



## Installation Instructions for Multi-Bottle Monoruptr(r) Vacuum Interrupters

Thank you for purchasing a SEECO Monoruptr® vacuum interrupter. We are pleased to be able to provide this product to you, and we believe that it will meet or exceed your performance expectations. We appreciate all comments with regard to our product, and welcome any suggested modifications to the design or installation procedures which would better suit your future application needs.

The following pages provide a generalized, step-by-step descriptive procedure for the field installation and adjustment of SEECO-style multi-bottle vacuum interrupters. This procedure covers many of the most common configurations, however it cannot cover all details or every variation in equipment. **As you review the installation instructions, please refer to the accompanying drawings for the complete bills of material with quantities, locations and adjustment parameters for the specific interrupter being installed. These instructions are intended to complement the drawings provided and are not a replacement or substitute for the drawings.**

A word about safety: These instructions are general guidelines and should not supercede your organization's own work and safety procedures. These guidelines must always be interpreted in light of the specific workplace or site conditions, personnel experience and equipment capability.

If at any point during the installation process you have questions or need additional information or assistance, you are encouraged to call us at 704-392-1396. We welcome the opportunity to assist you.

### I. SUGGESTED TOOLS AND EQUIPMENT

1. 12" Adjustable Wrench
2. 3/8" Open-End Wrench
3. 1/2" Open-End Wrench
4. 9/16" Open-End Wrench
5. 3/4" Open-End Wrench
6. 1/2" Drive Ratchet
7. 3/8" Socket
8. 1/2" Socket
9. 9/16" Socket
10. 3/4" Socket
11. Tape Measure
12. Lineman Pliers
13. Round (Rat Tail) File

### II. RECEIVING, STORAGE AND UNCRATING

#### A. Receiving

Each three phase set of interrupters is typically shipped in a single (large) crate. Depending on the material ordered, a second smaller crate of blade clamps and auxiliary contacts may accompany the larger interrupter crate. **All material should be checked against the accompanying bill of lading when the interrupter set is received. Confirm that the number of shipping units (crates) received exactly matches the number of shipping units on the bill of lading.**

**All interrupter crates must also be visually inspected for physical damage.** If physical damage is apparent or suspected, you must file a claim immediately with the transportation company and notify your SEECO representative. Physical damage is indicated by leaking interrupters (oil on exterior surface of the interrupter column), broken or bent trip arms, broken welds on u-tube arms, bent u-tubes, or any other abrasions, scratches or deformation to the surface of the interrupter units. In the absence of visible damage to the



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interrupter units, hidden damage may be indicated by crating lumber that is broken or cracked, crating members that have pulled away from the main crate, missing members or torn shrink wrap, all of which may be indications of rough or inappropriate handling by the transportation company. If you suspect hidden damage we advise you to note this on the bill of lading before the driver has departed your location.

**Please note that the responsibility to determine if a shipment is complete and without damage rests with you and your organization. Failure to identify shortages or transit damage at the time the material is delivered may compromise your claim with the transportation company and result in the material being replaced at additional cost to your organization.**

### B. Storage

Material may be stored outdoors. All interrupter units should be left in their original shipping containers until ready for use. Please exercise care in handling and storage as interrupter units are easily damaged. Damage due to rough handling is not covered under warranty and will be corrected at additional cost.

### C. Uncrating materials at the job site

1. Do not remove the interrupter units from their crate (image 1) until each interrupter is to be mounted to the corresponding installed single phase assembly. Both when crated and uncrated, interrupter units are to be kept upright at all times. **Failure to keep the interrupter unit upright may cause some of the dielectric oil to leak out of the top of the unit and may void the warranty.**
2. The mounting hardware for each interrupter unit is included in a plastic bag, which is stapled to the wooden pallet at the base of each interrupter column. Do not remove the hardware from the plastic bag at this time.
3. An installation drawing, with accompanying bill of material and adjustment dimensions, is provided in a sealed black plastic bag, which is secured (taped) to one of the interrupter unit u-tube arms. The sealed bag also includes instructions for hi-potting the interrupter. Please locate the black plastic bag and review the drawing before proceeding with installation.

## III. HI-POT PROCEDURE

### A. Each interrupter unit is fully hi-pot tested prior to shipment.

1. It is not normally necessary to repeat this test unless you suspect that damage has occurred in-transit. If you suspect damage we recommend that you hi-pot test prior to installation to confirm the condition of the interrupter unit.
  - a. A copy of SEECO's suggested hi-pot test procedure is included in the sealed bag containing the installation drawing. **Note: This procedure is offered as general guidance and should not supersede your organization's own work and safety procedures.**
  - b. In place of the complete hi-pot test, a continuity test of each vacuum bottle in both the closed and open contact position may be substituted if there is no visible external damage to the interrupter unit.
  - c. A hi-pot test is the only absolute way to confirm the integrity of the vacuum bottles. Please contact SEECO for guidance if there is doubt about the appropriate use of a continuity test vs the more complete and definitive hi-pot procedure.



