

UNDERGROUND SERVICE

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500.0 GENERAL

500.1 UNDERGROUND SERVICES

Underground services are installed in Customer provided conduit. See paragraphs 501 and 502 for U.G. Riser and Conduit Requirements. See Section 600 for Trenching Requirements. Consult with an CRA-ES Customer Service Representative for information regarding specifics to your situation.

500.2 TRENCHING

Remember to always call your local Blue Stake office for underground utility location at least two days before you dig. (See paragraph 100.12 Section 100) The phone number in the Parker area is . See Trenching Requirements Section 600.

500.3 UNDERGROUND SERVICE PLANNING

In order to eliminate unnecessary delays, changes, etc., the Customer shall contact CRA-ES at the initial planning stage so that the location of the service and meter can be determined. CRA-ES phone numbers are in front of this manual on pages "B" and "C".

CRA-ES RESERVES THE RIGHT TO DETERMINE ALL METER AND UNDERGROUND SERVICE LOCATIONS AND ONLY AUTHORIZED PERSONNEL SHALL DETERMINE THE LOCATION.



501.0

UNDERGROUND RISER REQUIREMENTS

501.1-1 RESIDENTIAL SINGLE PHASE U.G. RISER SIZE

<u>SES Rating</u>	<u>Trade Size</u>	<u>Min. Radius Size</u>
100 - 225A	2 1/2"	24"
226 - 400A	3"	24"
600A	2 - 3"	24"
800A	2 - 4"	24"

501.1-2 NON-RESIDENTIAL SINGLE PHASE U.G. RISER SIZE

<u>SES Rating</u>	<u>Trade Size</u>	<u>Min. Radius Size</u>
100 - 225A	2 1/2"	24"
* 226 - 400A	4"	24"
* 600A	2 - 4"	24"
* 800A	2 - 4"	24"

* Includes multi-meter packs for multi-family residential installations.

501.1-3 NON-RESIDENTIAL AND RESIDENTIAL THREE PHASE U.G. RISER SIZE

<u>SES Rating</u>	<u>Riser Trade Size</u>	<u>Min. Radius Size</u>
100 - 225A	3"	24"
225 - 400A	4"	36"
600A	2 - 4"	36"
800A	2 - 4"	36"
1000A	2 - 4"	36"
1200A	3 - 4"	36"
1600A	4 - 4"	36"
2000A *	5 - 4"	36"
2500A *	7 - 4"	36"
3000A *	9 - 4"	36"

* Dedicated Service Trench required for each S.E.S., separated by 10' center to center horizontally. Also only a maximum of 9 service conduits are allowed in any trench. 1/0 Primary (not 750) conductors are allowed in service trenches.

NOTE:

Outside diameter is approximately 1/2" larger than riser trade size.

501.2 RISER MATERIAL

Riser shall not be cut with a torch, welded or brazed. Underground risers shall be of Schedule 80 PVC, Rigid Metallic or Intermediate Metallic Conduit (IMC) and listed or rated for their intended use. **Only true round cross-section risers will be acceptable.**

NOTE: A RISER THAT IS ENCLOSED IN ANY MANNER, WHETHER PARTIALLY OR IN ITS ENTIRETY SHALL BE OF RIGID OR INTERMEDIATE METALLIC CONDUIT.

501.2 -1 RISER COUPLINGS

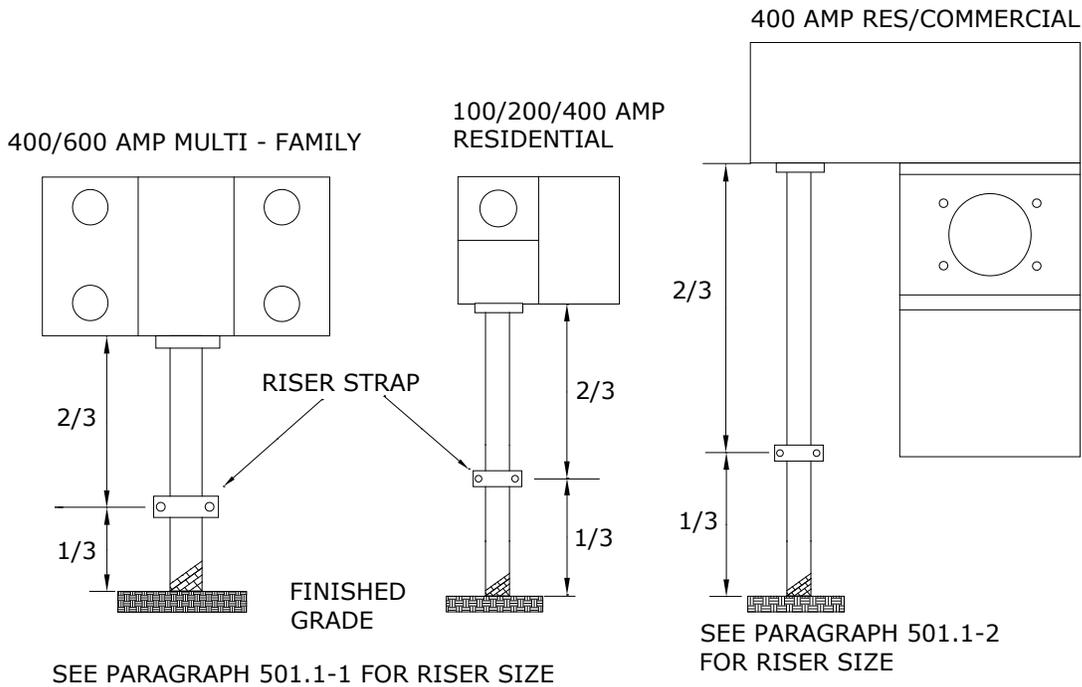
No PVC riser couplings allowed above grade.



501.3

RISER INSTALLATION

Risers shall be securely fastened to wall by at least one strap and the service equipment enclosure. The strap shall be located between the riser entrance to the service equipment and finished grade, plus or minus 6". Riser straps are not required if riser is 18" or less in length from ground to panel. The riser strap/straps shall be listed for the purpose for which it's intended. Plumbers tape or similar materials are unacceptable. The riser shall be plumb with no kicks or bends other than one sweep at the bottom for transition to trench elevation and securely fastened to wall with 1/4" lag screws or equivalent. Any deviation from plumb may result in the entire installation being turned down. (See Paragraphs 501.6-1, 2 and 3)



501.4

METALLIC RISER COATING

The portion of metallic risers below grade, up to a minimum of 6" above grade, shall be factory coated or shall be half-lapped with 20 mil. tape suitable for it's use, to a total thickness of 40 mil. The tape shall be labeled to include the thickness (20 mil.) and the manufacturer's name. If riser is factory coated, it shall have a U.L. label.

Note: The coupler connecting the PVC conduit system to the metallic riser shall also be taped per the above paragraph.



501.5 ATTACHMENT TO SES

Schedule 80 PVC conduit risers shall be secured to the pull section with a threaded male slip-sleeve connector and a steel lock nut, a threaded male slip-sleeve connector into a factory bolt-on hub, or a malleable “chase nipple” into a threaded female slip-sleeve connector on the riser. (See Figure 1)

Metallic conduit risers shall be secured to the pull section using a riser “hub” with a bondable lock nut/bushing, a factory bolt-on hub, or a self-bonding hub (Meyers or equivalent). **The self-bonding hubs shall be installed in the largest knock-out provided.** (See Figure 2)

NOTES:

1. If factory bolt-on hub is used, all knock-outs shall be removed.
2. Reducer washers shall be installed on the inside and outside of section whenever the largest knock-out is not used.
3. **A riser that is enclosed in any manner, whether partially or in it’s entirety, shall be of rigid or intermediate metallic conduit.**

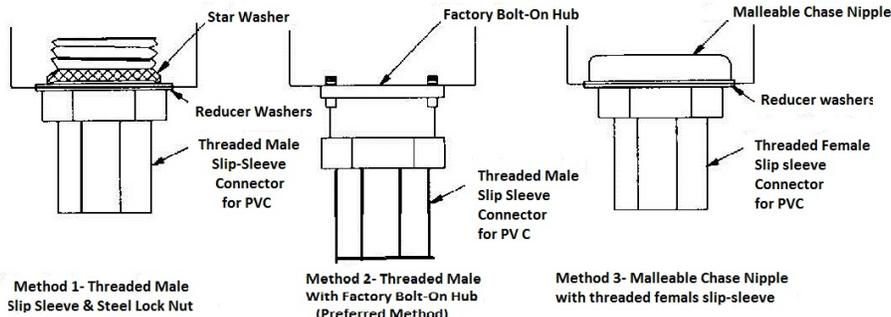


Figure 1- Approved Methods for PVC Riser Attachment

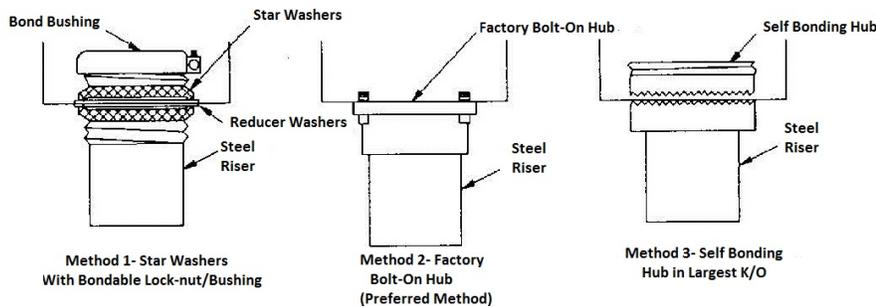


Figure 2- Approved Methods for Metallic Riser Attachment

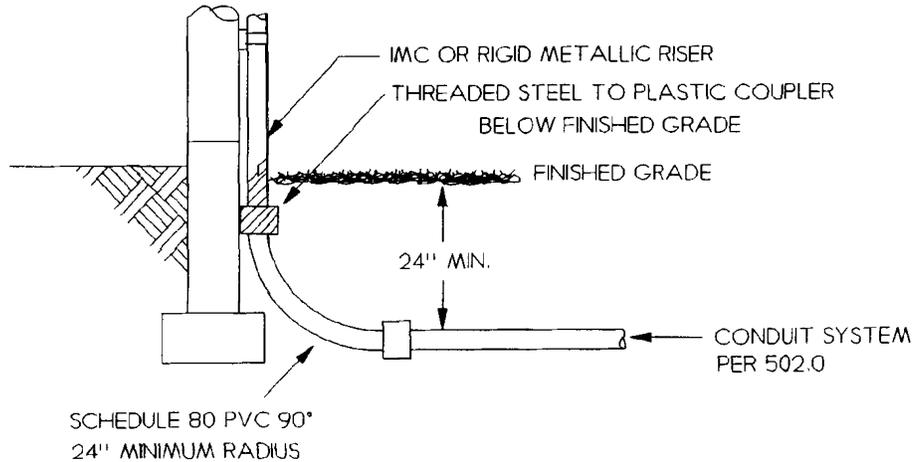
501.6 RISERS FOR SERVICES INSTALLED IN CONDUIT

When service conduit is extended away from riser bend, there are three methods of making the vertical to horizontal transition. They are listed in order of preference. (See 501.6-1,2,3)



501.6-1 METALLIC RISER WITH SCH 80 RIGID PLASTIC 90° SWEEP

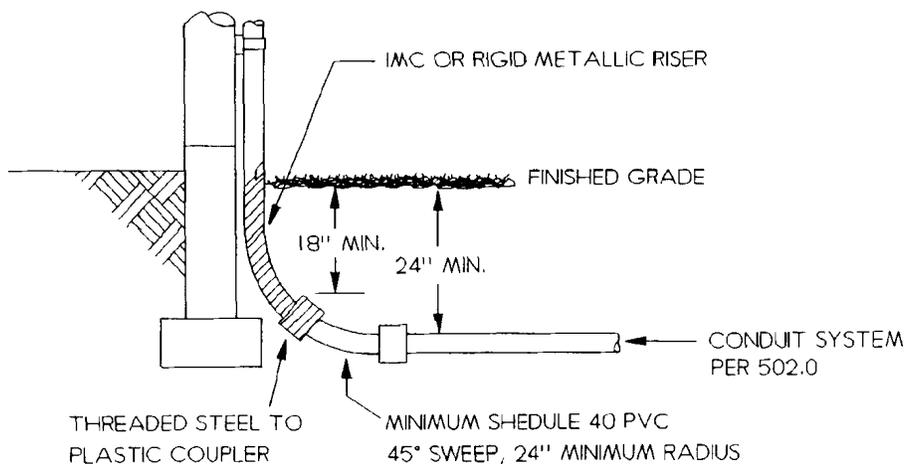
1. **No portion of plastic sweep, including fittings, will be above grade.**
2. A threaded steel to plastic fitting is installed at bottom of riser so that it will be below finished grade.
3. **Where sweep runs horizontal, it shall have 24" minimum cover.**
4. Sweep will have **24" radius** as a minimum and shall be of **Sch 80** grade rigid plastic conduit.
5. Metallic riser as required in Paragraphs 501.2, 501.4, 502.5 and 502.5-1.



METALLIC RISER COUPLED TO SCH 80 PVC 90° BEND FOR CONDUIT SYSTEM

501.6-2 METALLIC RISER WITH 45° SWEEP AND SCHEDULE 40 RIGID PLASTIC 45° SWEEP

1. A threaded steel to plastic fitting to make transition from steel riser to approved rigid plastic 45° sweep. (See Conduit Requirements, Paragraph 502.0) Metallic 45° sweep and plastic 45° sweep to be minimum 24" radius. **Where sweep runs horizontal, there shall be a minimum of 24" of cover.**
2. Metallic riser shall be as required in Paragraphs 501.2, 501.4, 502.5 and 502.5-1.



