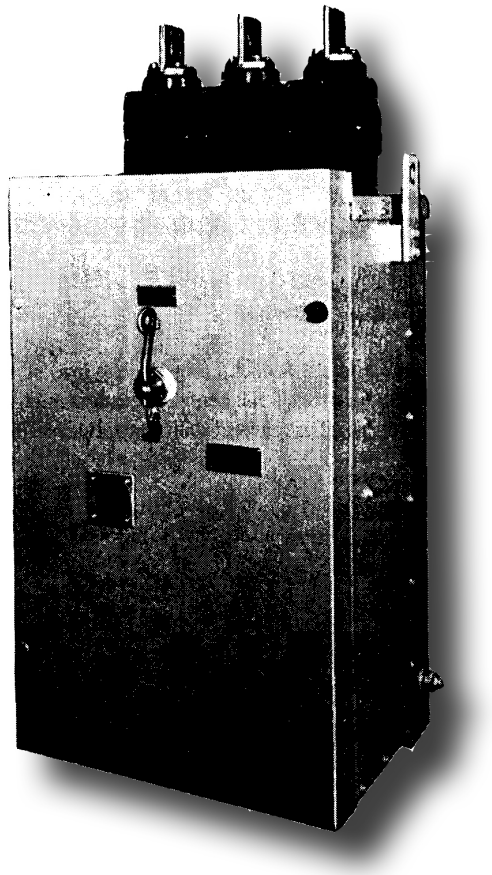
Instruction Booklet **IB 35-552-H**

Effective December 2010
Supersedes IB 35-552-G 12/95

Type CMD Network Protectors 1875 to 3000 Amperes



Read and understand these instructions before attempting any assembly, operation, or maintenance of the Network Protector.

See important disclaimer of warranties and limitation of liability on page ii

See important safety information on page iii and iv.

Powering Business Worldwide

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SAFETY PAGE

Keep this Instruction Book available to those responsible for the installation, maintenance, and operation of the network protector.

The installation, operation and maintenance of a network protector presents numerous potential unsafe conditions, but not limited to, the following.

- Improper operation
- Lethal voltages
- Moving machinery
- Heavy components

Specialized procedures and instructions are required and must be adhered to when working on such apparatus. Failure to follow instructions could result in severe personal injury, death, and/or product or property damage.

Additionally, all applicable safety procedures such as OSHA requirements, regional and local safety requirements, safe working practices, and good judgment must be used by personnel when installing, operating, and/or maintaining such equipment.

Safety, as defined in this instruction book, involves two conditions:

1. Personal injury or death.

2. Product or property damage (includes damage to the protector, other property, and reduced protector life).

Safety notations are intended to alert personnel of possible personal injury, death or property damage. They have been inserted in the instructional text prior to the step in which the condition is cited.

The safety notations are headed by one of three hazard intensity levels which are defined as follows:

1. DANGER: immediate hazard which will result in severe personal injury, death, or property damage.

2. WARNING: hazard or unsafe practice which could result in severe personal injury, death or property damage.

3. CAUTION: hazard or unsafe practice which could result in minor personal injury, or property damage.

Some major safety concerns involving the network protectors are listed below. Refer to appropriate areas of the Instruction Book for further instructions.

1. CMD Network Protectors are designed to operate within the current and voltage limitations given on their nameplates. Do not apply these units to systems with currents and/or voltages exceeding these limits. See Tables 1 and 2.

2. To perform work on this type of equipment requires personnel with training and experience in high voltage circuits. Only qualified* electrical workers familiar with the construction and operation of such equipment and the hazards involved, should be permitted to work on Type CMD Network Protectors.

3. There are several interlocks on the protectors. They are for personnel and/or equipment protection. UNDER NO CIRCUMSTANCES SHOULD THEY BE MADE INOPERATIVE. TO DO SO COULD CAUSE BODILY INJURY AND/OR PROPERTY DAMAGE.

4. Draw out protector's removable element before making any adjustments or doing maintenance of any nature.

5. Never energize the protector without the arc chutes and barriers in place.

6. Always be sure that all protector hardware is in place and bolted tightly before placing protector into its housing for operation.

7. Network Protectors are used where a large amount of power is distributed to high load density areas. As a result, any short circuit at any point in the system involves very high fault currents; thus, extreme care should be exercised when installing or working on an energized protector.

8. Extensive use has been made of barriers and interlocks in the CMD Network Protectors to provide greater safety to maintenance personnel. Keep barriers in place and immediately replace any that have been broken. Because barriers and interlocks are provided, insulated tools and gloves are not required to remove the drawout unit from the enclosure. However, the use of insulated tools and safety gloves must be utilized when removing fuses or at the initial installation of the protector on the system.

9. Before performing maintenance or removing a protector from service, deenergize the protector.

*Qualified Persons as defined in the National Electrical Code.

10. All Safety Codes, Safety Standards and/or Regulations as they may be applied to this type of equipment must be strictly adhered to.

Type CMD Network Protectors are manufactured with several built-in interlocks and safety features to reduce hazards and to provide proper operating sequences.

1. Levering Interlocks
Breaker must be open in the connected or disconnected position before access to the levering screw is permitted.

2. Control Module Interlocks
When the control module is withdrawn from the drawout unit, the breaker is held trip free.

3. Anti-Close Interlock
The anti-close device prevents the protector from closing, either electrically or mechanically when the trip contacts or the master relay (CN-33) or MPCR relay are closed with the breaker contacts open.

4. Facility for padlocking the protector in the open or automatic positions is provided.

5. Positive mechanical indicators show when the switch is open or closed.

6. The front protective steel panel prevents tools or hands from being inserted into an energized protector.

CAUTION

The network protectors described in this book were designed and tested to operate within their nameplate ratings. Operation outside of these ratings may cause the equipment to fail, resulting in bodily injury and property damage.

TABLE OF CONTENTS

SECTION 5 – MAINTENANCE **Page**

SECTION 6 – RENEWAL PARTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

Table 1 – Type CMD-1875 Network Protector Ratings: Submersible and Non-Submersible Enclosures

System Voltage	Continuous Current Ratings	Interrupting Rating	Close and Latch Rating ②	Suggested Transformer Rating ①
216 V	1875 Amps.	30,000 Amps. RMS	25,000 Amps. RMS	500 KVA
480 V	1200 Amps.	30,000 Amps. RMS	25,000 Amps. RMS	750 KVA
480 V	1875 Amps.	30,000 Amps. RMS	25,000 Amps. RMS	1000 KVA

Table 2 – Type CMD-2000-2250 Network Protector Ratings: Submersible and Non-Submersible Enclosures

System Voltage	Protector Ratings	Interrupting Rating	Close and Latch Rating ②	Suggested Transformer Rating ①
216 V	2000-2250 Amps.	60,000 Amps. RMS	40,000 Amps. RMS	600 KVA
480 V	2000-2250 Amps.	45,000 Amps. RMS	40,000 Amps. RMS	1000 KVA

Table 3 – Type CMD-2500-2825 Network Protector Ratings: Submersible and Non-Submersible Enclosures

System Voltage	Protector Ratings	Interrupting Rating	Close and Latch Rating ②	Suggested Transformer Rating ①
216 V	2825 Amps.	60,000 Amps. RMS	40,000 Amps. RMS	750 KVA
480 V	2825 Amps.	45,000 Amps. RMS	40,000 Amps. RMS	1500 KVA

Table 4 – Type CMD-3000 Network Protector Rating: Submersible and Non-Submersible Enclosures

System Voltage	Protector Ratings	Interrupting Rating	Close and Latch Rating ②	Suggested Transformer Rating ①
216 V	3000 Amps.	60,000 Amps. RMS	40,000 Amps. RMS	1000 KVA
480 V	3000 Amps.	45,000 Amps. RMS	40,000 Amps. RMS	2000 KVA

① The suggested transformer size associated with the above protectors is based on conventional electric utility practices for 125/216 and 277/480 Y connected secondary networks.

② Addition of the stored-energy mechanism derates the close and latch rating significantly at all ratings.

INTRODUCTION

PURPOSE

This instruction book is expressly intended to describe the installation, operation, and maintenance of the Types CMD network protectors. Should any item not be sufficiently covered by these instructions and additional information is required, contact your local Cutler-Hammer office.

It is not the intent of this bulletin to describe the operation of a secondary network. For this, refer to Descriptive Bulletin 35-552. Information regarding operation, maintenance, and testing of network relays is contained in Instruction Book 35-580.

For application information, consult your nearest Cutler-Hammer sales office, or see appropriate NEMA Standards.

CAUTION

IT IS NOT SAFE TO OPERATE THE CMD NETWORK PROTECTORS UNLESS THEY ARE INSTALLED IN A SUITABLE METAL ENCLOSURE OF ADEQUATE STRENGTH TO WITHSTAND THE EFFECTS OF HIGH CURRENT SHORT CIRCUIT FORCES; OR BODILY INJURY AND/OR PROPERTY DAMAGE COULD RESULT.

The need to provide electrical power at the utilization voltage—without increasing equipment size—has resulted in a shift from 125/216-volt to 277/480-volt systems. With this trend toward the higher voltage a change in operating and maintenance procedures is required, because of the difference in arcing characteristics at 480-volts as compared to those at 125/216-volts. For example, while an arc in a 216-volt system is normally self-extinguishing, an arc in a 480-volt system will usually burn until it is interrupted by an extinguishing device or until it totally consumes the arcing material.

The Cutler-Hammer CMD Network Protectors are designed to assure service continuity in 125/216- and 277/480-volt, Y-connected secondary network systems. These systems, in either distributed grid or spot network form, are commonly used in such areas of high load density as metropolitan and suburban business districts.

When a fault on a primary system (cable or network transformer) occurs, the CMD Network Protectors will open to isolate the fault from the network system. Loss of the feeder will not result in service outage to any load on the secondary network. The other primary feeders will carry the load until the faulted feeder can be brought back into service.

The CMD Network Protectors consist basically of an air circuit breaker, a breaker operating mechanism, network relays and control equipment. It is available in both semi-dust-tight and submersible enclosures, for either separate or transformer throat mounting.

The CMD units have a drawout design with positive safety interlocks that provide protection for personnel against contact with energized components while disconnecting the unit for test or maintenance. All the main current carrying and mechanical operating components are located behind a "dead-front", steel panel that prevents tools or hands from being inserted into an energized protector. The drawout unit is operated by a hand-cranked levering system, which cannot be engaged unless the circuit breaker is open; and it cannot be disengaged unless the drawout unit is either fully disconnected or fully connected.

The modular construction facilitates field maintenance and/or replacement of parts of the drawout unit.

A sping-close operating mechanism in the network protectors prevents partial closures. The CMD spring-close mechanism will not permit a closing motion of the contacts to start until the closing springs are fully charged.

Externally-mounted, silver-sand fuses are provided to interrupt fault current by disconnecting the protector from the network bus in case the network protector would fail to trip.

Also, a low-energy, direct-trip actuator provides a mechanical force to trip the circuit breaker.

SECTION 1 – RECEIVING, HANDLING AND STORING

1.1 RECEIVING

Each unit shipped comprises a housing containing a drawout unit which may have externally mounted fuse housings, which are equipped with Type NPL fuses, and are supplied with spade terminals or threaded studs.

The type MPCR solid state network protector relay is normally shipped with the network protector, mounted on the relay panel. Use of the MPCR relay can be found in I.B. 35-581.

When receiving new network protectors, make a general inspection looking particularly for damage which may have occurred in handling and shipping. If any damage is apparent, file claim with carrier within 24 hours. If the unit is to be placed in storage for more than a few weeks, it should be inspected and tested thoroughly and any deficiencies reported.