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2. Each organization will have its own policy for routine hi-pot testing of newly received interrupter units. Please refer to your own policy for guidance in this situation.

### IV. LIFTING INTERRUPTER UNITS

#### A. Safety

1. The procedures provided here for lifting the interrupter units are suggested guidelines only and should not replace or supercede the customer's own work and safety procedures. These guidelines must always be interpreted in light of specific site conditions, personnel experience and equipment capability.
2. Slings, cables, ropes, hoists and chain falls must all be properly rated for the weight of the lifting load. For reference: a three bottle interrupter weighs approximately 100 lbs per individual unit; a four bottle interrupter weighs approximately 125 lbs per individual unit. Contact SEECO for confirmation if you are unsure of the weight of the interrupter units.
3. If the interrupter is provided with the switch, the interrupter units should be lifted separately from the single phase switch units. Do not attempt to mount the multi-bottle interrupter to the single-phase switch unit on the ground.

#### B. Proper Location of the Sling

1. Aluminum channel spacers with yellow discard labels are provided to secure the interrupters during shipment. These are a shipping convention only and must be removed before securing the sling. The lock-washers and nuts that secure the channel spacers to the "head" of the interrupter may also be discarded. Do not remove or discard the hex head machine screws.
2. Carefully wrap the sling around the top fiberglass tube immediately below the flat plate of the interrupter "head" (image 2). Pull the sling up as close to the under side of the flat plate as possible before tightening the sling around the fiberglass housing.
3. **Do not attempt to lift the interrupter by the horizontal u-tube arms (image 2); the arms are not a lifting point.**
4. Note: Always maintain the interrupter in an upright and vertical position. Do not lay interrupter horizontal or at an angle. Failure to keep the interrupter upright may damage the device and void the warranty.
5. Attach a hand line to the interrupter (image 2) to provide stability while lifting.

#### C. Lifting and Mounting the Interrupter Units

1. The mounting hardware is located in a plastic bag which is stapled to the wooden pallet at the base of each interrupter column. Line personnel will need the hardware bag to attach the interrupter unit to the mounting plate (copper casting) on top of the stationary pedestal insulator. One bag is provided per interrupter unit and includes three 1/2" stainless steel hex head machine bolts and lockwashers.
2. With the sling and hand line properly located, support the weight of the interrupter unit with the sling and then remove the lag screws that secure the tripod base to the wooden pallet.
3. Lift the interrupter unit slowly and in a smooth, controlled fashion. Avoid jerky or violent movements that may damage the interrupter.



