

Three-way cable interlock kit for Magnum drawout circuit breakers (Type 31 interlock)

⚠ WARNING

(1) ONLY QUALIFIED ELECTRICAL PERSONNEL SHOULD BE PERMITTED TO WORK ON THE EQUIPMENT.
 (2) ALWAYS DE-ENERGIZE PRIMARY AND SECONDARY CIRCUITS IF A CIRCUIT BREAKER CANNOT BE REMOVED TO A SAFE WORK LOCATION.
 (3) DRAWOUT CIRCUIT BREAKERS SHOULD BE LEVERED (RACKED) OUT TO THE DISCONNECT POSITION.
 (4) ALL CIRCUIT BREAKERS SHOULD BE SWITCHED TO THE OFF POSITION AND MECHANISM SPRINGS DISCHARGED.
 FAILURE TO FOLLOW THESE STEPS FOR ALL PROCEDURES DESCRIBED IN THIS INSTRUCTION LEAFLET COULD RESULT IN DEATH, BODILY INJURY, OR PROPERTY DAMAGE.

⚠ WARNING

THE INSTRUCTIONS CONTAINED IN THIS IL AND ON PRODUCT LABELS HAVE TO BE FOLLOWED. OBSERVE THE FIVE SAFETY RULES:

- DISCONNECTING
- ENSURE THAT DEVICES CANNOT BE ACCIDENTALLY RESTARTED
- VERIFY ISOLATION FROM THE SUPPLY
- EARTHING AND SHORT-CIRCUITING
- COVERING OR PROVIDING BARRIERS TO ADJACENT LIVE PARTS

DISCONNECT THE EQUIPMENT FROM THE SUPPLY. USE ONLY AUTHORIZED SPARE PARTS IN THE REPAIR OF EQUIPMENT. THE SPECIFIED MAINTENANCE INTERVALS AS WELL AS THE INSTRUCTIONS FOR REPAIR AND EXCHANGE MUST BE STRICTLY ADHERED TO IN ORDER TO PREVENT INJURY TO PERSONNEL AND DAMAGE TO THE SWITCHBOARD.

Section 1: General information

These instructions deal with the installation and operation of the Magnum three-way mechanical cable interlock (type 31). This mechanical interlock allows two specific breakers to operate independently of each other. Closing either breaker will hold the third breaker in the open (tripped) position. In addition, closing the third breaker will hold both of the other two breakers in the open (tripped) position. A lever assembly is mounted on each breaker that interfaces with the pole shaft and the tripper bar. The lever assemblies are interconnected with cables. Cable can be used for any orientation of the breakers, and are available in 5, 6, 8, and 10-foot lengths (1,5; 1,8; 2,4; and 3,0 m). Individual cable kits are ordered separately.

Required tools

- 10 mm socket and 1/4-inch drive socket
- 10 mm open end wrench
- 11/16-inch open end wrench
- 3/8-inch open end wrench (2)
- 0.5 mm feeler gauge
- 4 mm Allen wrench
- Drive extension
- Pliers

Kit parts identification

Refer to **Figure 1** and **Figure 2** for visual identification of the parts listed below:

Kit 1 (2A11857G03, shown in **Figure 1**): Interlock Assembly Kit

- (A) M6 x 12 mm hex bolt (nine)
- (B) M6 x 25 mm flat-head screw (three)
- (C) M6 lock washer (ten)
- (D) M6 x 16 mm hex bolt (six)
- (E) Drive arm (three)
- (F) M6 square nut (six)
- (G) Interlock assembly (three)
- (H) Grease tube (one)

Kit 2 (2A11858G01-G04, shown in **Figure 2**): Interconnecting Kit (includes cables)

- (I) Cable bracket (two)
- (J) M6 x 10 mm thread-forming screws (four)
- (K) Cable assembly (two) - in 5-, 6-, 8-, or 10-foot lengths (1,5; 1,8; 2,4; or 3,0 m)

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Note: Two sets of kit 2A11858G01, G02, G03, or G04 (total of four cables) are required for this installation.

Note: Parts (D) and (F) are not used for this installation.

