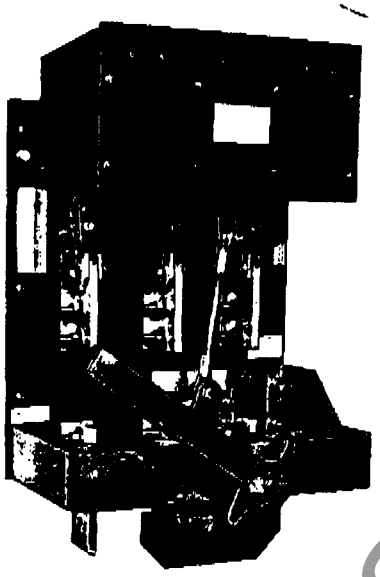
BOLT-LOC® Switches
Manual Front Operating Mechanism



CAUTION:
Before attempting any service work be sure switch is completely de-energized.

DESCRIPTION

BOLT-LOC switches provide the most reliable method for making a high current connection by using the bolted bus bar technique. The BOLT-LOC switch does this with all the convenience of a conventional safety switch with the use of the exclusive Kinematic Action. This exclusive Square D feature assures anti-tease operation by moving the switch blades at high speeds in both opening and closing of the switch, regardless of the speed with which the operating handle is moved.

The BOLT-LOC switch has successfully passed the Underwriters' Laboratories requirements as outlined in UL Subject 977: Requirements for Fused Power Circuit Devices. BOLT-LOC switches are UL Listed through 4,000 amperes on circuits capable of delivering 100KA @ 240V AC or 200KA @ 480/600V AC RMS symmetrical amperes.

BOLT LOC switches are available in the open style or in NEMA 1, 3R, or 12 enclosures. The enclosures are designed for cable entry in the top and out the bottom although "special" enclosures can be engineered upon request. The 800 thru 4000 ampere sizes are free standing.

MAINTENANCE
Lubrication Instructions

The BOLT-LOC Switch as received from the factory, has been properly lubricated. Periodic cleaning and lubrication of the switch will be required, and the maintenance interval between lubrications will be dependent upon the amount of usage, ambient conditions, etc. The maximum recommended maintenance intervals should not exceed one year.

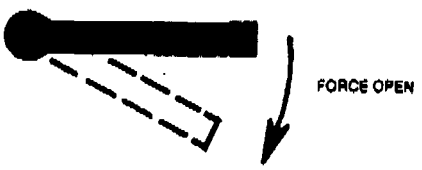
When performed, the contact area on the line side terminals and between the switch blades should be thoroughly cleaned with CRC type CO contact cleaner #02016 (or equivalent) and wiped clean with a dry cloth. Apply a thin coating of Alvania #2 grease, Shell part #71012 (or equivalent) to the cleaned surfaces.

The operating mechanism should be periodically exercised to ensure operation. This period should not exceed one year.

Lubrication of the mechanism should be performed using Molybdenum Disulfide Grease.

Five years is the maximum interval between lubrications of the mechanism. Adverse ambient conditions may require more frequent maintenance.

NOTE:
The manual front operated mechanisms are equipped with a force-open feature which puts positive control between the operating handle and the moveable blades when the switch is in the open position. To activate, it is only necessary to rotate the operating handle clockwise approximately 30° below the horizontal center line.



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The Blade Stud is directly driven by a lever from the Operating Arm and Crossbar so it rotates counter-clockwise to close and clockwise to open.

The Crossbar, Operating Arm, Lever, Blade Stud, Cam Locking Arm and Stop Pin are used to transmit the force from the operating mechanism to the blades in the proper sequence so the blades close, the bolted pressure contacts tighten up and the reverse action opens the switch.

The Crossbar is bolted directly to the Operating Arm (fig. 1). The Operating Arm is held to the Blades by the Operating Arm Pin. The Cam Locking Arm pivots about the Cam Locking Arm Pin and a Torsion Spring keeps it in the proper position. As the switch closes, the operator force is transmitted directly to the Crossbar, then to the Operating Arm. The Operating Arm is prevented from pivoting by the Cam Locking Arm so the blade pivots closed on the hinge end Blade stud.

