



## Installation Instruction for Phase-Over-Phase GOABS(r)

Thank you for purchasing a SEECO phase-over-phase GOABS ® switch. We are pleased to be able to provide this product to you and we believe that it will meet or exceed your performance expectations. SEECO phase-over-phase GOABS ® are designed and manufactured with the philosophy of quality, functionality and reliability, as well as installation simplicity in mind. 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 assembly, adjustment and installation of SEECO-style phase-over-phase switches. This procedure covers many of the most common configurations and mounting applications, however it cannot cover all details or every variation in equipment.

**As you review the installation instructions please refer to the accompanying drawings, which provide the complete bill of materials with quantities, location and adjustment parameters for the specific switch being assembled. These instructions are intended to be read in conjunction with the drawings provided and are not a replacement or substitute for the drawings.**

An additional instructional guide is the SEECO Lineman's Guide. This guide contains many of the most important adjustments and required dimensions in a compact, handy format that can be easily referenced during installation. This guide is to be used in conjunction with the complete switch installation instructions and is not intended as a substitute.

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              | 14. 5/8" Shallow Socket         |
| 2. 14" Adjustable Wrench              | 15. 3/4" Socket                 |
| 3. 3/8" Open-End Wrench               | 16. 15/16" Shallow Socket       |
| 4. 7/16" Open-End Wrench (2 required) | 17. Carpenters Square (2' - 0") |
| 5. 1/2" Open-End Wrench               | 18. Blum Bob                    |
| 6. 9/16" Open-End Wrench (2 required) | 19. Round (Rat Tail) File       |
| 7. 3/4" Open-End Wrench               | 20. Flat File                   |
| 8. 7/8" Open-End Wrench               | 21. Lineman Pliers              |
| 9. 15/16" Open-End Wrench             | 22. Tape Measure                |
| 10. 1/2" Drive Ratchet                | 23. Hammer                      |
| 11. 1/2" Breaker Bar Ratchet          | 24. Crowbar                     |
| 12. 1/2" Extension, 6" Long           | 25. Metal Cutting Saw           |
| 13. 1/2" Socket                       | 26. Level                       |

### II. RECEIVING, STORAGE AND UNCRATING

#### A. Receiving

Each phase-over-phase switch typically consists of the following major components: welded aluminum frames, one or more crates of current carrying parts, one crate of control mechanism components and one or more bundles of control pipe. Depending on the requirements of the application you may also receive per



## Installation Instruction for Phase-Over-Phase GOABS(r)

switch: one pallet of insulators, one crate of vacuum interrupters and additional galvanized steel beams and/or mounting channel assemblies. When the switch is received all material should be checked against the accompanying bill of lading. Confirm that the number of shipping units (crates, bundles, pallets, etc.) actually received exactly matches the number of shipping units on the bill of lading.

All shipping units must also be visually inspected for physical damage. If physical damage is apparent, please check the contents of each shipping unit against the packing slip to determine if there are broken or missing components. A detailed packing slip accompanies each shipping unit and is attached to the exterior of the container, crate or bundle.

In the event that you received less than the bill of lading indicates or that visual inspection reveals physical damage, you should file a claim as soon as possible with the transportation company and notify your SEECO representative. **The responsibility to determine if the shipment is complete and without damage rests with the customer. 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 parts should be left in their original shipping containers until ready for use and installation. Moisture absorbing cartons or containers should be covered or in some means protected. Please exercise care in the handling and storage of the switch, especially porcelain insulators and vacuum interrupters, which 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 Monoruptr(r) vacuum interrupter from its' crate until the interrupter is to be lifted to the pole mounted single phase assembly. Both when crated and uncrated, the vacuum interrupter is to be kept upright at all times.
2. All hardware is pre-sorted by application and color coded with each color code referenced to a specific field assembly drawing. Do not utilize the hardware apart from the matching field assembly drawing. Do not remove the hardware from the plastic bags at this time.
3. Uncrate and sort the switch components using the single phase and control mechanism drawings. These drawings can be found in the sealed black bag, which is shipped inside the control crate.

## III. FRAMES AND FRAME ASSEMBLY

### A. Frame assembly of switches rated 15 - 69 kV

1. Most switches rated 15 to 69 kV are provided with aluminum frame support structures that are completely welded requiring no field assembly. For these switch frames the rotating insulator bearings and the stationary insulator pedestals (sub-base) have already been installed. The rotating insulator stops have also been factory installed, but customer field personnel will adjust their position later if required.
2. For those switch frames that require some field assembly, retrieve the frame assembly drawing for the hardware list and assembly guidance. Utilize a level surface where available for frame and single phase assembly.