1.2 HANDLING

1.2.1 Lifting the Breaker

To facilitate lifting, the drawout unit frame contains two 1-3/8 inch diameter lifting lugs.

A SPREADER MUST BE USED TO ENSURE THAT NO DAMAGE TO THE BARRIERS OR ARC CHUTES OCCUR.

1.2.2 Lifting the Enclosure

Two lifting holes, 1-3/8 inch diameter, are located near the top at each side of the enclosure. Spreaders must be used on chains or slings to prevent damage to the fuse housing.

For shipping, network protectors are mounted on wooden skids designed for use with fork lift trucks. Insert fork at the rear of unit and tilt unit slightly toward truck before lifting.

1.2.3 Weights of Drawout Units and Enclosures

Table 3 – Typical Weights of Type CMD Network Protectors

Drawout Units	Pounds
CMD-1875	400
CMD-2000/3000	500
Enclosures	
Submersible Enclosure for CMD-1875	600
Submersible Enclosure for CMD-2000/3000	1050
Non-Submersible Enclosure for CMD-1875	450

1.3 STORING

Submersible units may be stored as received with door tightly closed and with the shipping cover over the throat opening. Shipping covers should not be considered watertight, as they are for dust protection only.

NOTE: Units should be transported and stored in upright position only.

SECTION 2 – DESCRIPTION

2.0 GENERAL

Type CMD network protectors are air circuit breakers equipped with relays that operate in response to voltage across the protector or current through the protector. These relays cause the protector to close or to open as required by the conditions between the network and the feeder transformers. Control power is taken directly from the system and therefore no separate power source is required.

CMD units are available as standard, for 216Y/125 volts or 480Y/277 volts at 60 Hertz; with other voltages as well as 50 Hertz units available upon request.

Fig. 1 shows a CMD Submersible Enclosure for transformer mounting. Fig. 2 shows a NEMA 1A semi-dust-tight enclosure for transformer mounting.

WARNING

TYPE CMD NETWORK PROTECTORS ARE PROTECTIVE DEVICES. AS SUCH, THEY ARE MAXIMUM CURRENT RATED DEVICES. THEREFORE, THEY SHOULD NOT UNDER ANY CIRCUMSTANCES BE APPLIED OUTSIDE THEIR NAMEPLATE RATINGS. OPERATION OUTSIDE OF THESE RATINGS COULD CAUSE THE EQUIPMENT TO FAIL, RESULTING IN SEVERE PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

The submersible enclosure is equipped with type NPL fuses in an externally mounted fuse housing located on top of the network body. The ventilated unit may be supplied with the externally mounted fuse housings or with thru-bushings.

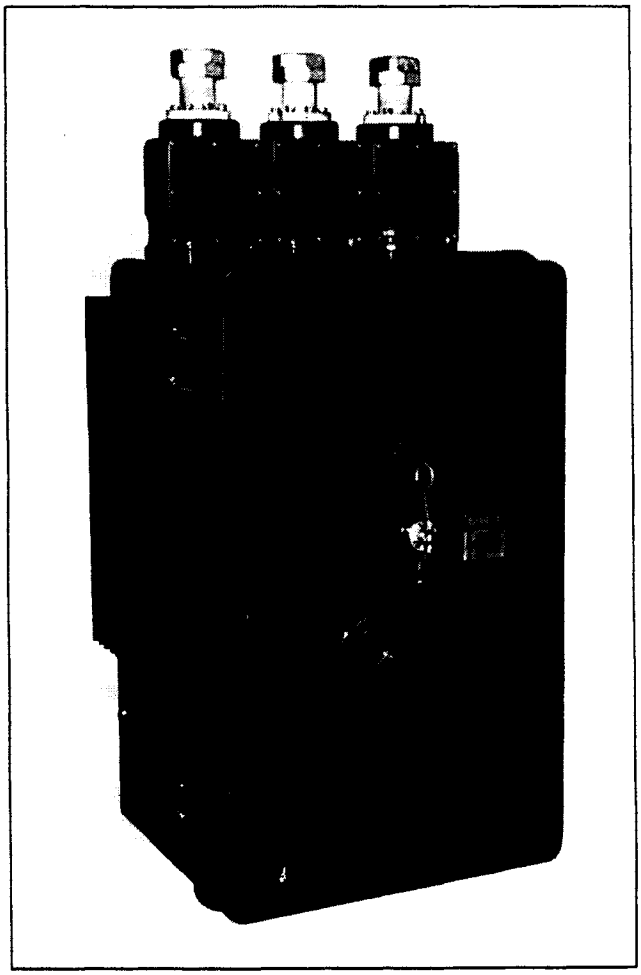


Fig. 1 *Front View of CMD Submersible Enclosure*

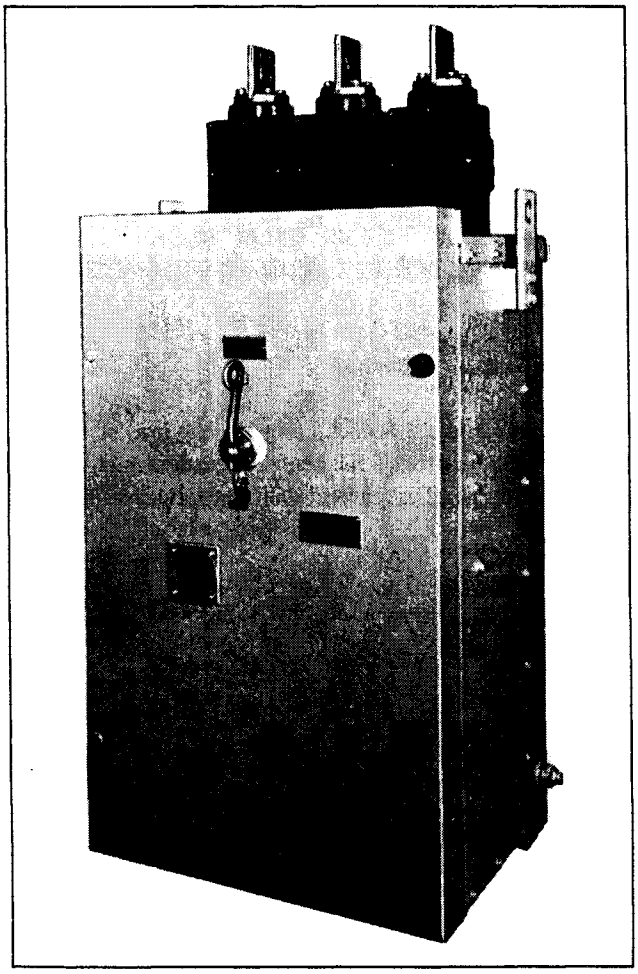


Fig. 2 *Front View of Non-Submersible CMD-1A Enclosure*

The normal power flow direction is in at the throat from the transformer, down to the transformer side disconnect device on the levering-out unit, up thru the unit to the network side disconnect device, out the top of the enclosure into the fuse housings, thru the fuse to the supplied mounting terminal.

2.1 CMD Network Protectors

The complete drawout unit consists of the air circuit breaker and its associated relaying equipment consisting of four major elements.

2.1.1 Frame: The supporting structure and levering device.

2.1.2 Circuit Breaker Unit: Three identical elements, each contains an arc chute, contact system, current transformer and primary disconnects.

The circuit breaker consists of three identical pole unit assemblies made up of a hinged contact, a fixed contact assembly, an arc chute, disconnect fingers and a current transformer, Figs. 34 and 35.

2.1.2.1 The main stationary contacts on the 1875 protector consist of five-butt type fingers which are supported in a stainless steel cage under a copper block. Each finger is spring-biased so that a constant pressure is applied both to the conducting pivot point in the copper block and to the main contact surface which bears against the moving main contact. Just above the main stationary contacts are the arcing contacts.

2.1.2.2 On the 2000/3000 amp protector the main stationary contacts, which carry the main continuous load current, are of the butt type composed of a multiplicity of fingers. Each finger is hinged at the upper end under controlled pressure. Compression springs at the lower end apply predetermined pressure against the moving main contact in closing and in the closed position. With this construction, the pressure on the main contact surfaces is increased during the carrying and opening of high, short-circuit currents because the magnetic field of the current pushes the lower end of the finger toward the moving contact. Hinging the finger at the top, thus results in what is sometimes called "blow-on" action. This greatly increases the capability of the entire contact assembly to withstand the high-fault currents associated with these breaker ratings.

2.1.2.3 The stationary arcing contacts are spring biased toward each other. When the moving arcing contact travels forward to the closed position, it wedges between the two stationary arc contact blades.

2.1.2.4 The moving contact members on the 1875 unit consist of blades hinged at the bottom of the lower main terminal through controlled-pressure rotating contacts and with main and arcing contacts at the upper end. The arcing contact tips are of arc-resisting metallic composition. The moving contact assembly is driven by a rigid insulating push rod.

Similarly, on the 2000/3000 amp protectors the moving contact members consists of blades hinged at the bottom of the lower main terminal through controlled-pressure rotating contacts and with main and arcing contacts at the upper end. The arcing contact tips are of arc-resisting metallic composition. The moving contact assembly is driven by a rigid insulating push rod.

2.1.2.5 The push rods, on both units, are connected to levers welded to the main operating shaft which is located in the mechanism module.

2.1.2.6 Arc chutes are constructed from a one-piece molded body, which has been designed to accept the splitter plates. A single, captive, hold-down screw is located in the front bracket of each arc chute to facilitate its removal.

2.1.2.7 Current transformers are cast-resin encapsulated with exposed 0.190-32-threaded terminals.

2.1.2.8 Barrier Insulation: The individual pole units assemblies in the upper module are separated by Red Glass-polyester barriers extending from the front to the back of the enclosure. These barriers reduce personnel exposure during maintenance and provide additional reliability when the protector is in service. See Fig. 3.

2.1.2.9 The Operating Mechanism consists of an independent spring-closing mechanism, spring-charging motor, trip device and the anti-close device.

2.1.2.10 The Withdrawable Control Module consists of auxiliary switches, relays, transformer and secondary disconnects. It is electrically connected to the operating mechanism by plugs and sockets.

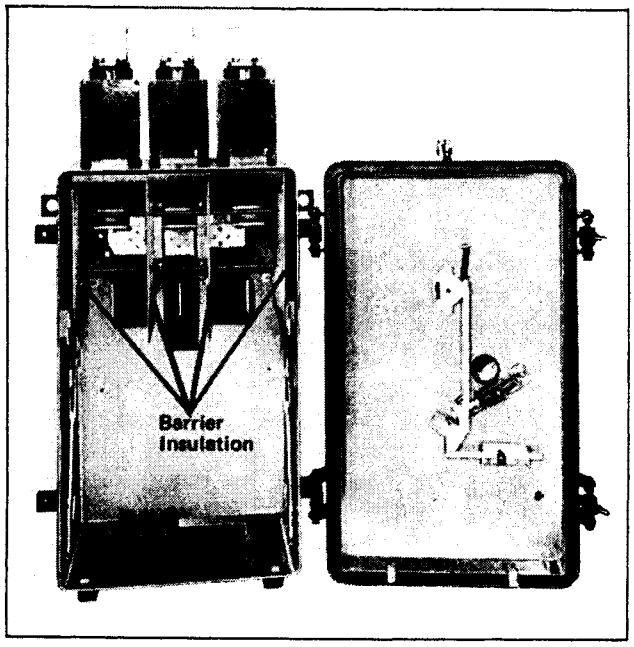


Fig. 3 *CMD Network Protector Enclosure*

SECTION 3 – OPERATION

3.1 PROCEDURE TO REMOVE THE DRAWOUT UNIT FROM HOUSING

When the enclosure is not attached to a transformer, the enclosure must be supported in a way that will prevent tipping forward when the door is open and the drawout unit is on the extension rails.