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Image 1

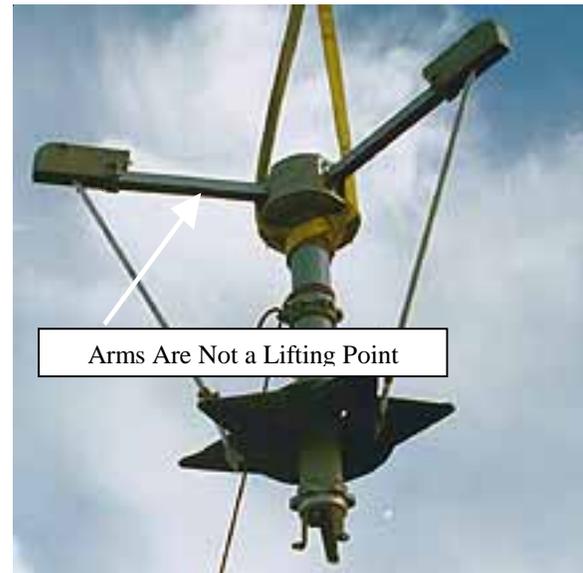


Image 2



Image 3

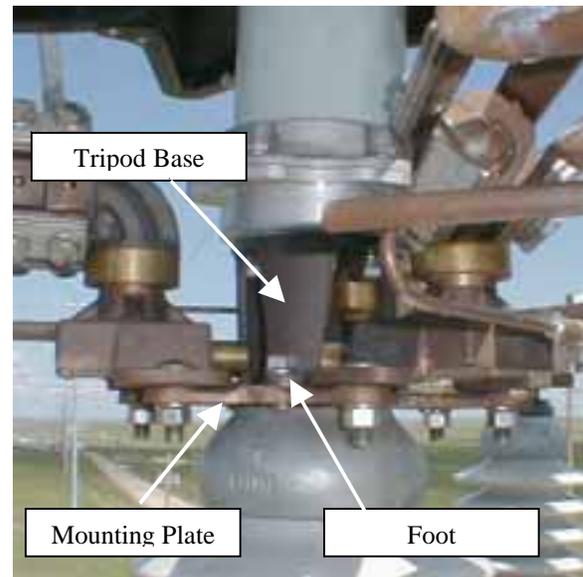


Image 4

4. Unless equipment and circumstances dictate otherwise, it is typically more advantageous to mount the first interrupter unit on the bottom phase switch, the second interrupter unit on the middle phase switch, etc. (image 3). This reduces the possibility of the crane boom and cable being obstructed by the interrupter units of the above phases if they were installed in a different sequence.
5. Orientation of the interrupter unit in the installed position is indicated by the u-tube arms (image 5), which extend from the “head” of the interrupter. The arms always point away from the pole structure and in the direction of switch opening. The interrupter unit has a tripod base with three feet that align with matching tapped holes on the mounting plate of the stationary pedestal insulator (image 4). Lift the interrupter unit into position with the u-tube arms oriented outward from the switch and structure and then locate the three tapped holes closest to each foot.



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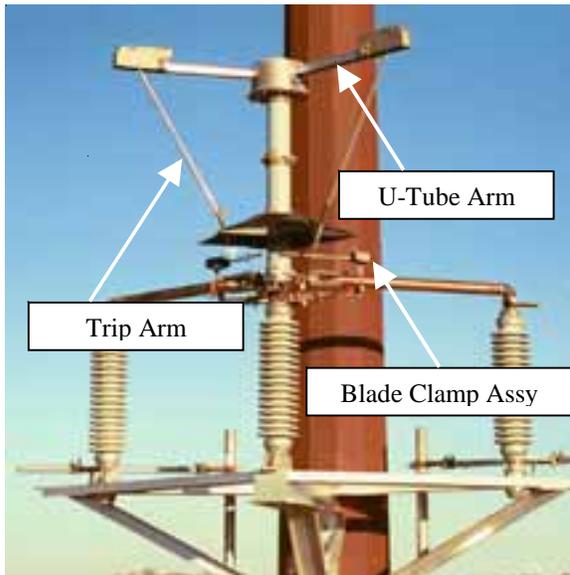


Image 5

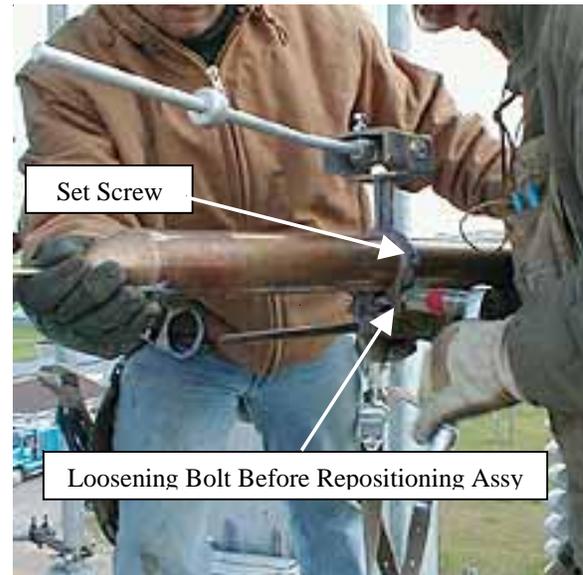


Image 6

To confirm that the orientation of the interrupter unit is correct, visually confirm that each blade clamp assembly (image 5) will engage a trip arm when the switch is opening. If orientation is incorrect, one or more blade clamp assemblies will not engage a trip arm during switch opening.

6. When bolting the interrupter to the mounting plate, it is often helpful to partial tighten only the first two 1/2" hex head machine bolts; this will allow for some adjustment or play when locating and tightening the third bolt.

### V. BLADE CLAMP AND AUX MOVING CONTACT ADJUSTMENT

Blade clamp assemblies (image 5) are provided to engage the interrupter unit trip arm (image 5) in the opening direction of switch operation. The aluminum pick-up rod of the blade clamp assembly catches the trip arm and pulls the arm out to the required point of interruption.

For interrupter units ordered and shipped with switches, the blade clamp assemblies are shipped mounted to the blades. For interrupter units ordered and shipped for addition to an existing switch, the blade clamp and auxiliary contact assemblies are shipped in a separate crate.

