

MAINTENANCE INSTRUCTION

MOTOR FIELD CURRENT REVERSING SWITCH

INTRODUCTION

Only skilled personnel familiar with electrical equipment and the hazards involved should be permitted to service the switch. All safety precautions should be observed.

Minimum maintenance is required to keep the switch in serviceable condition. Moving mechanical parts should be free from excess friction. Parts should also be checked for excessive wear. The bearing surfaces of the switch are designed to operate without lubrication. Do not oil or grease at any time.

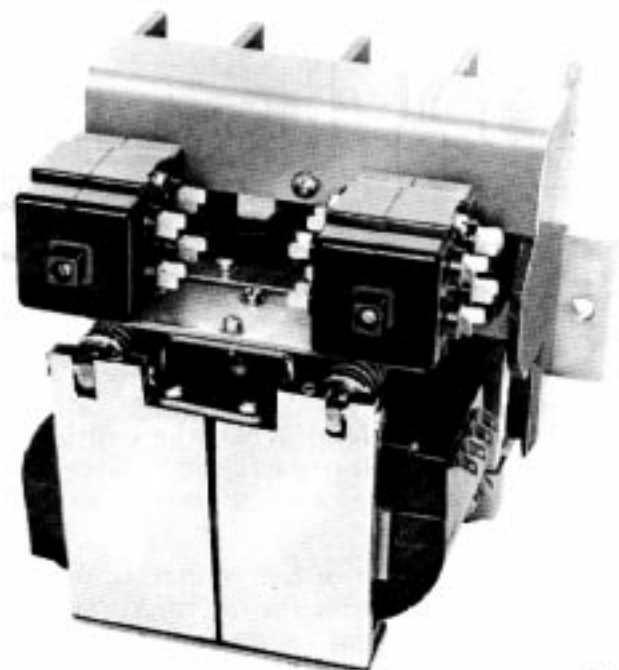
Contact tips are normally oxidized and smoked from regular service. Other switch parts should not show effects of high temperature operation.

The switch should be kept clean, connections must be tight, and should be inspected and serviced at intervals as specified in the applicable Scheduled Maintenance Program.

DESCRIPTION

The motor field current reversing switch, Fig. 1, is a dual two-pole (two independent two-pole power circuits), single throw device. This non-interrupting switch is rated at 500 amps continuous and is insulated for 1500 volts DC.

The switch, Fig. 2, is a clapper-type containing two magnetic coils, either of which impels a corresponding movable contact assembly by pivoting a hinged metal plate or armature. Each armature is connected to a movable contact assembly by operating levers. The movable contact assembly shifts to mate with a set of stationary contacts. The switch has two, three, or four normally open main contacts and two



24850

Fig.1 - Motor Field Current Reversing Switch

interlock switches (one for each two-pole circuit) connected to the operating lever. Each interlock has four circuits.

OPERATION

When either magnetic coil is energized, a magnetic field is propagated, drawing the corresponding armature in against the tension of the return springs. The armature pushes the armature levers which are fixed to the movable contact assembly. After the movable contacts have mated with the fixed contacts and completed a circuit, the motion of the levers continues to provide a wiping action between the fixed contacts and the movable contacts. One end of the movable contact is fixed while the

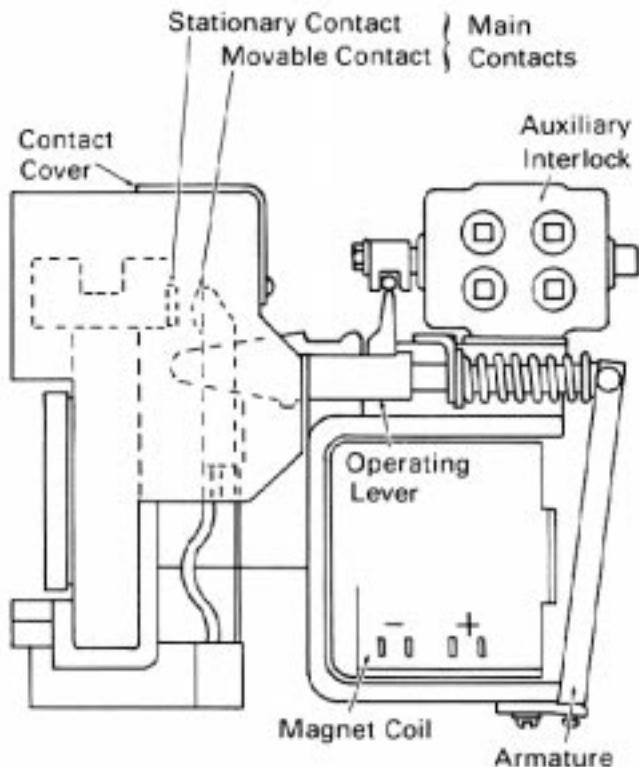


Fig.2 - Switch Assembly

contacting end is free. When the coil is de-energized, the movable contact assembly is returned to the open position by a return spring.

