Southern States

The Quality Name in High Voltage Switching

Type ES-1 & ES-1B (Copper)
Aluminum
Side Break Disconnect Switch

All Ratings

INSTALLATION &

INSTRUCTION

MANUAL

Safety Information

DANGER

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 have direct knowledge and experience dealing with the 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 read and comprehend this instruction book – understanding that these instructions are general in nature
- to accept personal responsibility to prepare and maintain an intrinsically safe work environment and maintain control of the work site to safeguard all persons present
- to develop and implement a proper rigging, lifting, and installation plan along with all safety precautions required to insure safe and proper lifting and installation of the equipment.
- to distinguish between energized and non energized parts
- to determine proper approach distances to energized parts
- to properly work with and around energized or de-energized equipment that may be pressurized with gas
- for proper use of personal protective equipment, insulating and shielding materials, insulated tools for working near energized and /or pressurized electrical equipment
- to recognize and take necessary precautions for the unique and dynamic conditions of site and specialized equipment to maintain a safe work environment during handling, installation, operation, and maintenance of high voltage switching equipment

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 during normal business hours (EST) or 770-946-4565 after normal business hours.

LIMITED WARRANTY

Southern States, LLC ("SSLLC") warrants only to the Warranty Holder (hereinafter defined as the "End User" or the "Immediate Purchaser", as applicable, pursuant to the terms and conditions of this Limited Warranty as set forth below), that the Product identified below will, upon shipment, be free of defects in workmanship and material for the applicable Warranty Period. The "Warranty Period" is that period of time during which this Limited Warranty is effective, and such period begins on the invoice date issued by SSLLC for the Product, and continues until the earlier to occur of (1) the expiration of the Warranty Duration period, or (2) the Number of Operations, both as specified in the table below. If the Product is both purchased and installed within the United States or Canada, this Limited Warranty is granted to each end user of the Product who acquired the Product for its own use during the Warranty Period ("End User"). In all other situations, this Limited Warranty is granted only to the first purchaser of the Product ("Immediate Purchaser") from SSLLC. No primary or remote purchaser or owner of the Product who is not a Warranty Holder may claim any benefit under this Limited Warranty, or any remedial promise included in this Limited Warranty. SSLLC shall, upon prompt written notice from the Warranty Holder, correct a nonconforming Product by repair or replacement at the sole discretion of SSLLC of the nonconforming Product or any part or component of a nonconforming Product necessary in SSLLC's discretion to make such Product conforming. Any transportation charges, labor for removing, reinstalling the Product or part, and/or costs related to providing access to the Product shall be the responsibility of the Warranty Holder. Correction in this manner will constitute the Warranty Holder's exclusive remedy and fulfillment of all SSLLC's liabilities and responsibilities hereunder. SSLLC's duty to perform under this limited warranty may be delayed, at SSLLC's sole option, until SSLLC has been paid in full for all products purchased by the Warranty Holder. No such delay will extend the Warranty Period. If SSLLC does not make such repair or replacement, SSLLC's liability for damages on account of any claimed nonconformity will in no event exceed the purchase price of the Product in question. This Limited Warranty does not apply to any Product that has been disassembled, repaired, or altered by anyone other than SSLLC. This Limited Warranty will not apply to any Product that has been subjected to improper or abnormal use of the Product. SSLLC has no responsibility to repair or replace any Product or component thereof manufactured by another party, but SSLLC will assign, to the extent assignable, to the Warranty Holder any manufacturers' warranty that applies to products and components not manufactured by SSLLC.

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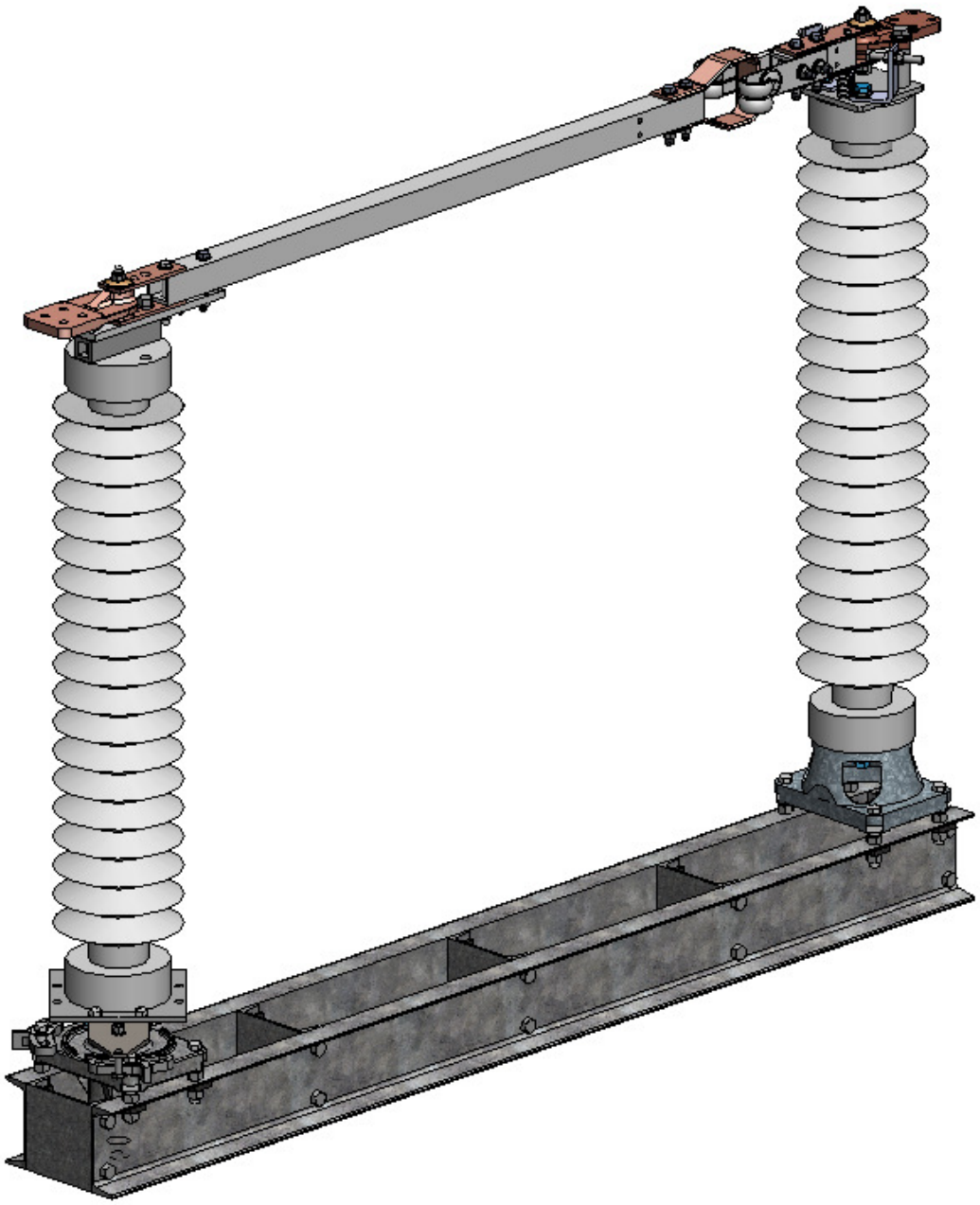
Product Purchased Region	Product Installed Region	Warranty Holder	Warranty Duration
U.S and Canada	U.S and Canada	End User	Five (5) Years
All Other Conditions		Immediate Purchaser	Earlier of 1 year from installation or 18 months from shipment

Revised 7/14/15

Type ES-1 & ES-1B



Installation and Adjustment Procedures

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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.