#### A. Position the Assembly

1. If shipped mounted to the blade, the blade clamp assembly is located back (retracted) from its proper position to protect the aluminum pick-up rod from damage in transit (image 6). You will need to slide the assembly forward to its proper position. This is most easily accomplished with the blade in the partially open position.
  - a. Loosen the single square head set screw on the side of the blade clamp, then loosen the 1/2" stainless steel hex head machine bolt located on the dog ear of the clamp (image 6) and slide the assembly forward to its proper position.
  - b. The clamp may be compressed tightly around the blade; if so, rock the clamp assembly from side to side as you slide it toward the tip of the blade.



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Image 7



Image 8

2. Position the blade clamp six inches from the tip of the blade (image 7). This dimension is measured from the longest point of the beveled end of the blade to the closest point of the blade clamp.
3. The orientation of the clamp assembly must be kept as vertical as possible (image 8). Do not let the assembly rotate around the axis of the blade. For reference, the vertical "stem" of the blade clamp must be in the 12 o'clock position if the cross section of the blade were viewed as the face of a clock.
4. Confirm that the set screw has been backed off; do not tighten the 1/2" bolt if the set screw is in contact with the blade.
5. Confirm that the auxiliary moving contact (horizontal copper rod) is parallel to the blade (image 8). If necessary adjust the moving contact to achieve the parallel condition. Adjustment is made by pivoting the contact up or down; it may be necessary to loosen the 1/2" bolt at the blade clamp dog ear.
6. Tighten the 1/2" bolt on the dog ear of the clamp.
7. Now tighten the set screw (image 8). It is not necessary to pierce the blade tube; simply turn the set screw until resistance is felt (contact with the tube) then tighten an additional two or three turns.

### VI. AUX STATIONARY CONTACT ADJUSTMENT

Auxiliary stationary and moving contact assemblies (image 9) are provided to protect the main blade and jaw contacts during the closing operation of the switch. The auxiliary contacts pickup the circuit before the main contacts so that any pitting or burning is limited to these more easily replaced and less costly components. They are also utilized during switch opening to properly sequence the transfer of current from the main contacts to the aluminum pick-up rod and interrupter trip arm.

For interrupter units ordered and shipped with switches, the stationary contact assemblies are shipped mounted to the jaw contacts. For interrupter units ordered and shipped for addition to an existing switch, the stationary contact assemblies are shipped in a separate crate.



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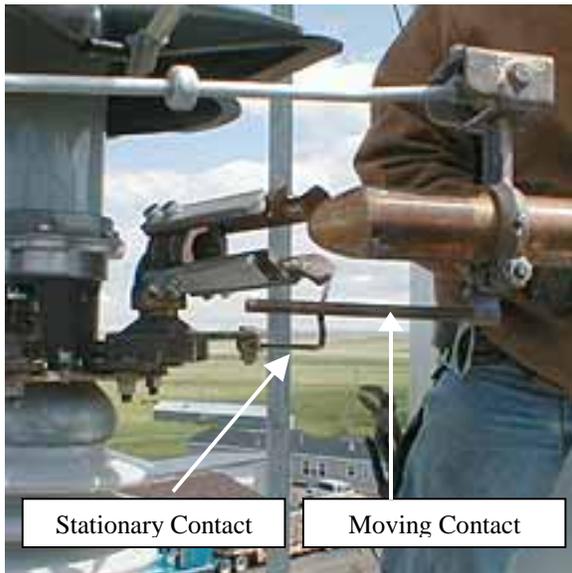


