Prepared by: MZGD

INSTALLATION OF IN−OUT AUTOMATIC PAD-MOUNTED INTERRUPTERS FOR UNDERGROUND DISTRIBUTION LINES

068188

Asset Type: Electric Distribution **Function:** Design and Construction

Issued by: Ryan Kowdley (RSKG) **Date:** 03-25-22

Rev. #09: This document replaces PG&E Document 068188, Rev. #08. For a description of the changes, see Page 24.

Purpose and Scope

This document shows the installation instructions of in−out automatic pad-mounted interrupters for underground distribution lines.

General Information and Application

1. The pad-mounted equipment shown in this document shall be designed, manufactured, and tested to meet the requirements of this document and to meet all applicable American National Standards Institute (ANSI) and all applicable Institute of Electrical and Electronic Engineers (IEEE) standards including IEEE/ANSI Standards C37.60 and C37.74, and the Enclosure Integrity Standards C57.12.28 and C57.12.29.
2. In−out PMI's feature one three phase operating device or three single phase operating devices. They are meant to have one set of incoming and one set of outgoing cables. For multi−way PMI's, see Document 076270.
3. The precast flat pad shown in this document shall be designed, manufactured, and tested to meet the requirements of PG&E Engineering Material Specification No. 29. The box-pad shown in this document shall be designed, manufactured, and tested to meet the requirements of PG&E Engineering Material Specification No. 21.
4. The electronically controlled fault interrupters approved for purchase in this document provide automatic, non−reclosing, three−phase, overcurrent interruption on underground systems where both phase and ground fault sensing are required. In addition, the PMI-4R, provides automatic, non-reclosing, single or three phase overcurrent interruption, although ground fault sensing is not available on this device. These 27 kV interrupters have been designed so they can be used anywhere in the system on 4 kV, 12 kV, 17 kV, and 21 kV circuits.
5. These fault interrupters may be used:
   A. To provide automatic sectionalizing of underground feeders, minimizing the areas affected by load side faults.
   B. To protect radial lines where a single customer's high load current requires such a large fuse that it is not possible to coordinate with the upstream protective device.
   C. To protect existing primary cable from thermal damage caused by excessive I^2t, where cable replacement is uneconomical. Use line-to-ground fault current values. See Document 027844.
   D. To protect three phase and two−wire, single phase loads using the three phase operating in−out PMI. PMI-4R's in non−PMH replacement applications may only be used to protect three phase loads if a three phase in−out PMI is not available and its use has been approved by the responsible distribution engineer.
   E. To protect one−wire single phase loads using the single phase operating PMI-4R. The PMI-4R is capable of opening either three phase or single phase but the closing operation will always be single phase.
   F. To replace existing PMH-4 equipment use the PMI-4R, regardless of load type.
6. No separate 120 Vac is required for the control. The control is self-powered by the load current CTs and an internal flux transformer. Only 15 amperes (A) of load current is required to power the control. When the load current is between 0 and 15 A and a fault occurs, the control will power up in 1/2 a cycle.
7. If the Elastimold or Elastimold equipped interrupter is open due to an automatic or manual operation, the indicating lights on the control will not illuminate. The control can be powered through the external power port shown in Figure 18 on Page 19, using a +12 VDC to +24 VDC external power source (M241617). The Model 80 and 380 controls can also be powered using a programming cable and a USB equipped laptop.
8. The Model 20 and G&W controls contains dip switches that are settable to provide electronic simulation of numerous fuse and relay curves. See Figure 18 and Figure 19 on Page 19 and 20.

9. SCADA is not available on this equipment.
10. In addition to coordination with adjacent protective devices, the following requirements must be met in the application of fault interrupters:
    A. The interrupting rating of the interrupter must be equal to or greater than the maximum asymmetrical fault current at the point of installation.
    B. The minimum trip current of the interrupter must not exceed the minimum symmetrical fault current at the ends of the line sections to be protected by the interrupter.
    C. The continuous current rating of the interrupter should be adequate to carry the normal and emergency load currents with reasonable allowance for growth. See Document 038718A and Document 058712 for additional information.

Operation

11. Any equipment with protective relays contained in this document shall be pre-commission tested with the following tests per TD-2916S and TD-2916P-01. Equipment without protective relays do not require these tests.
    A. Mechanical function test
    B. Contact resistance test
    C. Insulation resistance test
    D. Vacuum bottle integrity test
    E. Primary current injection trip test
12. The interrupter and enclosure are designed to be externally operable by one qualified worker.
13. The 200 A and 600 A interrupters are bidirectional and operate identically when the source is connected to either set of bushing wells. The PMI-4R is also bidirectional, but due to cable operation restrictions the source side cables should be connected to the high set of bushings when installed on a flat-pad.
14. The 600 A fault interrupter is supplied with 600 A apparatus bushings for connection to the primary cables. To connect cable sizes 600 and 1,100 kcmil, use 600 A separable insulated connectors with basic insulated plugs.
15. The 200 A fault interrupter is supplied with 200 A bushing wells. Cable size 1/0 AWG shall be connected to the interrupter with a 200 A load-break insert and load-break elbow connector.
16. The pad-mounted interrupter is only rated to successfully interrupt 40 A of pure capacitive current (approximately 0% power factor). This occurs when the switch is located directly feeding only a capacitor bank or banks. If the interrupter is located in a normal location, such that it is feeding normal load and a capacitor bank with a power factor of 70% or greater, then the interrupter can successfully interrupt either the 200 A or 600 A rating of current.
17. Three phase in−out should be used to protect two−wire, single phase loads. However, if only two load cables are connected or if loads are significantly unbalanced, ground protection may not be enabled. Cap off any unused phases with load−break test elbows.
18. A mode switch is housed on the G&W interrupter. It will cut out the relay making the interrupter into a switch when placed in the “SW” mode. The relay is cut in and all protective settings are active when the switch is placed in the “VI” mode.

Grounding

19. For 200 A installations use #2 solid bare copper for both ring bus and ground wire. For 600 A installations use 250 kcmil copper for the ring bus and #2 solid bare copper for the ground wire. Ground the equipment in two locations using the supplied ground nuts and approved lugs. Ensure the ring bus is connected to both ground rods and connected to the enclosure in at least two locations. All concentric neutral wire are to be individually pressed to the ring bus. All other permanent grounding connections including case grounds and connections to ground rods shall be attached to the ring bus utilizing #2 solid copper and press connections.

Installation of IN−OUT Automatic Pad-Mounted Interrupters for Underground Distribution Lines

Location

20. All cabinets shall have a minimum distance from other structures of 8 feet in front, 8 feet in back, and 3 feet on each side as required by Document 051122. This provides adequate space for using hot tools and portable grounds.

Intallation

21. Equipment must be caulked 360 degrees between the equipment and the pad.

References	Location	Document
Corrosion Resistant Ground Rods and Ground Rod Clamps	UG-1: Connectors/Greenbook	013109
Cutouts and Fuses for Underground Distribution Lines	UG-1: Switches	015226
Connectors for Insulated Cables Underground Distribution Systems	UG-1: Connectors/Greenbook	015251
Corporation Padlock With Chain	Design Standards, Substation Design	020861
Guide for Calculating Short Circuit Currents on Distribution Lines	EPM−Protection	027844
Corrosion Area Overhead Lines	OH: General/EPM	032911
Tags for Identifying Underground Cables and Equipment	UG-1: Marking	033582
Premolded 200-Amp Terminations for Primary Underground Cable	UG-1: Terminations	035314
Overcurrent Protection for Distribution Lines	FRO: Switches	038718A
Cables for Underground Distribution	UG-1: Cable	039955
Guide for the Planning and Design of Underground Distribution Systems	ELS	043904
600-Amp Separable Insulated Connectors	UG-1: Terminations	051071
Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment	UG-1 :General/Greenbook	051122
Pad-Mounted, Load-Break Switches and Fuses	UG-1: Switches	053318
Thermal Limits of Primary Distribution Lines Under Fault Conditions	ELS	058712
Fault Indicators for Underground Application	UG-1: General	061683
Underground Conduits	UG-1: Conduits	062288
Electric Distribution Preventive Maintenance Manual		EDPM
Engineering Material Specification No. 21 “Box-Pad Style Transformer Pads”	TIL	EMS21
Engineering Material Specification No. 29, “Pre-Cast Pads”	TIL	EMS29
Electric Distribution Line Control Device Pre-Commisioning Tests	TIL	TD-2916P-01
Electric Distribution Line Control Devices (LCD)	TIL	TD-2916S
Review and Implementation Process for Microprocessor-Based Outdoor Distribution Feeder Cabinet-protection Relay Settings	TIL	WP-3340−03

Three Phase Solid Dielectric Pad-Mounted Interrupters (PMI)

1 These switches should be used when three phase loads are involved. They come equipped with a controller that is only capable of three phase, gang operation.

