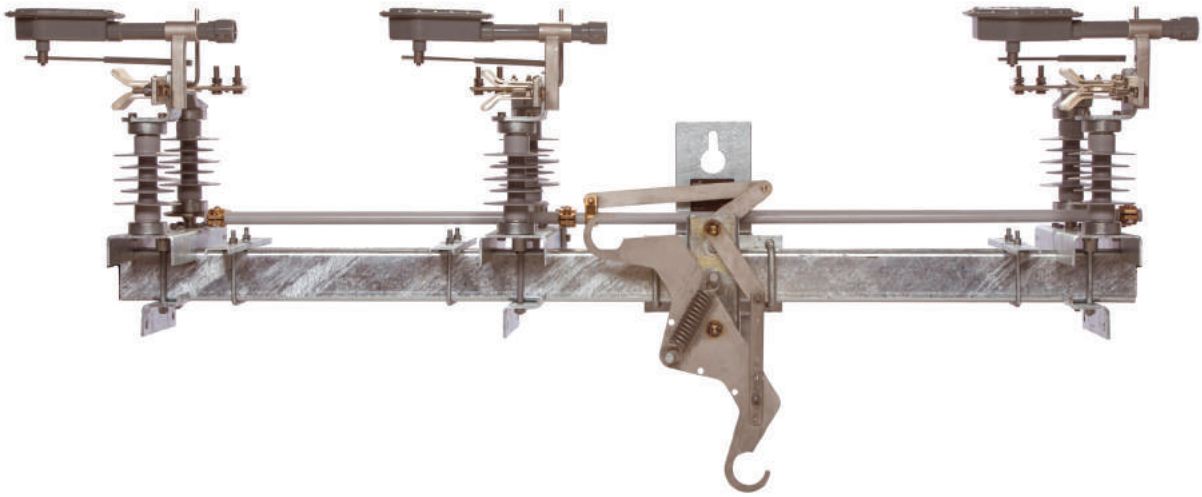
Manually-Operated M-Force Switch Installation and Operation Instructions



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Safety for life

Eaton meets or exceeds all applicable industry standards relating to product safety in its Cooper Power™ series products. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Eaton employees involved in product design, manufacture, marketing, and service.

We strongly urge that you always follow all locally-approved safety procedures and safety instructions when working around high-voltage lines and equipment, and support our "Safety For Life" mission.

Safety information

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians who are familiar with this equipment should install, operate, and service it.

A competent technician has these qualifications:

- Is thoroughly familiar with these instructions.
- Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.
- Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.
- Is trained in the care and use of protective equipment such as arc flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Indicates a potentially hazardous situation which, if not avoided, may result in equipment damage only.

Safety instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

⚠ DANGER

Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally-approved safety procedures when working around high- and low-voltage lines and equipment. G103.3

⚠ WARNING

Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling, or maintenance can result in death, severe personal injury, and equipment damage. G101.0

⚠ WARNING

This equipment is not intended to protect human life. Follow all locally-approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage. G102.1

⚠ WARNING

Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install, or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage. G122.2

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Introduction

This manual provides installation and operation instructions for Eaton's Cooper Power™ series M-Force™ three-phase overhead loadbreak switch.

Read this manual first

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional information

These instructions cannot cover all details or variations in the equipment, procedures, or processes described, nor provide directions for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, contact your Eaton sales representative.

Acceptance and initial inspection

Each switch is completely assembled, inspected, tested, and adjusted at the factory. It is in good condition when accepted by the carrier for shipment. Upon receipt of a switch, inspect the switch thoroughly for damage and loss of parts incurred during shipment. If damage or loss is discovered, file a claim with the carrier immediately.

Handling and storage

Be careful during handling and storage of the switch to minimize the possibility of damage.

If the switch is to be stored for an appreciable time before installation, provide a clean, dry storage area. Locate the switch so as to minimize the possibility of mechanical damage.

Quality standards

ISO 9001:Certified Quality Management System.

Description of operation

The M-Force switch is a distribution-class, gang operated, and factory unitized three-phase overhead loadbreak switch, offered in distribution voltage classifications of 15.5 kV, 27 kV, and 38 kV. The M-Force switch may be used for line sectionalizing, paralleling, by-passing, and isolating. M-Force stands for "magnetic force." The switch has reverse loop contacts found on distribution-class sidebreak switches; a contact usually reserved for transmission switches. The reverse loop contacts utilize high current magnetic forces for added reliability. The reverse loop design allows for high contact pressure to be maintained during fault conditions. This feature prevents pitting and distorting of the switch blade and contacts even under momentary overload.

Ratings and specifications

Check switch ratings prior to installation

The switch must be applied within its specified ratings. Check nameplate ratings and compare with the system characteristics at the point of application prior to installation.

Table 1. Electrical characteristics

	Max	BIL	Cont. Current	Loadbreak	Momentary*	3 Second	Fault Close (ASM)
14.4 kV	15.5 kV	110 kV	900 A	50 @ 600 A/10 @ 900 A	40 kA Asy. rms	25 kA Sym. rms	1 @ 20 kA, 3 @ 15 kA
25 kV	27 kV	150 kV	900 A	50 @ 600 A/10 @ 900 A	40 kA Asy. rms	25 kA Sym. rms	1 @ 20 kA, 3 @ 15 kA
34.5 kV	38 kV	200 kV	900 A	10 @ 900 A	40 kA Asy. rms	25 kA Sym. rms	1 @ 20 kA, 3 @ 15 kA

* Momentary peak current is 65 kA.

Dimensions and weights

Shipping weights and dimensions

The shipping weights as specified in Table 2 include the 2.25" bolt hole circle silicone rubber insulators for 15.5 and 27 kV ratings. For alternate insulators, refer to Table 3 for change in weight.

