[redacted]

Southern States

The Quality Name in High Voltage Switching

TYPE EV-1
SCE EDITION

Aluminum Vertical Break
Disconnect Switch

550kV Single Pole (Only)

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

550kV
Type EV-1

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Summary & Introduction

Summary

These instructions do not intend 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 arise 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 obligations 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.

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 550kV Type EV-1 is a heavy duty, single phase (Pole) operated vertical break air disconnect switch. The switch is specifically designed to carry the mechanical and electrical stresses of higher voltage and amperage ratings. The switch can be operated using a manual operator or electrical motor operator. The installation procedure for this disconnect switch and operating mechanism is explained herein.

Note: All drawings in this manual are for illustration only. Actual switch components may differ slightly in appearance. Switch operating mechanism drawings must be used for assembly of each switch.

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

The instructions contained within this manual are necessary for the safe installation, maintenance, and operation of the Type EV-1 switch. A qualified person, familiar with this of type equipment, should carefully read and follow the instructions.

These instructions are intended to provide a general guideline for the installation, adjustment, and maintenance of the Type EV-1 switch. It is not possible to cover all details, equipment variations, and potential conditions. Contact Southern States, LLC in the event conditions associated with a specific application are not sufficiently addressed.

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, 7:30am-4:00pm EST Monday-Friday.
> After Hours: 770-946-4565

Distinctive signal words are used to indicate the degree of hazard that may be encountered by the user. Identification of the signal words and their definition follow:

⚠ DANGER	Indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.
⚠ WARNING	Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

Ratings

Table 1: Ratings Table

Ratings			
Maximum Voltage Rating (kV)	245	362	550
BIL (kV)	900/1050	1050/1300	1550/1800
Rated Power Frequency	60 Hz		
Continuous Current	2000 A – 4000 A		
Short-Time Symmetrical Withstand (3 Sec.)	63 kA RMS		
Peak Withstand	164 kA		
Ambient Temperature Rating	-40°C to +50°C Standard -50°C Optional		

Product Description

Typical Disconnect Switch

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

- Refer to the Unit Assembly drawing included with the disconnect package for assembling disconnects.
- Assemble disconnect switch on level surface, verify the switch base is perpendicular and level.
- Mount the insulators to the switch base. Verify that insulators are plumb (straight up and down) and rotating insulator is true (No “Wobble”).
- Mount the live parts to the insulators. Verify that live parts are level and shim or adjust if necessary.
- Mount the switch base to the structure. Refer to the *Operating Mechanism Drawings* for structure and mounting details.
- Install operating mechanism components.
- Final adjustment and tuning.

Receiving, Handling & Storage

Unpacking

Unpack the equipment and check for damages or material 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 EV-1 vertical break disconnect switch are suitable for outdoor use and do not have any special storage requirements. Keep bearings out of standing water. Keep upright and support live parts with base. 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 of less than 1 year. If long term storage is required please notify factory at time of order placement so that special crating can be used.

Installation & Adjustment Procedures

Recommended Tools & Values

Table 2: Recommended Tools and Torque Values

Recommended Tools	
Type	**Sizes**
Hand Wrenches and/or Sockets	15/16”, 3/4", 5/8”, 9/16”
Drill Bit	1/4”

Recommended Torque Values	
Bolt/Nut size	**Torque (Ft-lb)**
1/2”	50 (S. Steel) 40 (All Others)
5/8”	92
3/4"	127
1”	286

General Information & Mandatory Pre-Installation Requirements

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 on switch opening direction and handle location(s). *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 Service Department is available for field installation assistance along with providing parts support for all Southern States products.

Contact the Service Department at 770-946-4562 between 7:30am and 4:00pm EST M-F.
After hours – 770-946-4565

Removal of the Live Parts

1. Open the switch completely by manually rotating the switch arm clock-wise.

⚠ DANGER **Failure To Open The Switch Completely Prior To Removing The Mounting Bolts May Result In Severe Injury And/Or Death**

