Southern States

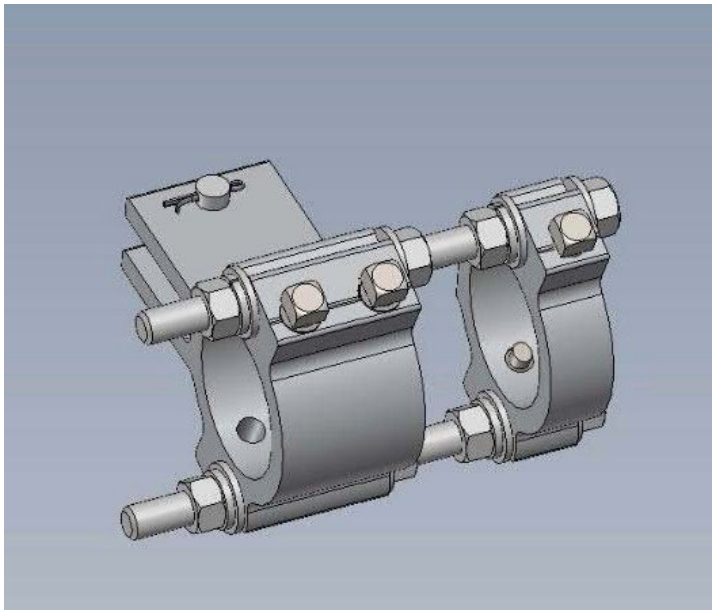
The Quality Name in High Voltage Switching

Type ES-1 Aluminum Side Break Phase-Over-Phase Disconnect Switch All Ratings

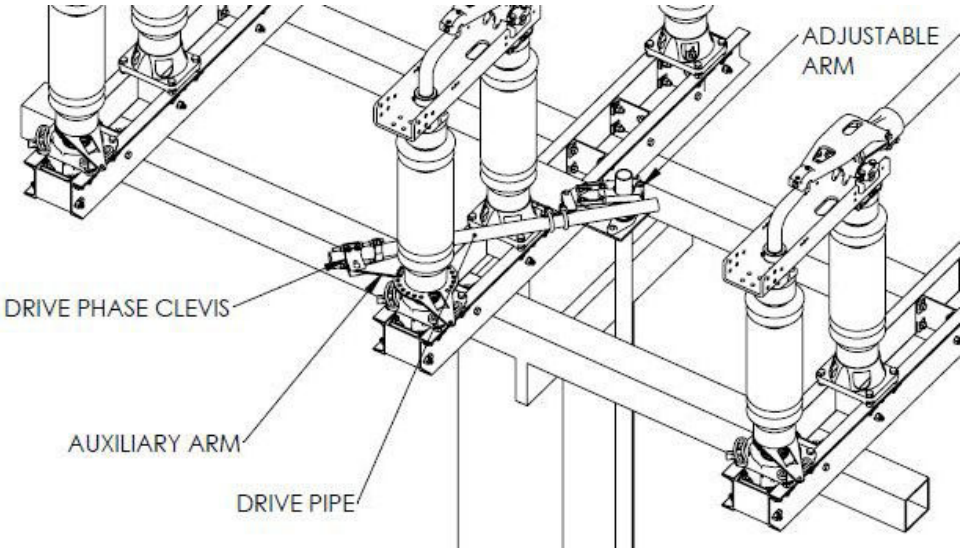
Installation & Instruction Manual

ATTENTION:

Southern States will begin supplying a portion of new operating mechanism designs with Rapid-Set clevises for orders designed after 9/1/23. If your Operating Mechanism print calls for Rapid-Set clevises (see image below for an example), please utilize the instructions on the following pages for all linkage adjustments. If not, please adhere to the standard instructions provided.

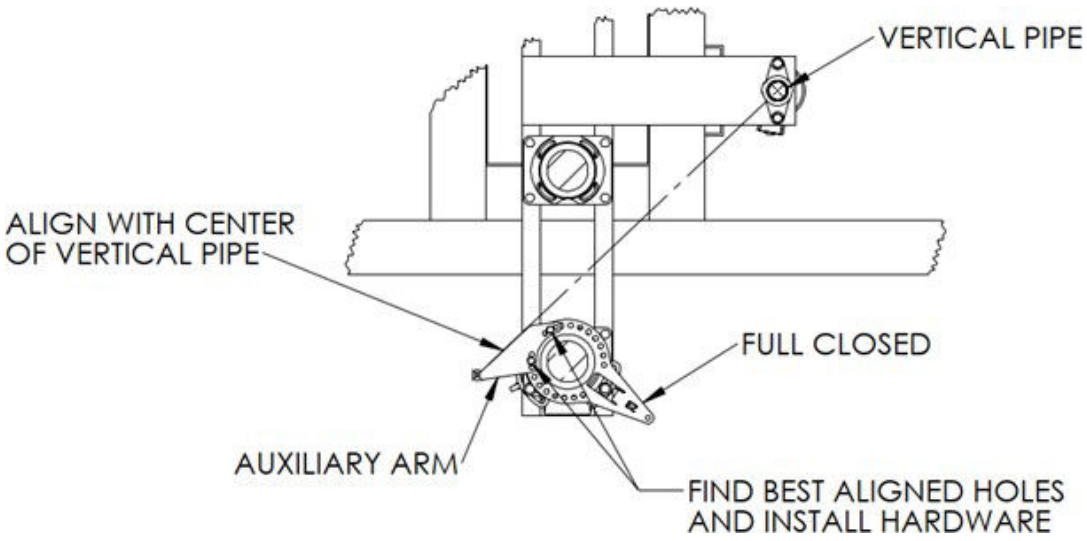


Please scan or use the link below for video instructions of Rapid-Set.
[Southern States Rapid Set Instructions]



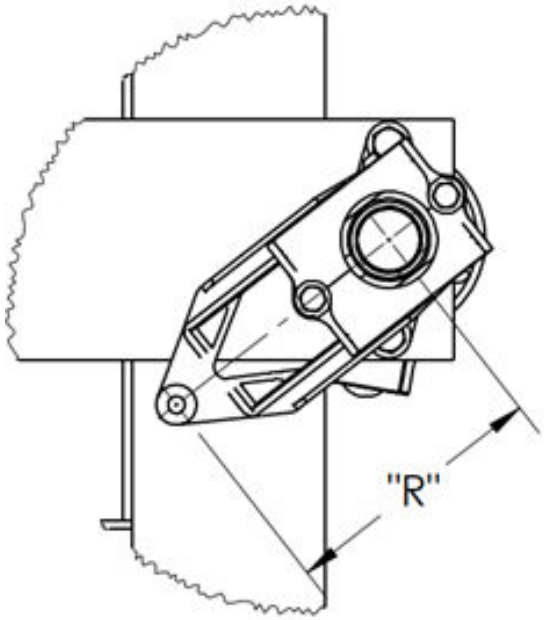
STEP 1:

Install the auxiliary arm by aligning the straight edge of the arm with the center of the vertical pipe and bolting it into place using two of the provided mounting holes. Do this with the switch phase set to the full closed position as shown below.



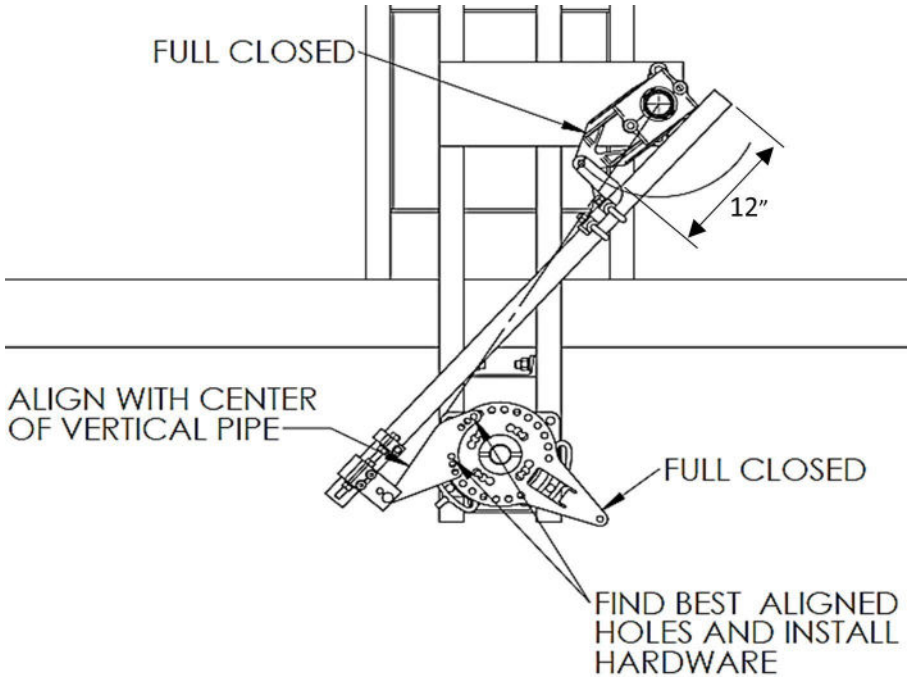
STEP 2:

Install the adjustable arm with the radius “R” set to the recommended length provided in the operating mechanism drawings.



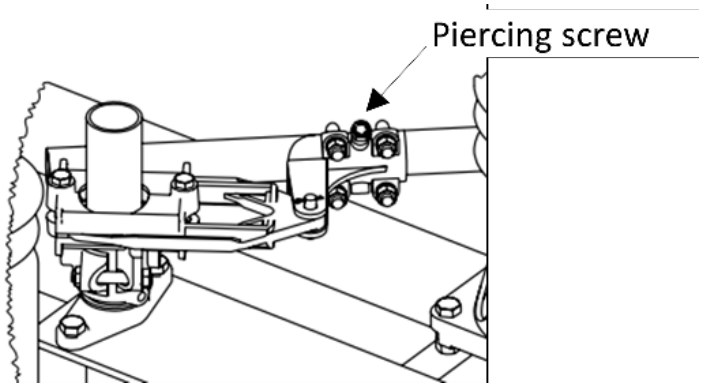
STEP 3:

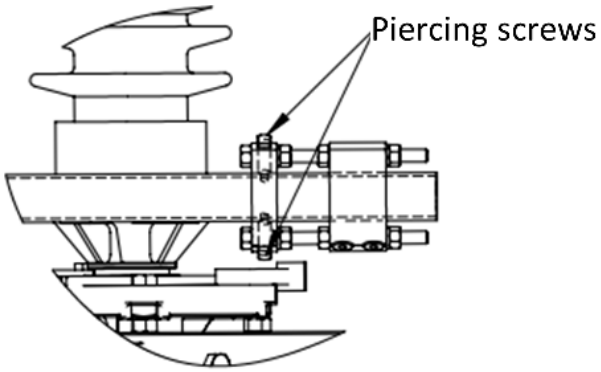
Install the auxiliary arm Rapid-Set clevis and drive pipe. Ensure that roughly 12” of pipe extends beyond the adjustable arm clevis connection so that the pipe makes contact with the adjustable arm in the position shown. This may be the open or closed position depending on the job specific drawings. The pipe should contact the adjustable arm in this position.