Table 2. Shipping weights and dimensions (2.25" bolt circle polymer insulators standard, 3.00" on 35 kV)

	Voltage Class	15.5 kV		27 kV		38 kV	
	Crossarm	Steel	Fiberglass	Steel	Fiberglass	Steel	Fiberglass
Horizontal Upright	Crate L" x W" x H"	94" x 27" x 34"	94" x 27" x 34"	104" x 30" x 38"	104" x 30" x 38"	134" x 37" x 41"	134" x 37" x 41"
	Weight	381 lbs.	347 lbs.	414 lbs.	380 lbs.	478 lbs.	444 lbs.
Horizontal Pole-Top	Crate L" x W" x H"	94" x 27" x 34"	94" x 27" x 34"	94" x 27" x 34"	94" x 27" x 34"	134" x 37" x 41"	134" x 37" x 41"
	Weight	377 lbs.	343 lbs.	410 lbs.	376 lbs.	474 lbs.	440 lbs.
Phase-Over-Phase	Crate L" x W" x H"	100" x 27" x 34"	100" x 27" x 34"	110" x 30" x 38"	110" x 30" x 38"	140" x 37" x 41"	140" x 37" x 41"
	Weight	462 lbs.	428 lbs.	495 lbs.	461 lbs.	559 lbs.	525 lbs.
Vertical Riser	Crate L" x W" x H"	94" x 27" x 34"	94" x 27" x 34"	104" x 30" x 38"	104" x 30" x 38"	134" x 37" x 41"	134" x 37" x 41"
	Weight	402 lbs.	368 lbs.	435 lbs.	401 lbs.	499 lbs.	465 lbs.
Triangular	Crate L" x W" x H"	93" x 27" x 73"	94" x 27" x 73"	93" x 30" x 73"	93" x 30" x 73"	199" x 37" x 85"	99" x 37" x 85"
	Weight	471 lbs.	437 lbs.	504 lbs.	470 lbs.	568 lbs.	534 lbs.

Note: G095 spacing and special switch options will cause slight variations.

Table 3. Weight adders

	15.5 kV		27 kV		38 kV
	2.25" B.C.	3.00" B.C.	2.25" B.C.	3.00" B.C.	3.00" B.C.
Polymer Insulators	–	14 lbs.	–	3 lbs.	–
Epoxy Insulators	9 lbs.	41 lbs.	14 lbs.	54 lbs.	57 lbs.
Porcelain Insulators	54 lbs.	114 lbs.	57 lbs	164 lbs.	199 lbs.

Standard M-Force switch configurations

The M-Force switch configurations include horizontal, horizontal pole-top, phase-over-phase, or triangular. Refer to the corresponding Figures 1 through 5 for a specific configuration, and refer to Table 4 for dimensional information.

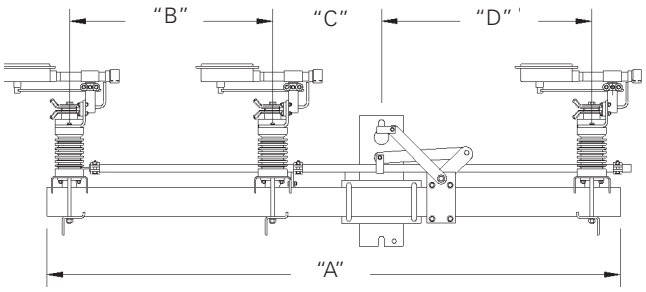

Figure 1. Horizontal switch configuration

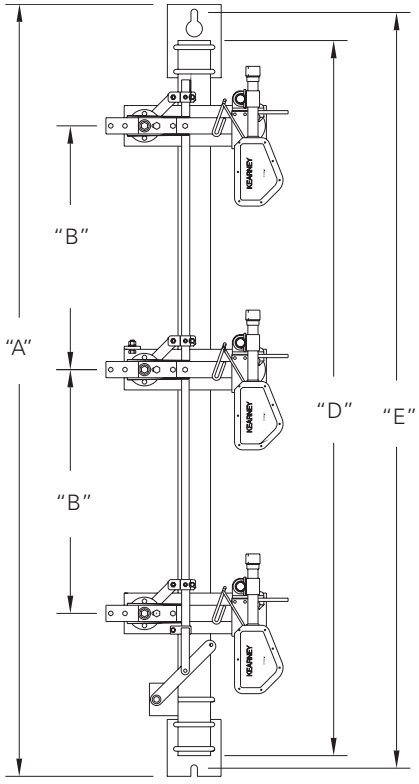

Figure 2. Phase-over-phase switch configuration

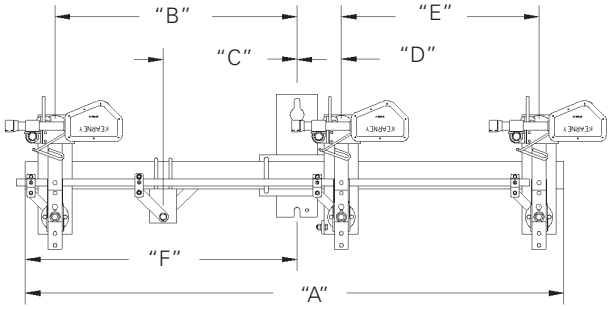

Figure 3. Vertical switch configuration

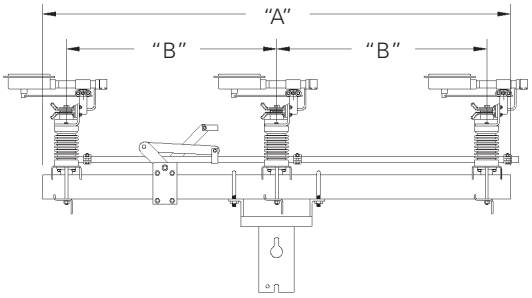

Figure 4. Horizontal pole-top switch configuration

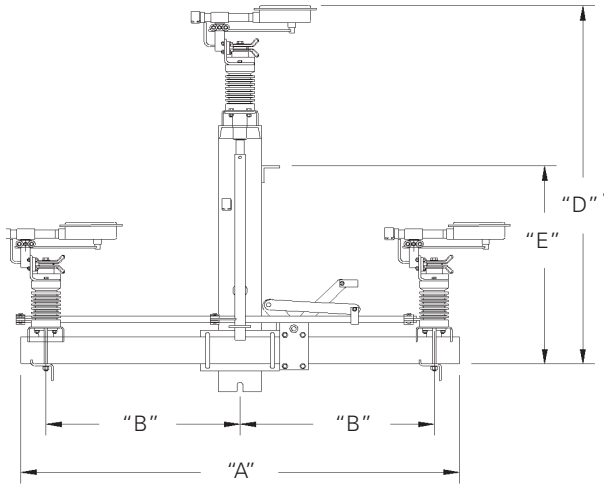

Figure 5. Triangular switch configuration

Table 4. Dimensional information

	Horizontal						Vertical (Riser)						Phase-Over-Phase			Triangular		
	Standard			G095			Standard			G095								
Dim.	15 kV	25 kV	35 kV	15 kV	25 kV	35 kV	15 kV	25 kV	35 kV	15 kV	25 kV	35 kV	15 kV	25 kV	35 kV	15 kV	25 kV	35 kV
A	79"	88"	119"	97"	108"	126"	79"	88"	97"	108"	119"	126"	95"	104"	126"	61"	73"	79"
B	28"	33"	42"	28"	33"	42"	35.5"	40"	45"	49.5"	56"	54.5"	30"	34.5"	45.5"	27"	33"	36"
C	15"	15"	18"	24"	24"	24"	19.5"	19.5"	19.5"	19.5"	19.5"	19.5"	N/A	N/A	N/A	N/A	N/A	N/A
D	29"	33"	52"	38"	43.5"	52.5"	6.5"	6.5"	6.5"	22"	22.5"	22.5"	88"	97"	119"	58"	61"	73"
E	N/A	N/A	N/A	N/A	N/A	N/A	29"	33.5"	45"	29"	33.5"	42"	93"	102"	124"	34"	34"	42"
F	N/A	N/A	N/A	N/A	N/A	N/A	39.5"	45"	48.5"	53.5"	59.5"	58"	N/A	N/A	N/A	N/A	N/A	N/A

