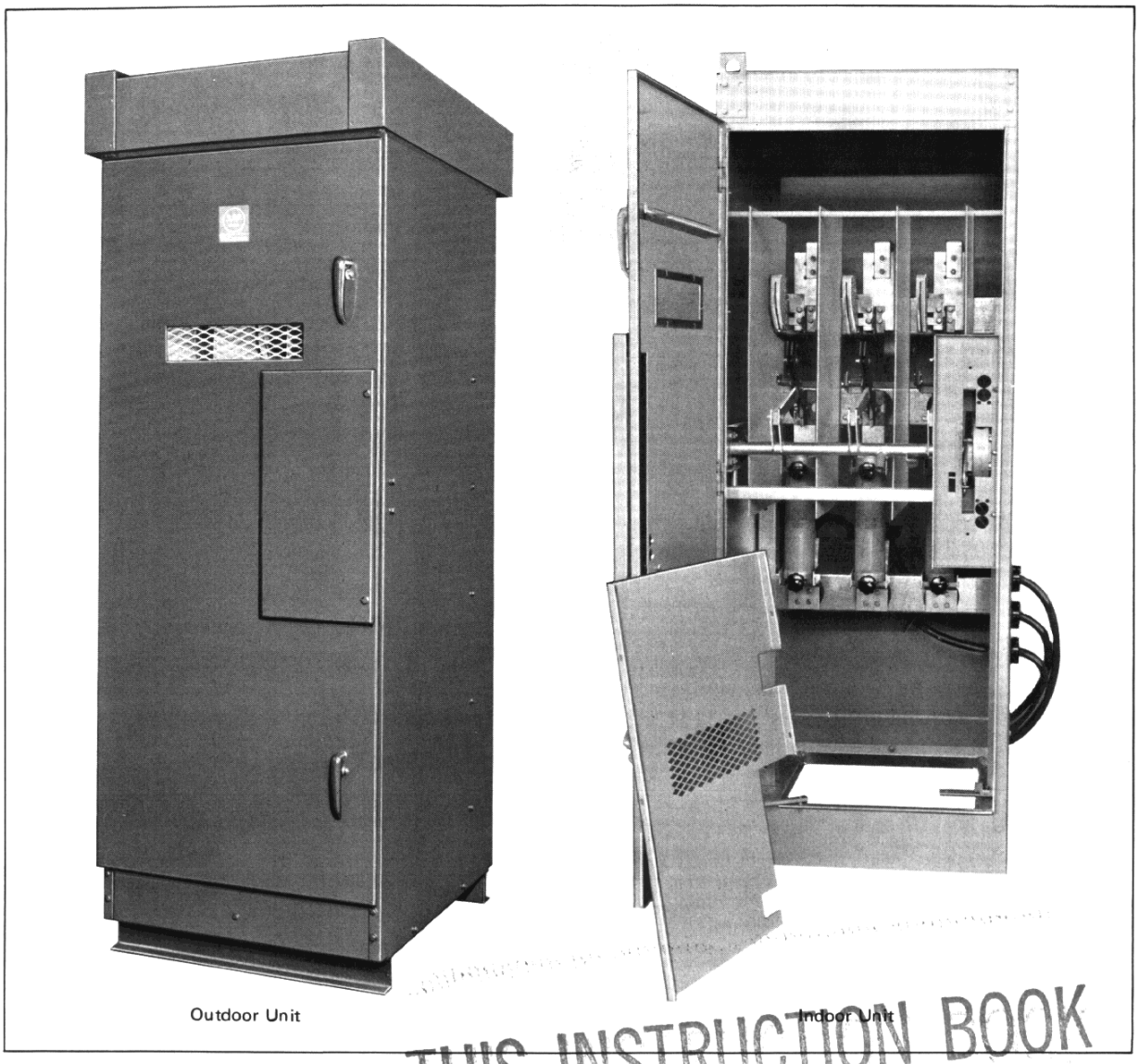
Instructions for
Type WLI Load Interrupter Switchgear
5.0 kV, 15.0 kV, 25.8 kV, and 38.0 kV

I.L. 31-930-B



Typical Outdoor and Indoor Units

Read and understand these instructions before attempting any Installation, Operation or Maintenance of this switch.

Effective December, 1984 Supersedes I.L. 31-930-A dated June, 1977

PURPOSE

This instruction book is expressly intended to cover the installation, operation and maintenance of type WLI load interrupter switches. It does not purport to cover all possible contingencies, variations, and details that may arise during installation, operation or maintenance of this equipment.

If further information is desired by purchaser regarding this particular installation, contact the local Westinghouse sales office. For application information, consult your nearest Westinghouse sales office, see Westinghouse Descriptive Bulletin 31-935, and read the appropriate ANSI standards.

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SECTION 1 – INTRODUCTION

1.0 Basic Description and Application

Type WLI load interrupter switchgear consists of an air insulated, three pole, gang-operated, quick-make, quick-break, load interrupter switch in a floor mounted metal enclosure. It can be applied in combination with power fuses and many other protective devices to provide safe, low-cost switching and circuit protection where infrequent disconnecting means is required.

1.1 Switch Identification

A nameplate is located inside the small access door of all type WLI switches (see Fig. 1). Contained on this nameplate are the Westinghouse order number, drawing number, and switch style number. This information should be given to the Westinghouse sales office if a question should arise concerning the switch or if renewal parts are required. These numbers allow the factory to completely identify the switch.

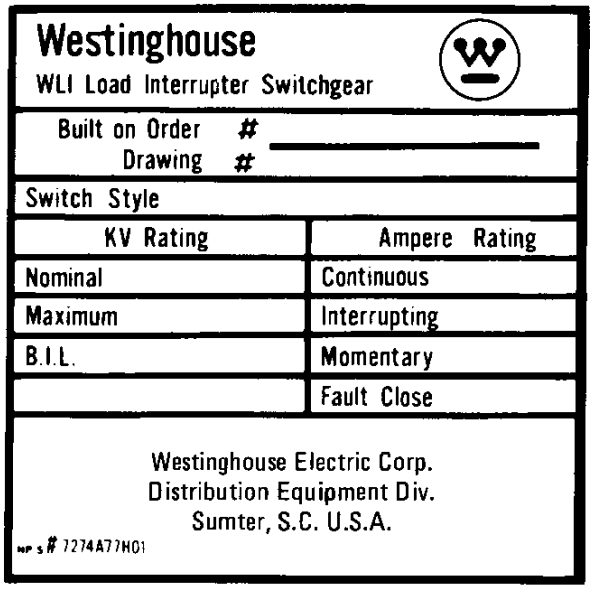

Fig. 1 *Typical Nameplate*

Also located on the nameplate are voltage and current ratings for the switch.

WARNING

Do not exceed nameplate ratings of WLI switchgear. To do so could cause property damage, severe injury, or death.

1.2 Safety Features

Type WLI load interrupter switches have several built-in features to reduce hazards and to provide proper operating sequences.

1. A door interlock prevents opening the enclosure front door while the switch is in the closed position.

2. A switch interlock prevents manual operation of the handle mechanism with the door open.

3. A viewing window is provided to verify each switch contact position.

4. Facility for padlocking the switch in the open or closed position is provided.

5. Facilities for padlocking the door handles closed are provided.

6. Mechanical indicators show whether the switch mechanism is open or closed.

7. Key interlocks, when provided, force a sequence of operation.

CAUTION

Never attempt to operate the WLI switch with key interlock bolt in the extended position. Damage to the operating mechanism and/or severe injury could result.

1.3 Safe Practices

Only qualified electrical workers with training and experience on high voltage circuits should be permitted to work on this equipment. They should be familiar with the work to be performed, the safety equipment required, and hazards involved.

1. Read and understand these instructions before attempting any assembly, operation, or maintenance of the switch.

2. Type WLI load interrupter switches are designed to operate within the current and voltage limitations on the switch nameplate. Do not apply these switches to systems with currents and/or voltages exceeding these limits.

3. Disconnect all power sources before making any adjustments or performing maintenance.

4. After opening switch and before opening door, use viewing window to insure that all three switch blades are open. If necessary, use a flashlight to verify all three contacts are open.

5. There are several interlocks on the switches. They are for personnel and/or equipment protection. Under no circumstances should they be made inoperative when switch is in service. To do so could cause bodily injury or property damage.

6. Never energize the switch without the arc chutes and barriers installed in place.

7. Always be sure that all switch hardware is in place and bolted tightly before putting switch into operation.

8. Before replacing covers, carefully inspect buswork and phase barriers to insure that no tools or other objects are accidentally left inside the unit.

SECTION 2 – RECEIVING, HANDLING AND STORAGE

2.0 Receiving

A visual inspection – inside and out – should be performed immediately upon receipt of the switchgear and before removing it from the truck. Shipping papers should be checked to be sure all boxes or other accompanying pieces have been received. If any damage or shortages are evident, a claim should be filed at once with the carrier, and the nearest Westinghouse sales office notified.

The order data nameplate for each switch assembly is located inside the access door. The order number and drawing number are located on this nameplate and should be given to the Westinghouse representative whenever identification of the assembly is required.

2.1 Handling

Removable lifting plates are provided on the top of the WLI structure for insertion of hooks to lift the complete structure. This is the only recommended method of moving the WLI structure. Extreme care should be used not to damage or deform the unit if other moving methods are employed.

2.2 Storage

If it is necessary to store the equipment before installation, keep it in a clean, dry location with ample air circulation and heat to prevent condensation. Like all electrical apparatus, these units contain insulation which must be protected against dirt and moisture. Outdoor units may be stored outside only if roof caps are installed and space heaters energized.

SECTION 3 – INSTALLATION

Refer to shipping list (Form SUM-T-3) for location of bus, hardware and all other joining and installation material.

3.0 Joining Type WLI Enclosures

3.0.1 Identification of Shipping Splits

Refer to the front view drawing. Below this drawing, shipping splits will be identified in relation to group numbers for each cubicle. Normally shipping sections will not exceed 154 inches in width.

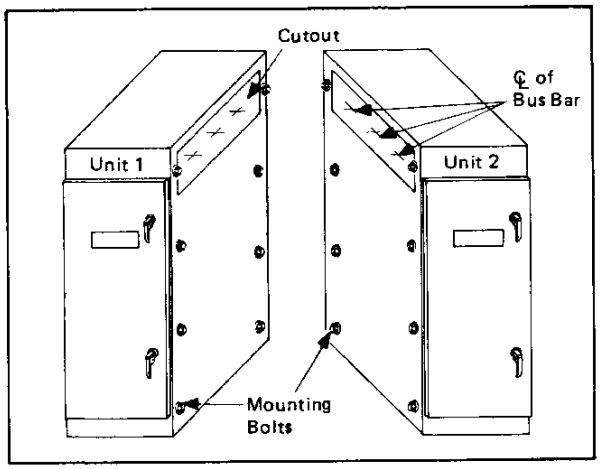

Fig. 2 *Joining WLI Enclosures*

3.0.2 Procedure for Joining WLI Enclosures at Shipping Splits (Refer to Fig. 2)

a. Remove the eight 3/8 inch bolts from each side sheet.

b. Position the switches next to each other. The eight holes will match holes in adjacent side sheet.

c. Bolt the side sheets together using eight bolts removed from one side sheet.

d. Make main and ground bus connections using splice plates and hardware furnished. Bus bar is usually tin or silver plated. To insure a proper electrical connection, care should be taken to protect the plating from damage. Do not use joint compound.

e. Bolted connections should be tightened to the torque values given in Appendix A.