METALLIC RISER WITH 45° BEND COUPLED TO A PVC CONDUIT SYSTEM

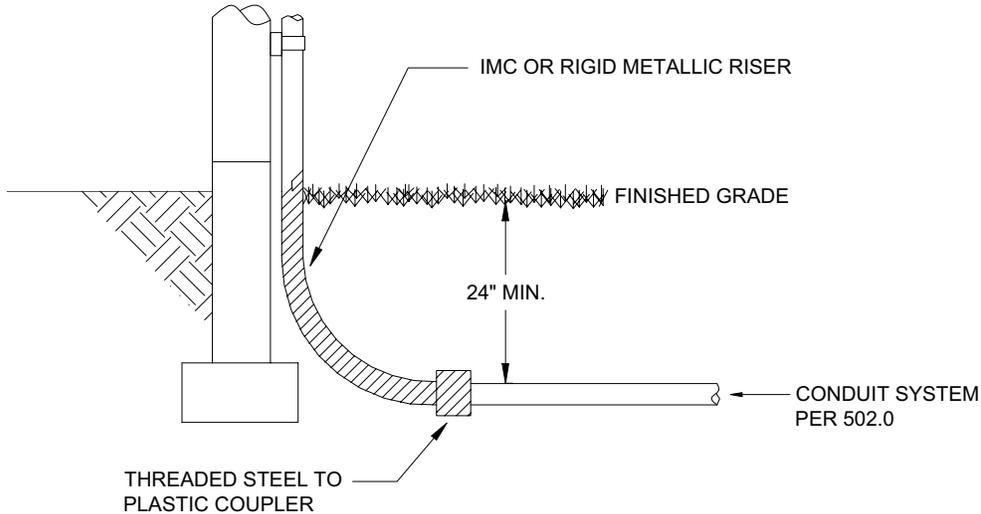
Electric Service Requirements 501.6-1



501.6-3

METALLIC RISER WITH 90° SWEEP

1. A threaded steel to plastic fitting is installed at bottom of metallic sweep to make transition from metallic to approved rigid plastic conduit (See conduit requirements 502.0). **Where sweep runs horizontal, it shall have 24" minimum cover.**
2. Metallic riser shall be as required in Paragraphs 501.2, 501.4, 502.5 and 502.5-1



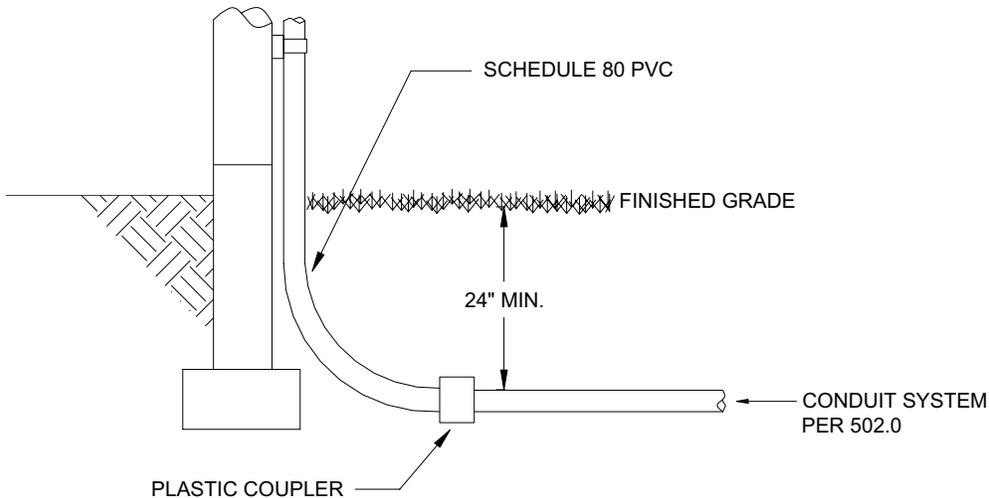
24" MIN RADIUS, METALLIC RISER WITH 90° BEND COUPLED TO A PVC CONDUIT SYSTEM (See Paragraph 502.5 and 502.5-1)

501.6-4

SCHEDULE 80 PVC RISERS WITH 90° SWEEP

1. A riser that is enclosed in any manner, whether partially or in its entirety shall be of rigid or intermediate metallic conduit.
2. No PVC couplings allowed above grade.
3. See paragraph 501.6-6 and 502.4

NOTE: Schedule 80 PVC markings on conduit riser shall remain visible for inspection purposes.



24" MIN RADIUS, SCHEDULE 80 PVC WITH 90° BEND COUPLED TO A PVC CONDUIT SYSTEM (See Paragraph 502.5 and 502.5-1)

Electric Service Requirements 501.6-3

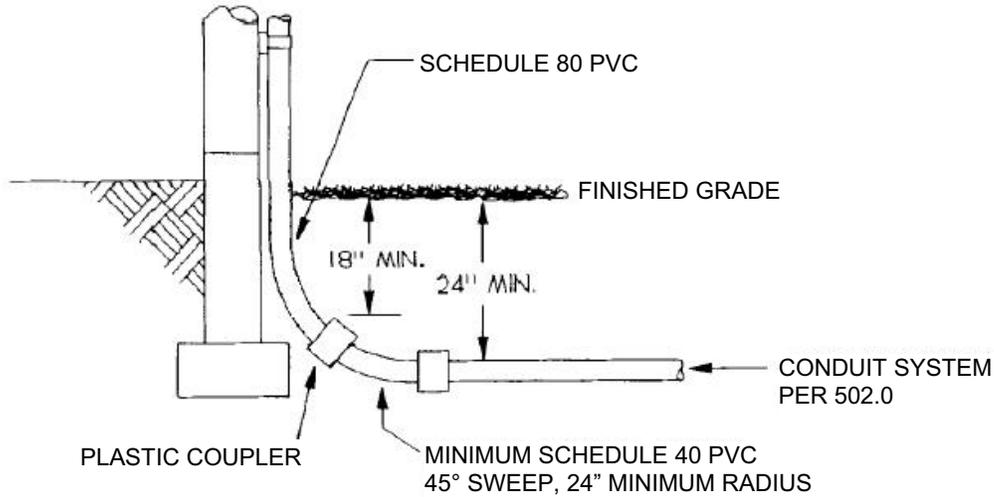


501.6-5

SCHEDULE 80 PVC RISER WITH 45° SWEEP AND SCHEDULE 40 RIGID PLASTIC 45° SWEEP

1. A riser that is enclosed in any manner, whether partially or in its entirety shall be of rigid or intermediate metallic conduit.
2. No PVC couplings allowed above grade.
3. See paragraphs 501.6-6 and 502.4

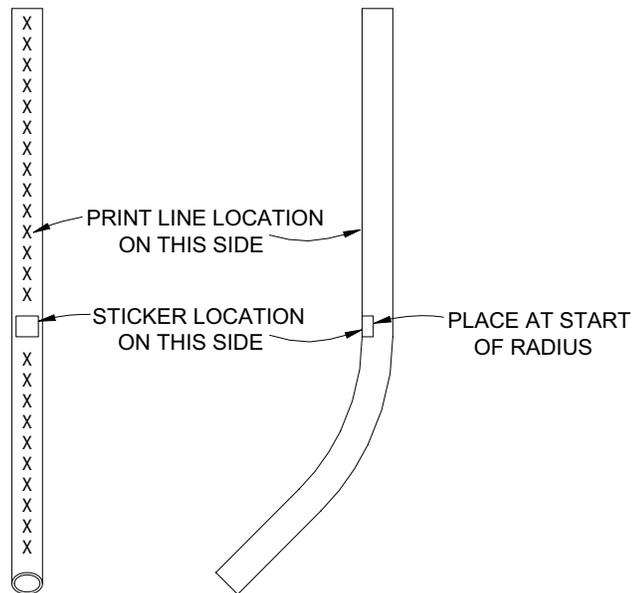
NOTE: Schedule 80 PVC markings on conduit riser shall remain visible for inspection purposes.



24" MIN RADIUS, SCHEDULE 80 PVC WITH 45° BEND COUPLED TO A PVC CONDUIT SYSTEM (See Paragraph 502.5 and 502.5-1)

501.6-6

SCHEDULE 80 PVC MANUFACTURER RISER MARKINGS OR STICKER PLACEMENT



1. The print line or sticker placement for a SCH 80, 24"R x 45° PVC riser shall be as shown. This will facilitate inspection of the riser after installation.

Electric Service Requirements 501.6-5



SERVICE CONDUIT REQUIREMENTS

502.1 MATERIAL FOR SERVICE CONDUIT

Material for service conduit shall be listed as electrical conduit. Acceptable material shall be PVC rigid conduit and when specified, IMC or Rigid metallic conduit taped or coated per 501.4 for direct burial.

502.2 STEEL CONDUIT

All rigid or intermediate conduits and fittings shall be hot-dipped galvanized. Rigid or Intermediate steel conduit shall be installed with threaded couplings and joints made up tight. Screw set type fittings not allowed. (See Paragraph 501.4 for taping and coating requirements)

Conduit shall not be cut with a torch, welded or brazed.

502.3 NON-METALLIC CONDUIT

Non-metallic conduit shall meet the following material and marking requirements for each application by product material used or as specified on the construction or composite drawing.

**TABLE 502.3
APPROVED SERVICE CONDUIT FOR CUSTOMER INSTALLATION**

APPLICATION	ACCEPTABLE PRODUCT MATERIAL	CONDUIT MARKING REQUIREMENTS
Straight Conduit (See Notes 1 & 2)	PVC DB-120 (Modulus 400,000 PSI)	Mfg. name, nom. size, 90°C, Type (i.e. DB120), ASTM F-512, PVC 12254
	PVC SCH 40 or SCH 80	Mfg. name, nom. size, PVC, SCH 40 mx SCH 80, NEMA TC-2
Bends, Sweeps and Elbows (See Note 3)	PVC SCH 40 or SCH 80 (See Note 4)	Mfg. name, nom. size, PVC, SCH 40 mx SCH 80, NEMA TC-2 radius, degree of curvature
Fittings	PVC SCH 40 or SCH 80	Mfg. name, nom. size, PVC, SCH 40 mx SCH 80, NEMA TC-2 (marking may be on packaging material)

NOTES:

1. 12254B minimum cell classification per ASTM D-1784.
2. PVC DB-100, modulus 400,000 PSI, ASTM F-512 is suitable for 4" and 5" diameters.
3. 4" diameter & under - SCH 40 NEMA TC-2; 5" diameter & larger - SCH 80 NEMA TC-2, 60" radius.
4. Sweeps at house end may be required to be SCH 80. (See Paragraph 501.6-1)
5. All PVC shall be gray.

502.4 MARKINGS ON PLASTIC CONDUIT

Each length of plastic conduit shall be marked at least every 5'. Each bend shall also be marked. All markings must include the items required in Table 502.3, above.

502.5 BENDS AND SWEEPS

METALLIC - One shot bending. Specified radius maintained. Internal diameter of conduit not effectively reduced. Factory bent sweeps are preferred; however, field bent sweeps are acceptable if done properly.

NON-METALLIC - Factory bent sweeps shall be used.



502.5-1 MINIMUM BENDING RADIUS FOR SWEEPS IN A CONDUIT SYSTEM

All sweeps in a conduit system to be a minimum of 24" radius, "unless otherwise specified." All sweeps in a 4" conduit system designed for 3Ø to be a minimum of 36" radius, "unless otherwise specified." All non-metallic sweeps to be Schedule 40 minimum except as specified in Paragraph 501.6-1.

502.6 WORKMANSHIP (PVC)

Conduit shall be cut cleanly and square. All burrs and sharp edges which may damage conductors shall be removed before joining. PVC joints shall be primed before gluing. Gluing solvent shall be applied to both pieces to be joined. The conduit system shall be clean of internal obstructions and contaminants which may interfere with pulling of the conductors, the life of the conductors or conduit system. Installed conduit shall not be left uncapped.

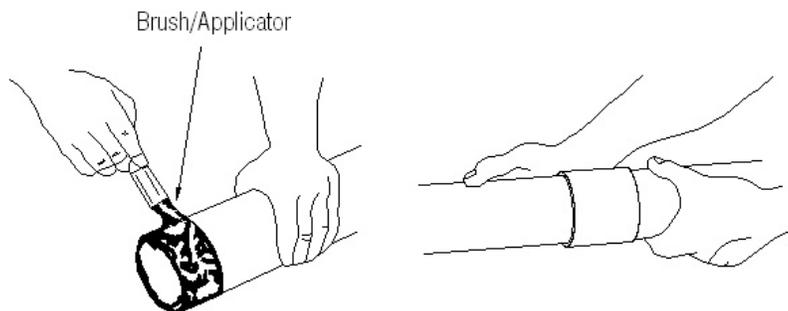
502.7 INSTALLATION OF NON-METALLIC CONDUIT

- a) **Conduit transitions from Schedule 40 or Schedule 80 to DB conduit shall be chamfered.**
All conduit and fittings not chamfered by the manufacturer shall be chamfered in the field with a knife, half-round file or abrasive open mesh cloth, to provide a smooth transition which will not cause scuffing of the cable when it is pulled through the conduit during installation.
- b) Wipe dirt and foreign material from conduit and fitting with a clean, dry cloth.

502.7-1 PVC TO PVC JOINTS

Apply purple primer/cleaner ASTM F 656, to both the fitting socket and the conduit. Avoid puddling of the primer. Verify all surfaces to be joined are covered. This primer coat is important, as it helps to penetrate the hard inner surfaces on most bell-end conduit and on fittings which are fabricated from conduit stock. Many of the extruded conduit stocks and some molded fittings have hard inner surfaces, and are more difficult for the cement to penetrate without aid from the primer. **Apply a coat of gray PVC to PVC cement ASTM D 2564**, to both parts of the joint, and immediately push the joint together with a slight rotating motion (in one direction only). When the joint bottoms out, hold without motion for 15 seconds (1 minute in extreme cold weather), so that conduit does not push out of the fittings. Do not twist or drive conduit after insertion is complete.

NOTE: The requirement for the purple color on the primer and the gray color on the PVC cement is to aid in the inspection of finished work. Use of clear cement makes for poor inspection, performance and failure to use primer with any PVC system results in a joint that is almost guaranteed to fail.

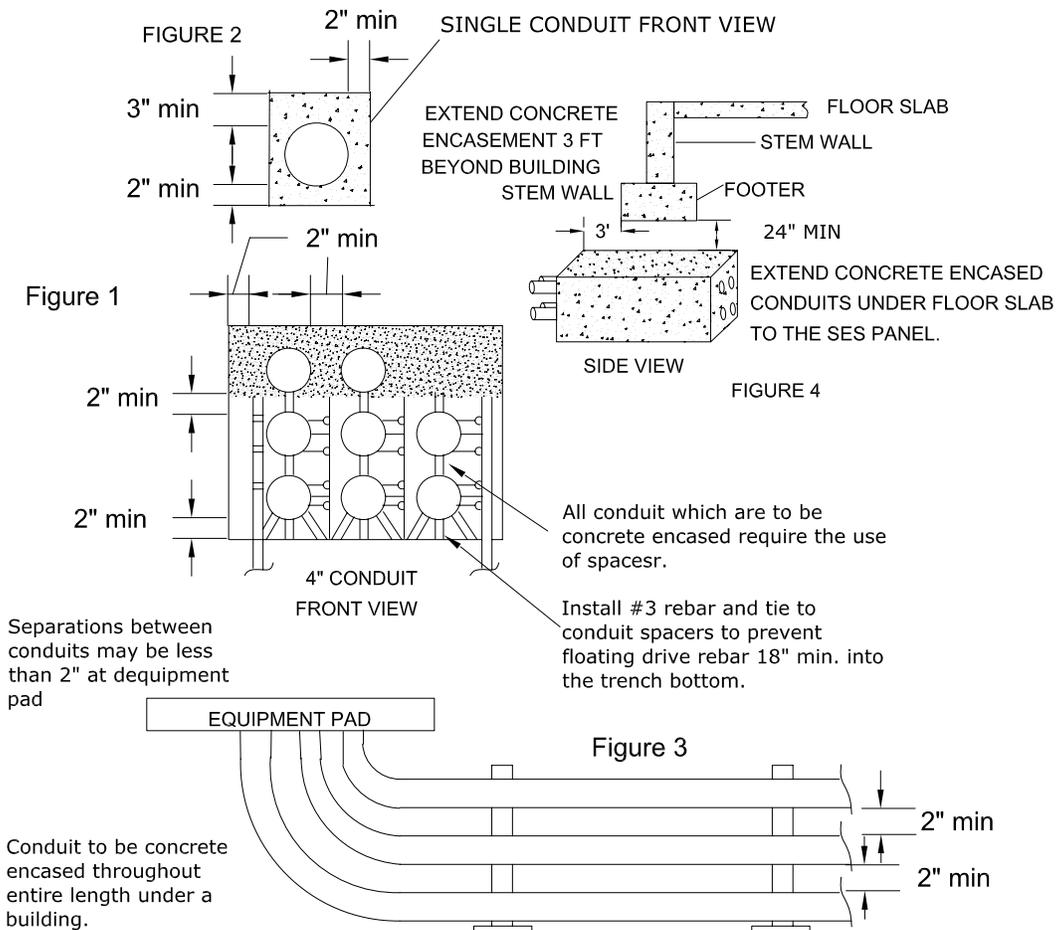


502.7-2 USE OF PRIMERS OR CEMENTS, OTHER THAN THE ONES LISTED ABOVE, WILL RESULT IN UNACCEPTABLE JOINTS

A natural bristle brush or the applicator supplied with the cement container shall be used. Plastic bristle brushes shall not be used as the primer and cement will dissolve the bristles. Follow the manufacturer's instructions on the primer and cement containers. Do not use any cement which shows signs of thickening. Shelf life on the unopened container is 3 years from the date of manufacture stamped on the container.

