Instructions for

Horizontal Drawout Fuse and Switch Unit

Type DFS

For Use in Indoor and Outdoor Metal Enclosed Switchgear

Westinghouse Electric Corporation

Assembled Switchgear & Devices Division, East Pittsburgh, Pa.
I.B. 32-251-11A, November 1962. (New Format 3/67)

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Horizontal Drawout Fuse and Switch Unit

GENERAL DESCRIPTION

The .type DFS Fuse and Switch Unit is a three-pole horizontal drawout unit for use in metal enclosed switchgear for the control of 5, 7.5 and 15 KV circuits. Basically, it is a mechanically operated stored energy device, but a model is also available for electrical operation for automatic control or control from a remote location.

The unit contains a three-pole spring operated load break disconnect switch and three power fuses. The switch is capable of interrupting the continuous current of the largest fuse, and the mechanism has sufficient force to close the switch against the interrupting current of the largest fuse. Since the switch is spring operated, its closing and opening speed is entirely independent of the operator.

Overload and short circuit protection is provided for the circuit by the power fuses connected in series with the switch. When a fault occurs, the fuses will operate to clear the circuit.

The switch parts and fuses are supported by glass polyester channels which in turn are mounted on the glass polyester side plates of the unit. The switch mechanism and unit front panel are supported on a welded fabricated steel frame with four wheels for mobility.

In the lower front part of the frame is located the switch operating mechanism. Energy for this device is obtained by manually charging a spring by means of a removable handle inserted in a socket at the front of the unit. The unit may also be supplied with a motor charged spring mechanism for electrical operation. Upon charging the spring, the mechanism is restrained from immediate operation by means of two latches: one to initiate closing the switch and the other to initiate opening the switch. Each latch is operated by a hand pull knob at the front of the unit.

A time delay interlock prevents immediate operation of the second knob after the first knob has been operated. This is to allow sufficient time for the fuse to operate if the switch has been closed on an overloaded circuit.

A switch and spring position indicator is visible through an opening at the lower right of the front panel. This will show whether the spring is charged or discharged and the switch open or closed.

Near the top of the panel are located two "Tee" handles. These lock the drawout unit in the cell, and both must be turned to the horizontal position after the unit is completely levered into the connected position and before the switch is closed.

At the top rear of the drawout unit are located the primary disconnecting contacts. These are clusters of spring loaded contact fingers arranged to engage the stationary contacts of the cell.

Behind the front steel panel of the drawout unit is located an interlock bar, operated by the mechanism. This prevents inserting the unit into the cell or withdrawing the unit when the switch is in the closed position. Also, the switch cannot be closed unless the unit is completely in the connected position or out of the cell.

Three power fuses are located in their clips at the rear of the drawout unit. There may be either type BA, or type BAL current limiting fuses. Complete safety is insured during inspection or replacement of fuses as the unit must be completely withdrawn

from the cell to gain access to the rear of the unit.

RECEIVING, HANDLING AND STORING

Receiving

The Fuse and Switch Unit is completely assembled and given operating tests at the factory, and is then carefully inspected and prepared for shipment. The complete unit is shipped in a single crate.

After the equipment has been unpacked, make a careful inspection of any damage which may have occurred in transit. If the apparatus has been damaged, file a claim immediately with the carrier and notify the nearest Westinghouse Sales Office.

Handling

emove crating and packing carefully. To avoid damage from negligent handling of crow bars or other tools use a nail puller for the uncrating.

The base of the crate may be used as a skid for moving the unit, or it may be lifted with slings under the crate. If the unit is to be lifted with slings, move it while it is still crated. After the Fuse and Switch Unit is unpacked, the best way to move it is by rolling it on its own wheels. If it is necessary to lift it with slings, place them under the frame with sufficient blocking to prevent slipping or tilting of the unit.

Storing

The storing of the Fuse and Switch Unit for any period of time should be in a clean dry place sufficiently warm to prevent moisture condensation.

INSTALLATION

he type DFS Drawout Fuse and Switch Unit is shipped completely assembled, adjusted, and ready for service when placed in its metal-enclosed cell. No change in adjustments should be required, and none should be made unless it is obvious it has been disturbed. However, the unit should receive a visual inspection and operational check to determine that all components are in working order, and to become familiar with its operation, before placing in service.

CAUTION

Severe injury may be sustained if struck by the switch blades, the mechanism castings or the spring parts. Extreme care should be followed when inspecting the moving parts after the main operating spring has been charged. Always hold the spring charging handle firmly during the charging stroke and follow through in a direct motion sweep. NEVER uncharge the spring with the handle, nor allow the handle to remain in the socket after a charging operation.

Before placing the type DFS Switchgear in service, it is advantageous to become familiar with the construction and functions of the various parts of the unit. The following material should be studied carefully before placing the equipment in service. Observe the operation of the drawout unit outside of the metal enclosed cell to better note the action.