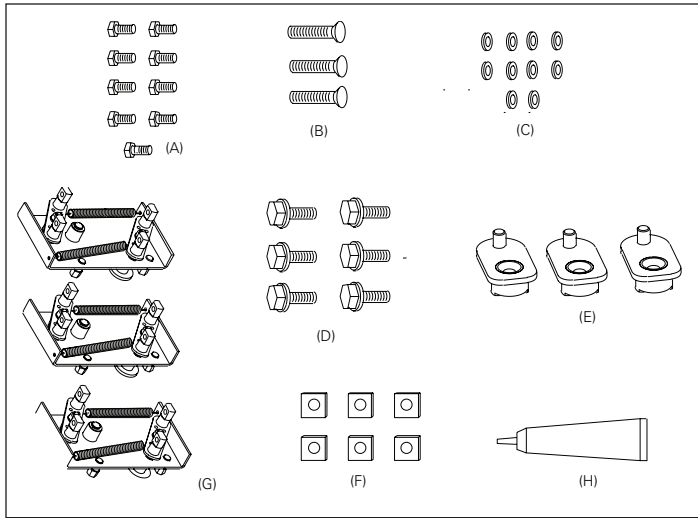


Figure 1. Contents of Kit 1

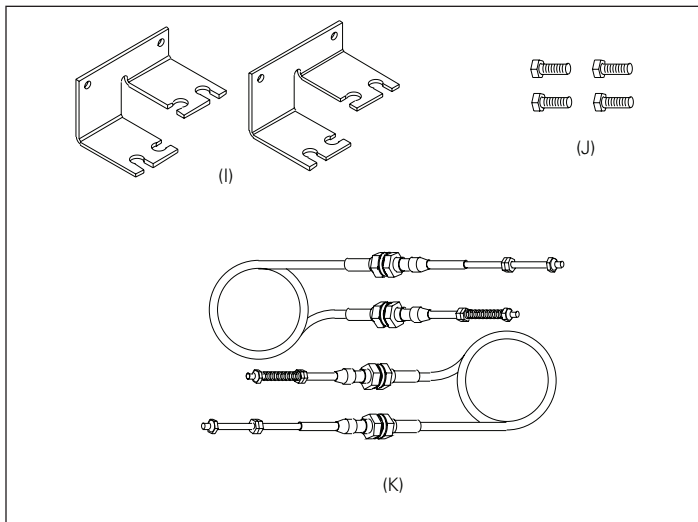


Figure 2. Contents of Kit 2

Section 2: Installation of three-way cable interlock

Proceed with the following 12 steps.

Step 1: Remove the front cover by unscrewing the hex-head captive bolts (four for three-pole, six for four-pole) that join the cover to the breaker housing using a 10 mm 1/4-inch drive socket. Then hold the charge handle down approximately 45 degrees to pull off the cover.

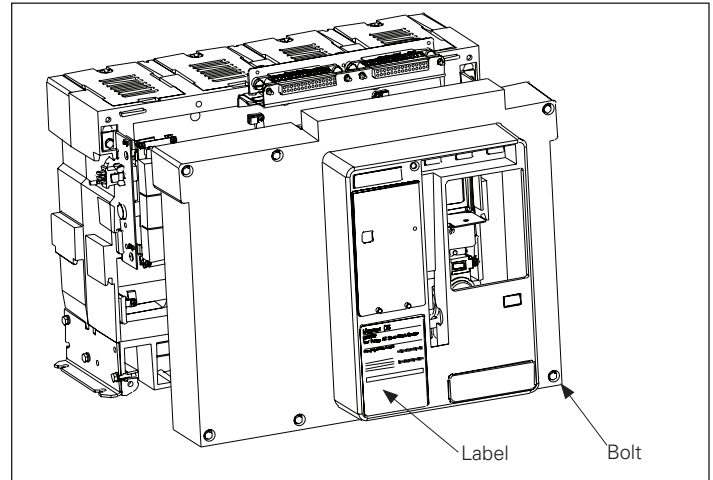


Figure 3. Step 1

Step 2: Remove the knockout (a U-shaped tab) from the right side of the front cover using pliers. Carefully file any excess material from the broken edge.

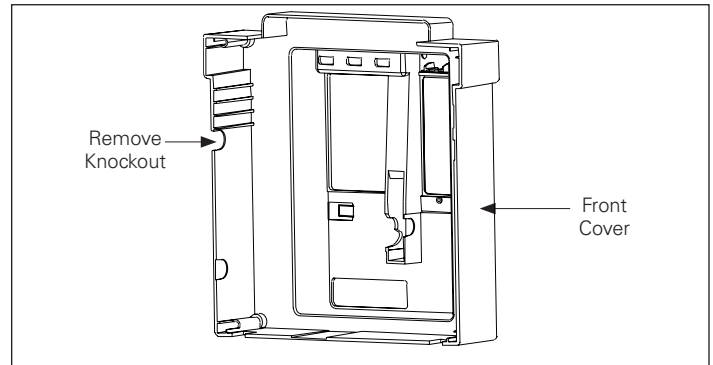


Figure 4. Step 2

Step 3: Install drive arm (E) to the right end of the pole shaft using an M6 x 25 mm flat-head screw (B) and 4 mm Allen wrench. The drive arm should be oriented as shown. Torque to 65-85 in-lbs (7,3-9,6 Nm).

