



**Type ES-1 2 & 3 Way
Aluminum Side Break
Phase-Over-Phase
Disconnect Switch**

For All Ratings

INSTALLATION &

INSTRUCTION

MANUAL

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 non 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

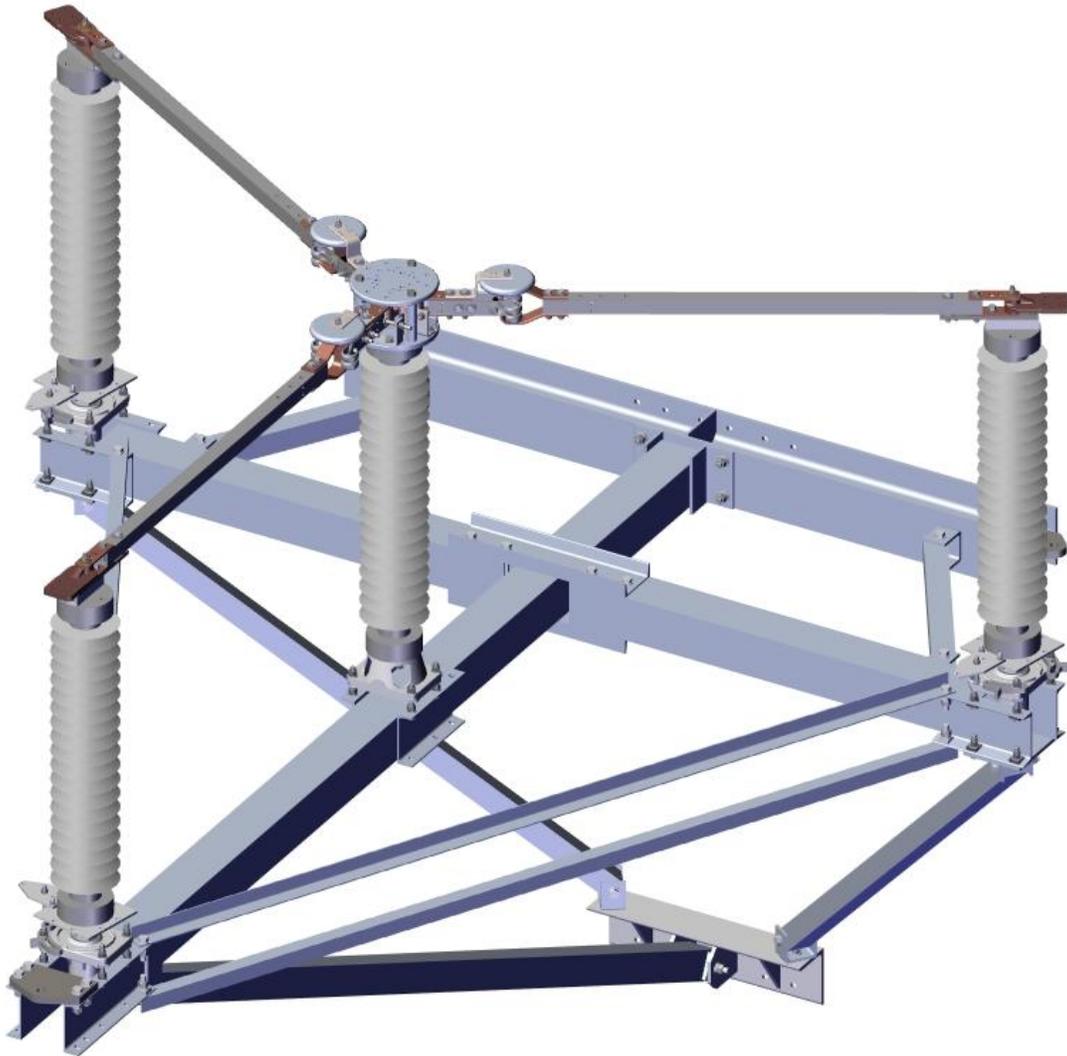
The instructions in this manual are general guidelines for this type of equipment and not specific to the equipment supplied. Portions of it may not be applicable or may not have complete instructions for your specific equipment. If you do not understand any part of these instructions or need assistance,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

Type ES-1 2 Way



The Quality Name in High Voltage Switching

Type ES-1 3 Way



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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.

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 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 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.

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Introduction

The Southern States Type ES-1 2 & 3 Way 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		Torque Values	
Type	Sizes	Bolt Size	Torque (Ft-lb)
Hand Wrenches	1 1/8", 15/16", 3/4", 9/16", 7/16"	1/4"	8
Sockets	1 1/8", 15/16", 3/4", 9/16", 7/16"	3/8"	16
Screw Drivers	Flat Head	1/2"	40
Pliers	Needle Nose	5/8"	92
		3/4"	127

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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 a 2 Way 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). Each switch blade is operated by a separate operating mechanism. A 2 Way has two operating mechanism and a 3 Way has three mechanisms. 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 2 & 3 Way ES-1 Switches have both right-hand (clockwise rotating) and left-hand (counterclockwise rotating) switch blades and operating mechanisms. This is necessary so that both switch blades closest to the pole open away from the pole, thereby preserving line to ground clearance on a smaller frame.

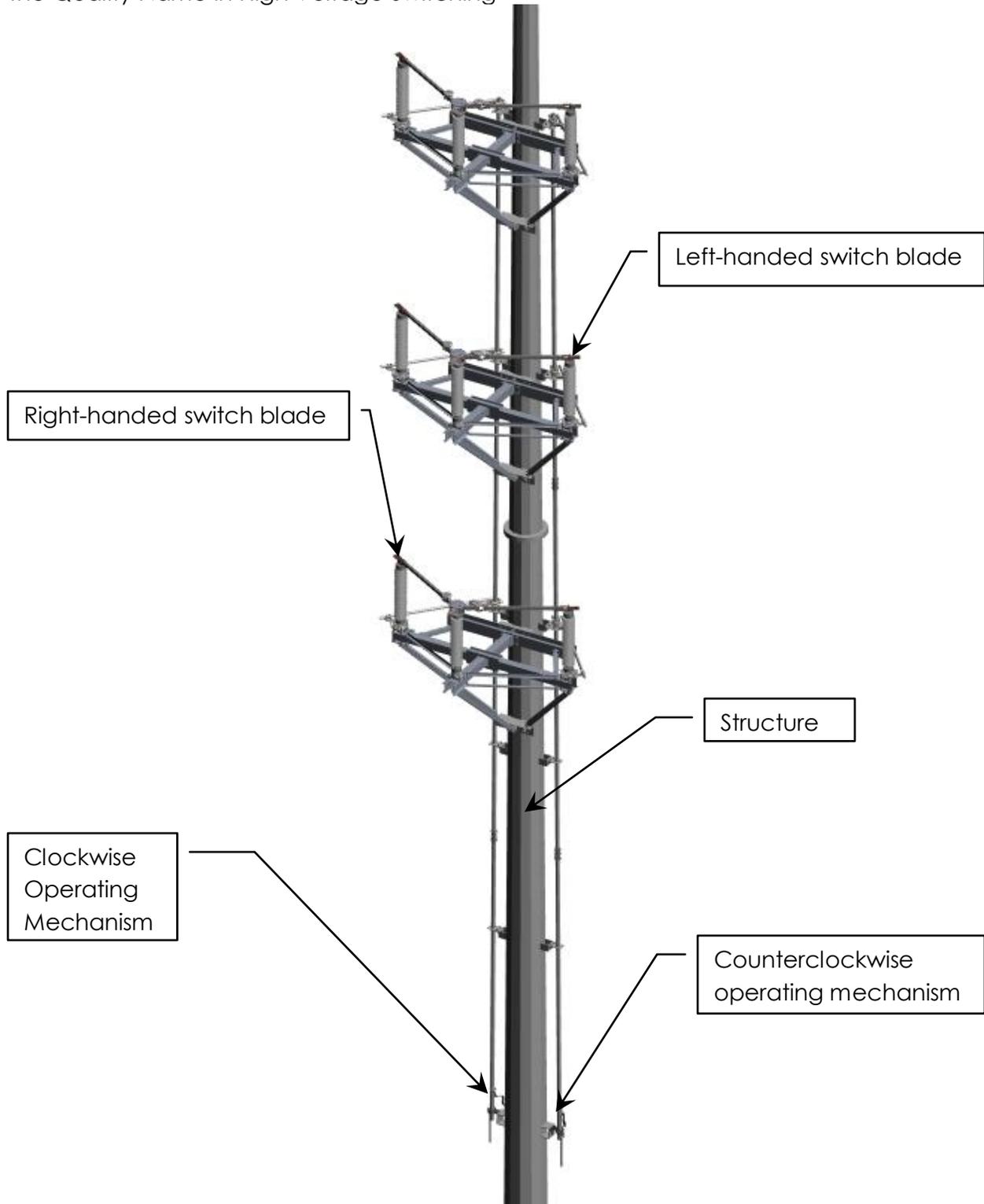


Figure 1: Typical Pole Mounted Switch with Operating Mechanism

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Installation and Adjustment Procedures

Typical Disconnect Switch

In general, installing a Southern States Type ES-1 2 or 3 Way Disconnect Switch consists of the following:

- Unfolding the switch.
- Mounting the cross braces to the switch base.
- Mounting the switch base to the structure.
- Mounting the remaining frame components to the structure.
- Installing operating mechanism components.
- Final adjustment of the switch and operating mechanism.