When the blades are within approximately 5 degrees of being fully closed, the Cam Locking Arm hits the clip support pad which causes the Cam Locking Arm to pivot about the Cam Locking Arm Pin and release the Operating Arm. The Operating Arm is then free to pivot about the Operating Arm Pin. The Levers then rotate the clip and hinge Blade Studs completing the bolted pressure contact action.

The Operating Arm pivots first on opening, releasing the bolted pressure contact. When the Operating Arm pivots sufficiently to hit the Stop Pin, the blades open as the operator force is then transmitted directly to the blades causing them to pivot on the hinge end Blade Stud.

The Cam Locking Arm Pin (fig. 1) also serves as a blade spreader to keep the internal contact spring from squeezing the blades together and hitting on the stationary arc tip on closing.

OPERATOR

The BOLT-LOC Operator consists of a Manual, Reversing, Trip Free, Over Center Spring Drive System mechanism. The mechanism is built into a support frame which is bolted to the switch base. When properly installed the switch mounting channels are at ground potential so the operating mechanism and operator handle are also at ground potential.

The operating mechanism is divided into two mechanical functions. The front part is the direct manual drive part, and the rear section is the spring drive part which is independent of the Operator Handle.

The direct manual drive part is made up of a Drive Shaft Assembly, Front Cam Plate, Spring Guide Plate, Spring Guide Shaft, Compression Spring and Spring Guide Pivot (fig. 2). The Operator Handle is connected directly to the Drive Shaft Assembly.

When the Operator Handle is rotated counter-clockwise from the open to closed positions the Drive Shaft Assembly rotates and the Front Cam Plate rotates at the same time (direct connection). As the Front Cam Plate rotates it forces the Spring Guide Plate to rotate on the Drive Shaft Assembly (bearing connection). When the Spring Guide Plate rotates, it forces the Compression Springs to compress on the Spring Guide Shaft as it approaches the dead center position. Between 3 degrees and 12 degrees over center, the Compression Springs fire and the Spring Guide Plate rotates independent of the Operating Handle.

The reverse action takes place when the Operator Handle is rotated clockwise from the closed to open positions.

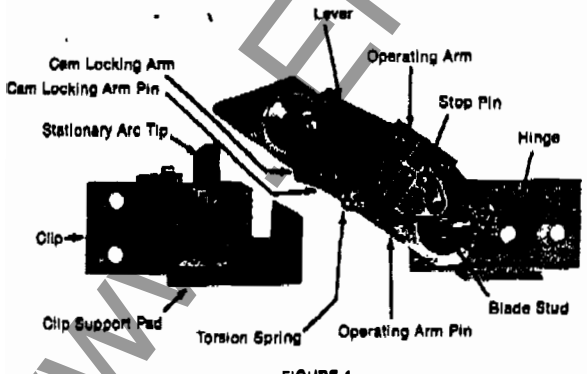

FIGURE 1

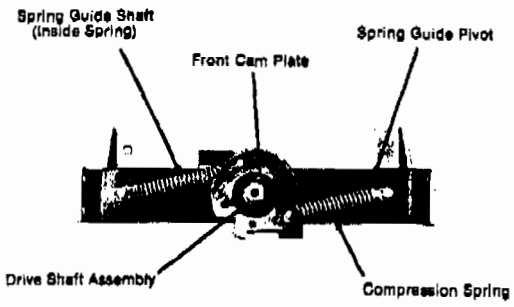

FIGURE 2

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The Operator Handle is effectively disconnected from the Spring Drive System (trip free), from the time the springs fire and the switch opens or closes until the Operator Handle is rotated in the opposite direction.

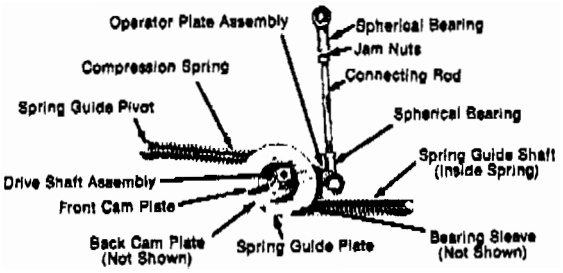

FIGURE 3

The Spring Drive section is made up of the Drive Shaft Assembly, Front Cam Plate, Spring Guide Plate, Spring Guide Shaft, Compression Spring, Spring Guide Pivot, Back Cam Plate, Operator Plate Assembly, Spherical Bearings and Connecting Rod (fig. 3).