An interlock operator or arm is attached to each operating lever to drive the interlock switches. These switches are used for making and breaking various locomotive circuits.

SAFETY PRECAUTIONS

WARNING

The contactor was designed for specific application to set up various circuits where circuits and devices are enclosed in suitably protective cabinets. Care has been taken in the design of the equipment to provide adequately for the safety of operating and service personnel, provided reasonable care and caution are exercised in the performance of operating and service functions.

The following safety considerations should always be carefully observed in the application, operation, or servicing of the equipment.

1. **ELECTRICAL RATINGS** of the equipment are values that should be considered to be **EXTREMELY DANGEROUS** to personnel.
2. **EQUIPMENT SHOULD ALWAYS BE COMPLETELY DE-ENERGIZED BEFORE HANDLING OR PERFORMING ANY SERVICE OPERATIONS.** De-energizing the operating coil is not sufficient to render the equipment safe; the power lines must also be disconnected or otherwise de-energized. If power lines are not de-energized, all parts of the device should be considered to be at the maximum system voltage.
3. **IF INSPECTION OF ENERGIZED EQUIPMENT IS NECESSARY, DO NOT TOUCH OR HANDLE ANY PARTS. DO NOT STAND IN FRONT OF THE EQUIPMENT OR AT CLOSE RANGE TO PERFORM VISUAL INSPECTIONS.**
4. Operating temperatures for the switch are high. **SERIOUS BURNS CAN RESULT FROM HANDLING THE EQUIPMENT AFTER IT HAS BEEN IN SERVICE AND BEFORE IT HAS BEEN ALLOWED TO COOL.**

SWITCH INSPECTION

1. Remove dust and dirt with a brush or air hose.
2. Check molded parts for burns, breaks, and cracks.
3. Check for free movement of all moving parts. Moving mechanical parts should be free from excess friction.
4. Check continuity of all leads.
5. Check for loose or damaged terminals. Electrical connections must be kept tight to prevent overheating at the terminals.

MAIN CONTACTS

The main contact tips should be free of foreign matter, but need not be smooth. Contact tips should not be cleaned, dressed, or filed. The contacts will operate satisfactorily even though blackened, pitted, or eroded. A discolored contact tip with a surface as rough as coarse sandpaper is quite satisfactory and provides an excellent electrical connection.

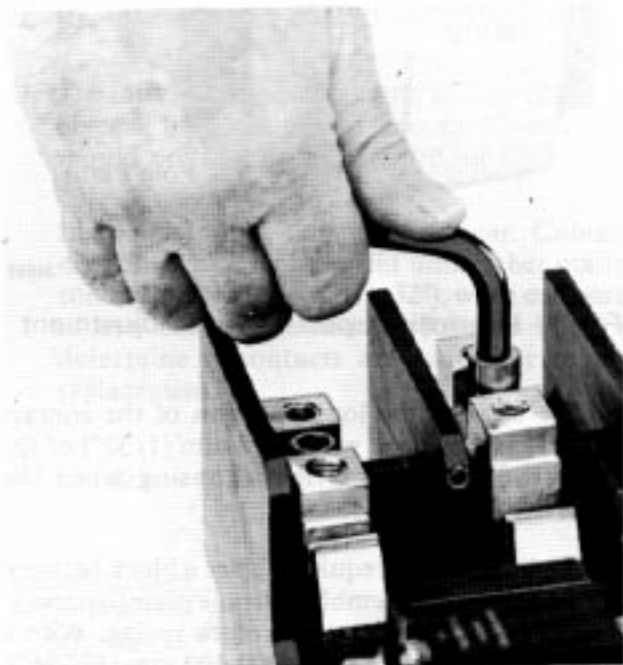
Overtravel is provided at the contact support to compensate for allowable contact tip wear.

INSPECTION

1. Remove contact cover mounting screw, and remove contact cover, Fig. 2.
2. Check contact tip surfaces for wear. The stationary contact tip is 3.18 mm (1/8") thick when new. The movable contact tip, which is slightly curved, is 3.18 mm (1/8") at its thickest part and 2.38 mm (3/32") at its thinnest part. Maximum allowable wear is 1.59 mm (1/16") per contact tip pair. If the stationary or movable contact tips are badly burned or worn beyond the allowable limit, then all contacts should be replaced with new contacts.

STATIONARY CONTACT RENEWAL

1. With contact cover removed, remove hex socket head cap screw, Fig. 3, and lockwasher from top of stationary contact. Lift out stationary contact.