STEP 4:

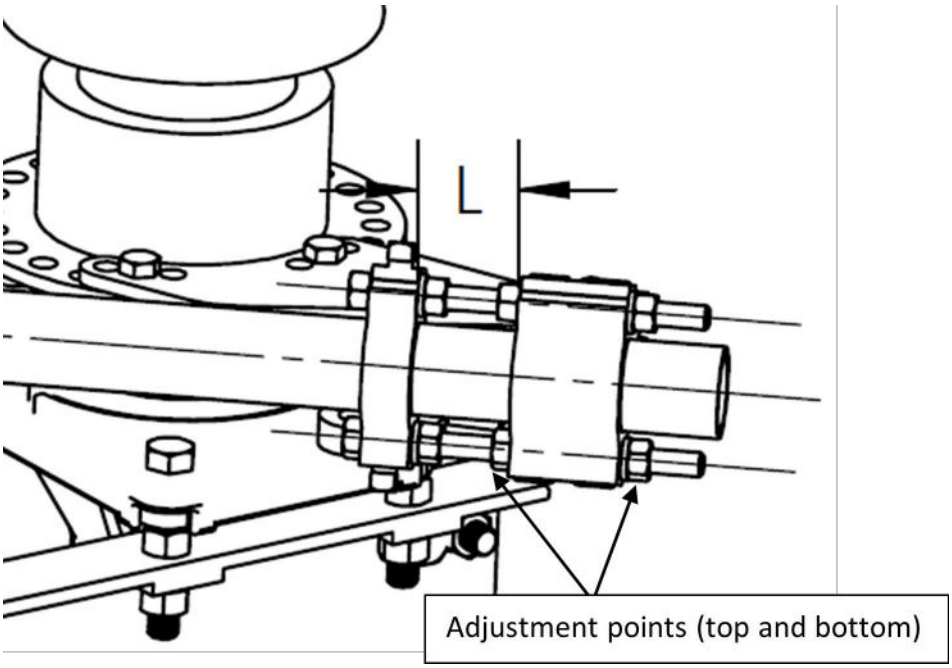
With the auxiliary arm properly aligned with the vertical pipe and the switch phase in the full closed position, pierce the pipe at both ends. **NOTE:** U-bolt style clevises require pre-drilling on all pipes thicker than SCH40. Drill guides are provided on the operating mechanism BOM when required. Pierce the adjustable arm clevis by hand tightening until it penetrates the pipe and continue until snug (note piercing screw may still have threads showing). Do not remove plastic caps from the Rapid-Set clevis at this time. To pierce the Rapid-Set clevis, tighten each piercing screw until the head contacts the aluminum extrusion. Do not over tighten.





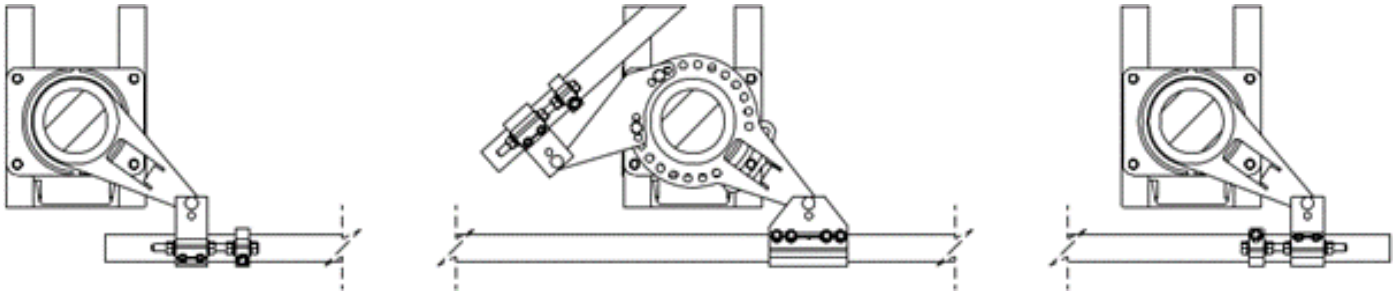
STEP 5:

Begin to manually open the phase using the operator. Observe the phase closed and open stops during operation and modify the length of the adjustable arm as needed to provide the proper amount of travel. Lengthen the arm to add travel and shorten the arm to decrease travel. The mechanism should have sufficient toggle (spring load) during closed and open position. To balance the force at closed and open positions, adjust the length “L” of the Rapid-Set clevis by adjusting the four nuts shown below. Ensure that both the top and bottom sets are adjusted in equal increments.



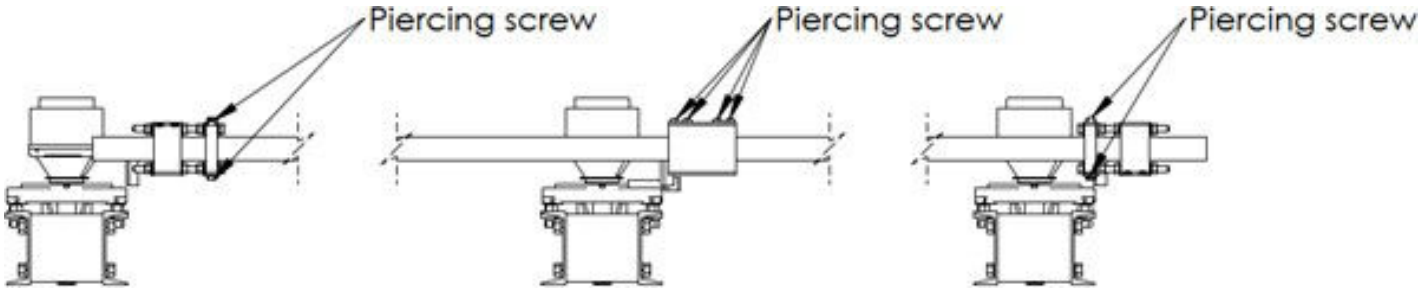
STEP 6:

After the drive phase is adjusted to operate correctly, set all phases to full closed, and install the interphase pipe following the procedure below.

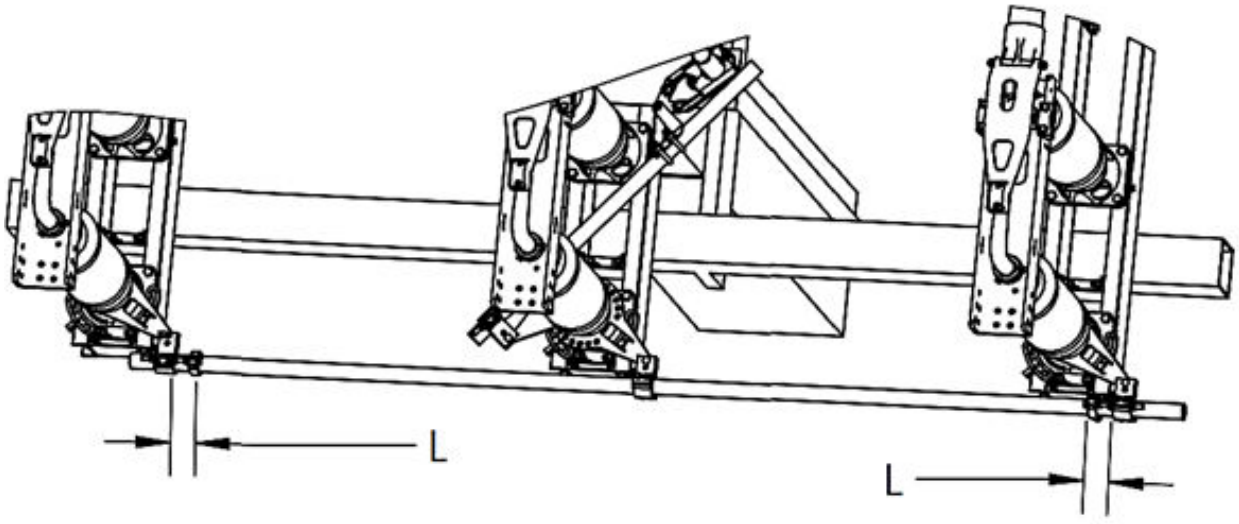


For switches driven by the center phase:

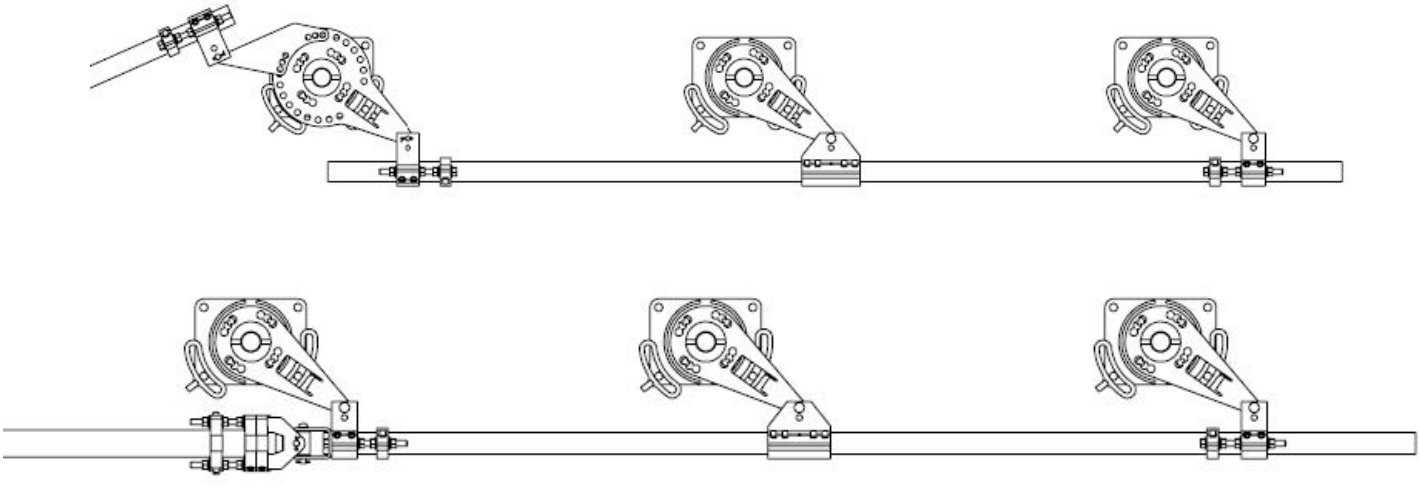
a. With the interphase pipe centered and all clevises in place, pierce the interphase pipe at the locations shown. Do not remove plastic caps at this time.



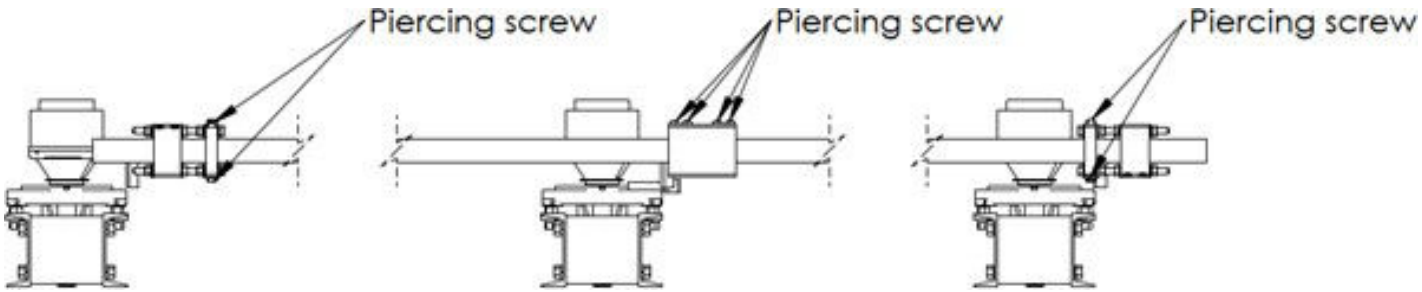
b. Adjust the timing of the two driven phases by adjusting the length “L” of each Rapid-Set clevis.



