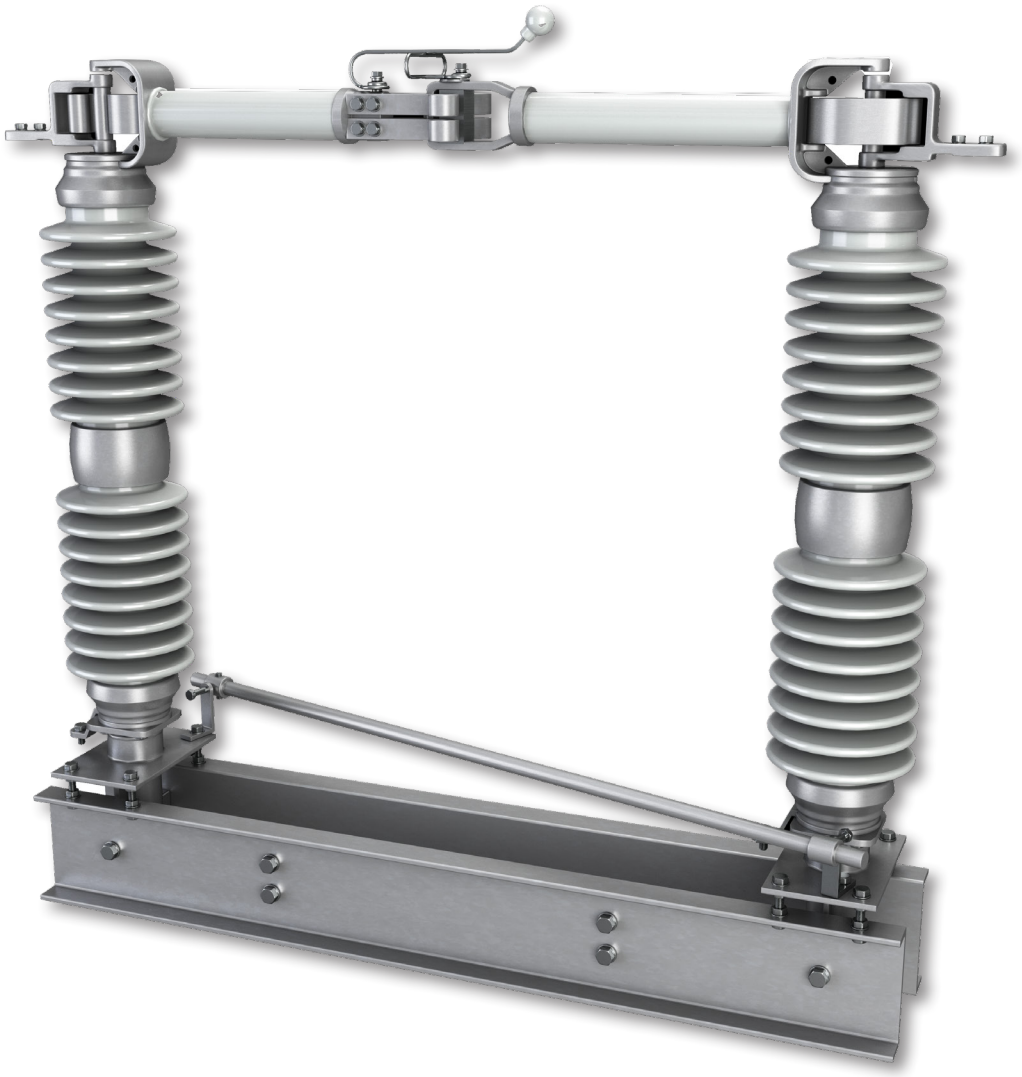
HUBBELL
Power Systems, Inc.



USCO™

Types AGCH5 & GCH4

Group Operated, Outdoor, Center Break Air Switch

8.3 - 362 kV, 1200 - 6000 A

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Receiving Inspection

Each group operated switch shipment normally consists of (1) the crated switch units (three phases), (2) the control parts box, (3) banded operating pipe, (4) special mounting steel if required, and (5) the crates of the insulators when ordered bulk packed.

When the shipment is received, verify the material against the packing list (in a waterproof package attached to the switch crate). If any of the crates are damaged, verify the contents of the crate for broken or missing parts. There is a bill of material (BOM) in the box containing the control parts to find out if parts are damaged or lost.

If the switch crate is damaged, remove the tie wires on each phase unit and operate the switch a few times, making sure the switch is not affected. If damage is found or suspected, file a claim immediately with the freight company and notify your local Hubbell representative.

Handling and Storage

Take a reasonable amount of care when handling and storing air break switches. Porcelain insulators are fragile and may be broken with improper handling. The switch live parts could be broken or distorted if handled carelessly. Never lift crates using the switch live parts.

Air break switches may be stored outdoors or indoors. Protect moisture absorbing cartons, such as wood or cardboard, if you plan to store them outdoors for a long period. Keep all shipments in the crates until assembly and installation.

