



# Instructions for Mechanical-Latch Attachments for Type SJA, SJD, SJO and SJS Contactors, 360 or 720 Amperes



**DANGER**

## HAZARDOUS VOLTAGE.

READ AND UNDERSTAND THIS MANUAL AND THAT PERTAINING TO ITS ELECTRICALLY-HELD CONTACTOR (SEE TABLE I) IN THEIR ENTIRETY BEFORE INSTALLING OR OPERATING THE CONTROLLER. INSTALLATION, ADJUSTMENT, REPAIR AND MAINTENANCE OF THIS TYPE OF EQUIPMENT MUST BE PERFORMED BY QUALIFIED PERSONNEL. A QUALIFIED PERSON IS ONE WHO IS FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED.

## APPLICATION

These instructions apply to Type SJA, SJD, SJO and SJS contactors that are fitted with mechanical-latch attachments.



**CAUTION**

A LATCHED CONTACTOR SHOULD BE APPLIED ONLY WHEN NECESSARY, AND WITH DUE REGARD TO THE POSSIBLE FAILURE MODES OF THE SYSTEM, FOR EXAMPLE, A POWER LOSS OR SOLENOID COIL FAILURE. ONCE LATCHED, THE CONTACTOR WILL REMAIN CLOSED, ALLOWING A FAILURE. SINCE POWER IS REQUIRED TO TRIP THE UNLATCH SOLENOIDS, PROVISION SHOULD BE MADE FOR MANUAL TRIPPING, USING THE MECHANICAL TRIP ARM, OR A STANDBY POWER SUPPLY, SHOULD THE MAIN CONTROL POWER BE LOST.

## OPERATION

When a Type SJ contactor with latch attachment is open, the latch mechanism is unlatched and de-energized. When the coil of a latch contactor is momentarily energized, its armature closes, closing the main power

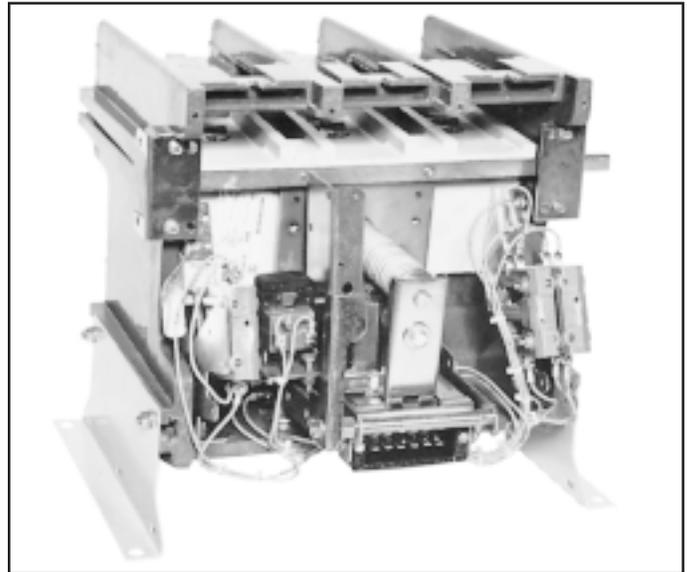


Fig. 1 Type SJO with Latch Attachment

**TABLE I. REFERENCE MATERIAL**

| Electrically-Held Contactor Type | Ampere Rating | Instruction I.L. or I.B. |
|----------------------------------|---------------|--------------------------|
| Type SJA                         | 360A          | I.B. 48002               |
| Type SJA                         | 720A          | I.B. 48005               |
| Type SJD                         | 360A          | I.B. 48004               |
| Type SJO                         | 360A          | I.L. 16-200-33           |
| Type SJO                         | 720A          | I.L. 17047               |
| Type SJS                         | 360A          | I.B. 48003               |

contacts. As the armature seals to the magnet, a spring pushes the latch arm up into position behind the armature to hold it closed mechanically, at the same time an auxiliary coil-clearing contact (L63) on the contactor opens the contactor coil circuit to de-energize the contactor magnet. Although the magnet is de-energized, the contactor will remain latched closed until a trip coil is energized or the latch is tripped mechanically by a push against its trip arm.