After the unit has been removed from the shipping crate, place it in a convenient position where the following sequence of operations may be performed:

1. Visually inspect the unit to ascertain that all insulating surfaces are clean and dry, and that no foreign objects have lodged in the unit. The unit is shipped with the switch in the closed position.

2. Open the switch by first charging the spring. See Operation Nameplate on unit front panel. Place the spring

charging handle, a 3/8 inch diameter solid steel bar about 20 inches long, in its socket. The socket will be at the lower position, visible through the slot in the front panel. Lift the handle all the way upward until the mechanism spring snaps over toggle. The switch and spring position indicator will show "Spring Charged To Open Switch". Move the time delay interlock slide to its extreme left position by rotating the threaded screw counterclockwise when facing the left side of the unit. The time delay is approximately 15 seconds. The right hand knob "Pull To Open" may then be drawn, and the switch will open. The position indicator will then show "Spring Discharged Switch Open".

3. When the switch is open, the open gap between the side auxiliary blade and the edge of the interrupting chamber must be a minimum of four inches for the 5 KV rating and a minimum of six inches for the 7.5 and 15 KV ratings. Also clearances from live parts to ground metal should also be at least equal to this distance.

4. A light film of graphite grease has been applied to the hinge contact surfaces at the bottom of the switch blades and also to the silver contact surfaces of the break jaw. This is intended and should not be disturbed, but other dust or foreign material should be wiped from the switch parts. The insulating mounting channels and side plates should be cleaned of any dust or dirt accumulation.

5. The hinge and break jaw contact pressures have been adjusted at the factory and will be maintained by the spring washers and the conical springs. Although the tie bolts may appear loose when the blades are in the open position, the adjustment should not be altered until the blades have been accurately checked in the closed position.

6. The three power fuse units may be shipped in separate cartons and must be placed in their clips at the rear of the DFS Unit. The silver plated contact surfaces on the fuse clips and the fuse ferrules must be clean.

CAUTION

When type BA boric acid fuses are employed, a discharge filter or condenser MUST BE USED at the bottom of each fuse unit. Also the glass polyester insulating baffles MUST be in place in the stationary metal enclosed cell directly beneath the discharge filters when the drawout unit is in the operating position.

NOTE

When type BAL current limiting power fuses are used, the discharge filter and cell baffles are not employed.

When installing type BA power fuse units, consult the instruction sheet enclosed with each refill for the proper assembly of the refill in the fuse holder. The horizontal restraint yoke beneath the bottom fuse clips on the drawout unit must be located between the lower fuse ferrule and the discharge filter or condenser when placing the fuse in its clips.

7. To close the switch, the spring must be again charged. Place the charging handle in its socket which will now be near the top of the slot. Press down all the way until the operating spring snaps over toggle. The position indicator will then show "Spring Charged To Close Switch". Move the time delay interlock slide to its extreme right position by rotating the threaded screw clockwise when facing the left side of the unit. The left hand knob "Pull To Close" may then be drawn, and the

switch will close. The indicator will then show "Spring Discharged Switch Closed".

8. Open and close the switch several times to become thoroughly familiar with its operation, and to be certain that all parts are functioning properly. The switch operation should be quick and positive in both closing and opening.

Both the main switch blades and the auxiliary blade must be in proper alignment with their stationary counterparts. When the switch is closed, each set of main blades should have its contacts well centered on the silver inserts of the stationary break jaw contacts. If correction is necessary, the adjustment is made for each switch pole by removing the 1/2 inch diameter pin at the rotating shaft end of the insulating pull rod. After loosening the 3/4-10 locknut, the rod end is lengthened or shortened in the casting to correct the switch blade position. The pin is replaced, and secured by cotter pins. Tighten the locknut. The switch should be operated several times, and the adjustment rechecked.

9. The drawout unit is now ready to be moved into its metal enclosed cell. The switch must be in the open position before it can be placed in the connected position in the cell. Position the unit in front of the cell so that the wheels of the truck will ride on the outside of the rails on the cell floor. Center and push the unit into the cell while observing the clearances at the sides. When the truck begins to enter the cell, an extended lever at the top left rear of the truck will automatically release the latch holding the two safety doors closed. The fuse clips at the rear will push back the safety doors as the unit moves in. Continue pushing the unit in until the disconnecting main contacts touch. This will be 1 to 1-1/2 inches before the front panel of the drawout unit becomes flush with the front of the cell.

To complete the travel into the cell, place the "U" shaped reversible levering-in and levering-out handle through the slot at both sides of the unit. Hold the handle so that the words "levering-in" appear to the operator. The handle is pointed downward at approximately 45° and the square bars at the top extreme ends of the handle are hooked under the round pin at each side of the cell. Dropping the handle downward will cause the second set of square bars on the handle to press against the round pins at the sides of the drawout truck. Further downward movement of the handle will move the unit completely into the connected position so that the panel is flush with the front of the cell.

