

Model # \_\_\_\_\_

# The Solid-State Polarization Cell Replacement (PCR)



## Operating and Installation Instructions

### INTRODUCTION

The Polarization Cell Replacement (PCR) is a solid-state DC isolation/AC grounding (i.e., coupling) device designed for use in conjunction with cathodically protected equipment located in Class I, Division 2 hazardous (classified) locations or ordinary (non-hazardous) locations. The PCR is suitable for: (1) AC voltage mitigation, (2) over-voltage protection of insulated joints and similar structures and equipment, (3) DC isolation and AC grounding of cathodically protected structures and electrical equipment in cathodically protected structures.

The PCR can be used in a variety of different applications, each of which requires specific installation guidelines. These installation instructions cover the following common applications.

- DC isolation/AC grounding of cathodically protected structures containing electrical equipment. See Figures 1 and 2. Figure 1 can also apply when necessary to DC isolate a non-cathodically protected structure to prevent galvanic corrosion.
- DC isolation of an electric power utility grounding system from a users grounding system. See Figure 3.
- Over-voltage protection of insulated joints. See Figures 4, 5 and 6.
- AC voltage mitigation. See Figure 8. If the pedestal enclosure was ordered, also see Figure 7.

Some applications listed may not apply in some counties due to different codes and practices. If your application is not covered by these installation instructions, contact DEI. "Application Notes" for most applications are also available on the DEI website.

### CERTIFICATIONS

#### United States:

The PCR is Underwriters Laboratories (UL) listed for use in hazardous locations in accordance with NFPA 70, (U.S. National Electric Code) Articles 500-505 for Class I, Div. 2 for Groups A, B, C, and D. Over-voltage protection due to lightning complies with the pertinent requirements of ANSI C62.11. The PCR is also UL listed as meeting the requirements of an effective grounding path as defined in NFPA 70 Article 250.2, 250.4(A)(5) and as suitable for the isolation of objectionable DC current from cathodically protected systems to ground as defined in Article 250.6(E).

#### Canada:

The PCR has been C-UL listed to Canadian Standards Association (CSA) as meeting the criteria for "an effective grounding path" as defined in CSA Code Section 10-500, 10-806, and CSA C22.2 No. 0.4-M1982. Further, it is C-UL listed for Division 2 locations per Canadian code C22.2 No. 213-M1987.

#### Europe:

The devices have been examined by a Notified Body (UL/Demko) for compliance with ATEX directive 94/9/EC using EN50021. The device is marked II 3 G EEx nA II T5 for Zone 2 use and should be installed using wiring methods appropriate for the above classification.

The listings are valid for ambient temperatures from -45°C to +65°C.

### ENCLOSURE

The standard enclosure is rated NEMA 4X (comparable to IP66). This enclosure is rain-tight and suitable for non-submersible applications. An alternate enclosure for submersible applications is rated NEMA 6P. Confirm that the enclosure furnished is suitable for its intended installation location.

### RATINGS

The system on which this PCR is installed should be compatible with the ratings on the nameplate of the product ordered. The ratings available and the ratings of this PCR are listed as follows.

<b>AC Fault Current Ratings (Amps AC-RMS Symmetrical)</b>				
<b>60 Hz</b>	<b>PCR</b>	<b>PCR</b>	<b>PCR</b>	<b>PCR</b>
<b>Cycles</b>	<b>3.7KA</b>	<b>5KA</b>	<b>10KA</b>	<b>15KA</b>
1	6,500	8,800	20,000	35,000
3	5,000	6,800	15,000	27,000
10	4,200	5,700	12,000	21,000
30	3,700	5,000	10,000	15,000
<b>50 Hz</b>	<b>PCR</b>	<b>PCR</b>	<b>PCR</b>	<b>PCR</b>
<b>Cycles</b>	<b>3.7KA</b>	<b>5KA</b>	<b>10KA</b>	<b>15KA</b>
1	6,100	8,800	19,000	33,000
3	4,700	6,800	14,000	25,000
10	3,900	5,700	11,000	20,000
30	3,500	5,000	9,000	14,000

This unit:

- 3.7KA (60 Hz)/ 3.5 KA (50 Hz)
- 5KA (60 Hz)/ 5KA (50 Hz)
- 10KA (60 Hz)/ 9 KA (50 Hz)
- 15KA (60 Hz)/ 14 KA (50 Hz)

**50/60 Hz Steady-State  
Current Ratings  
(Amps AC-RMS Symmetrical)**

Ambient Temp.	Standard	Optional
80A	45A	
20°C	50A	90A
65°C	40A	70A
This unit:		
45A		<input type="checkbox"/>
80A		<input type="checkbox"/>

**Lightning Current Rating**

All models: 100kA peak  
(8 x 20 waveform)

**DC Blocking Voltage**

This unit:

-3.0 V / +1.0 V (Standard)

-2.0 V / + 2.0 V (Optional)

- \_\_\_ V / + \_\_\_ V (Custom)

The symmetrical version which blocks +/-2.0 volts will be identified by a suffix "S" in the model number after the fault current rating. A custom version will have the above blocking voltage values listed as a suffix in the model number on the nameplate.

**PCR OPTIONS AND ACCESSORIES**

Any options or accessories ordered with this PCR will be identified by a check mark in the appropriate box.

**Terminals**

Compact Connector (CC)

4 hole NEMA terminal (4H)

**Enclosure Rating**

NEMA 6P (CS2)

**Stainless Steel Nameplate**

(LA)

Note: stainless nameplates are

now standard.

**Weld Tab Mounting**

If this option was ordered, the PCR was furnished with steel weld tabs preassembled to each terminal, and may be marked with the "-WTM" suffix. This option is generally specified when the PCR is to be used to provide over-voltage protection for an insulated flange. Refer to Figure 6 for installation details.

**Pedestal Mounting Enclosure**

If a pedestal mounting enclosure was ordered, one of the following pedestal models will have been provided, but normally packaged and shipped separately from the PCR. The PCR may be marked with the "-PED" suffix.

Pedestal - 36" (Standard)

Pedestal - \_\_\_ (Optional)

The required hardware to mount the PCR in the pedestal is furnished with the PCR. The base of the pedestal is normally buried in earth about 8" to 12" (200 to 300 mm) for stability. See Figure 7.

**Leads/Connectors**

If leads and connectors were ordered, they will normally be packaged with the PCR (unless too long to fit in the same carton).

**Adapter Plates**

Normally specified to facilitate connection across an insulated joint using the existing flange bolts. See Figures 4 and 5. Ordered separately from the PCR but normally packaged with the PCR.

**Pipe Mounting Accessories**

PCR with "- PM2" suffix

If specified, the PCR is furnished with a stainless steel back plate and U-bolts for mounting the PCR to a user furnished 2" schedule 40 steel pipe (O.D. = 2.375" or 60.3 mm).

A complete pipe mounting kit may have been ordered as follows.

36" height - PM2K/36

48" height - PM2K/48

This kit includes the accessory PM2 described above, plus either a 36" (914 mm) or a 48" (1219 mm) long 2" galvanized steel pipe, a 4-bolt threaded pipe flange base suitable for mounting to a field fabricated concrete foundation, and four 5/8" x 12" (16 x 305 mm) galvanized anchor bolts, each with two nuts for leveling the flange base. All items in a pipe mounting kit (except for the U-bolts) will be packaged separately from the PCR.

