

# The Solid-State Polarization Cell Replacement



**PCR:** For Class I, Div. 2, Zone 2  
and Non-Hazardous Locations

**PCRH:** For Class I, Div.1 Locations

## INTRODUCTION: PCR/PCRH

The Polarization Cell Replacement (PCR) is a solid-state device commonly used in conjunction with cathodically protected structures. This product is an ideal replacement for electrochemical polarization cells because the solid-state design eliminates the maintenance requirements and the potentially hazardous electrolytes associated with polarization cells. Furthermore, the operating parameters offer a number of distinct advantages. Because the device has a higher DC blocking voltage, one device can often replace two or more polarization cells. The product is easy to apply because its operating parameters are precisely defined.

This product is available in two different versions to most economically accommodate the two different hazardous location listings which are available. In many applications, these products are used in a hazardous location; hence, the reason for hazardous location listings.

All model numbers with a PCR prefix are listed for use in Class I, Division 2, Groups B, C, and D hazardous locations per NFPA 70 (the U.S. National Electric code) and for Zone 2 locations per EN50021.

All model numbers with a PCRH prefix are listed for Class I, Division 1, Groups C and D hazardous locations.

These products prevent the flow of DC current when the absolute voltage (i.e., the DC plus peak AC voltage) across the terminals is between -3.0 volts and + 1.0 volt while simultaneously providing a grounding (or coupling) path for steady-state AC current, if AC current is present. A symmetrical version, which blocks +/-2.0 volts is available as an option. Custom versions with other voltage blocking levels will be considered upon request. These products also provide over-voltage protection to both lightning and AC fault current.

**PCRH**  
(Leads Optional)



## TYPICAL APPLICATIONS: PCR/PCRH

- Over-Voltage Protection of Insulated Joints
- Mitigation of Induced AC Voltage
- Blocking Stray DC Voltage
- AC Grounding and DC Isolation of Cathodically Protected Electrical Equipment (such as Motor-Operated Valves)
- DC Isolation of Cathodically Protected Equipment from Power Utility Grounding Systems
- Over-Voltage Protection of Equipment from AC Faults, Lightning, and Switching Transients

## RATING INFORMATION REQUIRED: PCR/PCRH

The following information is required for each application in order to select the appropriate product rating.

- 1) The AC fault current available to flow through the device under a fault condition. (This will often be less than the total fault current available).
- 2) The steady-state AC current available to flow through the device while blocking the flow of DC current.
- 3) The DC blocking voltage required.
- 4) The hazardous location listing required for the planned installation location. If not applicable, or if a Class I, Division 2 location applies, select a PCR model. If a Class I, Division 1 location applies, select a PCRH model.

## PCR



Items (1) and (2) on previous page will not apply in all applications.

## ELECTRICAL RATINGS: PCR/PCRH

The following ratings apply both to the PCR and PCRH unless otherwise noted.

### AC FAULT CURRENT RATINGS: PCR/PCRH

Three different fault current ratings are offered at 60 Hz and 50 Hz with the following current-time relationship:

<b>AC Fault Current Ratings (Amps AC-RMS Symmetrical)</b>			
<b>60 Hz Cycles</b>	<b>PCR or PCRH</b>		
	<b>3.7KA</b>	<b>10KA</b>	<b>15KA</b>
1	6,500	20,000	35,000
3	5,000	15,000	27,000
10	4,200	12,000	21,000
30	3,700	10,000	15,000

<b>50 Hz Cycles</b>	<b>PCR or PCRH</b>		
	<b>3.5KA</b>	<b>9KA</b>	<b>14KA</b>
1	6,100	19,000	33,000
3	4,700	14,000	25,000
10	3,900	11,000	20,000
30	3,500	9,000	14,000

### Understanding 60 Hz Fault Current

To select the correct fault current rating, it is necessary to know how much AC fault current is available to flow through the PCR or PCRH in the event of an AC fault.

### Faults from the Primary (Power Utility) System

If the PCR or PCRH is used to mitigate AC voltage on a pipeline that is in the same corridor as an electrical transmission line, the PCR or PCRH could be subject to AC fault current from the

transmission line in the event of a line-to-ground fault. For safety, the PCR or PCRH allows all current to pass immediately to ground with minimal voltage drop across the terminals (i.e., less than 10 volts under maximum rated fault current). When the fault condition has cleared, the PCR or PCRH returns to its normal operating mode, which passes low level steady-state AC current (if present) while blocking the flow of DC current. Another example is when the PCR or PCRH is installed across an insulated joint to provide over-voltage protection from lightning and AC faults. In this case, the product protects the joint by passing all AC current through the PCR or PCRH around the insulating joint while limiting the voltage across the joint insulation. After the fault or lightning event, the device automatically returns to its normal mode of blocking the flow of DC current.

### Faults from the Secondary (User) System

For example, consider a PCR or PCRH used to provide AC grounding and DC isolation for an item of electrical equipment that is an integral part of a cathodically protected pipeline (e.g., a motor-operated valve). If the equipment has an electrical short-circuit, the PCR or PCRH allows all current to flow through itself to ground, thus grounding the fault. The amount of available secondary fault current can be calculated from the data on the transformer nameplate (kVA rating, the % transformer impedance, and the transformer secondary voltage) using the information in the next section.

### How to Determine Fault Current Available for a Specific Application

- If the potential fault current is from the primary (power utility) system, call the local power utility and request the phase-to-ground fault current magnitude and duration (i.e., number of cycles of current) at the specific locations of interest.

- If the potential fault current is from the secondary (user) system: step 1: determine the “secondary full load current” of the transformer providing power by using the appropriate following formula:

$$\text{Secondary Full Load Current} = \frac{1 \text{ Phase Transformer kVA}}{\text{kV Secondary}}$$

OR

$$\text{Secondary Full Load Current} = \frac{3 \text{ Phase Transformer kVA}}{\sqrt{3} \text{ kV Secondary}}$$

Step 2: Determine the “worst-case” fault current using the following formula.

$$\text{Available Fault Current} = \frac{\text{Secondary Full Load Current}}{\% \text{ Transformer Impedance}} \times 100$$

(This gives the fault current available directly at the transformer terminals, which is the worst case scenario. Fault current decreases rapidly with distance from the transformer.)

Select a PCR or PCRH fault current rating that encompasses the fault current available.

### STEADY-STATE AC CURRENT RATINGS: PCR/PCRH

This rating represents the maximum steady-state AC current that is allowed to flow through the device while still blocking the flow of DC current. Two ratings are available for the PCR and one for the PCRH as shown in the following table.

The table represents maximum values. As the DC voltage approaches the maximum blocking voltage rating selected, the allowable steady-state AC current is reduced as shown in Figures 1 and 2.

### Steady-State Current Ratings (Amps AC-RMS Symmetrical)

Ambient Temp	60 Hz Ratings	
	Standard 45A Rating PCR/PCRH	Optional 80A Rating PCR ONLY
20°C	50A	90A
65°C	40A	70A

Ambient Temp	50 Hz Ratings	
	Standard 40A Rating PCR/PCRH	Optional 70A Rating PCR ONLY
20°C	45A	80A
65°C	35A	60A

There are a number of applications where a PCR or PCRH may be required to block DC while simultaneously carrying steady-state AC current. For example, when a pipeline is in the same corridor as an electrical transmission line, steady-state AC voltage is often induced on the pipeline. The PCR or PCRH can mitigate this voltage by providing a low AC impedance path to ground while simultaneously preventing the flow of DC current.

The steady-state AC impedance of the PCR or PCRH at 60 Hz is 9.8 milliohms for the standard 45 ampere rating and 4.9 milliohms for the optional 80 ampere rating. At 50 Hz, the comparable impedances are 11.9 milliohms for the standard 40 ampere rating and 5.8 milliohms for the optional 70 ampere rating. Under an AC fault or lightning current condition, these impedances momentarily become virtually zero.

### Determining Steady-State Current Rating: PCR/PCRH

To determine the steady-state AC current rating it is necessary to determine how much steady-state AC current is available to flow through the PCR or PCRH. If this cannot be determined by analytical means, it can be measured as follows. Connect a solid jumper (i.e. short circuit) between the two points to which the PCR or PCRH will be connected and measure the steady-state AC current with a clamp-on AC ammeter. For greatest accuracy, measure during a known electrical system load (on the electrical transmission system) and then

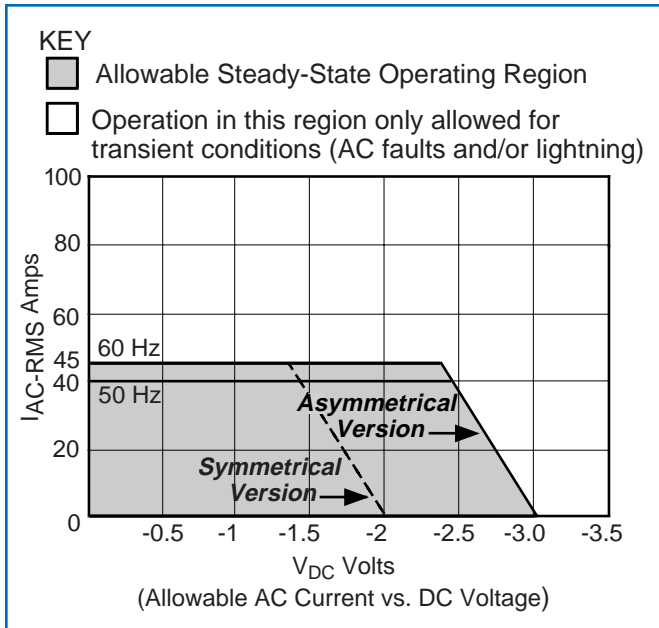
ratio the results to the expected peak electrical system load. The local power utility can provide known system load and its ratio to peak system load. Select a steady-state rating that is above the maximum steady-state current to be expected for the foreseeable future.

