

# TABLE OF CONTENTS

## Section 4 Underground Service

A.	GENERAL .....	4-7
B.	PRIMARY SERVICE - RESIDENTIAL SYSTEMS ON PRIVATE PROPERTY.....	4-7
C.	PRIMARY SERVICE - COMMERCIAL SYSTEMS ON PRIVATE PROPERTY.....	4-7
D.	TRENCHING .....	4-8
E.	CONDUIT AND FITTINGS FOR DISTRICT INSTALLED CONDUCTORS .....	4-13
F.	TEMPORARY CONSTRUCTION SERVICE .....	4-18
G.	RESIDENTIAL SERVICE EQUIPMENT.....	4-19
H.	METER PEDESTAL - 200 AMP & 400 AMP METER SOCKET .....	4-25
I.	CONVERSIONS, O/H TO U/G .....	4-29
J.	COMMERCIAL/APARTMENT SECONDARY PEDESTALS .....	4-31
K.	PADMOUNT TRANSFORMER EQUIPMENT, CLEARANCE .....	4-31
L.	CONNECTION TO PADMOUNT TRANSFORMERS, SECONDARY CABINETS SECONDARY HANDHOLES OR SECONDARY PEDESTALS .....	4-34
M.	CONCRETE VAULTS, PADS AND HANDHOLES.....	4-36
N.	GROUNDING .....	4-40
O.	VAULT ROOMS .....	4-41
P.	MAINTENANCE.....	4-43
Q.	INCREASING CAPACITY - EXISTING VAULT LOCATION .....	4-43

---

**This Page Intentionally Left Blank**

## Section 4 Illustrations And Tables

FIGURE 4-1	TRENCHING DETAIL .....	4-10
FIGURE 4-2	TRENCHING DETAIL .....	4-11
FIGURE 4-3	TRENCHING & CONDUIT LAYOUT .....	4-12
FIGURE 4-4	TEMPORARY CONSTRUCTION SERVICE .....	4-18
FIGURE 4-5	RESIDENTIAL SERVICE EQUIPMENT .....	4-19
FIGURE 4-6	TYPICAL 200 AMP SERVICE, RISER 2-1/2" MINIMUM.....	4-21
FIGURE 4-7	TYPICAL 400 AMP SELF-CONTAINED METER SOCKET .....	4-22
FIGURE 4-8	TYPICAL 201 - 400 AMP CT ENCLOSURE MIN. 3" SERVICE RISER.....	4-23
FIGURE 4-9	TYPICAL CT ENCLOSURE, MIN. 3" SERVICE RISER.....	4-24
FIGURE 4-10	TYPICAL METER PEDESTAL 201 - 400 AMP SELF-CONTAINED ..	4-26
FIGURE 4-11	TYPICAL METER PEDESTAL 201 - 400 AMP CT ENCLOSURE.....	4-27
FIGURE 4-12	TYPICAL METER PEDESTAL 200 AMP & 400 AMP CLASS 320 .....	4-28
FIGURE 4-13	CONVERSIONS, O/H TO U/G, SERVICE RISER CONVERSION.....	4-29
FIGURE 4-14	CONVERSIONS, O/H TO U/G, METER BASE CONVERSION .....	4-30
FIGURE 4-15	PADMOUNT TRANSFORMER EQUIPMENT, CLEARANCE .....	4-32
FIGURE 4-16	TRANSFORMER GUARD POST LOCATIONS.....	4-33
FIGURE 4-17	SECONDARY TRAINING IN VAULTS.....	4-35
FIGURE 4-18	RESIDENTIAL CUSTOMER VAULT SITE PREPARATION.....	4-36
FIGURE 4-19	CONDUIT ENTRANCE AND GROUTING IN VAULTS .....	4-39
FIGURE 4-20	GROUNDING .....	4-40
FIGURE 4-21	INCREASING CAPACITY - EXISTING VAULT LOCATION .....	4-43
FIGURE 4-22	ONE 1Ø OPEN BOTTOM J-BOX VAULT .....	4-46
FIGURE 4-23	ONE 1Ø CUSTOMER OPEN BOTTOM VAULT WITH PEDESTAL, 50 THROUGH 167KVA, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER.....	4-47
FIGURE 4-24	ONE OR MORE 1Ø CUSTOMERS OPEN BOTTOM VAULT AND SECONDARY HANDHOLE, 167 KVA OR LESS, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER .....	4-48

## Section 4

### Illustrations And Tables

FIGURE 4-25	ONE 1Ø CUSTOMER TRANSFORMER VAULT, 167 KVA OR LESS, SERVICE CONDUCTORS CONNECTED DIRECTLY TO TRANSFORMER .....	4-49
FIGURE 4-26	ONE OR MORE 1Ø CUSTOMERS, TRANSFORMER VAULT WITH SECONDARY HANDHOLE, 167 KVA OR LESS, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER, OPTION 1 .....	4-49
FIGURE 4-27	ONE OR MORE 1Ø CUSTOMERS, TRANSFORMER VAULT WITH SECONDARY HANDHOLE, 167 KVA OR LESS, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER, OPTION 2 .....	4-50
FIGURE 4-28	ONE OR MORE 1Ø CUSTOMERS, TRANSFORMER VAULT WITH SECONDARY HANDHOLE, 167 KVA OR LESS, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER, OPTION 3 .....	4-50
FIGURE 4-29	ONE 3Ø CUSTOMER TRANSFORMER VAULT, 75-500 KVA, SERVICE CONDUCTORS CONNECTED DIRECTLY TO TRANSFORMER.....	4-51
FIGURE 4-30	ONE 3Ø CUSTOMER TRANSFORMER VAULT, 75-500 KVA, SERVICE CONDUCTORS CONNECTED DIRECTLY TO TRANSFORMER, CONDUCTORS SIZES 500 KCMIL AND LARGER.....	4-51
FIGURE 4-31	ONE OR MORE 3Ø CUSTOMERS, TRANSFORMER VAULT WITH SECONDARY HANDHOLE, 75-500 KVA, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER.....	4-52
FIGURE 4-32	ONE 3Ø CUSTOMER, TRANSFORMER VAULT, 750-2500 KVA, SERVICE CONDUCTORS CONNECTED DIRECTLY TO TRANSFORMER, CONDUCTOR SIZES LESS THAN 500 KCMIL....	4-53
FIGURE 4-33	ONE OR MORE 3Ø CUSTOMERS, TRANSFORMER VAULT WITH SECONDARY CABINET, 75-500 KVA, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER.....	4-54
FIGURE 4-34	ONE 3Ø CUSTOMER TRANSFORMER VAULT, 750-2500 KVA, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER .....	4-55

## Section 4 Illustrations And Tables

FIGURE 4-35	ONE OR MORE 3Ø CUSTOMERS, 750-2500 KVA, SERVICE CONDUCTORS CONNECTED DIRECTLY TO TRANSFORMER, CONDUCTOR SIZES 500 KCMIL AND LARGER. ....	4-56
FIGURE 4-36	ONE OR MORE 3Ø CUSTOMERS, TRANSFORMER VAULT WITH SECONDARY CABINET, 75-500 KVA, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER .....	4-57
FIGURE 4-37	ONE OR MORE 3Ø CUSTOMERS, TRANSFORMER VAULT WITH SECONDARY CABINET, 750-2500 KVA, SERVICE CONDUCTORS NOT CONNECTED DIRECTLY TO TRANSFORMER.....	4-58
FIGURE 4-36	SMALLSECONDARY TERMINATION CABINET .....	4-59
FIGURE 4-37	LARGE SECONDARY TERMINATION CABINET .....	4-60
TABLE 1	MINIMUM CONDUIT SIZE.....	4-16
TABLE 2	1Ø PADMOUNT TRANSFORMER SELECTION GUIDE .....	4-44
TABLE 3	3Ø PADMOUNT TRANSFORMER SELECTION GUIDE .....	4-45

---

**This Page Intentionally Left Blank**

# UNDERGROUND SERVICE

## A. GENERAL

1. All conditions for service application, availability of service, type of service, electrical wiring permit, inspection, right-of-way, easements, etc., are covered in “Section 2, General Requirements.”
2. Availability and location of District facilities for providing underground service shall be determined at the District’s office before proceeding with the wiring. Only one service strike will be allowed per building with the exception of single-family residential zero-lot-line townhomes [units that share common wall(s)]. For these townhomes, a separate individual service run and meter base/socket will be allowed for each unit. Plans, specifications, load data, grades and stakes Form #1373 for all underground services shall be submitted to the District as much in advance as possible prior to any construction.
3. The District will design, install, own and maintain the complete primary underground electric distribution system and all associated secondary distribution in the public right-of-way.
4. Underground service installation requiring a special voltage or more than 30 feet of road boring will require individual consideration for feasibility and charges required.
5. The customer shall notify Utilities Underground Location Center by calling **811** or **1-800-424-5555** not less than two-business days or more than ten business days before the commencement of excavation or trenching to allow for location of existing underground utilities by their representatives (RCW 19.122.030).

## B. PRIMARY SERVICE - RESIDENTIAL SYSTEMS ON PRIVATE PROPERTY

1. The customer shall prepare the vault site, provide easements, trenching, conduits, pull ropes, and related equipment on private property.
2. The District will install, own and maintain the vault, grounds, secondary handhole and secondary service conductors.

## C. PRIMARY SERVICE - COMMERCIAL SYSTEMS ON PRIVATE PROPERTY

1. The customer shall provide easements, trenching, conduits, pull ropes, vaults, handholes, grounds, secondary service conductors and related equipment on private property.

## Section 4. Underground Service

- Transformer vaults, pulling/switching handholes and other equipment vaults shall be located in accordance with the requirements listed in Section 4-K of this section. Refer also to Section 4 Table 2 & 3 for specifics on various vaults, pads and handholes required for each individual project as determined by the District.

**Note:** Acceptable precast concrete products are locally available from three companies:

**Oldcastle Precast, Inc.**  
Auburn, WA - phone - 800-892-1538

**CUZ Concrete Products**  
Arlington, WA - phone - 800-659-1941

**Granite Precasting & Concrete, Inc.**  
Bellingham, WA - phone - 800-808-2251

- Systems on Private Property

The District will design, install, own and maintain the primary underground cable, transformers and switch cabinets as required for distribution systems on private property.

**Exception:** The District shall not normally provide this service beyond primary metering if the system is customer owned.

### D. TRENCHING

- For primary and secondary service trenching requirements refer to Figures 4-1 through 4-3.
  - The minimum cover depth for secondary service shall be 24 inches and the maximum trench depth shall be 47 inches.
  - The minimum cover required for primary, 36". The maximum trench depth for secondary or primary conductor shall be 47". Refer to Figure 4-1.
- All secondary service conductors are to be installed in continuous conduit from the meter base or CT can to the District's point of service.
- In general, all trenching, backfilling and restoration work on private property shall be done by the customer.
- Minimum depth requirements may be reduced where unusual soil conditions dictate. Contact the District for specific requirements for these cases.
- Gas lines shall be staked every 10' as required to maintain separation.
- For minimum separation between electric lines and other utilities refer to Figure 4-1 on Page 4-10.



## Section 4. Underground Service

7. 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. Backfill within 6" of the electrical conduit should be free of solid material greater than 4" maximum or sharp edges likely to damage it. The balance of backfill should be free of solid material greater than 8" in maximum dimension. All backfill should be free of materials that may damage the conduit system (large rock or paving material, cinders, large or sharply angular substance, or corrosive material). Refer to NESC 321. Sand shall be required if select backfill material is not available. Select backfill or sand shall provide a 3" bedding below the conduit and a minimum cover of 3". Refer to Section 1, page 2, Backfill definition. Backfill material should be adequately compacted.

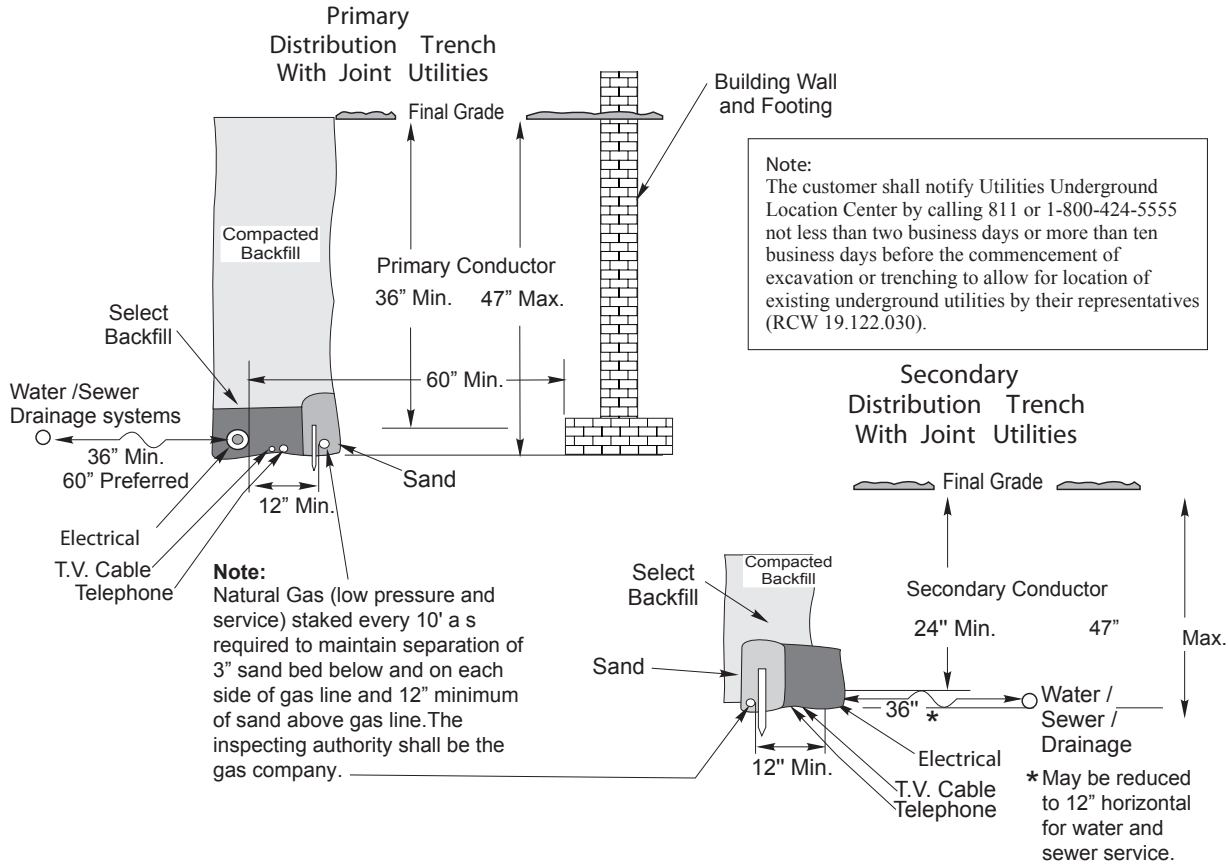
**Note:** *The District must inspect and approve all conduit installations prior to backfilling.*

8. The customer shall trench all the way to the District pedestal or point of service.
9. Within 24 hours after the District's inspection of the ditch and conduit and prior to the District installing the service and meter the customer shall prepare a work area leveled and cleared of all debris and obstructions at the metering point to provide the service conductors to be safely installed by the District. This work area shall be 5 feet x 5 feet minimum centered around the meter base, backfilled and compacted to within 4 inches of final grade.

# Section 4. Underground Service

## TRENCHING DETAIL

**FIGURE 4-1**



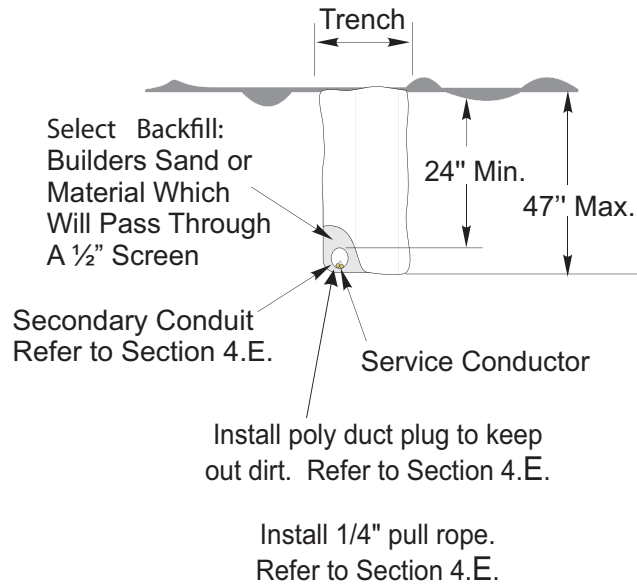
**Minimum Clearances from District Underground Lines in Conduit**

Type of Utility Line	Vertical Separation (Crossings)			Horizontal Separation		
	Electric Primary	Electric Secondary Main	Electric Secondary Service (300V Max.)	Electric Primary	Electric Secondary Main	Electric Secondary Service (300V Max.)
Communication	6"	6"	6"	0"	0"	0"
Communication Service	3"	3"	3"	0"	0"	0"
High Pressure Gas	12"	12"	12"	36" (60" Preferred)	36" (60" Preferred)	36" (60" Preferred)
Low Pressure Gas	6"	6"	6"	12"	12"	12"
Gas Service	6"	6"	6"	12"	12"	12"
Sewer Main & Lateral	12"	12"	12"	36" (60" Preferred)	36" (60" Preferred)	36" (60" Preferred)
Sewer Service	12"	12"	6"	36"	36"	12"
Water Main & Lateral	12"	12"	12"	36" (60" Preferred)	36" (60" Preferred)	36" (60" Preferred)
Water Service	12"	12"	6"	36"	36"	12"
Storm & Roof Drains	12"	12"	6"	36" (60" Preferred)	36" (60" Preferred)	36" (60" Preferred)
Lighting & Electric Supply	6"	6"	6"	0"	0"	0"

## Section 4. Underground Service

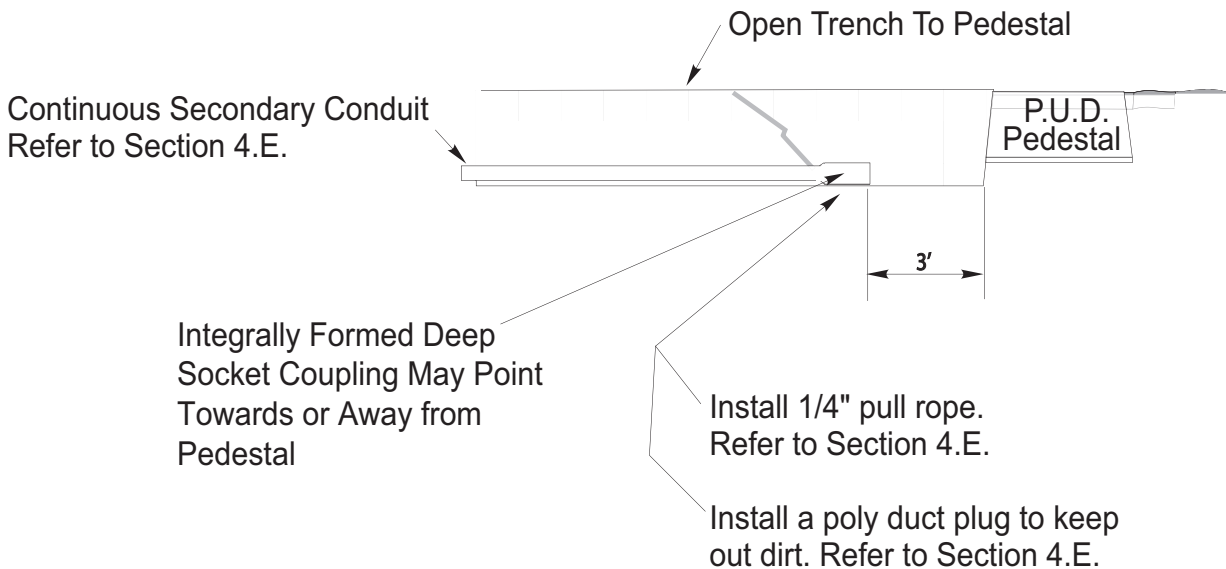
### TRENCHING & CONDUIT DETAIL

**FIGURE 4-2**



**Note:**

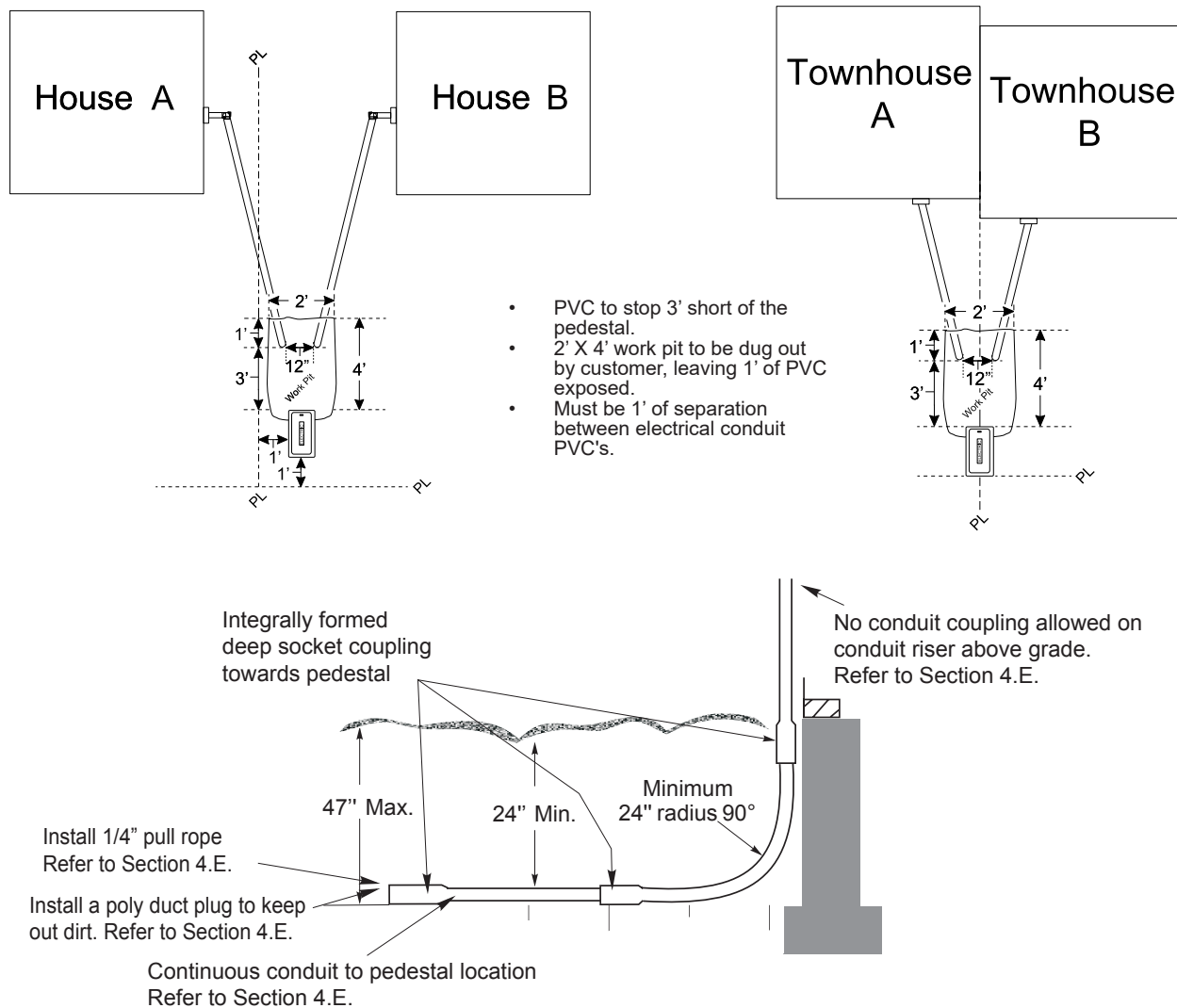
The customer shall notify Utilities Underground Location Center by calling 811 or 1-800-424-5555 not less than two business days or more than ten business days before the commencement of excavation or trenching to allow for location of existing underground utilities by their representatives (RCW 19.122.030).