## Installation Instruction for Phase-Over-Phase GOABS(r)

### B. Frame assembly of switches rated 115 - 230 kV

1. Most one-way, 115 kV aluminum frames are completely welded assemblies; all other one-way, two-way and three-way aluminum frames are factory welded, but broken down into major sub-assemblies for more economical shipment
2. Retrieve the frame assembly drawing for the hardware list and assembly guidance. Use the frame assembly hardware (color coded blue) and make certain the correct hardware lengths and diameters are used in the proper locations per the assembly print. Utilize a level surface where available for frame and single phase assembly.
3. Assembly practices - different practices have been adopted by customers for the assembly of the aluminum frames. Several of these practices are listed briefly below. Your choice of method should be influenced by the equipment and site conditions available to you, and your established safety procedures.
  - a. Assemble two and three-way frames upside down with the flat "deck" of the frame flush to the ground. The assembled frame is then turned upright and secured to a stub pole for assembly of the single-phase units. Alternately, the frame can be secured to a line truck or other vehicle or structure.
  - b. Same procedure as "a" above (assembled upside down) except the frame is turned upright and placed in a hole that has been trenched deep enough for the center support section of the frame (approximately 7'-0"). Railroad ties or timbers are used to support the deck of the frame at ground level. Shim the timbers to provide a level work surface and then assemble the single-phase units.
  - c. Assemble the two halves of two and three-way frames together with their aluminum channel spacers but without the center support and the two tubular frame support sections. The assembled halves and the channel spacers form a "deck" for the assembly of the single-phase units. After assembly of the single-phase units, use slings to lift the assembled and bolted halves to a sufficient height where the center support and tubular support sections can be bolted to the underside of the frame. After frame assembly is complete, attach the upper and lower frame spacers (galvanized steel beams) to the frame and then lift the entire assembly direct to the pole structure.

Depending on the frame supplied, bolting the center support section to the assembled frame halves may require loosening the hardware, which connects the channel spacers to the frame halves. If required, loosen the bolted connections only enough to allow the center support section to be eased into position. The fit will be tight and you will need to loosen one bolted channel spacer at a time until the entire center support section has been attached. Tighten all hardware.

4. Reference the control mechanism print to identify the upper and lower frame spacers (galvanized beams) and the frame assembly print to identify the assembly hardware (blue coded plastic bag). Assemble the spacers to the frame using the specified hardware.
5. Reference the single phase print to identify the insulator bearings and pedestal. Install the rotating insulator bearings and the stationary insulator pedestal (sub-base) using the mounting hardware (orange coded plastic bag).

## IV. ASSEMBLY OF SINGLE-PHASE UNITS

In addition to these installation instructions please refer to the accompanying single phase drawing(s), which provide the complete bill of materials with quantities, location and adjustment parameters for the switch being assembled. These instructions are intended to be read in conjunction with the single phase drawings and are not a replacement or substitute for the drawings.



## Installation Instruction for Phase-Over-Phase GOABS(r)

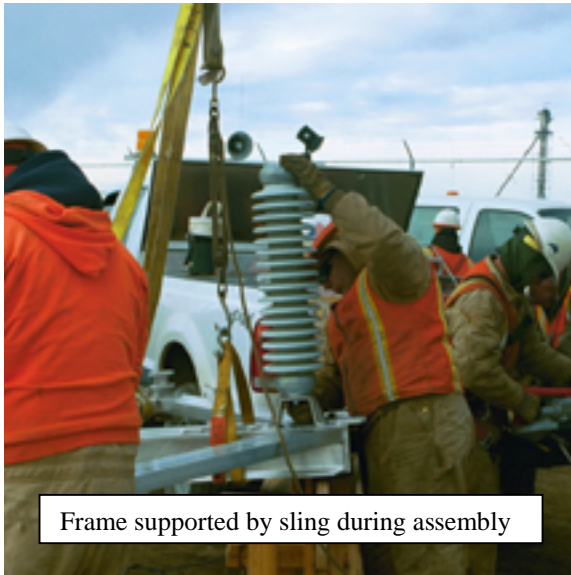


Image 1

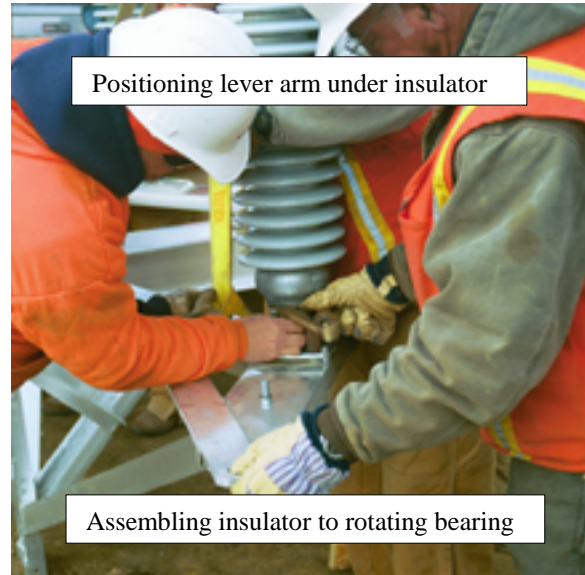


Image 2



Image 3



Image 4

### A. Insulators

1. Make certain that the rotating insulator levers are correctly positioned and then use the insulator hardware (red-coded bag) to bolt the insulators to the base bearings and sub-base. Reference the single phase drawing for the correct position of the levers (image 2) relative to the orientation of the blade.
2. Insulators must be mounted perpendicular to the frame. Switches rated 69 kV and below typically do not require shimming as the current carrying parts include significant adjustment capability. For switches rated 115 kV to 230 kV utilize the leveling screws, which are located on the rotating insulator bearing and the stationary insulator pedestal (sub-base).





