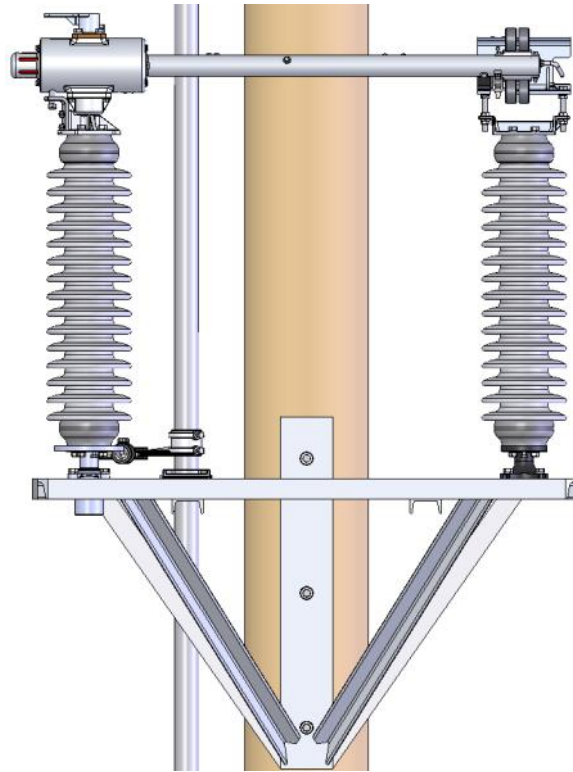




TS2

Group Operated Turner Side Break Switch

1-Way Phase Over Phase Switch Installation Instructions



WARNING

De-energize and properly ground any applicable and adjacent equipment before performing any installation or maintenance. Work should only be undertaken by qualified personnel.



CAUTION

Do not operate switch until adjusted properly damage can occur.



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Introduction

Turner Electric switches and operating mechanisms are designed for rapid and simple installation. By carefully following these instructions, the possibility of error and delay can be minimized. Time spent reading the instructions can save many hours of installation time.

These instructions are to be used for adjusting the switch after the jumpers are attached. In some situations, the switches are adjusted properly in the factory before shipping. However, depending on the style of mounting, the adjustment of the switch can be thrown off from the weight of the loading from the jumpers.

These instructions are written to cover the installation of the most common 1-way switches and mechanisms. They do not take the place of the switch and mechanism drawing layouts furnished with this order, but are intended to supplement them. If these instructions do not adequately meet the demands of your installation, please contact the factory for assistance at (618) 797-5000.

Receiving and Inspection

Check the total shipment for completeness against the bill of material on the installation drawings. If the switch shipping crate or the switch show evidence of shipping damage, note the damage on the bill of lading and notify the appropriate person in your territory for inspection.

Uncrate and/or remove all wire ties and check to see that the switch is undamaged. When uncrating, be careful not to discard any attached bags of parts. If damage is evident, report it immediately to the appropriate person in your territory for inspection.

Operating mechanism components are shipped on a maximum assembled basis and labeled, showing part numbers on their associated operating mechanism drawing. The operating mechanism components are crated, boxed or bagged, and shipped separately from the switch units. All necessary pipe is bundled and tagged for shipment.