2. Make reference marks (Match-marks) as shown in **Figure 1** to ensure correct orientation during reassembly.

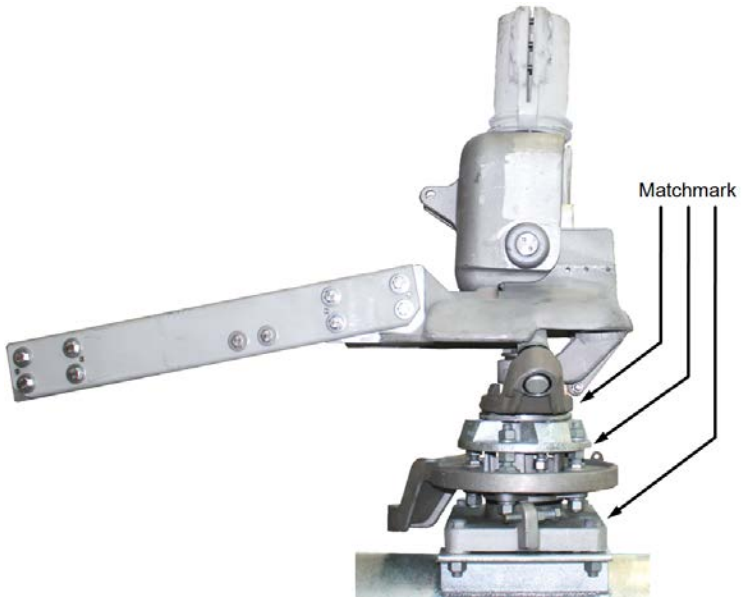


Figure 1 - Switch Match-marks

3. To remove the jaw (Clip), remove the bolts holding the jaw to the base adaptor and retain all of the ½" spacer(s). (See **Figure 6**)

4. Remove the bolts holding the hinge and yoke assembly. Carefully remove these parts as a unit and set aside.

Mounting the Base

It is preferable to assemble the disconnect switch on the ground, but if this is not possible. Install the switch base on top of the structure prior to mounting the insulators and live parts.

Mounting the Insulators

1. Prior to installing insulators on the base, verify that you have the correct insulators on hand ((2) PX0792 & (1) PX0794)) each consisting of a bottom, middle and top section.
2. Level the mounting plate (**Figure 2** "C") prior to mounting the insulator on the switch base.
3. Mount the insulator to the mounting plate (4 bolts).
4. Use a plumb line and minimum 3' level to insure that the insulators are level.

Rotating Insulator Adjustment

1. For proper adjustment of the rotating insulator for concentric rotation (Wobble) please refer to **Figure 3** & **Figure 4**.
2. Refer to **Figure 2**
    a. To adjust the insulator stack angles, loosen four nuts (B). Tilt the insulator to the required position by screwing up or down on nuts (A). Mounting plate (C).