IMPORTANT

Turn the two "Tee" handles outward to horizontal position to lock the unit in the cell.

10. To close the switch, follow the procedure previously outlined in paragraph 7. (See procedure nameplate on the panel.) The operating spring may be left in the discharged position, or may be charged so that the switch may be ready for an opening operation.

11. To open the switch, follow the steps previously outlined in paragraph 2.

12. To withdraw the unit from the cell, the switch MUST be in the open position. Turn the two "Tee" handles to the vertical position. Place the "U" shaped reversible levering-in and levering-out handle through the slots at both sides of the unit. Hold the handle so that the words "levering-out" appear to the operator. The handle is pointed upward at approximately 45°, and the lower square bars on the extreme ends of the

handle are hooked over the round pin on the sides of the drawout truck. Lifting the handle will cause the upper set of square bars to press against the round pins on the sides of the cell, and move the unit out. When the disconnecting contacts have been separated, the unit may be withdrawn by pulling on the two "Tee" handles.

As the unit is withdrawn, the two safety doors will automatically follow closed and latched. If it is desired, a padlock may be placed through the two pusher loops at the bottom corners of the doors to prevent a unit being placed in the cell of a circuit that has been taken out of service.

ADJUSTMENT AND MAINTENANCE

Mechanism

The mechanism of the unit is adjusted at the factory and is designed to give long trouble-free performance. Do not make any adjustment unless faulty operation is observed.

The latch for the close operation and the latch for the open operation are a fixed part of the main operating shaft. The adjustment is determined by fixed limits of the shaft rotation established by the opening stops, and closing stop. The depth of the stops have been set at the factory, and should not require any adjusting. The stops have been set to allow from 1/32 to 1/16 inch clearance between the roller and latch surfaces when the spring is in the 'uncocked' positions.

Load-Break Switch

The contact pressures at the break jaw and the hinge of the main blades of the switch have been adjusted at the factory, and should not be changed throughout the life of the switch. However, if the main blades have been removed for any reason, they are readjusted as follows: The "acorn" hex nut at the hinge side of the blade is turned to "finger tight" position and then tightened by a wrench an additional "4-flats" and on to the nearest cotter pin location. Replace and spread the cotter pin.

With the switch in the closed position the silver contacts on the moving blades should be centered on the stationary contacts. This adjustment was described under paragraph 8 of Installation.

The conical compression springs supplying contact pressure above and below the break jaw should be compressed to a 1/2 inch height. Care must be taken not to exceed this setting. Always replace the cotter pin.

The hex nut on the pivot bolt of the auxiliary blade must be tight enough to prevent side play of the blade assembly, but must not distort the main blades nor cause binding of the auxiliary blade.

If the switch has been closed against high fault currents, the contacts may show burned spots or become roughened. A fine flat file should be used lightly on the contact silver inserts and on the auxiliary blade contact edge. Remove only enough to take off the high spots. Under normal usage the "wiping" action of the contacts is all that is necessary to keep them clean. It is recommended that the switch be opened and closed and wiped off occasionally to remove excessive dirt accumulation. A very light film of graphite grease (Westinghouse No. 8831-9) should be applied to the moving contact surfaces of the main blades.

"De-ion" Arc Chamber

With ordinary usage and relatively small currents, the interrupting chambers should require no maintenance other than an occasional inspection. The normal life of the

chamber is 25 operations at 1200 amperes for that rating or 100 operations at 600 amperes for the standard 600 ampere interrupter switch. When the current interrupted is smaller, the life is proportionally longer. If at inspection, there appears to be considerable wear the complete chamber should be replaced.

The best criteria to judge replacement of the arc chute and auxiliary blades, can be observed by the erosion of the auxiliary blade tip itself. When the top original square corners have been eroded to a point of approximately 1/4" to 3/8" radius, the arc chute and auxiliary blade assembly should be renewed.

The auxiliary blade should also be replaced when the tungsten alloy tip has worn to approximately one-half of its original thickness or 1/16 inch. Also if any pieces are broken from the insert, the blade should be replaced.

When the arc chamber or auxiliary blade is replaced, the pull rod should be disconnected from the mechanism as previously described. This will allow the individual pole to be slowly closed by hand to a point where it can definitely be determined that all switch parts are in proper alignment and that the auxiliary blade enters the interrupting chamber and contacts properly. Excessive friction due to misalignment will retard quick opening action and may cause failure. After it is found that the pole units operate freely, the pull rod is reconnected to the mechanism by replacing the 1/2 inch diameter pin and the cotter pins.