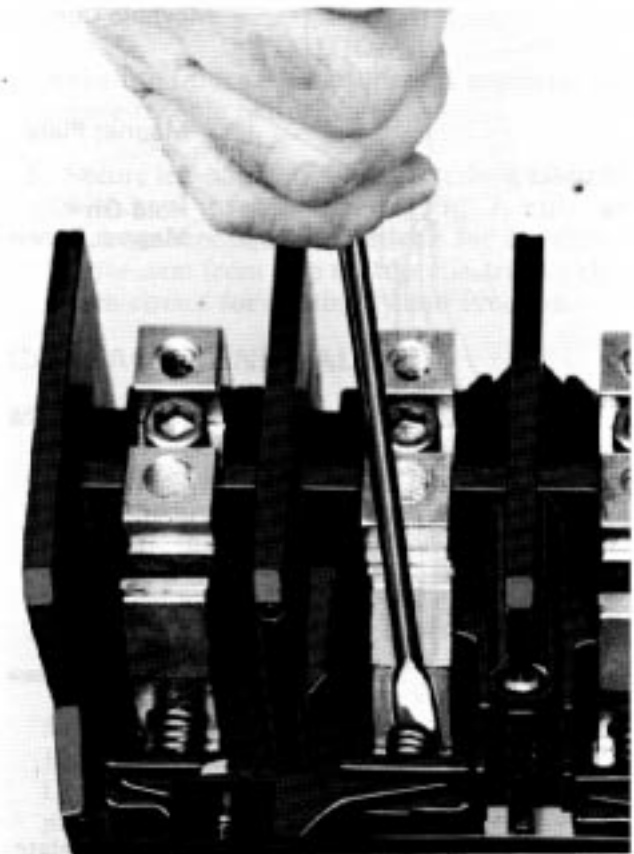
22203

Fig.3 - Stationary Contact Renewal

2. Place new stationary contact into position and install hex socket head cap screw and lockwasher. Do not tighten screw at this time.
3. Ensure that stationary contact is properly seated and aligned with the movable contact, then tighten hex socket head cap screw securely.

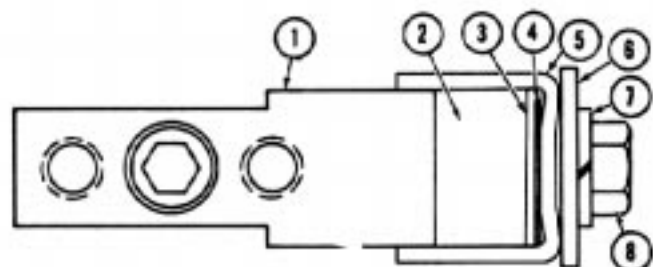
MOVABLE CONTACT RENEWAL

1. Compress and remove movable contact spring, Fig. 4, from between the movable contact assembly and the operating lever.
2. Remove cap screw (8), Fig. 5, lockwasher (7), and plain washer (6) holding the movable contact assembly (2) to lower contact block (1).



22204

Fig.4 - Removing Movable Contact Spring



10853

- | | |
|------------------------|-----------------|
| 1. Lower Contact Block | 5. U-Clamp |
| 2. Movable Contact | 6. Plain Washer |
| 3. Contact Strip | 7. Lockwasher |
| 4. Flat Spring | 8. Cap Screw |

Fig.5 - Movable Contact Mounting Components (Bottom View)

3. Remove U-clamp (5) from lower contact block. A screwdriver may be used to pry U-clamp loose from block.
4. Remove movable contact assembly, Fig. 6, from out of the bottom of the contactor.