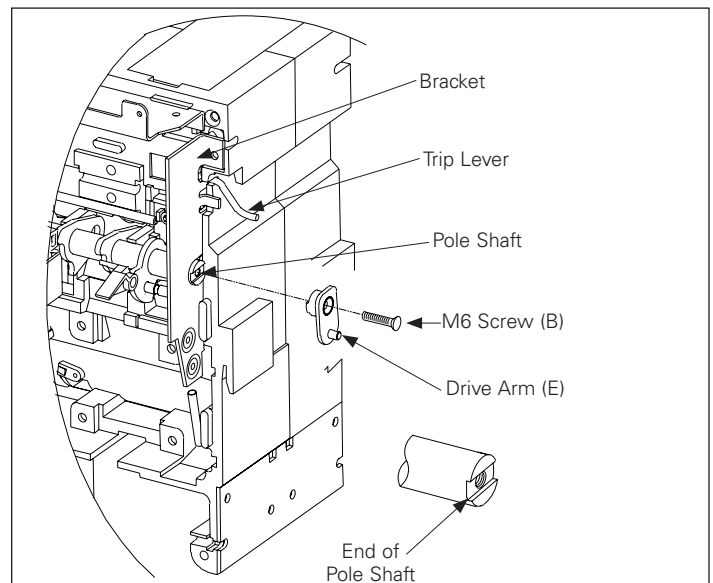


Figure 5. Step 3

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Step 4: Reinstall front cover (removed in **Step 1**). Perform **Steps 1 to 4** for each breaker.

Step 5: Fasten the interlock assembly (**G**) to the drawout cassette's right-side sheet as shown, using three M6 x 12 mm hex bolts (**A**) and lock washers (**C**). Torque to 40–50 in-lbs (4,5–5,6 Nm).

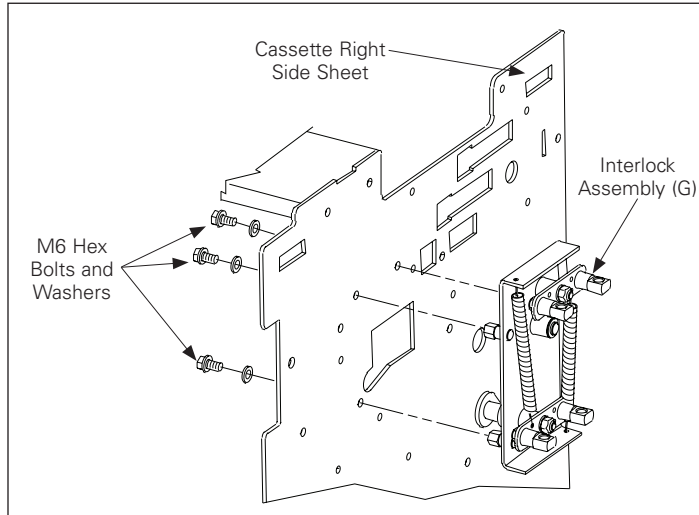


Figure 6. Step 5

Step 6: Fasten the cable bracket (**I**) to the drawout cassette's right-side sheet (below the interlock assembly installed in **Step 5**) as shown, using two M6 x 10 mm thread-forming screws (**J**). Torque to 65 – 85 in-lbs (7,3 – 9,6 Nm). Perform **Steps 5 to 6** for each breaker.

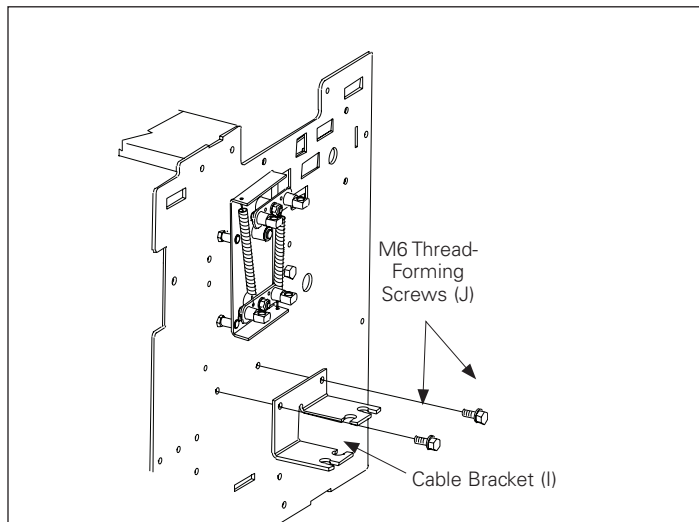


Figure 7. Step 6

Step 7: Check the functionality of the interlock assemblies by performing the following three checks. Refer to **Figure 8**:

Check 1:

- Fully insert the breaker into its cassette to the CONNECTED position.
- Make sure the drive arm (**E**) and the interlock assembly's inner trip arm pass clearance. The teardrop-shaped follower arm of the interlock assembly should engage with the pin on the drive arm. The inner trip arm of the interlock assembly should engage with the tripper bar of the breaker.
- Perform this check for each breaker.