When the Compression Spring Fires (3 degrees to 12 degrees over center) the spring force is transmitted from the Spring Guide Plate to the Back Cam Plate by means of the Bearing Sleeve. (The bearing sleeve rotates on the Drive Shaft Assembly-Bearing Connection). The Back Cam Plate then drives the Operator Plate Assembly by means of pins similar to the Front Cam Plate-Spring Guide Plate operation. The Operator Plate Assembly then rotates on its own bearings (supported on the Bearing Sleeve and Drive Shaft Assembly) and transmits its rotation to a direct thrust on the Cross Bar by means of the Spherical Bearings and Connecting Rod. Welded stops on the support frame stop the travel of the Operator Plate Assembly in both the open and closed positions.

The reverse action takes place when the operator handle is rotated in the opposite position.

There is one short interval of Operator Handle Rotation when the entire operator is directly connected from the Operator Handle to the Cross Bar. This short interval is the rotation from just before dead center until just after dead center. During this short interval the blades start to lift on an opening operation and the Bolted Pressure action starts to unbolt. This short interval of direct connection varies from switch to switch and between switch sizes.

A proper closing or opening operation consists of a fast steady rotation of the Operator Handle. Obviously as the size of the switches increases, the operating effort on the Operator Handle increases.

The design of the switchboard should allow for good leverage on the larger size switches.

ADJUSTMENT
Adjustment Procedure

Every BOLT-LOC Switch goes through a routine test procedure before leaving the factory. The design is such that only two places of adjustment are built into the switch:

1—The adjustable nut on the blade assembly (Figure 4).
2—The connecting rod on the operator (Figure 3).

All of the other parts are made to sufficient tolerance or factory assembled so as not to require adjustment.

Open Gap Adjustment

The switch should be put in the open position with the operator plate assembly (Fig. 3) against the welded stop on the rear support frame. The connecting rod has left hand and right hand threads. The open gap is set by loosening the two jam nuts on the connecting rod and turning the rod to obtain the correct open gap. CAUTION — Check the open gap on each pole as there may be a slight variation between phases. Retighten the jam nuts, then close and open the switch. Recheck the open gap.

Open Gap Measurements

IMPORTANT: The minimum dimensions must be maintained. (See Figure 5)

Switch	Open Gap Min.	Max.
800-2500 Amperes	2⅜"	2¾"
3000 Amperes	2⅝"	2⅞"
4000 Amperes	2¼"	2½"

CONTACT PRESSURE ADJUSTMENT: (see Figure 5 for pictorial definitions)

Close the switch and remove the locking screws and locking plates from all adjustable nuts (6 on a 3 pole device). (See Figure 4)

Rotate the adjustable nuts counterclockwise (ccw) to snug up the blades to the clip and hinge terminals.

Tighten each adjustable nut equally to a point which is finger tight plus approximately 5 degrees. Reinstall the locking plates and screws. CAUTION — See Figure 5 for correct placement of lock washer.

Open and close the switch several times. When properly adjusted, the switch should open and close with a crisp sound and the blades should be fully seated against the terminal pads. Sluggishness indicates the adjustable nuts are too tight and should be loosened slightly.

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If the adjustable nuts are too loose, the blades will bounce when the switch is closed. This can be determined by observing the relationship between the blades and terminal mounting pads when the switch is in the closed position. A gap will be visible between the bottom of the blade and the mounting pad if the bouncing occurs. Readjust if necessary.

IMPORTANT: The open gap and contact pressure adjustments must be made together as they are inter-related.

The correct adjustment of the clip and hinge end adjustable nuts can also be determined by measuring the contact resistance in Micro-Ohms. The correct measurements for each amperage size are as follows:

Resistance Testing — Use Biddle Ductor. (See Figure 5)

Switch	Resistance
800 Amp.	13 Micro-Ohms Max.
1200 Amp.	13 Micro-Ohms Max.
1600 Amp.	11 Micro-Ohms Max.
2000 Amp.	8 Micro-Ohms Max.
2500 Amp.	7 Micro-Ohms Max.
3000 Amp.	6 Micro-Ohms Max.
4000 Amp.	7 Micro-Ohms Max.