Introduction

Southern States type ES-1 is a three phase, group operated, side break air disconnect switch. Poles can be mounted in a horizontal “upright”, vertical, or underhung position. The switch may be operated using a manual operator or electrical motor operator.

The installation procedure for all mounting positions and operating schemes are similar and explained herein. A system of pipes, bearings, and adjustable length arms are utilized to open and close the switch from a ground level operator.

Unpacking

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 vertical break 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

Recommended Tools	
Type	**Sizes**
Hand Wrenches and/or Sockets	15/16”, 3/4", 5/8”, 9/16”

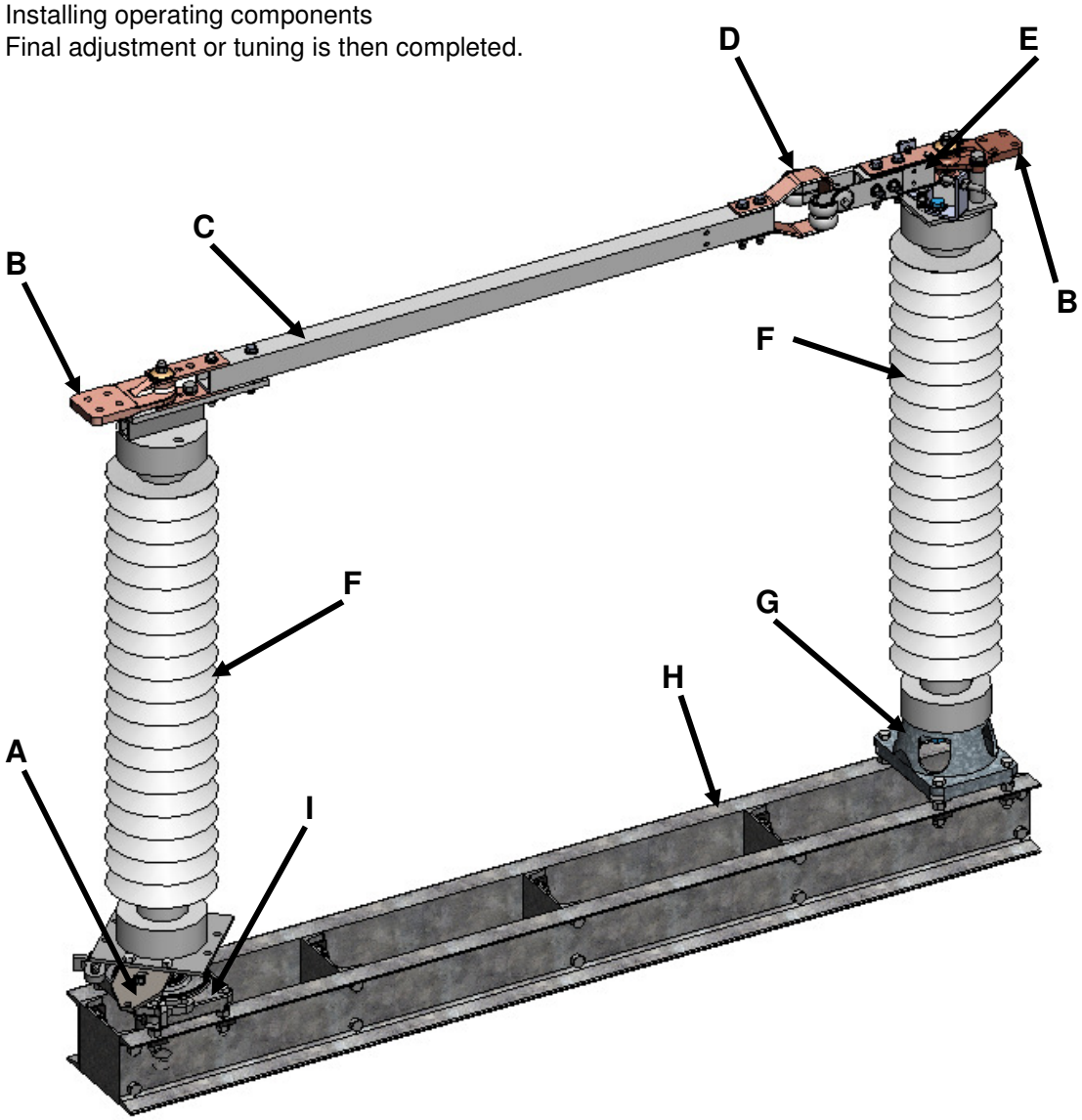
Recommended Torque Values	
Bolt/Nut size	**Torque (Ft-lb)**
1/2”	40
5/8”	92
3/4"	127
1”	286

Installation and Adjustment Procedures

Typical Disconnect Switch

In general, installing a disconnect switch consists of the following:

- Mounting the insulators to the switch base
- Mounting the live parts to the insulators
- Mounting the switch base to the structure
- Installing operating components
- Final adjustment or tuning is then completed.



A – Switch Operating Arm
B – Terminal Pad
C – Male Blade Assembly
D – Contacts
E – Female Blade Assembly
F – Insulator
G – Insulator Adapter
H – Switch Base
I – Insulator Bearing

Figure 1: Typical ES-1 Disconnect Switch & Common Terminology

Installation and Adjustment Procedures

1.1 Preferred Switch Assembly Method:

1.1. **If disconnect switch is shipped assembled on insulators Skip Section 1 and Continue To Section 2**.

1.2. Switches rated 72.5 KV and above are normally shipped assembled separately from their insulators, with the live parts of each unit bolted to their own base. Installation consists of removing the live parts from the base, mounting the base on the structure, the insulators to the base, and the live parts to the insulators.

1.2.1. Alternately (and easier) each pole may be assembled on the ground and hoisted to the structure as a complete unit. **CAUTION:** To prevent overturning during assembly, the switch base must be bolted to a level, stable platform (e.g. metal sawhorses). **CAUTION:** Lift fully assembled pole unit by the base only. **DO NOT** lift the pole unit by the live parts. Refer to **Figure 1** and **Figure 6**.