Horizontal Pole-Top			
Standard			
Dim.	15 kV	25 kV	35 kV
A	79"	79"	97"
B	36"	36"	45"

Phase units

Each phase unit shall be secured to the crossarm with locking spacers to eliminate distortion of the phase unit base. Dead-end brackets shall incorporate locking tabs that will eliminate movement under side forces present when the conductor is dead-ended at an angle.

Refer to Figure 6 and Table 5 for phase unit dimensions. The switch shall be capable of opening or closing under a 3/8" ice layer without ice shields. The switch shall be capable of opening or closing under a 3/4" ice layer with ice shields.

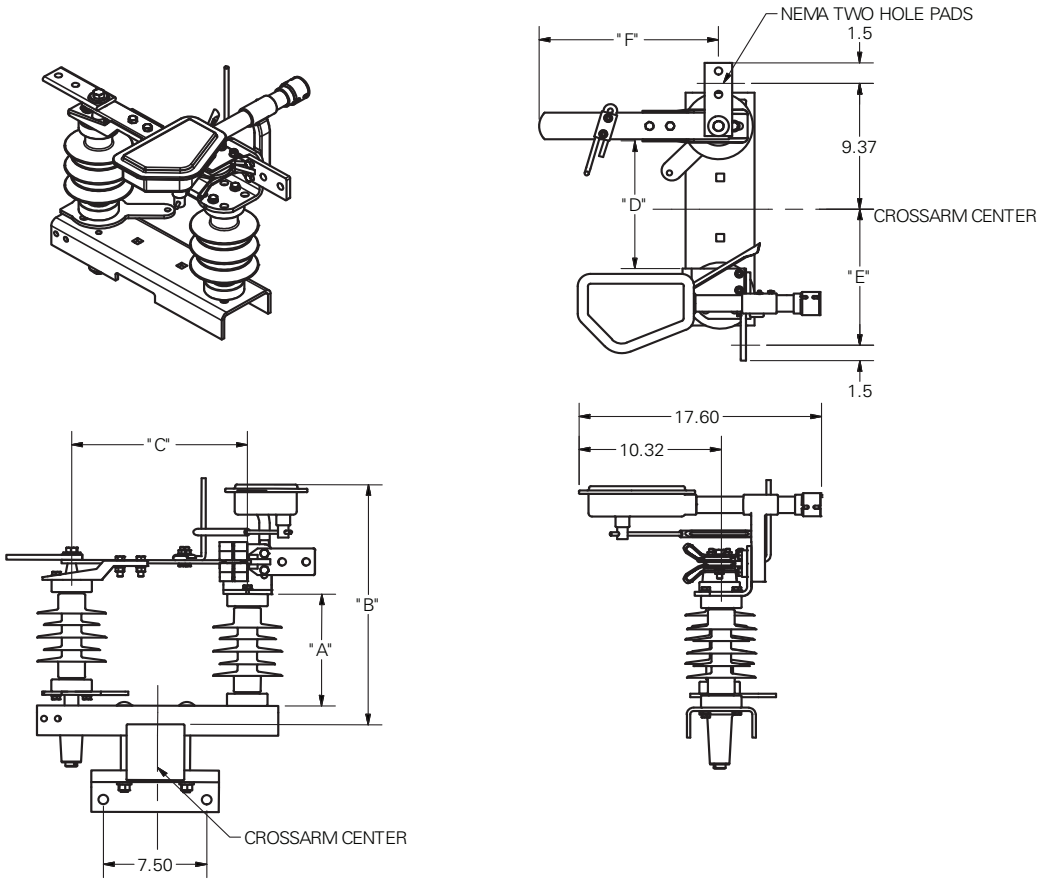

Figure 6. Phase unit for the standard M-Force switch

Table 5. Phase unit dimensions

	Voltage Class	**15.5 kV**		**27 kV**	
Dim.	**Insulator Material**	**57 mm (2.25") B.C.**	**76 mm (3.00") B.C.**	**57 mm (2.25") B.C.**	**76 mm (3.00") B.C.**
A	Cycloaliphatic	178 mm (7.00")	216 mm (8.50")	254 mm (10")	254 mm (10")
	Porcelain	205 mm (8.00")	254 mm (10.00")	254 mm (10")	356 mm (14")
	Silicone Rubber	213 mm (8.4")	254 mm (10.00")	274 mm (10.8")	356 mm (14")
B	B = A + 254 mm (10.00")				
C		324 mm (12.75")		390 mm (15.37")	
D		241 mm (9.48")		310 mm (12.19")	
E		254 mm (10.01")		321 mm (12.63")	
F		330 mm (13.00")		397 mm (15.62")	

Note: Dimensions, given in mm (in), are approximate.

Insulators

The M-Force switch comes standard with 57 mm (2.25") bolt circle silicone rubber insulators. These non-porcelain insulators offer exceptional dielectric and mechanical characteristics adding to the reliability of the M-Force switch, while lowering the weight. The switch can also be provided with 76 mm (3.0") bolt circle insulators and with alternate porcelain or cycloaliphatic epoxy designs.

Table 6. Insulator creep distances

	2.25" Bolt Circle Insulators		3.00" Bolt Circle Insulators
	15.5 kV	**27 kV**	**38 kV**
Polymer Insulators	20.2"	28.0"	37.00"
Epoxy Insulators	18.3"	22.70"	37.69"
Porcelain Insulators	14.0"	17.38"	37.00"

Installation procedure

IMPORTANT

Do not remove factory installed wire ties holding the blade to the clips until the switch is fully erected.

⚠ WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage.