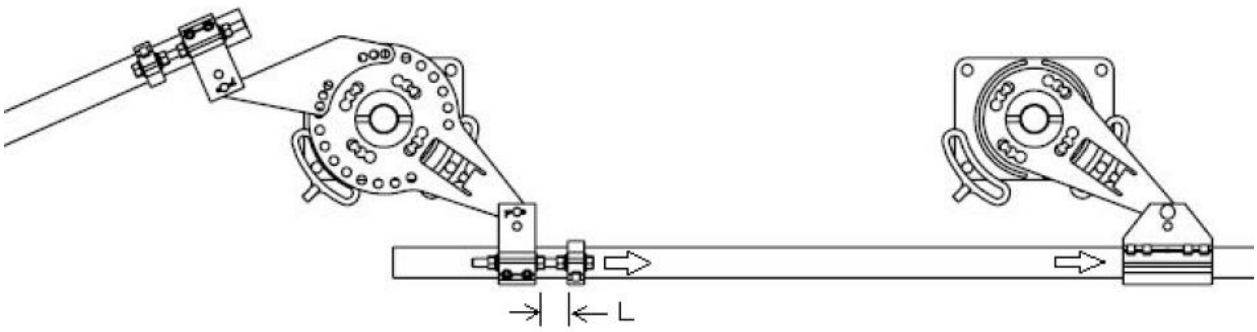
For switches driven by one of the end phases:



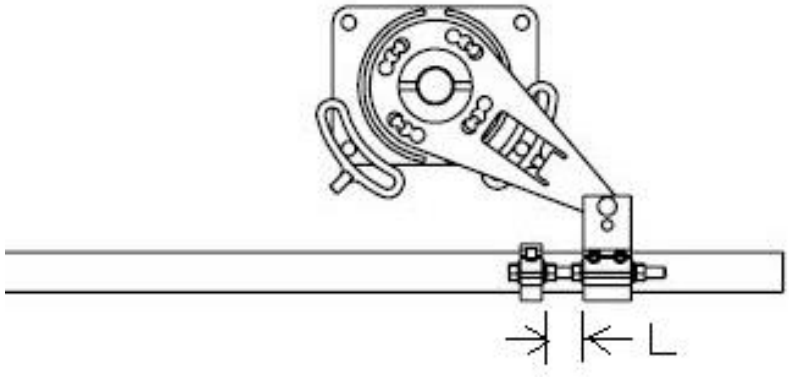
a. With the interphase pipe centered and all clevises in place, pierce the interphase pipe with at the locations shown. Do not remove plastic caps at this time.



b. Adjust the timing of the center phase by adjusting the length “L” of the Rapid-Set clevis attached to the drive phase.



c. Set the timing of the last phase by adjusting the length “L” of the Rapid-Set clevis attached to the last phase.

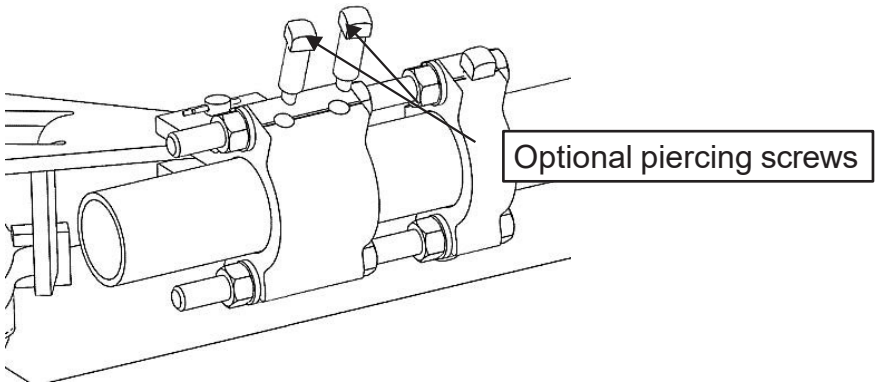


STEP 7:

With all the phases adjusted, open and close the three phase assembly and inspect for proper operation. Once adjustments are finalized, pierce all remaining connections (switch operator, adjustable arm, etc).

STEP 8:

Each Rapid-Set clevis is provided with 2 extra piercing screws. These are for optional use. To install these, remove the plastic cover caps and install them as shown below. Note, adding these will restrict any additional adjustment. Remove them before making any adjustments and then reinstall them on the bottom side of the clevis.



Type ES-1 1200A

Type ES-1 1-Way 2000A

Table of Contents

Important

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Southern States reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material, or both, the latter shall take precedence.

Summary

These instructions do not purport to cover all details or variations in equipment, or provide for every possible contingency to be met in connection with installation, operation or maintenance. Should information be desired or should particular problems arises which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Southern States Representative. The contents of this instruction manual should not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Southern States. The warranty contained in the contract between the parties is the sole warranty of Southern States. Any statements contained herein do not create new warranties or modify the existing warranty.

Safety Information

DANGER

THE EQUIPMENT COVERED IN THIS MANUAL SHOULD BE HANDLED, INSTALLED, AND MAINTAINED BY TRAINED PERSONNEL ONLY. IMPROPER HANDLING, INSTALLATION, OPERATION OR MAINTENANCE OF THIS EQUIPMENT MAY CAUSE IMMEDIATE HAZARDS WHICH WILL LIKELY RESULT IN SERIOUS PERSONNEL INJURY OR DEATH.

WARNING

The equipment covered by this publication must be handled, installed, operated and maintained by qualified persons who understand any hazards involved and are thoroughly trained in the handling, installation, operation and maintenance of high voltage transmission and distribution equipment. These instructions are meant for only such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

A qualified person is one who is trained in and has skills necessary:

- to distinguish between energized and de-energized parts
- to determine proper approach distances to energized parts
- to determine proper approach to energized or de-energized equipment that may be pressurized with gas
- proper use of personal protective equipment, insulating and shielding materials, insulated tools for working near energized and /or pressurized electrical equipment
- Knowledge of special purpose equipment that may be unbalanced, pressurized or may have other special attributes that require precautions in handling, installation, operation and maintenance

The instructions in this manual are general guidelines for this type of equipment and not specific to the equipment supplied. Portions of it may not be applicable or may not have complete instructions for your specific equipment. If you do not understand any part of these instructions or need assistance, contact Southern States Service Division at 770-946-4562.

Introduction

The Southern States Type ES-1 switches are three phase, group operated, side break air disconnect switches. The switches may be operated using a manual operator or an electric motor operator. The installation procedure for all mounting positions and operating schemes is similar and explained herein. A system of pipes, bearings, and adjustable length arms is utilized to open and close the switch from a ground level operator.

Receiving

Unpack the equipment and check for damages or shortages immediately. The bill of material from the Unit Assembly (switch) and Operating Mechanism drawings should be used for this purpose. If damage or a shortage is noted, file a claim immediately with the carrier and contact the factory.

Storage

All components of the ES-1 disconnect switch are suitable for outdoor use and do not have any special storage requirements. If a motor operator is furnished be sure to connect the heater circuit, using the provided external wiring, while the unit is in storage. Discard the wiring upon installation. Typical crating is intended for storage less than 1 year. If long term storage is required please notify factory at time of order placement so that special crating can be furnished.

General Information

All photographs and sketches in this manual are for illustration purposes only and may not be to scale. Refer to the Unit Assembly drawing or the Operating Mechanism drawing provided with each disconnect switch for specific details. During installation, it may be necessary to make adjustments other than those described in this manual. Contact your local representative or the factory if questions should arise. **Southern States After Sales and Service Department is available for field installation assistance along with providing parts support for all Southern States products. Contact After Sales and Service at 770-946-4562.**

Table 1: Recommended Tools and Torque Values

Tools	
Type	Sizes
Hand Wrenches	1 1/8", 15/16", 3/4", 9/16", 7/16"
Sockets	1 1/8", 15/16", 3/4", 9/16", 7/16"
Screw Drivers	Flat Head
Pliers	Needle Nose
Hammer	Soft Face (ex. Rawhide)

Torque Values	
Bolt Size	Torque (Ft-lb)
1/4"	8
3/8"	16
1/2"	40
5/8"	92
3/4"	127

Principles of Operation

These switches are designed to be opened and closed as a three-phase unit by a system of pipes that translates the rotational movement of an operator on the ground (whether manual or electrical) to simultaneous rotation of the end insulator of each switch pole. Figure 1 shows a typical operating mechanism for an ES-1 switch. In all cases the operating principle remains the same and the methods of installation and adjustment are virtually identical.

The operating mechanisms are intended to fully open and fully close the disconnect switch by rotating the vertical operating pipe 180° using an operator (manual or electrical). The reach rod translates the motion of the vertical operating pipe to the rotating insulator. The adjustable arm controls the total amount of switch operation available.

The ES-1 switches may be either right-hand (clockwise rotating) or left-hand (counterclockwise rotating) switch blades and operating mechanisms. This is necessary so that the switch blade always rotates away from the pole, maintaining line to ground clearance.

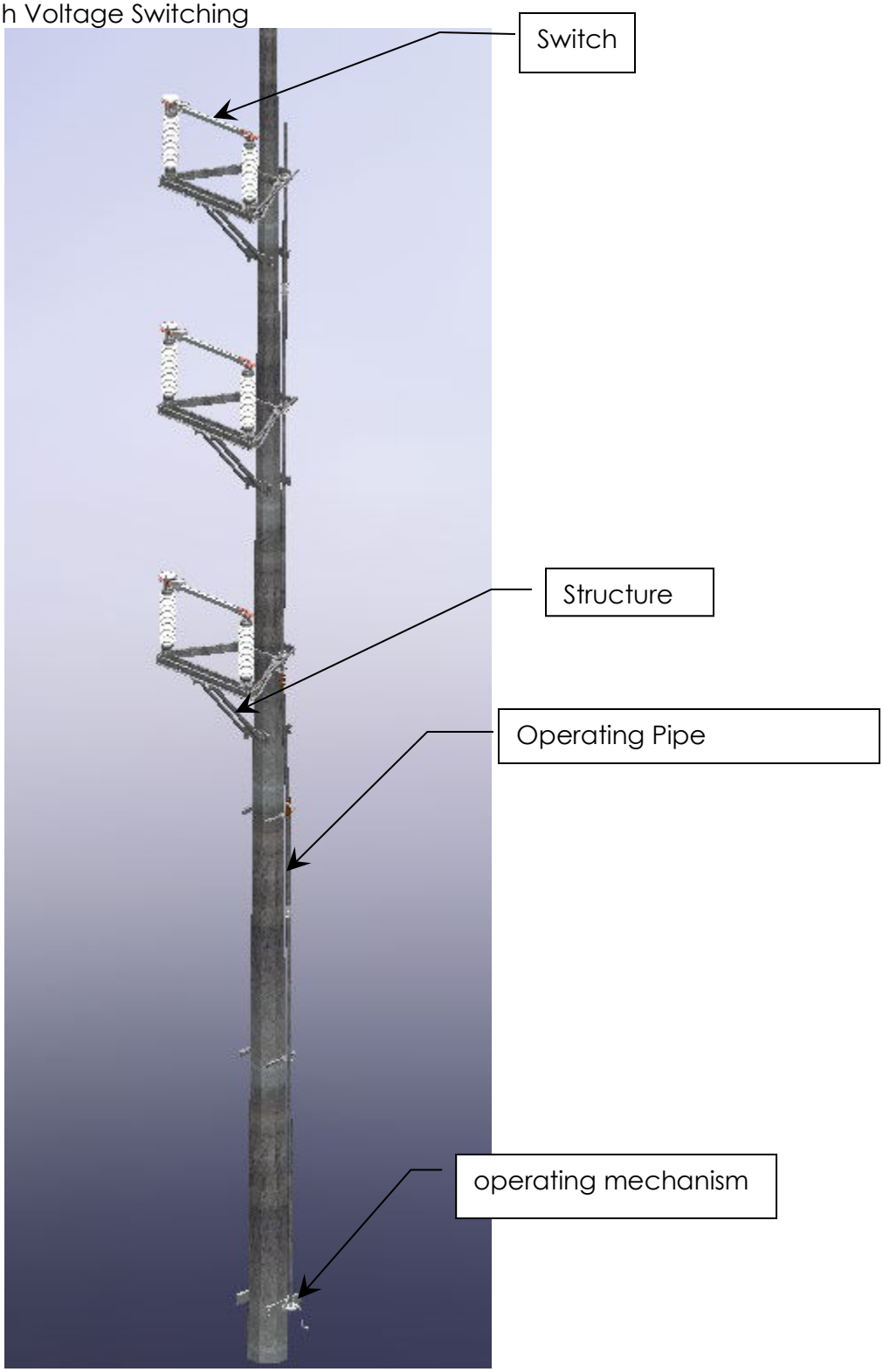


Figure 1: Typical Pole Mounted Switch with Operating Mechanism

Typical Disconnect Switch

In general, installing a Southern States Type ES-1 Way Disconnect Switch consists of the following:

- Mounting the switch to the upper frame.
- Mounting the upper frame to the structure.
- Mounting the remaining frame components to the structure.
- Installing operating mechanism components.
- Final adjustment of the switch and operating mechanism.