Image 9

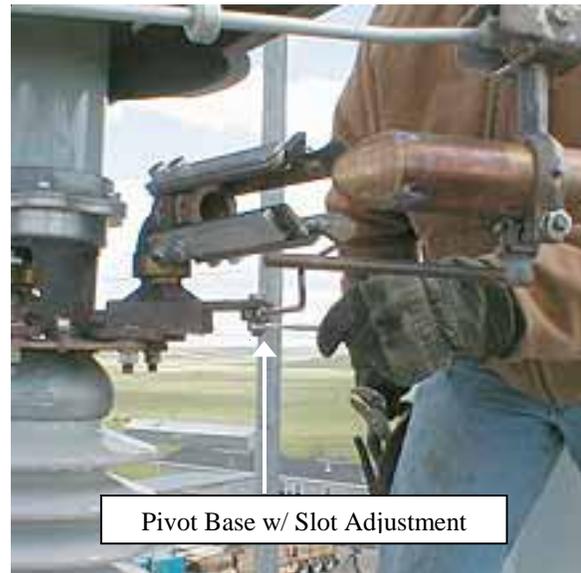


Image 10

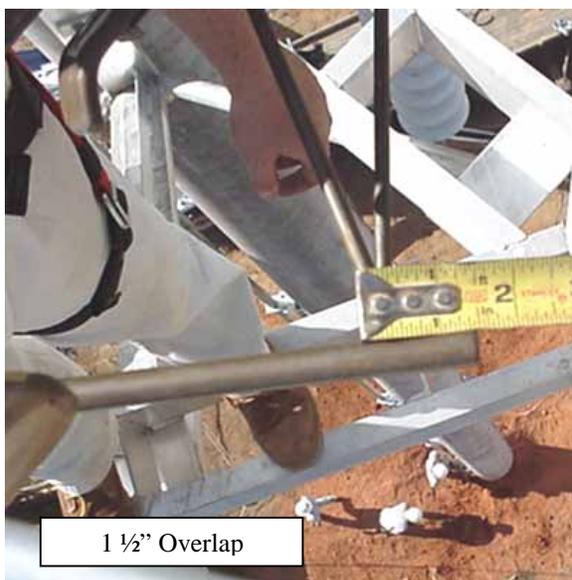


Image 11



Image 12

### A. Horizontal Adjustment (1 1/2" Overlap)

1. From the switch open position, move the blade assembly in the closed direction until the moving contact tangentially touches the stationary contact (images 9 and 12).
2. Adjustment of the stationary contact is provided through a pivot base (copper casting) with slot adjustment (image 10); the base is located on the under side of the jaw contact fingers. Loosen the two 3/8" stainless steel hex-head machine bolts so that the stationary contact can pivot freely.
3. Adjust the stationary contact until there is a 1 1/2" overlap (image 11) at the tangent point. Tighten the hardware at the pivot base.



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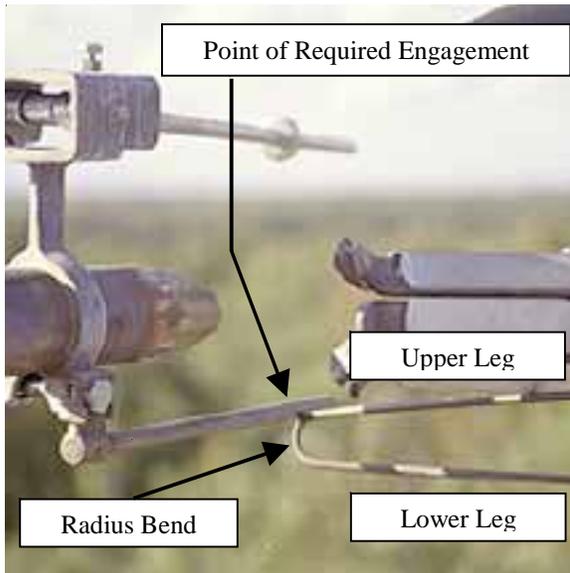


Image 13

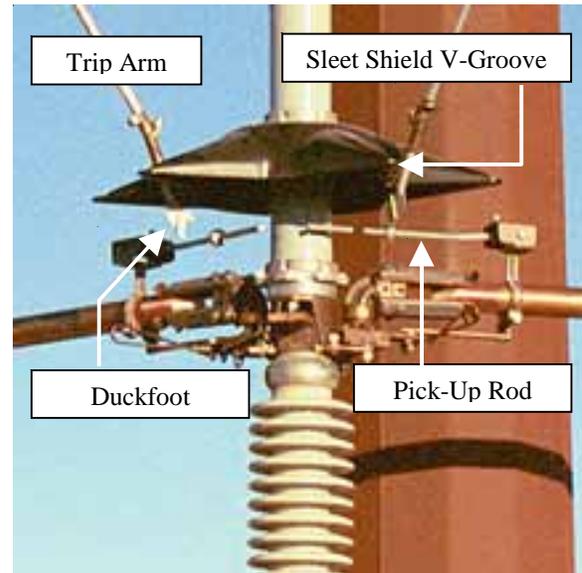


Image 14

### B. Vertical Adjustment

The moving contact must engage the stationary contact on the upper 1/3 of the radius bend (images 12 and 13) when closing. This allows the moving contact to consistently ride up the bend and along the upper leg of the stationary contact and properly re-set for the next open switch operation. Contact engagement outside of this position can result in damage to the main blade and jaw contacts or failure to engage the interrupter on the next switch open operation.