Lubrication

In general, lubricants are not in wide spread use on equipment of this type. For most of the operating parts, lubricants can be avoided. In a few places, the use of a special lubricant is desirable - provided it is done carefully. This means applying it in very small quantities to avoid drippings and accumulations. Care should be taken to avoid any lubricant on the glass polyester insulating parts.

Since it is not expected that the Fuse and Switch unit will have many operations per year, most of the moving parts will perform best with the surfaces clean, and only a very light film of lubrication. After a long period of service with few operations, an accumulation of dried or oxidized lubricant may make it necessary to disassemble the parts and clean them. Carbon tetrachloride is a good solvent for this, but care should be exercised to use it only in well ventilated areas.

The needle bearings on each end of the rotating shaft casting should receive a very light application of graphite grease Westinghouse No. 8831-9.

A few drops of a good grade of machine oil should be applied to the moving surfaces on the rounded part of the rotating shaft casting and the "spring" and "handle castings".

The rollers and pins on the mechanism latch assembly should receive a very small quantity of a molybdenum lubricant Westinghouse Material No. 8577-2. Care should be taken that this material is not applied to any current carrying surfaces.

Insulation

The flame retardant, track resistant glass-mat polyester insulating materials are used for supports and barriers. This material has a long established record for insulation and mechanical dependability.

Insulation maintenance consists primarily in keeping the surfaces of the material clean. This can be done by wiping the surfaces with cloths free of grease or

metallic particles each time the unit is removed from the cell for inspection.

Overvoltage tests have been made on this equipment before shipment as follows:

5 Kv Rating	19 Kv - 60 cycle for 1 minute
7.5 & 15 Kv Rating	36 Kv - 60 cycle for 1 minute

This voltage is applied between phases and between insulated parts to ground. During servicing periods the unit can be tested at 75% of the factory level indicated above. The apparatus should take this test without breakdown for a period of one minute.

MOTOR OPERATING MECHANISM

Description

The motor driven spring charging mechanism is an addition to the basic manually operated drawout unit previously described. Minor modifications to the welded truck and to one of the several mechanism castings are required when this device is included in the unit. The drive motor, speed reducer, auxiliary and limit switches, and linkages are located in the lower part of the drawout truck. Two four-point disconnecting contacts complete the low voltage control circuits to the stationary cell.

As in the manually charged unit, the switch mechanism is restrained from immediate operation after spring charging by two latches. The first to control the closing of the switch and the second for the opening of the switch. To provide remote operation, these latches are released by individual coils. The two pull knobs are retained at the front of the panel for manual operation.

The units are available in a complete range of standard control voltages from 32 through 250 volts A-C or D-C.

Operation

When control power is supplied to the unit, and the spring is discharged, the motor will run to immediately charge the spring for the next operation, whether it be to open or to close the switch. Upon completion of the spring charging cycle, a limit switch de-energizes the motor.

Two four-stage auxiliary switches are linked to the main switch operating shaft casting. Four stages control the direction of rotation of the drive motor depending whether the spring is being charged for switch opening or closing. Two stages are employed as cut-off contacts for the close and trip coils, while the remaining two stages are connected for remote indication of the switch position.

5 KV UNIT

The motor driven speed reducer is coupled to the basic switch operating mechanism by a chain and sprocket drive. This gives a 3 to 1 speed reduction in addition to the 100 to 1 ratio of the single stage speed reducer.

An electric clutch located between the drive motor and the speed reducer eliminates any effect of motor coasting upon mechanism adjustment. The clutch coil is connected across the motor armature for immediate de-energization upon the operation of the limit switch.

Refer to the Schematic Diagrams. When the control power is from an A-C Source, Fig. 2A applies while Fig. 2B covers the D-C control. The only difference being the addition of a full wave rectifier in the clutch coil circuit for A-C control.

It will be noted from the diagrams that both limit switches, LS-1 and LS-2, are indicated as having normally closed contacts (NC). When the operating spring is completely charged, the sprocket casting

moves against the operating arm of the appropriate limit switch thus opening that circuit to the motor.

When the main switch blades are open, the auxiliary switch "b" contacts will be closed; and the motor shaft will rotate in a counterclockwise (CCW) direction as viewed from the front of the drawout unit. At the end of the spring charging cycle, limit switch LS-1 will open. A third "b" contact in series with the close coil (CC) completes the circuit, and will de-energize the coil upon closing the main switch.

When the main switch is closed, auxiliary switch "b" contacts open and the "a" contacts close reversing the connections to the motor armature. In this position the motor shaft will rotate in a clockwise direction to charge the spring for switch opening. At the end of the charging cycle, a pin on the sprocket casting moves the arm of limit switch LS-2 to de-energize the motor circuit. A third "a" contact in series with the trip coil (TC) will cut off the current after the main switch opens.

EMERGENCY MANUAL OPERATION (5 KV)

In the event of control power failure, the unit may be manually operated. The spring charging procedure of the electrically operated unit differs from that of the manual type previously described in the first pages of this instruction book.

