30-800 Amp
Series R38™ and Series S38™
Automatic Transfer Switches

# Contactor Service Manual

KOHLER
Transfer Switches

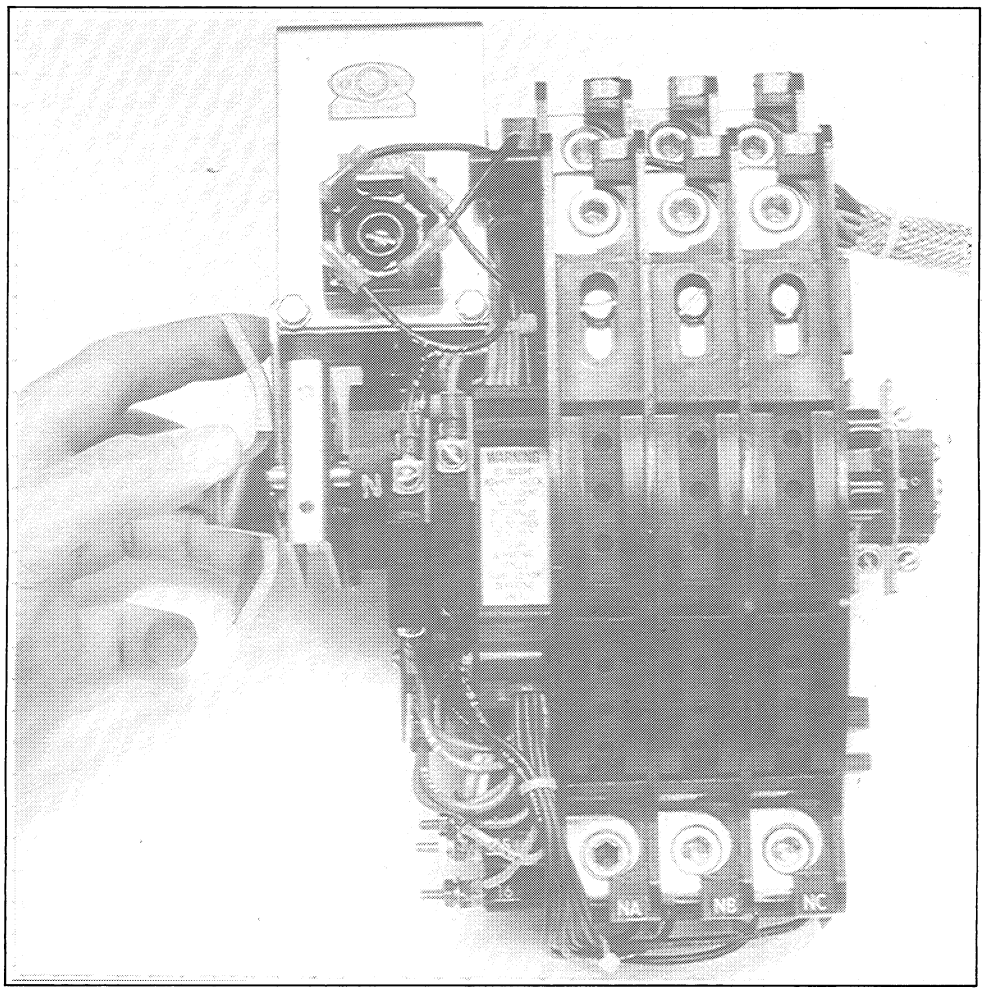
# Table of Contents

# Appendix A
# Non-Detachable Manual Operating Handle
# 30-150 Amp. (600 Volt) Class

A new style of **non**-detachable manual operating handle (to be referred as Type II) has been introduced in the 30 through 150 ampere models. This three-point handle is located on the far left-hand side of the contactor shaft and is secured by an external retaining ring. Models using this type of handle, will not be equipped with the detachable red tip operating handle (Type I). To operate, grasp three-point handle and rotate, see Figure below. Be sure to rotate the handle all the way to the stop position.

**⚠ WARNING**

**BODILY INJURY!** The manual operating handle is to be used for maintenance purposes only. Return the transfer switch to the Normal position when service is complete.



# Introduction

This manual covers operation, troubleshooting and repair of Kohler Automatic Transfer Switches. Differences between models are noted throughout the manual.

Read and understand the instructions, and those on labels affixed to the Kohler Automatic Transfer Switch. Note any optional accessories that may have been furnished on this switch, and review their operation.

## Service Assistance

See the Yellow Pages under GENERATORS — Electric for your closest Kohler Generator Dealer. Give Switch and Serial Numbers from the Transfer Switch nameplate for complete parts list and information.

Whenever information is needed, include the voltage used as this may affect the Switch Number. The Switch Number reflects what was sent from the factory and may not be correct if a field-installed coil change for contactor voltage conversion was made or a field-installed kit was added.

**⚠ WARNING**

**HIGH VOLTAGE!** Remember that wherever electrical energy is present, there is the potential danger of electrocution. Keep everyone away from the set and take precautions to prevent unqualified personnel from tampering. Have the set and electrical circuits serviced only by qualified technicians. Wiring should be inspected frequently — replace leads that are frayed or in poor condition. Do not operate electrical equipment when standing in water, on wet ground or when your hands are wet.

## General Maintenance

Reasonable care in preventive maintenance will insure high reliability and long life for the Automatic Transfer Switch. Follow all applicable local codes and standards that apply, and keep a log book for scheduled maintenance and repairs.

**Operate Transfer Switch at Least Once a Month.** Use the Test Switch to check the electrical operation of the Transfer Switch. Because the Test Switch only simulates failure of the normal source, service is interrupted only during the actual transfer of the load. It is recommended that an actual load be connected while transfer takes place.

**Keep Automatic Transfer Switch Clean.** During installation protect the switch from construction grit and metal chips. Once a year brush and vacuum away any excessive dust accumulation. Leave the cover on the Control Panel.

**Maintain Transfer Switch Lubrication.** The Transfer Switch has been properly lubricated, and under normal operating conditions no further lubrication is required. Renew factory lubrication if the switch is subjected to severe dust or abnormal operating conditions. Relubricate the contactor core and spring if the TS coil is replaced.

**Inspect Main Current Carrying Contacts.** Once a year de-energize all sources, then remove barriers to check condition of contact material. Replace contacts when pitted or worn excessively on contactors rated 225 Amperes and larger. Replace the entire contactor with ratings of 30 through 150 Amperes.

**Torquing of Contactor Lug Set Screws.** Set screws must be properly torqued to specs when installed and should be checked every six months. When alumnium conductor is used, apply joint compound to conductor. Check contactor lugs after tightening and wipe off excess joint compound.

**Effect of Ambient Temperature and Humidity Conditions.** The contactor should be operated in an ambient temperature of 32°-104°F (0°-40°C). Contact Kohler Co. if the contactor is to be operated in a higher or lower ambient temperature. Humidity can vary from 0 to 100% without affecting operation.

# Transfer Switch Part Number Explanation

**K- 1 6 1 3 4 1 - 0 1 5 0**

## Type of Transfer Switch

K — Automatic Transfer Switch
KB — Automatic Transfer Switch and By-Pass Isolation Switch
KN — Non-Automatic Transfer Switch

## Type of Logic
**(Determining Digit A)**

1 — Solid State
2 — Relay
3 — Manual

## Voltage and Frequency
**(Determining Digit B)**

**(Up to 240 Volt AC)**
21 — 110V, 50Hz
22 — 120V, 60Hz
23 — 220V, 50Hz
24 — 240V, 60Hz
27 — 190V, 50Hz
28 — 208V, 60Hz

**(Up to 600 Volt AC)**
60 — 600V, 60 Hz
61 — 110V, 50Hz
62 — 120V, 60Hz
63 — 220V, 50Hz
64 — 240V, 60Hz
65 — 550V, 50Hz
66 — 480V, 60Hz
67 — 190V, 50Hz
68 — 208V, 60Hz
69 — 440V, 50Hz
71 — 380V, 50Hz
73 — 416V, 50Hz

## Number of Poles
**(Determining Digit C)**

2 — 2 pole
3 — 3 pole 3 $\phi$
4 — 3 pole 1 $\phi$
5 — 3 pole 3$\phi$ with Overlapping Neutral Contact

## Number of Wires
**(Determining Digit D)**

2 — 2 wire
3 — 3 Wire
4 — 4 Wire

## Type of Enclosure
**(Determining Digit E)**

0 — Open
1 — Nema 1
2 — Nema 12
3 — Nema 3R

## Ampere
**(Determining Digit F)**

0030-0800

**For Example:** Part Number K-161341-0150 is a Solid State, 110 Volt, 50 Hz, 3 pole, 4 wire, Nema 1 enclosed, 150 Amp. transfer switch.

# Section 1
# 30 THROUGH 150 AMPERES

**⚠ WARNING**

**BODILY INJURY!** A manual operator handle is provided on the Transfer Switch for maintenance purposes only. Return the Transfer Switch to the Normal position. Remove manual operator handle (if used) and store it on the Transfer Switch in the place provided when service is completed.

**⚠ WARNING**

**SHOCK HAZARD!** De-energize both normal and emergency sources before proceeding. Move controller main switch to OFF position and disconnect battery negative (-) before working on transfer switch! Turn the transfer switch selector switch to the OFF position.

## Manual Operation

The detachable manual operator handle is to be used for maintenance purposes only. Move the installed handle up and down to manually operate the transfer switch. The switch should operate smoothly without binding. Return the transfer switch to the Normal position when service is completed. See Figure 1-1 for directions on installing the handle.

**CAUTION**

After installation or service is complete, manually operate the power-switching contacts from normal to emergency and back again to ensure a smooth non-binding operation before energizing the transfer switch. If binding occurs during manual operation, do *not* test electrically.

## Coil Change for Contactor Voltage Conversion

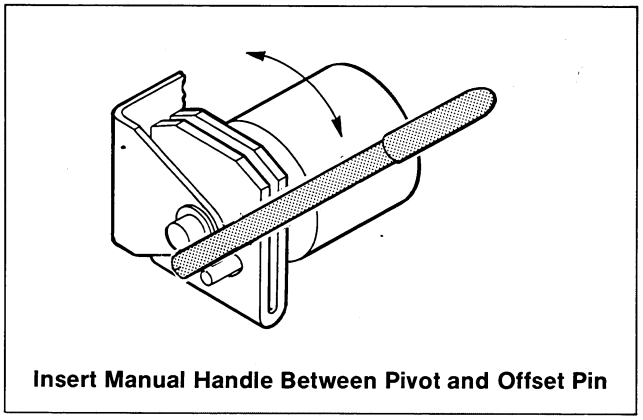
The voltage on R38 and S38 Series Automatic Transfer Switches can be changed by replacing the transformer assembly, coil kit, rectifier kit, spring kit and resistor kit to ones which are proper for the new voltage.

When the coil change for contactor voltage conversion is performed, it will be necessary to replace the existing nameplate to one which reflects the new voltage and frequency, number of poles, and number of wires.

When the solenoid assembly is replaced it will be necessary to adjust the coil clearing contacts controlling contactor operation. See Coil Clearing Contact Replacement and Adjustment for more information.

Since the contactor voltage conversion for the 150 ampere model is significantly different than that of the 30-104 ampere models it has its own procedure.

See Figures 1-2, 1-3 and 1-4 for location and identification of components found on 30-150 ampere transfer switches.



**Insert Manual Handle Between Pivot and Offset Pin**

**Figure 1-1. 30-150 Amperes**

**Coil Replacement (30-104 Ampere)**

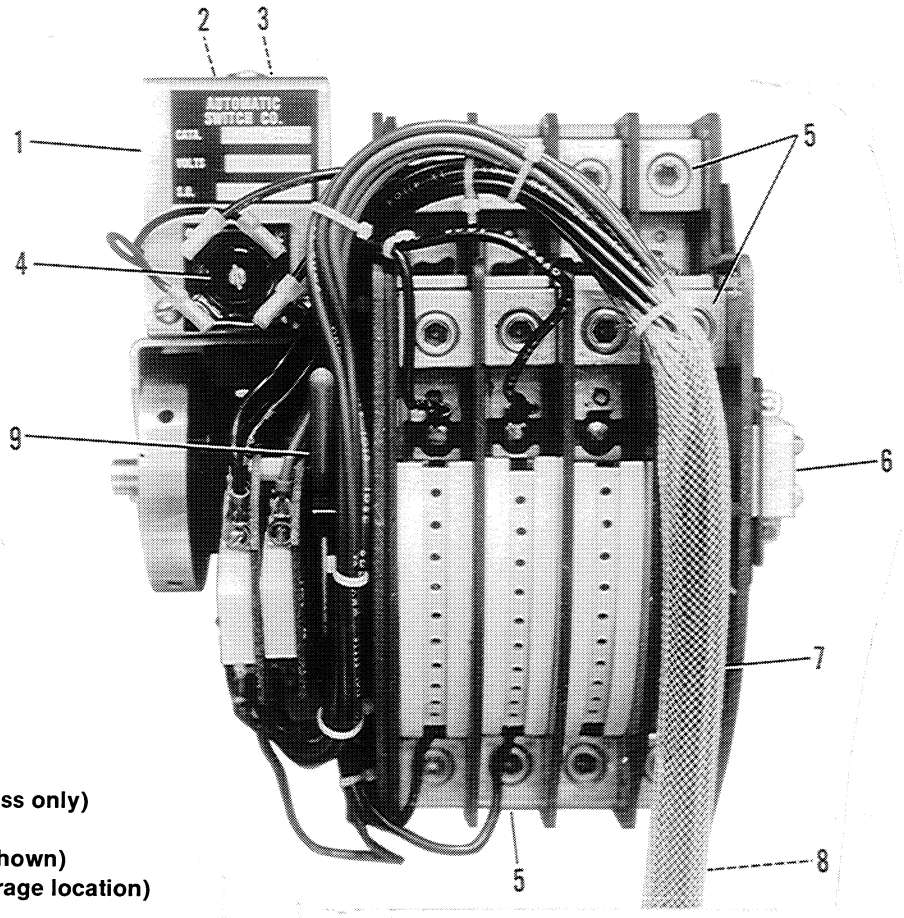
For identification of components for Transfer Switch Coil replacement on 30-104 ampere models see Figure 1-5.

1. Disconnect the leads from rectifier assembly. Note the leads as to where they were connected. The AC leads go to terminals marked by yellow dots and the coil's leads go to the other two terminals. Polarity need not be observed.
2. Snap open and remove retaining cap, or remove retaining clip from top of core tube assembly.
3. Remove coil and yoke assembly.
4. Remove coil from yoke.
5. Install new coil and coil sleeves into yoke.
6. To Replace Spring and/or Core Tube.
   a. Remove flux ring (older models only).
   b. Remove (2) screws to disassemble core tube from mechanism and remove mounting plate (older models) or core tube retainer (newer models) from core tube.

   **CAUTION**

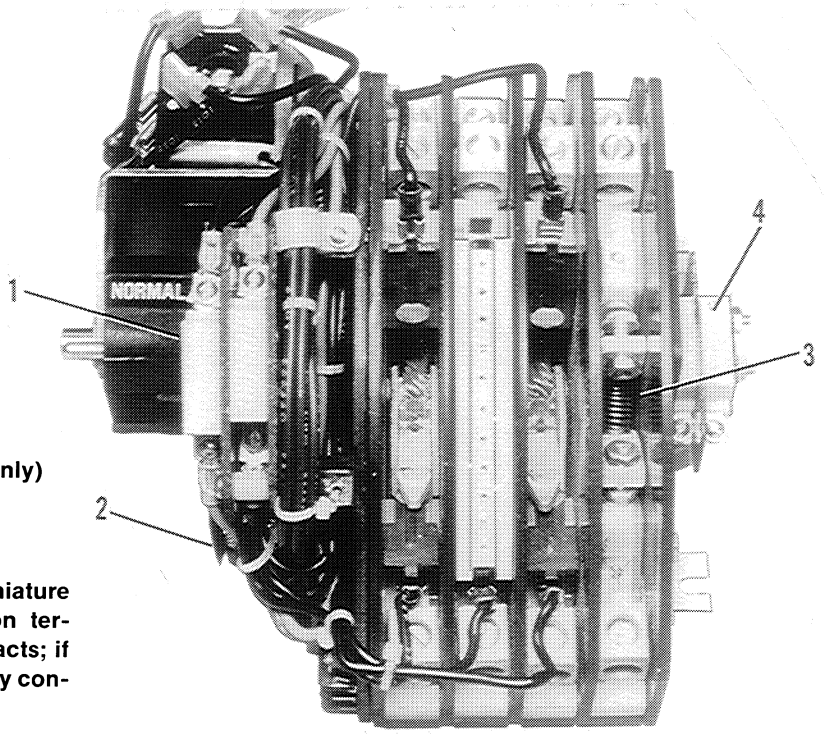
   These parts are under spring pressure and should be held securely while removing screws.

   c. Remove core tube and spring, and place on a clean surface. Do not clean lubricant from solenoid core.
   d. Install proper spring into solenoid core.
   e. Replace core tube making sure spring is properly seated in core tube and core.
   f. Slide mounting plate (older models) or core tube retainer (newer models) with (2) screws and lock washers onto core tube.
   g. Tighten screws to assemble core tube to mechanism.
   h. Replace flux ring (older models only).
7. To Replace Rectifier.




1. Yoke/Coil Kit
2. Spring Kit
3. Core Tube
4. Resistor/Rectifier Kit
5. Contactor Lugs
6. Auxiliary Contact (600 Volt Class only)
7. Contactor Harness
8. Contactor Harness Plug (not shown)
9. Manual Operating Handle (storage location)

Figure 1-2. 30-104 Amp. Contactor (150 Amp. Similar)




1. Coil Clearing Contact
2. Miniature Contacts (Standard)
3. Movable Overlapping Neutral Transfer Contact
4. Auxiliary Contacts (600 Volt Class only)

**NOTE**

**To determine between auxiliary and miniature contacts — note terminals. If push-on terminals are used, order miniature contacts; if screw terminals are used, order auxiliary contacts.**

Figure 1-3. 30-104 Amp. Contactor with Arc Chute Removed (150 Amp. Similar)

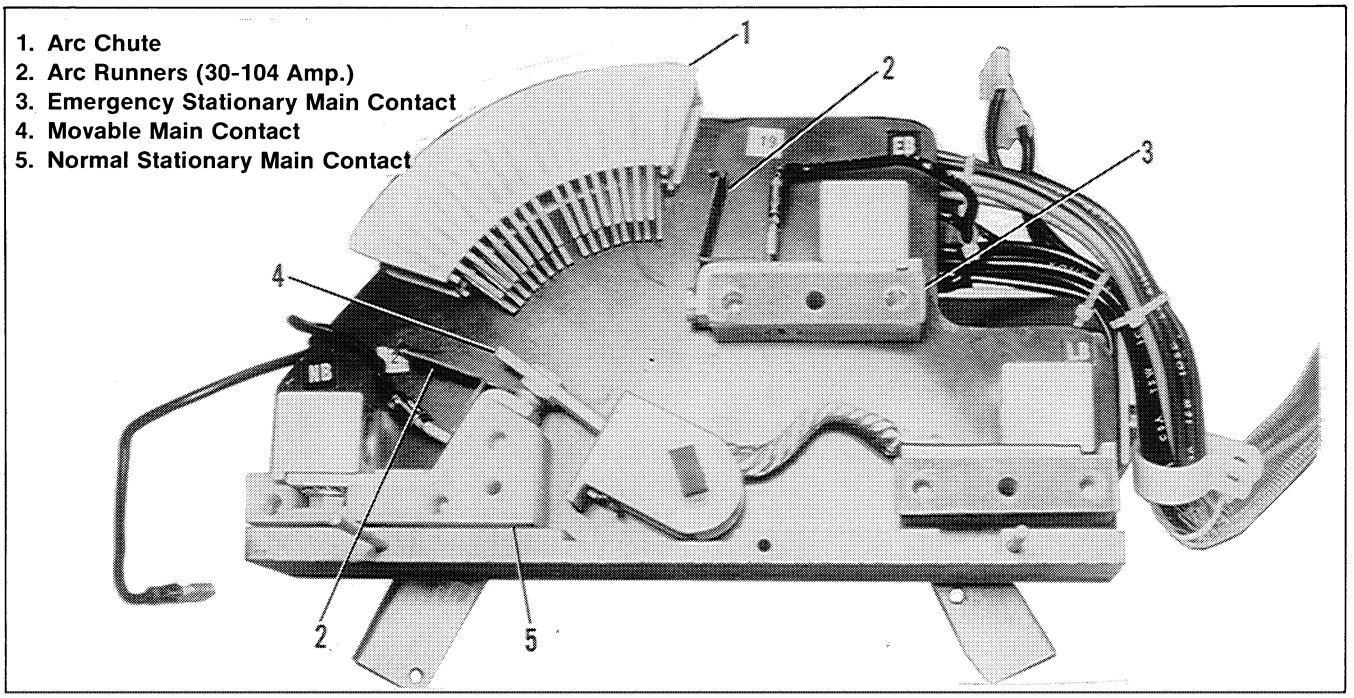



**Figure 1-4. 30-104 Amp. Contactor Internal View (150 Amp. Similar)**

a. Disconnect leads from rectifier, if not already done.

b. Remove rectifier mounting screw.

c. Mount rectifier on yoke with screw and lock washer. Do not overtighten!

8. Replace coil and yoke assembly. Make sure yoke aligns properly with the two pins.

9. Replace retaining cap or retaining clip on end of core tube assembly.

10. Attach AC wires to terminals on rectifier with yellow dots.

11. Attach coil wires to the remaining two terminals on the rectifier. Polarity need not be observed.

12. Operate switch several times with manual operator handle to ensure a smooth non-binding operation.

**Coil Replacement (150 Ampere)**

For identification of components for Transfer Switch coil replacement on 150 ampere model see Figure 1-6.

1. Disconnect leads from rectifier assembly. Note the leads as to where they were connected. The AC leads go to terminals marked by yellow dots and the coil leads go to the other two terminals. Polarity need not be observed.

2. Remove retaining ring from top of core tube assembly.

3. Remove (2) hex. screws holding L bracket to contactor mechanism. Lift L bracket and rectifier assembly from end of core tube.

4. Remove coil, spacer washer(s), and spring washer.

5. To Replace Spring and/or Core Tube.

a. Remove spacer ring.

b. Remove (3) hex. screws to disassemble core tube from mechanism.