## OPERATION (Continued)

The latch may have one or two trip (unlatch) solenoids. Each solenoid has an isolated trip coil that may be AC or DC operated. Either or both solenoids, when energized, will trip the latch arm by pushing down the latch arm located below the contactor armature, thus allowing the armature to move into the open-contacts position. The latch arm has a roller-bearing cam wheel on the end that engages the armature, so that friction is minimized and the trip action is fast.

The contactor pickup coil and trip solenoid coils are rated for intermittent duty and will burn-out if energized continuously under normal operating conditions. The contactor coil may be operated at its rated voltage continuously if the armature has been sealed against the magnet and both windings of the coil are connected in series. There are many possible operating schemes and diagrams, and the installer must check the operation of the latch against the specified diagram for the specific application. It is recommended that the contactor and solenoid coils be automatically de-energized by auxiliary contacts on the contactor itself, without depending on supplementary relays elsewhere.

The latch sensitivity is adjustable. If unlatching occurs accidentally from vibration or impact, the sensitivity should be decreased. If either unlatch solenoid fails to trip the latch when rated solenoid voltage is applied, then the sensitivity should be increased. Refer to the section on **MAINTENANCE**.

## CONTROL POWER REQUIREMENTS

A control power transformer, whose primary winding is connected to the same source supplying power to the motor, is the usual source of control power used to close the contactor. This same transformer can also be used as the voltage source for the trip (unlatch-open) solenoids, but a manual operator (pushbutton type) must be installed in order to open the contactor in case of a power failure. Where a standby control voltage source (usually battery-supplied DC) is available to operate a trip solenoid, the manual operation is not required. Most solenoid coils furnished have both an AC and a DC intermittent duty rating. See Table II for inrush VA requirements. Some latch attachments are supplied with two trip solenoids, each rated for a different voltage. The latch attachment will unlatch when either solenoid is energized.

## MANUAL UNLATCH OPERATOR

Where it is desirable or necessary to add a manual unlatch (trip) operator, use Part Number 10935H3, an external operator kit marked RESET. This operator requires a 1.20" (30 mm) diameter hole opposite the trip arm of the latch attachment. The location of the latch trip target center (1.20" diameter hole) is shown in Figure 2. A faster and probably more accurate way to locate the

**TABLE II. COIL INRUSH DATA**

| Coil Function   | Rating      | Volt-Amperes |
|-----------------|-------------|--------------|
| Close Contactor | 110-120 VAC | 1300         |
| Close Contactor | 220-240 VAC | 1400         |
| Close Contactor | 125 VDC     | 1500         |
| Close Contactor | 250 VDC     | 1600         |
| Open Contactor  | AC          | 225          |
| Open Contactor  | 24 VDC      | 600          |
| Open Contactor  | 48 VDC      | 190          |
| Open Contactor  | 125 VDC     | 300          |
| Open Contactor  | 230 VDC     | 265          |

target center is to use a temporary clamp to attach a 3-inch (76 mm) right angle bracket to the face of the trip arm with one leg of the bracket pointing towards the door. Attach to this leg an eraser-tipped pencil or a strip of any sponge material that will absorb stamp pad ink or similar marking material.

Position the pencil along the extended leg so that the ink-soaked projection will strike the inside of the door when it is closed. Use the mark on the door to select the unlatch (reset) operator center.

After installing the RESET operator, adjust its operating length (cutting the threaded stud if necessary) so that the trip arm can be pushed sufficiently far to unlatch the contactor. Verify that door deflection does not unlatch the contactor accidentally.

## INSTALLATION

This industrial type control is designed to be installed, operated, and maintained by adequately trained personnel, with adequate supervision. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operation, or maintenance. Care must be exercised to comply with local, state, and national regulations, as well as safety practices, for this class of equipment.