Check 2:

- With the breaker still CONNECTED and OPEN, observe the position of the DRIVE (LOWER) LEVER. The gap between the lower right-hand corner of the drive lever and interlock assembly flange should be 0 – 4 mm (see **Figure 8, BREAKER OPEN**).
- Now charge and CLOSE the breaker, and the drive lever should rotate 60 degrees counterclockwise. The gap between the lower left-hand corner of the drive lever and the interlock assembly flange should be a 1 – 7 mm (see **Figure 8, BREAKER CLOSED**).
- If either of these gaps is out of specification, DO NOT CONTINUE THE INSTALLATION. Consult Eaton for additional instructions. To reach an EatonCare representative, call (877) 386-2273.
- Perform this check for each breaker.

Check 3:

- This check is for the function of the DRIVEN (UPPER) LEVER and the TRIPPER BAR on each breaker. With the breaker OPEN, the upper left-hand corner of the driven lever should be held in contact with the interlock assembly flange by the return spring, and the inner trip arm that operates the tripper bar should protrude a few millimeters beyond the right edge of the interlock assembly.
- With the breaker CLOSED, grasp and slowly rotate the driven lever counterclockwise. After about 30 degrees of rotation (lever approximately horizontal), the breaker should trip. If the breaker does NOT trip before the upper right-hand corner of the driven lever is within 3 mm of the interlock assembly flange, the driven lever and/or tripper bar are out of specification. If this is the case, DO NOT CONTINUE THE INSTALLATION. Consult Eaton for additional instructions. To reach an EatonCare representative, call (877) 386-2273.
- Perform this check for each breaker.

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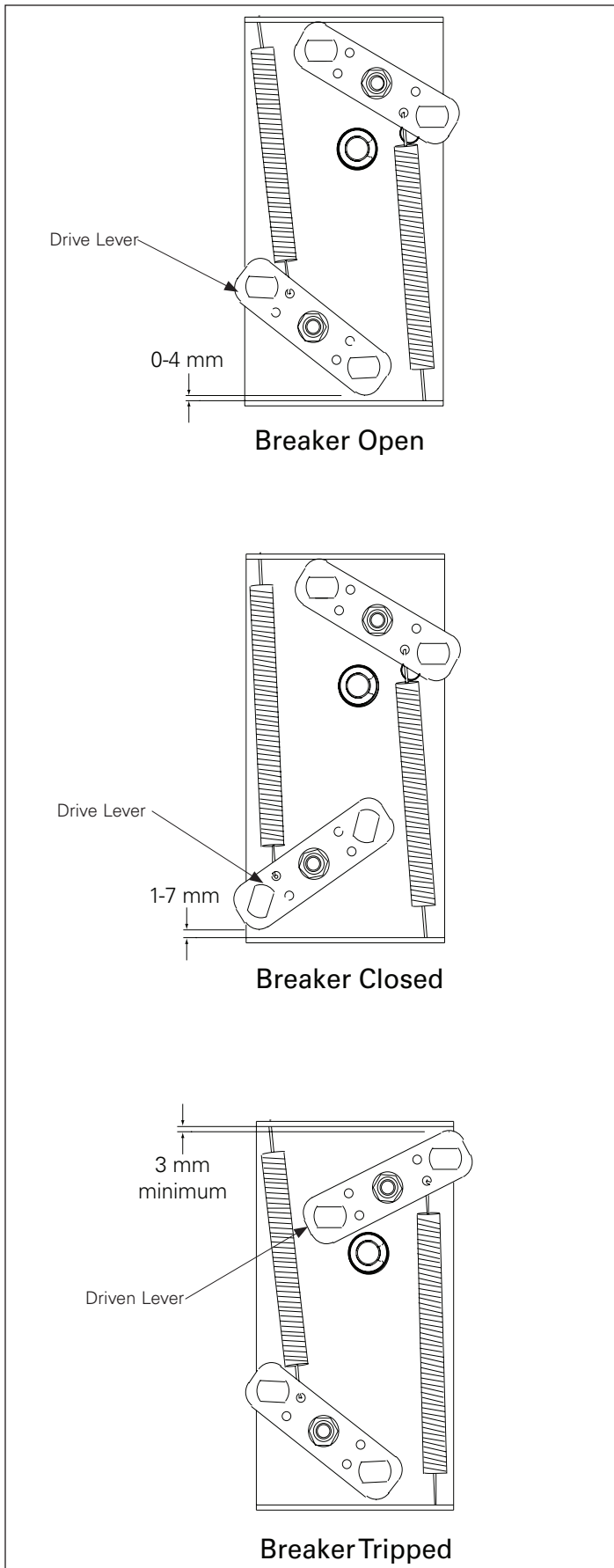


Figure 8. Step 7

Step 8: This step will prep the cables before they are attached to the interlock assemblies. Check to be sure that all cables move freely in their cable housing. Each cable should have a long rod end and a short rod end. To perform the cable prep:

1. Remove the upper lock nut and spacer tube from both rod ends.
2. Remove the compression spring from the short rod.
3. Two loose nuts should be positioned on the threads of each rod. Shoulder the lower nut against the end of the rod threads until the nut stops. Using two 3/8-inch wrenches, tighten the upper nut against the lower nut (see **Figure 10**).