1.3. Before disassembling the live parts from the switch base you must match mark the insulator bearing hub, switch arm, and rotating base to ensure correct reassembly (**See Figure2**). Match-mark A to B and B to C. Failure to complete this step will make final adjustment more difficult.

1.4. **OPEN THE SWITCH** and remove the switch live parts. Place them in a safe place to avoid damage.

1.5. Refer to the Unit Assembly and Field Assembly (SF) Drawings for bolt sizes. Mount the insulators to the base adapters and the switch arm plate on the bearing. Confirm match marks are aligned and properly torque the bolts (see **Table 1** on page 2).

1.6. Confirm proper insulator alignment. The rotating insulator must be as near to perpendicular as possible to both the long and short axis of the disconnect switch base. **NOTE:** The original insulator stack height must be maintained. When the nuts on the jack bolts are used to adjust insulator tilt, opposite nuts must be turned equally (run one nut up a certain number of turns, turn the opposite nut down the same number of turns). Refer to **Figure 3**.

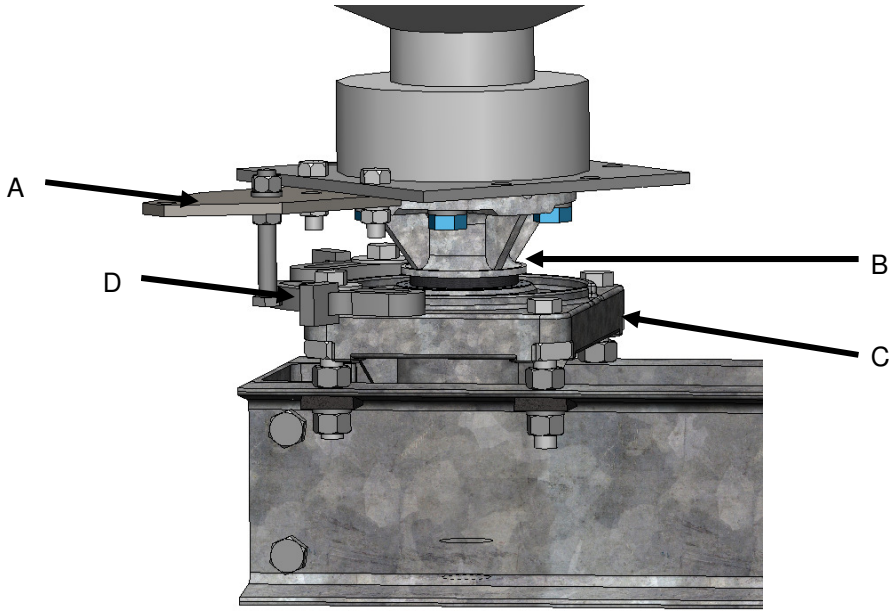


Figure 2: Match-Marked Components

A = Operating Arm, B = Bearing Hub, C = Bearing Housing, D = Bearing Stop

Installation and Adjustment Procedures

1.6.1. Always be sure to tighten the bottom hex nuts securely after jackscrew adjustments are complete.

1.6.2. Once the hinge insulator is aligned, do not readjust it. Any contact alignment adjustments will be made to the jackscrews that support the jaw insulator.

1.6.3. Mount the jaw contact assembly to the insulator and, for the moment, leave the bolts loose. Close the switch blade into the contacts, checking for alignment as shown in **Figures 4 and 5.** Usually bolt hole tolerances will be sufficient to align the contacts properly. However, the jackscrews that support the jaw insulator stack can also be used to tilt the insulator as required

1.6.4. Most importantly, however, final contact adjustment and inspection can be made only after the conductors are attached to both ends of the switch pole. This is because the weight of long conductors can deflect insulators sufficiently to cause contact misalignment. **MAKE FINAL CONTACT ADJUSTMENT ONLY AFTER CONDUCTOR ATTACHMENT.**

How to adjust Alignment:

- **Caution:** Do not turn stud!
- Loosen all four “A” nuts.
- Tilt insulator to necessary angle using “B” nuts.
- Adjust all four “B” nuts (up or down) until proper alignment is achieved.
- Retighten nuts to proper torque.

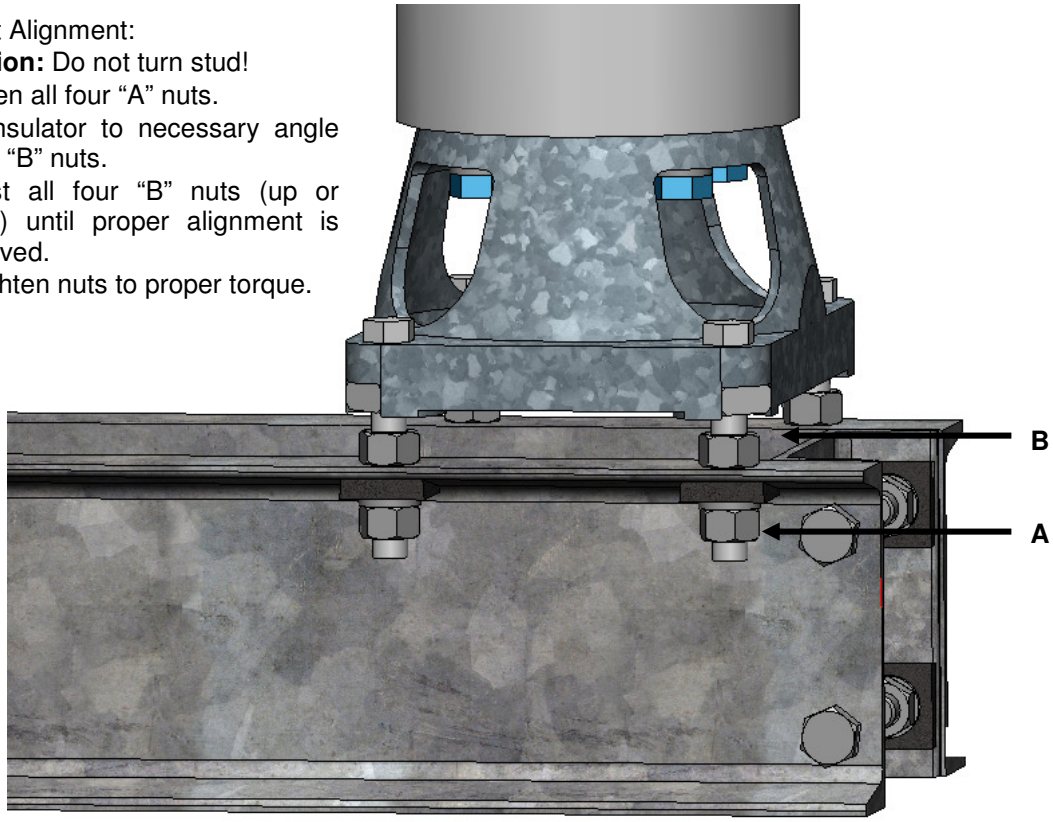


Figure 3: Insulator Stack Alignment

1.6.5. Confirm that switch is oriented properly, per the unit assembly drawing.

1.6.6. Confirm that the match marks are aligned and all hardware is tight.

Installation and Adjustment Procedures

2.1 Contact Adjustment:

2.1. There are two conditions that determine proper contact adjustment. Both conditions must be checked after conductor attachment to both ends of the switch pole

2.1.1. In the closed position, use a level to ensure both blades are in a horizontal plane and the centerlines are aligned. The male contact should be vertical, as seen in **Figure 4**.