**CAUTION**

These parts are under spring pressure and should be held securely while removing screws.

c. Slide core tube, stub core, and spring off of solenoid core and place on a clean surface. Do not remove lubricant from solenoid core.

d. If a new core tube is required, disassemble old core tube. The stub core and core tube retainer will be reused.

e. Place stub core into new core tube, if required.

f. Place proper spring into core tube.

g. Replace core tube retainer onto core tube.

h. Slide core tube assembly onto solenoid core and align core tube retainer to mounting holes.

i. Replace and tighten (3) hex. screws to assemble core tube to mechanism.

**NOTE**

Be sure stub core is properly aligned in core tube.

j. Replace spacer ring.

6. To Replace Coil.

a. Replace spring washer with the concave side facing upward. (As the transfer switch would be viewed in the installed position.)

b. Replace spacer washer(s), as required, to give a snug fit.

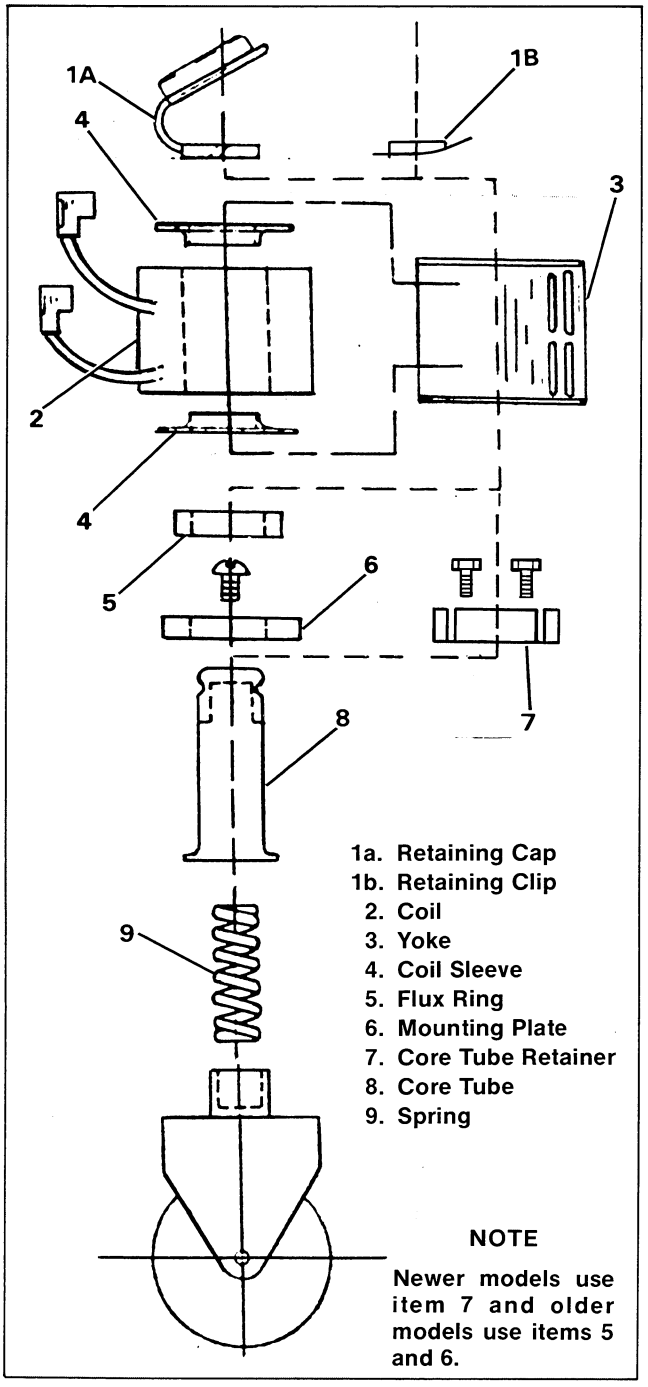



**Figure 1-5. Solenoid Assembly (30-104 Ampere)**

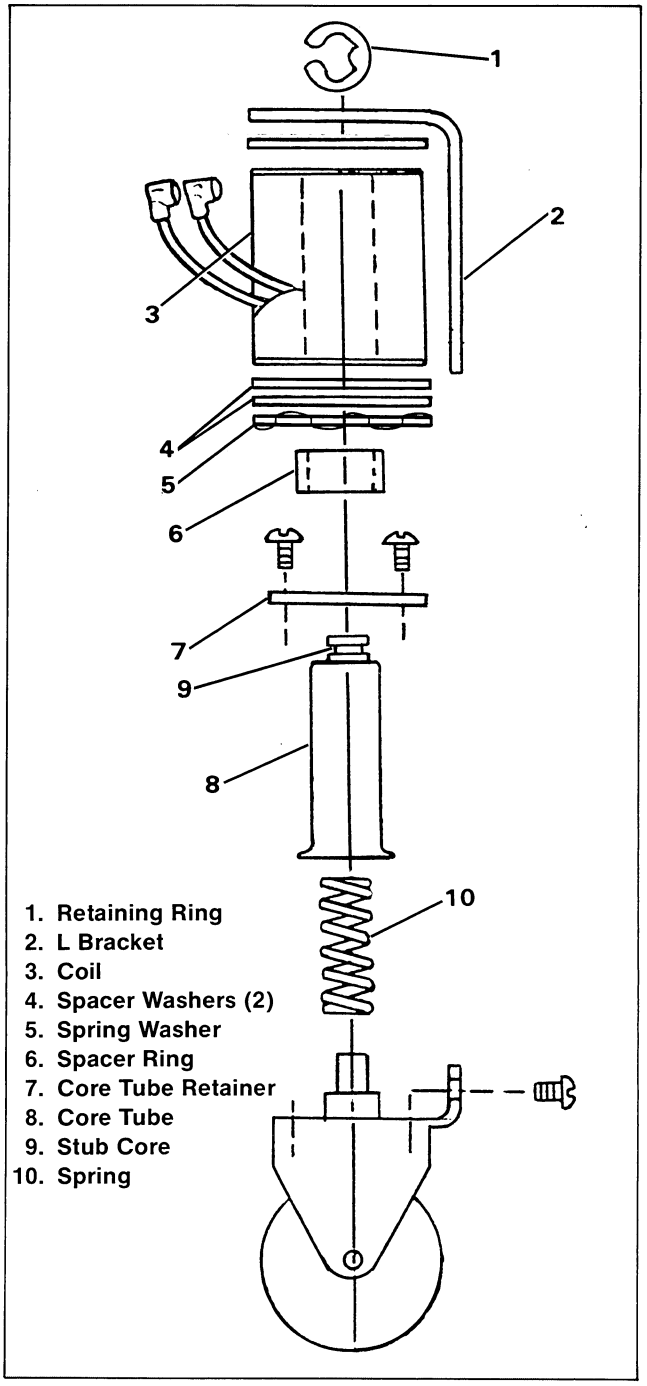



**Figure 1-6. Solenoid Assembly (150 Ampere)**

c. Replace coil with wires to the outside.

7. To Replace Rectifier.

   a. Disconnect leads from rectifier, if not already done.

   b. Remove rectifier mounting screw.

   c. Mount new rectifier on L bracket with screw and lock washer. Do not overtighten!

8. Slide L bracket and rectifier assembly over stub core, and align with two mounting holes.

9. Replace and tighten (2) hex. screws mounting L bracket to contactor mechanism.

10. Replace retaining ring to top of core tube assembly.

11. Attach AC wires to rectifier terminals marked by yellow dots.

12. Attach coil wires to remaining terminals on rectifier. Polarity need not be observed.

**NOTE**

It may be necessary to loosen the rectifier screw in order to rotate the rectifier so that the coil wires will reach the proper terminals. Tighten screw.

13. Operate switch several times with manual operator handle to ensure a smooth non-binding operation.

## Coil Clearing Contacts Replacement and Adjustment

This solenoid operator is momentarily energized through control contacts located below the coil assembly. If the transfer switch coil is replaced or the setting is suspected to be incorrect, it must be checked and adjusted as necessary. This procedure requires the use of a test light or an ohmmeter.

The contacts numbered 8 and 9 control the normal to emergency contact transfer. The contacts numbered 6 and 7 control the emergency to normal contact transfer.

Removal of coil clearing contacts requires removal of the screws which also control the adjustment feature. One set of contacts consists of two switches that are series activated. These are replaced as a set only. See Figure 1-7.

1. To Replace Contacts.
   a. Loosen screws and remove leads from contacts.

**NOTE**

Newer versions have leads marked with a number which corresponds to a numbered contact. However, some older models do not. These will require tagging of leads to ensure proper connection later.

   b. Remove screws and/or nuts to remove contacts from chassis mechanism.
   c. Remove hardware from old contact and install on new contact in the same manner.
   d. Install contacts on chassis mechanism, do not tighten screws.

**NOTE**

Contacts numbered 6 and 7 must be installed first followed by contacts numbered 8 and 9.

   e. Reconnect leads to corresponding contact terminals and tighten screws.

2. To Adjust Contacts (Method A).
   a. To check the normal to emergency coil clearing contact, connect test light to contact terminals 8 and 9.

**NOTE**

Contacts should open at 85-90% of full stroke. Full stroke is defined as point where solenoid is fully extended out to point where solenoid is fully compressed. Full stroke should not be confused as being the cycle stroke. See Figure 1-8.

   b. Using manual operator handle move contact mechanism from normal to emergency. Contacts should open at 85-90% of full stroke. If not, adjust by sliding on slotted hole, tighten and recheck.
   c. To check the emergency to normal coil clearing contact, connect test light to contact terminals 6 and 7.
   d. Using manual operator handle move contact mechanism from emergency to normal. Contact should open at 85-90% of full stroke. If not, adjust by sliding on slotted hole, tighten and recheck.

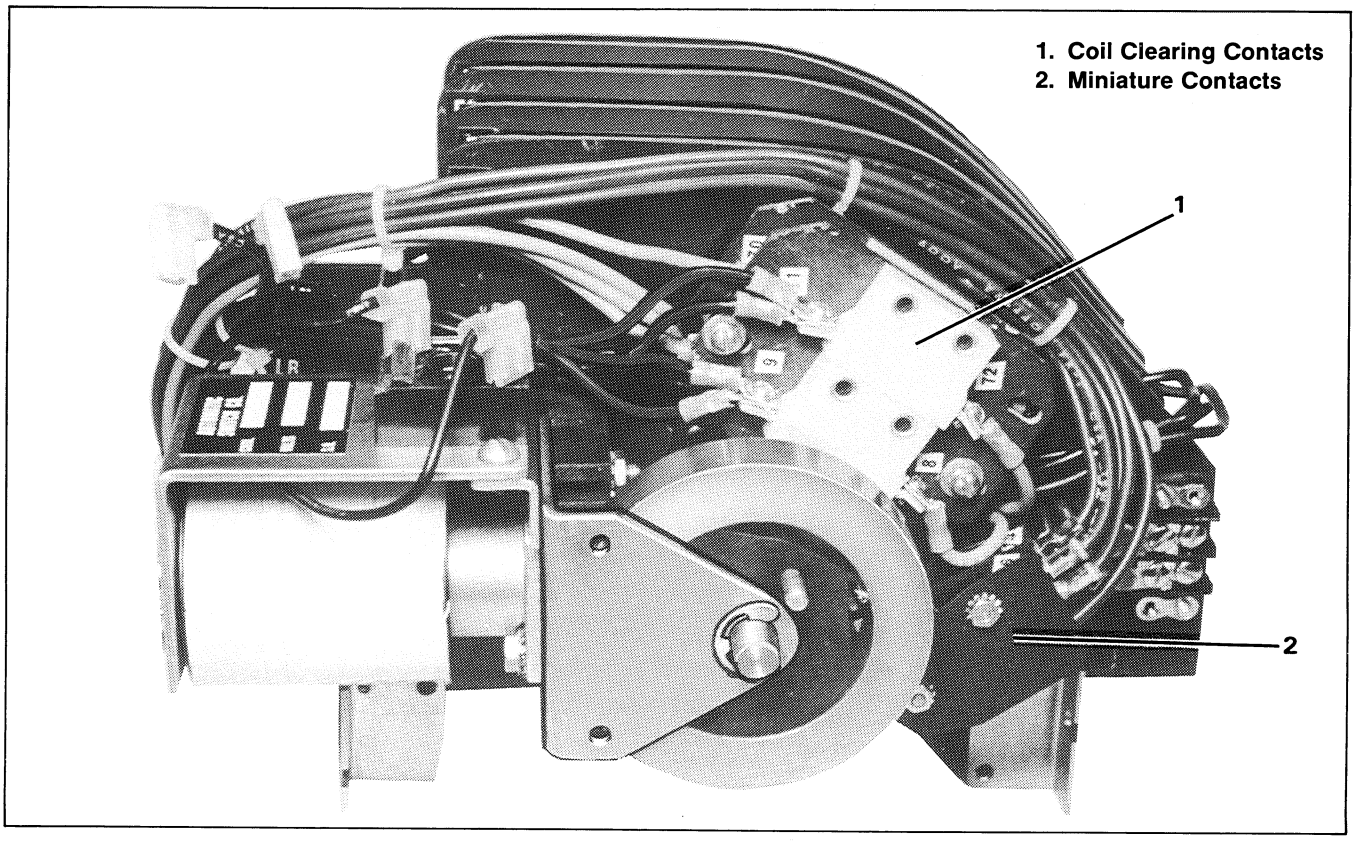



**Figure 1-7. 30-150 Amp. Contactor (Contacts)**

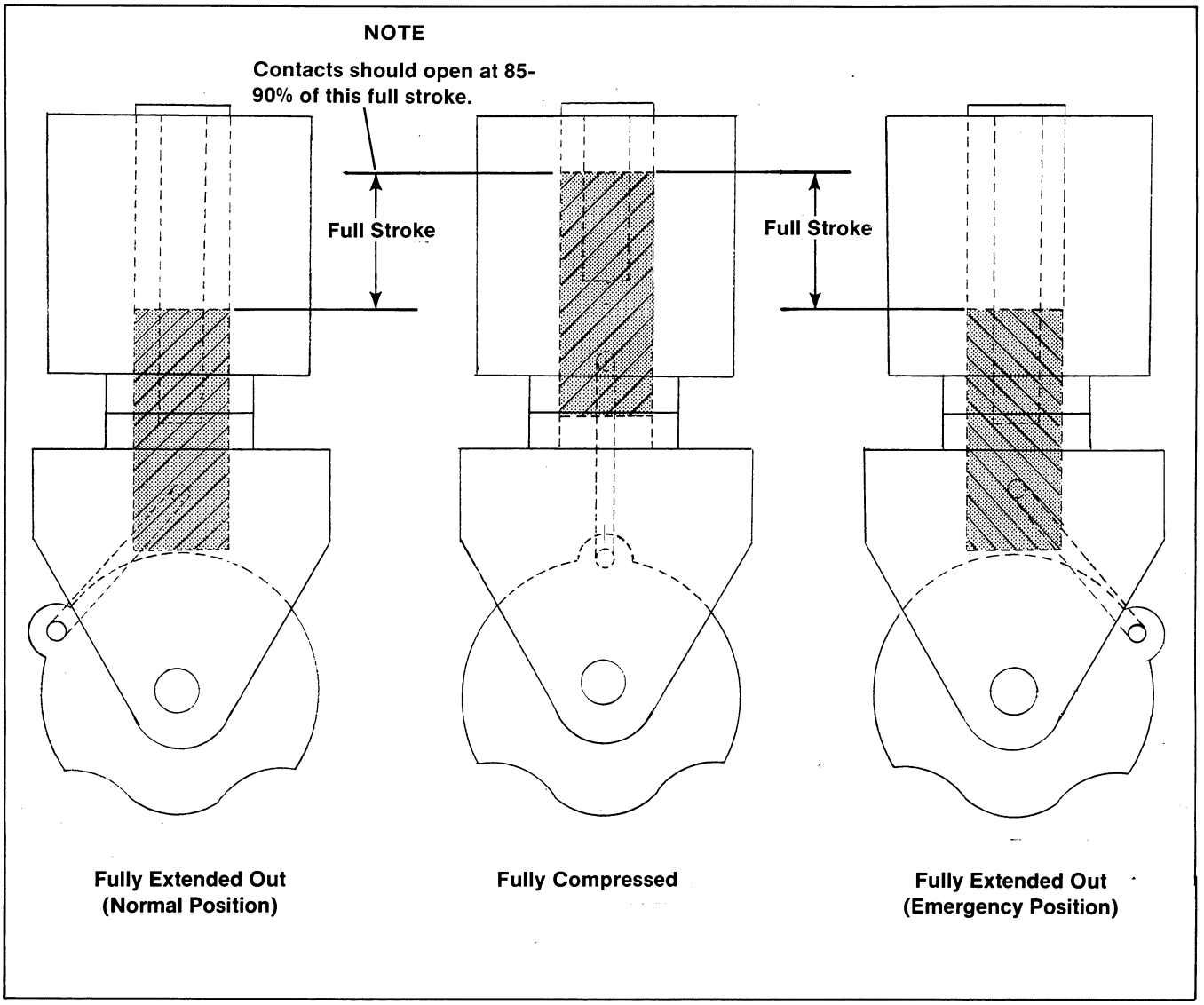



**Figure 1-8. Normal to Emergency Cycle Stroke**

**NOTE**

Some models are such that they have screws which secure both contacts simultaneously. This requires special attention since adjusting one contact may change the setting on the other. Always check both contact adjustments after final tightening of screw. Remember to tighten locking nut on adjustment screw, if so equipped.

3. To Adjust Contacts (Method B).

   A visual check for proper adjustment can be made by using an ohmmeter or test light, and using the following procedure:

   a. Connect ohmmeter to contact terminals 8 and 9.

   b. With manual operator handle, move transfer switch from normal to emergency. Contacts should open at about .125-.187 in. (3.18-4.75 mm) before high point of cam. See Figure 1-9.

   c. Adjust as necessary.

   d. Connect ohmmeter to contact terminals 6 and 7.

   e. With manual operator handle, move transfer switch from emergency to normal. Contacts should open at about .125-.187 in. (3.18-4.75 mm) before high point of cam. See Figure 1-10.

**NOTE**

Cam used to open normal to emergency contacts is *not* the same as one which opens emergency to normal contacts.

Cam to open emergency to normal contacts is difficult to see because of contactor restrictions.

   f. Adjust as necessary.

   g. Recheck.

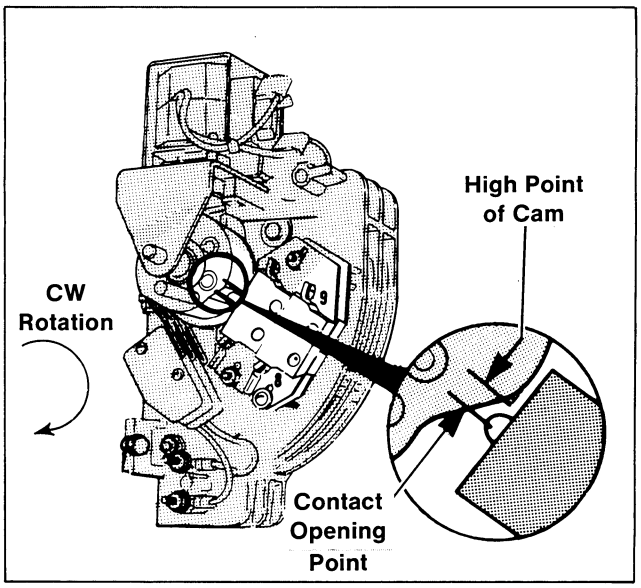



Figure 1-9. Normal to Emergency Cam

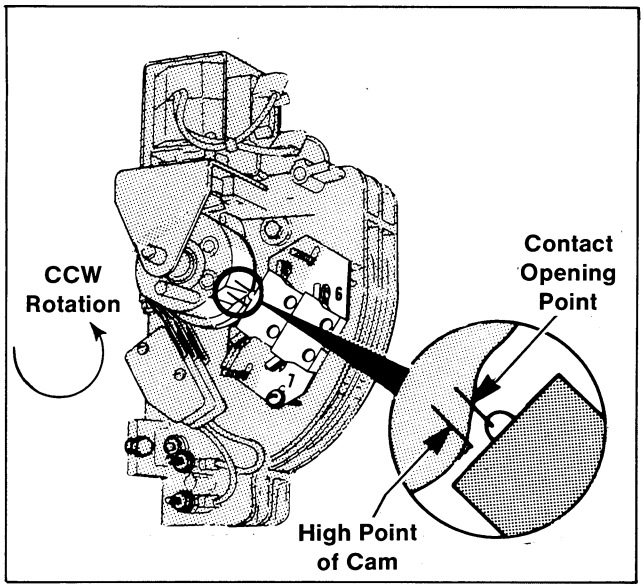



Figure 1-10. Emergency to Normal Cam

## Auxiliary/Miniature Contacts - 250 Volt Class Transfer Switches

No auxiliary (screw terminal) contacts are available. Contacts 14-15- are available at the switch for auxiliary connections. Contacts 16-17-18 are available, if accessories 12-A, B, C, or D are not selected, see Figure 1-11. Miniature contacts are rated 15 Amps. at 250 Volts.

**NOTE**

Contacts 23-24-25 (override logic) are not to be used for auxiliary connections.

**NOTE**

Contacts 16-17-18 are not to be used if accessories 12-A, B, C, or D have been selected (accessories connected to terminals 16, 17, and 18 of main logic board.)

**NOTE**

Contacts 14-15- are available at the switch for auxiliary connections.