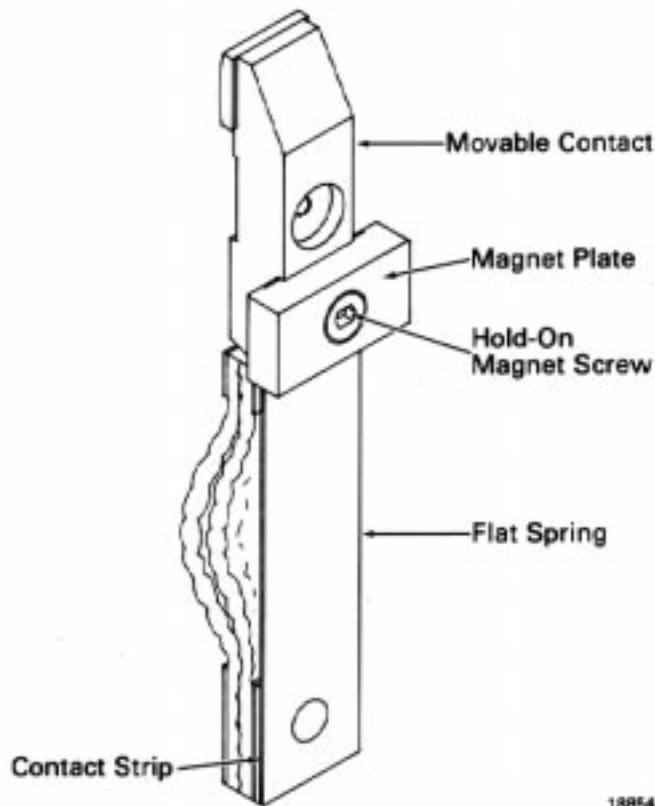


Fig.6 - Movable Contact Assembly

5. Remove hold-on magnet screw, magnet plate, and flat spring from worn movable contact and install a new contact.
6. Install new movable contact assembly through bottom of contactor. Apply contact strip (3), Fig. 5, and U-clamp (5) ensuring that all components are installed in proper order. Install plain washer (6), lockwasher (7), and cap screw (8), but do not tighten.
7. Tighten cap screw while holding the top of the movable contact in alignment with the stationary contact so that it does not rub against any other part after final tightening.
8. Insert movable contact spring, Fig. 4, between movable contact assembly and operating lever.

AUXILIARY INTERLOCK ASSEMBLY

INSPECTION AND ADJUSTMENTS

Check the following conditions of the interlock assembly and make adjustments if required.

1. Top of contact carrier assembly, Fig. 7, should be within 0.8 mm (1/32") of top of interlock housing when device is de-energized.

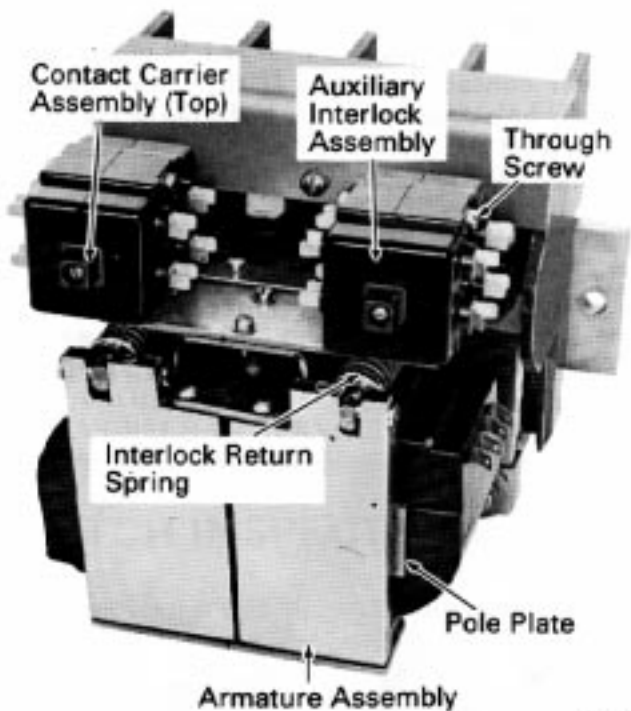


Fig.7 - Interlock Inspection And Adjustment

2. The step on the lower portion of the contact carrier should be within 0.8 mm (1/32") of the bottom of the interlock housing when the device is energized.
3. If adjustment is required, place a block between the armature assembly and pole plate to prevent damage to the interlock return spring. With a large adjustable wrench 300-400 mm (12"-16"), bend the operating lever in front of the interlock spring cups, one side at a time. In making the adjustment, overbend and then bend back slightly to the desired position, relieving the internal stresses in the lever.

CONTACT INSPECTION

Auxiliary interlock contacts may be inspected without removing the interlock assembly from the contactor. To inspect contacts proceed as follows:

1. Separate interlock housing halves by removing two through screws, Fig. 7, nuts, and lockwashers. Carefully remove left-hand housing, Fig. 8.

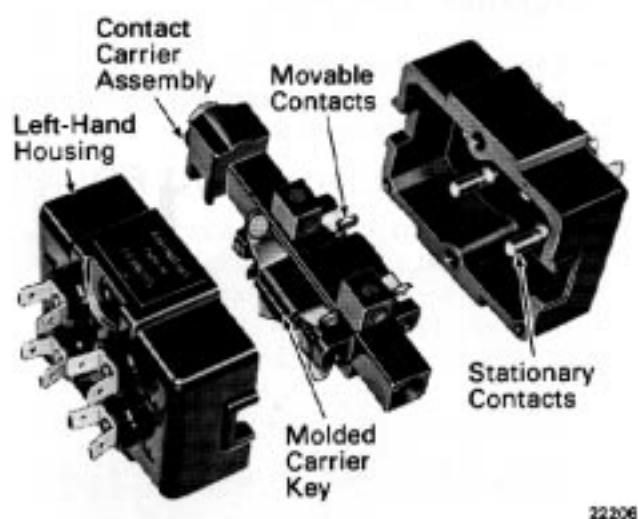


Fig.8 - Auxiliary Interlock Contact Inspection

2. Remove interlock contact carrier assembly.
3. The interlock contacts should be free of foreign objects, but need not be smooth. Contact tips should not be cleaned, dressed, or filed.