## Section 4. Underground Service

### TRENCHING & CONDUIT LAYOUT

**FIGURE 4-3**



#### NOTES:

1. The customer shall notify Utilities Underground Location Center by calling 811 or 1-800-424-5555 not less than two business days or more than ten business days before the commencement of excavation or trenching to allow for location of existing underground utilities by their representatives (RCW 19.122.030).
2. No entities other than the District are allowed in or around the pedestal within a 12" radius.
3. If a pedestal serves multiple customers the District's engineer shall determine if an easement is required.
4. Only townhouse services should have pedestals that straddle their property line.
5. For services to two single family homes fed from one pedestal, the pedestal should be installed 1 ft. over and 1 ft. in from the property corners, and an easement should be provided for the pedestal and any appropriate area for services.
6. For the scenario above where customer A's service wire would cross Customer B's property, and the pedestal serving both customers was installed on Customer B's property, where no easement can be provided, then the District shall either:
  - a. Install a second pedestal for Customer A, on Customer A's property (preferred) or,
  - b. Install the pedestal just outside the property lines in the road right-of-way.

## Section 4. Underground Service

### E. CONDUIT AND FITTINGS FOR DISTRICT INSTALLED CONDUCTORS

1. All nonmetallic PVC conduit and fittings shall be pigmented gray in color and must be manufactured by a currently approved District manufacturer in addition to meeting the following requirements:
  - a. The following information shall be imprinted on all PVC conduit:
    1. *Manufacturer's name or trademark*
    2. *Nominal size*
    3. *Material (PVC)*
    4. *Standard designation (for example, NEMA TC-2)*
    5. *Type (for example, Schedule 40)*
    6. *Maximum 90° wire, Max. 90°C wire or equivalent phraseology*
    7. *Date code or month and year of manufacture*
  - b. 1", 2", 2-1/2" and 3" PVC conduit shall be gray and shall meet or exceed the requirements of the following standards:
    1. *NEMA TC-2 (Schedule 40 or 80)*
    2. *District Material Standard No. 250027.1*
  - c. 4" and 6" PVC shall be gray and shall meet or exceed the requirements of District Material Standard No. 250027.1 and any one of the following standards:
    1. *NEMA TC-6 DB-60*
    2. *NEMA TC-8 DB-120*
    3. *NEMA TC-2 (Schedule 40 or 80)*
    4. *ASTM F-512 DB-60*
  - d. Schedule 40 or 80 gray PVC conduit is required for service riser according to NEC 300-5d. and NEMA Standard TC-2 for applications listed below:

*Type III - Designed for normal-duty applications above ground (Sch 40)*  
*Type IV - Designed for heavy-duty applications above ground (Sch 80)*  
*(Hazardous areas, e.g., next to driveways)*
  - e. Primary conduit bends shall be heavy wall fiberglass or hot-dip galvanized rigid steel electrical conduit.
  - f. All conduit bends shall be long radius type.

<u>Conduit Diameter</u>	<u>Minimum Radius</u>
2", 2-1/2", 3"	24"
4"	48"
6"	60"

## Section 4. Underground Service

- g. Each PVC conduit joint must be permanently assembled using a PVC solvent cement appropriate for the application.
- h. The District accepts smooth-wall coilable polyethylene electrical plastic conduit, also known as high density polyethylene (HDPE) conduit or poly pipe, for directional bore applications only. Poly pipe must meet the following requirements:

1. *District Material Standard 250027.2 High Density Polyethylene Conduit*

Trade Size	Type	Reference Standard
2", 2-1/2", 3"	EPEC Schedule 40	NEMA TC 7
4", 6"	SDR 13.5	ASTM D 3035

3. *Color*

*The conduit material shall conform to any one of the following three color alternatives. The order of the District's preference is a., b. and c.*

- a. *Solid black compound which is UV stabilized for outdoor use per ASTM D 3350 with three continuous red stripes co-extruded longitudinally into the black compound. The red stripes shall be spaced 120° apart. The red color compound shall be compatible with the black compound, and shall also be UV stabilized. The red stripes shall be a minimum of 1/4" wide.*
  - b. *Solid red compound UV stabilized for outdoor use per ASTM D 3350.*
  - c. *Solid gray compound UV stabilized for outdoor use per ASTM D 3350.*
4. *Identification*  
*The following permanent identification markings (items a. - e.) are required and shall be provided at intervals of not more than 5 feet. The information may be listed on the conduit in the order preferred by the manufacturer.*
- a. *Manufacturer's name or trademark*
  - b. *Trade size (in inches)*
  - c. *Wall thickness, schedule or dimension ratio (DR)*
  - d. *Date code or month and year of manufacture*
  - e. *HDPE*
  - f. *NEMA TC 7 (for conduit sizes 2", 2-1/2", 3") and ASTM D 3035 (for conduit sizes 4" and 6")*
  - g. *Other markings are acceptable if they do not conflict with and cannot be confused with the required markings.*

5. *Couplings*

The customer shall provide mechanical couplings designed for joining PVC conduit to each end of the poly pipe without the use of adhesive compounds. The customer shall install the couplings on the poly pipe only if directed to do so by the District. The poly pipe ends shall be made round to enable proper installation of couplings.

## Section 4. Underground Service

2. Secondary Conduit Requirements
  - a. Continuous conduit from the customer's service entrance to the District's point of service must be used for all underground secondary service cable installations.
  - b. Schedule 40 PVC shall be used as a minimum.
  - c. Conduits shall stop 3 feet from the point of service as provided by the District.
  - d. The formed deep socket coupling (large flared end) of the conduit may be pointed in either direction.
  - e. A continuous length of knot-free 1/4 inch polypropylene pull rope, or Herculine P1250W 1/2" polyester pull tape, shall be installed by the customer with a 2 foot tail at each end for **all** secondary conduit(s), including future conduit(s), regardless of length of run.
  - f. All bends shall be Schedule 40 PVC long radius (Refer to 4.E.1.f.). Factory made bends, including "pronto" type bends are acceptable. PVC conduit shall not be mechanically heated in the field to form any sweep (bend).
  - g. Conduit couplings (and formed swedge reducers) are not allowed on an underground service riser above final grade. Per the NEC bends above final grade shall be so made that the conduit will not be damaged and the internal diameter of the conduit will not be effectively reduced. Field bends shall be made only with identified bending equipment.
  - h. A bell end shall not be installed on the end of the conduit, however, a tapered manufactured poly conduit plug (no duct tape) shall be installed on all conduit ends to seal exposed ends of conduits, including future conduit(s), to keep out dirt and foreign objects prior to the District installing the conductors. If requested, the District may furnish the customer with the plug(s).
  - i. The District will extend the conduit into the pedestal or riser pole with a manufactured elbow, rigid, or flex conduit when service is installed.
  - j. The maximum continuous service conduit run shall be 250 feet in length, from the meter base to the point of service.
  - k. Secondary conduit shall be allowed a maximum total aggregate of 270° of total bends including the riser. All bends shall be long radius type (24 inch minimum).
  - l. The conduit size for a 200 amp residential service riser shall be a minimum of 2-1/2 inches for 4/0 - 2/0 triplex.
  - m. The conduit size for a 201 - 400 amp residential service riser shall be a minimum of 3 inches for 350 kcm - 4/0 triplex.
  - n. Refer to Table 1 for conduit fill requirements.

**Table 1**

**Minimum Conduit Size  
Triplex and Quadruplex Secondary Conductors**

600V XLP Insulated Conductors		Triplex		Quadruplex	
Phase	Neutral	One Run	Two Runs	One Run	Two Runs
1/0	2	2-1/2"	3"	3"	3"
4/0	2/0	2-1/2"	3"	3"	4"
350 kcmil	4/0	3"	4"	3"	4"
500 kcmil	250 kcmil	4"	4"	4"	6"
500 kcmil	300 kcmil	4"	4"	4"	6"
500 kcmil	350 kcmil	4"	4"	4"	6"
750 kcmil	400 kcmil	4"	6"	4"	6"
750 kcmil	500 kcmil	4"	6"	4"	6"
1000 kcmil	500 kcmil	4"	6"	4"	6"

**Notes:**

1. Conduit sizes in Table 1 apply to 2-1/2" and 3" Schedule 40 and 4" and 6" DB-60.
2. Table 1 assumes proper alignment of conduit and proper cable installation where the length of the pull and the number and size of conduit bends are within reasonable limits.
3. The minimum conduit size for a 200 amp residential service riser shall be 2-1/2" for 4/0-2/0 triplex cable.
4. Five inch conduit is unacceptable as it is not a District standard. Customers must use conduit sizes compatible with District standards to enable the District to repair or extend customer-installed conduit in the future, if necessary.

3. Primary Conduits in Trenches

- a. Conduit is required for all primary conductors on private property. All bends shall be long radius fiberglass or rigid steel electrical conduit. A maximum of 180° of bends shall be allowed.

**Exception:** Naturally formed long sweeps of PVC conduit of 1° to 90° will be allowed.

1.) *All bends shall be Schedule 40 PVC long radius (Refer to 4.E.1.f.). Factory made bends, including "pronto" type bends are acceptable. PVC conduit shall not be mechanically heated in the field to form any sweep (bend).*

2.) *Conduit shall not be placed in the trench to form a long sweep prior to the setup of cement in all joints involved. Cement setup time shall be per the manufacturers recommendations.*

- b. There shall be a 60-inch minimum separation between a primary conduit and a building wall.



## Section 4. Underground Service

- c. Minimum primary conduit sizes shall be 2 inches for single phase and 4 inches for three phase. Larger backbone feeder conduits shall be specified and required on an individual project design basis.
- d. The use of 2-1/2" and 5" conduit is unacceptable as they are not a District standard size for primary conduit.
- e. No conduit reducers of any kind shall be used on primary conduit runs.
- f. The customer shall install a continuous length of knot-free 1/4 inch polypropylene pull rope, or Herculine P1250W 1/2" polyester pull tape, (with a 2 foot tail at each end) and a tapered, manufactured poly conduit plug (no duct tape) at each end for **all** primary conduit(s), including future conduit(s), regardless of length of run.

### 4. Under Buildings

The District will only allow powerlines to be installed under a building when it is absolutely unavoidable and is approved by the District Manager or his designee prior to installation.

- a. The required conduit(s) shall be paralleled by an equal spare conduit(s) from the pole to the vault or between vaults.
- b. Conduits shall not pass through or conflict with the building's foundation walls.
- c. Conduits shall be encased in concrete. Minimum encasement shall be 2 inches thick on all sides of the conduits.

**Exception:** The concrete encasement requirement can be waived if the building will have a minimum 4 inch thick concrete slab first floor and no basement.

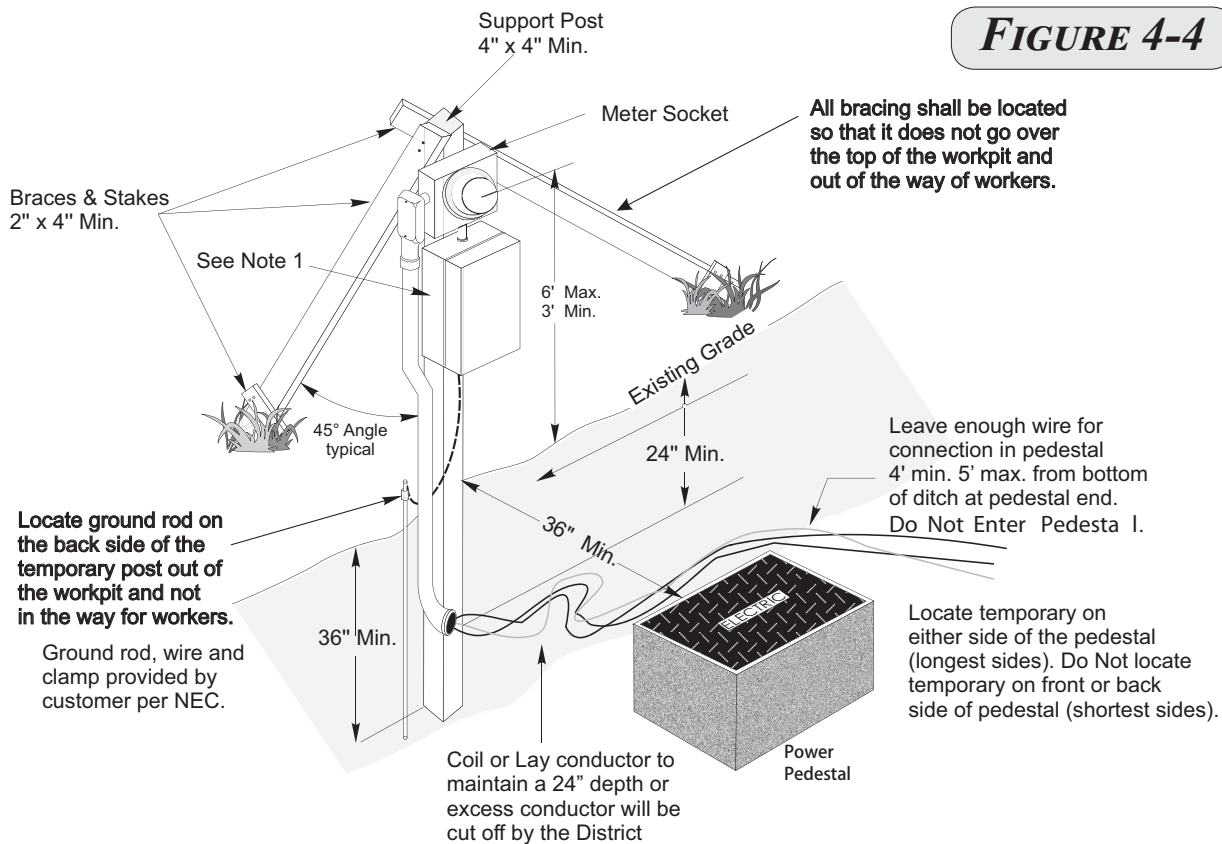
- d. A Hold Harmless Clause will be added to and become part of the power line easement.
5. Conduits terminating in a handhole or vault shall have protective bushings on steel conduits. PVC conduit shall extend 5 inches into the vault and be temporarily sealed with a tapered, manufactured poly conduit plug. The District will install all bell ends on PVC conduit entering vaults, for primary conductors.

## F. TEMPORARY CONSTRUCTION SERVICE

1. The customer shall furnish and install all required equipment.
2. Approved service equipment provided by customer includes support post and bracing, conduit, meter socket, ground rod, conductors, weatherproof disconnect switch and receptacle box.

## Section 4. Underground Service

3. The District Point of Connection shall be at the pedestal or transformer for both residential and commercial temporary installations. The customer shall be responsible for voltage drop between the point of connection and the meter.
4. Temporary post and bracing to be clear of the pedestal and/or transformer with at least a 3 foot minimum distance from the nearest source of power. Refer to Figure 4-4.
5. All temporary installations shall be on private property.
6. The District will not energize service until the installation is approved by the appropriate electrical inspector.
7. The customer shall provide select backfill for the District to use in shading the service conductors after energizing them. Sand shall be required if select backfill material is not available. The select backfill or sand shall provide a 3" bedding below conductors and a minimum cover of 3" above conductors. Refer to Section 1, Page 1-2, Backfill definition. The customer shall backfill the entire temporary service excavation within 24 hours after the District has energized and shaded the service conductors.



Note: It is the responsibility of the developer to maintain the structural integrity of the temporary meter installation. This includes keeping the post and braces upright.

## Section 4. Underground Service

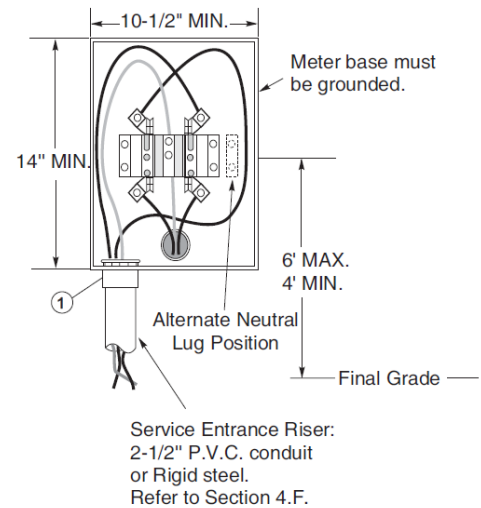
### G. RESIDENTIAL SERVICE EQUIPMENT

1. A meter socket with a minimum capacity of 125 amps is required. Sockets shall be listed for use with aluminum/copper conductors. Typically a 200 amp socket with a 2-1/2" service entrance riser is used, refer to Figure 4-5. The customer's wiring entrance into the meter socket shall be offset from the District's so as not to physically block the source lugs. An oxide inhibitor is required on stranded aluminum conductors of #8 awg or larger for terminal connectors (State of Washington Electric Code requirements).

**Note:** Meter socket may be surface mount or flush mount.

2. For single phase service 201 to 400 amps, a 320 amp meter base with link by-pass is preferred. Refer to Figure 4-7. When current transformer enclosures are used, they shall be installed on the outside of the building and will be those specified in Section 5, Metering requirements.
3. The standard 200 amp service entrance riser shall be a minimum of 2-1/2 inch.
  - a. Schedule 40 PVC is required for normal-duty applications.
  - b. Schedule 80 PVC is required for heavy-duty applications above ground. (hazardous areas, e.g. next to driveways). Refer to section 4.E.d.
4. Secure riser conduit with galvanized pipe straps and lag bolts, a maximum 5 foot spacing.
5. It shall be the customer's responsibility to mount the meter base and riser securely to the building studs or other structural members to provide a solid base for cable pulling.
6. Service riser conduit shall not enter at the center of the bottom of the meter-base but shall be offset to one side.
7. All secondary main and secondary service cable installations shall be installed in continuous Schedule 40 PVC conduit.

Typical 200 Amp Underground Meter Socket



NOTES:

1. Requires double lock nuts and protective bushing on rigid steel conduit.  
P.V.C. plastic conduit requires threaded terminal coupling, one lock nut and protective bushing.
2. Underground service sockets must have a minimum enclosure depth of four inches (4").