If the insulators have been installed at the factory, skip to Page 5, "Mounting the Switch and Controls"

Installation of Insulators

1. Uncrate the switch phases and cut the tie wires that hold the switch closed. Operate and inspect each phase for proper operation or any shipping damage
2. With the phases closed, remove the live parts from the switch base. Mount the insulators on the switch bearings. Hand tighten the insulator bolts
3. Check that the insulators are level in reference to each other by measuring from one insulator to the other on the top and bottom. These centers should be the same. If alignment is needed, use the leveling studs if furnished. Use of leveling studs is explained on Page 9. If leveling studs are not furnished, the insulators should be shimmed
4. Place the live parts on top of the insulators with the phase closed. Line up the painted match marks on the lower operating arms with the mark on the hinge blade supports to ensure proper alignment. Hand tighten the upper insulator bolts

5. Make sure that the lower operating arm is against the closed stop, the blades are centered on the switch base, and the contacts are firmly seated. Tighten all insulator bolts, starting with the lower bolts and working up. Confirm that the operating arm stays against the closed stop.
6. Operate the switch phase from the fully closed to the fully open position, then bring the blades back to the closed position to make sure the male contact is timed with the center of the jaw. If not, close the switch, loosen the insulator cap bolts on top, push the blades to the full closed position, and tighten the cap bolts while holding the blades closed. Check the contact alignment as-shown on page 7. If adjustment is needed up, down, in or out, close the switch, loosen the peg bolts on the side of the switch base, and adjust the leveling studs as shown on page 9 to align the contacts. If leveling studs are not furnished, use shims under the lower insulator cap to align the contacts
7. **No field adjustments need to be made to the live parts, the bearing stops, or the innerpole linkage. All of these items have been adjusted at the factory**
8. For 362 kV switches, install corona rings as shown on the drawing furnished. Clean and coat mounting surfaces with a suitable electrical joint compound, "HTJC" compound or equivalent

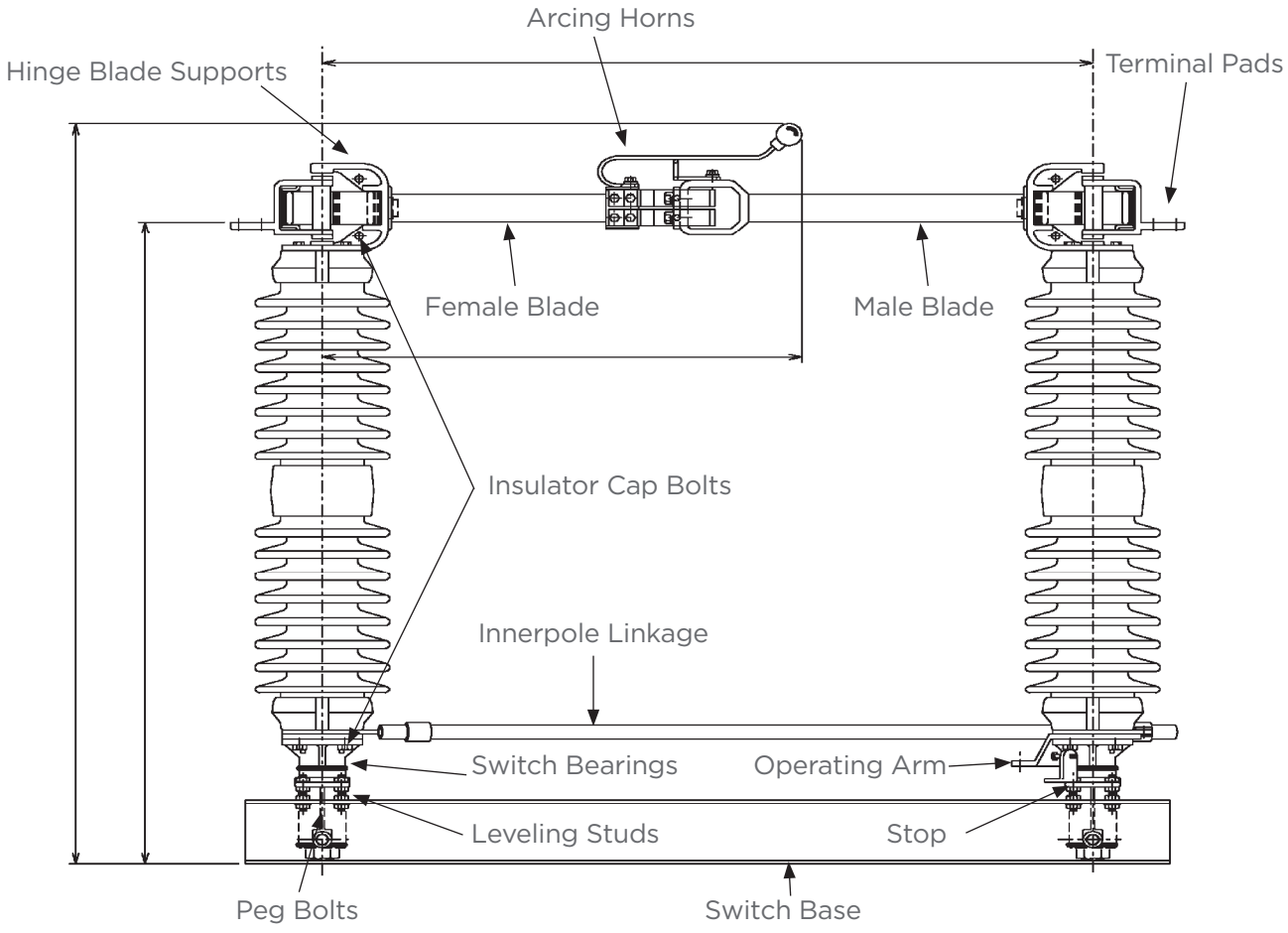

FIGURE 1 - TYPICAL PHASE UNIT

Mounting the Switch and Controls

IMPORTANT - Make sure applicable and adjacent equipment is de-energized and properly grounded before performing any installation or maintenance.