Current Tests leads must be on extreme ends of terminals and jaw connection with potential leads approximately one inch from current test lead connection. NOTE: All resistance tests must be on the 0 to 100 micro-ohm scale and with 100 Amps. DC. flowing through the pole unit.

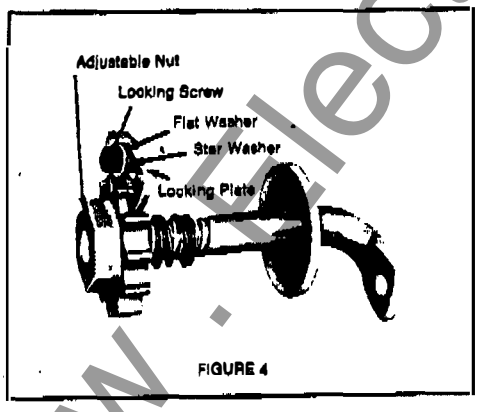

FIGURE 4

Fuse Terminal—Hinge—Blade—Clip Alignment

Although factory aligned and tested, the fuse terminal, hinge, blade and clip alignment is one of the most critical and most misunderstood relations of the BOLT-LOC Switch.

The clips and hinges must be parallel in both directions for proper bolted pressure contact, arc tip and operating mechanism operation. A left to right or right to left distortion of the hinge is magnified by the blades and can cause incomplete closing and excessive heating. A front to back twist of the clip is magnified by the stationary arc tip and can cause incomplete closing, excessive heating and improper current transfer from arc tip to clip on closing or opening with the resulting burning and pitting.

The fuse terminal must also be parallel in both directions as well as the fuse itself. A distorted fuse or fuse terminal can twist the hinge with the results noted above.

Standard production fuse terminals are parallel in both directions within 1/32" or less.

The most common field trouble with BOLT-LOC Switches is distorted clips and hinge/fuse terminals. Improperly fit bus work, excessive cable weight and distorted fuses are the usual causes.

Bus work should be bolted to the switch terminals first, clamped with bus supports and then assembled away from the switch. When bus work is connected to the switch last in the assembly sequence, any mis-alignment is then forced against the switch terminals resulting in distortion of the terminals.

NOTE:
The switch terminals are not intended as cable supports and the weight of several cables per phase can distort the switch terminals. All cable connection adapters should be individually supported to prevent twisting of clips or fuse terminals.