Repeat the above process on both long and short rods on any given cable.

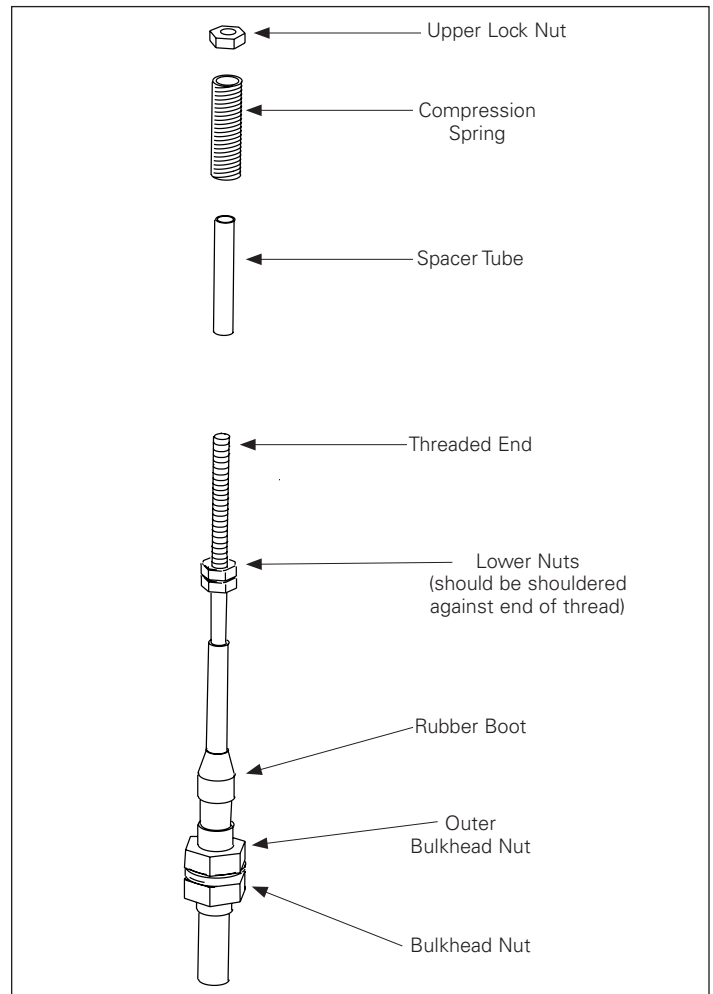


Figure 9. Step 8 - Cable Assembly

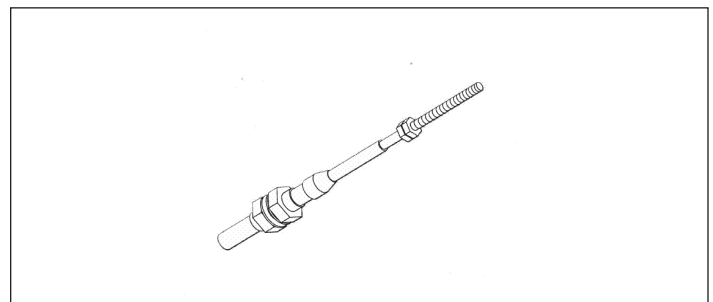


Figure 10. Step 8 - Cable Prep

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Step 9: This step describes how to route the cables between breakers. Each breaker should be in the OPEN and DISCHARGED position. When routing cables, adhere to the following recommendations:

- 4 inch (102 mm) minimum allowable cable housing bend radius and minimal number of total bends
- Use plastic wire ties/clamps to attach cable housing to the structure after installation and adjustment
- Do not compress cable housing
- Recheck to ensure cables move freely

Refer to **Table 1** and **Figure 11** for installation details. Routing the cables in this way will allow Breakers **1** and **3** to close independently of each other. Closing Breakers **1** and/or **3** holds Breaker **2** tripped. In addition, closing Breaker **2** will hold BOTH **1** and **3** tripped.

Table 1. Cable Routing

Type 31 (Four Cables)	
From Cassette/ Fitting	To Cassette/ Fitting
—	—
1C	2B
2A	1D
2C	3B
3A	2D
—	—

Step 10: This step describes how to attach the cables to the interlock assemblies. Each breaker needs at least one long rod and one short rod attached. The short (drive) rods will be attached first.