The position of the switch and the operating spring will be shown on the indicator visible through an opening at the lower right of the front panel. If the spring is charged, it will only be necessary to pull the appropriate knob to operate the switch.

To Charge Spring for Switch Closing

Place the hand crank on the square shaft visible through the opening in the lower center of the front panel. Turn the crank counterclockwise (CCW) until the operating spring snaps over toggle. This will require approximately 65 turns. Continue an additional 12 turns in a counterclockwise direction. REMOVE THE CRANK. The main switch is closed by pulling the "Pull to Close" knob. It may be necessary to operate the time delay slide by means of the threaded shaft before the knob can be pulled.

To Charge Spring for Switch Opening

This is similar to that described for switch closing with the exception that the crank must be rotated in a clockwise (CW) direction. Continue an additional 12 turns in a clockwise direction after the operating spring snaps over toggle. REMOVE THE CRANK.

ADJUSTMENT AND MAINTENANCE (5 KV)

The mechanism is completely adjusted and lubricated at the factory and under normal circumstances, no adjustment in the field should be necessary. It is strongly recommended that the factory adjustments not be tampered with unless need for re-adjustment occurs.

Limit Switches

The cutoff points of the two limit switches, LS-1 and LS-2, are adjusted by bending the phosphor-bronze operating arms of the switches. These are sensitive and should be bent only a very small amount at a time. Finger pressure or a pair of long-nose pliers is all that is required; and the arm must be supported to prevent twisting or damage to the switch pivots.

The correct cutoff point is determined by the clearance between the sprocket casting and the stop bracket. This should be 1/8 to 1/16 inch as shown in Fig. 1. When the spring is charged to close the switch, this clearance will be measured from the bottom of the rear leg of the stop. With

the spring charged to open the switch, the clearance is measured at the bottom front of the stop.

Electric Clutch

No maintenance is required as the clutch plate is self-adjusting for wear. However, if the motor has been removed for any reason, the two parts of the clutch must be aligned. With the clutch field de-energized and its plate moved toward the gear box, there should be 3/32 inch clearance between the clutch rotor/field assembly and the clutch plate. The plate must be free to slide over to the field when it is energized.

Drive Motor and Speed Reducer

The bearings in these items are lubricated for life, and under normal conditions will not require re-lubrication. The bronze outboard bearing on the output shaft of the speed reducer may receive a drop of light machine oil. An occasional drop of light oil on the links of the chain will be of benefit, but care must be exercised to prevent an excessive amount of oil as it will oxidize and collect dirt.

The chain tension is adjusted by means of shims under the speed reducer. The outboard bearing and drive motor must be adjusted accordingly to maintain alignment.

15 KV

The motor driven spring charging mechanism employed in the 15 KV drawout unit differs slightly from the 5 KV unit previously described. The chain and sprocket drive connecting the speed reducer to the mechanism castings is replaced by a modified Geneva gear drive. An arm and roller assembly keyed to the output shaft of the speed reducer engages the forked handle casting on the switch mechanism shaft and rotates it 90°. This charges the main operating spring in the same manner as the manual charging handle covered on pages 3 and 4.

As soon as the operating spring is discharged and control power is available, the motor mechanism will operate to recharge the spring for the next switch operation.

Schematic Diagram, Fig. 3, is applicable for either A-C or D-C operation. The main limit switches, LS-1 and LS-2 are connected with normally closed contacts (NC), while the auxiliary limit switches, LS-1A and LS-2A, have normally open contacts (NO).

When the main switch blades are open, the auxiliary switch "b" contacts are closed. The motor shaft driving the speed reducer will rotate in a clockwise direction as viewed from the right hand side of the drawout unit. The arm and roller assembly on the output shaft rotates in the same direction. This will charge the operating spring for switch closing, by the same action as the manual spring charging handle inserted into its socket and pressed downward. At the end of this spring charging cycle, the fork of the handle casting moves against the arm of the top rear limit switch LS-1 causing it to open its contact.

However, just before the roller moves out of the forked casting, a lobe on the hub of the arm assembly closes the bottom front auxiliary limit switch LS-1A. As the two limit switches are connected in parallel, the motor will continue to run for a short time after the spring is charged. This is to insure that the roller is clear of the fork so as not to impede any future manual operation on loss of control power.

A third "b" contact in series with the close coil will de-energize the coil upon closing the main switch.

As the main switch closes, the auxiliary switch "b" contacts open and the "a" contacts close reversing the connections to the

motor armature. In this position, the motor shaft will rotate in a counterclockwise direction to charge the spring for switch opening. At the end of the charging cycle, the top front limit switch LS-2 will be opened by the front of the handle casting. However, the lobe on the hub of the arm assembly will have closed the bottom rear auxiliary limit switch LS-2A to continue motor operation until the roller is clear of the fork.