Inspect interlock contacts for wear. Contacts do not require replacement until either mating contact is worn 0.79 mm (1/32"), when compared to new contact dimensions. Refer to Fig. 9 to determine if contacts are usable or require replacement.

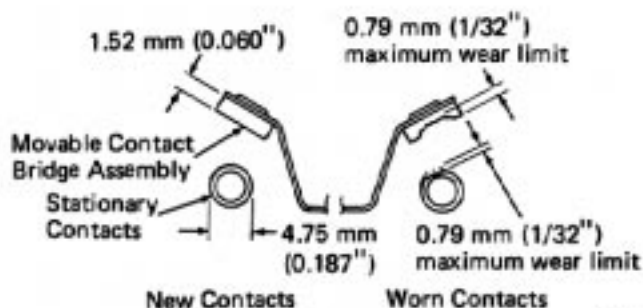


Fig.9 - Interlock Contact Wear Limits

NOTE

If the movable contacts are worn beyond the maximum wear limit shown in Fig. 9, the contact bridges should be renewed. Refer to Contact Renewal section.

If the stationary contacts are loose, defective, or worn beyond the maximum limit, the auxiliary interlock assembly should be renewed. Refer to Assembly Renewal section.

4. Reinstall contact carrier, Fig. 8, into right-hand interlock housing. Ensure that cylindrically-shaped molded carrier key faces the left-hand (A-B, E-F, or J-K, L-M) housing. A molded button in the right-hand housing will prevent improper assembly.

CAUTION

Absolute internal cleanliness is essential to ensure reliable performance.

5. Secure left-hand housing to interlock assembly, with two through screws, Fig. 7, nuts, and lockwashers. Check interlock for freedom of movement from stop to stop. Electrically check each circuit for continuity and function.

CONTACT RENEWAL

MOVABLE CONTACTS

1. Separate interlock housing halves by removing two through screws, Fig. 7, nuts, and lockwashers. Carefully remove left-hand housing half, Fig. 8.
2. Remove interlock contact carrier assembly.

NOTE

All parts of the interlock contact carrier, Fig. 10, are retained by the single center screw. Disassemble carrier in an area where small parts will not be lost if dropped.

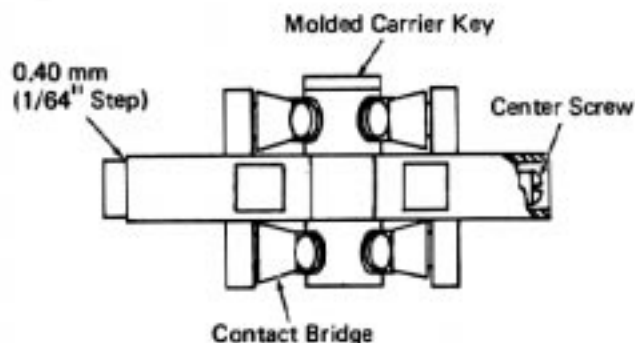


Fig.10 - Auxiliary Interlock Contact Carrier Assembly

3. Hold contact carrier assembly in palm of hand and carefully loosen center screw only until top, center, and bottom elements of the contact carrier can be separated sufficiently to remove one of the movable contact bridges.

CAUTION

Each contact bridge must be positioned properly and not inverted since this could cause switch malfunction. Refer to Fig. 11 for correct position of contact bridges.

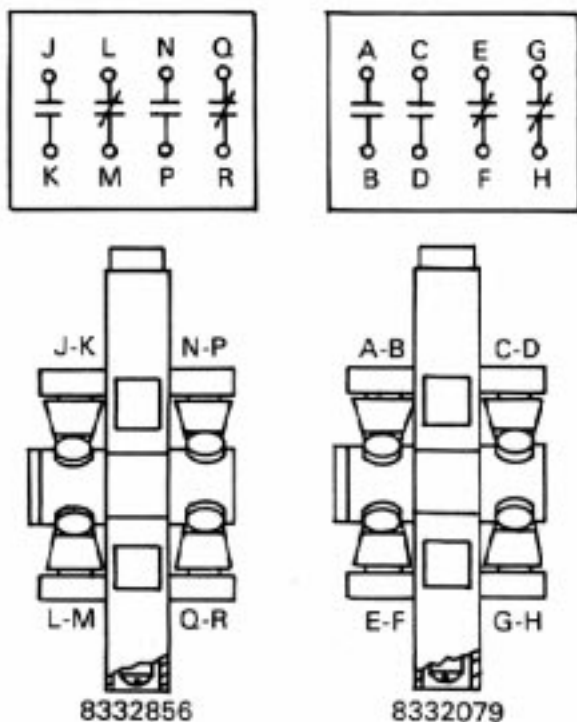


Fig.11 - Auxiliary Interlock Contact Arrangement

24853

4. Remove and replace worn movable contact bridges one at a time.
5. Install contact carrier into right-hand housing, Fig. 8, ensuring that cylindrically-shaped molded carrier key faces the left-hand (A-B, E-F, or J-K, L-M) housing. A molded button in the right-hand housing will prevent improper assembly.