**DANGER**

**WARNING: ALL WORK ON THIS CONTACTOR SHOULD BE DONE WITH THE MAIN DISCONNECT DEVICE OPEN. AS WITH ANY CONTACTOR OF THIS VOLTAGE CLASS, THERE IS DANGER OF ELECTROCUTION AND/OR SEVERE BURNS. MAKE CERTAIN THAT POWER IS OFF.**

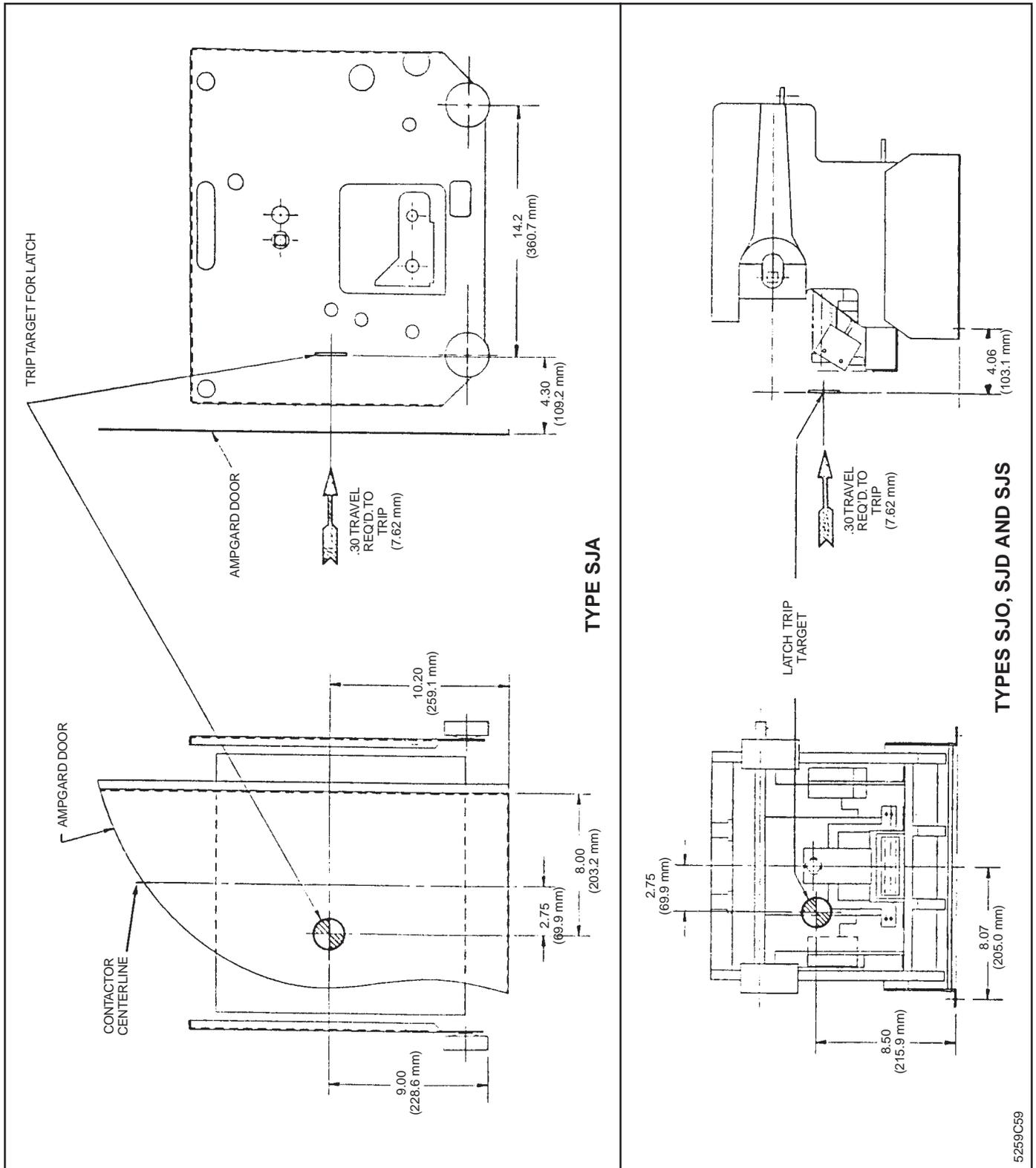


Fig. 2 Trip Target Location (Dimensions In Inches)