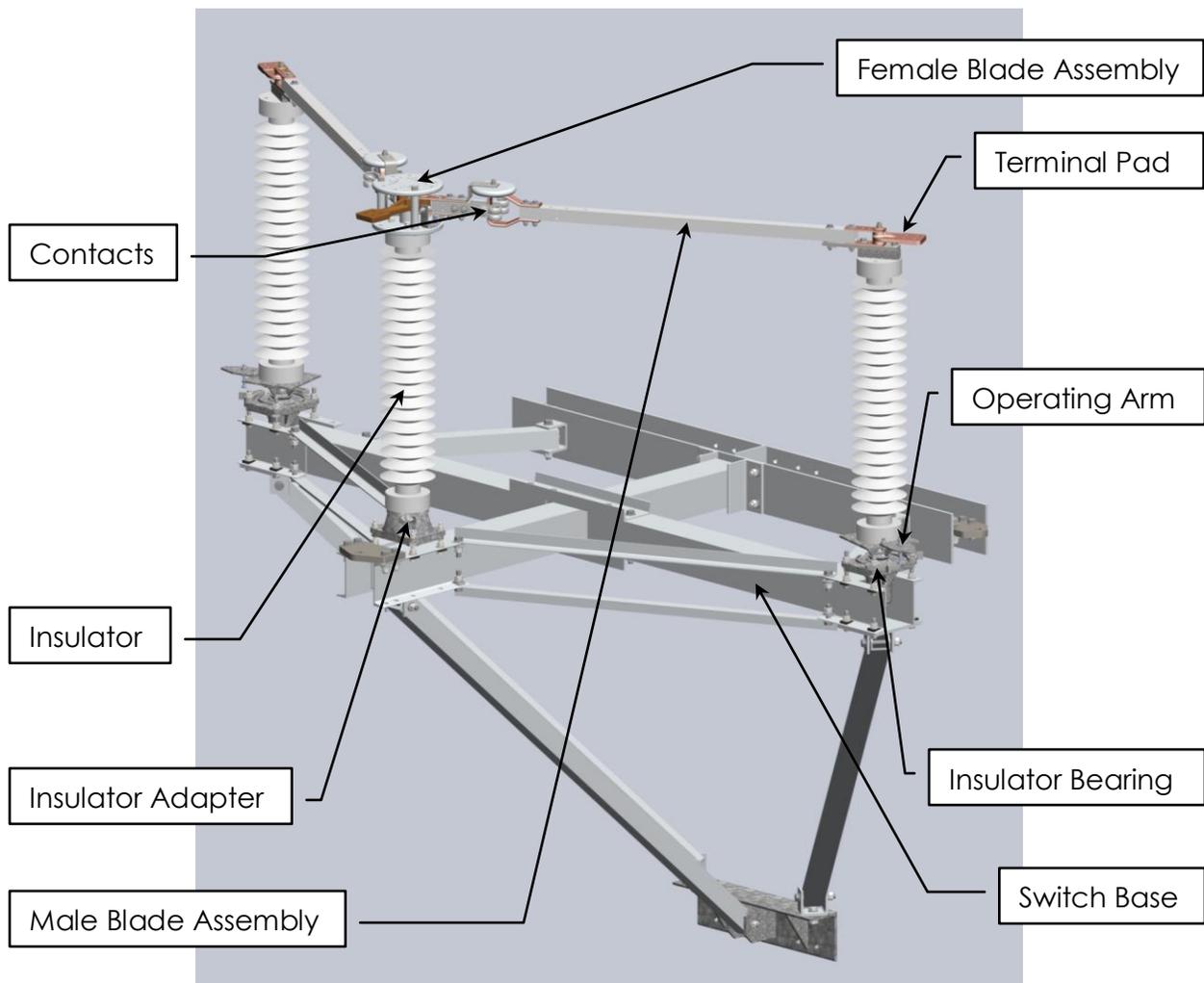


Figure 2: Common ES-1 2 & 3 Way Terminology

Important

Safety precautions must be taken and safety guidelines carefully followed. Follow all NESC, OSHA, user, manufacturer, and local safety requirements. Steps shown apply equally to both 2 and 3 Way ES-1 switches.

Unfold 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.

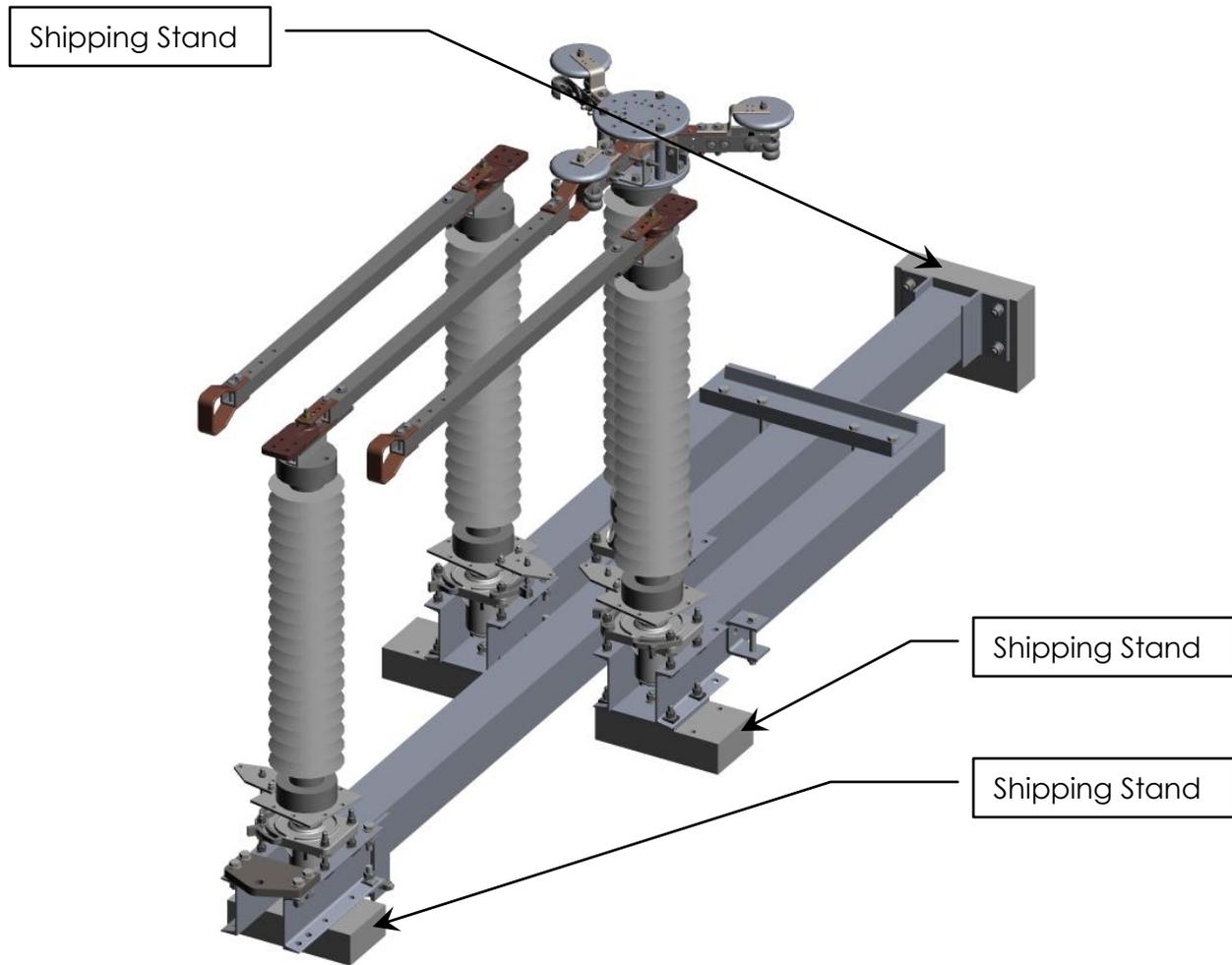


Figure 3: Folded Switch

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2) Rotate switch base member 90°. See Figure 4.

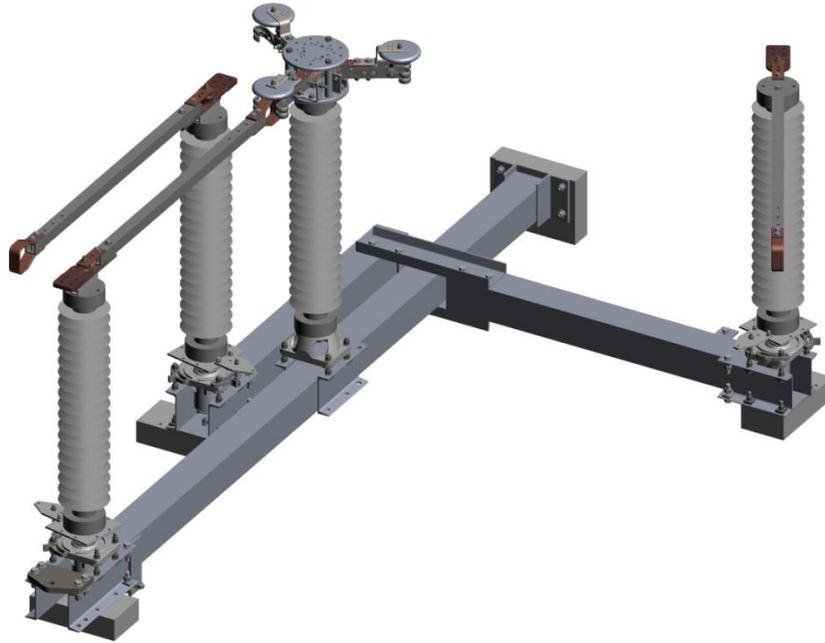


Figure 4: Unfolding First Base Member

3) Repeat with the other switch base member. See Figure 5.