1. Using the control details furnished to determine the correct placement of the individual phases, mount the phases on the structure. Slings or rigging used for lifting should be attached to the switch base. Avoid lifting from the insulators or live parts as damage may occur. No field adjustments need to be made to the live parts, the switch bearing stops or the innerpole linkage
2. Install the outboard bearing support and bearing. On the single row ball bearing, slide the vertical pipe up through the bearing to the proper height, and pierce the set screws to hang the pipe. On the double row ball bearing, remove the through bolts on the end of the vertical pipe, slide the pipe up on the bearing shaft, and replace the through bolts
3. Check the control drawing for the location of pipe guides, interlocks and other accessories on the vertical pipe. Slide these items up on the pipe (in the order shown on the drawings) and mount them
4. Attach the operating handle or gearbox. If necessary to match the support mounting, the gearbox U-shaped bracket may be flipped over. Leave 1/2" clearance between the operating handle clamp and the support plate. **For the gearbox, make sure the vertical pipe and gearbox coupler do not rest on the gearbox hub.** The outboard bearing should support the full weight of the vertical pipe. Tighten the clamp bolts on the operating handle or the gearbox coupler. Tighten the set screws, but do not pierce the pipe. If necessary, the directional indicator on the gearbox handle may be reversed by removing the two mounting screws, and flipping the indicator over
5. If a single row ball bearing is used, slide the adjustable arm over the top of the vertical pipe. Do not tighten the set screws at this time. Double row ball bearings already have the adjustable arm attached
6. Fasten clevises on the phase operating arms, and install the interphase pipe. Tighten the clevises on the interphase pipe, starting with the phase farthest from the vertical operating pipe. While tightening, ensure the lower drive arm stays firm against the closed stop
7. Connect the reach rod as shown on the control drawing. If necessary, slide the adjustable arm up to the proper elevation and rotate it to the correct position (as shown on the control drawing), and pierce the set screws to hold the adjustable arm