CAUTION

Absolute cleanliness is essential to ensure reliable performance.

6. Secure left-hand housing to interlock assembly, with two through screws, Fig. 7, nuts, and lockwashers. Check interlock for freedom of movement from stop to stop. Electrically check each circuit for continuity and function.

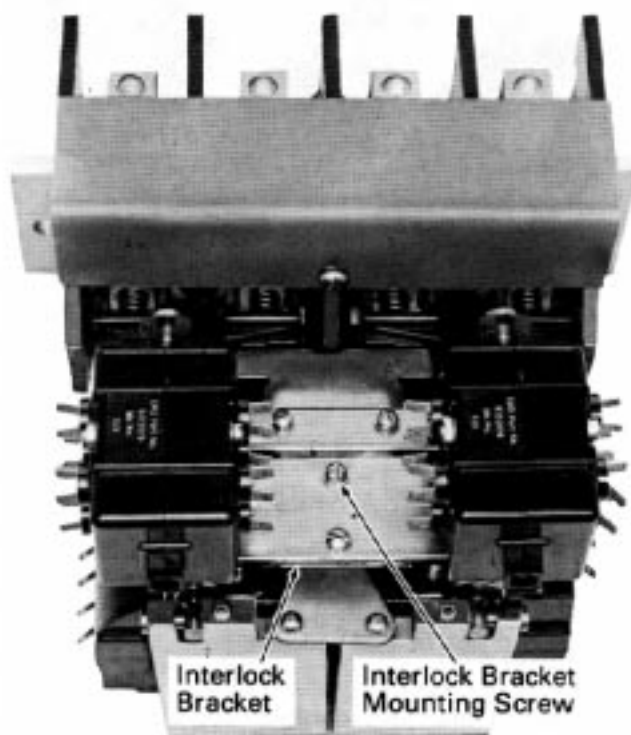
STATIONARY CONTACTS

Defective stationary contacts indicate that the auxiliary interlock should be renewed as an assembly.

Although the stationary contacts can be renewed by changing interlock housings, it is recommended that the entire interlock assembly be renewed. Refer to Assembly Renewal section.

ASSEMBLY RENEWAL

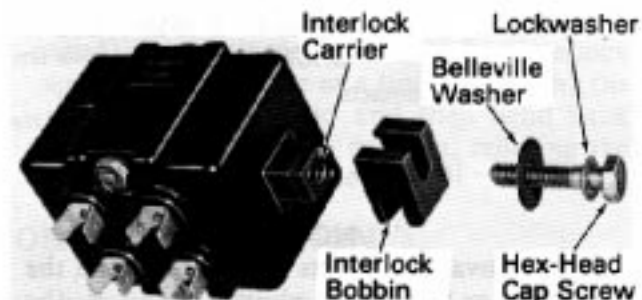
1. Remove interlock bracket, Fig. 12, and interlock as an assembly from contactor by removing two mounting screws and washers.



24854

Fig.12 - Removing Interlock Bracket And Interlocks

2. Remove interlock assembly from bracket by removing two mounting screws and lockwashers.
3. Remove hex-head cap screw, Fig. 13, lockwasher, and Belleville washer holding interlock bobbin to the interlock carrier. Remove interlock bobbin.



22211

Fig.13 - Interlock Actuating Components

4. Install interlock bobbin on new interlock and replace Belleville washer, lockwasher, and hex-head cap screw.
5. Attach interlock assembly to interlock bracket, Fig. 12, with two mounting screws and lockwashers.
6. Install interlock bracket on contactor with two mounting screws and washers.

MAJOR COMPONENT RENEWAL

Under ordinary circumstances, renewal of main and auxiliary interlock contacts is the extent of the periodic maintenance needed to ensure reliable operation. However, if a switch component is to be serviced or renewed refer to the appropriate procedure below and Fig. 14.

WARNING

Do not disassemble switch in cabinet. Disconnect switch power cables and leads to interlock assembly, and then remove switch from control cabinet.

CONTACT CARRIER ASSEMBLY

The following procedure should be followed when necessary to service the switch contact carrier assembly (24), Fig. 14, and/or associated parts.

1. Remove four hex head screws (39) and loosen main movable contact components from lower support block (33).
2. Remove cover mounting screw (16) and remove contact cover (10).
3. Remove four flat head screws (23), lockwashers (22), and plug nut (48).
4. Separate contact carrier assembly (24) from remainder of switch.
5. Remove stationary contact assemblies (20), magnet plates (12), and lower support blocks (33).
6. To assemble, reverse Steps 1 through 5, substituting new parts where required.