**GENERAL INSTALLATION INSTRUCTIONS**

These general instructions apply to all applications. For specific installation instructions, refer to the figure numbers that apply to the application as noted on the first page.

**MOUNTING**

Mount the PCR so that the total length of lead to the connection points will be as short as possible if the PCR is going to be used to provide over-voltage protection from lightning. All leads have inductance which will cause a significant voltage per unit of lead length when subject to lightning surge current. To minimize the voltage developed between the connection points, install the PCR as close as practical to the required connection points and cut the lead to the shortest possible length during installation. For most insulated joint applications the PCR can, and should, be installed with about 6 inches (≈ 150 mm) of lead. Leads can develop 1-3 kV/ft. (approx. 3-10 kV/meter) of length due to lightning; hence, the reason, leads should be kept as short as possible in lightning applications. Lead length is not critical for limiting voltage due to 50 Hz or 60 Hz current.

**POLARITY**

If the PCR purchased has asymmetrical blocking characteristics and it is being connected between a cathodically protected structure and ground, connect the negative terminal of the PCR

to the cathodically protected structure and the positive terminal to ground. If being connected between two different cathodically protected systems, attach the negative terminal to the more negative structure and the positive terminal to the less negative structure. A label on the PCR cover shows the polarity of each lead. If a symmetrical version of the PCR was furnished, the polarity marks are not relevant since the unit has identical voltage blocking with either polarity.

5. If the cathodic protection system is ON, one can check the leakage current through the PCR as follows, if desired. Connect a Hall Effect DC current measurement device over one of the PCR leads to read the leakage current. The value of current measured at normal cathodic protection voltages should be negligible.

If any measurements do not produce the expected results, contact DEI.

## FIELD TESTING

Before installation, the following measurements are suggested to confirm that the steady-state conditions imposed on the PCR will be within its ratings.

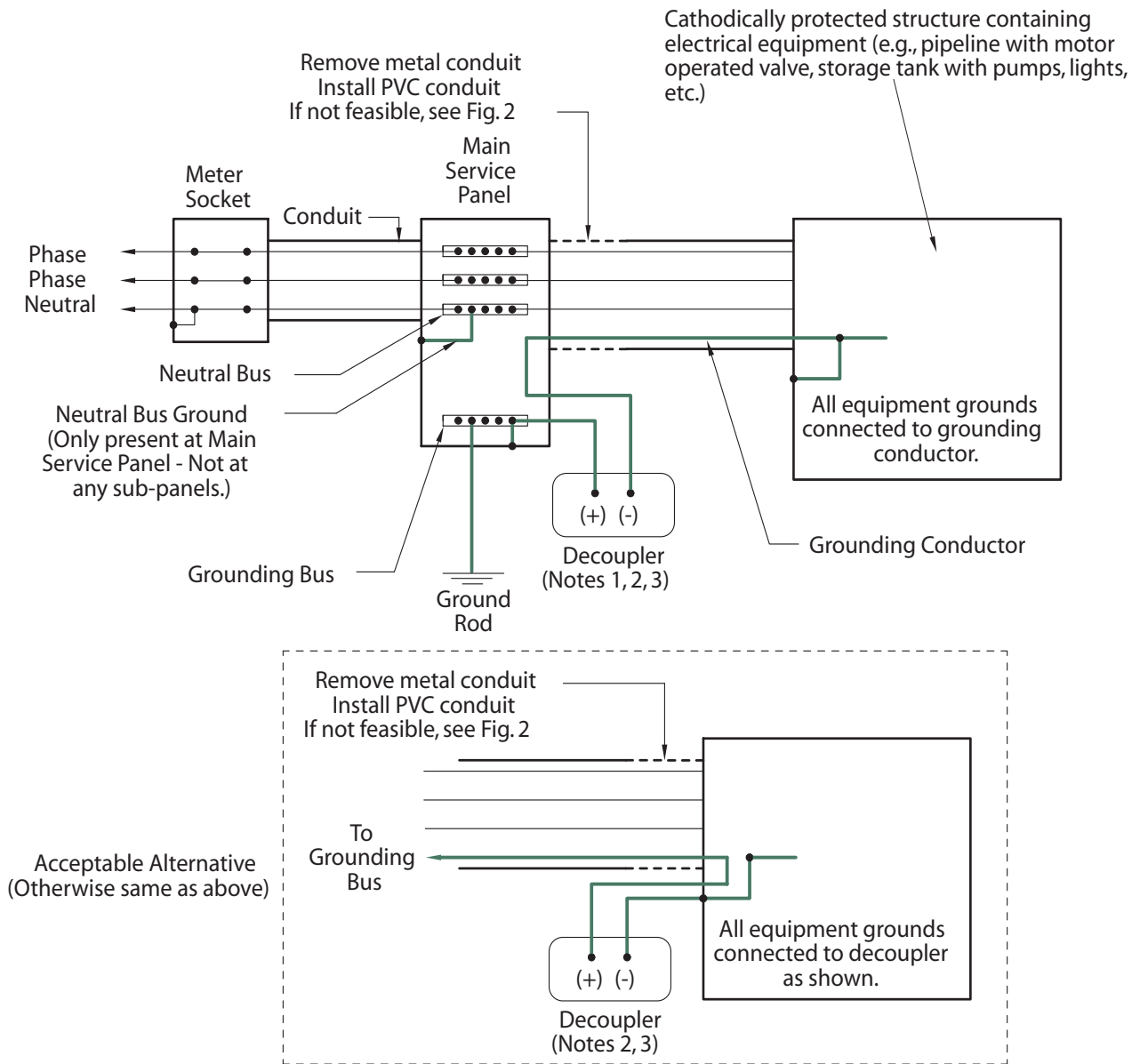
1. Measure the open-circuit DC voltage between the PCR connection points with a multimeter. The open-circuit DC voltage measured should be within the DC blocking voltage rating of the model selected (i.e., normally -3.0 V/+1.0 V or +/-2.0 V, unless a custom version has been ordered).

2. Measure the steady-state short-circuit AC-RMS current between the PCR connection points with a clamp-on ammeter. The short-circuit AC-RMS steady-state current measured should be less than the steady-state AC current rating of the PCR model ordered.

3. After installation, the DC voltage across the PCR terminals can be measured to confirm that the expected value of cathodic protection voltage exists, assuming the cathodic protection system is ON. (The voltage measured with a voltmeter will be less than the actual cathodic protection voltage because it is not being measured with respect to a reference cell.)

4. After installation, the steady-state AC current through the PCR leads can again be measured. The current measured should be comparable to the value measured prior to installation since the AC impedance of the PCR is negligible (i.e., about 10 milliohms at 60 Hz).