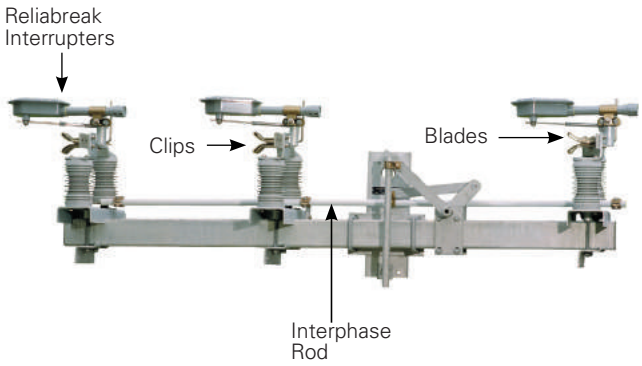

Figure 7. Horizontal M-Force switch

Mounting instructions

1. Do not hoist by or allow lifting slings to contact the switch phase unit parts.
2. Mount the unitized switch to the pole using 3/4" bolts at the desired location. Refer to Figure 8 for pole bracket detail. Remove the lifting straps.
3. Remove the factory installed contact tie wires from the phase units.
4. Operate the crossarm bellcrank, inspecting for operational difficulties.
5. Ensure that there is adequate travel for the switch blades to completely engage.
6. Check all phases for full closure of all main contacts.
7. Adjustment:
   a. If all phases require equal adjustment, loosen the clamp on the hotstick bellcrank extension. Adjust the inter-phase rod, as required.

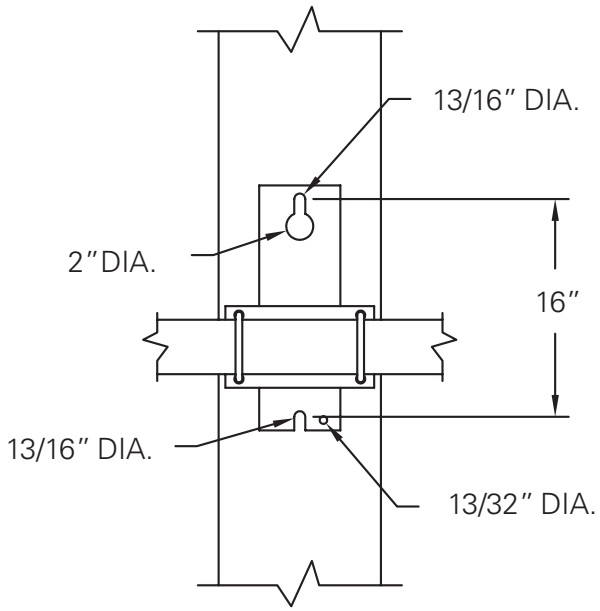

Figure 8. Pole bracket detail

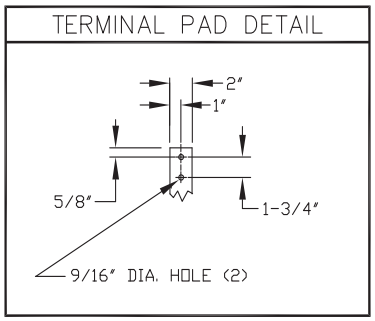

Figure 9. Terminal pad detail

   b. To adjust individual phases, close the switch using a vigorous stroke and loosen the individual clamp on the rotating insulator. Fully close the subject phase and tighten the clamp to the inter-phase rod.
8. Repeat Steps 6 and 7 until the following conditions exist:
   a. When the switch is closed and the hotstick operator is in the locked position, all contacts are fully closed.
   b. When the switch is opened and the hotstick operator is in the locked position, all switch contacts are parallel with the crossarm.

Grounding

Grounding the M-Force switch

Use your local operating practices when installing the M-Force switch. The pole-mounting bracket has a hole at the bottom of the bracket for the purpose of attaching a ground lug. The M-Force switch may be ordered with a grounding lug, option "T". The lug will accommodate cable sizes from #2 AWG to 250 MCM.

⚠ DANGER

Hazardous voltage. Switch must be solidly grounded. Follow all locally approved procedures and safety practices when grounding this equipment. Improper grounding can result in contact with high voltage, which will cause death or severe personal injury.