**FIGURE 4-5**

## Section 4. Underground Service

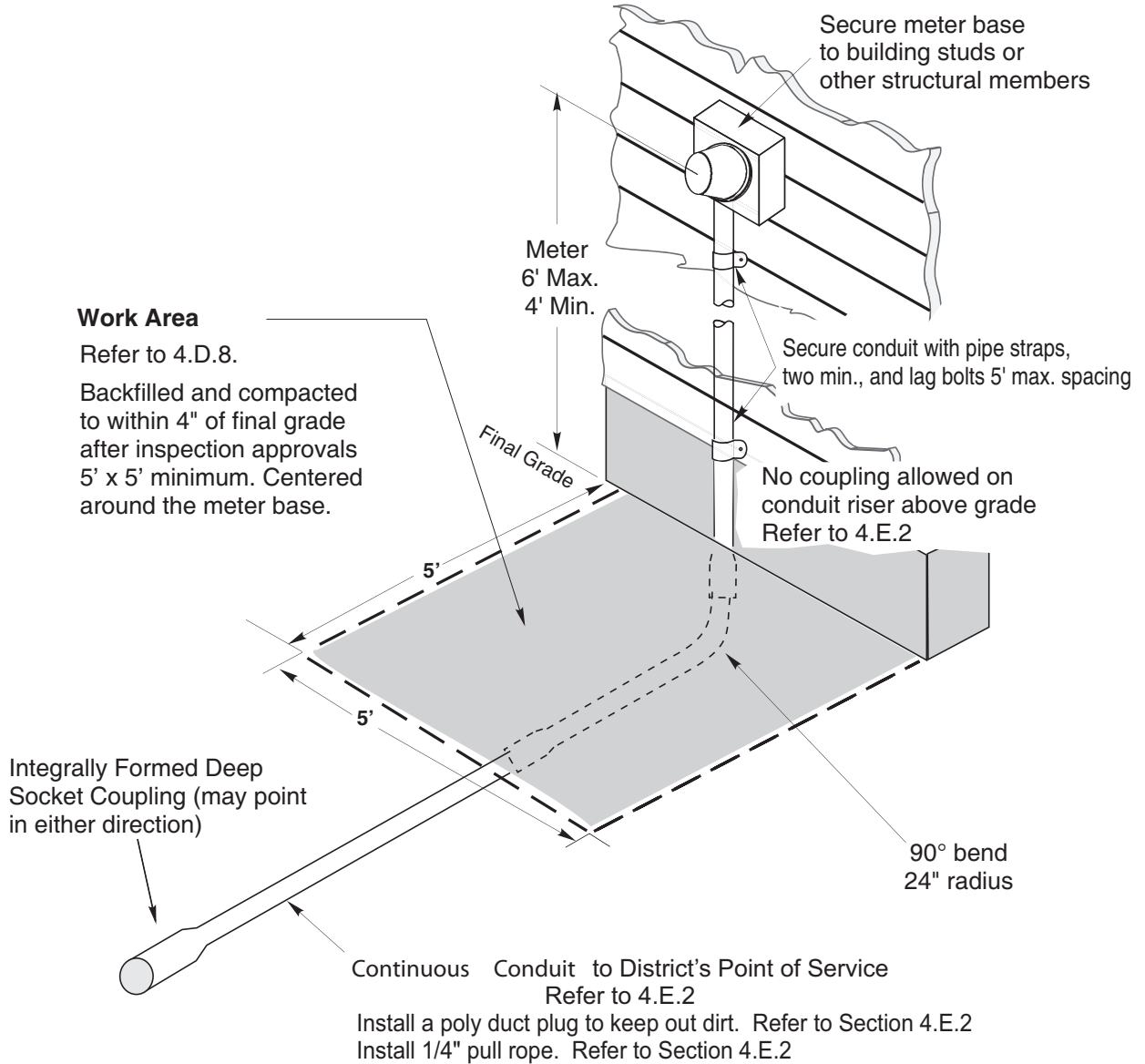
8. All bends shall be Schedule 40 PVC long radius (Refer to 4.E.1.f.). Factory made bends, including "pronto" type bends are acceptable. PVC conduit shall not be mechanically heated in the field to form any sweep (bend).
9. Secondary conduit shall be allowed a maximum total aggregate of 270° of total bends including the riser. All bends shall be long radius type (24 inch minimum).
10. The maximum a continuous service conduit run shall be 250 feet in length, from the meter base to the point of service. Secondary conduit shall be allowed a maximum total aggregate of 270° of total bends including the riser. All bends shall be long radius (Refer to 4.E.1.f.).
12. The customer shall trench all the way to the District pedestal.
13. Install ground per NEC Requirements.

**Note:** *The District must inspect and approve all conduit installations prior to backfilling.*

## Section 4. Underground Service

### TYPICAL 200 AMP UNDERGROUND RISER, 2-1/2" MINIMUM

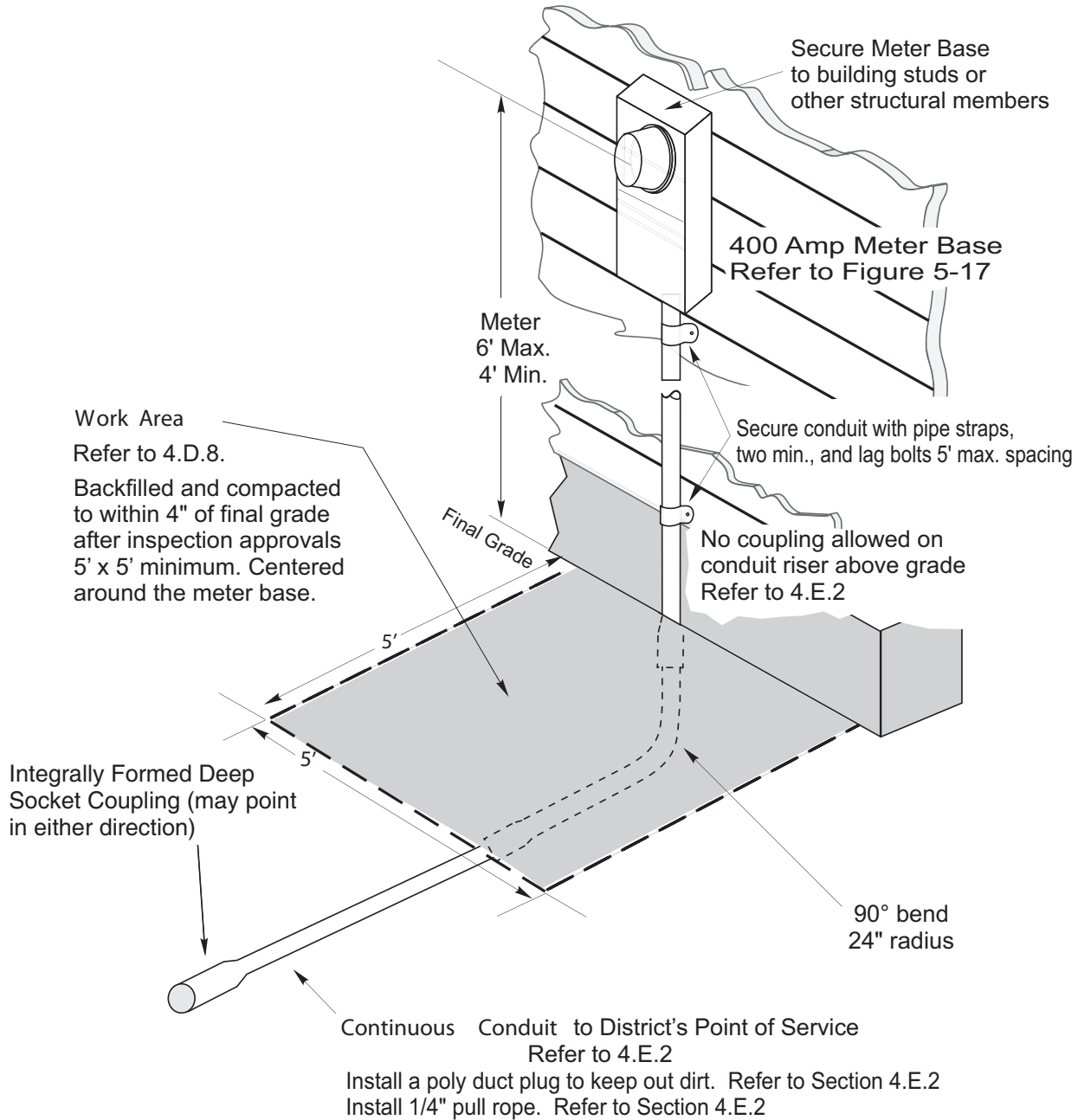
**FIGURE 4-6**



# Section 4. Underground Service

## TYPICAL 400 AMP SELF-CONTAINED METER SOCKET FOR USE WITH A CLASS 320 METER

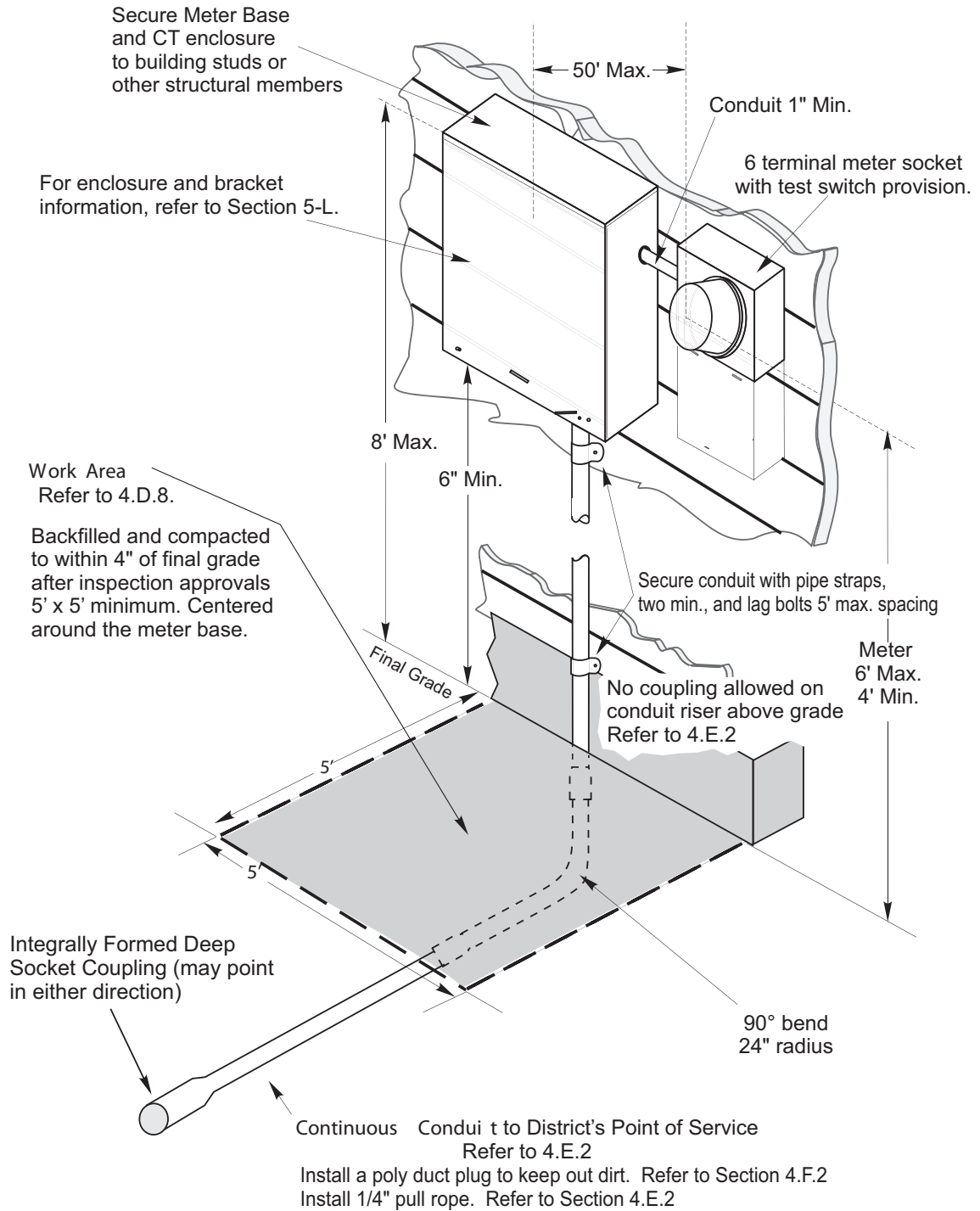
**FIGURE 4-7**



## Section 4. Underground Service

### TYPICAL 201 - 400 AMP CURRENT TRANSFORMER ENCLOSURE, 3" SERVICE RISER MINIMUM

**FIGURE 4-8**

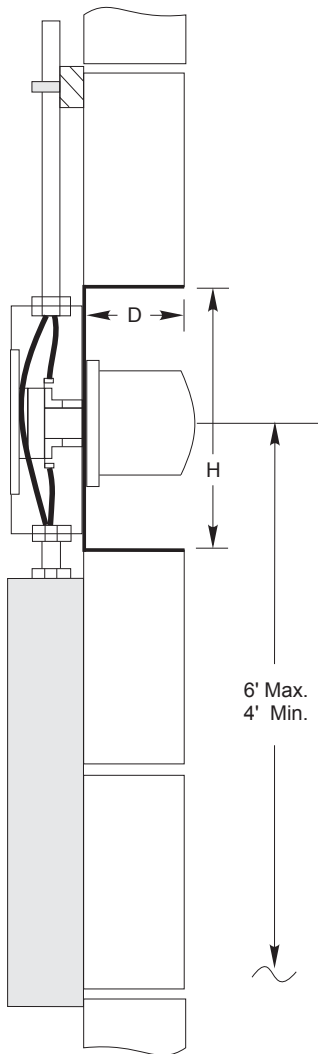


## Section 4. Underground Service

### TYPICAL CURRENT TRANSFORMER ENCLOSURE, 3" SERVICE RISER MINIMUM

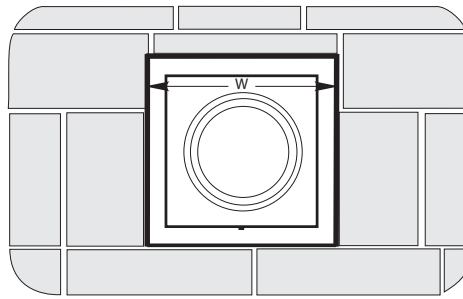
**FIGURE 4-9**

All meters shall be readily removable i.e., not plastered in or built in, and if installed in a recessed opening, the socket shall be trough type. The meter recessed opening shall be as follows with the socket centered therein.



"Ring type meter base required."

Doors over meters are not allowed.



Phase	Metered Voltage	H Height	W Width	D Depth in Front of Socket
Single	240	16 Inch	16 Inch	7 Inch
Poly	240	22 Inch	16 Inch	11 Inch
Poly or Max Demand	480	22 Inch	24 Inch	11 Inch



## Section 4. Underground Service

### H. METER PEDESTAL - 200 AMP & 400 AMP METER SOCKET

1. A factory assembled pedestal must be UL listed and approved or District approved and accepted. It must be set a minimum of 2' in the ground with a concrete pad of 2' x 2' x 3-1/2" poured in place around the pedestal for support. Refer to Fig 4-12, Exhibit A.
2. An on-the-job assembled meter pedestal, which is composed of listed or approved meter socket and conduit or raceways, must be supported by one of several methods. The preferred installation is by using two pieces of Unistrut channel embedded in a 12" diameter poured concrete footing 36" deep. Minimum Unistrut channel acceptable shall be hot dip galvanized 12 gauge steel 1-5/8" x 1-5/8", or District approved equivalent. Also acceptable is using two pieces of 2" hot dip galvanized steel angle iron or 2" hot dip galvanized rigid steel pipe with a 2" hot dip galvanized steel cap embedded in a 12" diameter poured concrete footing 36" deep. The concrete footing should not encase the service riser conduits. Refer to Fig 4-12, Exhibit B and Fig 4-12, Exhibit C. Alternately, the District will accept a fully pressure treated 6" x 6" x 10' wood post set a minimum of 36" deep, however, it is the least desired method since it may not last as long as the other methods. The wood post shall not be encased in concrete, but shall be backfilled with gravel to facilitate drainage.
3. The customer shall install the poured concrete footing, backfill and compact prior to inspection approval and service installation.
4. When the District installs or is to own the service, the conduit shall be 2-1/2" minimum for 200 amp and 3" minimum for 400 amp.
5. Secondary meter pedestals may be used provided they meet the minimum requirements of Section 5. Refer to Figures 4-10 through 4-12.
6. If a disconnect is required per the NEC, the disconnect shall be located on the customer side of the meter.

# Section 4. Underground Service

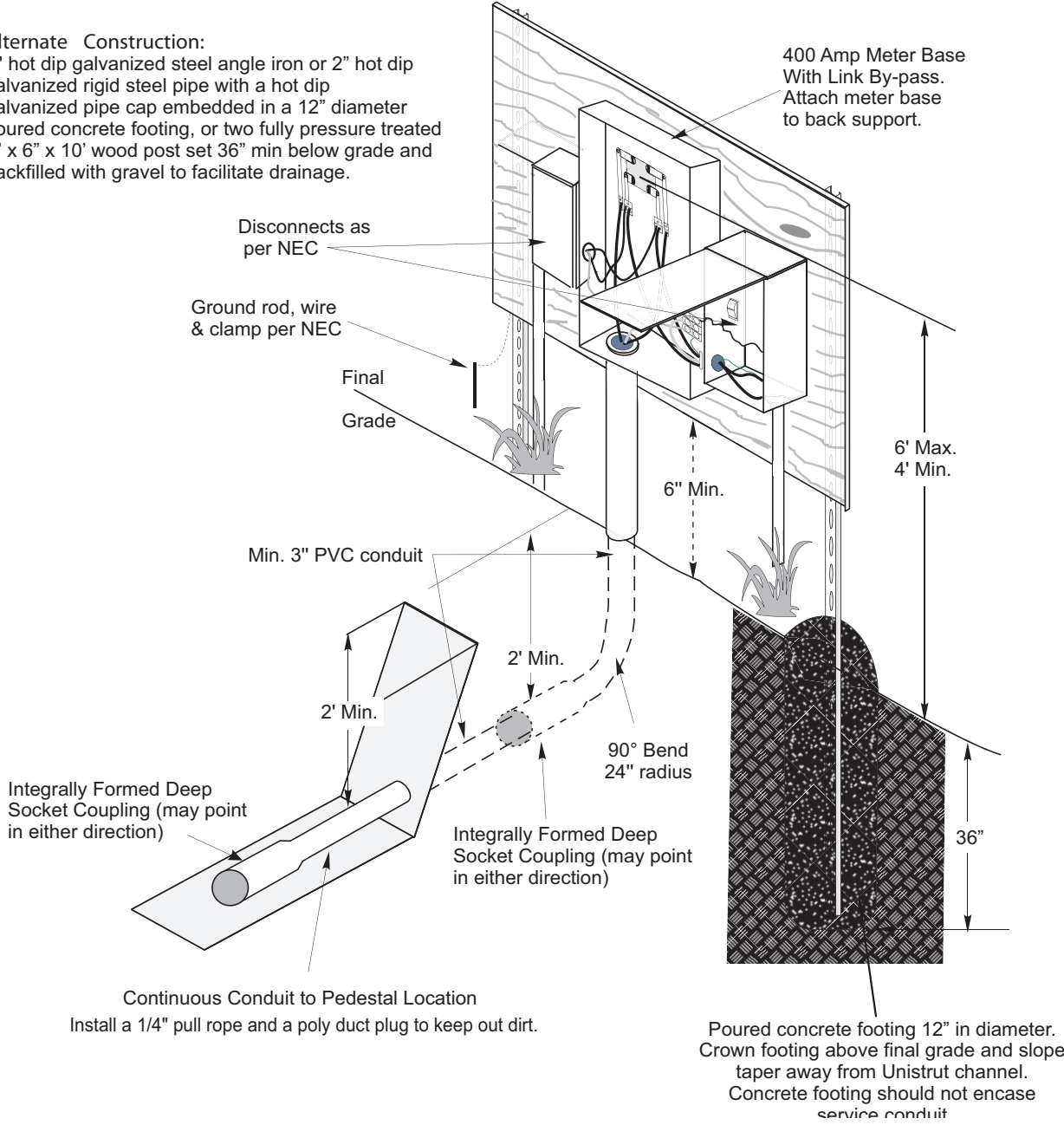
## TYPICAL METER PEDESTAL FOR A 201-400 AMP SELF-CONTAINED METER SOCKET FOR USE WITH A CLASS 320 METER, RISER 3" MINIMUM

Preferred Construction:  
 Bolt service entrance equipment to \*Unistrut channels with two pieces of \*Unistrut crossmembers, two 2" x 6" fully pressure treated crossbeams or 3/4" min. exterior grade plywood. Extend each \*Unistrut leg 36" min. below grade and embed each leg in a 12" diameter poured concrete footing. The concrete should not encase the service entrance conduit.

**FIGURE 4-10**

\*Minimum Unistrut channel acceptable shall be hot dip galvanized 12 gauge steel 1-5/8" x 1-5/8" or District approved equivalent.

Alternate Construction:  
 2" hot dip galvanized steel angle iron or 2" hot dip galvanized rigid steel pipe with a hot dip galvanized pipe cap embedded in a 12" diameter poured concrete footing, or two fully pressure treated 6" x 6" x 10' wood post set 36" min below grade and backfilled with gravel to facilitate drainage.



## Section 4. Underground Service

### TYPICAL METER PEDESTAL FOR A 201 - 400 AMP CURRENT TRANSFORMER ENCLOSURE INSTALLATION, RISER 3" MINIMUM

**Preferred Construction:**

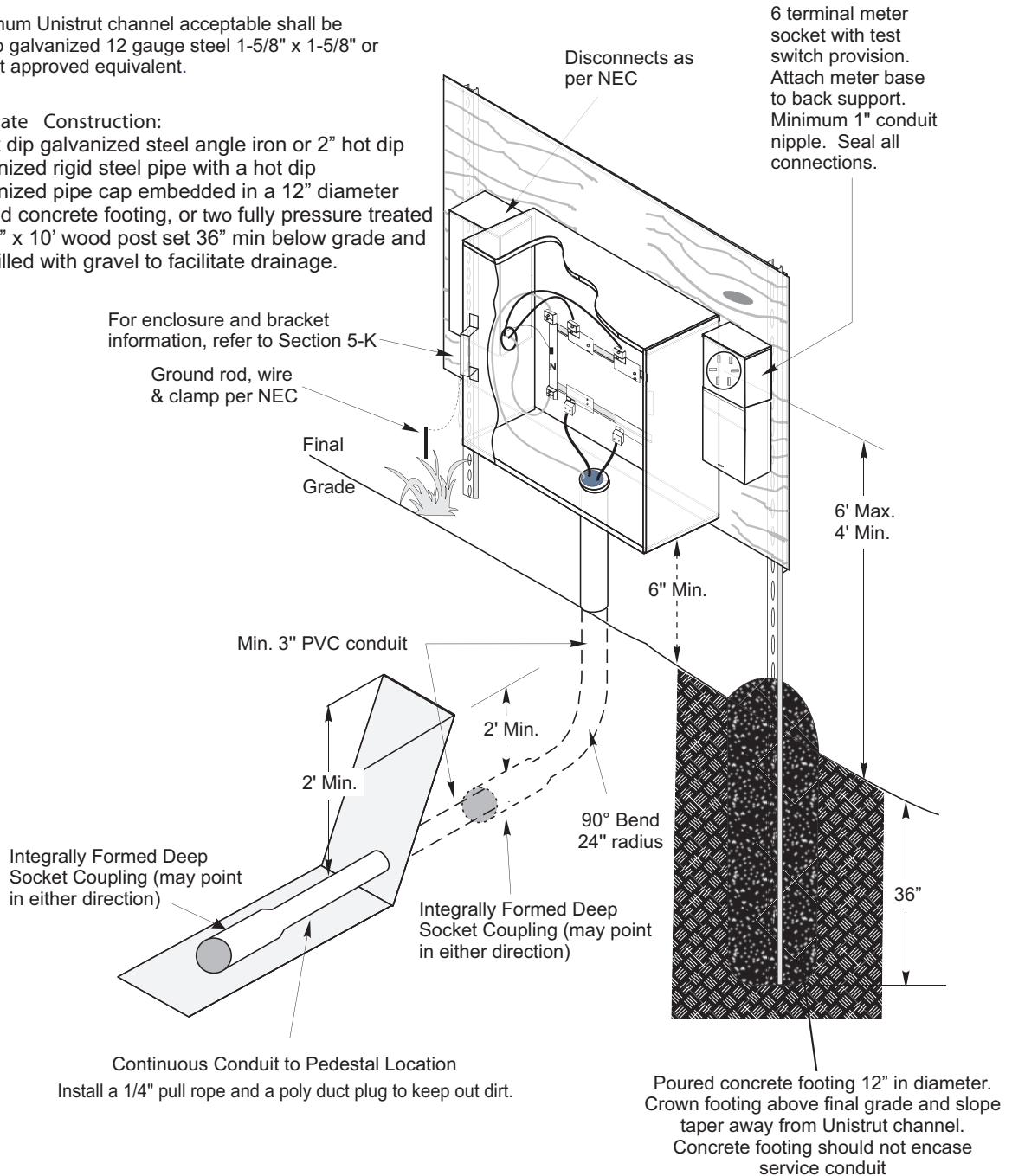
Bolt service entrance equipment to \*Unistrut channels with two pieces of \*Unistrut crossmembers, two 2" x 6" fully pressure treated crossbeams or 3/4" min. exterior grade plywood. Extend each \*Unistrut leg 36" min. below grade and embed each leg in a 12" diameter poured concrete footing. The concrete should not encase the service entrance conduit.