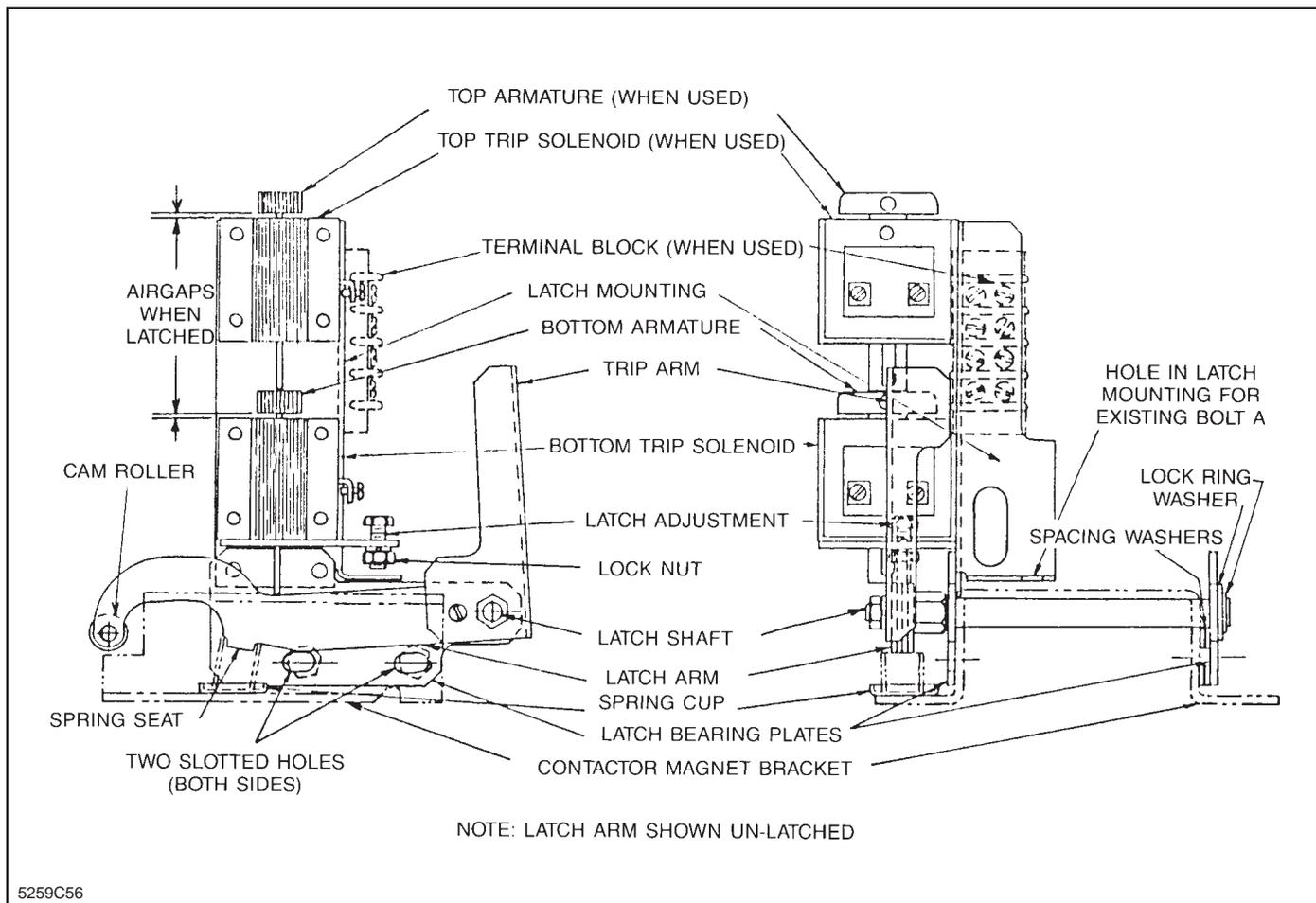


Fig. 3 Mechanical Latch Assembly

## OPERATION

Figure 3 shows a latch assembly before it is mounted on a contactor. The enlarged detail shown in Figure 4 shows the relationship between the cam roller on the end of the latch arm and a notch in the lower left corner of the contactor armature. When the latch is installed, it appears as shown in the lower portion of Figure 4.

Latch sensitivity can be understood by studying the inset of Figure 4, which is a magnified detail view showing the lower left corner of the armature and the cam roller. The cam roller travels between positions (U) and (L) through an arc around the latch shaft. In the unlatched (open) contactor position, the cam roller is in position (U). It cannot travel upward to position (L) even though the latch spring is pushing the latch arm upward because latch edge (F) of the armature stops it. However, when the contactor operating coil is energized, the armature rotates toward the magnet and latch edge (F) travels across the cam roller easily. As latch edge (E) passes the centerline of the cam roller, the roller starts moving

upward, driven by the latch spring. By the time the armature reaches the magnet, the cam roller passes completely by latch edge (E) into position (L), and the contactor is latched closed.

The cam roller cannot travel to the top of the notch in the armature because the latch arm stops against the latch adjustment bolt. The further into the notch the cam roller penetrates, the less sensitive the latch becomes.

There will always be some "free-play" clearance between the contactor armature and magnet in order to provide free motion. This clearance needs to be only a few thousandths of an inch; so for practical purposes, the contactor is held "fully" closed.

When either or both trip solenoids are momentarily energized, their armatures push the latch arm downward against its spring. As the centerline of the cam roller passes below latch edge (E) of the armature, the contactor armature will snap to the fully open position; i.e., the contacts are open.

