
	INSTALLATION OF AUTOMATIC SUBSURFACE INTERRUPTERS FOR PRIMARY EQUIPMENT ENCLOSURES		066208
	Asset Type: Electric Distribution		Function: Design and Construction
Issued by: Ryan Kowdley (RSKG)		Date: 03-25-22	
Rev. #13: This document replaces PG&E Document 066208, Rev. #12. For a description of the changes, see Page 25.			

Purpose and Scope

This document provides ordering information and installation details for subsurface fault interrupters in 4' x 6' 6" x 5' and 4' 6" x 8' 6" x 6' primary equipment enclosures.

General Information and Application

1. The subsurface 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 Standard C37.60 and C37.74, and the Enclosure Integrity Standard C57.12.32.
2. 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. The interrupters can be used anywhere in the system for 4.16 kV, 12 kV, 17.2 kV, and 20.78 kV three and four wire circuits.
 - A. Trayer interrupters may be used on two-wire single phase circuits by connecting the cables to phases connected to the PT see wiring diagrams for connection.
 - B. Elastimold interrupters may be used on two or one-wire single phase circuits. See protection section for more information.
 - C. When protecting one-wire single phase loads, use single phase operating interrupters whenever possible. Currently single phase interrupters are only available on some pad-mounted equipment.
3. 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 single customer 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](#).
4. For proper operation of the Trayer subsurface interrupter, the source cables must be connected to the "L" bushings and the load cables must be connected to the "R" bushings.
5. The Trayer 600A and 200A interrupters are unidirectional devices. The source side device must be connected to the line side bushings, as this will keep the potential transformer energized when the interrupter is open. If the source side device is connected to the load side bushings, as may occur if the equipment is built incorrectly or if the circuit is in an abnormal configuration, then the protective relay will require a wakeup time before being able to operate. This will affect the devices ability to coordinate and can cause reliability issues.
6. The Elastimold 200A interrupter is bidirectional and is not affected in these situations. See Note 4 on Page 18 for directionality of Trayer switch-interrupter-switch.

Safety

All the safety procedures regarding underground equipment enclosures and aboveground observers shall be followed in the course of operating these interrupters.

Operation

The interrupter and enclosure are designed to be surface operable by one employee.

Protection

In addition to coordination with adjacent protective devices, the following requirements must be met in the application of fault interrupters.

1. The interrupting rating of the interrupter must be equal to or greater than the maximum symmetrical fault current at the point of installation. See Table 1 on Page 4 for interrupter ratings.
2. 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.
3. The continuous current rating of the interrupter should be adequate to carry the normal and emergency load currents with reasonable allowance for growth.
4. When protecting two-wire single phase loads using the interrupter, ground protection may not be enabled when using the Elastimold interrupters as these devices will detect an imbalance due to the unused phase. As long as the protected two-wire tap contains only line to line connected loads, ground protection may be enabled when using the Trayer interrupters as the SEL relays compensate for this imbalance.

See [Document 038718A](#) and [Document 058712](#) for additional information.

Controls

1. 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
2. The manner in which the interrupters are controlled differs between the two manufacturers.
 - A. Trayer
 - (1) The internal relay is a Schweitzer SEL-551 (or 551C) microprocessor-based relay which contains surge protection, event recording, and harmonic filtering. The harmonic filtering will prevent nuisance tripping due to harmonics. Relay settings templates for these relays have been posted to the Distribution Planning Sharepoint.
 - (2) A fiber optic communication cable link is installed on the 600A interrupter and switch-interrupter-switch such that the settings and event information can be safely and easily obtained just outside the equipment enclosure with a laptop computer. The small remote box at the end of the 20-foot fiber optic cable contains a fiberoptic-to-RS232 converter. The 200A interrupter can only be programmed by removing the cover.
 - (3) An internal line-to-line potential transformer (PT) is installed along with an internal switch for 4.16 kV, 12 kV, 17.2 kV, or 20.78 kV operation. **Important:** This switch is on the face of the relay and **must** be put in the proper position to match the system voltage before energizing.
 - (4) The internal step-up transformer always provides 120 V control voltage for relay operation. SCADA is not available on this equipment at this time.
 - (5) The following are instructions for sealing the cover. New Trayer interrupters will have a faceplate outlining this process. "Cover Installation Procedure: Ensure that all sealing surfaces are clean and free from debris. Working in a clockwise direction, tighten all nuts until lock washers are compressed. Once lock washers are compressed, tighten all nuts an additional half turn each."
 - (6) The Trayer 200A interrupter and switch-interrupter-switch have a mode selector switch that can cutout the ground in 1 step or both the phase and ground in the second step, turning an interrupter into a switch. The switch is labeled Relay Cut-in/Ground Relay Cutout/Relay Cutout. The Trayer 600A interrupter has a ground relay cutout switch, but does not have a relay cutout setting. For the location of these switches see Figure 2 on Page 5, Figure 11 on Page 14, and Figure 14 on Page 19 for the Trayer 200A, Trayer 600A, and Trayer Switch-Interrupter-Switch respectively.
 - (7) Trayer interrupters with pressure plugs on the control housing must be pressurized with 5 psig of dry nitrogen when being sealed after opening in order to maintain a dry environment.

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

Controls (Continued)

B. Elastimold

- (1) The internal control is accessible via a computer connection with the ESETII software. The software is available for download from IT Store. ESETII is a version of software used to program the Elastimold molded vacuum interrupters. It has features such as custom protection coordination curves (TCCs), phase and ground protection for three-phase units, and the ability to read current per phase real-time. It also allows for separate ground curves and password protected programmed control.
- (2) To program the control, a computer connection must be made. Connect the MVI-STP-USB (M343329) to the 20' controllable extension (M343330) and attach the USB connector to the USB port on the computer. The controllable extension is completely submersible and included with the interrupter.
- (3) The control is inside the mechanism and accessed via a programming port in the housing. The control is not user serviceable.
- (4) 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 15A of load current is required to power the control. When the load current is between 0 and 15A and a fault occurs, the control will power up in 1/2 a cycle. These devices are 3 cycle devices, so the control power-up, if needed, adds 1/2 cycle to the process.
- (5) This unit does not allow for SCADA control.
- (6) The Elastimold interrupter has a mode switch that will cut out the control making an interrupter into a switch. There is also a cut-in/cutout switch for the ground-fault relay. See Figure 8 on Page 9.

References	Location	Document
Corrosion Resistant Ground Rods and Ground Rod Clamps	UG-1: Connectors/Greenbook	013109
Connectors for Insulated Cables Underground Distribution Systems	UG-1: Connectors/Greenbook	015251
Guide for Calculating Short Circuit Currents on Distribution Lines	EPM-Protection	027844
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
600-Amp Separable Insulated Connectors	UG-1: Terminations	051071
Identification Plates for Subsurface Enclosures	UG-1: Marking	051768
Thermal Limits of Primary Distribution Lines Under Fault Conditions	TIL	058712
Conductors for Overhead Lines	OH: Conductors	059626
Grounding of Underground Equipment	UG-1: General	060462
Fault Indicators for Underground Application	UG-1: General	061683
Primary Electric Underground Equipment Enclosures	UG-1: Enclosures/Greenbook	062000
Underground Conduits	UG-1: Conduits/Greenbook	062288
Electric Distribution Maintenance Requirements for Miscellaneous Overhead and Underground Equipment	TIL	TD-2302P-05
Electric Distribution Line Control Device Pre-Commissioning Tests	TIL	TD-2916P-01
Electric Distribution Line Control Devices (LCD)	TIL	TD-2916S

UG-1: Switches

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

Table 1 outlines the interrupter ratings and material codes for all of the interrupters discussed in this document.

Table 1 Fault Interrupter Ratings and Codes Table

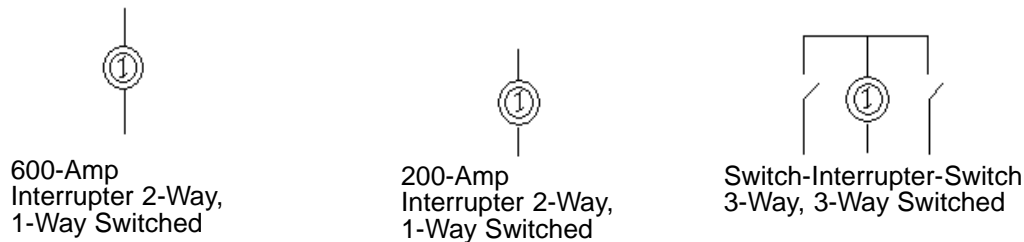
Material Code	343325	343198	342620	343327	343352
Manufacturer	Trayer	Elastimold ²	Trayer	Trayer	Trayer
Continuous Current Maximum (AMPS)	200	200	600	Switches ¹ -600 Interrupter ¹ -200	Switches-600 Interrupter-600
Configuration	Interrupter	Interrupter	Interrupter	Switch-Interrupter-Switch	Switch-Interrupter-Switch
Nominal Voltage (kV)	25	25	25	25	25
Maximum Design Voltage (kV)	27	27	27	27	27
Basic Insulation Level (BIL) (kV)	125	125	125	125	125
Interrupting Capacity (AMPS SYM)	10,000	12,500 ³	12,000	10,000	12,500
Momentary (AMPS ASYM)	15,000	20,000 ³	20,000	15,000 (200A Interrupter) 20,000 (600A Switches)	20,000
Cable Charging Current Interrupting Rating (A) (20 ops.)	25	25	25	25	25

¹ The continuous current rating of the two switches is 600A while the rating of the interrupter is 200A.

² Solid dielectric and preferred installation.

³ Symmetrical interrupting and asymmetrical momentary capacities are limited to 10,000 A and 15,000 A respectively by the use of 200A terminations

Figure 1 shows the single line diagrams of the interrupters discussed in this document.