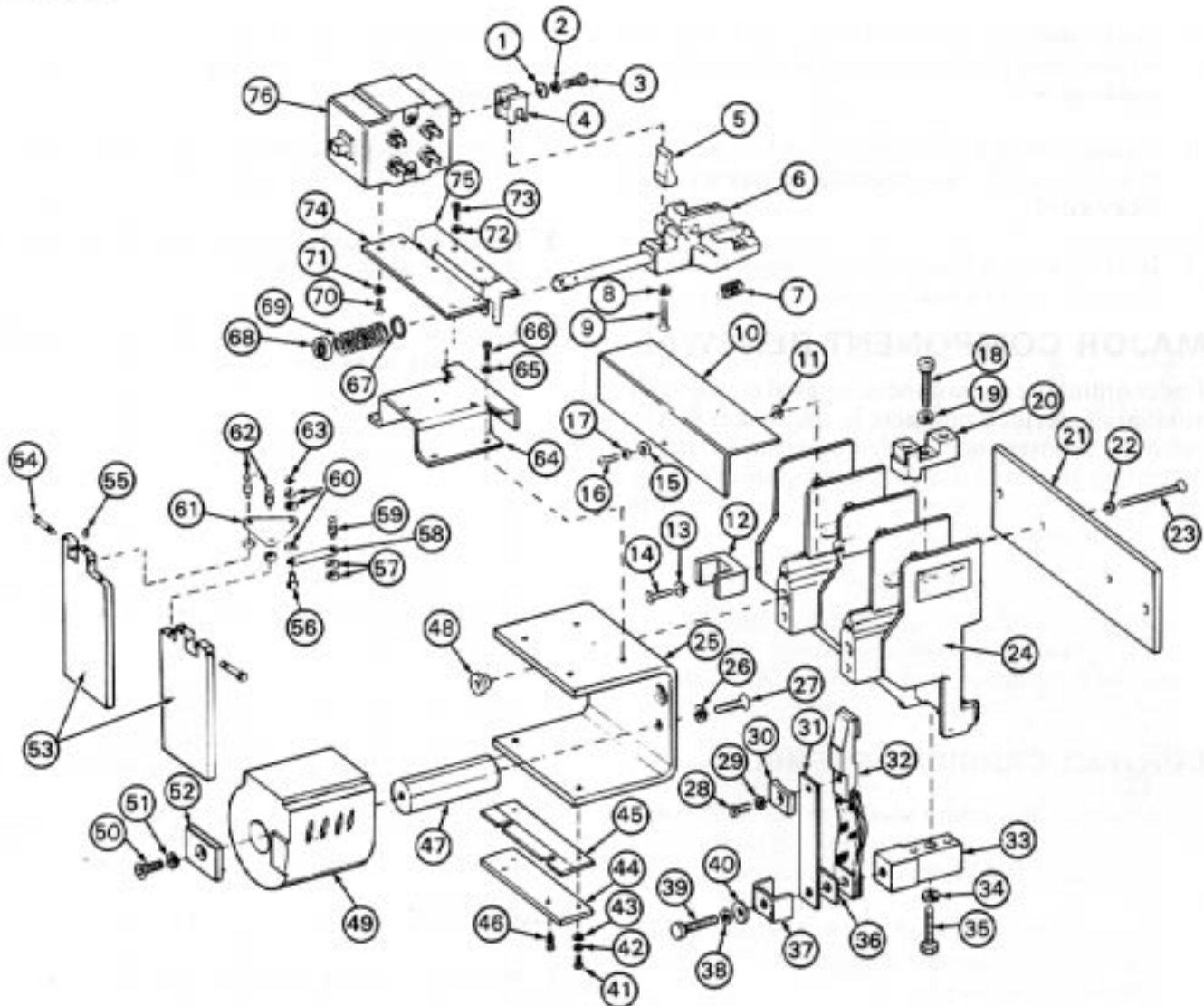
CONTACT OPERATING LEVERS

The following procedure should be followed when necessary to service the switch operating levers (6), Fig. 14, and/or associated parts.

1. Remove four hex head screws (39) and loosen main movable contact components from lower support block (33).
2. Remove cover mounting screw (16) and washer (17). Remove contact cover (10).
3. Remove four flat head screws (23), lockwashers (22), and plug nuts (48).
4. Separate contact carrier assembly (24) from remainder of switch.
5. Remove interlock mounting bracket (75) with auxiliary interlocks (76).
6. Remove hex socket head set screws (55). Loosen, but do not remove, hex socket inner set screws. Remove operator pins (54) connecting contact operating levers (6) to armature assembly (53).
7. Remove auxiliary interlock operating lever (6), cup washer (68), return spring (69), and eyelet (67) from each contact operating lever (6).
8. To assemble, reverse Steps 1 through 7, substituting new parts where required.