3.1 Installation of Roof Caps on Outdoor Units

Roof caps are necessary to complete the roof of all outdoor WLI units. They are shipped in separate cartons.

a. Remove the end lifting plates from the WLI structure and replace the bolts. Center lifting plates do not require removal.

b. Remove bolts from the front and rear ends of the WLI roof structure (see Fig. 3).

c. Install the roof caps so that the holes align. Secure using same hardware removed in b.

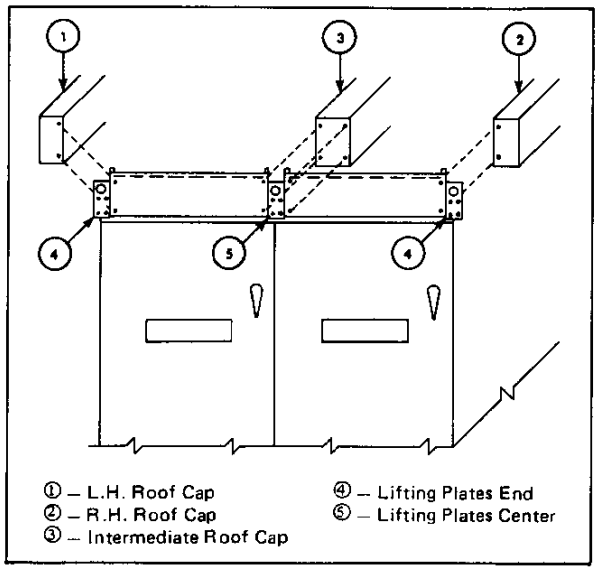

Fig. 3 *Installation of Roof Caps on Outdoor Units*

3.2 Connection of Type WLI Switch to Transformer

3.2.1 Physical Connection

3.2.1.1 Indoor Assemblies

Holes are predrilled in the side of the WLI structure to match holes provided in the transformer.

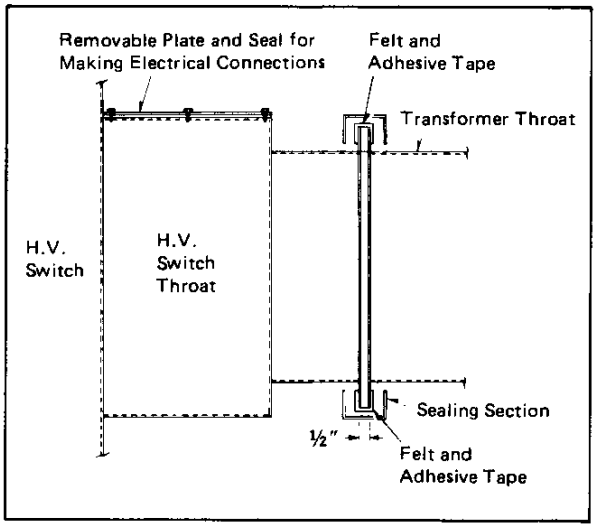

Fig. 4 *Transformer Connection to WLI Switch*

3.2.1.2 Outdoor Throat Connection (See Fig. 4)

a. Switch and transformer should be brought together to give spacing of 1/2 inch between throat flanges.

b. Apply double adhesive tape supplied with WLI switch to outside surfaces of both flanges.

c. Press felt supplied with WLI switch into place on adhesive tape. Felt is to seal against entrance of dust and to prevent transmission of vibration produced by transformer resonance to the WLI switch.

d. Install sealing section provided by sliding U shaped frame down from top and securing to bottom section with bolts supplied.

3.2.2 Electrical Connection

3.2.2.1 Connection by Cable Supplied with Type WLI Switch

a. Cables are <u>not</u> factory pre-cut to proper length. Installer <u>must</u> cut to fit.

b. Since factory cables are unshielded, they must be properly separated from each other, from all grounded metal parts, and from transformer bushings of other phases.

c. Type WLI switchgear conforms to NEMA standards concerning phasing. Phases are arranged A, B, C, front to rear, top to bottom, and left to right at connection points unless otherwise noted on the drawings. The installer is responsible for maintaining continuity of phasing throughout the system.

d. Lugs are provided with the switch for terminating cable to the transformer bushings.

3.2.2.2 Connection by Bus Bar

a. Splice plates and hardware are furnished with the WLI switch.

b. Bus bar is usually tin or silver plated. To insure a proper electrical connection, care should be taken to protect the plating from damage. <u>DO NOT</u> use joint compound.

c. All bolts should be tightened according to Appendix A.

3.3 Connection to AMPGARD Starter Lineup

a. Holes are predrilled in the side of the WLI structure to match holes provided in the starter. Bolt together using hardware furnished with WLI.

b. Make bus connections per Section 3.2.2.2.

3.4 Connection to Metal Clad Switchgear Lineup

3.4.1 Indoor Switchgear – Follow Same Procedure Outlined in Section 3.3.

3.4.2 Outdoor Switchgear (See Fig. 5).

a. Position units side by side. Holes in WLI side sheet around bus cutout will match holes in metal clad switchgear flange.

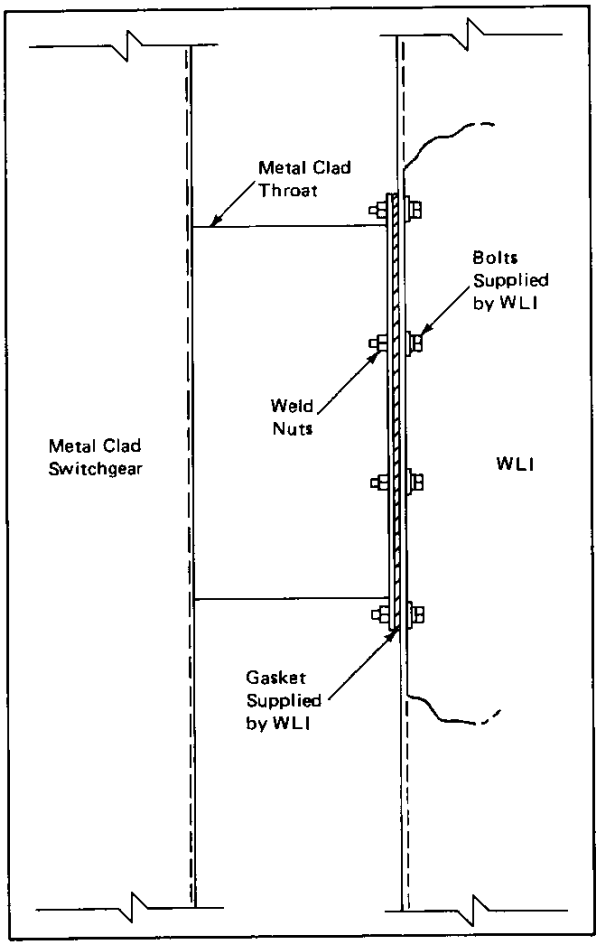

Fig. 5 *Connection to Metal Clad Switchgear Lineup – Outdoor Unit*

b. Press cork neoprene gasketing tape supplied with WLI onto flange for weather-tight seal.

c. Join enclosures using bolts supplied with WLI. Opposite side of metal clad switchgear flange has nuts welded in place for ease of connection.

d. Make bus connections per Section 3.2.2.2.

3.5 Connection of Customer Power Cables

Cable termination space is normally provided in the rear of the cubicle for top or bottom cable entry as shown on the drawings. Adequate electrical clearance must be maintained between cables, energized parts, and grounded metal parts. It is also the installer's responsibility to adequately support cables such that insulators or bus bars do not carry the strain of the cables.

Tin-plated aluminum clamp type terminals are supplied as standard and are suitable for acceptance of copper or aluminum cable. If potheads or other special terminators are supplied, termination should be made according to the terminator manufacturer's recommendations.

3.6 Field Taping of Electrical Connections (See Fig. 6)

Field taping of electrical connections should be done where shown on drawings, or as tagged by the factory inspector. Taping materials are supplied with the WLI assembly.

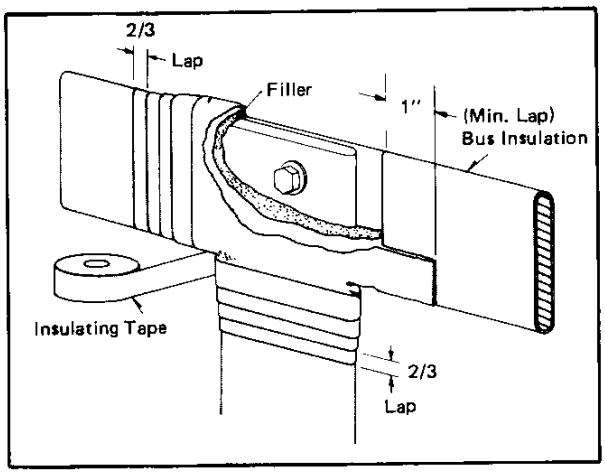

Fig. 6 *Field Taping of Electrical Connections*

3.6.1 Materials

a. Filler – insulation putty

b. Insulating tape – black, linerless H.V. EPR tape, 1" wide.

c. Finish tape – red vinyl tape, 3/4" wide.

3.6.2 Procedure

a. Clean area of dirt and foreign matter per Section 5.4.

b. Apply filler over bare conductor and hardware to cover and smooth out the surface. Blend contour into pre-insulation surfaces. Cover conductors and hardware with at least 1/8" of filler.

c. Apply insulating tape, lapping and layering as specified in the chart. Tape must overlap pre-insulation by 1". Elongate insulating tape 10 to 25 percent during application to insure a smooth, tight fit. Should a tape roll expire, start the new roll by overlapping any previous end by 1/2 turn.

d. Apply one layer of red vinyl finish tape. This tape should not be stretched or torn at the ends.

Taping Chart		
	Lap of Tape	**No. of Layers**
Up to 5 kV	1/2	1
Over 5 kV to 38 kV	2/3	2

3.6.3 Pre-insulation is made from NORYL, a high-performance engineering thermoplastic. It can be irreversibly damaged if it comes in contact with certain chemicals. See Section 5.4 for cleaning procedures.

WARNING

NORYL insulated equipment electrical joint compounds must not be used on connections or terminations to or from this equipment.

Do not use solvents, oils or greases on or near this equipment.

Water and isopropyl alcohol are the only approved cleaners for this equipment.

3.7 Securing WLI Unit to Foundation

All tie down hardware is to be supplied by the installer.

3.7.1 Indoor units can be secured to the foundation using 1/2" anchor bolts. The four 5/8" holes in the base for these bolts are shown on the floor plan included with the drawings. These holes may also be drilled out to allow the installation of lead anchors in the floor.

3.7.2 Outdoor units are secured using tie down clips and foundation bolts as shown in Fig. 7. Lead anchors and lag screws may be used in place of J-bolts if desired. An alternate method is to tack weld base to floor sills.