TS2 Nomenclature

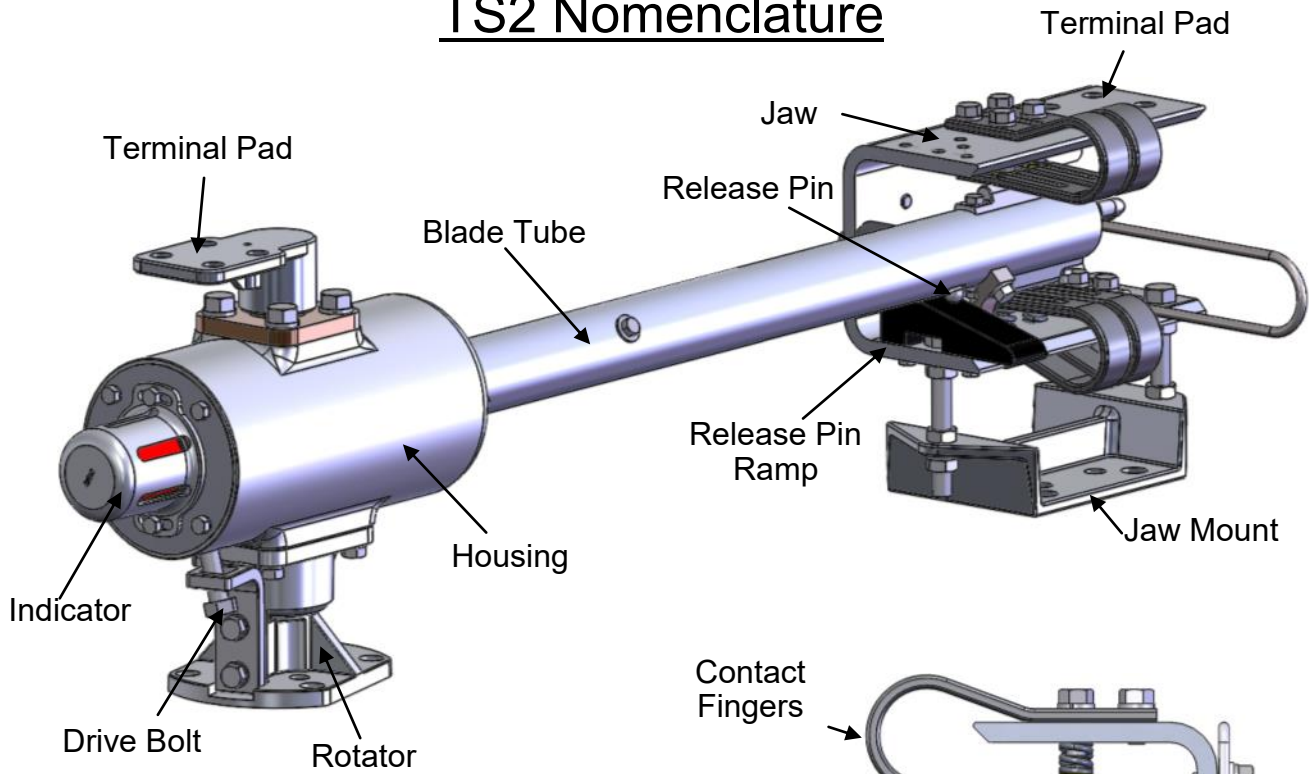


Figure 1 — Live parts shown in latched position

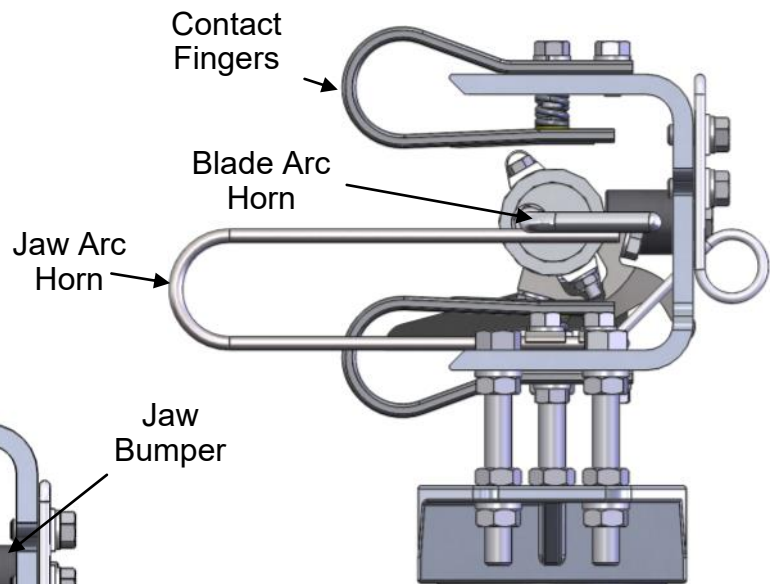


Figure 3 — Blade in jaw unlatched position, end view

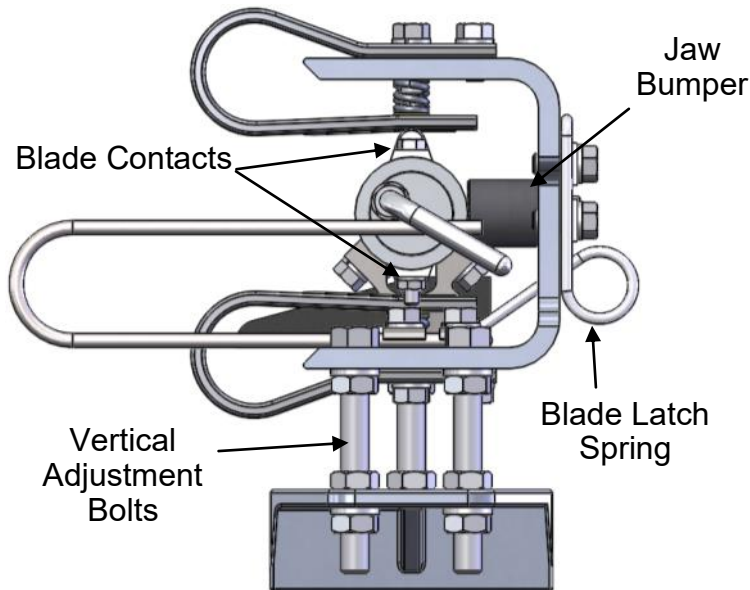


Figure 2 — Blade in jaw latched position, end view

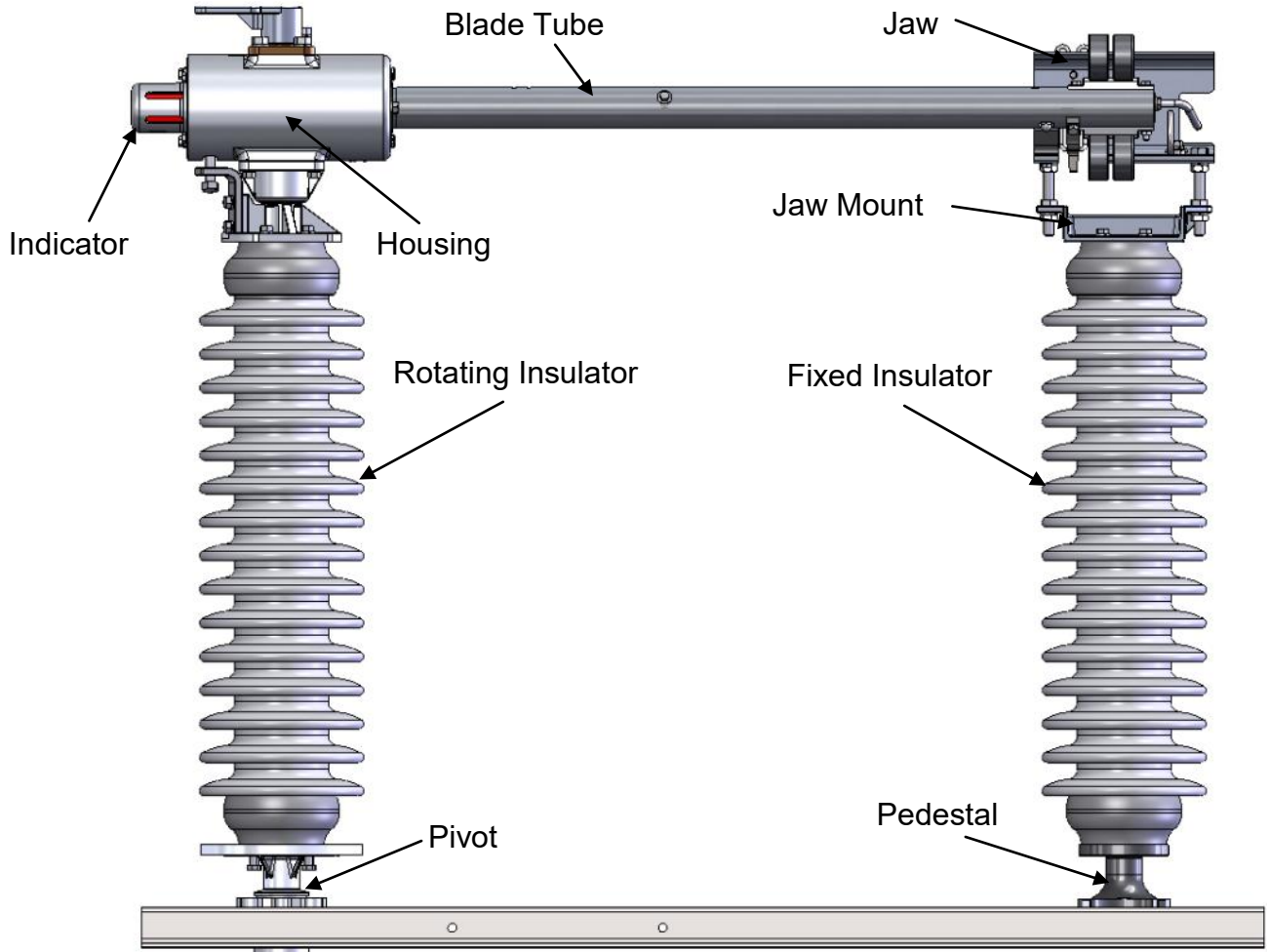


Figure 4 — Full switch in latched position

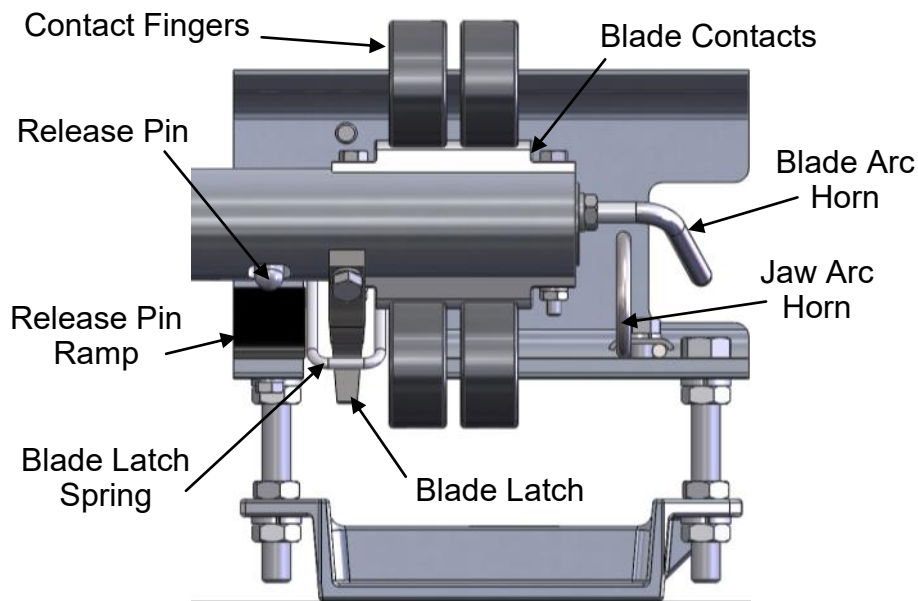


Figure 5 — Blade in jaw, latched position, front view



Installation of Switches and Vertical Operating Pipe

When you are ready to install the switch, check all the parts in the crates against the bill of material on the drawing to make sure all the parts are there. Transmission switches can be preassembled on the ground and then hoisted into position on the structure and attached.

- 1. Mount the insulators to the pivots and to the pedestals that are pre-attached to the frame from the factory.
- 2. Add the live parts to the insulators. Live parts are shown in Figure 1. Pay careful attention to the orientation of the pivot levers on the pivot and the live parts to make sure that they match the drawing.
- 3. If the switch is equipped with a TECORupter, install the TECORupter on the jaw and the TECORupter pickup hardware on the blade per the drawing and instructions.

NOTE
Pickup hardware may already be set by factory but still needs to be checked per the drawing and instructions.

- 4. Close the blade into the jaw and latch it. The indicator will show completely red as

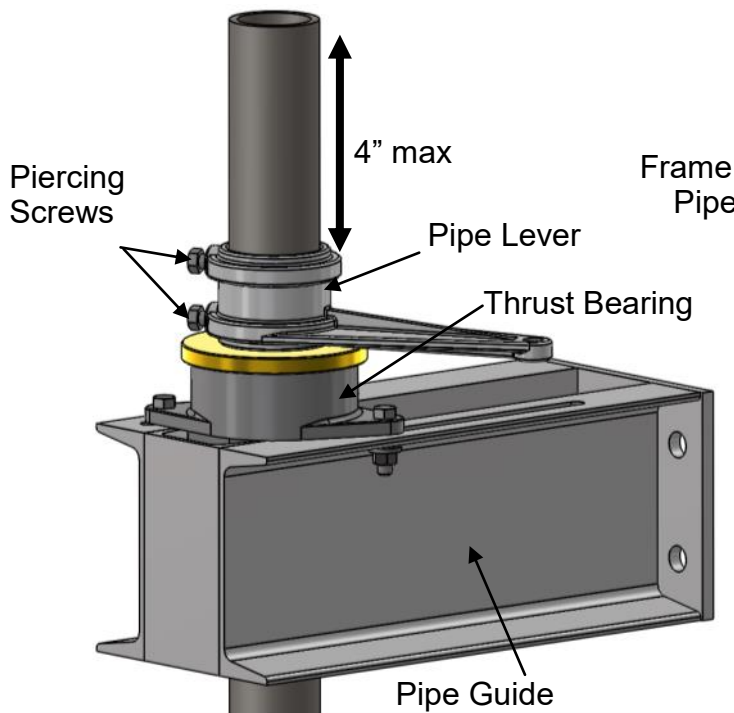


Figure 6 — Thrust bearing, top

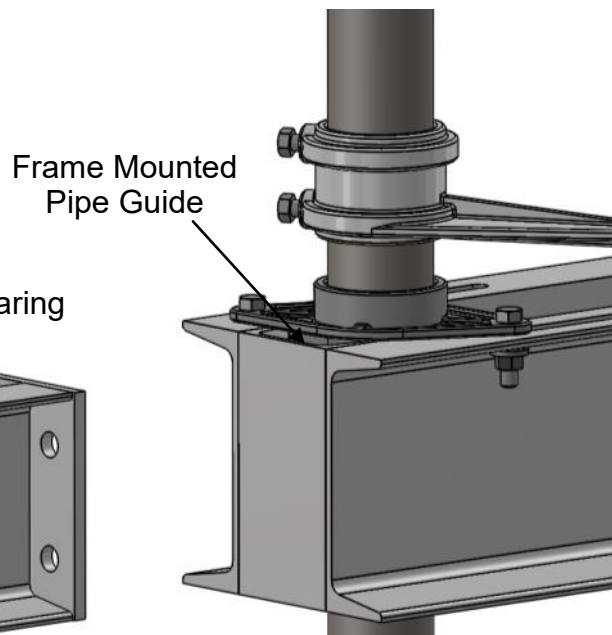


Figure 7 — Frame mounted pipe guide, middle and top phases



shown in Figure 1.