Figure 5: Both Base Members Unfolded

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- 4) Insert hardware specified on the switch assembly drawing. Do not tighten hardware at this time. See Figure 6.

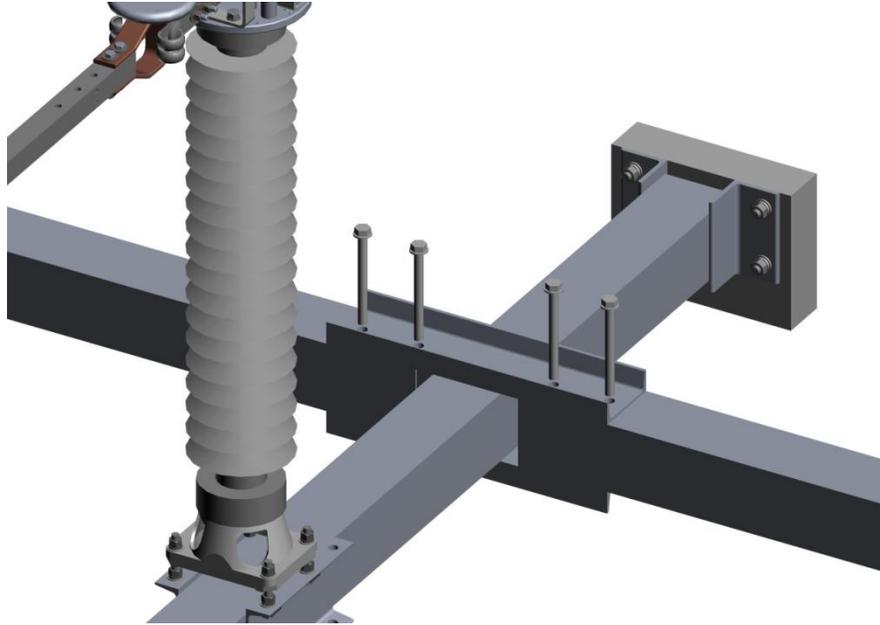


Figure 6: Base Member Hardware

- 5) Close the switch blades. See Figure 7.



Figure 7: Closed Switch

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- 6) Extend the bearing stop bolt until it can interact with the bearing stops. See Figure 8.

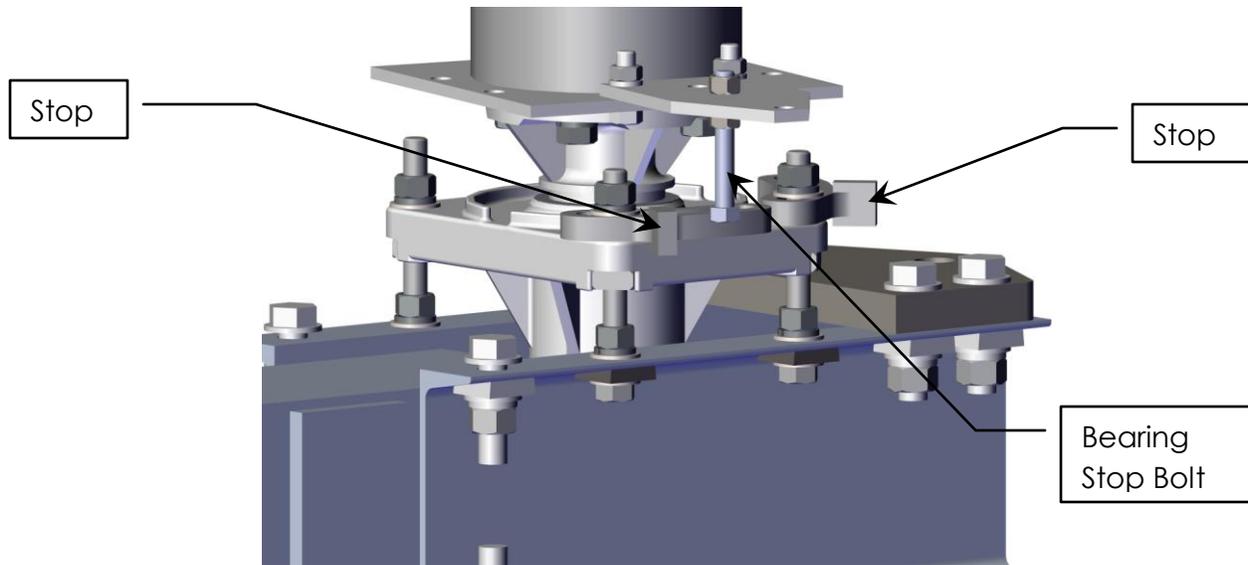


Figure 8: Bearing Stop Bolt Height

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Mount Cross Braces to Switch Base

- 1) Attach back member and cross braces specified in Operating Mechanism Drawing. See Figure 9.

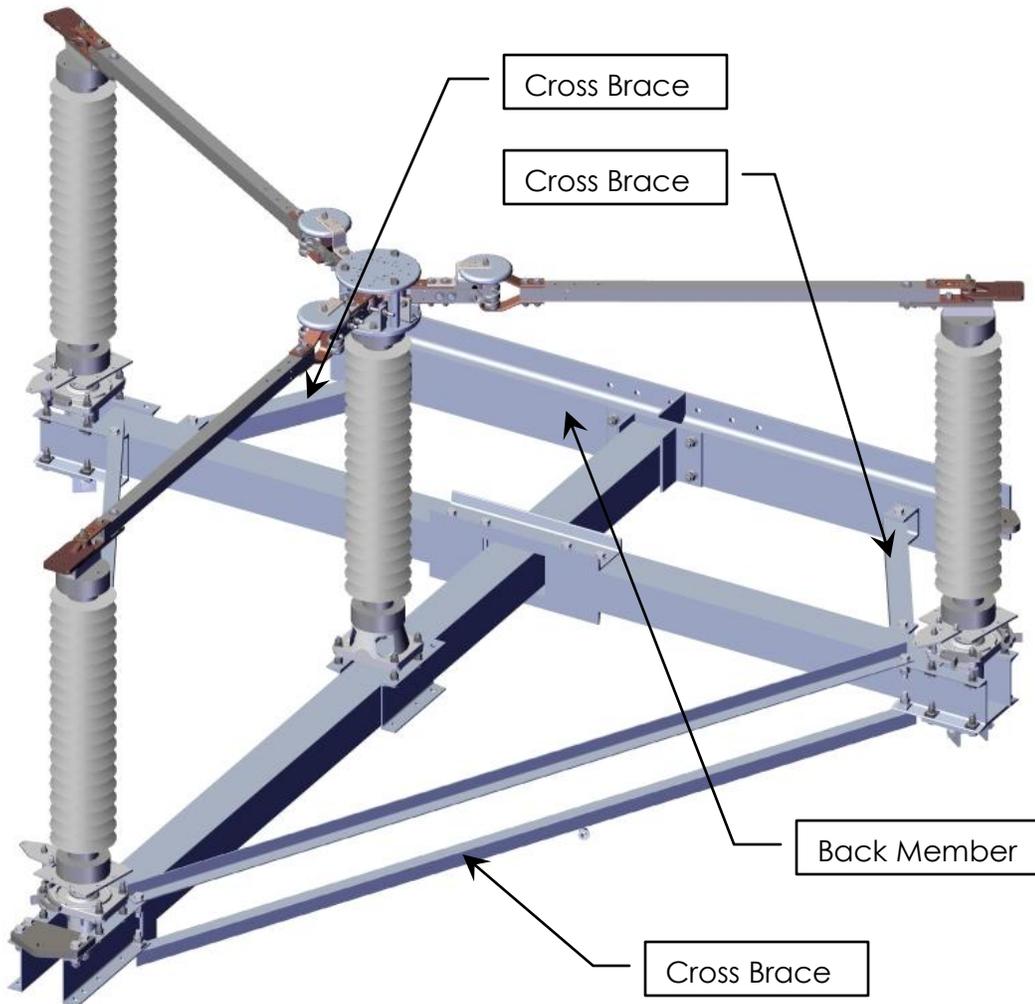


Figure 9: Base Frame Components Attached

- 2) Tighten the back member hardware, the cross brace hardware, and the switch base member hardware. See Table 1 for proper torque values.

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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. See Figure 10.

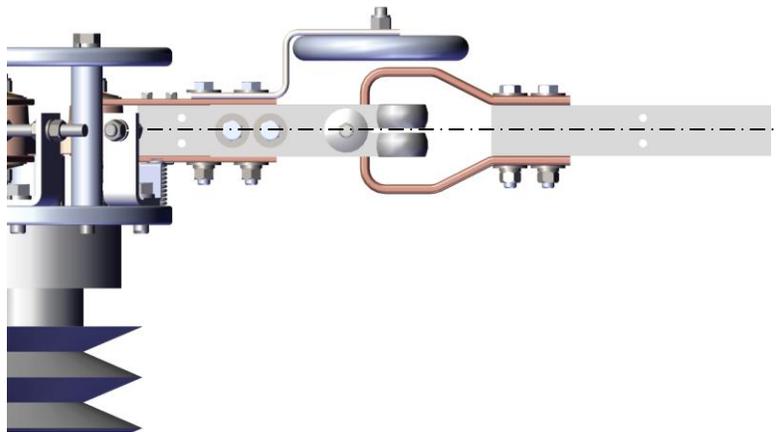


Figure 10: Blade Alignment

- 3) Measure the gap between the blade tip and the blade stop. The gap should be less than 1/16". See Figure 11.