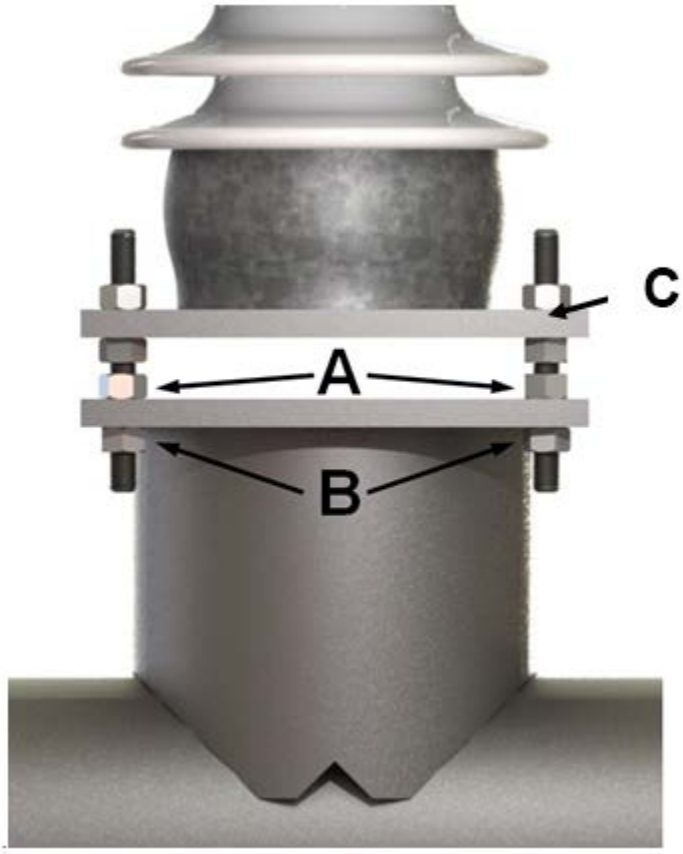


Figure 2: Insulator Adjustment

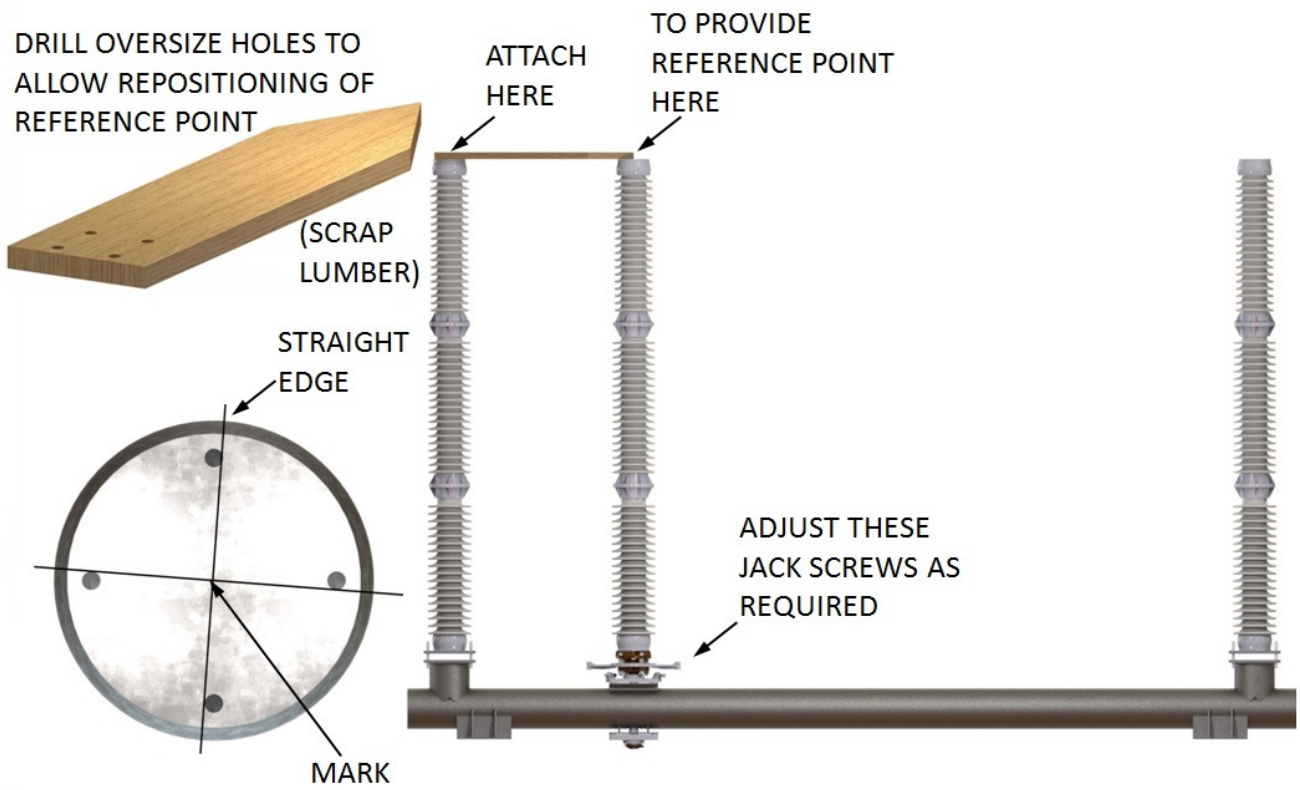
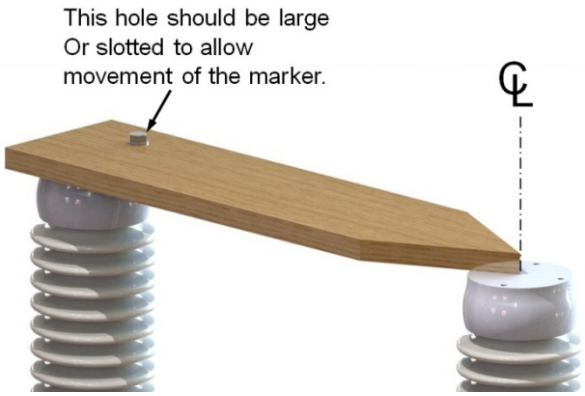


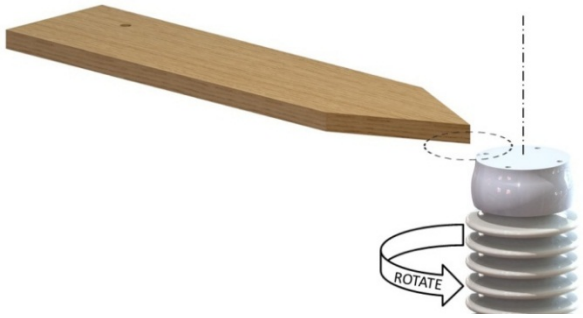
Figure 3: Method for locating center of rotating insulator cap

STEP ONE

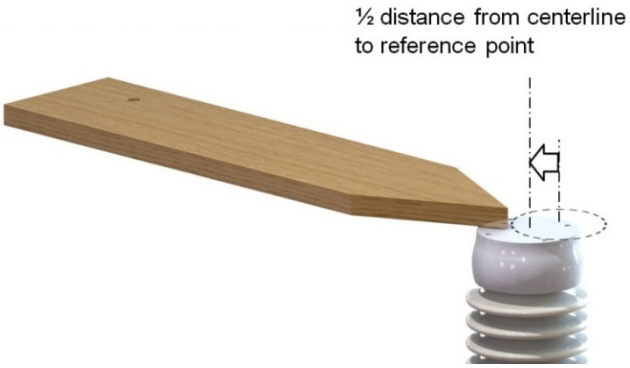
Use a piece of scrap lumber or metal and attach it to the top of the non-rotating insulator to use for a reference. Place the point of the lumber/metal over the center of the rotating insulator. The rotating insulator should be up against a bearing stop (Full open or closed position).