**Figure 1
Single Line Diagrams**

Table 2 Communication Repair Parts

Description	Code	Used On
Fiber-Optic Repair Kit – includes protective cover, sealing gasket, cord grip, fiber optic serial transceiver, transceiver box with handle, and fiber optic cable.	M343540	M342620, M343327, M343352
Fiber-Optic Serial Transceiver Kit – includes two transceivers and 25' cable.	M343541	M342620, M343327, M343352

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

200A Interrupters

Notes

1. The 200A interrupter must be installed in a 4' x 6' 6" x 5' enclosure for new construction. The 200A interrupter may be installed in a pre-existing #5 enclosure when replacing a subsurface fused switch and when the enclosure has a minimum depth at 42".
2. The Trayer 200A interrupter has an adjustable operating handle that can be collapsed or fully extended.
3. The Trayer 200A interrupter's CT ratio is 200:5. The Elastimold 200A interrupter's CT ratio is 1000:1.
4. The Trayer 200A interrupter is unidirectional and the source and load must be oriented properly. The Elastimold 200A interrupter is bidirectional (meaning the source and load can be connected to either set of bushings). See Note 5 on Page 1 for more on directionality of devices.
5. The Elastimold 200A interrupter mounting frame is adjustable from 17.16" to 29.16" in 4" increments.
6. Included with the Elastimold 200A Interrupter is a 20' programming extension cable (M343330). This is used, along with the MVI-STP-USB programming cable (M343329), to program the device.

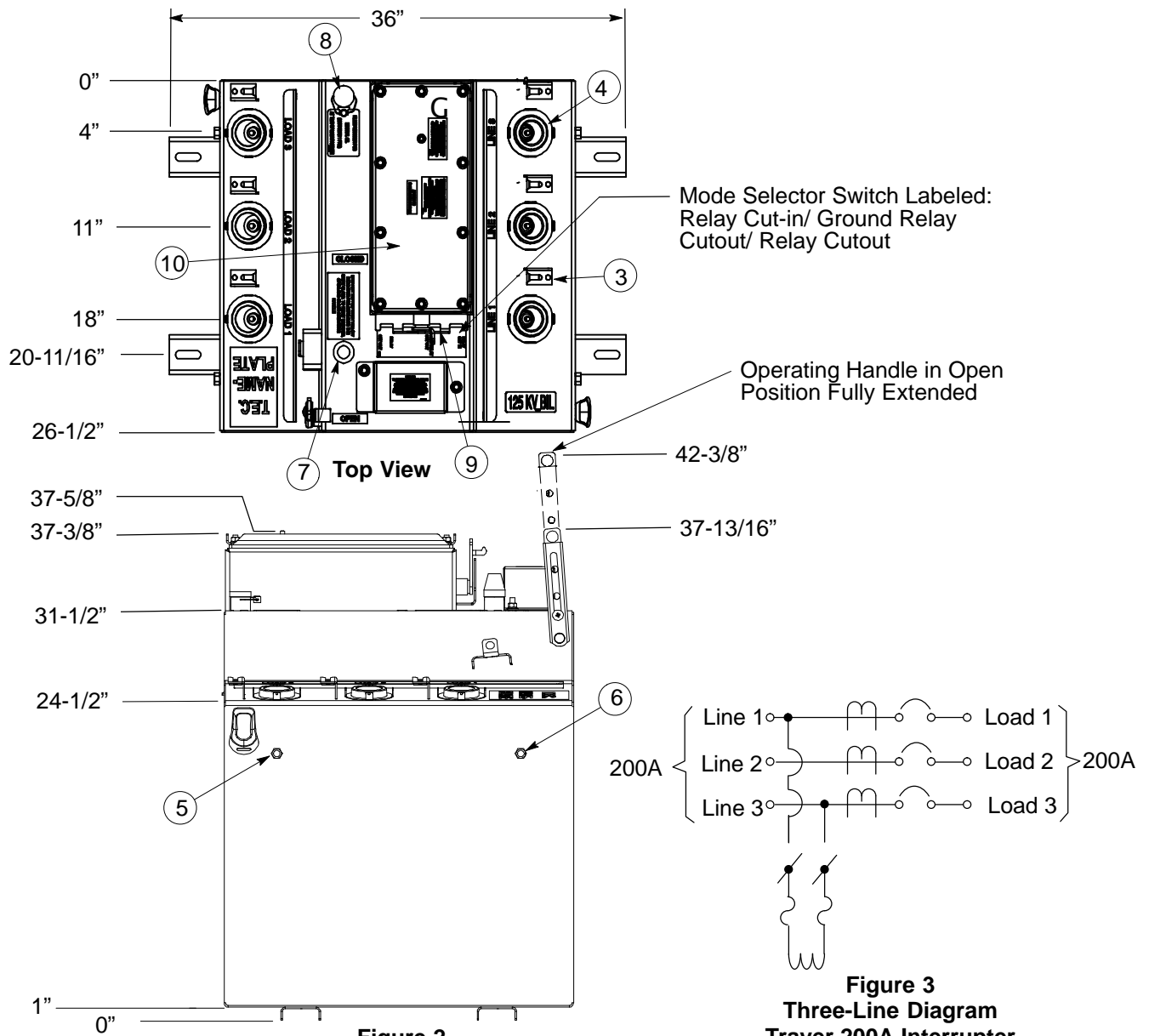


Figure 2
Trayer 200A Interrupter Material Drawing
 (see Table 3 on Page 6 for Bill of Materials)

Figure 3
Three-Line Diagram
Trayer 200A Interrupter

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

200A Interrupters (continued)

Table 3 shows the bill of materials for the Trayer 200A interrupter. This material will be supplied by the manufacturer with purchase of the interrupter.

Table 3 Manufacturer-Supplied List of Components for Trayer 200A Interrupter

Item	Quantity	Description
1	1	Fault Interrupter, Three-Phase, Submersible
2	2	3 A Fuses Internally Mounted with a Two-Pole Disconnect Switch
3	6	Parking Stand, Non Load-Break
4	6	200A Bushing Wells
5	2	Lifting Lug
6	4	Grounding Nut
7	1	Interrupter Trip Indicator
8	1	Liquid-Level Gauge
9	1	Ground Relay Cutout Switch and Relay Cutout
10	1	Waterproof Box Which Contains Schweitzer SEL-551C Relay and Voltage Switch



Figure 4
Trayer 200A Interrupter Top View Picture
 (see Table 4 on Page 8 for List of Materials)

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

200A Interrupters (continued)

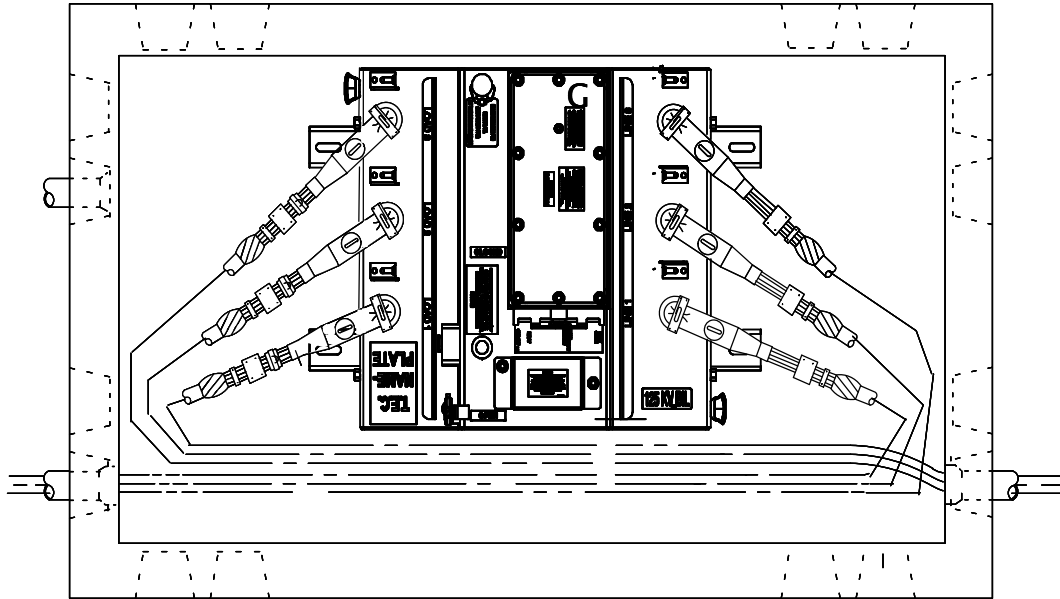


Figure 5
Trayer 200A Interrupter Top View Installation Drawing
(see Table 4 on Page 8 for List of Materials)

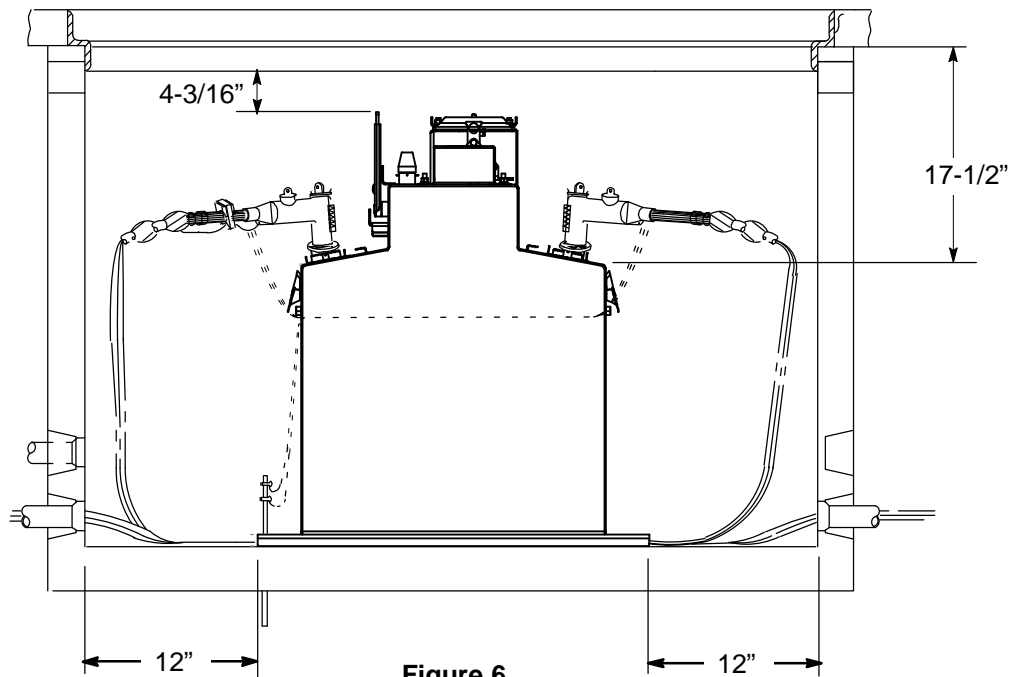


Figure 6
Trayer 200A Interrupter Side View Drawing Installation
(see Table 4 on Page 8 for List of Materials)

200A Interrupters (continued)

Table 4 shows the list of materials for the Trayer and Elastimold 200A interrupters. This material is necessary for the installation of these interrupters.