EMERGENCY MANUAL OPERATION (15 KV)

In the event of control power failure, the 15 KV drawout unit may be manually operated as described on pages 3 and 4 of this instruction book. The motor mechanism is automatically disengaged from the switch mechanism at the end of each operation, and requires no additional procedure for manual operation.

ADJUSTMENT AND MAINTENANCE (15 KV)

Limit Switches

The limit switches LS-1 and LS-2 must be adjusted to open their contacts when the main operating spring is fully charged in each of its two positions. This is done by carefully bending the phosphor-bronze operating arm of the switch.

The auxiliary limit switches LS-1A and LS-2A should be similarly adjusted to continue motor operation until the roller has cleared the forked casting. The overtravel is not critical, but should be held between 20° and 45°. Also the auxiliary limit switches should close their contacts before the main limit switch contacts open to eliminate any pause in the control power to the motor.

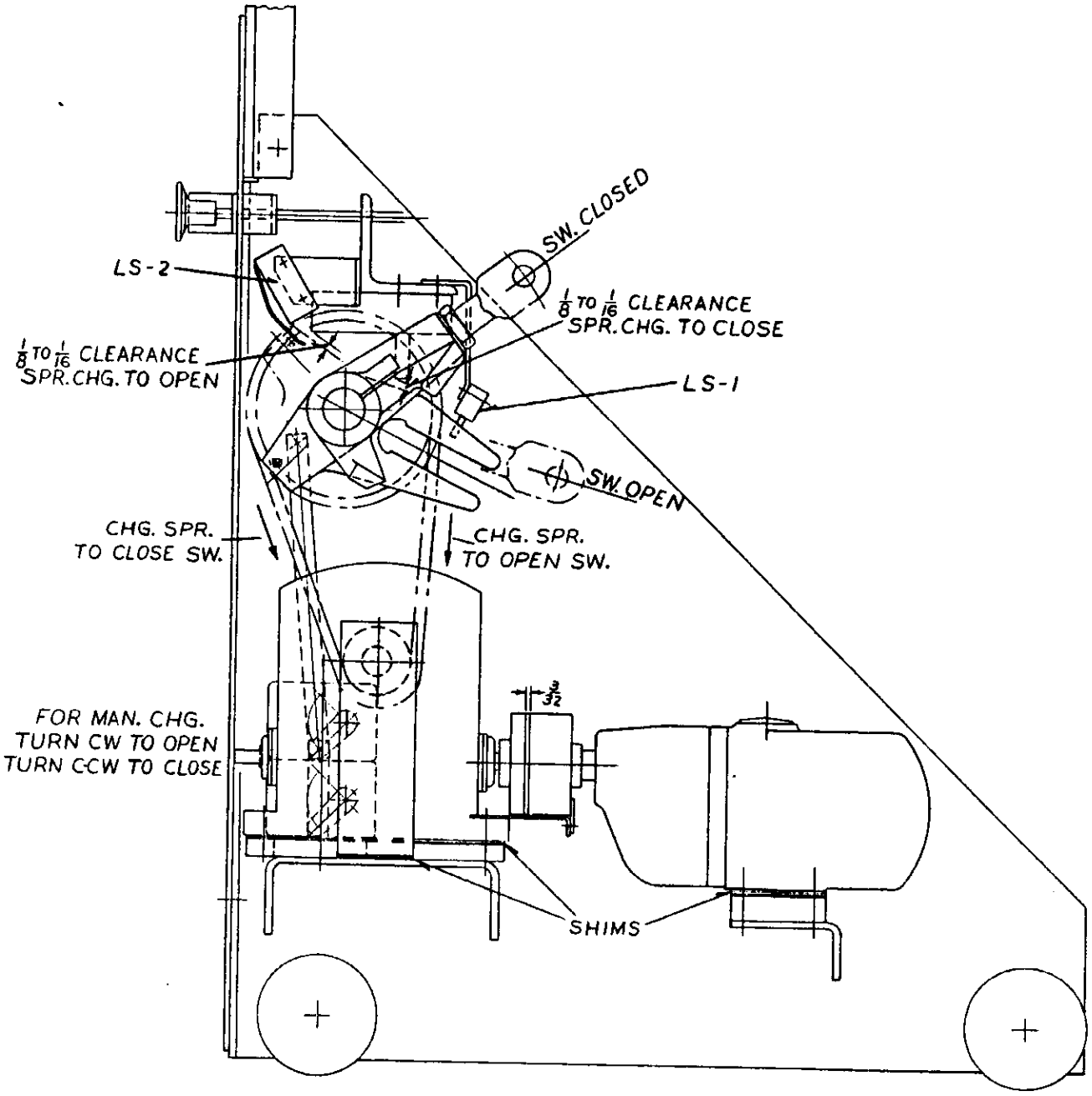
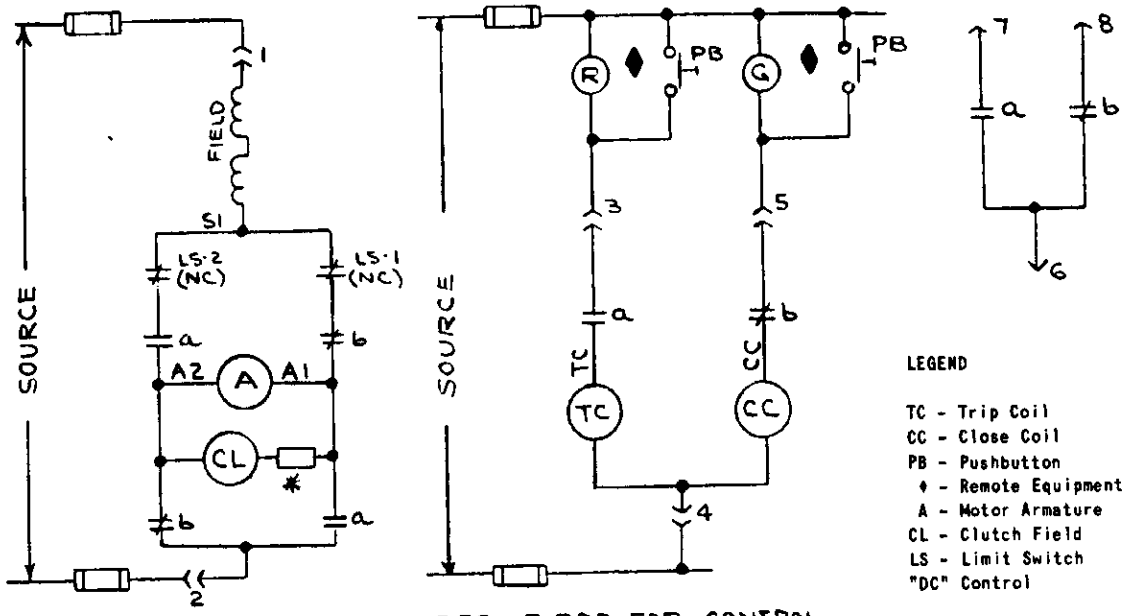