### DC BLOCKING VOLTAGE RATING: PCR/PCRH

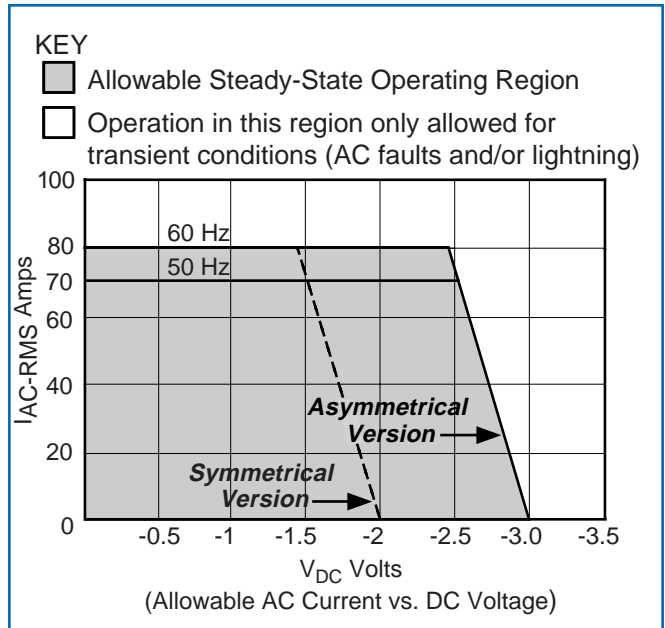
The standard, and most commonly specified, PCR or PCRH model has an asymmetrical voltage blocking rating of -3.0 volts to +1.0 volt. Either model can also be furnished with a symmetrical voltage blocking rating of +/- 2.0 volts. Other voltage blocking ratings will be considered upon request.

The reasons for symmetrical and asymmetrical choices are best described with an example. If the PCR or PCRH is used to provide over-voltage protection for an insulated joint and both sides of the joint are cathodically protected, the DC voltage across the joint will be the difference in voltage between the two cathodic protection systems, normally

**FIGURE 1** PCR/PCRH Operating Characteristics @ 43°C (Standard 45A @ 60 Hz, 40A @ 50 Hz)



**FIGURE 2** PCR Operating Characteristics @ 43°C (Optional 80A @ 60 Hz, 70A @ 50 Hz; Not applicable to PCRH )



near zero volts. For this application it is desirable to select the symmetrical +/- 2.0 volt blocking rating. In the event that the cathodic protection system is OFF on one side of the joint, the device can block  $2.0 V_{DC}$  in either direction.

If one side of the insulated joint is cathodically protected and the other side is grounded, then it is preferable to select the asymmetrical version which blocks from -3.0 volts to +1.0 volt since DC current flow only needs to be blocked in one polarity. Whenever one side is referenced to ground, the asymmetrical version is suggested because this initiates voltage clamping when any positive voltage on the cathodically protected structure attempts to exceed +1.0 volt.

The DC leakage current of any model is well under 1.0 milliamperes under typical operating conditions where the DC voltage is in the 0.85 to 1.25 V range,

even when the temperature is up to 65°C. See Figure 3.

### LIGHTNING SURGE CURRENT RATING: PCR/PCRH

All models have the same lightning surge current rating which is shown in the following table.

Lightning Surge Current Rating For all models PCR/PCRH	
Peak Amperes	100,000

When providing over-voltage protection from lightning, the PCR or PCRH should always be installed with the shortest possible lead length to minimize clamping voltage. When used across an insulated joint, the PCR can, and should, be installed with about 6" ( $\approx 150$  mm) leads.

The peak voltage directly across the voltage-clamping elements within the device is less than 250 volts at rated lightning surge current; however, the voltage developed between the lead connection points will be greater due to the effect of lead inductance. Leads can develop from 1 to 3 kV per foot (approx. 3 to 10 kV/meter) when subject to lightning current. This is the reason that leads should be kept as short as possible.

### FEATURES AND CHARACTERISTICS: PCR/PCRH

#### Certifications

Underwriters Laboratories (UL) has listed the PCR and PCRH as meeting the criteria for "an effective grounding path" as defined in Section 250-51 of previous editions, and 250-2(d) starting with the 1999 edition of the U.S. National Electrical Code (NFPA 70), thereby enabling its use as an AC grounding device. The PCR is also C-UL listed in Canada 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.

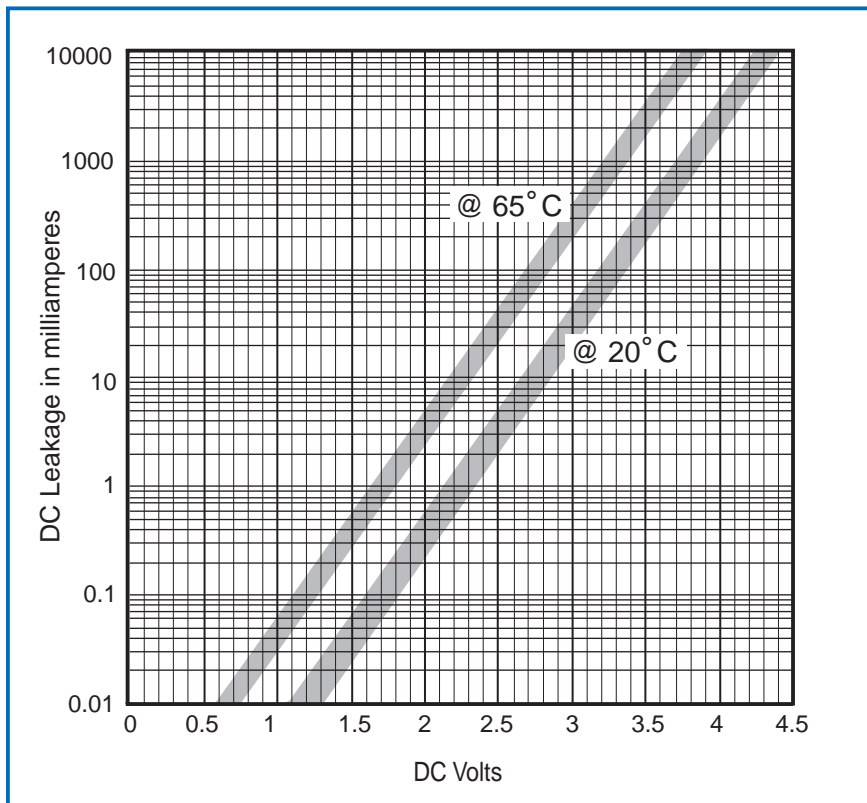
The PCR and PCRH are also listed by UL as meeting:

- The requirements of a DC isolating/AC coupling device suitable for the isolation of objectionable DC current from cathodically protected systems to ground as defined in NFPA 70 Article 250-6(e), initially introduced with the 1999 edition.
- An over-voltage protective device, having been tested to the applicable requirements of ANSI C62.11.

Listings that are unique to each version are summarized as follows:

The PCR is listed by Underwriters Laboratories (UL) for use in hazardous locations in accordance with NFPA 70 (U.S. National Electric Code), Articles 500-505 for Class I, Division 2, Groups B, C, and D. The applicable UL standard to which the PCR is listed is

**FIGURE 3 DC Voltage vs. DC Leakage Current (Standard Asymmetrical PCR/PCRH)**



UL 1604 which deals with non-sparking products to meet Class I, Division 2 requirements. The PCR is also C-UL listed to the above classifications per Canadian code C22.2 No. 213-M1987.

For Zone 2 use, the PCR has been given a Type Examination by a Notified Body (UL/Demko) for compliance to ATEX directive 94/9/EC using EN50021. The device is marked II 3 G EEx nA II T5.

The PCRH is listed by Underwriters Laboratories (UL) for use in hazardous locations in accordance with NFPA 70 (U.S. National Electric Code), Articles 500-505 for Class I, Division 1, Groups C, and D. (Optional: Groups B, C and D are available in a non-raitight enclosure.) The applicable UL standard to which the PCRH is listed is UL 1203 which deals with explosion proof products to meet Class I, Division 1 requirements. The listing is valid for ambient temperatures from -45°C to +65°C. The operating temperature code is T5 (100°C). Refer to NFPA 70 for comparable zone listings if required. The PCRH is also C-UL listed to the above classifications per Canadian code C22.2 No. 30-M1986.