## Installation Instruction for Phase-Over-Phase GOABS(r)



Image 5

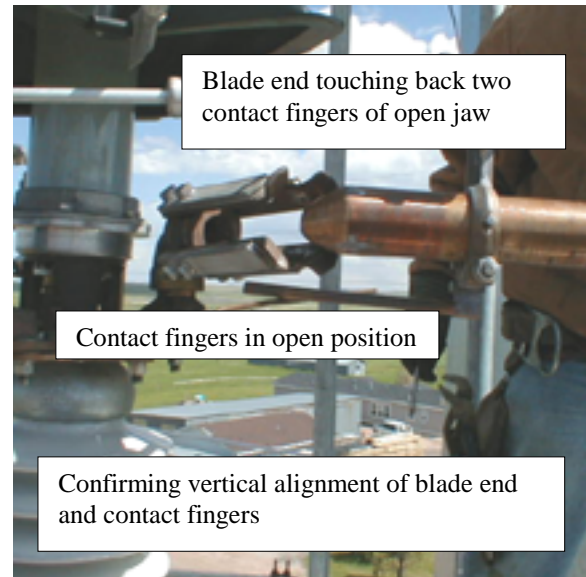


Image 6

### B. Mounting live parts on insulators

1. Using the insulator mounting hardware (red-coded plastic bag), attach the clip cap to the stationary insulator (image 4). Reference the single phase drawing for proper orientation of the clip cap and hardware quantities and location. Next, fully retract the individual clip (jaw) assemblies back towards the center of the stationary insulator using the slotted hardware feature where the jaw bolts to the flat clip cap. Now tighten the hardware.
2. From the closed stop position, rotate each insulator and lever towards the switch open position. Rotate only enough for the blade end to clear the open clip (jaw) assembly after attaching the blade/hinge. A small amount of rotation will create working space so that the clip assembly does not contact the blade end and impede your installation of the blade/hinge. Using the insulator mounting hardware (red-coded plastic bag), attach the hinge/blade assemblies (image 5) to the rotating insulators. After each blade/hinge is attached, rotate the insulator (and blade) back towards the switch closed position and just short of the open clip (jaw) contacts.

For two and three-way switches, be sure to confirm that the blade/hinge assembly has the correct blade end orientation before installation on each insulator. Each blade end has a long side and a beveled side. The long side leads when closing into each clip (jaw) assembly and the beveled side leads when the switch is opening.

### C. Single-phase adjustment of live parts

1. Vertical adjustment of blade end for proper contact engagement - Pull each blade towards the closed position so that the blade end is just short of making contact with the contact fingers of the open clip (jaw) assembly. Look at the position of the blade end relative to the open contact fingers to determine if the blade end is properly aligned vertically with the jaw. For proper contact engagement the blade end must be centered between the two back contact fingers (image 6). This determination can be made with simple visual inspection, a precise measurement is not required.

If adjustment is required, raise or lower the blade end by manipulating the two hex head bolts (image 7) on