502.8 ENCASEMENT OF CONDUIT

Where service conduits must be installed under a building, the conduits shall be concrete encased, (3000 psi at 28 days) and the top of the encasement shall have a minimum of 24 inches clear separation below the structure foundation. A minimum of 2 inches vertical and horizontal separation is required between concrete-encased conduits. (See Figure 1) Sidewalls and bottom of trench shall provide a minimum of 2 inches separation from conduit (See Figure 1 and 2). The top of concrete encasement to be a minimum of 3 inches from top of conduit. Sweeps are to be concrete encased also with a minimum of 2 inches of concrete; however, the minimum separations between conduits do not apply at service entrance or transformer pads. (See Figure 3) All concrete encased conduit require the use of spacers to insure conduit does not move during pouring of concrete. (See Figure 3 for maximum distance between spacers.) All conduits encased in concrete shall be mandrelled.



ELECTRIC SERVICE REQUIREMENTS 501.7 - 2



502.9 USABILITY OF THE CONDUIT SYSTEM

Extreme care shall be exercised to ensure that concrete and other foreign matter does not enter the conduit being laid, while encasing, or at any time thereafter. All conduit shall be free of obstruction, dirt, rock, etc. **The conduit system shall be a clean useable system at the time CRA-ES installs conductors.** In all cases the customer is responsible for the usability of the conduit system at the time CRA-ES installs conductors.

502.10 CONNECTING TO EXISTING CONDUITS

Empty conduits which have been stubbed out by CRA-ES for future attachment to Customer, may be located and exposed by the Customer performing the attachment. (See 502.12-3,4,5) Contact an CRA-ES Customer Service Representative for the approximate location of service conduit stub-outs on your property.

502.11 SEPARATION FROM OTHER UNDERGROUND INSTALLATIONS

In order to permit access to and maintenance of either facility without damage to the other, a 24 inch horizontal separation shall be maintained between CRA-ES Electric Facilities and water, sewer or gas pipeline systems. A minimum 12 inch clear vertical separation is required between cable installed in conduit and the outside wall of the pool or it's auxillary equipment. CRA-ES facilities shall not be installed beneath cool decking.

Exception: Natural gas facilities shall be permitted to be "Joint-Trench" with CRA-ES facilities, provided all requirements of Section 600 are met.

In the event of an inconsistency or conflict with any Municipal specifications, the more stringent specification shall apply.

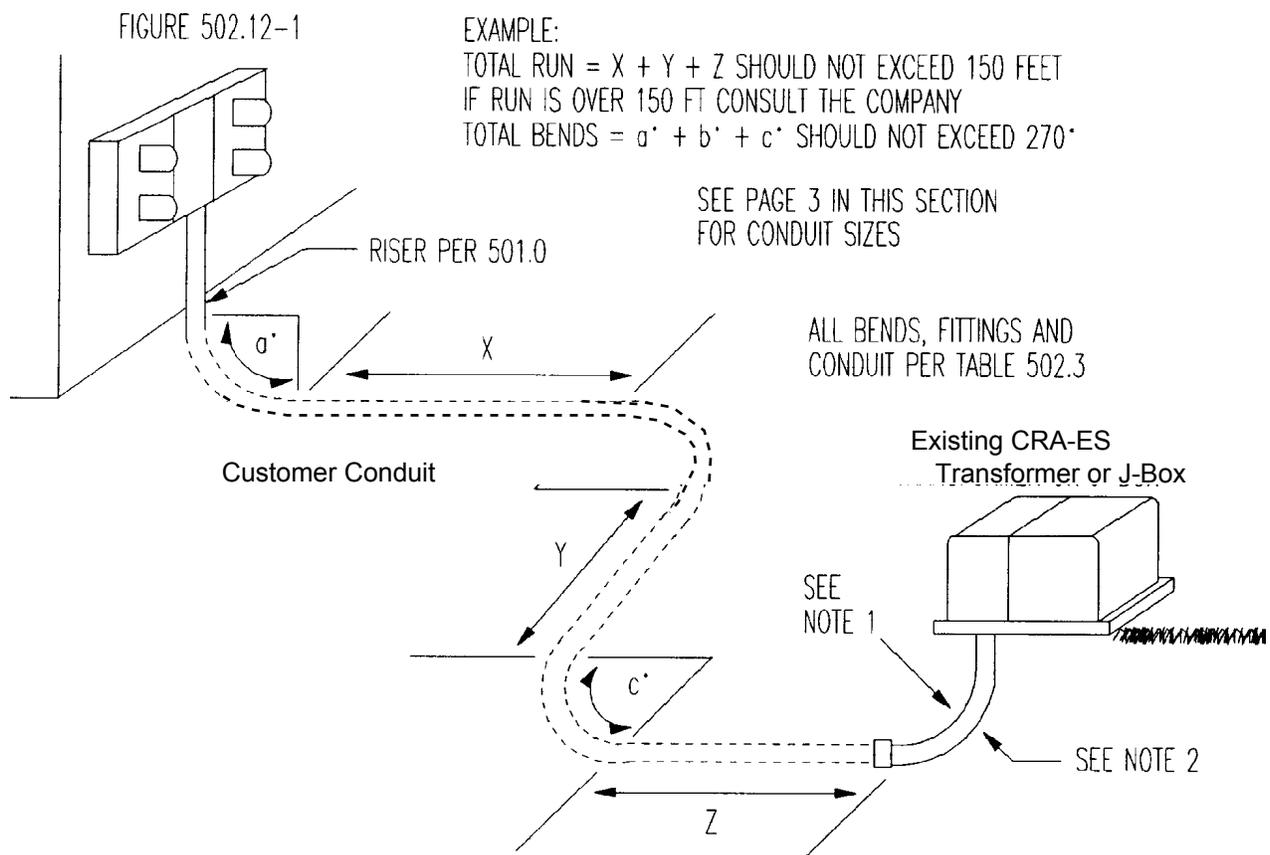


502.12-1 THE SERVICE CONDUIT SYSTEM (EXISTING TRANSFORMER OR J-BOX)

DESIGN GUIDELINES:

Each single-phase service conduit system, from the bottom of service equipment enclosure to source of service as designated by CRA-ES, shall meet the following requirements unless otherwise directed by CRA-ES.

- A) Conduit to be same trade size as approved single-phase riser (see 501.1-1 and 501.1-2).
- B) Total run shall not exceed 150 ft. total length or more than 270° of bends including 90° sweep at riser bottom. 90° sweep at transformer is not included in 270° total.
- C) A service conduit system in excess of that described in "B" may require larger radius bends and/or concrete encased sweeps. CRA-ES Division Engineering should be consulted in these instances.
- D) **The conduit shall have as a minimum, 24" of cover to finished grade from top of conduit.**



NOTES:

1. Customer to install conduit from service entrance equipment to transformer pad or j-box. Conduit to be capped. Customer to provide 36" x 36" x depth of facilities "bell hole" per 502.12-5.
2. CRA-ES to install Customer provided sweep into energized source.
3. For conduit installation procedure, see Paragraph 502.0.
4. **This drawing shows existing transformer with no future stub-outs installed. For existing transformers with stub-outs, see Paragraph 502.12-3, 502.12-4 and 502.12-5.**
5. Customer to follow Blue Stake requirements.

Electric Service Requirements 502.12-1

502.12-2 THE SERVICE CONDUIT SYSTEM - (FROM TRANSITION POLE) SINGLE PHASE

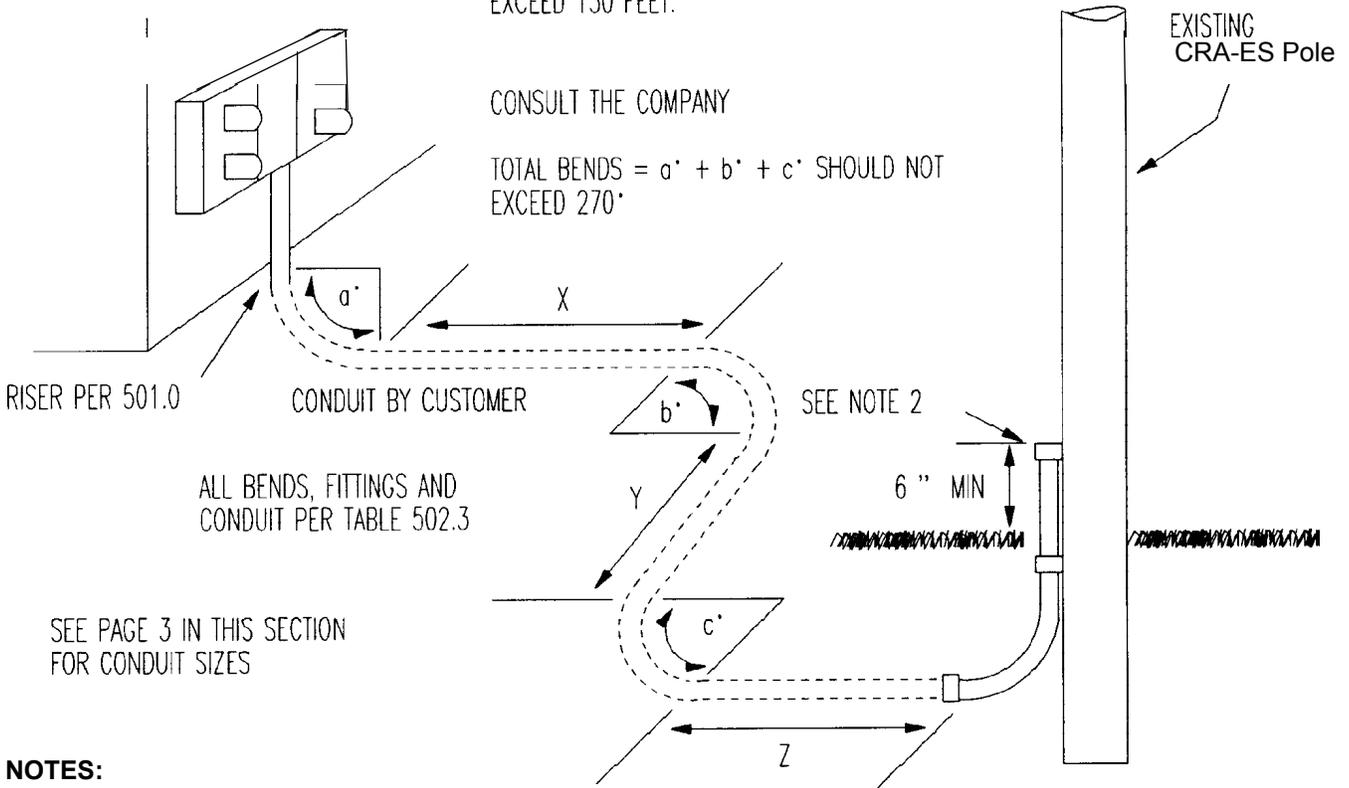
DESIGN GUIDELINES:

Each single phase service conduit system, from bottom of service equipment enclosure to source of service as designated by CRA-ES, shall meet the following requirements unless otherwise directed by CRA-ES.

- A) Conduit to be the same trade size as approved 1ø riser. (See 501.1-1 and 501.1-2)
- B) Total run shall not exceed 150' total length or more than 270° of bends including 90° sweep at riser bottom. A 90° sweep at pole is not included in the 270° total.
- C) A service conduit system in excess of that described in "B" may require larger radius bends and/or steel sweeps. CRA-ES Engineering should be consulted in these instances.
- D) **The conduit shall have a minimum 24" of cover to finished grade from top of conduit.** If crossing a street or right of way, check with CRA-ES Engineering for minimum depth requirements.

FIGURE 502.12-2

EXAMPLE:
TOTAL RUN = X + Y + Z SHOULD NOT EXCEED 150 FEET.



NOTES:

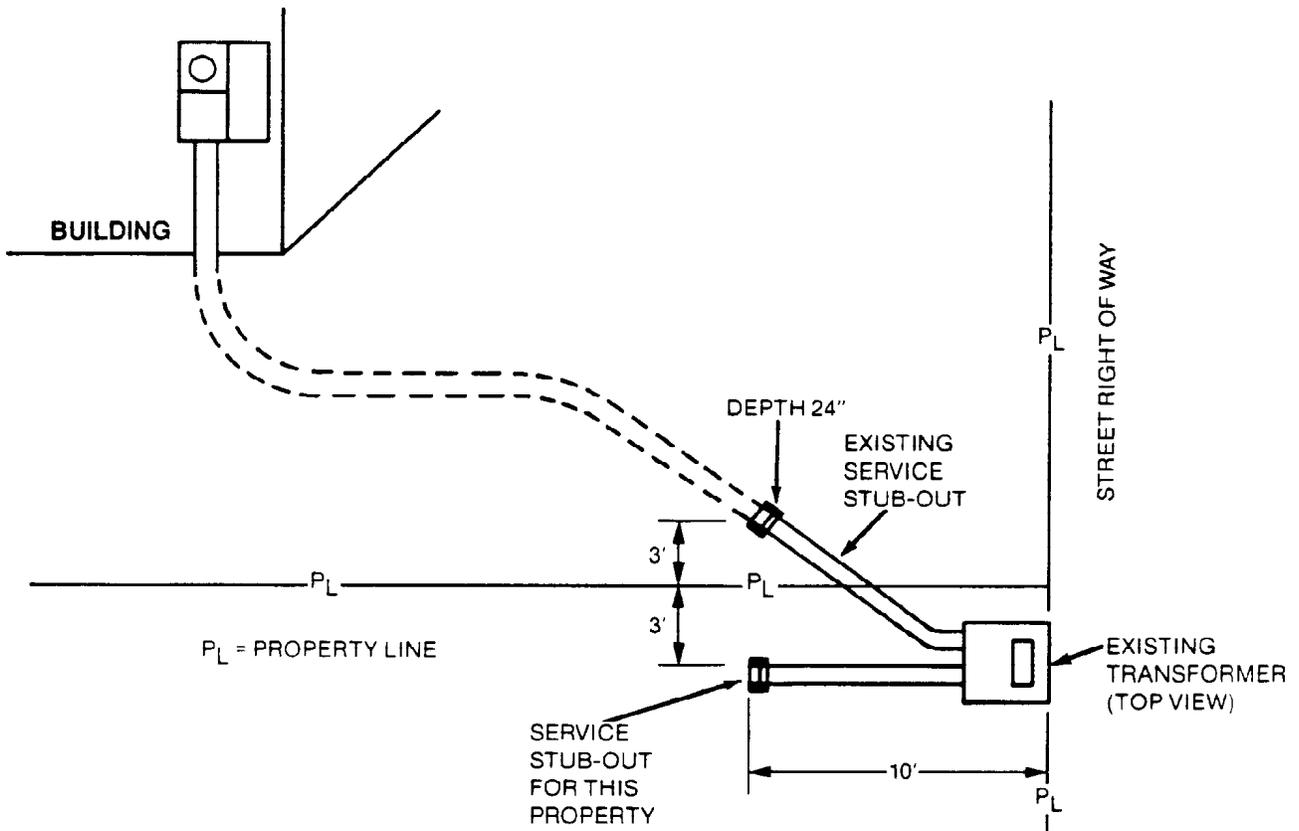
- 1. Customer shall contact a qualified CRA-ES representative prior to trenching to determine the trench alignment and location of the transition sweep at the pole.
- 2. Customer to install conduit from service entrance to base of CRA-ES pole and install approved sweep at pole location. Conduit to be extended a minimum of 6" above finished grade and capped.
- 3. Customer to follow Blue Stake requirements.
- 4. For conduit installation procedure, see Paragraph 502.0.