Table 4 List of Material Needed for Installation of Trayer and Elastimold 200A Interrupters

Item	Description	Reference	Document	Code
1	Fault Interrupter, Three-Phase	UG-1: Switches	062288	Trayer-343325 Elastimold-343198
2	Enclosure 4' x 6' 6" x 5' deep	UG-1: Enclosures	062000	-
3	Load-Break Bushing Inserts (as required)	UG-1: Terminations	035314	300481
4	Separable Insulated Connector, Load-Break Elbow Receptacle, 200A (as required)	UG-1: Terminations	035314	-
5	Cable Insulated for Underground Distribution (rating and type as required)	UG-1:Cable	039955	-
6	Wire, Ground, Bare Copper, #2 AWG Solid, Approx 20'	OH: Conductors	059626	290074
7	Conduit and Bell Ends (as required)	UG-1: Conduits	062288	-
8	Ground Rod, 3/4" x 12' 0"	UG-1: Connectors/ Greenbook	013109	10098
9	Clamp, Ground Rod, 3/4"	UG-1: Connectors/ Greenbook	013109	187017
10	Connector, Tap, Compression for #2 Cu to #2 Cu	UG-1: Connectors	015251	305244
11	Ground Lug	UG-1: Connectors	015251	301546
12	Fault Indicator (as required) ¹	UG-1: General	061683	-
13	Phase Designation Tag	UG-1: Marking	033582	-
14	Sectionalizing Tag	UG-1: Marking	033582	31809
15	Bolt, Anchor, Wedge, Steel, Stainless, 1/2" x 3-3/4"	-	-	190445
16	Switch Number Tag (Switch and Enclosure)	UG-1: Marking	051768	-

¹ Fault indicators are to be used when specified by the distribution planning engineer.

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

200A Interrupters (continued)

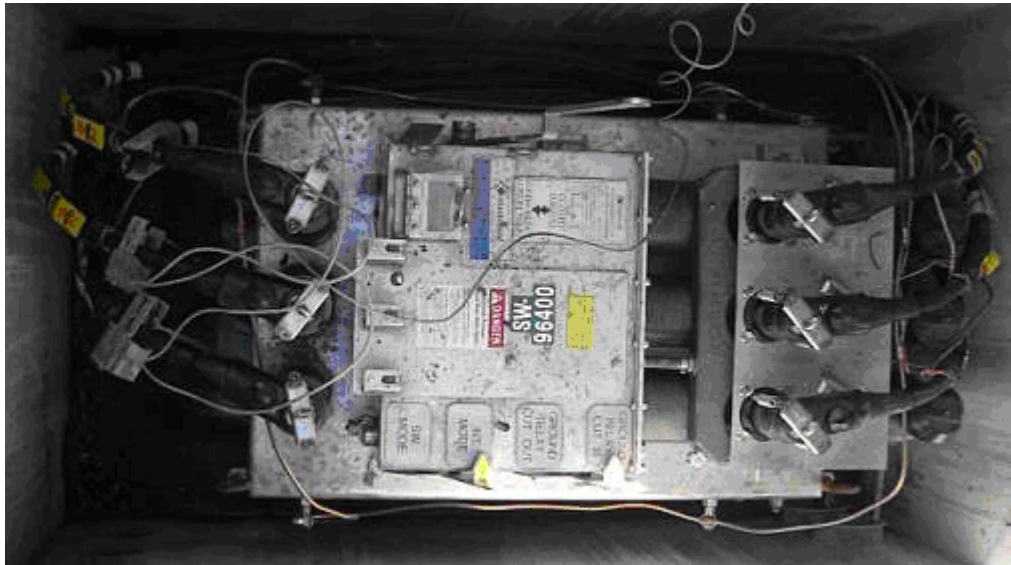


Figure 7
 Elastimold 200A Interrupter Top View Picture
 (see Table 5 on Page 11 and Table 4 on Page 8 for Bill and List of Material)

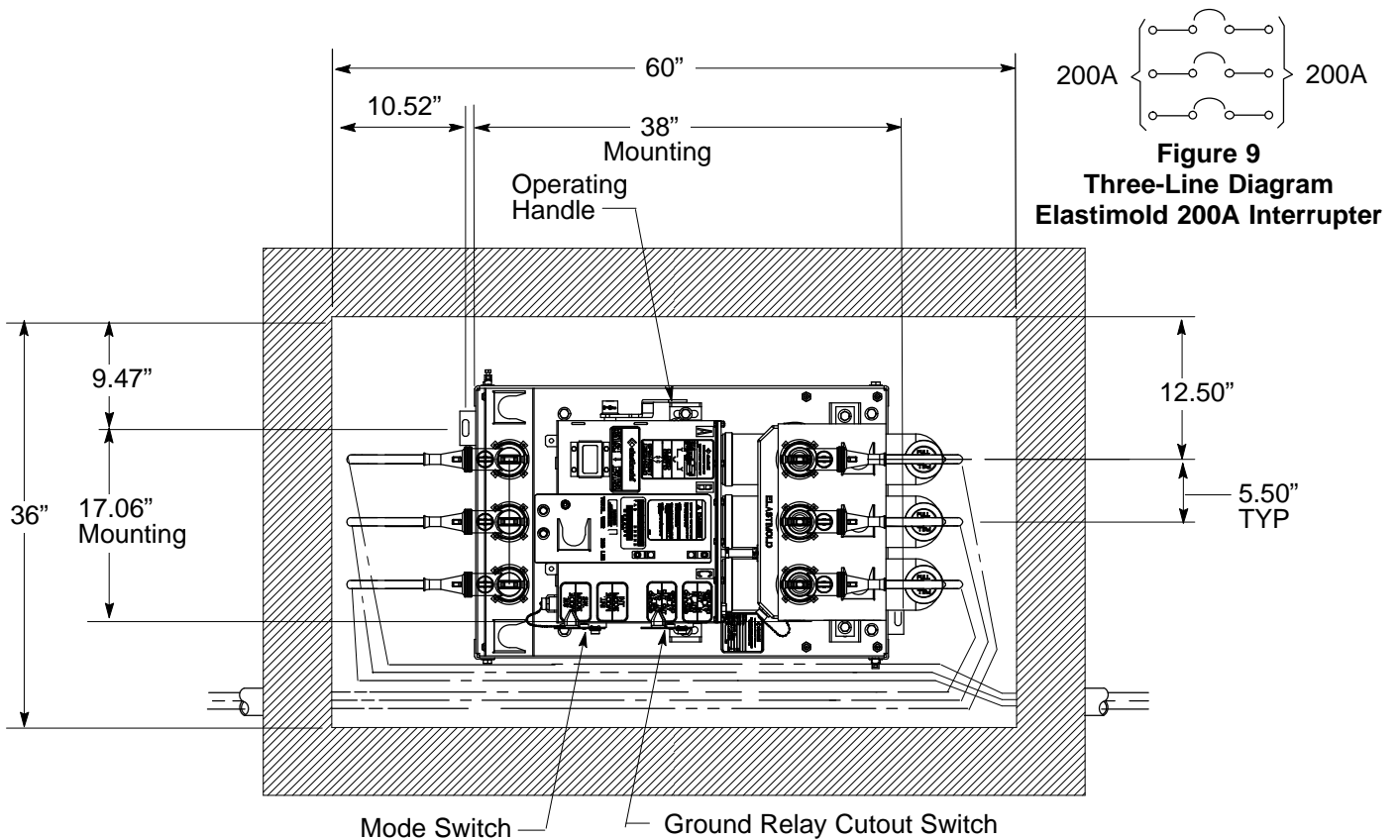


Figure 8
 Elastimold 200A Interrupter Top View Installation Drawing
 (see Table 5 on Page 11 and Table 4 on Page 8 for Bill and List of Material)

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

200A Interrupters (continued)