- 5. Repeat for the next two phases.
- 6. Hoist the frames into position and secure all three frames and frame mounted pipe guides to the pole.
- 7. Loosely attach the thrust bearing to the top frame and the frame mounted pipe guides to the middle and bottom frames. See Figures 6 and 7.
- 8. Hoist the top piece of the vertical operating pipe up through the pipe guides, the pipe levers and the thrust bearing on the top phase. Leave a maximum of about 4 inches of pipe above the top of the pipe lever on the top phase. See Figure 6.
- 9. The top pipe lever sits directly on the thrust bearing and supports the vertical operating pipe stack. Pierce the vertical operating pipe with the pipe lever piercing screws on the **TOP PHASE ONLY**.
- 10. Add the rest of the vertical operating pipe. Connect the pipe with the pipe couplings as shown on the Control Mechanism Drawing. Run the pipe through the frame mounted pipe guides adding a pipe lever at each phase and pole mounted pipe guides to the pipe.
- 11. All the pipe levers must be exactly in line with the top phase. Tighten but **DO NOT** pierce the piercing screws on the middle and bottom phase pipe levers. Mark the lever and pipe with a dark marker to check for slipping during trial-operations.
- 12. Adjust the frame mounted pipe guides so that the vertical operating pipes are straight. The thrust bearings will likely have to be as far away from the pole as possible.
- 13. Cut the pole mounted pipe guides to the appropriate lengths so the vertical operating pipes continue to run straight all the way to the bottom of the pole. This will prevent bowing and binding of the pipe.
- 14. Install the operator mechanism at the bottom of the vertical operating pipe. For installation of a swing handle or worm gear see the appropriate section in this manual. Installation of a motor operator is not included in this manual. See the appropriate installation manual for a motor .
- 15. Install all conductors and jumpers. Make all crimps in place to minimize loading on the terminal pads.

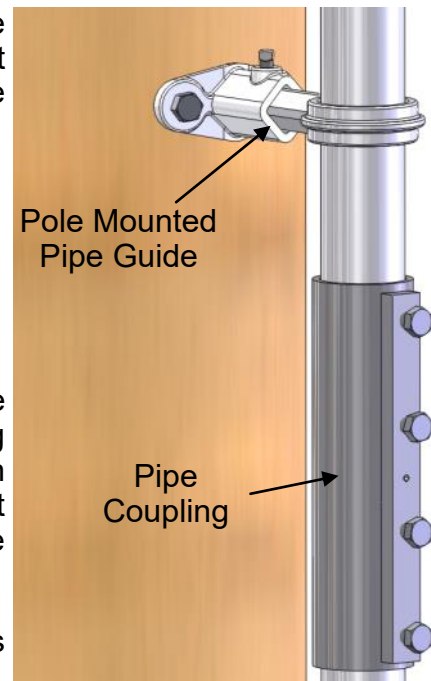


Figure 8 — Pole mounted pipe guide



Switch Adjustment

Adjusting the switch is an important step to make sure that the blade is aligned with the jaw during operation. Each phase can be operated individually by disconnecting the reach rod from the pivot lever if the reach rod was previously installed. In order to ensure proper operation, follow these instructions for how to adjust the switch:

- 1. Ensure all conductors and jumpers are connected to live parts on the switch before making any adjustments to minimize the need for readjustment after the final loads are imposed on the switch.

NOTE
Conductors and jumpers can throw off the alignment of the blade with the jaw.

- 2. For proper alignment, both insulators will have to be adjusted. To ensure the smoothest operation, the rotating insulator needs to be plumbed at a right angle to the base first. Use a carpenter's square to check the alignment in at least two directions. See figures 11 and 12.

NOTE
Unlatch the blade before making any adjustments to the switch.

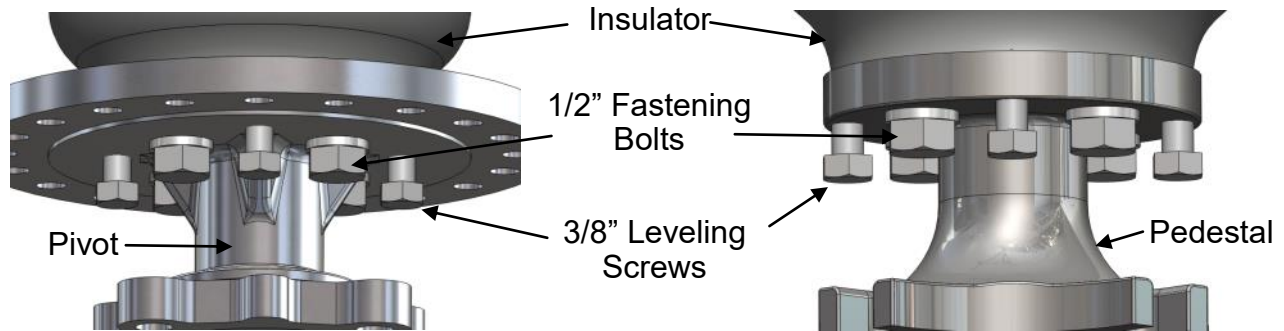


Figure 9 — Insulator leveling screws — 15-69kV

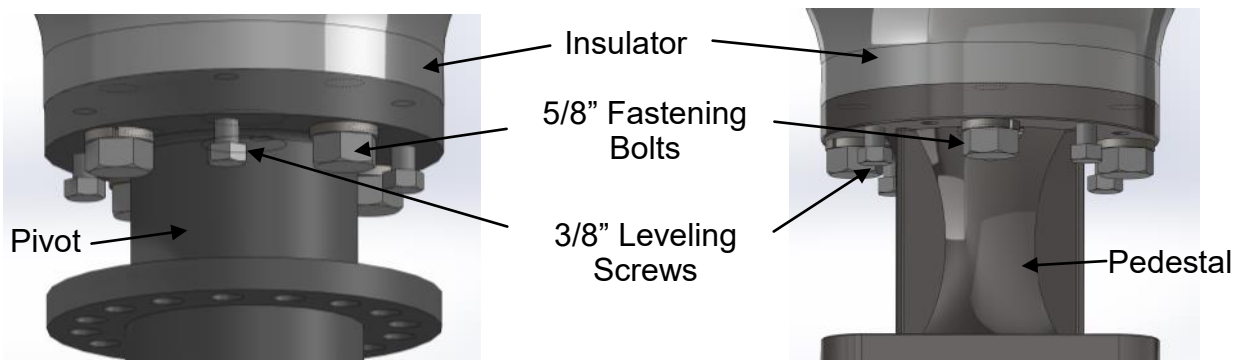


Figure 10 — Insulator leveling screws — 115-161kV



- 3. Adjustment of the insulators is done using the leveling screws. First, loosen the fastening bolts slightly and then tighten the leveling screws. Adjust until the rotating insulator is perpendicular to the base and the frame as shown in Figures 11 and 12. Tighten the fastening bolts when adjustment is finished. Refer to Figures 9 and 10 for location of the fastening bolts and the leveling screws.
- 4. Once the rotating insulator is perpendicular to the base, use the same method as described in step 3 to adjust the fixed insulator so that it sits at a right angle to the frame as shown in Figure 11.

NOTE

The fixed insulator only needs to be perpendicular to the frame in the direction that is illustrated in Figure 11. The insulator may not be perpendicular to the frame in the direction illustrated in Figure 12. The adjustment of the insulator in this direction is covered in the next section.

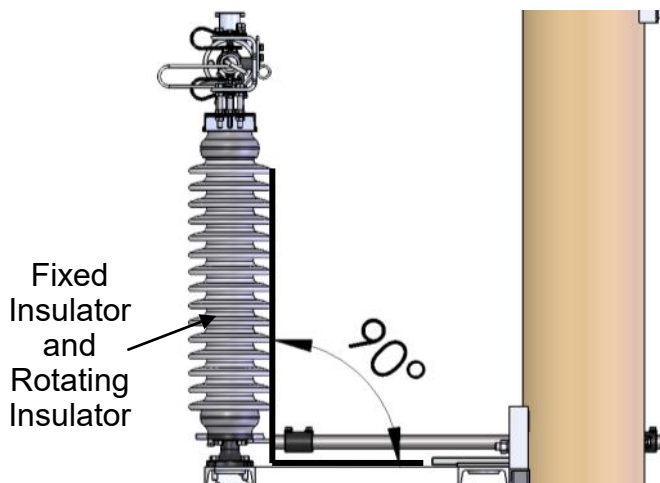


Figure 11 — Adjustment of rotating and fixed insulator, side view

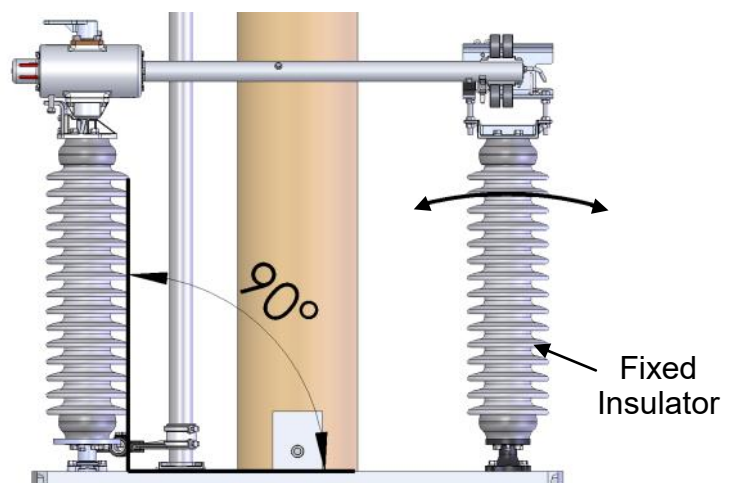


Figure 12 — Horizontal adjustment of fixed insulator, front view



Blade and Jaw Alignment

Once the fixed insulator is perpendicular to the base as shown in Figure 11, check the alignment of the blade in the jaw. The blade should be aligned in the jaw as shown in Figures 13 and 14.

