 20  
**CONDUIT RISER INSTALLATION**



**PRE-CAST CONCRETE VAULTS**  
**(5x7x5 JUNCTION VAULT & 5x5x4 TRANSFORMER VAULT)**

*Adopted from CCPUD Standard Practice 750.000*

**EXCAVATION**

- All vault locations shall be identified and approved prior to excavating.
- No vaults shall be placed on an existing utility.
- The excavation bottom shall be level and free from rock.
- The Customer shall abide by all state safety regulations whenever excavation depths exceed four feet.
- All excavation boundaries shall be as required to allow the vault to be square with the adjacent roads, property lines, sidewalks or structures.

**SUBGRADE PREPARATION**

- Each vault shall be placed on a six inch base of  $\frac{3}{4}$ " minus crushed rock. A drain field composed of 1-1/2" -3" washed drain rock, a minimum of 2' wide by 1' deep and extending the width of the vault, shall be located directly under the vaults sump.

**INSTALLATION:**

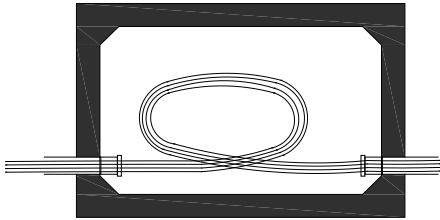
- Vaults shall be set square with adjacent roads, property lines, sidewalks or structures unless otherwise directed by the Districts representative.
- All vaults shall be rigged and hoisted with approved lifting devices. Slings shall be of adequate length to minimize stresses on the vault walls.
- Vault shall be aligned with the conduit trenches so that all conduits can be brought straight into the vault.
- Lid shall be plumbed and set prior to backfilling. Should lids require shimming to match the slope of the vault lid with the existing surface, all voids between the lid and vault body shall be filled with a quick setting, non-shrinking, nonmetallic grout.
- All conduits shall enter the vault through the fabricated knockouts. Two inches of separation shall exist between conduits of multiple-conduit entrances. Knockouts shall not be made larger than necessary to accommodate conduits entering the vault.
- Knockout voids shall be sealed with a quick setting, non-shrinking, non-metallic grout, approved by the District. All grout finishes, inside and out shall be smooth and flush with the vault's surfaces.
- The interior of the vault shall be swept clean of concrete and grout debris.

**SYSTEM GROUNDING:**

- Vault shall be ordered with pre-grounded unless otherwise specified by District Engineer.

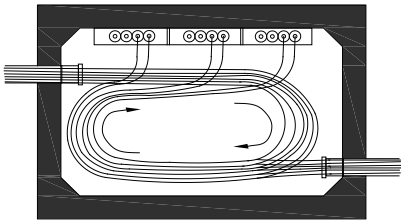
**BACKFILL:**

- Prior to initiating the backfill the customer shall receive approval from Districts representative of all pad installations.
- Select backfill (sand) will be used as bedding and cover for all conduits and around all conduit entrances. Do not use backfill with rocks, vegetation, trash, and scrap conduit or other non-native debris
- Materials mixed with snow or excessive moisture will not be allowed.



TOP VIEW – CABLE AND CONDUIT ROUTING FOR PULL VAULTS

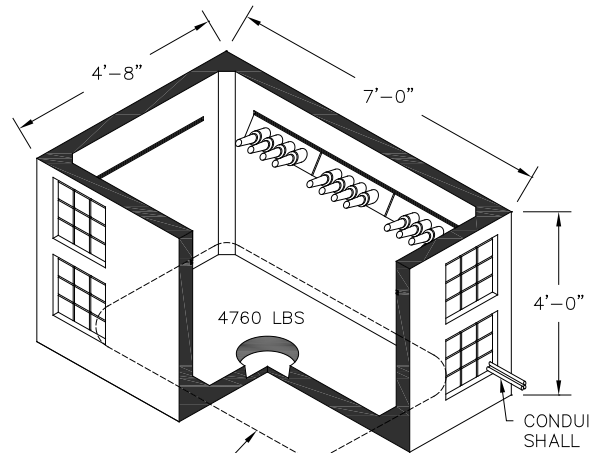
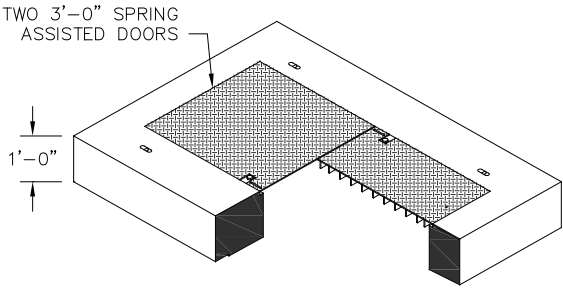
CABLES SHOULD ENTER THE VAULT SO THAT ALL OF THE CABLES WILL LAY IN THE SAME DIRECTION



TOP VIEW – CABLE AND CONDUIT ROUTING FOR JUNCTION VAULTS

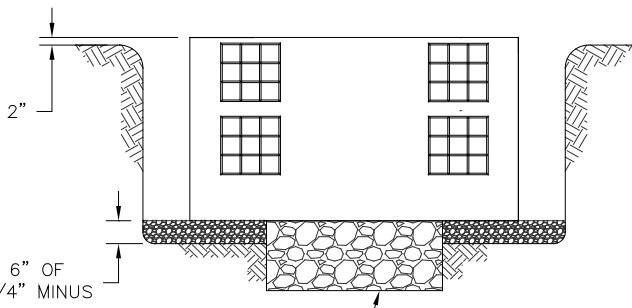
CABLES SHOULD ENTER THE VAULT SO THAT ALL OF THE CABLES WILL LAY IN THE SAME DIRECTION