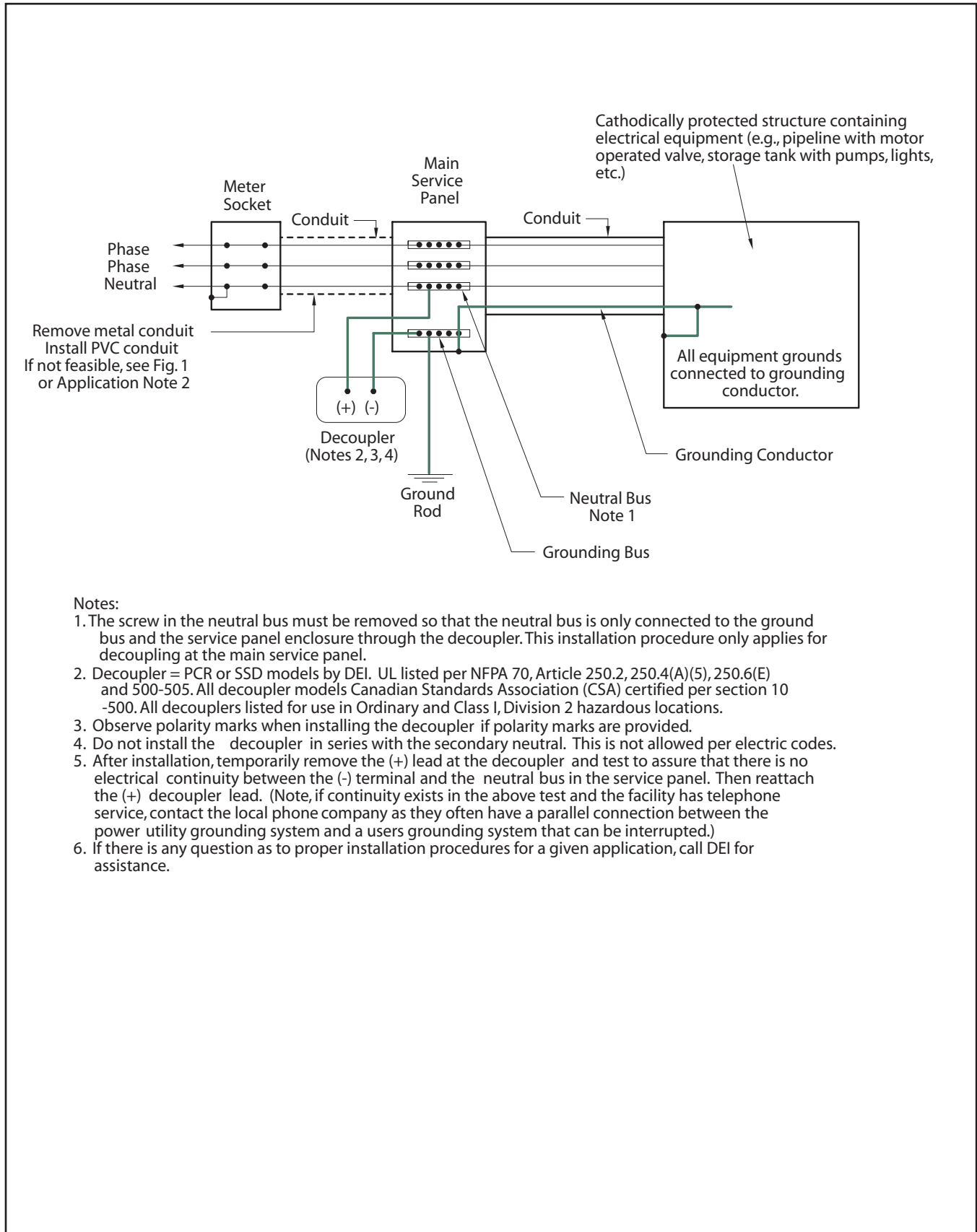
**FIGURE 1** Typical Installation to Provide DC Isolation and AC Grounding for Cathodically Protected Structure Containing Electrical Equipment