\*Minimum Unistrut channel acceptable shall be hot dip galvanized 12 gauge steel 1-5/8" x 1-5/8" or District approved equivalent.

**Alternate Construction:**

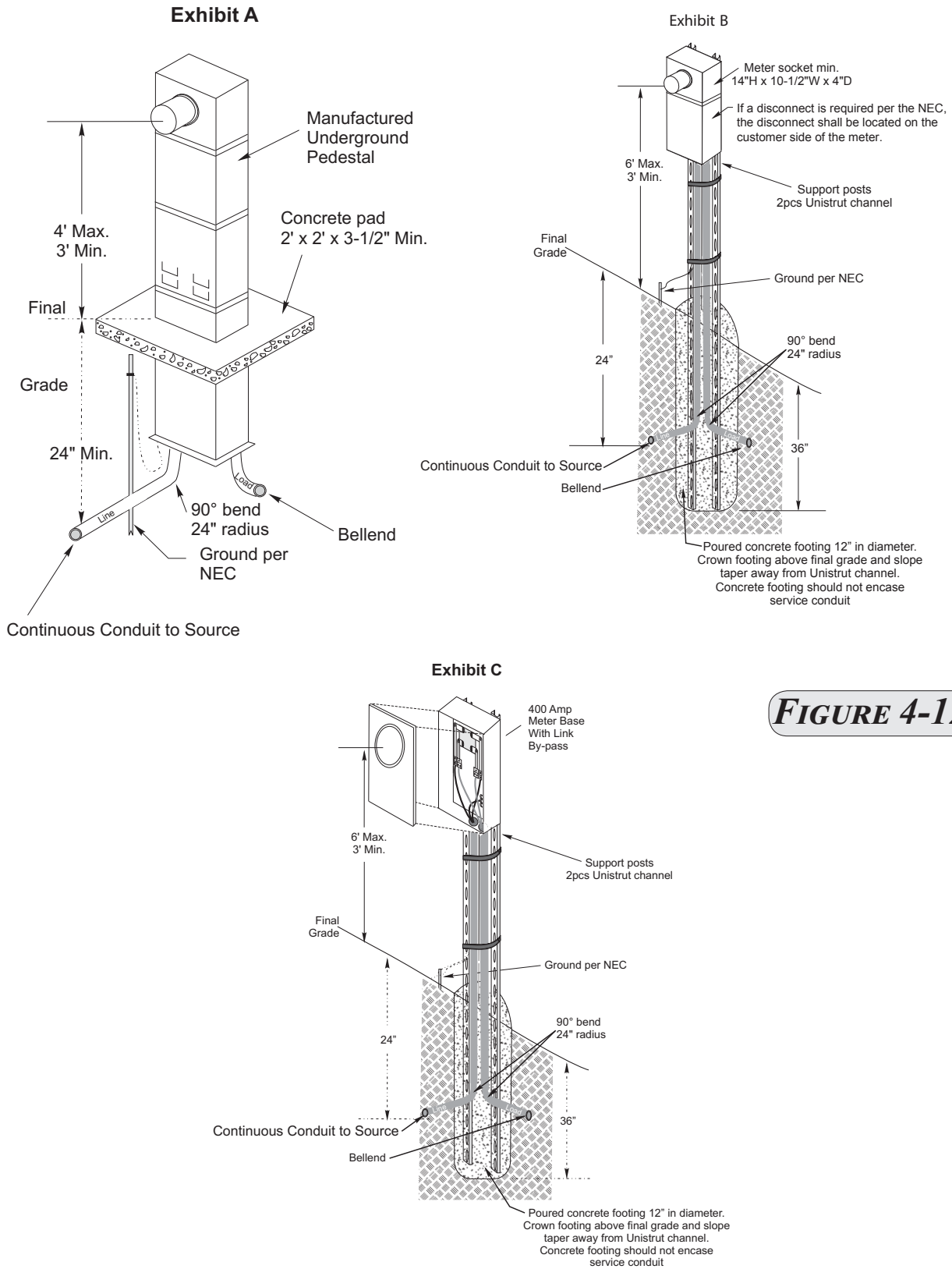
2" hot dip galvanized steel angle iron or 2" hot dip galvanized rigid steel pipe with a hot dip galvanized pipe cap embedded in a 12" diameter poured concrete footing, or two fully pressure treated 6" x 6" x 10' wood post set 36" min below grade and backfilled with gravel to facilitate drainage.

**FIGURE 4-11**



# Section 4. Underground Service

## TYPICAL METER PEDESTAL FOR A 200 AMP & 400 AMP CLASS 320 METER



**FIGURE 4-12**

## Section 4. Underground Service

### I. CONVERSIONS, O/H TO U/G

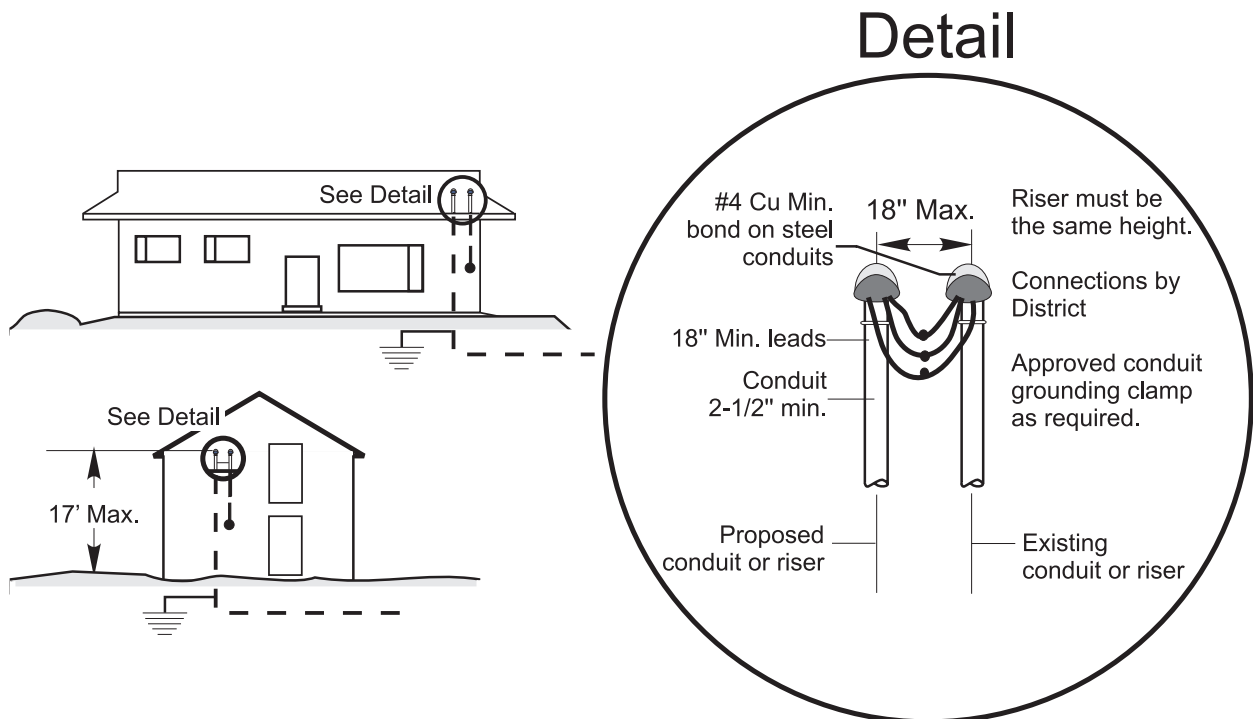
1. In general, overhead to underground service conversions require individual attention on specific requirements.

**Note:** The NEC requires that, where necessary, existing breakers, switches, panels, etc. must be upgraded to present requirements. Contact the State of Washington Department of Labor and Industries or the appropriate governmental agency for specifics.

2. The underground service equipment installation shall comply with District requirements for a new service.
  - a. An underground riser conduit may be extended up to match the height of the existing overhead mast. This new riser must be within 18 inches of the existing mast. Refer to Figure 4-13.

### TYPICAL SERVICE RISER CONVERSION

**FIGURE 4-13**



## Section 4. Underground Service

- b. Existing 200 amp surface-mounted meter bases, may be converted by installing an underground service riser conduit into the bottom of the meter base for installation of new underground service conductors. Refer to Figure 4-14.

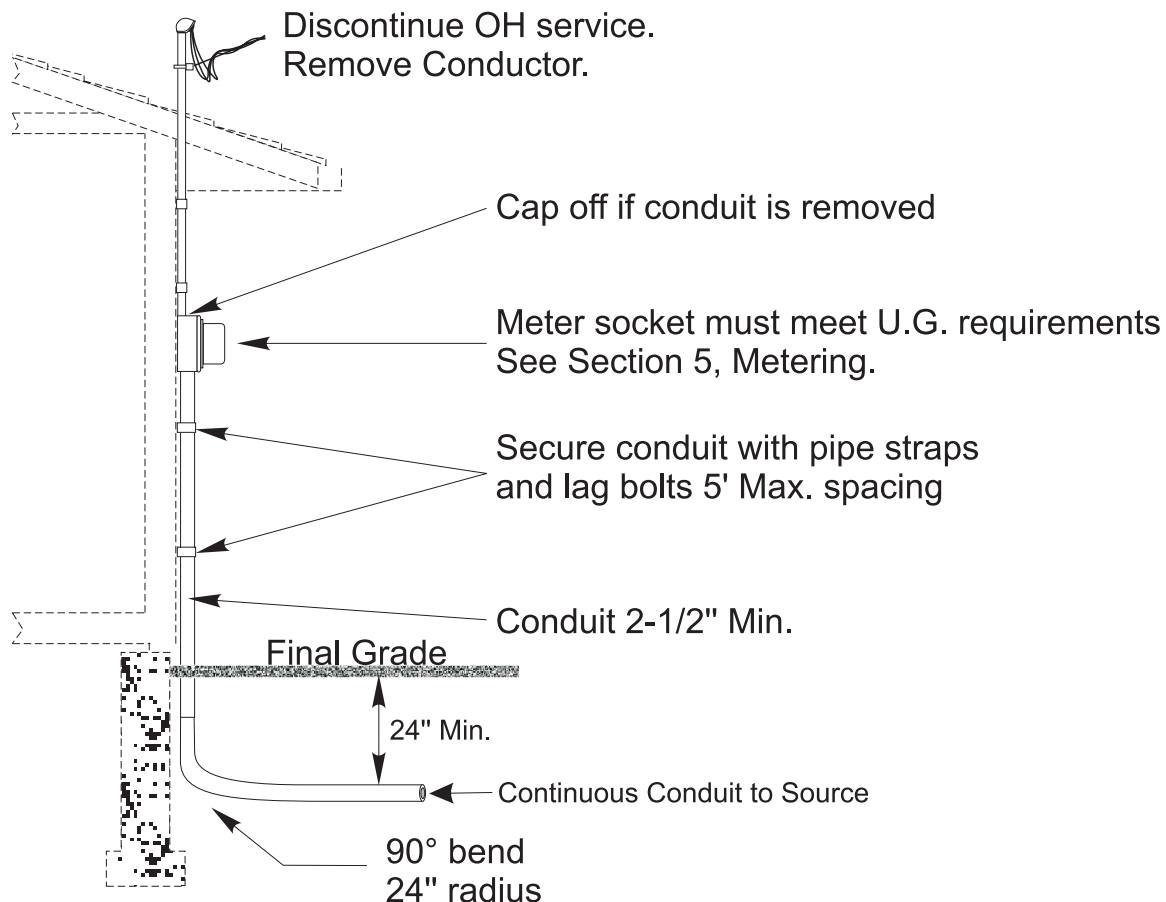
**Exceptions:** The following conditions must apply:

- 1) Conduit must enter to one side of the bottom, not the center.
- 2) Meter base must be a minimum size of 10-1/2" wide, 14" tall and 4" deep.

### TYPICAL METER BASE CONVERSION

Coordinate with the District

**FIGURE 4-14**



## Section 4. Underground Service

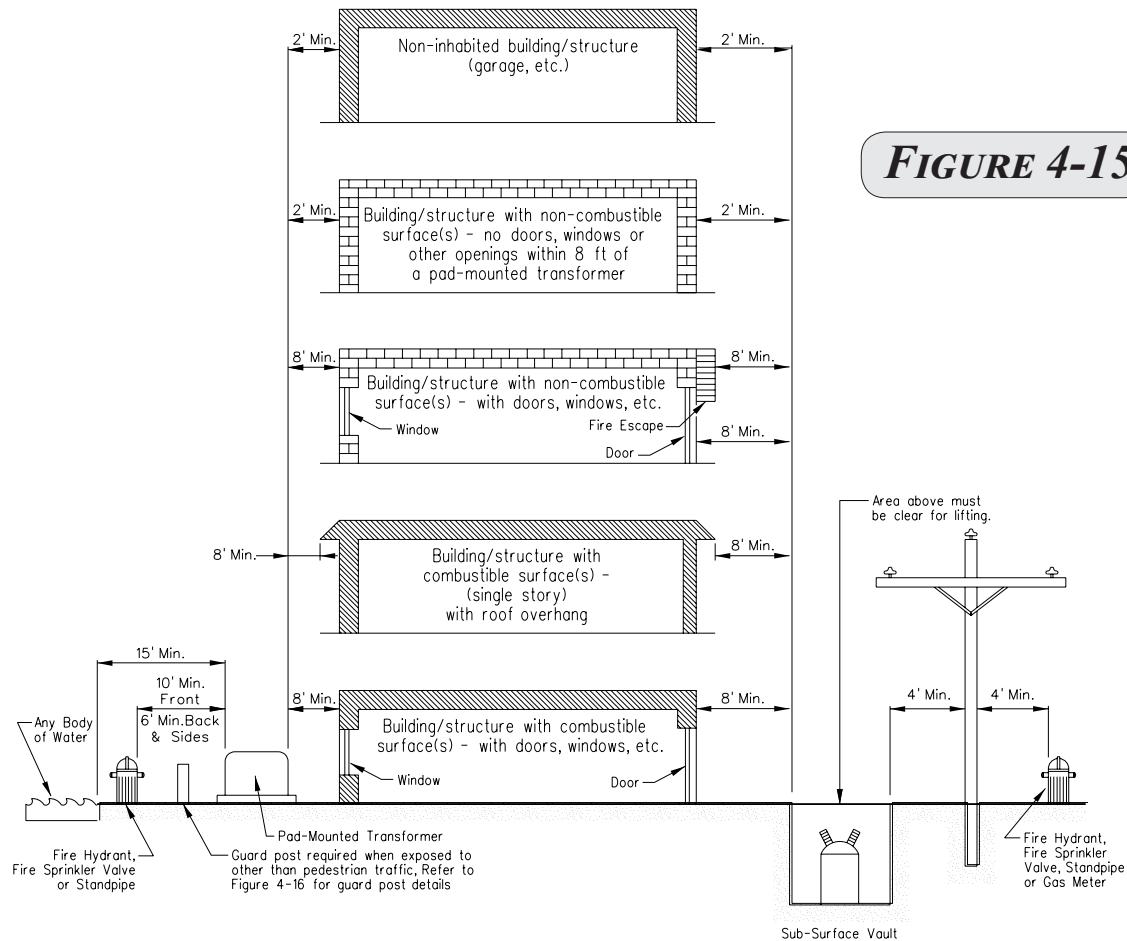
### J. COMMERCIAL/APARTMENT SECONDARY PEDESTALS

1. The District shall install, own and maintain a pedestal on private property (normally at a property corner) as a source of secondary service to commercial or apartment buildings.
2. The customer may be required to install an additional vault for secondaries to terminate in non-standard installations.
3. The customer shall install, own and maintain all secondary service conductors on private property.
4. The District will make all secondary connections in the pedestal, provided that the customer-installed conductors are compatible with the District's stock connectors.
5. A maximum number of secondary connections per phase shall be coordinated with the District.
6. Allowable conductor sizes shall be:  
**Aluminum or Copper:** #2 to 750 kcm
7. If, through variance, other conductor sizes are allowed the customer shall be responsible for providing the required connectors, their installation and any future maintenance. Refer to Section 2, Variance Application.
8. The District will determine when the quantity and/or size of the secondary service conductors exceeds the practicality of a pedestal-type installation.

### K. PADMOUNT TRANSFORMER EQUIPMENT, CLEARANCE

1. The customer shall be responsible for maintaining access to and clearance around all District-Owned padmount equipment. Refer to Section 2-O for access and Figure 4-15 for clearances.
2. Guard posts shall be furnished and installed by the customer when padmount equipment is located within an area of vehicular traffic (WAC 296-46B-450). The District shall determine the number and location of all guard posts. Refer to Fig. 4-16.

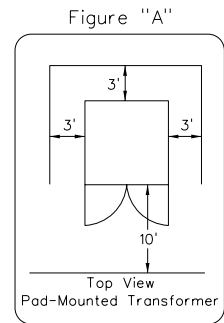
## PADMOUNT TRANSFORMER EQUIPMENT, CLEARANCE



**FIGURE 4-15**

**Notes:**

1. All measurements are from the nearest metal part of the transformer.
2. For variations and reduced clearance options, consult Engineering Standards.
3. References: WAC 296-46B-450 and NESC 127.
4. Some examples of non-combustible building/structure surfaces are brick, concrete, steel, stone and fiber-cement siding material that complies with ASTM E136, such as Hardiplank®.
5. A 3 ft minimum clearance is required between transformers and natural gas connections, valves, gauges or meters.
6. Transformers shall not be located within 20 ft of fuel storage tanks or fueling points for highly combustible liquids or gases (e.g., service station gasoline pumps and tanks, propane bulk dispensing tanks, etc.).
7. Transformers shall not be located within 10 ft of self-contained emergency diesel generators, or diesel fuel storage tanks or fueling points for emergency generators.
8. Enclosures for total underground mineral oil filled transformers, e.g., sub-surface vaults, must not be located within 8 ft of a doorway, operable window, stairway or fire escape. Adequate space must be maintained above the enclosure so that a boom may be used to lift the transformer from the enclosure.
9. Location of pad-mounted equipment shall not be more than 15 ft from access road or driveway.
10. Finish grade at the transformer location must be such that leaking oil will flow away from the building.
11. A clear and level working area shall be maintained in front of the transformer.
12. Refer to Figure "A" for minimum working space requirements around pad-mounted transformers located in areas with obstructions such as fences, walls, trees and shrubs. Landscaping which does not interfere with the installation, removal, operation and maintenance of the transformer may be allowed within the working space.

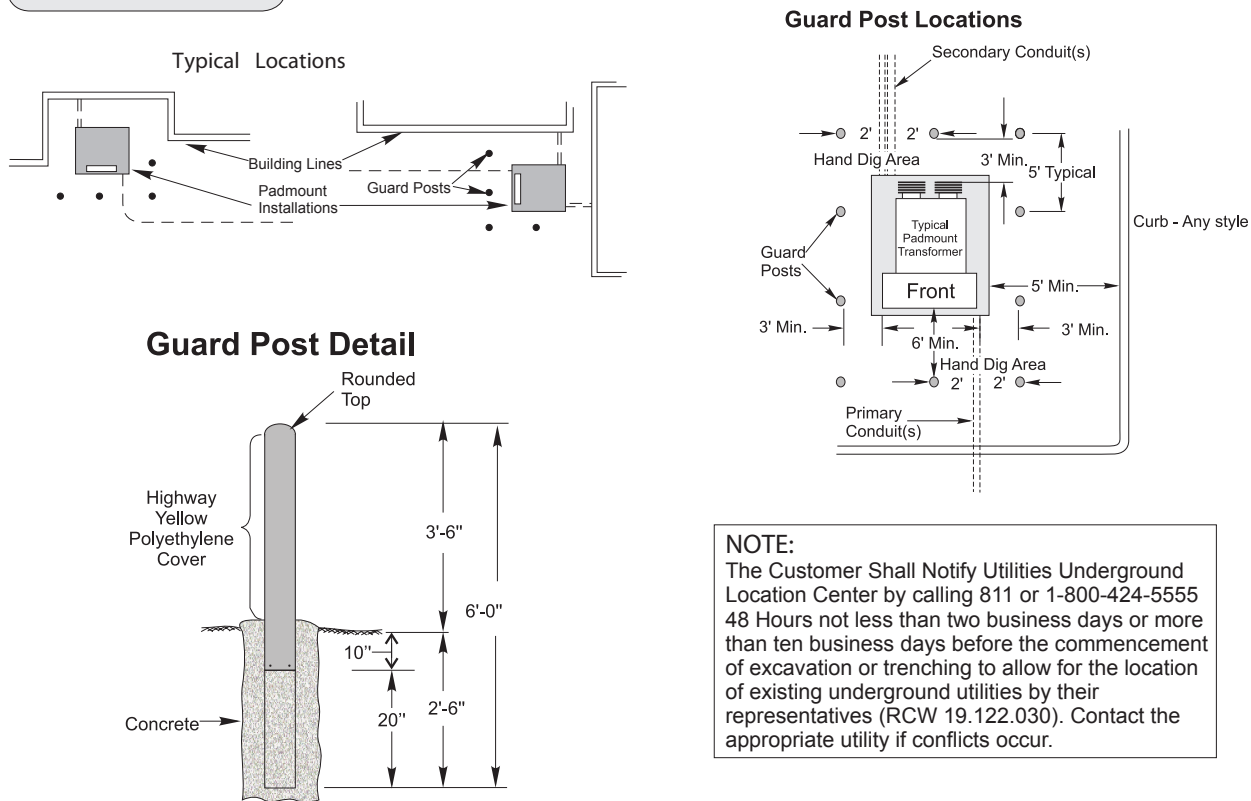




## Section 4. Underground Service

**FIGURE 4-16**

### Transformer Guard Post Locations



Guard posts are required by the State of Washington Electrical Inspection Division (WAC 296-46B-450) when transformers are located where exposed to vehicular traffic or other mobile type machinery.