3.1.1 To Open Door

The quick opening enclosure is opened by loosening all the bolts, starting with the bolts on the hinged side. The hinge bolts are loosened until the bolts come against the stops. Then the bolts on the opening side are loosened until they are completely disengaged from the housing blocks.

3.1.2 Removing Shipping Brace

Before the drawout unit can be withdrawn from the enclosure, two shipping brackets must be removed. The shipping brackets are bolted to each side of the drawout unit adjacent to the enclosure rails by 3/8-inch bolts. Remove bolts and shipping angles and discard.

3.1.3 Positioning Extension Rails (Refer to Fig. 4)

Pivoting extension rails rest in catch plates in both sides of the enclosure. Raise the rail to about 40^{o} above the horizontal, push on the rail and lower it to the horizontal. The extension rail is now solidly attached to the fixed rail by a pivot pin and ledge.

3.1.4 Withdrawing the Drawout Unit (Fig. 5)

Remove and discard the 1/4-20 bolt securing the levering crank. With the levering crank held in the left hand, depress the trip plate with the socket end of the crank, lift the shutter exposing the pinned head of the levering shaft. Release the trip button (it is now trapped in the trip position) and insert the socket over the pinned head of the shaft. **RELEASE THE SHUTTER, INSURING THAT THE SHUTTER RIDES ON THE CRANK.** Failure to do so will result in damage to the levering device. See Fig. 6.

Rotate the crank counterclockwise (see Fig. 7) and observe the rotation of the levering device arms. They will move down and towards the rear of the drawout unit. When the arms are in the horizontal plane, the load on the crank increases because the stop has been reached. Approximately sixteen turns of the crank are required to complete the levering out operation.

DO NOT APPLY FORCE ON THE CRANK HANDLE AFTER THE STOP HAS BEEN REACHED AS THE DISCONNECT POSITION HAS BEEN OBTAINED. The crank can now be removed. (It is trapped in all positions, except when the protector is fully engaged or completely disconnected.)

Pull the drawout unit on the extension rails, allowing the front rollers to seat in the depressions at the end of the extension rails. In this position, the protector can not tip as it is trapped in the extension rail anti-tilt brackets (refer to Fig. 8).

With the drawout unit on the extension rails, remove the plastic tubing from the fixed rail hold down hooks.

CAUTION

The fishpaper protective sheet covering the secondary disconnects, located at the bottom rear of the enclosure, should not be removed until the unit is permanently mounted in its vault location.

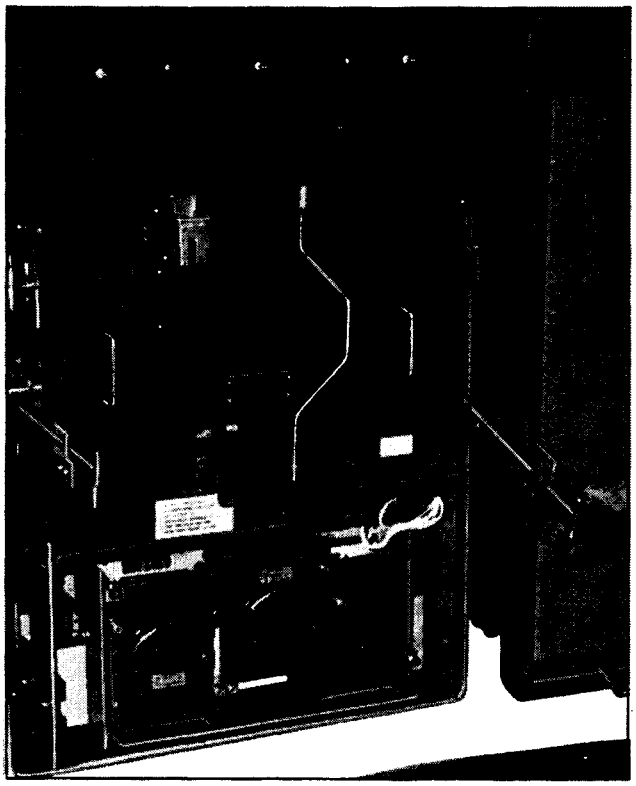


Fig. 4 *Positioning Extension Rails on CMD Network Protectors*

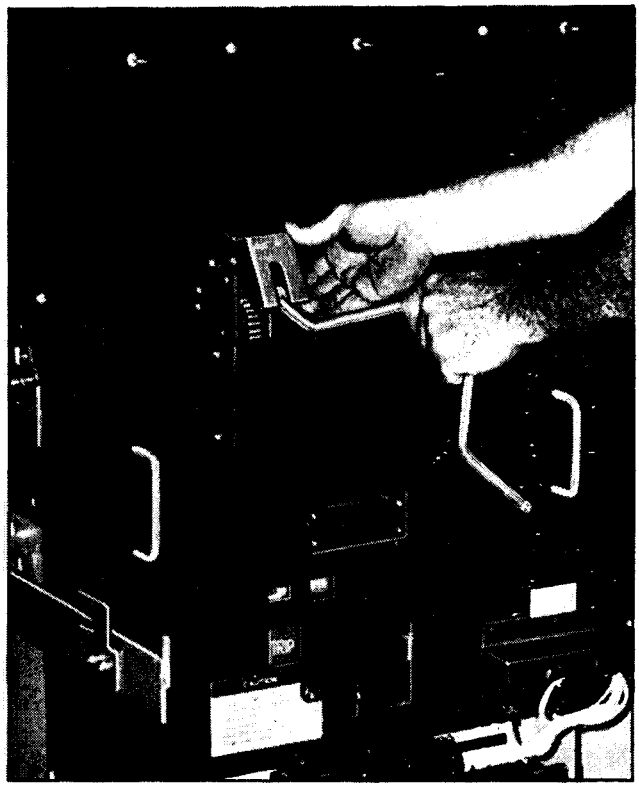


Fig. 6 *Inserting Levering Crank Socket Over Head of Levering Shaft*

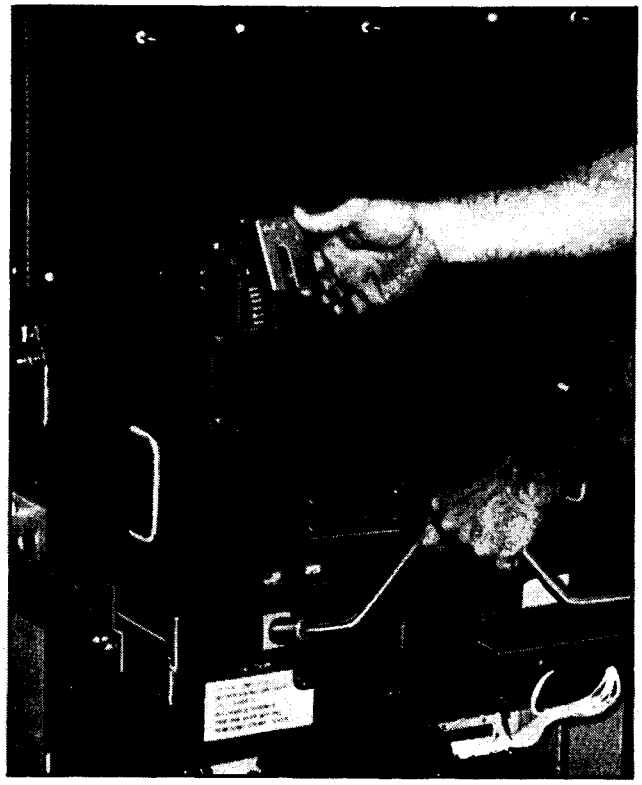


Fig. 5 *Preparing to Drawout Breaker on CMD Network Protectors*

Fig. 7 *Levering Crank in Position on CMD Network Protectors*

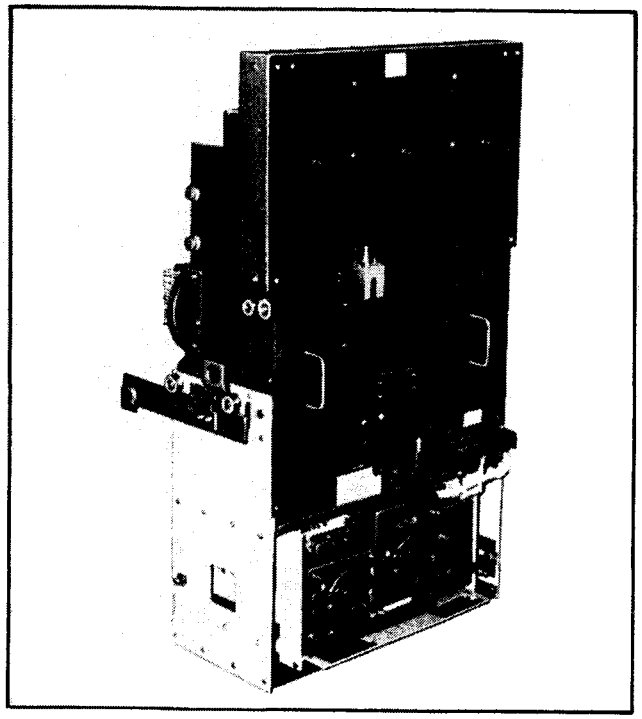


Fig. 8 *CMD Network Protector Out on Rails*

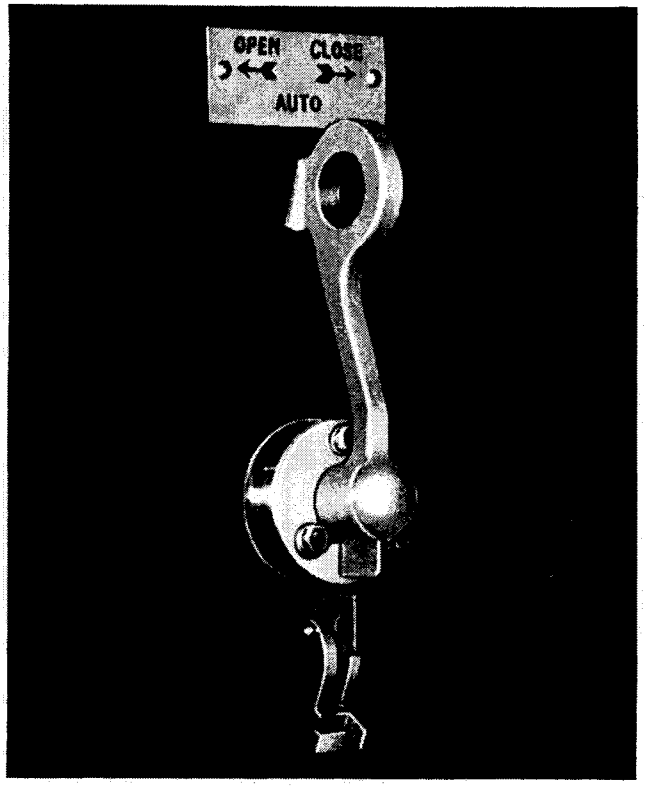


Fig. 9 *CMD Network Protector Operating Handle*

3.2 ENCLOSURE

The CMD submersible enclosure is of welded steel construction, which has been bonderized and protected by several coats of high grade paints, thereby minimizing corrosion in service. This enclosure incorporates several innovative designs on network protectors, such as:

1. Door mounted external operating handle. See Fig. 9.
2. Internal door mechanism. See Fig. 10.
3. Housing gasket. See Fig. 37.
4. Externally mounted fuse housing. See Fig. 1.