## Installation Instruction for Phase-Over-Phase GOABS(r)

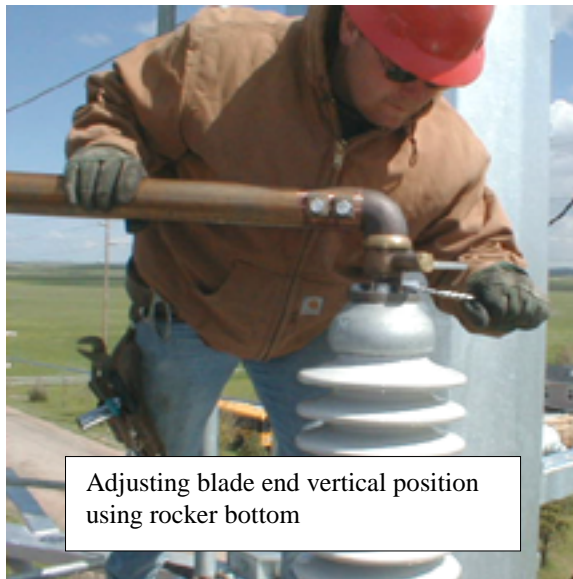


Image 7

Adjusting blade end vertical position using rocker bottom

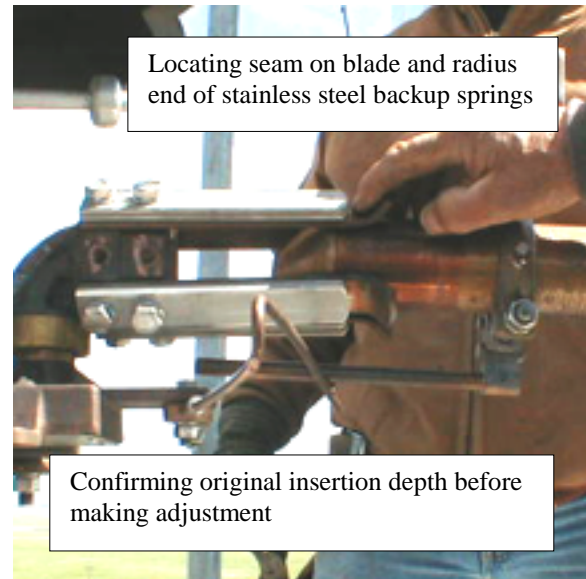


Image 8

Locating seam on blade and radius end of stainless steel backup springs

Confirming original insertion depth before making adjustment

the rocker bottom of the hinge assembly that are in-line (parallel) with the blade. To raise the blade end, loosen the front bolt and tighten the rear bolt. To lower the blade end, loosen the rear bolt and tighten the front bolt. When the blade end is centered on the two rear contact fingers, tighten hardware so that all lockwashers are fully compressed and flat. Reconfirm the vertical alignment. Repeat this step for all blades.

2. Horizontal adjustment of clip (jaw) assembly for proper contact engagement - Push the blade into the fully closed position where the blade and clip assembly are completely straight and in-line with each other. Do not push the blade beyond this position; maximum contact pressure and operating performance is achieved when the blade and jaw are in straight alignment. The clip assembly can be damaged if you push the blade substantially beyond this point.

Visually inspect the insertion depth of the blade into the jaw (image 8). Find the parting line of the blade where the blade end casting (bronze color) and the blade tube (copper color) meet to form a visible seam. Find the radius end of the stainless steel backup spring on any of the four copper contact fingers. The tip of the radius end is the approximate position of the spherical silver contact buttons on the underside of the contact fingers.

Optimal contact engagement is achieved when the visible seam of the blade overlaps, or extends, beyond the radius end of the backup spring by 1/4" - 3/8". In this range the spherical silver contact buttons pass current to the high conductivity copper tube rather than the lower conductivity blade end casting.

If the insertion depth of the blade end does not meet the required range of 1/4" - 3/8", you will need to slide the clip (jaw) assembly forward or backward using the slotted adjustment feature of the jaw housing. Start by marking the existing hardware position with a black marker, knife or screw driver (image 9). Mark both the casting and the bolt head, which is your starting position before adjustment. Pull the blade out of the jaw in the open switch direction; the jaw will also open. Now push the jaw closed (image 10) with moderate effort and it will lock in place when it reaches the switch closed position.

Loosen the hardware on both sides of the clip (jaw) assembly (image 11). Slide the jaw forward or backward as needed (image 12) to increase or decrease the original insertion depth and gain the required range of overlap. Use the black mark or scratch line on the casting as a reference point. As you slide the jaw be sure



## Installation Instruction for Phase-Over-Phase GOABS(r)



Image 9

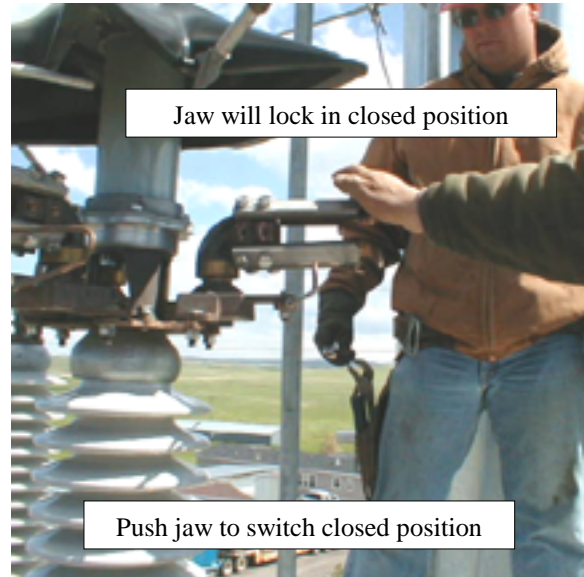


Image 10

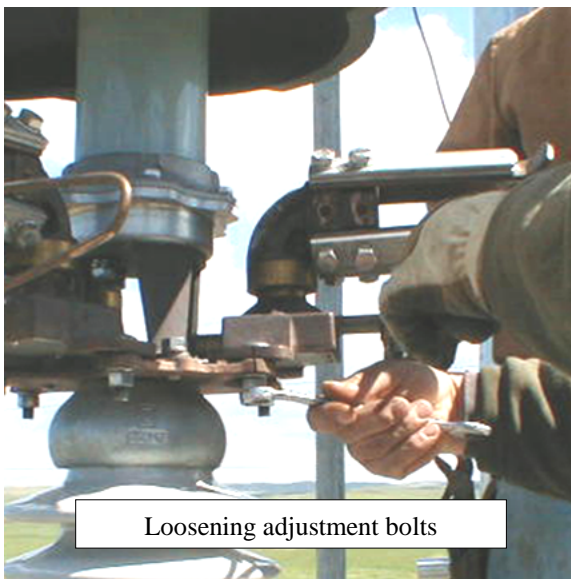


Image 11



Image 12

to keep the movement parallel to the original position, not allowing one side of the jaw housing to lead the other. This can be determined by simple visual inspection and does not require measurement.