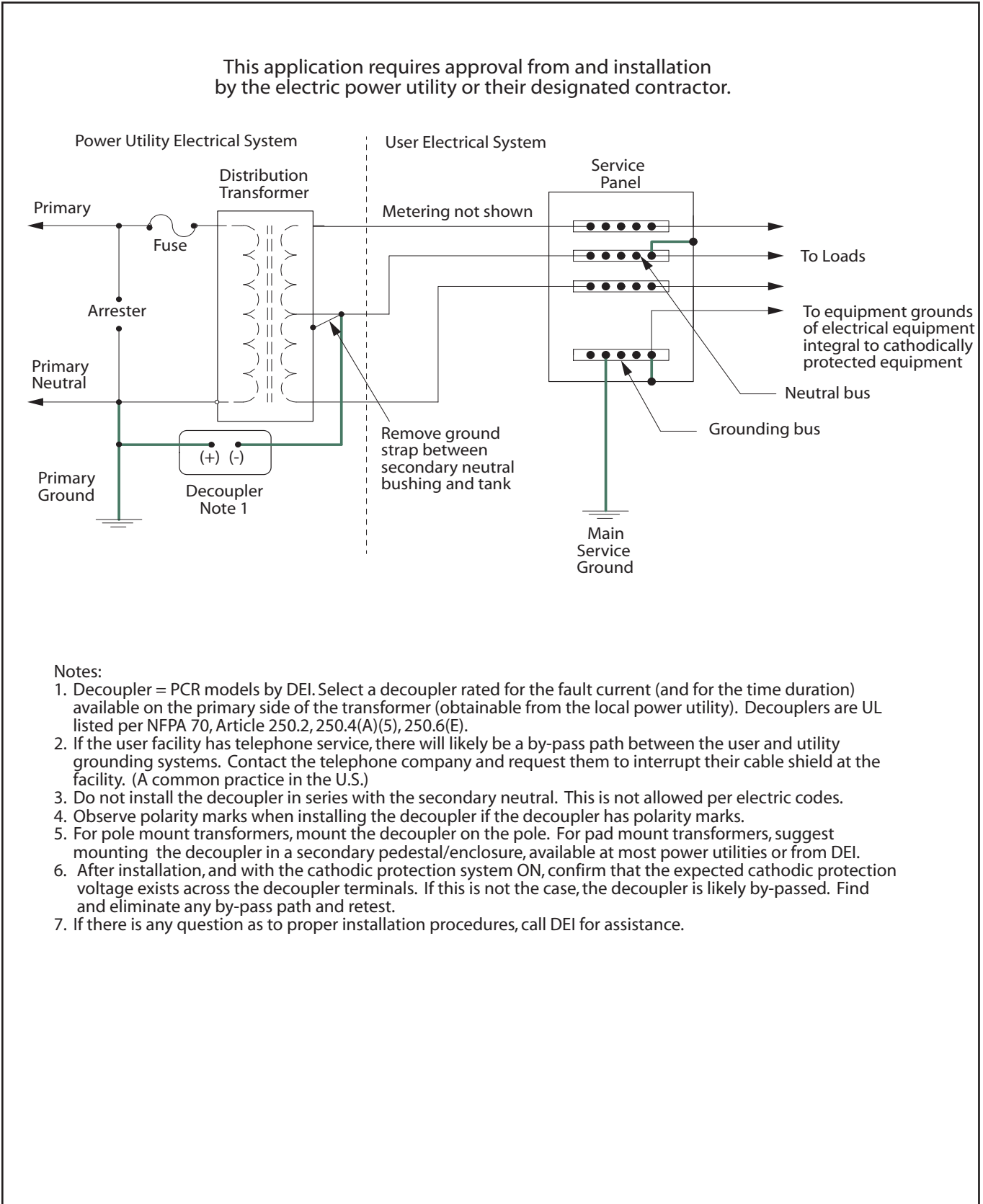
**Notes:**

1. Decoupler = PCR or SSD models by DEI. UL listed per NFPA 70, Article 250.2, 250.4(A)(5), 250.6(E) and 500-505. All decoupler models Canadian Standards Association (CSA) certified per section 10 -500. All decouplers listed for use in Ordinary and Class I, Division 2 hazardous locations.
2. Observe polarity marks when installing the decoupler if polarity marks are provided.
3. Do not install the decoupler in series with the secondary neutral. This is not allowed per electric codes.
4. After installation, temporarily remove the (+) lead at the decoupler and test to assure that there is no electrical continuity between the (-) terminal and the neutral bus in the main service panel. Then reattach the (+) decoupler lead. (Note, if continuity exists in the above test and the facility has telephone service, contact the local phone company as they often have a parallel connection between the power utility grounding system and a users grounding system that can be interrupted.
5. If there is any question as to proper installation procedures for a given application, call DEI for assistance.

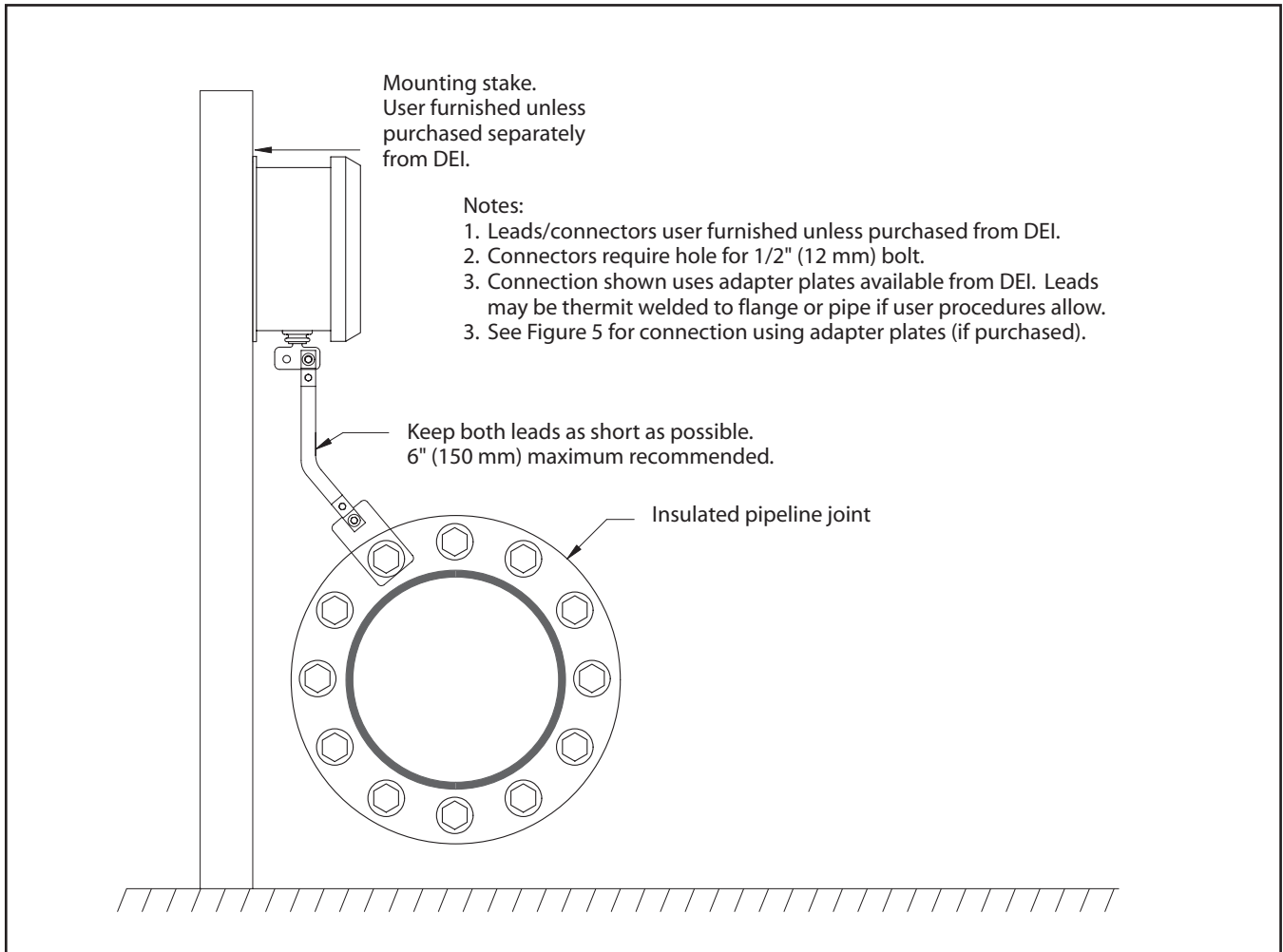
**FIGURE 2 DC Decoupling/AC Grounding Of Electrical Equipment In Cathodically Protected Systems**



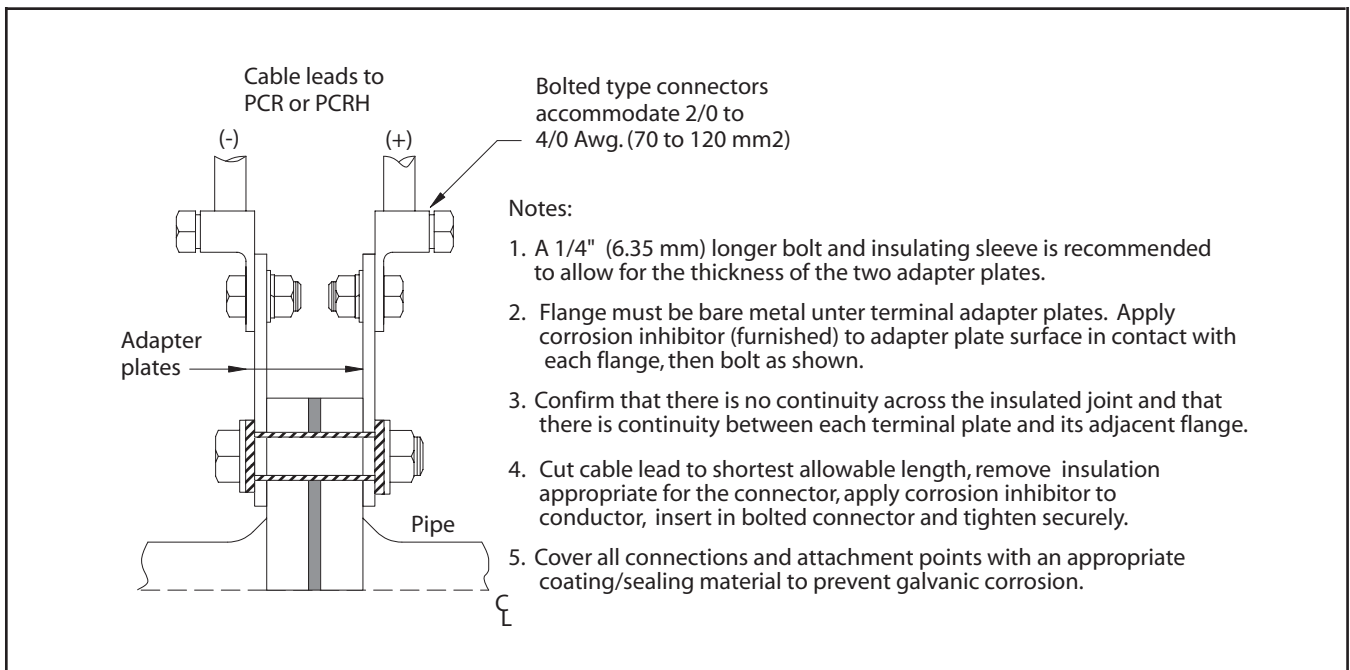
**FIGURE 3 DC Decoupling Between Power Utility Grounding System and User Grounding System**