2.1.2. If the male contact is not vertical, shims my be placed between the live parts and the insulators to obtain proper blade alignment.

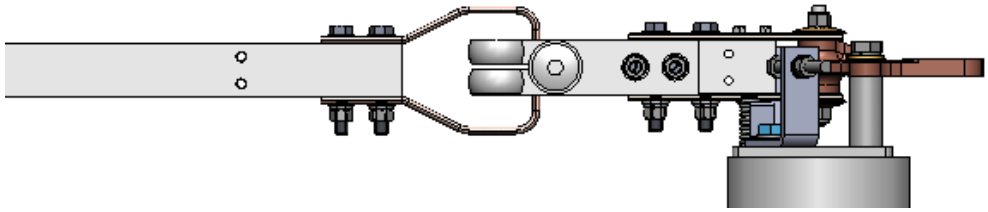


Figure 4. Blade Horizontal Alignment

2.1.3. The blade tip must be within 1/16-inch of the blade stop, as seen in **Figure 5**.

2.1.4. To obtain the proper gap, adjust the jack bolts using the procedure in **Figure 3**.

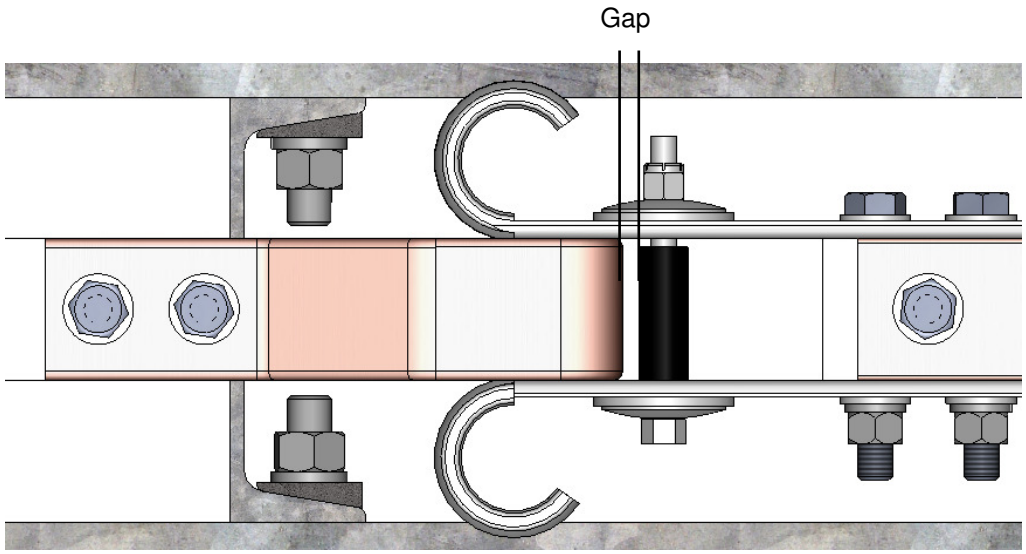


Figure 5. Blade Tip Clearance

2.1.5. **ENERGIZE THE SWICH ONLY AFTER A FINAL INSPECTION OF BOTH OF THESE CONDITIONS FOR PROPER CONTACT.**

Installation and Adjustment Procedures

3.1 Mounting Disconnect Switch Onto the Structure

3.1. If the switch has been assembled on the ground, at this time mount it on the structure. Check the Operating Mechanism Drawing for proper position. **LIFT THE SWITCH BY THE BASE ONLY.**

3.2. With the switch closed, secure the blade using rope or other type of strap, to avoid movement during lifting.

3.3. Secure the switch arm to the bearing stop using a wire or strap prior to lifting.

3.4. Lift the assembled switch by the switch base only. Refer to **Figure 6.**

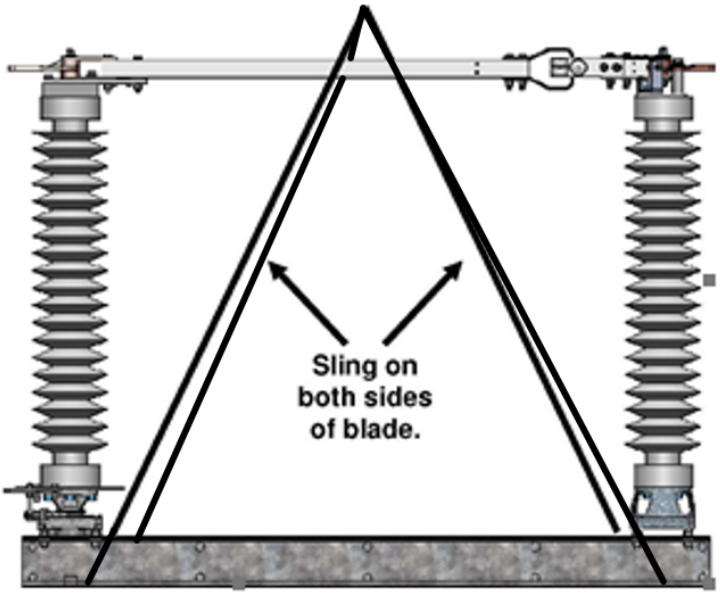


Figure 6: Sling Attachment

3.5. Mount the disconnect switch to the structure using the hardware indicated by the Operating Mechanism drawing (see **Table 1** for torque spec).

3.6. The minimum blade opening, 70°, is shown in **Figure 7**. The switch can be set to both right and left hand opening.

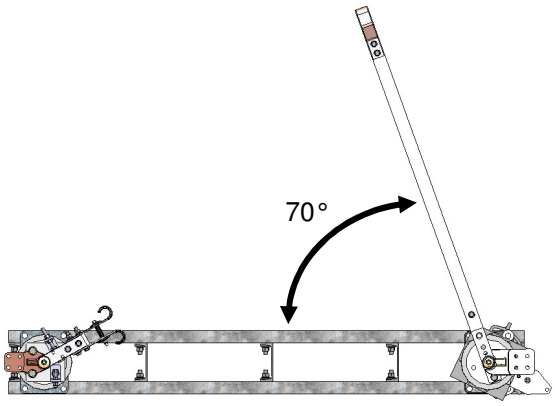


Figure 7: Minimum Open Angle

Installation and Adjustment Procedures

3.6.1. Conventional blade open position shown in **Figure 7**. Slight changes to the blade fully open angles are easily made in the field. Simply adjust the open position stop on the bearing, as seen in **Figure 2**.