Tighten the hardware. Push the jaw open with moderate effort. Now pull the blade closed so that both blade end and clip (jaw) assembly are completely straight and in-line with each other. Check the new insertion depth to confirm that the required overlap has been achieved. Repeat for all remaining clip (jaw) assemblies.

3. If arcing horns (quick-whips) are provided with your switch, reference the arcing horn assembly drawing and adjust the horns and hook to the dimensions shown on the drawing.
4. If MONORUPTR® vacuum interrupters are provided with your switch, reference the MONORUPTR®





## Installation Instruction for Phase-Over-Phase GOABS(r)

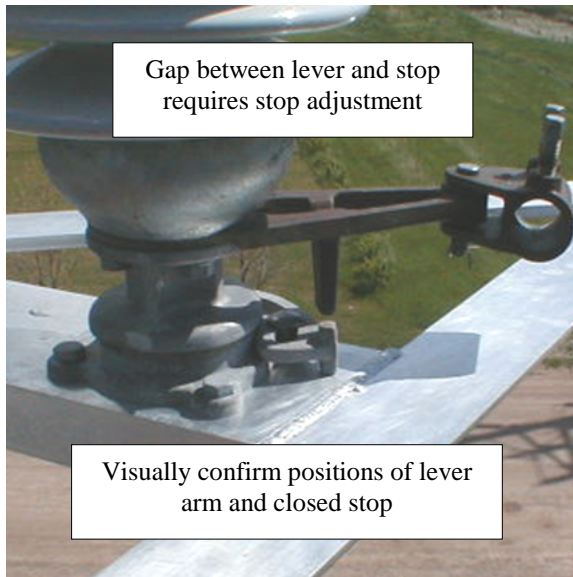


Image 13



Image 14



Image 15

Note: Stops vary in size and shape based on the kV rating of the switch. Switches rated 115 kV and up have separate open and closed stops. Switches rated 34.5 - 69 kV have a single unitary stop that is used for both the open and closed lever position. Switches rated 23 kV and below have separate open and closed stops. Reference the accompanying single phase drawing for additional guidance on stop and lever position and adjustment.

assembly drawing and adjust the auxiliary stationary and moving contacts from the dimensions shown on the drawing. Do not install the Monorupters at this time.

5. Closed stop adjustment - For proper contact engagement the blade should not carry the clip (jaw) assembly beyond the completely straight, in-line position when the switch is closed. The closed stop at the base of the rotating insulator is the mechanism which prevents the blade from traveling beyond the proper closed position. Note: Blade travel beyond the straight, in-line position does not improve contact engagement and may damage the contacts resulting in diminished performance or failure.

To determine if stop adjustment is required, pull the blade into the switch closed position with the blade and jaw completely straight and in-line. Visually inspect the rotating insulator lever arm and closed stop to





## Installation Instruction for Phase-Over-Phase GOABS(r)

confirm that the lever is in contact with the stop (image 13); if not, loosen the stop hardware (image 14) and gently tap (image 15) the stop towards the lever until they are in contact. Re-confirm that the blade and jaw are still straight and in-line and then tighten the stop hardware.

Repeat this procedure for all rotating insulator bearings to confirm that levers contact the closed stop when the switch is closed.

### D. Outboard bearings, bearing plates, guide plates

1. Please refer to the accompanying control mechanism drawing for guidance on assembly of these components, including quantity, location and orientation.
2. For most one-way, two-way and three-way switches rated 69 kV and below, and one-way switches rated 115 kV and up, the outboard bearing and the associated bearing and guide plates will be assembled directly to the aluminum frame structure at this point. Mounting hardware is included with each individual assembly. If provided, do not tighten the piercing set screws at this time.
3. For two-way and three-way switches rated 115 kV and up, depending on the type of pole structure and its' size, the outboard bearing and associated bearing and guide plates will be assembled to the upper frame spacers (galvanized steel beams) or, alternately, directly to the pole structure. The control mechanism drawing will indicate the required location for these components.
4. Outboard bearing and bearing plate assemblies are typically mounted on the top phase switch frame. Guide bearing plate assemblies are typically mounted on the middle and bottom phase switch frames.

### E. Cranks, clevis assemblies and interphase pipe

1. Refer to the control mechanism drawing for correct identification of these components, their quantities, location and orientation.
2. For convenience or ease of installation you may wish to assemble the interphase pipe and clevis assemblies on the ground rather than later on the pole structure. One clevis is located at each end of the pipe; snug the set screws but do not pierce them at this time.

Note: Some three-way and one-way switches utilize a second style of clevis with a longer radius in addition to the primary clevis. On three-way switches this second clevis is typically used on the rotating insulator end of each tap switch interphase pipe. On one-way switches with a delta mounting configuration this additional clevis is typically used on the off-set phase. Refer to the control mechanism drawing for guidance on location and identity for each style of clevis used.

3. The crank assemblies can now be attached to the clevis assemblies at one end only of each interphase pipe. The crank is attached with a round head pin and cotter key.

Note: Some customers prefer to "thread" the vertical control pipe through each crank assembly and lift the pipe and crank together to the pole structure.