TWO 3'-0" SPRING ASSISTED DOORS



INTERNAL VAULT GROUND SUPPLIED BY MANUFACTURER

CONDUITS SHALL ENTER VAULT AT THE LOWEST CORNER



1 1/2" - 3" WASHED DRAIN ROCK (FRENCH DRAIN) 1' DEEP x 2' WIDE x 6' LONG LOCATED DIRECTLY UNDER VAULT SUMP

Std Dwg No: 790.600

Figure 21

**5x7x5 CONCRETE JUNCTION or PULLING VAULT INSTALLATION**

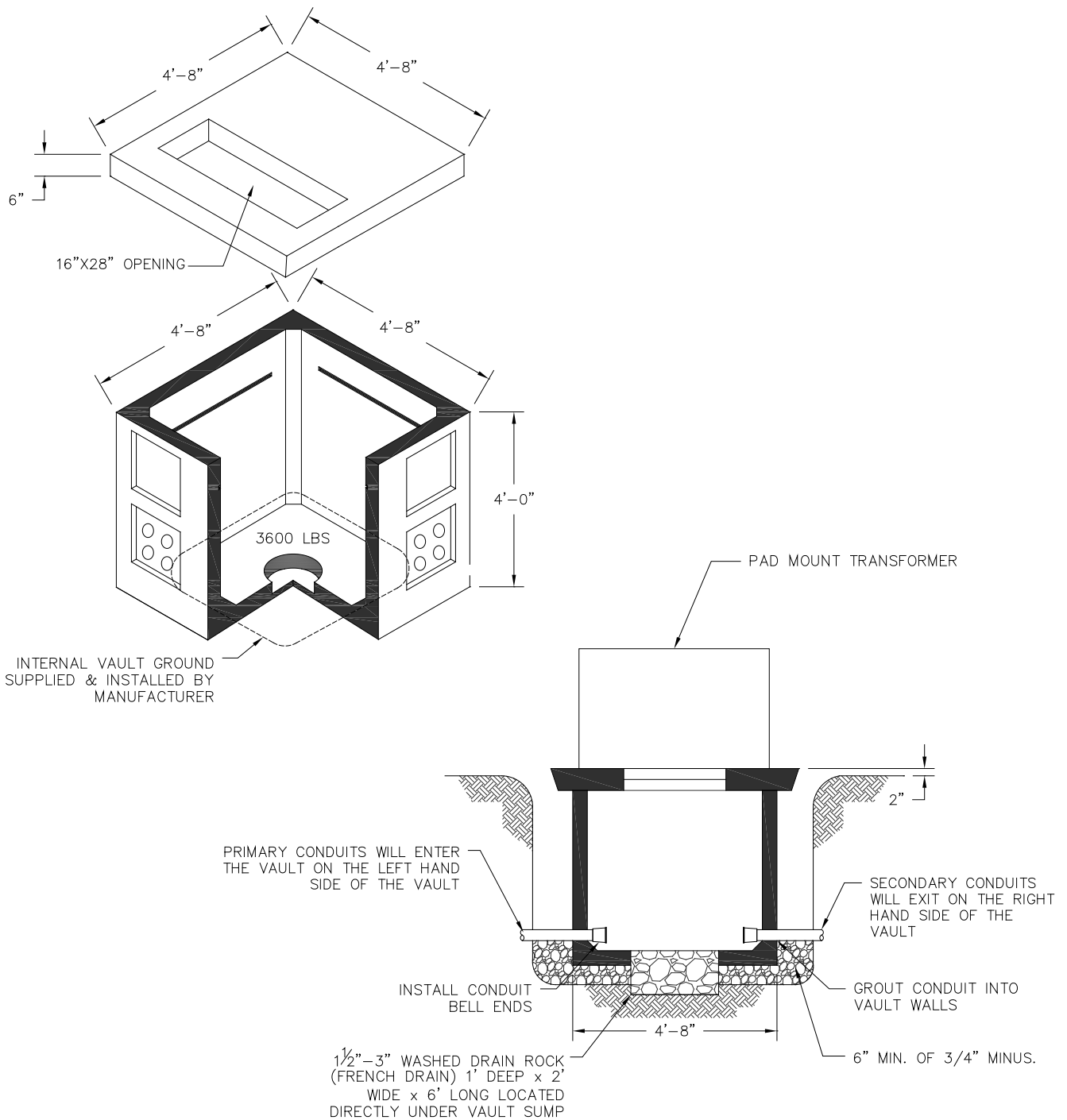


Figure 22

Std Dwg No: 790.300

**5x4x4 CONCRETE TRANSFORMER VAULT/PAD  
FOR 100 & 167kVA TRANSFORMER INSTALLATIONS**



**Call two full working days  
before you dig!**

**It's required by law,  
and you could be held liable for any  
damages to utility services.**

**1-800-424-5555**

At no charge to you, **Northwest Utility Notification Center** (Dig Council) will mark where power, water, gas lines, and other utilities are located on your property, using the following color codes:

<b>RED</b> .....	Electric
<b>YELLOW</b> .....	Gas – Oil
<b>ORANGE</b> .....	Telephone – CATV
<b>BLUE</b> .....	Water
<b>GREEN</b> .....	Sewer
<b>PURPLE</b> .....	Reclaimed Water
<b>PINK</b> .....	Survey
<b>WHITE</b> .....	Proposed excavation