Electric Service Requirements 502.12-2



502.12-3 THE SERVICE CONDUIT SYSTEM - (CONDUIT STUB-OUTS) SINGLE PHASE

- a) Customer to contact an CRA-ES Customer Service Representative for the approx. location of conduit stub-out on property then, Customer to locate and expose end of existing conduit stub-out from transformer. See drawing on next page for typical location of stub-out.
- b) Customer to install conduit from service entrance to exposed stub-out.
- c) Customer to join existing stub-out and conduit from service entrance. Make certain no debris enters conduit. (See Paragraph 502.9)
- d) See Paragraph 502.12-1 & 2 for maximum number of bends in conduit run. (Check with your Customer Service Representative for number of bends in existing stub-outs. Maximum number of bends includes bends in stub-out conduit.)
- e) CRA-ES to install service conductors.

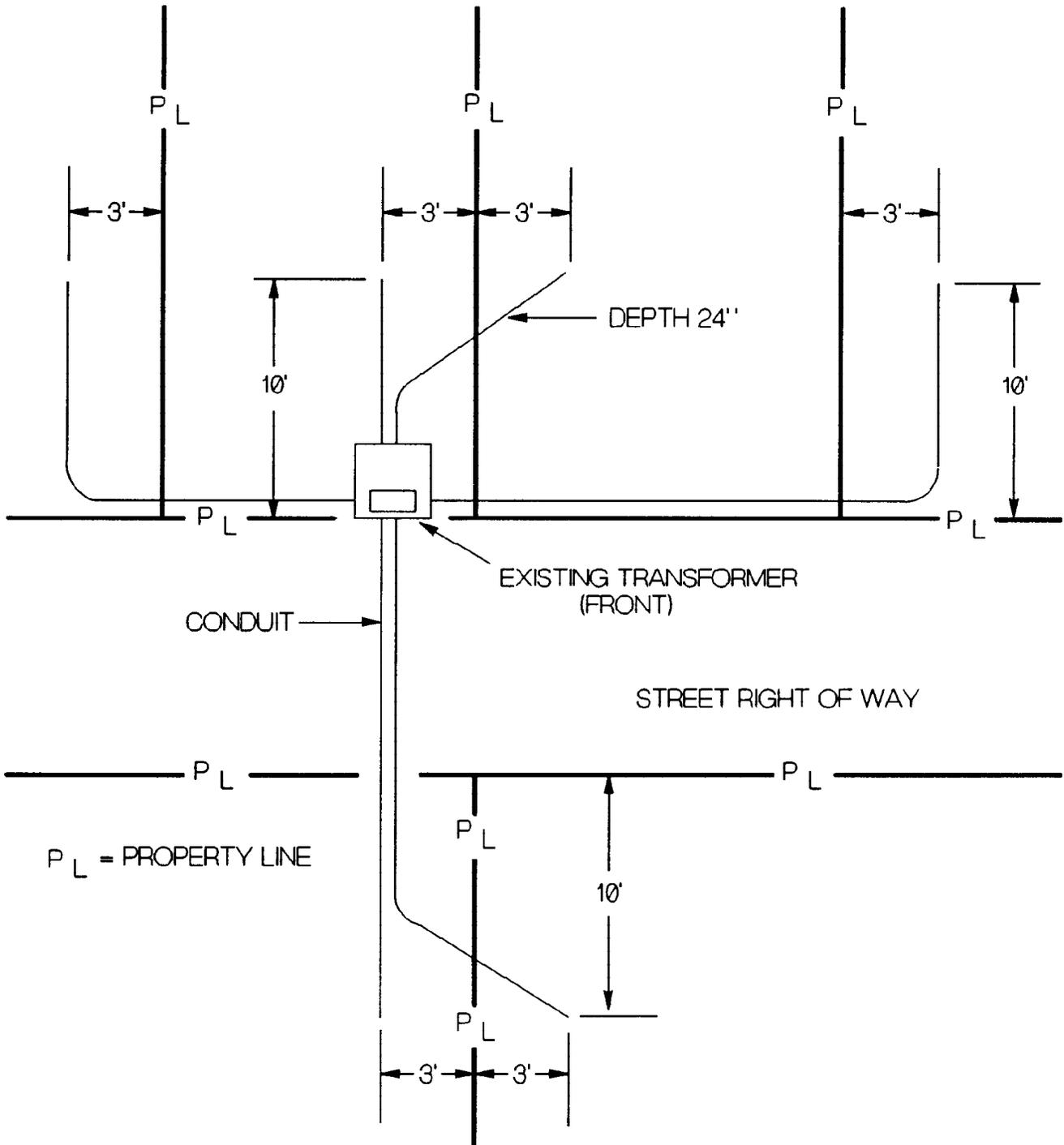


Electric Service Requirements 502.12-3



THE SERVICE CONDUIT SYSTEM - SINGLE PHASE

TYPICAL CONDUIT STUB-OUT LOCATIONS FOR USE WITH RIGID STUB-OUTS:



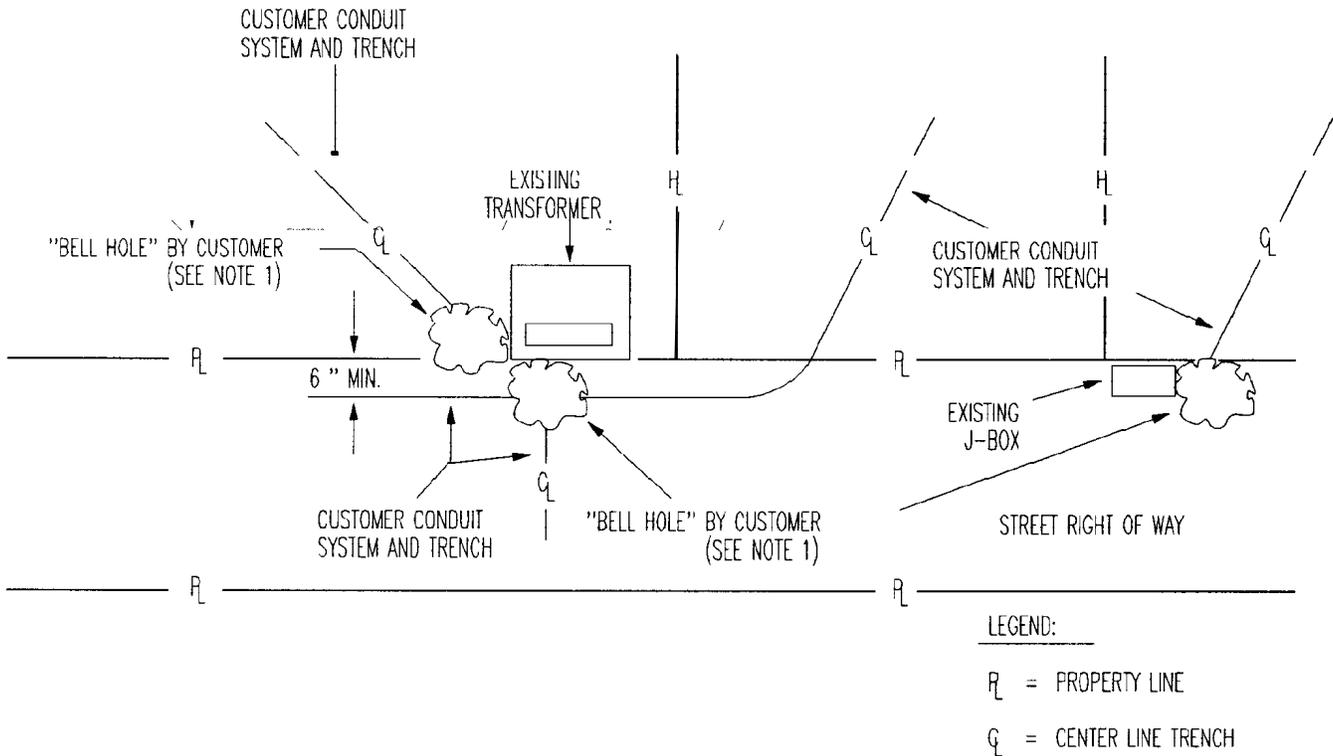
CHECK WITH AN CRA-ES CUSTOMER SERVICE REPRESENTATIVE FOR THE APPROX. LOCATION OF CONDUIT STUB-OUTS ON YOUR PROPERTY

Electric Service Requirements 502.12-4



502.12-5 THE SERVICE CONDUIT SYSTEM - SINGLE PHASE

TYPICAL SECONDARY CONDUIT ENTRY FOR EXISTING TRANSFORMERS AND J-BOXES:



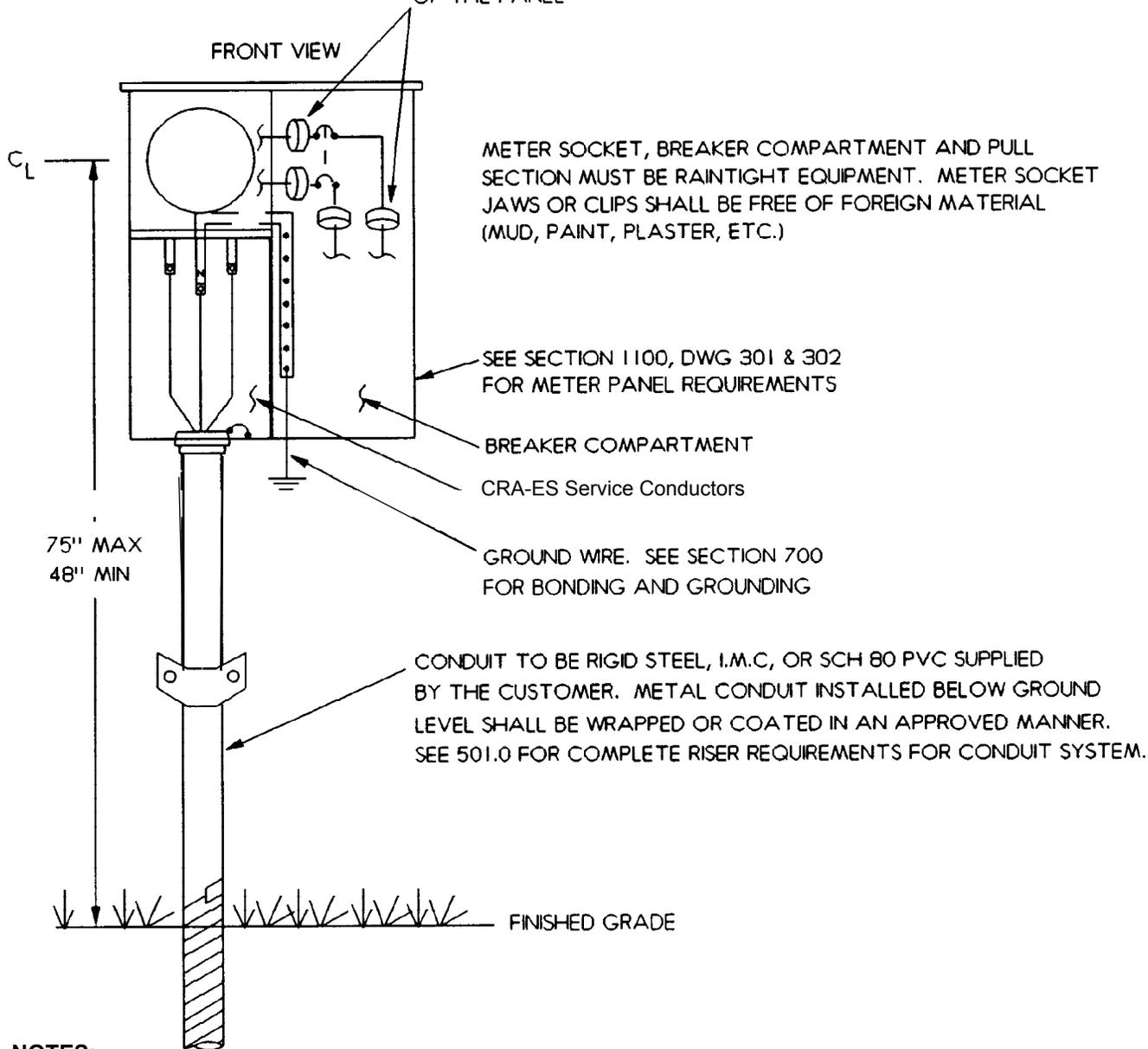
CHECK WITH AN CRA-ES CUSTOMER SERVICE REPRESENTATIVE FOR THE APPROX. LOCATION OF CONDUIT STUB-OUTS ON YOUR PROPERTY

NOTE:

1. "Bell Hole" shall be dug by Customer to a location designated by **CRA-ES Representative** at transformer or J-box, with minimum dimensions of 36" x 36" x depth of facilities being installed.



ALL NEW RESIDENTIAL SERVICE PANELS MUST PROVIDE SPACE FOR LOAD CONTROL CURRENT TRANSFORMERS ON THE CUSTOMER SIDE OF THE PANEL

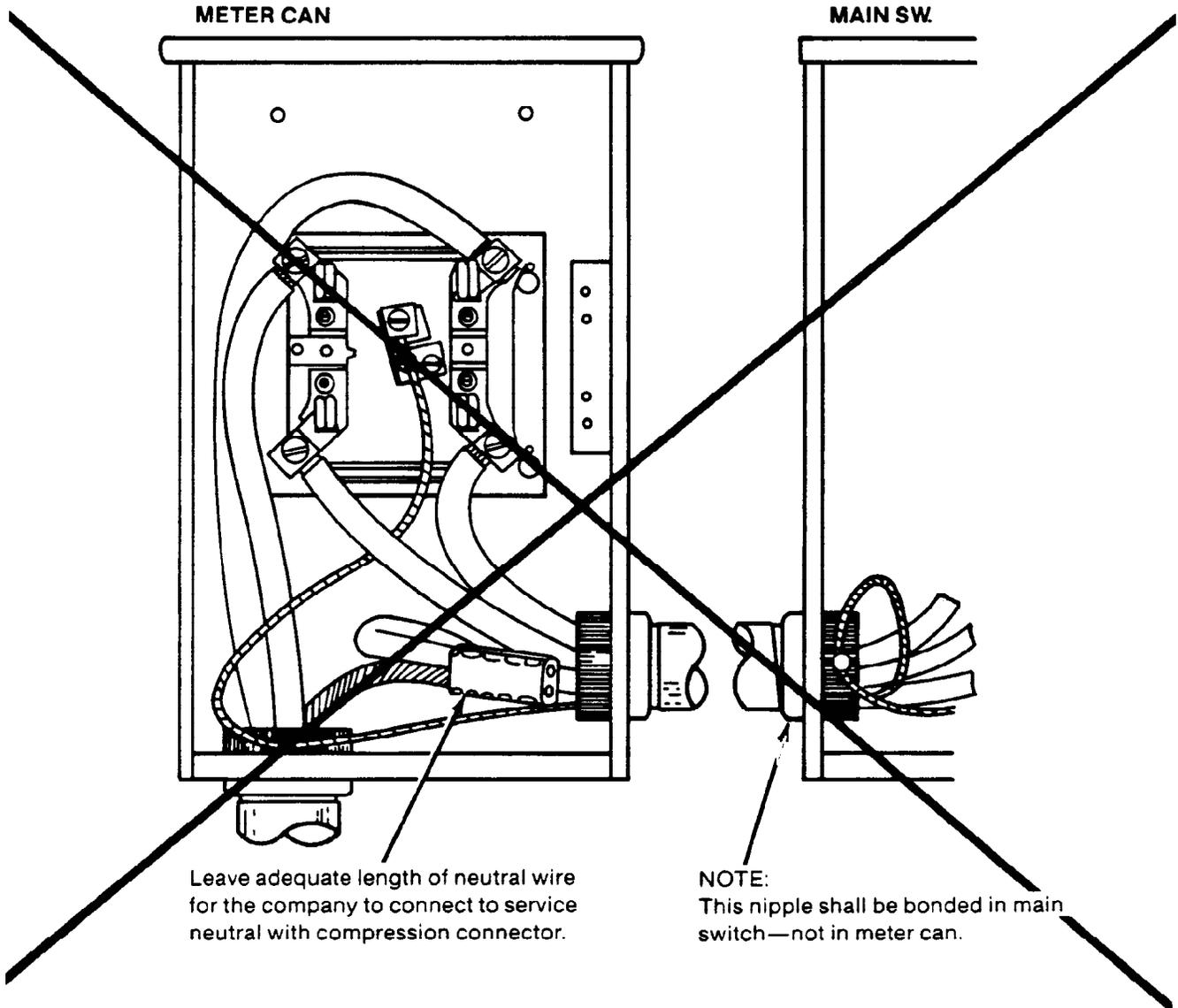


NOTES:

1. See Section 1100 Dwg. 301 & 302 for residential meter panel requirements.
2. Underground service conductors and connections to service terminals provided by CRA-ES.
3. This is the preferred installation for single family residential applications.