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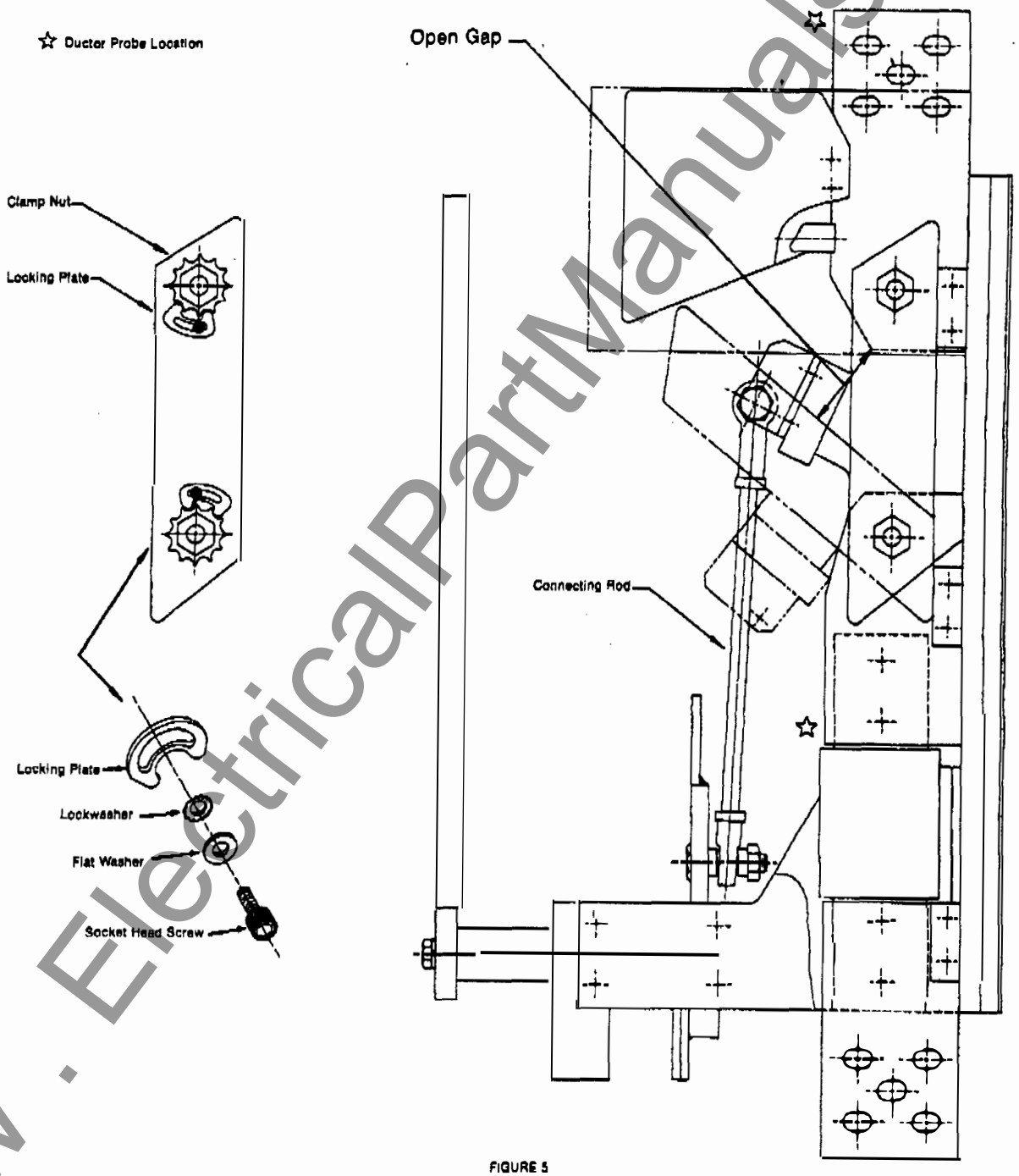