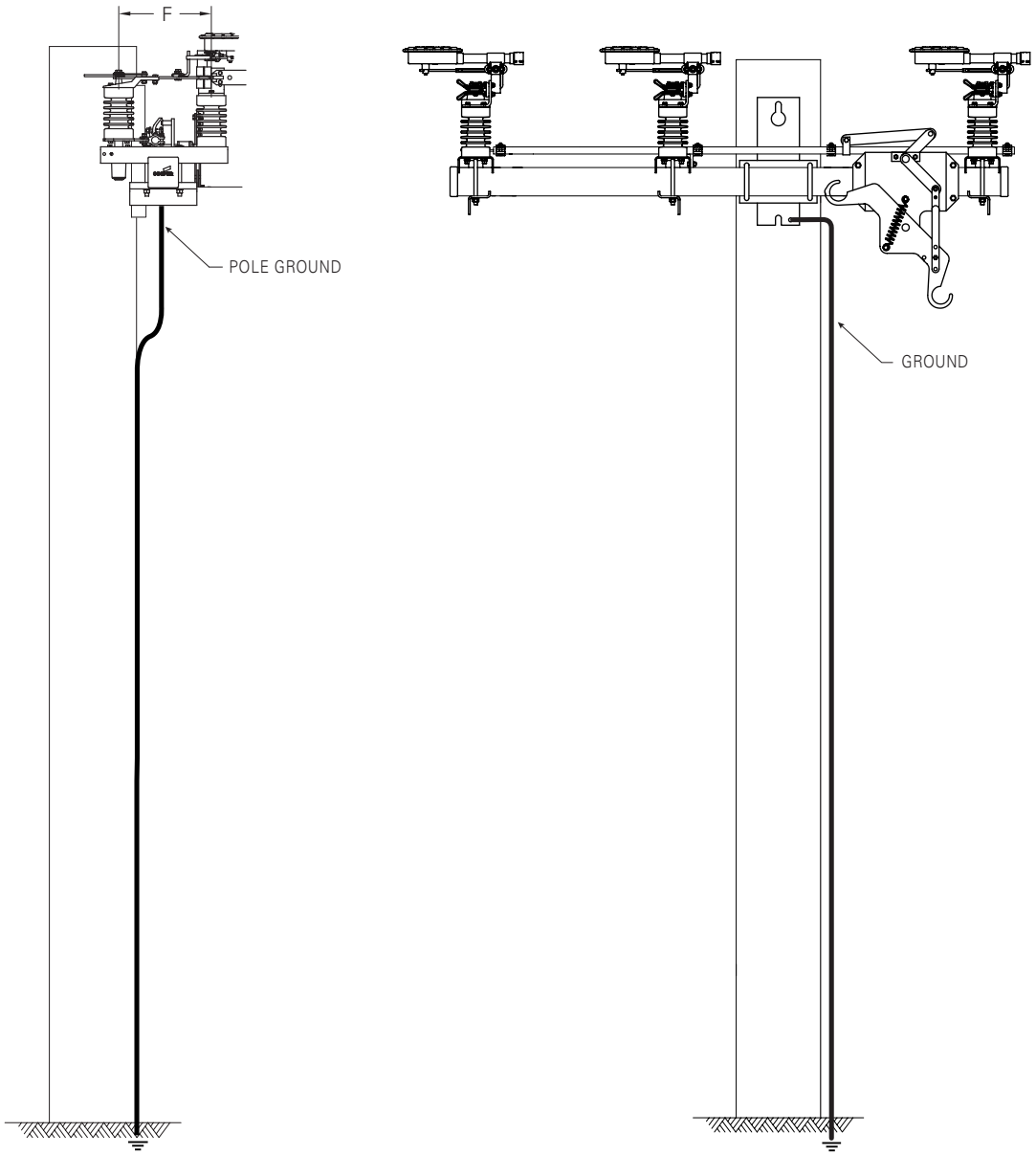

Figure 10. Grounding the M-Force switch

Switch operation

Manual switch operation

Note: Under icy conditions, additional force may be necessary to fully complete an opening or closing sequence.

⚠ WARNING

Equipment misoperation. Never attempt to open an energized M-Force switch giving indication of a partial close operation. In this state, the M-Force switch may not safely interrupt. Failure to comply can result in equipment damage and serious injury.

Hookstick operated

⚠ DANGER

Hazardous voltage. Always use a hotstick when working with this equipment. Failure to do so could result in contact with high voltage, which will cause death or severe personal injury.

IMPORTANT

The hotstick tip must be placed in the groove under the eyelet of the manual operating handle when closing the switch.

The hotstick M-Force switch is opened and closed by applying downward force upon the pivoting bellcrank operator. A hotstick must always be used to operate the bellcrank operator. Follow these steps to manually open and close the hotstick M-Force switch. Refer to Figure 11.

⚠ WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage.

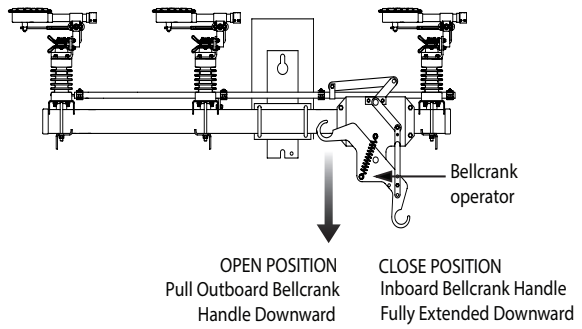

Figure 11. Open and close positions of hotstick M-Force switch manual operation handles

⚠ DANGER

Hazardous voltage. Do not rely on the open position of the hotstick-operated bellcrank; it does not ensure that the line has been de-energized. Always establish a visible disconnect and observe the position of the switch blades. Failure to follow proper safety practices can result in contact with high voltage, which will cause death or severe personal injury.

Opening switch

- Using a hotstick, quickly and forcefully pull the outboard handle of the manual bellcrank operator downward to open the switch.

Closing Switch

- Using a hotstick, quickly and forcefully pull the inboard handle of the manual bellcrank operator to close the switch.

Reciprocating handle

- Unlock the control handle if it is in a locked position.
- Operator should position body so that stable footing is ensured throughout the entire motion of the control handle.
- Once the operator is ready to begin the opening or closing sequence, begin the motion quickly and continue the movement from the upper limit to lower limit (or vice versa) until the control mechanism is fully open or closed. This should result in a fully opened or closed blade position with respect to the contacts. It is important to not stop motion during the open/close sequence as a partially closed blade could introduce arcing.
- Ensure the control handle is in a secured position, and lock it if your company does so.

Note: If control operation is not smooth, refer to the **Maintenance** and **Troubleshooting** sections.

Torsional handle

- Unlock the control handle if it is in a locked position.
- Operator should position body so that stable footing is ensured throughout the entire motion of the control handle.
- Once the operator is ready to begin the opening or closing sequence, begin the motion quickly and continue the movement from one side to the other until the control mechanism is fully open or closed. This should result in a fully opened or closed blade position with respect to the contacts. It is important to not stop motion during the open/close sequence as a partially closed blade could introduce arcing.
- Ensure the control handle is in a secured position, and lock it if your company does so.

Note: If control operation is not smooth, refer to the **Maintenance** and **Troubleshooting** sections.

Returning the switch to service

⚠ WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage.

The following procedure must be followed to return the switch to service upon completion of in-shop service or maintenance operations.

1. Verify that any termination clamps loosened during the out-of-service period are tight.
2. Verify that ground connections to the switch are secure.
3. Remove any padlock or locking device that may have been attached to the hookstick operator.
4. Complete any procedures normally performed as part of any local Return to Service practices.
5. The switch may be returned to normal service conditions.

Maintenance

The M-Force switch is designed for long life in outdoor conditions. Certain preventative maintenance checks can be performed periodically to extend the life of the switch. These recommended maintenance inspections should be performed yearly, more frequently if located in an environment with pollution. Replacement parts are available from Eaton, if needed.

For additional information, refer to IEEE Std C37.35™-1995 standard, *IEEE Guide for the Application, Installation, Operation, and Maintenance of High Voltage Air Disconnection and Load Interrupter Switches*.

Control rods and mechanisms

- Inspect all connections and bolts for adequate torque and damage.
- Check that control handles do not have excessive play; adjust if necessary.

Mounting hardware

- Inspect all connections and bolts for adequate torque and damage.

Terminal pads

- Inspect terminals and pads to ensure all connections are tight and have no corrosion.
- If necessary, clean with approved solvent, apply approved contact grease, and retighten terminals to pads.

Switch motion

- Inspect all moving parts for corrosion and damage.
- Operate the switch three (3) times to ensure smooth motion of the controls, switch blades, and interrupters.
- If switch motion is not smooth, refer to the **Troubleshooting** section.

Reliabreak interrupter

- Inspect all Reliabreak interrupters for physical damage.
- Ensure that there is no corrosion or carbon deposits from arcing on the Reliabreak arm.
- Ensure the trip arms operate freely and properly during switch operation.