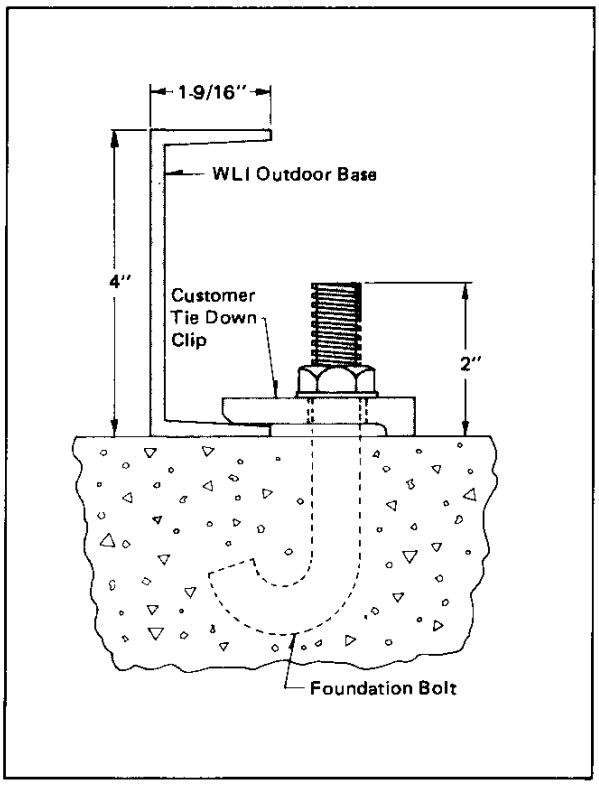

Fig. 7 *Bolting WLI Unit to Foundation*

3.8 Connection of Space Heaters to Customers Source

Space heaters, when supplied, must be energized to prevent condensation. Heaters are supplied for 120, 240, or 480 volts as shown on drawings.

For single units with no heater control devices, (thermostats, circuit breakers or safety switches), the installer must bring control wiring in and wire directly to terminals located on the space heater.

For lineups or units with heater control devices, heaters will be internally wired and brought to a terminal block. A wiring diagram will be furnished with the drawings showing connection points for control power.

3.9 Superstructure Assembly (See Figs. 8 and 9)

3.9.1 Receiving

Check to see that all parts necessary for assembly have been received. The packing list will show all required items (bus, hardware, phase barriers, taping material, etc.) and will indicate in which shipping unit the various parts are located.

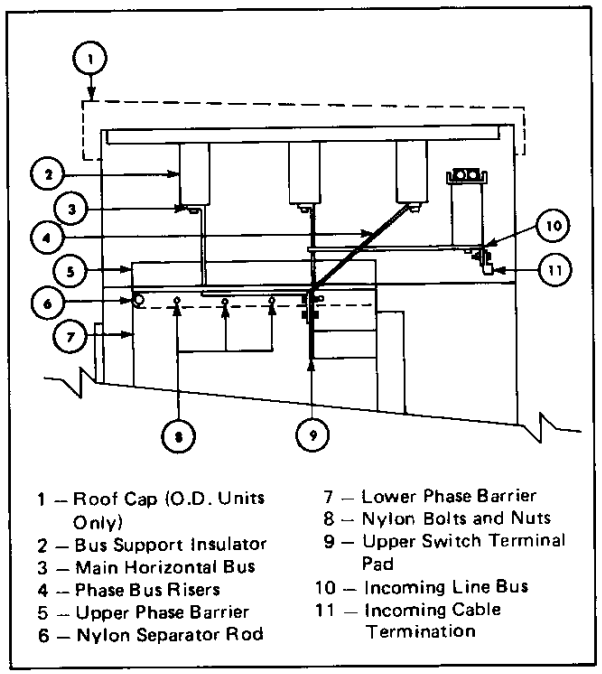

Fig. 8 *Section View, Superstructure Assembly*

3.9.2 Installation of Superstructure

a. If a lineup, join per Section 3.0. Secure switches to foundation per Section 3.7.

b. Remove top sheet from switch unit. On indoor units this top sheet will later be re-installed on the superstructure using the same mounting hardware. Outdoor

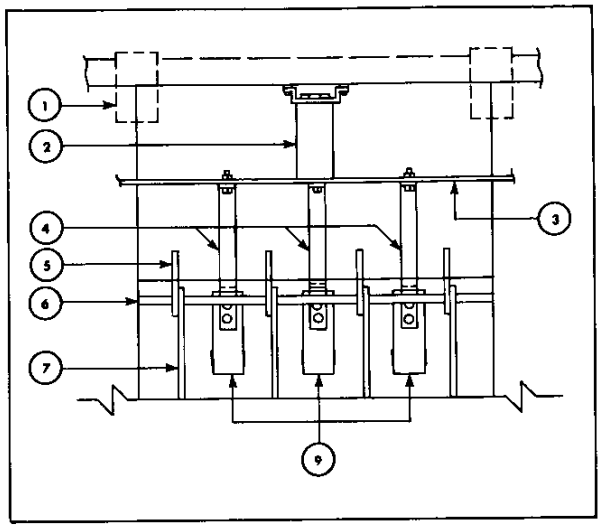

Fig. 9 *Front View, Superstructure Assembly*

units are shipped with the roof attached to the superstructure. The top sheet on the switch is used for shipping purposes only, and may be discarded after removal.

c. Remove lifting eyes and replace mounting bolts after removal.

d. Remove superstructure from shipping pallet and then remove all bolted covers from it. Shipment of more than one WLI will be tagged to identify superstructures with their corresponding switch units. Install superstructure atop switch using the bolts, nuts, washers, and/or self tapping screws as provided. Occasionally the superstructure assembly will become slightly "sprung" in shipment so that it does not align exactly with the top of the switch enclosure. If this should occur, install bolts or screws in all holes that align then use a pinwrench to pry adjacent holes into alignment.

3.9.3 Bus Assembly

All bus sections have been assembled at the factory and checked for clearance prior to shipment.

a. Units without horizontal main bus require installation of one piece of bus section per phase from the upper switch terminal pad to the incoming line termination. Each phase bus is attached in two places – to the upper switch terminal pad and to the bus support insulator mounted in the superstructure. Use the bolts provided.

b. Units with main bus also require horizontal bus sections bolted to the bus support insulators. Phase bus

risers are then bolted from the switch terminal pad to the main horizontal bus. Lineups shipped in more than one section will be supplied with horizontal bus lengths corresponding to widths of shipping sections. After installation, join horizontal bus sections using splice plates provided.

c. Tighten all bolted bus connections to torque values given in Appendix A.

d. Bus requiring field taping will be identified by a red taping tag. Taping material will be provided and taping procedures described in Section 3.6 should be followed.

3.9.4 Upper Phase Barrier Installation

Remove upper nylon separator rod from phase barriers in switch unit. Care should be taken not to lose the "E" rings which secure the separator rod to the barriers. Mount upper phase barriers to lower phase barriers using nylon nuts, bolts and washers provided. Large hole in upper barriers should align with hole in lower barriers for separator rod.

Replace nylon separator rod using "E" rings to secure to phase barriers. Barriers should be aligned straight and true with maximum clearance from live parts.

3.9.5 Replacing Covers

CAUTION

Before replacing covers, carefully inspect buswork and phase barriers to insure that no tools or other objects are accidentally left inside the unit.

a. Install roof and covers using hardware provided.

b. Install roof caps on outdoor units per Section 3.1.

3.10 Switch Inspection Before Startup

Each switch is properly adjusted at the factory before shipment. However, vibration and mechanical stresses imposed by transit and installation can adversely affect switch adjustment; therefore, a final inspection is essential before energizing. If this inspection reveals any defects in adjustment, they should be corrected according to alignment procedures in Section 5.2.

Inspection procedures require closing and opening the switch with the main door open. This requires override of the switch safety latch as described in Section 5.2.1 and must be accomplished before energization.

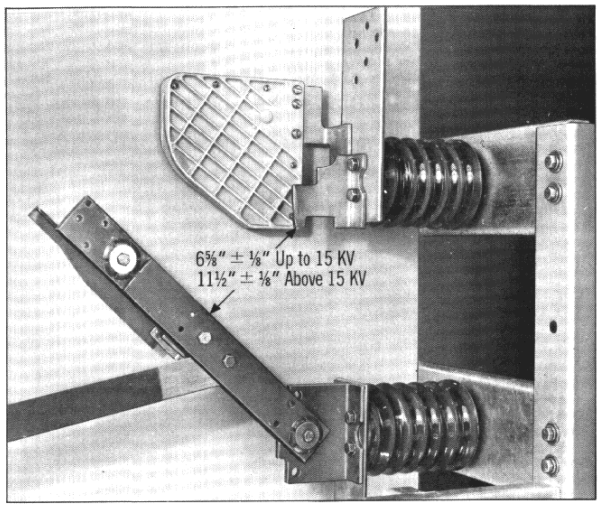

Fig. 10 *Main Blade Adjustment*

Inspection Procedure:

a. With switch in the open position (see Fig. 10) the distance between the edge of the main blade and the closest point of the break jaw should be:

6-5/8" ± 1/8" for 5 and 15 kV switches
11-1/2" ± 1/8" for 25 and 35 kV switches

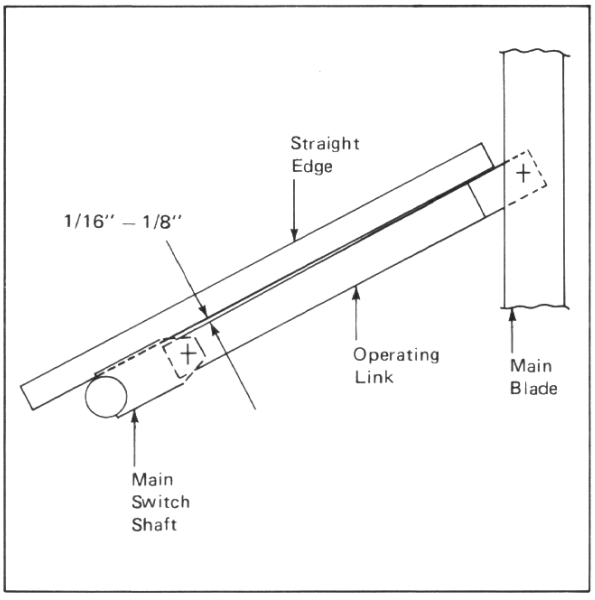

Fig. 11 *Drive Rod Links and Shaft Ears Alignment*

b. Main and flicker blades must be in proper alignment with break jaws and arc chute openings respectively. This can be checked by closing the switch and then partially opening it using the maintenance hub as described in Section 5.1.3.

c. In the closed position the drive rod links and shaft ears must be 1/16" to 1/8" over toggle when checked with a straight edge (see Fig. 11).