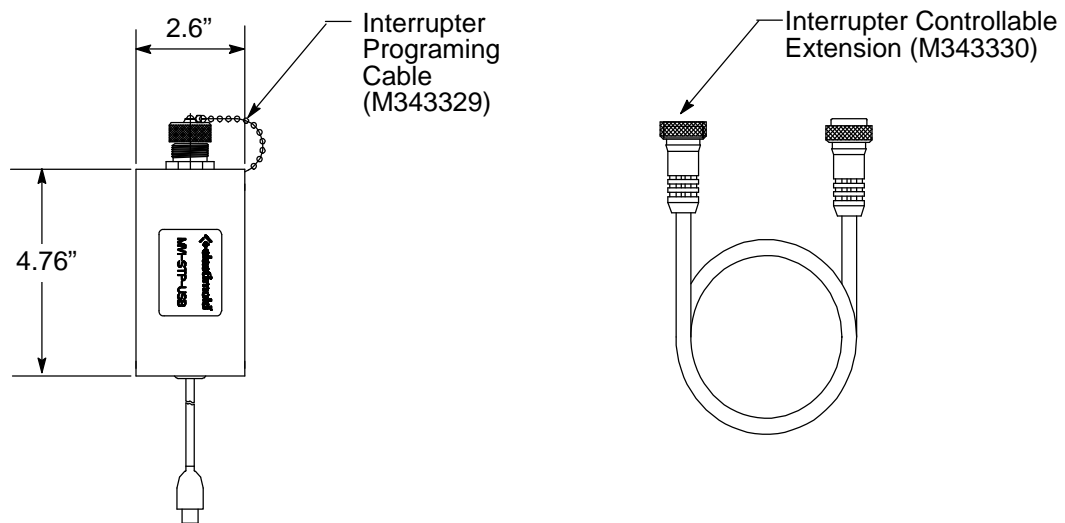
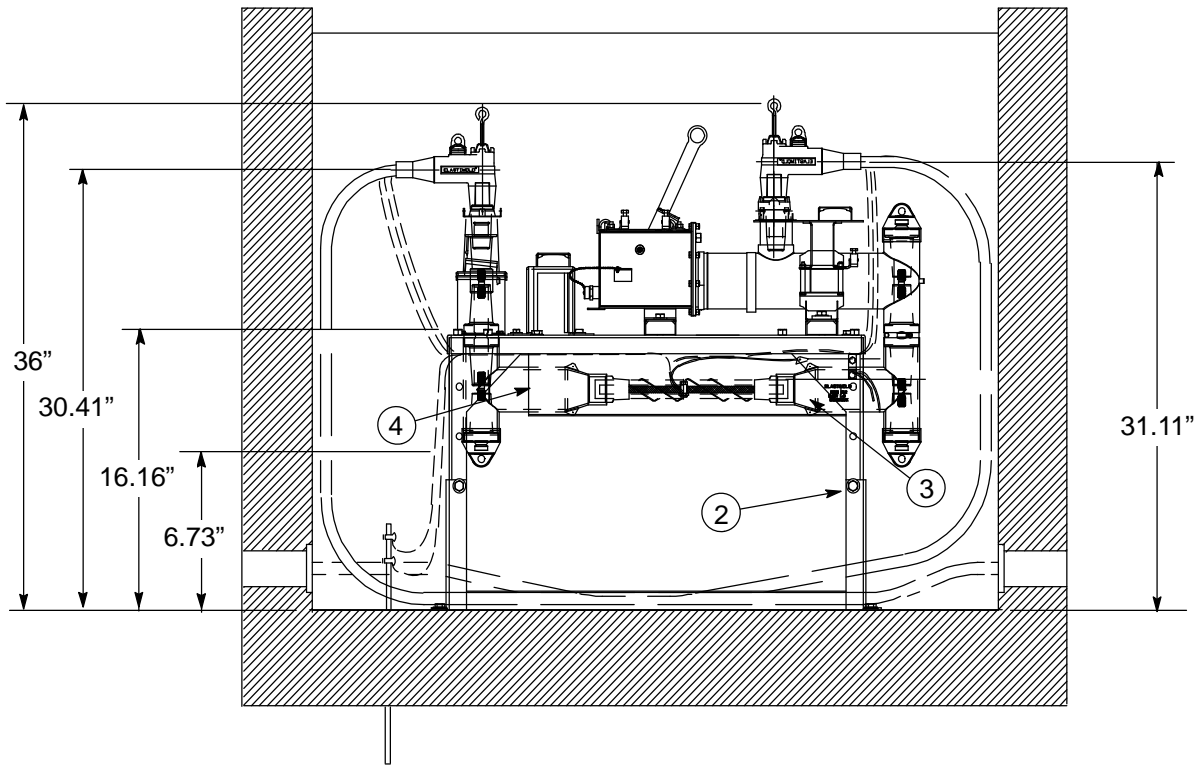


Figure 10
Elastimold 200A Interrupter Side View Installation Drawing and Communication Cables
(see Table 5 on Page 11 and Table 4 on Page 8 for Bill and List of Material)

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

200A Interrupters

Table 5 shows the bill of materials for the Elastimold 200A interrupter. This material will be supplied by the manufacturer with purchase of the interrupter. See Table 4 on Page 8 for a list of the material necessary for the installation of this interrupter.

Table 5 Manufacturer-Supplied List of Components for Elastimold 200A Interrupter

Item	Quantity	Description
1	1	Solid Dielectric Vacuum Interrupter
2	1	Adjustable Stainless Steel Interrupter Stand for Floor Mounting
3	3	Jumper Bus Assembly with Support Bracket and Cover
4	6	200Ampere Bushing Wells
5	1	Ground-Fault Cut-In/Cutout Switch
6	1	Vacuum Interrupter/Switch MODE Switch
7	1	Internal Electronic Control Relay
8	1	Programming Port
9	1	20' Programming Extension Cable
10	3	CT's for Fault Sensing
11	1	Hook Stick Operated Handle
12	1	Switch Open or Closed Indicator
13	1	Spring-Assisted Switch Mechanism
14	4	Ground Connections
15	4	Provisions for Threaded Lifting Eyes
16	6	Parking Stands for Dead-Break Elbows

200A Interrupters (continued)

Installation Notes (continued)

Step 1 Work by Substructure Crew

- A. Provide a 6' x 7' excavation for a 4' x 6' 6" x 5' deep enclosure (Follow guidelines set in [Document 062000](#).)
- B. Prepare the excavation with 6" of drain rock per [Document 062000](#), Note 5D on Page 1.
- C. Assist (as required) the enclosure manufacturer in the "in hole" delivery of the enclosure
- D. Install the primary conduit exactly as illustrated on Page 7 and 9 for Trayer and Elastimold respectively.
Note: If installation of conduit is not possible as shown, contact the electric foreman for instructions.
- E. Feed conductors into the enclosure through the end wall conduits. Leave 20 feet of cable in the enclosure and cap and seal the cable ends.
- F. Install a 3/4" x 12' ground rod, leaving the top of the ground rod approximately 18 inches above the floor of the enclosure.
- G. Grout in conduits, backfill and tamp around the enclosure.

Step 2 Work by Electric Crew

- A. Before installation, pre-commission the interrupter as required by Note 1 on Page 2.
- B. Install a ring bus around the interrupter.
- C. Install the interrupter in the enclosure.
Center the primary bushings in the enclosure as shown on Page 7 and 9 respectively to provide equal distance for cable training on both ends. Bolt the interrupter rails (Trayer) or base (Elastimold) to the floor. Connect the ring bus to ground with #2 bare copper, solid wire.
- D. Train the primary cables into their final position and cut them to the proper length (so cables do not block the viewing ports or manual operating handles). For the Trayer interrupter, check that source cables are connected to line bushings and load cables are connected to load bushings.
- E. For 200A premolded separable terminations, install 200A separable connections on the cable ([Document 035314](#)).
- F. Connect the cable neutral wires and interrupter ground wires to the #2 bare copper ring bus.
- G. Install phase designation tags, cable identification tags, and interrupter number plate.

Step 3 Checklist

- A. Verify that the interrupter can be operated with a switching stick including the manual handle, mode switch, and ground relay cutout switch (Elastimold only).
- B. Verify that the interrupter is in interrupter mode.
- C. Verify that the ground relay cutout switch is left in the "cut-in" position.
- D. For the Elastimold interrupter, verify that the 20' programming extension cable (M343330) is accessible and removable with a switching stick. The Trayer 200A interrupter does not have a communication cable.
- E. Ensure that the cables do not block viewing ports or manual operating handles.
- F. Check separable connectors for cleanliness and secure them in place
- G. On the Trayer interrupter, check the oil level. For sight glass type oil-level indicators, a black color indicates satisfactory oil level and red indicates low oil level.
- H. Ensure that all cable tags are properly installed and visible from the surface.
 - I. Open and close the interrupter with the manual lever located on the interrupter to verify proper operation of the interrupter.
- J. Check the interrupter for the proper switch position.
- K. Check to see that the interrupter switch number on top of the enclosure is in place.
- L. After the primary cables are energized, test each test point with an approved voltage detector to verify proper operation.
- M. Close and secure enclosure covers.

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

600A Interrupter

Notes

1. The interrupter's relay CT ratio is 600:5.
2. The fault interrupter is supplied with 600A apparatus bushings for connection to the primary cables. To connect cable sizes 600 and 1,100 kcmil, use 600A separable insulated connectors with load-break test elbows.
3. Cable size 1/0 AWG shall be connected to the interrupter with 200A separable elbow connectors, bushing extensions, and 600/200A reducing tap plugs.
4. The Trayer 600A interrupter is a unidirectional device, and the source and load bushings must be oriented properly. See Note 5 on Page 1 for more information on directionality of devices.

Table 6 shows the bill of materials for the Trayer 600A interrupter. This material will be supplied by the manufacturer with purchase of the interrupter.

Table 6 Manufacturer-Supplied List of Components for Trayer 600A Interrupter

Item	Quantity	Description
1	1	Trayer (SCADA) Motopak (optional) ¹
2	1	3-Amp Fuses Internally Mounted with a Two-Pole Disconnect Switch
3	6	Parking Stand, Load-Break
4	6	600-Amp Bushing
5	2	Lifting Lug
6	4	Grounding Nut
7	1	Interrupter Trip Indicator
8	1	8-Pin (SCADA) Connector With Cap ¹
9	1	9-Pin (SCADA) Connector With Cap ¹
10	1	Liquid Level Gauge
11	1	Ground Relay Cutout Switch
12	1	Waterproof Box Which Contains Schweitzer SEL-551 Relay and Voltage Switch

¹ As there is no currently approved SCADA controller for use with subsurface interrupters, these items are listed for reference only.