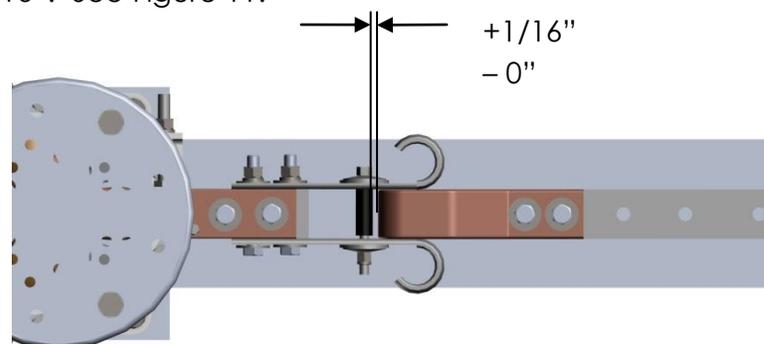


Figure 11: Male Blade Tip Depth

- 4) There should be a small gap, less than one inch, between the female blade contacts and the male blade tip when the female blade assembly is fully open. See Figure 12.

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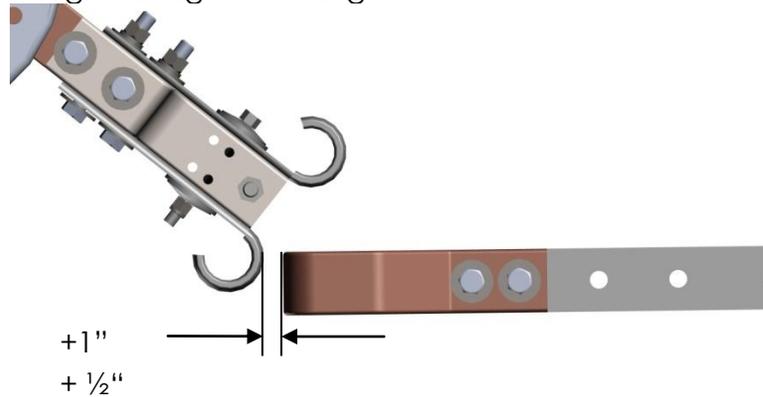


Figure 12: Blade Open Gap

- 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.

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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 $\frac{1}{4}$ " and $\frac{1}{2}$ ". See Figure 13. If necessary, use the live parts close position stop bolt to adjust the over toggle.

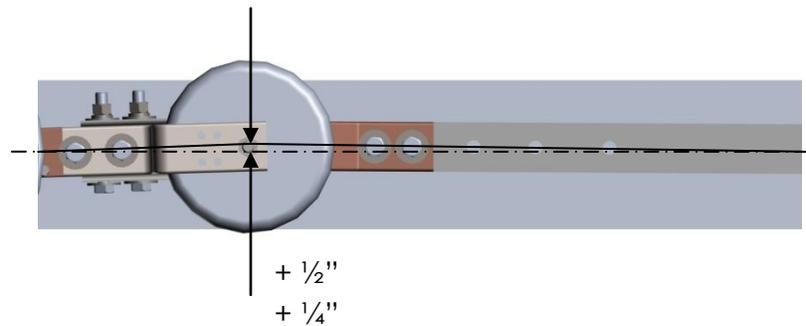


Figure 13: Left-handed Switch Blade Over Toggle

- 3) The live part closed position stop is correctly engaged when it touches the female blade lightly. Adjust the bolt if necessary. Figure 14 illustrates the left-handed live part stop bolt. The right-handed live parts stop bolt is on the opposite side of the female blade.

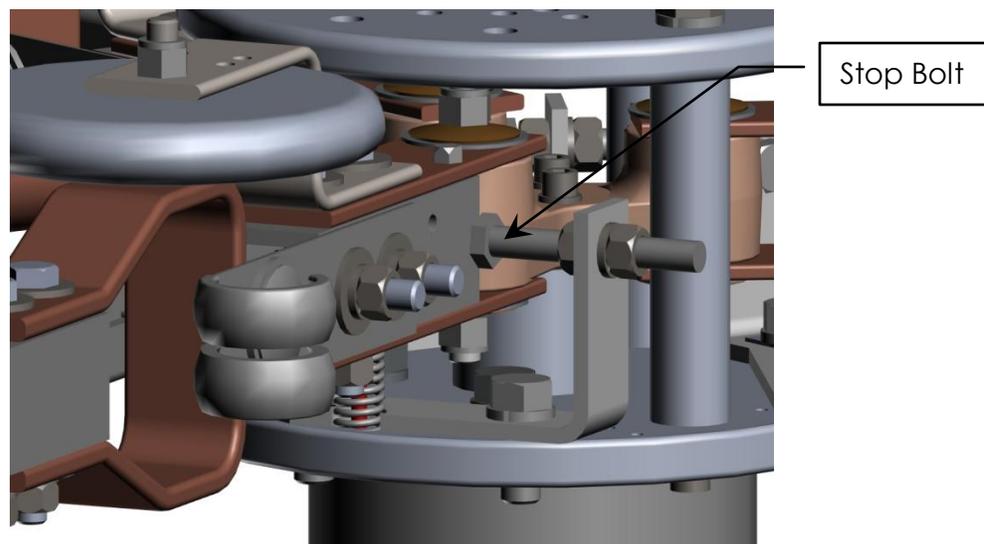


Figure 14: Left-Handed Live Parts Closed Position Stop

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- 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 15.

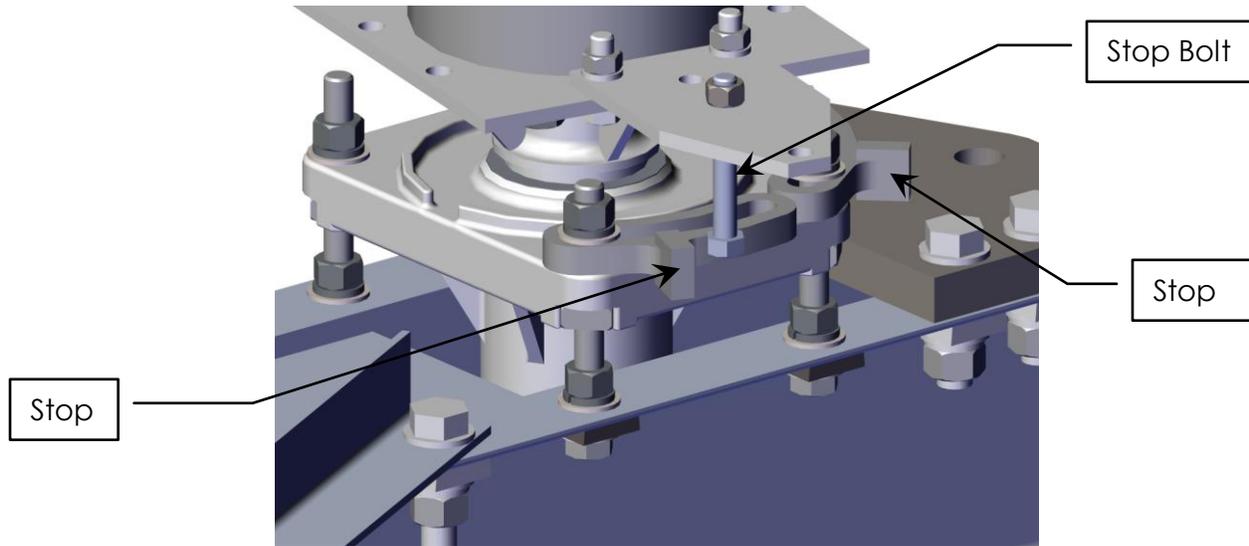


Figure 15: Closed Position Bearing Stop

- 5) To facilitate Operation Mechanism adjustment, loosen the opened position bearing stop at this time.
- 6) Open the switch.
- 7) The spring should be directly beneath the blade catch and the catch parallel to and fully engaged on the female blade in the open position. A slight over travel by the female blade is permissible. Ensure copper anti-seize lubricant is applied to where the catch and female blade contact. Figure 16 illustrates a left-handed switch blade. The catch is on the opposite side of the female blade on a right-handed switch blade.

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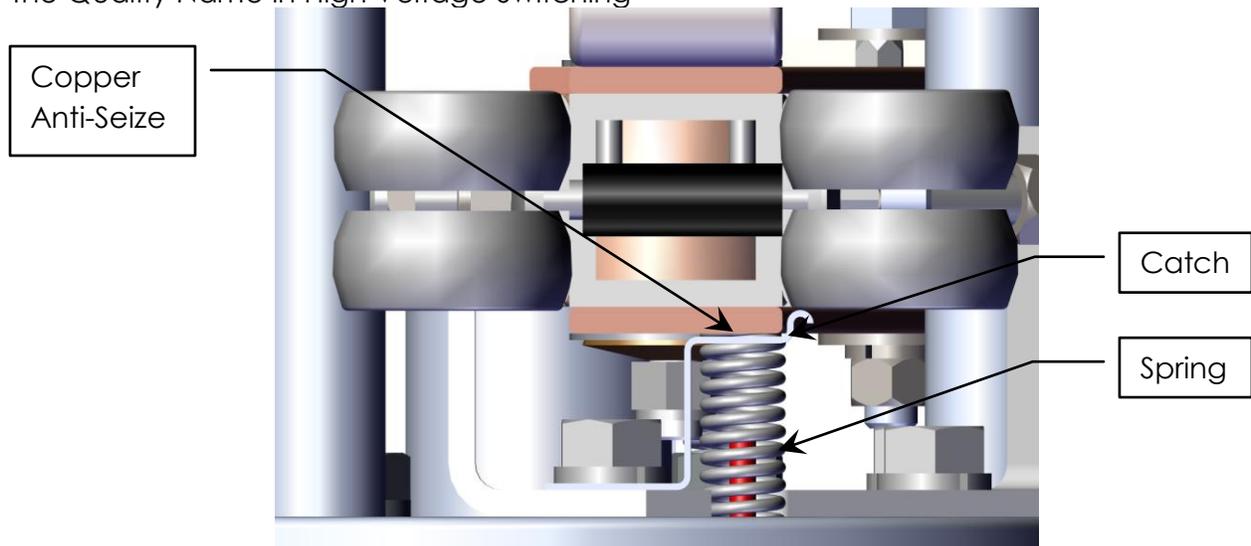


Figure 16: Left-Handed Blade Catch Position

- 8) If necessary, adjust the catch by loosening the bolt attaching the catch just enough to allow the catch to rotate. Move the catch to the proper position and hold it in position while the bolt is tightened. See Table 1 for recommended torque values.
- 9) The open position stop bolt should lightly touch the female blade at the fully open position. Adjust bolt if necessary. See Figure 17.