A cover is arranged so that it may be hinged on either side, without changing operating handle location, while providing ready access to the housing interior. The cover is equipped with the external operating handle and a window for inspection of the position indicator and operation counter. The window is of tempered glass clamped by gaskets for a cushioning action to keep the housing watertight. The operating handle is made watertight through the cover by use of an O-ring held captive with a retaining plate.

3.2.1 OPEN and AUTO Positions

Upon opening the door, a mechanism is clearly visible mounted on the inside surface of the door and is actuated by the external operating handle. The operating handle has three positions; OPEN, AUTO, and CLOSE as indicated on the nameplate located directly above the handle. The door mechanism has three major active components which are described as the detent cam, slider bar, and trip actuator (refer to Fig. 10).

The handle is held captive in both the OPEN and AUTO positions by means of the detent cam, but is spring returned from the CLOSE position to the AUTO position. External padlock provisions are available in both the AUTO and OPEN modes through use of a pivoting latch, which swings upward, permitting the lock hasp to fix housing, latch, and handle.

A block mounted on the slider bar, is made to engage the microswitch mounting pad located in the upper left corner of the control module. The switch mounting pad is spring loaded so as to take-up any differences which may occur as the housing gasket takes a set.

A roller is positioned at the extension point of the trip actuator linkage which is to engage with the trip flag on the breaker. This linkage, when full extended, is spring loaded as to take up any differences in the gasket seating depth.

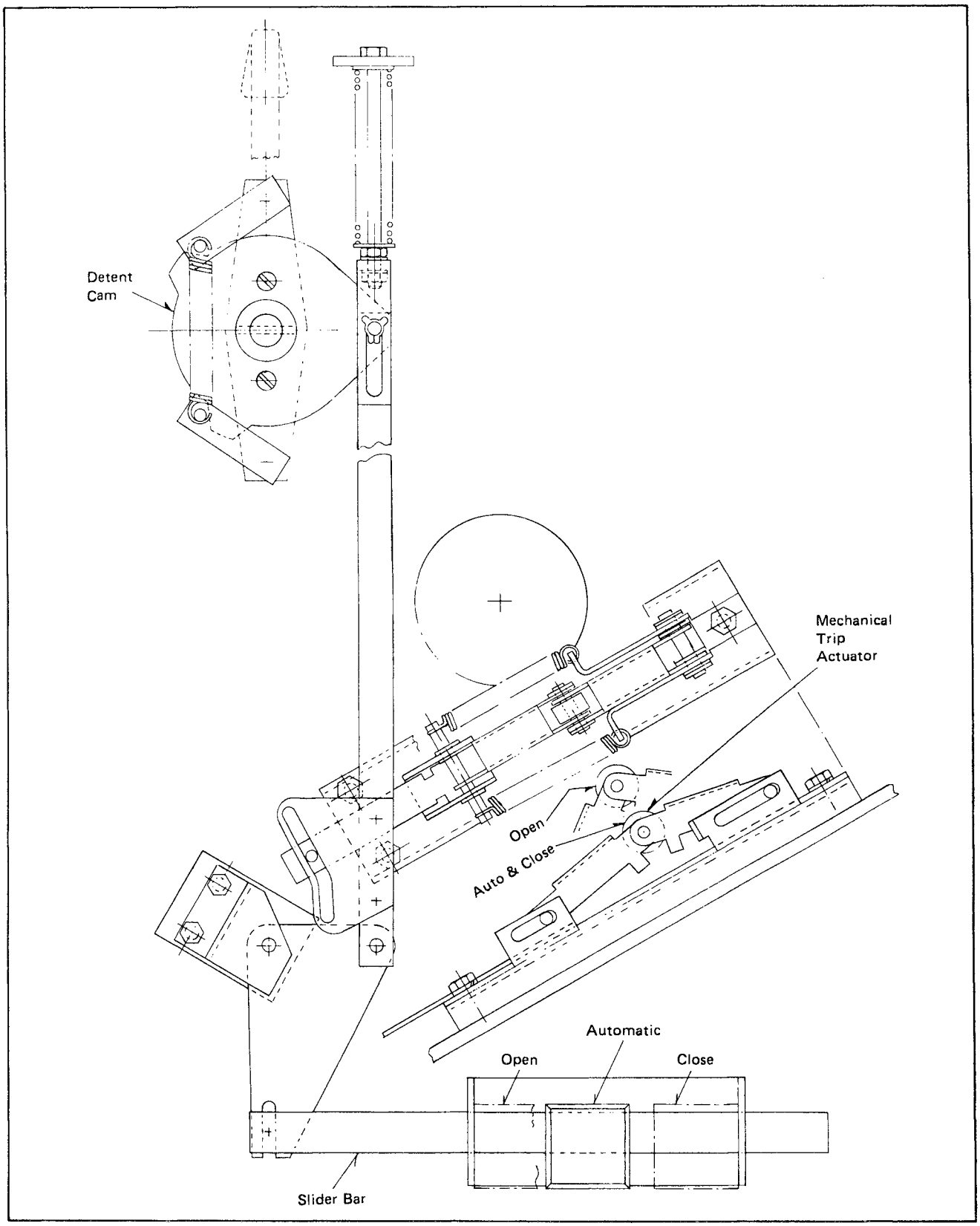


Fig. 10 *Door Mechanism Operation on CMD Network Protectors*

When the operating handle is moved from the AUTO position to the OPEN position the contact block, mounted on the slider bar, travels to the extreme right (as viewed with the door closed) and is stopped by the slide bracket. This removes the block from the microswitch indicated as "JA" (refer to Wiring Diagram Fig. 47). At the same time, the trip actuator linkage is being extended, applying the necessary force to depress the trip flag, and hence trip the breaker. Therefore, external tripping mode is accomplished entirely through a mechanical system.

When the operating handle is moved from the AUTO position to the CLOSED position, the contact block travels to the left (as viewed with the door closed) removing the contact block from switch "JA" to switch indicated "JC" (refer to Wiring Diagram Fig. 47). Therefore, the external closing function is made up electrically, in the breaker, through the door mechanism. Once the breaker has been closed, the operating handle should be released permitting its spring load to return it to the AUTO position. It should not be the intent of the operator to attempt to place the network into service by utilizing the close mode. Rather, the protector should be placed in the AUTO position to permit the relays to control the breaker functions. An exception to the following would be in the initial closing of a protector on a known dead bus which lacks connected load to correctly operate the relays. Repeated attempts utilizing the CLOSE mode are highly discouraged if the breaker fails to stay latched, since it indicates a malfunction exists and should be repaired.

All enclosure types will be supplied with the door mounted external handle and door mechanism as previously described. Only submersible units require the neoprene housing gasket.

3.3 INTERLOCKS

The CMD network protectors incorporate several mechanical interlocks which provide for operator safety and proper equipment function.

CAUTION

DO NOT ATTEMPT TO DEFEAT OR REMOVE ANY OF THE SPECIFIED INTERLOCKS. TO DO SO COULD CAUSE BODILY INJURY AND/OR EQUIPMENT DAMAGE.

3.3.1 Levering Interlocks

Refer to Figs. 11, 12, and 13 to gain access to the levering crank, the breaker must be in the following positions:

1. The breaker must be in the connected or disconnected positions.

2. The trip plate must be depressed.

3. The protector contacts must be open.

Access to the levering screw is obtained by raising the shutter. This shutter is interlocked to the levering device by an interlock plate, the trip plate and the open-close flag by a push rod.

Raising the shutter drives the pin (1) down through the interlock plate (2). This is only permitted in the connected or disconnected position, Figs. 12 and 13. The shutter also drives a push rod (3) in the operating mechanism. The downward motion of this rod is barred by a projection on the trip plate (4) and a pin on the open-close lever (5). To clear these obstacles, the trip plate must be depressed and open-close lever (and hence the breaker contacts) must indicate open.

With the levering crank inserted on the levering screw, the shutter rests on the levering crank. In this position, the trip plate remains depressed, Fig. 11.

Therefore, this interlock system demands that the breaker must be in the connected or disconnected position and the breaker must be open before access to the levering screw is permitted. Further, the breaker is held trip free and the levering crank is trapped in all positions except connected and disconnected, Figs. 12 and 13.

3.3.2 Procedure to Service a CMD Network Protector if the Breaker Fails to Open

DANGER

READ THIS SECTION COMPLETELY BEFORE ATTEMPTING ANY EMERGENCY WORK ON THE NETWORK PROTECTOR.

IF THE BREAKER DOES NOT OPEN, IT BECOMES IMPERATIVE TO ISOLATE THE NETWORK PROTECTOR ELECTRICALLY FROM BOTH THE TRANSFORMER-SIDE AND THE NETWORK-SIDE POTENTIALS, AS THE LEVERING-IN DEVICE IS INOPERATIVE IF THE BREAKER CONTACTS DO NOT PART. HENCE, THE LEVERED-OUT OR RACKED-OUT POSITION CANNOT BE OBTAINED.

PERFORMING MAINTENANCE ON A CMD NETWORK PROTECTOR WITHOUT ISOLATING IT ELECTRICALLY CAN RESULT IN EQUIPMENT DAMAGE AND/OR BODILY INJURY. DO NOT PROCEED WITH ANY OF THE FOLLOWING PROCEDURES UNTIL THE UNIT IS ELECTRICALLY ISOLATED.

a. With the housing door open, drill out the two .190-32 machine screws which fasten the interlock bracket to the dead-front panel. These screws are located to the left of the shutter opening and are fastened through the panel by means of press nuts. (See RPD 35-552, Pages 4, 5, Fig. 1, Item 7). The bracket and hardware, once free, will fall onto the mechanism top pan and must be removed after the dead-front panel is removed. Turn the three, 1/4-turn fasteners, and remove the front panel.

b. Attempt to trip the breaker with the push-to-trip button while noting if the trip bar freely rotates. The trip bar should rotate approximately 30 degrees. Check to ensure that the latch is free to move and is not restrained by the trip bar. Tap lightly on the center push rod stud to force the main and/or arcing contacts apart.

c. If the trip bar does not rotate when the push-to-trip button is depressed, force its rotation by pushing inward on the lower portion of the trip shaft, near the Capacitor Trip Actuator plunger.

d. If the contacts are welded together, remove the push rods from the moving contact assembly permitting the breaker mechanism to reset; this in turn allows the levering-in device to operate. Remove the entire pole unit module once the breaker is levered out on its rails. See Item 5.9.

e. Once the necessary repairs have been made, reassemble the dead-front interlock bracket to the dead-front panel with pop-rivets after removing the two press-nuts in the front panel.

CAUTION

THE DEAD-FRONT INTERLOCK MUST BE REASSEMBLED TO ENSURE THE SAFETY INTEGRITY OF FUTURE OPERATIONS OF THE UNIT, OTHERWISE, IT COULD CAUSE EQUIPMENT DAMAGE AND/OR BODILY INJURY.

g. Check the main contact pressure and adjust it if necessary. Completely retest the network prtoector with a three-phase, portable test kit prior to energizing it to ensure proper relay and mechanical operation.

3.3.3 Protective Steel Shield

The rear face of the protective steel shield has a bracket which, when the levering device is in the connected position, is engaged by a pin on the levering shaft such that the shield cannot be removed.

3.3.4 Control Module Interlock

A spring-loaded lever is mounted in the mechanism left side sheet and its position controlled by the relay module front sheet. If the control module is removed, or its two locking screws, mounted on the main frame side sheet, are removed or backed off, the lever, driven by its spring, blocks the resetting motion of the trip shaft. The protector will remain in a trip free position.

3.3.5 Anti-Close Interlock

Should the master relay call for "trip", with the protector open, the anti-close device will deenergize the closing motor thus preventing electrical operation, while mechanically holding the breaker trip free, preventing a closing operation by the manual closing handle. (See Fig. 14.)