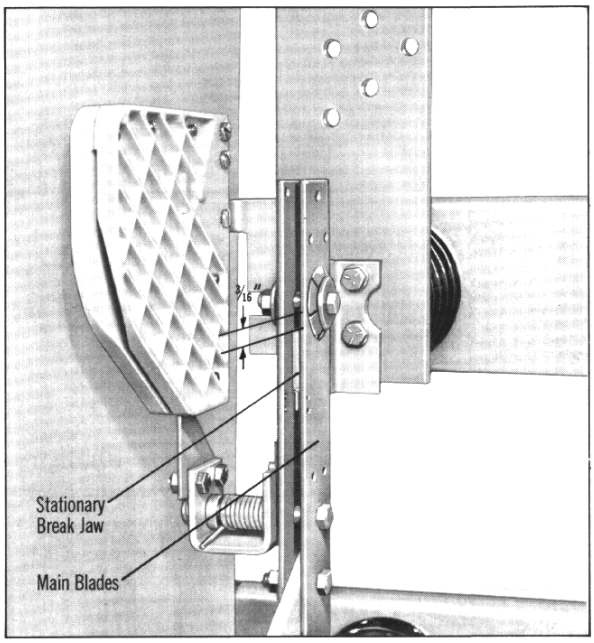

Fig. 12 *Main Blade Spacer Adjustment*

d. With the switch closed, the upper spacers of the main blades should rest 3/16" ± 1/16" above the bottom of the depression of the stationary break jaw (see Fig. 12).

e. Check bolted bus connections for proper tightness, referring to Appendix A for torque values.

f. If fixed mounted fuses are supplied, check the plastic knobs that hold fuses in place. They should be hand tight.

g. If disconnect fuses are supplied, check to see that they are completely latched closed.

h. For units fitted with expulsion-type, boric acid fuses, check the discharge filters on the lower end of the fuses for tightness. They must be securely hand tightened.

i. Check to see that space heaters, if supplied, are energized.

j. Wipe away any dust or dirt that may have accumulated in compartment(s) paying particular attention to insulators and insulating material. If bus is insulated, see Section 5.4 for cleaning procedures.

k. A final thorough inspection should be made to insure that no tools or other objects are accidentally left inside the enclosure.

SECTION 4 – OPERATION

4.0 Mechanical Safety Interlocks

The WLI switch is equipped with switch interlocks and door interlocks as well as provisions for padlocking in either the open or closed position.

WARNING

Do not disengage or defeat interlocks unless power is turned off and locked out from all sources. Failure to do so could result in severe injury or death.

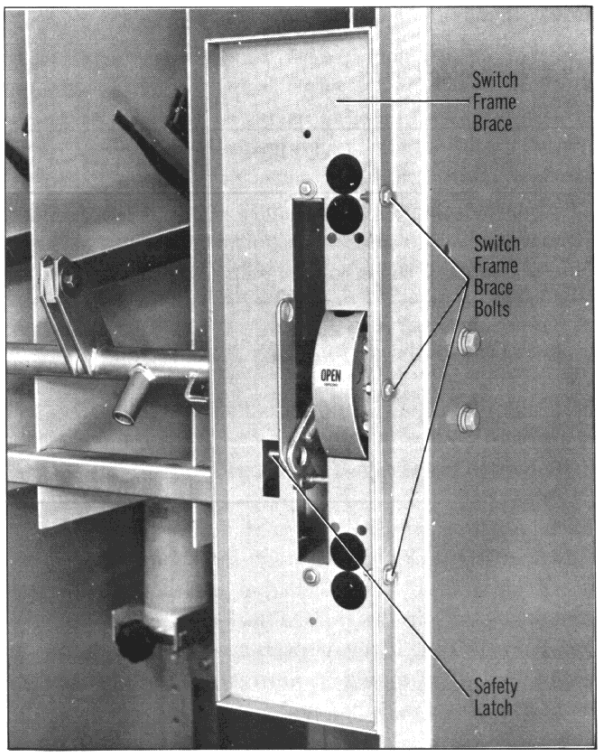

Fig. 13 *Safety Latch Location*

4.0.1 Switch Interlock

This interlock prevents inadvertent closure of the switch if the enclosure door is open. When the door is closed, the pointed latch lug welded to the inside of the door causes the safety latch to move out of the blocking position (see Fig. 13).

4.0.2 Door Interlock

This interlock prevents the door of the enclosure from being opened when the switch is closed. When the switch is closed, a hook lug welded to the operating shaft engages a hasp welded to the inside of the switch door, preventing the door from being opened. (See Fig. 14.)

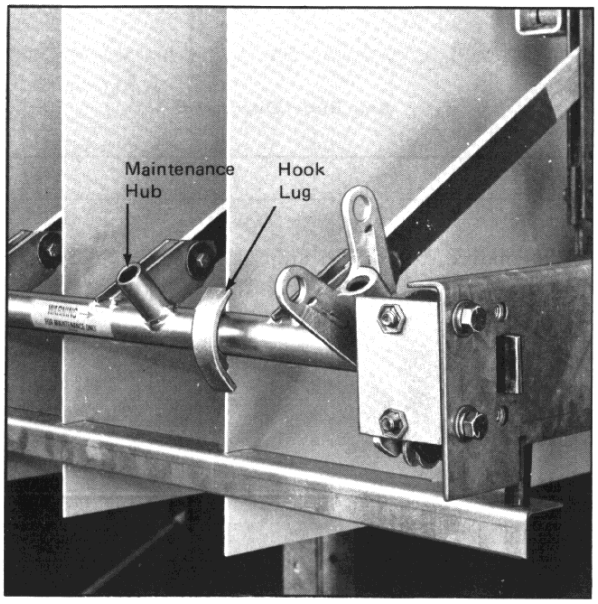

Fig. 14 *Maintenance Hub Location*

4.0.3 Key Interlocking

Key interlocks are supplied when specified. Standard schemes are available for locking the switch in the open position or the closed position as well as locking the main door closed. Numerous other schemes are available for special requirements which can coordinate with upstream or downstream devices supplied by other Westinghouse divisions.

WARNING

Key interlocks, when supplied from the factory, will have a key for each lock; however, for correct sequence of operation, one or more of the keys must be eliminated. These excess keys must either be destroyed or locked away where they will not be accessible to operating personnel. Failure to do so may result in severe injury or death.

CAUTION

Never attempt to operate the WLI switch with key interlock bolt in the extended position. Damage to the operating mechanism and/or bodily injury could result.

4.1 Switch Operation

To manually close or open the switch, the small access door must be opened and the operating handle withdrawn from the clips at the left side of the opening. The handle is inserted into the handle casting and rotated through an angle of 120 degrees. This charges the compression spring, and as the spring lever goes over toggle, the stored energy of the spring is transferred to the shaft which snaps the switch open or closed. The blades thus move at a predetermined speed which is independent of the operator.

The quick-make mechanism provides power to overcome blowout forces which occur when the switch is closed into a fault. However, these forces are not transmitted to the operating handle since it is not rigidly connected to the blades. Therefore, the switch can be safely closed under short circuit conditions within its fault-close rating.

Load interruption is accomplished by a flicker blade and engaging contact fingers located inside a DE-ION® arc chute. On opening the switch, the main blades open first and all current is shunted through the spring loaded flicker blades. Further travel of the main blades causes the flicker blades to snap out of their contact fingers where associated arcing takes place within the arc chutes. (See Fig. 15 for sequence of operation.)

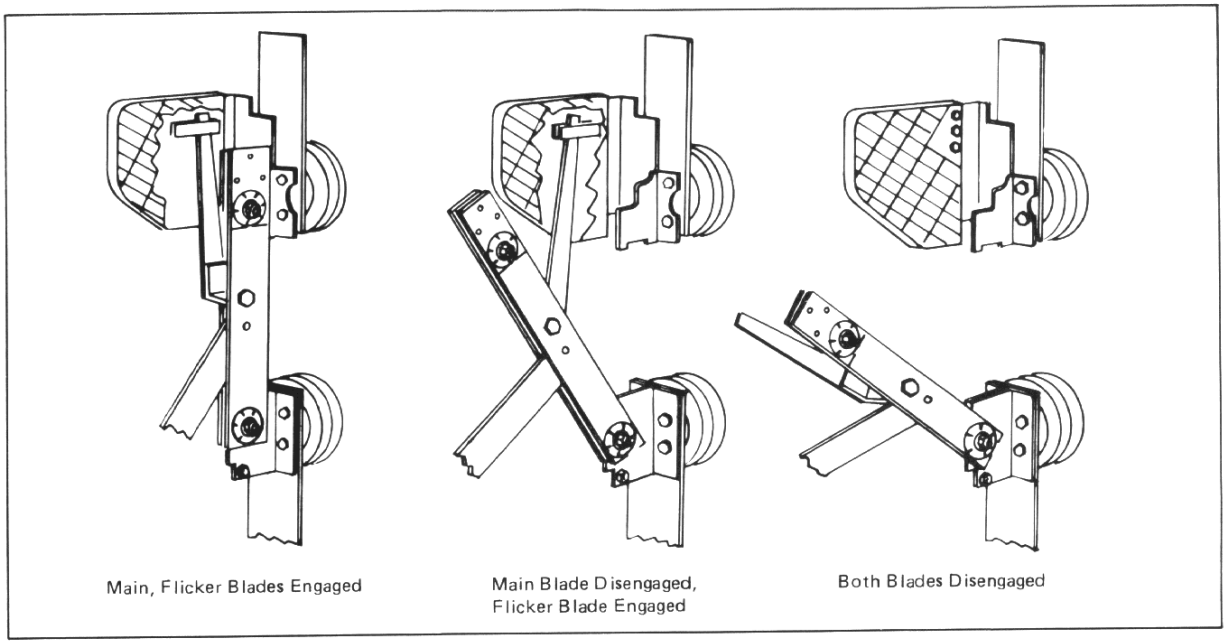

Fig. 15 *Flicker Blade Operation*

4.2 Fuse Replacement

> **WARNING**
>
> Before accessing fuses the following steps must be taken. Failure to do so could result in severe injury or death.

a. All upstream devices which could energize the fuse should be opened, padlocked, and tagged so that inadvertent closure cannot create a hazard.

b. The WLI switch should be opened by rotating the handle downward.

c. Before opening the door, look through the window to visually verify that all blades are disengaged from their stationary contacts. Use a flashlight if necessary.

d. After opening the door, a stick mounted voltage sensing device should be used to determine if voltage is present.

e. If no voltage is present, a suitable grounding device should be attached to the fuse terminals to discharge any static charge and assure that the fuse terminals remain at ground potential.

Fuses are removed by loosening the phenolic hand knobs and removing the locking bars. Fuses are then free to be removed. When fuses are re-installed, knobs should be tightened hand tight. (See Fig. 16.)

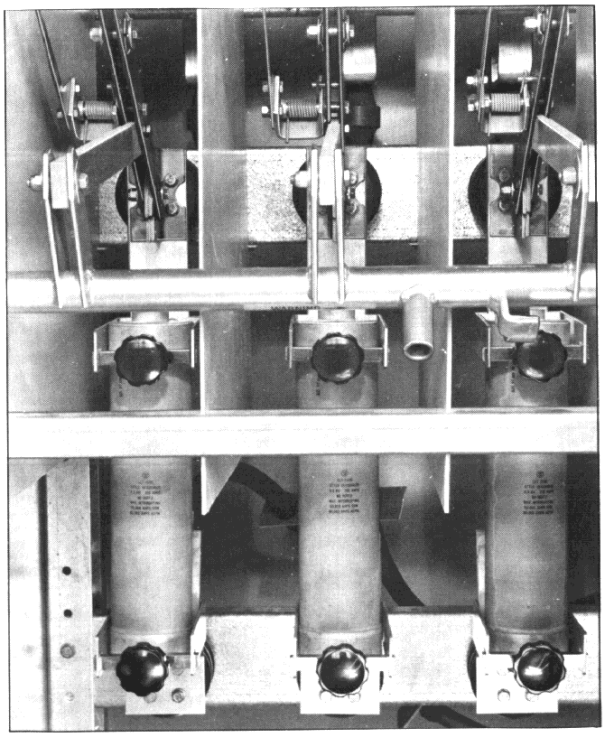

Fig. 16 *Fuses*

SECTION 5 – MAINTENANCE

WARNING

The switch must be completely disconnected from all power sources before any maintenance or alignment is attempted. Failure to do so could result in severe injury or death.