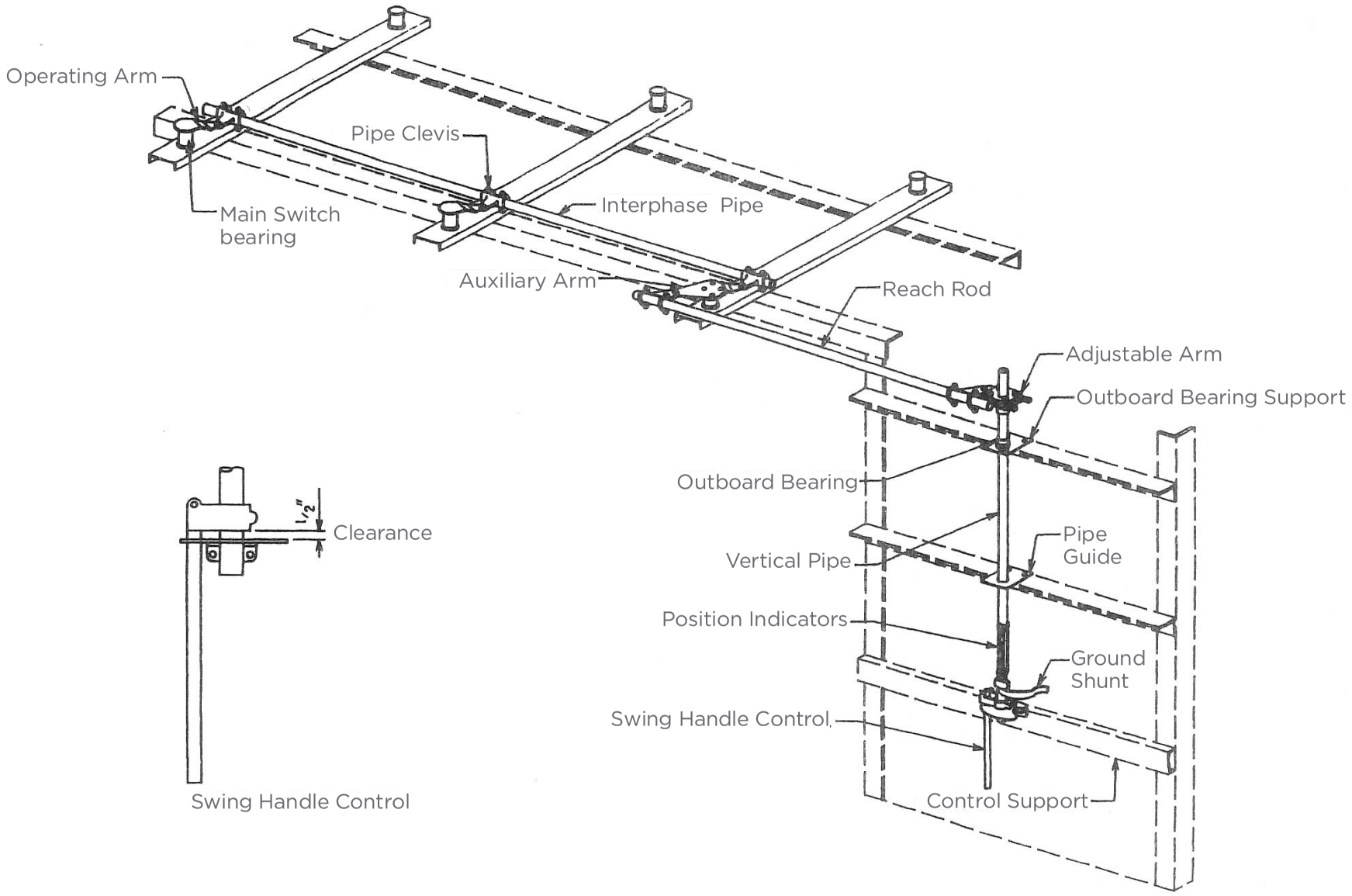

FIGURE 2 - TYPICAL CONTROL ASSEMBLY

Switch and Control Adjustment

1. The adjustable arm normally will be set at a trial radius to travel 180 degrees, and toggle in the open and closed positions. Check the arm trial radius given on the control drawing
2. Operate the switch. If the adjustable arm does not travel 180 degrees, but the switch is fully open, the trial radius length is too long. If the adjustable arm travels 180 degrees, but the switch is not fully open, the trial radius length is too short. Close the switch, loosen the clevis on the adjustable arm, loosen the four clamp bolts and adjust the length of the arm 1/4" as needed. Reset and tighten the clevis. Check the operation - a few tries are usually necessary to fine tune the switch from closed stop to open stop operation

Arcing Horn Inspection and Adjustment

Check the arcing horns, if furnished, ensuring that continuous contact occurs after breaking and before making the main contacts. If not, slightly bend the arcing horns to make contact.

Jaw Contact Alignment

The switch contact pressure is set at the factory. No adjustments are needed. The alignment should be as shown below (if adjustment is necessary use the leveling studs, or shims under the live parts):

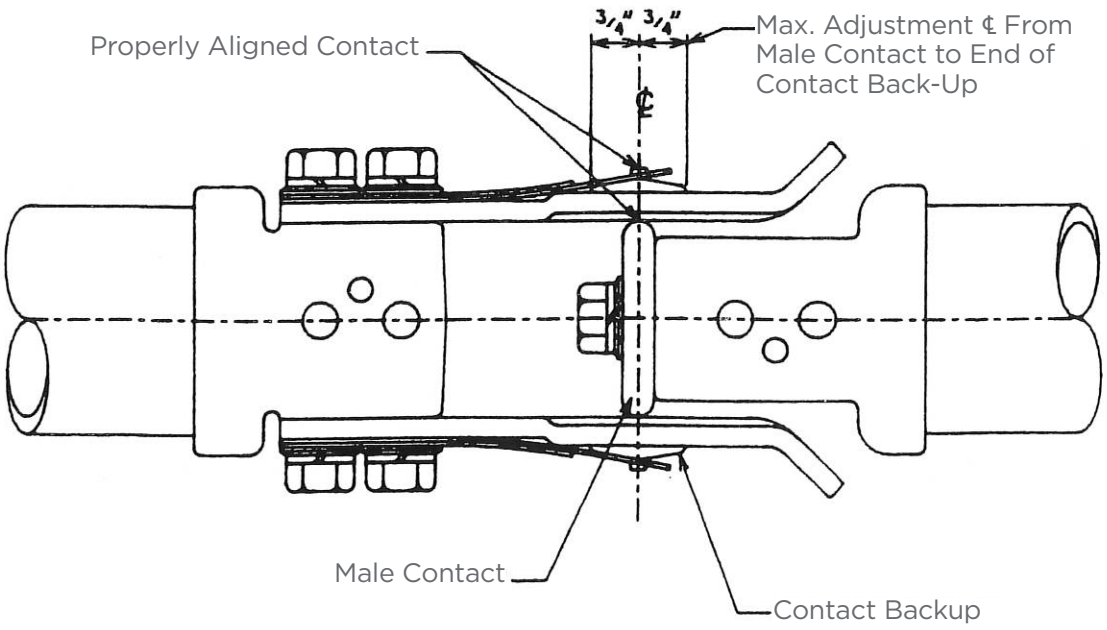

FIGURE 3 - JAW CONTACT TOLERANCES

Terminal Connections

For non-plated terminal pads, clean the terminal pads with a stiff wire brush to produce a clean metallic surface. For plated surfaces, do not wire brush, but instead clean lightly with steel wool. Immediately coat the connections surfaces with a non-gritted corrosion inhibiting joint compound, such as "HTJC" compound or equivalent. Wire brush the pad surface again through the compound, attach the conductor terminals to the switch terminal pads, and torque the connection bolts. Do not wipe off the excess compound that squeezes out. This will serve as a moisture seal for the connection.