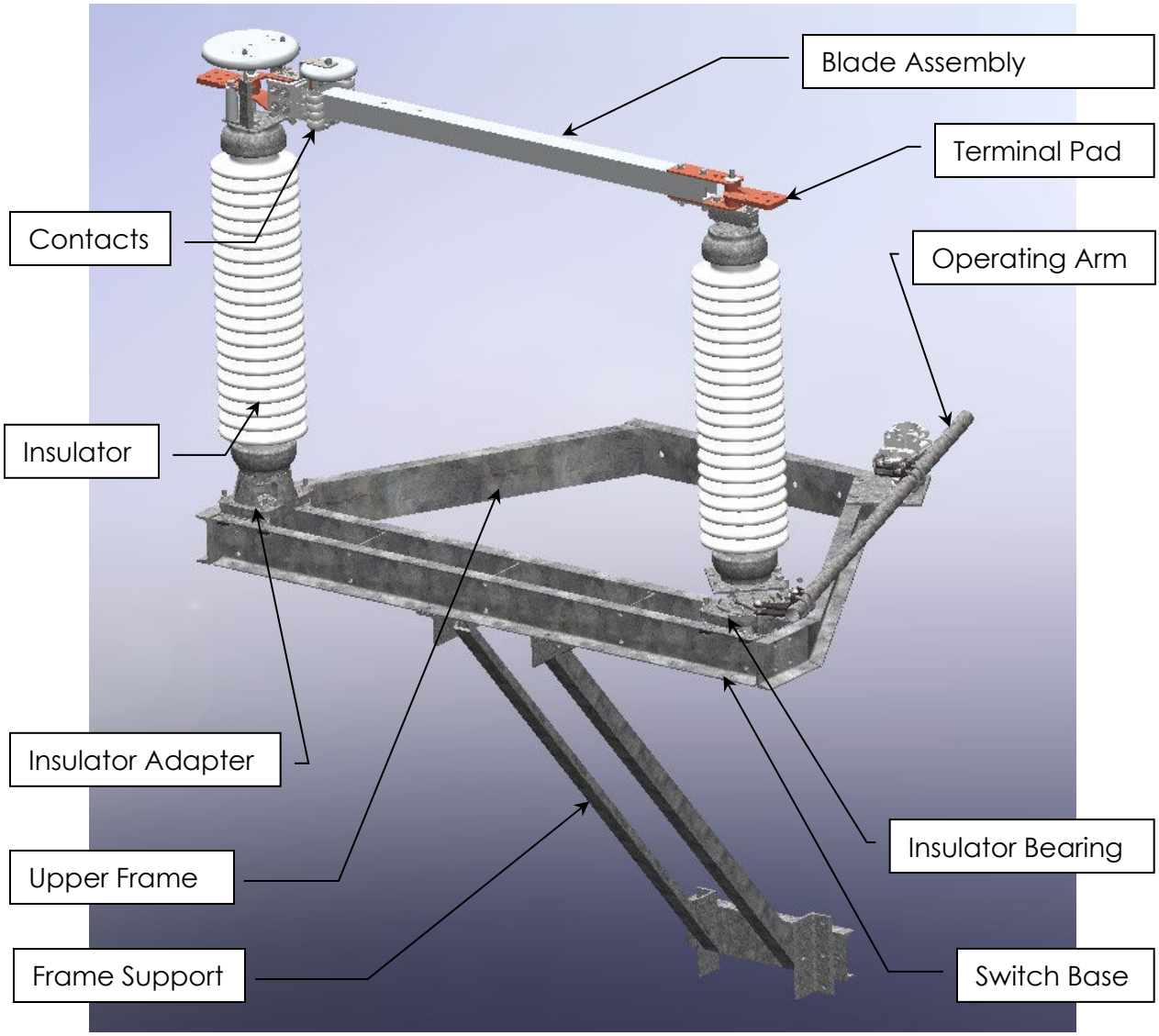


Figure 2: Common ES-1 Terminology

Preferred Switch Assembly Method

Important

Safety precautions must be taken and safety guidelines carefully followed. Follow all NESC, OSHA, user, manufacturer, and local safety requirements.

Unpack Switch

1) Remove any shipping braces or straps from the switch. Leave the shipping stands attached to the switch base to facilitate assembly. See Figure 3.

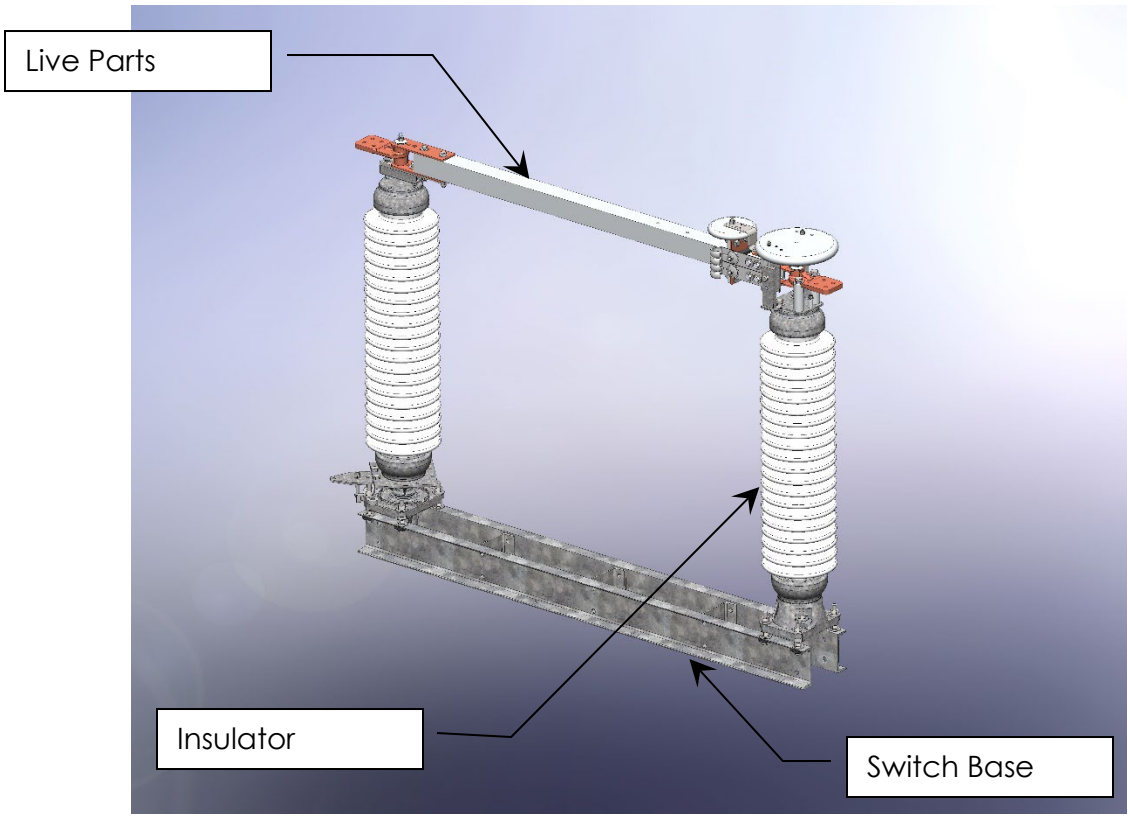


Figure 3: Switch as received

2) Attach switch base to upper frame. Secure with provided hardware. See Figure 4.

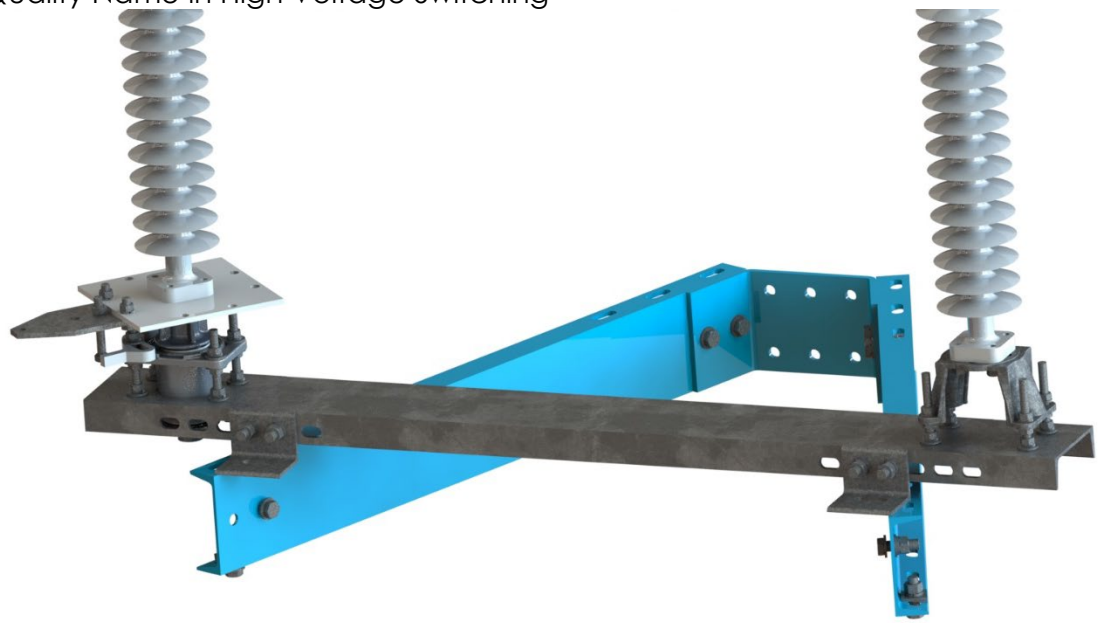


Figure 4: Attach upper frame to switch base

3) Mount the switch to the pole. **Only lift the switch from the switch base.** Continue to support the switch until the frame support components are in place. See Figure 5 and 6.