Front View

Back View

Figure 1
Photograph of 600-Amp Pad-Mounted Interrupter
(with Elastimold unit, Model 20 Controller shown)

Front View

Back View

Figure 2
Photograph of 200-Amp Pad-Mounted Interrupter
(with Elastimold unit, Model 20 Controller shown)

Three Phase Solid Dielectric Pad-Mounted Interrupters (PMI) (continued)

Table 1 Bill of Materials (see Figure 3 on Page 6 through Figure 5 on Page 7)

Item	Quantity	Description	Code	Document
1	1	Box-pad (preferred) or Flat-pad	(see Table 2 on Page 6)	–
2	1	Pad-Mounted Interrupter	(see Table 2 on Page 6)	–
3	2	Ground Rod, 5/8” x 8’	187013	013109
4	2	Clamp, Ground Rod, for 5/8” Rod	187012	013109
5	As Required	Wire, Ground, No. 2 AWG, Solid Bare Copper	290074	059626
6	As Required	Wire, 250 kcmil, Stranded Bare Copper (neutral bypass/ring bus)	290254	
7	As Required	Conduit, Plastic, for Primary (size as required)	–	062288
8	As Required	End Bell, (size as required)	–	
9	As Required	Tie, Cable	399095	033582
10	2	Decal, **“High Voltage/Maintain 8’ Clearance”** Label	621599	
11	As Required	Decal, Equipment Number	–	
12	As Required	Tag, Phase Identification, Pre-Punched	–	
13	As Required	Tag, Voltage identification, Pre-Punched	–	
14	As Required	Tag, Sectionalizing	–	
15	As Required	Connector, Separable, Insulated, 200 A, Load-Break	–	035314
16	As Required	Load-Break Bushing Insert	300481	
17	As Required	Elbow Receptacle, 600 A, Dead-Break	303572	051071
18	As Required	Adapter, Cable	–	
19	As Required	Connector, Threaded Spade	–	
20	As Required	Plug, Basic Insulating	303576	
21	As Required	Cable, Insulated (size and rating as required)	–	039955
22	As Required	Ground Lug	301546	015251
23	As Required	Connector, Tap, Compression, for #2 Cu to #2 Cu	305244	
24	As Required	Connector, Tap, Compression, for #2 Cu to 250 kcmil Cu	305845	
25	As Required	Connector, Compression, Straight, for 250 Cu to 250 kcmil Cu	305202	
26	4	Bolt, 1/2 − 13 x 1−1/2”, Everdur	193023	
27	As Required	Compound, Caulking	495228	–
28	As Required	Grout, Zero Shrink	121016	–
29	4	Washer, Galvanized, for 1/2” Bolt	195273	058778
30	2	Padlock, Corporation	016583	–
31	As Required	#14 Bare Copper (spare concentric wire)	–	–
32	As Required	Twisted Concentric Wire Tail	–	–

Three Phase Solid Dielectric Pad-Mounted Interrupters (PMI) (continued)

Table 2 Application and Ordering Information (PMI)

Rating kV/BIL/ Amps	Description	Manufacturer Part Number	Code
27/125/200	Pad-Mounted Interrupter (painted 409 stainless steel)	MIW-JS-4042-200 A	342616 [2]
	Pad-Mounted Interrupter (painted 304 stainless steel)	MIW-JSS-4042-200 A	342618 [1]
27/125/600	Pad-Mounted Interrupter (painted 409 stainless steel)	MIW-JS-4042-600 A	342619 [2]
	Pad-Mounted Interrupter (painted 304 stainless steel)	MIW-JSS-4042-600 A	342617 [1]
–	Polymer Concrete Box-Pad	BP484846−00000	343506 [3]
–	Precast Concrete Flat Pad	MIW-IP−4848	342615 [3]

1 For all applications, both corrosive and non-corrosive environments.
2 For non-corrosive areas only. This material is no longer available, utilize the 304 stainless equivalent code in this table.
3 Only one pad, box-pad or flat pad required. Box-pad is the preferred installation.

Table 3 Overcurrent Relays

PMI Type	Relay Type	Code
200A/600A In-Out PMI	Elastimold Model 80 (three phase operation only)	M590742
200A PMI-4R	Elastimold Model 380 (single or three phase operation only)	M590741

1 This material does not need to be ordered as it is provided with the PMI.

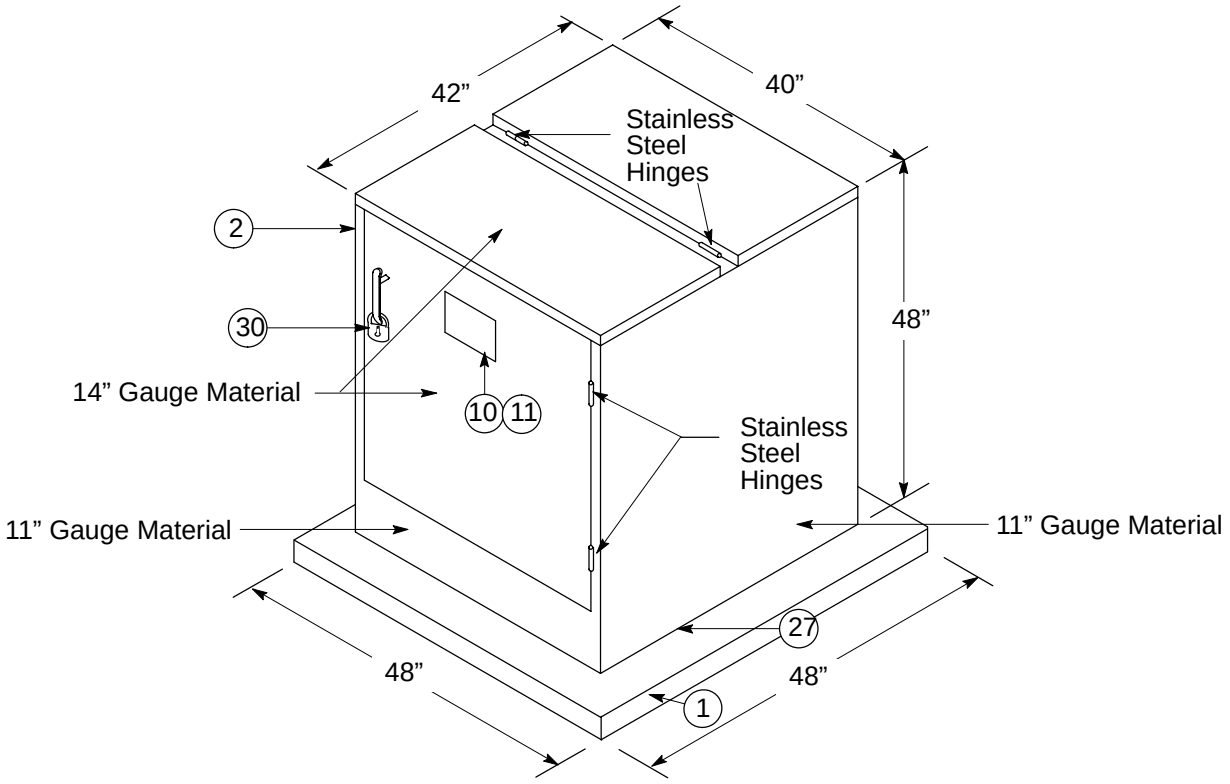
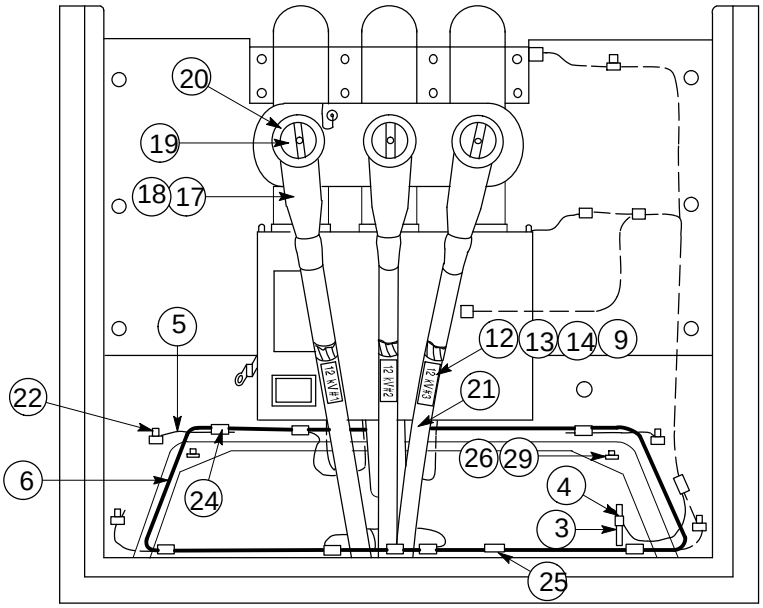


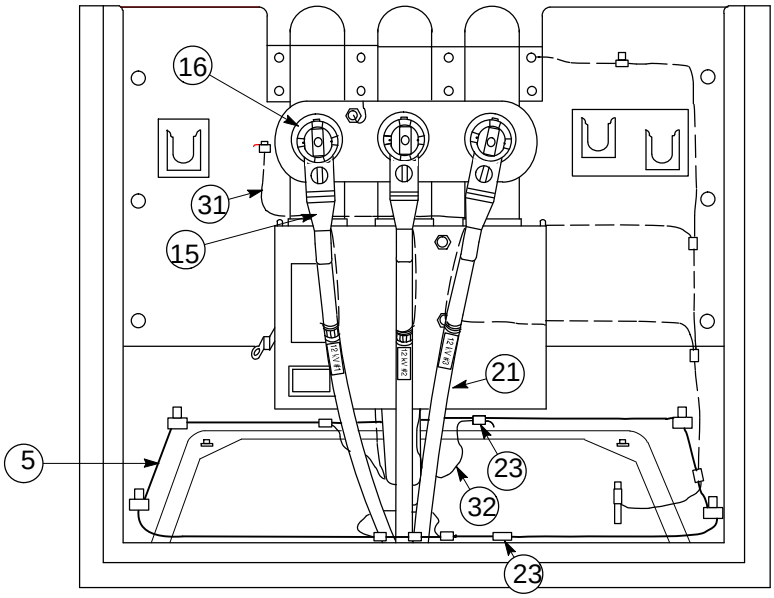
Figure 3
Pad-Mounted Interrupter on Flat Pad
600-Amp and 200-Amp
(see Table 1 on Page 5 for item numbers)

Three Phase Solid Dielectric Pad-Mounted Interrupters (PMI) (continued)



Front View

Figure 4
Pad-Mounted 600-Amp Interrupter
(see Table 1 on Page 5 for item numbers)



Front View

Figure 5
Pad-Mounted 200-Amp Interrupter
(see Table 1 on Page 5 for item numbers)

Single Phase Solid Dielectric Pad-Mounted Interrupter (PMI-4R)