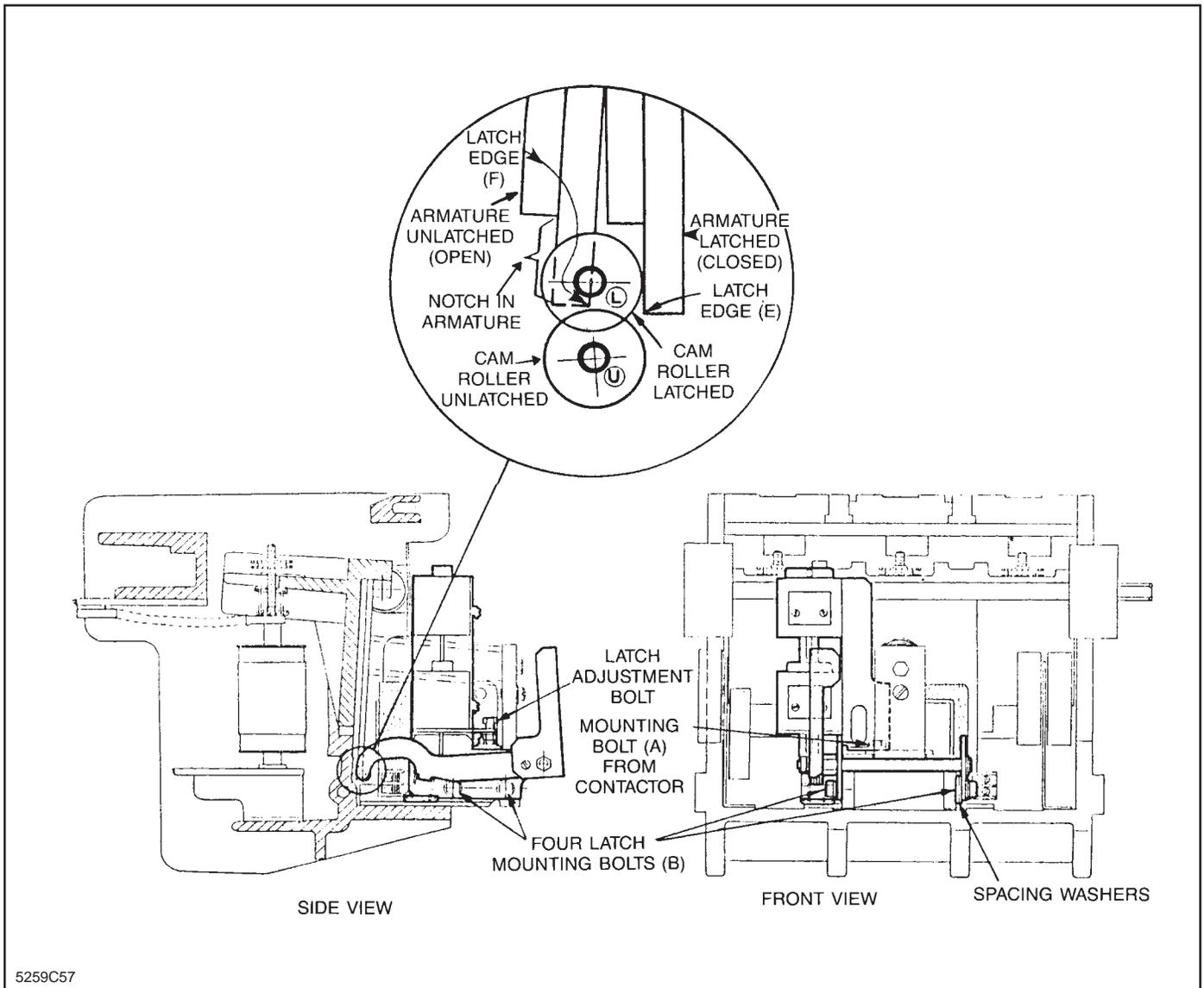


Fig. 4 Mechanical Latch Installed, 360A Contactor

If the latch has been de-energized with an adjustment that allows the cam roller to travel high into the armature notch when latched, the trip solenoids have an increased resistance of their push. In a poorly adjusted latch, this may prevent tripping at 80% of trip solenoid voltage, in which case the latch must be made more sensitive.

**CHECK-OUT, MECHANICAL**

Refer to the instruction material relating to the electrically-held version of the contactor. See Table I.

Make sure all power circuits are isolated. The contactor can be checked in its enclosure or outside. If the starter is a new factory assembly it is probably easiest to test

the contactor as installed. Check all mechanical interlocks as installed, to make certain that they function properly.



**CAUTION**

**A LATCH IS SOMEWHAT LIKE A MOUSETRAP. USE CARE TO PROTECT FINGERS IN THE EVENT OF AN ACCIDENTAL TRIP DURING CHECK-OUT.**

### CHECK-OUT, MECHANICAL (Continued)

If the contactor is checked in its enclosure, make certain that the contactor coil is electrically isolated, to prevent feedback into a control power transformer that could be hazardous.

With an extension cord and a separate power source of correct voltage, connect power to the coil of the contactor. Operate appropriate pushbuttons to close. If the contactor does not close fully, refer to **MAINTENANCE**. The contactor should automatically latch and stay closed. Make sure that the coil-clearing contact automatically removes control circuit voltage after the contactor is closed, to prevent coil burnout.

While the contactor is closed, observe the overtravel gap between the pivot plates on the crossbar and the underside of the lower bottle nut on each pole. This overtravel gap should be no less than .070 inch (1.8 mm) when the contactor is new. If less, refer to **MAINTENANCE**.

**Note:** When a contactor is latched, it has a small amount of “free-play” to insure freedom of motion. The armature is not sealed against the magnet as in an electrically-held contactor. Therefore, the full .075-inch (1.9-mm) overtravel specified for an electrically-held contactor cannot be achieved.