- 5. Horizontal Alignment Check
For both the 600 amp and 1200 amp switches, the release pin should make contact with the center of the release pin ramp. The blade latch should be centered in the slot in the bottom of the jaw such that the blade latch enters the blade latch spring without hitting either arm of the blade latch spring. If the blade and jaw are not aligned as described, proceed to the horizontal adjustment section. Proper alignment is illustrated in Figures 13 and 14.
- 6. Horizontal Adjustment
The horizontal direction is illustrated in Figures 12 and 13. The blade needs to be in the unlatched position before making any adjustments. For horizontal jaw adjustment, use the 3/8"-16 leveling screws located on the pedestal at the bottom of the fixed insulator. First, loosen the fastening bolts slightly and then tilt the insulator by adjusting the leveling screws. There are several things to check for when aligning the jaw horizontally. See the horizontal alignment check section for proper alignment.
- 7. Vertical Alignment Check

NOTE
As shown in Figure 13 the contact fingers will **NOT** be centered on the blade contacts for a 600 Amp switch.

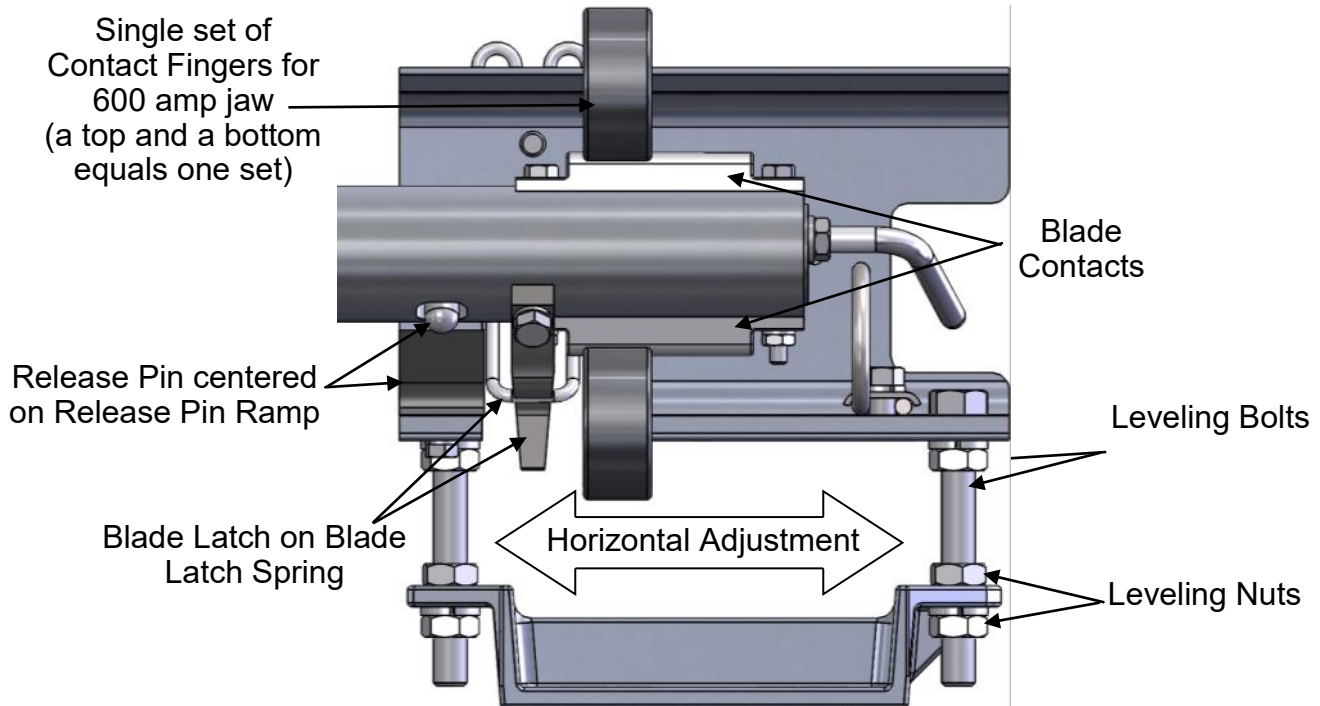


Figure 13 — Horizontal adjustment, latched position, 600 amp jaw



In order to check the vertical alignment of the switch, temporarily remove the jaw arc horn out of the way of the blade arc horn. When the switch is properly aligned the blade tube should be parallel to the jaw. The blade contacts should **not** make contact with the contact fingers until the blade begins to rotate into the fully closed position. When entering the jaw in the unlatched position, the gap between each contact finger and blade contact should be equal.

If the blade and jaw are not aligned as described, proceed to the vertical adjustment section. If the blade and jaw are properly aligned, replace the jaw arc horn to its original position. The jaw arc horn should make contact with the blade arc horn when the blade enters the jaw but it should **not** heavily push the blade up into the contact fingers.

- 8. Vertical Adjustment
For vertical adjustment of the jaw, use the three 1/2"-13 x 4" leveling bolts that are located directly underneath the jaw. Loosen the hex jam nut on the bottom of the jaw mount. Adjust the 1/2"-13 hex jam nut on the top side of the jaw mount until the blade is centered between the contact fingers. Check to make sure that the jaw is parallel as shown in Figures 14 and 15. Once the jaw is aligned, tighten all three jam nuts on the bottom side of the jaw mount. See vertical alignment check section for proper alignment of the jaw.
- 9. Blade Latch Alignment Check
Likewise, the blade latch should not make contact

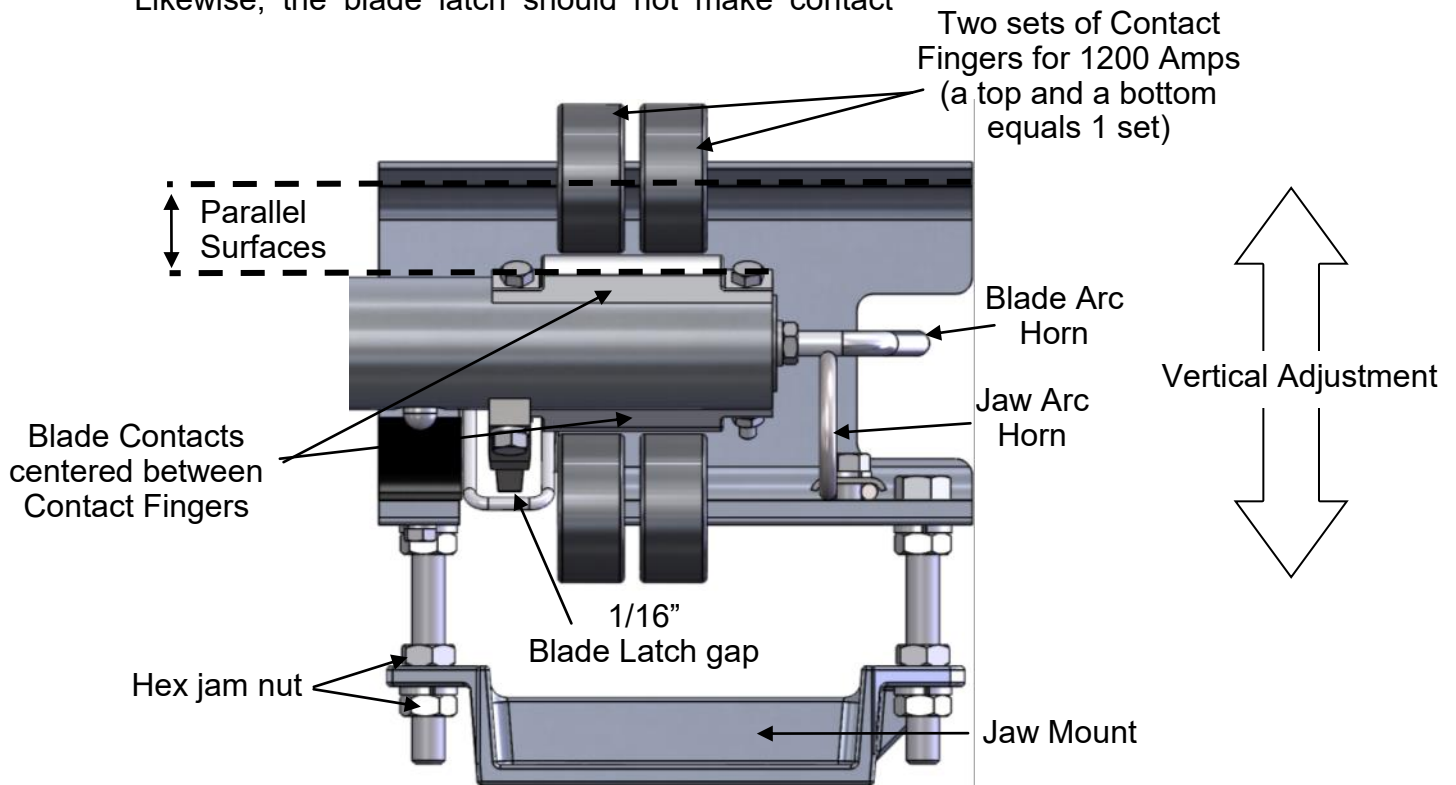


Figure 14 — Vertical alignment, unlatched position, 1200 amp jaw



with the blade latch spring until the blade is latched in the fully closed position. There should be a 1/16" gap between the blade latch and the blade latch spring when the blade is entering the jaw. See Figure 14 or 16 for proper alignment of the blade latch. Ensure that when the switch is fully closed, the blade latch is engaged with the blade latch spring.