Table 4 Bill of Materials (see Figure 6 through Figure 7 on Page 9)

Item	Quantity	Description	Code	Document
1	1	Box-pad (preferred) or Flat-pad	(see Table 5)	–
2	1	Pad-Mounted Interrupter, PMI-4R	343466	–
3	2	Ground Rod, 5/8” x 8’	187013	013109
4	2	Clamp, Ground Rod, for 5/8” Rod	187012	013109
5	As Required	Wire, Ground, No. 2 AWG, Solid Bare Copper	290074	059626
6	As Required	Conduit, Plastic, for Primary (size as required)	–	062288
7	As Required	End Bell, (size as required)	–	
8	As Required	Tie, Cable	399095	033582
9	2	Decal, **“High Voltage/Maintain 8’ Clearance”** Label	061599	
10	As Required	Decal, Equipment Number	–	
11	As Required	Tag, Phase Identification, Pre-Punched	–	
12	As Required	Tag, Voltage identification, Pre-Punched	–	
13	As Required	Tag, Sectionalizing	–	
14	As Required	Connector, Separable, Insulated, 200 A, Load-Break	–	035314
15	As Required	Cable, Insulated (size and rating as required)	–	039955
16	As Required	Ground Lug	301546	015251
17	As Required	Connector, Tap, Compression, for #2 Cu to #2 Cu	305244	015251
18	4	Bolt, 1/2 − 13 x 1−1/2”, Everdur	193023	015251
19	As Required	Compound, Caulking	495228	–
20	As Required	Grout, Zero Shrink	121016	–
21	4	Washer, Galvanized, for 1/2” Bolt	195273	058778
22	2	Padlock, Corporation	016583	–
23	As Required	#14 Bare Copper (spare concentric wire)	–	–
24	As Required	Twisted Concentric Wire Tail	–	–
25	As Required	200 A Cold Shrink Semiconducting Re-Shielding Kit (PMH Replacement Only)	300495	035314

Table 5 Application and Ordering Information (PMI-4R)

Rating kV/BIL/ Amps	Description	Manufacturer	Manufacturer Part Number	Code
27/125/200	Pad−Mounted PMI−4R Interrupter	Elastimold	ESD123-LLL−222-CS1853	343466
–	Polymer Concrete Box-Pad	New Basis	BP484846−00000	343506 [1]
–	Precast Concrete Flat-Pad	Hubbel	MIW-IP−4848	342615 [1]

1 Only one pad, box-pad or flat pad, is required. Box-pad is the preferred installation..
2 Pads not required when replacing a PMH using the existing pad.

Single Phase Solid Dielectric Pad-Mounted Interrupter (PMI-4R) (continued)

Figure 6
PMI-4R Single Phase Vacuum Fault Interrupter - Source Side
(replacement construction shown)

Figure 7
PMI-4R Single Phase Vacuum Fault Interrupter − Load Side
(replacement construction shown)

Pad Installation Instructions − New Construction

Box Pad Installation

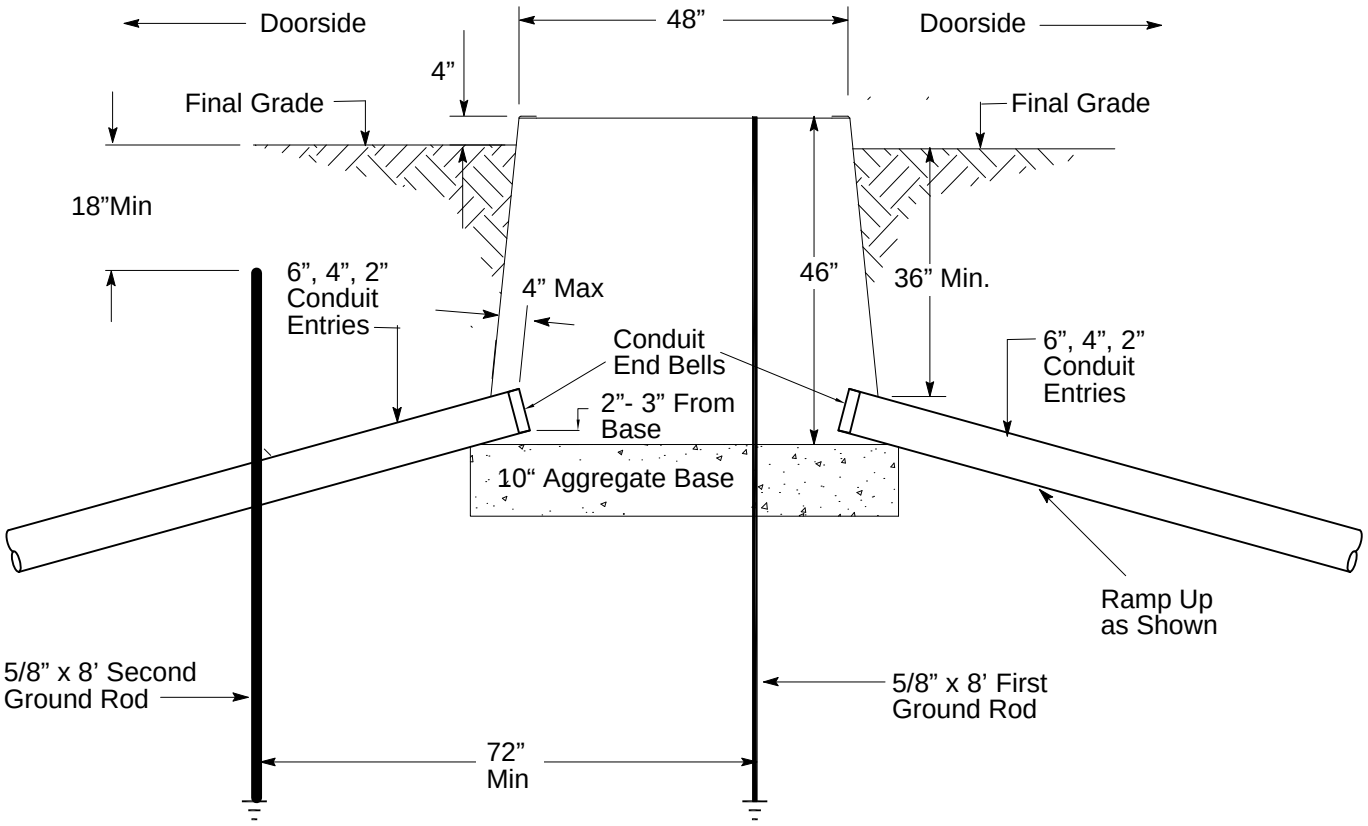


Figure 8
Box-Pad Conduit Layout

1. The box pad is the preferred method of installation.
2. This box pad shall feature mousehole knockouts for conduit entry into the enclosure. The mousehole knockouts will be located as shown above for a total of eight potential entry points into the enclosure.
3. The box pad should be installed on a layer of 10" 3/4" Class 2 Aggregate Base (AB) with the top of the box pad elevated 4" above final grade. Coarser material and construction debris may damage cable insulation and may not be used.
4. The first ground rod should be 5/8" x 8' with the top of the rod flush with the top of the box pad. The second ground rod should be 5/8" x 8' with the top of the rod at least 18" below final grade. The two ground rods must be a minimum of 72" apart.

Pad Installation Instructions − New Construction (continued)