While the contactor is closed, operate the manual trip arm to assure that the unlatch mechanism functions.

Reclose the contactor, and trip it electrically using each trip solenoid separately. Check the coil-clearing auxiliary contact to make sure that each solenoid is de-energized automatically after operating, to prevent solenoid coil burnout. There should be no voltage between the terminals of any trip solenoid coil after the contactor has been opened. When tripped, the latch should move briskly. If it is sluggish, adjust as explained under **MAINTENANCE** below.

### CHECK-OUT, ELECTRICAL

Refer to the instructions for the electrically-held contactor.

### MAINTENANCE

Establish a maintenance program as soon as the contactor is installed and put into operation. After the contactor has been inspected a number of times at monthly intervals, and the condition noted, the frequency of inspection can be increased or decreased to suit the conditions found, since this will depend upon the severity of the contactor duty. It is a matter of operator judgement.

### Failure To Latch Or Unlatch

First, establish that the latch operates freely without mechanical interference. (The contactor can be operated electrically with an extension cord, as described previously under **CHECK-OUT, MECHANICAL**.)

Remove the latch spring. Block the single or bottom (if there are two) solenoid open temporarily with a pencil or other shim on top of its magnet frame and underneath its armature. Hold the contactor in the fully sealed-closed position electrically, and manually close/open the latch using the trip arm. The latch should move easily. If it does not move freely, check the roller end of the latch arm to see if the latch arm rubs against the armature. To eliminate rubbing, loosen the two latch mounting bolts (B) (Figure 4 or Figure 5) on the right side and move the right latch bearing plate rearward until the latch arm clears the armature. Retighten the mounting bolts. Re-check for free motion.

Next, hold the contactor in the fully sealed-closed position, operate the latch with the trip arm, then release the trip arm abruptly. The latch should fall freely into the open position. If it doesn't, the “free-play” clearance is insufficient. To increase the clearance on a 360A contactor, loosen all five latch mounting bolts (A) and (B) (Figure 4) and tap both the left and right bearing plates rearward a few thousandths of an inch. Re-tighten the five bolts and recheck both the free-fall release and the freedom from rubbing between the latch arm and the armature. To increase the clearance on a 720A contactor, loosen all four latch mounting bolts (A) and (B) (Figure 5) and tap both bearing plates rearward as explained above. Re-tighten and recheck as explained above.

Re-install the latch spring. Fingers work better than a tool. Check the overtravel of the main vacuum interrupters, since increasing “free-play” decreases overtravel. Overtravel must not be below .020 inch (5 mm) with worn contacts. Measure overtravel with the armature tight against the magnet face.

Remove the blocking shim from the bottom trip solenoid. Check that both solenoid armatures move freely.

### Failure to Latch

After making adjustments as outlined in the previous section, operate the contactor electrically. If it fails to latch:

- a. Check voltage applied to the contactor coil to be sure it is within 80% of coil rating.
- b. Check setting of the Type L-63 normally-closed coil-clearing auxiliary contact to see if it opens too soon and does not allow the contactor to close far enough to latch.
- c. Make certain that the latch spring is properly in place.
- d. Decrease the sensitivity of the latch by loosening the lock nut on the latch adjustment and backing-off (unscrewing) the latch adjustment bolt one-half turn. Try again, and if latching is not successful, back-off another half-turn, etc., until the latch works. Retighten the lock nut.