Guard posts shall be furnished, installed and maintained by the contractor/customer at no expense to the District. The District shall determine the number and establish the locations of all guard posts. The exposed portion of the post shall be painted highway yellow or have a highway yellow thermoplastic polyethylene bumper post sleeve securely installed over the post.

Two types of guard posts are accepted by the District. One type is a 6" x 6'0" steel pipe set in and filled with concrete. Another type is a 6" x 6'0" or a 9" x 6'0" precast steel reinforced concrete post set in concrete.

Reinforced concrete posts can be purchased from Cuz Concrete, Arlington, WA or Utility Vault Company, Auburn, WA.

Bumper post sleeves can be purchased from Ideal Shield, 888-308-7290, or online at [www.idealshield.com](http://www.idealshield.com).

Refer to figure 4-16 above for clearances to padmount equipment.

## Section 4. Underground Service

### L. CONNECTION TO PADMOUNT TRANSFORMERS, SECONDARY CABINETS, SECONDARY HANDHOLES OR SECONDARY PEDESTALS:

1. Under no circumstance shall the Customer penetrate the wall of an existing energized vault with either conduit or conductor. Only District personnel are authorized to penetrate into an existing energized vault.
2. The District shall make all primary and secondary connections on District owned transformers, secondary cabinets or secondary pedestals.
3. For commercial installations the customer shall install, own and maintain all secondary conductors from the service location to the secondary termination handhole. A minimum length of 15 feet of secondary cables per leg for vault sizes 4'8" x 4'8" or a minimum length of 25 feet of secondary cables per leg for vault sizes larger than 4'8" x 4'8" shall be provided inside the vault, sealed and identified.

For a Single or Duplex family residence, after the customer provides the conduit(s), trench and backfilling the District will own and maintain the secondary service conductors. In some installations these conductors may be provided and installed by the District or by the customer.

4. The District's engineer shall determine if J-boxes are required for a particular job. If J-boxes are needed, in addition to the vault requirements identified below, the customer shall provide a 4'8" square x 3'6" deep vault with a 4'8" square diamond plate lid to house the J-boxes.
5. Acceptable conductor sizes:

<b>Commercial:</b>	<b>Aluminum or Copper:</b>	#2 to 750 kcmil
<b>Residential:</b>	<b>Aluminum Triplex:</b>	1/0, 4/0 AWG or 350 kcmil

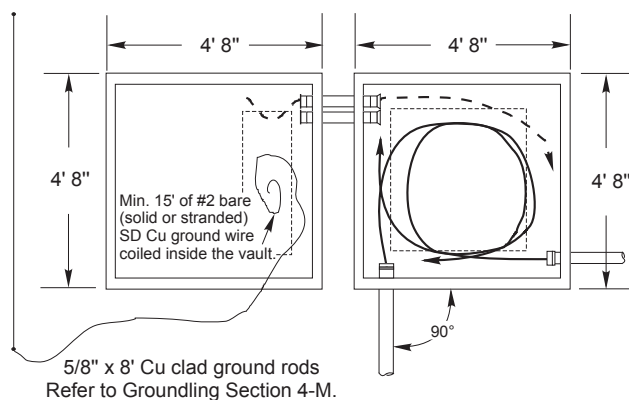
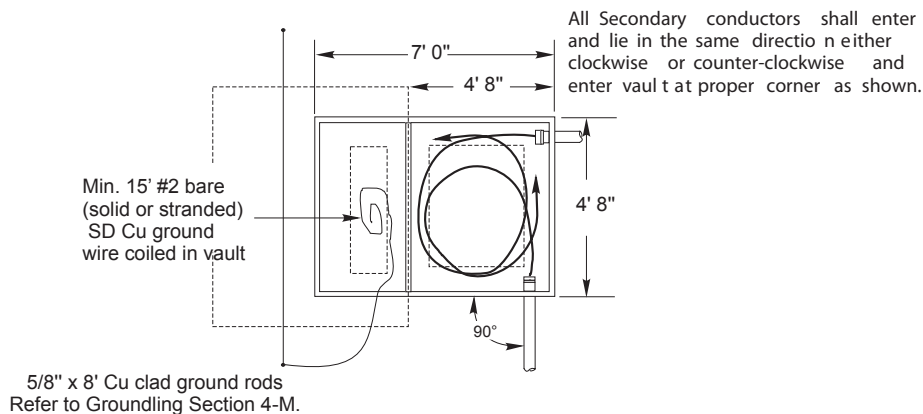
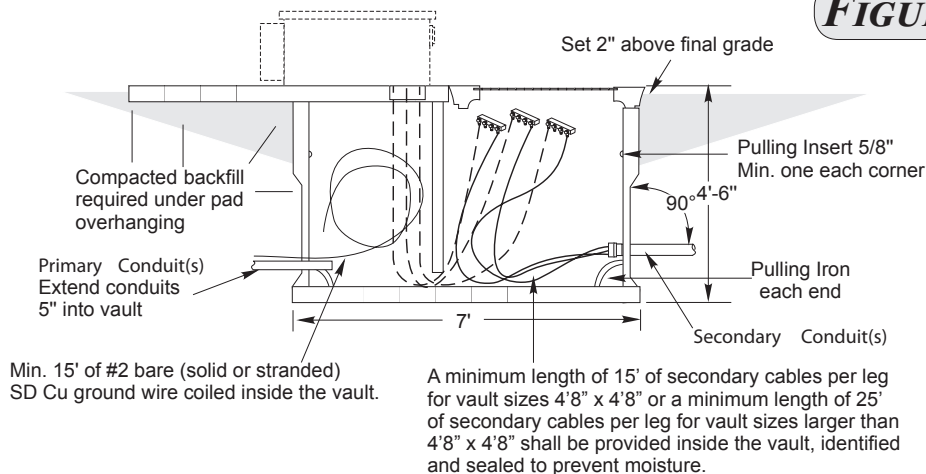
6. Acceptable conductor type:  
**600V XLP Type USE-2:** Cable with ruggedized insulation is not acceptable
7. In certain cases it may be acceptable to connect single customer-owned service conductors directly to the low voltage terminals of a padmount transformer. Consult with the District's engineer to determine allowable cases. The vault option(s) and maximum number of secondary connections allowed per leg shall be as follows in Table 2 and Table 3. Consult with the District's engineer for acceptable vault option(s) prior to proceeding.
8. For commercial installations the customer shall install, own and maintain a secondary handhole adjacent to the transformer vault. The District will install conductors from the transformer to the secondary handhole and make all of the connections in that handhole.
9. For residential installations the secondary conductors from the transformer vault to the secondary terminations pedestal shall be installed, owned and maintained by the District.

## Section 4. Underground Service

10. The customer shall furnish and install the required conduit(s) between the transformer vault and secondary handhole(s).
11. All secondary conductors shall enter and lie in the secondary handhole(s) or compartment in the same direction, either clockwise or counter-clockwise without conflicting with each. Refer to Figure 4-17 for typical samples.

### SECONDARY TRAINING IN VAULTS

**FIGURE 4-17**

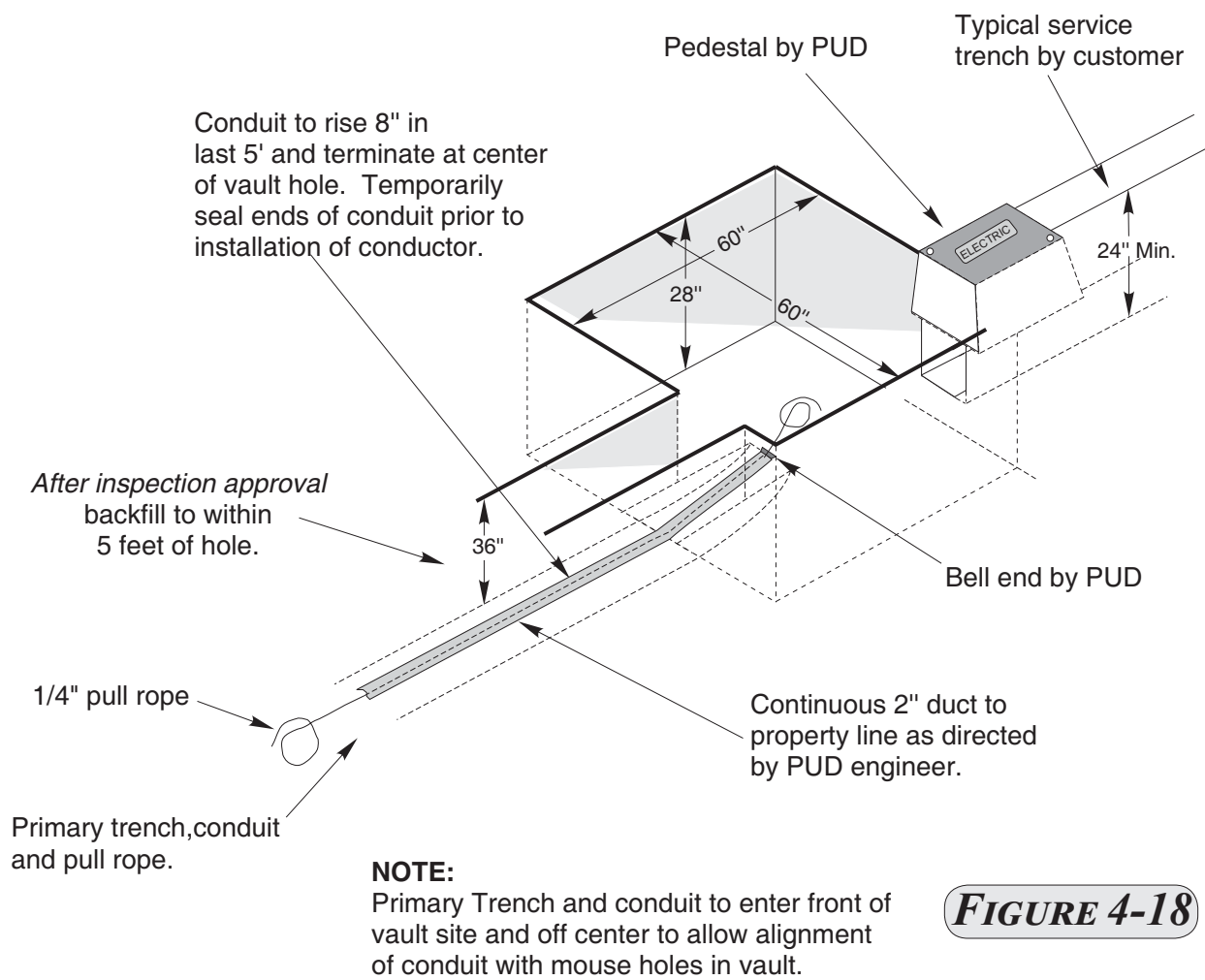


## Section 4. Underground Service

### M. CONCRETE VAULTS, PADS AND HANDHOLES

When a vault is installed in areas where it may be exposed to pedestrian foot traffic a slip-resistant SlipNot type coating is required on the vault cover.

1. Residential customer vault site preparation.
  - a. The customer shall prepare the vault site in accordance with Figure 4-18.
  - b. The District will provide and install the vault, ground rods, ground wire and secondary service pedestal.
  - c. The vault hole shall be plumb, level and square.
  - d. The customer shall install the primary and the secondary conduits and pull ropes. The customer shall seal all ends with tapered, manufactured poly conduit plugs to keep out dirt prior to the installation of conductors.
  - e. After inspection and approval, the customer shall backfill the trenches prior to the installation of the electrical system.



## Section 4. Underground Service

2. Commercial Vault Installation Requirements
  - a. Specific job requirements will be determined by the District's engineer.
  - b. There shall be no express circuits allowed through vaults.
  - c. All vaults shall be designed and installed in a manner such that water from the vault will drain into an acceptable outlet. Water shall be all that is drained or pumped from vaults into acceptable outlets. Unacceptable outlets are salmon streams and storm drains. Vault drains shall not connect to storm drains, nor shall storm drains empty into a vault.
  - d. All vaults shall be installed to allow for the following minimum safe working clearances:
    - *Padmount Transformer Vault: 10' in front and 3' on the rear or either side.*
    - *Secondary Cabinet Vault: 4' on all sides.*
  - e. All transformer and switch cabinet vaults shall be set so that their lids are 2 inches above final grade. Switching vaults and secondary handholes may be set at final grade.
  - f. Two ground rods with 1/0 stranded bare copper wire installed a minimum of 6' apart are required at all secondary cabinet vaults.
  - g. Two ground rods shall be required if installation is at the end of a lateral. They shall be installed a minimum of 6 feet apart.
  - h. Fifteen feet of copper ground wire (solid or stranded) shall be left coiled inside the vault.
  - i. All secondary conductors entering the handhole shall be protected at minimum by a piece of PVC conduit. This conduit shall be permanently sealed around its exterior and interior with cement grout.
  - j. All secondary conductors shall be labeled as to what they serve.
  - k. All secondary conductors shall extend a minimum length of 15 feet of secondary conductor per leg for vault sizes 4'8" x 4'8" or a minimum length of 25 feet of secondary conductor per leg for vault sizes larger than 4'8" x 4'8" shall be provided inside the vault, identified and sealed to prevent moisture.
  - l. Conduit shall enter the vault perpendicular to the vault walls which they are entering, and in a manner that ensures that all conductors can be trained to lay in the same direction (clockwise or counter-clockwise) and also in such a way as not to interfere with other conduit entrances. Refer to Figure. 4-17.
  - m. Conduit shall not enter at same corners of a vault.
  - n. Typically, conduit for primary conductor shall use lower knockout only, conduit for secondary conductors shall use upper knockout only, however, multiple conduit requirements shall use both upper and lower knockouts.

## Section 4. Underground Service

- o. Conduit for secondary jumpers shall be installed by the contractor between the transformer vault and the secondary handhole. The size and quantity will be determined by the District's engineer.
- p. Cement grout is required to seal all holes and around all conduits. Refer to Figure 4-19.
- q. Padmount cover specifications vary with the size of the padmount transformer or switch cabinet to be used. The District's engineer will specify cover size, access hole size and location.
- r. When a handhole is used as a primary switching vault, a lid with a diamond plate access cover is required. Access opening size will be specified by the District's engineer.
- s. Vaults and covers shall be located and oriented so that proper door clearance from buildings/obstructions may be maintained. Refer to Section 4-K.
- t. Bell ends are required on all commercial secondary conduits. The length of the conduit shall protrude into the vault just long enough to accommodate the bell end. The District will install the bell ends on the primary conduits.
- u. Pulling irons, one at each corner, are optional for secondary vaults.
- v. Pulling irons, one at each corner, are acceptable but not required in primary vaults unless specified by the District for a particular situation. Refer to Figure 4-19.

**Exception:** Pulling facilities are not required on J-Box or Open Bottom vaults. Refer to Figure 4-22 & Figure 4-23.

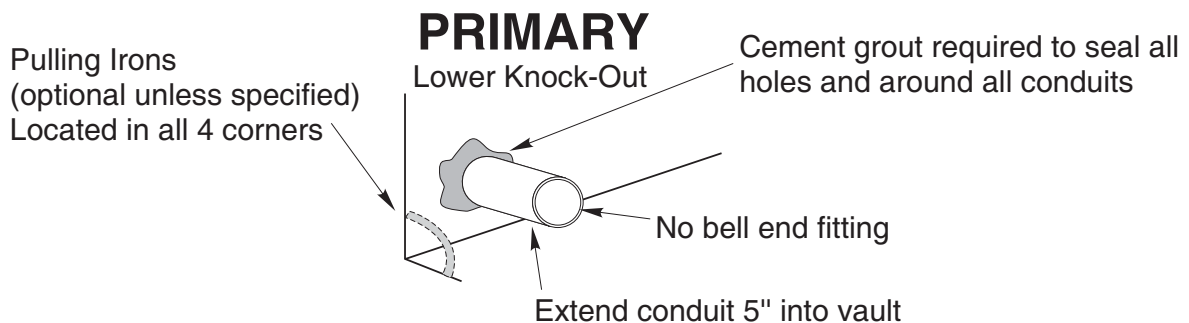
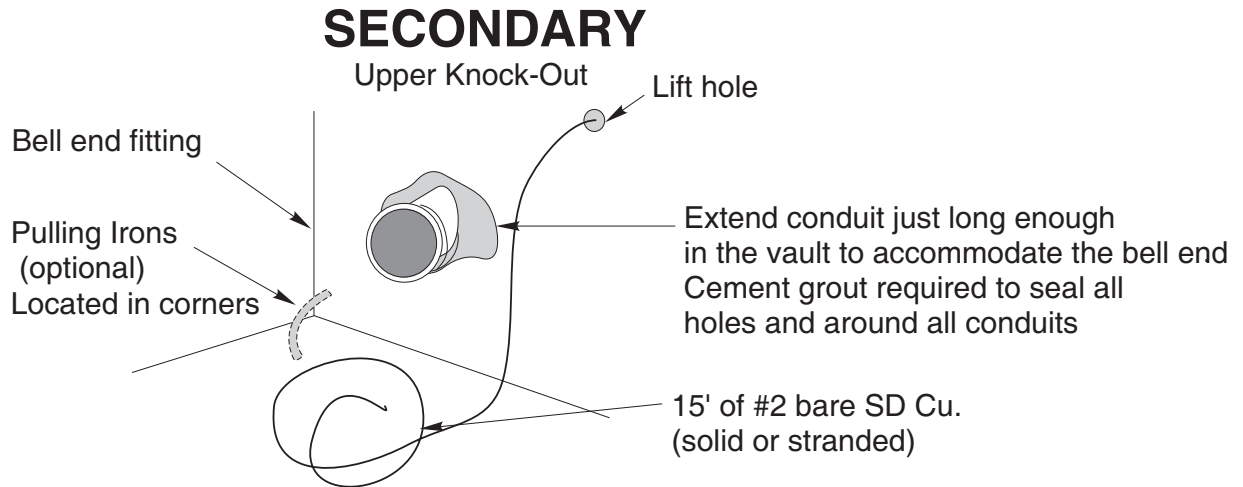
### 3. Identification

To identify their function, the word POWER, or ELECTRIC, shall be neatly and permanently marked in plain uppercase letters on the covers of subsurface electrical vaults and handholes that do not have pad-mounted equipment mounted on them. Letters shall be a minimum of 2" and a maximum of 3" in height. Letters shall be inscribed in the concrete cover or embossed on the metal door (where applicable). The identifying word shall be squarely in alignment with a vault edge for a neat appearance and shall be placed in a consistent location from one cover to the next. Where practical, the identifying word shall be aligned so that it can be read from the front of the vault, that is, from the side of the vault where the door latch or vault tag is located.

## Section 4. Underground Service

### CONDUIT ENTRANCE AND GROUTING

**FIGURE 4-19**

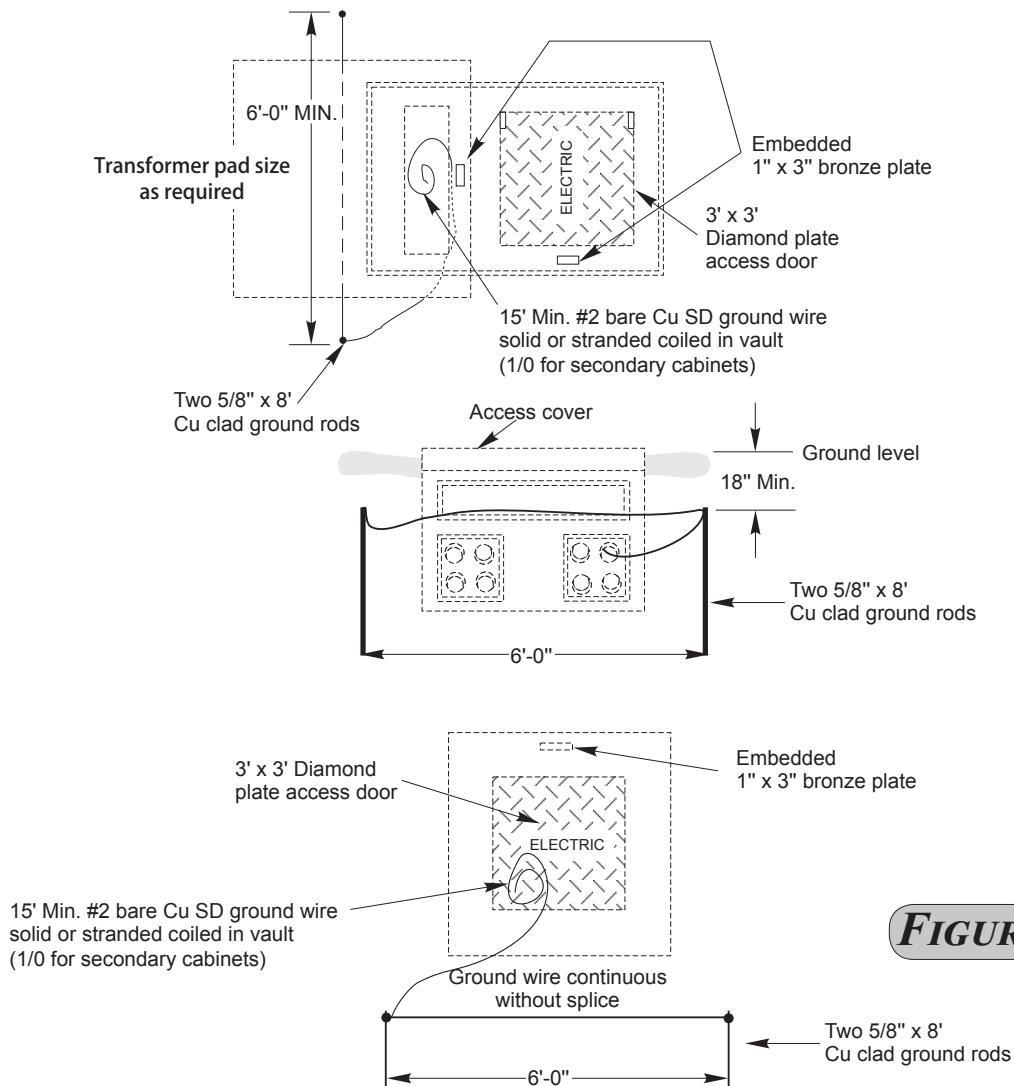


**NOTE:** Only District personnel are authorized to penetrate into an existing energized vault.  
Under no circumstance shall the Customer/Contractor penetrate the wall of an existing energized vault with either conduit or conductor.