1. Slide the rubber boot toward the tip of the rod.
2. Unthread the outer bulkhead nut and slide the nut and lock washer upwards.
3. Slide the smaller diameter portion of bulkhead fitting in to the slot on the cable bracket (see **Figure 12**).
4. Raise cable assembly until threads of the bulkhead fitting show above the slotted hole in the bracket (see **Figure 12**).
5. Insert threaded end of rod into its swivel fitting.
6. Bring the bulkhead washer and nut down to the threads and hand-tighten.
7. Adjust the two bulkhead nuts to approximately center the fitting on the slot. Hand-tighten.
8. Replace the rubber boot over end of fitting.
9. If short rod is in Position **A** (see **Figure 11**):
 - a. Lower threaded rod tip back through swivel.
 - b. Replace spacer tube and compression spring on rod end before sliding the rod tip through the swivel fitting of the lower lever. To aid in sliding the rod tip upwards, grip the nuts that were tightened in **Step 8**.
10. If short rod is in Position **C** (see **Figure 11**):
 - a. Replace spacer tube on rod end.
 - b. Replace compression spring on rod end.
 - c. Manually compress the compression spring to replace the lock nut.
11. Replace the lock nut on the rod end.
12. Hold the nuts that were tightened in **Step 8** with pliers and use a 3/8-inch socket or a 3/8-inch open-ended wrench to tighten the lock nut until it touches the spacer tube. Torque to 30-40 in-lbs (3,3-4,5 Nm).

Next, the long (driven) rods will be attached. The long rods are attached in the same way as the short rods except they do not use compression springs.

Repeat the above processes for all cable ends. At the end of cable installation, the breakers should still be in the OPEN position.