MAGNET COIL

1. Remove retaining ring (63), Fig. 14.
2. Lift the triangular interlock link (61), which is attached to the armature (53), from pin (56).
3. Loosen hex socket head screw (55) and remove pins (54) from armatures.
4. Remove two filister head screws (41) from pivot support (44). The armature assembly can now be removed for access to the magnet coils (49).
5. Remove hex sockets head screws (50), lockwashers (51), and pole plates (52) from magnet cores (47).
6. Slide magnet coils (49) forward off the magnet cores (47) and replace with new magnet coils.
7. To assemble switch, reverse above Steps 1 through 6.



- | | | |
|------------------------------|------------------------------|--|
| 1. Belleville Washer | 28. Hex Socket Head Screw | 52. Pole Plate |
| 2. Lockwasher | 29. Lockwasher | 53. Armature |
| 3. Hex Head Screw | 30. Magnet Plate | 54. Pin |
| 4. Operating Bobbin | 31. Flat Spring | 55. Hex Socket Head Set Screw |
| 5. Operator | 32. Movable Contact Assembly | 56. Pin |
| 6. Operating Lever | 33. Lower Support Block | 57. Washer |
| 7. Contact Spring | 34. Lockwasher | 58. Link |
| 8. Lockwasher | 35. Hex Socket Head Screw | 59. Drive Screw |
| 9. Flat Head Screw | 36. Contact Strip | 60. Washer |
| 10. Contact Cover | 37. Clamp | 61. Triangular Interlock Link |
| 11. Washer | 38. Lockwasher | 62. Drive Screw |
| 12. Magnet Plate | 39. Hex Head Screw | 63. Retaining Ring |
| 13. Lockwasher | 40. Washer | 64. Interlock Assembly Support |
| 14. Flat Head Screw | 41. Filister Head Screw | 65. Lockwasher |
| 15. Washer | 42. Lockwasher | 66. Filister Head Screw |
| 16. Round Head Screw | 43. Washer | 67. Eyelet |
| 17. Lockwasher | 44. Pivot Support | 68. Cup Washer |
| 18. Hex Socket Head Screw | 45. Pivot Shim | 69. Return Spring |
| 19. Lockwasher | 46. Drive Screw | 70. Filister Head Screw |
| 20. Upper Stationary Contact | 47. Magnet Core | 71. Lockwasher |
| 21. Mounting Plate | 48. Plug Nut | 72. Lockwasher |
| 22. Lockwasher | 49. 74 V Magnet Coil | 73. Filister Head Screw |
| 23. Flat Head Screw | 50. Hex Socket Head Screw | 74. Return Spring Bracket |
| 24. Contact Carrier | 51. Lockwasher | 75. Interlock Mounting Bracket |
| 25. Magnet Yoke | | 76. Auxiliary Interlock (2 NO/NC - Left) (2 NO/NC - Right) |
| 26. Lockwasher | | |
| 27. Hex Socket Head Screw | | |

Fig.14 - Switch Exploded View

SERVICE DATA

SPECIFICATIONS

Weight (Approx.) 38 lbs

SWITCH RATING

Continuous Current Per Pole - at 100° C (212° F) 500 Amps
 Maximum Voltage Between Poles 1500 VDC
 Interrupting Capacity (at 10 VDC) 500 Amps
 Thru-current Capability 15,000 Amps

AUXILIARY INTERLOCK RATING

Resistance Load
 125 V DC or less 10 Amps
 250 V DC 2.5 Amps

OPERATING COILS (Continuous Duty)

Volts DC	Resistance Ohms at 20° C	Min. Volts To Seal	Drop-Out Volts
74	125	50	10

MAIN CONTACTS

Contact Rating 500 Amps
 Contact Pressure (final) 3 to 4 kg (6 to 9 lbs)
 Wear Allowance - Each Contact 1.6 mm (1/16")
 Contact Opening - New Contacts 6 mm (1/4")

INTERLOCK CONTACTS

Wear Allowance - Minimum (per mating pair) 1.6 mm (1/16")

HI-POT

60 Hz, 1 Minute

Magnet Coils To Mounting 1500 VAC
 Main Contact To Mounting 5400 VAC
 Main Contacts To Magnet Coil 5400 VAC
 Main Contacts To Auxiliary Interlocks 5400 VAC
 Between Adjacent Main Poles 5400 VAC
 Auxiliary Interlocks To Mounting 3000 VAC
 Between Open Main Contacts 3000 VAC

• • • • **A Service Department Publication** • • • •

Electro-Motive Division Of General Motors La Grange, Illinois 60525