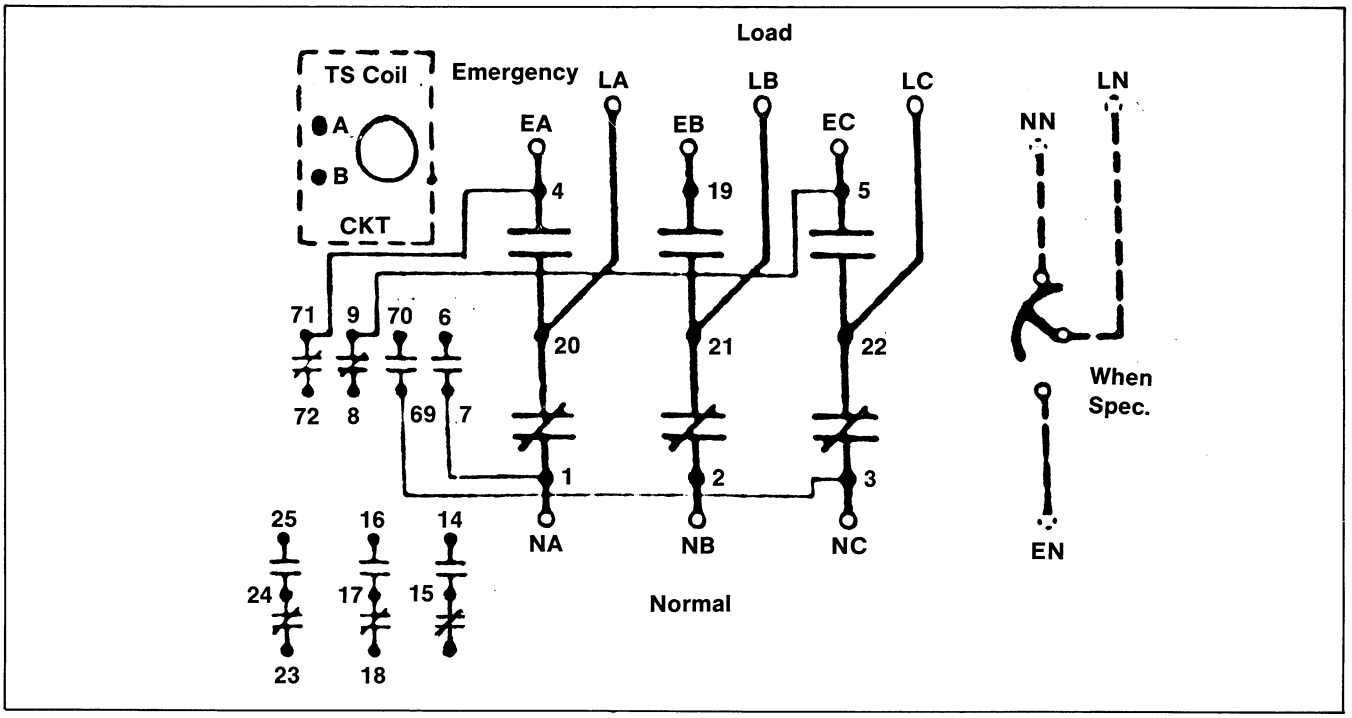



Figure 1-11. 250 Volt Class Transfer Switch Wiring Diagram (Normal Position shown)

**Auxiliary Contacts — 600 Volt Class Transfer Switches**

Auxiliary contacts are rated 10 Amps. at 480 Volts.

Contacts 10-11 and 12-13 are standard. Depending upon accessories installed, up to three contacts for each normal and emergency sides are optional.

**NOTE**

Contacts 10-11 and 12-13 are available at the switch for auxiliary connections.

See Figure 1-12 for location and type of installation. Auxiliary contacts are installed with (2) screws and an insulator in a vertical position and are series activated.

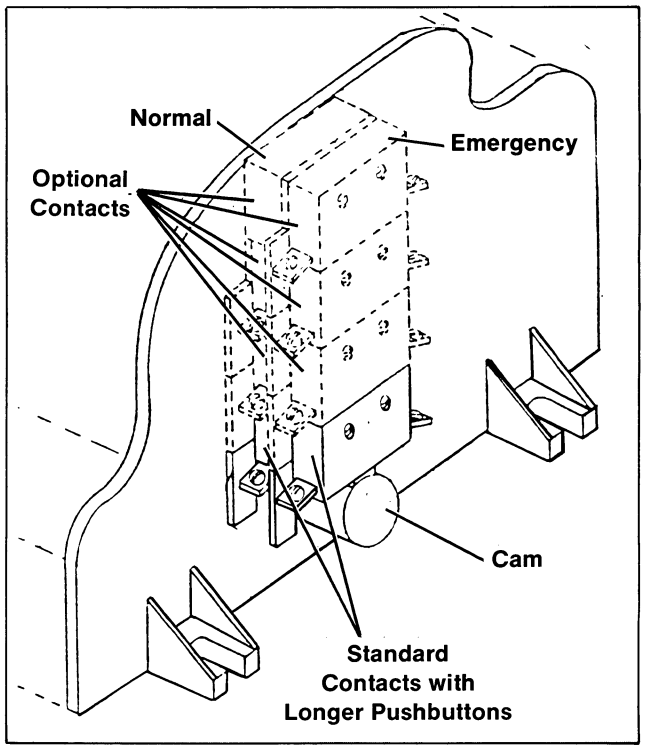



**Figure 1-12. Auxiliary Contacts**

Contacts installed closest to the contactor mechanism are closed when transfer switch is closed on normal. Contacts installed on the outside of contactor mechanism are open when transfer switch is closed on normal.

Contacts activated by auxiliary contact cam are not the same as those which are activated by another contact. The difference is in the length and shape of the push-button. The push-button on the contact activated by the cam is about 1/4 in. (6.4 mm) long and is slightly rounded. The push-button on the contact which is activated by another contact is about 1/32 in. (.8 mm) long and is flat.

**NOTE**

These contacts are *not* interchangeable. Be sure to order proper contacts when replacing or adding new contacts.

For location of contacts and terminals, see wiring diagram (Figure 1-14).

**Miniature Contacts — 600 Volt Class Transfer Switches**

Miniature contacts are rated 15 Amps. at 250 Volts. Two contacts are standard. See Figure 1-13 for location on transfer switch and type of installation.

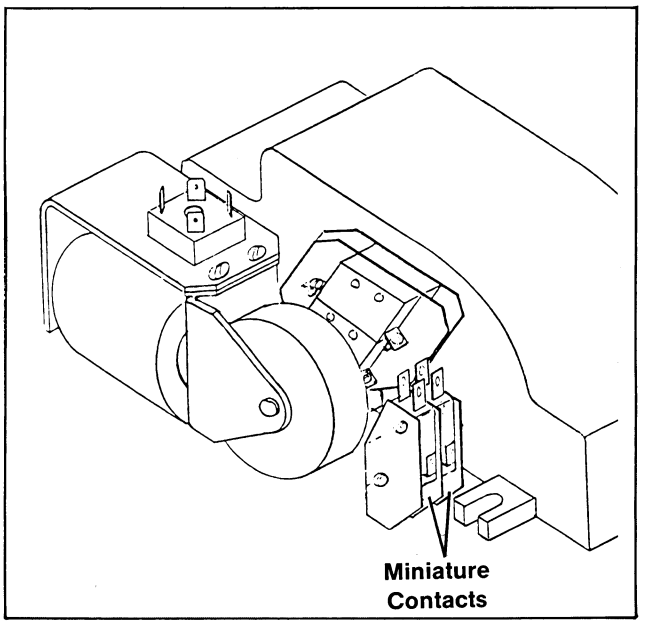



**Figure 1-13. Miniature Contacts**

Miniature contacts are serviced by removing (2) screws. Insulators are placed after each set of contacts.

For location of contacts and terminals see wiring diagram (Figure 1-14).

**NOTE**

To determine between auxiliary and miniature contacts — note terminals. Miniature contacts use push-on terminals and auxiliary contacts use screw terminals.

**NOTE**

Contacts 16-17-18 are not to be used if accessories 12-A, B, C, or D have been selected (accessories connected to terminals 16, 17, and 18 of main logic board).

**NOTE**

Contacts 14-15 (override logic) are not to be used for auxiliary connections.

## Main Contacts — Inspection

Remove arc chute by either removing hex. screw and arc runner, or loosening slotted screw and sliding up locking bracket. Using manual operator handle, move switch mechanism from one position to the other. By doing this it is possible to better examine all contacts and associated parts. Look for worn or corroded contacts, broken parts and accumulated dust/dirt. In most cases, the main con-

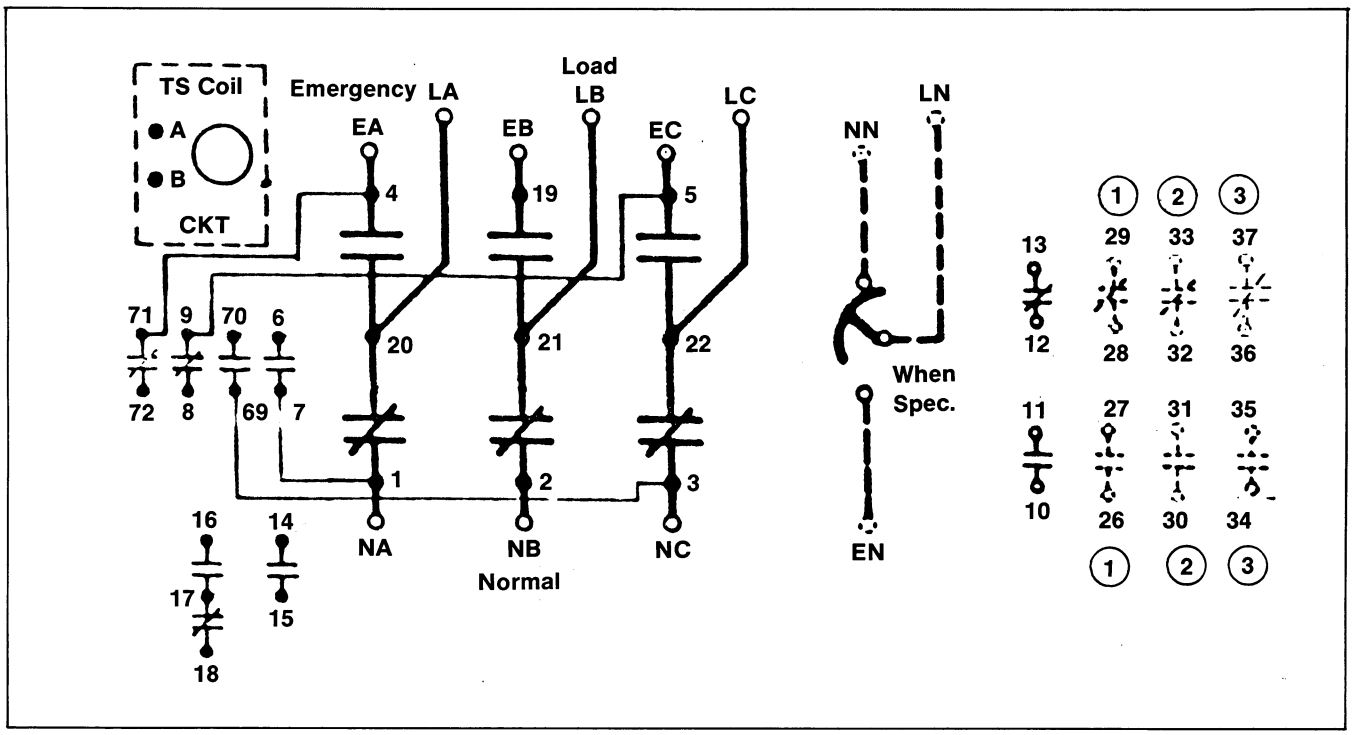



**Figure 1-14. Auxiliary/Miniature Contacts 600 Volt Class Transfer Switch Wiring Diagram (Normal Position shown)**

tacts can be wiped clean with a dry, lint-free cloth. Do not file or use abrasive cleaners on main contacts. See Figures 1-2, 1-3 and 1-4 for location of parts.

**NOTE**

The main contacts and all other internal components are not serviceable individually. If these parts require replacement, it will be necessary to replace the entire contactor mechanism.

## Rectifier Check

The 30-150 ampere transfer switch models use a rectifier to change AC line voltage to operate the DC coil. An out-of-circuit test can be made to check for proper function. Remove all leads from terminals on rectifier and using an ohmmeter (R x 1 scale), place test leads across rectifier terminals.

The test is the same as if (4) separate diodes were being checked. Diodes, as you know, allow current to pass in one direction and offer high resistance in the other direction. Figure 1-15 shows how the diodes are connected inside the rectifier.

Place one test lead on the cathode terminal of the diode and one on the anode terminal. Then reverse the test leads. Noting the meter reading each time.

1. If the meter reads high resistance one way and low resistance in the other direction, the diode is good.
2. If the meter reads high resistance both ways, the diode is open. Replace the rectifier.
3. If the meter reads low resistance both ways, the diode is shorted. Replace the rectifier.
4. Repeat for each of the four diodes.

**NOTE**

Diodes are not serviceable individually. If one of the diodes check out bad, it will require replacement of the rectifier.

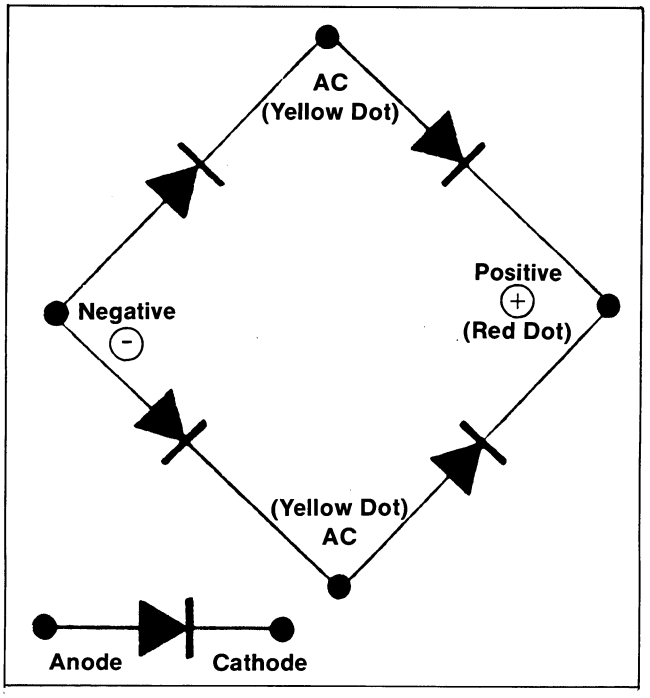



**Figure 1-15. Rectifier (4 Diodes)**

## Coil Resistance Values

A listing of coil resistance values is included in this manual to help determine if there is a defective coil. At least one lead from coil must be disconnected from circuit in order for the ohmmeter to give an accurate reading. The coil resistance values can be useful in determining the voltage rating of a given coil. See Tables 1-1 and 1-2.

**NOTE**

Since ohmmeters do vary in their accuracy, use Tables 1-1 and 1-2 as a reference for approximate readings. Readings must be at room temperature.

**Table 1-1. 250 Volt Class Transfer Switch**

| Model | 2 Poles | 3 Poles | Coil Resistance (in Ohms) |
|---|---|---|---|
| 30 Ampere | 110-120 | 110-120 | 17.2 |
| | 220-240 | 220-240 | 89.0 |
| | 190-208 | — | 54.0 |
| | — | 190-208 | 17.2 |
| 70 to 100 Ampere | 110-120 | — | 6.7 |
| | 190-208 | — | 17.2 |
| | — | 110-120 | 5.6 |
| | — | 190-208 | 14.1 |
| | — | 220-240 | 22.4 |
| | 220-240 | — | 24.6 |

**Table 1-2. 600 Volt Class Transfer Switch**

| Model | 2 Poles | 3 Poles | 3 Poles and Overlapping Neutral Contact | Coil Resistance (in Ohms) |
|---|---|---|---|---|
| 30 Ampere | 110-120 | 110-120 | — | 12.3 |
| | — | — | 110-120 | 11.5 |
| | 190-240 | 190-240 | — | 38.0 |
| | 380-416 | 380-480 | 380-416 | 140.0 |
| | 440-480 | — | — | 216.0 |
| | — | — | 440-480 | 196.0 |
| | 550-600 | 550-600 | 550-600 | 240.0 |
| | — | — | 190-240 | 17.2 |
| 70-104 Ampere | 110-120 | — | — | 6.7 |
| | — | 110-120 | 110-120 | 5.6 |
| | 190-208 | — | — | 17.2 |
| | — | 190-208 | 190-208 | 14.1 |
| | 220-240 | — | — | 24.6 |
| | — | 220-240 | 220-240 | 22.4 |
| | 380-416 | 380-480 | 380-480 | 89.0 |
| | 440-480 | — | — | 102.0 |
| | 550-600 | — | — | 140.0 |
| | — | 550-600 | 550-600 | 125.0 |
| 150 Ampere | 110-120 | — | — | 8.0 |
| | — | 110-120 | 110-120 | 10.7 |
| | — | 190-208 | 190-208 | 25.5 |
| | 190-208 | 220-240 | 220-240 | 40.0 |
| | 220-240 | — | — | 68.0 |
| | 380-416 | — | — | 262.0 |
| | — | 380-416 | 380-416 | 130.0 |
| | — | 440-480 | 440-480 | 169.0 |
| | 440-480 | 550-600 | 550-600 | 260.0 |
| | 550-600 | — | — | 406.0 |

# Section 2
# 225 THROUGH 400 AMPERES

**⚠ WARNING**

**BODILY INJURY!** A detachable manual operator handle is provided on the Transfer Switch for maintenance purposes only. Return the Transfer Switch to the Normal position. Remove manual operator handle and store it on the Transfer Switch in the place provided when service is completed.

**⚠ WARNING**

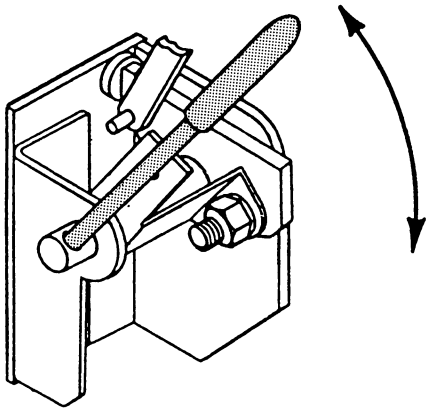
**SHOCK HAZARD!** De-energize both normal and emergency sources before proceeding. Move controller main switch to OFF position and disconnect battery negative (-) before working on transfer switch! Turn the transfer switch selector switch to the OFF position.

## Manual Operation

The detachable manual operator handle is to be used for maintenance purposes only. Move the installed handle up and down to manually operate the transfer switch. The switch should operate smoothly without binding. Return the transfer switch to the Normal position when service is completed. See Figure 2-1 for directions on installing the handle.

**CAUTION**

After installation or service is complete, manually operate the power-switching contacts from normal to emergency and back again to ensure a smooth non-binding operation before energizing the transfer switch. If binding occurs during manual operation, do *not* test electrically.



**Insert Manual Handle in Shaft Hole as Shown.**

**Figure 2-1. 225-400 Ampere**

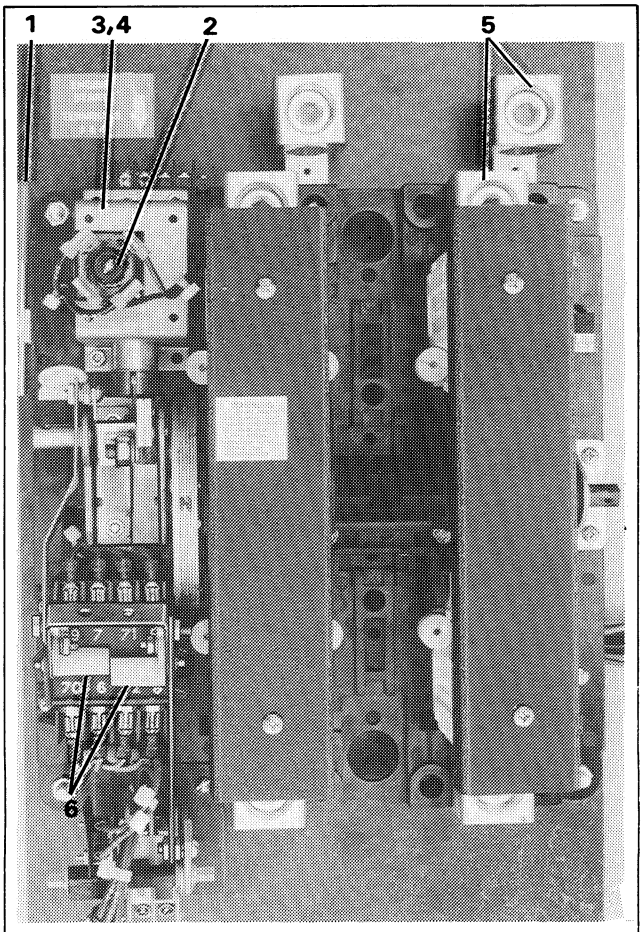
## Coil Change for Contactor Voltage Conversion

The voltage on R38 and S38 Series Automatic Transfer Switches can be changed by replacing the transformer assembly, coil kit, rectifier kit, spring kit and resistor kit to ones which are proper for the new voltage.

When the coil change for contactor voltage conversion is performed, it will be necessary to replace the existing nameplate to one which reflects the new voltage and frequency, number of poles, and number of wires.

When the solenoid assembly is replaced it will be necessary to adjust the coil clearing contacts controlling contactor operation. See Coil Clearing Contact Replacement and Adjustment for more information.

See Figures 2-2, 2-3 and 2-4 for location and identification of components found on 225-400 ampere transfer switches.