STEP TWO
Rotate the insulator to the opposite bearing stop. Observe for eccentric rotation (“wobble”).



STEP THREE
If during rotation the insulator has wobbled, leave it against the bearing stop in step two. Use the jacking bolts mounting the rotating insulator to the bearing to tilt it back ½ the distance to the reference point on the marker.



STEP FOUR
Rotate the insulator back to the starting position. Loosen the marker and place the reference point over the center of the insulator again. Repeat the last three steps until the insulator rotates true. (Up to 1/4” wobble is acceptable.) This method works whether the rotating insulator is out of adjustment axially, laterally, or any combination in between

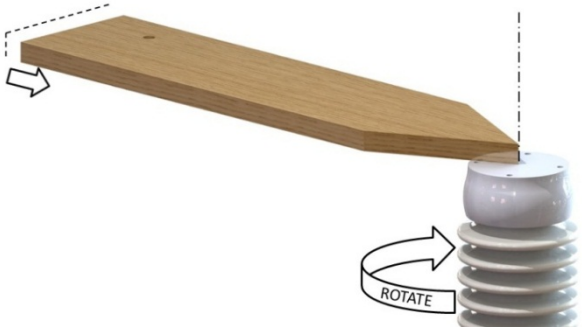


Figure 4 – Adjusting the Rotating Insulator for Concentric Rotation
Do Not Re-Adjust **the center stack once it rotates true. Make all subsequent adjustments to the other two insulator stacks as required.**