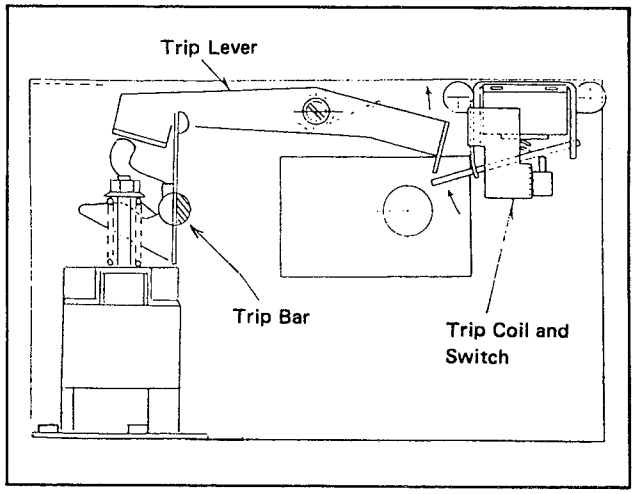
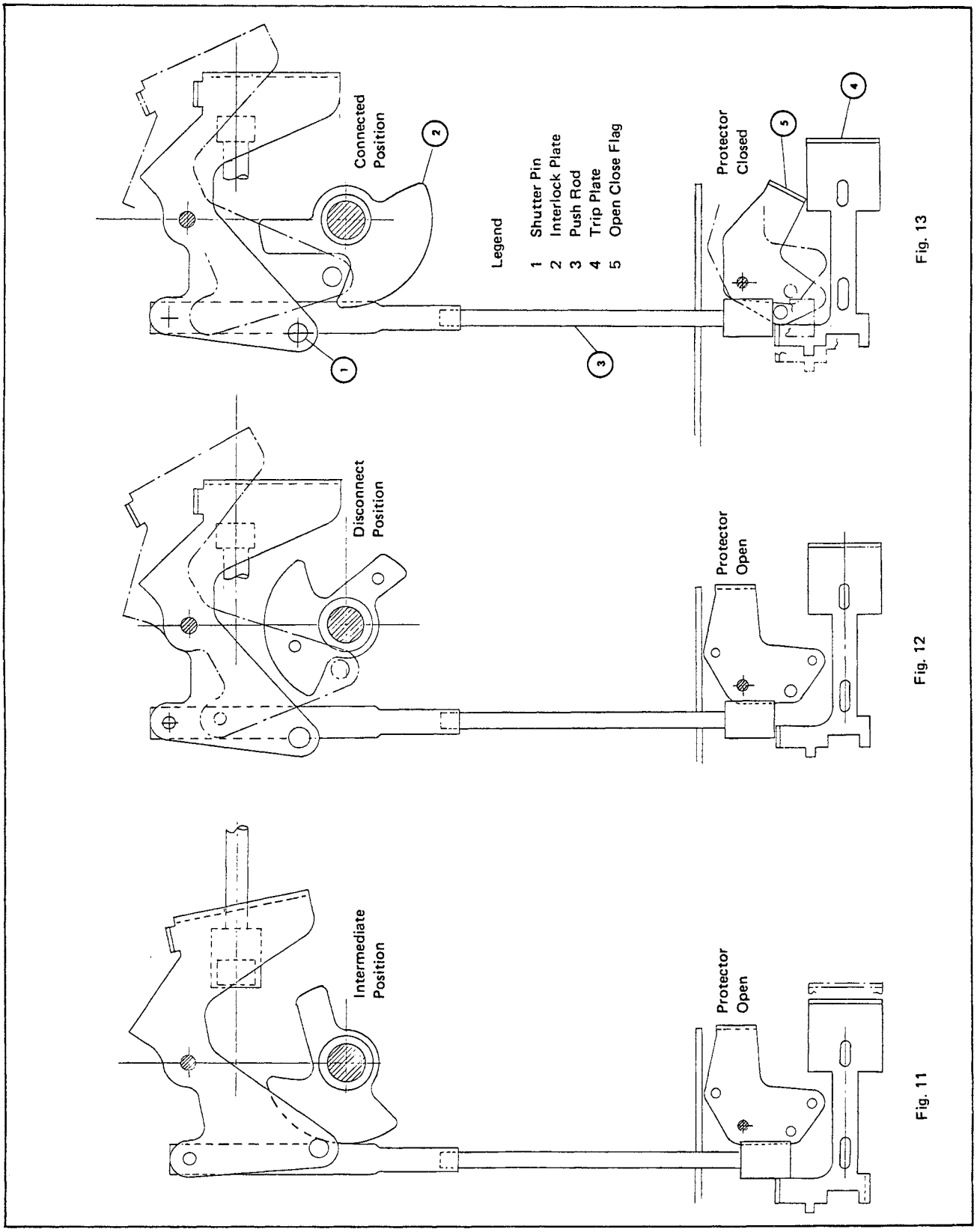


Fig. 14 *Anti-Close Interlock Device*



Figs. 11, 12 and 13 *Levering Interlock Operation of CMD Network Protectors*

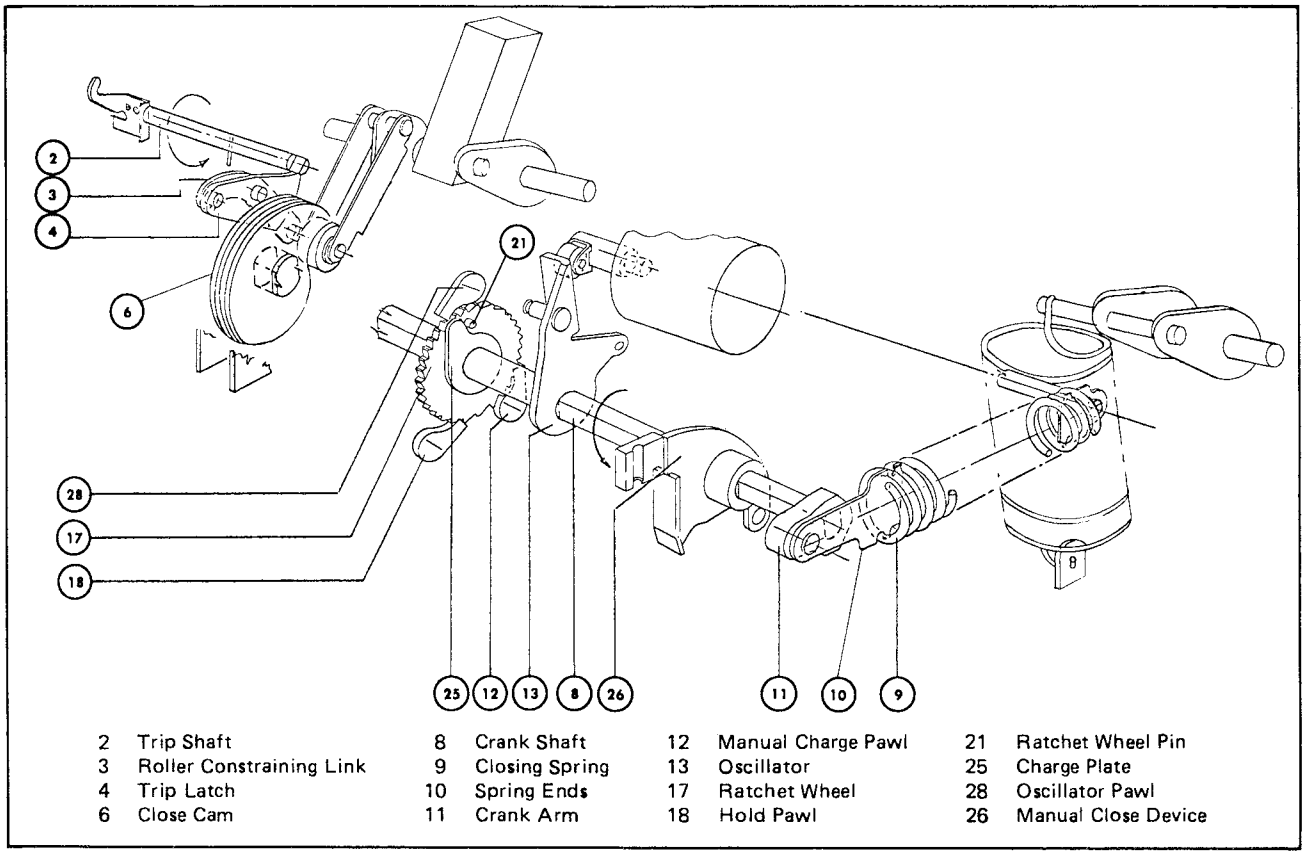


Fig. 15 *Spring-Closing Mechanism Detail (Exploded View): CMD Network Protectors*

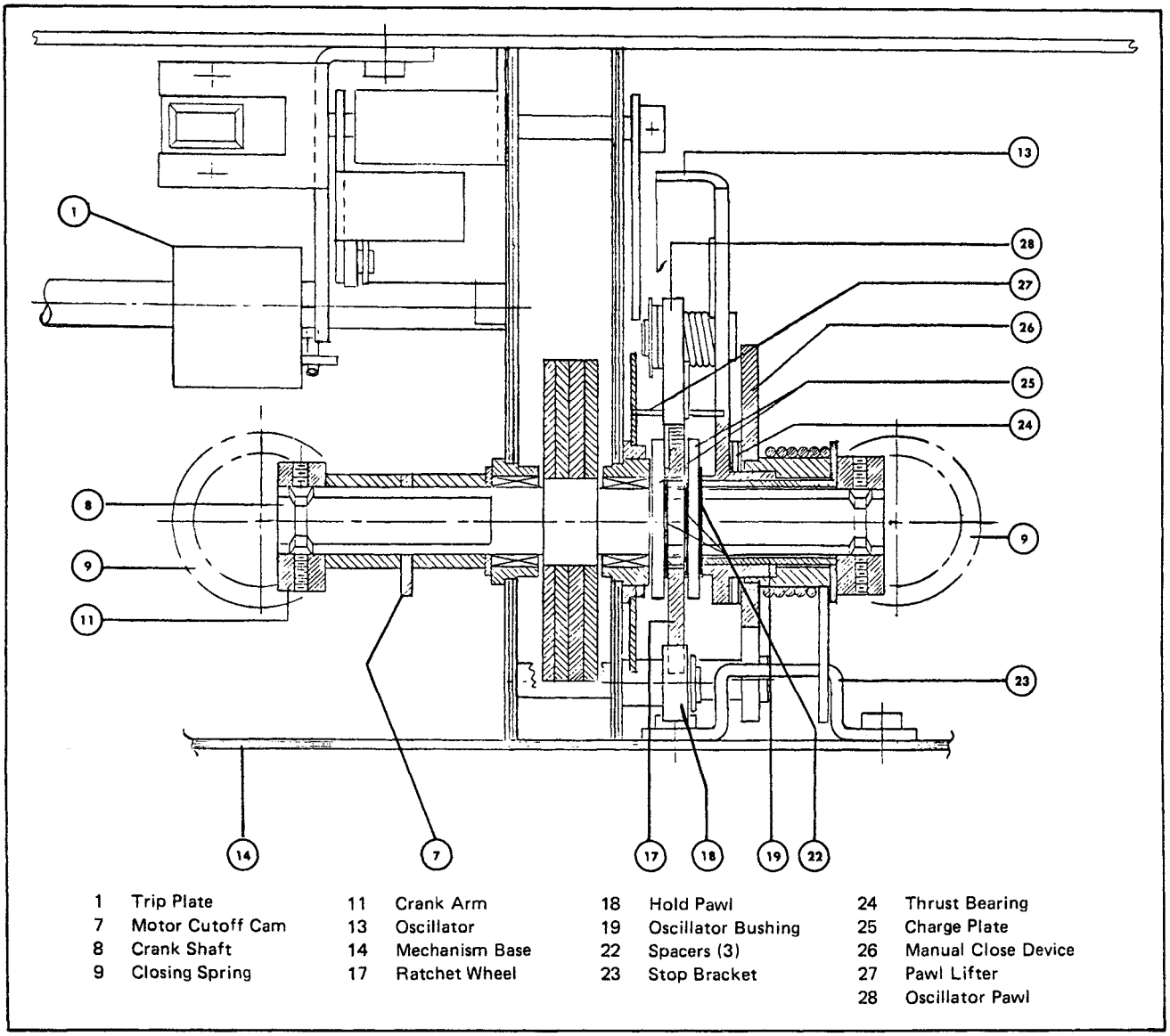
3.4 OPERATION OF SPRING-CLOSING MECHANISM

Fig. 15 is an isometric diagram of the principle parts of the spring charging portion of the mechanism.