600A Interrupter (continued)

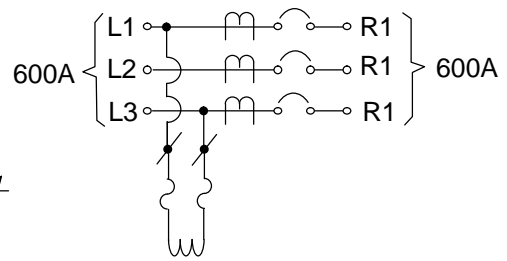
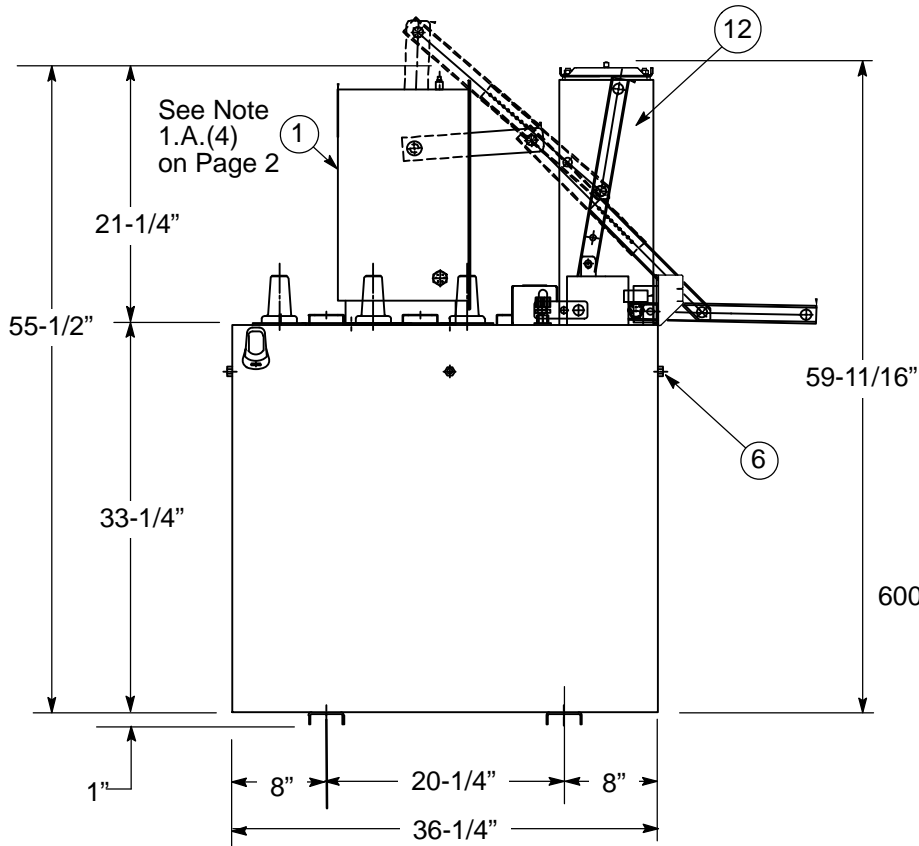
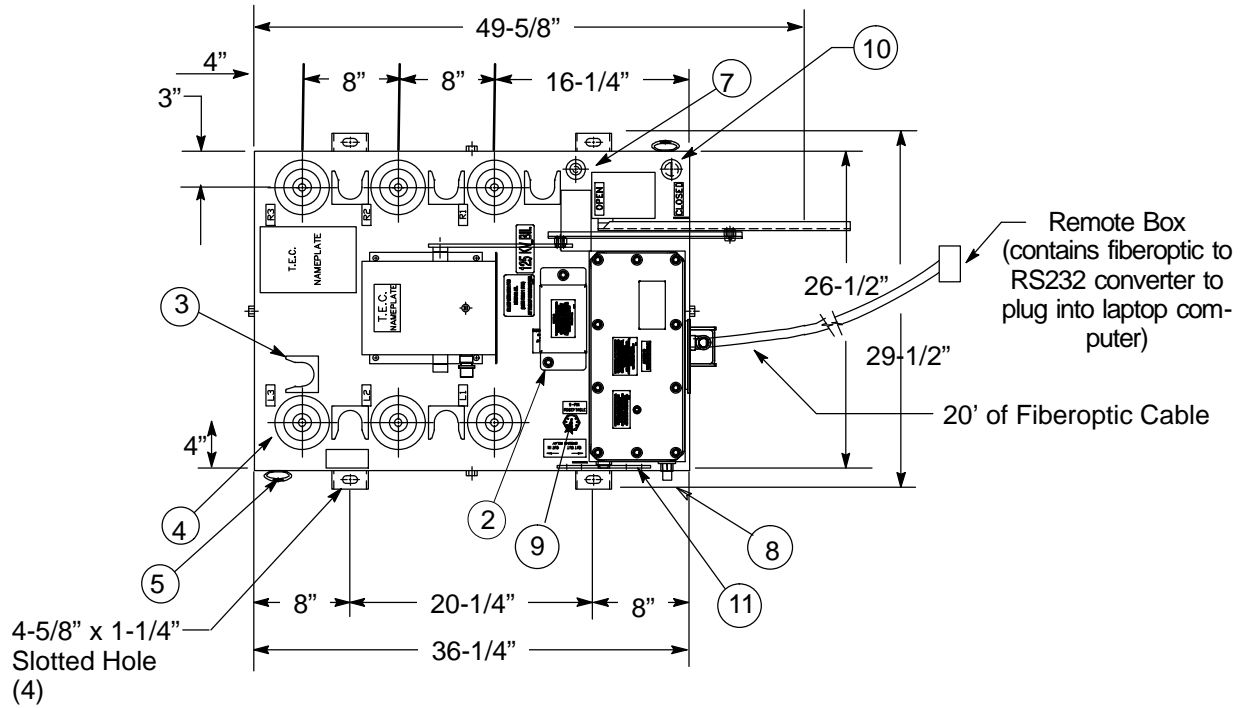


Figure 11
Trayer 600A Interrupter Material Drawing
(see Table 6 on Page 13 for Bill of Materials)

Figure 12
Three Line Diagram
600A Interrupter

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

600A Interrupter (continued)

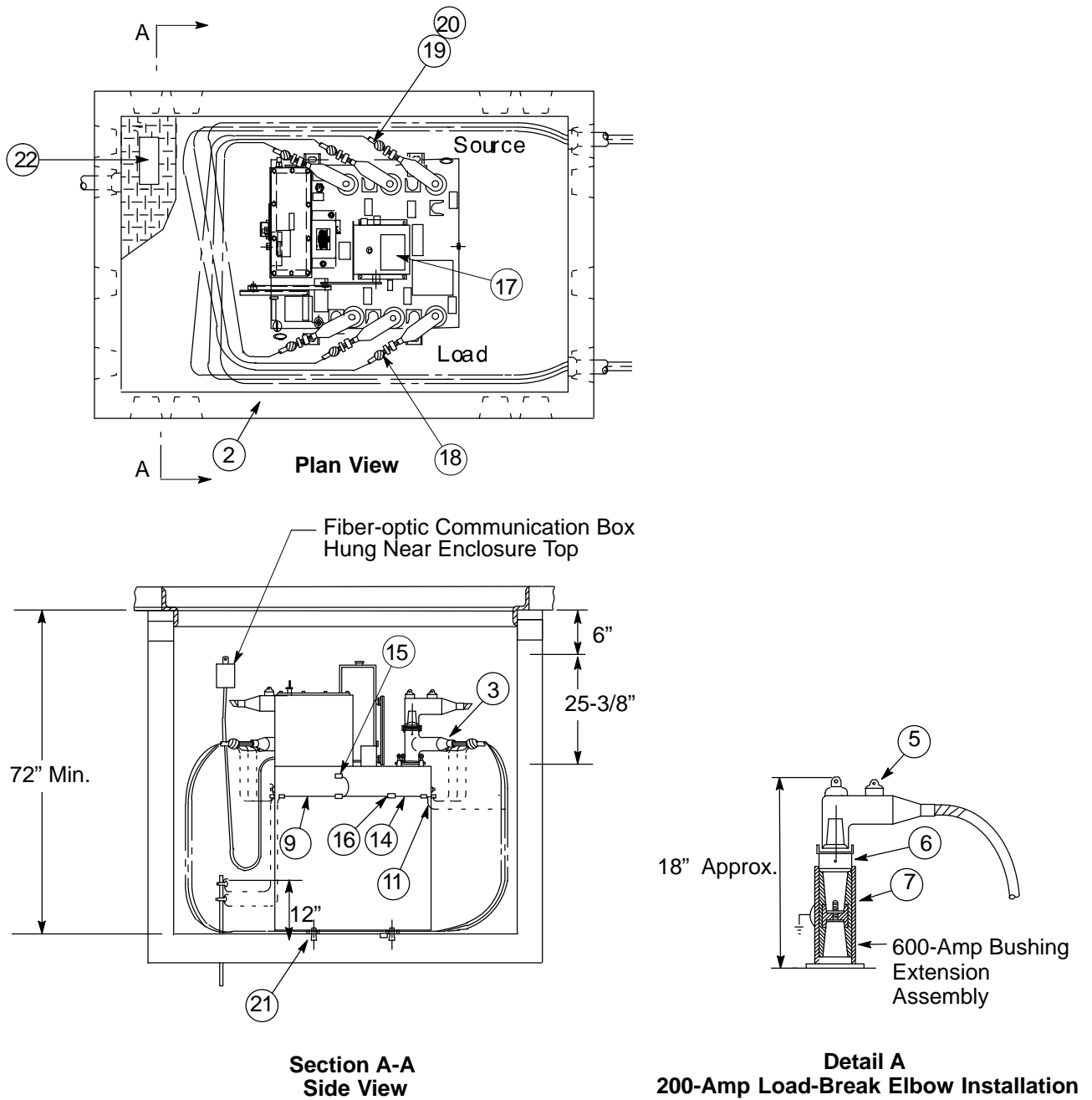


Figure 13
Trayer 600A Interrupter Installation Drawing
 (see Table 7 on Page 16 for List of Materials)

600A Interrupter (continued)

Table 7 shows the list of materials for the Trayer 600A interrupter. This material is necessary for the installation of the interrupter.