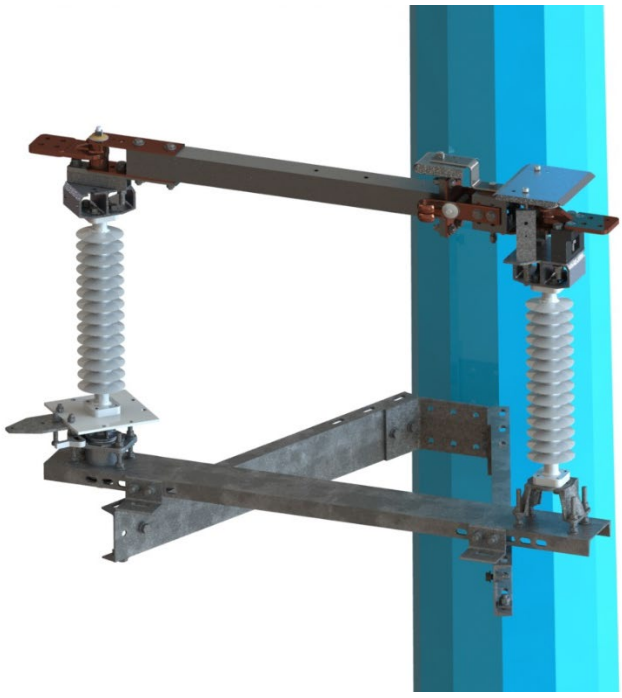


Figure 5: Mount switch to pole

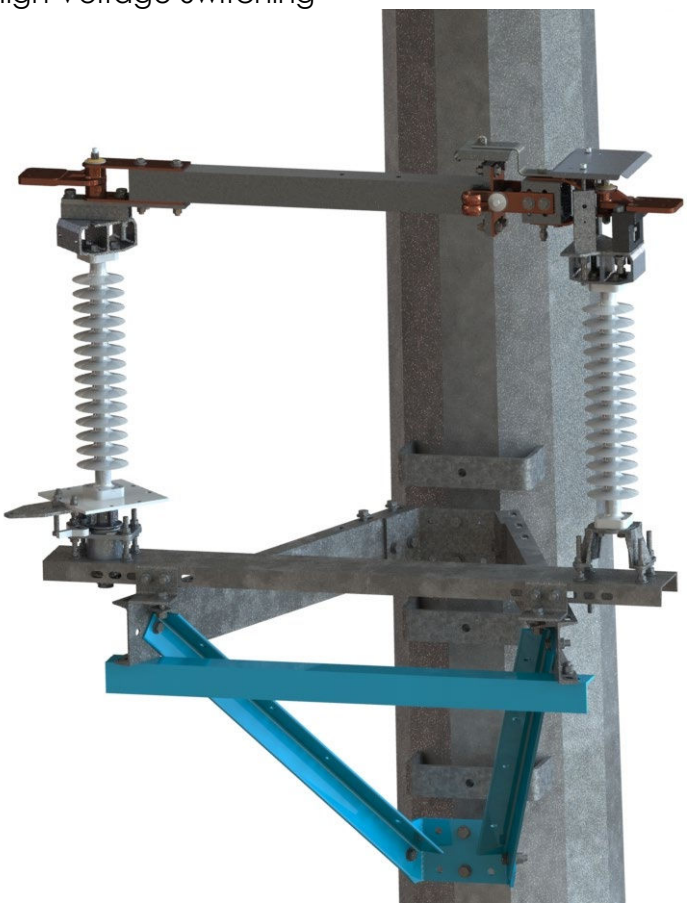


Figure 6: Attach frame support

4) Attach pipe bearings, vertical pipe, and reach pipe. Refer to job specific Operating Mechanism drawing for details. See the section Install Operating Mechanism Components for more instructions.

5) Extend the bearing stop bolt until it can interact with the bearing stops. See Figure 7.

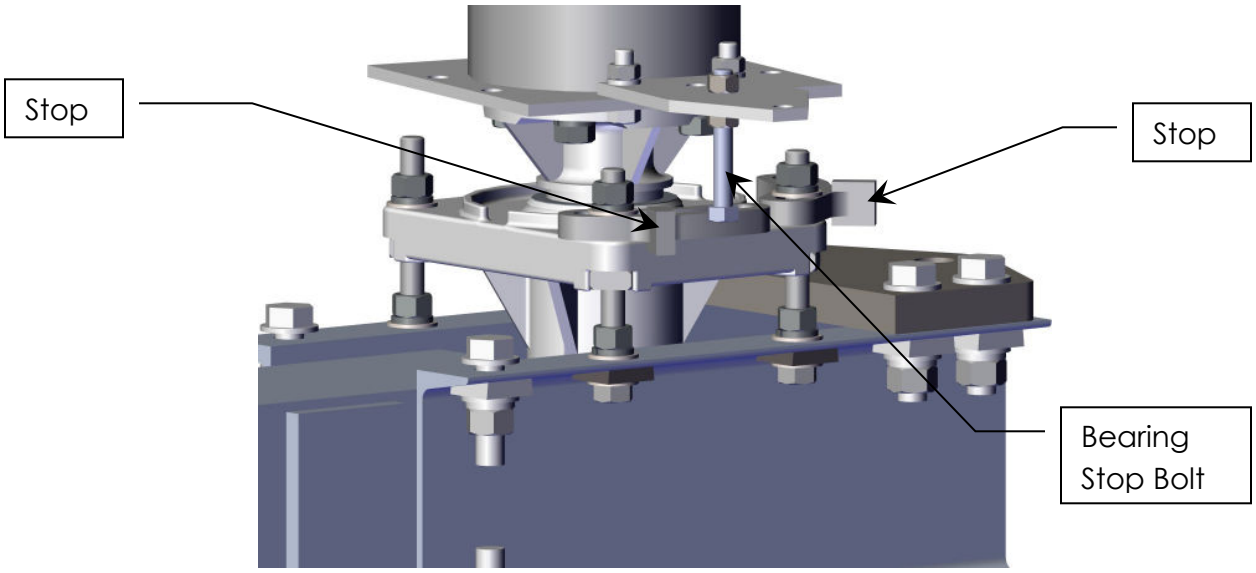


Figure 7: Bearing Stop Bolt Height

Check Contact Adjustment

All switches are factory adjusted and should require only fine tuning once attached to the structure. Still, it is a good idea to check the adjustment prior to mounting the switch.

1) Close the switch and ensure the switch base is level.
2) Ensure the centerlines of both blades are aligned. Blade should be centered +/- 1/8". See Figure 8.

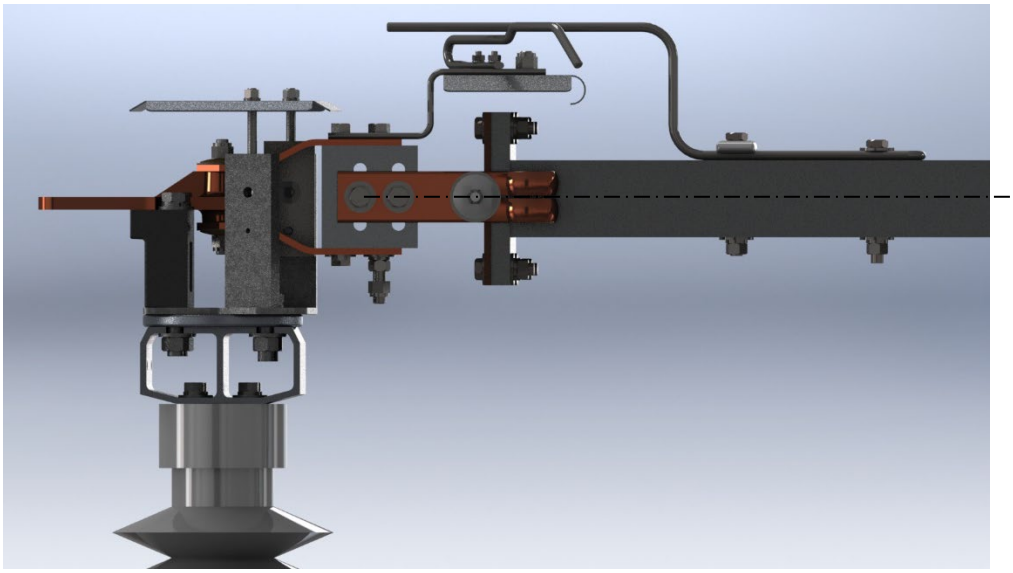


Figure 8: Blade Alignment

3) Measure the gap between the blade tip and the blade stop. The gap should be between 1/16" and ¾". See Figure 9.

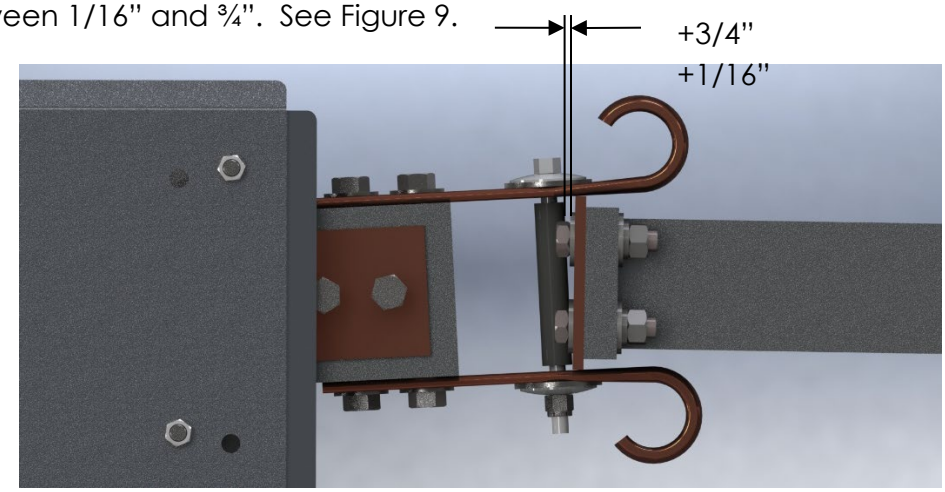


Figure 9: Male Blade Tip Depth

4) There should be a gap of approximately ½" to 1" between the female blade contacts and the male blade tip when the female blade assembly is fully open. See Figure 10. It is critical that this gap is maintained to provide the proper clearance on opening.

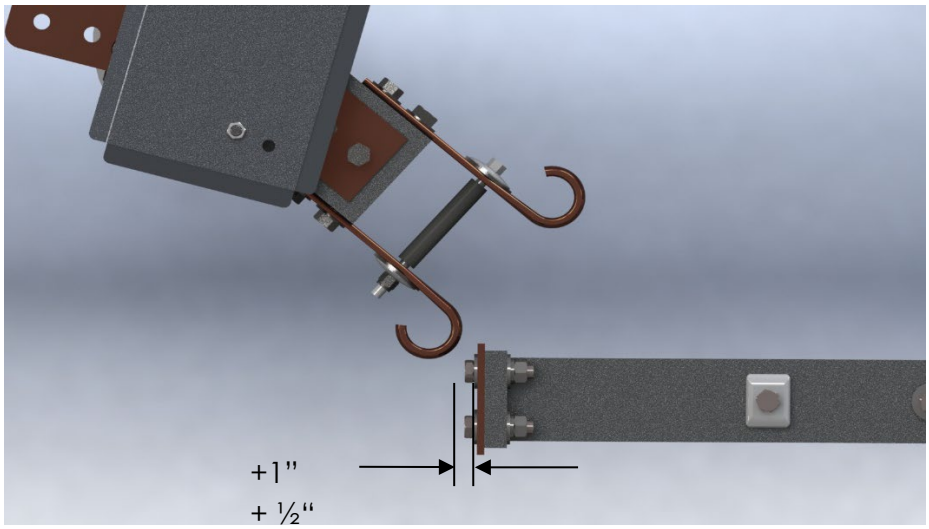


Figure 10: Blade Open Gap

5) If the blades are parallel and level and the gaps within the specified ranges, move on to the next section.
6) If the gaps are too large, use the insulator bearing jack bolts to tilt the male blade towards the jaw. Use the provided shims between the live parts and the insulator to level the male blade.
7) If the gaps are too small, use the insulator bearing jack bolts to tilt the male blade away from the jaw. Use the provided shims between the live parts and the insulator to level the male blade.
8) If the blade open gap is difficult to achieve using the above methods, ensure the female blade assembly is fully opening and the live parts catch fully engaging. See the next section for detailed instructions.
9) Conductor loads and switch attachments, such as interrupters, can alter fine switch adjustments, so final adjustments should be performed after connecting these components.