1. From the switch open position, move the blade assembly in the closed direction until the moving contact tangentially touches the stationary contact (images 12 and 13).
2. If the moving contact strikes the stationary contact outside of the required position you must adjust the stationary contact by gently displacing the lower leg of the contact up or down.
  - a. The stationary contact is fabricated from spring temper material and is intended to be field adjusted at need.
  - b. Support the contact with one hand at the point where the lower leg is secured to the pivot base (copper casting) and with the other hand on the bend, gently pull or push the bend up or down. Caution: do not damage the soldered connection by forcefully displacing the bend.
3. After the initial adjustment, move the blade out and in so that the moving contact can strike the stationary contact and provide visual confirmation that the point of engagement is the upper 1/3 of the radius bend (images 12 and 13). Do this multiple times in succession until you are satisfied the contacts will engage properly.
4. Move the blade assembly into the fully closed position. The moving contact must be in continuous engagement with the stationary contact along the length of the upper leg. Adjust the upper leg of the stationary contact as required if continuous contact is not maintained.
5. Now open the switch and visually confirm that continuous engagement is maintained. Adjust as necessary.



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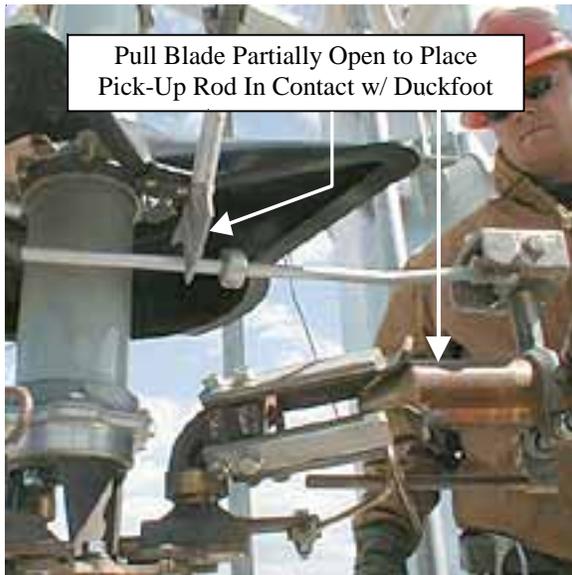


Image 15

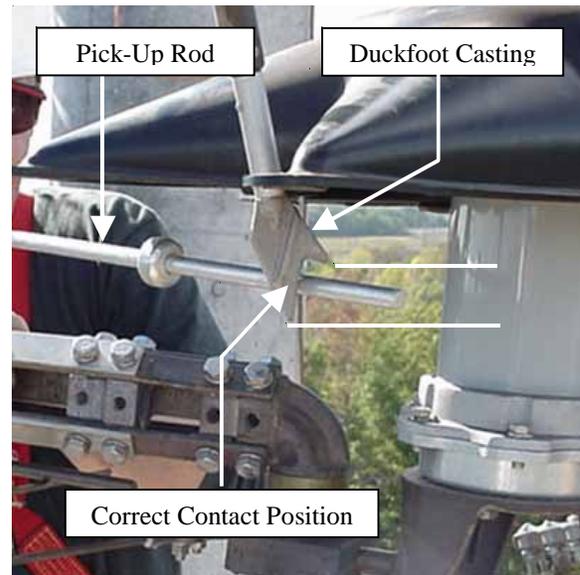


Image 16

### VII. BLADE CLAMPS AND INTERRUPTER TRIP ARMS

Interrupter units are provided with either one or two trip arms (image 14) depending on the configuration of the accompanying phase-over-phase switch. One-way switches will utilize an interrupter with a single trip arm. Two and three-way switches will utilize an interrupter with two trip arms.

For one and two-way switches, each blade and blade clamp assembly will utilize a dedicated interrupter trip arm. For three-way switches, two of the ways will share a single interrupter trip arm and the third way will utilize the second dedicated interrupter trip arm.

The adjustment procedure for the pick-up rod is generalized and common for all one, two and three-way configurations of switches. Please note that one procedure step is uniquely specific to three-way switches and is addressed separately in section B on page 10.

### VIII. PICK-UP ROD ADJUSTMENT

The aluminum pick-up rod (image 14) of the blade clamp assembly engages the interrupter unit trip arm in the opening direction of switch operation. The pick-up rod catches the trip arm in the rest position of the sleet shield v-groove (image 14) and pulls the arm out to the required point of interruption. The initial point of engagement is where the end of the pick-up rod contacts the casting (duckfoot) at the bottom of the interrupter trip arm in its rest position (image 15). An adjustment mechanism is provided that allows the pick-up rod to be aligned vertically on this casting. Proper vertical alignment will insure that the trip arm is carried to the point of interruption and subsequently released for interrupter re-set and the next switch open operation.