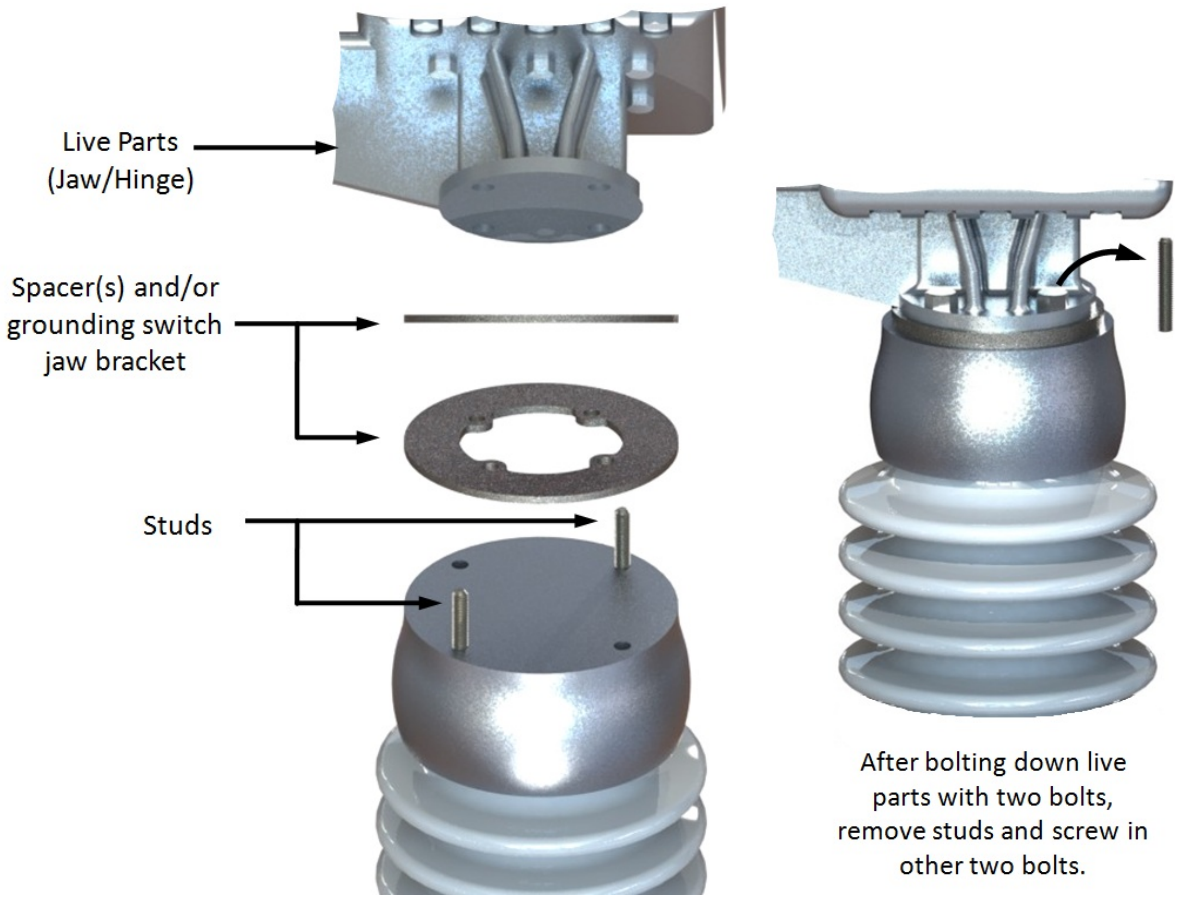


Figure 5 – Mounting Live Parts

Mounting the Live Parts

1. With the switch blade in the fully open position, mount the hinge and blade assembly. Be sure to retain the spacers provided between the live parts and the insulators. Using the bolts specified on the operating mechanism drawing, install the bolts on the rotating insulator first making sure the match marks made in step 2 (Page 6) are properly aligned.
2. Install the bolts on the terminal end (fixed insulator) of the hinge assembly. DO NOT FORCE THE PARTS. If the mounting holes do not align with those of the insulator cap, adjust the jack screws at the bottom of the fixed insulator (Not the rotating insulator) until they do. Mount the ground switch jaw (Clip), if applicable, and the line switch jaw (**Figure 7**). These assemblies are mounted with common bolts as specified on the operating mechanism drawing. If possible, install conductors at this time to avoid later realignment of insulator stacks due to the effects of conductor loads.
3. Install the arcing horns, taking care to apply Red Loctite #271 to the threads and to insure that it is seated properly in the switch blade and the set screw is properly tightened. Adjust so that they touch with sufficient pressure to maintain contact throughout their stroke. However, they

should not bind or force the blade sideways. If necessary, bend the stationary arcing horn slightly to achieve proper contact.

4. Install the corona rings.

Figure 6 - Switch Jaw

Disconnect Switch Adjustments

1. When all poles are fully assembled and bolts are fully tightened, carefully close each switch pole. The blade should enter the jaw centrally with equal clearance as shown in **Figure 7**. Additionally, the contact on the blade tip should be centered in the contacts as shown in **Figure 7**. If any misalignment is observed, adjust the jack screws at the bottom of the jaw insulator (only) to either, tilt, raise, or lower the jaw as required. Always secure jack screw adjustments with the upper or lower jam nut as conditions require.
2. The switch is fully closed and will have adequate contact pressure when the blade has rotated to within plus or minus 5° of a horizontal plane (see **Figure 7**). However, an attempt should be made to get all blades to rotate to a completely horizontal position. This is done by adjusting the closed position stop.

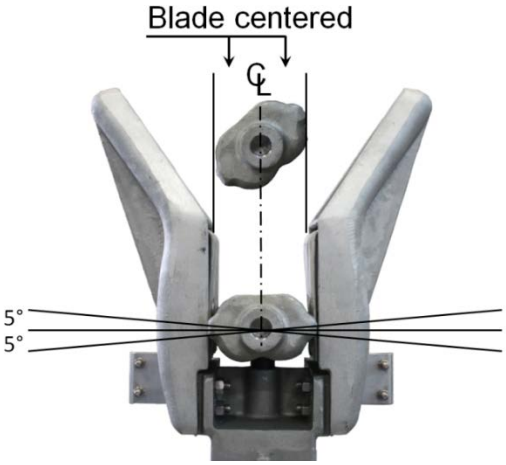


Figure 7 - Blade Adjustment

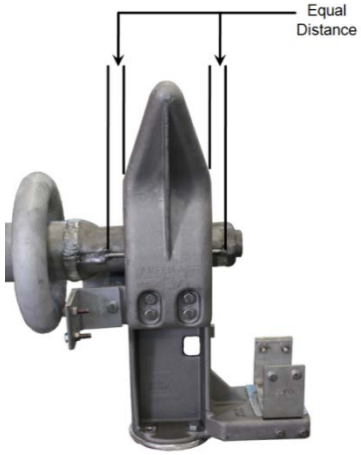


Figure 8 - Blade Silver Centered

Disconnect Switch Operating Mechanism Installation

Refer to the Operating Mechanism drawings, and install all operating mechanism components except the mechanical interlock and the auxiliary switch, when supplied. These last two items should be installed only after adjustments to the drive mechanism are complete. The pipe collar and outboard bearing should support the entire weight of the vertical pipe (**Figure 9**).

- Note: When installing the operating mechanism, tighten all set screws to grip the pipe securely, but do not pierce the pipe until after all adjustments are made. Match mark all parts that might slip during trial operation. Refer to Operating Mechanism drawings for proper installation of the switch adjustable arm. (The grounding switch should be left in the open position and should NOT be adjusted until after the line switch is operating satisfactorily).