## Section 4. Underground Service

### N. GROUNDING

1. Only one ground rod with #2 bare copper ground wire is required at each transformer vault when there is more than one vault in succession.
2. Two ground rods are required if installation is at the end of a lateral (the end vault). They shall be installed a minimum of 6 feet apart.
3. Two ground rods are required at all j-box vaults. They shall be installed a minimum of 6 feet apart. Refer to Figure 4-20.
4. Four ground rods are required at all feeder switch cabinet vaults and splice vaults. Refer to T&D Compatible Unit N0321 for grounding details.
5. Two ground rods with 1/0 stranded bare copper wire are required at all secondary cabinet vaults. They shall be installed a minimum of 6 feet apart.



**FIGURE 4-20**



## Section 4. Underground Service

### O. VAULT ROOMS

Customer-furnished transformer vault rooms shall be submitted to and approved by the District **prior to construction**, in full compliance with NEC Articles 110 and 450, for each individual installation and in accordance with the minimum requirements listed below:

1. The size of the transformer(s) shall determine the size of the vault, size of oil entrapment sill or sump, access size and amount of ventilation required.
2. If the vault room is equipped with a drain, then provisions must be made for oil containment and recovery. Vaults without drains shall include a 12" diameter by 12" deep sump with a metal grate cover (Olympic Foundry inlet grating No. 3300 or District approved equivalent). The sump shall be placed within reach of the vault entrance but outside the path for installing or replacing the transformer. The vault floor slope toward the sump shall be one half inch per ten feet. A removable oil sill shall be located behind the vault entrance. The sill shall be a minimum of 4 inches tall (but no greater than 8 inches), shall be constructed of angle-iron, painted yellow, and securable to the vault wall with threaded inserts.
3. The vault walls, floor and ceiling shall be minimum 6 inch reinforced concrete and minimum 3-hour fire rated.
4. The room shall be illuminated by a minimum of 3 permanent fixtures and positioned so that all sides of the transformers are illuminated and arranged so that qualified individuals may change lamps or make repairs without violating the 2 foot minimum clearance requirement from energized primary conductors and equipment. There shall be a minimum of 10 foot candles. The light switch shall be installed within easy access of the vault entrance. Two duplex outlets shall also be installed on opposite ends of the vault walls. The first duplex outlet in the circuit shall be a ground fault interrupter. Outlets shall be installed at a minimum height of thirty-six inches (36") above the floor. Overcurrent protection shall be provided via a customer installed 30 amp Square D QO load center with one 20 amp single pole QO breaker. Power for this circuit will be supplied directly from the District's transformers.
5. Permanent pulling irons shall be provided opposite primary duct entrances.

## Section 4. Underground Service

6. 3-hour fire door(s) shall be provided in accordance with NEC 450 and a heavy duty panic bar exit device (*Precision No. 4R0FL5103-603, 703A or 808A trim*) and heavy duty automatic door closure (*Stanley No. D-4550- Std.*) shall be installed on the door(s). Key boxes and/or other panic bar and automatic door closures from alternate manufacturers are not acceptable. The door shall open towards egress of the room. During the construction phase, the panic bar exit device shall be equipped with a BEST Access Systems construction core on the outside of the door. When the vault room is ready to be energized, the District will furnish and change the construction core out to a District's "P" tumbler series which will then accept only the District's master "P" series key. The locking system shall limit access to qualified District employees only and not allow access to unqualified individuals (WAC 296-307-36230).

For lock, automatic closure and exit bar device information contact:

**Contract Hardware, Inc**  
**Attention: Kelsey Nicholls**  
**12100 NE 195th St. Suite 250**  
**Bothell, WA 98011**  
**Phone: 1-206-298-4770**  
**Fax: 1-206-298-4777**

7. The owner and his/her agents and/or the homeowners association of the building shall be responsible to install, retain and maintain the District's required BEST knobset, panic bar exit device and automatic door closure for the life of the service to the premises or the electrical service to the building will be subject to disconnection. Should any maintenance or replacement of this customer owned equipment be necessary an authorized District employee shall assist the customer with the work.
8. The District shall furnish and install a sign on the exterior door stating "Electrical Vault Room". In multiple unit complexes, the customer shall provide building identification signage.
9. Transformer vault rooms must meet or exceed requirements of the applicable laws and noise ordinances of the Washington Administrative Code.
10. Foreign pipes and ducts shall not enter or pass through transformer vaults (NEC 450).
11. A specific easement is required that allows the District to own, operate and maintain its electrical cables and equipment placed within the customer's vault room.

## Section 4. Underground Service

### P. MAINTENANCE

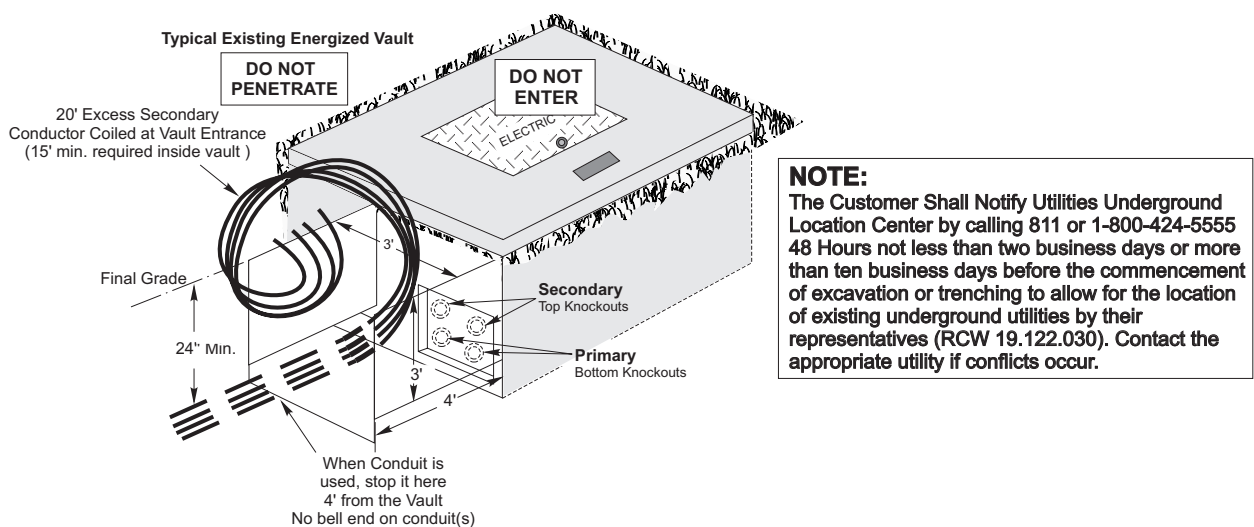
Maintenance of District-Owned Underground Service Conductors:

The District will not charge for normal maintenance of underground service. If a fault occurs in a conductor as a result of improper backfill or dig-in damage caused by a customer or contractor, charges for repair will be determined by the District's Claims Department and billed to the responsible party.

### Q. INCREASING CAPACITY - EXISTING VAULT LOCATION

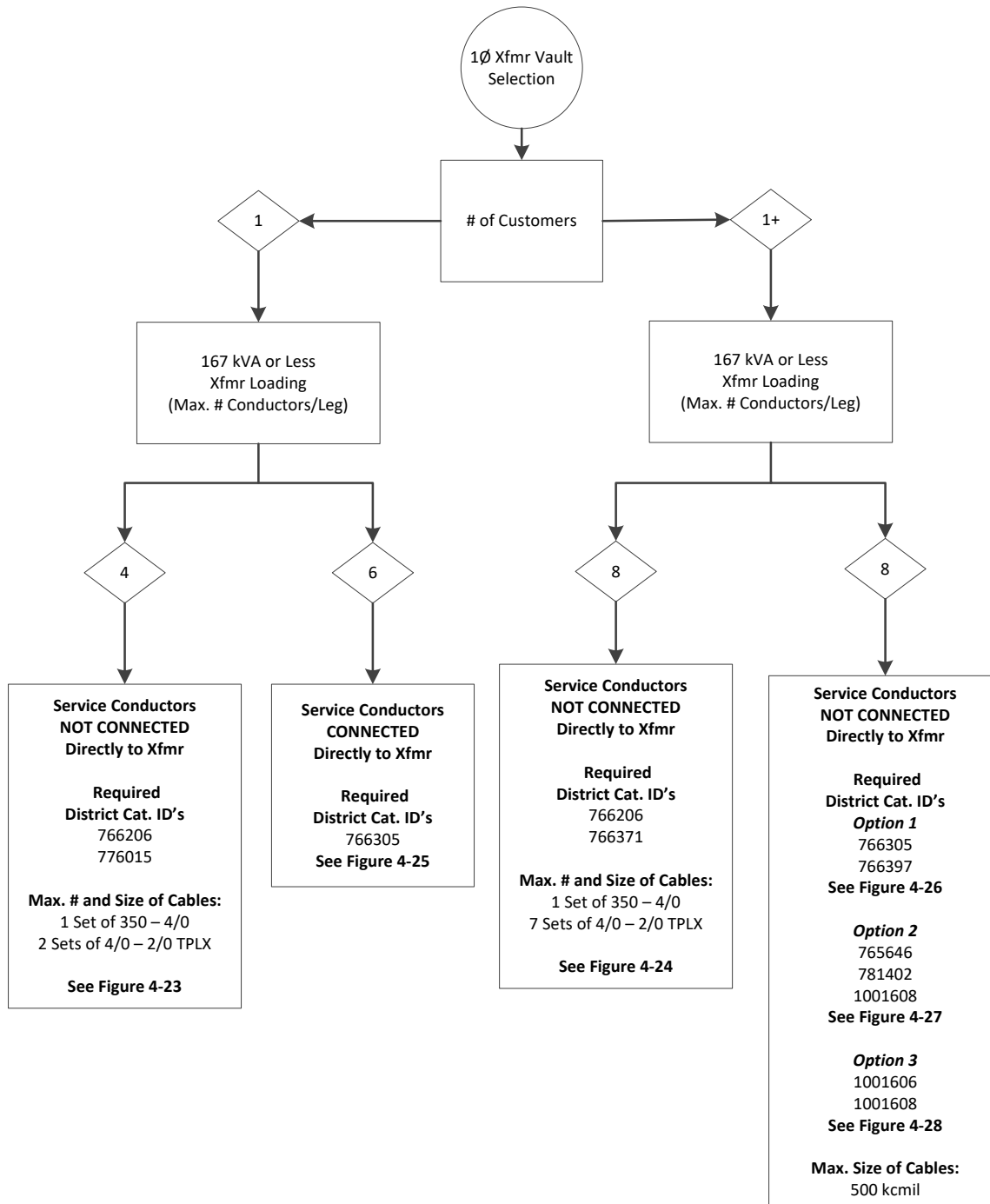
1. When adding secondary feeds to an existing energized padmount transformer, secondary handhole or pedestal, stop outside the vault and provide 20' of excess conductor and a work hole 3 foot wide x 3 foot deep x 4 foot back from vault for **District personnel to penetrate the vault, extend the conductors and/or conduit(s) and make the connections.**
2. Any costs associated with damage and repair to the existing primary, secondary(s) or ground wires are the responsibility of the customer/contractor.
3. **Under no circumstance shall the Customer penetrate the wall of an existing energized vault with either conduit or conductor. Only District personnel are authorized to penetrate into an existing energized vault.**
4. Contact engineering to determine which corner of an existing vault is available for the service to enter.

**FIGURE 4-21**



# Section 4. Underground Service

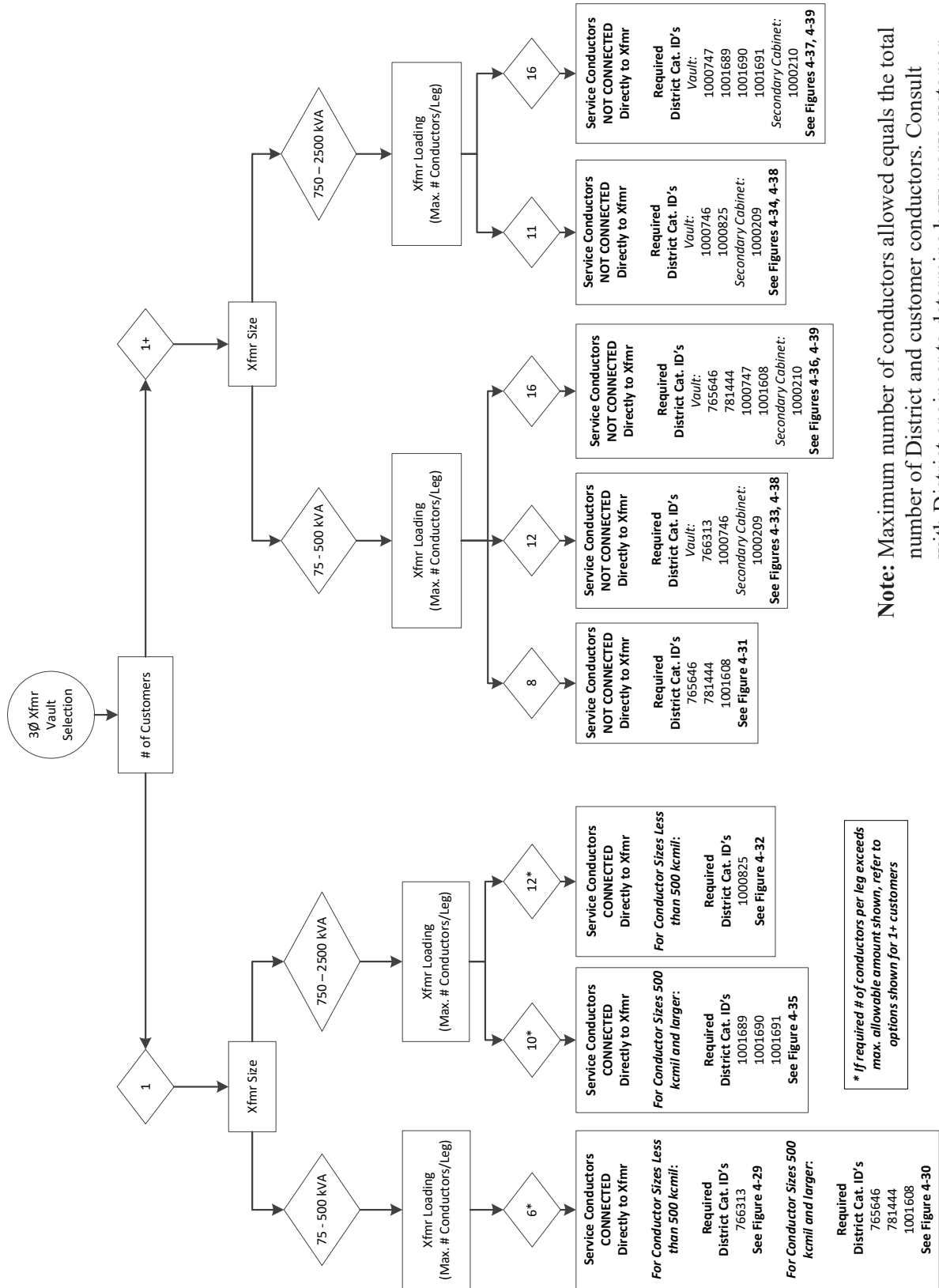
**Table 2 - 1Ø Xfmr Vault Selection Criteria**



**Note:** Maximum number of conductors allowed equals the total number of District and customer conductors. Consult with District engineer to determine how many customer conductors are allowed for a given transformer size.

# Section 4. Underground Service

**Table 3 - 3Ø Xfmr Vault Selection Criteria**



**Note:** Maximum number of conductors allowed equals the total number of District and customer conductors. Consult with District engineer to determine how many customer conductors are allowed for a given transformer size.

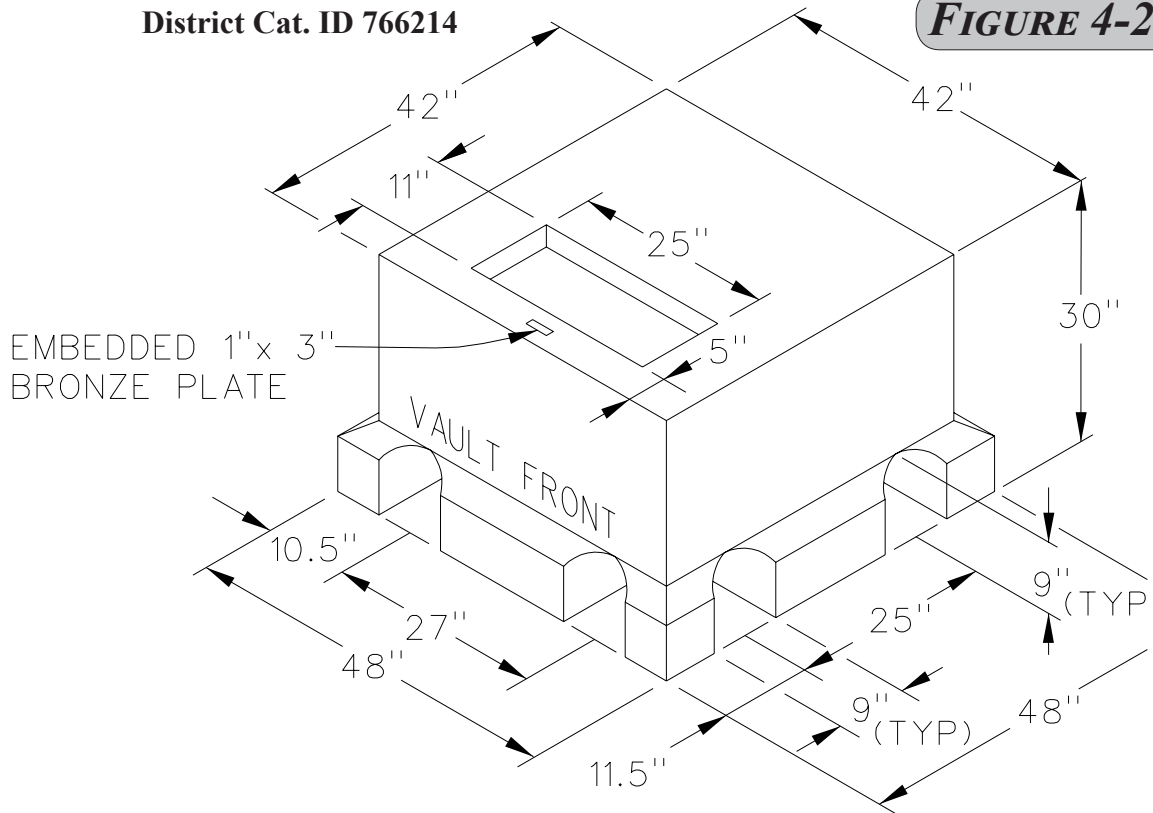
## Section 4. Underground Service

### One 1Ø Open Bottom J-Box Vault

**Note:** This vault is used to support a junction box for single family residential and small commercial services. In small commercial applications the customer shall furnish and install the concrete vault, two ground rods, clamps and ground wire. Refer to Grounding, Section 4-N.

District Cat. ID 766214

**FIGURE 4-22**



## Section 4. Underground Service

### One 1Ø Customer Open Bottom Vault with Transformer

Transformer 50 kVA through 167 kVA

Maximum of 4 conductors per leg.

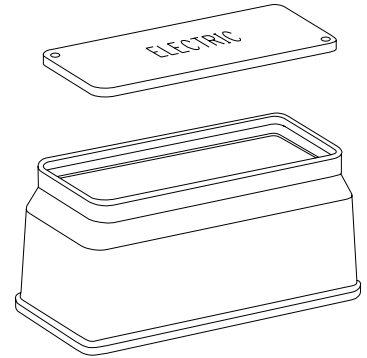
Service conductors *not connected* directly to transformer.