Referring to Figs. 15 and 16, the basic elements are mounted on the crank shaft (8). This is a shaft with four flats machined on it and a crank arm (11) attached to each end. Each crank arm connects to its closing spring (9) by a formed spring end (10). The rear of the springs anchor to the rear of the mechanism frame. The crank arms (11), motor seal-in switch cam (7), close cam (6) and drive plates (25) have matching flats and are thus anchored to the crank shaft. The rachet wheel (17), oscillator (13), manual charge device (26) and the pawl lifter (27) are free to rotate. The motor crank shaft assembly, carrying a roller for driving the oscillator (13), is pivoted in the right-hand mechanism frame. The hold pawl (18) is mounted by means of a pin on the mechanism side frame as shown.

In operation, rotation of the motor crank pushes the oscillator arm counterclockwise and the oscillator pawl (28) engages the ratchet wheel slightly more than one tooth in the counterclockwise direction. The holding pawl (18) snaps behind the corresponding advanced tooth and retains the ratchet wheel as the oscillator arm rotates clockwise to engage a further tooth. Thus the ratchet wheel rotates counterclockwise until the ratchet wheel pin (21) engages the two drive plates (25) which in turn rotate the crank shaft assembly and charge the closing spring. After approximately 30^{o} of crank shaft rotation, the motor cutoff switch, actuated by the cam (7) seals in the motor control relay. The spring charging continues until the crank arms are over center and the closing spring torque drives the crank shaft assembly counterclockwise and the protector closes.

In closing, the lobes of the pawl lifter (27) disengages the drive and hold pawls from the ratchet wheel. Thus, the stopping point of the motor is not critical.



1	Trip Plate	11	Crank Arm	18	Hold Pawl	24	Thrust Bearing
7	Motor Cutoff Cam	13	Oscillator	19	Oscillator Bushing	25	Charge Plate
8	Crank Shaft	14	Mechanism Base	22	Spacers (3)	26	Manual Close Device
9	Closing Spring	17	Ratchet Wheel	23	Stop Bracket	27	Pawl Lifter
						28	Oscillator Pawl

Fig. 16 *Mechanism Assembly (Front View): CMD Network Protectors*

The mechanism is provided with a manual closing device. The operation is similar to that of the motor and oscillator except a separate pawl (12) is used to advance the ratchet wheel.

The mechanism is of the general variety of mechanically trip-free mechanisms, which implies that the breaker can open or be made trip free from the closing mechanism at any point in the closing stroke.

It can be seen in Figs. 17, 18, 19 and 20 that the main drive link roller is constrained to move in a circular path by the roller constraining link (3) which pivots about a pin on the trip latch (4). The trip latch is restrained from rotating by the trip shaft (2). When the trip shaft is rotated, Fig. 19, the trip latch is released, therefore no restraint is exhibited on the main drive link. Under this condition the breaker, if closed, will open. With the breaker open, no closing force can be transmitted to the pole shaft and hence the protector will not close.

Extreme care should be utilized in performing trip-free operations, as the entire energy of the mechanism (that which is generated by charging the springs) is dissipated through the two crank shaft bearings and the sudden discharge of the two charging springs. This in turn reduces both spring and bearing life.