5.0 Inspection Schedule

The WLI switch should be inspected once a year or after 50 rated current interruptions whichever occurs first. After the switch has been closed against a fault current, it should be inspected at first opportunity. If the switch has been moved or otherwise subjected to mechanical strain, inspection procedures described in Section 3.10 should also be performed.

5.1 Inspection Procedure

WARNING

The switch must be completely disconnected from all power sources before performing inspection. Failure to do so could result in severe injury or death.

5.1.1 Check main blade contacts and leading edges of flicker blades for arc erosion. Severely damaged blade assemblies should be replaced as described in Section 5.3.1. If less than half the contact surfaces are damaged, the arcing contacts and flicker blades may be cleaned with a few light strokes of a fine file. No attempt should be made to file out pit marks. Do not use abrasive material for cleaning as small bits of abrasive material may cause the contact to overheat or even weld during faults.

NOTE: The main current carrying contacts should not be filed. Opening and closing the switch will keep them clean.

5.1.2 Inspect arc chute sides for cracks or erosion and replace if damaged. Use a flashlight to examine the flicker blade contacts inside the arc chute. If contacts are found to be burned or pitted over half their surfaces, or if the contacts are out of alignment, the arc chute should be replaced.

5.1.3 Check the engagement of the flicker blades by first closing the switch. Next, insert the removable handle in the pipe-like maintenance hub welded to the switch shaft (see Fig. 14) and slowly open the switch. The flicker blades should remain engaged in their contact fingers while the main blades open. When the main blades clear the break jaws, they will hit a stop on the flicker blade brackets and start the flicker blades out of their contact fingers. The flicker blades will then snap open from the forces in their charged torsional springs.

CAUTION

During a slow open or close operation using the maintenance hub, the operating spring is being charged and will tend to return the switch to its initial position. Therefore, to avoid bodily injury, care must be taken to hold the operational handle firmly until the spring energy is discharged and the switch is returned to its initial position.

5.1.4 Check interphase barriers for carbon or metallic deposits. Replace if deposits are present.

5.1.5 Wipe away any dust or dirt that may have accumulated inside the cubicle, paying close attention to insulators and insulating material. If bus is insulated, see Section 5.4 for cleaning procedures.

5.1.6 Close and open the de-energized switch at least three times to check the performance of the operating mechanism.

5.2 Alignment Procedures

WARNING

The switch must be completely de-energized from all sources before any attempt is made to align the switch. Failure to de-energize switch could result in severe injury or death.

5.2.1 Override of Switch Interlock Safety Latch

To operate the switch with the door open, the safety latch (Fig. 13) must be disengaged. To close the switch, insert the handle in the handle casting and push upward, at the same time pushing the latch on the left side of the

safety barrier downward until the butterfly on the handle casting clears the locking pin. Reverse this procedure to open the switch.

5.2.2 Closed-Open-Stop Adjustment

a. Remove the switch frame brace (Fig. 13) by removing the three bolts in the side sheet flange. Viewing switch mechanism from the top, the bottom stop bolt and nut adjusts the closed position (Fig. 17). In the closed position, the shaft rod ends should be slightly over toggle. This can be easily checked by laying a straight edge on top of the drive rod so that its end extends over the shaft (see Fig. 11). If a 1/16″ to 1/8″ gap appears between straight edge and drive rod, adjustment is correct.

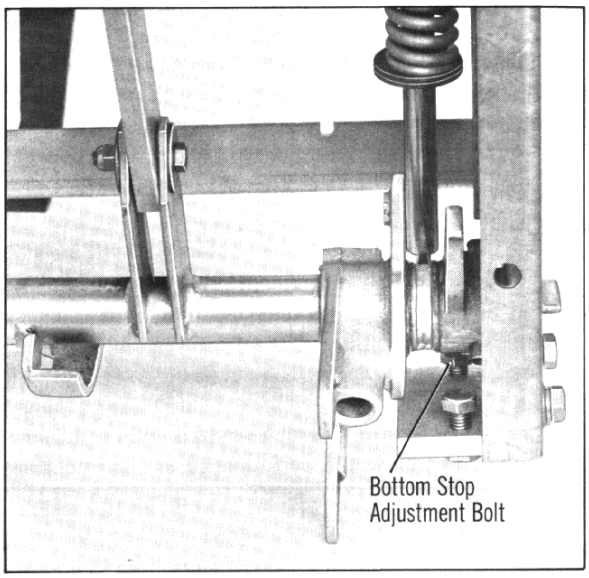

Fig. 17 *Closed-Open-Stop Adjustment*

b. Check to see that the blades are closing fully. To do this, measure the distance from the upper switch terminal pad to the outer edge of the main blade. This dimension should be 3-5/16″ to 3-7/16″ up to 15 kV, 3-5/16″ to 3-1/2″ above 15 kV. Should adjustment be required, loosen the bolt holding the drive rod to the shaft and adjust the blade travel. Re-tighten the bolt to 35 foot pounds.

c. In the open position, clearance between the edge of the main blade and the break jaw should be 6-5/8″, ± 1/8 inch for up to 15 kV, 11-1/2″ ± 1/8 inch above 15 kV (see Fig. 10). The top stop bolt adjusts this dimension (see Fig. 17).

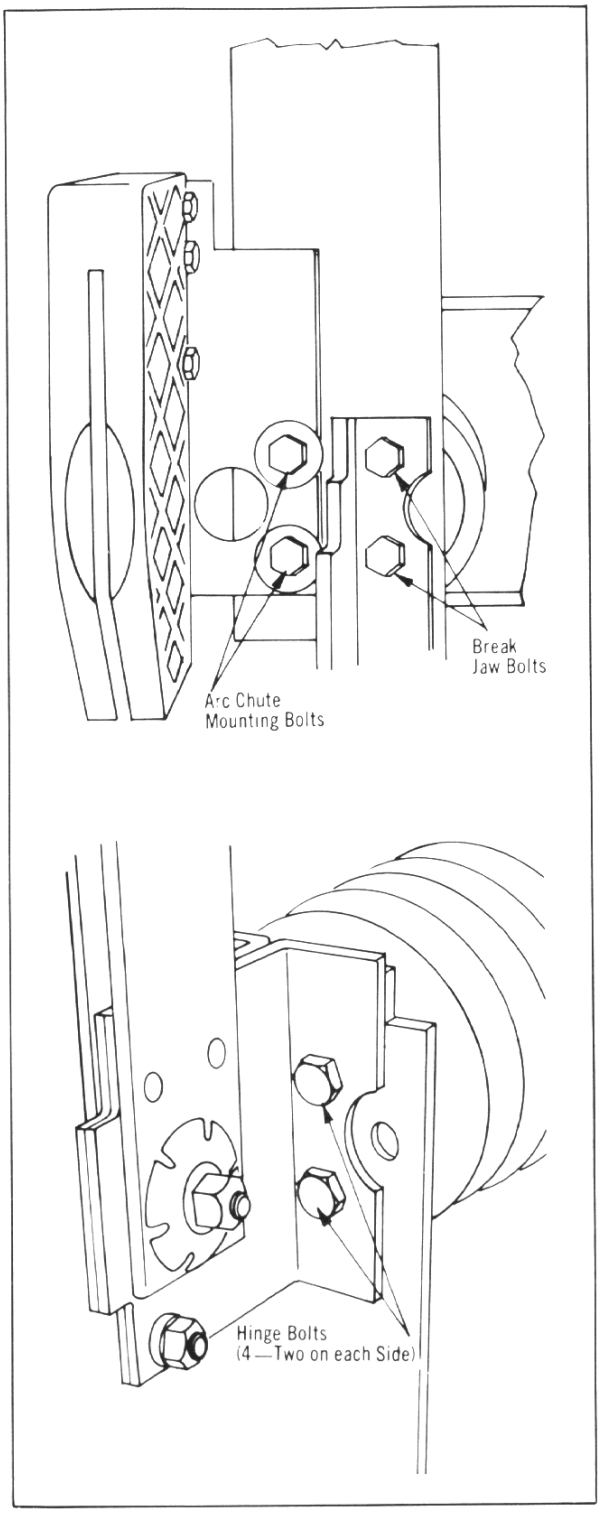

Fig. 18 *Main Blade and Arc Chute Alignment*

d. If the switch is equipped with key interlocking, care must be taken when replacing the switch frame brace to insure that it is properly positioned. Elongated holes in the WLI side sheet allow for vertical adjustment. The key interlock bolt must clear the aluminum handle casting when retracted, yet engage the slot(s) in the casting when extended.

5.2.3 Main Blade Alignment (Fig. 18)

Loosen the four hinge bolts (bottom drawing) and the two break jaw bolts (top drawing). Insert the removable handle in the maintenance hub on the shaft and close the switch. (For safety purposes, the switch will not fully close and will revert to the open position if pressure on the handle is released). Hold the switch in the closed position with the handle and tighten the bolts on both the hinge and jaw per Appendix A.

5.2.4 Arc Chute Alignment (Fig. 18)

Loosen the two arc chute mounting bolts (top drawing). Adjust the arc chute so that its opening is parallel to the main blade. Lightly tighten the mounting bolts. Using the blade alignment hub, slowly close the switch and check that the flicker blade is in line with the arc chute opening. If necessary, move the arc chute left or right until it lines up with the flicker blade. Tighten the arc chute mounting bolts and recheck the alignment.

5.2.5 Vertical Position of Break Jaw

Close the switch. Check that the upper spacers of the main blades are 3/16" ± 1/16" above the tops of the break jaws. (See Fig. 12.) If they are not, loosen the bolts holding the break jaw support insulator to the back pan. Adjust as necessary. When setting is correct, tighten bolts to proper torque value.

5.2.6 Break Jaw Contact Bolt

The break jaw contact bolt holds the upper spacer of the main blades for proper contact with the break jaw when the switch is closed (see Fig. 19). The locking nut should be tightened to a value of 10 ft. lbs. with the switch closed. Standard ohmic readings between blade and break jaw should not exceed 60 micro ohms.

5.3 Replacement Procedures

WARNING

The switch must be completely disconnected from all power sources before any replacement procedure is attempted. Failure to do so could result in severe injury or death.