□ 10. Blade Latch Spring Adjustment

For vertical adjustment of the blade latch spring, loosen the 3/8"-16 bolts on the back side of the jaw. See blade latch alignment check section for proper alignment of the blade latch spring. Tighten the bolts after adjustment.

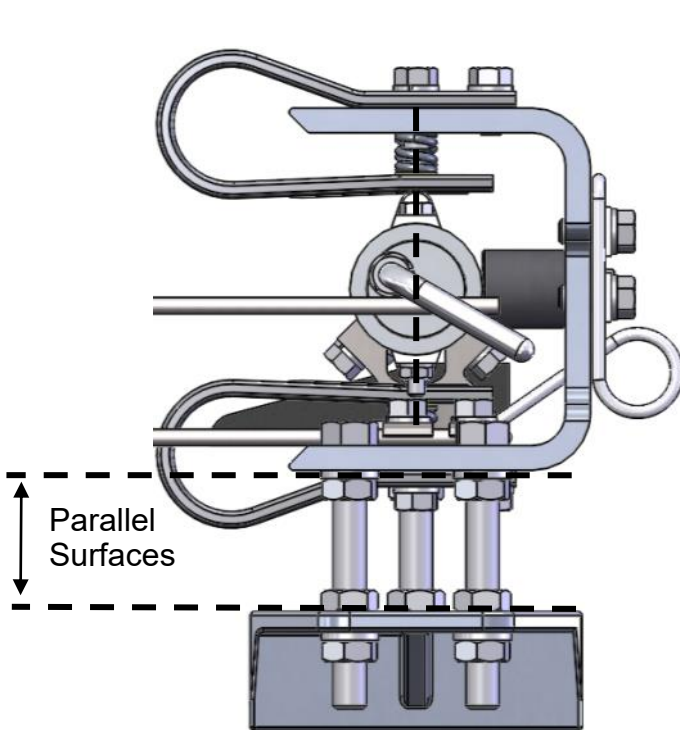


Figure 15 — Vertical adjustment, latched position, end view

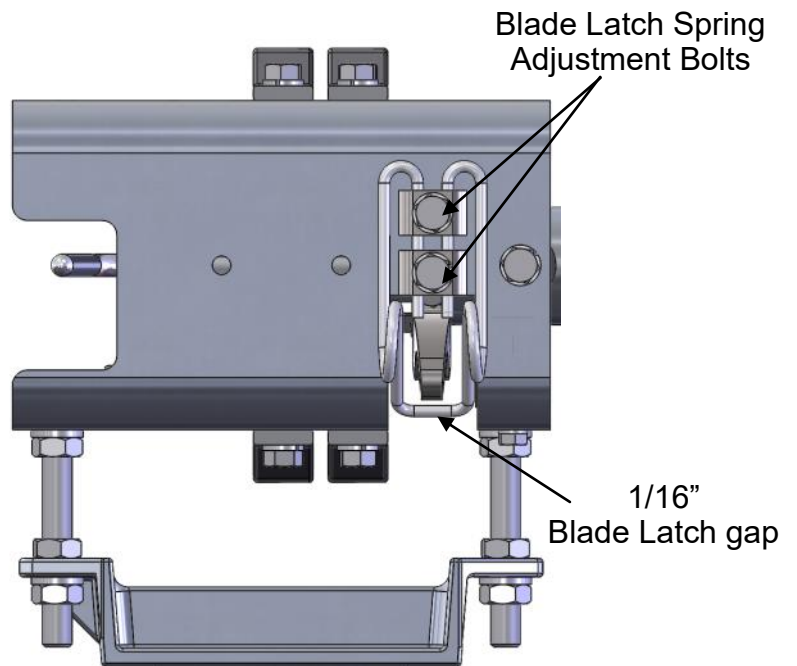


Figure 16 — Blade latch spring, unlatched position, back view



Interconnection

At this point each phase should be operating correctly when operated by itself.

- 1. Assemble the reach rod for the top phase to the pipe levers and pivot levers using the clevis assemblies according to the Control Mechanism Drawing.
- 2. Open the top phase approximately 30° from the jaw as shown in Figure 21. Set the levers so they are perpendicular to the reach rod as shown in Figures 17 and 18.
- 3. Allow approximately 1/2 inch of reach rod to extend past the clevis on the pipe lever end. Leave the excess reach rod sticking out past the clevis on the pivot lever end. This can be cut off later but should be left on for the time being to allow for further adjustments if needed.
- 4. Tighten all piercing screws for this phase but **DO NOT** pierce the pipe.

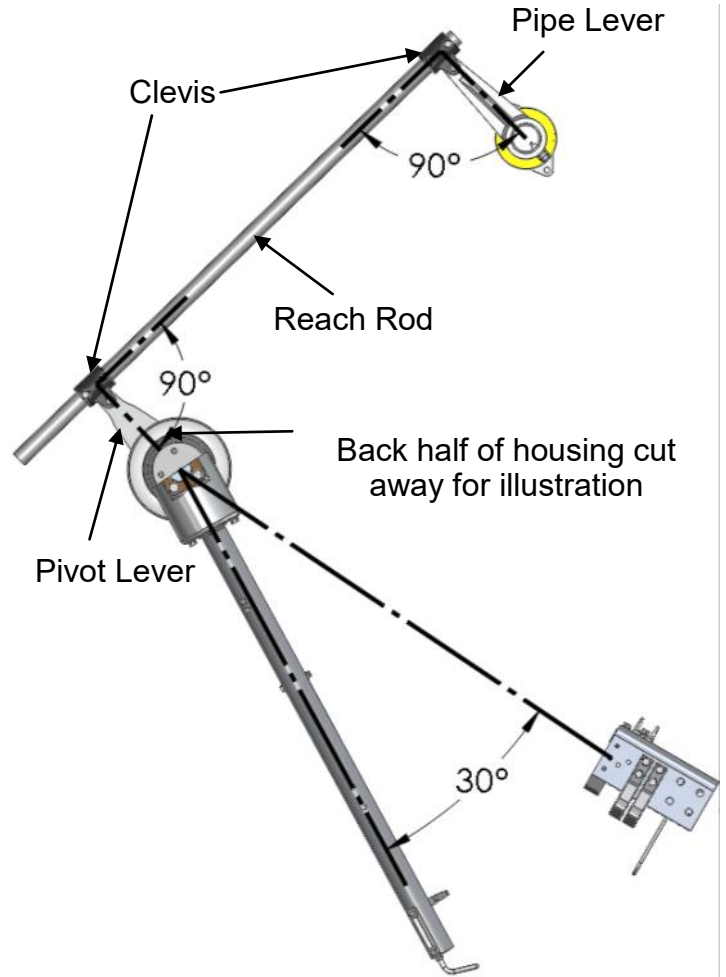


Figure 17 — Reach rod assembly

NOTE

Depending on the type of mounting, the pivot and pipe levers may be positioned differently than shown in Figure 21. Refer to Control Mechanism Drawing for proper positioning of the levers.

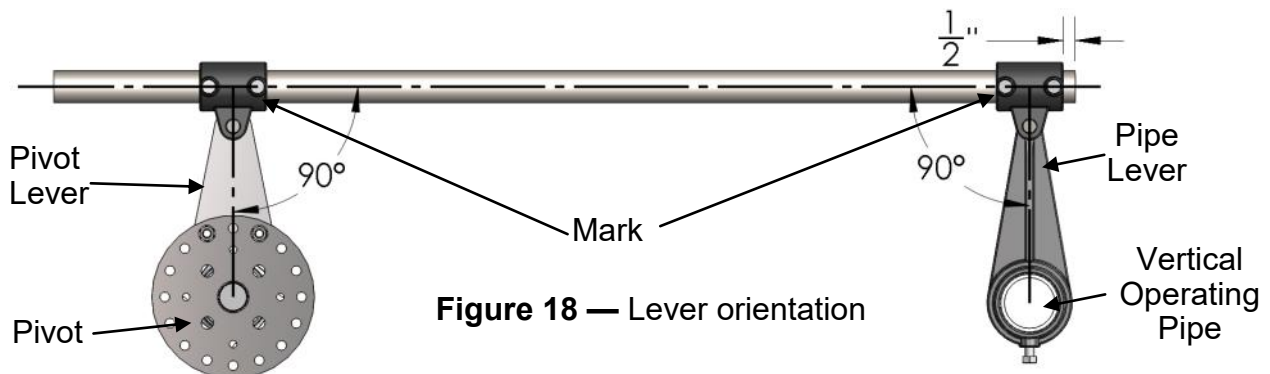


Figure 18 — Lever orientation



Operation Check

- 5. From the ground use the operator mechanism to slowly rotate the blade towards the jaw and continue until the blade has rolled completely closed and latched.
- 6. Mark both points shown in Figure 18 with a dark marker to check for slippage during trial operations.
- 7. Operate the phase several times to make sure that it fully opens and closes each and every time. When the phase is fully closed, the blade contacts should be straight up and down in the jaw as shown in Figure 15 and the indicator should have changed from green to fully red as in Figure 20.