1. **Manual Operator Handle (storage location)**
2. **Rectifier**
3. **Yoke/Coil (coil located under rectifier)**
4. **Spring (not shown)**
5. **Contactor Lug**
6. **Coil Clearing Contacts**

**Figure 2-2. 225-400 Amp. Contactor (Top View)**

1. Arc Chute
2. Main Contact Spring
3. Arc Runner
4. Normal or Emergency Stationary Main Contact
5. Movable Main Contact
6. Contactor Harness
7. Contactor Harness Plug
8. Spring Retainer

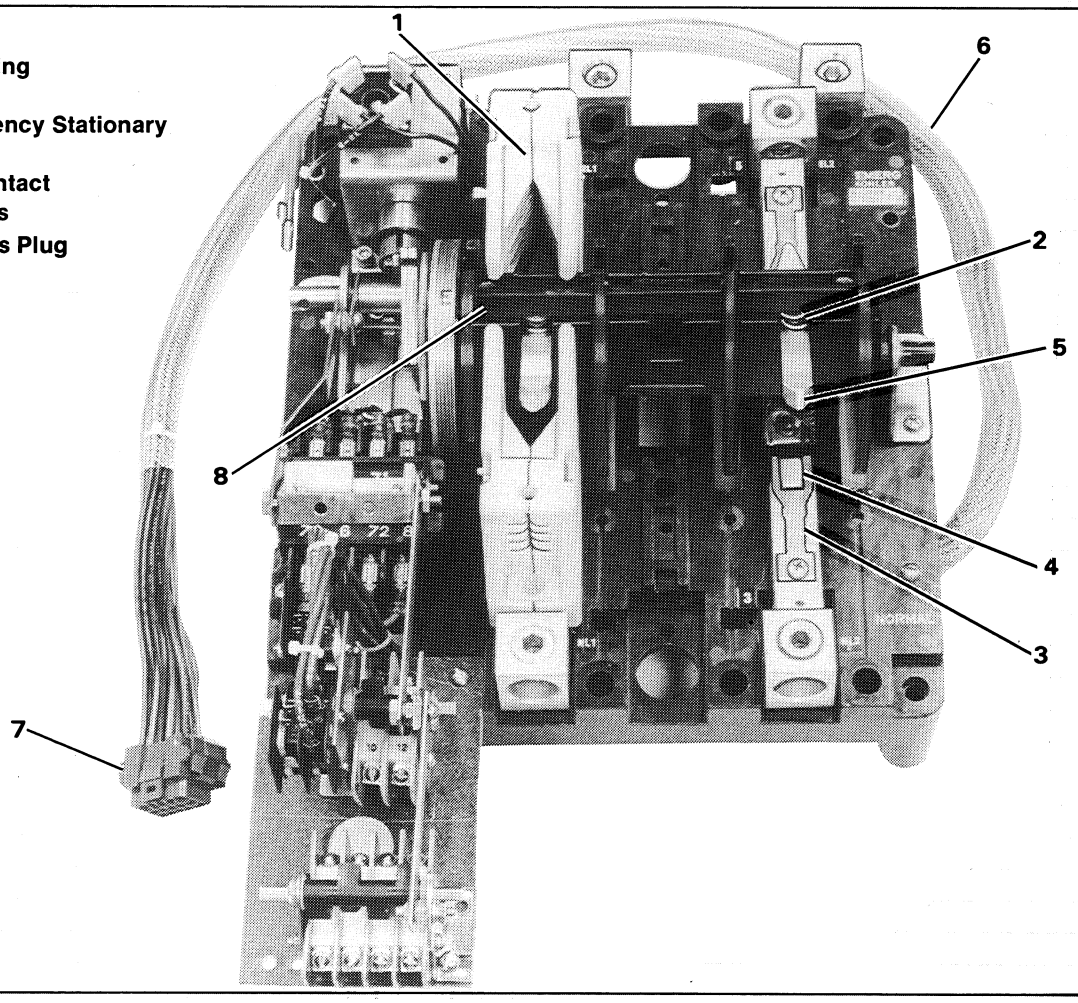



Figure 2-3. 225/260 Amp. Contactor Breakdown

**NOTE**

To determine between auxiliary and miniature contacts —note terminals. If push-on terminals are used, order miniature contacts; if screw terminals are used, order auxiliary contacts.

1. Arc Chute
2. Arc Runner
3. Coil Cleaning Contacts
4. Auxiliary Contacts (Std.)
5. Miniature Contacts (Std.)
6. Auxiliary Contacts (Opt.)
7. Miniature Contacts (Opt.)

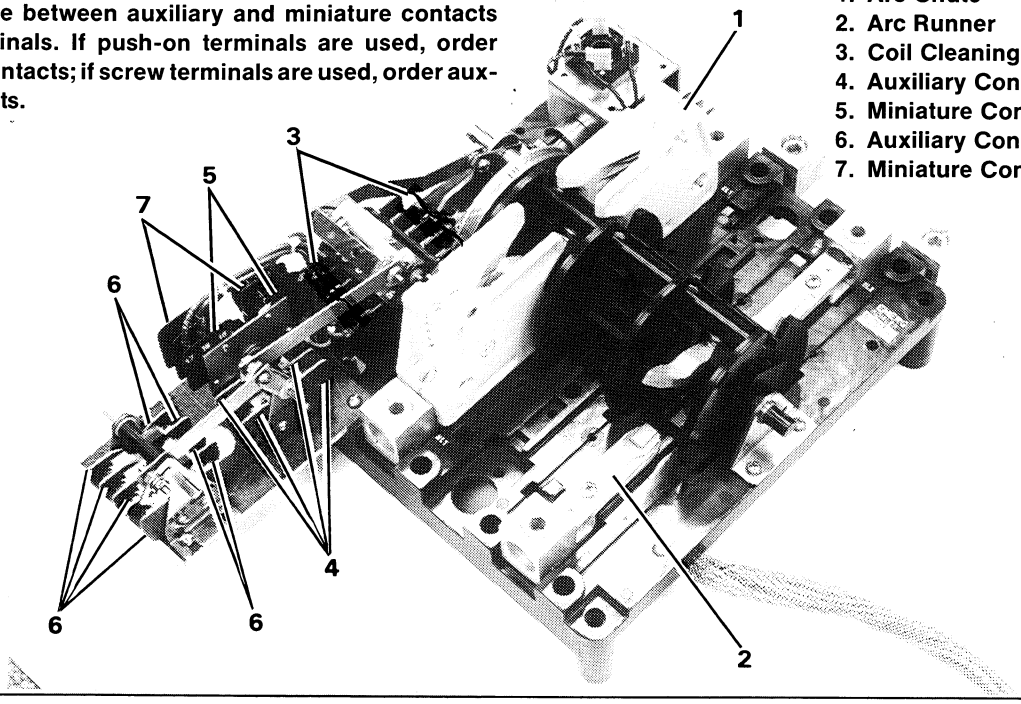
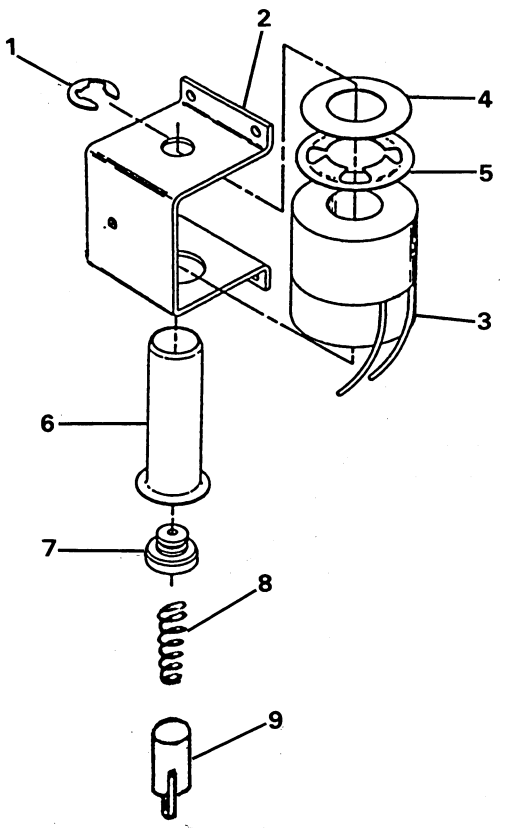



Figure 2-4. Side View of 225-400 Amp. Contactor




1. Retaining Ring
2. Frame
3. Coil
4. Spacer Washers (2)
5. Spring Washer
6. Core Tube
7. Stub Core
8. Spring
9. Solenoid Core

**Figure 2-5. Solenoid Assembly (225-400 Ampere)**

For identification of components for Transfer Switch coil replacement see Figure 2-5.

**Coil Replacement**

1. Insert manual operator handle in hole on end of contactor shaft. Move handle down to manually operate transfer switch to emergency position.
2. Disconnect the leads from rectifier assembly. Note the leads as to where they were connected. The AC leads go to terminals marked with yellow dots. The coil leads go to the other two terminals. Polarity need not be observed.
3. Removing the solenoid assembly:

**CAUTION**

The solenoid assembly is under spring pressure, so perform the next step carefully.

Firmly grasp the solenoid assembly and remove (2) socket cap screws holding the solenoid assembly to contactor base. It will be easier if the top screw is removed last. The solenoid assembly will suddenly push upward when these two screws are removed.

4. Hold the solenoid assembly including the solenoid core together and slide the solenoid core linkage off of the contactor mechanism.
5. Remove solenoid core and spring from core tube, and set on a clean surface. Do not remove lubricant.
6. To Replace Rectifier:
   a. Disconnect leads from rectifier, if not already done.
   b. Determine style of rectifier used.
      (1) Old version uses rectifier/resistor assembly.

**NOTE**

Old version rectifier/resistor assembly is no longer available.

      (2) New version uses rectifier only.
   c. To remove old version rectifier/resistor assembly:
      (1) Remove rectifier/resistor assembly by pushing in the tab on nylon posts while lifting up on assembly.
      (2) Using a small blade screwdriver remove the nylon posts from the coil/yoke assembly. These will not be reused.
   d. To remove the new version rectifier assembly:
      (1) Remove rectifier mounting screw.
   e. Mount new rectifier on yoke with screw and lock washer. Do not overtighten!

**NOTE**

When mounting new version rectifier on older models, the proper mounting hole may not be present. If not, either a new yoke will be required or it will be necessary to rework the existing yoke.

7. Remove retaining ring and slide out core tube and stub core from coil/yoke assembly.
8. Remove the coil making note as to which side the coil leads are on, in regard to the yoke.
9. If the yoke requires rework (see NOTE above):
   a. Drill a .156 in. (3.96 mm) dia. hole in yoke. For location see Figure 2-6. When drilling hole, coil must be removed to prevent damage to the coil windings. Remove any burrs.
   b. Mount new rectifier on yoke with self-tapping screw (not supplied). The length of self-tapping screw must be such that it will not damage the coil windings.
10. Install proper coil using spring washer and spacer washer(s) as required to give a snug fit in yoke.
11. Reinstall core tube, stub core, and retaining ring.
12. Install proper spring and put solenoid core into core tube.
13. While holding the assembly together, position it in the mounting location and slide solenoid core linkage over the contactor mechanism pin.

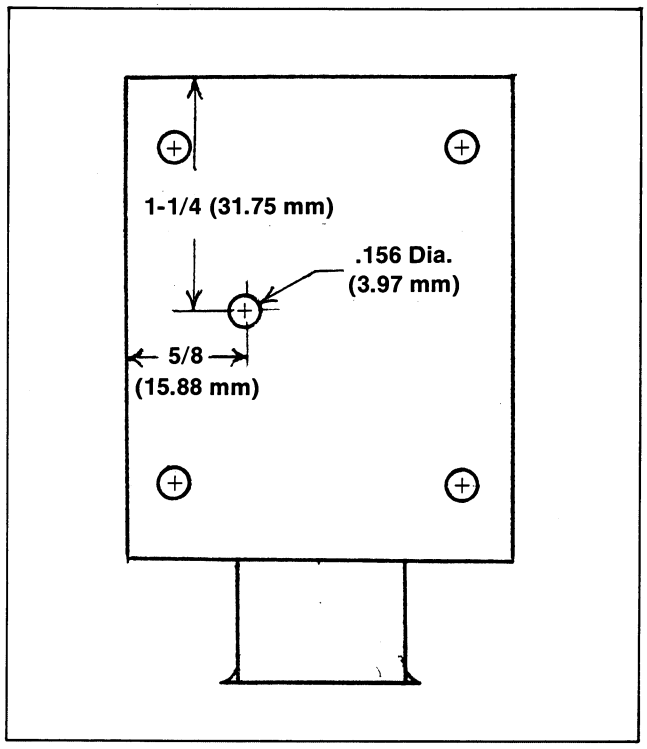



**Figure 2-6. Rectifier Mounting Hole**

**NOTE**

It will be easier to do the next step if the transfer switch is in the normal position.

14. Compress the solenoid using downward pressure and reinstall the (2) socket cap screws starting with the top one.
15. Reconnect the rectifier assembly leads. The AC leads connect to the terminals marked with yellow dots and the coil leads go to the other two terminals. Polarity need not be observed.
16. Using the manual operator handle, operate the switch several times to ensure that the mechanism works smoothly without binding.

## Coil Clearing Contacts Replacement and Adjustment

The solenoid operator is momentarily energized through control contacts located below the coil assembly. If the transfer switch coil is replaced or the setting is suspected to be incorrect, it must be checked and adjusted as necessary. This procedure requires the use of a test light or an ohmmeter.

The contacts numbered 8 and 9 control the normal to emergency contact transfer. The contacts numbered 6 and 7 control the emergency to normal contact transfer.

See Figure 2-4 for location of coil clearing contacts.

1. To Replace Contacts:
   a. Remove hex screw to remove linkage from solenoid.
   b. Remove screw to remove linkage to auxiliary contacts.
   c. Remove all leads from contacts.

**NOTE**

Each lead is marked with a number which corresponds to a numbered contact.

   d. Remove (3) screws to remove coil clearing contact assembly from mechanism chassis.
   e. Remove (3) screws from the underside of the contact assembly and remove top portion if a better view of the contacts is needed.
   f. Reassemble and tighten (3) screws on contact assembly.

**NOTE**

If one set of contacts needs replacement it will be necessary to replace the complete contact assembly.

   g. Install new contact assembly using (3) screws. Installation will be easier if the inside screw is started first, then slide contact assembly into place, then replace other (2) screws and finally tighten screws.
   h. Connect leads to contact terminals.

**NOTE**

Numbers on leads must correspond to numbers on contacts.

   i. Replace screw connecting linkage to auxiliary contacts. The nut used to connect linkage to auxiliary contacts must be a self-locking nut. Do not tighten, some play must exist in linkage.

**NOTE**

A self-locking nut can be identified by a triangle design on one side and the inability to thread it easily by hand. The side with triangle should be started last.

   j. Replace hex. screw to connect linkage to solenoid. When hex. screw is properly tightened some play should remain between drive link and coil clearing drive arm.
2. To Adjust Contacts:
   a. To check the normal to emergency coil clearing contact, connect test light to contact terminals 8 and 9.

**NOTE**

Contacts should open at 85-90% of full stroke. Full stroke is defined as point where solenoid is fully extended out to point where solenoid is fully compressed. Full stroke should not be confused as being the cycle stroke.

   b. Using manual operator handle, move contact mechanism from normal to emergency. Contacts should open at 85-90% of full stroke. If not, loosen nut on cam bracket and adjust. Tighten nut.

c. To check the emergency to normal coil clearing contact, connect test light to contact terminals 6 and 7.

d. Using manual operator handle, move contact mechanism from emergency to normal. Contact should open at 85-90% of full stroke. If not, loosen nut on cam bracket and adjust. Tighten nut.

e. Place a drop of red insulating varnish or equivalent on the two coil clearing contact adjustment brackets, if available.

## Auxiliary Contacts/Miniature Contacts

### Auxiliary Contacts

Auxiliary Contacts are rated 10 Amps. at 480 Volts.

For adding Aux. Contacts (1) and (2) see Figure 2-7 for location and type of installation.

1. Remove screw attaching drive link to drive arm of miniature contacts 10-11 and 12-13.
2. Remove (4) screws attaching miniature contacts 10-11 and 12-13, and fibre board from transfer switch chassis.
3. Mount new auxiliary contacts 1 and 2 and fibre board assembly to transfer switch chassis using existing hardware.

**NOTE**

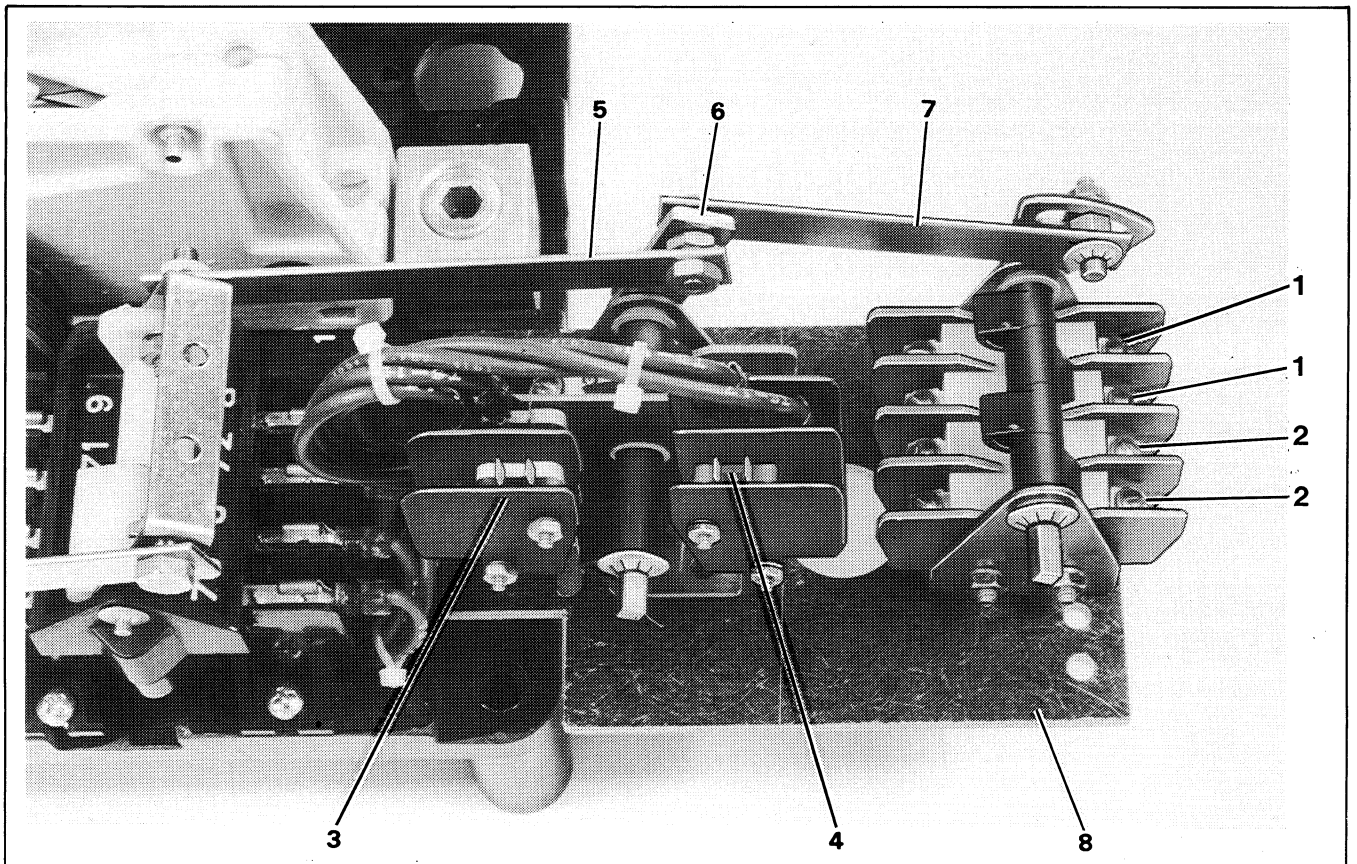
Two screws attach fibre board to chassis. The other (2) screws attach bracket of miniature contacts 10-11 and 12-13 to fibre board.

4. Install screw into drive link of auxiliary contacts 1 and 2, then through either hole in drive arm of miniature contacts 10-11 and 12-13, and install first nut allowing for some play.

**NOTE**

The second nut used should be a self-locking nut. This can be determined by a triangle design on one side and the inability to thread it easily by hand. Side with triangle should be started last.

5. Install lock washer, slide on drive link of miniature contacts and install second nut. Tighten second nut just far enough to have threads exposed and allowing for play between screw head and first nut.
6. Using manual operator handle, operate switch several times to ensure a smooth non-binding operation.




1. Auxiliary Contacts No. 1
2. Auxiliary Contacts No. 2
3. Miniature Contact No. 3
4. Miniature Contact No. 4
5. Miniature Contact Drive Link
6. Drive Arm
7. Auxiliary Contact Drive Link
8. Fibre Board

**Figure 2-7. 225-400 Amp. Contactor Contacts (Optional)**

**NOTE**

Auxiliary contacts 1 and 2 have an adjustable actuator cam and is factory set at about mid-way on slotted hole.

For location of contacts and terminals see wiring diagram (Figure 2-8).

### Miniature Contacts

Miniature Contacts are rated 15 Amps. at 250 Volts.

For adding Miniature Contacts (3) and (4) see Figure 2-7 for location and type of installation.

1. Remove the existing hardware holding contacts 14-15 and 16-17-18.
2. Use the longer screws supplied with kit and mount the miniature contacts next to the supplied contacts. Make sure switches are located so that contact (3) is mounted next to contact 14-15 and contact (4) is mounted next to contact 16-17-18. The cam to drive contacts (3) and (4) was supplied with the transfer switch. For location of contacts and terminals see wiring diagram (Figure 2-8).

**NOTE**

To determine between auxiliary and miniature contacts — note terminals. Miniature contacts use push-on terminals and auxiliary contacts use screw terminals.

**NOTE**

Contacts 10-11 and 12-13 are available at the switch for auxiliary connections.

**NOTE**

Contacts 16-17-18 are not to be used if accessories 12-A, B, C, or D have been selected (accessories connected to terminals 16, 17, and 18 of main logic board.)

**NOTE**

Contacts 14-15 (override logic) are not to be used for auxiliary connections.

## Main Contacts — Inspection

Remove contact cover/plates. On 225/260 Amp. models, remove four screws and contact cover. On 400 Amp. models, remove two screws and contact plate, for each pole assembly.

Remove arc chutes. On 225/260 Amp. models, remove flat head screw and arc chute. On 400 Amp. models, remove two nylon nuts and arc chute.