Blades and clip contacts

- Inspect all blades and clip contacts for physical damage.
- Ensure that there is no corrosion on the blades or clips.
- Ensure that there is no evidence of carbon deposits on the contacts.
- If necessary, adjust the blade position so that it is fully latched in the closed position.
- If necessary, relubricate contacts with an appropriate lubricant.

Troubleshooting procedures

Should any components of the M-Force switch need adjustments, follow the steps in this troubleshooting section. For further details, contact your Eaton representative.

Phase spacing

Measure the phase distances as shown on the switch drawing and confirm they are in agreement. If any of the phase spacing dimensions are off by more than 1", bring the unit down to the ground to adjust the spacing. Loosen the hardware under the phase base and move the phase unit to the proper position. Retighten the hardware and torque to 50 ft-lbs.

Closed position of blade

While the switch is in the closed position, check that all blades are fully latched into the clip contacts. When the blade is positioned correctly, it will be entirely within the contact walls. If the blade is not fully within the clip contacts, loosen the set screw and bolt securing the phase unit of that blade and reposition the blade. Tighten the bolt back to 20 ft-lbs.

While the blade is in the closed position, the top and bottom clip contacts should have equal compression distances. If the difference in compression between the top and bottom contact clip is more than 1/8", that means the blade is off center and should be adjusted. Loosen the bolts behind the clip contact brackets and move the contacts to the correct position. If the compression difference cannot be corrected, other potential causes include:

- the retaining ring on the spindle assembly of the moving insulator has become dislodged;
- the blade or connection has become bent; or
- the blade connection hardware has become loose.

If any of these are the root cause of the compression differences, the switch should be taken down from the pole in order to correct it. If further diagnosis is necessary, contact your Eaton representative.

Contact resistance

While in the closed position, the resistance value between the blade and clip should be less than or equal to 60 μΩ. Connect a resistance tester to the terminal pads and measure this resistance value. If it is higher than 60 μΩ, perform a few switch operations and measure again. If the value is still too high, contact your Eaton representative for diagnosis.

Note: If the switch has been stored outside for more than one year prior to installation, the resistance reading may appear higher than the recommended value. In this case, operate the switch several times and measure again.

Reliabreak positioning

Checking the trigger angle – At the closed position, slowly pull the Reliabreak operating rod until the mechanism spring is triggered. Stop at the point where the spring is triggered and check the angle of the rod position. That position should be 90°±10° from the starting position of the rod. If the trigger position is not within that tolerance, the Reliabreak unit should be replaced. When replacing the old unit with a new Reliabreak unit, check that the triggering position is correct.

Checking the closed position – At the closed position, pull the rod until it is in the open position as described in the "Checking the trigger angle" paragraph (approximately 100° from the starting position). Fully release the rod. The rod should snap back to the fully closed position. If it does not snap back to the fully closed position, it should be replaced by a new Reliabreak unit. Check that the new unit snaps back to the fully closed position.

Reliabreak arm

The Reliabreak Pick-up Arm, as shown in Figure 12, is insulated on one side, which isolates the interrupter from the current path during a close operation. This feature allows for a wide range of adjustments between the Reliabreak arm and the blade catch finger. This increased tolerance removes the possibility of misalignment during operation, which ensures proper load interruption.

IMPORTANT

Whatever adjustments are done to the Reliabreak, there must be at least a 0.125" (3 mm) gap between the Reliabreak arm and the edge of the trip rod. When properly adjusted, a 0.125" gap is typical. (See detail in Figure 24).

Reliabreak Arm Adjustment

1. Adjustments may be made by moving the Reliabreak arm in and out.

IMPORTANT

Do not bend the Reliabreak arm. A 0.125" (3 mm) minimum clearance gap must be maintained.

2. When properly adjusted, the distance from the radius to the tip of the Reliabreak arm is typically 300 mm (11.82").
3. Adjustments may be made by moving the trip rod in and out.
4. When properly adjusted, the distance from the edge of the blade to the center of the trip rod is typically 66 mm (2.58").
5. The Reliabreak arm housing may be rotated about the mounting pipe by a maximum of 127 mm (5.0") on the M-Force switch. The housing is typically perpendicular to the blade on 15 kV and 27 kV M-Force switches.

NOTICE

Equipment damage. Verify the Reliabreak arm is fully engaged with the trip rod during an equipment OPEN operation. Failure to comply may result in equipment damage.

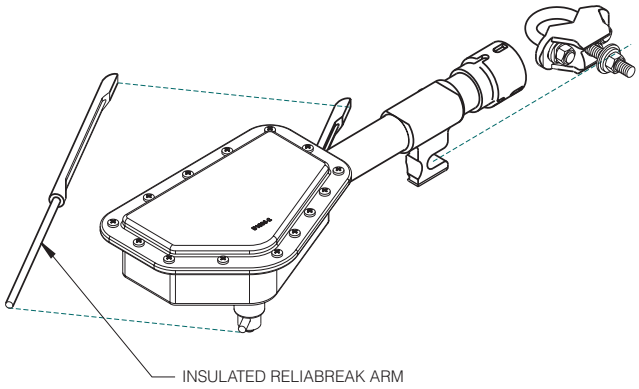

Figure 12. Exploded view of Reliabreak including insulated Reliabreak arm

Control mechanism/rod operation

After installation, operate the control rod/mechanism at least three (3) times to ensure the M-Force switch operates smoothly. Check that the handle base assembly is in the correct open and closed positions. When locking the handle closed or open, ensure that the position of the switch matches the position of the handle. If the control mechanism does not operate smoothly, check that all rod connections are those provided by Eaton and are installed and aligned properly.

Reliabreak Replacement Instructions

Replacing a Reliabreak unit with the offset mounting configuration (October 2016 - present)

1. Inspect the new Reliabreak unit. The Reliabreak trip arm will be factory-preset to 2". See Figure 13.
2. Remove the bolts securing the Reliabreak unit using a 9/16" socket or wrench. See Figure 14.
3. Remove the Reliabreak unit.
4. Line up the through-holes on the Reliabreak mounting arm with the threaded holes in the L-bracket.
5. Insert the bolts and tighten to 25 ft-lbs.
6. Loosen the bolts holding the catch on the switch blade until the catch slides back and forth. Do not remove the bolts completely. See Figure 15.
7. Insert the gauge (supplied) as shown in Figure 16 (the width of the gauge is 1.68").
8. Adjust the catch to the point that it holds the gauge in place.
9. Tighten bolt #1 to ensure the gauge is snug between the blade and the catch. See Figure 16.
10. Remove the gauge.
11. Tighten both bolts and torque to 20ft-lbs.
12. Close the switch and observe the operation of the Reliabreak unit per the instructions in "Guide to proper operation of a Reliabreak type interrupter" on page 16.