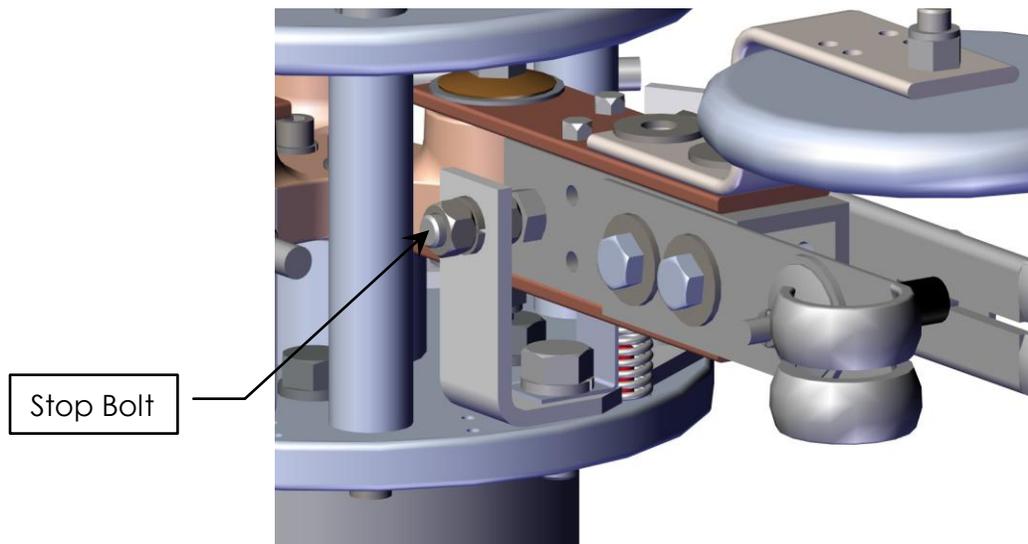


Figure 17: Left-Handed Open Position Live Parts Stop

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- 10) The typical blade opening, 90°, is shown in Figure 18 for a left-handed switch blade. Blade attachments may alter the opening angle. Refer to the Unit Assembly drawing for details.

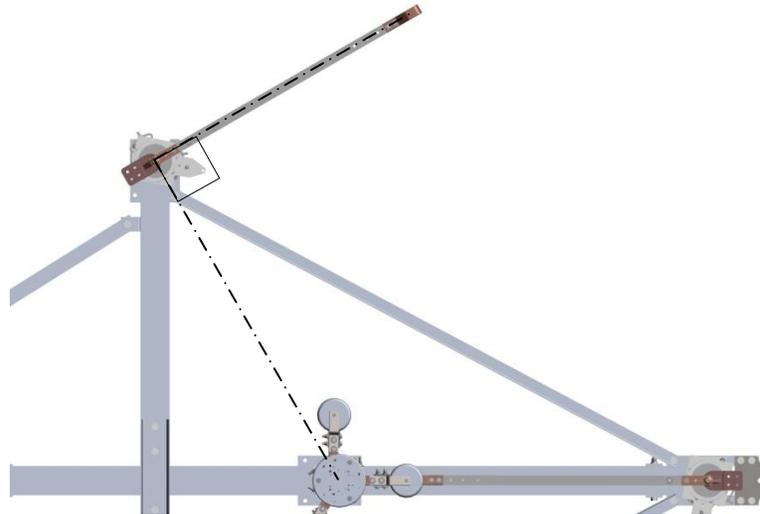


Figure 18: Left-Handed Minimum Open Angle

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

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Mount Switch Base to Structure

- 1) Check the Operating Mechanism Drawing for proper mounting position.
- 2) With the switch closed, secure the blades using rope or other type of strap to avoid movement during lifting.
- 3) Secure the bearing stop using a wire or strap prior to lifting.
- 4) **Lift the assembled switch by the switch base only.** Refer to Figure 19.

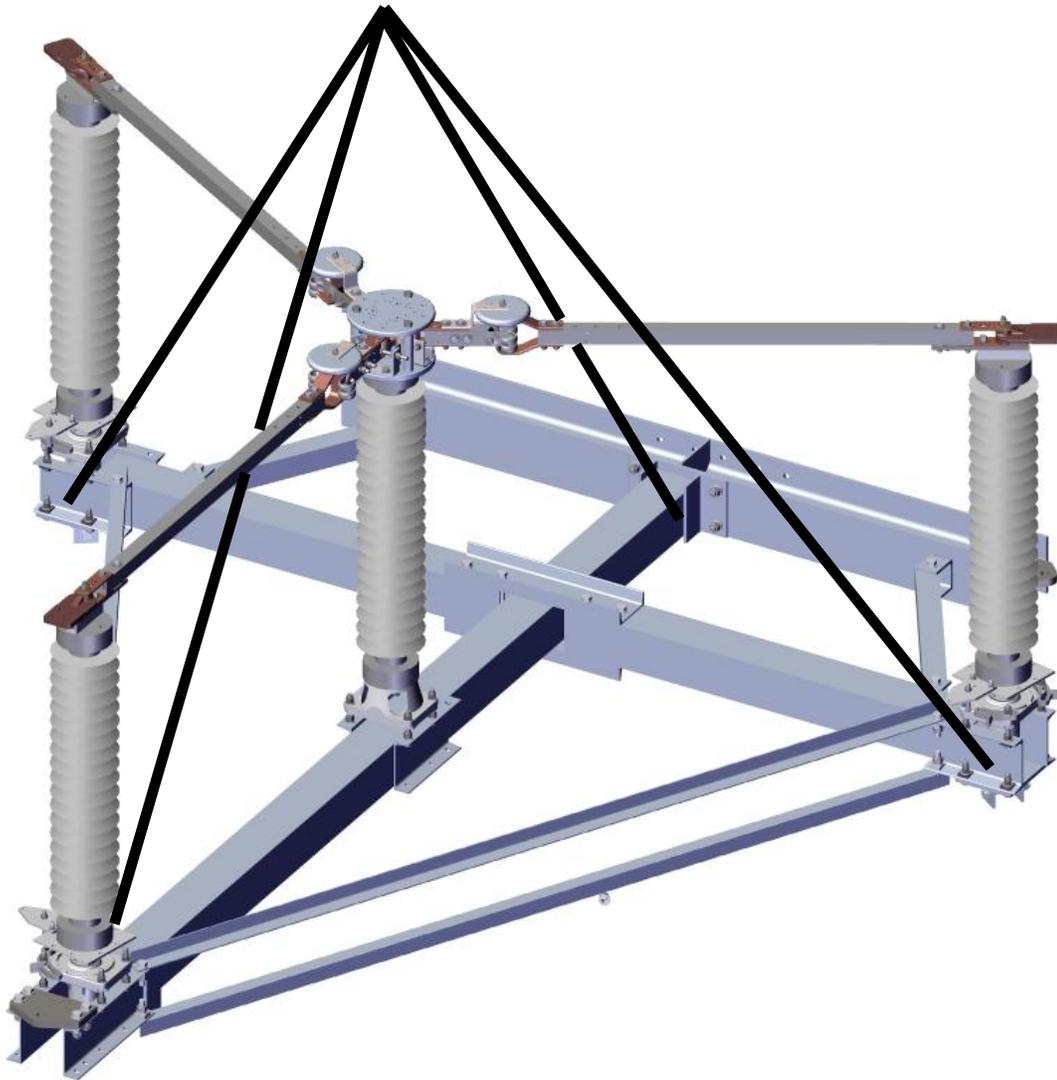


Figure 19: Lifting Strap Locations

- 5) Mount the disconnect switch to the structure using the hardware indicated by the Operating Mechanism drawing (see Table 1 for torque spec).
- 6) **Do not remove lifting straps until remaining frame components are installed.**

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Mount Frame to Structure

- 1) Check the Operating Mechanism Drawing for proper position of all frame members. See Figure 20.