3.7. The live part close position stop is correctly engaged when touching lightly. The over travel bearing stops at the bottom of the insulator are correctly adjusted when there is a 1/16" to 1/8" clearance between the stop and the stop bolt. A blade over toggle of 1/2" in the fully closed position is acceptable.

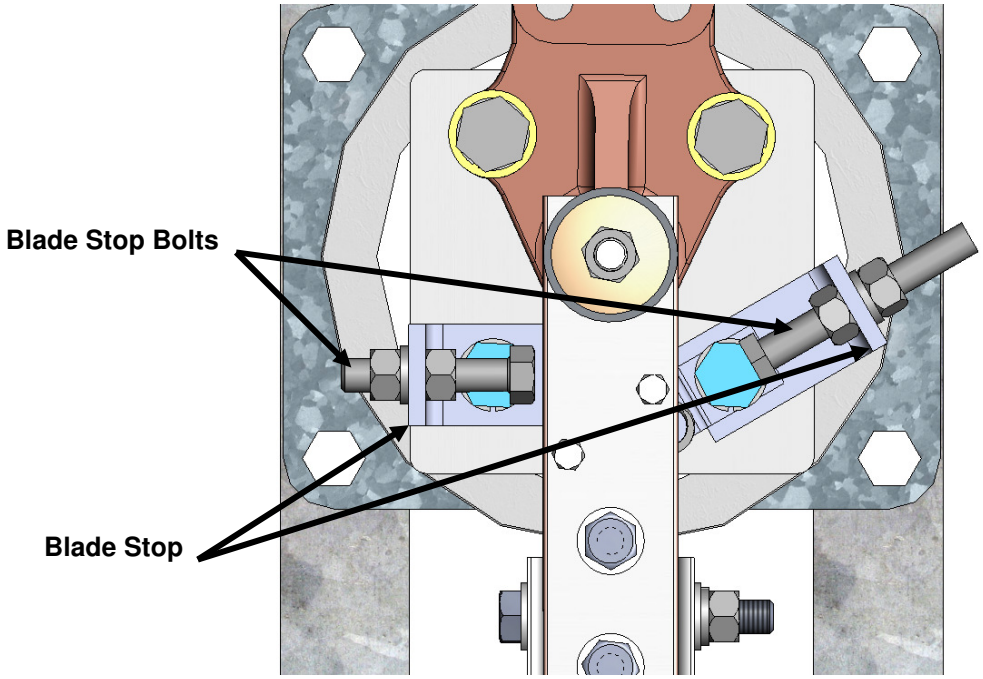


Figure 8: Blade Stop (Closed Position)

3.8. The live part open position stop is correctly set when the following conditions are met:

3.8.1. The spring must be directly beneath the catch and the catch fully engaged on the female blade assembly in the open position. A slight over travel by the female blade is permissible. Refer to **Figure 9**.

3.8.2. There must be a small gap, less than one inch, between the contacts when the female blade assembly is fully open. Refer to **Figure 10**.

3.8.3. The open stop bolt must lightly touch the female blade assembly at the fully open position.

Installation and Adjustment Procedures

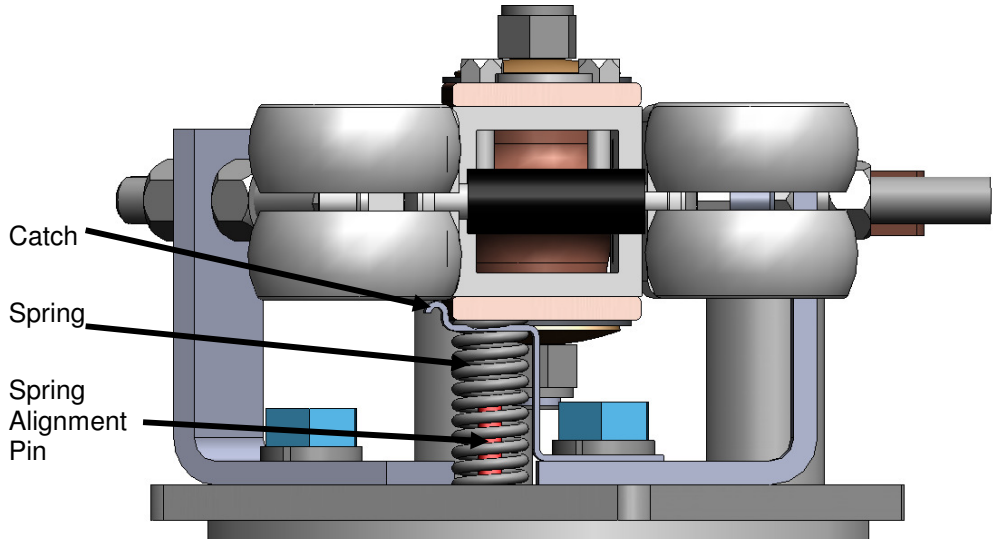


Figure 9: Female Blade Catch - Open Position

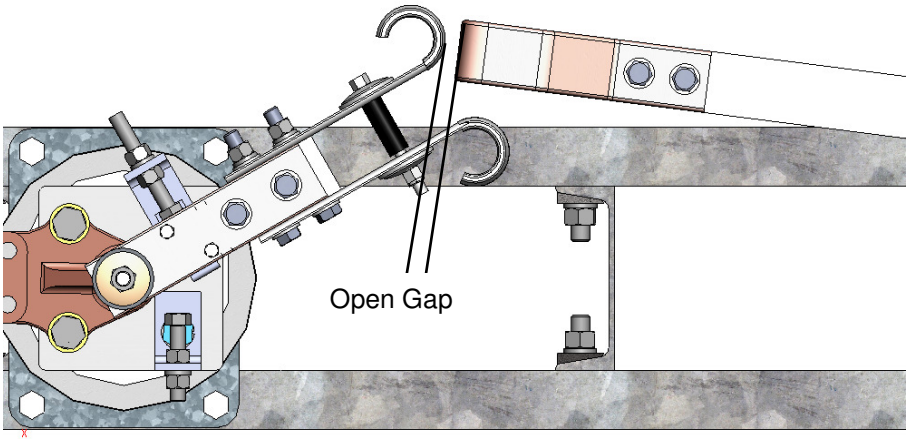


Figure 10: Female Blade Open Gap

3.9. Conductor loads can alter fine switch adjustments, so final adjustments should not be performed prior to connecting the conductors