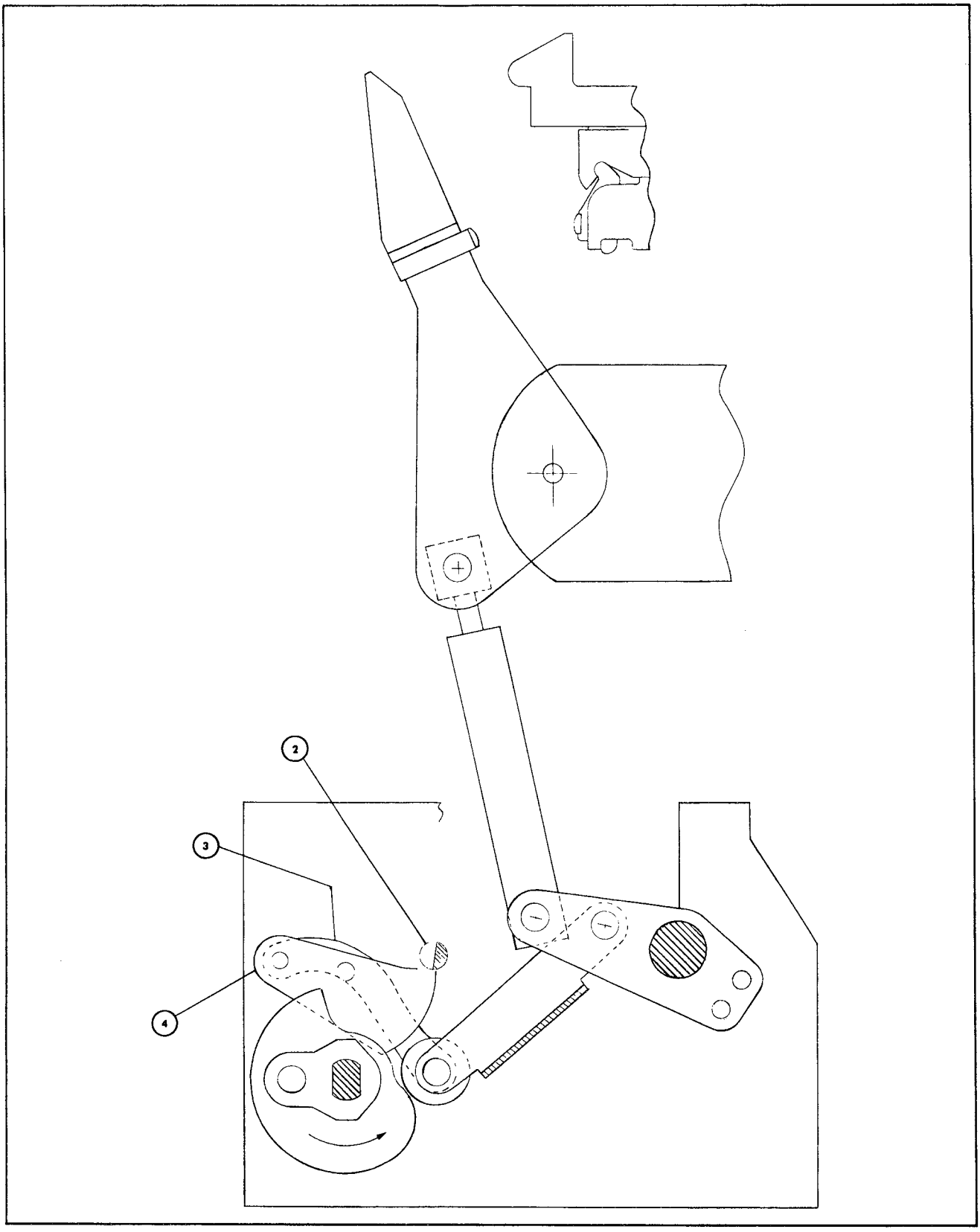


Fig. 17 *Protector Closing: CMD-1875 Network Protector*

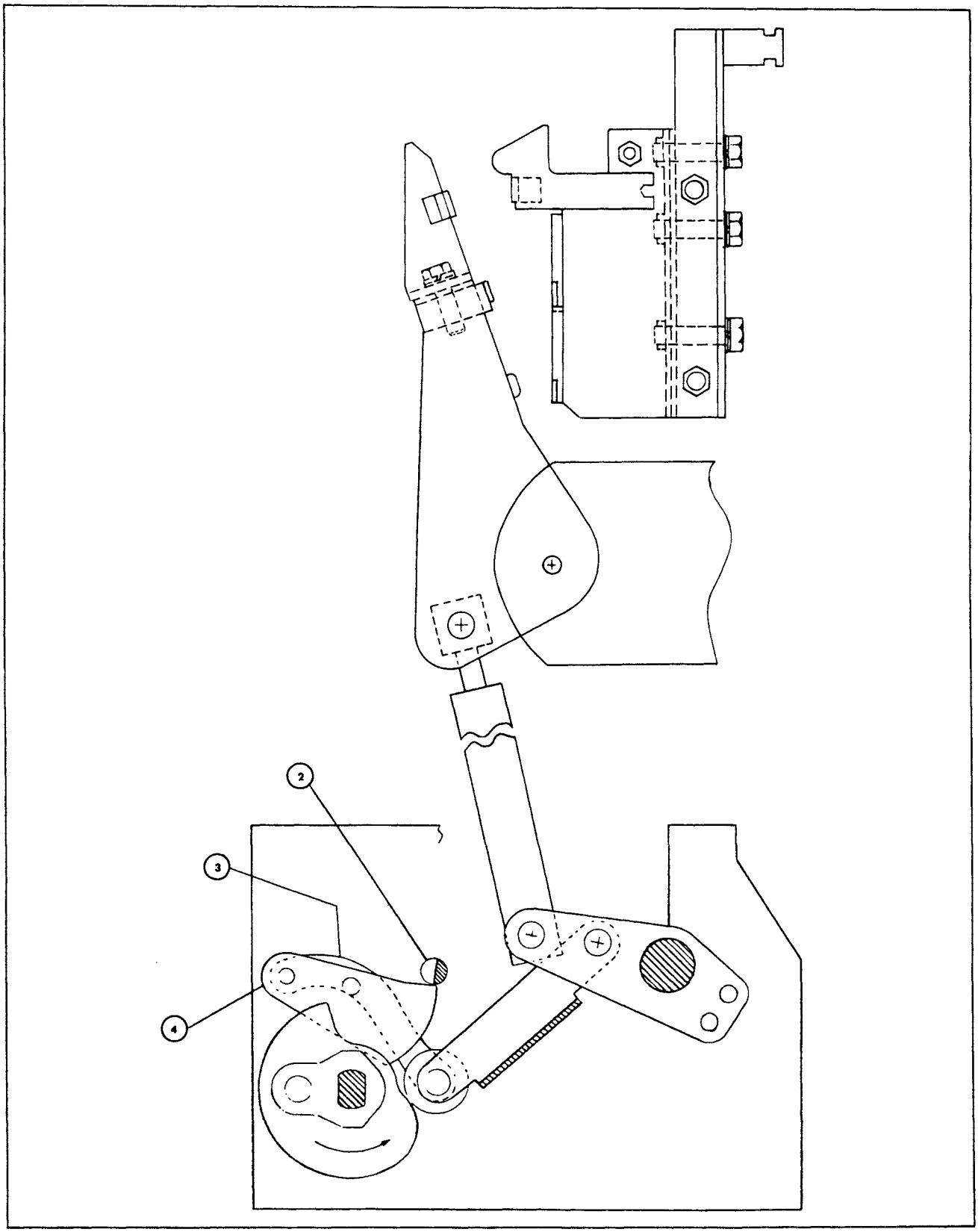


Fig. 18 *Protector Closing: CMD-2000/3000 Network Protector*

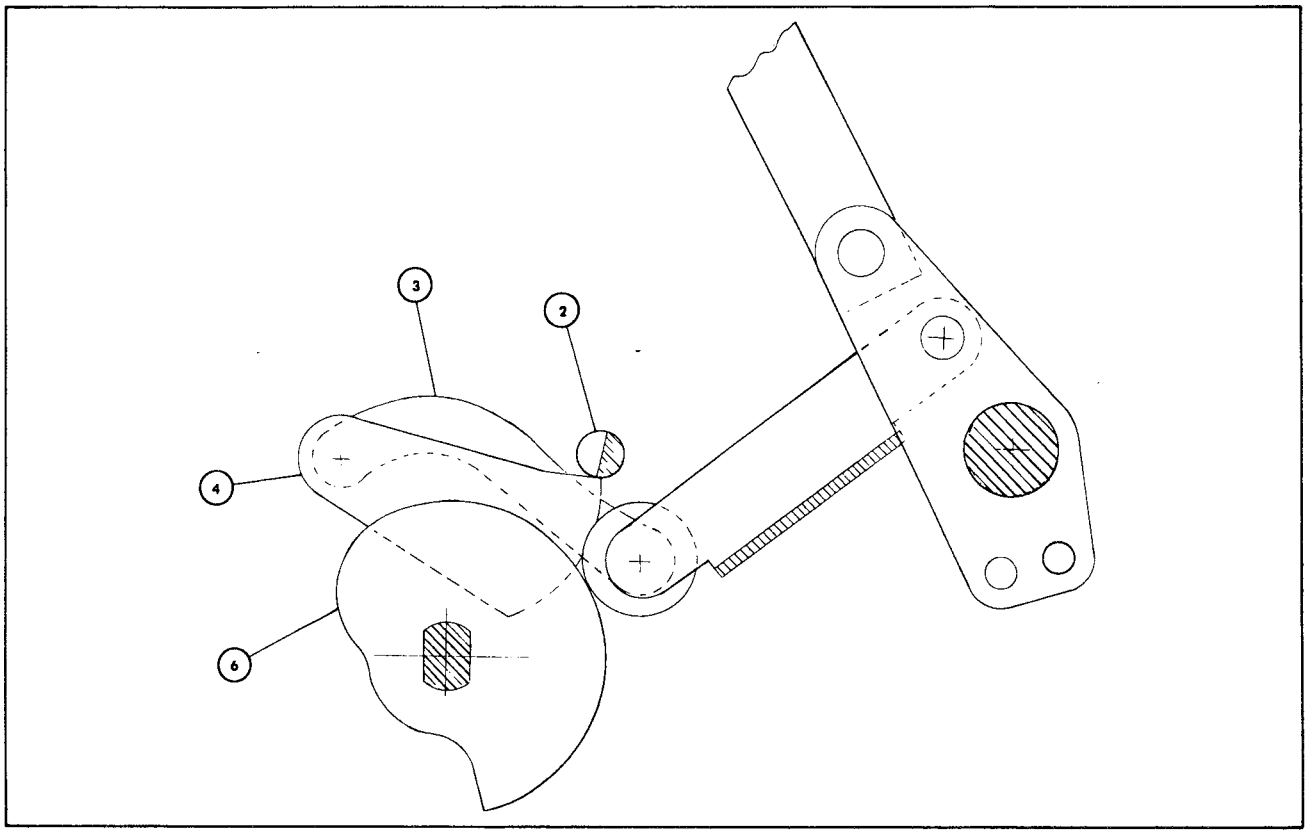


Fig. 19 *CMD Network Protector Closed*

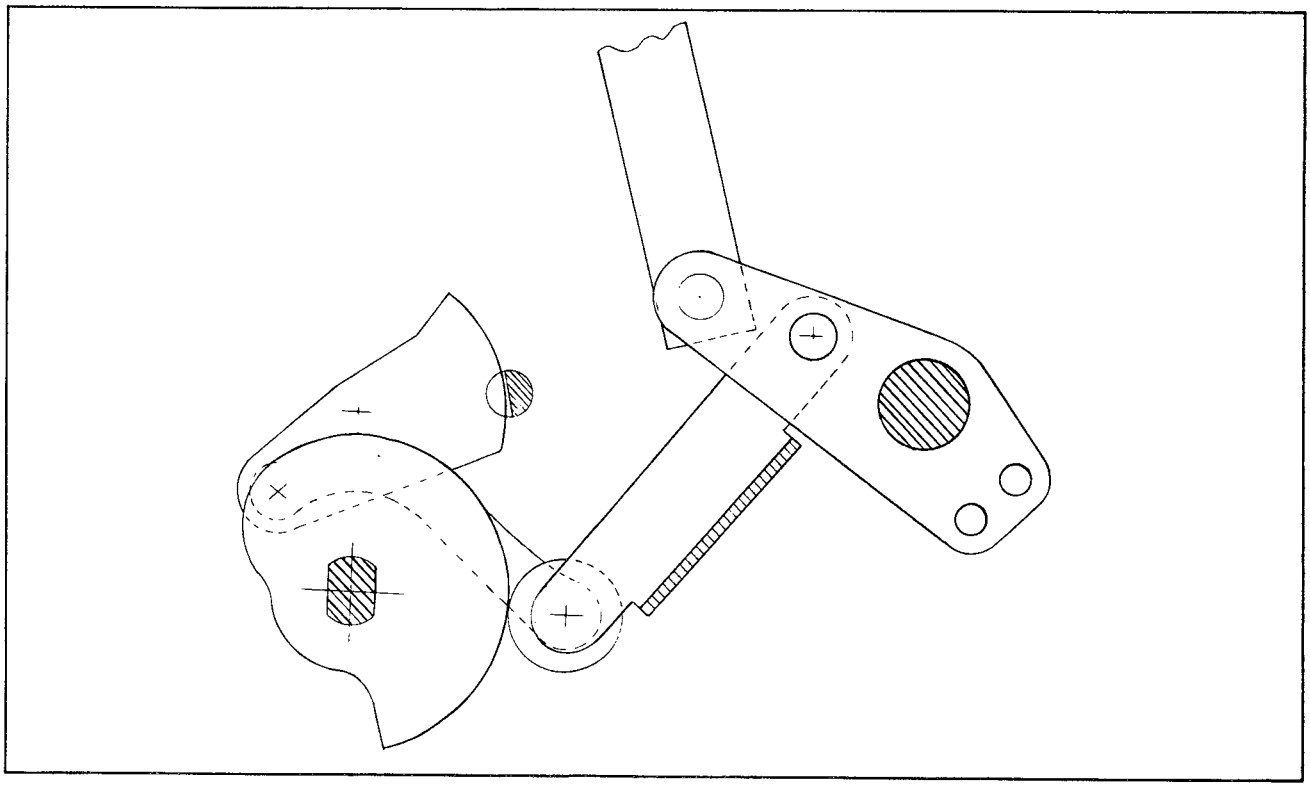


Fig. 20 *CMD Network Protector Open*

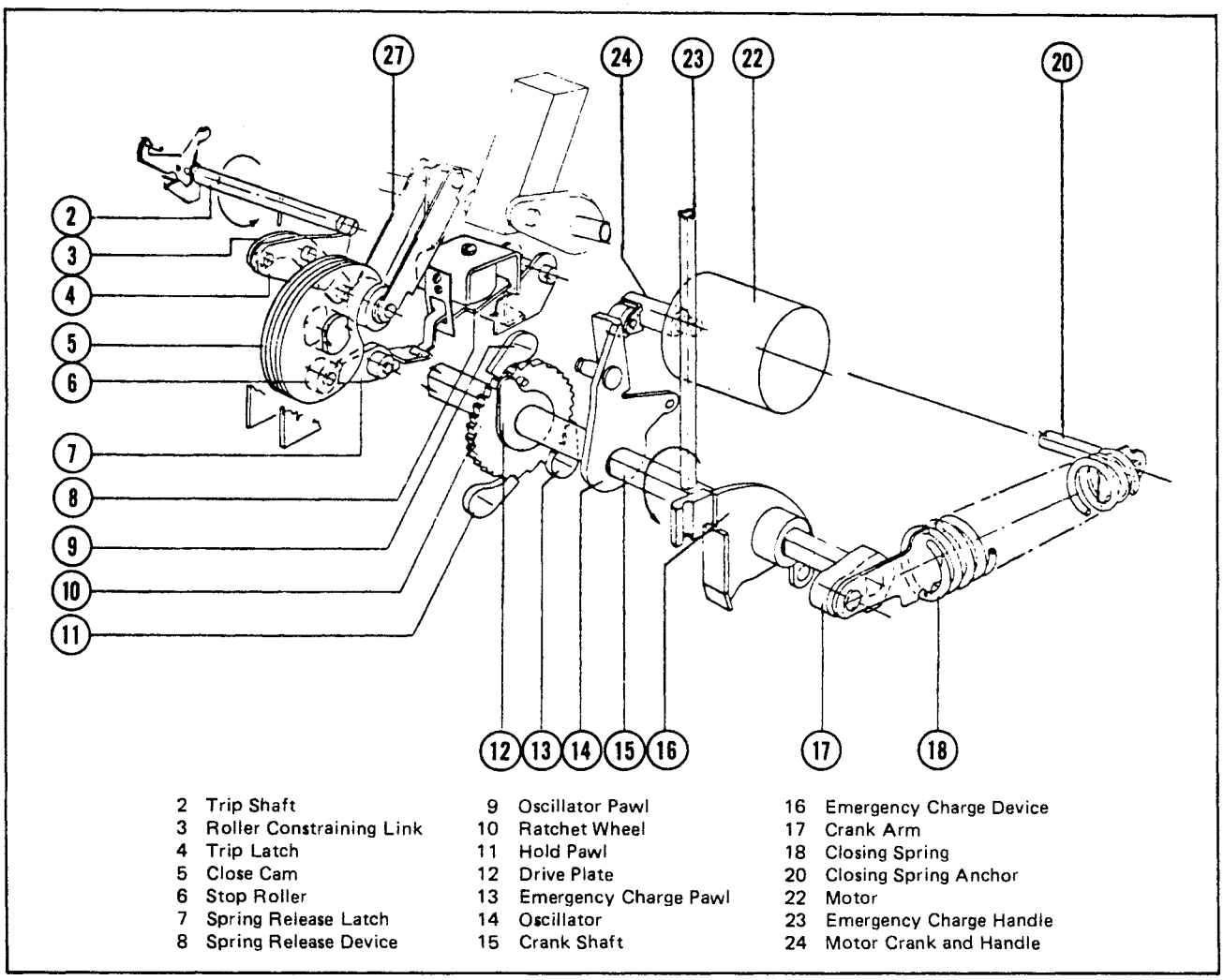


Fig. 21 *Arrangement of the Principal Parts of a Stored-Energy Mechanism. The Close Spring is shown in the Charged Position.*

3.4.1 Operation of the Stored-Energy Mechanism (Optional)

Fig. 21 is an isometric diagram of the principal parts of the stored-energy mechanism.

Referring to Fig. 21, the basic elements are mounted on the crank shaft (15). This is a shaft with four flats machined on it and a crank arm (17) attached to each end. Each crank arm connects to its closing spring (18) by a formed spring end. The rear of the springs anchor to the rear of the mechanism frame. The crank arms (17), motor seal-in switch cam, close cam (5) and drive plates (12) have matching flats and are thus anchored to the crank shaft. The ratchet wheel (10), Oscillator (14), and the manual charging device (16) are free to rotate. The motor crank shaft assembly, carrying a roller for driving the oscillator (14), is pivoted in the right-hand mechanism frame. The holding pawl (11) is mounted by means of a pin on the mechanism side frame as shown.