Pedestal - 13"W x 24"L x 15"D

Maximum number and size of cables allowed:

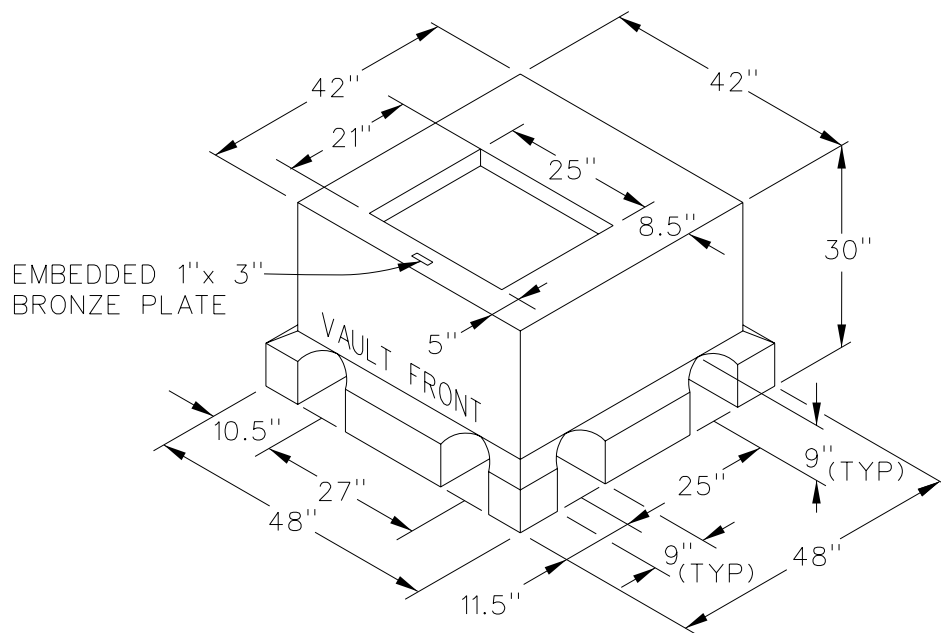
1-Set of 350/4/0 Triplex & 2-Sets of 4/0-2/0 Triplex

**District Cat. ID 776015**  
**(13"W x 24"L x 15"D)**



**FIGURE 4-23**

**District Cat. ID 766206**



**Note:** This vault and pedestal combination is used for single family residential and small commercial services. In small commercial applications the customer shall furnish and install the concrete vault, two ground rods, clamps, and ground wire. Refer to Grounding, Section 4-N.

## Section 4. Underground Service

### One or More 1Ø Customers, Open Bottom Vault and Secondary Handhole

Transformer 50 kVA through 167 kVA

Maximum of 8 conductors per leg.

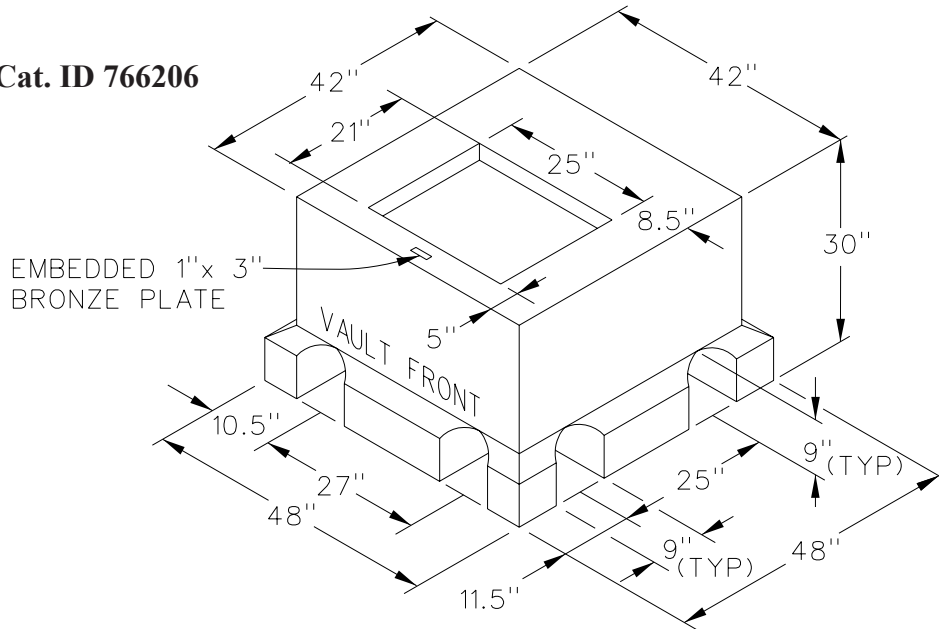
Service conductors *not connected* directly to transformer.

Handhole - 4'W x 4'L x 4'D

Maximum number and size of cables allowed:

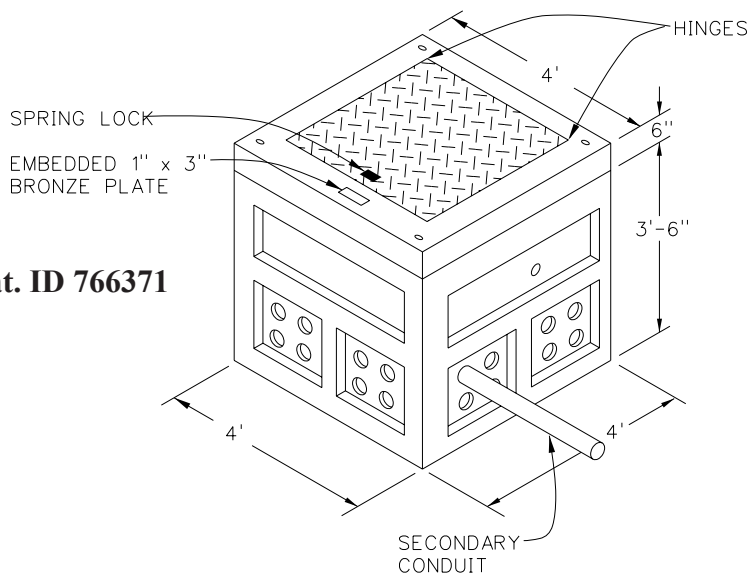
1-Run of 350/4/0 Triplex & 7-Runs of 4/0-2/0 Triplex

District Cat. ID 766206



**FIGURE 4-24**

District Cat. ID 766371



**Note:** This vault and handhole combination is used for single family residential and small commercial services with limited space. In small commercial applications the customer shall furnish and install the concrete vaults, two ground rods, clamps, and ground wire. Refer to Grounding, Section 4-N.



## Section 4. Underground Service

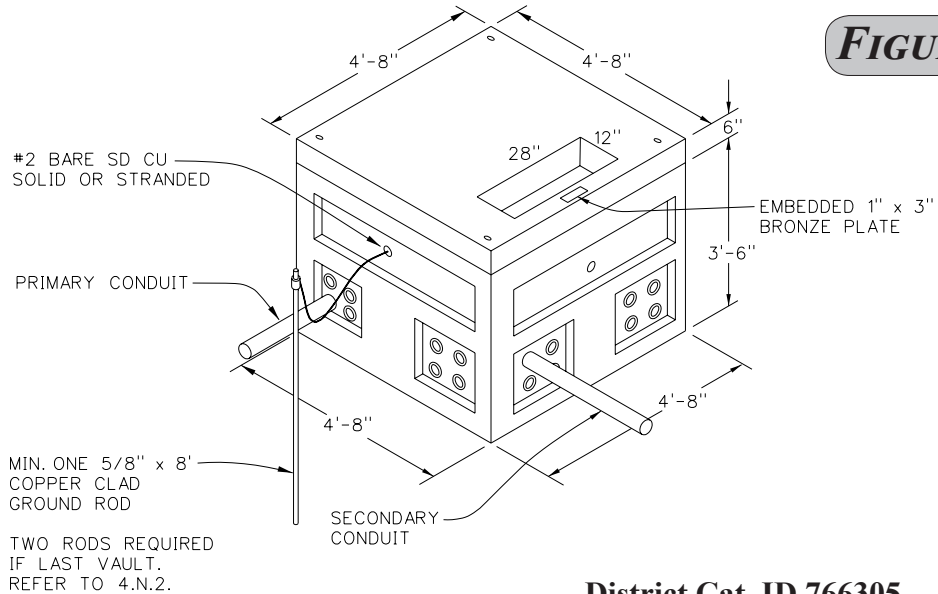
### One 1Ø Customer Transformer Vault

Transformer 167 kVA or less

Maximum of 6 conductors per leg

Maximum size of conductor 500 kcmil

Service conductors *connected* directly to transformer



District Cat. ID 766305

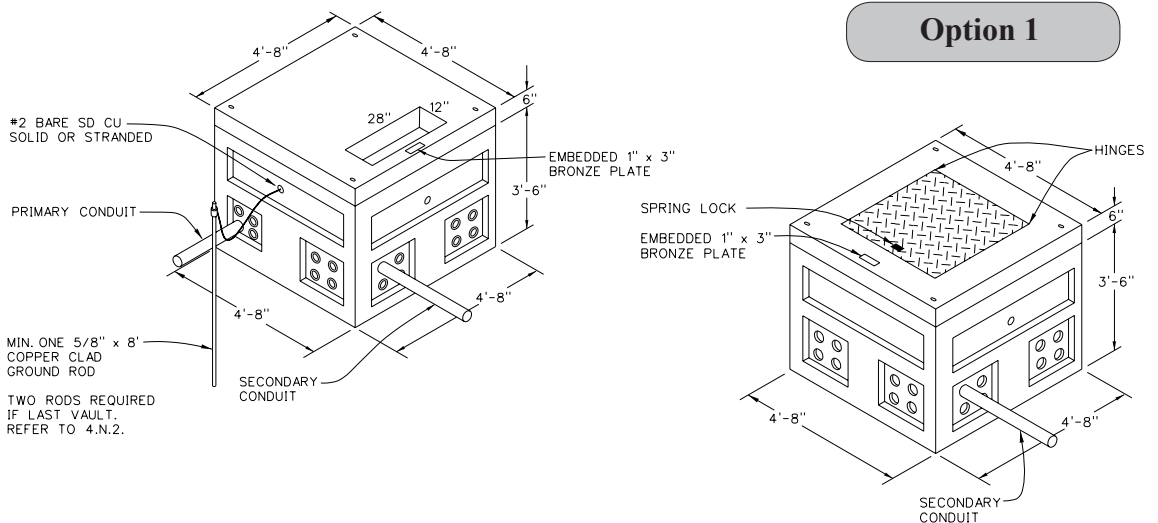
### One or More 1Ø Customers, Transformer Vault with Secondary Handhole

Transformer 167 kVA or less

Maximum of 8 conductors per leg

Maximum size of conductor 500 kcmil

Service conductors *not connected* directly to transformer



District Cat. ID 766305

District Cat. ID 766397

## Section 4. Underground Service

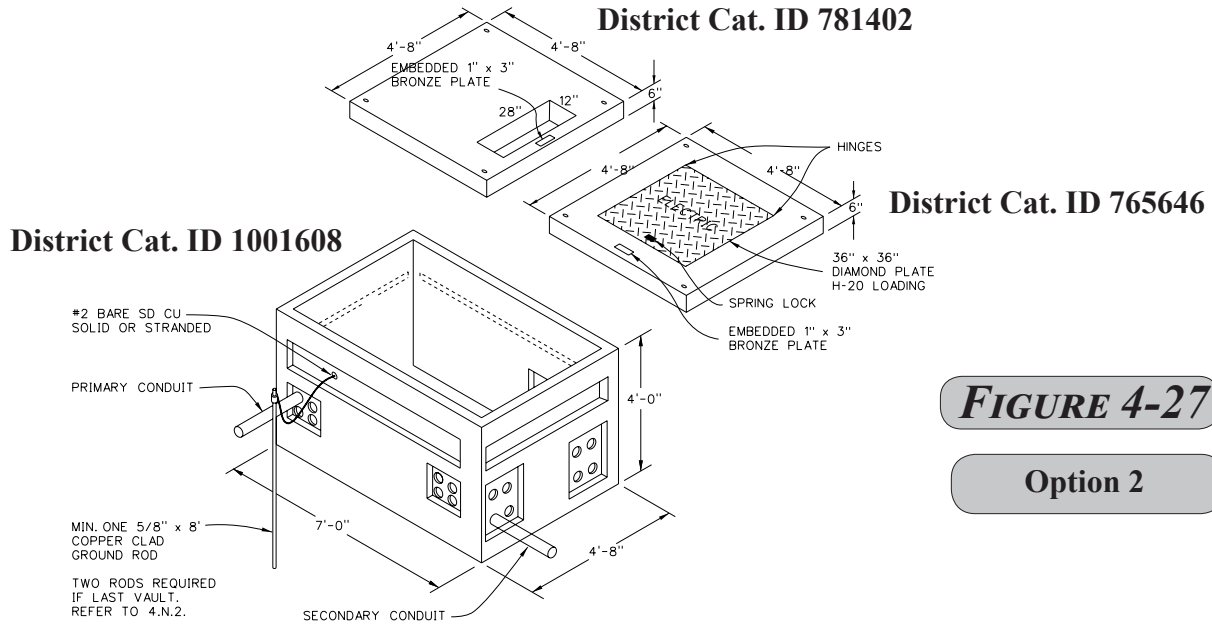
### One or More 1Ø Customers, Transformer Vault with Secondary Handhole

Transformer 167 kVA or less

Maximum of 8 conductors per leg

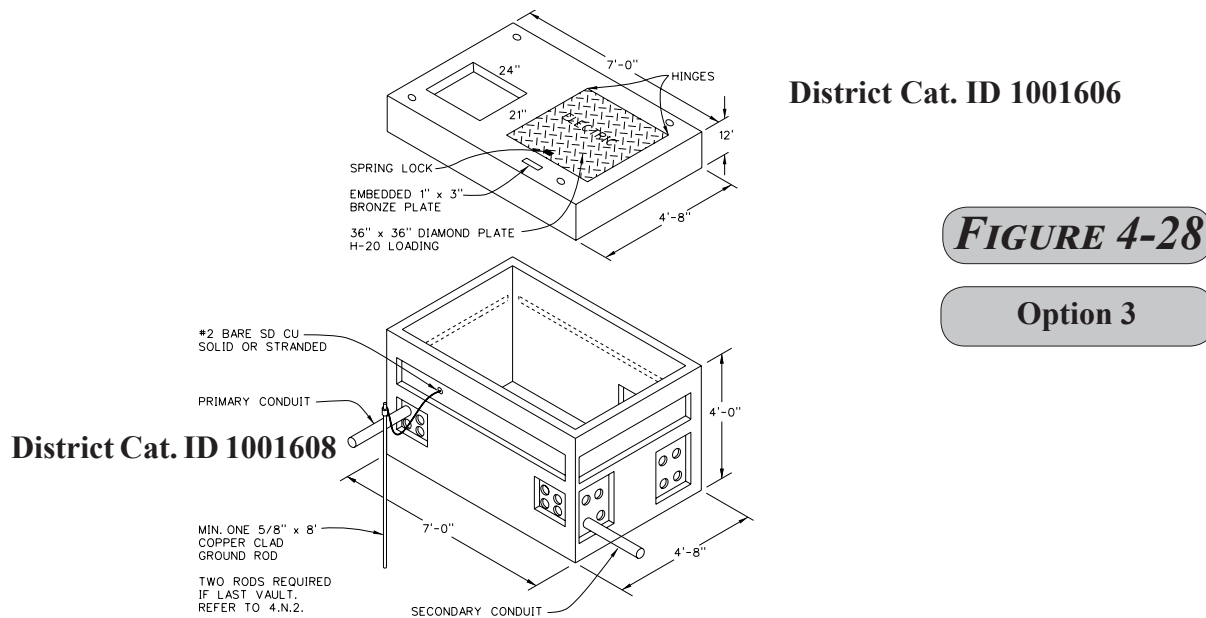
Maximum size of conductor 500 kcmil

Service conductors *not connected* directly to transformer



**FIGURE 4-27**

**Option 2**



**FIGURE 4-28**

**Option 3**

## Section 4. Underground Service

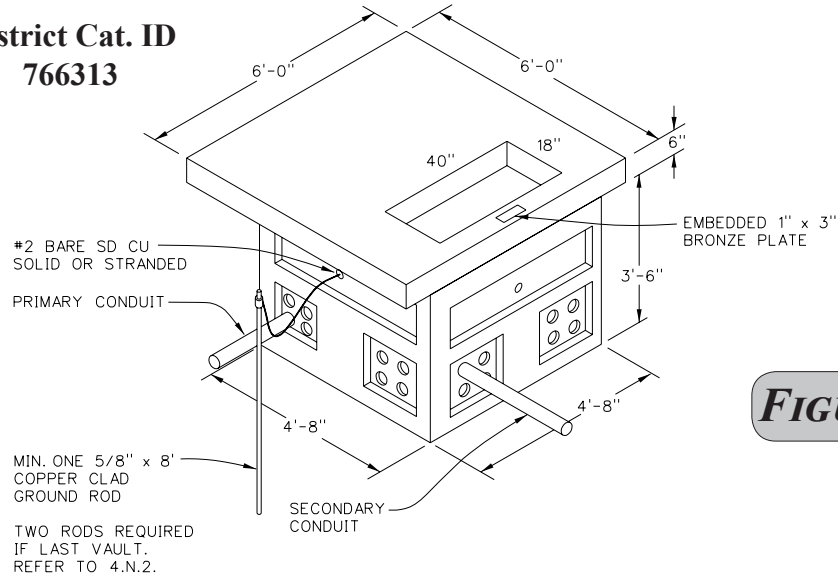
### One 3Ø Customer Transformer Vault

Transformer 75 - 500 kVA

Maximum 6 conductors per leg. Maximum conductor size less than 500 kcmil.

Service conductors connected directly to transformer.

District Cat. ID  
766313



**FIGURE 4-29**

### One 3Ø Customer Transformer Vault

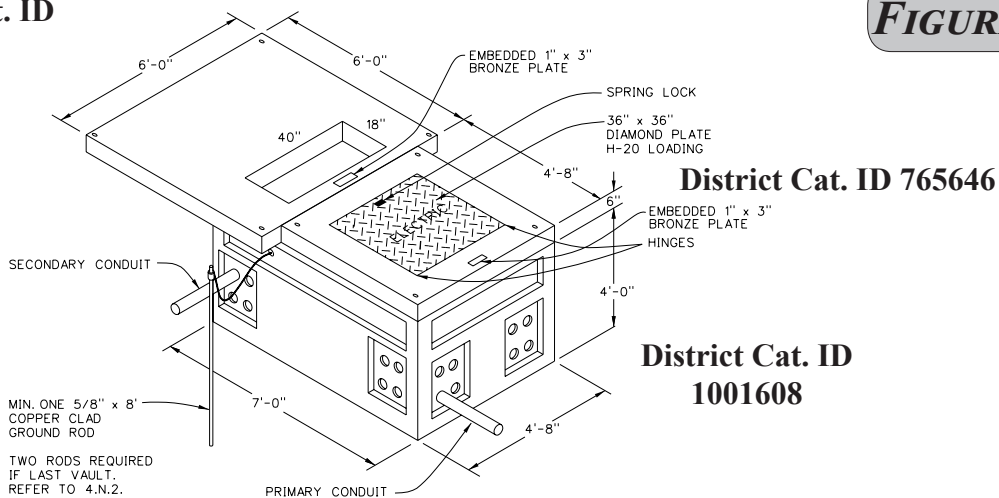
Transformer 75 - 500 kVA

Maximum 6 conductors per leg. For conductor sizes 500 kcmil and larger.

Service conductors connected directly to transformer.

**For conductor sizes 500 kcmil and larger a diamond plate access cover shall be provided as shown below.**

District Cat. ID  
781444



**FIGURE 4-30**

District Cat. ID 765646

District Cat. ID  
1001608

## Section 4. Underground Service

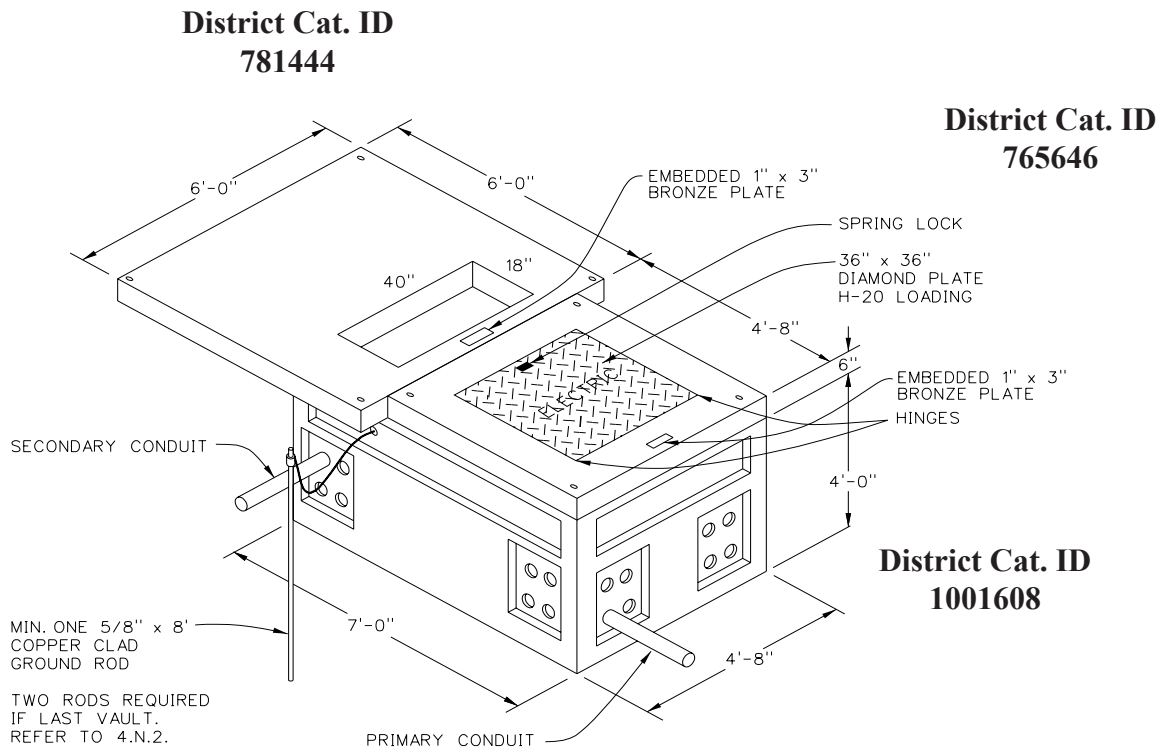
### One or More 3Ø Customers, Transformer Vault with Secondary Handhole

Transformer 75 — 500 kVA.

Maximum of 8 conductors per leg.

Service conductors *not connected* directly to transformer.