SW. CLOSED
LS-2
1/8 TO 1/16 CLEARANCE
SPR. CHG. TO CLOSE
1/8 TO 1/16 CLEARANCE
SPR. CHG. TO OPEN
LS-1
SW. OPEN
CHG. SPR.
TO CLOSE SW.
CHG. SPR.
TO OPEN SW.
3/32
FOR MAN. CHG.
TURN CW TO OPEN
TURN CCW TO CLOSE
SHIMS

FIGURE 1

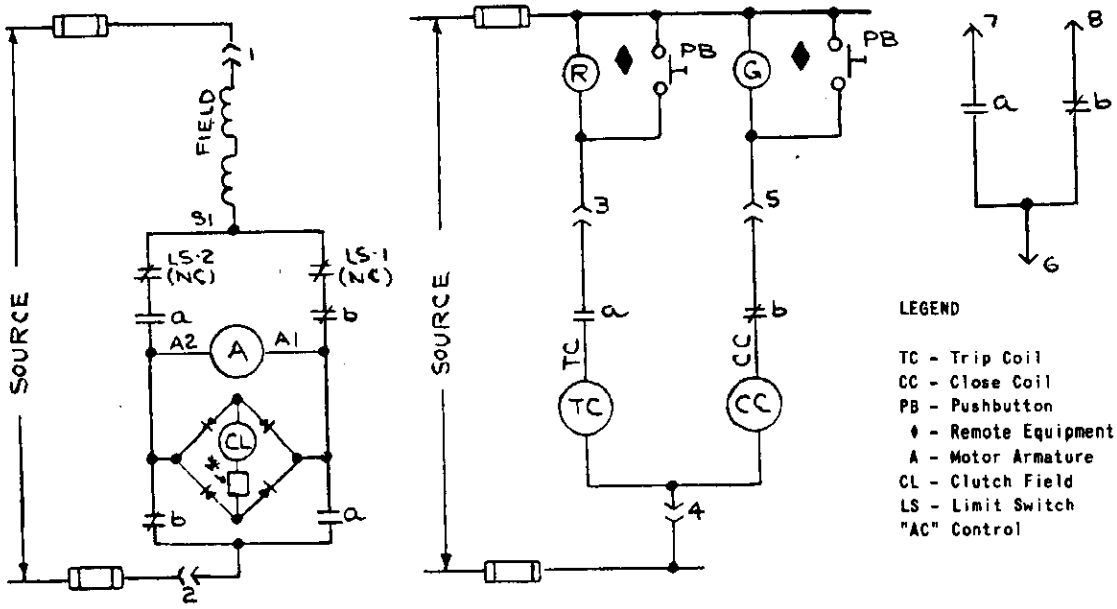
SKV HORIZONTAL DRAWOUT TYPE "DFS" MOTOR OPERATED SPRING CHARGING DEVICE - CONTROL POWER FROM DC SOURCE