TABLE 1: MINIMUM RECOMMENDED TORQUE VALUES FOR 1/2" DIAMETER BOLTS

Bolt Material	Lubricated Threads Foot-Pounds	Dry Threads Foot-Pounds
Aluminum	25	35
Steel, Galvanized or Stainless	40	45

Final Checklist

1. As a final check, operate the switch, checking that (1) the blades line up in the open position, (2) when closing, the blades strike the arcing horn or enter the jaw contact at approximately the same time, and (3) when closed, the male blade contact is aligned in the female jaw contact and centered on the switch base
2. After all adjustments are completed, tighten all set screws to pierce the pipe
3. **Do not apply grease to the jaw contacts**. Should the contacts need additional lubrication, lightly spray with dry graphite lubricant

Use of Leveling Studs

1. The leveling studs are mounted on the switch bearing. Check the side of the switch base for peg bolts. Loosen these bolts before attempting adjustment. To adjust the leveling studs, loosen the top nuts (nut A) on the pair opposite the direction of desired movement of the insulator
2. Turn nut B on each stud counterclockwise until the adjustment is made. Note that tall insulators will only require a slight movement at the leveling studs to move the insulator several inches. Tighten nut A (and the peg bolts if equipped)

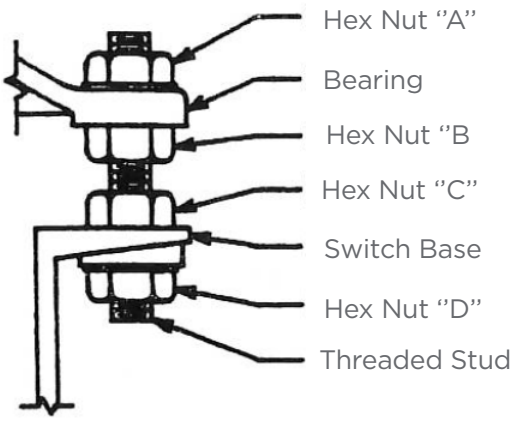

FIGURE 4 - LEVELING STUD BREAKDOWN

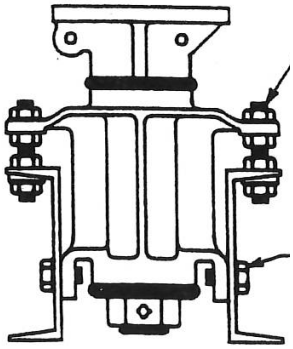

FIGURE 5 - LEVELING STUD ASSEMBLY ON SWITCH BEARING

Changing Switch Opening Direction

To change the switch from right hand opening to left-hand opening, or vice versa, open the switch. Remove the insulator cap bolts and the live parts. Swap the live parts end for end (in other words move the blade with the male contact to the insulator that had the blade with the female contact and vice versa), and remount the live parts with the blades closed.

Operate the switch several times to verify that the contacts are properly aligned and the switch phase travels fully open and closed.

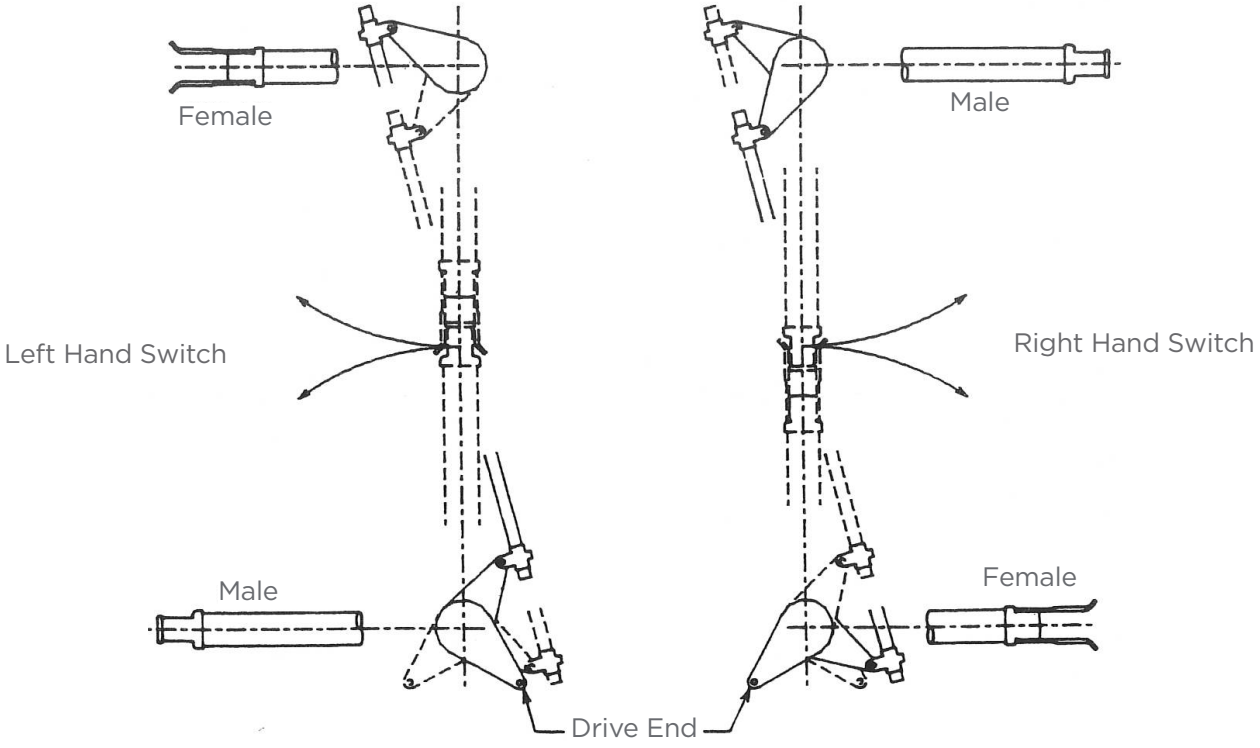

FIGURE 6 - SWITCH OPENING DIRECTIONS

Installation Troubleshooting

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Contact your local Hubbell representative for additional information or troubleshooting assistance.