FIGURE 5

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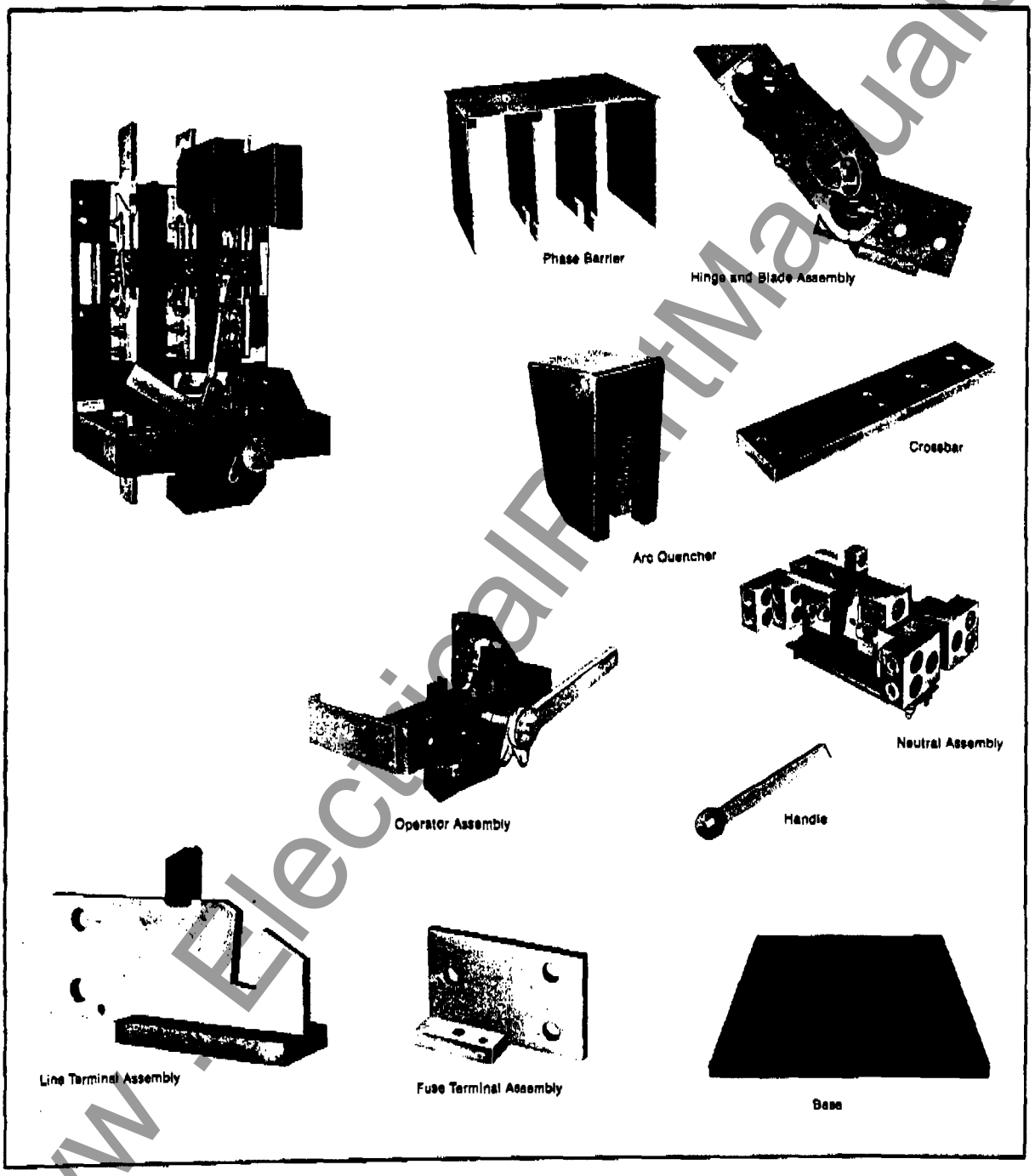

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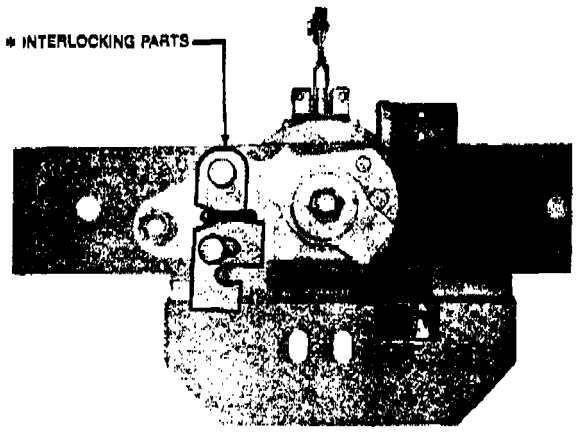

* These parts are the interlocking parts that are used on the manual BOLT-LOC switch when ordered as an inverted switch. These parts are required to insure positive switch latching when the switch is inverted and should be inspected and lubricated periodically in accordance with the lubrication instructions on page 1 of this bulletin.

PARTS LIST

Description	Manufacturing Number	
	Inverted	Upright
Operating Mechanism Assembly— 800 A.	44004-219-50	44004-214-50
1200 A.	44004-319-50	44004-318-50
1600 A.	44004-220-50	44004-215-50
2000 A.	44004-221-50	44004-216-50
2500 A.	44004-423-50	44004-422-50
3000 A.	44004-222-50	44004-217-50
4000 A.	N/A	44004-501-50
Operating Handle— 800-1600 A.	44001-064-50	44001-064-50
2000-2500 A.	44001-064-51	44001-064-51
3000-4000 A.	44001-064-52	44001-064-52
Position Indicator Nameplate— 800-1600 A.	44001-938-01	44001-331-01
2000-3000 A.	44001-701-01	44001-331-01
4000 A.	N/A	44001-331-50
Door Interlock Assembly	44001-320-50	44001-320-50

ORDERING INSTRUCTIONS

When ordering replacement parts, provide part description and nameplate data of the switch for which parts are required. The nameplate is located on the base of the switch.