It is now possible to carefully examine the individual contacts and associated parts. Look for worn or corroded contacts, broken parts and accumulated dust/dirt. In most

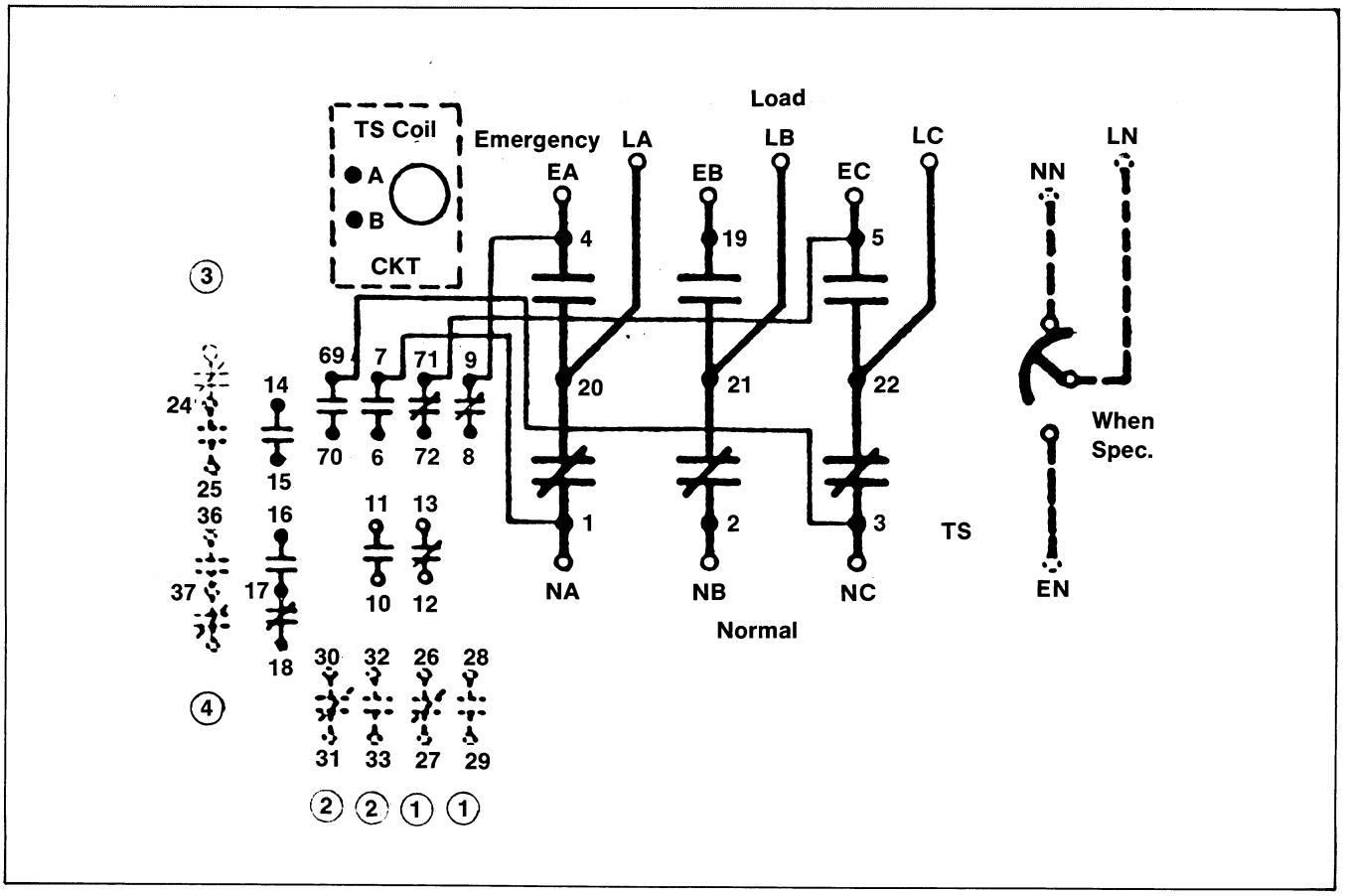



**Figure 2-8. Auxiliary/Miniature Contacts Wiring Diagram (Normal Position shown)**

cases, the main contacts can be wiped clean with a dry, lint-free cloth. Do not file or use abrasive cleaners on main contacts. Replace parts as necessary. See Figures 2-2, 2-3, 2-4 and 2-9 for location of parts.

Depending upon ampere rating and options, the disassembly procedure and hardware used will vary. The following is typical for all transfer switches in the 225-400 ampere range.

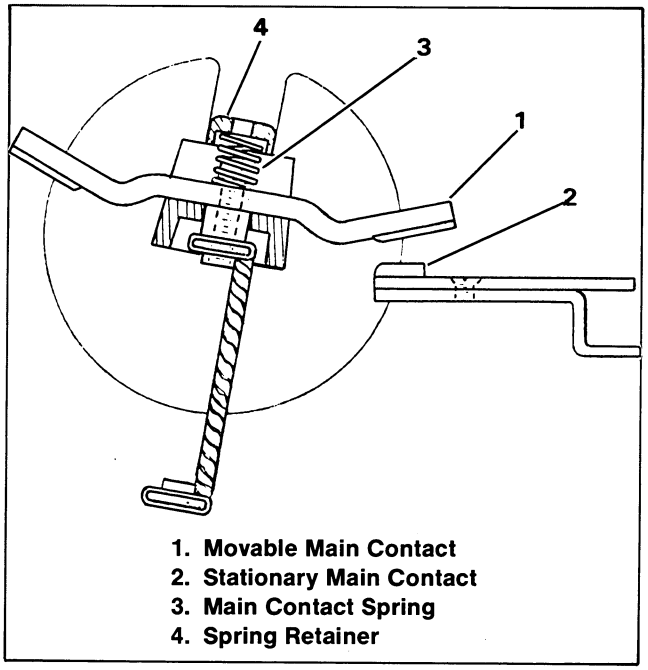



**Figure 2-9. Main Contacts**

## Contactor Lug Replacement

1. Loosen set screw(s) on contactor lug and remove lead connection(s). See Figure 2-2.
2. Remove screw and (2) washers from underside of transfer switch chassis.
3. Install new contactor lug and required hardware.

**NOTE**

Small washer is a lock washer. Replace with concave side first.

4. Insert lead connection(s) in contactor lug and tighten set screw(s).

**NOTE**

Set screws must be properly torqued when installed and should be checked every six months. When aluminum conductor is used, apply joint compound to conductor.

## Arc Chute/Arc Runner Replacement

1. Remove contact cover/plates. See Figures 2-2, 2-3 and 2-4.
   a. 225/260 Amp. — Remove contact cover by removing four screws.
   b. 400 Amp. — Remove contact plate by removing two screws, for each pole assembly.
2. Remove arc chutes.
   a. 225/260 Amp. — Remove flat head screw from arc chute and remove arc chute.
   b. 400 Amp. — Remove two nylon nuts from arc chute and remove arc chute.
3. Remove arc runners.
   a. 225/260 Amp. — Remove arc runner screw and arc runner. See Figure 2-10.

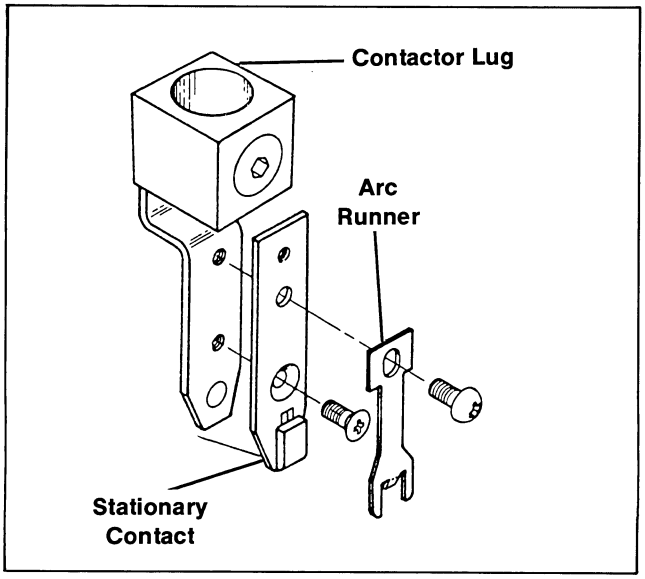



**Figure 2-10. 225/260 Amp. Stationary Contact**

   b. 400 Amp. — Remove arc runner screw and loosen stationary main contact. Slide out arc runner. See Figure 2-11.

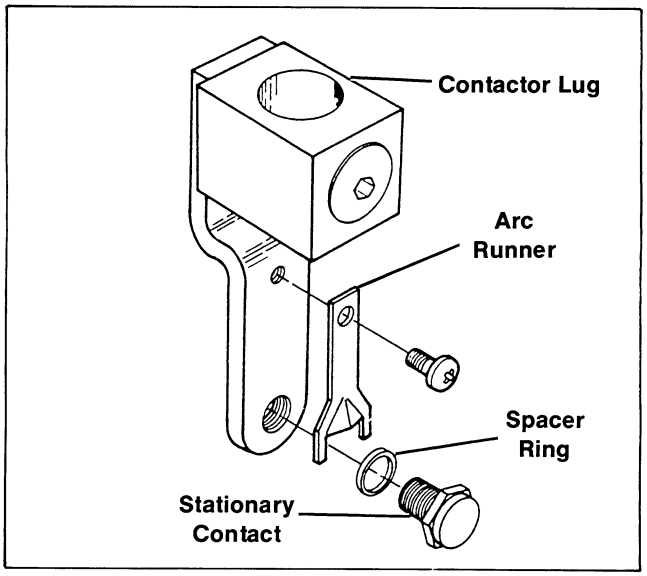



**Figure 2-11. 400 Amp. Stationary Contact**

**NOTE**

If additional contact parts need replacement, do not perform steps 4-7 at this time.

4. Install new arc runner.
   a. 225/260 Amp. — Align arc runner tab in square hole and push arc runner as close as possible toward the stationary main contact. Install and tighten arc runner screw.
   b. 400 Amp. — With formed side up, slide arc runner under spacer ring. Install arc runner screw, but do *not* tighten! With arc runner jaws positioned equally under spacer ring, torque stationary main contact to 100 in. lb. (11.3 Nm). Tighten arc runner screw.
5. Install arc chute.
   a. 225/260 Amp. — Install arc chute using flat head screw and torque to 20 in. lb. (2.3 Nm).
   b. 400 Amp. — Install arc chute using two nylon nuts and torque to 12-14 in. lb. (1.4-1.6 Nm).
6. Operate contactor mechanism with manual operator handle and check contact clearance with arc chutes. Adjust as necessary.
7. Replace contact cover/plates.
   a. 225/260 Amp. — Install contact cover using four screws.
   b. 400 Amp. — Install contact plate using two screws, for each pole assembly.

## Stationary Main Contacts Replacement

The following replacement procedure applies to both normal and emergency stationary main contacts. See Figures 2-3, 2-10 and 2-11.

1. With contact cover(s) and arc chutes removed, place contacts in open position on side to which work is to be performed using manual operator handle.
2. Remove arc runner screw. On 225/260 Amp. models, remove arc runner.
3. Remove stationary main contact.
   a. 225/260 Amp. — Remove flat head screw and lift off stationary main contact.
   b. 400 Amp. — Unscrew stationary main contact, remove spacer ring, and remove arc runner.
4. Install new stationary main contact.
   a. 225/260 Amp. — Install new stationary main contact and tighten flat head screw.
   b. 400 Amp. — Place spacer ring on stationary main contact and mount to contactor lug. Do *not* final tighten!
5. Install arc runner.
   a. 225/260 Amp. — Align arc runner tab in square hole and push arc runner as close as possible toward the stationary main contact. Install and tighten screw.
   b. 400 Amp. — With formed side up, slide arc runner under spacer ring. Install arc runner screw, but do *not* tighten! With arc runner jaws positioned equally under spacer ring, torque stationary main contact to 100 in. lb. (11.3 Nm). Tighten arc runner screw.
6. Repeat procedure for each normal and emergency stationary main contacts in need of replacement.
7. See Movable Main Contacts Replacement.

## Movable Main Contacts Replacement

This procedure is to be done in conjunction with the Stationary Contact Replacement. The normal and emergency movable main contacts are one-piece. See Figures 2-3 and 2-9.

1. Remove contact cover/plates and arc chutes, if not already done.
2. Remove four hex screws and remove spring retainer (black insulator bar) from center of movable main contacts.

**CAUTION**

Retainer is under spring pressure. Hold retainer securely above springs, while gradually loosening each screw. This will prevent undue pressure from breaking the spring retainer.

3. Remove springs from screw heads.
4. Remove socket cap screw from movable main contact.
5. Remove movable main contact, and copper bushing (225/260 Amp. models).
6. Install movable main contact.
   a. 225/260 Amp. — With copper bushing between movable main contact and contactor lug, install movable main contact with socket cap screw and lock washer.
   b. 400 Amp. — Apply conductive lubricant to mounting surfaces of movable main contact and contactor lug. Install movable main contact with socket cap screw and lock washer. Torque to 100 in. lb. (11.3 Nm).

**CAUTION**

Failure to use conductive lubricant between 400 Amp. contactor lug and movable main contact may cause overheating.

7. Repeat steps 4-6 for each movable main contact needing replacement.
8. Replace springs on screw head for each movable main contact.
9. Replace spring retainer (black insulator bar) and tighten four hex head screws. Apply pressure only to area above springs, while gradually tightening each screw.

**NOTE**

Each screw has a fibre washer underneath the spring retainer. Check that each spring is properly seated while tightening screws.

10. Replace arc chutes and hardware.
11. Replace contact cover/plates and hardware.

## Overlapping Neutral Transfer Contacts Replacement

1. Remove insulator housings at each end of overlapping neutral transfer contacts by removing nut, lock washer and washer.
2. With the transfer switch in the normal position, remove movable portion of normal neutral contact by removing nut and sliding out screw.

**NOTE**

The movable overlapping neutral transfer contact is under spring pressure. Hold bar securely while removing screw.

3. Remove spring.

**NOTE**

Movable neutral contact spring is identical to one used in movable main contacts.

4. Remove normal stationary neutral contact.
5. Install new normal stationary neutral contact.
6. Replace spring.
7. With pivoting spacers in place, install normal movable overlapping neutral transfer contact by compressing spring with neutral contact while sliding screw through hole. Tighten nut. Check that spring is properly seated.
8. Adjust screw and nylon nut so that while contact is in open position there is about 3/32-1/8 in. (2.38-3.18 mm) clearance between movable and stationary neutral contacts. Tighten locking nut.
9. Place transfer switch in the emergency position and repeat Steps 2-8 for the emergency overlapping neutral transfer contacts.
10. Replace insulator housings over each end of overlapping neutral transfer contacts. Replace washer, lock washer and tighten nut.

## Rectifier Check

The 225-400 ampere transfer switch models use a rectifier to change AC line voltage to operate the DC coil. An out-of-circuit test can be made to check for proper function. Remove all leads from terminals on rectifier and using an ohmmeter (R x 1 scale), place test leads across rectifier terminals.

This test is the same as if (4) separate diodes were being checked. Diodes, as you know, allow current to pass in one direction and offer high resistance in the other direction. Figure 2-12 shows how the diodes are connected inside the rectifier.

Place one test lead on the cathode terminal of the diode and one on the anode terminal. Then reverse the test leads. Noting the meter reading each time.

1. If the meter reads high resistance one way and low resistance in the other direction, the diode is good.
2. If the meter reads high resistance both ways, the diode is open. Replace the rectifier.
3. If the meter reads low resistance both ways, the diode is shorted. Replace the rectifier.
4. Repeat for each of the four diodes.

**NOTE**

Diodes are not serviceable individually. If one of the diodes check out bad, it will require replacement of the rectifier.

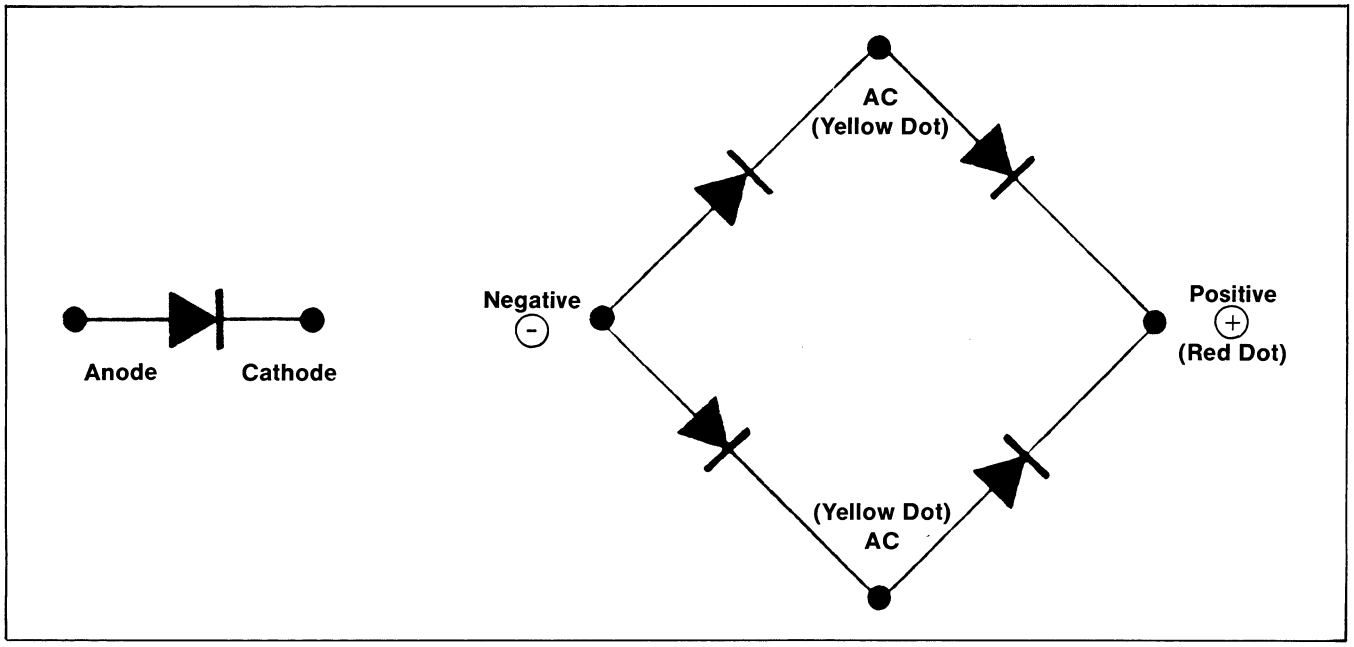



**Figure 2-12. Rectifier (4 Diodes)**

## Coil Resistance Values

A listing of coil resistance values is included in this manual to help determine if there is a defective coil. At least one lead from coil must be disconnected from circuit in order for the ohmmeter to give an accurate reading. The coil resistance values can be useful in determining the voltage rating of a given coil. See Table 2-1.

**NOTE**

Since ohmmeters do vary in their accuracy, use Table 2-1 as a reference for approximate readings. Readings must be at room temperature.

**Table 2-1. 600 Volt Class**

| Model | 2 Poles | 3 Poles | 3 Poles and Overlapping Neutral Contact | Coil Resistance (in Ohms) |
|---|---|---|---|---|
| 225/260 | 110-120 | 110-120 | — | 6.6 |
| Ampere | — | — | 110-120 | 4.0 |
| | — | — | 190-208 | 14.0 |
| | 190-208 | 190-240 | 208-240 | 25.5 |
| | 220-240 | — | — | 40.0 |
| | 380-416 | — | 380-416 | 68.0 |
| | 440-480 | 380-480 | 440-600 | 107.0 |
| | 550-600 | 550-600 | — | 169.0 |
| 400 Ampere | 110-120 | 110-120 | 110-120 | 2.7 |
| | 190-208 | 190-240 | — | 17.2 |
| | — | — | 190-240 | 13.5 |
| | 220-240 | — | — | 25.5 |
| | 380-416 | 380-480 | 380-480 | 68.0 |
| | 440-600 | 550-600 | 550-600 | 107.0 |

# Section 3
# 600 AND 800 AMPERES

**⚠ WARNING**

**BODILY INJURY!** A detachable manual operator handle is provided on the Transfer Switch for maintenance purposes only. Return the Transfer Switch to the Normal position. Remove manual operator handle and store it on the Transfer Switch in the place provided when service is completed.

**⚠ WARNING**

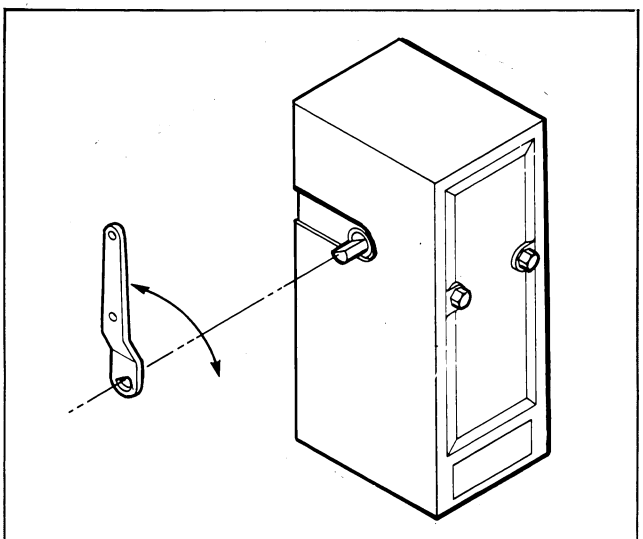
**SHOCK HAZARD!** De-energize both normal and emergency sources before proceeding. Move controller main switch to OFF position and disconnect battery negative (-) before working on transfer switch! Turn the transfer switch selector switch to the OFF position.

## Manual Operation

The detachable manual operator handle is to be used for maintenance purposes only. Move the installed handle up and down to manually operate the transfer switch. The switch should operate smoothly without binding. Return the transfer switch to the Normal position when service is complete. See Figure 3-1 for directions on installing the handle.

**CAUTION**

After installation or service is complete, manually operate the power-switching contacts from normal to emergency and back again to ensure a smooth non-binding operation before energizing the transfer switch. If binding occurs during manual operation, do *not* test electrically.



**Insert Manual Handle into Pivot Shaft Extension, Left Side of Operator**

**Figure 3-1. 600-800 Ampere**

## Coil Change for Contactor Voltage Conversion

The voltage on R38 and S38 Series Automatic Transfer Switches can be changed by replacing the transformer assembly, coil kit, rectifier kit, spring kit and resistor kit to ones which are proper for the new voltage.

When the coil change for contactor voltage conversion is performed, it will be necessary to replace the existing nameplate to one which reflects the new voltage and frequency, number of poles, and number of wires.

When the solenoid assembly is replaced it will be necessary to adjust the coil clearing contacts controlling contactor operation. See Coil Clearing Contact Replacement and Adjustment for more information.

See Figures 3-2, 3-3 and 3-4 for location and identification of components found on 600 and 800 ampere transfer switches.

For identification of components for Transfer Switch Coil replacement see Figure 3-5.

### Coil Replacement

1. Remove manual operator handle from its storage area. Place manual operator handle onto pivot shaft extension and move handle down to manually operate transfer switch to emergency position.
2. Remove (2) hex. head screws that hold red plastic cover and remove cover.
3. Disconnect both coil leads from rectifier. Polarity need not be observed.