Setting Delay

- 8. Move down to the next phase and repeat step 1 for this phase.
- 9. Set the phase above to where the blade is in the jaw but in the unlatched position as shown in Figure 2.
- 10. For the remainder of the installation process, apply a slight pressure to the operator mechanism (i.e. swing handle, worm gear) in the direction that would close the switch. This will keep the slack out of the control mechanism.
- 11. Set the blade in the jaw such that the blade is a 1/2 inch from the jaw bumper as shown in Figure 21.
- 12. While continuing to apply pressure from step 10 remove as much slack out of the reach rod assembly as possible.
- 13. Tighten all the piercing screws for this phase but **DO NOT** pierce them.

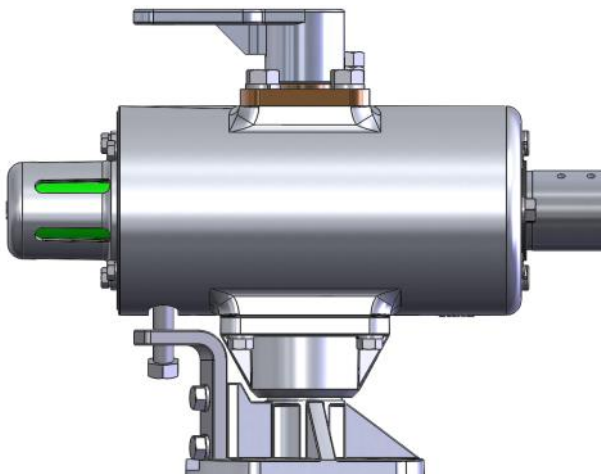


Figure 19 — Indicator showing an unlatched switch

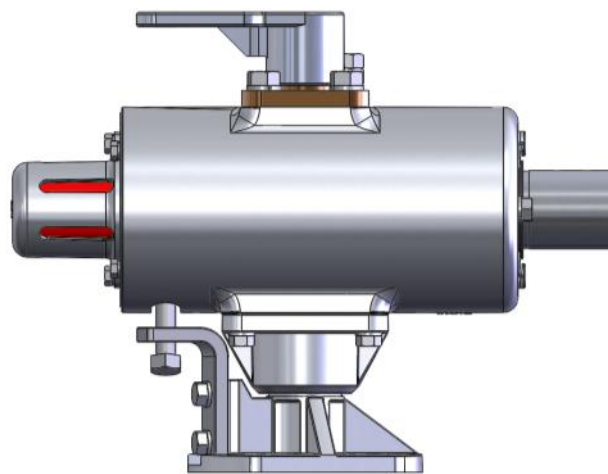


Figure 20 — Indicator showing a latched switch



NOTE

When the blades are open they should not line up. It is important that the top phase enters the jaw before the middle phase and the middle phase enters the jaw before the bottom phase. There should be a small delay from phase to phase to compensate for pipe wrap.

- 14. Repeat steps 5–7 for this phase to check for proper operation.
- 15. After ensuring proper operation of the middle phase, repeat steps 9-14 for the bottom phase.
- 16. After all three phases are connected and operation is confirmed, pierce all the pipe levers and the pipe connections.

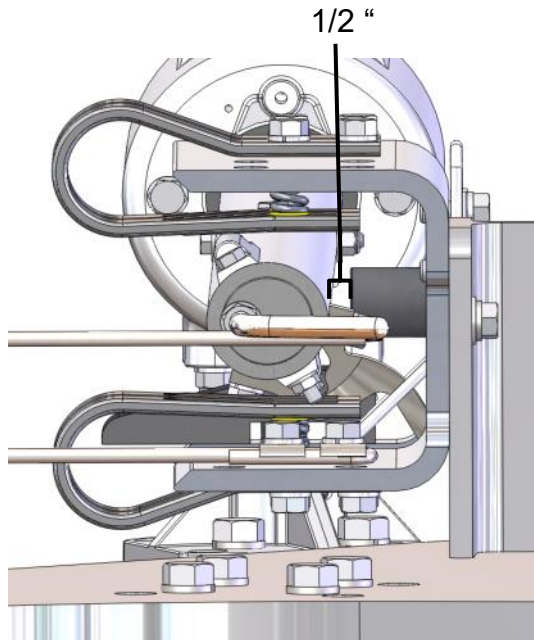


Figure 21 — Setting delay

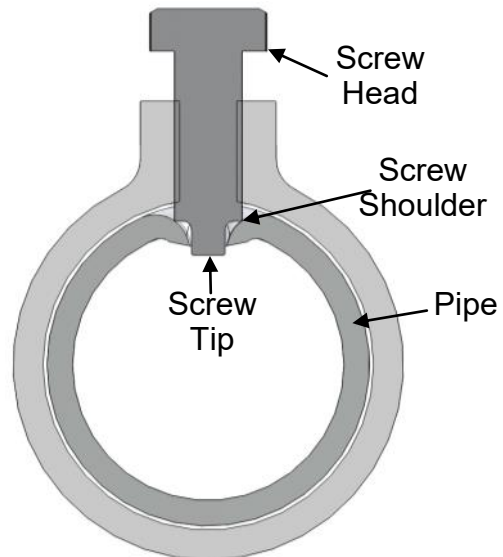


Figure 22 — Piercing screw (section view)

Pipe Piercing

Piercing screws are used to prevent various components from slipping on pipe. Thread the piercing screw in until the tip of the screw hits the pipe. At this point keep tightening the screw until the tip pierces the pipe. There should be an audible “pop” when the screw pierces the pipe. After the tip of the screw pierces the pipe, the screw may become loose. Continue tightening the screw until it becomes tight again.

NOTE

DO NOT over tighten the piercing screws. Once the pipe is pierced, the screw shoulder will bottom out on the pipe. If the screw is over tightened after the pipe is pierced, the threads will fail.



Swing Handle Installation

- 1. Slide the handle clamp onto the bottom of the vertical operating pipe. Tighten the clamping bolt and the piercing screws but **DO NOT** pierce.
- 2. Mount the locking plate to the pole. Leave the locking tabs loose on the plate.
- 3. Cut the vertical operating pipe so that it hangs approximately 12 inches below the locking plate.

NOTE

Finish all adjustments of the switch before proceeding with setting the handle

- 4. After all installation and adjustment of the switch is finished at the top of the pole, open the switch so that it is 30° open from the jaw as shown in Figure 17.
- 5. Loosen the clamping bolt and piercing screws. Without rotating the vertical operating pipe, move the handle clamp so that it is 2 inches above the locking plate and the handle is centered in the front of the locking plate as shown in Figure 23. Tighten the clamping bolt and pierce the piercing screws.
- 6. Slowly rotate the handle until the switch is completely closed and latched. Make sure that all three indicators show completely red.
- 7. Move the closed locking tab so that it holds the handle as shown in Figure 24. Tighten the locking tab bolts.
- 8. Rotate the handle until the switch is completely open. Repeat step 7 for the open locking tab.

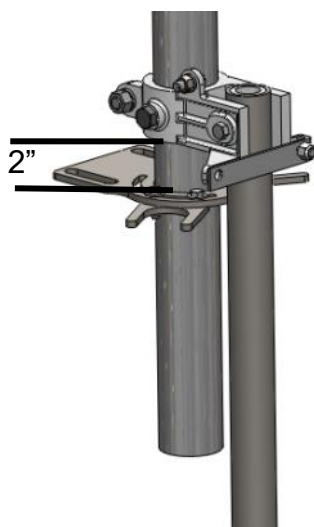


Figure 23 — Swing handle centered in front of locking plate

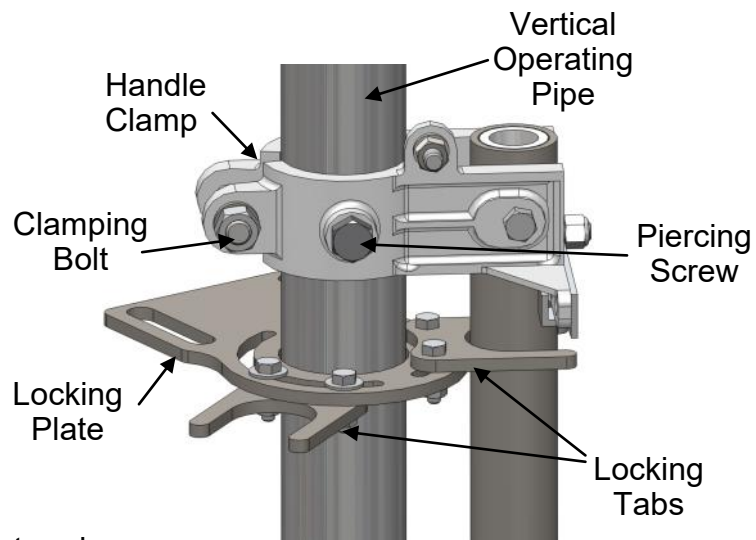


Figure 24 — Swing handle locked position



Worm Gear Installation

- 1. Mount the gear box to the pole and cut the vertical operating pipe so that it sits a half inch above the pipe clamp ledge as shown in Figure 25. Refer to the Control Mechanism Drawing for proper mounting to the pole.
- 2. Tighten the u-bolts and piercing screws on the pipe clamp but **DO NOT** pierce. Remove the open and closed stops from the top of the gear box.

NOTE
Finish all adjustments of the switch before proceeding with setting the worm gear

- 3. After all installation and adjustment of the switch is finished at the top of the pole, open the switch so that it is 30° open from the jaw as shown in Figure 17.
- 4. Loosen the u-bolts and piercing screws. Without rotating the vertical operating pipe, rotate the worm gear handle until the pipe clamp is positioned as shown in Figure 25. Tighten the u-bolts and pierce the piercing screws at this time.
- 5. Slowly rotate the worm gear handle until the switch is completely closed and latched. Make sure that all three indicators show completely red.