#### A. Vertical Adjustment (All Switches)

1. From the switch closed position, move the blade in the open direction until the pick-up rod of the blade clamp assembly tangentially touches the duckfoot (images 15 and 16) of the aluminum interrupter trip arm. Do not advance the pick-up rod to the point where the interrupter trip arm moves from the v-groove rest position. If the trip arm moves outward, pull the blade and pick-up rod back until the trip arm returns to its



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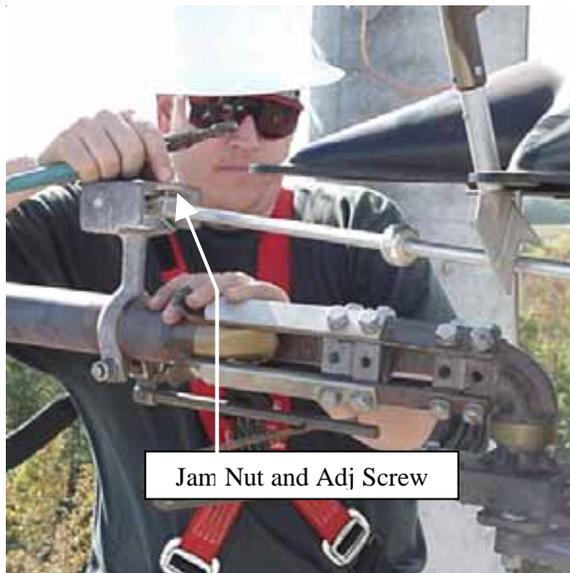


Image 17

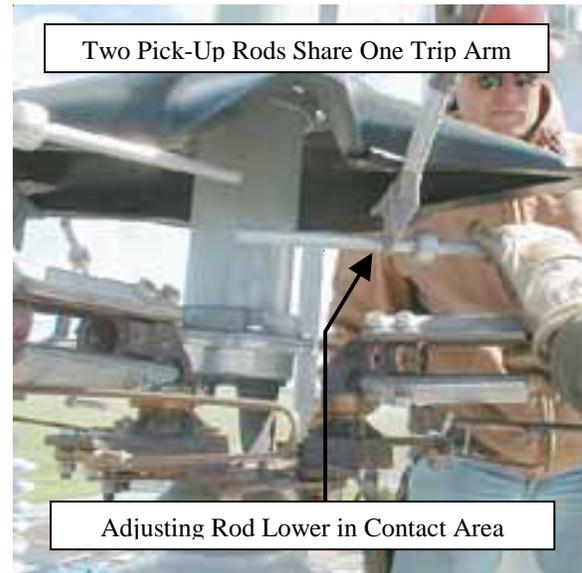


Image 18

rest position, then repeat this step again.

2. Look at the initial point of contact (image 16) between the pick-up rod and duckfoot. The correct contact position is achieved when the pick-up rod is located approximately mid-point between the thumb and finger of the duckfoot.
3. If vertical adjustment up or down is required, an adjusting screw and jam nut are provided on the top surface of the blade clamp casting. Loosen the jam nut (image 17) and run the adjustment screw down or up to properly locate the pick-up rod at the mid-point of the contact area. Tighten the jam nut to make the adjustment permanent.

### B. Vertical Adjustment (Three-Way Switches Only)

1. Three-way switches will have two blades per phase that share a single, common trip arm (image 18). In the above image you can see the two aluminum pick-up rods and one trip arm. Because they share the same trip arm, both pick-up rods will be in close proximity to each other when the switches are closed. To avoid physical interference in the opening and closing directions, the positions of both rods must be off-set somewhat in the vertical plane. **Note: Adjustments described below are to be made at the point where the rod first makes tangent contact with the duckfoot. Do not allow the pick-up rod to pull the trip arm out of the v-groove.**
2. Using the center-point of the duckfoot contact area as a reference, adjust the contact point for each pick-up rod. One rod should be adjusted up slightly; the other should be adjusted down slightly. In the above image (image 18) the pick-up rod has been adjusted down. Be sure that each rod continues to engage within the duckfoot contact area (thumb to fingertip) and maintains contact with the interrupter trip arm past the point of interruption (audible click).
3. The pick-up rods can make contact in opening and closing directions provided they do not catch (hang up). The rods are hinged, allowing displacement or movement in the downward direction. Incidental contact as one rod pushes past the other will cause the lower of the two rods to displace downward. The lower rod will return to its original position in the vertical plane after contact separation .



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### IX. OPERATION AND RE-SET

After all adjustments have been completed, it is recommended that the switch be opened and closed several times so the sequence of operation among interrupters, switch auxiliary contacts and blade clamp assemblies can be observed. All components should operate in a similar and consistent fashion when compared to other switches on different phases.