**Failure To Unlatch**

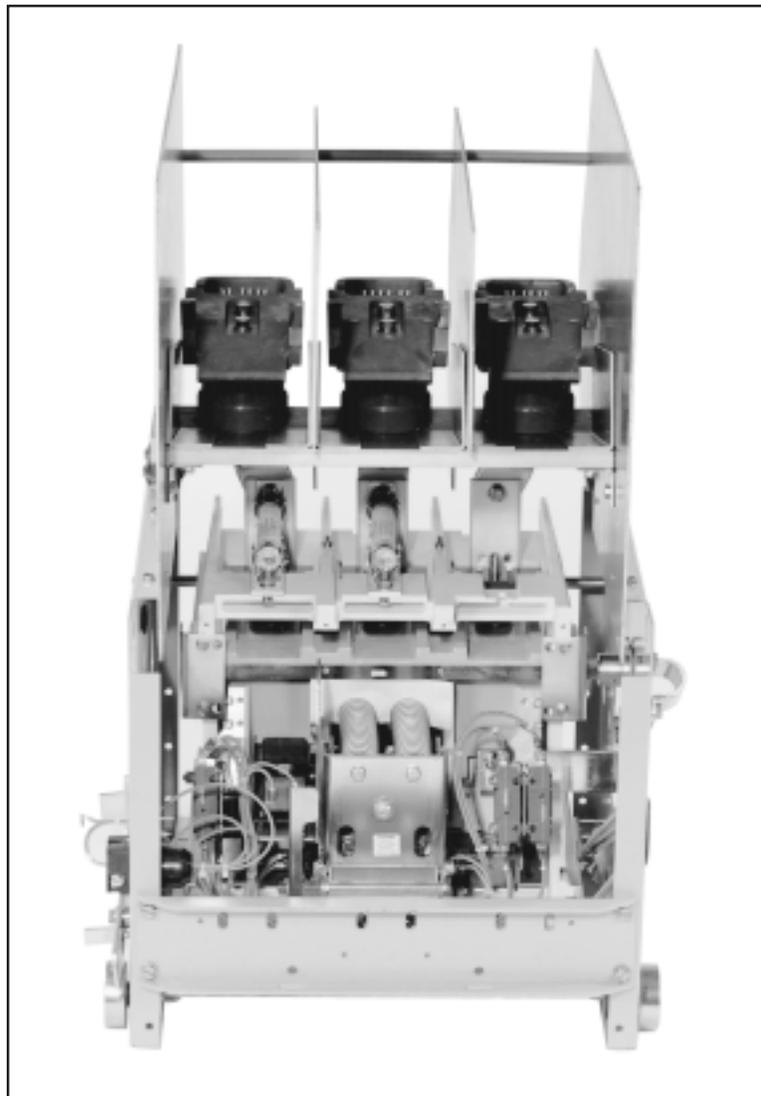
After making adjustments as outlined in the previous two sections, operate the contactor electrically. If the trip solenoid(s) do not unlatch the mechanism:

- a: Check voltage applied to the solenoid(s) to be sure it is within 80% of rated voltage.
- b. Check each solenoid coil for continuity. Replace if burned open. See Table III.
- c. Make certain there is an airgap under each solenoid armature of .120 to .130 inch (3.05-3.30 mm) when the contactor is latched. If there is no gap, the solenoid armatures cannot move to push the latch arm.

- d. Increase the sensitivity of the latch by loosening the lock nut on the latch adjustment and tightening (turn bolt clockwise) one-half turn. Try again, and if unlatching is not successful, turn bolt another half-turn, etc., until each solenoid unlatches dependably. Re-tighten the lock nut.

**Failure To Remain Latched**

If nuisance unlatching occurs, de-sensitize the latch adjustment as described under **Failure to Latch**.



*Fig. 5 Mechanical Latch Installed, 720A Contactor*

| <b>TABLE III. REPLACEMENT SOLENOIDS</b> |                               |
|---|-------------------------------|
| <b>Trip Coil Rating</b>                 | <b>Trip Solenoid Part No.</b> |
| 115-120 VAC, 48 VDC                     | 5259C46H01                    |
| 230-240 VAC, 96-125 VDC                 | 5259C46H02                    |
| 460-480 VAC, 230 VDC                    | 5259C46H03                    |
| 575-600 VAC                             | 5259C46H04                    |
| 24 VDC                                  | 5259C46H05                    |

## Cutler-Hammer

221 Heywood Road  
Arden, NC 28704

Effective 11/97  
Printed in U.S.A./CCI