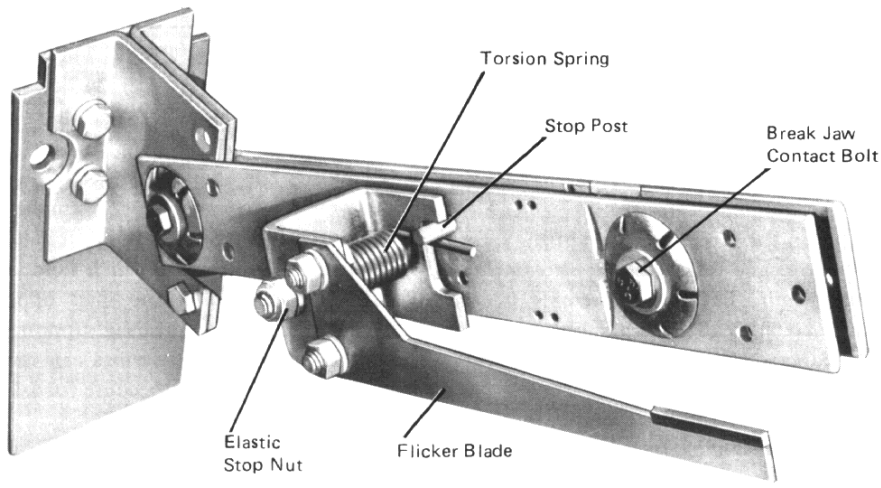

Fig. 19 *Flicker Blade Replacement*

5.3.1 Main Blade, Jaw and Hinge Replacement

Disconnect the drive rod from the main blade assembly by unbolting. Remove the four bolts holding the hinge assembly to the lower terminal pad. The hinge, main blade and flicker blade are now free from the switch. Remove the two bolts holding the jaw to the upper terminal. The jaw is now free. Replace these items. Replace the jaw and finger tighten the two mounting bolts. Mount the hinge on top of the lower terminal pad and install the four bolts finger tight. Tighten the lock nut on the spring washer on the jaw end of the blade. Set the main blade to an open position of approximately 45 degrees. The weight of the blade should let the blade fall slowly open at a constant speed. If the blade fails to fall open, loosen the lock nut on the hinge spring washer until the blade slowly falls open. If the blade falls too fast, tighten the lock nut. Now align the blade per paragraph 5.2.3. Tighten the jaw and hinge mounting bolts.

Align flicker blade and arc chute per paragraph 5.1.3. Recheck alignments. If satisfactory, connect the drive rod to main blade. Check the switch for adjustments per paragraph 5.2.2 and 5.2.5. Perform the pre-operation check (see Section 3.10).

5.3.2 Spring Replacement

The main spring is a large compression spring along the inside of the switch frame on the handle side. (See Fig. 20.) For higher ratings, (15 kV 61 kA fault close) there is an auxiliary spring connected to the other end of the main shaft. To disengage the main spring, remove the switch frame brace (Fig. 13). Take a 5/16-18 threaded rod 4" long and screw it into the rear end of the spring rod. Make a spacer 1-1/2" long from a pipe or tube with a 1" I.D. put this over the 5/16" rod. Take a washer with an O.D. larger than the spacer and place it on the rod. Run a 5/16-18 nut down the rod and center the spacer. Tighten the nut until tension on the pin at the front of the spring rod is released. Remove the retaining rings holding the pin in and remove the pin. The spring assembly is now free from the shaft. To reinstall the assembly, or to re-engage the spring rod, reverse this procedure.

To remove the auxiliary spring, put switch in closed position and remove the retaining rings and pin holding the spring retaining rod to the small arm of the main shaft while the compression spring is in its longest condition. Pull the spring retaining rod away from its rear support. The spring is now free of the rod. To re-install, reverse this procedure.

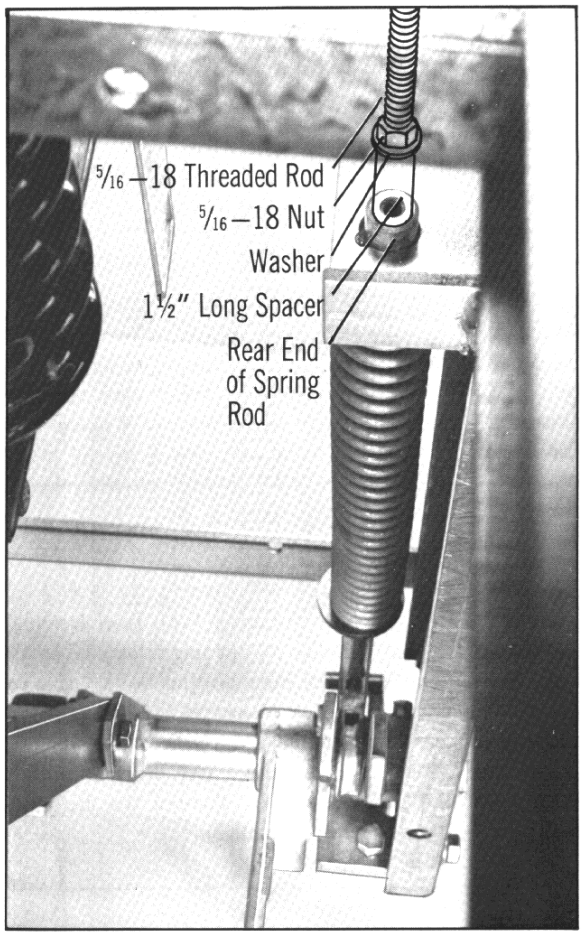

Fig. 20 *Stored Energy Spring Replacement or Adjustment*

5.3.3 Shaft or Bearing Replacement

To replace the shaft bearings, disengage the springs as instructed in paragraph 5.3.2. Remove the drive rods from the switch main shaft ears by unbolting the connection. Remove the four bolts which hold the bearing support plates on the end of the shaft opposite the operating mechanism. Slide the bearing support plates up and away from the shaft. The bearings can now be removed and replaced. Reverse the procedure for assembly.

5.3.4 Preoperation Check

After completing any maintenance, the alignment should be checked. (See Section 5.1.) After completing any alignment, the switch should be operated at least three "close-open" operations to indicate proper performance.

5.4 Insulated Bus Maintenance

5.4.1 Insulated bus sleeving is made from NORYL, a high-performance engineering thermoplastic. NORYL can be irreversibly damaged if it comes in contact with certain chemicals. Such petroleum containing products as solvents, oils, greases and electrical joint compounds are especially harmful. No non-metallic materials, not specifically approved by Westinghouse Engineering, should come in contact with the NORYL. Only specified tapes and fillers should be used when insulating bus bar joints. See Section 3.6.

WARNING

NORYL Insulated Equipment

Electrical joint compounds must not be used on connections or terminations to or from this equipment.

Do not use solvents, oils or greases on or near this equipment.

Water and isopropyl alcohol are the only approved cleaners for this equipment.

5.4.2 Cleaning Procedure

The intent of the cleaning procedure is to remove as much dirt, dust and other foreign material as possible from the insulation with minimum exposure to any solvents. The recommended cleaning procedure is to use a lint-free cloth. In most cases this will be sufficient. For accumulations which cannot be removed by the above procedure, a lint-free cloth, slightly dampened with water, can be used. Allow the apparatus to dry for at least four hours at room temperature before energizing. If a lint-free water-dampened cloth does not produce satisfactory results, use a lint-free cloth dampened with isopropyl alcohol. Dry the same as when using a water-dampened cloth.

CAUTION

Isopropyl alcohol is flammable. Provide adequate ventilation and keep away from flames and other ignition sources. Consult your safety department before using.

5.5 Lubrication

This should be done during switch maintenance (see Section 5.0). In general, the switch requires only moderate lubrication. All excess must be removed with a clean cloth to prevent any accumulation of dust or dirt. Avoid any lubrication on insulation. Care must be taken to prevent any molybdenum lubricant from reaching any current carrying contact surface.

Conductive graphite grease should be applied sparingly to contact surfaces on break jaw and between blade and hinge.

Dow Corning, MOLYKOTE BR2-S grease, a mixture of molybdenum disulfide in grease, should be applied to spring rods at the end pivots.

SECTION 6 – SELECTOR SWITCH

When supplied, a two position no load selector switch is connected in series with a WLI switch. To operate the selector switch, the WLI switch must be in the open position. A mechanical interlock is thus released so that the main WLI switch door can be opened, revealing the selector switch operator.

After inserting the removable handle, pivot the selector switch operator (Fig. 21) to disengage it from the locking bracket, then raise or lower the handle to select the desired position. Pivot the operator again and re-engage it into the locking bracket.

Since the selector switch is a no load switch, speed of operation is not essential for safe operation. However, to insure good contact when changing feeders, move the handle rapidly and forcefully when changing feeder positions.

SECTION 7 – DUPLEX SWITCH ASSEMBLY

When supplied, the duplex arrangement consists of two WLI switches connected by a common load side bus. If fusing is included, it normally consists of only one set of fuses located in one of the switch compartments between the load side bus and outgoing terminals. This arrangement allows the selection of either of two incoming lines.

As standard, this arrangement is supplied with key interlocking for safe operation. Key interlocking normally consists of a lock on each switch to lock the switch in the open position and a lock on each door to lock the main door closed. Each of the locks is keyed alike and only one key should be available to operating personnel. Since the key is retained in its lock when a switch is closed or when a door is opened, two things are assured:

a. Only one switch may be closed at a time to prevent paralleling of incoming lines.

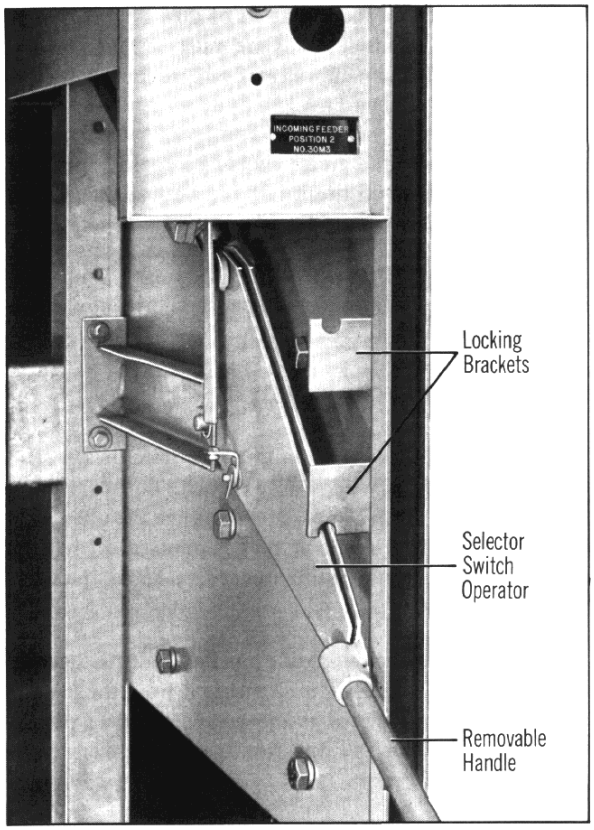

Fig. 21 *Selective Switch Operation*

b. Both switches must be locked in the open position to unlock either main door, preventing access to energized load side bus or fuses.

WARNING

Only one key should be available to operating personnel for this interlock scheme. When shipped from the factory, each lock will have a separate key. All excess keys must be destroyed or otherwise made inaccessible to operating personnel. Failure to do so could result in severe injury or death.

SECTION 8 – MOTOR OPERATION

8.0 Description

The motor operated WLI switch is essentially a standard manually operated switch with the operating shaft extended into a separate low voltage compartment and coupled to a motor driven linear actuator. Because all basic switch parts are identical to those of the standard manually operated switch, sections of this instruction book pertaining to installation, inspection before startup, maintenance, and parts replacement also apply to the motor operated switch.