Problem: In the closed position, the operating arms are against the closed stops, but in the open position, the switch phases are not fully open and the operating arms are not against the open stops.

Solution: With the switch closed, loosen the U-bolts on the adjustable arm clevis (or remove the pin on a threaded clevis), loosen the clamp bolts on the adjustable arm, and lengthen the adjustable arm by about 1/4″. Tighten the clamp bolts and the clevis U-bolts (for threaded clevises, reset the length of the turnbuckle and pin the clevis), and operate the switch. If the operating arms still do not hit the stops, lengthen the adjustable arm once more. If the operating arms hit the stops too hard, shorten the adjustable arm slightly. It may take a few adjustments to fine-tune the switch operation.

Problem: In the closed position, the operating arms are against the stops, but when opened, the operating arms push the open stops hard, and the adjustable arm will not toggle.

Solution: With the switch closed, loosen the U-bolts on the adjustable arm clevis (or remove the pin on a threaded clevis), loosen the clamp bolts on the adjustable arm, and shorten the adjustable arm by about 1/4″. Tighten the clamp bolts and the clevis U-bolts (for threaded clevises, reset the length of the turnbuckle and pin the clevis), and operate the switch. If the operating arms still hit the stops hard, shorten the adjustable arm once again. If the operating arms do not hit the open stops, lengthen the adjustable arm slightly. It may take a few adjustments to fine-tune the switch operation.

Problem: One or two of the phase operating arms are against the open or closed stops, but the other phase(s) are not.

Solution: With the switch closed, loosen the clevises on the interphase pipe, and push all operating arms against the closed stops. While keeping pressure against the stop, tighten the clevis. (For threaded clevises, release the locknut and tum the turnbuckle nut to push the operating arm against the stop).

Problem: In the open position, the blades do not line up when viewed from the side.

Solution: First, check each phase to see that the operating arm is against the open stop. If necessary, close the switch and reset the clevises on the interphase pipe so the operating arms are against the closed stops. Lastly, open the switch and verify the alignment of the blades.

Problem: When closing the switch, the contacts do not come together properly to seat. The male contact comes in too slow or fast to the female contact.

Solution: First, verify that the blades are installed on the correct insulator. The bearings at the base of the insulators have painted match marks with the switch blades to ensure correct placement.

Verify that these marks line up. If the blades are on the correct insulator, fully close the switch then loosen the upper insulator cap bolts. Shake the blades back and forth to relieve any binding. While holding the blades closed and centered over the switch base, tighten the insulator cap bolts. This will allow the switch phase to self-time. Verify the operation of the switch phase. If improvement is observed but more adjustment is necessary, the procedure may be repeated using the lower insulator cap bolts.

Problem: When operating the switch, the adjustment seems to change. The switch appears to be properly adjusted, but changes during the next operation.

Solution: There are two possible root causes for this performance. First, it may be caused by loose bolts on the insulator caps, control brackets, or control fittings. During operation, look for movement of the switch base, outboard bearing support, control supports, or other notable areas of motion. Tighten any problematic bolts and readjust the control mechanism to correct the issue. Secondly, if the leveling studs were adjusted without loosening the the bearing peg bolts, contact alignment will change between operations. To correct, loosen peg bolts, adjust contact alignment with the leveling studs, and tighten the peg bolts when finished.

Considerations for the Installation of High Voltage Disconnecting Switches IEEE 37.30.1

5.1 Personal Safety During Installation: Safety precautions should be carefully followed. When erecting switches, particular care should be given to the following

1. De-energize and properly ground any applicable and adjacent equipment before performing any installation or maintenance. Work should only be undertaken by qualified personnel
2. Protect the workers, if required, from adjacent live parts by barriers, screens, etc.
3. If energized equipment is in the accessible vicinity of the installation, a specific person, preferably at the ground level, should be responsible for observing the movements of the installers continuously to alert of movement in the direction of the energized equipment
4. Follow IEEE C2-2023, as well as local and OSHA requirements

5.2 Instructions for Assembly: To ensure proper performance, manufacturer's instructions for assembly and equipment drawings should be carefully followed.

5.3 Alignment: Switches should be carefully aligned on the supporting structure. The surface on which the switch bases are mounted should be flat and true, otherwise the bases may become twisted when bolted to the structure. Such twisting could result in difficult operation, unaligned operating parts, and strained insulator stacks. See 5.9 for adjustment considerations.

5.4 Rigidity: All switch bases and associated stationary parts should be rigidly bolted in place.

5.5 Line Conductors: Conductors should not subject the switching equipment to undue strains which could cause contact misalignment.

5.6 Bus Conductors: Bus conductors are impacted by temperature-driven dimensional changes and electromagnetic forces. They should be properly reinforced by bus support insulators and connected to the switches with expansion terminals to minimize forces' impact on switch performance.

5.7 Equipment Connections: Contact surfaces must be clean and smooth. Excess strains should be carried by auxiliary supports. When dissimilar metals are combined in a current-carrying joint, adequate protection against galvanic and chemical action must be provided.

5.8 Ground Connections: The bases of all switches must be grounded.

5.9 Adjustments: When the equipment is installed, adjustment should be made with standard weight or strain on the insulators and current-carrying parts.