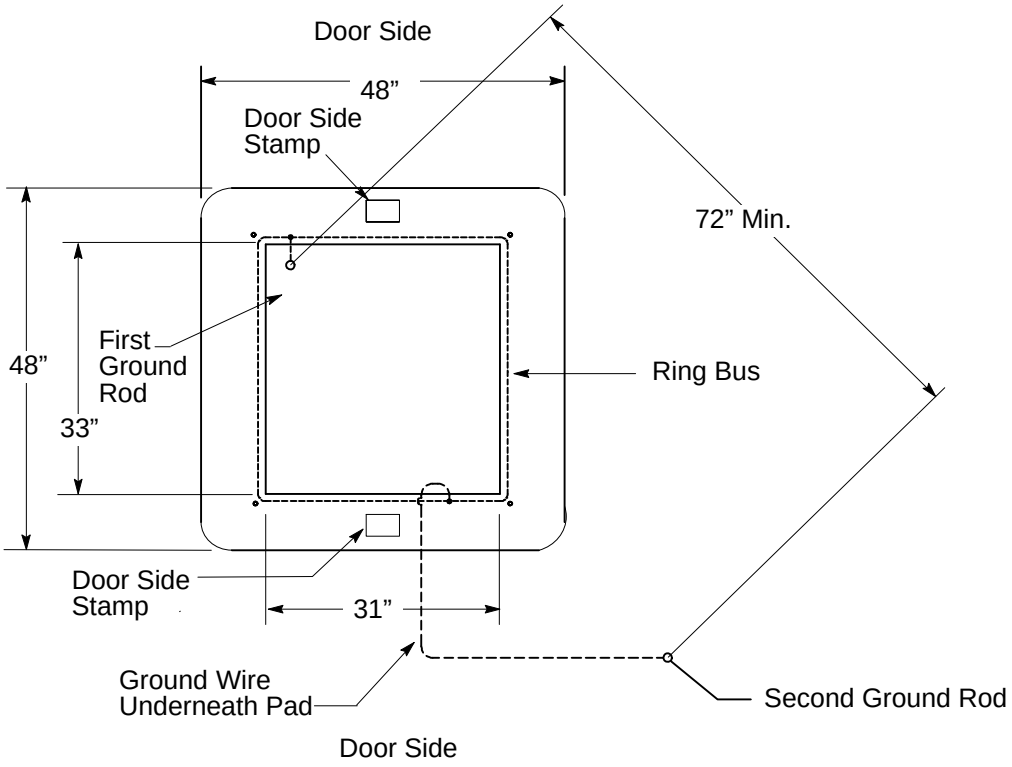
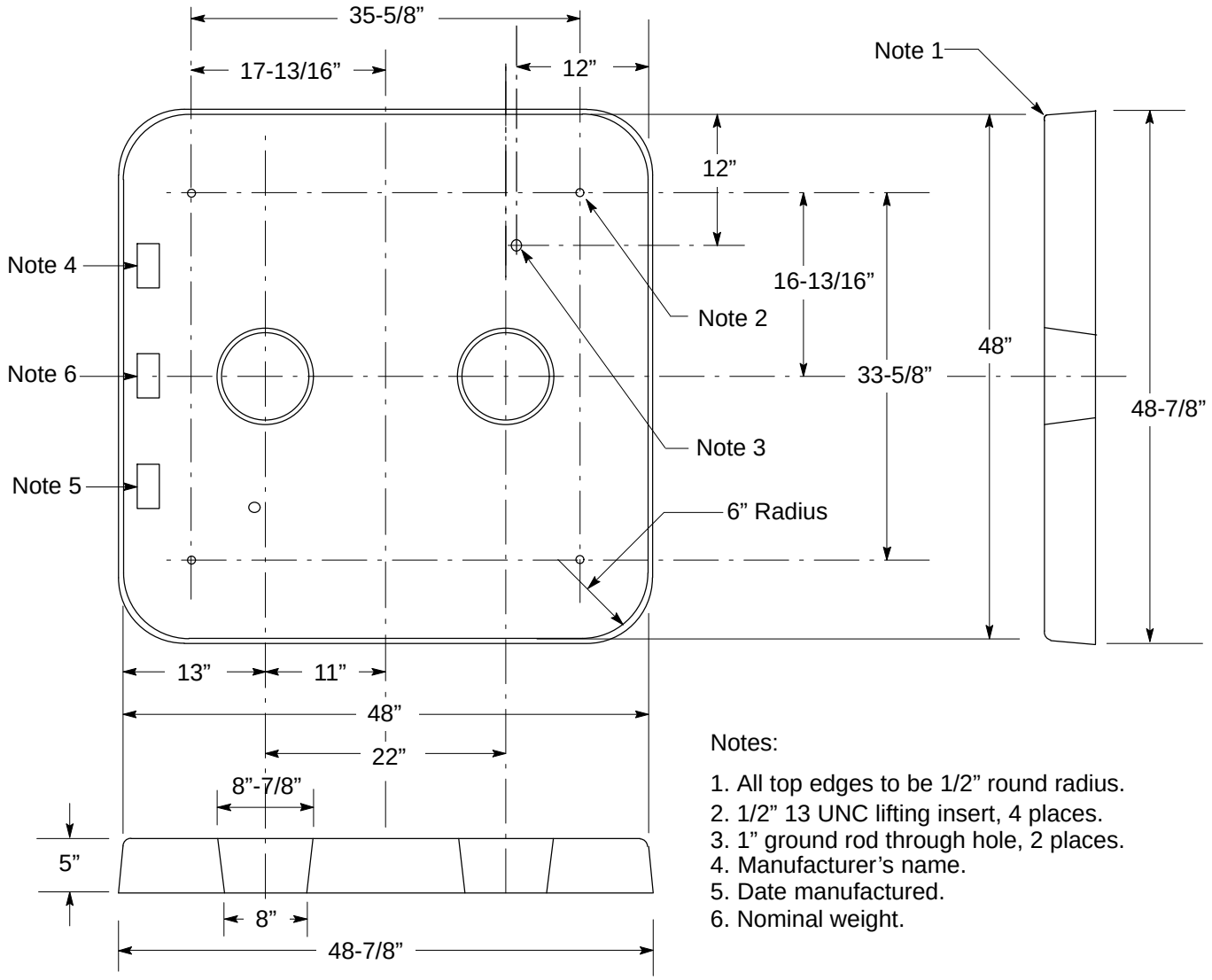


Figure 9
Standard Grounding Installation for Box-Pad Installations

5. Using an angle grinder with a diamond tip blade, open only the required knockouts to accommodate the 2”, 4”, or 6” conduits to be used.
6. After the pad is set in place, but prior to backfill, apply spray foam sealant on the exterior of the pad to fill any voids between and around the conduits and pad wall to prevent soil migration.
7. Install conduits entering the box pad at a slight upward angle so that the bottom of the conduit after cutting is approximately 2” above the rock base.
8. Cut conduits to 3” inside the box pad and install end bell fittings on each of the conduits.
9. Cables should enter the enclosure as site details dictate is best. Always consider cable racking and the field crews’ ability to initially install and future cable replacement from the chosen entry point. Cables can come in from the same side, opposite sides, or at right angles from each other.
10. At least three-quarters of a rotation of cable (minimum 12’ for this size boxpad) should be looped around the enclosure before terminating at the bushings. Do not go straight from the conduit entry points to the bushings.
11. 21 kV one wire installations must be installed in separate 2” conduits. Keeping the one wire taps separate enables future maintenance to be completed without affecting the other phases.
12. Ground per Note 19 on Page 2.

Pad Installation Instructions − New Construction (continued)

Flat Pad Installation



Notes:

1. All top edges to be 1/2” round radius.
2. 1/2” 13 UNC lifting insert, 4 places.
3. 1” ground rod through hole, 2 places.
4. Manufacturer’s name.
5. Date manufactured.
6. Nominal weight.

Figure 10
Precast Flat Pad Details

Pad installation Instructions − New Construction (continued)

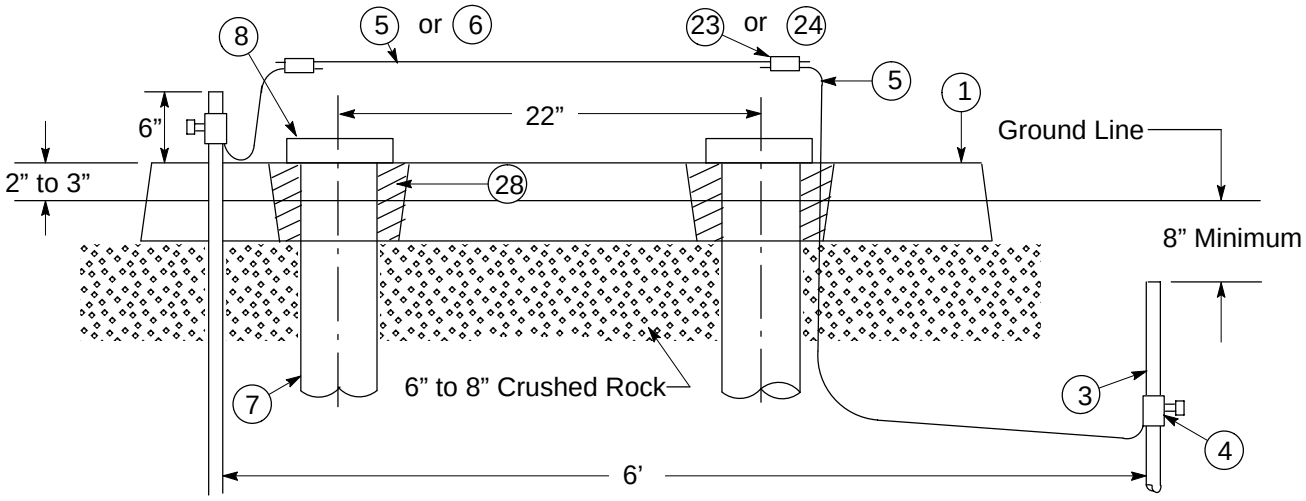


Figure 11
Flat Pad Installation
(see Table 1 on Page 5 for item numbers)

1. Excavate, as required, for pad and conduits. The area under the pad shall be excavated to the required grade, or to a depth necessary to reach firm, undisturbed material, whichever is deeper. The material can be considered firm if it cannot be penetrated by thumb except with moderate effort. If firm material has not been reached within a depth of 3 feet, excavate 3 feet beyond the perimeter of the pad and backfill the entire excavated area to the required grade and to the requirements of Note 9.
2. Use 3/4” Class 2 Aggregate Base (AB) as necessary when not backfilling with native material.
3. Install primary conduit bends into the pad excavation, ensuring proper spacing. Conduits must be centered in the windows to ensure proper cable training and operation.
4. Backfill and compact per Note 9. Install and level a 6-inch to 8-inch layer of 3/4-inch minus crushed rock.
5. Install an exterior ground rod, and run the ground wire to the pad excavation per Figure 11.
6. Install the pad and route the ground wire through the opening. The pad shall be placed on firm, compacted, native material or on engineered fill, that has been compacted at least to the requirements of Note 9.
7. Install an interior ground rod and cut the conduits to 1 inch above the surface of the pad. Install conduit end bells and grout the windows per Figure 11. Asphalt or blacktop is not approved for grouting.
8. Ground per Figure 11 and Note 19 on Page 2.
9. In case it has been necessary to excavate deeper than the required grade to reach firm material, backfill to the required grade in one of the following ways:
   A. Backfill with clean, non-expansive soil compacted to 90% of maximum density. Soil shall be placed in layers not more than 8 inches thick before compaction. Maximum density and in-place density are to be determined by California Test Method No. 216-G, Part I and II respectively, or by ASTM D-1556 and D-1557 . A copy of the test results may be required by PG&E.
   B. Backfill with soil-cement slurry consisting of one sack of Portland cement per cubic yard of clean native soil or sand.
10. In areas of known soft soil conditions, trenches within the pad excavation area for the installation of conduits shall be backfilled in accordance with Note 9.
11. When installing a PMI-4R on a flat pad, use dead-break terminations and inserts instead of the standard load-break on the short cable side. For all other new 200 A installations, including the front/tall side of the PMI-4R, load-break terminations must be used.