Standard Ratings:

Operating Voltage	120 Vac, Single Phase
Full Load Current	4 Amps
Spring Charging Time	4-6 Seconds

8.1 Receiving and Startup

For rigidity during transit, WLI switches are always shipped in the closed position. Motor operated units are shipped with the switch closed and the linear actuator decoupled from the shaft. Before the switch door can be opened, the switch must be manually opened as described in Section 8.4. The linear actuator may then be connected to the operating shaft and the switch is ready for electrical operation.

8.2 Electrical Operation

The linear actuator opens the switch in the extended position and closes it in the retracted position. Since the linear actuator drives the spring over-toggle mechanism, the switch blades move at a speed independent of the speed of the linear actuator.

The operating shaft is equipped with a button release decoupling pin located in the motor operator compartment. Removal of this pin allows the motor to be operated (for test purposes) without affecting WLI switch position.

The linear actuator operates at 120 volts as standard and control power is normally supplied by the customer. For a schematic diagram and wiring diagram of the motor operator circuitry, refer to the job drawings.

8.3 Safety Interlocking

8.3.1 The standard interlock scheme consists of a normally open micro switch located on the WLI switch door. When the door is opened, this micro switch opens, interrupting control power to the motor operator circuitry.

8.3.2 An optional scheme consists of a key interlock, located in the motor operator compartment. The key interlock bolt, when extended, not only mechanically locks the WLI switch in the open position, but also breaks electrical motor contacts integral to the key interlock, and

permits the key to be removed. With the key the operator can then open the lock on the main switch door. This scheme prevents closing the switch with the main door open.

WARNING

Only one key should be available to operating personnel for this key interlocking scheme. When shipped from the factory, each lock will have a separate key. All excess keys must be destroyed or otherwise made inaccessible to operating personnel. Failure to do so could result in severe injury or death.

8.4 Manual Operation (See Fig. 22)

A steel clevis pin connects the linear actuator to the motor operated shaft. When this pin is removed, the linear actuator is disconnected from the shaft and can be pivoted to the rear. The switch then can be manually operated with the removable handle provided. Never attempt to operate the linear actuator when it is disconnected from the shaft. Motor operated switches should be operated manually only when absolutely necessary. Since interlocking is sometimes accomplished thru the use of electrical contacts, disconnecting the motor may defeat the interlock schemes.

WARNING

Do not attempt to manually operate a motor operated switch while energized with the switch door open. Doing so could cause severe injury or death.

8.5 Maintenance

The linear actuator itself is completely weathersealed. It and associated bearings are lubricated for their normal life many times in excess of the main switch and requires no maintenance.

SECTION 9 – ELECTROMECHANICAL STORED ENERGY RELEASE (SHUNT TRIP)

9.0 Description

The stored energy release feature of the WLI load interrupter switch allows the operator to manually compress the main operating spring until it snaps over toggle. At this point, the stored energy lever system reacts to restrain further motion, and holds the spring in its compressed state until a signal is given to discharge. The open or close

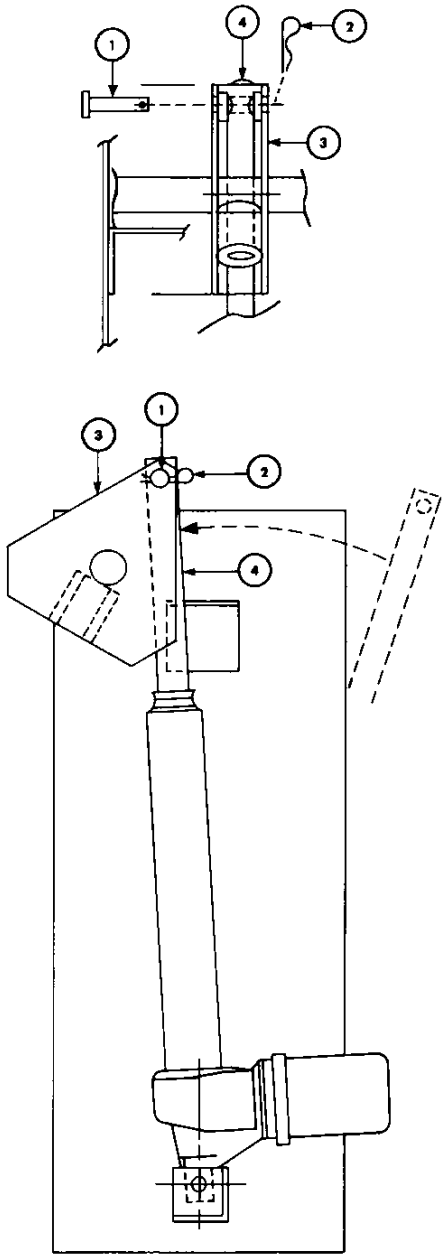

Fig. 22 *Manual Operation*

operation can then be initiated manually by upward pressure on the trigger latch, or electrically by energizing the trigger coil (see Fig. 23 for operating characteristics of trigger coils). When the restraining mechanism is released, the stored energy in the main operating spring is released to rapidly rotate the main shaft to close or open the switch. (See Fig. 24.)

WLI Switch – Stored Energy Trip Coil Operating Data			
Coil Rating	Applied Voltage	Inrush Current	Steady Steam Current
677C903G04 24 VDC	24 VDC RMS 30 VDC RMS 14 VDC RMS	– – – – – – – – –	14.1 A RMS 17.7 A RMS 8.2 A RMS
677C903G05 115 VAC	115 VAC RMS 125 VAC RMS 95 VAC RMS	17.9 A RMS 18.7 A RMS 15.1 A RMS	9.6 A RMS 11.2 A RMS 7.6 A RMS
677C903G06 220 VAC	220 VAC RMS 250 VAC RMS 190 VAC RMS	12.0 A RMS 13.4 A RMS 9.6 A RMS	6.0 A RMS 7.4 A RMS 4.6 A RMS
677C903G01 48 VDC	48 VDC 60 VDC 25 VDC	– – – – – – – – –	5.3 A DC 7.4 A DC 1.7 A DC
677C903G02 125 VDC	125 VDC 140 VDC 70 VDC	– – – – – – – – –	4.2 A DC 4.8 A DC 2.3 A DC
677C903G03 250 VDC	250 VDC 280 VDC 140 VDC	– – – – – – – – –	1.6 A DC 1.3 A DC .89 A DC

Fig. 23 *WLI Switch – Stored Energy Trip Coil Operating Data*

9.1 Operation

9.1.1 Charging the Spring

To initiate the closing action, the handle is inserted into the handle casting, and is rotated upward through an angle of 120 degrees. The handle casting presses against the spring lever (Fig. 25) which then rotates with the handle casting. The spring rod is thus forced to compress the spring until the spring rod is snapped slightly over toggle. At this point the spring is now charged and the handle must be removed and returned to its storage location.

WARNING

Immediately remove the operating handle from switch mechanism after a spring charging operation. Failure to do so and a subsequent tripping operation will cause the handle to rotate rapidly and forcefully. Severe injury could result.

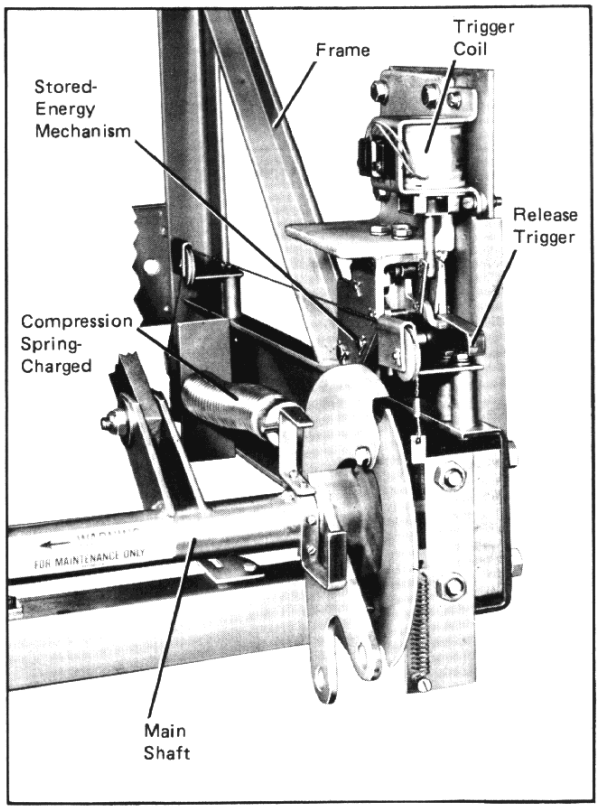

Fig. 24 *Stored Energy Mechanism with Barriers and Mechanism*

The spring rod stops with a clicking sound as the rear teeter bar roller seats against the lip of the trip link. It is held locked in this position by the resulting force vectors of the trip link assembly (see Fig. 26). At the same time, the front roller of the teeter bar presses down on the trigger latch with sufficient pressure to resist trip forces. Consequently, the charged spring is held compressed by the mutually reacting forces of the spring restraint linkage, teeter bar, and trigger latch. The final result as shown in Fig. 26 is a charged spring restrained slightly over toggle by the spring restraint linkage. The switch, in this description, is open.

9.1.2 Closing the Switch

When the trigger latch is forced upward, either manually or by the action of the trigger coil, the front roller of the teeter bar drops over and down the lip of the trigger latch. The rear roller moves up and over the lip of the trip link. This releases the restraining linkages to the spring rod and allows the switch to rapidly close. The final result is a closed switch with the operating spring in an uncharged condition (Fig. 27).