Select the appropriate version (i.e., PCR or PCRH) for the application.

### **Solid-State Design: PCR/PCRH**

Both versions use proven solid-state components which have an instantaneous response with respect to voltage, thereby initiating voltage clamping immediately when the voltage attempts to exceed the blocking level selected.

### **Fail-Safe: PCR/PCRH**

An important safety feature is that if subject to AC fault current or lightning surge current in excess of rating such that failure occurs, failure will occur in the shorted mode. In the shorted mode, the unit can carry greater than rated fault current or lightning surge current and still provide an effective grounding (or conducting) path.

### **Enclosure: PCR Only**

The PCR enclosure is made of a light gray fiberglass-reinforced polyester material suitable for outdoor non-submersible applications and is rated NEMA 4X (comparable to IP 66). Optionally, the PCR can be supplied as a submersible device with the same dimensions rated NEMA 6P (comparable to IP68). The PCR enclosure is not “explosion-proof” because this is not a requirement for a Class Division 2 listing.

### **Enclosure: PCRH Only**

All PCRH enclosures are explosion-proof and are made of cast aluminum. The standard enclosure is NEMA 4X (comparable to IP66). This enclosure is listed for Groups C and D by UL in the U.S., and for Groups B, C, and D by UL in Canada.

### **Mounting: PCR Only**

The PCR is made to mount on a flat surface (e.g., a rectangular wood treated post) with two 3/8" (≈ 10mm) diameter bolts furnished by user; however, a number of optional mounting methods and accessories are available for specific applications.

For insulated joint application, “Weld Tabs” can be furnished as an option, provided that welding to the flange is user acceptable. This maximizes joint protection by minimizing lead length, and provides physical support for the PCR. See Figure 6.

For AC mitigation and similar applications, the PCR can be mounted inside of an enclosed pedestal which is partially buried in the earth. See Figure 7.

### **Mounting: PCRH Only**

All PCRH versions have a 3/16" (4.8 mm) thick aluminum back-plate which can be mounted to a flat surface

with two 1/2" (12 mm) bolts, user furnished. All models are also furnished with appropriate holes in the back plate, suitable for U-bolt mounting to a 2" pipe (2.375" or 60.3 mm outer diameter). If desired, DEI can also furnish the U-bolts, a 36" (0.9 m) or 48" (1.22 m) galvanized pipe, an appropriate 4-bolt hole pipe flange base, and four 12" (305 mm) galvanized anchor bolts with nuts suitable for embedding in a user constructed concrete foundation. It is always recommended that the product be mounted so that the total lead length to the connection points is kept as short as possible so as to minimize the voltage developed due to lead inductance. (Refer to section on lightning current ratings.)

### **Packaged Weight/Unit: PCR Only**

Approximately 12 to 20 pounds (5.5 to 9.1 kg) depending on model selected, exclusive of packaging.

### **Packaged Weight/Unit: PCRH Only**

The PCRH-3.7KA (60 Hz) or PCRH-3.5KA (50 Hz) and the PCRH-10KA (60 Hz) or PCRH-9KA (50 Hz) models weigh about 30 lbs. (13.6 kg). The PCRH-15KA (60 Hz) or PCRH-14KA (50Hz) model weighs about 39 lbs. (17.7 kg). These weights are exclusive of packaging, leads, or other accessories that may be ordered and packaged with the product.

### **Polarity/Electrical Connection: PCR Only**

Polarity marks (+) and (-) are provided above the lead connection points to aid in proper installation. Connections are normally made with leads to two-hole terminal pads which already contain 1/2" stainless steel bolts, nuts and washers (unless an alternate connection

method is selected). Leads and compression connectors are normally user furnished.

Terminals, pre-connected to adapter plates, are also available to facilitate mounting across insulated joints or to similar bolted connection points.

**Polarity/Electrical Connection: PCRH Only**

Polarity marks (+) and (-) are provided above the lead connection points to aid in proper installation. Lead connections are made to bushings which have a 1/2" x 13 diameter threaded stud that is 0.875" long. It is suggested that the PCRH be purchased with factory furnished leads and connectors to simplify field installation. The lead length is user-specified when ordering. Two lead connection options are offered. Leads can be either axial connected to the bushing studs (preferred, and only possible with components furnished by DEI) or angle connected (90° or 45°) using commercially available connectors with a hole that accommodates a 1/2" (12 mm) bolt.

Terminals, pre-connected to adapter plates, are also available to facilitate mounting across insulated joints or to similar bolted connection points. See Figure 5.

**Size: PCR/PCRH**

Refer to the following figures for dimensional data for each product. PCR: Figures 8A–8C. PCRH: Figures: 9A, 9B.

**Ambient Temperature: PCR/PCRH**

-45° C to +65° C

**Number of Operations: PCR/PCRH**

Virtually unlimited under maximum ratings, provided the operations are not immediately repetitive.

**Energy Requirements:**

None. The devices are totally passive.

**Model Number Structure: PCR Only**

**For Class I, Div. 2, Zone 2 and Non-hazardous locations**

**Model # = PCR-A/B-C-D-E**

Select desired value for "A." Model positions "B," "C" and "D" are options to be specified only if required. (Any accessories must be ordered separately by model number.)

**A: Fault Current**

Symmetrical AC-RMS fault current rating at 30 cycles in kA .

(See previous rating table for capability at 1, 3, and 10 cycles.)

60Hz	50Hz
3.7KA	3.5KA
10KA	9KA
15KA	14KA

Examples:

- PCR-10KA (60Hz)
- PCR-3.5KA (50Hz)

**B: Steady-State Current**

Optional higher AC current rating.

If the standard 45 ampere rating at 60 Hz or 40 ampere rating at 50 Hz is acceptable, then omit "B." (The standard rating is sufficient for most applications.) If a higher steady-state rating is required, insert "80A" to specify an 80 ampere rating at 60 Hz or "70A" to specify a 70 ampere rating at 50 Hz.

Example:

- PCR-10KA (Standard rating)
- PCR-10KA/80A (Optional Rating)

**C: Asymmetrical vs. symmetrical voltage blocking**

The standard PCR has asymmetrical

voltage blocking characteristics. It blocks the flow of DC current from -3.0 volts to +1.0 volt. Omit "C" if the standard asymmetrical blocking is acceptable (suitable for most applications). If it is desired to have a PCR that has symmetrical voltage blocking, from -2.0 volts to +2.0 volts, then specify "S" in this model position.

Example:

- PCR-3.7KA (Asymmetrical blocking)
- PCR-3.7KA-S (Symmetrical blocking)

**D: Terminals**

Two-hole spade terminals are standard, but compact connectors are available. See photos on the following page showing both choices. Compact connectors are recommended where necessary to insulate the connections to the PCR after installation (for example, with a user furnished heat-shrink sleeve). Add "CC" to the end of any model number only if compact connectors are required.

Examples:

- PCR-10KA (Standard connector)
- PCR-10KA-CC (Compact connector)

**E: Options**

Any factory authorized option may be added to the end of the catalog number. One such option is "-CS2" to obtain a PCR with a NEMA 6P environmental rating for submersion.

Example:

- PCR-3.7KA-CS2.

**Accessories: PCR Only**

If desired, order separately as follows.

**Weld Tab Mounting Option**

For some insulated joint applications, the Weld Tab Mounting option is desirable where welding to the flange is permitted (user determined) because this minimizes lead length and maximizes over-voltage protection due to lightning. This option is limited to the following

standard PCR model numbers: PCR-3.7KA and PCR-10KA at 60 Hz, and PCR-3.5KA and PCR-9KA at 50 Hz. (If this option is desired for any other model, contact DEL.)

See Figure 6 for Weld Tab Mounting details. If desired, add “-WTM” as an additional suffix to any PCR model number that does not also specify compact connectors. (Standard connectors are required with the WTM option.) When specified, the PCR will be furnished with the weld tabs factory bolted to the terminals and ready for welding in the field. The channel bracket, normally furnished with a PCR, will be omitted as it is not used when this option is provided.

Examples:

PCR-3.7KA-WTM (60 Hz)  
PCR-9KA-WTM (50 Hz)

### Pedestal Mounting Options

A light green fiberglass pedestal is available for enclosing the PCR and all cable connections. When the PCR is used in applications where both cable lead connections come from below ground level (e.g., AC voltage mitigation applications) or where it is desired to provide a second level of protection around the standard PCR enclosure, the Pedestal Mounting Option can be ordered as a separate item from the PCR. When a pedestal is ordered along with a PCR, add the suffix “-PED” to the PCR model ordered and also sepa-

rately order the pedestal by model number. All mounting hardware required to mount the PCR in the pedestal will be packaged with the PCR. The channel bracket, normally furnished with a PCR, will be omitted.