Check Blade Stop Adjustment

All switches are factory adjusted and should require only fine tuning once attached to the structure. Still, it is a good idea to check the adjustment prior to mounting the switch.

1) Close the switch.
2) The switch blade over toggle should be between ¼" and ½". See Figure 11. If necessary, use the live parts close position stop bolt to adjust the over toggle.

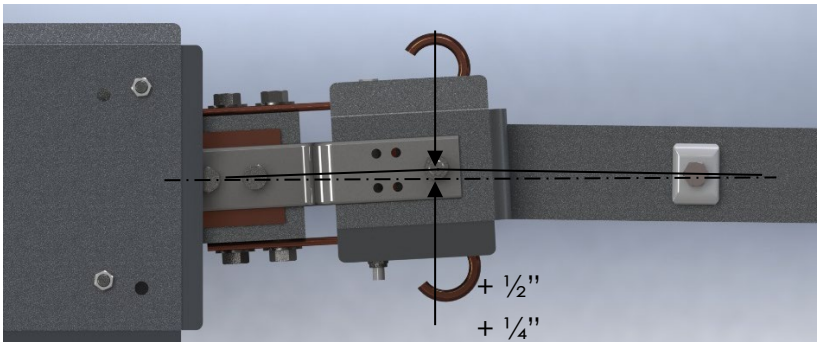


Figure 11: Left-handed Switch Blade Over Toggle

3) The live part closed position stop is correctly engaged when it touches the female blade lightly. Adjust the bolt if necessary.

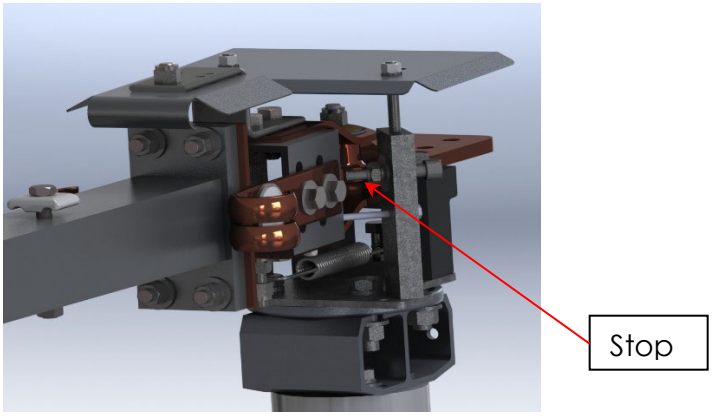


Figure 12: Live Parts Closed Position Stop

4) The closed position bearing stop, located at the bottom of the insulator, is correctly adjusted when there is a 1/16" to 1/8" clearance between the stop and the stop bolt. Adjust the stop if necessary. See Figure 13.

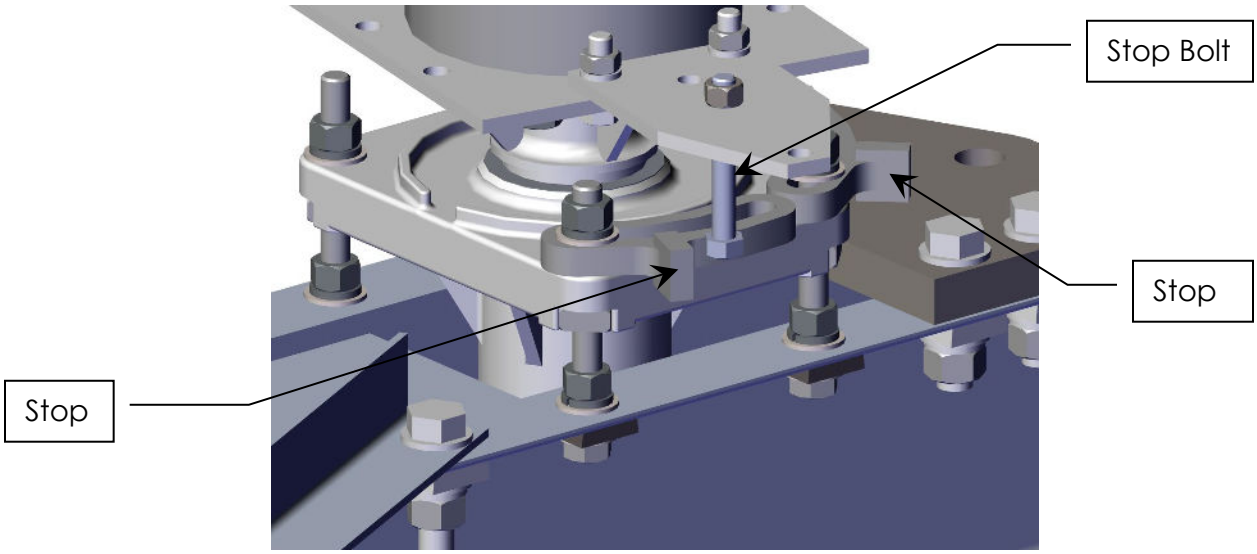


Figure 13: Closed Position Bearing Stop

5) To facilitate Operation Mechanism adjustment, loosen the opened position bearing stop at this time.
6) Open the switch.

7) The open stop is built into the jaw design of the ES-1. No adjustment is required.

8) The typical blade opening is 90°. Blade attachments may alter the opening angle. Refer to the Operating Mechanism drawing for details.

9) Conductor loads and switch attachments, such as interrupters, can alter fine switch adjustments, so final adjustments should be performed after connecting these components.

Install Operating Mechanism Components

1. Lay out all the operating mechanism parts and check them against the Operating Mechanism drawing bill-of-material.
2. In most cases piercing bolts can be installed on the bottom sides of the clevises to aid switch inspection from the ground. **Do not pierce pipe at this time.**
3. Refer to the Operating Mechanism drawing and install all mounting brackets, bearings, and bushings to the pole. See Figure 16 for an example ES-1 Operating Mechanism.

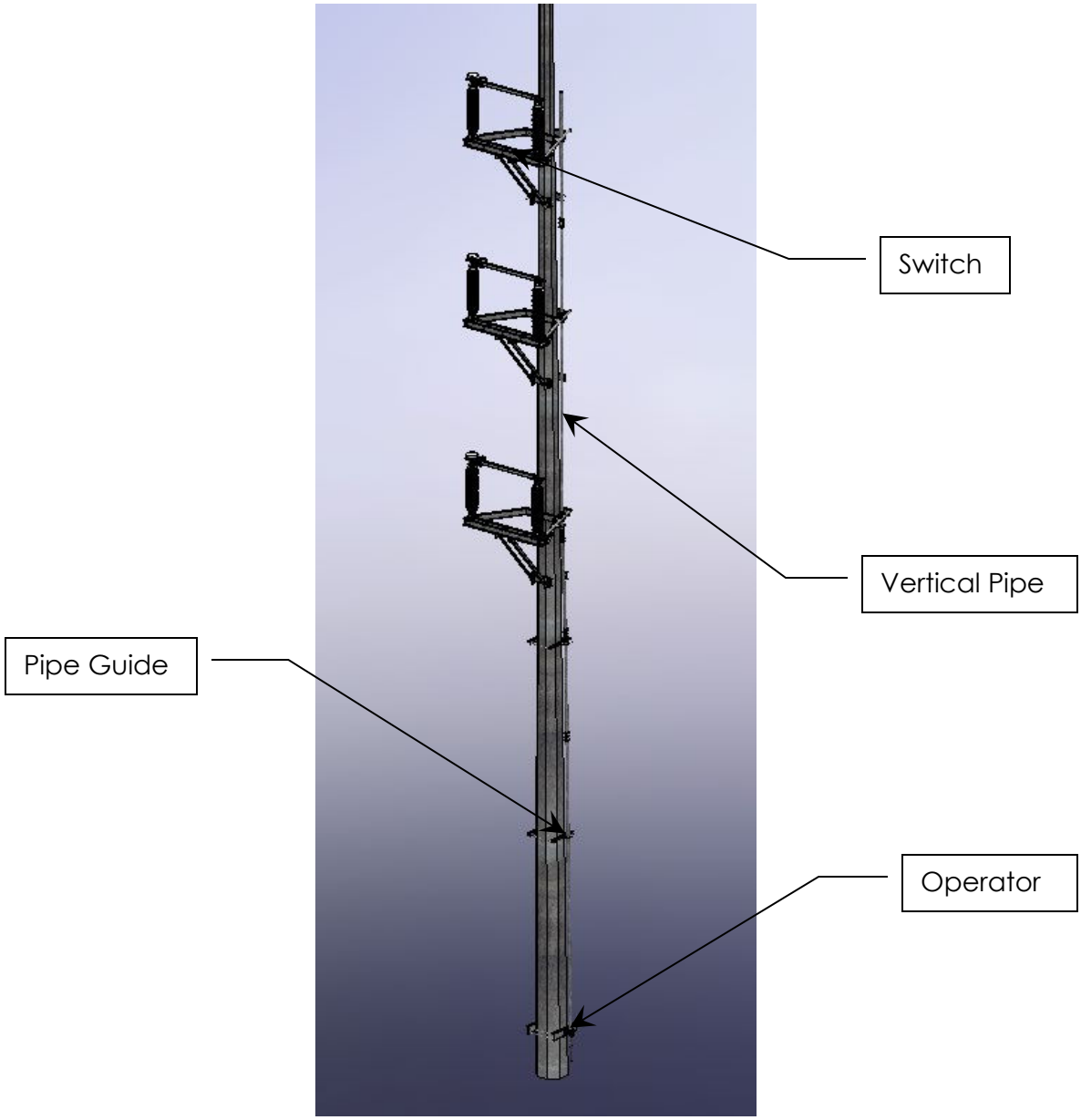


Figure 16: Example ES-1 Operation Mechanism

4. Tighten all hardware on the top bearing support. See Table 1 for recommended torque values.
5. Attach all required pipe clevises, adjustable arms, and other necessary components while mounting the first section of the vertical operating pipe. Refer to the Operating Mechanism Drawing for details.
6. Hang the first section of the vertical operating pipe from the top bearing by piercing the pipe with the bearing collar set screw. **CAUTION:** The pipe collar (above the vertical bearing support) must support the entire weight of the vertical operating pipe. **Do not allow the pipe to rest on the operator.** Refer to Figure 17 and Figure **18.**