NOTE
When operating a switch with a worm gear mechanism, only crank the handle one full rotation after the switch is fully closed. **DO NOT** over rotate the handle causing the worm gear to bind.

- 6. Reattach the closed stop to the top of the gear box. Position it so that the carriage bolt is making contact with the pipe clamp as shown in Figure 26. Tighten both bolts on the closed stop and the jam nut on the carriage bolt.
- 7. Rotate the worm gear handle until the

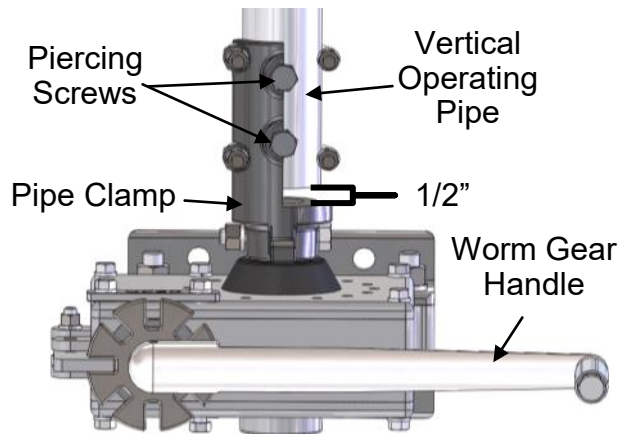


Figure 25 — Worm Gear

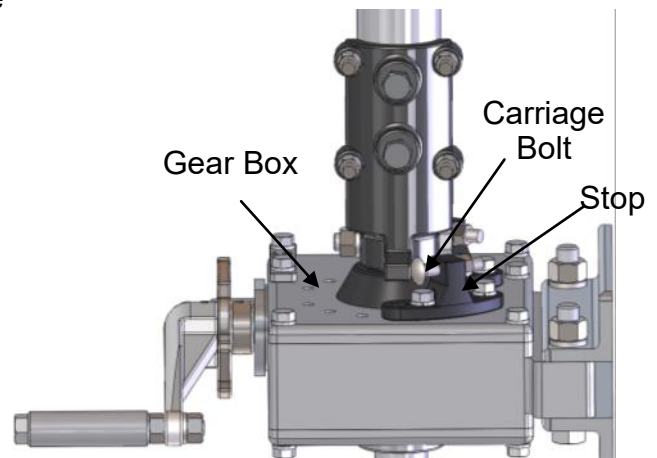


Figure 26 — Pipe clamp hitting carriage bolt



Operating the Switch

Turner Electric side break switches are designed to be operated using minimal force. Operation of the switch is accomplished through the use of the vertical operating pipe. Rotating the vertical operating pipe results in operation of the switch.

Opening the Switch

Going from the closed, latched position to the fully open position requires 120° of rotation on the vertical operating pipe. The first 30° of rotation rolls the blade tube 30° to the position shown in Figure 28. The blade tube stays in the jaw until it rolls into the unlatched position. The indicator will turn from red to green during the first 30°. Further rotation of the vertical operating pipe will cause the blade tube to exit the jaw. Side break switches are designed to open 90° as shown in Figure 27.

Closing the Switch

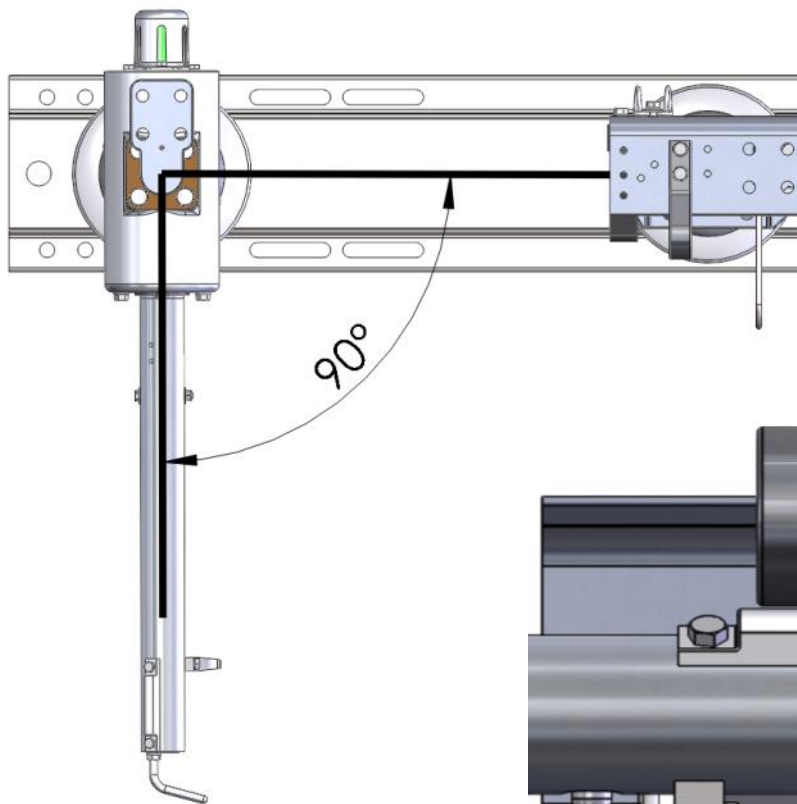


Figure 27 — Fully open position

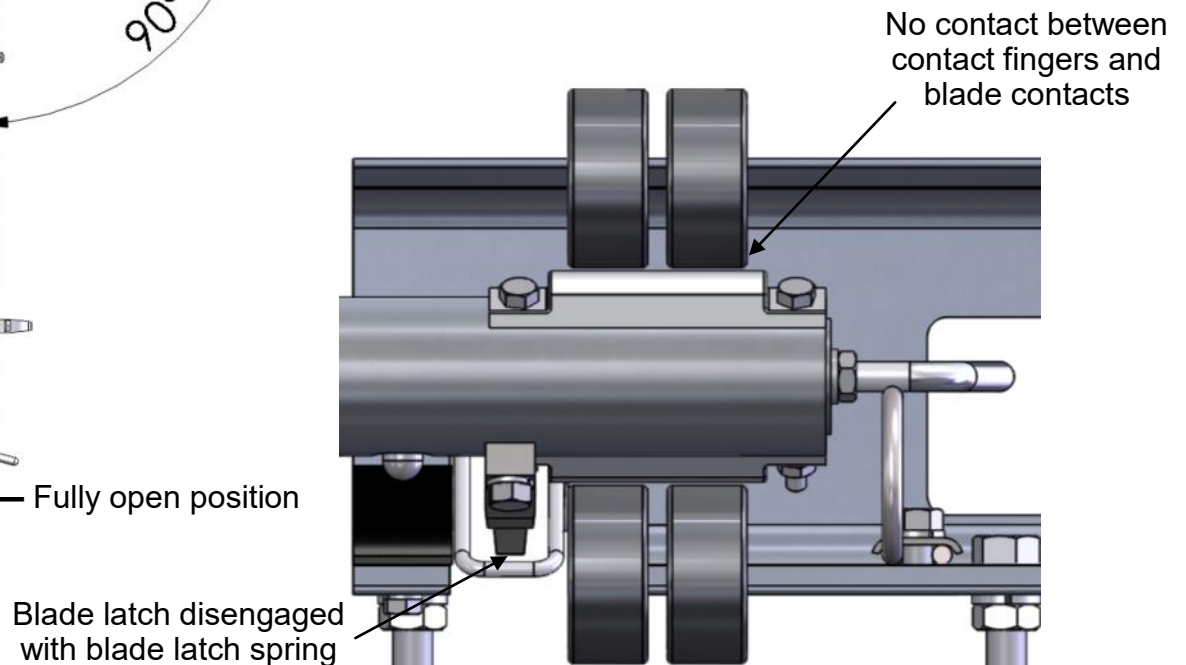


Figure 28 — Blade in jaw, unlatched position, front view



Going from the fully open position to the closed, latched position requires 120° of rotation on the vertical operating pipe. The first 90° of rotation rotates the housing and causes the blade tube to enter the jaw. Once the blade tube hits the bumper in the jaw, the blade tube will begin to roll. At this point an additional 30° of rotation will roll the blade tube into the latched position as shown in Figure 30. The indicator should change from green to completely red when it is properly latched in the jaw. If there is any green showing on the indicator as shown in Figure 29, the blade tube has not completely rolled.