3.10. Verify that the insulators are still properly aligned.

3.10.1. Refer to **Figure 3** and **Figure 11**. Adjust both "A" nuts and "B" nuts equally to correct any misalignment.

3.10.2. After adjustment, torque the nuts properly (see **Table 1**).

Installation and Adjustment Procedures

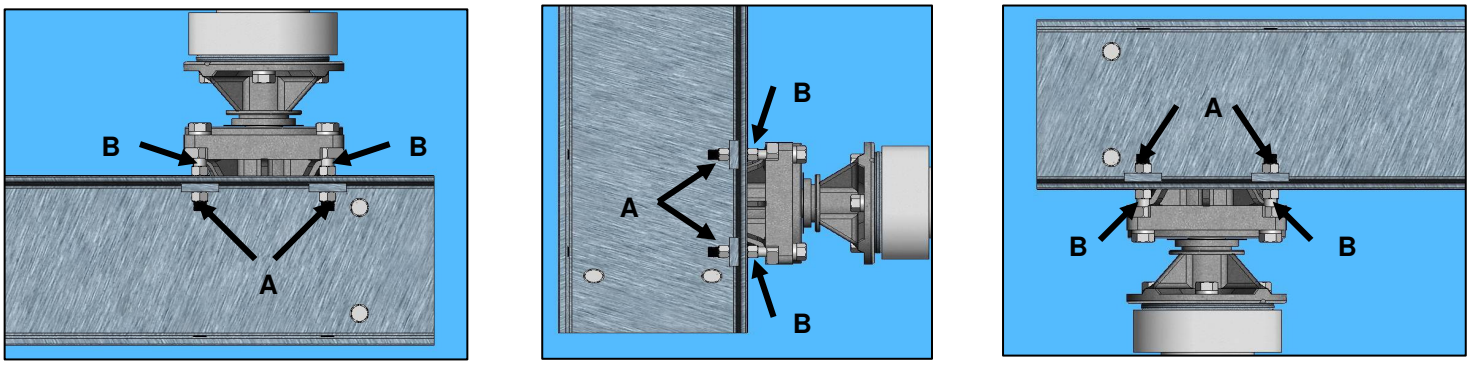


Figure 11: Insulator Stack Adjustment for Various Mounting Positions

4.1 Optional Accessories:

4.1. Arcing Horns (if equipped):

4.1.1. Refer to the Unit Assembly drawing for necessary hardware and installation location.

4.1.2. Arcing horns should rub lightly together with sufficient pressure to maintain contact, but not to cause binding.

4.1.3. Arcing horns should be touching when the switch is fully closed as shown in **Figure 12**. If necessary the jaw (stationary) arcing horn may be bent to achieve proper contact.

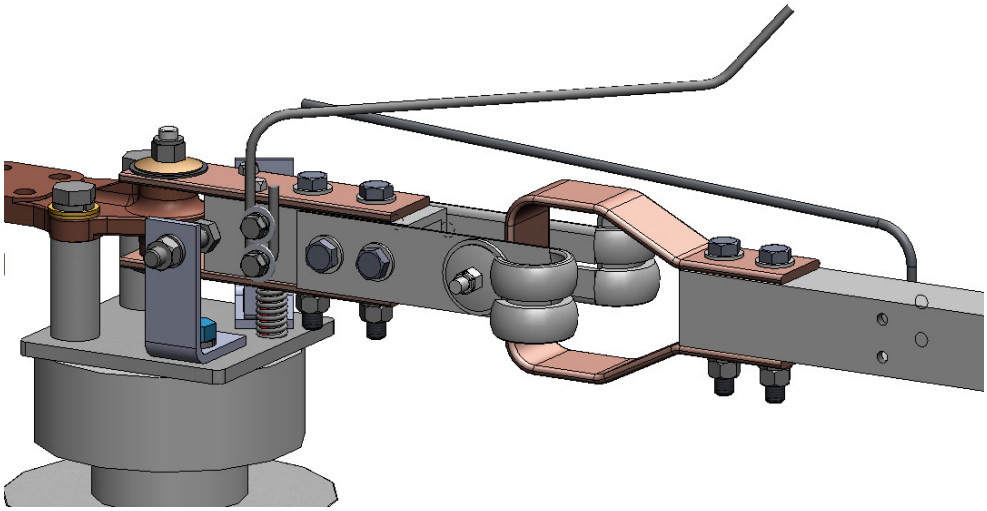


Figure 12: Arcing Horn Attachment

5.1 Operating Mechanism:

5.1. 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 motor) to simultaneous rotation of the end insulator of each switch pole.

5.2. **Figure 13** shows a typical operating mechanism for a ES-1 side break switch. **Figure 14** shows alternate operating mechanism designs, each of which is employed as being the simplest arrangement for a given structure. In all cases, however, the operating principle remains the same, and the methods of installation and adjustment are virtually identical.