506.2-1



U.L. APPROVED BONDING HUBS MAY BE USED IN LIEU OF BONDING BUSHINGS.

OBSOLETE: FOR MAINTENANCE ONLY
See Paragraphs 506.1 and 506.2



Purpose and Scope

This document shows methods acceptable by CRA-ES, to be used by residential and non-residential (200-amp or less main service switch) customers when converting existing 2-wire or 3-wire overhead services to underground.

General Information

1. A typical overhead service conversion is illustrated in Figure 1. CRA-ES will install cable in a conduit system provided by the applicant. Various surface mount and semi-flush meter socket installations (illustrated in Figure 2 on Page 3 through Figure 7 on Page 4) are used with services converted to underground. The conversion option selected by the customer shall comply with all local building codes and ordinances. The customer shall furnish, install, own, and maintain termination facilities on or within the building to be served.
2. Local ordinances may include requirements in addition to those shown in this document. Consult local inspection authorities for these requirements. In areas where local ordinances require permits and inspection, these must be obtained before CRA-ES can establish service. CRA-ES will install meter(s) after an inspection clearance has been given by the appropriate electrical inspection authority.
3. When a service larger than 200 amps is desired, the customer shall consult with the local CRA-ES representative.
4. Service Conduit and Termination
 - A. CRA-ES will install the underground service cable and make the connections at the service termination point. The underground service lateral conductors will be installed, owned, and maintained by CRA-ES from CRA-ES's distribution system to the termination facility as indicated in Figure 2 through Figure 7 on Pages 23 through 24.
 - B. The customer shall provide trenching, conduit and backfill on his property in accordance with CRA-ES specifications.
 - C. Service conductors will be installed in conduit as shown in Figure 1 on Page 23. For conduit size, refer to CRA-ES 501.1-2.
 - D. The customer shall contact the local CRA-ES office to discuss service arrangements and agree upon the "Electric Service Location" before trenching or wiring.
 - E. The customer shall provide and install, in addition to termination facilities, all equipment needed to modify the service entrance when changing from overhead to underground service.
 - F. For conduit type on or within the applicant's building, refer to CRA-ES 501.1-2. Also consult local code authority.
 - G. Install bend in direction of service trench. To facilitate cable installation, only one 90° bend is permitted in the riser. If a deeper trench is required, a minimum radius bend, per CRA-ES 501.1-2 shall be installed to the same depth as the trench.
 - H. If the trench is used jointly with other facilities (telephone, cable TV, etc.), increased cable depth may be required. Refer to
 - I. Size and type of cable, conduit and other facilities on the load side of the service termination point are subject to local code requirements.
 - J. To avoid cable insulation damage, the ends of all risers shall be provided with a suitable termination fitting such as bushing, nipple, hub or end bell, etc.
 - K. Pull termination box as specified in Table 506.3-1 on blow item d6 is for service up to 250 kcmil cable. For larger conductor size box as required.
 - L. The point where CRA-ES's service conductors connect to the customer's conductors as shown in Figure 2 through Figure 7, is identified as "CRA-ES Service Termination Point".
 - M. Item 3 on Figure 4 and Figure 5 may be used only if service conductor is 1/0 AWG or smaller and can be pulled from the CRA-ES end of the service.
 - N. Customer may install short-radius conduit fitting (ie, service elbows that prevent water from penetrating the fitting at termination to meter panel). Short radius conduit fittings should not contain splices or taps. The cover also must be sealable by CRA-ES personnel.
5. Grounding: The customer shall be responsible for bonding and grounding all exposed non-current carrying metal parts. Grounding shall be in accordance with the National Electric Code (NEC) and local ordinances, except that the grounding wire shall be protected against mechanical damage by rigid steel conduit or armored copper ground wire.
6. Metering Requirements: Meter will be furnished and installed by CRA-ES.



506.3-1 Overhead to Underground Conversion

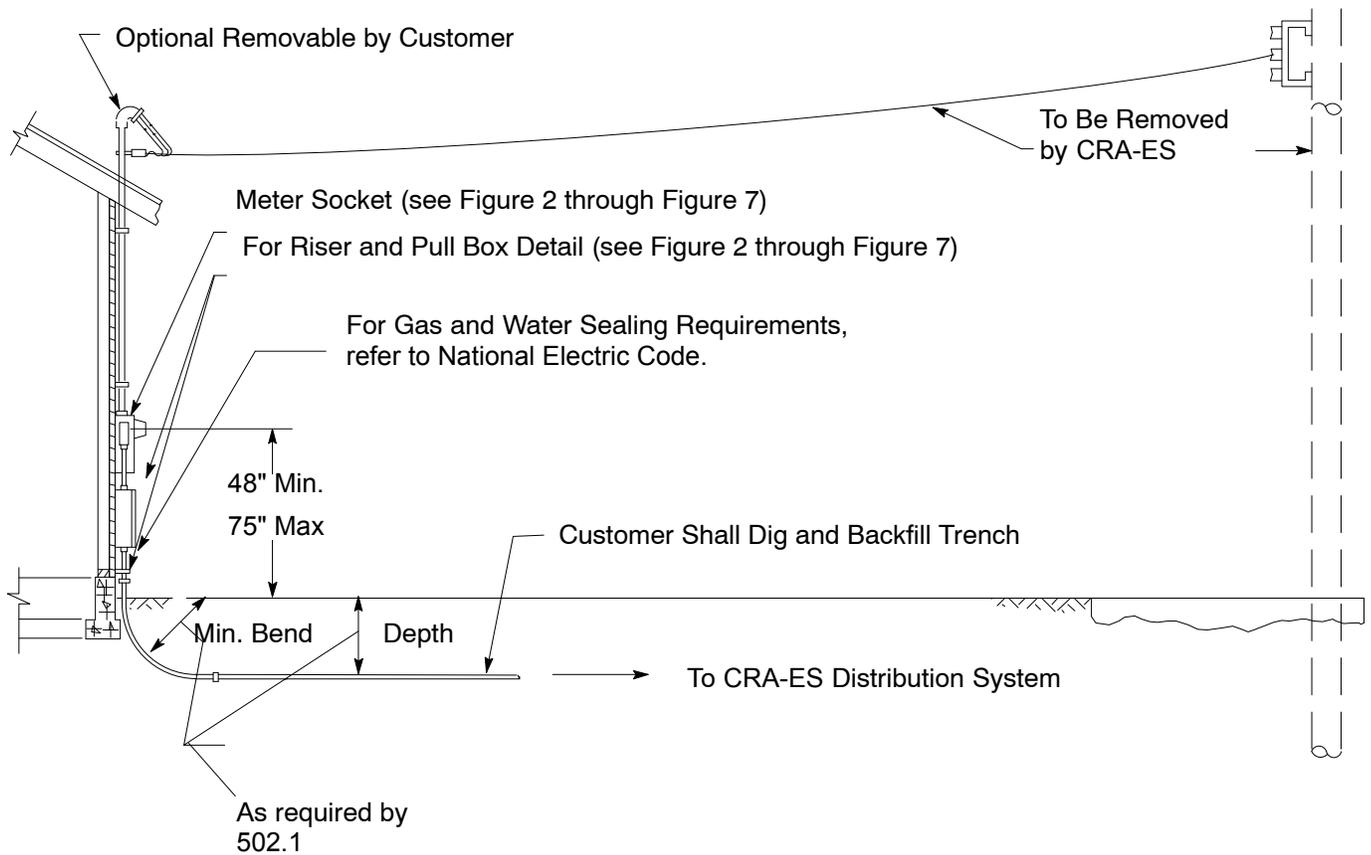
Table 506-3.1 Description of Items to be Furnished and Installed by Customer

Item	Description
1	Option 1: Meter Adapter, Cooper B-Line Cat. No. MARR20L45GRSD (160A) Use with Customer's Panel Rated at 160A Continuous ^{1, 2}
	Option 2: Meter Adapter, Ekstrom Industries No. 722B (175A). Specify Left, Right, or Bottom Hub
2	Combination Service Meter and Breaker Panel (rating as required)
3	Pull Termination Box, 8" x 12" x 4", Rain-Tight, Circle A-W (Cooper B-Line) No. R-9007A or Equivalent (see Note 4M on Page 2)
4	Conduit, See Notes 4C and 4G on Page 1
5	Hub to Be Closed and Made Tamper Proof
6	Pull Termination Box, 12" x 26" x 6", Rain-Tight, Circle A-W Catalog Number R-90008, or Equivalent (see Note 4K on Page 21)

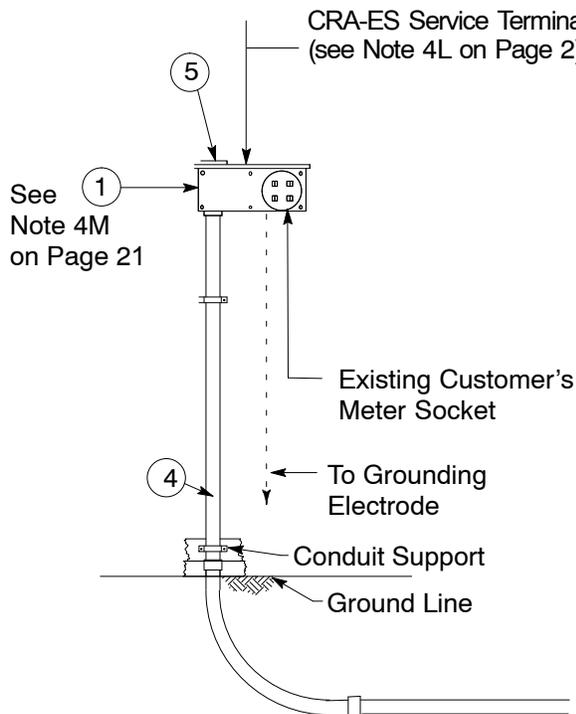
¹ Fifth jaw accessory, use Cooper B-Line Cat. No. 50365.

² Reducer hub and gasket accessories for 2" conduit, use Cooper B-Line Cat. No. AW200 and 12750A.