Figure 13. Check trip arm setting

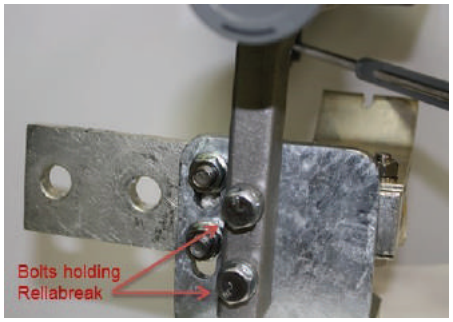

Figure 14. Remove the bolts securing the unit

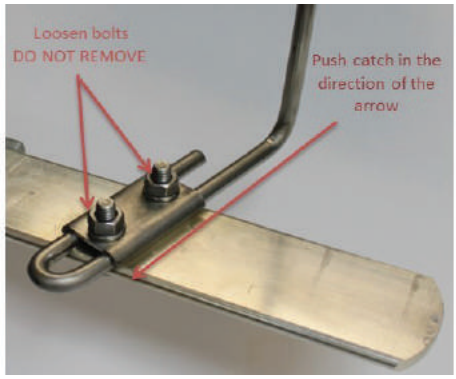

Figure 15. Loosen the bolts holding the catch

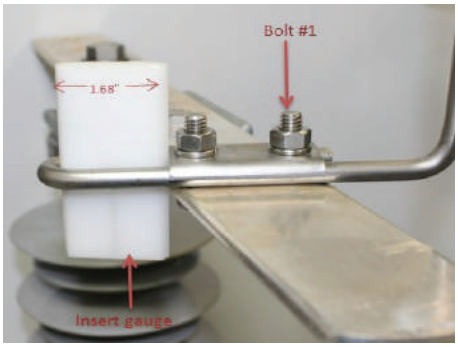

Figure 16. Adjust the catch and tighten the bolt

Replacing a Reliabreak unit with a U-bolt and mounting pipe configuration (pre-2015 version)

1. Loosen the nut as shown in Figure 17.
2. Slide the Reliabreak off the bolt. If the U-clamp has not been damaged, leave it in place.
3. Slide the replacement unit onto the bolt and torque the nut to 25 ft-lbs. See Figure 12.
4. Double check the adjustment per the instructions in "Guide to proper operation of a Reliabreak type interrupter" on page 16.
5. If the U-clamp has been damaged and requires replacement, loosen the two bolts and remove the clamp. Mark the location of the clamp on the pipe.
6. Attach the new clamp and torque to 25 ft-lbs.

Note: The casting must be located flush with the top of the pipe. See Figure 18.

7. Make adjustments per the instructions in "Guide to proper operation of a Reliabreak type interrupter" on page 16.

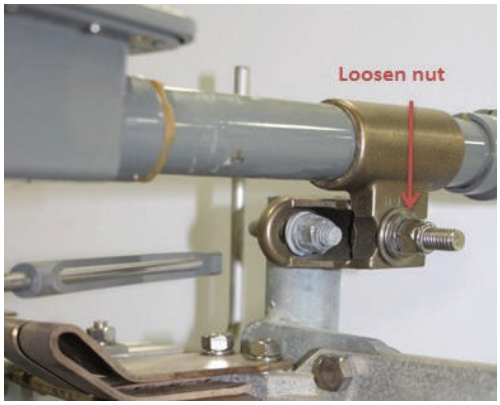

Figure 17. Loosen the nut on the Reliabreak

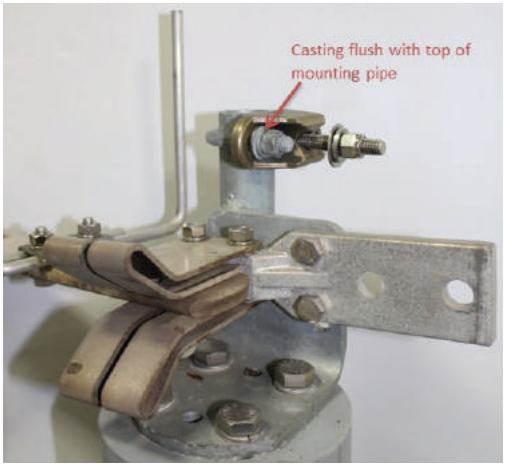

Figure 18. Attach the new clamp

⚠ DANGER

Hazardous voltage. Contact with hazardous voltage will cause severe injury or death. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.

Converting a shared bolt mounting to current offset mounting configuration (April 2015 - October 2016)

Note: To perform this replacement, the switch must be in the open position.

1. De-energize the switch on both the line and load sides.
2. Locate the bolts that connect the L-bracket to the insulator using two 3/8" bolts for 2-1/4" bolt center insulators (four 1/2" bolts are used for 3" BC insulators). See Figure 19.
3. Remove the bolts using a 9/16" wrench or socket for the 3/8" bolts (a 3/4" wrench or socket is required for the 1/2" bolts).
4. Lift and remove the entire Reliabreak/contact assembly.
5. Place the offset Reliabreak/contact assembly onto the insulator and secure with the existing bolts or bolts supplied in the Reliabreak kit. See Figure 20.
6. Torque the bolts to 25 ft-lbs. for 3/8" bolts or 50 ft-lbs. for 1/2" bolts.
7. Follow steps 6 through 12 in the "Replacing a Reliabreak unit with the offset mounting configuration" procedure on page 13.

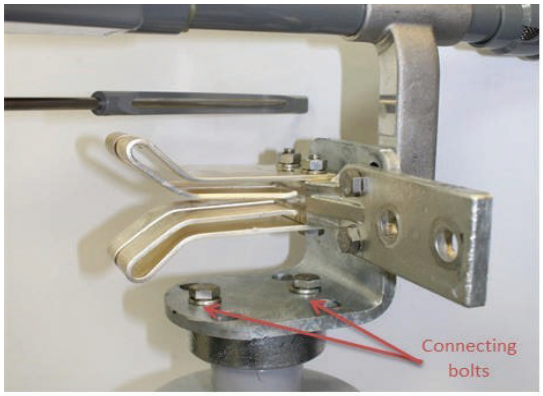

Figure 19. Locate the bolts

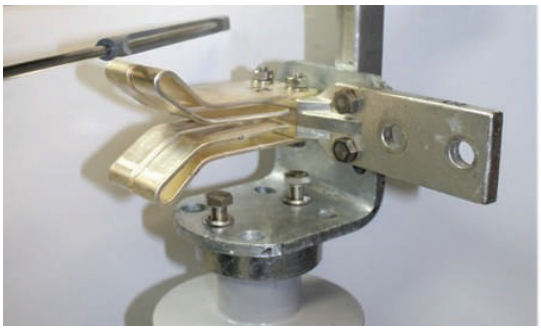

Figure 20. Replace the Reliabreak assembly

Converting the old U-bolt configuration to the new offset mounting configuration

Follow the steps in the "Converting a shared bolt mounting to current offset mounting configuration" procedure on page 15.