PMH Replacement (PMI-4R only)

1. The PMI-4R will fit on existing PMH-4 pads of both 14.4kV and 25kV styles. The PMI-4R will also fit on the existing 200 A pad-mounted three-phase interrupter polymer concrete pre-cast pad, although this may require some front/back adjustment.
2. As ground rod installation locations in existing PMH installations can vary, it should be identified prior to install if the ground rod needs to be relocated because it interferes with the PMI-4R's differing dimensions. If the ground rod does not interfere, no change is necessary. If the ground rod does interfere, call 811 for USA and relocate as shown below.

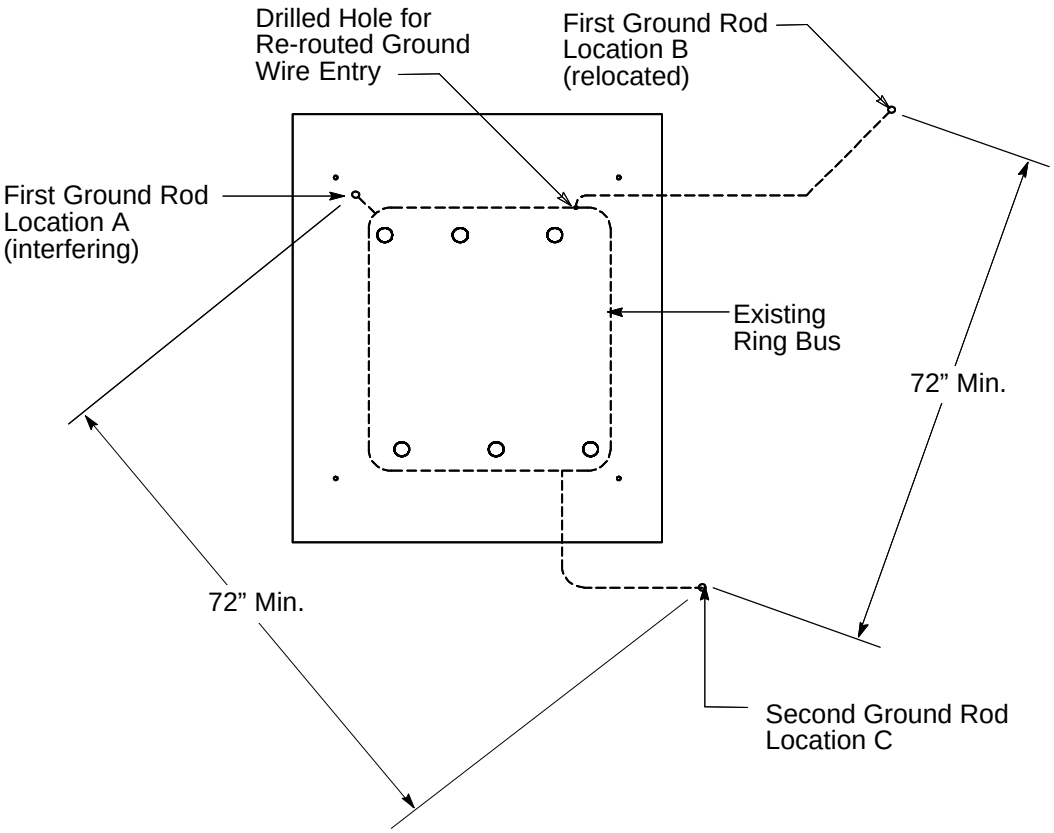


Figure 12
Example Interfering Ground Rod Relocation

3. As shown in the above figure, when an existing ground rod in Location A interferes with the PMI-4R bottom flange, it should be removed and relocated to an external Location B that as best as is possible maintains a minimum 72” distance from the existing externally located ground rod at Location C. Location B as shown in the figure above may vary as long as the stated requirements are met. The pad should be drilled to allow for the ground wire to pass from the existing ring bus to the newly located ground rod.
4. When changing from live-front terminations found on PMH installations to dead-front terminations, use cold shrink semiconducting re-shielding kits to replace the semiconductor and install 200 A terminations as required. See Engineering Document 035314, Table 7 for ordering information.
5. If the 200 A cable is damaged or more length is required a repair elbow (cable net gain 3 1/4” longer than a standard elbow) or an extended elbow (cable net gain 8 7/8” longer than a standard elbow) to obtain the vertical height of the dead-front terminations in line with the new dead-front bushing well insert. The repair elbows, extended replacement elbows and re-shielding kits are found in Engineering Document 035314. If the 600 A cable is damaged and more length is required, consider pulling slack from a nearby splice box. If additional cable is still required, cable replacement may be necessary.

Pad-Installation Instructions (New Construction) (continued)

6. When installing a PMI-4R on an existing flat pad (a pad other than a box-pad), normally oriented installations should have the long cables where load-break elbows will be installed going towards the source. The dead-break elbows will be installed on the short cable side and should be going towards the load.
7. In the event that the short cables are going to the source and the long cables are going to the load, it is acceptable for replacement installation only to install the PMI-4R with the source side short cables going to the short bushings and the load side long cables going to the taller bushings. The PMI-4R is bi-directional and this alternate installation method will not affect the equipment's operation.
8. PMI-4R's come equipped with load-break inserts on the source side of the equipment and dead-break reducing tap plugs on the load side of the equipment. If replacing the dead-break reducing tap plugs with load-break reducing tap plugs, such as during box-pad installation, no ground wire is necessary for the RTP's.

Components and Ratings

Table 6 List of Components as Purchased From Manufacturer (see Figure 13 and Figure 14 on Page 17 and Figure 16 on Page 18)

Item	Quantity	Description
1	1	Pad-Mounted Cabinet With Interrupter
2	1	Three Phase Fault Interrupter (PMI only)
3	1	Electronic Control With Ground Relay Cutout Switch − See Note 2 on Page 19
4	3	600-Amp Source Bushing (600 A PMI only)
5	3	Current Transformers
6	1	Hook Stick Operated Handle
7	1	Interrupter Open or Closed Indicator (Qty 3 for PMI-4R)
8	1	Interrupter Mechanism
9	3	Grounding Connector
10	4	Ground Nuts
11	3	600-Amp Load Bushing
12	3	200-Amp Source Well (200 A PMI and PMI-4R only)
13	6	Parking Stand, Load-Break
14	3	200-Amp Load Well (200 A PMI only)
15	3	Single Phase Fault Interrupter (PMI-4R only)
16	1	Equipment Nameplate

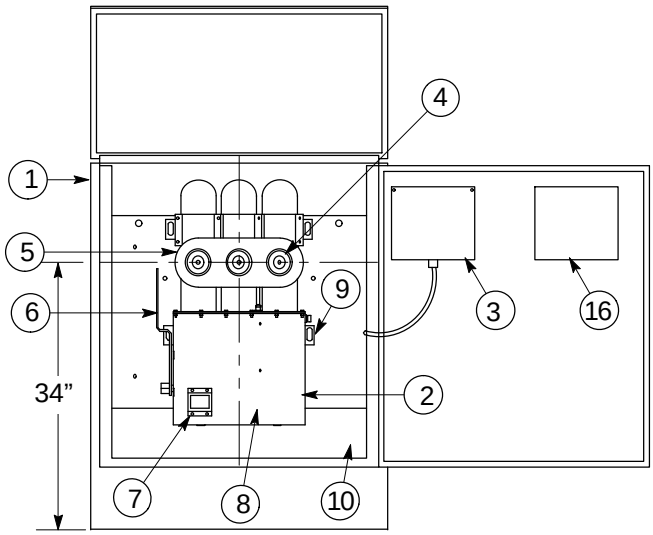
Table 7 Fault Interrupter Rating Table (600 A PMI)

Description	Rating
Nominal Voltage	27 kV
Maximum Design Voltage	29 kV
Basic Insulation Level (BIL)	125 kV
Continuous Current (maximum in amps)	600 A
Load Interrupting and Loop Switching	600 A
Capacitor or Cable Charging Interrupting (20 operations)	25 A
Interrupting Capacity (symmetrical)	12,500 A
Momentary and Fault Making (asymmetrical)	20,000 A

Table 8 Fault Interrupter Rating Table (200 A PMI, PMI-4R)

Description	Rating
Nominal Voltage	27 kV
Maximum Design Voltage	29 kV
Basic Insulation Level (BIL)	125 kV
Continuous Current (maximum in amps)	200 A
Load Interrupting and Loop Switching	200 A
Capacitor or Cable Charging Interrupting (20 operations)	25 A
Interrupting Capacity (symmetrical)	10,000 A
Momentary and Fault Making (asymmetrical)	15,000 A

Components and Ratings (continued)



Front

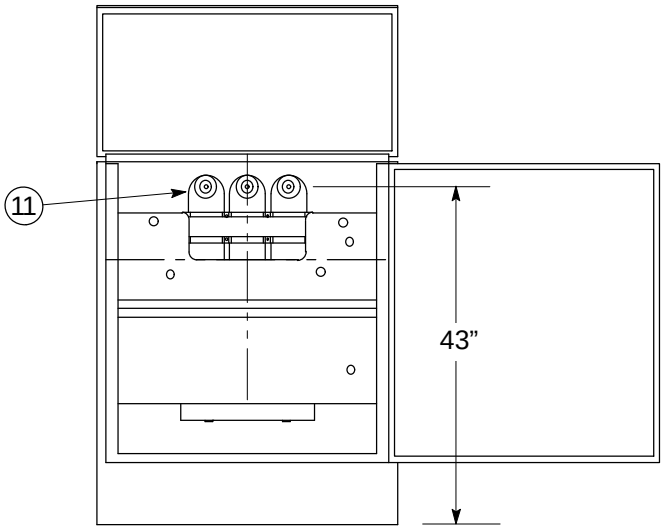


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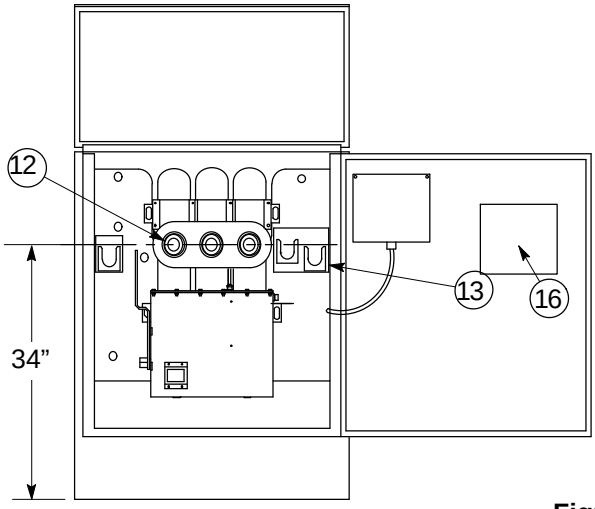
Figure 13
600-Amp Fault Interrupter Enclosures
(see Table 6 on Page 16 for item numbers)