Installation and Adjustment Procedures

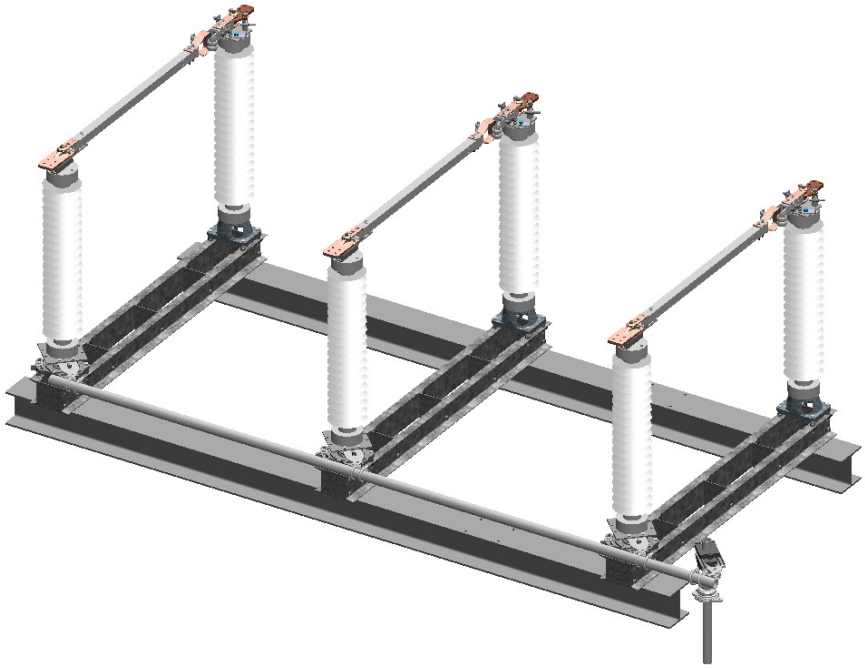


Figure 13: Typical Operating Mechanism For ES-1

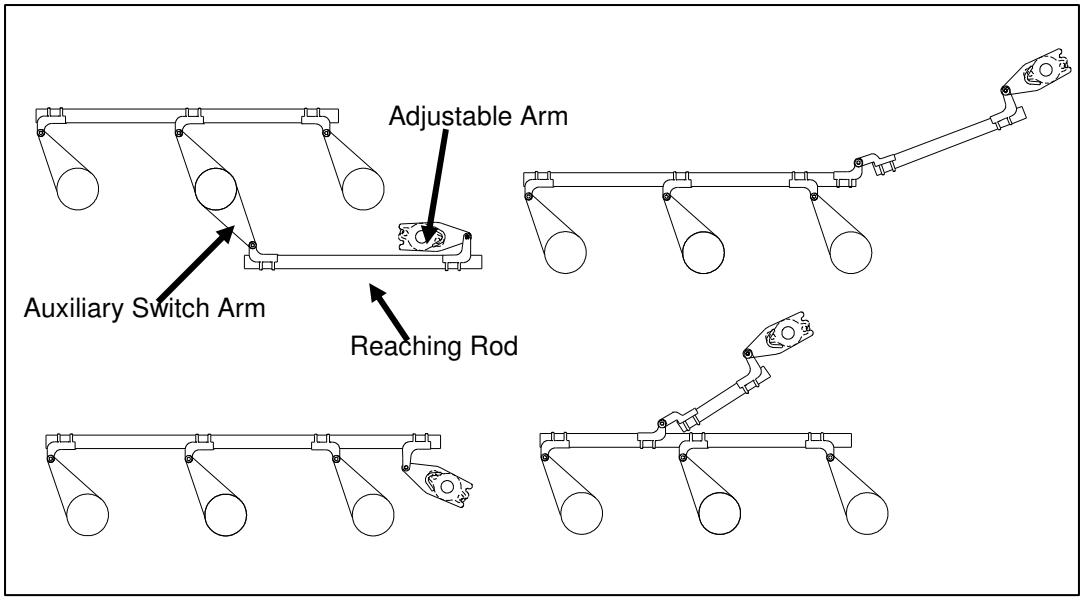


Figure 14: Alternate Operating Mechanism Designs

5.3. Lay out all the operating mechanism parts and check them against the Operating Mechanism drawing bill-of-material.

5.4. To aid switch inspection from the ground, set screws can be installed in most cases on the bottom sides of the clevises so they can be viewed from the ground when pinned. Do not pierce pipe at this time.

Installation and Adjustment Procedures

5.5. To ensure that the bearing stops do not interfere with switch adjustments, loosen each open/close bearing stop and slide them out of the way.

5.6. Refer to the Operating Mechanism drawing and install all mounting brackets, bearings, bushings, pipe clevises, switch operating device, adjustable arm, reach rod, and other necessary components. Refer to **Figure 15**. Do not connect the interphase pipe at this time.

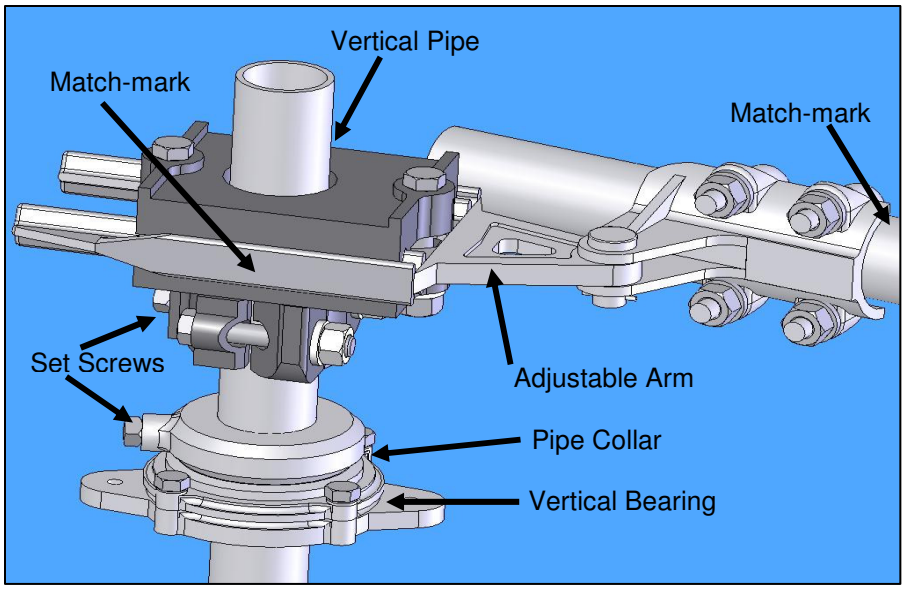


Figure 15: Typical Operating Arrangement

5.7. 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 switch operating device.** Refer to **Figure 15** and **Figure 16.**

5.8. When a switch uses an auxiliary switch arm, installation will be easier if this pole is adjusted **before** installing the interphase pipe. This will eliminate trying to coordinate and adjust all three poles at once.

5.9. While installing the pipes and clevises that have set screws, do not pierce the pipe until instructed. Tighten the set screws such that they grip the pipe until all adjustments are made.

5.10. After mounting all the operating mechanism components, match-mark all clevis connections, the adjustable arm, and the switch operating device's coupling, so that you can tell if slippage occurs during trial operations.

6.1 Switch Adjustments (Tuning):

6.1. The operating mechanism is intended to fully open and fully close the disconnect switch by rotating the vertical operating pipe 180° using an operator (manual or electrical). The interphase pipe controls the individual operation of each switch pole, using a push/pull control. The reach rod translates the motion of the vertical operating pipe to the interphase linkage. The adjustable arm controls the total amount of switch operation available.

HINT: For easiest adjustment start with the reach rod connected to the drive phase and the interphase pipe disconnected from the other two phases. Once the drive phase is properly adjusted, connect the interphase pipe and continue tuning the other two phases.

6.2. Switch Operating Devices:

6.2.1. Worm gear operator (HOGO – High Output Geared Operator)

6.2.1.1. The operator handle is factory set to rotate either clockwise or counter-clockwise to open the switch.

Installation and Adjustment Procedures

6.2.1.2. 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. Refer to **Figure 16**.

6.2.1.3. **Caution:** Be aware that there is an adjustable stop on the operator. **Do not** over operate as damage will occur to the operator.