**FIGURE 4-31**



## Section 4. Underground Service

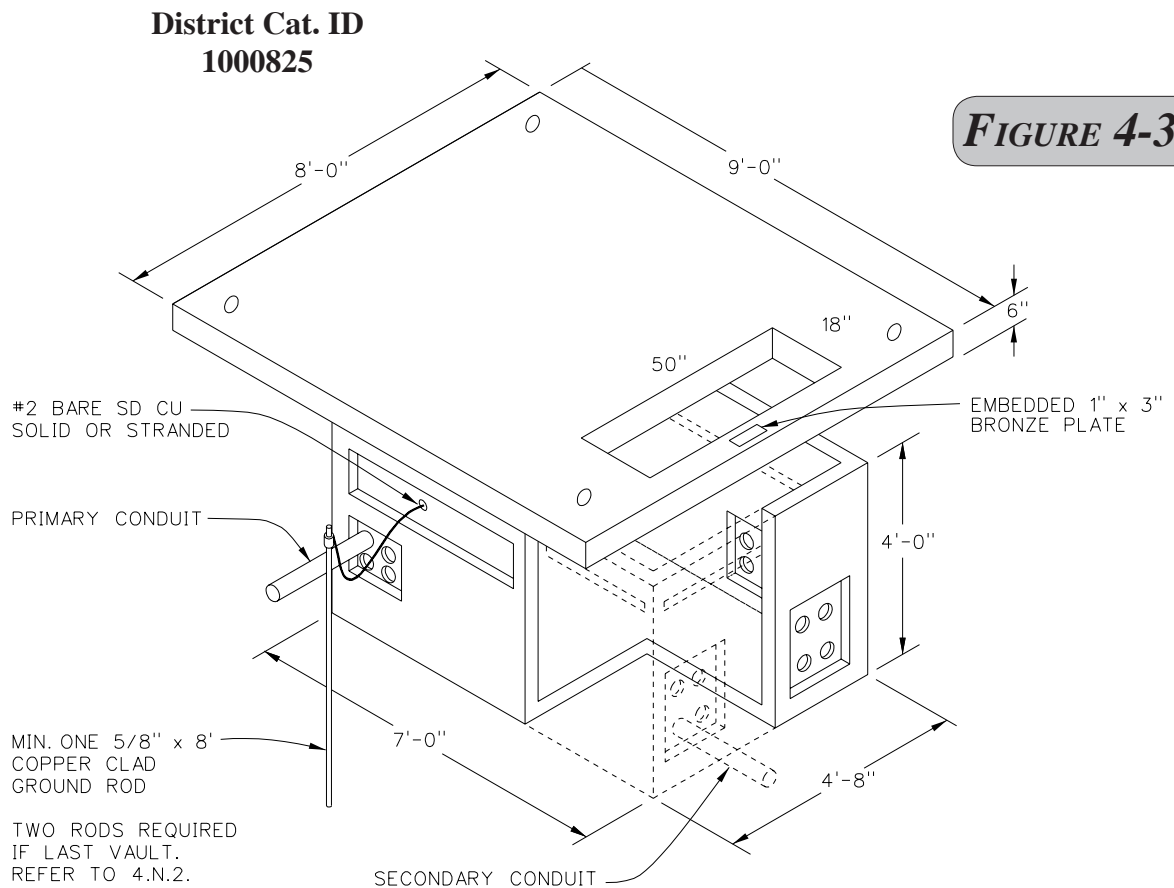
### One 3Ø Customer Transformer Vault

Transformer 750 — 2500 kVA.

Maximum of **12** conductors per leg.

For any conductors **less than 500kcmil**.

Service conductors *connected* directly to transformer.



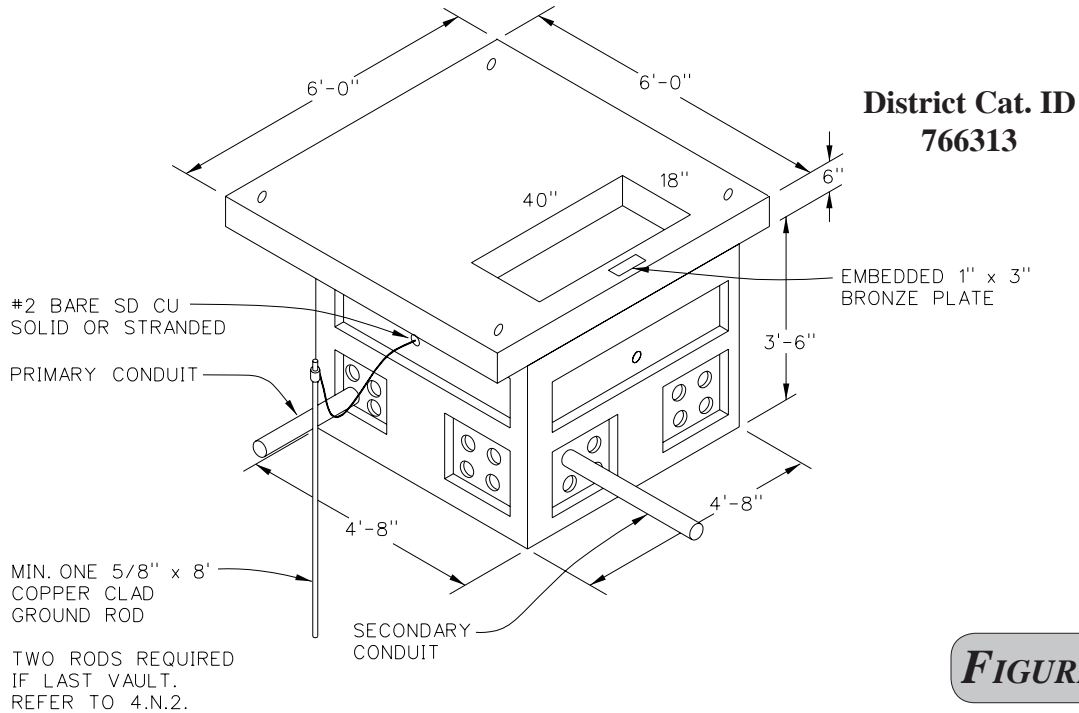
# Section 4. Underground Service

## One or More 3Ø Customers, Transformer Vault with Secondary Cabinet

Transformer 75 — 500 kVA.

Maximum 12 conductors per leg (including District conductors)

Service conductors *not connected* directly to transformer.

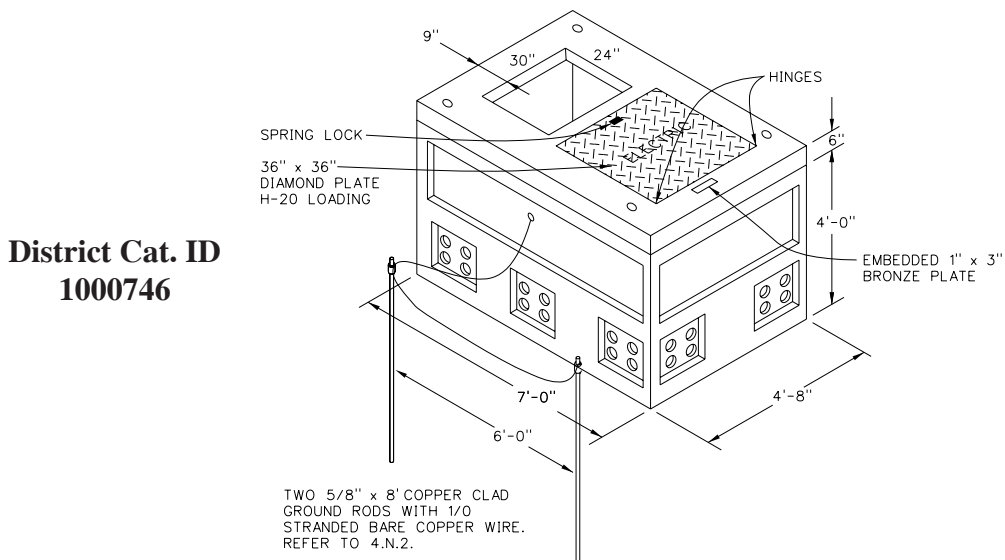


**FIGURE 4-33**

**Note:**

See Figure 4-38 for  
Secondary Cabinet  
Illustration.

Refer to 4.M.2.d. for vault spacing requirements.



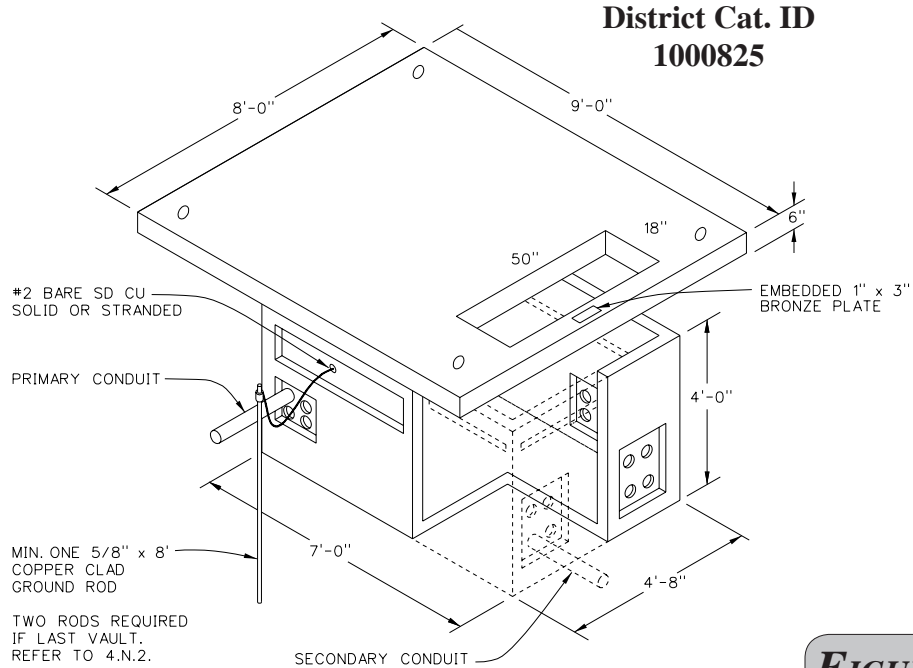
## Section 4. Underground Service

### One or More 3Ø Customers, Transformer Vault with Secondary Cabinet

Transformer 750 — 2500 kVA.

Maximum **11** conductors per leg (including District conductors)

Service conductors *not connected* directly to transformer.

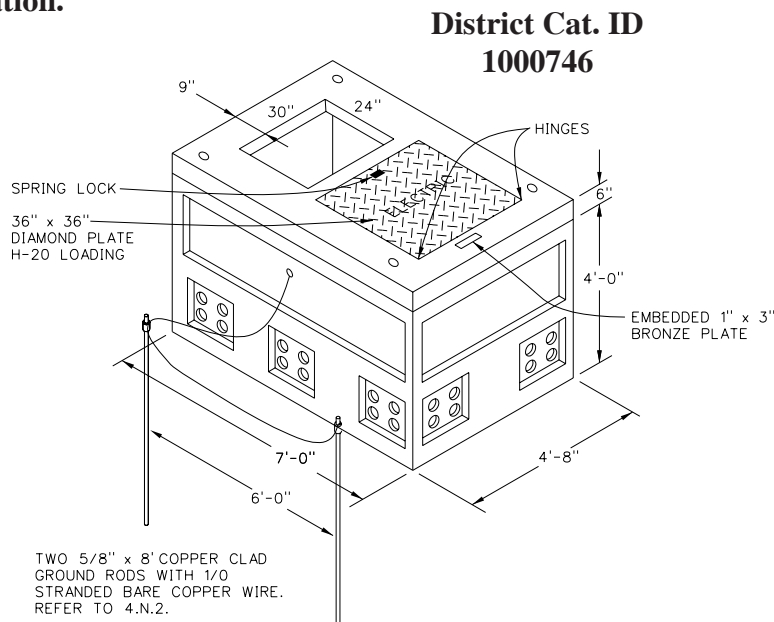


**FIGURE 4-34**

**Note:**

See Figure 4-38 for Secondary Cabinet Illustration.

Refer to 4.M.2.d. for vault spacing requirements.



## Section 4. Underground Service

### One 3Ø Customer, Transformer Vault

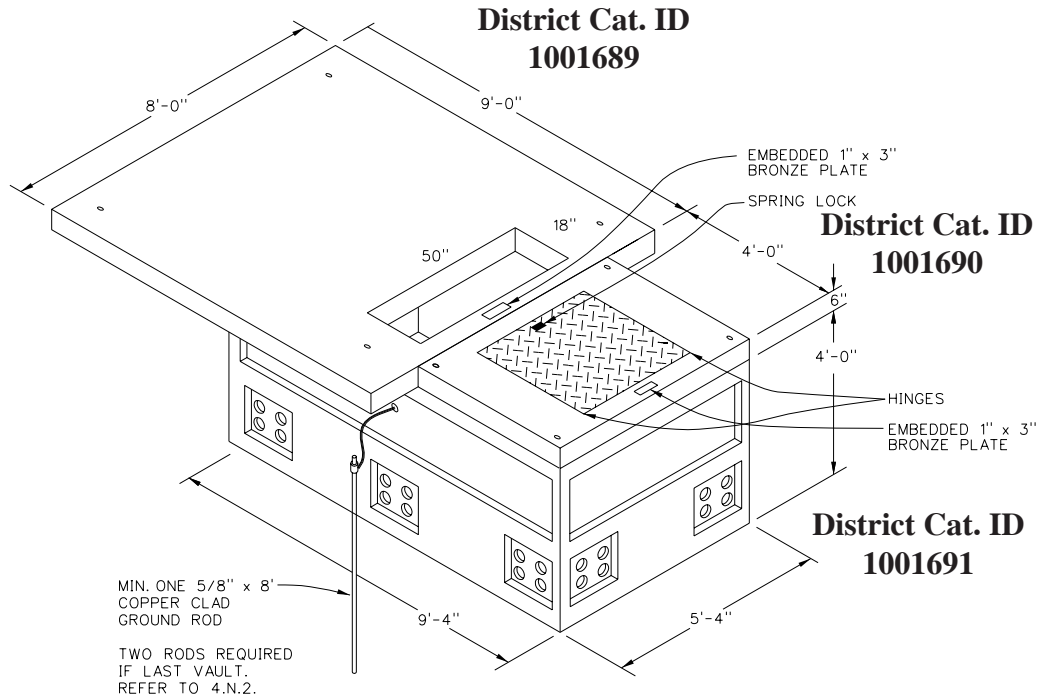
Transformer 750 — 2500 kVA.

Maximum **10** conductors per leg.

For conductor sizes 500kcmil and larger

Service conductors *connected* directly to transformer.

**FIGURE 4-35**





## Section 4. Underground Service

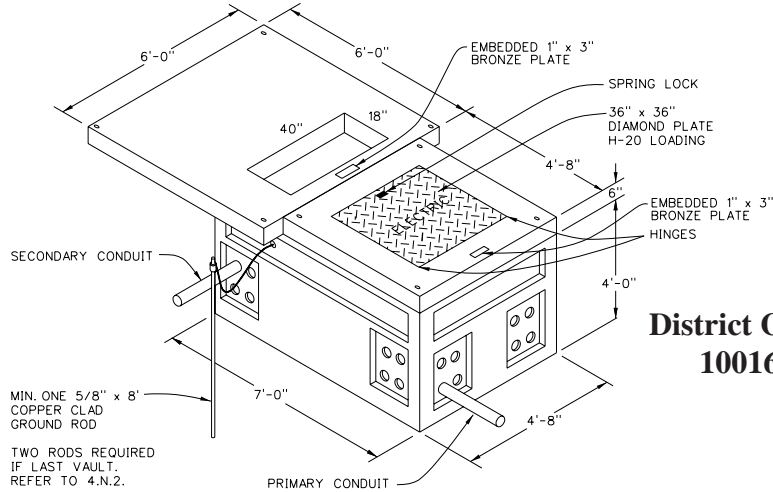
### One or More 3Ø Customers, Transformer Vault with Secondary Cabinet

Transformer 75 — 500 kVA.

Maximum 16 conductors per leg (including District conductors)

Service conductors *not connected* directly to transformer.

District Cat. ID  
781444



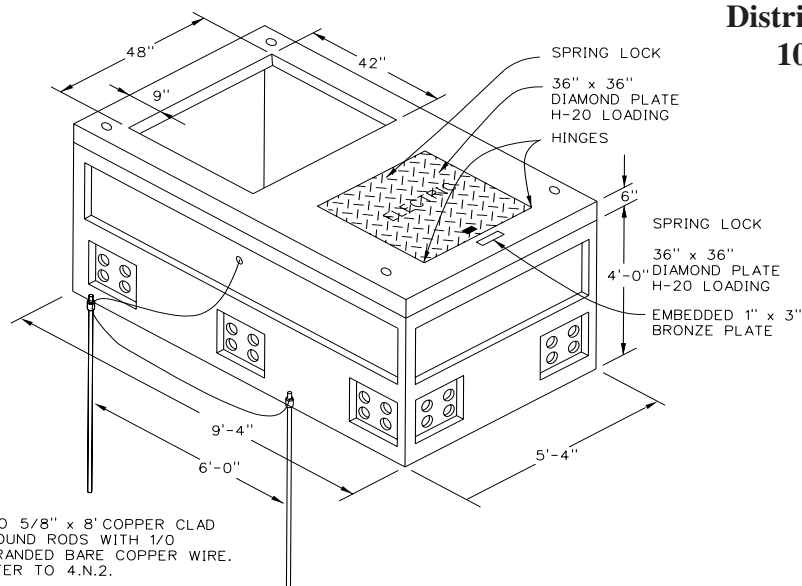
District Cat. ID  
765646

District Cat. ID  
1001608

**FIGURE 4-36**

**Note:**  
See Figure 4-39 for  
Secondary Cabinet  
Illustration.

Refer to 4.M.2.d. for vault spacing requirements.



District Cat. ID  
1000747

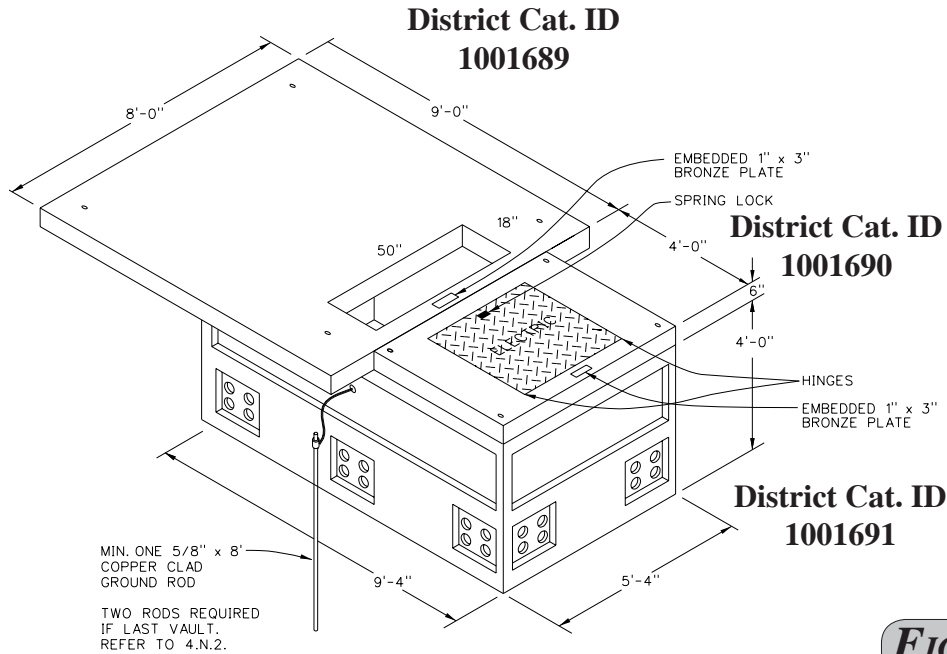
## Section 4. Underground Service

### One or More 3Ø Customers, Transformer Vault with Secondary Cabinet

Transformer 750 — 2500 kVA.

Maximum **16** conductors per leg (including District conductors)

Service conductors *not connected* directly to transformer.

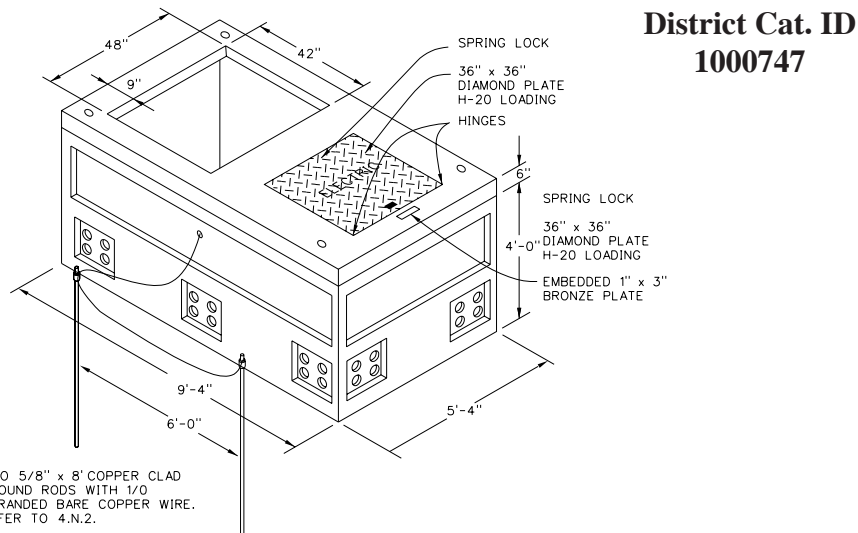


**FIGURE 4-37**

**Note:**

See Figure 4-39 for Secondary Cabinet Illustration.

Refer to 4.M.2.d. for vault spacing requirements.



## Section 4. Underground Service

### Small Secondary Termination Cabinet

Maximum 12 conductors per leg (including District conductors)



District Cat. ID  
1000209

**FIGURE 4-38**



**Note:** Install on District vault assembly Cat. ID 1000746.  
Refer to 4.N.5. for grounding.

## Section 4. Underground Service

### Large Secondary Termination Cabinet

Maximum 16 conductors per leg (including District conductors)



District Cat. ID  
1000210

**FIGURE 4-39**



**Note:** Install on District vault assembly Cat. ID 1000747.  
Refer to 4.N.5. for grounding.