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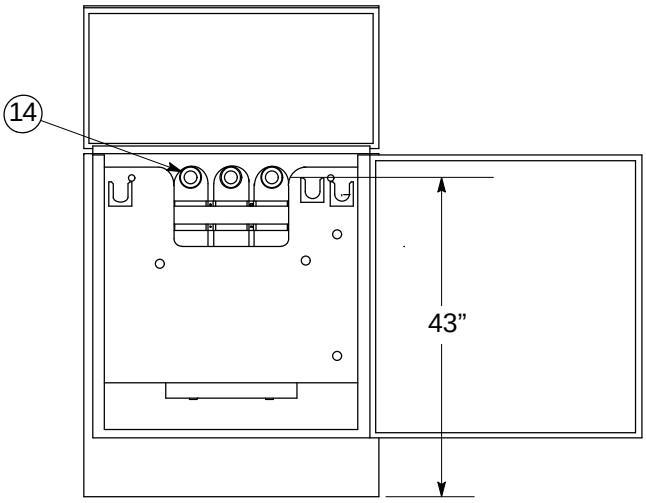


Back

Figure 14
200-Amp Fault Interrupter Enclosures
(see Table 6 on Page 16 for item numbers)

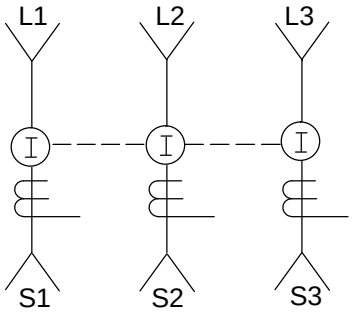
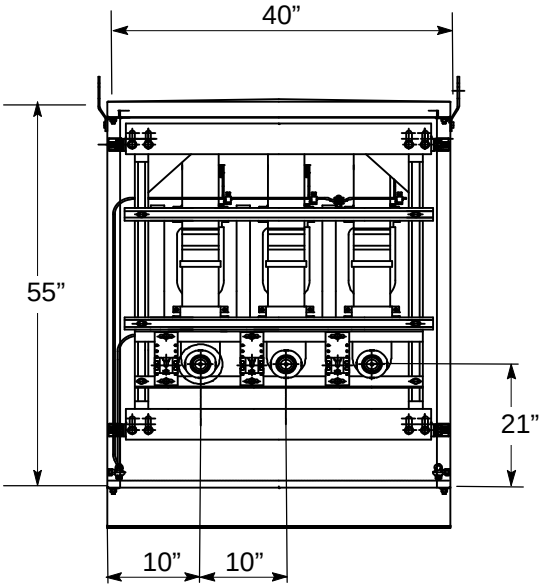
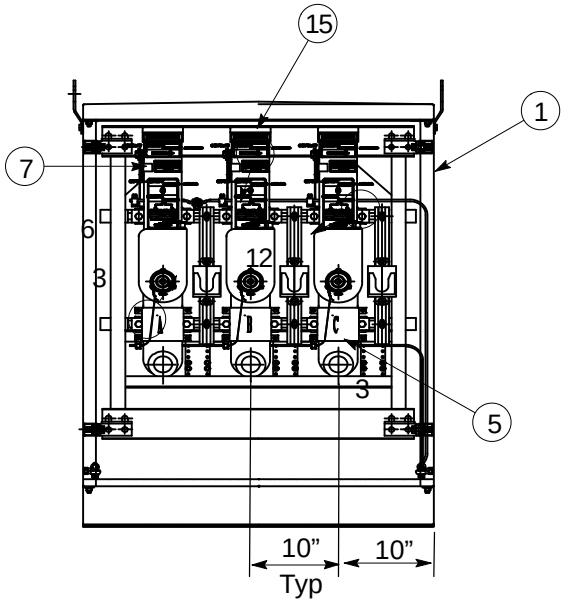


Figure 15
Schematic Diagram
(see Table 5 on Page 16 for item numbers)

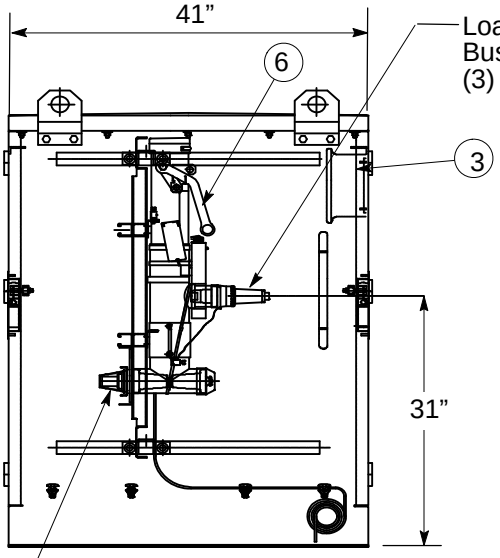
Components and Ratings (continued)



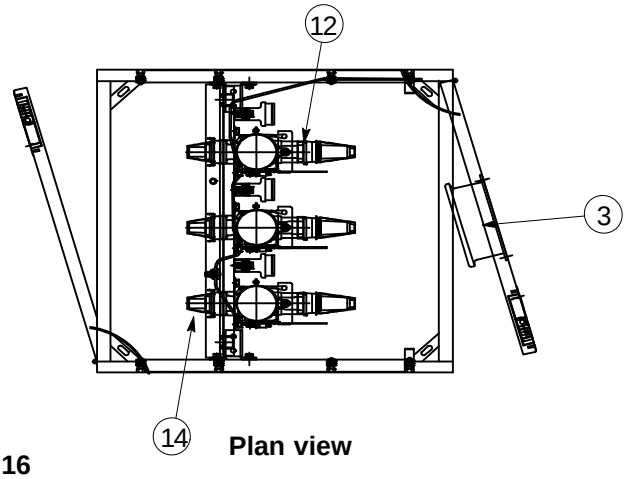
Load Side



Source Side



Side View



Plan view

Figure 16
Schematic Views of PMI-4R

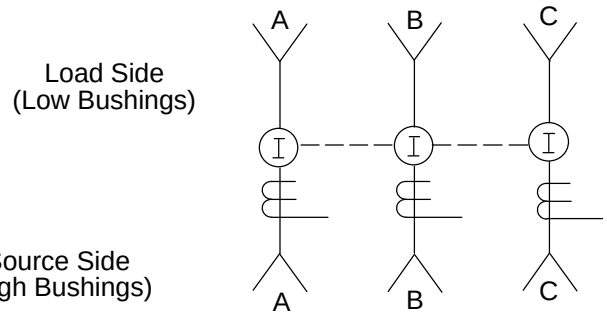


Figure 17
Schematic Diagram for PMI-4R
(see Table 6 on Page 16 for item numbers)

Protective Relays

Notes − Elastimold Model 20 (three phase only)

1. This relay is no longer provided on new Elastimold products. The Model 80 will be provided on new three phase pad-mounted interrupters and can replace existing Model 20 controllers in the field.
2. Inside the control cover is a setting marker board where the control settings can be written using a grease pencil.
3. The control contains dip switches that are settable to provide electronic simulation of numerous fuse and relay curves.
4. The relay curves on this control do not have adjustable levers and do not offer instantaneous capability.
5. The ground fault protection is achieved with a logic that looks at the percentage of imbalance between the phases. This percentage is adjustable in the control.
6. The interrupter will trip if picking up a load one phase at a time without the ground relay cut out via the toggle switch.