**NOTE**

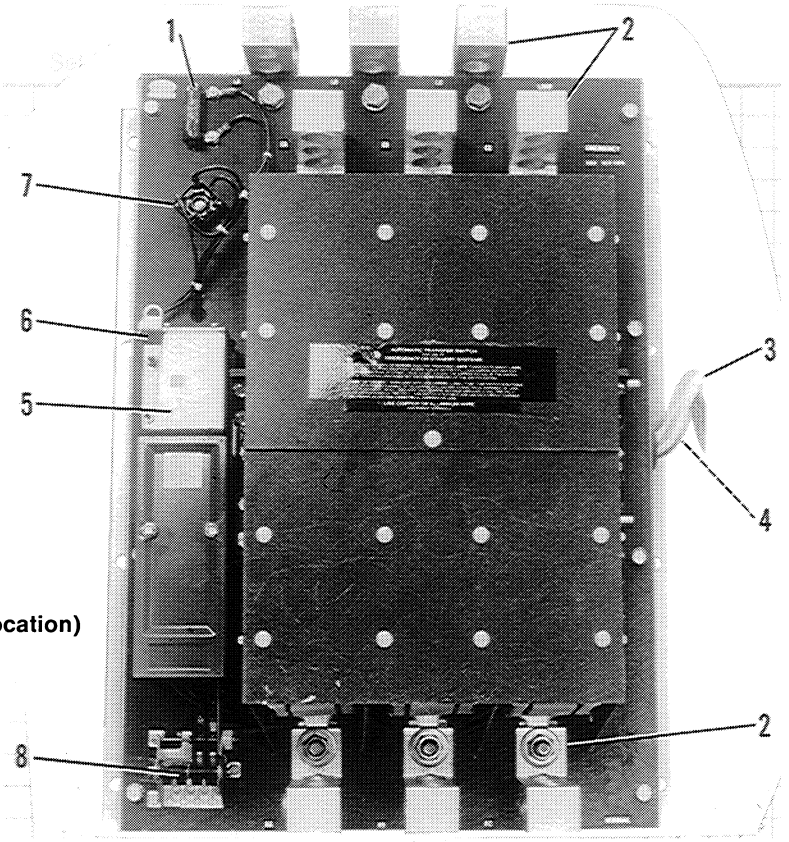
It will be necessary to cut off some of the cable ties. Be careful not to damage the insulation on the leads.

4. Remove (2) hex. head screws that hold coil and frame assembly to operator mechanism chassis. Carefully pull coil/frame assembly slightly outward so that the short flanged guide pins on coil/frame assembly line up with key slots on mechanism chassis. When pins are lined up it will be possible to lift coil/frame assembly upward freeing it from spring and solenoid core. Do not clean lubricant off solenoid core. See Figure 3-6.

**CAUTION**

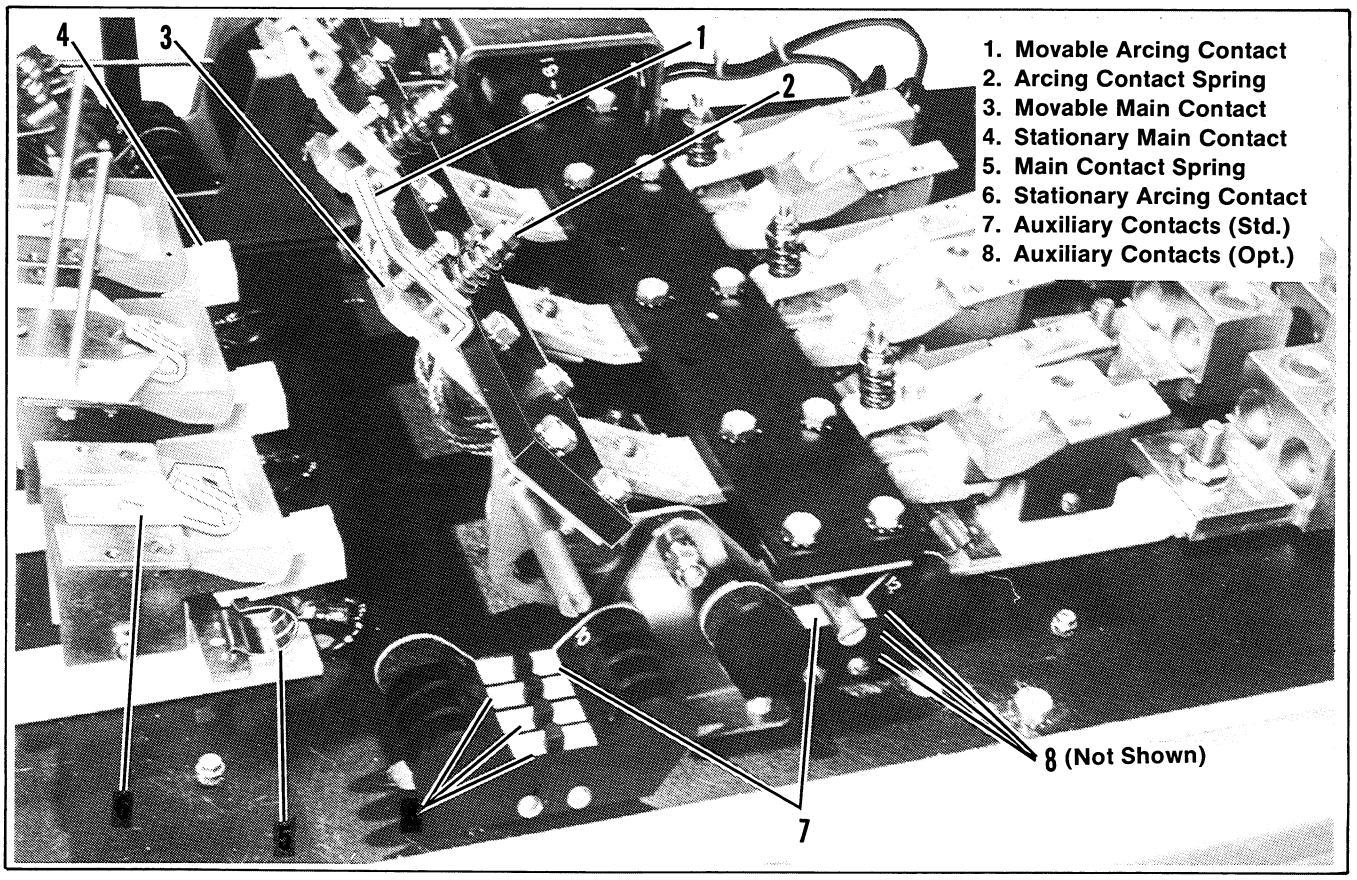
These parts are under spring pressure and should be held securely while disassembling.

5. Loosen (2) coil positioning screws in top of coil frame. This is done by first loosening locking nut and then turning screw.
6. Using thin-blade screwdriver remove retaining ring that holds core tube assembly to coil/frame assembly. Push core tube/stub core assembly out the other end.



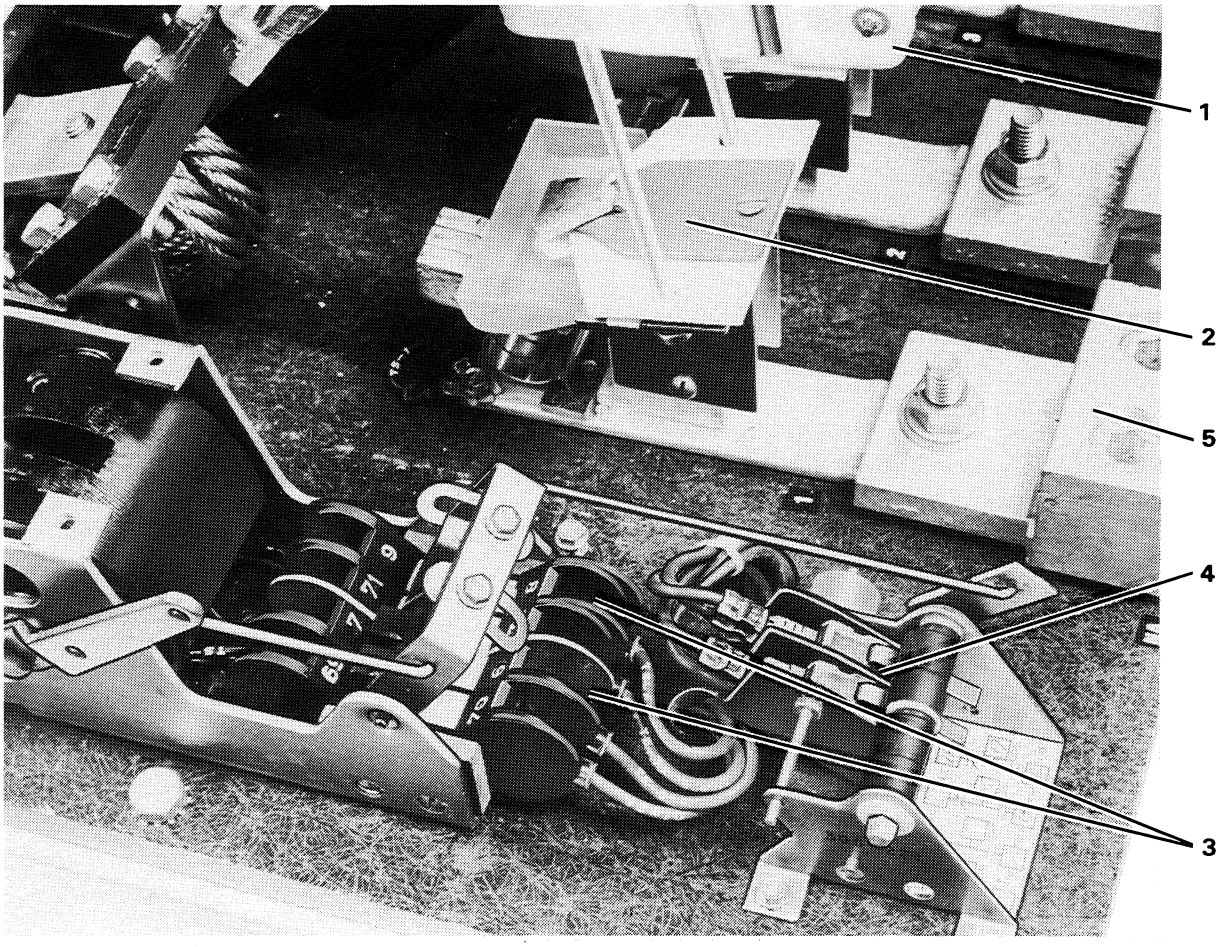

1. Resistor
2. Contactor Lugs
3. Contactor Harness
4. Contactor Harness Plug (not shown)
5. Yoke/Coil Kit (Spring Kit)
6. Manual Operating Handle (storage location)
7. Rectifier
8. Miniature Contact

**Figure 3-2. 600-800 Amp. Contactor**




1. Movable Arcing Contact
2. Arcing Contact Spring
3. Movable Main Contact
4. Stationary Main Contact
5. Main Contact Spring
6. Stationary Arcing Contact
7. Auxiliary Contacts (Std.)
8. Auxiliary Contacts (Opt.)

**Figure 3-3. Internal View of 600-800 Amp. Contactor**




1. **Arc Chute**
2. **Arc Runner**
3. **Coil Clearing Contacts**
4. **Miniature Contacts**
5. **Contactor Lug**

**NOTE**

**To determine between auxiliary and miniature contacts —note terminals. If push-on terminals are used, order miniature contacts; if screw terminals are used, order auxiliary contacts.**

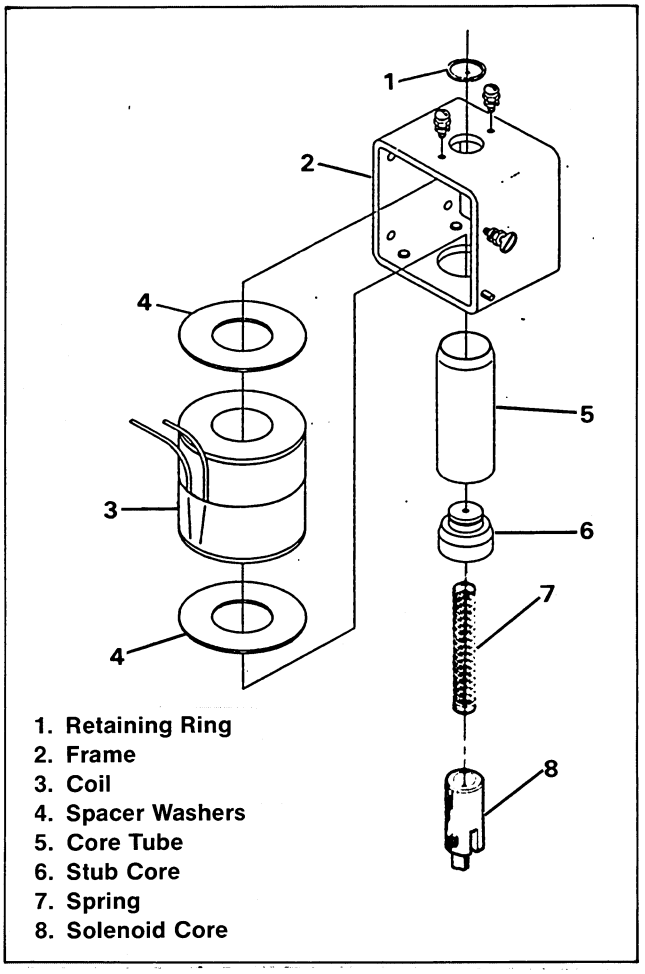
**Figure 3-4. 600-800 Amp. Contactor (Contacts)**

7. Remove coil and spacer washer(s) from frame.
8. Install proper coil using spacer washer(s) as required to give a snug fit in frame. Coil leads should be to the outside as viewed from the installed position.
9. Install core tube and stub core into coil/frame assembly.
10. Push stub core through other end of frame and while holding it in place install the retaining ring.
11. Tighten (2) coil positioning screws in top of coil/frame assembly. This is done by first turning nut, by hand, as close to the screw head as possible. Then tighten screw into coil/frame assembly and finally tighten nut against coil/frame assembly.

**NOTE**

This step only prevents coil from turning inside frame. Do not overtighten as damage to the coil windings may result.

12. Place new spring into solenoid core, if required. Carefully place solenoid core with spring into core tube. Position the coil/frame assembly against the mechanism chassis so that guide pins on coil/frame assembly go through key slots on mechanism chassis.
13. Press coil/frame assembly to mechanism chassis and reinstall (2) hex. head screws, fastening coil/frame assembly to mechanism chassis.
14. Using manual operating handle, operate switch two or three times to see that it works smoothly and without mechanical binding.
15. To Replace Rectifier:
    a. Remove coil leads from rectifier, if not already done.
    b. Remove two remaining leads from rectifier terminals marked with yellow dots.
    c. Remove rectifier mounting screw.
    d. Mount new rectifier on chassis with screw. Do not overtighten!




1. Retaining Ring
2. Frame
3. Coil
4. Spacer Washers
5. Core Tube
6. Stub Core
7. Spring
8. Solenoid Core

**Figure 3-5. Solenoid Assembly (600 and 800 Ampere)**

e. Connect AC leads to terminals on rectifier marked with yellow dots.

f. Connect coil leads to the remaining terminals on rectifier. Polarity need not be observed.

16. To Replace Resistor:

    a. Remove mounting nuts on resistor.

    b. Remove hardware and leads.

    c. Install new resistor and leads.

    d. Replace washers, lock washers and nuts.

17. Using two hex. screws reinstall red plastic cover.

## Coil Clearing Contacts Replacement and Adjustment

The solenoid operator is momentarily energized through control contacts located below the coil assembly. If the transfer switch coil is replaced or the setting is suspected to be incorrect, it must be checked and adjusted as necessary. This procedure requires the use of a test light or an ohmmeter.

The contacts numbered 8 and 9 control the normal to emergency contact transfer. The contacts numbered 6 and 7 control the emergency to normal contact transfer.

See Figure 3-4 for location of coil clearing contacts.

1. Remove (2) hex. head screws that hold red plastic cover, and remove cover.
2. To Replace Contacts:

    a. Loosen screws and remove leads from contact.

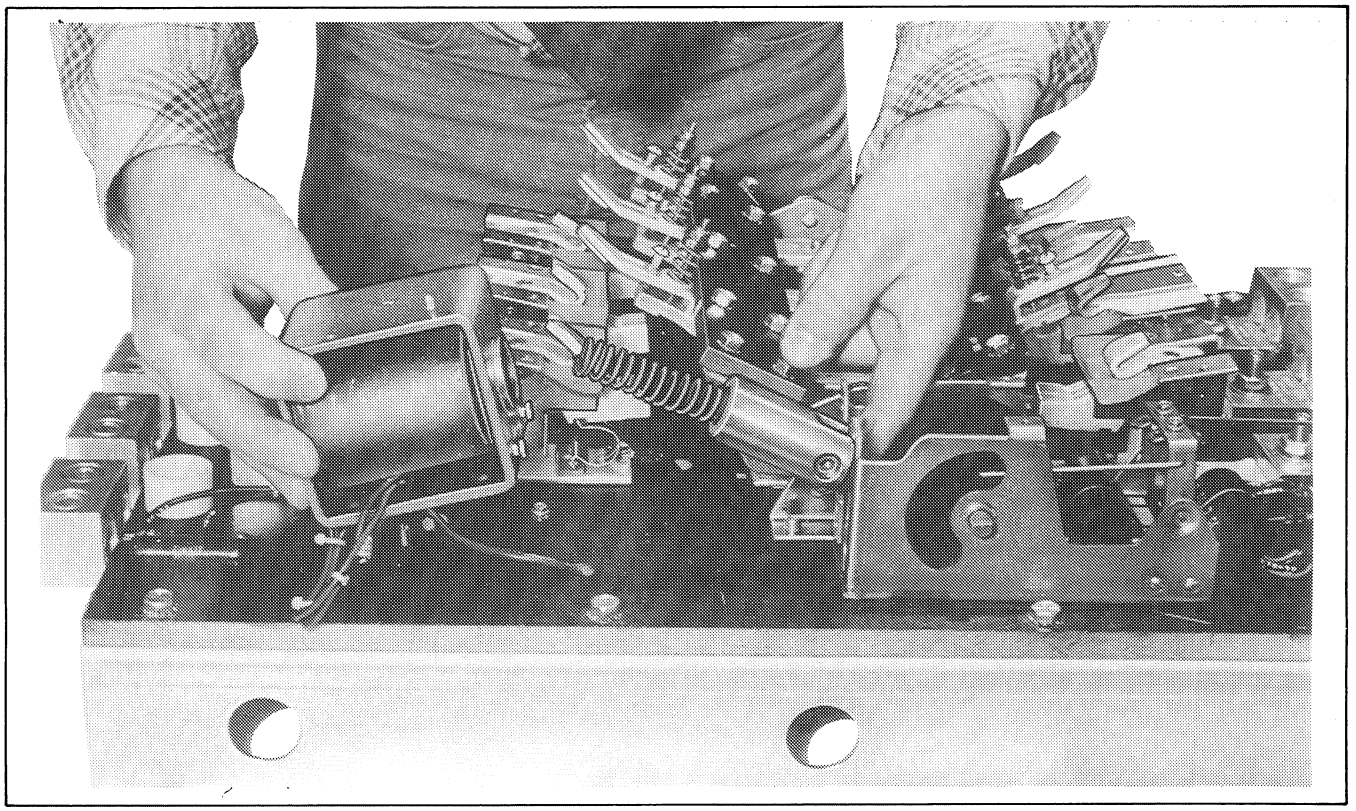


**Figure 3-6. 600-800 Amp. Contactor Coil Replacement**

**NOTE**

Each lead is marked with a number which corresponds to a numbered contact.

b. Remove (2) screws on outside edge of contact bracket.

c. Remove required contact(s). It will be necessary to move the actuator cam to the 'up' position for clearance of the contact.

**NOTE**

Take notice of where contact was removed as it must be replaced in the same location in respect to the other contacts.

d. When placing contact into insulator housing be sure that internal contact parts go to the inside of the insulator housing.

e. Install contact back into bracket in same location as it was removed.

f. Replace (2) screws on outside edge of contact bracket. If installation is correct, numbers on contacts will be right-side up and plunger on contact will be directly below actuating cam. Tighten screws.

g. Replace leads to corresponding contact screws and tighten.

3. To Adjust Contacts:

a. To check the normal to emergency coil clearing contact, connect test light to contact terminals 8 and 9.

**NOTE**

Contacts should open at 85-90% of full stroke. Full stroke is defined as point where solenoid is fully extended out to point where solenoid is fully compressed. Full stroke should not be confused as being the cycle stroke.

**NOTE**

To measure full stroke of solenoid core, place a piece of stiff wire (about 5 in. (127 mm) long) into small hole at end of core tube stub shaft. With wire pressed against solenoid core, mark points with solenoid core in fully extended and fully compressed positions. Full stroke should be about .937 in. (23.8 mm). Contacts should open at 85-90% of full stroke or .797-.844 in. (20.2-21.4 mm).

b. Using manual operator handle, move contact mechanism from normal to emergency. Contacts should open at 85-90% of full stroke. If not, loosen hex screw on cam bracket and adjust. Tighten screw.

c. To check the emergency to normal coil clearing contact, connect test light to contact terminals 6 and 7.

d. Using manual operator handle, move contact mechanism from emergency to normal. Contacts should open at 85-90% of full stroke. If not, loosen hex screw on cam bracket and adjust. Tighten screw.

e. Place a drop of red insulating varnish or equivalent on the two coil clearing contact adjustment brackets, if available.

4. Replace red plastic cover and tighten (2) hex head screws.

# Auxiliary Contacts/Miniature Contacts

## Auxiliary Contacts

For adding Auxiliary Contacts (1), (2), and (3) see Figure 3-3 for location and type of installation. One contact for each of the normal and emergency sides is standard, and two are optional for each side. Auxiliary contacts are rated 10 Amps. at 480 Volts.

1. Remove the two mounting screws that are used to hold the auxiliary contact to the corresponding movable contact arm support.
2. Install the desired number of auxiliary contacts.
3. Select the appropriate hardware to mount the additional auxiliary contacts. See below.

| Total Number of Contacts (per side) | Screws Required (2) |
|---|---|
| 2 | 8-32 x 1-5/16" |
| 3 | 8-32 x 1-13/16" |

4. Mount the auxiliary contacts.
5. Select the appropriate drivers for contacts (1) and (2).

| Total Number of Contacts (per side) | Driver |
|---|---|
| 1 or 2 | Supplied |
| 3 or 4 | 295170 |

6. Mount driver to bracket, do not tighten nut. Since the threaded portion is eccentric to the shaft, the driver can be adjusted by rotating it. There should be some travel left in the push-button of the auxiliary contact after the main contacts are fully closed. When properly adjusted, tighten nut.

For location of contacts and terminals see wiring diagram (Figure 3-7).

## Miniature Contacts

Miniature Contacts are rated 15 Amps. at 250 Volts.

For servicing Miniature Contacts see Figures 3-2 and 3-4 for location and type of installation.

1. Remove the existing hardware holding contacts 14-15 and 16-17-18.
2. Install miniature contacts and insulators as needed, make sure miniature contacts remain in their original location.
3. Replace using original hardware. For location of contacts and terminals see wiring diagram (Figure 3-7).