Operate the switch at different speeds. A slower speed initially will allow for easier confirmation of proper sequence. Increase the speed to approximate the normal operating speed used by field personnel. **Do not slam the switch and interrupter with violent force and high speed. SEECO's phase-over-phase switches are to be operated with a smooth, continuous motion. No slamming is required.**

#### A. Opening Sequence

1. Operate the switch in the open direction. The main contacts will separate and the current path will be carried for a brief interval by the auxiliary contacts until the blade clamp pick-up rod engages the duckfoot of the interrupter trip arm. Confirm that initial contact is between the thumb and the tip of the finger consistently at every speed of operation.
2. Continue in the open direction pulling the trip arm out of the v-groove. As the trip arm is pulled outward, it should move in an arc like the pendulum of a clock. At some distance outward an audible "click" can be heard. This is the point where the vacuum bottle contacts have opened inside the interrupter unit.
  - a. This distance is pre-set in the factory; no field adjustment is required to attain the correct distance.
  - b. If you have questions about the trip point, refer to the installation drawing for the required switch open gap distance. If your questions are not resolved by the drawing, please contact SEECO for guidance.
3. Continue in the open direction until the interrupter trip arm is released by the blade clamp pick-up rod. The trip arm will return to its' original rest position in the sleet shield v-groove. Proper re-set of the trip arm must occur consistently at every speed of operation. If the trip arm returns outside the original v-groove position, contact SEECO for guidance.

#### B. Closing Sequence

1. Operate the switch in the closing direction. The auxiliary contacts will be the first to engage in closing. Confirm that the moving contact strikes the stationary contact on the upper third of the radius bend.
2. Continue in the closing direction until the blade clamp pick-up rod makes contact with the leading edge of the duckfoot. The trip arm has a one directional knuckle (hinge) that will allow the pick-up rod to pass under as the switch continues to close. The pick-up rod is also hinged and will displace downward somewhat as it passes under the duckfoot. Confirm that the pick-up rod passes under consistently at every speed of operation.
3. Continue in the closing direction. Confirm that the auxiliary contacts remain engaged the entire length of travel along the upper leg of the stationary contact until the main contacts are fully closed.

#### C. Utility Personnel

After all adjustments are complete and proper operation is verified, we recommend that the utility personnel responsible for operation of the switch be allowed to exercise it several times to gain experience and an understanding of the proper sequence of operation and expected operating effort.



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### X. TROUBLESHOOTING

- A. If at any point in the previous procedure (section IX) the operation of the interrupter unit, auxiliary contacts or blade clamp assemblies does not provide the described result, refer back to the original adjustment procedure and repeat the adjustment.
- B. The auxiliary contacts, blade clamps and pick-up rods are the sole adjustment mechanisms provided for all field installation procedures described in this document.
  - 1. All installation procedures and adjustments can be accomplished with these components alone.
  - 2. The interrupter unit is factory adjusted for proper trip arm opening and closing travel and for interruption at the required switch open gap dimension. No field adjustment to the interrupter unit is required for any procedure in this document. Any attempt to change the original factory settings will void the warranty and may require the unit to be returned to SEECO.
- C. Please contact SEECO if you are not able to troubleshoot a problem through the adjustment procedures of this document. Do not attempt to improvise or freelance a solution to an adjustment problem. Contact us if you have any questions or concerns and we will provide you with immediate assistance.

### XI. MAINTENANCE

- A. Interrupter units do not require regular, scheduled maintenance.
- B. Both the switch and interrupters should be visually inspected for external signs of damage whenever the line is removed from service for other line maintenance considerations. External indications that an interrupter unit may have been damaged include:
  - 1. Tracking or burning on the surface of the fiberglass tubes, which indicates possible failure of the vacuum bottles. The integrity of the vacuum bottles must be confirmed through hi-pot testing.
  - 2. Oil dripping or puddling on the aluminum flanges or surface of the fiberglass tubes, which indicates that an internal o-ring seal or glue joint may have failed. To confirm the source and degree of leakage, wipe the surface of the interrupter unit clean with a clean cloth and de-natured alcohol anywhere oil is present. If oil immediately reappears in quantity sufficient to run, drip or puddle, the seal is defective and will require removal of the unit from service. If oil does not immediately run, drip, puddle or reappear in quantity, dust the surface with baby powder and wait several minutes. The powder will reveal the eventual presence of oil and the location and degree of weepage.

**The appearance of oil on the exterior surface is not an absolute indication that the interrupter is damaged.** The oil has an extremely low viscosity and a small amount of oil may pass through the walls of the fiberglass tube and stain or spot the exterior of the tube. This small amount of weepage is permissible and does not reflect a loss of dielectric sufficient to compromise the interrupter.
  - 3. Interrupter trip arms that have broken off at the u-tube hinge point and are missing.
  - 4. Auxiliary contacts that have significantly burned or are deformed.
- C. If you recognize any of the above conditions or if you have any doubts or concerns about the ability of the interrupter units to perform their function, please contact SEECO for immediate assistance.