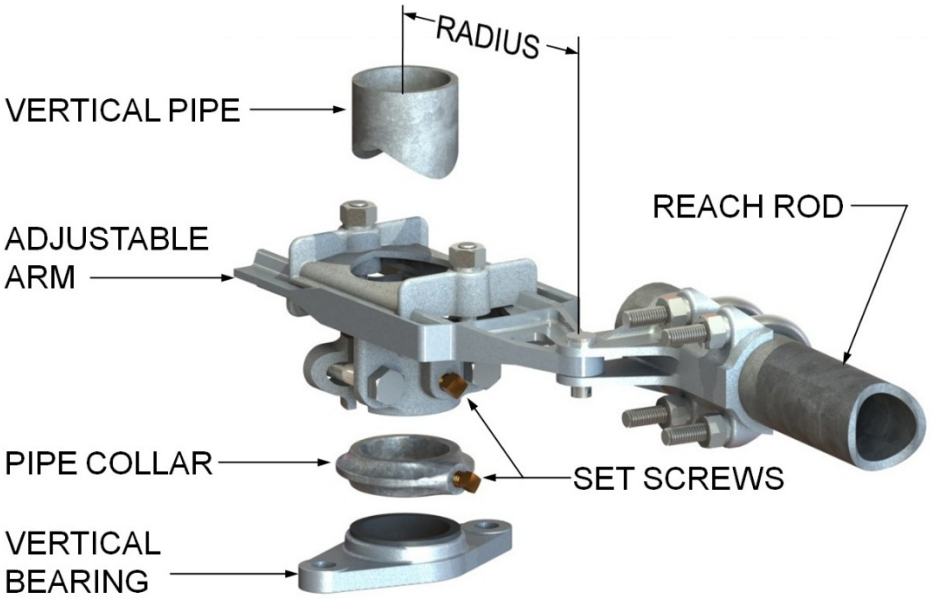


Figure 9 - Adjustable arm assembly.

Disconnect Switch Operating Mechanism Adjustment

1. Do not use electrical operation until all line switch adjustments are made. Always test adjustments and switch operation by manually operating the disconnect and/or grounding switch.
2. The adjustable arm should travel 180° from toggle closed to toggle open.
3. If the switch does not fully open, the radius of the arm is too short. To correct:
   3.1. Check first to see that nothing has slipped
   3.2. Return the switch to the near closed position.
   3.3. Loosen the adjustable arm and clevis bolts as shown in **Figure 10**.
   3.4. Lengthen the radius of the adjustable arm about ¼" and allow the clevis to reposition itself the same distance (shortening the pipe). Retighten the bolts.
   3.5. Manually test operate again and adjust as necessary
4. If the switch is fully open before the control handle reaches the open position, the radius of the adjustable arm is too long. To correct:
   4.1. Check to see that nothing has slipped.
   4.2. Return the switch to the near closed position.
   4.3. Loosen the adjustable arm and clevis bolts as shown in **Figure 10**.
   4.4. Shorten the radius of the adjustable arm approximately ¼" and allow the clevis to reposition itself (lengthening the pipe). Retighten the bolts.
   4.5. Manually test operate again and adjust as necessary.
5. When the switch is completely adjusted and switch has been accepted by the proper site authorities, securely tighten all bolts, and tighten all set screws until the pipe walls are pierced. (For heavy wall pipe, drill the set screw holes, using the threaded drill guides supplied and a ¼" drill.).

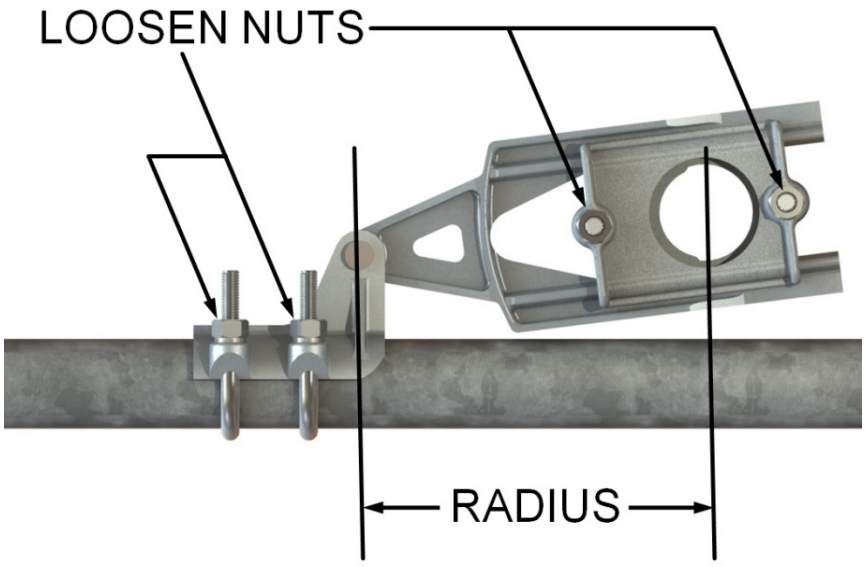


Figure 10 - Adjustable Arm

Grounding Switch Adjustment (if supplied)