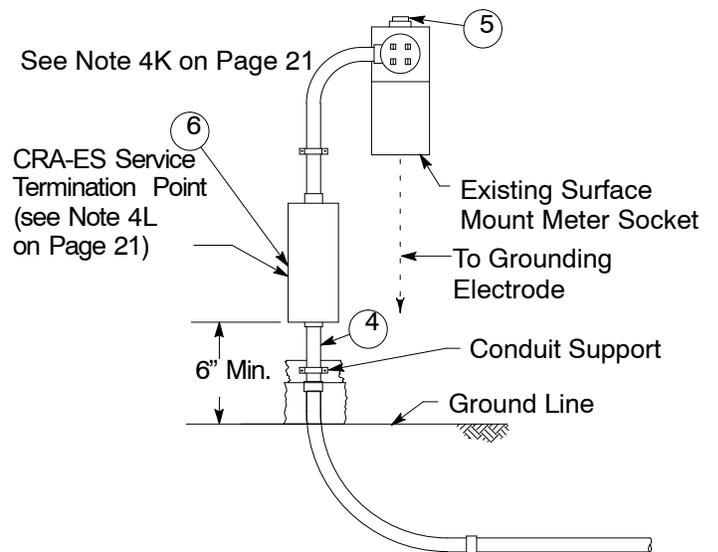




**Figure 1
Typical Service Conversion**



**Figure 2
Cooper B-Line Meter Adapter**



**Figure 3
Surface Mount Meter Socket**

Electric Service Requirements

506.3



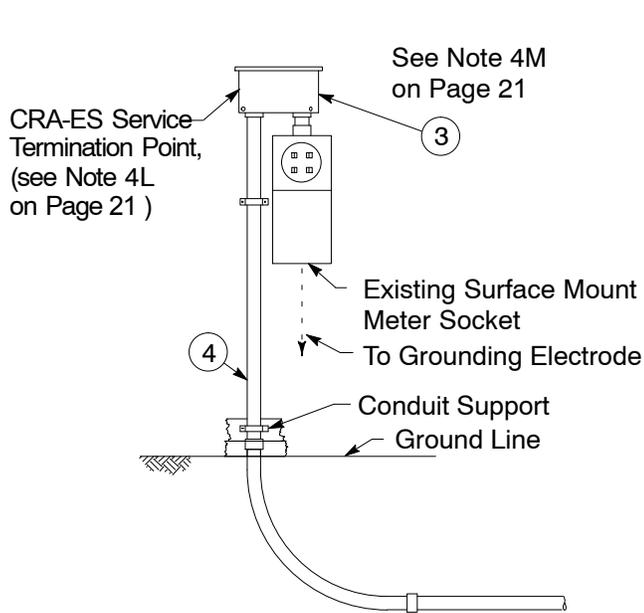


Figure 4
Surface Mount Meter SocketC

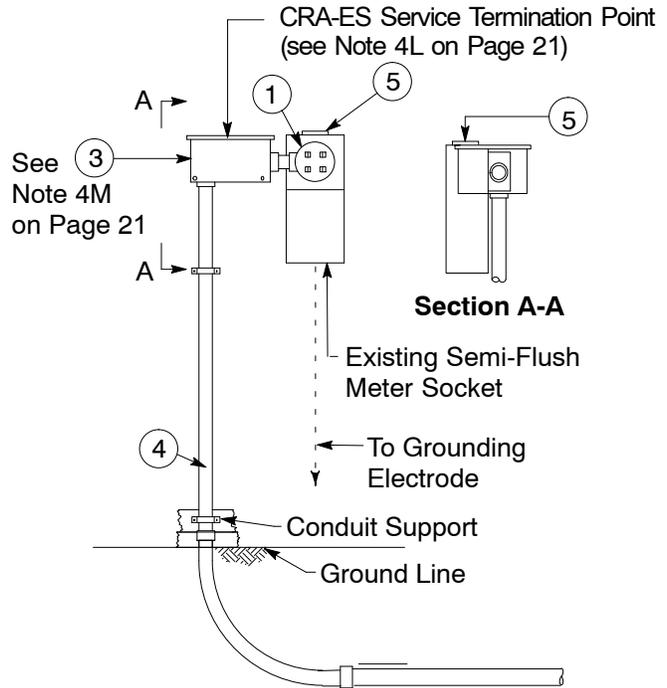


Figure 5
Semi-Flush Meter Socket

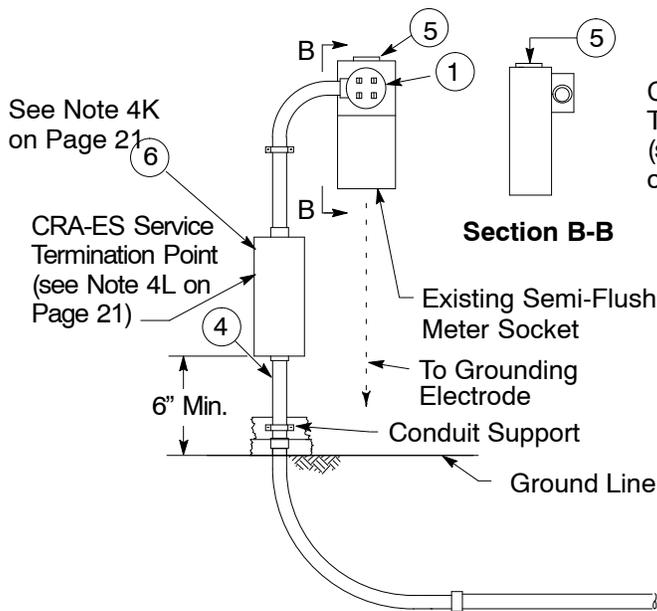


Figure 6
Semi-Flush Meter Socket

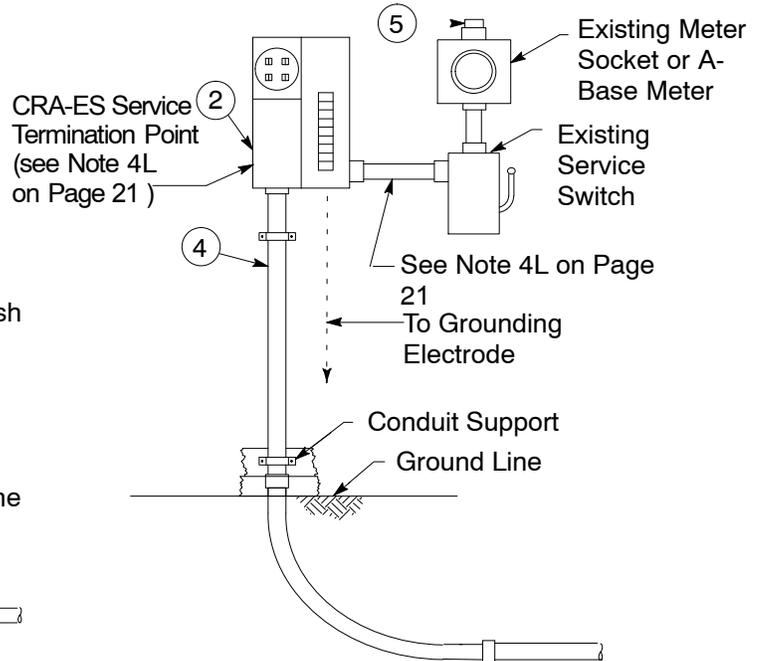
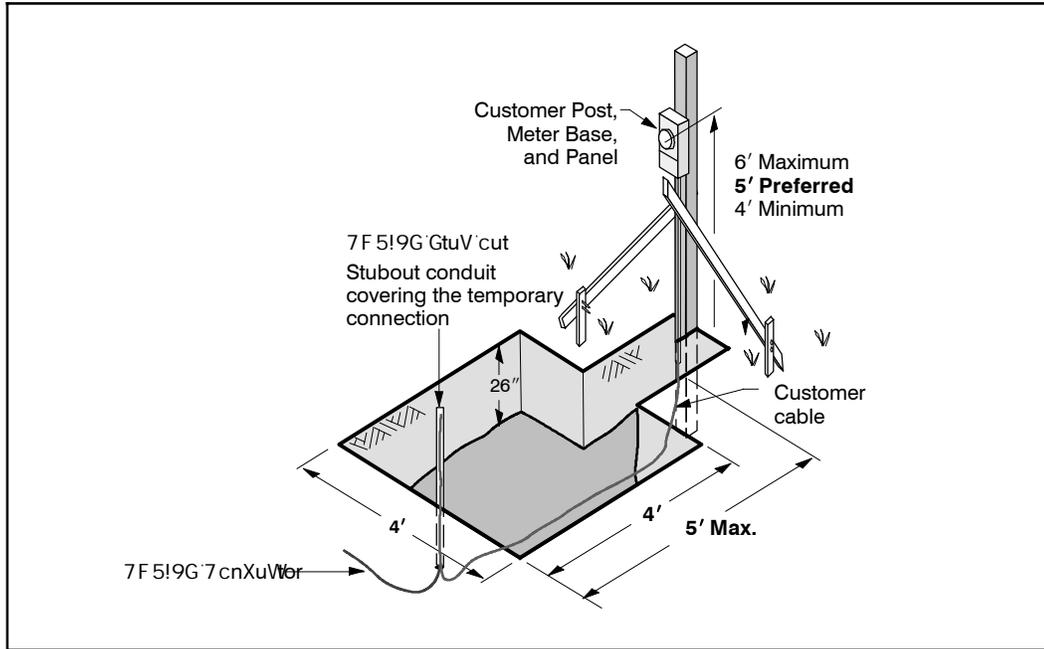


Figure 7
2-Wire or A-Base Meter Connection

TEMPORARY FOR CONSTRUCTION - SERVICE AND METER POLE, SINGLE PHASE THREE WIRE, 120/240 VOLT



NOTES:

1. CRA-ES to determine which transformer or junction box shall feed service pole.
2. Approved service wires in conduit shall be installed by Customer and extended to a point designated by CRA-ES. **A sufficient coil of wire to reach the secondary terminals of the transformer must be left.** CRA-ES to terminate service in transformer. If conduit stub-out from source is not available, see 502.12-5.

Exception: Temporary services of 200 amps or less, located 10 feet or less from the junction box or transformer, may use approved direct-buried wire instead of conduit.

3. All wires and equipment shall be per N.E.C. and local codes. See Section 400 Paragraph 402.2 for recommended pole material requirements. See Section 500 Paragraph 506.6-1 for alternative installation. See Section 100 for definition of "temporary".
4. **If temporary pole cannot be set within 10 feet of a junction box or transformer, all conduit sizes shall be per 501.1-2 and must meet all permanent installation requirements. (CRA-ES will install wire from meter to junction box or transformer.)**

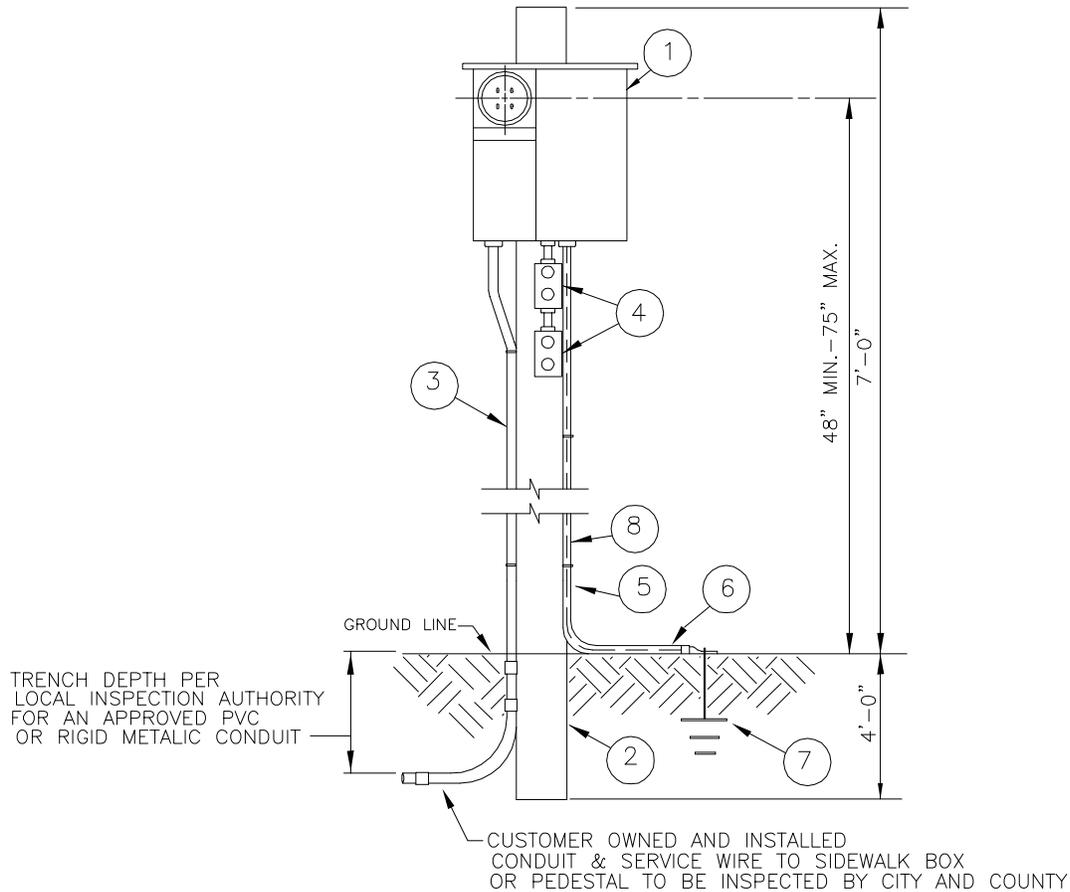
CAUTION

Before setting pole and driving ground rod be sure to notify Blue Stake. See Section 100, Paragraph 100.12 for phone number.



506.5 TYPICAL TEMPORARY/PERMANENT SERVICE ENTRANCE (RESIDENTIAL)

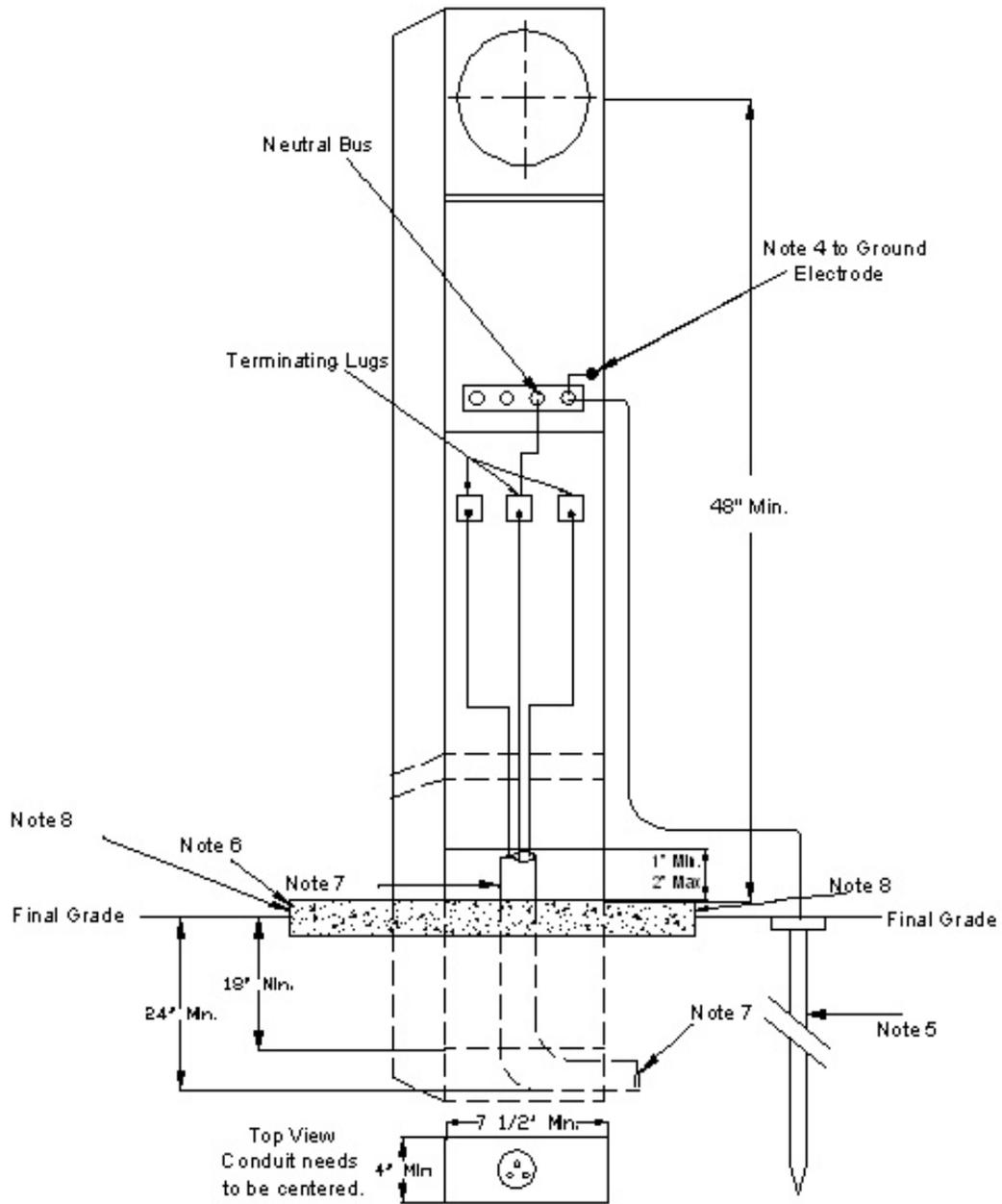
1. Customer shall obtain permit for temporary service for this type of installation from Local Inspection Agency before installing the equipment. **May not be available in all jurisdictions.**
2. Customer shall install service equipment on wall in permanent location.
3. CRA-ES shall install underground service to entrance on a permanent basis.
4. Customer's installation shall be approved by the Inspection Agency.



MATERIALS TO BE FURNISHED AND INSTALLED BY THE CUSTOMER

ITEM	DESCRIPTION
1	SERVICE TERMINATION ENCLOSURE, COMBINATION METER SOCKET PANEL
2	POST, MIN. DIM. 4" x 4" x 11'-0" LONG --- SEE NOTE 2
3	CONDUIT, RIGID STEEL, GALVANIZED OR PVC SCH 80
4	WEATHERPROOF OUTLETS
5	CONDUIT, RIGID STEEL GALVANIZED, WITH PIPE STRAP
6	HUB AND CLAMP, GROUNDING
7	GROUND-TYPE & MATERIAL PER LOCAL INSPECTION AUTHORITIES AND CODE.
8	GROUND WIRE, BARE COPPER (SIZE IN ACCORDANCE WITH APPLICABLE ELECT. CODES & LOCAL REQ.)





All Dimensions shown are in Inches.

Page 1 of 2- for notes, see page 25.



(Page 2 of 2)

INSTALLATION GUIDELINES:

1. See Section 1100, DWG. 307 for meter pedestal requirements.
2. Pedestal may be used as temporary for construction.
3. Pedestal and power outlet section shall be rated 10,000 A.I.C. minimum.
4. The grounding electrode conductor shall be continuous to the neutral landing block in the breaker compartment and shall not pass through the service termination section or meter compartment. Bare copper conductor may be used if properly supported. Connect pedestal bond lug as shown.
5. Grounding shall be provided by the Customer in compliance with the N.E.C. Made electrodes shall have a resistance-to-ground of not more than 25 Ohms.
6. Poured concrete slab shall be 24" x 24" minimum size and have a 3-1/2 inch thickness.
7. Customer to provide and install 2-1/2 inch rigid PVC conduit and sweeps per 502.0. A 24" radius is required. Conduit to extend a minimum of 1" and a maximum of 2" above the concrete slab. (See drawing). Cascaded pedestals are not allowed.
8. Customer shall be responsible for final grade of the utility island and the included meter pedestal.
9. Receptacle plugs, cords or "hard-wire" connections shall not block access to panel(s) covering service cable and termination pull section. (See note 6)
10. Meter location to be approved by CRA-ES. See Section 300, Paragraph 301.3 for details.