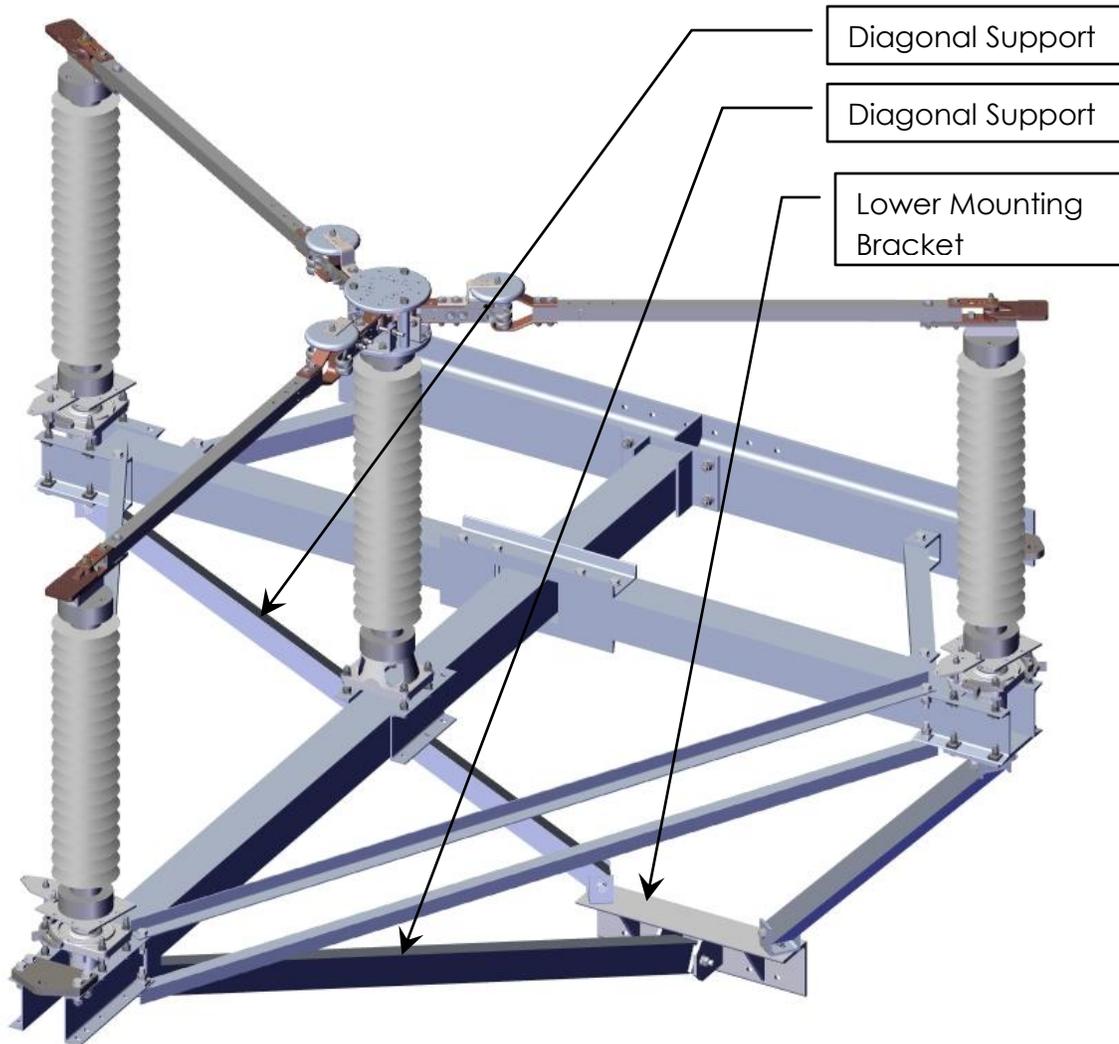


Figure 20: Typical Frame Design

- 2) Mount the frame members using the hardware indicated by the Operating Mechanism Drawing.
- 3) To aid frame member alignment, tighten bolts only after all hardware on all members has been installed. See Table 1 for recommended torque values.

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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 21 for a typical 2 Way ES-1 Operating Mechanism.

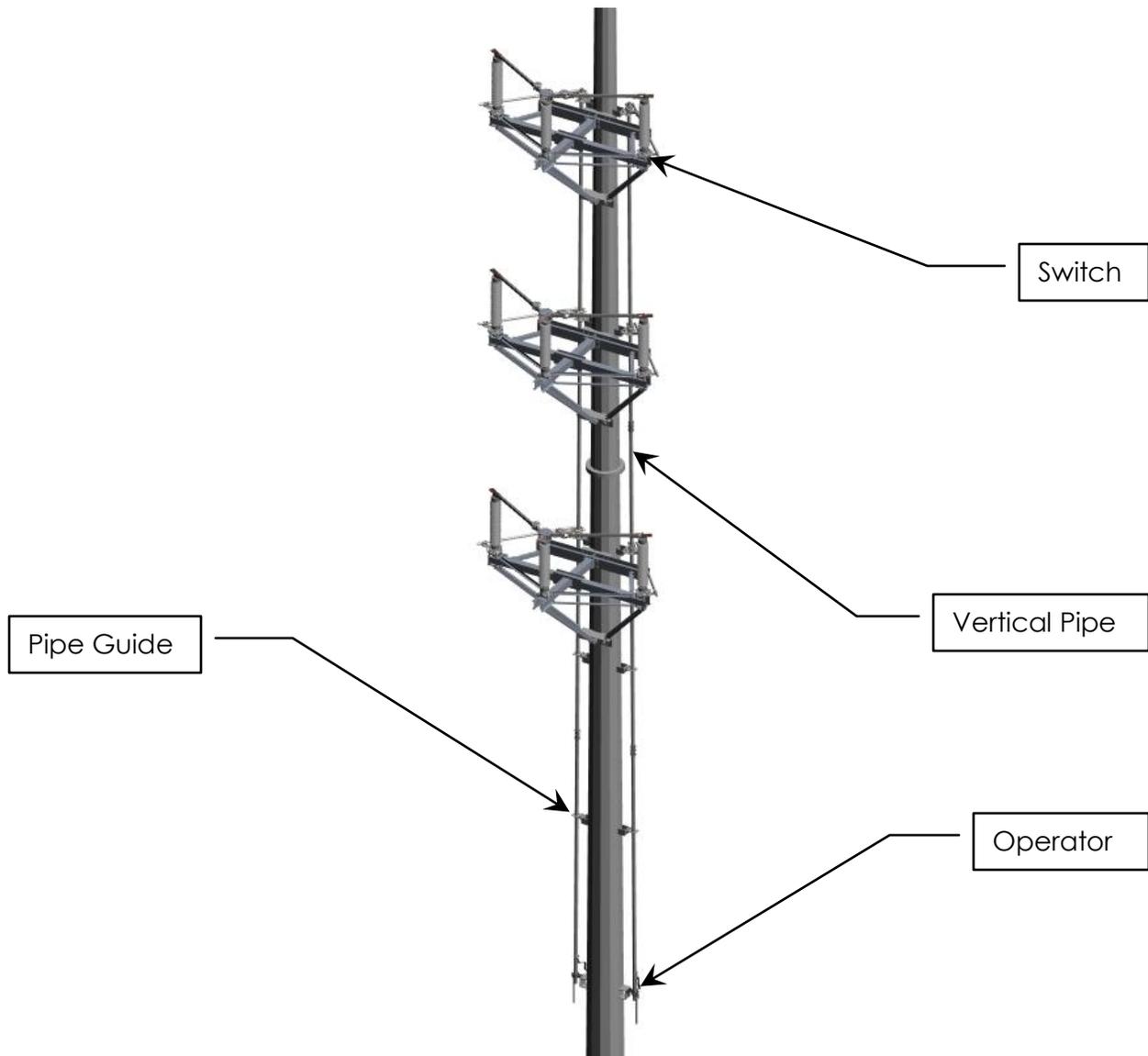


Figure 21: Typical 2 Way ES-1 Operation Mechanism

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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 22 and Figure 23.