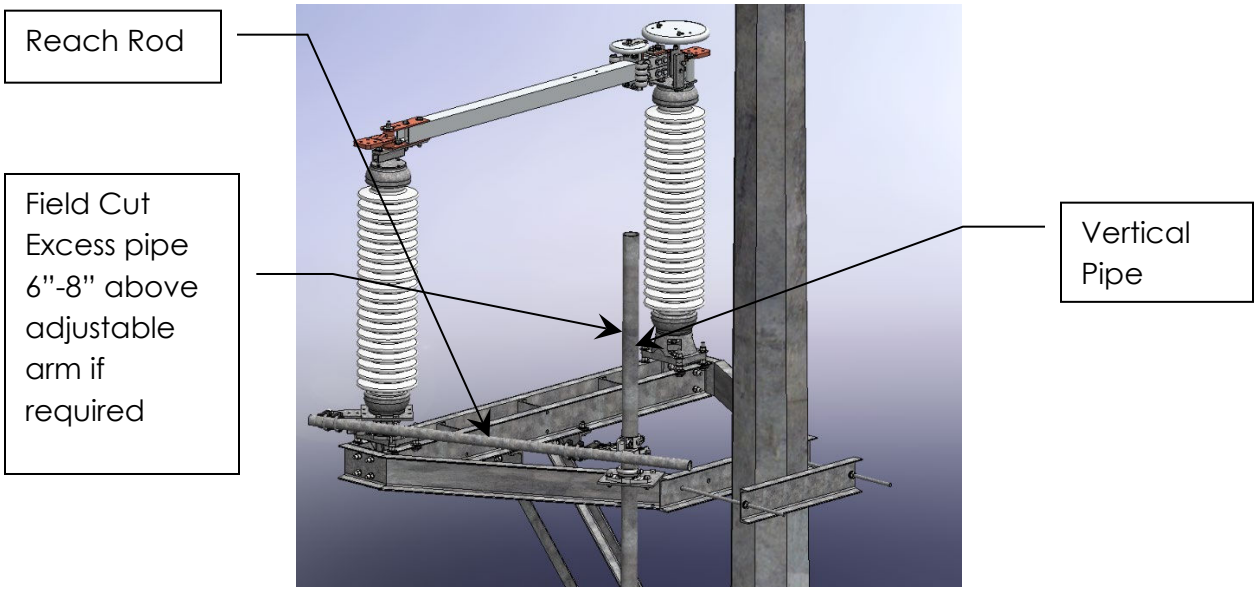


Figure 17: Top Phase Operation Mechanism

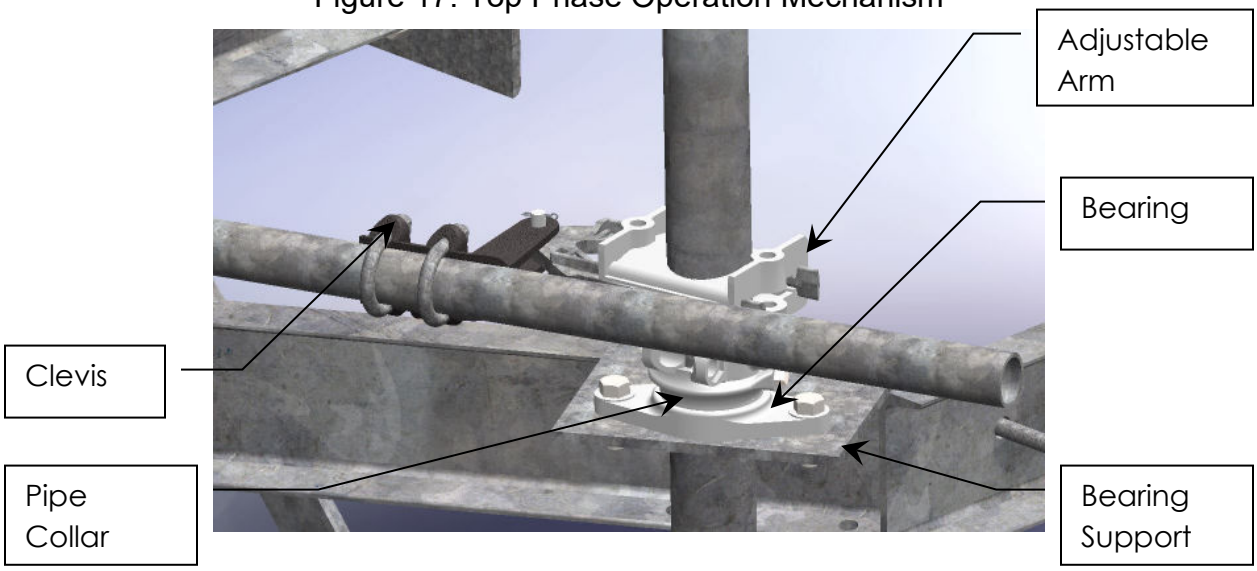


Figure 18: Vertical Bearing Support

7. Repeat steps 4 through 6 at every bearing support as more vertical operating pipe sections are added.
8. Tighten hardware on any remaining pipe guides, bearings or bushings as the remaining sections of vertical pipe are hung.
9. While installing the clevises that have piercing bolts, do not pierce the pipe until instructed.

Adjust Switch and Operating Mechanism

1) Switch Operating Devices:
   a) Worm gear operator (HOGO or SEGO)
      i) The operator handle is factory set to rotate either clockwise or counter-clockwise to open the switch.
      ii) When the switch is properly adjusted the operator handle should hang vertically and free in both the open and closed positions to permit the use of a customer supplied padlock.
      iii) **Caution:** Be aware that there is an adjustable stop on the operator. **Do not** over operate as damage will occur to the operator.
   b) Swing handle operator
      i) When the switch is properly adjusted the handle should hang vertically and free in both the open and closed positions to permit the use of a customer supplied padlock. See Figure 19.

Figure 19: Typical Swing Handle

c) Electrical motor operator
   i) Please refer to motor operator instruction manual for proper installation and setup.
   ii) Use manual operation while completing switch setup.
   iii) **Do not** electrically operate until all switch adjustments are complete. **ALWAYS** operate the motor operator decoupled first to ensure proper setup.

2) Preliminary Switch Settings:
   a) Start with the disconnect switch and operating mechanism in the closed position.
   b) Set the adjustable arm on the top phase to the preliminary setting specified on the Operating Mechanism Drawing.
   c) Match-mark the adjustable arm and all clevises.
   d) Repeat Steps b and c at the middle and bottom phases.
   e) After mounting all the operating mechanism components in their proper initial orientations match mark all clevis connections, adjustable arms, and the switch operating device's coupling so that if slippage occurs during trial operations it can be detected.

3) Final Adjustment:
   a) Open the disconnect switch with the operator.
   b) If the switch is not fully open before the operator reaches the fully open position, the adjustable arm radius is too short. To correct:
      i) Check to see that nothing has slipped.
      ii) Return the switch to **almost** the closed position, but not toggled.
      iii) Match-mark the adjustable arm and the pipe clevis
      iv) Loosen the bolts on the adjustable arm and pipe clevis
      v) Lengthen the adjustable radius arm approximately ¼-inch. Allow the pipe clevis to reposition itself the same ¼ inch. Tighten the clevis bolts. See Figure 20.

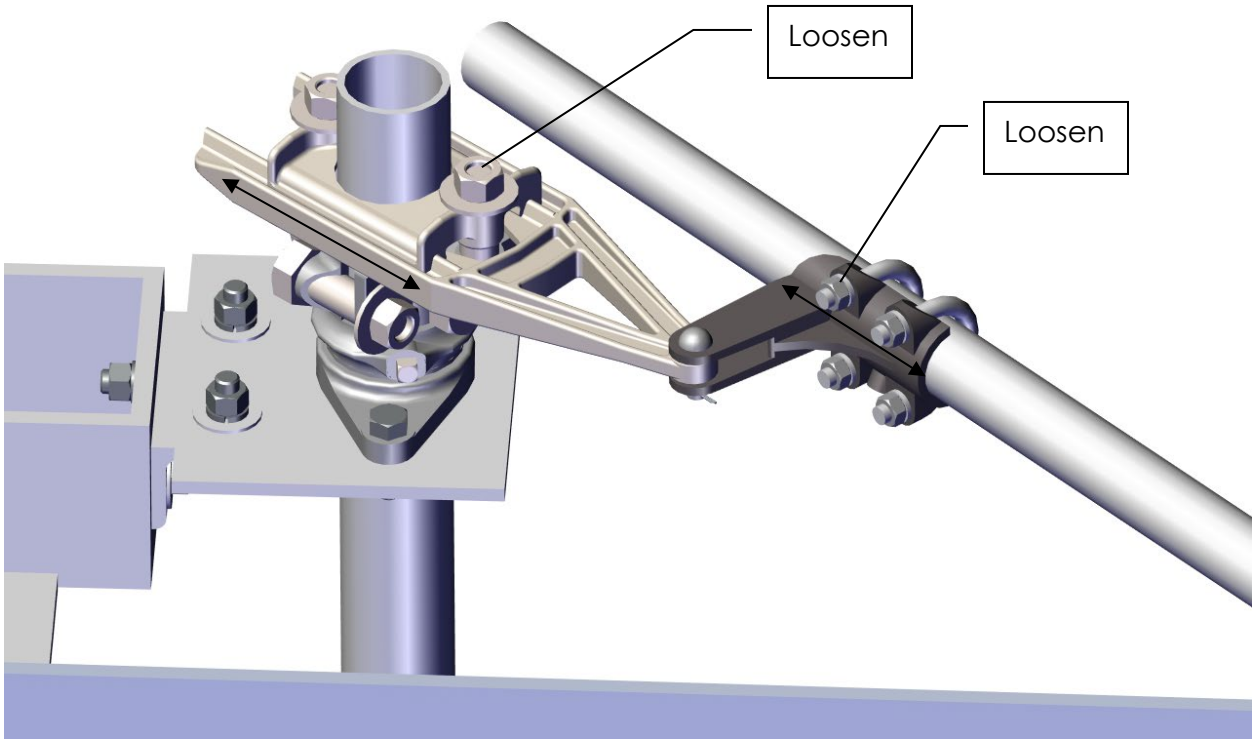


Figure 70: Adjusting the Adjustable Arm

vi) Test operate the switch and readjust as necessary.

c) If the switch is fully open before the operator reaches the fully open position, the adjustable arm radius is too long. To correct:
   i) Check to see that nothing has slipped.
   ii) Return the switch to **almost** the closed position, but not toggled.
   iii) Match-mark the adjustable arm and the pipe clevis
   iv) Loosen the bolts on the adjustable arm and pipe clevis
   v) Shorten the adjustable radius arm approximately ¼-inch. Allow the pipe clevis to reposition itself the same ¼ inch. Refer to Figure 12.
   vi) Operate and readjust as necessary.
d) All phases of the fully adjusted disconnect switch should operate together although a slight variance between poles is acceptable. The primary objective is for all phases to fully open and fully close.

4) Final Check:
   a) Once all final adjustments are complete, be sure that all nuts and bolts are tightened to their specified torque. See **Table 1**.
   b) Repeat Check Contact Adjustment and Check Blade Stop Adjustment Sections.

c) The bearing opened position stop at the bottom of the insulator is correctly adjusted when there is a 1/16" to 1/8" clearance between the stop and the stop bolt. Adjust stop if necessary. See Figure 21.

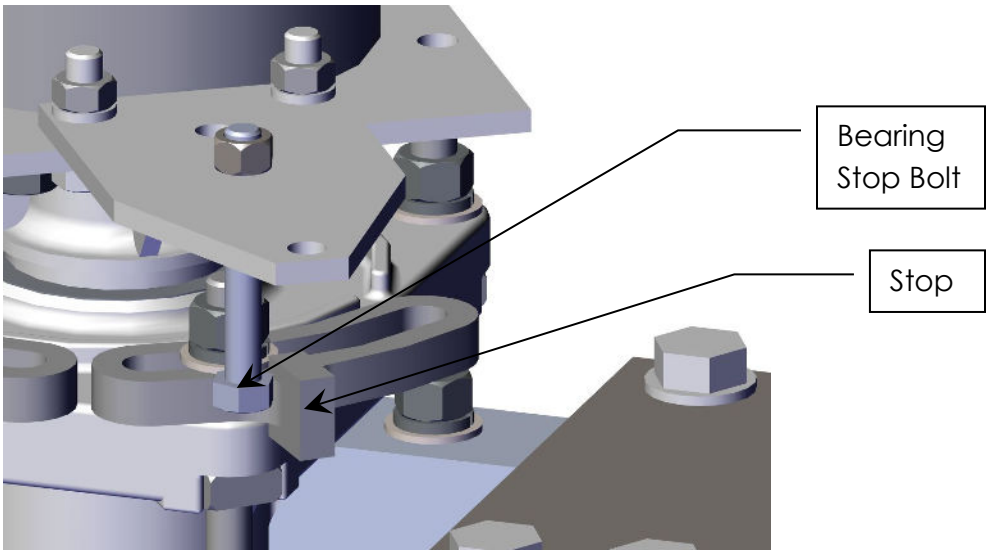


Figure 21: Bearing Opened Position Stop

d) Apply a minimal amount of grease to the point of each piercing bolt and then tighten the bolt until it pierces the pipe wall. For heavy walled pipe, (schedule 80 or above, 3 inch or above) pre-drill the set screw holes with a threaded drill guide (provided) and a ¼ inch drill bit.

e) SS lubricant (part number 08137110) is recommended on the switch contacts.

f) **ENERGIZE THE SWICH ONLY AFTER FINAL INSPECTION.**

Optional Attachments

Several different attachments can be mounted on ES-1 Switches. As this instruction book cannot contain all possible combinations, refer to the provided drawings for all mounting details. Please contact Southern States After Sales and Service Department for field installation assistance and parts support if needed.