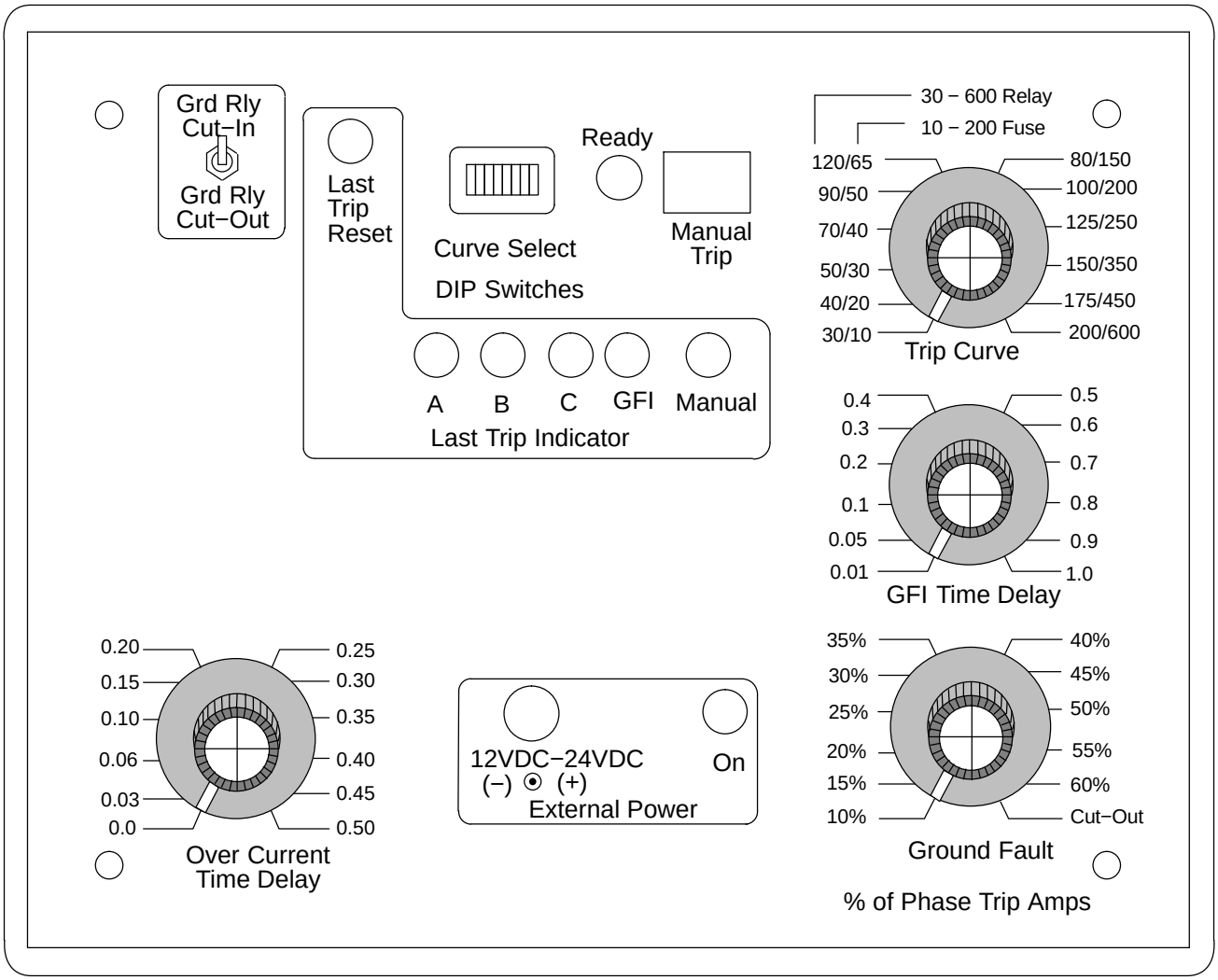


Figure 18
Type 20 Electronic Control Detail for Elastimold Interrupter

Protective Relays (continued)

Notes − G&W Control Type 2

1. Inside the control cover is a setting marker board where the control settings can be written using a grease pencil.
2. The control contains dip switches that are settable to provide electronic simulation of numerous fuse and relay curves.
3. The relay curves on this control do not have adjustable levers.
4. This control offers a phase instantaneous setting.
5. The ground fault protection is achieved with a logic that looks at the percentage of imbalance between the phases. This percentage is adjustable in the control.
6. The ground protection on this control uses the same curve that is chosen for the phase minimum trip setting.
7. The interrupter will trip if picking up a load one phase at a time without the ground relay cut out via the toggle switch.
8. Figure 12 below illustrates an older G&W control. Controls purchased after March 2009 will have CUT IN and CUT OUT instead of ENABLE and BLOCKED.
9. To cut out ground protection, set the toggle switch in the lower right corner to the ENABLE or CUT IN position. To CUT OUT ground protection, set the toggle switch to the BLOCKED or CUT IN position.

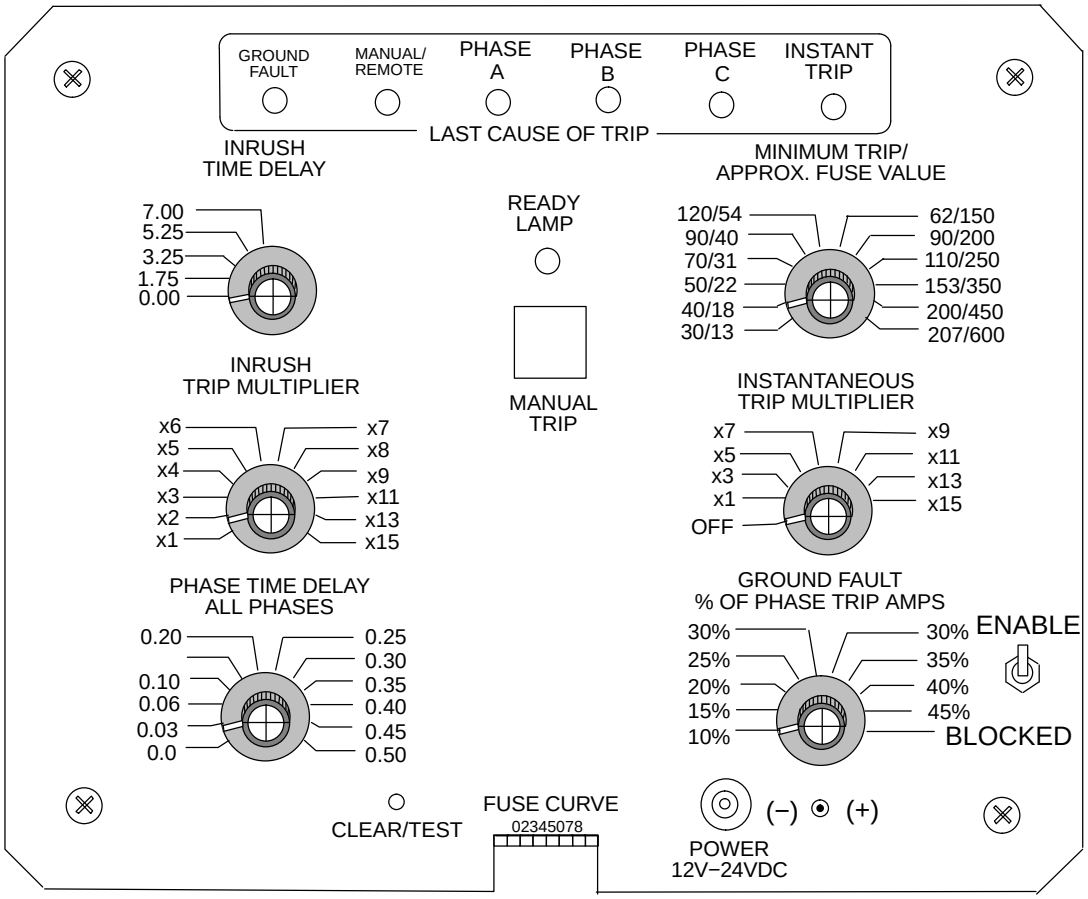


Figure 19
Electronic Control Detail for G&W Interrupter

Protective Relays (continued)

Notes − Elastimold Model 80 (Three Phase Only)

1. .The Model 80 Control is available to replace existing Type 20 controls in the Elastimold three phase interrupters. It is not used on the PMI-4R. The Model 80 is used also on other pieces of Elastimold pad-mounted equipment.
2. The Model 80 monitors the individual phase currents of the Elastimold three phase system using 1000:1 current sensors. the control is powered by a +12 VDC to +24 VDC external power source
3. The READY indicator will blink approximately every 2.5 seconds when the control has enough power to operate (approximately 15 amps). **Note:** Even if there is not enough line current to power the control and the READY indicator to blink, the circuit is still protected (see Note 5 on Page 1, General Information and Application).
4. The MANUAL TRIP push button can be used to **trip all three phases simultaneously** when the control is fully powered. **Caution:** The READY indicator must be blinking before pushing the MANUAL TRIP button.
5. THE LAST TRIP INDICATORS will shoe the phase(s) that experienced an overcurrent condition. The LED marked GFI shows that the cause of the trip was a ground fault.
6. The LAST TRIP RESET clears all LED trip indicators.
7. The dial can be set to 3 different settings:
   A. When the dial is set to 3 ∅ TRIPPING-RELAY CUT IN, all three phases will trip simultaneously if there is fault on any phase and also if there is a ground fault. The ground fault function will only work if it has been programmed in with the use of the E-SET software.
   B. When the dial is set to 3 ∅ TRIPPING-RELAY CUT OUT, all three phases will trip if there is a fault on any phase, but will not trip if there is a ground fault.
   C. When the dial is set to RELAY CUT OUT/SWITCH MODE, all protection functions are disabled and the unit functions as a manual switch. The unit will not trip for any faults.
   D. When (+12vdc to +24vdc) external power is applied, the Ready LED is illuminated. The external power can be connected through the input jack using the handheld battery supply (M241617). The control may also be powered using the programming cable and a USB equipped laptop. When external power is connected the Ready LED will either be on or blinking (if the last trip was a remote trip) and the appropriate trip indicators will show if an overcurrent fault trip was the last cause of a trip.
8. In order to load settings into the control, a computer with the approved E-SET software must be connected to PROGRAMMING PORT using the MVI−STP or MVI−STP−USB programming cable (M343329 with M343330). The approved E-SET installation program is available on the PG&E IT Store.