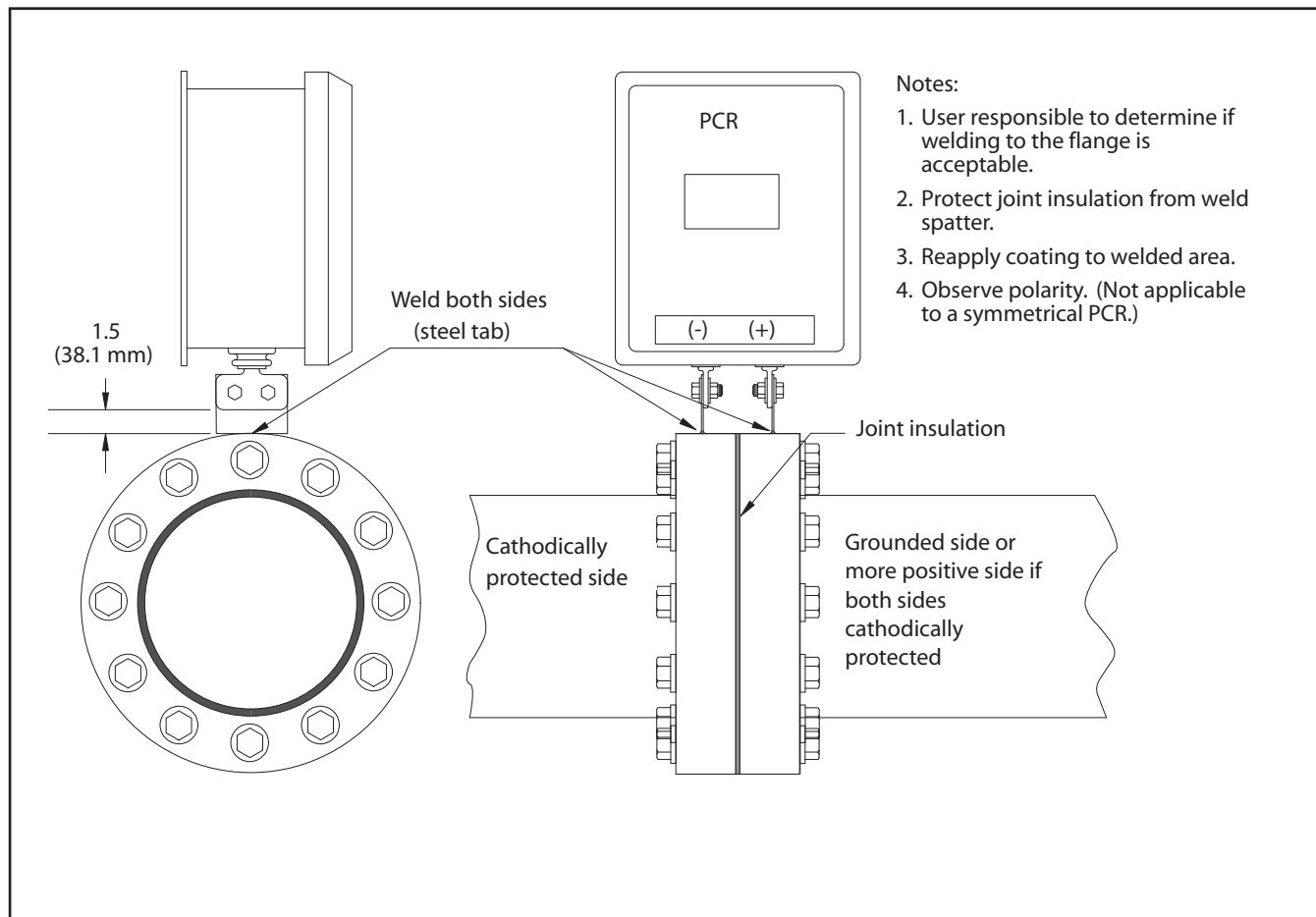
**FIGURE 4 Typical Installation for Insulated Joint Protection**



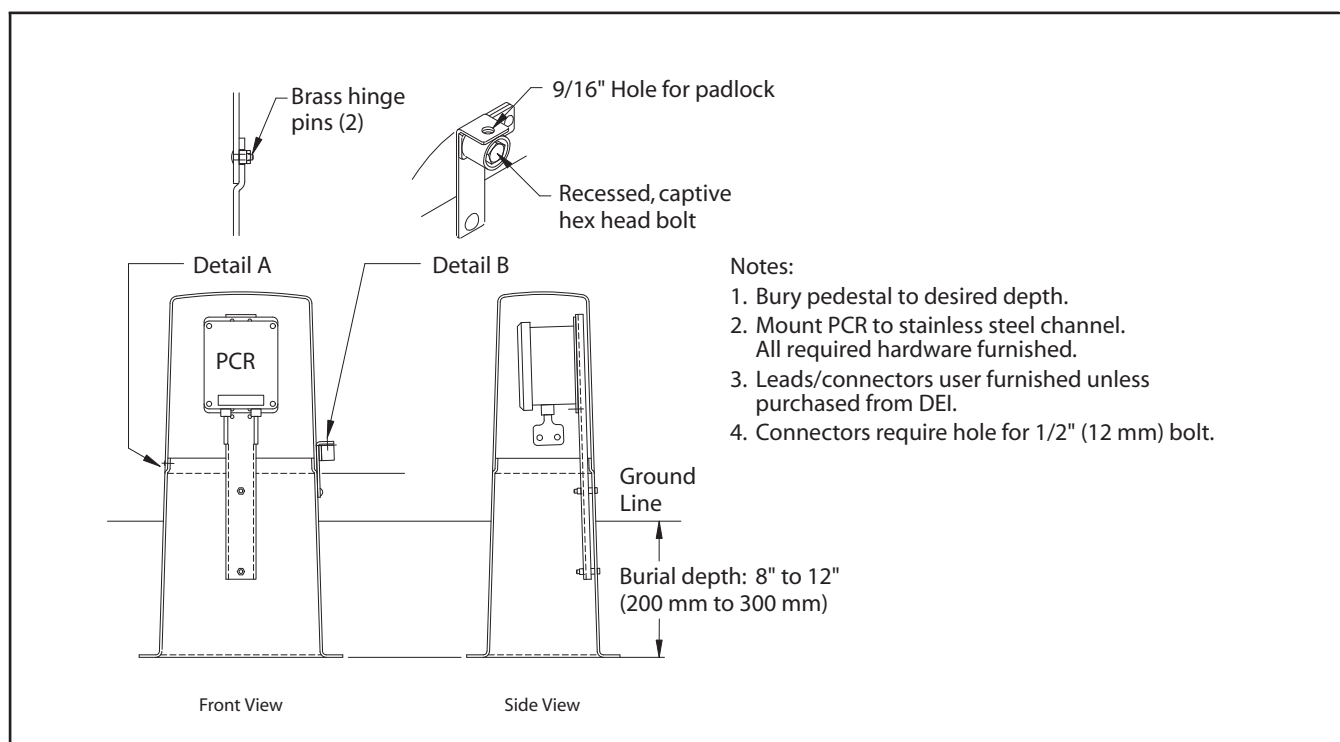
**FIGURE 5 Connection to Bolted-Type Insulated Joint using Adapter Plates**