Table 7 List of Material Needed for installation of Trayer 600A Interrupters

Item	Description	References	Document	Code
1	Fault Interrupter, Three-Phase, Trayer	UG-1: Switches	066208	342620
2	Enclosure 4' 6" x 8' 6" x 6' 0" deep	UG-1: Enclosures	062000	-
3	Separable Insulated Connector, Dead-Break Elbow Receptacle, 600A (as required)	UG-1: Terminations	051071	303572
4	Test Plug Elbow Receptacle (as required)	UG-1 Terminations	035314	301585
5	Separable Insulated Connector, Elbow Receptacle, 200A, (as required)	UG-1 Terminations	035314	-
6	Tap Plug, 600/200A			303593
7	Bushing Extension (as required)	-		303617
8	Cable Insulated for Underground Distribution (rating and type as required)	UG-1: Cable	039955	-
9	Wire, 250 kcmil, Bare Copper, Standard (as required)	-	-	290254
10	Conduit and Bell Ends (as required)	UG-1: Conduits	062288	-
11	Connector, Tap, Compression-Type, #2 to 250 kcmil	UG-1: Connectors	015251	305845
12	Ground Rod, 3/4"	UG-1: Connectors/ Greenbook	013109	10098
13	Clamp, Ground Rod , 3/4"	-	-	187017
14	Wire, Ground, Bare Copper, #2 AWG Solid	-	-	290074
15	Ground Lug	-	015251	301546
16	Connector, Straight, Compression-Type, 250 kcmil, Copper-to-Copper	UG-1: Connectors	015251	305202
17	Switch Number Tag	UG-1: Marking	033582	-
18	Fault Indicator (as required) ¹	UG-1: General	061683	-
19	Phase Designation Tag	UG-1: Marking	033582	
20	Sectionalizing Tag	-	-	-
21	Bolt, Anchor, Wedge, Steel, Stainless, 1/2"-13 x 3-3/4"	-	-	190445
22	Switch Number Tag (with number)	UG-1: Marking	051768	

¹ Fault indicators are to be used when specified by the distribution planning engineer.

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

600A Interrupter (continued)

Installation Notes (continued)

Step 1 Work by Substructure Crew

- A. Provide a 6' 6" x 10' 6" excavation 7' 6" below the final grade for a 4' 6" x 8' 6" x 6' 0" deep enclosure.
- B. Prepare the excavation with 6" of drain rock per [Document 062000](#), Note 5D on Page 1.
- C. Assist (as required) the enclosure manufacturer in the "in hole" delivery of the enclosure.
- D. Install the primary conduit exactly as illustrated on Page 15. Note: If installation of conduit is not possible as shown, contact the electric foreman for instructions.
- E. Feed conductors into the enclosure through the end wall conduits. Leave 20 feet of cable in the enclosure and cap and seal the cable ends.
- F. Install a 3/4" x 12' ground rod, leaving the top of the ground rod approximately 18 inches above the floor of the enclosure.
- G. Grout in conduits, backfill and tamp around the enclosure.

Step 2 Work by Electric Crew

- A. Just before installation, pre-commission the interrupter as required by Note 1 on Page 2.
- B. Install the ring 250 kcmil Cu. bus around the interrupter.
- C. Install the interrupter in the enclosure.
Center the primary bushings in the enclosure as shown on Page 15 to provide equal distance for cable training on both ends. Bolt the interrupter rails to the floor. Connect the ring bus to ground with #2 bare copper, solid wire.
- D. Train the primary cables into their final position and cut them to the proper length so cables do not block the viewing ports or manual operating handles. Check that source cables are connected to line bushings and load cables are connected to load bushings.
- E. For 600A separable insulated connectors, install the apparatus connection assembly kits ([Document 051071](#)) on the cable. Test plug elbows shall be installed on each 600A elbow receptacle to provide for phasing and grounding of mainline conductors and 600A receptacles. Place the elbow receptacle on the interrupter. Install the 600/200A reducing tap plugs. Place the test plug elbow receptacle (candled elbow) on the reducing tap plugs.
For 200A separable insulated connectors, install elbows on the cable ([Document 035314](#)). Install the bushing extensions and 600/200A reducing tap plugs on the interrupter bushings ([Document 051071](#)). Place the load-break, 200A elbows on the reducing tap plugs. See Detail A of Figure 13 on Page 15 and Table 7 on Page 16 for the 200A load-break elbow installation. Note: When used, bushing extensions must be grounded to the ground ring bus using a spare piece of concentric wire.
- F. Connect the cable neutral wires and interrupter ground wires to the 250 kcmil copper ring bus.
- G. Install phase designation tags, cable identification tags, and interrupter number plate.
- H. Hang the fiber-optic access box near the top of the enclosure on a 1/2" anchor bolt.

Step 3 Checklist

- A. Verify that the interrupter can be operated with a switching stick including the manual handle and ground relay cutout switch.
- B. Verify that the interrupter is in interrupter mode.
- C. Verify that the ground relay cutout switch is left in the "cut-in" position.
- D. Verify that the remote box at the end of the fiber optic cable is accessible and removable with a switching stick.
- E. Simulate the movement of 200A cables, if installed, to standoff positions to ensure the proper operation of all components.
- F. Ensure that the cables do not block viewing ports or manual operating handles.
- G. Check separable connectors for cleanliness and secure them in place.
- H. Check the oil level. For sight glass type oil-level indicators, a black color indicates satisfactory oil level and red indicates low oil level.

600A Interrupter (continued)**Installation Notes (continued)**

- I. Ensure that all cable tags are properly installed and visible from the surface.
- J. Open and close the interrupter with the manual lever located on the interrupter to verify proper operation of the interrupter.
- K. Check the interrupter for the proper switch position.
- L. Check to see that the interrupter switch number on top of the enclosure is in place.
- M. After the primary cables are energized, test each test point with an approved voltage detector to verify proper operation.
- N. Ensure that the fiber-optic access box is hung near the roof of the enclosure
- O. Close and secure enclosure covers.

Switch-Interrupter-Switch**Notes**

1. The 200A Interrupter's relay CT ratio is 200:5. The 600A Interrupter's CT ratio is 600:5.
2. For the 200A Interrupter, the continuous current rating of the two switches is 600A while the rating of the interrupter is 200A.
3. Bushings that are rated at 600A may be converted to 200A by using a bushing extension and a 600/200A tap/plug. When used, the bushing extensions must be grounded to the neutral ring.
4. The Trayer switch-interrupter-switch is a bidirectional device, meaning the source side device may be connected to either 600A switched way. Do not connect the source side device to the interrupter way. See Note 5 on Page 1 for more information on directionality of devices.

Table 8 shows the bill of materials for the Trayer switch-interrupter-switch. This material will be supplied by the manufacturer with purchase of the interrupter.

Table 8 Manufacturer Supplied List of Components for Trayer Switch-Interrupter-Switch

Item	Quantity	Description
1	1	Switch-Interrupter-Switch, Three Phase, 3-Way, 3-Way Switched
2	2	3 A Fuses Internally Mounted with a Two Pole Disconnect Switch
3	9	Parking Stand, Load-Break
4	6 ¹	600A Bushing Wells
5	3 ¹	200A Bushing Wells
6	4	Lifting Lug
7	4	Grounding Nut
8	1	Interrupter Trip Indicator
9	1	Liquid-Level Gauge
10	1	Ground Relay Cutout Switch and Relay Cutout
11	1	Waterproof Box Which Contains Schweitzer SEL551 Relay and Voltage Switch

¹ If installing the all 600A switch-interrupter-switch, the unit comes with nine 600A bushing wells and no 200A bushing wells.

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

Switch-Interrupter-Switch (continued)