1. Do not attempt to adjust the grounding switch until AFTER the line switches and their operating mechanisms are completely installed, adjusted, and operating satisfactorily.
2. The adjustable arm should travel 180° from toggle closed to toggle open.
3. If the switch does not fully open, the radius of the arm is too short. To correct:
   3.1. Check first to see that nothing has slipped
   3.2. Return the switch to the near closed position.
   3.3. Loosen the adjustable arm and clevis bolts as shown in **Figure 10**
   3.4. Lengthen the radius of the adjustable arm about ¼" and allow the clevis to reposition itself the same distance (shortening the pipe). Retighten the bolts.
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   4.5. Manually test operate again and adjust as necessary.
5. When the switch is completely adjusted and has been accepted by the proper site authorities, securely tighten all bolts and set screws until the pipe walls are pierced. (For heavy wall pipe, drill the set screw holes, using the threaded drill guides supplied and a ¼" drill.).

Switch Operating Devices

1. Worm gear operator (HOGO – High Output Geared Operator) (Optional)
   1.1. The operator handle is factory set to rotate clockwise to open the switch.
   1.2. The weight of the vertical operating pipe should be supported by pipe collar (**Figure 9**) by maintaining the 1/4" - 3/8” gap (**Figure 11**).
   1.3. When the switch is properly adjusted the operator handle should hang freely in both the open and closed positions to permit the use of a customer supplied padlock.

⚠ CAUTION	**Be aware that there is an adjustable stop on the operator. <u>Do not</u> over operate as damage will occur to the operator.**

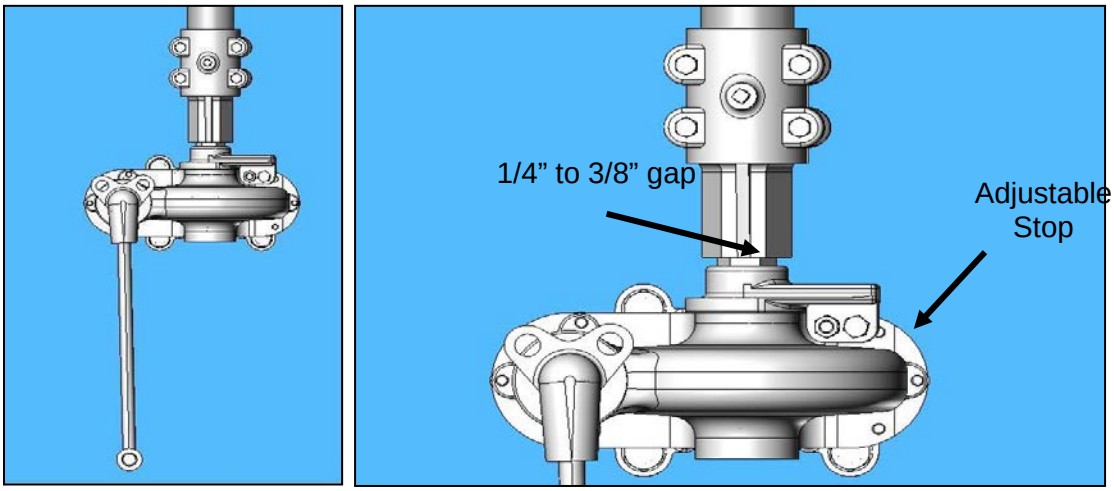

Figure 11 - Type HOGO (High Output Geared Operator) Front View

2. Worm gear operator (SEGO – Safety Enhanced Gear Operator) (Optional)
   2.1. The weight of the vertical operating pipe should be supported by pipe collar by maintaining the 1/4”-3/8” gap.
   2.2. When the switch is properly adjusted the operator handle should hang freely in both the open and closed positions to permit the use of the customer supplied padlock.