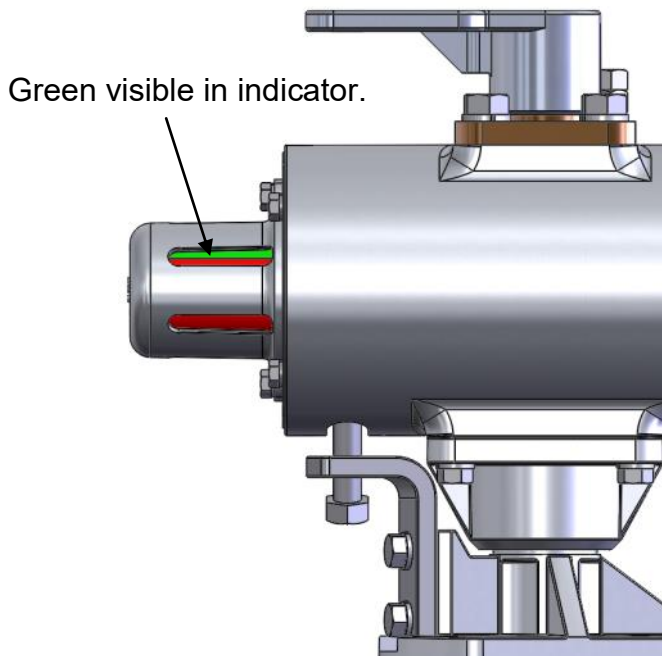


Figure 29 — Indicator showing switch is not completely latched

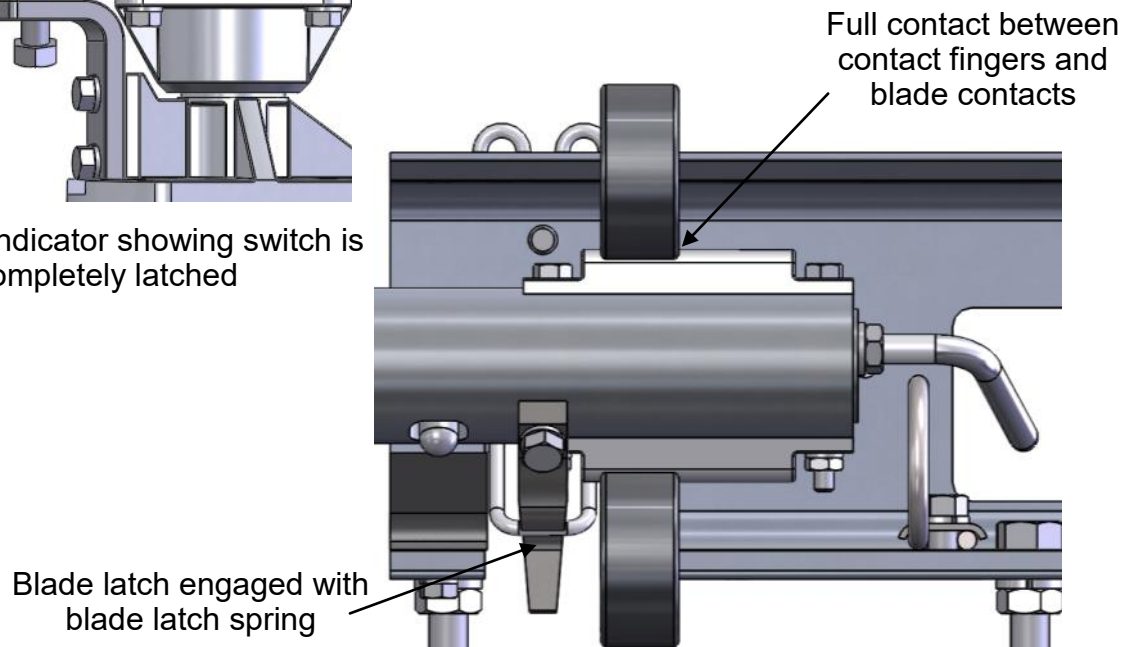


Figure 30 — Fully closed and latched position, front view



Whip Operation

The Turner Electric side break whip is designed for line-charging switching. A description of how the TS2 whip works is given in this section.

Opening the Switch with a Whip

When the switch is in the closed position, the whip should be located in the jaw as shown in Figure 32. During operation, the whip will make contact with the whip keeper. The whip will remain in contact as the blade tube exits the jaw as shown in Figure 31. It will remain in contact and load the whip until the blade tube reaches a distance far enough away from the jaw to prevent re-striking. Once the blade tube reaches this point, the whip keeper will release the whip. The whip will then hit the whip catch and settle on the shelf of the whip catch as shown in Figure 33.

Closing the Switch with a Whip

As the blade tube enters the jaw, the whip will make contact with the whip keeper. The whip keeper will then push the whip down so that the whip will pass under the keeper as the blade is rolled into the fully closed position. The whip should be located in the jaw as shown in Figure 32 when the switch is latched.

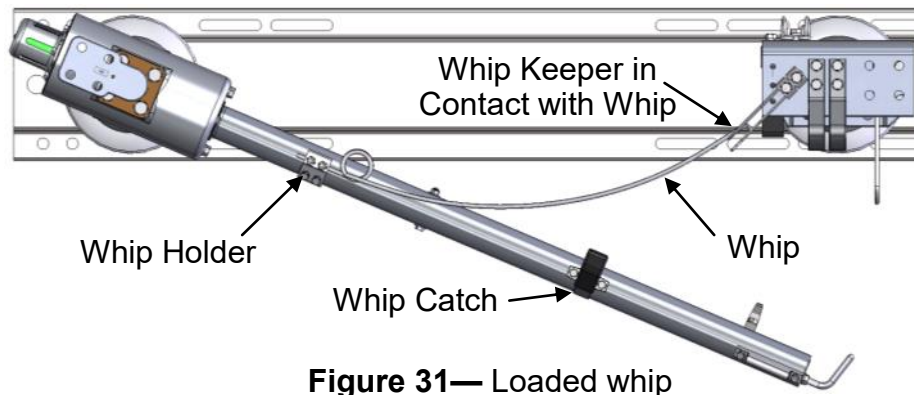


Figure 31— Loaded whip

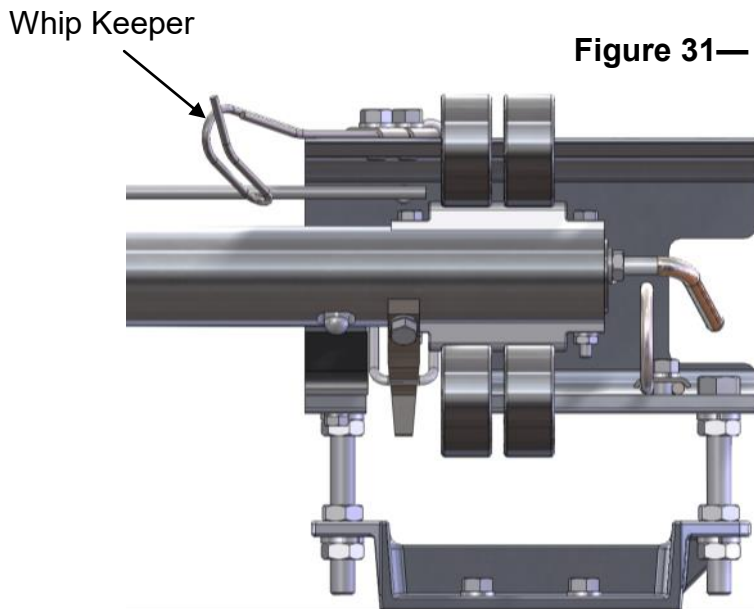


Figure 32 — Whip in jaw

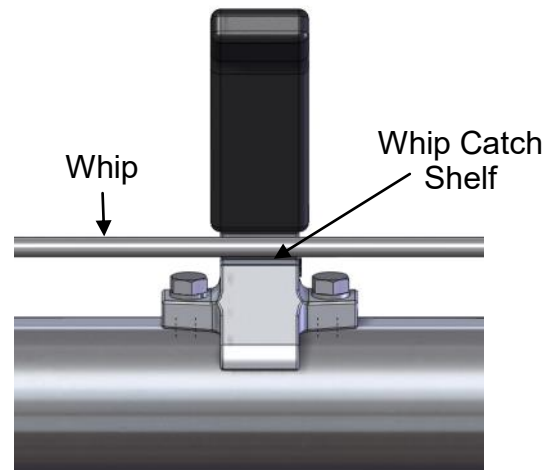


Figure 33 — Whip on whip catch



CAUTION

Do NOT use excessive force to try to complete the operation of the switch. If excessive force is needed check the alignment of the switch.

Trouble Shooting

- Top phase or middle phase blade is not rolling into fully closed position.
 1. See Interconnection section.
- Upon closing, the Blade Latch does not engage the Blade Latch Spring.
 1. Check the alignment of the Blade Latch Spring. The Blade Latch Spring should be aligned as described in the Vertical Alignment Check section. If not aligned properly, refer to the vertical adjustment, horizontal adjustment and blade latch adjustment sections.
- Upon closing, unable to roll a phase closed. This could result in the handle becoming extremely heavy to operate.
 1. Check the blade and jaw alignment of the switch. The blade contacts and contact fingers should be aligned as described in the vertical alignment check section.
 2. Check the amount of pressure that the jaw arc horn is applying to the blade. The jaw arc horn should not be forcing the blade into the contact fingers as described in the vertical alignment check section.
 3. Check to make sure the blade latch spring is not adjusted too high. The blade latch spring should be adjusted as described in the vertical alignment check Section.



131 Enterprise Drive • Edwardsville, IL 62025
 618-797-5000
 www.tecoswitch.com

Switch Identification

When contacting Turner Electric, refer to the serial number (S/N) shown on the nameplate. All information for the switch is filed under this number at our facility.

		TURNER ELECTRIC		S/N	CO-99999
131 ENTERPRISE DR		EDWARDSVILLE, IL 62025		TYPE	3TS2
kV MAX	72.5	kV BIL	350	AMPS CONT.	1200
AMPS SHORT-TIME	38 000	AMPS PEAK	99 000	DUR.	3 S
FREQ.	60	ACCC	D06	MFG DATE	2/01/16
CAT NO.	3TS206912				
THIS DEVICE IS PROTECTED BY ONE OR MORE OF THE FOLLOWING USA PATENTS: 2,779,880; 3,249,534; 4,070,182; 3,488,752; 3,420,887; 3,174,004; 2,830,145; 3,760,923; 3,010,522; 4,112,268					
					MP251745X

Replacement Parts and Factory Service

Replacement parts are usually readily available from the factory for normal maintenance issues. For emergency repairs consult the factory for a list of recommended spares that you may wish to keep on hand. For factory service assistance contact your local Turner Electric representative or call (618) 797-5000 or www.turnerswitch.com.