5.10 Cleaning Equipment: After the switching equipment has been installed, connected, and adjusted, the insulators, contacts, and moving parts should be cleaned in accordance with the manufacturer's instructions.

5.11 Inspection: Prior to being placed in service, the equipment should be carefully inspected and adjusted in accordance with the applicable drawings. The following suggestions are strongly advised prior to energization:

1. Examine all insulator units for cracked or defective parts
2. Check all contacts for fit, proper pressure, and alignment
3. Check all bolted connections for tightness
4. Examine all switch locks for security, positiveness, and ease of operation
5. Check operation mechanism for proper operation, lubrication, and travel. Linkage should not display lost motion, ill-fitting mechanical connections, or excessive deflection of controls or mounting
6. Check the adjustment of arcing horns on horn-gap switches
7. Verify break distances, clearances between live parts, and switch travel
8. Check phase-to-phase clearances and phase-to-ground clearances between live parts of switching equipment and adjacent structures

5.12 Load Interrupter Switches: Follow the manufacturer's instructions for installation and adjustment of interrupter switches.

Guide for the Operation of High Voltage Disconnecting Switches IEEE 37.30.1

Operation

Air Switches: High voltage disconnecting switches and ground switches are given no interrupting rating. If an interrupter is installed, the switch's break capability will be dependent upon the interrupter's ratings.

6.1 General: For satisfactory service, manufacturer's instructions for assembly and equipment drawings should be carefully followed.

1. Verify each individual operating the switch fully understands the relevant procedures for open and close cycles, whether by manual or motor operation
2. After operation, each blade should be visually checked to validate its alignment in both open and closed positions
3. Undue force should not be used to operate a switch. The operating mechanism is designed properly for the switch and any undue force may cause severe damage to the the switch or its operating mechanism. If frozen over, a few sharp raps on the vertical operating pipe or suddenly applied tugs on the operating handle may help to free the mechanism
4. Motor-operated switches should be operated periodically to ensure proper function of switches and their control mechanisms. If unable to operate the switch due to a lack of an outage, decouple the motor operator from the linkage to verify its performance independently

6.2 Disconnecting, Grounding, and Horn-gap Switches

1. Prior to operating a switch, check that no load is being carried
2. Prior to opening a grounding switch, check to determine that operation does not remove necessary safety grounds. Prior to closing, check the circuit to confirm that it is not energized
3. Disconnecting switches should be operated rapidly to reduce arcing time and possible burning of contacts

NOTE: It is common practice to use these devices for interrupting small currents such as the charging current of a short length of transmission or distribution line, transformer magnetizing currents, parallel and loop currents, and light load currents. Such operations result in unconfined arcs which, under unfavorable weather or circuit conditions, may cause a system fault. These duties impose varying degrees of switching severity upon the switch. If circuit interruption is contemplated, care should be taken to understand the circuit conditions with particular regard to current magnitude and the transient recovery voltage that will appear across the switch immediately following current interruption to determine what degree of success may be expected.

Devices such as arcing horns, quick-break horns, and air or gas blast attachments, are available for aiding the interrupting capability of a disconnecting switch. It should be recognized that some of these situations may require the use of an interrupter switch. For specific current interrupting applications, the switch manufacturer should be consulted.

6.3 Load Interrupter Switches: Switches with interrupters installed have specific capabilities for switching one or more of the following circuit types: 0.8 minimum lagging power factor load, parallel or loop load, transformer magnetizing, line charging, cable charging, and capacitor bank. Follow the manufacturer's instructions when operating interrupter switches.

Guide for Maintenance of High Voltage Disconnecting Switches IEEE 37.30.1

IMPORTANT - Make sure applicable and adjacent equipment is de-energized and properly grounded before performing any installation or maintenance.

Introduction: High voltage disconnecting switches are assigned certain ratings and standard tests are conducted to assure the user that the switch, when new, will perform within the ratings shown on the nameplate. It should be recognized that the switch in service will perform within these ratings only if properly operated and maintained. Prescribed safety rules should be followed at all times when operating or maintaining high voltage disconnecting switches. At least once a year, these switches should be inspected and maintained.

Maintenance

7.1 Disconnecting Switches: These switches are not readily serviced at frequent intervals. This does not, however, relieve the user of the responsibility for care and inspection. Frequency of inspection will be a function of atmospheric contamination, use of contamination control coatings, frequency of operation, fault current exposure, etc. A suitable maintenance program must be established and followed by the user.

If a switch cannot be maintained on a periodic basis, its service life may be affected. The switch should be opened and closed several times if practicable in order to clean the contacts and free the moving parts. A visual inspection of the switch, likely aided by infrared temperature detectors, may indicate hot spots which are possible sources of trouble. Directional microphones or ultrasonic detectors can be used to locate local corona sources on switches, which can then be removed during normal switch maintenance. Live line servicing and maintenance procedures may be used.