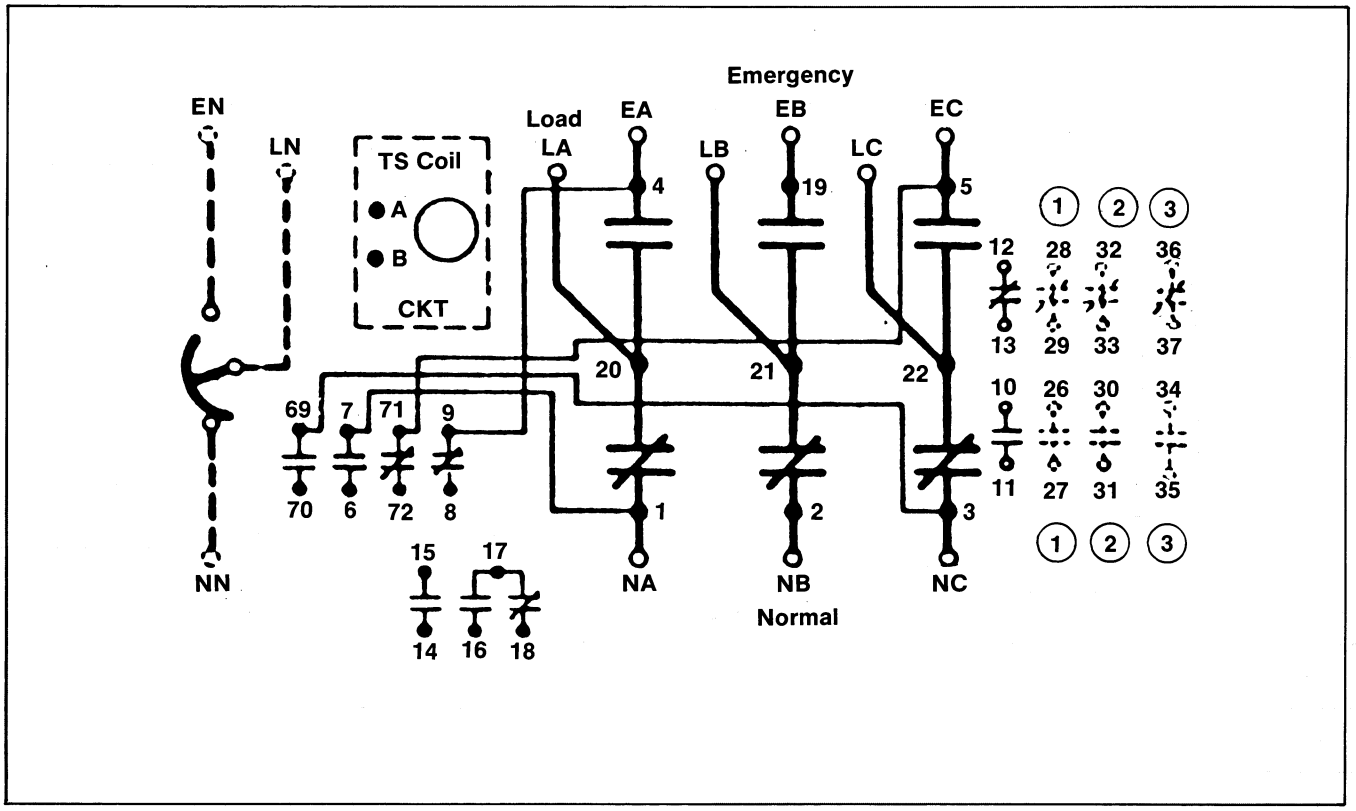



**Figure 3-7. Auxiliary/Miniature Contacts Wiring Diagram (Normal Position shown)**

**NOTE**

To determine between auxiliary and miniature contacts — note terminals. Miniature contacts use push-on terminals and auxiliary contacts use screw terminals.

**NOTE**

Contacts 10-11 and 12-13 are available at the switch for auxiliary connections.

**NOTE**

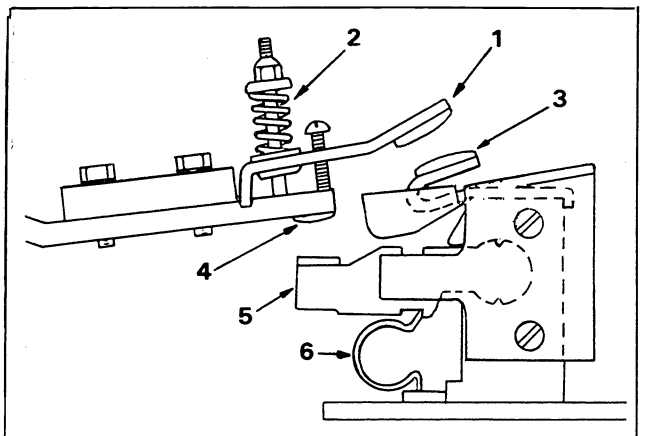
Contacts 16-17-18 are not to be used if accessories 12-A, B, C, or D have been selected (accessories connected to terminals 16, 17, and 18 of main logic board.)

**NOTE**

Contacts 14-15 (override logic) are not to be used for auxiliary connections.

## Main Contacts — Inspection

Loosen (4) hex. screws and remove contact cover. Using manual operator handle move switch mechanism from normal to emergency and back again. This is done to better examine all contacts and associated parts. Look for worn or corroded contacts, broken parts and accumulated dust/dirt. In most cases, the main contacts can be wiped clean with a dry, lint-free cloth. Do not file or use abrasive cleaners on main contacts. Replace parts as necessary. If further examination is required, remove the arc chute. This is done by removing the (2) nylon nuts and insulator plate, then lifting arc chute from threaded rods. See Figures 3-3, 3-4 and 3-8 for location of parts.




**Arcing Contacts**
1. **Movable Arcing Contact**
2. **Arcing Contact Spring**
3. **Stationary Arcing Contact**

**Main Contacts**

4. **Movable Main Contact**
5. **Stationary Main Contact**
6. **Main Contact Spring**

**Figure 3-8. Main and Arcing Contacts**

## Contactor Lug Replacement

1. Loosen set screw(s) on contactor lug and remove lead connection(s). See Figures 3-2 and 3-4.
2. Remove nut and (2) washers, slide off contactor lug.
3. Install new contactor lug and required hardware.

**NOTE**

Small washer is a lock washer. Replace with concave side first.

4. Insert lead connection(s) in contactor lug and tighten set screw(s).

**NOTE**

Set screws must be properly torqued when installed and should be checked every six months. When aluminum conductor is used, apply joint compound to conductor.

## Arc Chute/Arc Runner Replacement

1. Loosen (4) hex. screws and remove contact cover.
2. Remove (2) nylon nuts and insulator plate. Lift arc chute from threaded rods. See Figure 3-4.
3. Remove flat head screw and fastener. Slide out arc runner.

**NOTE**

If additional contact parts need replacement, do not perform Steps 4-7 at this time.

4. Slide new arc runner into position and tighten flat head screw to fastener.
5. Replace arc chute by aligning with threaded rods.
6. Install insulator plate and (2) nylon nuts. Do not overtighten.
7. Replace contact cover and tighten (4) hex screws.

## Stationary Main and Arcing Contacts Replacement

The following replacement procedure applies to both normal and emergency stationary main contacts. See Figures 3-3, 3-4 and 3-8.

**NOTE**

Arcing contacts must also be replaced if it is necessary to replace the main contacts.

1. With contact cover and arc chutes removed, place contacts in open position on side to which work is to be performed using manual operator handle.
2. Remove two screws holding bracket assembly to main contacts.
3. Remove flat head screw and fastener. Slide out arc runner.
4. Remove insulator by sliding it off of threaded rods, while simultaneously rocking bracket assembly.
5. Remove bracket assembly.
6. Remove the (3) sections of the main stationary contact while pushing down on the spring. Remove spring.
7. Apply contact lubricant to the main contact hinge joints. Use tip of finger to spread a thin film on curved surface of each new contact section. Also apply a thin film inside the pivot block channel. Wipe off excess.
8. Position spring into guide holes and press down while sliding the (3) sections of the main stationary contact into place.
9. Remove flat head screw holding stationary arcing contact. Remove contact.
10. Install new stationary arcing contact and tighten screw.
11. Reinstall bracket assembly.
12. Replace insulator over threaded rods and slide into place while simultaneously rocking bracket assembly.
13. Slide arc runner into position and tighten flat head screw to fastener.
14. While aligning holes replace (2) screws, lock washers and nuts connecting bracket assembly to main contacts. Tighten nuts.
15. Repeat procedure for each normal and emergency stationary main contacts in need of replacement.
16. See Movable Main and Arcing Contacts Replacement.

## Movable Main and Arcing Contacts Replacement

The following replacement procedure applies to both the normal and emergency sides of the movable contacts. This procedure is to be done in conjunction with the Stationary Main and Arcing Contacts Replacement. See Figures 3-3 and 3-8.

**NOTE**

Arcing contacts must also be replaced if it is necessary to replace the main contacts.

1. Using manual operator handle place contacts in open position on emergency side. The contact cover and arc chutes should already be removed.
2. Remove screw holding braided wire to movable main contact. Do this for each movable main contact.
3. Remove (8) screws (four on each end) holding black insulator bars to switch mechanism. It is now possible to remove the entire movable contact assembly.
4. Remove (4) screws holding movable main contact to black insulator bar. Do this for each movable main contact.
5. Remove lock nut on screw which holds movable arcing contact and spring to movable main contact. Lift off spring retainer, spring and movable arcing contact.
6. Install nylon screw and locking nut from old movable

arcing contact to new one. Screw in about 1/3 of threads.

7. Apply contact lubricant to legs of movable arcing contact.
8. Insert flat head screw into new movable main contact. Install movable arcing contact, metal strip (if used), nylon spring retainer, spring, metal spring retainer and lock nut. Check to see that spring is properly seated in spring retainers. Make sure legs of movable arcing contact move freely in holes of movable main contact. Tighten screw just enough to remove any play.
9. Repeat Steps 5-8 for other end of movable main contact.
10. Repeat Steps 5-9 for each of the remaining movable main contacts.
11. Install (4) screws holding movable contact to black insulator bar. Do this for each movable main contact.
12. See Overlapping Neutral Transfer Contacts Replacement, if required.
13. Carefully place movable contact assembly over mounting holes. Install (8) screws (four on each end) holding black insulator bars to switch mechanism.

**NOTE**

If difficulty in starting screws arises, place movable arcing contacts in a neutral position. This is done by holding the manual operator handle in a position between the normal and emergency main contacts.

14. With contacts open in the emergency position, replace screw holding braided wire to movable main contact. Repeat for each movable main contact.
15. See Adjustment of Main Contacts.
16. Replace arc chute over threaded rods. Install (2) nylon nuts and insulator plate.
17. Replace contact cover and tighten (4) hex. screws.

## Overlapping Neutral Transfer Contacts Replacement

1. Remove movable contact assembly, if not already done. To do this remove (8) screws (four on each end) holding black insulator bars to switch mechanism.
2. To remove center portion of overlapping neutral transfer contacts, remove screw from braided wire and remove (2) nuts from underneath chassis insulator board.

**NOTE**

Emergency neutral contactor lug is located with the normal contactor lugs and the normal neutral contactor lug is located with the emergency contactor lugs.

3. Remove emergency neutral contact by removing nut and washer.
4. Install new emergency neutral contact and tighten nut.
5. Remove normal neutral contact by removing nut, washer and copper strip.
6. Install new normal neutral contact. Replace copper strip with insulator cup, washer and tighten nut.
7. Install center portion of overlapping neutral transfer contacts by replacing (2) nuts and tightening screw to braided wire.
8. Carefully place movable contact assembly over mounting holes. Install (8) screws (four on each end) holding black insulator bars to switch mechanism.
9. With contacts open in the emergency position, replace screw holding braided wire to movable main contact. Repeat for each movable main contact.
10. Using manual operator handle check contacts of overlapping neutral transfer contacts. Adjustment screws are located in black insulator bars.

## Adjustment of Main Contacts

If main contacts are replaced or settings are suspected to be incorrect, they can be checked and adjusted to accepted standards. See Table 3-1 for adjustment settings.

**Table 3-1. Contact Adjustment**

| | |
|---|---|
| Main Contact Deflection | 3/32-3/16 inches (2.38-4.76 mm) |
| Arcing Contact Lead | 5/32 inches (3.96 mm) |
| Arcing Contact Spring Height | approx. 3/4 inches (19.05 mm) |
| Arcing Contact Pressure | 3 pounds (1.36 kg) |

Main contact deflection is measured with contact closed. Measure between bottom of nylon screw and top of movable main contact. Arcing contact lead is measured with movable and stationary arcing contact just touching. Measure between movable and stationary main contacts. See Figure 3-9.

Adjust arcing contacts by turning nylon adjusting screw until arcing contacts lead the main contacts by proper setting on closing. Use manual operator handle to check contact adjustment. When proper setting is reached, tighten locking nut. Arcing contact spring height is mea-

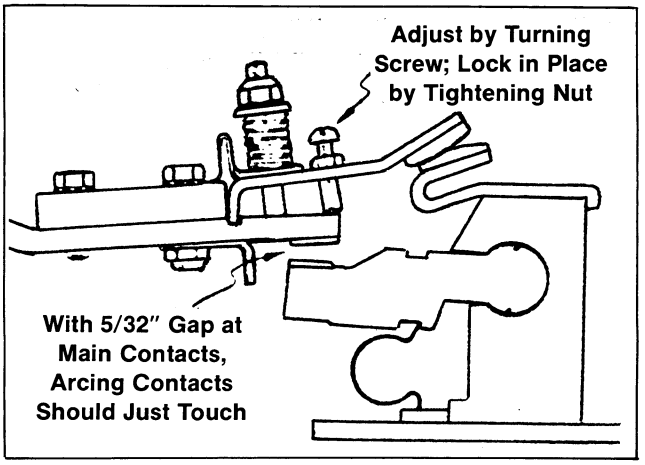



**Figure 3-9. Arcing Contact Lead**

sured with contact open. Measure between outside of metal spring retainer and inside of nylon spring retainer. Measurement is approximate.

All arcing contacts on one side should make simultaneously. The best method to check this is by using a test light or an ohmmeter.

## Rectifier/Resistor Check

The 600 and 800 ampere transfer switch models use both a rectifier and resistor(s). The resistor is in series with the AC terminal on the rectifier. When two resistors are used, they are connected in parallel with each other and then in series with the AC terminal on the rectifier. The rectifier is used to change AC line voltage to operate the DC coil.

To test resistor, remove from circuit and place ohmmeter across resistor terminals. If two resistors are used, they must be disconnected from each other before an ohm reading can be taken. Meter reading should be approximate to ohm value printed on resistor. See Resistor Ohm Values for listing.

An out-of-circuit test can be made to check for proper function of rectifier. Remove all leads from terminals on rectifier and using an ohmmeter (R x 1 scale), place test leads across rectifier terminals.

This test is the same as if (4) separate diodes were being checked. Diodes, as you know, allow current to pass in one direction and offer high resistance in the other direction. Figure 3-10 shows how the diodes are connected inside the rectifier.

Place one test lead on the cathode terminal of the diode and one on the anode terminal. Then reverse the test leads. Noting the meter reading each time.

1. If the meter reads high resistance one way and low resistance in the other direction, the diode is good.
2. If the meter reads high resistance both ways, the diode is open. Replace the rectifier.
3. If the meter reads low resistance both ways, the diode is shorted. Replace the rectifier.
4. Repeat for each of the four diodes.

**NOTE**

Diodes are not serviceable individually. If one of the diodes check out bad, it will require replacement of the rectifier.

## Coil Resistance Values

A listing of coil resistance values is included in this manual to help determine if there is a defective coil. At least one lead from coil must be disconnected from circuit in order for the ohmmeter to give an accurate reading. The coil resistance values can be useful in determining the voltage rating of a given coil. See Table 3-2.

**NOTE**

Since ohmmeters do vary in their accuracy, use Table 3-2 as a reference for approximate readings.

## Resistor Ohm Values

A listing of ohm values for 600 and 800 ampere transfer switches is included in the event that the resistor's ohm value cannot be read or is unknown. All resistors are rated 25 Watts with resistance tolerance of ±10%. To test resistor remove from circuit and place ohmmeter across resistor terminals.

Where an (*) appears to the right of the ohm values in Tables 3-3 and 3-4 indicates that there are two resistors each having a resistance value of one ohm.

**NOTE**

Since ohmmeters do vary in their accuracy, use Tables 3-3 and 3-4 as a reference for approximate readings. Readings must be at room temperature.

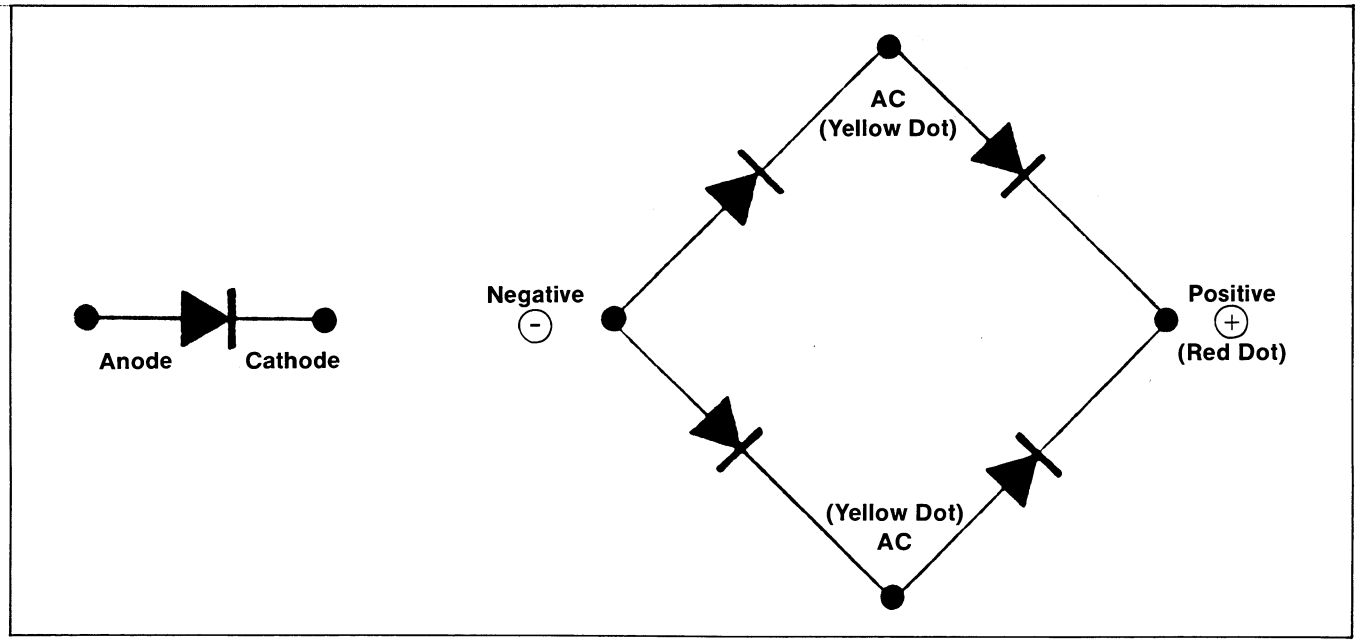



**Figure 3-10. Rectifier (4 Diodes)**

**Table 3-2. 600 Volt Class Transfer Switch**

| Model | 2 Poles | 3 Poles | 3 Poles and Overlapping Neutral Contact | Coil Resistance (in Ohms) |
|---|---|---|---|---|
| 600 Ampere | 110-120 | 110-120 | — | 4.1 |
| | — | — | 110-120 | 3.1 |
| | — | — | 190-208 | 7.3 |
| | 190-208 | 190-208 | 220-240 | 13.3 |
| | 220-240 | 220-240 | — | 15.7 |
| | — | — | 380-416 | 23.7 |
| | 380-416 | 380-416 | 440-480 | 48.5 |
| | 440-480 | 440-480 | 550-600 | 77.0 |
| | 550-600 | 550-600 | — | 103.0 |
| 800 Ampere | 110-120 | 110-120 | — | 3.1 |
| | — | — | 110-120 | 1.9 |
| | — | — | 190-208 | 5.2 |
| | 190-208 | 190-208 | 220-240 | 7.3 |
| | 220-240 | 220-240 | — | 13.3 |
| | — | — | 380-416 | 20.1 |
| | 380-416 | 380-416 | 440-480 | 23.7 |
| | 440-480 | 440-480 | — | 48.5 |
| | — | — | 550-600 | 41.0 |
| | 550-600 | 550-600 | — | 77.0 |

**Table 3-3. 600 Amp. Transfer Switch Resistor Ohm Values**

| Voltage | 2 Poles | 3 Poles 1Ø | 3 Poles 3Ø | 3 Poles and Overlapping Neutral Contact |
|---|---|---|---|---|
| 120 V. 60 Hz | 1 | — | 1 | 1* |
| 208 V. 60 Hz | 3 | — | 3 | 2 |
| 240 V. 60 Hz | 4 | 4 | 4 | 2 |
| 480 V. 60 Hz | 15 | — | 15 | 8 |
| 600 V. 60 Hz | — | — | 25 | 10 |
| 110 V. 50 Hz | 1 | — | 1 | 1* |
| 190 V. 50 Hz | — | — | 3 | 2 |
| 220 V. 50 Hz | 4 | 4 | 4 | 2 |
| 380 V. 50 Hz | — | — | 15 | 6 |
| 416 V. 50 Hz | — | — | 15 | 6 |
| 550 V. 50 Hz | — | — | 25 | 10 |

* Quantity of 2.

**Table 3-4. 800 Amp. Transfer Switch Resistor Ohm Values**

| Voltage | 2 Poles | 3 Poles 1Ø | 3 Poles 3Ø | 3 Poles and Overlapping Neutral Contact |
|---|---|---|---|---|
| 120 V. 60 Hz | 1* | — | 1* | 1* |
| 208 V. 60 Hz | 2 | — | 2 | 2 |
| 240 V. 60 Hz | 2 | 2 | 2 | 2 |
| 480 V. 60 Hz | 8 | — | 8 | 6 |
| 600 V. 60 Hz | — | — | 10 | 10 |
| 110 V. 50 Hz | 1* | — | 1* | 1* |
| 190 V. 50 Hz | — | — | 2 | 2 |
| 220 V. 50 Hz | 2 | 2 | 2 | 2 |
| 380 V. 50 Hz | — | — | 6 | 6 |
| 416 V. 50 Hz | — | — | 6 | 6 |
| 550 V. 50 Hz | — | — | — | 10 |

* Quantity of 2.