Interrupters

LLS-I, and LLS-II interrupters can be mounted to the ES-1. Please refer to the Instruction Manuals for each interrupter for instructions on their installation, adjustment, and maintenance.

Whips

Several different styles of whips are available for the ES-1. Whips are typically used in conjunction with arcing horns. Please refer to the individual drawings for part and hardware locations.

Arcing Horns

The arcing horns on ES-1 switches serve a mechanical purpose in addition to protecting the contacts from arcing. The 'bump' on the female jaw arcing horn is designed to catch the male side arcing horn and force open the female jaw, ensuring full opening and proper operation. **DO NOT ADJUST THE ARCING HORNS SO THAT THERE IS NO 'FORCE OPEN' OPERATION. DOING SO COULD CAUSE THE SWITCH TO OPERATE INCORRECTLY.** The arcing horns should be adjusted from the factory. If they are not, the male side arcing horn may be adjusted up or down by bending so that it makes contact with the female side arcing horn throughout its operation. The male side arcing horn should be on top at all times, it should never ride on the underside of the female arcing horn.

Without Interrupters

Typically uses the metal to metal arching horn with the bump.

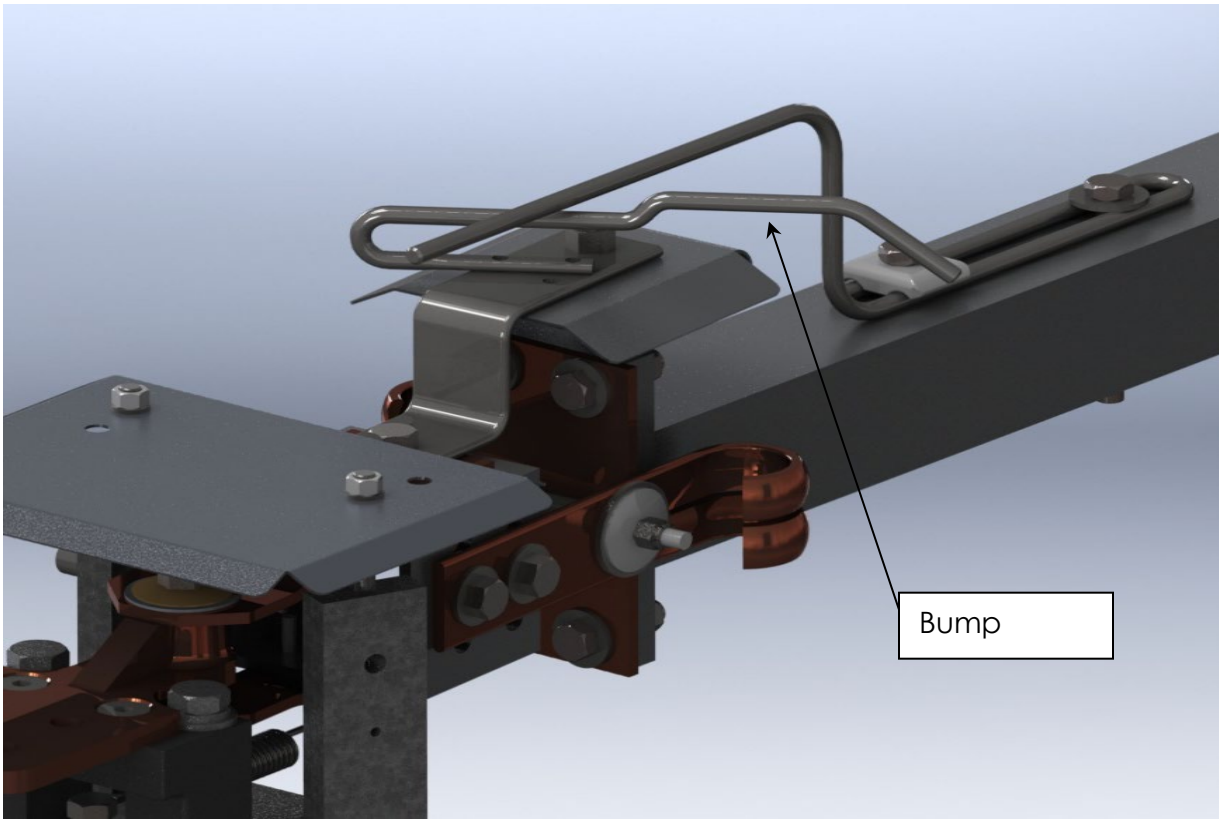


Figure 21: Metal Arcing Horn Bump

With Interrupters

The new style of arcing horns that are typically paired with ES-1s with interrupters are made out of fiber glass and do not contain a bend, but instead includes pickup arms with the arcing horn.

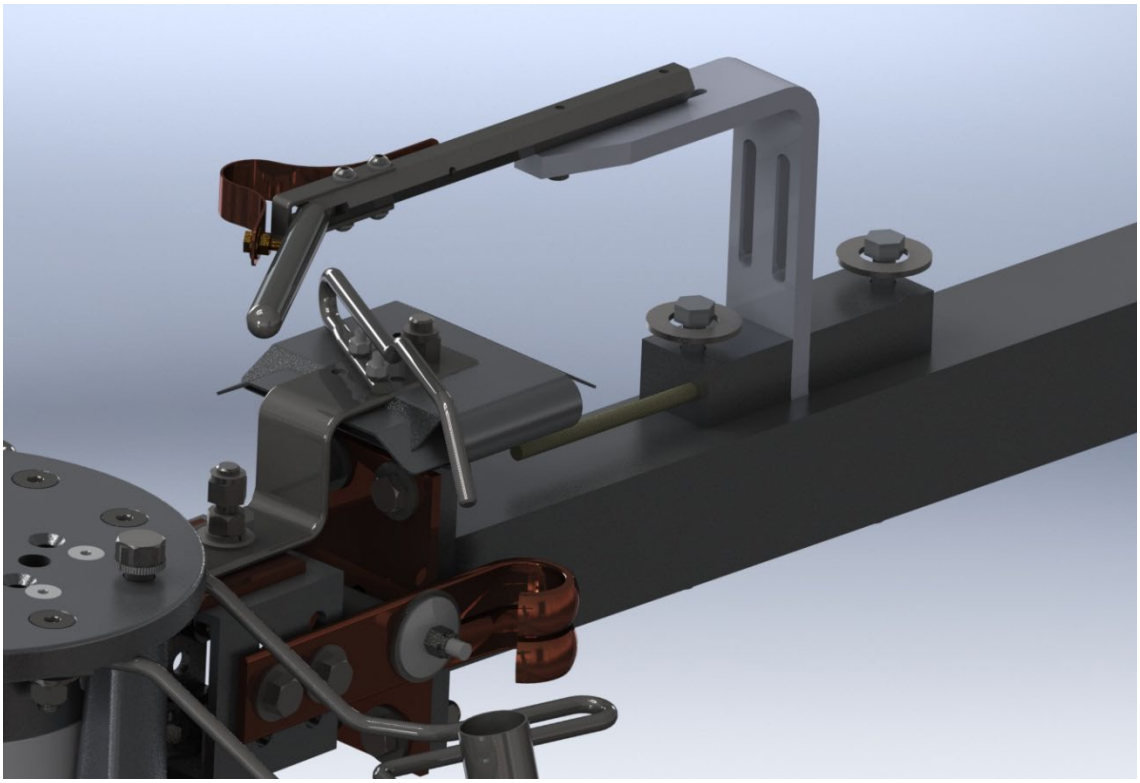


Figure 22: Fiber Glass Arcing Horn Assembly

Recommended Inspection and Maintenance

The Southern States ES-1 Disconnect Switches have been designed to operate with low maintenance. Periodic inspection is important for satisfactory operation. Frequency of inspection and maintenance depends on the installation site, weather, atmospheric conditions, experience of operating personnel, and special operation requirements. **ANSI Standard C37.35 is also a recommended guide for maintenance on air disconnect switches.**

Table 2: Recommended Inspection and Maintenance Schedule

		Installation Tests	Patrolling 6 Month	Routine 5 Year	Periodic 10 Year
Insulators	Contamination	X	X	X	X
	Damage	X	X	X	X
Cabinet*	Any loose parts on the floor of the cabinet?	X	X	X	X
	Wiring Secure	X	X	X	X
	Links Secure	X	X	X	X
	Inspect Mechanism for loose parts	X	X	X	X
	Heaters Energized	X	X	X	X
	Door Seal	X	X	X	X
Mechanical	Operational Tests	X		X	X
Electrical	Contact Resistance	X		X	X
Live parts Inspection	Inspect Contacts	X			X
	Inspect Arcing Horns	X			X

*Only applicable if a motor operator was supplied with the switch.

Patrolling Inspection (6 Months)

The patrolling inspection is a largely visual inspection on an energized unit in service. The frequency of the inspection is determined by the local conditions and policies of the owner of the equipment. Visually inspect the switch for any signs of damage. Equipment such as thermal cameras and directional microphones can be used to aid in detecting overheating parts or corona sources without de-energizing the switch. Refer to Table 2 for recommended inspection items.

Important

Safety precautions must be taken and safety guidelines carefully followed. Follow all NESC, OSHA, user, manufacturer, and local safety requirements. The switch must be disconnected from all power sources and adequate grounding put in place before Routine or Periodic Inspection and Maintenance of the switch.

Routine Inspection and Maintenance (5 year)

Routine inspection is performed on a de-energized unit. The frequency of the inspection is determined by the local conditions and policies of the owner of the equipment. Inspect the entire switch and all attachments for damage and contamination. Apply anti-seize to contacts and catch. Refer to page **Error! Bookmark not defined.**, Check Blade Stop Adjustment, step 8). Check operating mechanism for any signs of damage. Perform several test operations and a contact resistance check. Refer to Table 2 for recommended inspection items.

Periodic Inspection and Maintenance (10 year)

Periodic inspection is performed on a de-energized unit. The frequency of the inspection is determined by the local conditions and policies of the owner of the equipment. Inspect the entire switch and all attachments for damage and contamination. Apply anti-seize to contacts and catch. Refer to page **Error! Bookmark not defined.**, Check Blade Stop Adjustment, step 8). Check operating mechanism so any signs of damage. Perform several test operations and a contact resistance check. Check the blade contact alignment per Check Contact Adjustment on page 14. Check to live parts stop adjustment per Check Blade Stop Adjustment on page 16. Check the operating mechanism for proper adjustment per Adjust Switch and Operating Mechanism on page 21. Refer to Table 2 for recommended inspection items.

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