The following procedures are suggested for maintaining de-energized switches

1. Verify that the switch is disconnected from all electric power sources before servicing
2. Ground leads or their equivalent should be attached to both sides of the switch. All safety precautions in Section 5.1 (Personal Safety During Installation), including local and applicable OSHA regulations, should be followed
3. Inspect the insulators for breaks, cracks, burns, or deterioration. Clean the insulators particularly where abnormal conditions such as salt deposits, cement dust, or acid fumes prevail. This is necessary to avoid flashover as a result of the accumulation of foreign substance on the insulator surfaces
4. Check the switch for problematic alignment, uncalibrated contact pressure, eroded contacts, corrosion, and mechanical malfunction. Replace damaged or badly eroded components. If contact pitting is of a minor nature, smooth the surface with clean, fine sandpaper (remove) or per factory recommendation. **(Do not grease the contacts. If additional lubrication is desired, spray the contacts with a dry graphite aerosol.)** Inspect arcing horns for signs of excessive arc damage and replace if necessary

5. Check the blade lock or latch for adjustment
6. Inspect all live, parts for scarring, gouging, or sharp points which could contribute to excessive radio noise and corona. Check corona balls and rings for damage which could impair their effectiveness
7. Inspect interphase linkages, operating rods, levers, bearings, etc., to ensure that all joints are tight and pipes are not bent. Clean and lubricate the switch parts only when recommended by the manufacturer. Check for simultaneous closing of all blades and proper contact in the closed position. Check gear boxes for moisture which could cause damage due to corrosion or ice formation. Inspect the flexible braids or slip-ring contacts used for grounding the operating handle. Replace braids showing signs of corrosion, wear, or having broken strands
8. If installed, motor operators should be serviced according to the original equipment manufacturer's instructions. Verify the condition of motor hardware, internal circuitry, supply voltage, and any other factors that may impact proper operation of switch
9. Inspect overall switch and operating mechanism for good working condition. Verify that the bolts, nuts, washers, cotter pins, and terminal connectors are properly installed and in good condition. Replace items showing excessive wear or corrosion. Inspect all bus cable connections for signs of overheating or looseness
10. Inspect and check all safety interlocks and test for proper operation

7.2 Load Interrupter Switches: If installed, interrupters should be periodically inspected to ensure that they are in a condition to function properly. Many interrupter switches are so designed that material is consumed from the walls which are exposed to the electric arc. Particular attention should be given to such parts, and they should be maintained or replaced in accordance with the manufacturer's instructions.

In addition, since interrupter switches sometimes include all the features of disconnecting switches, their maintenance procedures should include the procedures outlined in Section 7.1.

Switch Identification

When contacting the factory, refer to the Sales Order (SO) and line item shown on the nameplate. All pertinent information on the switch is filed under this number.

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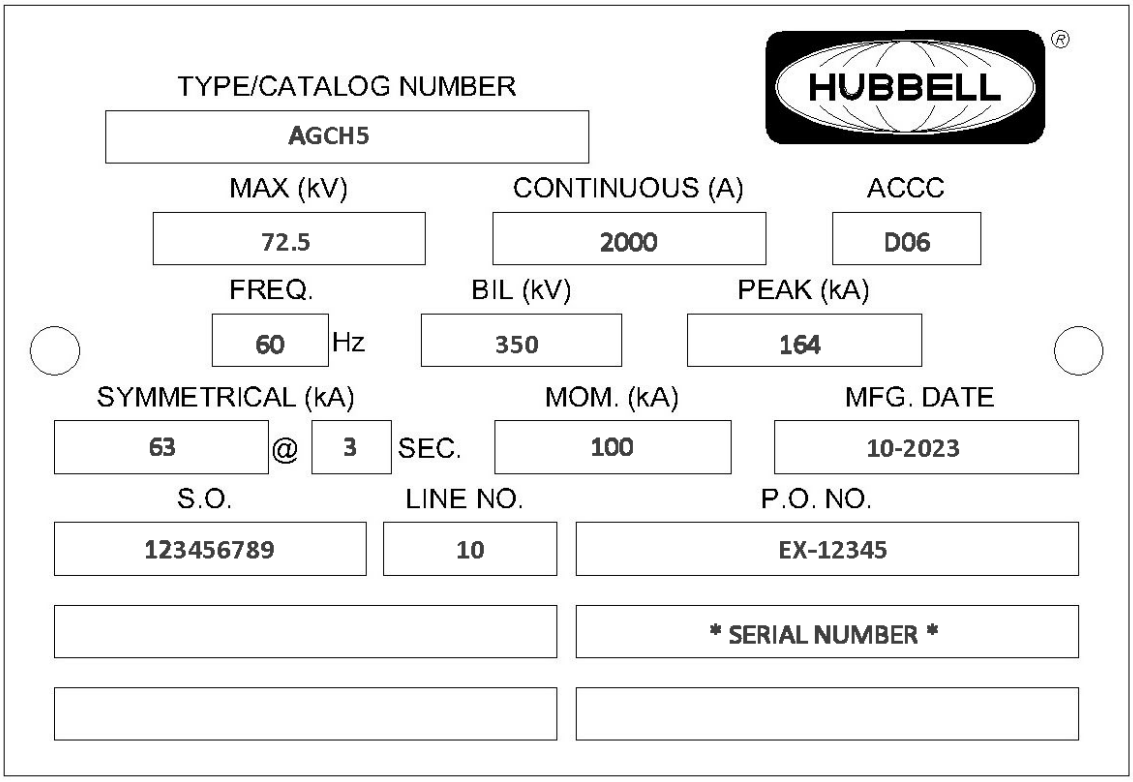
Renewal Parts and Factory Service

An inventory of renewal or replacement parts is not mandatory. Contact the factory for spare parts and factory service requirements.



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.

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