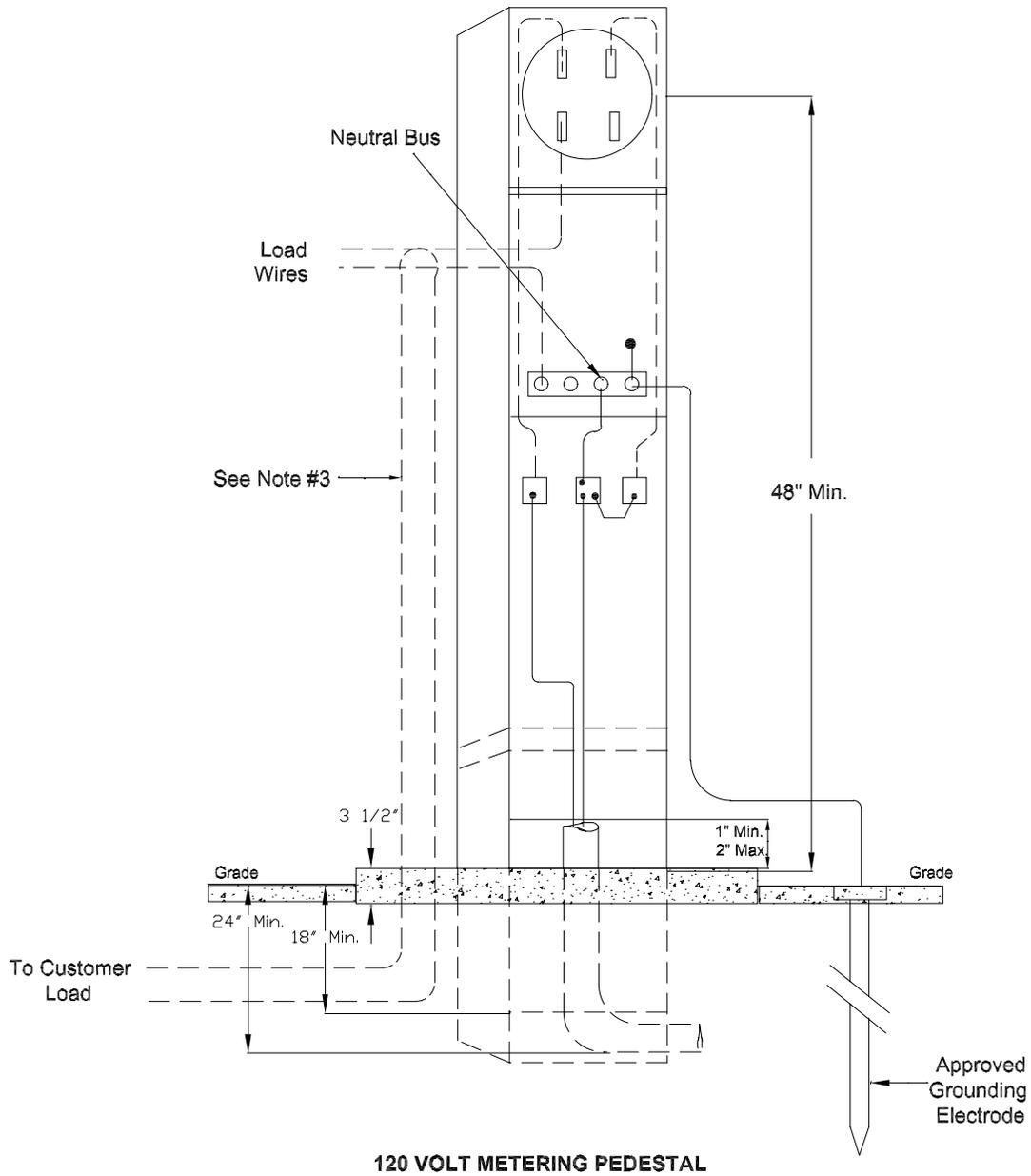
INSTALLATION PROCEDURE FOR CUSTOMER:

11. Set the meter pedestal in place over the 2-1/2" plastic service conduit.
12. Install the required size continuous grounding electrode conductor from an approved grounding electrode to the neutral bus in the breaker compartment.

Do not run the grounding electrode through the service pull section. Bond the pedestal through it's bonding lug with the grounding conductor as shown. Ground the neutral landing block to the pedestal by means of a jumper or the grounding screw.
(See Dwg 303.13, note 10).
13. Backfill around the pedestal, and compact fill to provide good support, plumb and level the pedestal, and pour the concrete slab. (See note 17 above) Observe that the fixed panel for the final grade and concrete pour is positioned so access is properly maintained to the service lugs through the removable panels.
14. CRA-ES shall connect the service conductors to the service lugs in the meter pedestal, install and seal the pull section panel, and blank off and seal the meter socket ring. The meter shall be set upon completion of the application for service by the Customer.
15. When the pedestal is used as temporary for construction power the edge of the pedestal concrete pad shall be a minimum of 2 feet from the edge of the transformer pad. Maximum distance shall be 10 feet from transformer pad. If terrain dictates a problem contact an CRA-ES customer service representative.

CAUTION - Before digging or driving ground rods be sure to notify Blue Stake or your local CRA-ES office to locate underground facilities. See Section 100, Paragraph 100.12.





Page 1 of 2 - for notes, see page 27.



506.7-2 TYPICAL 120 VOLT 2 WIRE PEDESTAL:
(Page 2 of 2)

NOTES:

1. Meter Pedestal to be U.L. Listed. (As Service Equipment)
2. See Section 1100 , Dwg 307 for meter pedestal requirements.
3. Load conductors shall not be run in Utility's service cable pull and termination section. Metallic conduit shall be wrapped or coated per Paragraph 501.4.
4. A 3 foot minimum working space in front of any removable panel(s) is required.
5. Wiring from meter pedestal to customer equipment shall be installed per National Electric Code.
6. Meter location is to be approved by CRA-ES.
7. Pedestal may be used for metered cable TV installations.

**** For additional installation requirements, see Paragraph 506.6-2 ****

Electric Service Requirements 506.7-2

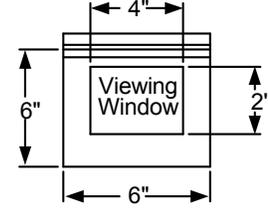
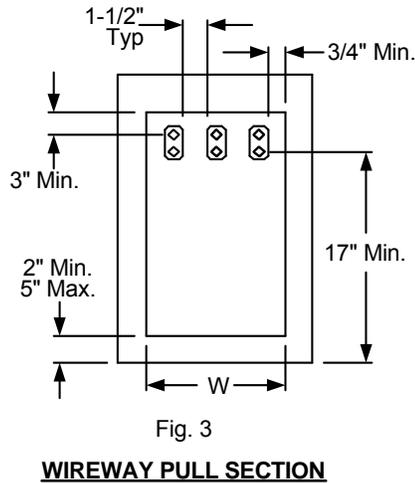
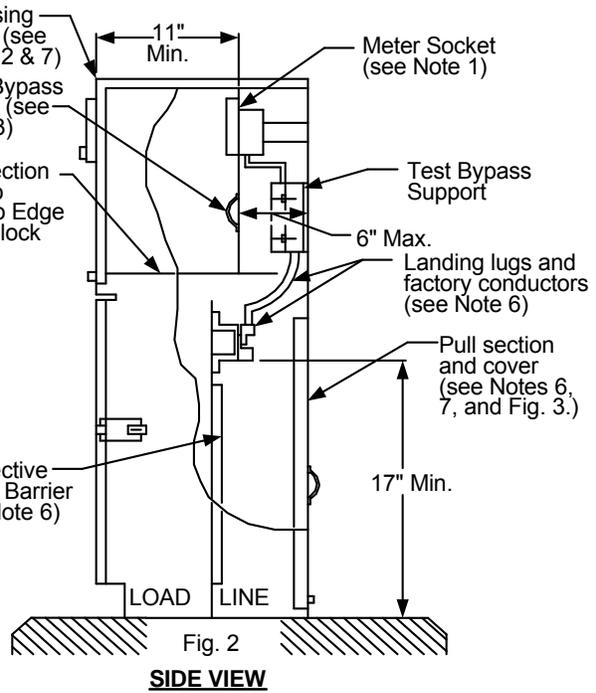
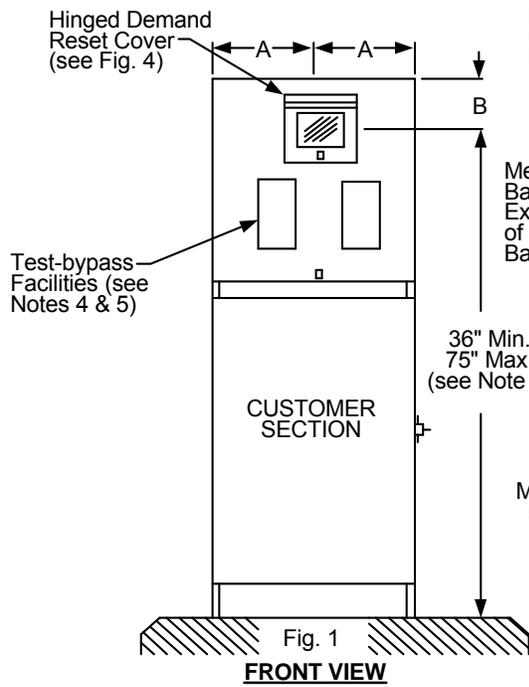


REVISION
07/25/2012

UNDERGROUND SERVICE
MOBILE HOME SERVICE AND METER PEDESTAL

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506.8-1 Typical Non-Residential Service and Meter Pedestal
Maximum 200 Amps, 0-600 volts service



SERVICE	W*	A**	B**
1 Phase	10-1/2"	10"	9"
3 Phase	12-1/2"		

* See Note 6 ** See Note 2

All Dimensions Shown are in Inches

ELECTRIC SERVICE REQUIREMENTS

506.8-1



**506.8-1 Typical Non-Residential Service and Meter Pedestal
Maximum 200 Amps, 0-600 volts service**

NOTES:

1. The meter socket shall be mounted on a support, attached to the meter panel, and provided with a sealing ring. Ringless sockets are not acceptable. Meter height is measured from the center of the meter-socket.
2. The meter shall be enclosed and the enclosing cover shall meet one of the following conditions:
 - a) The cover shall have a fixed top and sides with access to the metering compartment provided through a hinged door. The hinged door shall be equipped with a device to hold the door in the open position at 90 degrees or more.
 - b) The cover shall be hinged to allow the top and front to be rotated back, exposing the metering compartment. When the metering compartment side panels are attached to, and lift back with, the hinged cover, the "A" dimension does not apply. The "B" dimension does not apply. The cover shall not exceed a maximum weight of 25 pounds.

Note: "A" and "B" dimensions are measured from the center of the meter socket to the access opening return flanges.

3. Test-bypass compartment covers shall be sealable and fitted with a lifting handle. Covers exceeding 16 inches in width shall require two lifting handles.
4. Test-bypass blocks with rigid barriers shall be furnished, installed and connected to the meter socket by the manufacturer. Connection sequences shall be LINE-LOAD from left to right and clearly identified by 3/4" minimum block letter labeling. See RPM-11 and RPM-12 for test-bypass block details.
5. Test-bypass shall be installed with the following clearances:
 - a) 3-inches of vertical clearances from the upper test connector stud to the upper compartment access opening and 3 inches from the center of the cable terminal screw to the lower compartment access opening.
 - b) 1-1/2" of side clearance from the rigid insulating barriers to the compartment sides and 1" to the compartment access openings.
6. The terminating pull section shall:
 - a) Comply with the minimum dimensions shown in Table 1 (The "W" dimension is measured between the access opening return flanges), accept a minimum 3" conduit, and the cover shall be equipped with a lifting handle.
 - b) Be equipped with an aluminum-bodied, pressure-type lugs, with a range of No. 6 AWG through 250 Kcmil, for termination of the service conductors. Insulated cable or bus shall be installed between the termination lugs and the test-bypass facilities.
 - c) Have a protective metallic barrier (16 gauge minimum) provided between the pull section and the customer distribution section. There shall be a 1/4" minimum clearance between the customer section wall and the barrier to prevent screws and bolts from protruding into the pull section.
7. Utility compartment covers (i.e., meter cover, and pull section) shall be sealable and lockable with a padlock having a 5/16" lockshaft.
8. Internal equipment attached to the outer walls of the enclosure shall be secured in place with devices that may not be loosened from the outside. Screws or bolts requiring special tools for installation or removal are not acceptable.
9. For structural mounting and support of the pedestal consult the appropriate CRA-ES district.