4. Attach the assembled interphase pipe with clevis assemblies securely to the aluminum frames when lifting the single phase units to the pole structure.
5. A ground connector is provided for each aluminum frame. Attach the ground connector now if your grounding procedure requires the pole mounted frame to be tied to the ground wire on the pole.



## Installation Instruction for Phase-Over-Phase GOABS(r)

### VII. Mounting the Switch to the Pole Structure

#### A. Single-phase mounting hardware

Single-phase mounting hardware is the hardware utilized to mount the aluminum switch frames to the pole structure. The hardware may vary with the type of pole structure (wood, concrete, steel, light duty steel, laminated wood). All mounting hardware provided is required for proper operation and performance of the switch. If hardware provided is not fully utilized (apparent excess or un-used components), please consult the installation drawings to verify the locations and quantities indicated. Failure to utilize the mounting hardware as specified in the installation drawings can result in diminished performance, field failure and/or invalidation of the product warranty. Consult the factory for assistance if you have questions confirming use of mounting hardware.

1. For switches 7.5 to 69 KV, use the *single-phase* print to locate and identify the mounting hardware (color-coded yellow) when provided.
2. For switches 115 to 161 KV use the *control mechanism* print to locate and identify the mounting hardware (color-coded yellow) when provided.
3. Through bolts and lag screws, when required, are supplied by the customer or the customer's contractor. Curved washers are typically provided for wood, concrete and light duty steel pole structures and are used in conjunction with through bolts.
5. Rectangular washers are typically provided for wood, laminated wood, concrete and light duty steel pole structures and are used in conjunction with through bolts. Rectangular washers are placed between the bolt head of the through bolt and the slotted hole of the aluminum frame channel. The washer acts to prevent the bolt head from being pulled through the slotted hole or deforming and fatiguing the web of the channel. Do not place the rectangular washer between the pole side of the channel and the welded curved plate.
6. Lag straps are typically provided for wood and laminated wood pole structures. If supplied, be certain to assemble the straps to the aluminum frame before raising the switch units.

#### B. Lifting the single-phase switch units to the structure



Image 16



Image 17

1. The procedures provided here for lifting the single-phase switch 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.



## Installation Instruction for Phase-Over-Phase GOABS(r)



Image 18

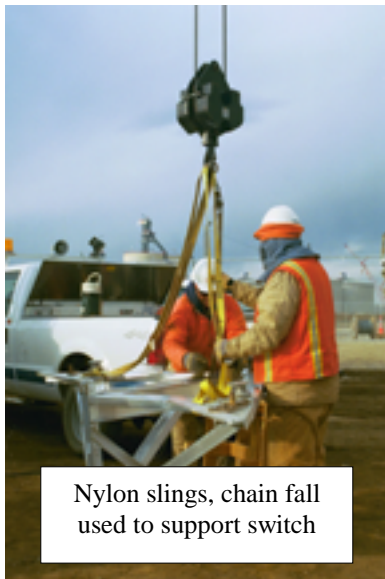


Image 19



Image 20

2. Slings, cables, ropes, hoists and chain falls must all be properly rated for the weight of the lifting load. If you are unsure of the weight of the single-phase switch units contact SEECO for confirmation.
3. For switches 115 to 230 KV, use nylon slings to lift the frame into place.
4. For switches 7.5 to 69 KV, either a sling or the factory drilled frame holes may be used to attach rope, cable or any other suitable lifting device.
5. Place the ball and hook over the switch units' center of gravity. Do not lift un-balanced loads. To balance the loads a chain fall (image 19) is often used to adjust the length of a sling.

For a one-way switch, two slings should be attached to the aluminum channel that supports the two switch insulators and is parallel to the switch blade. Each sling should be located at the ends of the aluminum channel beyond the switch insulators. A third sling should be located at the rear portion of the frame closest to the pole or structure. For a two-way switch (image 16, image 17), the slings should be attached to the frame adjacent to the two rotating insulators. A third sling should be located at the nose of the frame adjacent to the stationary insulator. For a three-way switch, the slings should be attached to the frame channel at the three outside insulators.

If a multi-bottle Monoruptr® (interrupter) is provided with the switch, the interrupter should be lifted separately (image 20). Do not attempt to mount the multi-bottle interrupter to the single-phase switch unit on the ground. To lift the interrupter unit, carefully wrap the sling around the top fiberglass tube immediately below the flat plate of the interrupter "head". Pull the sling up under the flat plate of the head as much as possible before tightening the sling around the fiberglass housing. Do not attempt to lift the interrupter by the horizontal u-tube arms; the arms are not a lifting point. 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.

6. Attach a hand line to the switch or interrupter (image 18, image 20) to provide stability while lifting.
7. Adjust the three phases into direct vertical alignment and tighten the mounting bolts.





## Installation Instruction for Phase-Over-Phase GOABS(r)

8. If the application requires the use of side mounted lag straps, form the straps around the pole and install 1/2" X 3" lag bolts through the holes provided.