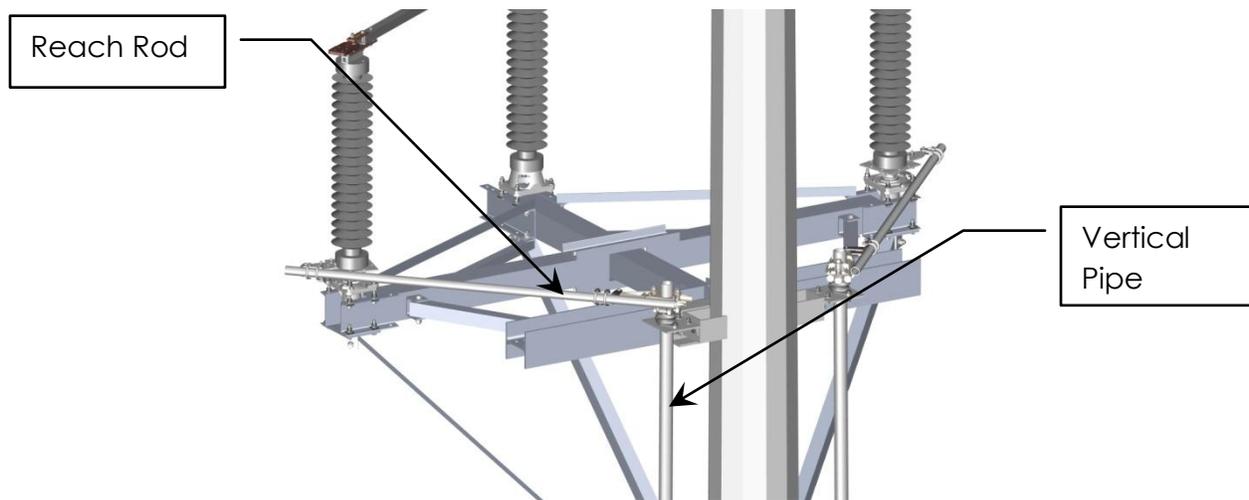


Figure 22: Top Phase Operation Mechanism

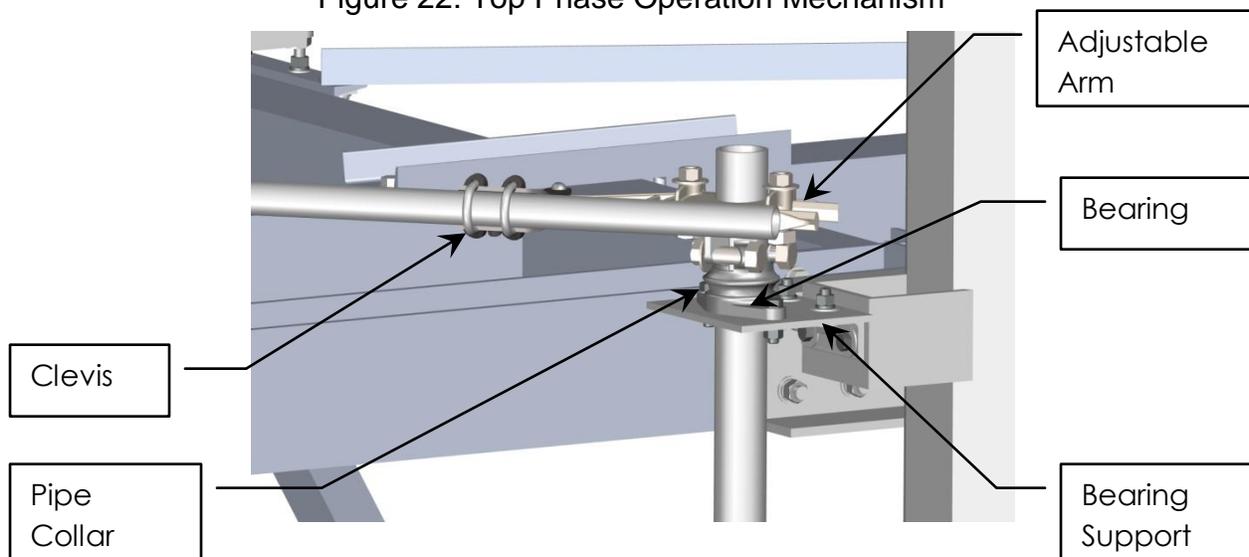


Figure 23: Vertical Bearing Support

7. Repeat steps 4 through 6 at every bearing support as more vertical operating pipe sections are added. See Figure 24.

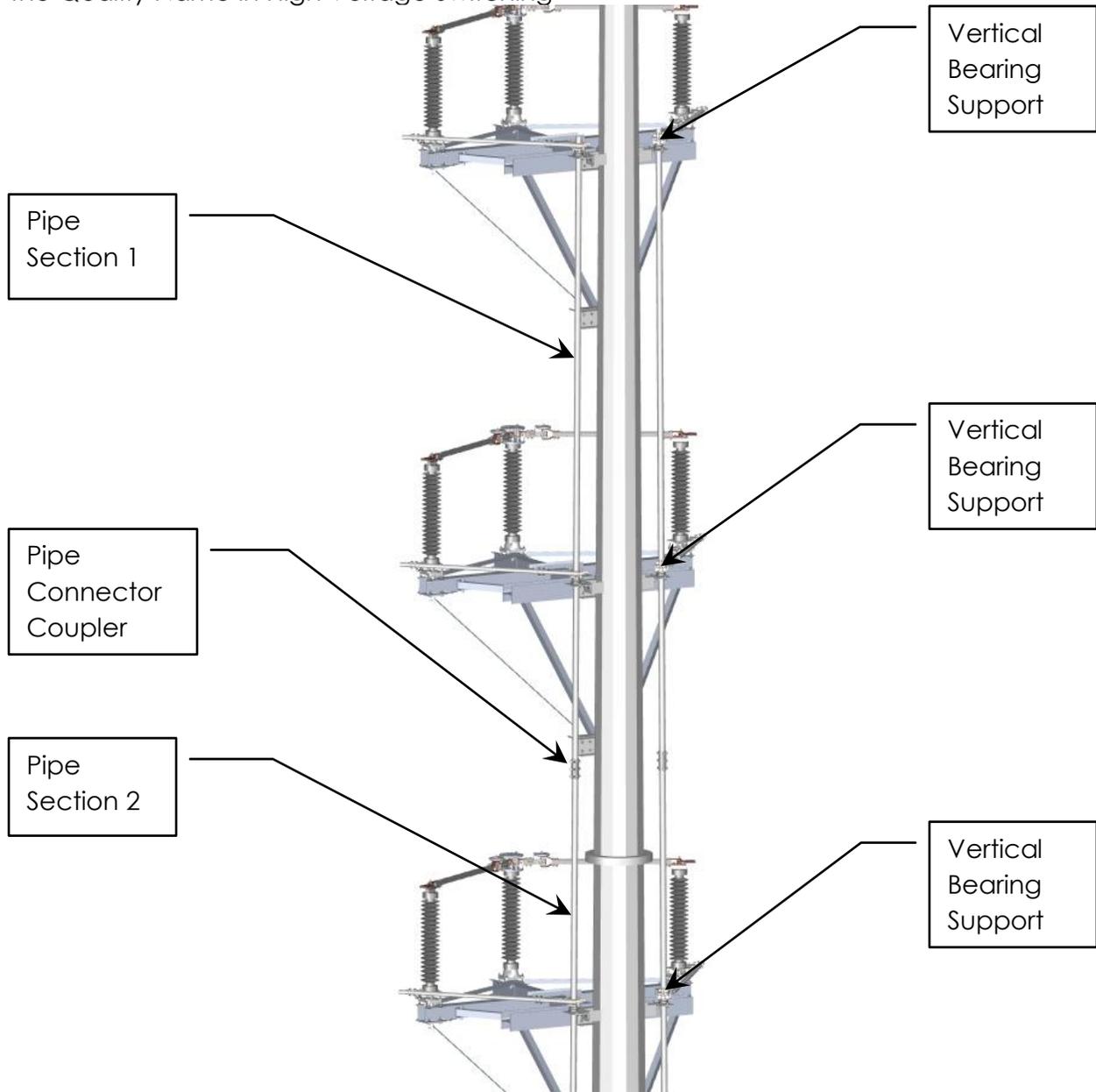


Figure 24: Typical Vertical Bearing Support Locations

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.

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Adjust Switch and Operating Mechanism

1) Switch Operating Devices:

a) Worm gear operator (HOGO – High Output Geared Operator)

- 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 25.

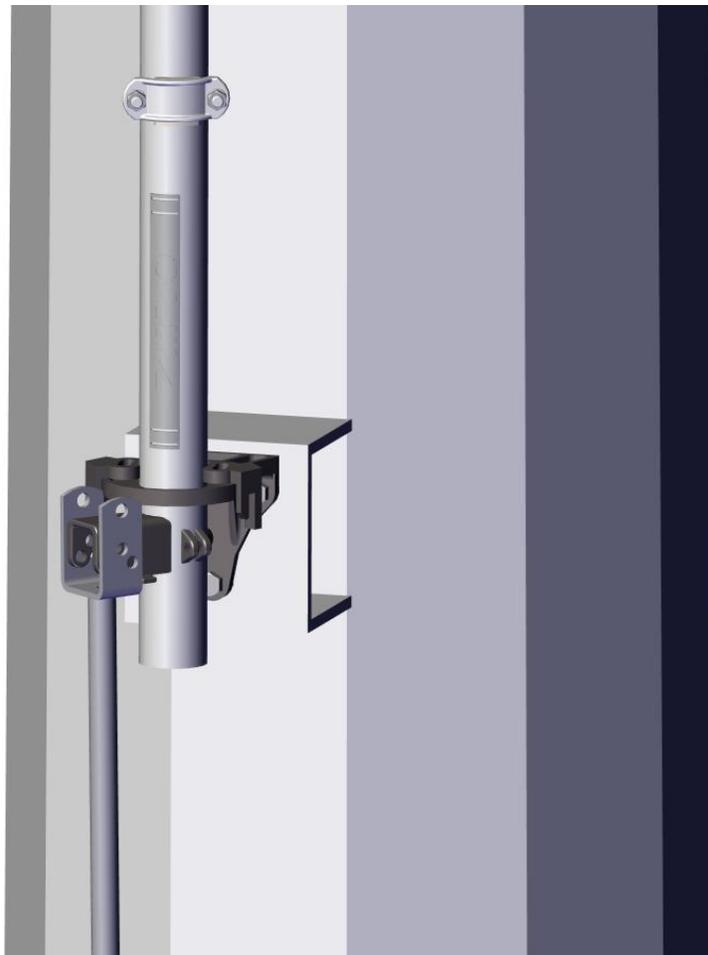


Figure 25: Typical Swing Handle

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- 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. See Figure 21.
 - b) Set the adjustable arm on the top phase to the preliminary setting specified on the Operating Mechanism Drawing. See Figure 26.