Protective Relays (continued)

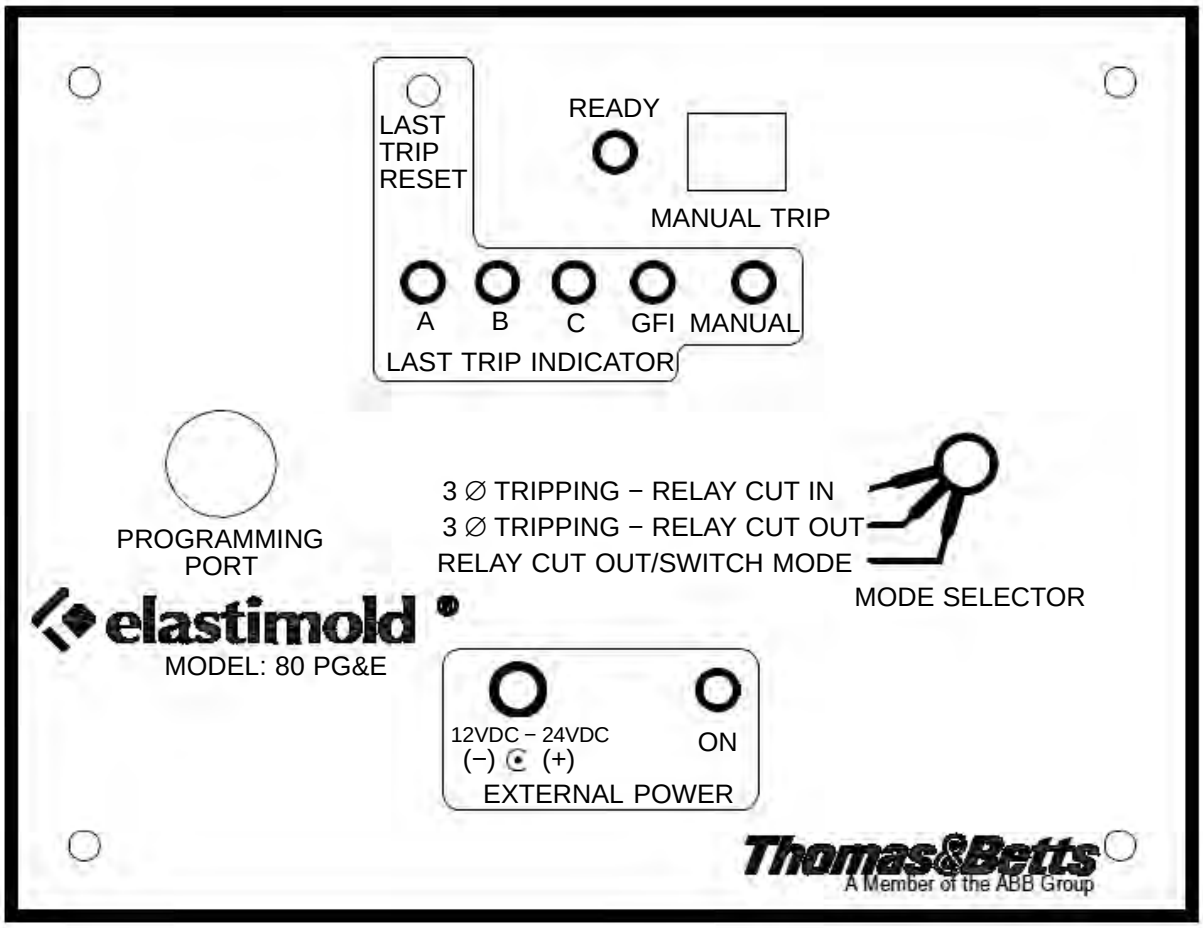


Figure 20
Type 80 Electronic Control Detail For T&B Interrupter (M590742)

Protective Relays (continued)

Notes − Elastimold Model 380 (Three Phase or Single Phase)

1. The Model 380 Control is only used on the PMI-4R in this document. The Model 380 is also used on other pad-mounted equipment.
2. The Model 380 monitors the individual phase currents of the Elastimold three phase system using 1000:1 current sensors. the control is powered by a +12 VDC to +24 VDC external power source.
3. The READY indicator will blink approximately every 2.5 seconds when the control has enough power to operate (approximately 15 amps). **Note:** Even if there is not enough line current to power the control and the READY indicator to blink, the circuit is still protected (see Note 6 on Page 1, General Information and Application).
4. The MANUAL TRIP push button can be used to **trip all three phases simultaneously** when the control is fully powered. **Caution:** The READY indicator must be blinking before pushing the MANUAL TRIP button.
5. THE LAST TRIP INDICATORS will show the phase(s) that experienced an overcurrent condition. The LED marked GFI shows that the cause of the trip was a ground fault.
6. The LAST TRIP RESET clears all LED trip indicators.
7. The dial can be set to 3 different settings:
   A. When the Dial is set to 3∅ TRIPPING/RELAY CUT IN, all three phases will trip simultaneously if there is a fault on any phase and also if there is a ground fault. It should be noted that the ground fault function would only work if it has been programmed in with the use of E-set Software. If the E-set program is set to Block then the ground fault will not trip the unit.
   B. When the Dial is set to 3∅ TRIPPING/GRD RLY CUT OUT, all three phases will trip simultaneously if there is a fault on any phase, but will not trip if there is a ground fault. This is true even if the E-set Software is set for a ground fault.
   C. When the Dial is set to RELAY CUT-OUT / SWITCH MODE the interrupters will not trip in the event an overcurrent on any phase. It should be noted that the E-Set selection of the RELAY CUT-OUT / SWITCH MODE takes precedence over the rotary switch selection on the front panel of the control.
   D. When the Dial is set to 1∅ TRIPPING/RELAY CUT IN, only the Phase that has the fault will trip. The interrupter will not trip on a ground fault.
8. When (+12 vdc to +24 vdc) external power is applied, the Ready LED is illuminated. The external power can be connected through the input jack using the handheld battery supply (M241617). The control may also be powered using the programming cable and a USB equipped laptop. When external power is connected and Ready LED will either be on or blinking (if the last trip was a remote trip) and the appropriate trip indicators will show if an overcurrent fault trip was the last cause of a trip.
9. In order to load settings into the control, a computer with the approved E-SET software must be connected to PROGRAMMING PORT using the MVI-STP or MV-STP-USB programming cable (M343329 with M343330). The approved E-SET installation program is available on the PG&E IT Store.

Protective Relays (continued))

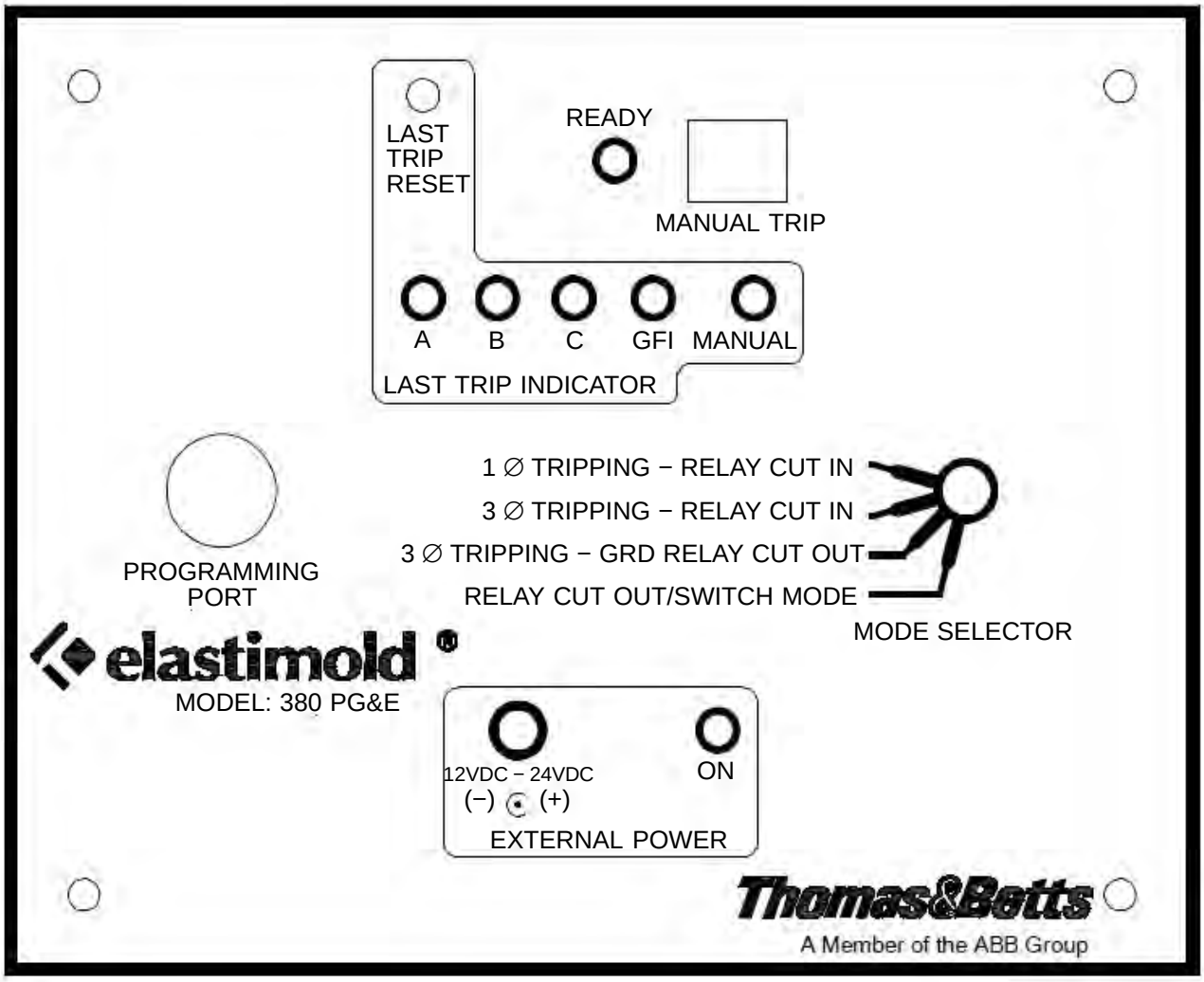


Figure 21
Type 380 Electronic Control Detail For T&B Interrupter (M590741)

Revision Notes

Revision 09 has the following changes:

1. Indicate 409 stainless material is no longer available for purchase.
2. Add ”in−out” descriptor to PMI’s in this document to distinguish from ”multi−way” PMI’s in Doc 076270.
3. Clarify allowable usage of single phase operating PMI’s protecting three phase loads in cases of material shortages in Note 5D on Page 1.
4. Add Note 17 on Page 3 to indicate that when using Elastimold interrupters that ground protection may not be enabled when protected two−wire single phase loads.
5. Harmonize grounding requirements for PMI’s with Doc 076270 by clarifying grounding in Note 19 on Page 3.
6. Add Table 3 on Page 6 to clarify what overcurrent relay comes with each PMI type.