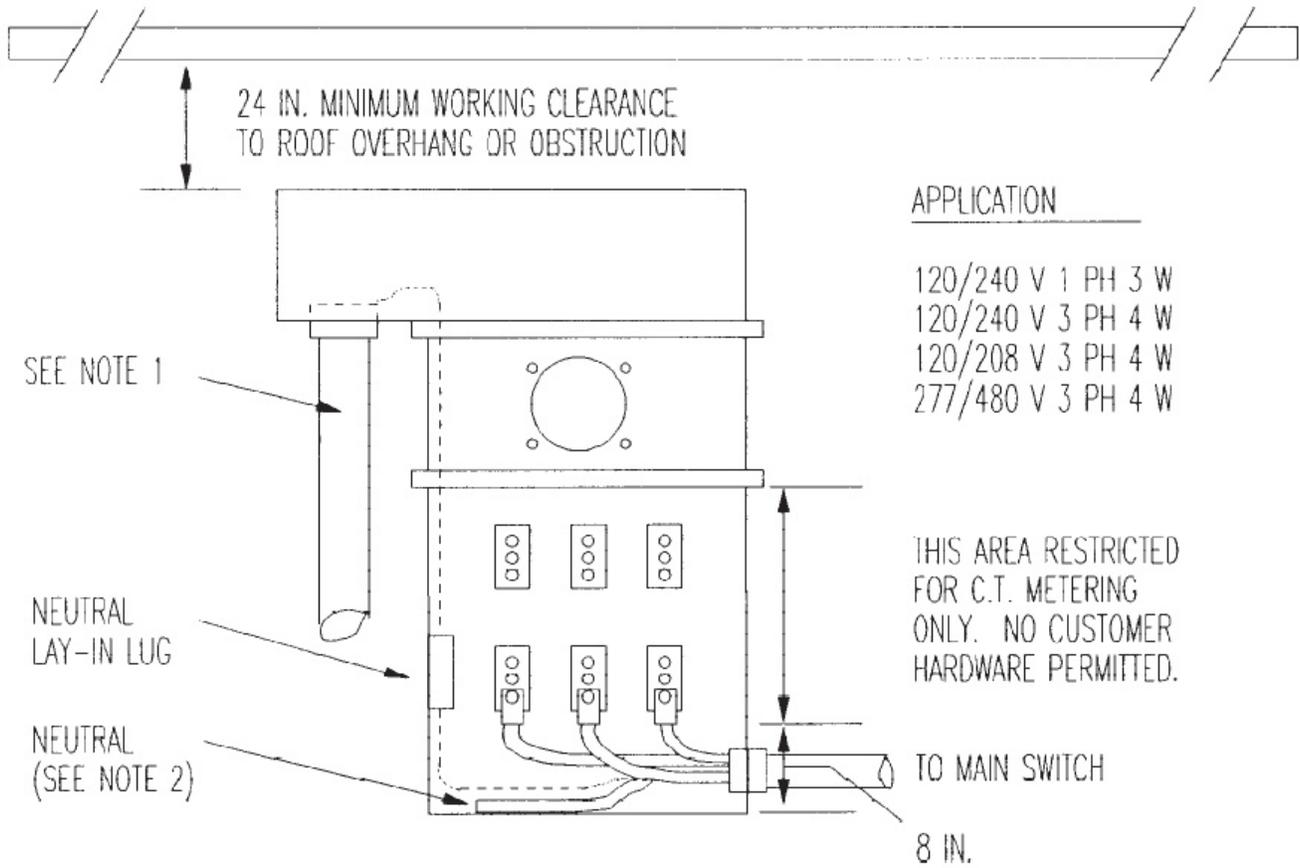


ELECTRIC SERVICE REQUIREMENTS

506.8-2

506.10

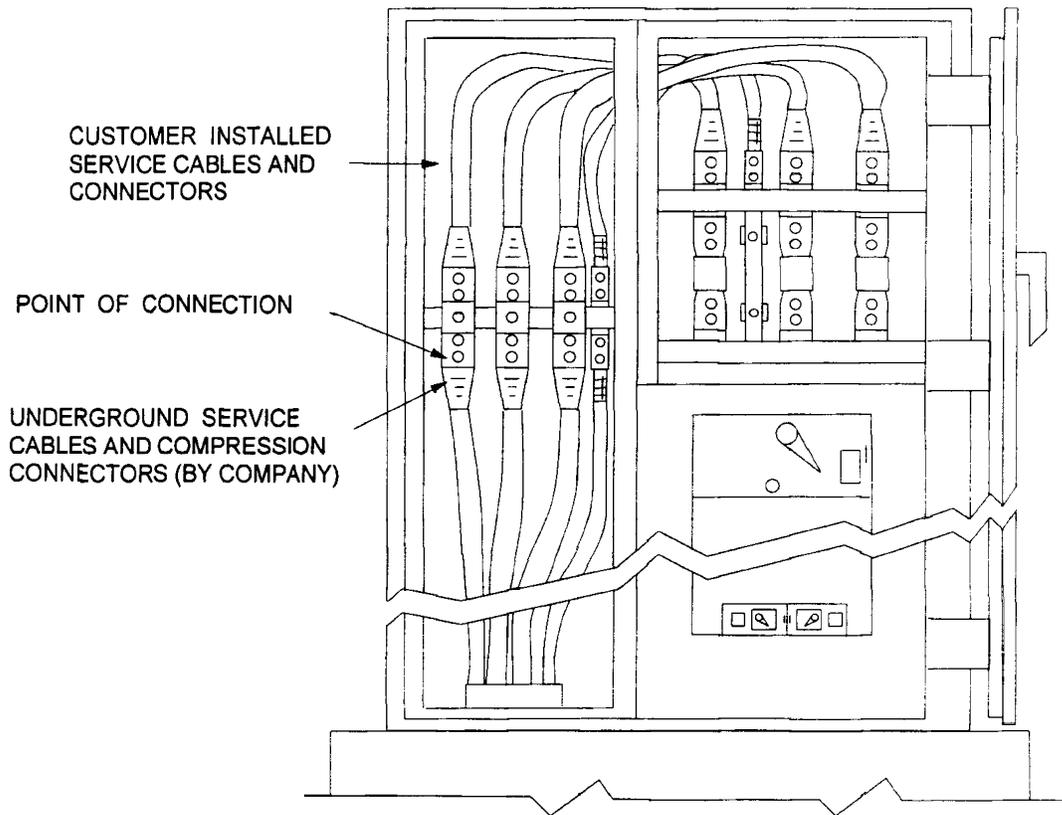
TYPICAL UNDERGROUND 400 AMP WALL MOUNT C.T./METER CABINET:



NOTES:

1. Side riser conduit will be existing panels, new panels will have their own pull section.
2. The Company furnishes and installs the C.T.'s, test switch and connects the Customer's neutral. The Customer installs the meter socket. Customer to run neutral wire from main disconnect.
3. **Service lines must be installed first before meter and CTs are installed.**





See Section 1100, Dwgs. 345 & 347 for wireway and cable landing requirements.



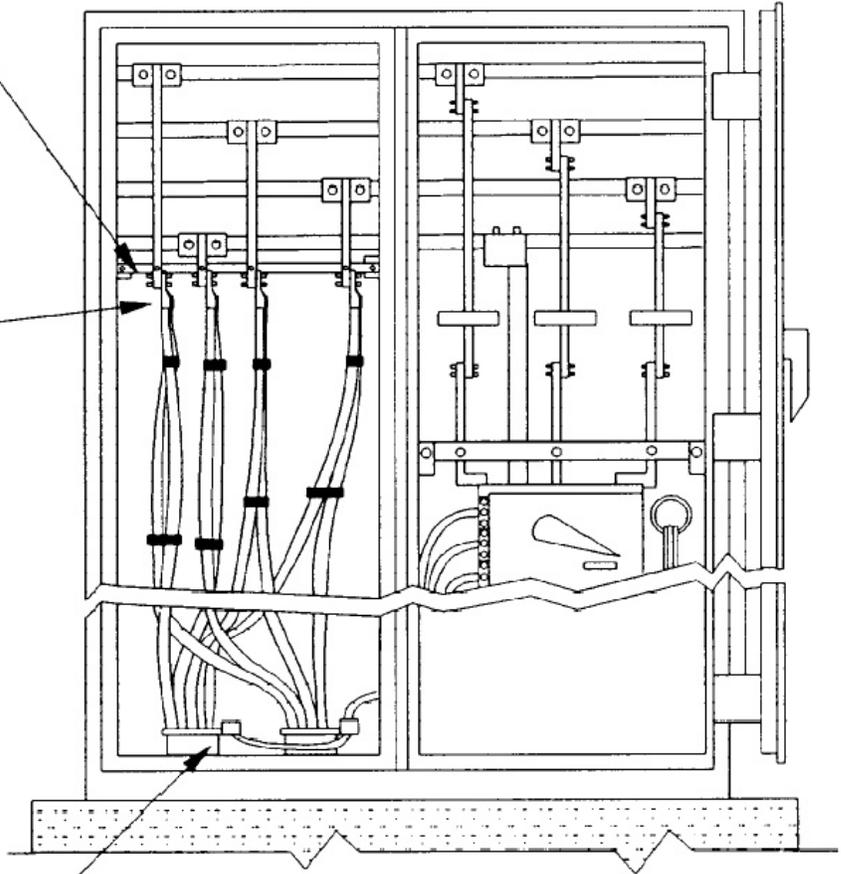
506.12

**S.E.S. UNDERGROUND 1001 THROUGH 3000 AMPS
(FREE STANDING S.E.S.)**

POINT OF CONNECTION

SEE SECTION 1100 FOR TYPE
OF LANDING POSITION TO BE
SUPPLIED BY CUSTOMER

U.G. SERVICE CABLES &
COMPRESSION CONNECTORS
(BY COMPANY)



METALLIC CONDUITS SHALL BE BONDED BY CUSTOMER

See Section 1100 Dwgs. 345 & 347 for wireway and cable landing requirements.

ELECTRIC SERVICE REQUIREMENTS

506.12

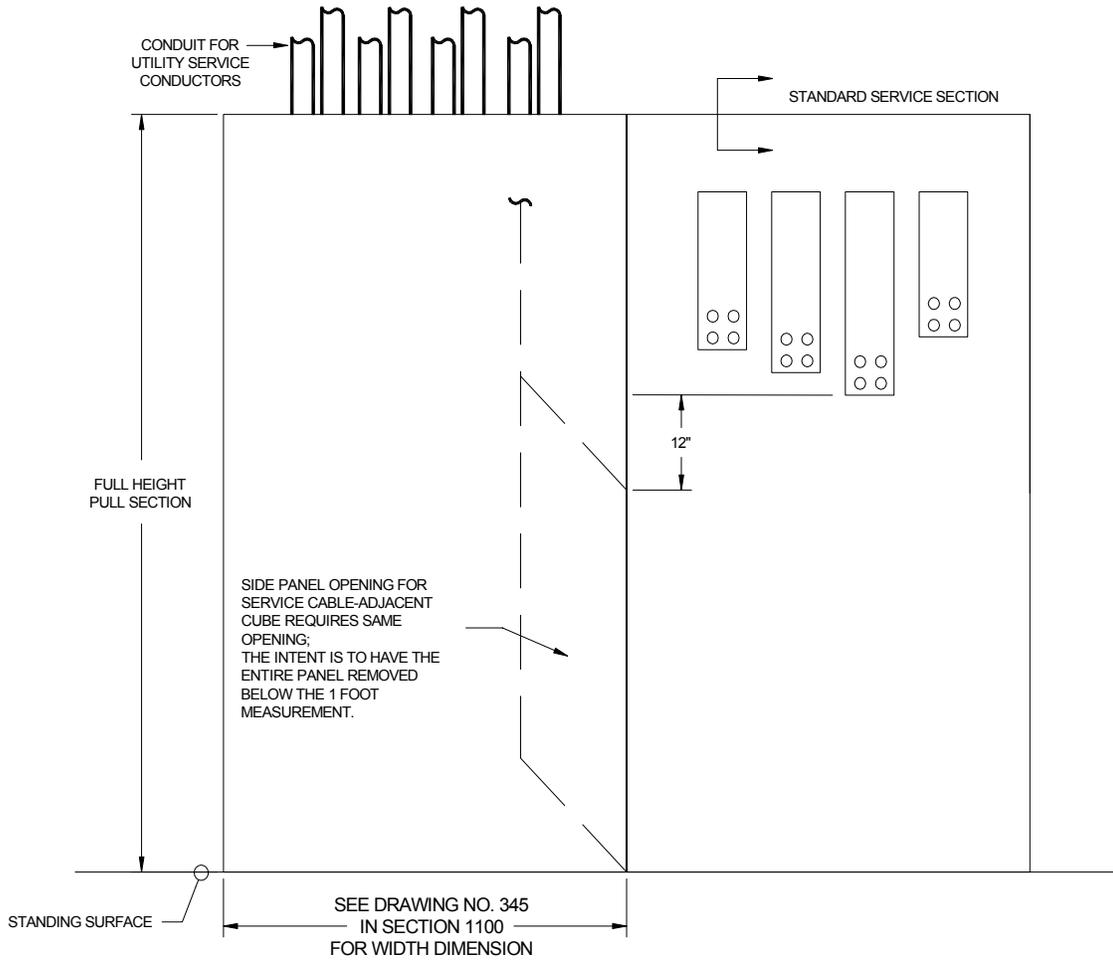
REVISION
07/25/2012

**UNDERGROUND SERVICE
TYPICAL SERVICE ENTRANCE SECTION - 3Ø 4 WIRE**

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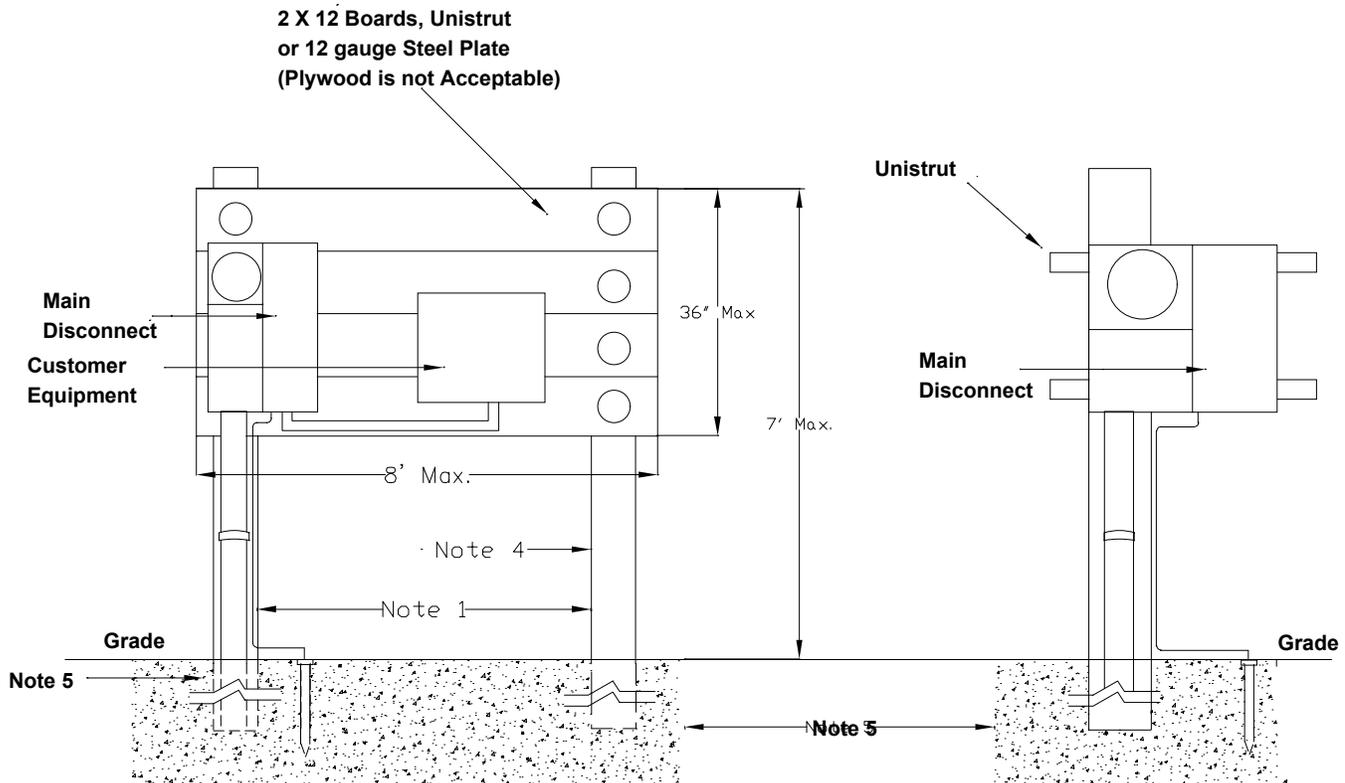


**OPTIONAL TOP ENTRY PULL SECTION FOR S.E.S. INSIDE BUILDINGS
(NOT APPLICABLE TO NETWORK INSTALLATIONS)**



NOTE: ENTRY SECTION TO BE EQUIPPED FOR UTILITY SEALS



**NOTES:**

1. All wood posts and poles used for service equipment shall be full length pressure treated as per RUS specification 1728F-700. See Section 400, paragraph 402.0 for wood pole requirements.
2. See Section 700 for grounding and bonding requirements.
3. Minimum dimensions of posts shall be"
 - A. Wood posts = 6" x 6" or 8" in diameter. (Maximum length = 10')
 - B. Pipe posts = 3" in diameter. Pipe posts to be of rigid galvanized steel. (Maximum length = 10')
4. The post shall be placed in the center of a 12" minimum diameter concrete footing. The footing shall be a minimum of 36 inches in the ground and extend a minimum of 4 inches above ground level, and have a 1/2 inch slope away from the post to allow for drainage. Except, concrete is not required for 6" x 6" or 8" diameter post buried 48"
5. All boards, steel and unistrut shall be attached to pole or post securely with a minimum 1/2" galvanized through bolt with a 1-1/2" galvanized backing and a lock nut. Nails or lag screws will not be acceptable. Pole shall be notched to the depth of the unistrut. (1" unistrut maximum.)
6. All service equipment shall be securely fastened to boards or steel with a minimum 1/4" through bolts. Nails or lag screws will not be acceptable.
7. Meter panel must meet CRA-ES requirements.