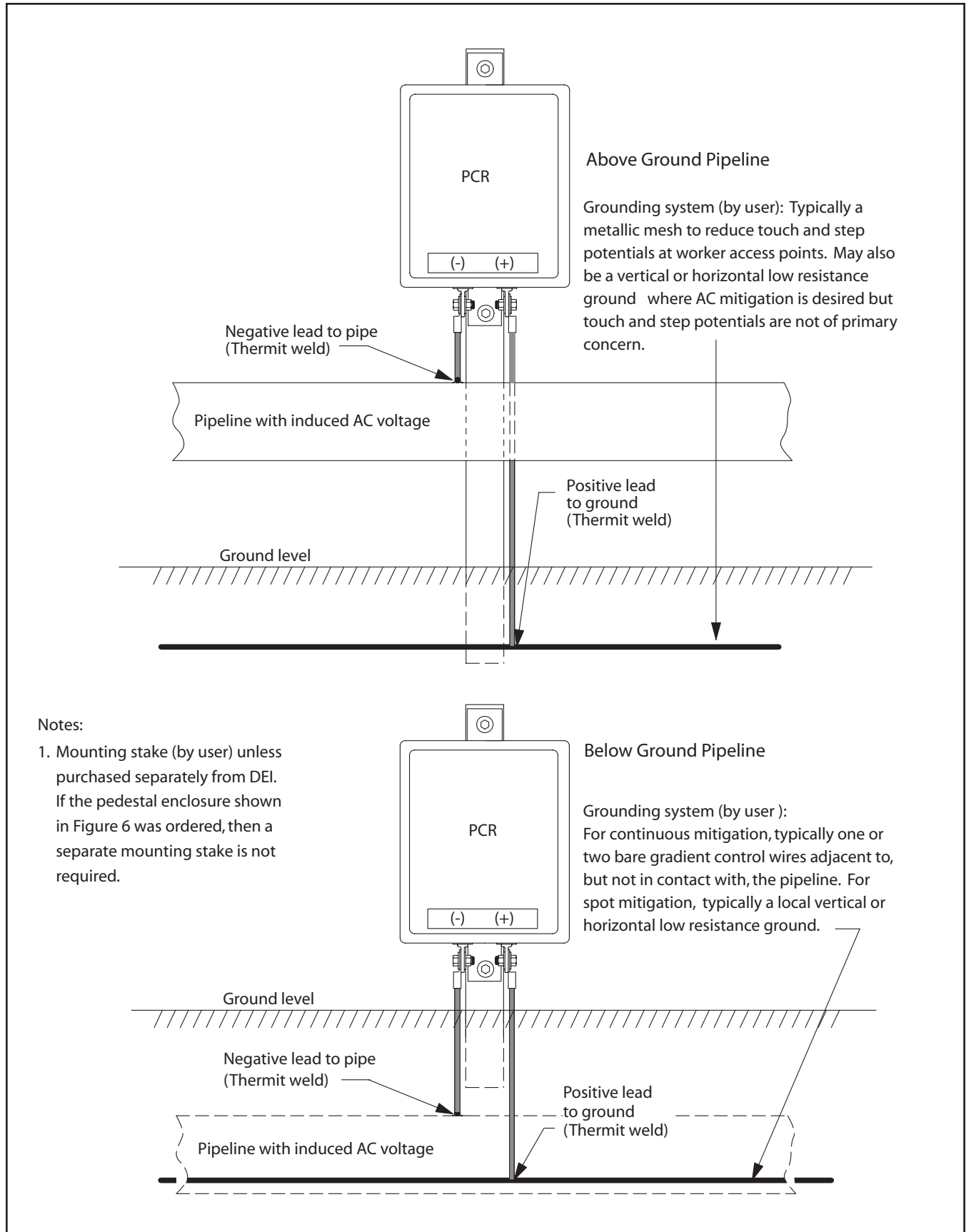
**FIGURE 6** Weld Tab Mounting of a PCR for Over-Voltage Protection of an Insulated Joint