# Section 4
# TROUBLESHOOTING

When troubleshooting a transfer switch contactor mechanism, don't overlook the possibility that the problem may be in another part i.e. logic board, exercise timer, generator set. Once the problem is isolated to the contactor mechanism, always consider the simplest causes first — broken or loose wires, corroded contacts, exposure to dirt or other foreign material, etc.

Verify that voltage on nameplate is the same as Normal Source voltage. The Switch Number reflects what was sent from the factory and may not be correct if a field installed coil change for contactor voltage conversion was made. Using the Transfer Switch Part Number Explanation section, determine voltage and frequency, number of poles and number of wires. This information should correspond to the normal source voltage. If the normal source voltage is unknown, use procedure following.

**⚠ WARNING**

**ELECTRICAL SHOCK!** The Automatic Transfer Switch is energized; proceed with care! High Voltage can cause personal injury, damage equipment or lead to future failures. Remove rings, watches and jewelry that can cause short circuits. This test should be done only by a qualified electrician. Follow manufacturer's instructions when operating tester.

Checking Normal Source Voltage Levels:

This reading can be taken at the contactor lugs on the transfer switch mechanism or on the transformer assembly terminals. On a three-phase system, voltmeter should read phase-to-phase voltage between terminals NA/NB, NA/NC and NB/NC. On a single-phase system, voltmeter should read system voltage between terminals NL1/NL2.

Checking Emergency Source Voltage Levels:

This reading can be taken at the contactor lugs on the transfer switch mechanism or on the transformer assembly terminals. On a three-phase system, voltmeter should read phase-to-phase voltage between terminals EA/EB, EA/EC and EB/EC. On a single-phase system, voltmeter should read system voltage between terminals EL1/EL2.

Wires in standard harness not passing through the harness plug:

Emergency Contactor Lug Term. 4 (EL1 or EA) to Coil Clearing Contact Term. 9

Normal Contactor Lug Term. 1 (LN1 or NA) to Coil Clearing Contact Term. 7

Normal Contactor Lug Term. 3 (NL2 or NC) to Contact Term. 69

Emergency Contactor Lug Term. 5 (EL2 or EC) to Contact Term. 71

Contact Term. 14 to Engine Start Term. 3

Contact Term. 15 to Engine Start Term. 4

**Troubleshooting**

| Condition | Possible Cause |
|---|---|
| Unit Will Not Transfer | 1. Mechanical Binding<br>a. Solenoid jammed or damaged<br>b. Faulty or worn spring<br>c. Main contact shaft bent<br>d. Main contacts jammed by foreign object<br>e. Contact lever or push-button jammed against solenoid counterweight<br>f. Loose hardware<br>g. Gear on cross-shaft not properly meshing with solenoid counterweight gear. (Some 30-150 Amp. 600V. class models only.)<br>h. Accumulation of dirt or other foreign material.<br>2. Electrical Malfunction<br>a. Burnt-out or wrong coil<br>b. Defective or wrong rectifier<br>c. Defective or wrong resistor (600-800 ampere models only)<br>d. Loose or broken wires<br>e. Corroded or fused contacts<br>f. Wrong setting on coil clearing contacts<br>g. Improperly wired harness<br>h. Wrong voltage applied |
| Chattering Noise (while unit is trying to transfer) | 1. Coil clearing contacts improperly adjusted<br>2. Applied voltage too low<br>3. Incorrect spring<br>4. Wrong coil (voltage rating) |

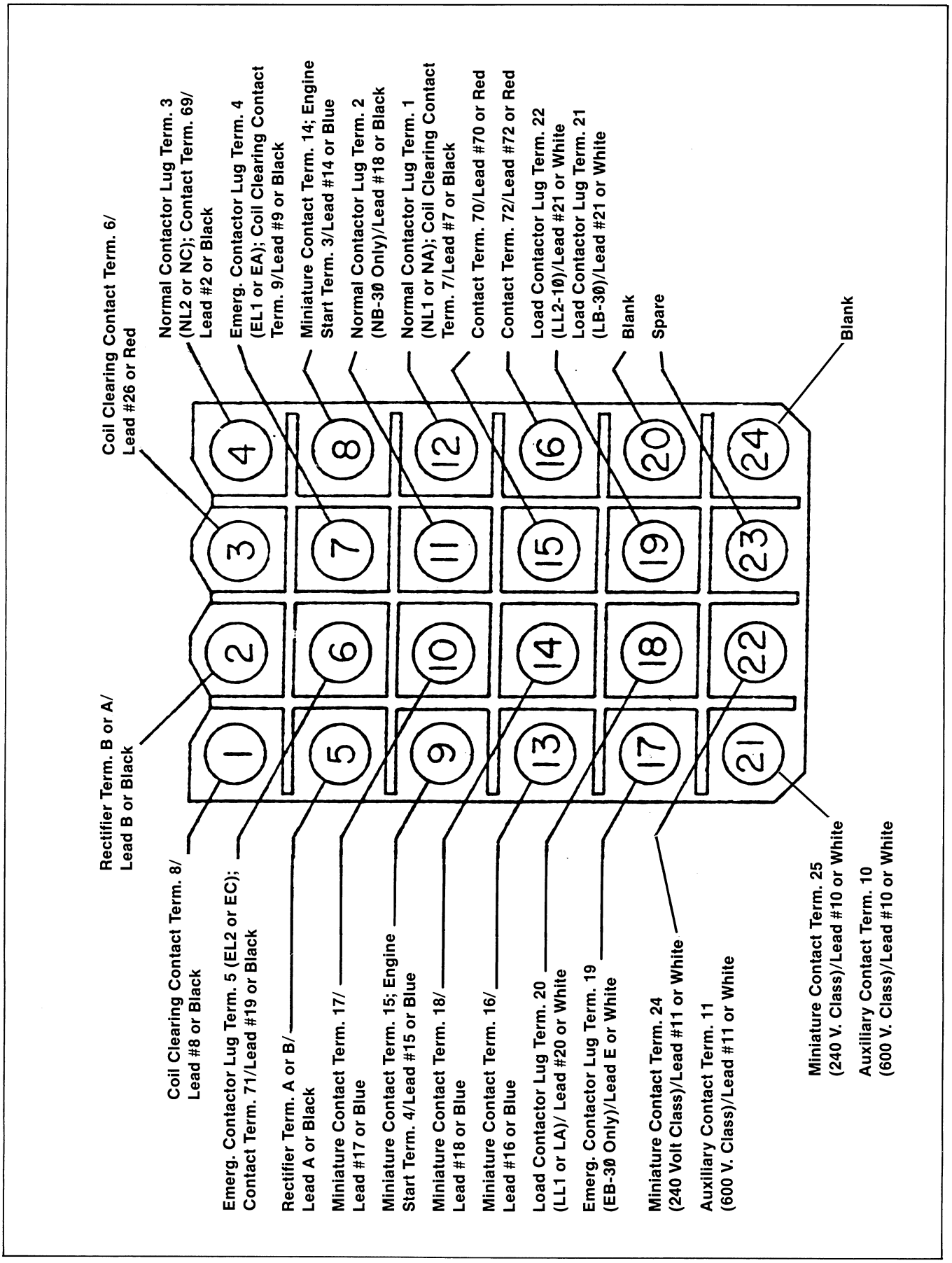
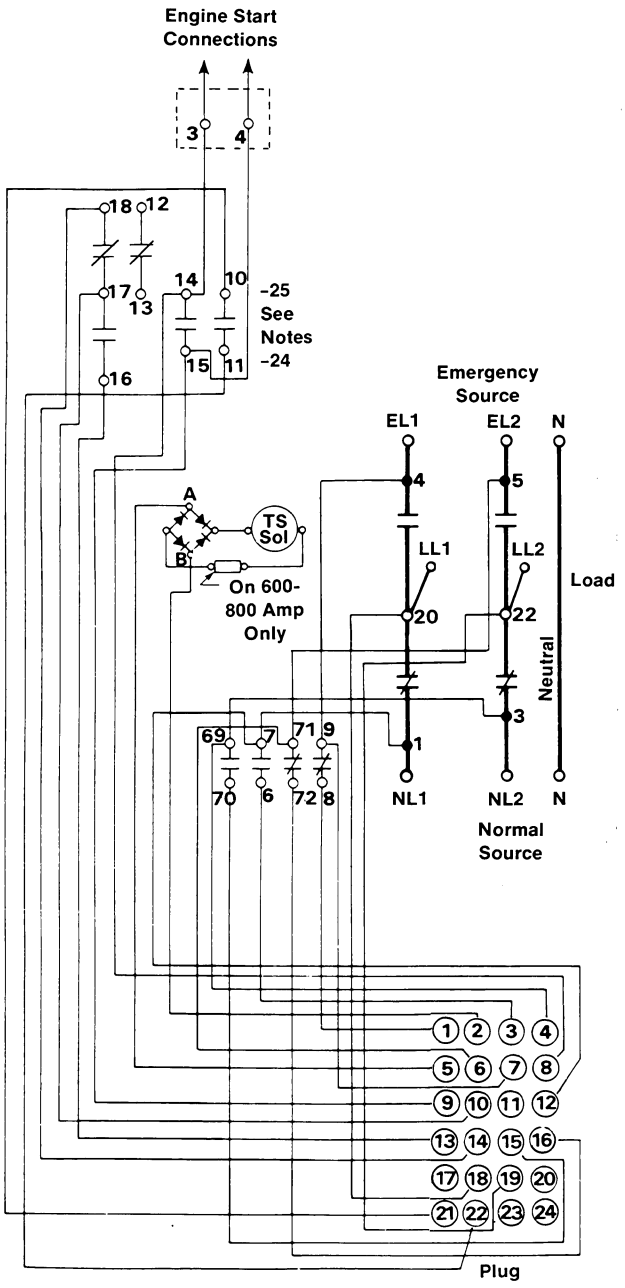



**Figure 4-1. Transfer Switch Plug (Female) Pin Socket Side**

**NOTE: Engine start terminals 3 and 4 are located on contactor.**

**30-150 Amp. — Lower Left Side**
**260-400 Amp. — Above TS Coil**
**600-800 Amp. — Upper Right Hand Corner**

**25-24 Miniature Contact on**
**30-100 Amp. — 240 Volt Class**
**10-11 Auxiliary Contact on**
**30-800 Amp. — 600 Volt Class**




Single Phase

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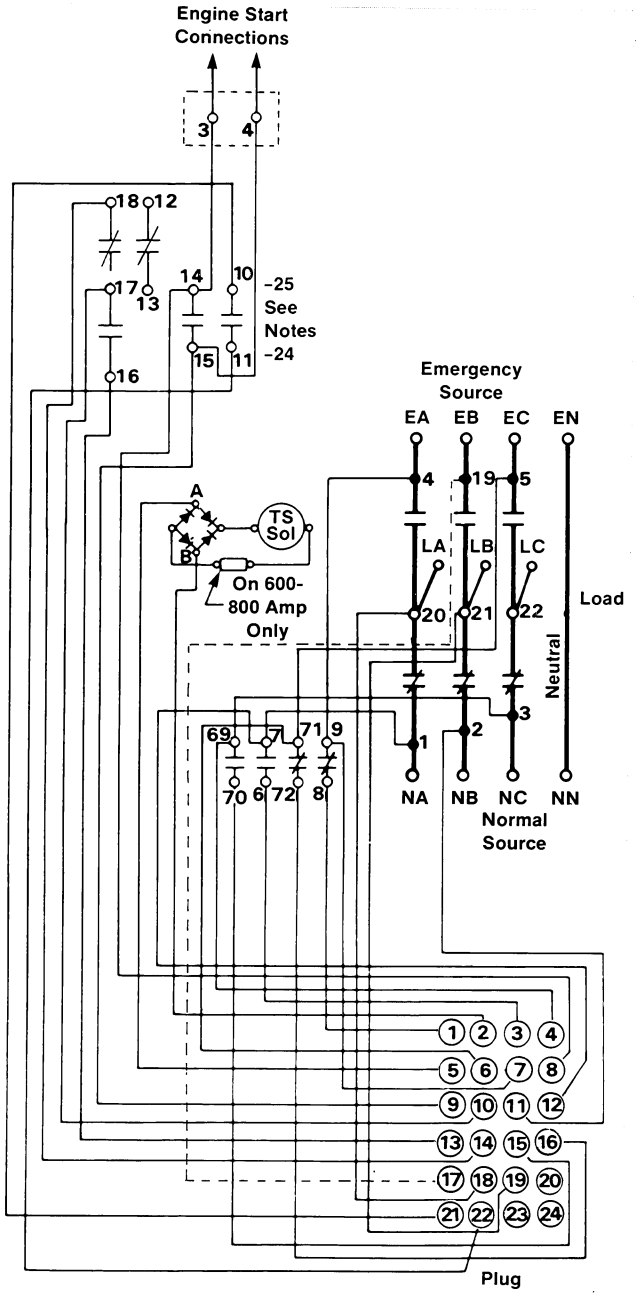


Three Phase

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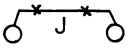
**Figure 4-2. Harness Plug Wiring Diagram (Normal Position Shown)**

# Notes

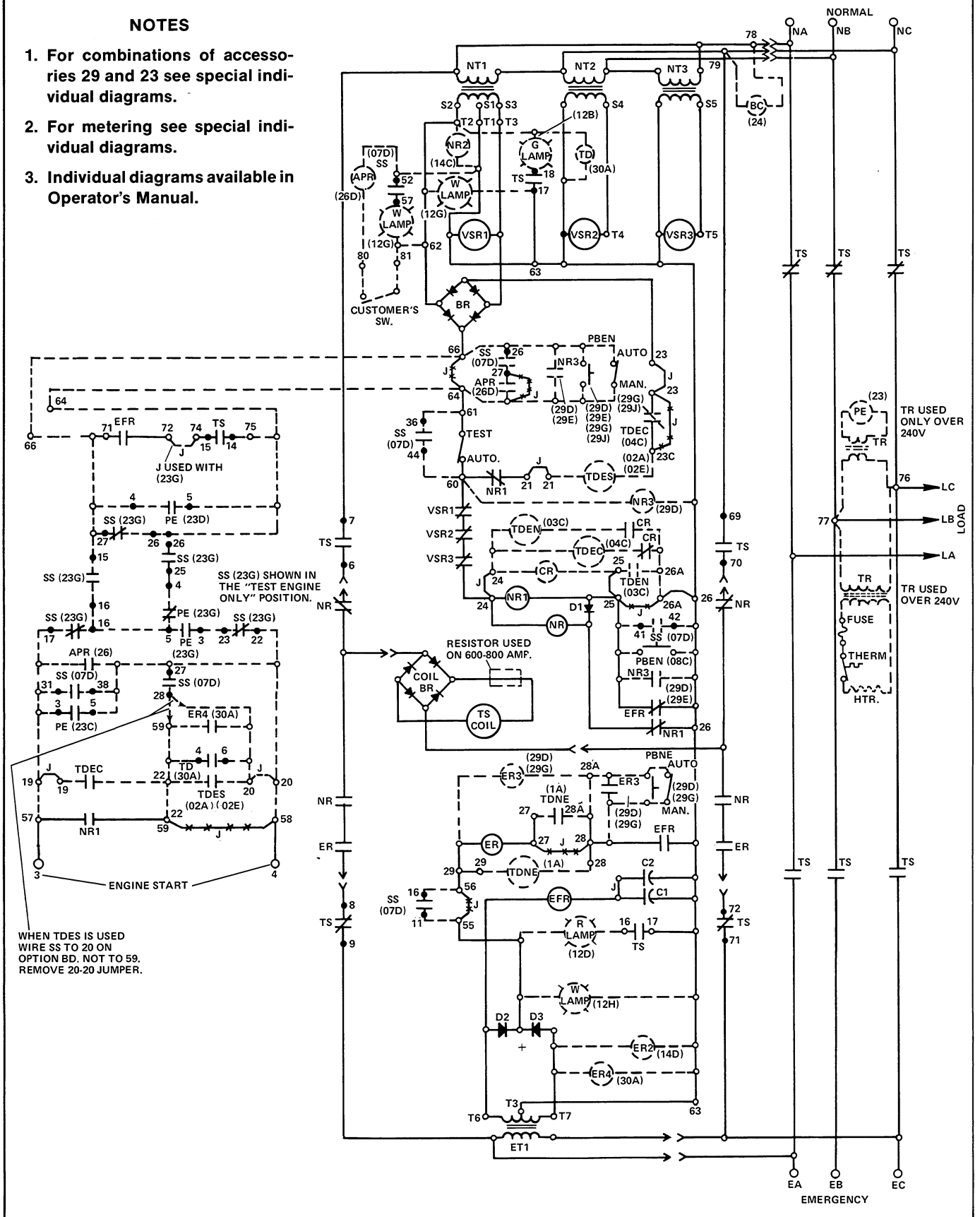
# Section 5
# WIRING DIAGRAMS

**Legend**

| Symbol | Definition |
|---|---|
| ○ | Accessible Terminal on Terminal Strip |
| 27● | Number of Terminal Located on a Part |
| ● | Internal Connection |
|   | Jumper to be Removed When Anything is Wired Across its Terminals |
| (23G) | Accessory Number |
| ---- | Dotted Items are Accessories |
| >> | Harness Plug and Socket |
| APR | Area Protection Relay |
| BC | Battery Charger |
| BR | Bridge Rectifier |
| CR | Control Relay |
| D | Diode |
| ECR | Engine Cool Off Relay |
| EFR | Emergency Frequency Relay |
| ER | Emergency Relay |
| ET | Emergency Transformer |
| J | Jumper Connection |
| NR | Normal Relay |
| NT | Normal Transformer |
| PBEN | Push Button, Emerg. to Normal |
| PBNE | Push Button, Normal to Emerg. |
| PE | Plant Exerciser |
| SS | Selector Switch |
| TD | Time Delay |
| TDEC | Time Delay — Engine Cool Off |
| TDEN | Time Delay — Emerg. to Normal |
| TDES | Time Delay — Engine Start |
| TDNE | Time Delay — Normal to Emerg. |
| TS | Transfer Switch |
| VSR | Voltage Sensing Relay |

## NOTES

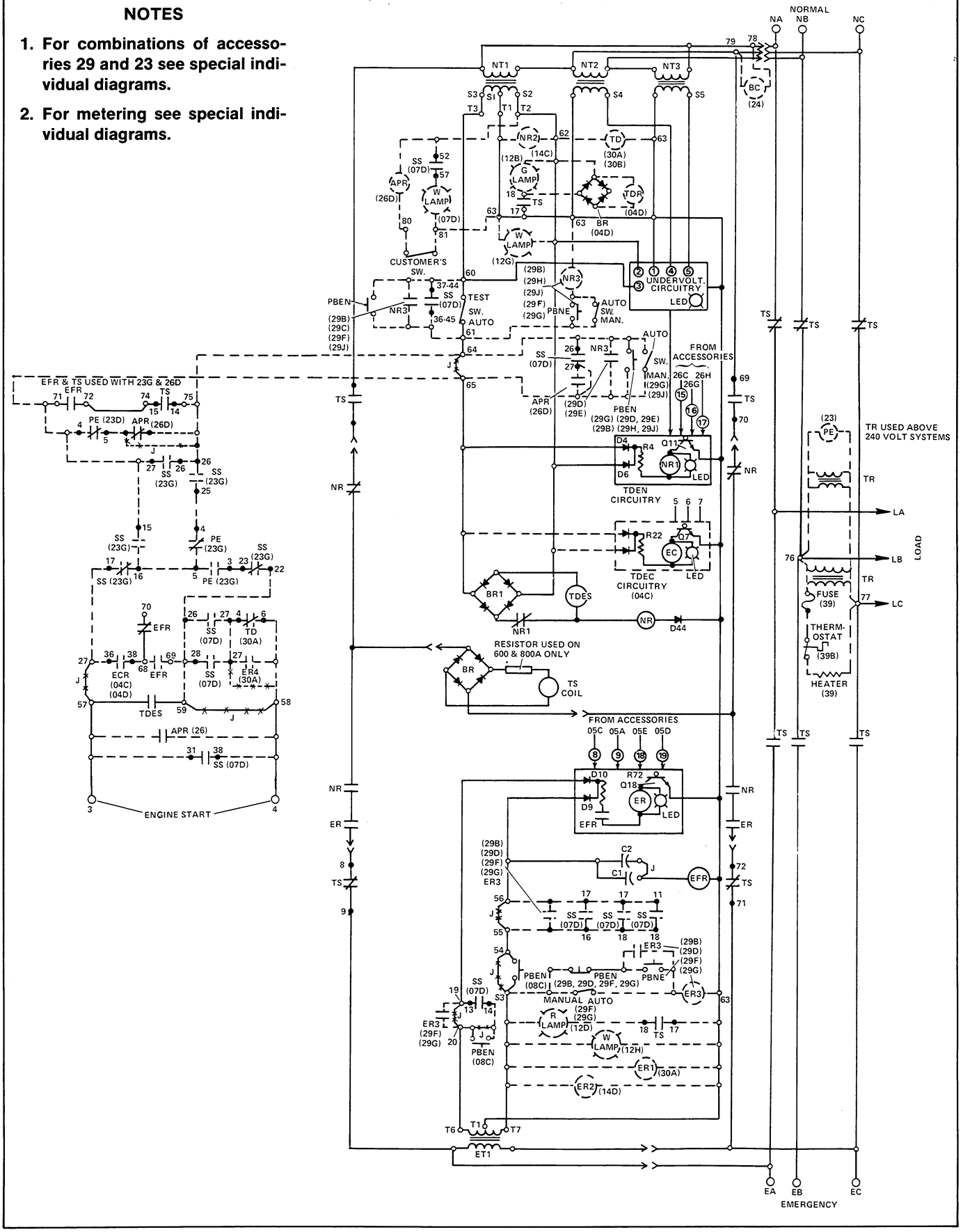
1. **For combinations of accessories 29 and 23 see special individual diagrams.**
2. **For metering see special individual diagrams.**
3. **Individual diagrams available in Operator's Manual.**




**Wiring Diagram — 3Ø Relay Logic**
**(Normal Position Shown)**

## NOTES

1. **For combinations of accessories 29 and 23 see special individual diagrams.**
2. **For metering see special individual diagrams.**




**Wiring Diagram — 30 Solid State Logic**
**(Normal Position Shown)**

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TP-5135 9/87
Printed in U.S.A.

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