### D. Dead-ending the conductors

All conductors must be dead-ended to the switch frames (or structure), sagging them to the prescribed value of tension. **Any adjustment performed prior to sagging the conductors may be lost either as a result of the frame or structure shifting.**

### E. Hanging the control pipe and associated parts

1. Using the *control mechanism* print as a guide, install the top portion of the control pipe through the crank and outboard bearing assembly of the top phase. Position the top of the pipe approximately 12" above the top of the outboard bearing plate.
2. Pierce the control pipe with the two set screws of the outboard bearing assembly.
3. If the pole has not been drilled for the pipe guides and swing handle supports, do so now, using the pipe guides and swing handle supports as templates. Elevations are noted on the *control mechanism* drawing.
4. Continue to install the pipe and couplings on down the structure using the materials specified in the control drawing. Using the correct length of control pipe where specified on the control drawing will insure that the couplers and universals (if provided) are properly located relative to the pipe guides and frames.

Do not forget to "thread" the pipe (image 20) through the crank assemblies, which should be located at frame level (above the guide or bearing plate) of each phase of the switch before adding the next coupling and pipe section. Pierce the set screws of all pipe couplings, universal joints and outboard bearing assemblies as they are added. **Do not pierce the set screws** of crank or clevis assemblies at this time.

5. Attach all components per the control drawing including the lock segment, swing handle and ground shunt.
6. Cut the control pipe approximately 6" below the lock segment assembly. Paint the freshly cut pipe with cold galvanizing spray to prevent corrosion.
7. Position the swing handle assembly approximately 6" above the lock segment assembly. Tighten the bolt and set screw only enough to keep the handle from slipping. **Do not pierce the set screws.**
8. Continue steps 1 through 7 for each switch control on two and three-way switches.

### F. Bearing and guide plate adjustment

1. Starting at the top phase of the switch, adjust the position of the bearing and guide plates so as to allow the vertical control pipe to hang as straight as possible to the base of the pole and the pipe to rotate freely without kinking or binding. Partial loosening of the hardware on the bearing and guide plates will often allow the pipe to straighten out under its own weight.

It is helpful to view the pipe from two different positions (90 degrees apart) in determining the correct alignment. It is recommended that pipe be allowed to follow the natural taper of the pole. It is not necessary for the pipe to orient in a true vertical (north-south) plane. Tighten the bearing and guide plate hardware once the vertical control pipe has been aligned.

2. Pierce all set screws on the bearing and guide plates where provided.



## Installation Instruction for Phase-Over-Phase GOABS(r)

### G. Cranks, Clevises and Interphase Pipe

An interphase pipe drives each rotating insulator. For each interphase pipe perform the following adjustment procedures:

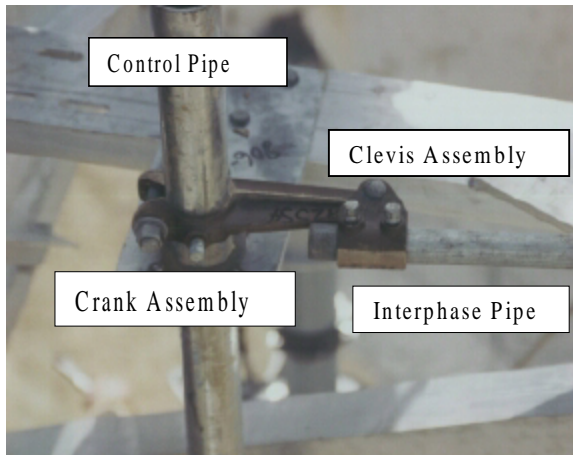


Image 20

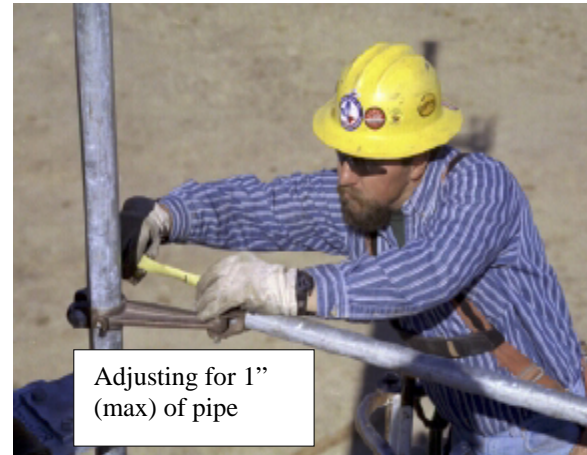


Image 21

1. Attach two clevis assemblies to each interphase pipe (reach rod). One clevis is then connected with a round head pin and cotter key to the crank assembly located on the vertical control pipe (image 20). The second clevis is connected with a round head pin to the lever arm under the rotating insulator.
2. Using a ruler or tape measure (image 21) extend the interphase pipe 1" (or less) through the crank end clevis. **Note: the pipe must not extend beyond 1" or it will prohibit proper toggle adjustment.**
3. Pierce the two setscrews (image 22) on the crank end clevis; **do not pierce other setscrews at this time.** To pierce the setscrew, tighten the screw until you hear a loud "pop," the screw will suddenly become easy to turn. Continue to tighten the screw until the threaded shoulder of the screw makes contact with the pipe and becomes difficult to turn once again. The screw is now pierced and set.

Note: Exercise care if utilizing an air operated impact wrench. Excessive tightening with an air wrench can strip the threads of the casting.