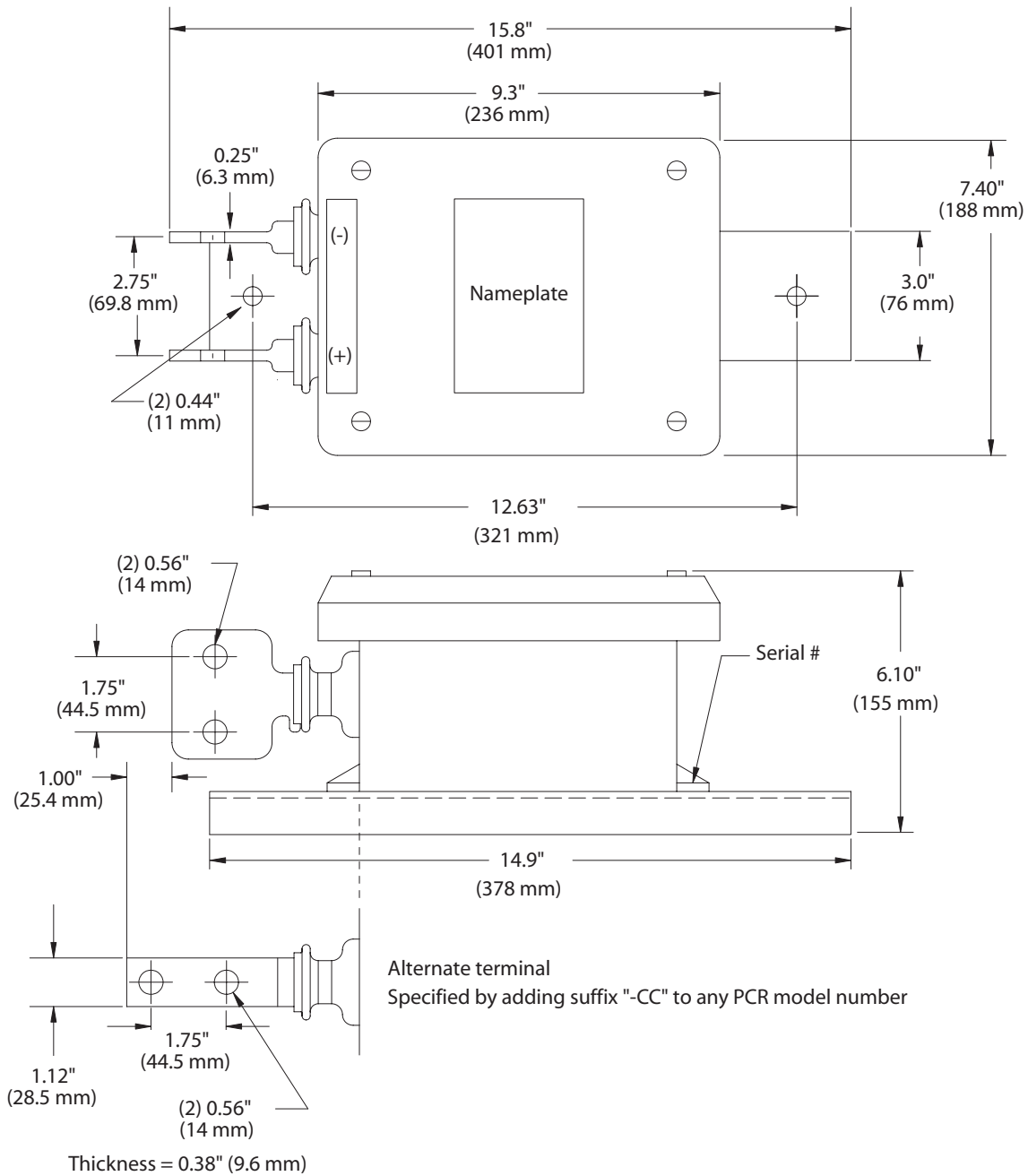
**FIGURE 7** PCR Mounted in a Pedestal Enclosure



**FIGURE 8** Typical Installation for AC Voltage Mitigation



**FIGURE 9A** PCR Outline Dimensions

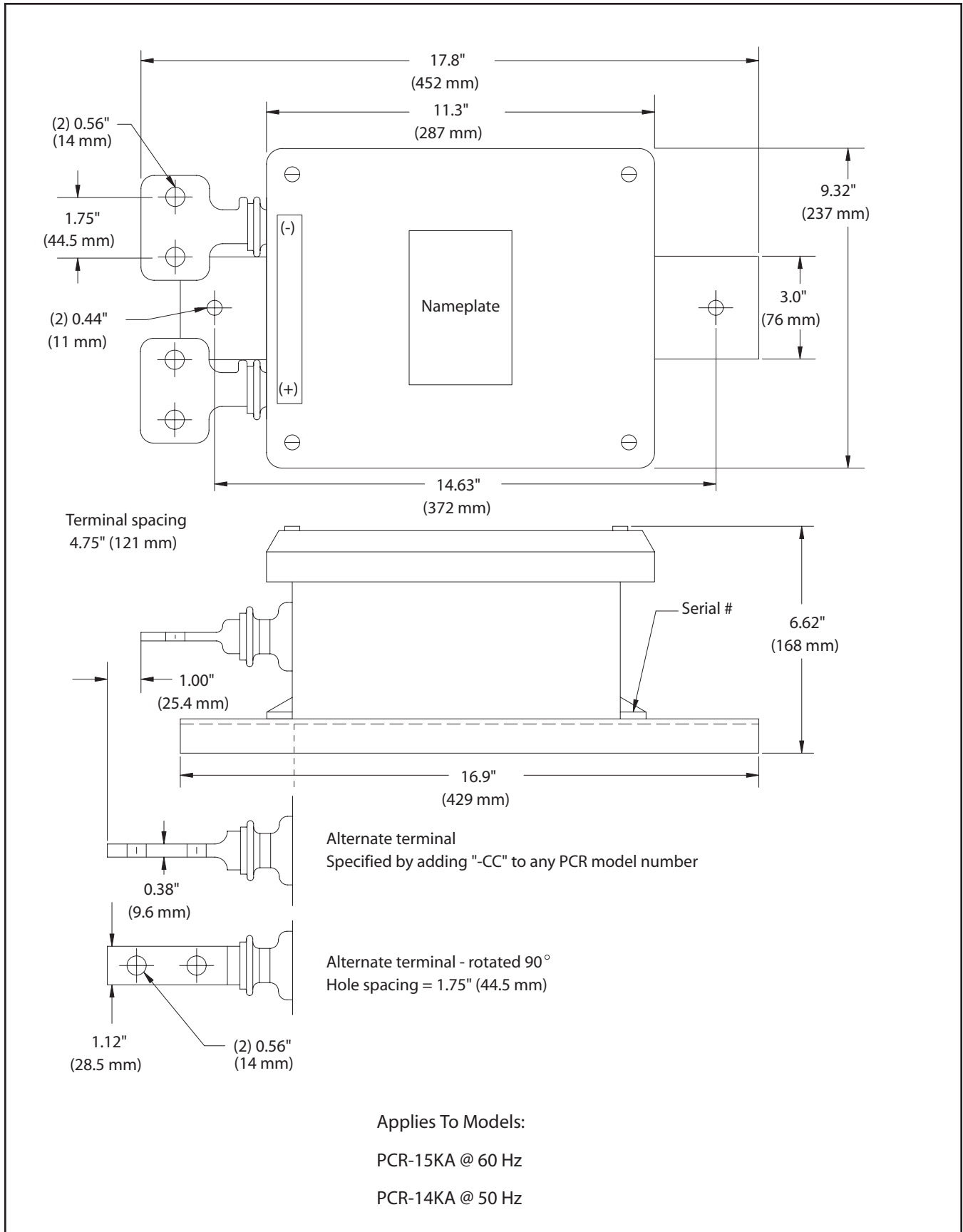


Applies To Models:

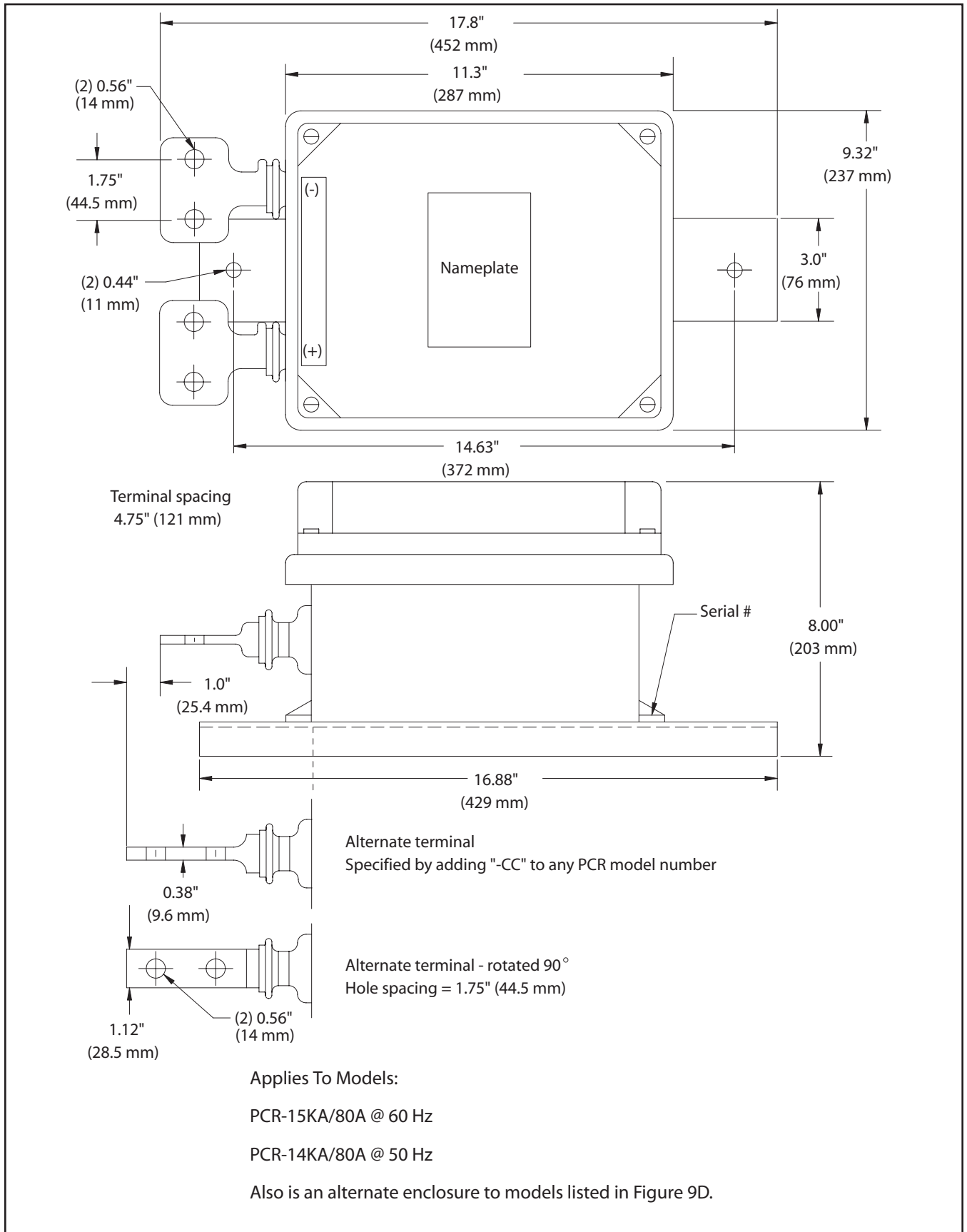
PCR-3.7KA PCR-5KA & PCR-10KA @ 60 Hz

PCR-3.5KA, PCR-5KA & PCR-9KA @ 50 Hz

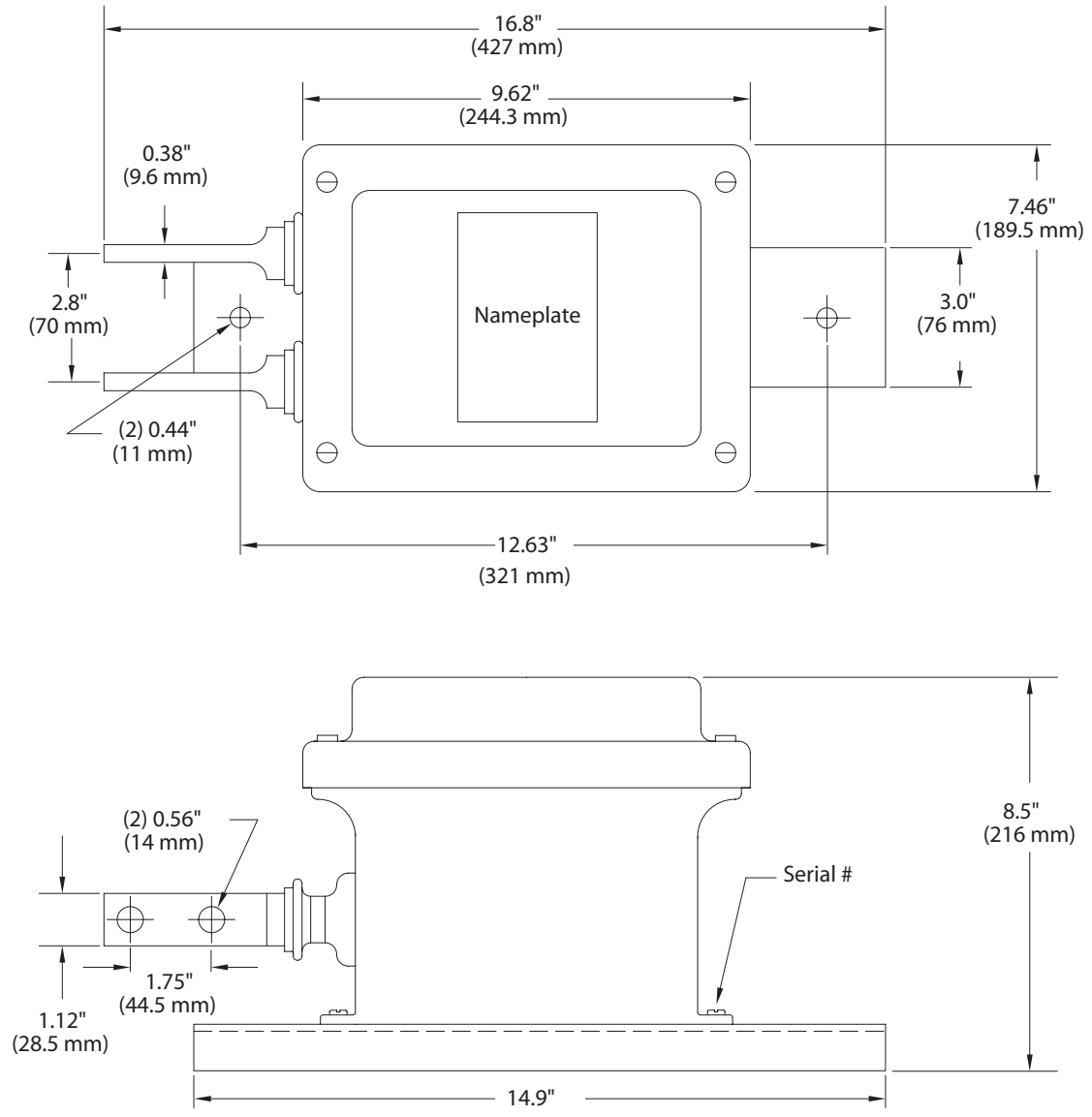
**FIGURE 9B PCR Outline Dimensions**



**FIGURE 9C PCR Outline Dimensions**



**FIGURE 9D PCR Outline Dimensions**



Applies To Models:

PCR-3.7KA/80A, PCR-5KA/80A and PCR-10KA/80A @ 60 Hz

PCR-3.5KA/80A, PCR-5KA/80A and PCR-9KA/80A @ 50 Hz

See notes in Figure 9C regarding alternate enclosure.