See Figure 7 for Pedestal details. The height of the standard pedestal is 36". To order, specify **Pedestal-36"** plus the desired PCR model. Consult DEI if a different height pedestal is desired.

Example:

Pedestal-36"  
PCR-3.7KA-PED

### Lead/Connector Options

It is suggested that users furnish their own leads and connectors required to attach to the PCR terminals; however DEI will furnish one lead size, suitable for any fault current rating, when specified. The standard lead is insulated, extra flexible, 2/0 copper cable.

All leads are provided with a compression terminal on one end ready for attaching to the PCR terminal pad. The following lead options are available.

Note: Two leads required per PCR.

**Lead # = L - T**

**L** = desired lead length in inches or mm. Specify length and units of measurement.

**T** = Specify BT3/8-10 for a bolted terminal which is attached with a 3/8" or 10 mm bolt, or NT for No Terminal.

Examples:

**Lead # = 10"-BT3/8-10**

**Lead # = 300mm-BT3/8-10**

**Lead # = 12"-NT**

If Leads and Adapter Plates (described in the next section) are purchased, specify NT above because the required terminals are furnished with the Adapter Plates.

Bolted terminals are furnished instead of compression connectors so that a compression tool is not required for field installation. Bolted terminals also enable a user to cut the lead to the shortest allowable length and install it with readily available tools in the field.

### Lead Adapter Plate Option

If the PCR leads are to be bolted to their connecting points in the field, such as across an insulated joint, a 1/8" (3.2 mm) thick, nickel plated, copper adapter plate can be furnished to simplify making this connection. The adapter plate has a factory-assembled bolted-type cable lead connector that accepts 2/0 to 4/0 (70 to 120 mm<sup>2</sup>) conductor with a mounting hole size specified by the user. Reference Figure 5 for Adapter Plate details.

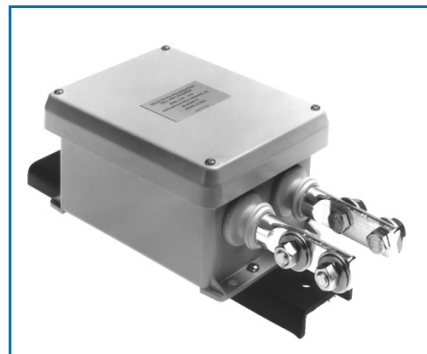
If Adapter Plates are desired, specify model **AP- "D"** where “D” is the user-specified hole diameter in inches or mm. Note: Normally two required per PCR.

When specifying a hole diameter for insulated joint applications, allow sufficient clearance for the outer diameter of the insulating sleeve over the flange bolts. Ideally, the insulating sleeve over the bolt, and the bolt to which the adapter plates are attached, should be 1/4" (6.4 mm) longer than the other sleeves/bolts to account for the thickness of two adapter plates. Most manufacturers of insulated joint kits can provide one different length bolt and insulating sleeve in an insulation kit upon request. (Also usable with the PCRH.)

The PCR with Standard Connectors



The PCR with Compact Connectors



## Pipe Mounting Options

Any PCR model can be furnished with a stainless steel backplate and U-bolts suitable for mounting to a user-furnished 2" pipe (outer diameter 2.375" or 60.3 mm) by adding the suffix "-PM2" to the model number. To order a complete Pipe Mounting Kit, also separately order a **PMK2/36** or a **PMK2/48**, described in the PCRH accessories section under Pipe Mounting Options.

### Model Number Structure: PCRH Only

#### For Class I, Div. 1, Hazardous Locations

#### Model # = PCRH-A-B-C

##### A: Fault Current

Symmetrical AC-RMS fault current rating at 30 cycles in kA .

(See previous rating table for capability at 1, 3, and 10 cycles.)

<u>60Hz</u>	<u>50Hz</u>
<b>3.7KA</b>	<b>3.5KA</b>
<b>10KA</b>	<b>9KA</b>
<b>15KA</b>	<b>14KA</b>

##### B: Asymmetrical vs. symmetrical voltage blocking

Omit B if the standard asymmetrical voltage blocking level of -3.0 volts to +1.0 volt is acceptable. If a PCRH with a symmetrical voltage blocking level of -2.0 volts to +2.0 volts is desired, then specify "S" in this model position.

Examples:

PCRH-3.7KA  
(Asymmetrical blocking)

PCRH-3.5KA-S  
(Symmetrical blocking)

##### C: Enclosure: Group Rating

Specify "CD" for the standard PCRH which is furnished in a raintight enclosure rated NEMA 4X (equivalent to IP66) and rated for Groups C and D.

Note: This same enclosure is listed for Groups B, C, and D by UL in Canada. For other enclosure/group rating combinations, contact DEI.

Examples:

PCRH-3.7KA-CD  
(Asymmetrical blocking,  
Groups C and D)

PCRH-3.5KA-S-CD  
(Symmetrical blocking,  
Groups C and D)

### Accessories: PCRH ONLY

If desired, order separately as follows.

#### Lead Options

When leads are not furnished with the PCRH, the user must make provision to connect the leads to a 1/2" x 13 diameter threaded stud that is 0.875" long ( $\approx$  25 mm dia. x 22 mm long). The stud is furnished with two hex brass jam nuts per stud. User furnished leads can only be installed with a right-angle or 45° angle connection using commercially available one-hole connectors. Factory furnished, axial-connected leads are suggested for most applications.

The PCRH can be furnished with extra flexible, insulated 2/0 ( $\approx$  70 mm<sup>2</sup>) stranded copper leads either for axial connection (recommended) or for right angle connection to the 1/2" ( $\approx$  12 mm) diameter bushing studs as illustrated in Figure 4. When axial-connected leads are furnished, a length of heat-shrink sleeve is provided to completely insulate the lead-to-bushing connection.

If Axial-Connected Leads are desired, specify **ACL-"L,"** where **L** is the desired length.

If Right-Angle Connected Leads are desired, specify **RACL-"L,"** where **L** is the desired length.

Specify the units for length "L" (e.g., inches, mm, etc.).

Each PCRH requires two leads. If only one length is specified, both leads will

be furnished to the same length. Axial-connected leads will be factory connected to the bushing stud and insulated for lead lengths up to about 15 ft. (4.6 m). (Always minimize lead length to provide the best over-voltage protection.) Longer leads will be packaged separately. If axial-connected leads of different lengths, but less than 15 ft. (4.6 m) are specified, advise which length goes to the positive and negative terminals, in which case they will be factory attached to the PCRH bushing studs and insulated.

#### Lead Adapter Plate Options

If the PCRH leads are to be bolted to their connecting points in the field, such as across an insulated joint, a 1/8" (3.2 mm) thick nickel-plated copper adapter plate can be furnished to simplify making this connection. The adapter plate has a factory-assembled cable lead terminal that accepts 2/0 to 4/0 (70 to 120 mm<sup>2</sup>) conductor with a mounting hole size specified by the user. Reference Figure 5 for Adapter Plate details.

If Adapter Plates are desired, specify **AP-"D"** where "D" is the user-specified hole diameter. Note: Normally two required per PCR.

When specifying a hole diameter for insulated joint applications, allow sufficient clearance for the outer diameter of the insulating sleeve over the flange bolts. Ideally, the insulating sleeve over the bolt, and the bolt to which the adapter plates are attached, should be 1/4" (6.4 mm) longer than the other sleeves/bolts to account for the thickness of two adapter plates. Most manufacturers of insulated joint kits can provide one different length bolt and insulating sleeve in an insulation kit upon request. (Also usable with PCR.)

#### Pipe Mounting Options

The PCRH comes with a backplate suitable for mounting to a flat surface with two 1/2" (or 12 mm) bolts, user fur-

nished. The backplate can be furnished with stainless steel U-bolts suitable for mounting to a 2" (2.375" or 60.3 mm outer diameter) user-furnished pipe.

If pipe mounting is desired, specify **PM2** for mounting to a 2" pipe. The PCRH will then be furnished with two stainless steel U-bolts.

A complete Pipe Mounting Kit includes the above items plus a 2" diameter pipe, 36" (914 mm) or 48" (1219 mm) long, a 4-bolt threaded pipe flange base suitable for mounting to a field fabricated concrete foundation, and four 5/8" x 12" (≈ 16 mm x 305 mm) galvanized anchor bolts, each with two nuts. To specify a complete Pipe Mounting Kit, specify **PMK2/36**, or **PMK2/48**. Complete Pipe Mounting Kits can also be ordered with any PCR models.

### Pedestal Mounting Option

The Pedestal Mounting Option described as a PCR accessory is also available as a PCRH accessory. To order add the suffix "-PED" to any PCRH model number and order the desired pedestal separately by model number. See Figure 7.