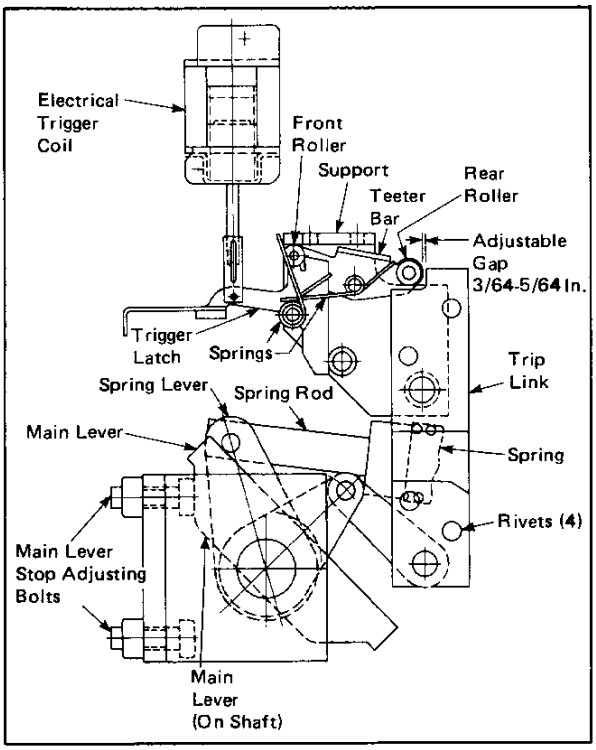

Fig. 25 *Switch Open, Spring Not Charged*

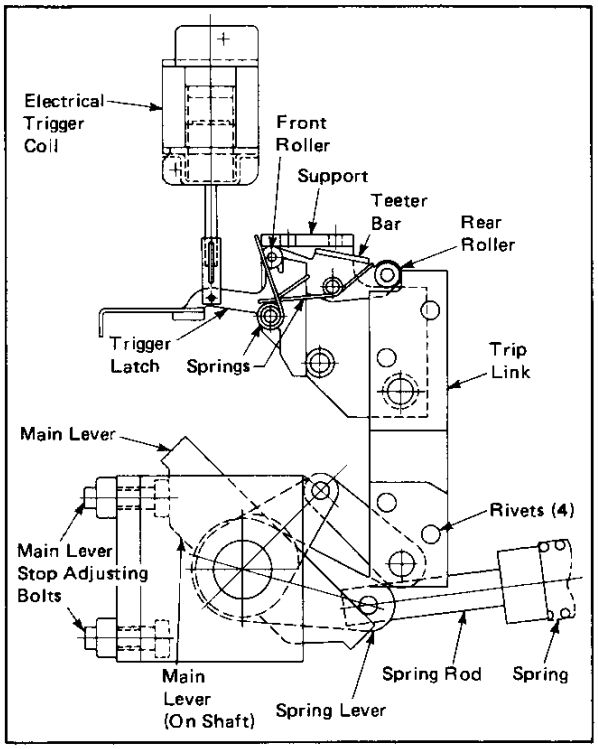

Fig. 26 *Switch Open, Spring Charged*

9.1.3 Opening the Switch

Similar conditions prevail when initiating the opening action. The basic difference is that the handle and handle casting are rotated downward through an angle of 120 degrees. The spring lever and spring rod move upward until the spring rod snaps slightly over toggle and the spring is fully charged. The teeter bar rollers again reset and restrain the spring release linkage similar to that described in Section 9.1.1. (See Fig. 28.) The switch will remain charged until triggered to open by an upward movement of the trip latch, either manually or electrically.

9.2 Door Interlock (Shaft Blocking Cam)

WARNING

No attempt should be made to defeat this interlock while the switch is energized. Severe injury or death could result.

When the enclosure door is opened, a spring biased cam assembly located at the left hand end of the operating

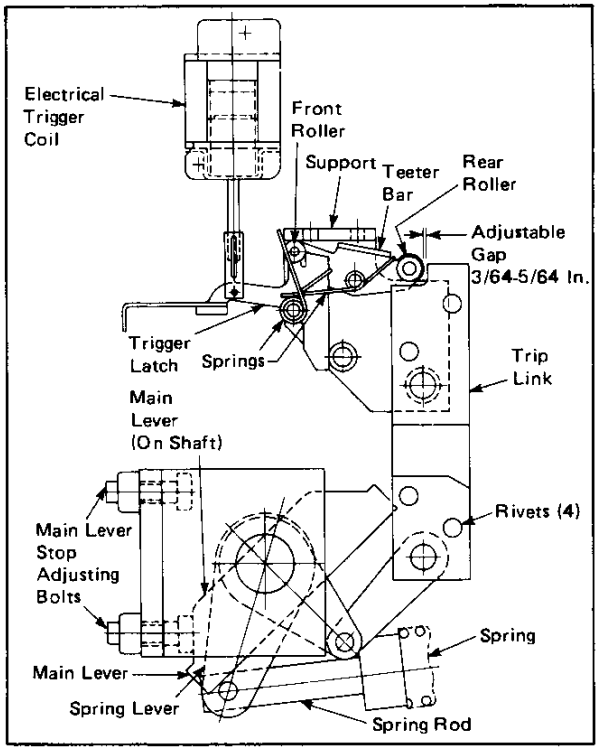

Fig. 27 *Switch Closed, Spring Not Charged*

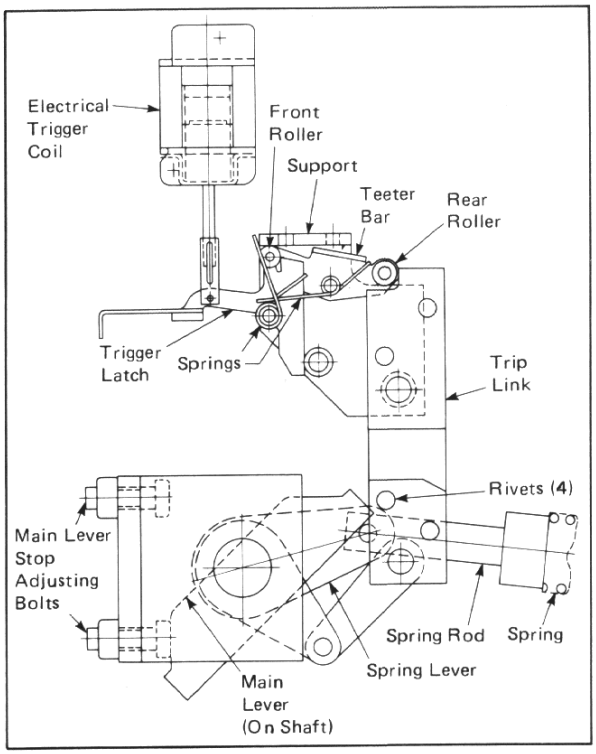

Fig. 28 *Switch Closed, Spring Charged*

shaft moves into position preparatory to blocking inadvertent shaft rotation and consequent switch closing.

The shaft rotation is inhibited by the blocking action between the blocking cam welded to the shaft, and the ramping cam of the spring biased assembly. If the door is open and a trip-to-close action is initiated, a jamming action takes place between the blocking cam and the ramping cam to stop shaft rotation; thus, the switch cannot close (see Fig. 29).

The blocking action must be released by inserting the operational handle into the maintenance hub and slightly rotating to reset the charged main spring again over toggle.

9.3 Inspection and Maintenance

WARNING

The switch must be completely disconnected from all power sources before any inspection or maintenance procedures are attempted. Failure to do so could result in severe injury or death.

9.3.1 Blade and arc chute alignment procedures are the same as for the standard WLI switch described in Section 5. However, before the maintenance hub may be used, the following steps must be taken:

a. Remove the shaft lock assembly by removing its two 3/8" bolts.

b. Close the switch and leave spring in its discharged position. The maintenance hub may now be used for alignment procedures provided the trigger latch is raised during initial rotation of the operating shaft. Failure to release the trigger latch will damage components in the linkage assembly.

WARNING

Following alignment, be sure to replace the shaft lock assembly before energization. Failure to do so could cause severe injury or death.

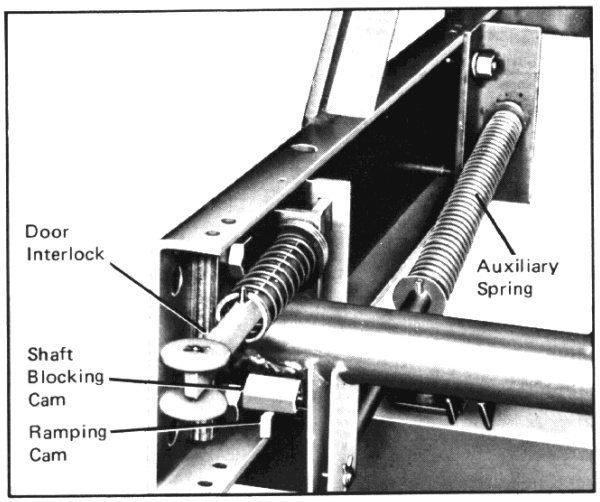

Fig. 29 *Operating Mechanism Showing Door Interlock, Auxiliary Spring, Shaft Blocking Cam and Ramping Cam*

9.3.2 Over Toggle Adjustment

There are two 1/2 inch diameter adjusting bolts on the front of the L-shaped bearing support bracket. This bracket is enclosed by the operating mechanism cover which must be removed before proceeding.

The bottom bolt adjustment affects the distance between the teeter bar roller and the lip of the trip link

(see Fig. 25). Proper operation of the restraining linkage requires 3/64" to 5/64" clearance between the rear teeter bar roller and the lip of the trip link. This adjustment is made with the switch closed and spring uncharged. Proper adjustment requires attention to the main blade alignment, over toggle alignment, and trip linkage alignment.

9.3.3 Open Gap Adjustment

The upper bolt adjustment affects the distance between the rear teeter bar roller and the lip of the trip link as shown in Fig. 27. This distance should be 3/16" to 5/64" for proper operation of the restraining linkage. This adjustment is made with the switch open and spring uncharged. Proper adjustment requires attention to the main blade alignment, over toggle alignment, and trip linkage alignment.

Improper adjustment of the upper or lower bolts can result in the following:

a. The spring operating rod cannot be forced over toggle.

b. The restraining linkage can become inoperative resulting in the switch immediately closing or opening when the charged spring snaps over toggle.

SECTION 10 – RENEWAL PARTS

The following is a list of renewal parts that are most subject to wear and, therefore, recommended for stock. When ordering parts, specify the part name plus switch style number, order number and drawing number found on the nameplate inside the switch access door. Parts differ slightly according to specific switch rating and date of manufacture, therefore, this information is necessary (see Fig. 29).

Example: Quantity 3 Arc Chutes for Switch 4891A51G02
Order Number DT24698
Drawing Number SM803A23A01

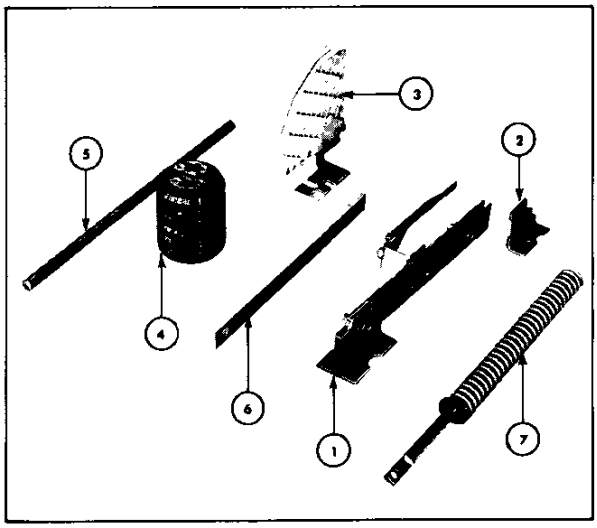

Fig. 30 *Renewal Parts*

Item	Part Description	No. per Switch
1	Main and Flicker Blade Assy (Inc. Hinge)	3
2	Break Jaw	3
3	Arc Chute	3
4	Insulator	6
5	Removable Handle	1
6	Drive Rod Link	3
7	Operating Spring	1
8	Polyester Barrier	4

APPENDIX A

WLI Switchgear
Bolt Tightness for Bus Connections

Use the following torque value for tightening bus joints. Use the widest standard flat washers that are consistent with bolt spacing.

Diameter	Torque in Foot Pounds for Bolt Diameter				
	1/4	5/16	3/8	1/2	5/8
Minimum Torque	3.75	8	16.5	41.25	56.25
Nominal Torque	5	12	22	55	75
Maximum Torque	6.25	15	27.5	68.75	93.75

Westinghouse Electric Corporation
Distribution and Control Business Unit
Construction Equipment Division
Sumter, SC 29150