Guide to proper operation of a Reliabreak type interrupter

Pre-stroke

Before attempting to operate Reliabreak arm, make sure that the Reliabreak arm and trip rod are in a position so that when the trip rod begins its arcing motion, it will catch on the inside of the Reliabreak arm. Make sure that before the contacts separate from one another that the trip rod is in contact with the bare metal surface of the Reliabreak arm.

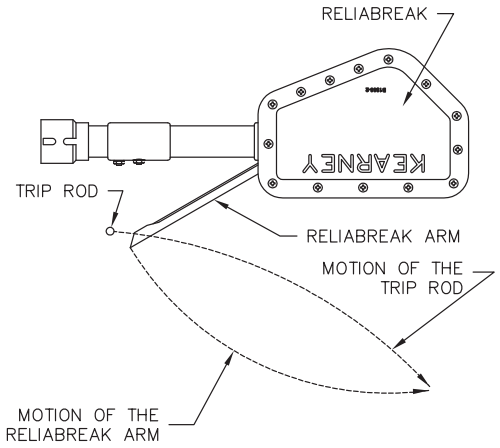

Figure 21. Reliabreak arm pre-stroke position

Mid-stroke (loadbreak)

Trip rod must contact the metal surface of the Reliabreak arm prior to the break of the contacts. From that point to when the Reliabreak breaks, the trip rod must remain in contact with the metal surface of the Reliabreak arm. At approximately 90°, the unit should break, indicated by the snapping sound coming from within the unit. See Figure 22.

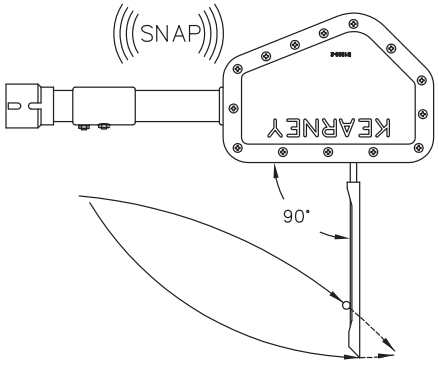

Figure 22. Reliabreak arm snap position

Release of arm

After loadbreak, the Reliabreak arm will travel approximately 10° past center. After this travel, the trip rod should become free and allow the Reliabreak arm to travel back to its resting position. The Reliabreak arm must snap back before the trip rod comes to a stop. See Figure 23.

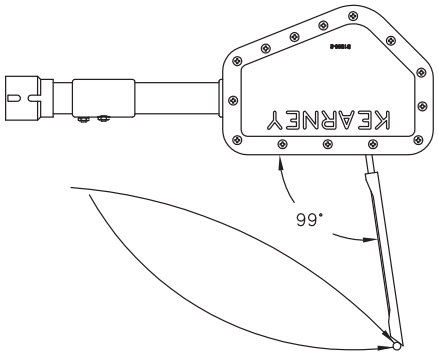

Figure 23. Trip arm full travel

Adjustments

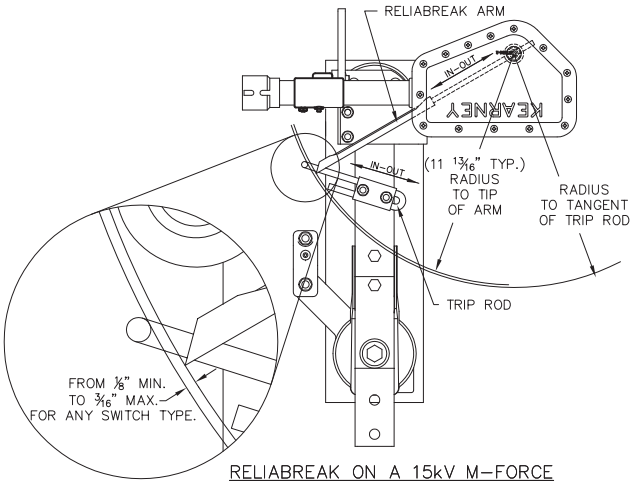

Figure 24. Adjustment dimensions

1/8" clearance gap

No matter what adjustments are done to the Reliabreak arm, there must be at least a 1/8" gap between the Reliabreak arm and the edge of the trip rod. When properly adjusted, a 1/8" gap is typical. See Figure 24.

Reliabreak arm

Adjustments may be made by moving the Reliabreak arm in and out. Do not bend the Reliabreak arm. 1/8" minimum clearance gap must be maintained. When properly adjusted, the distance from the radius to the top of the Reliabreak arm is typically 11-13/16".

Trip rod

Adjustments may be made by moving the trip rod in and out. Do not bend the trip rod. A 1/8" minimum clearance gap must be maintained between 1/8" and 3/16".

Trip arm return

When the trip arm returns to the closed position, it should hit the Reliabreak arm near the tip, travel past it, and return to the position stated in the "Pre-stroke" section on page 16.

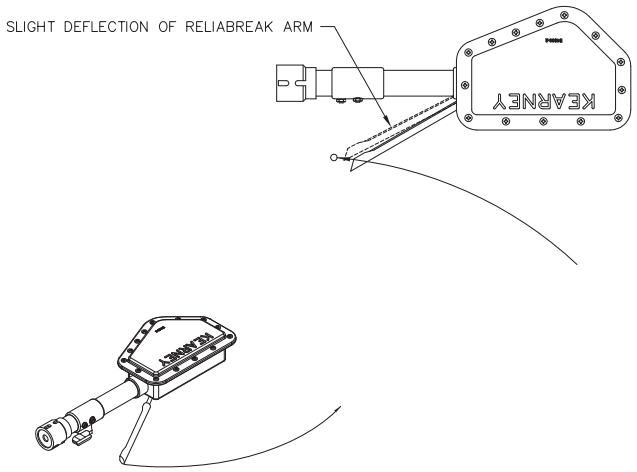

Figure 25. Trip arm path of travel

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