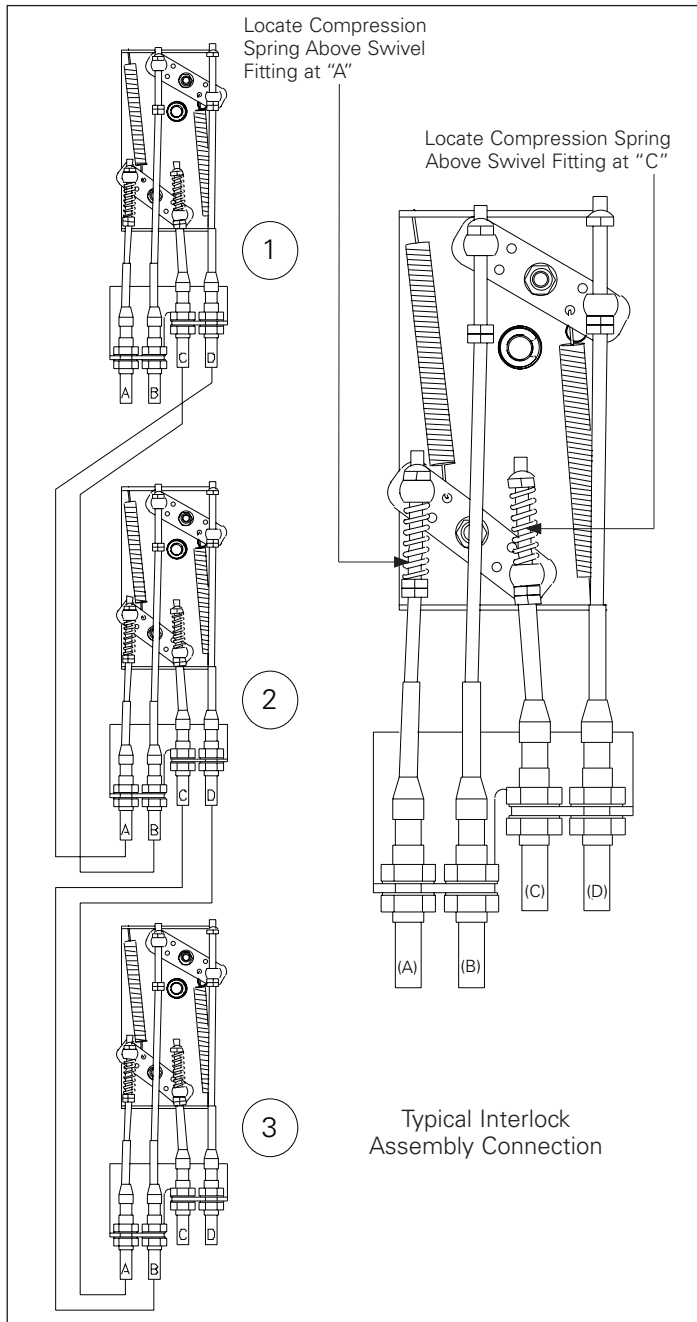


Figure 11. Step 9

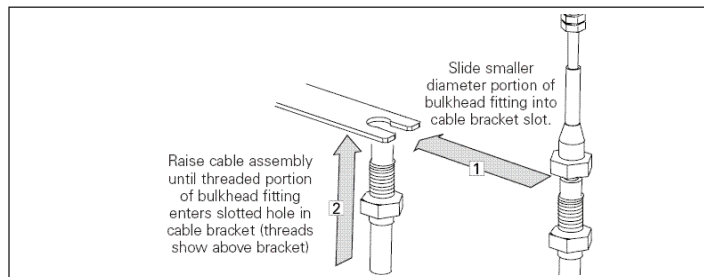


Figure 12. Step 10

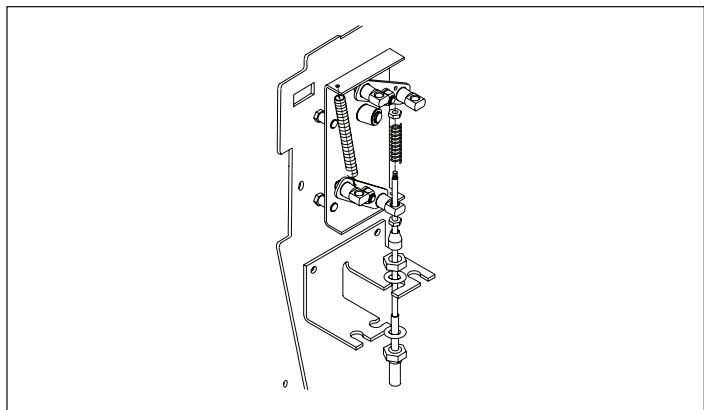


Figure 13. Step 10 - Short Rod Assembly (Position C)

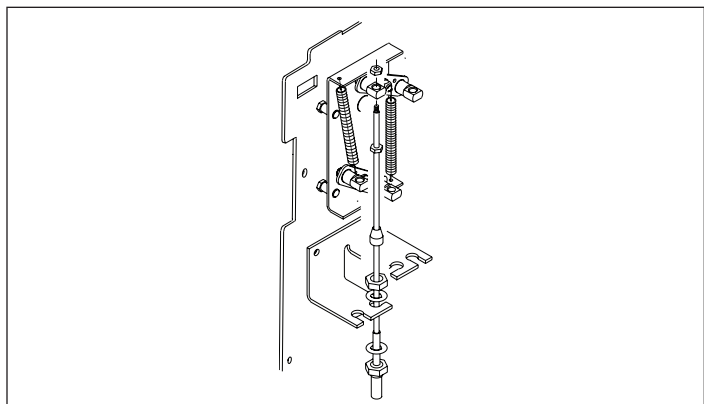


Figure 14. Step 10 - Long Rod Assembly (Position B)

Step 11: This step describes how to adjust the cables. Adjustment should be performed with the large bulkhead nuts **ONLY** and with all breakers **OPEN**. Ensure bulkhead fittings are still approximately centered on their slot. Secure cables by snugly tightening bulkhead nuts with an 11/16-inch wrench.

Perform initial adjustments on driven long rod of cable.

For driven (long) rods in Position **B** (see **Figure 15**): There should be a small (0.0 – 0.5 mm) clearance between the rod nut and the face of the swivel on which it pulls.

For driven (long) rods in Position **D** (see **Figure 15**): There should be a small (0.0 – 0.5 mm) clearance between the nuts that were tightened in **Step 8** and the bottom of the swivel on which they push.

Too much clearance: adjust both bulkhead nuts to retract cable housing.

No clearance: advance cable housing in a similar manner.

For additional adjustment length: use bulkhead nuts on other end of cable.

When the proper clearance is attained on the driven end, tighten the cable head nuts on both ends to a torque of 100 – 120 in-lbs (11 – 13 Nm).

Note: If experiencing difficulty or operating in a confined space, consider using an 11/16-inch flare nut crowfoot wrench drive to perform adjustments.