Image 22



Image 23



## Installation Instruction for Phase-Over-Phase GOABS(r)

### H. Toggle Adjustment

Toggle adjustment of the control mechanism provides a simple but highly reliable means to keep the switch closed under conditions such as excessive pole deflection, vibration and galloping conductors, without the use of blade locks or other latching devices. Proper over-toggle of the switch minimizes operating effort, extends the operating life of the switch and minimizes future maintenance requirements. It is one of the most important adjustments covered in this manual, however the procedure is straightforward if you follow these steps:

1. Start at the top phase and adjust each phase of a control column in sequence: top, middle and bottom. Optionally, for two and three-way switches you may wish to adjust the toggle of other switch(es) on the top frame before descending to the middle and bottom frames. For each phase do the following:
2. If you have not done so previously, back off the set screws on the clevis assembly at the rotating insulator end of the interphase pipe so that the pipe can slide freely in and out of the clevis. This will temporarily permit operation of the vertical control pipe, crank assembly and interphase pipe without movement of the rotating insulator and insulator bearing.
3. Loosen the carriage bolt and nut and back off the set screws on the crank assembly so that the crank and interphase pipe can rotate freely around the axis of the vertical control pipe. Raise or lower the interphase pipe and crank assembly so that the pipe is relatively horizontal (level) between the rotating insulator and the vertical control column. This can be adjusted by sight, a leveling device is not required.
4. Push the interphase pipe toward the closed position (image 23) until the inside of the clevis or the end of the pipe makes contact with (binds against) the rib of the crank assembly and rotation stops. Tighten the carriage bolt and nut (image 24) on the dog-ears of the crank assembly, while continuing to apply force on the inter-phase pipe in the closing direction. Do not let the crank assembly and interphase pipe “relax” or back off from the completely closed position while tightening the carriage bolt and nut. This is the crank toggled position.
5. Pierce the two set screws on the crank assembly. Do not pierce any other set screws at this time.

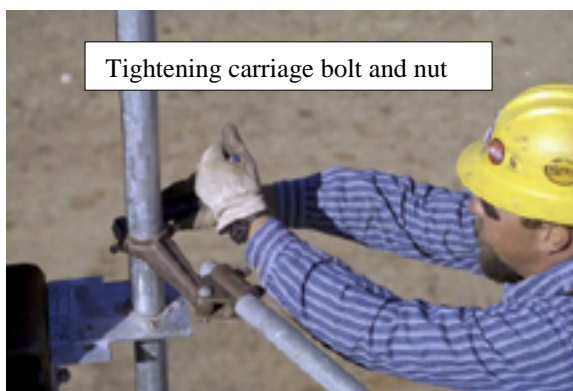


Image 24



Image 25

6. Before proceeding confirm that the blade of the switch is completely closed into the jaw. If not, pull the blade into the jaw until the blade and jaw are completely straight. At this point the down thumb (or arm) of the rotating insulator lever should be in direct contact with the closed stop so that no further rotation of the insulator is possible. If the thumb or arm of the lever is not in direct contact with the stop when the blade is in straight alignment with the jaw you must adjust the stop position before proceeding. Return to the prior procedure for adjustment of the stop.





## Installation Instruction for Phase-Over-Phase GOABS(r)



Image 26



Image 27

7. Push the rotating insulator clevis outward away from the pole structure. Using a marker or screw driver blade, scribe a line (image 25) on the interphase pipe on the inside of the clevis. The line should be flush against the clevis.
8. Open the switch with the swing handle very slowly until 1/4" appears (image 26) between the end of the clevis and the scribed line. While the switch is being opened, again push the clevis firmly outward.
9. Tighten (snug) the set screws, but do not pierce.
10. Operate the switch a few times. The switch should "snap" over center into the closed position. This motion is called "toggle."
11. If the switch closes completely with the reach rod in compression and the control does not toggle in, repeat steps 1 through 4 using 3/16" as opposed to 1/4".

Note: If you are adjusting the middle or lower phase it is often sufficient to open the switch with the swing handle to the point where the crank assembly of the above phase(s) comes out of toggle. In most instances the interphase pipe of your phase will be pulled to the necessary 1/4" dimension. If the actual dimension you measure is greater or less than 1/4", continue to open or close the switch slowly using the swing handle as needed until you achieve the required dimension.

When the 1/4" dimension has been achieved, but before you perform step 9, look upward to the phases above you to confirm that the blade(s) on the switches above have not begun to open out of their jaws. If the above phases have begun to open significantly, you must close the switch with the swing handle and repeat steps 7 and 8. A visual guide to making this determination is to observe if all fingers of the female jaw contact (clip) assembly are still in contact with the blade. A slight relaxation (movement) of the blade-jaw engagement is permissible but significant movement towards the opening direction is not acceptable.

12. Upon satisfactorily opening and closing the switch a few times, pierce the set screws (image 27) on the rotating insulator clevis. Repeat steps 1 through 12 for the middle and lower phases.
13. Note: If your switch configuration is a one-way delta with one phase opposite, please refer to the supplemental instructions for toggle adjustment of the off-set phase.