⚠ CAUTION	**Be aware that there is an adjustable stop on the operator. <u>Do not</u> over operate as damage will occur to the operator.**

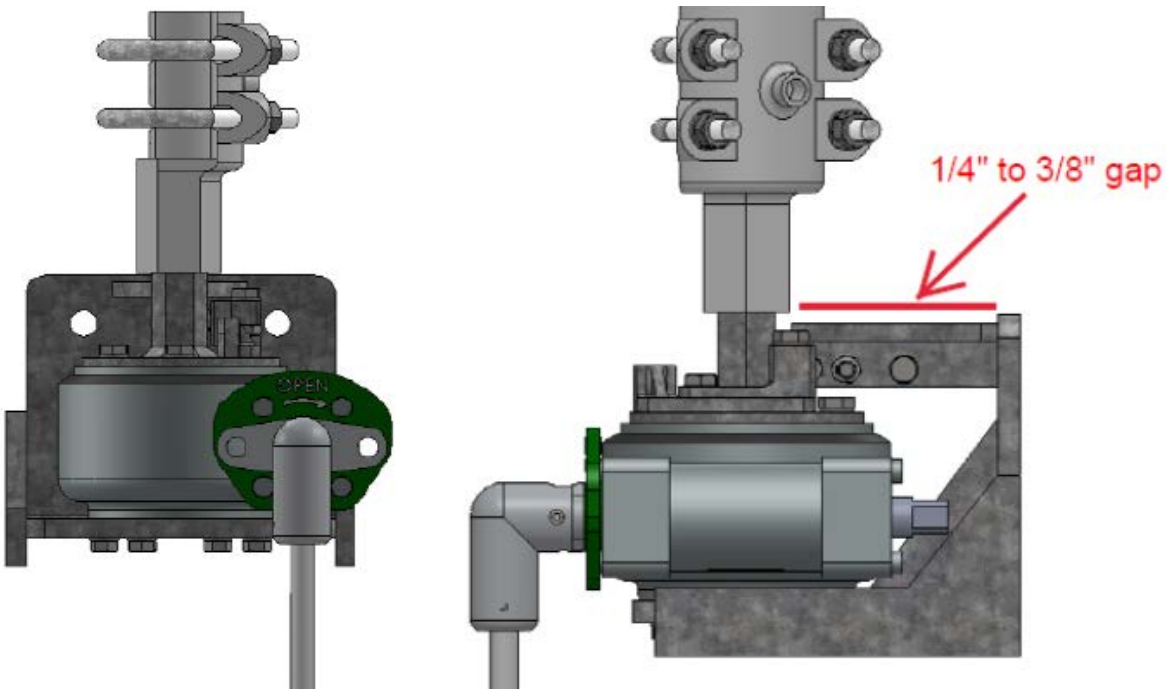

Figure 12: Type SEGO (Safety Enhanced Gear Operator)

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

Recommended Inspection Maintenance

The EV-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. It is suggested that maintenance on these switches be performed in accordance with ANSI STANDARDS C37.35-1976.

Table 3: 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		X	X
	Inspect Arcing Horns	X		X	X

*Note: Harsh environments with excessive airborne contaminants, such as, salt spray and industrial pollutants will require inspection/maintenance every two (2) years.
For specific instructions please refer to the SCE disconnect maintenance guidelines.

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 3** 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 3** 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 3** for recommended inspection items.

Inspection Checklist

550kV EV-1 TYPE DISCONNECTS (REV 6 2013)			
SUBSTATION NAME		POSITION	
SITE REP:		DATE:	
ACCEPTED BY QC:		DATE:	
INSTALLER:			
SAP NUMBER:		KV RATING:	
S.S. #		AMP RATING:	

ALL MEASUREMENTS PER MANUFACTOR'S MANUAL			
Initial and Date:	Installer	Site Rep	QC
Check for damage or material shortages (Page 1)			
All Nuts, Bolts and other hardware are tight and torque marked			
Pipe collar supporting vertical drive pipe			
All Cotter Keys are Bent			
Blades enter center of clip (Figures 7 & 8 Page 7)			
Arcing Horns installed and adjusted (Per Manufacturer's Drawings)			
Corona Ball Set screw secured with Red Loctite (Per Drawing 20134369)			
Insulators on Rotating Insulator stack (Pages 4 & 5)			
Blades Closed & Aligned (+/ -) 5 Degrees (Figure 7 Page 7)			
Blades Silver Centered in the Clip (Figure 8 Page 7)			
Blade in Open Position Plumb or Slightly past Plumb and Stop adjusted			
Open Rotation Stops set on Insulator Stack (Page 5)			
Closed Rotation Stops set on Insulator (Page 5)			
Verify Min. gap on HOGO handle 1/4 to 3/8" (Figure 11 Page 10)			
Handle is 40 inches from grade (+/-) 3 inches			
Handle is hanging free			
Handle - Clockwise to Open			
Handle and Structure Ground Attached			
Handle Stop Touching in The Closed Position			
Handle Stop Touching In The Open Position			
Handle operating pressure less than 35 pounds of force			
Name Plate attached by handle			
Signs- Open & Closed Properly Installed			

Toggle in closed position			
Toggle in open position			
HOLD Point contact QC 48 Hours Notice			
Piercing Bolts Set After Buy-off			

Comments:

Local Representative

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