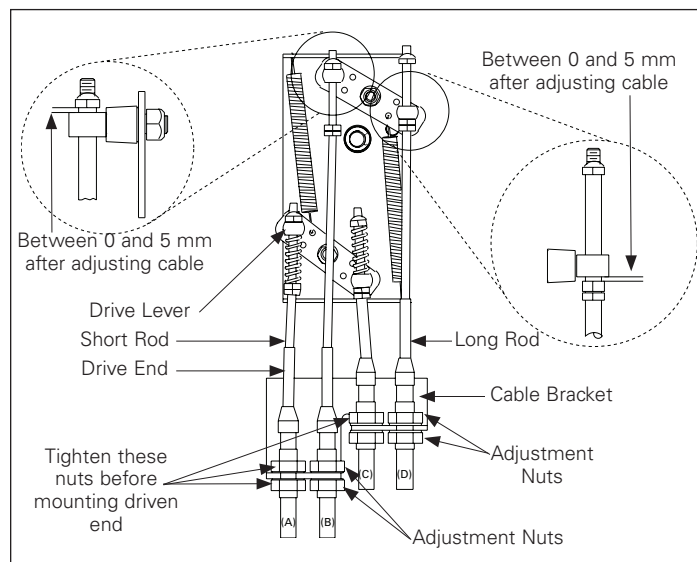
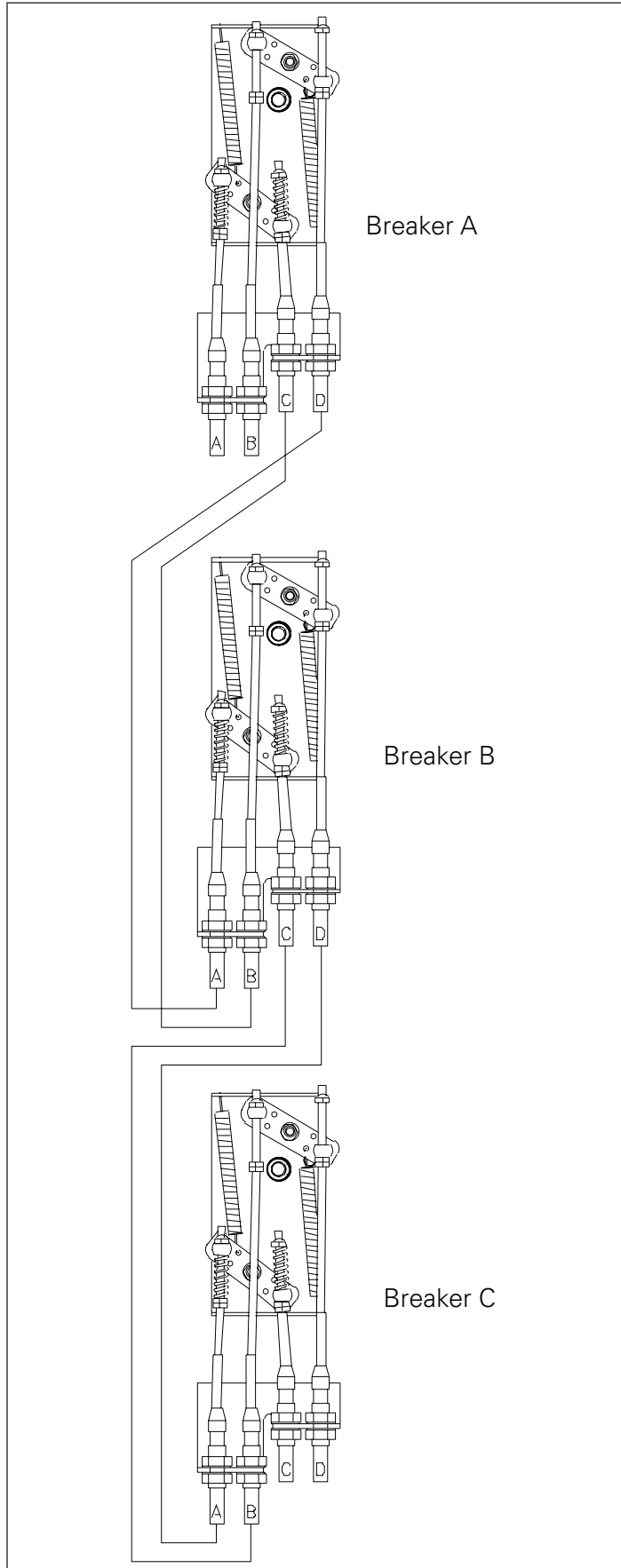


Figure 15. Step 11

Step 12: The final step is to test the interlock assembly to verify that it conforms to all states in **Table 2**. Perform the following functional tests:

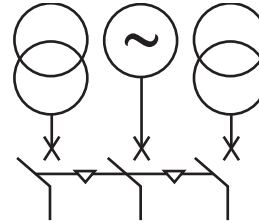
- CHARGE and CLOSE Breaker **A**. Breaker **B** should be held in the OPEN condition. Inspect the driven lever on Breaker **B**. The upper right-hand corner of the lever should be within 5 mm of its stop (the interlock assembly flange). CHARGE and attempt to CLOSE Breaker **B**, and verify that it does not respond to the CLOSE attempt (no noise, no spring discharge, no contact motion). If the breaker does not respond as described, review **Steps 3 through 12**.
- CHARGE and CLOSE Breaker **C**. Verify that Breaker **A** remains CLOSED. Again verify that Breaker **B** will not respond to a CLOSE attempt.
- OPEN Breaker **A**. Verify again that Breaker **B** will not respond to a close attempt.
- OPEN Breaker **C**—(all breakers now OPEN)—then CLOSE Breaker **B**. Inspect the driven levers on Breakers **A** and **C** to verify that the upper right-hand corner of the lever is within 5 mm of its stop (the interlock assembly flange). Verify that both Breakers **A** and **C** will not respond to a CLOSE attempt after charging.
- OPEN and discharge all breakers and the interlock should release.

Note: If the breakers don't respond as described, review Steps 3 through 12.



The mechanical interlock is now installed and is functioning properly. If some interlock parts are sticky, use a light amount of the lubricant grease **(H)** to reduce the friction. This is **ONLY** recommended if needed.

Table 2. Step 11 Logic



Type 31 (Four Cables)		
A	B	C
0	0	0
1	0	0
0	1	0
0	0	1
1	0	1

Figure 16. Step 12

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