*- RES. IF RQD. FOR CONTROL VOLTAGE

Figure 2B

SKV HORIZONTAL DRAWOUT TYPE "DFS" MOTOR OPERATED SPRING CHARGING DEVICE - CONTROL POWER FROM AC SOURCE



*- RES. IF RQD. FOR CONTROL VOLTAGE

Figure 2A

FIGURE 2

15kV HORIZONTAL DRAWOUT TYPE "DFS" MOTOR OPERATED SPRING CHARGING DEVICE - AC or DC control Power Source

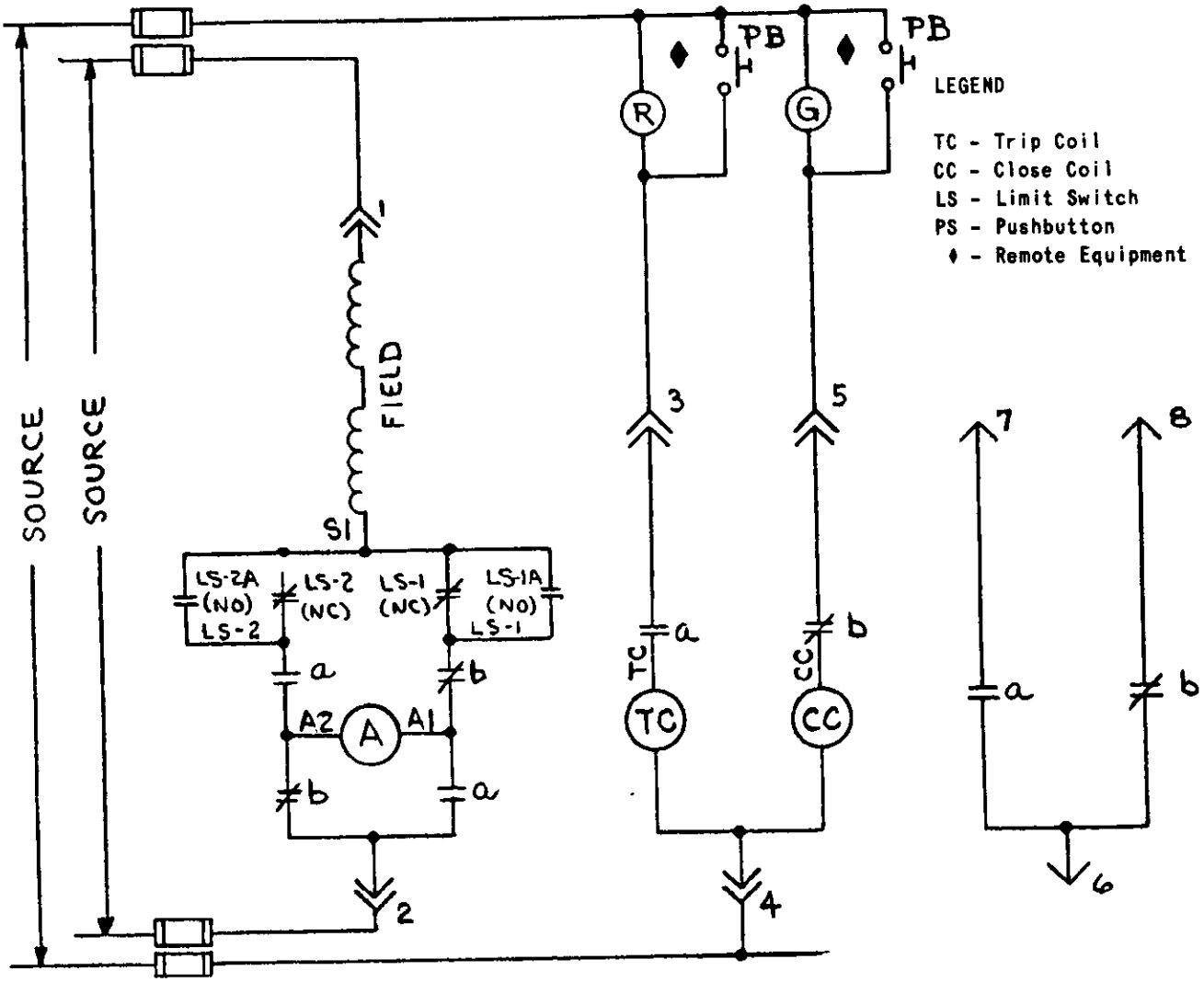


FIGURE 3