### Ordering Information: PCR Only

1. Select a model with the appropriate 50 Hz or 60 Hz AC fault current (short duration) rating from the following table:

<u>60 Hz</u>	<u>50Hz</u>
<b>PCR-3.7KA</b>	<b>PCR-3.5KA</b>
<b>PCR-10KA</b>	<b>PCR-9KA</b>
<b>PCR-15KA</b>	<b>PCR-14KA</b>

Example: PCR-10KA

2. Select the appropriate steady-state AC current rating. The standard PCR selected in Step 1 comes with a nominal steady-state current rating of 45 amperes at 60 Hz or 40 amperes at 50 Hz. At 60 Hz, a higher steady-state rating of 80 amperes can be obtained by adding a suffix **"/80A"** to the 60 Hz model selected. At 50 Hz, a

higher steady-state rating of 70 amperes can be obtained by adding a suffix **"/70A"** to the 50 Hz model selected. (Cost adder applies.)

Examples:

PCR-10KA/80A  
PCR-9KA/70A

3. For model position "C", insert **"S"** only if a PCR with symmetrical voltage blocking of +/- 2.0 volts is desired, otherwise omit position "C."

Example:

PCR-3.7KA-S

4. Two-hole spade terminals, as shown, are standard. Compact connectors are also available, though recommended only if it is necessary to insulate the connections to the PCR after installation (for example, with a user furnished heat-shrink sleeve). To order the compact connectors, add **"-CC"** to the end of any model number. (Cost adder applies.)

Examples:

PCR-10KA-CC  
PCR-10KA/80A-CC

5. Add any options to the end of the catalog number, such as the **"-CS2"** designation for submersible PCR.

6. Order any accessories separately by model number. Note: some accessories require an additional suffix to a PCR model number to order the accessory.

### Ordering information: PCRH Only

1. Select a model with the appropriate 50 Hz or 60 Hz AC fault current (short duration) rating from the following table:

<u>60 Hz</u>	<u>50Hz</u>
<b>PCRH-3.7KA</b>	<b>PCRH-3.5KA</b>
<b>PCRH-10KA</b>	<b>PCRH-9KA</b>
<b>PCRH-15KA</b>	<b>PCRH-14KA</b>

2. For model positions "B," insert **"S"** only if a PCRH with symmetrical voltage blocking of +/-2.0 volts is desired, otherwise omit position "B."

Example:

PCRH-10KA (Asymmetrical blocking, -3.0V to +1.0V)  
PCRH-10KA-S (Symmetrical blocking, -2.0V to +2.0V)

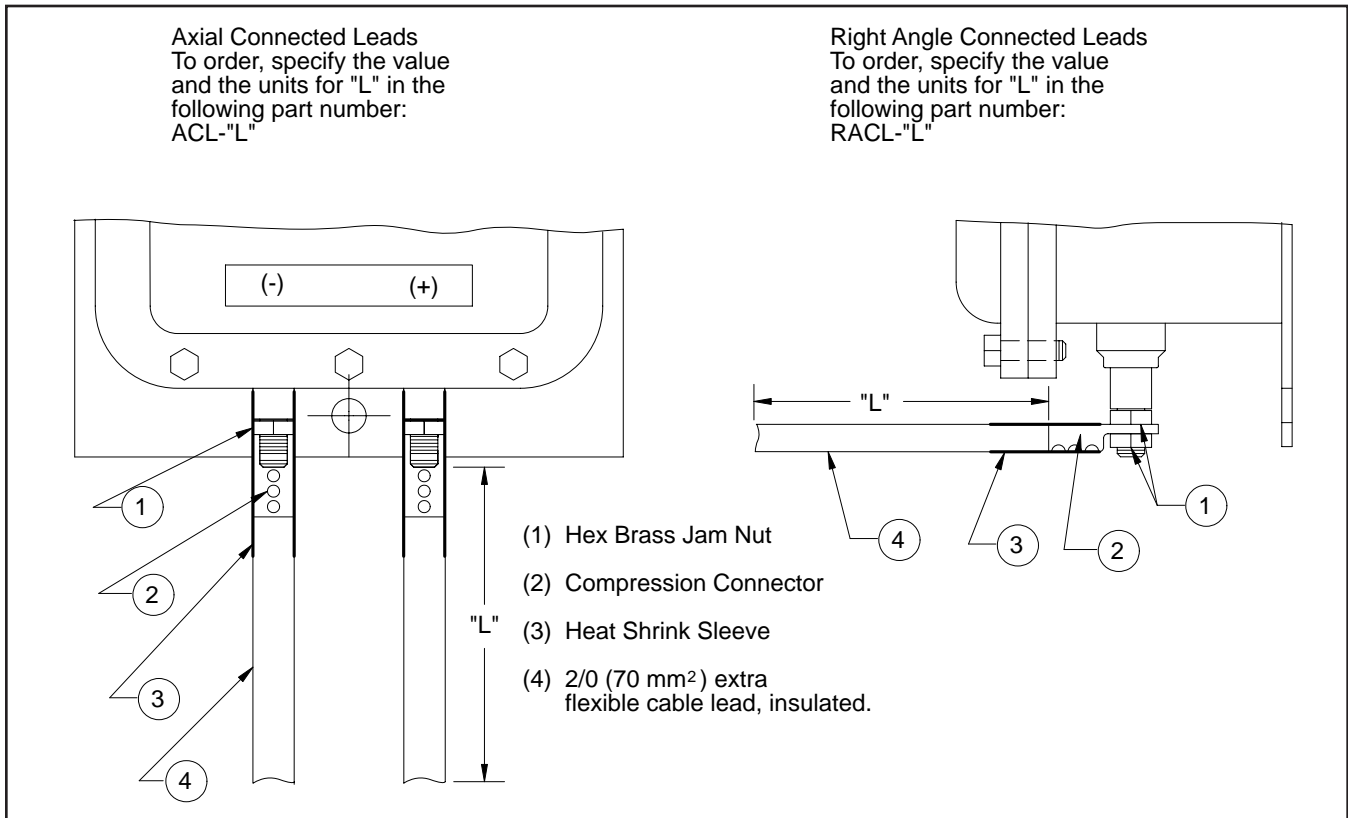
3. For model position "C," always insert **"CD"** for Groups C and D. If other Groups ratings are required, contact DEI.

Examples:

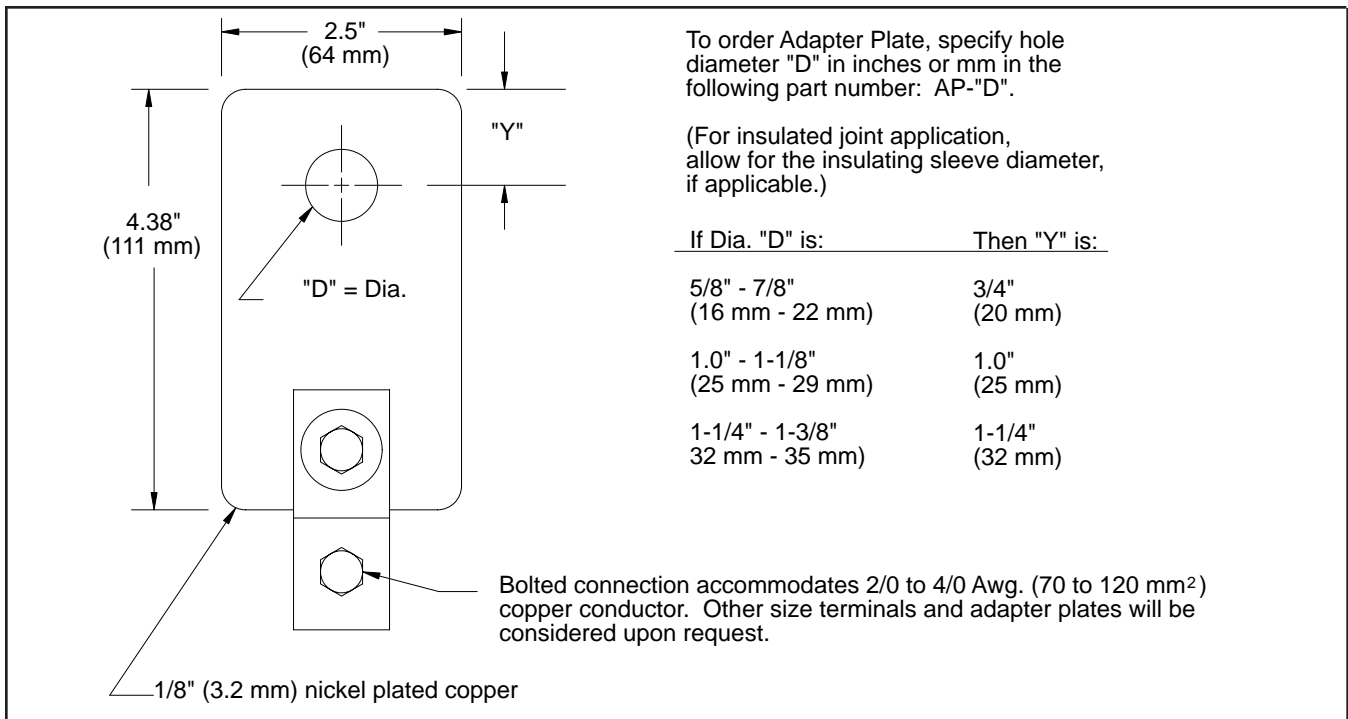
PCRH-10KA-CD (Asymmetrical blocking, -3.0V to +1.0V)  
PCRH-10KA-S-CD (Symmetrical blocking, -2.0V to +2.0V)

4. Separately order any accessories desired. Note: some accessories may require an additional suffix to a PCRH model number in addition to the model number required to order the accessory.