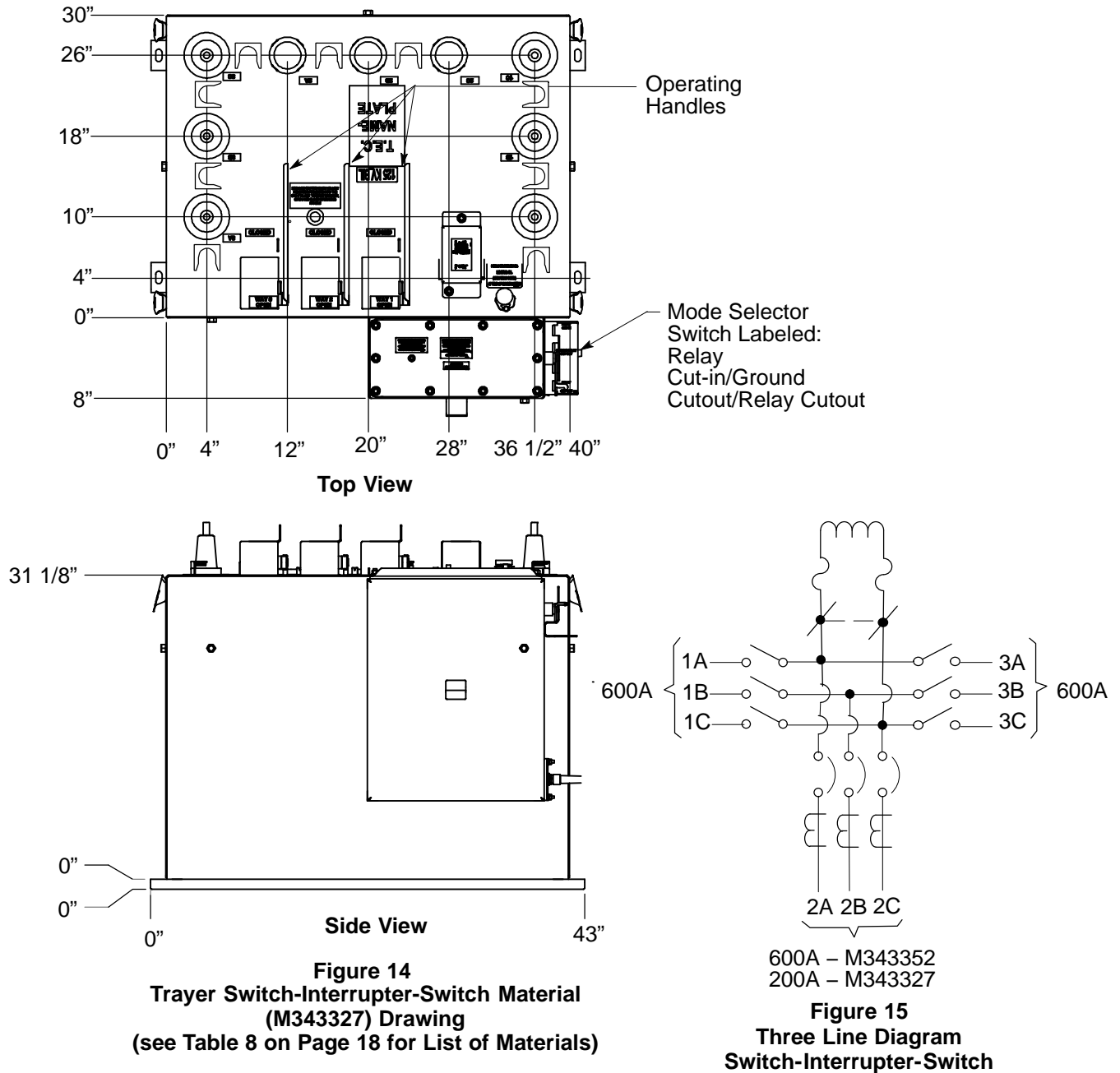


Figure 14
Trayer Switch-Interrupter-Switch Material
(M343327) Drawing
(see Table 8 on Page 18 for List of Materials)

Figure 15
Three Line Diagram
Switch-Interrupter-Switch

Switch-Interrupter-Switch (continued)

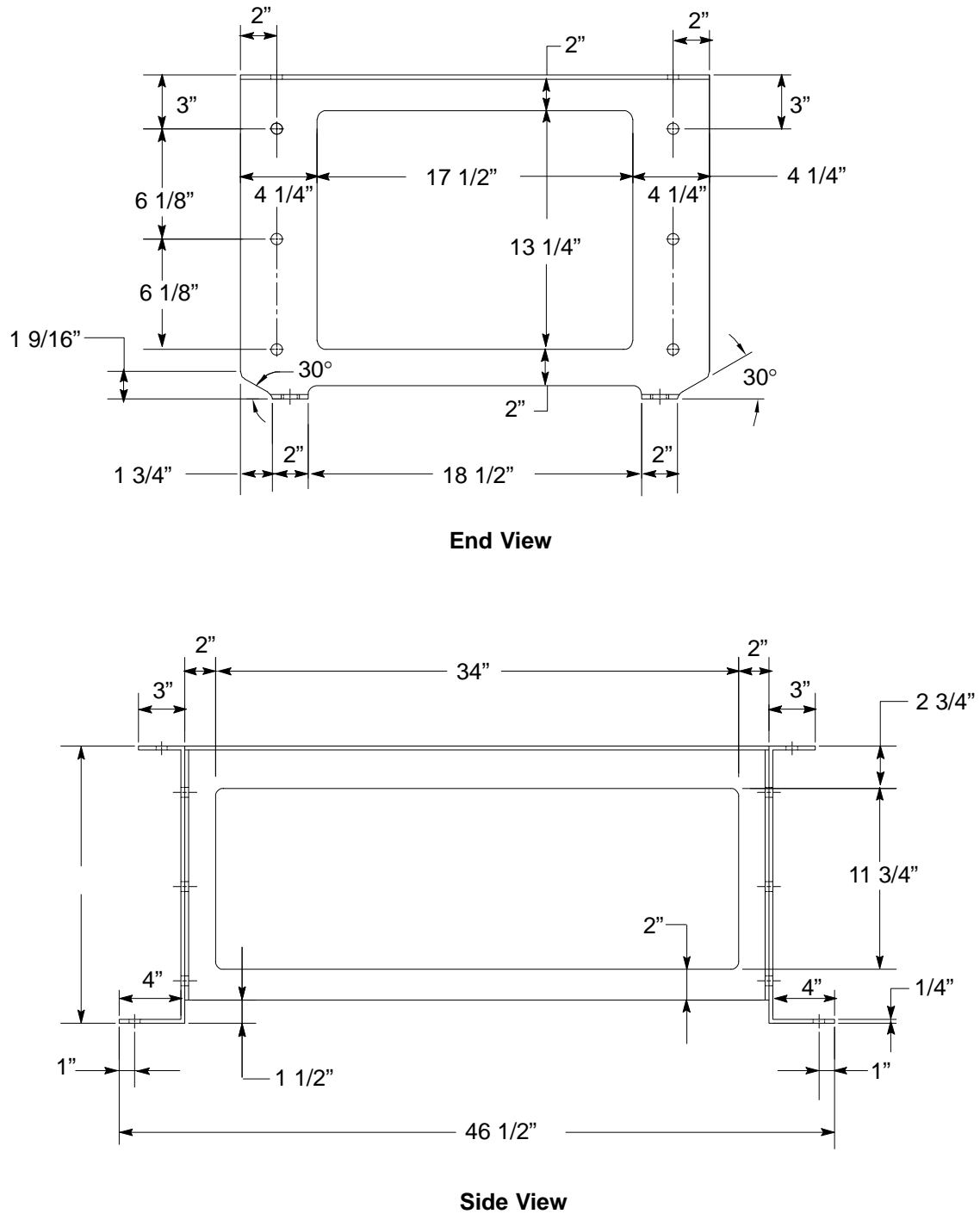


Figure 16
Trayer Stand for Switch-Interrupter-Switch Models (M343338)

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

Switch-Interrupter-Switch (continued)

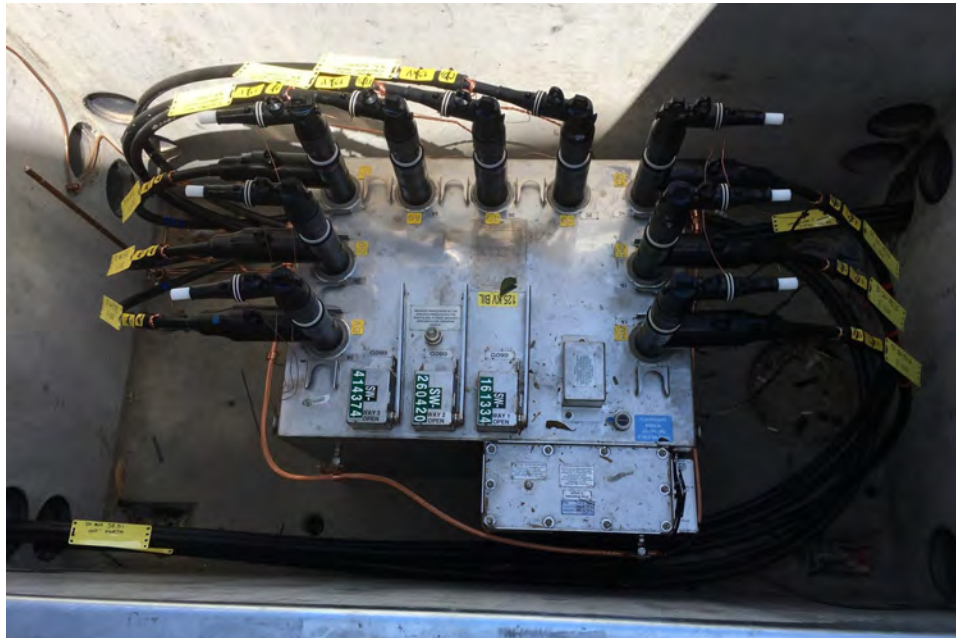


Figure 17
 Trayer Switch-Interrupter-Switch (M343352) Top View Picture
 (see Table 9 on Page 23 for List of Materials)

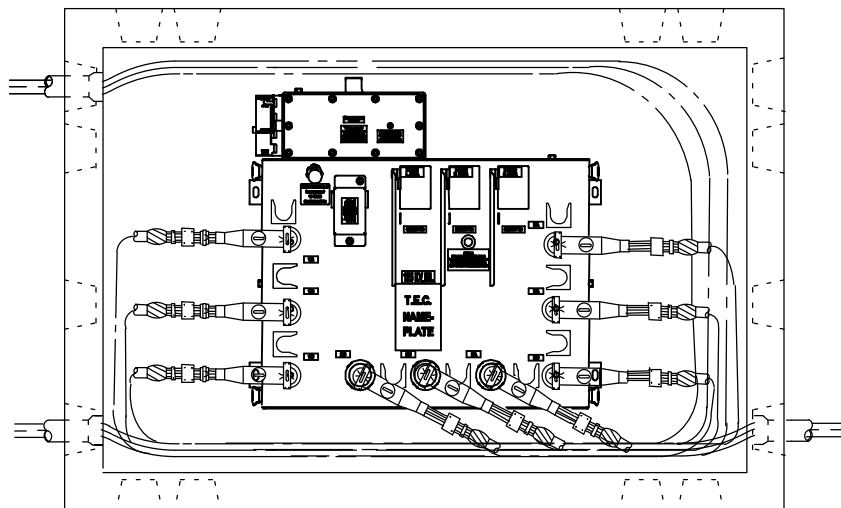


Figure 18
 Trayer Switch-Interrupter-Switch (M343327) Top View Installation Drawing
 (see Table 9 on Page 23 for List of Materials)