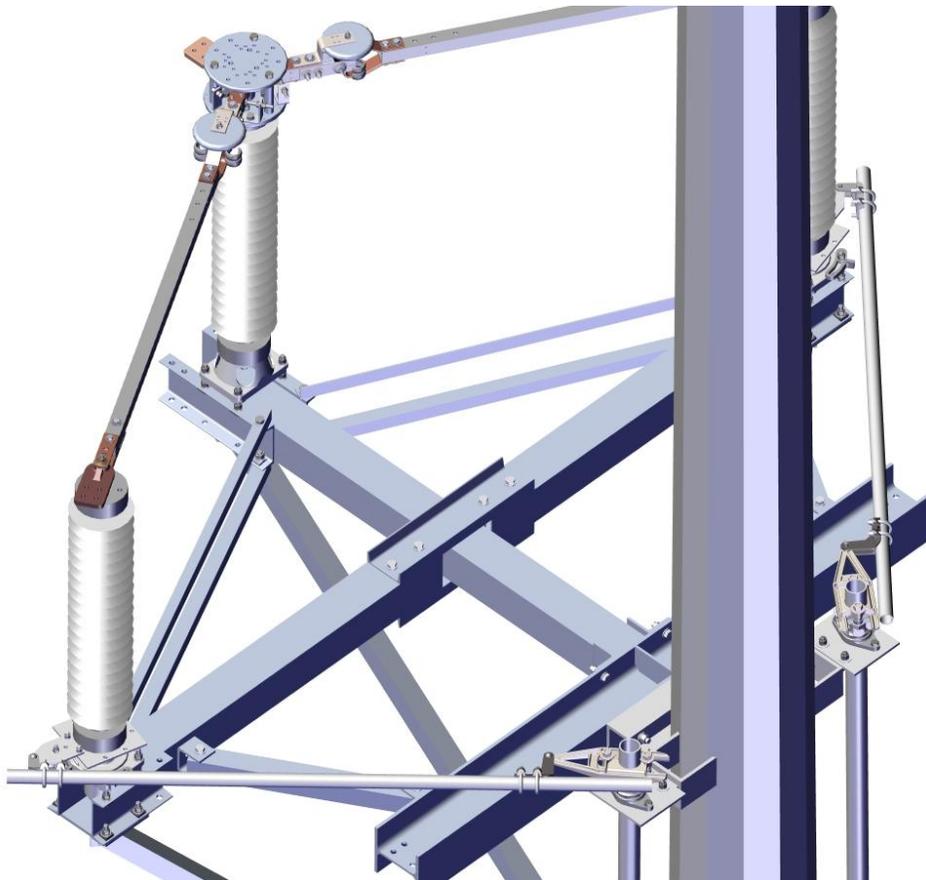


Figure 26: Typical Initial Setting.

- 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

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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. See Figure 27.

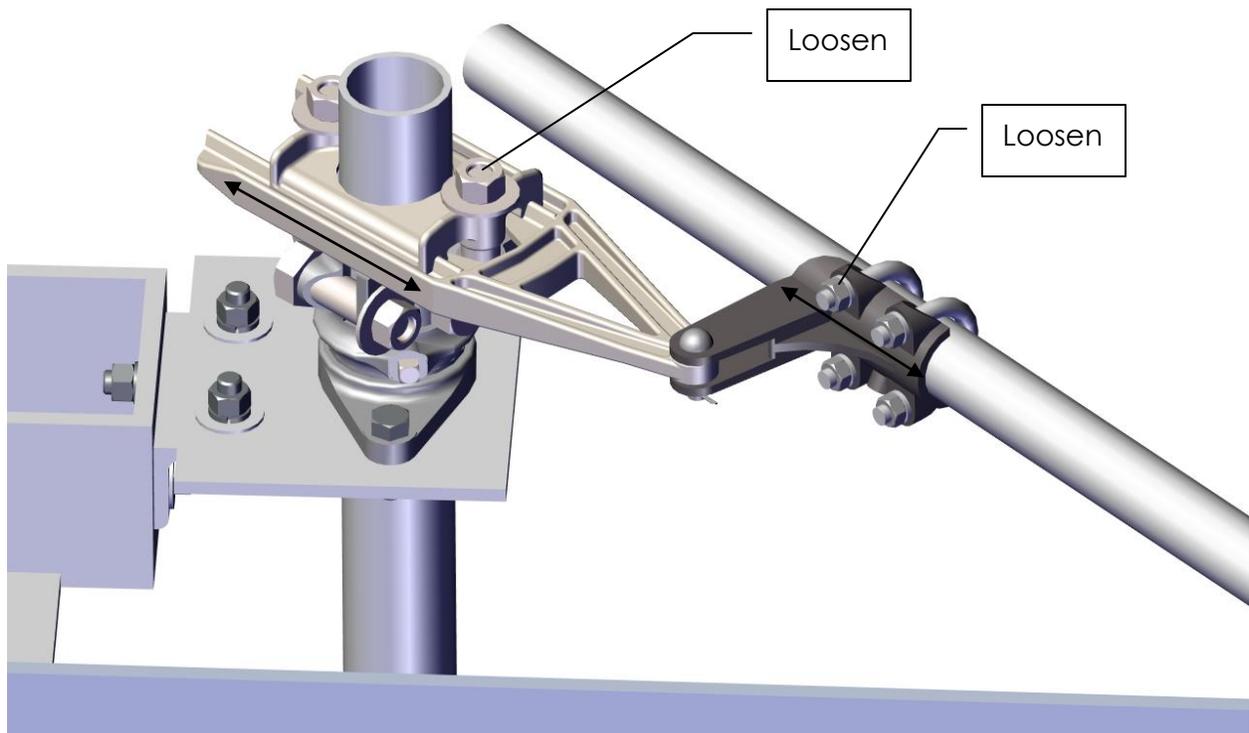


Figure 27: Adjusting the Adjustable Arm

- 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

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- v) Shorten the adjustable radius arm approximately ¼-inch. Allow the pipe clevis to reposition itself the same ¼ inch. Refer to Figure 27.
- 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 28.

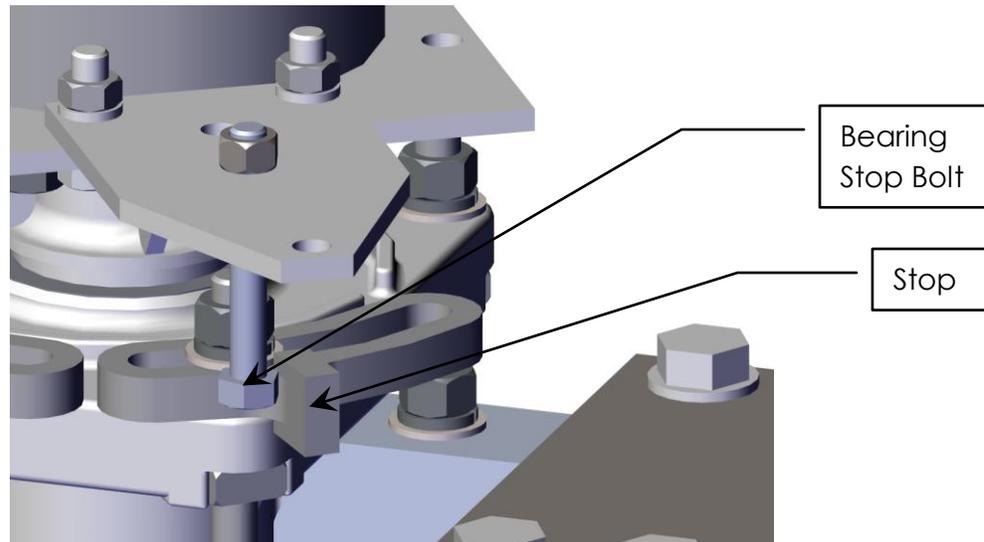


Figure 28: Bearing Opened Position Stop

- d) 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.
- e) Copper anti-seize lubricant is recommended on the switch contacts.
- f) **ENERGIZE THE SWITCH ONLY AFTER A FINAL INSPECTION OF BOTH OF THE CONDITIONS FOR PROPER CONTACT.**

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Optional Attachments

Several different attachments can be mounted on the 2 & 3 Way 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

MAG-I, LLS-I, and LLS-II interrupters can be mounted to the 2 & 3 Way 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 2 & 3 Way ES-1. Whips are typically used in conjunction with arcing horns. Please refer to the individual drawings for part and hardware locations. Figure 29 illustrates one such whip and arcing horn combination.

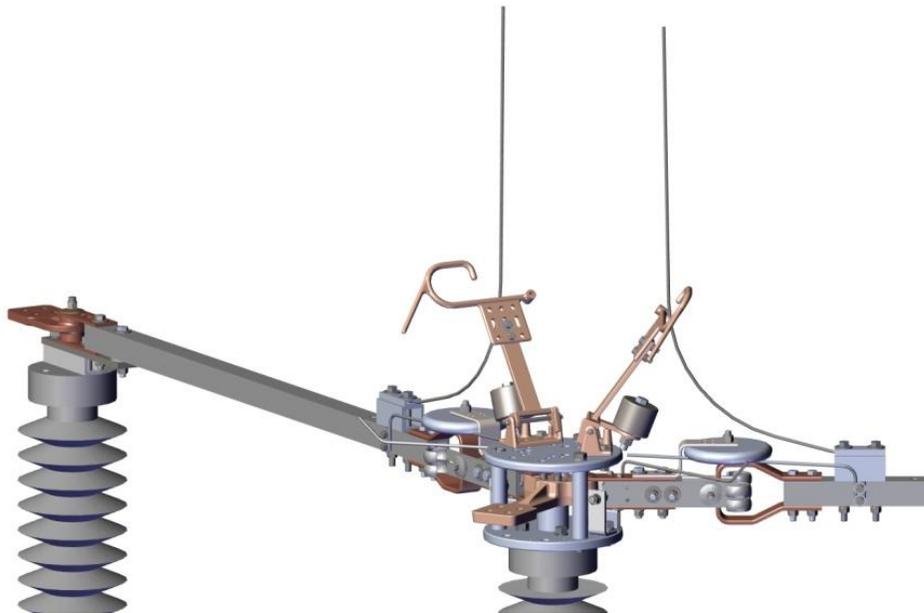


Figure 29: Quick Break Style Whip

Arcing Horns

Arcing horns are typically factory installed and can range from bent stainless steel rods to copper bars depending on the application. Please refer to the individual drawings for part and hardware location.

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Recommended Inspection and Maintenance

The Southern States ES-12 & 3 Way 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 19, 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 19, 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 15. Check to live parts stop adjustment per Check Blade Stop Adjustment on page 17. Check the operating mechanism for proper adjustment per Adjust Switch and Operating Mechanism on page 26. Refer to Table 2 for recommended inspection items.



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