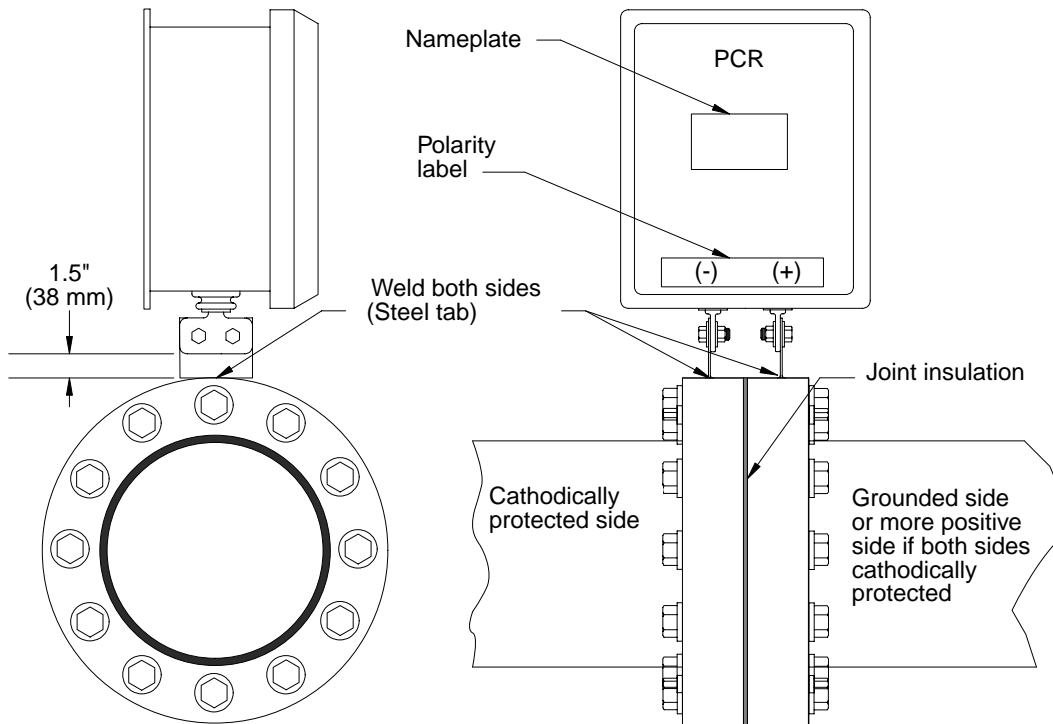
**FIGURE 4 Cable Lead Option – PCRH**



**FIGURE 5 Adapter Plates – PCR or PCRH**



**FIGURE 6** Weld Tab Mounted PCR



User to determine if welding to the flange is acceptable.

Applies to Models:

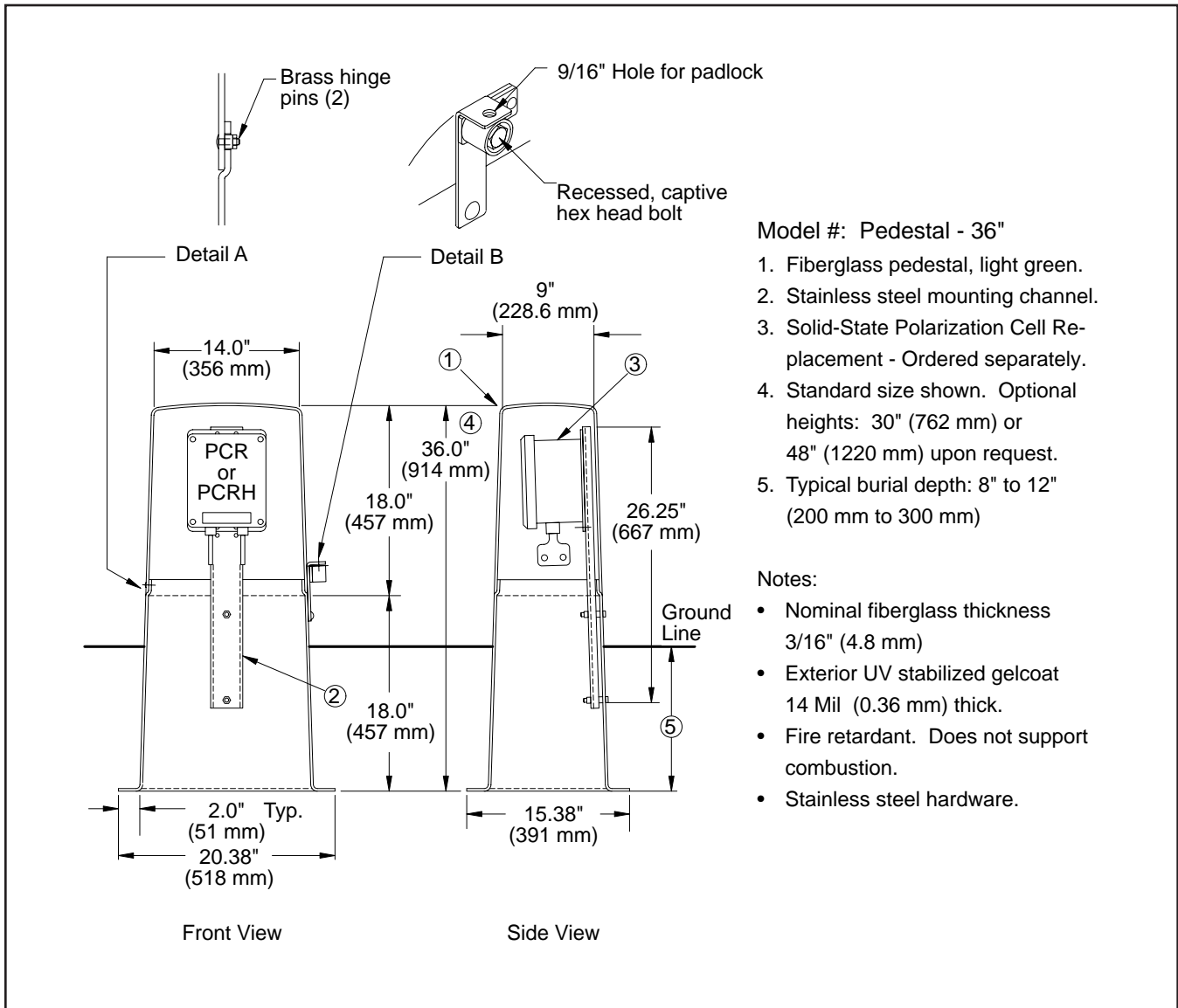
PCR-3.7KA and PCR-10KA @ 60 Hz

PCR-3.5KA and PCR-9KA @ 50 Hz

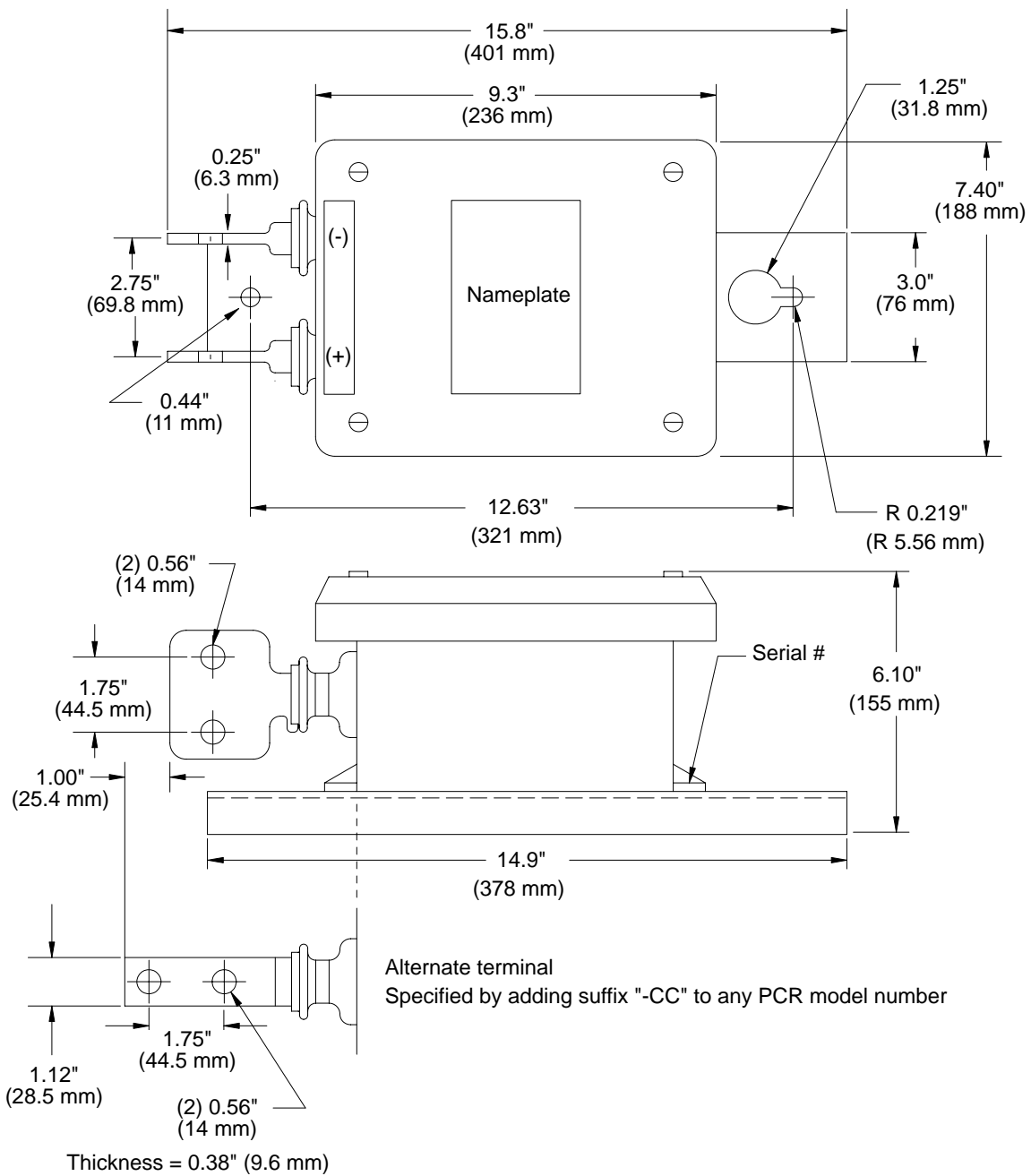
(Not applicable to PCRH Models.)

To order a PCR for Weld Tab Mounting,  
add the suffix "-WTM" to the PCR Model #.

**FIGURE 7** Pedestal Mounted PCR or PCRH



**FIGURE 8A** PCR Outline Dimensions

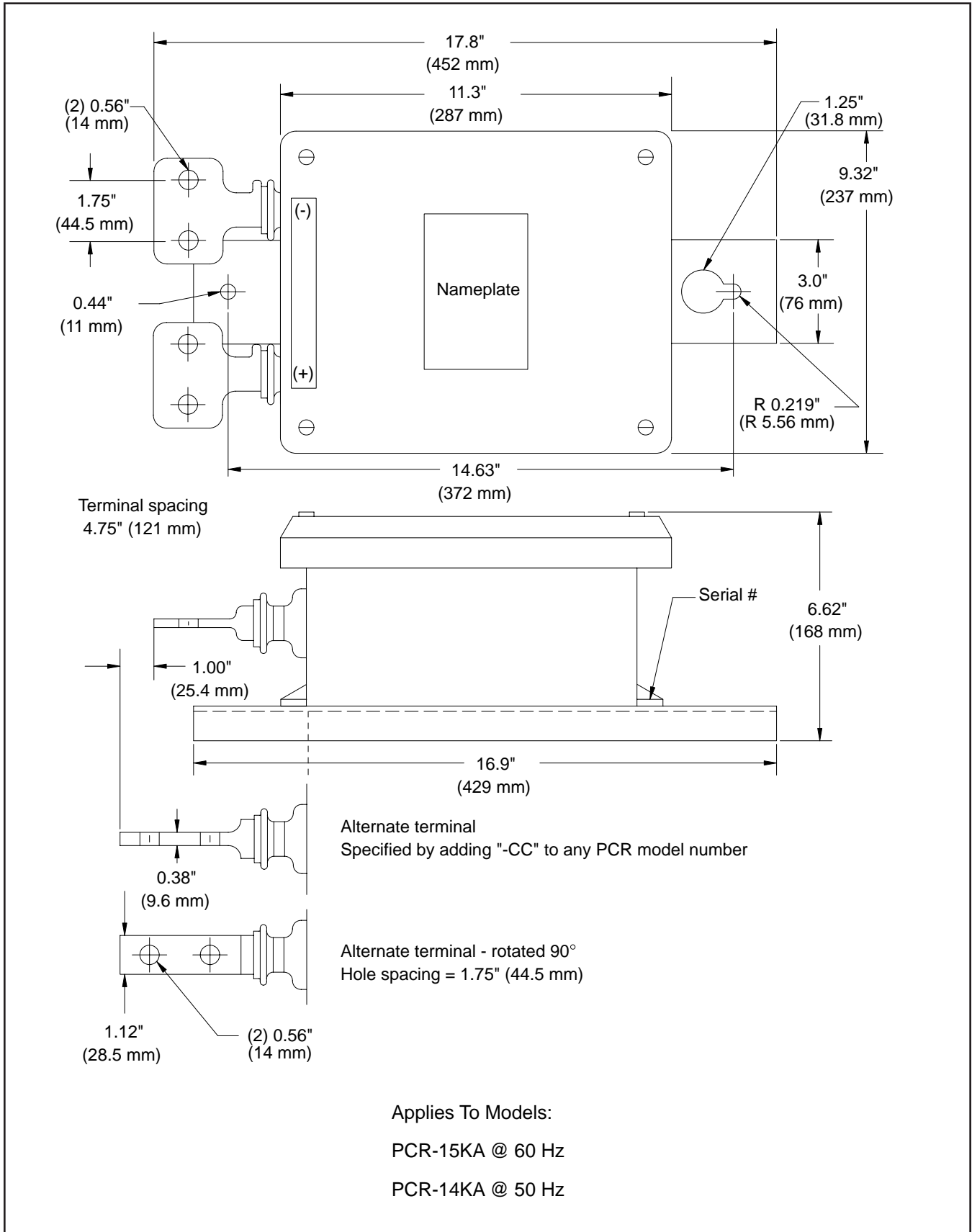


Applies To Models:

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

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

**FIGURE 8B PCR Outline Dimensions**



**FIGURE 8C PCR Outline Dimensions**

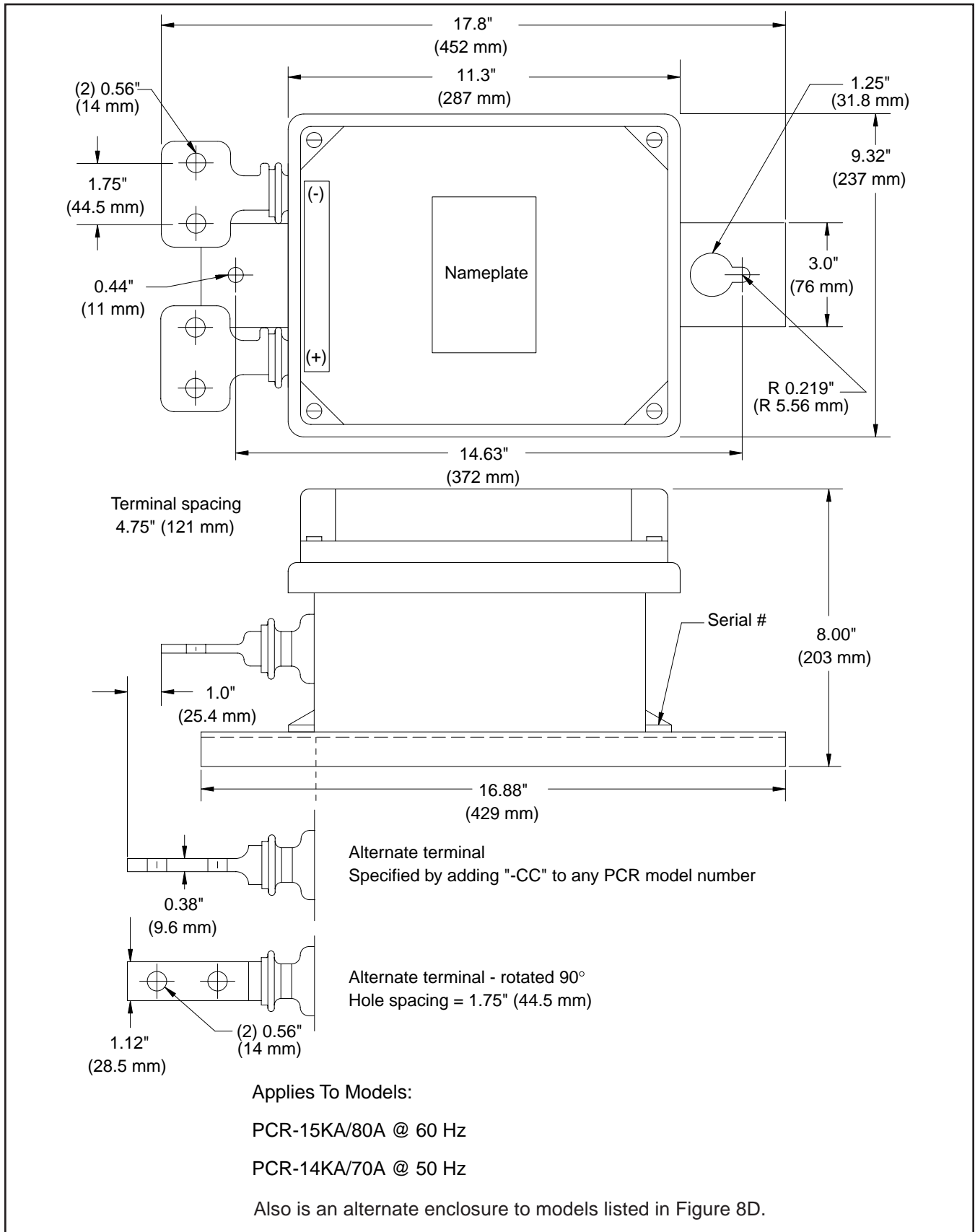
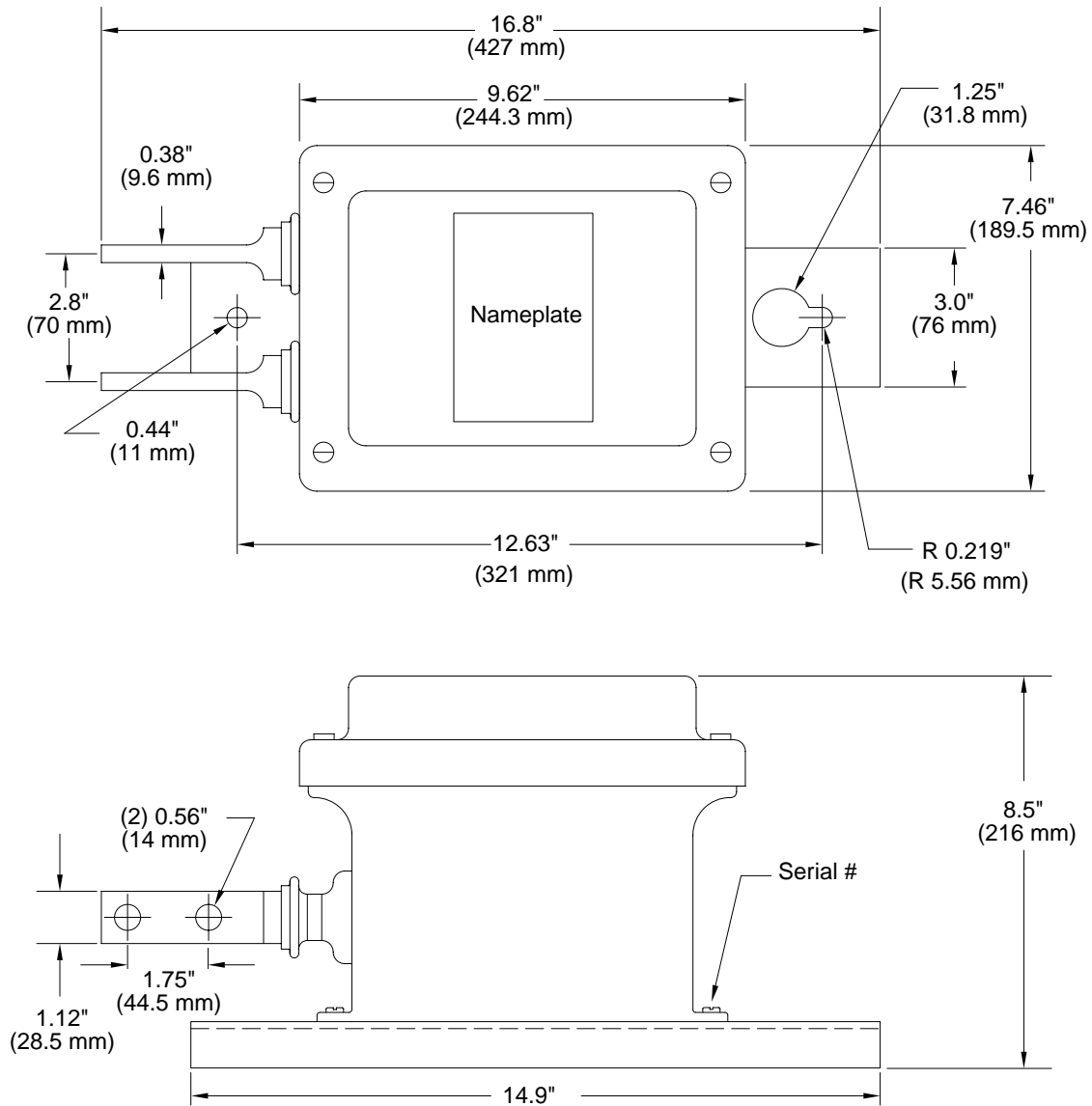


FIGURE 8D PCR Outline Dimensions



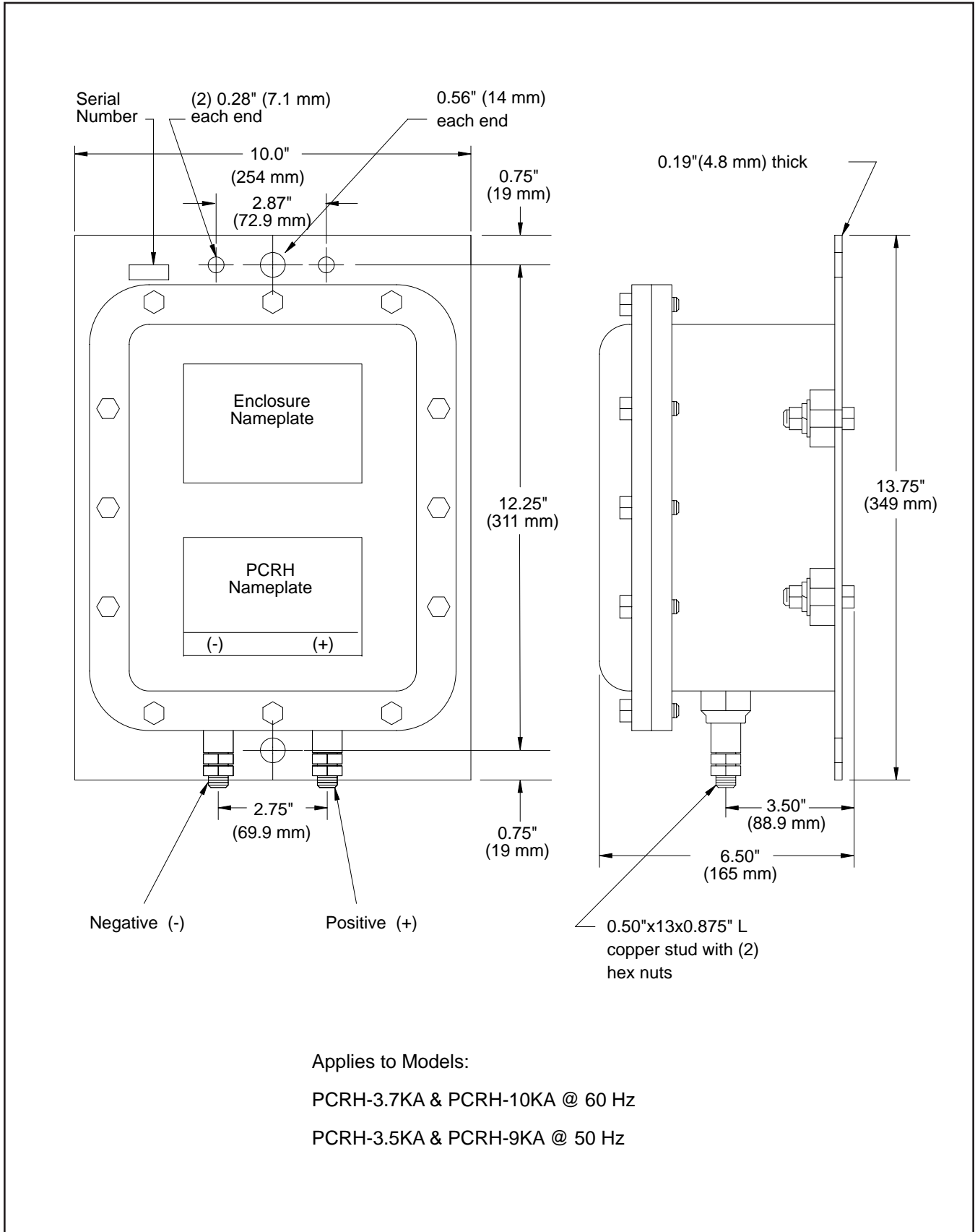
Applies To Models:

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

PCR-3.5KA/70A and PCR-9KA/70A @ 50 Hz

See notes in Figure 8C regarding alternate enclosure.

**FIGURE 9A** PCRH Outline Dimensions



**FIGURE 9B** PCRH Outline Dimensions