Switch-Interrupter-Switch (continued)

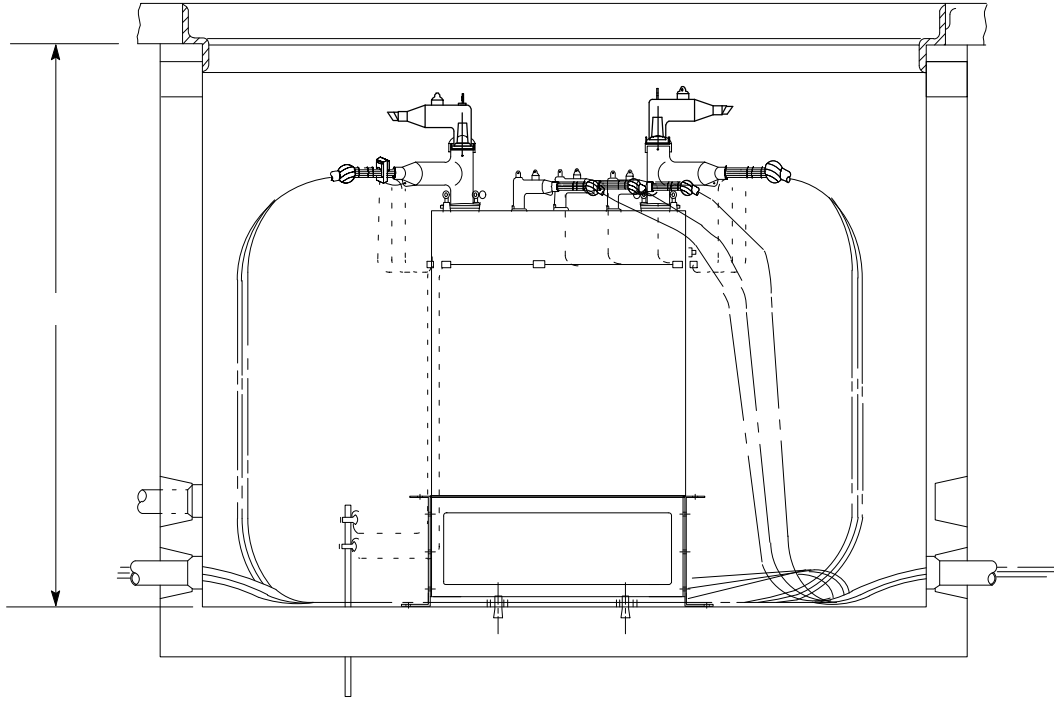


Figure 19
Trayer Switch-Interrupter-Switch (M343327) Side View Installation Drawing
(see Table 9 on Page 23 for List of Materials)

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

Switch-Interrupter-Switch (continued)

Table 9 shows the list of materials for the Trayer switch-interrupter-switch. This material is necessary for the installation of the interrupter.

Table 9 List of Material Needed for Installation of Trayer Switch-Interrupter-Switch

Item	Description	References	Document	Code
1	Switch-Interrupter-Switch, Three-Phase, Submersible, Trayer	UG-1 Switches	066208	200A – 343327 600A – 343352
2	Switch Stand 18" ¹	UG-1 Switches	066208	343338
3	Enclosure 4' 6" x 8' 6" x 6' 0" Deep	UG-1: Enclosures	062000	–
4	Separable Insulated Connector, Dead-Break Elbow Receptacle, 600A (as required)	UG-1: Terminations	051071	–
5	Test Plug Elbow Receptacle (as required)	UG-1: Terminations	035314	301585
6	Load-Break Bushing Inserts (as required)	UG-1: Terminations	035314	300481
7	Separable Insulated Connector, Load-Break Elbow Receptacle, 200A (as required)	UG-1: Terminations	035314	–
8	Tap Plug, 600/200A (as required)	UG-1: Terminations	051071	–
9	Bushing Extension (as required)	UG-1: Terminations	051071	303617
10	Cable Insulated for Underground Distribution (rating and type as required)	UG-1: Cable	039955	–
11	Wire, 250 kc mil, Bare Copper, Stranded, Approx. 20' (as required)	OH: Conductors	059626	290254
12	Conduit and Bell Ends (as required)	UG-1: Conduits	062288	–
13	Connector, Tap, Compression-Type (as required) #2 to 250 kc mil	UG-1: Connectors	015251	305845
14	Ground Rod, 3/4" x 12' 0"	OH: Conductors	059626	10098
15	Clamp, Ground Rod, 3/4"	–	–	187017
16	Wire, Ground, Bare Copper, #2 AWG Solid, Approx 20'	OH: Conductors	059626	290074
17	Ground Lug	UG-1: General	060462	301546
18	Connector, Straight, Compression-Type, 250 kcmil, Copper-to-Copper	UG-1: Connectors	015251	305202
19	Fault Indicator (as required) ²	UG-1: General	061683	–
20	Phase Designation Tag	UG-1: Marking	033582	–
21	Sectionalizing Tag	–	–	–
22	Bolt, Anchor, Wedge, Steel, Stainless, 1/2" x 3-3/4"	–	–	190445
23	Switch Number Tag (Switch and Enclosure)	UG-1: Marking	051071	–

¹ Stands for switch interrupter switches should not be used for enclosures shallower than 6' and the switchgear is to be bolted directly to the floor. For enclosures 6' or deeper, the stand is required. The standard enclosure for this device is 6' deep and thus requires a stand.

² Fault indicators are to be used when specified by the distribution planning engineer.

Switch-Interrupter-Switch (continued)

Installation Notes (continued)

Step 1 Work by Substructure Crew

- A. Provide a 6' 6" x 10' 6" excavation 7' 6" below the final grade for a 4' 6" x 8' 6" x 6' 0" deep enclosure.
- B. Prepare the excavation with 6" of 1" drain rock.
- C. Assist (as required) the enclosure manufacturer in the "in hole" delivery of the enclosure.
- D. Install the primary conduit exactly as illustrated on Page 21. Note: If installation of conduit is not possible as shown, contact the electric foreman for instructions.
- E. Feed conductors into the enclosure through the end wall conduits. Leave 25 feet of cable in the enclosure and cap and seal the cable ends.
- F. Install a 3/4" x 12' ground rod, leaving the top of the ground rod approximately 18 inches above the floor of the enclosure.
- G. Grout in conduits, backfill and tamp around the enclosure.

Step 2 Work by Electric Crew

- A. Just before installation, pre-commission the interrupter as required by Note 1 on Page 2.
- B. Install a 250 kcmil Cu. ring bus around the switch-interrupter-switch.
- C. Bolt switch to stand (M343338).
- D. Install the switch and stand in the enclosure. (See Footnote 1 for Table 9 on Page 23 for stand usage)
- E. Train the cables into their final position, and cut them to be proper length, so cables do not block the viewing ports or manual operating handles. Install a separable connector on the cable and place it on the proper switch bushing ([Document 051071](#)) and ([Document 035314](#)). Connect the concentric neutral wire (or shield tape ground wire) to neutral ring bus, and connect the ring bus to the ground rod with #2 copper wires.
- F. For 600A separable insulated connectors, install the apparatus connection assembly kits on the cable ([Document 051071](#)). Test plug elbows shall be installed on each 600A elbow receptacle to provide for phasing and grounding of mainline conductors and 600A receptacles. Install the 600/200A reducing tap plugs. Place the test plug elbow receptacle (candled elbow) on the reducing tap plugs.
For 200A interrupters place the elbow receptacle on the interrupter. See Detail A of Figure 13 on Page 15 and Table 9 on Page 23 for the 200A load-break elbow installation.
- G. Do not "piggyback" 600-amp elbows on top of the other 600-amp elbows at any time on the apparatus bushing.
- H. For 200A premolded separable terminations, install the apparatus connection assembly kits on the cable ([Document 035314](#)).
 - I. Install phase designation tags and sectionalizing tags.
 - J. Install switch numbers on the switch number plates.
- K. Hang the fiber-optic access box near the top of the enclosure on a 1/2" anchor bolt.

Step 3 Checklist

- A. Verify that the interrupter can be operated with a switching stick including the manual handles and mode selection switch.
- B. Operate the switches and place them in the proper positions.
- C. Verify that the interrupter is in interrupter mode.
- D. Verify that the ground relay is left in the "cut-in" position.
- E. Verify that the remote box at the end of the fiber optic cable is accessible and removable with a switching stick.
- F. Simulate the movement of 200A cables, if installed, to standoff positions to ensure the proper operation of all components.
- G. Ensure that the cables do not block viewing ports or manual operating handles.
- H. Check separable connectors for cleanliness and secure them in place.
 - I. Check the continuity of the switch.

Installation of Automatic Subsurface Interrupters for Primary Equipment Enclosures

Switch-Interrupter-Switch (continued)

- J. Check the oil level. For sight glass type oil-level indicators, a black color indicates satisfactory oil level and red indicates low oil level.
- K. Ensure that all cable tags are properly installed and visible from the surface.

Installation Notes (continued)

- L. Open and close the interrupter with the manual lever located on the interrupter to verify proper operation of the interrupter.
- M. Check the interrupter for the proper switch position.
- N. After the primary cables are energized, test each test point with an approved voltage detector to verify proper operation.
- O. Ensure that the fiber-optic access box is hung near the roof of the enclosure.
- P. Close and secure enclosure covers.
- Q. Check to see that the interrupter switch number on top of the enclosure is in place.

Revision Notes

Revision 12 has the following changes:

1. Clarify ground protection capability of interrupters when protecting two-wire single phase loads.
2. Add requirement to pressurize Trayer controls when sealing after opening the bolted cover.