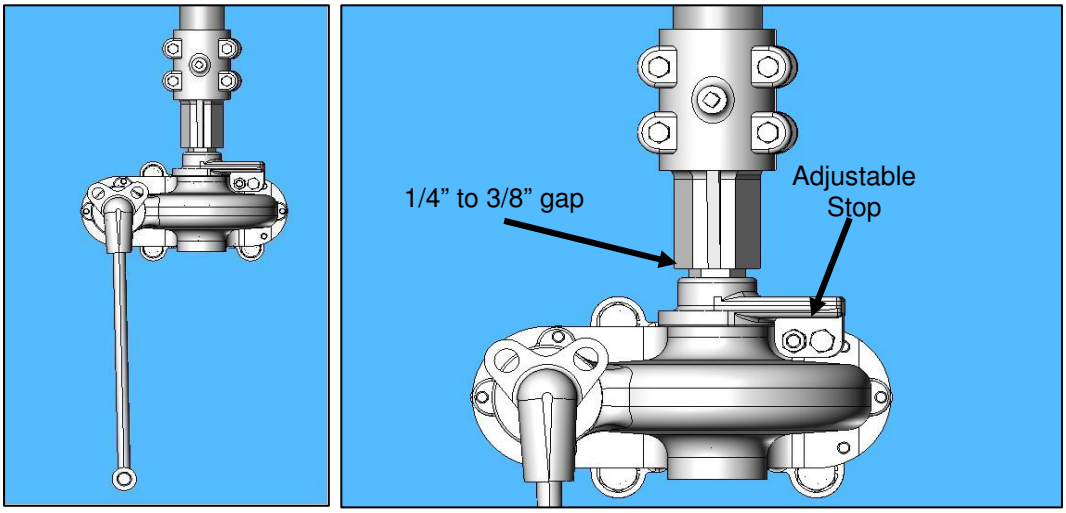


Figure 16: Type HOGO (High Output Geared Operator) Front View

6.2.2. Swing handle operator

6.2.2.1. 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.

6.2.3. Electrical motor operator

6.2.3.1. Please refer to motor operator instruction manual for proper installation and setup.

6.2.3.2. Use manual operation while completing switch setup.

6.2.3.3. **Do not** electrically operate until all switch adjustments are complete. **ALWAYS** operate the motor operator decoupled first to ensure proper setup.

6.3. Preliminary Switch Settings:

6.3.1. Start with the disconnect switch and operating mechanism in the closed position. Refer to **Figure 17**.

6.3.2. Set the adjustable arm to the preliminary setting specified on the Operating Mechanism drawing, adjustment may be necessary to achieve proper operation.

6.3.3. Be sure that all the lower bearing stops have been loosened to prevent binding during test operations.

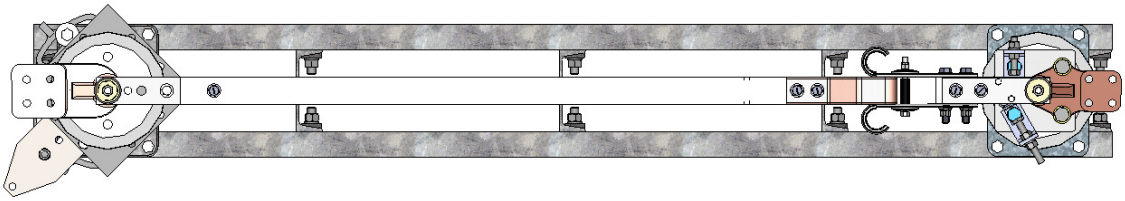


Figure 17: Switch – Fully Closed Position

6.4. Final Adjustment:

6.4.1. Before making any adjustments always check that none of the pinned joints have slipped. If slippage occurs, correct it and repeat the operation to verify that adjustment is really needed.

6.4.2. Open the disconnect switch with the operator.

6.4.3. If the switch is not fully open before the operator reaches the fully open position, the adjustable arm radius is too short. To correct:

6.4.3.1. Check to see that nothing has slipped.

6.4.3.2. Return the switch to **almost** the closed position, but not toggled.

6.4.3.3. Match-mark the adjustable arm and the pipe clevis

6.4.3.4. Loosen the bolts on the adjustable arm and pipe clevis

6.4.3.5. Lengthen the adjustable radius arm approximately ¼-inch. Allow the pipe clevis to reposition itself the same ¼ inch. Refer to **Figure 18**.

6.4.3.6. Test operate and readjust as necessary.

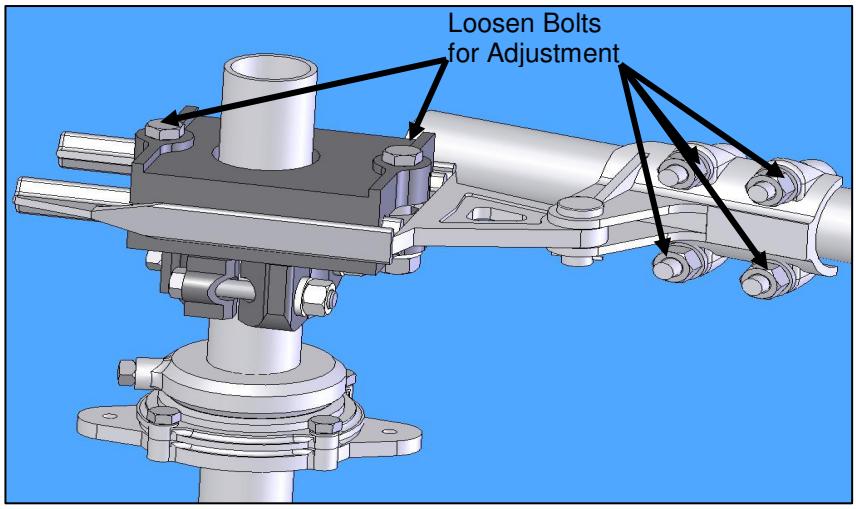


Figure 18: Adjustable Arm Assembly

6.4.4. If the switch is fully open before the operator reaches the fully open position, the adjustable arm radius is too long. To correct:

6.4.4.1. Check to see that nothing has slipped.

6.4.4.2. Return the switch to **almost** the closed position, but not toggled.

6.4.4.3. Match-mark the adjustable arm and the pipe clevis

6.4.4.4. Loosen the bolts on the adjustable arm and pipe clevis

6.4.4.5. Shorten the adjustable radius arm approximately ¼-inch. Allow the pipe clevis to reposition itself the same ¼ inch. Refer to **Figure 18**.

6.4.4.6. Test operate and readjust as necessary.

6.4.5. All poles of the fully adjusted disconnect switch should operate together although a slight variance between poles is acceptable. The primary objective is for all poles to fully open and fully close. Minor adjustments of the interphase pipe clevises may be necessary for pole coordination.

6.5. Final Check:

6.5.1. Once all final adjustments are complete, be sure that all nuts are tightened to their specified torque (refer to **Table 1** on page 2).

6.5.2. Apply a minimal amount of grease to the point of each set screw 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 threader drill guide (provided) and a ¼ inch drill bit.

Recommended Inspection and Maintenance

The ES-1 has 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 and atmospheric conditions, experience of operating personnel and special operation requirements.

Table 2: Recommended Installation and Maintenance Table

		Installation Tests	Patrolling Inspection 6 month	Routine 5 Year	Periodic 10 Year
Insulators	Contamination	X	X	X	X
	Damage	X	X	X	X
Cabinet (if motor operator supplied)	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
Liveparts Inspection	Inspect Contacts				X
	Inspect Arcing Horns				X

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. Refer to **Table 2** for recommended inspection items.

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. 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. Refer to **Table 2** for recommended inspection items.

ANSI Standard C37.35 is also a recommended guide for maintenance on air disconnect switches.

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