In operation, rotation of the motor crank pushes the oscillator arm counterclockwise and the oscillator pawl (9) engages the ratchet wheel slightly more than one tooth in the counterclockwise direction. The holding pawl (11) snaps behind the corresponding advanced tooth and retains the ratchet wheel as the oscillator arm rotates clockwise to engage a further tooth. Thus the ratchet wheel rotates counterclockwise until the ratchet wheel pin engages the two drive plates (12), which in turn rotate the crank shaft assembly and charge the closing spring. The spring charging continues until the crank arms are over center at which point the spring release latch (7) engages the stop roller (6) within the cam assembly and prohibits further rotation of the closing cam.

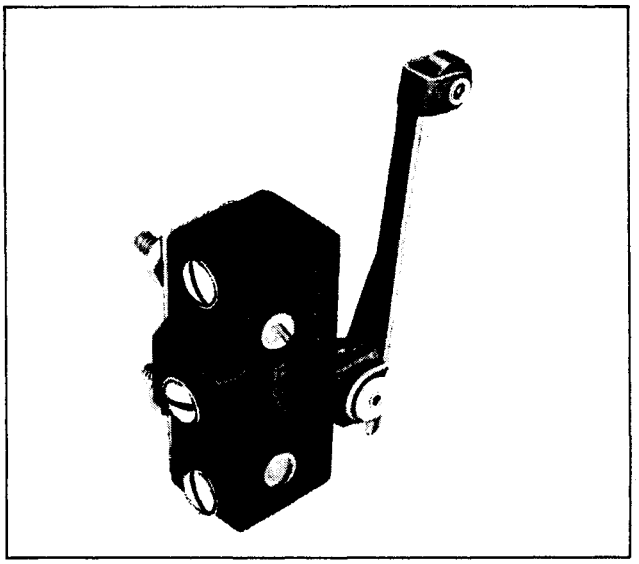


Fig. 22 *Latch Check Switch*

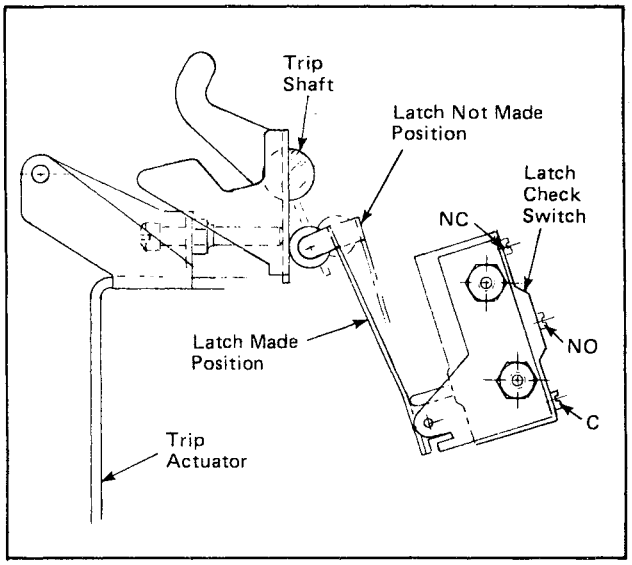


Fig. 23 *Latch Check Switch Operation*

Electrical closing is completed by energizing of the spring release (shunt close coil) (8). The spring release armature provides an upward force to the rear projection of the spring release latch (7), which permits the continued counterclockwise motion of the closing cam (5), closing the protector.

Manual closing, which should be used only while performing maintenance duties with the network protector withdrawn from the enclosure, is accomplished by lifting up on the manual close lever, after the springs are charged. The manual closing lever extends through the "dead front" cover, permitting operation with the "dead front" cover installed.

A spring position indicator, in the shape of a disk, is located next to the left-hand crank arm assembly. The indicator rotates with the crank arm assembly and has the letters "D" and "C" located around the edge of the disk, facing outward. The letters can be viewed through the "dead front" cover and the letter showing indicates spring discharged (D) or spring charged (C) (Fig. 25).

Referring to Fig. 23, the Latch Check Switch consists of a switch mounted on the inside at the left hand side sheet of the circuit breaker. The switch is located so that when the breaker trip shaft is in the "reset" position a normally closed contact of the switch is closed. See Figs. 22 and 23. When this switch is supplied, the contact is usually connected in the closing circuit of the circuit breaker to insure that the tripping system is reset before the circuit can be energized to close the breaker.

The mechanism is provided with a manual closing device. The operation is similar to that of the motor and oscillator except a separate pawl (13) is used to advance the ratchet wheel.

The mechanism is of the general variety of mechanically trip-free mechanisms, which implies that the breaker can open or be made trip-free from the closing mechanism at any point in the closing stroke.

It can be seen in Figs. 26, 27, 28 that the main drive link roller is constrained to move in a circular path by the roller constraining link (3) which pivots about a pin on the trip latch (4). The trip latch is restrained from rotating by the trip shaft (2). When the trip shaft is rotated, Fig. 28 the trip latch is released, therefore no restraint is exhibited on the main drive link. Under this condition the breaker, if closed, will open With the breaker open, no closing force can be transmitted to the pole shaft and hence the protector will not close.

Extreme care should be utilized in performing trip-free operations, as the entire energy of the mechanism (that which is generated by charging the springs) is dissipated through the two crank shaft bearings and the sudden discharge of the two charging springs. This in turn reduces both spring and bearing life.

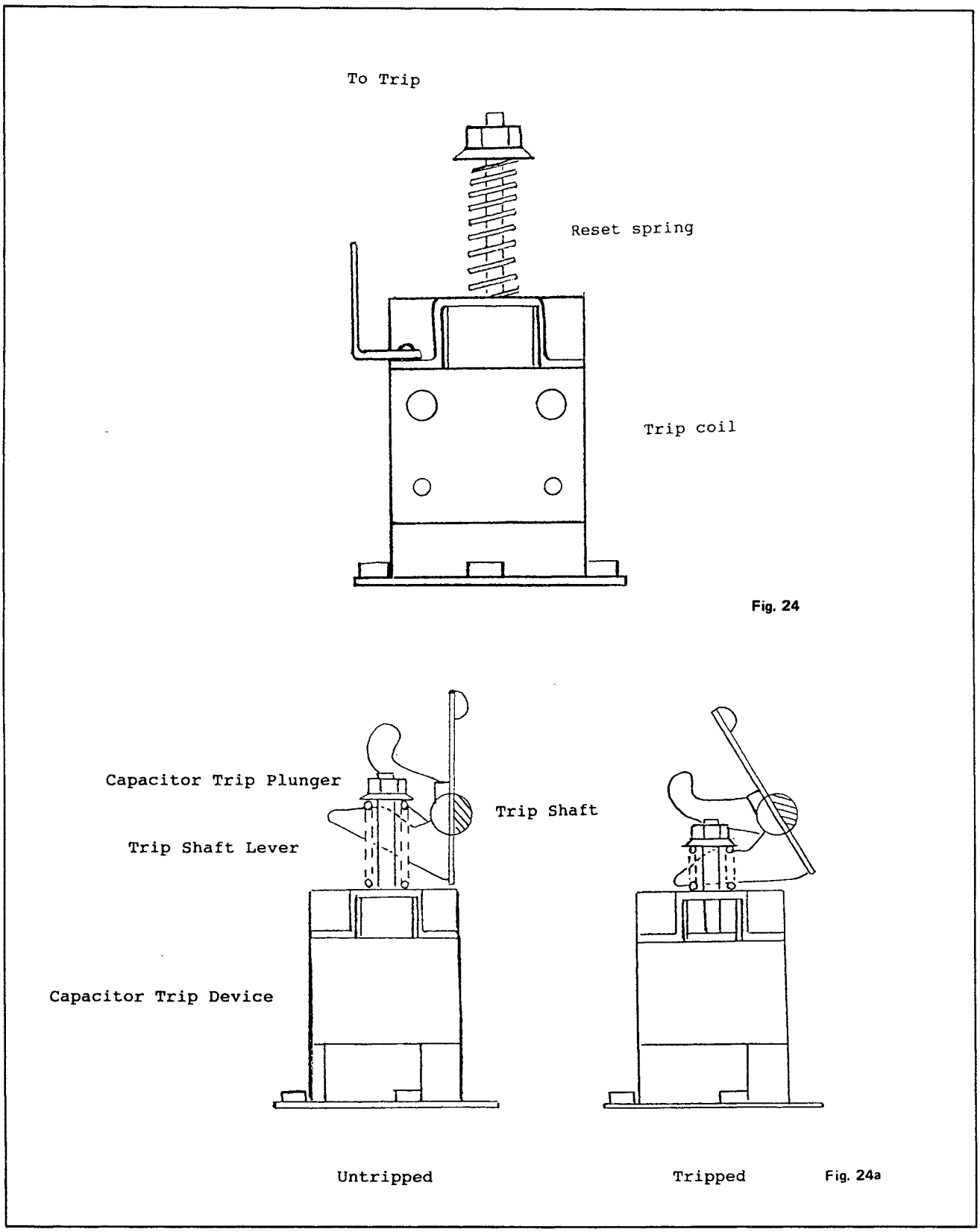


Fig. 24

Fig. 24a

Figs. 24 and 24a *Capacitor Trip Actuator*

3.4.2 Stored Energy Mechanism Operating Procedures

I. De-energizing Procedure

A. Trip the network protector via the outside operating handle. Do not move the operating handle until the final step of the energizing procedure.

B. Once the breaker opens its contacts, the closing motor will immediately charge the closing springs.

C. Open the enclosure door.

D. Raise the extension rails and lever-out the network protector as per Sec. 3.1.4, page 4.

E. Once the breaker has been completely levered-out, i.e. the levering-in arms are in the horizontal position, discharge the closing springs by lifting-up on the manual closing lever located at the bottom center of the dead-front panel.

CAUTION

THE BREAKER CONTACTS WILL CLOSE!

NOTE: Removing the dead-front panel will discharge the closing springs, if not done previously by lifting-up the manual closing lever.

F. Before proceeding further, trip the breaker by depressing the "trip" button.

G. You can now proceed with any routine maintanance having discharged the closing springs and opened the breaker contacts.

II. Energizing Procedures

A. Prior to energizing, the breaker contacts will be open and the closing springs should be discharged. Make certain that the springs are discharged by lifting-up on the manual closing lever and if a discharge is observed, trip the breaker by depressing the "trip" button.

B. Proceed to lever-in the breaker by depressing the "trip" button and raising the levering-in shutter.

C. Insert the levering-in crank.

NOTE: Release the shutter, insuring that the shutter rides on the crank. Failure to do so will result in damage to the levering device.

D. Turn the crank approximately 16 turns clockwise until the levering device comes to a complete stop.

CAUTION

Once the disconnect finger clusters engage the stabs, during the levering-in procedure, the closing motor will charge the closing springs, only if the transformer side is energized.

WARNING

DO NOT OPERATE THE MANUAL CLOSING LEVER OR DEPRESS THE "CLOSE/AUTO" PUSHBUTTONS ON THE RELAY AND CONTROL MODULE. TO DO SO WILL INADVERTENTLY PERMIT THE BREAKER CONTACTS TO CLOSE.

E. Remove the levering-in crank and place it in its storage position on the manual charging lever.

F. Note: Make certain the door handle is in the "open" position before closing the door.

G. Close the door. On submersible units, lag the door bolts down to their stops and pressure test at this time.

H. Move the outside operating handle to the "auto" position. This permits the relays to take control of the network protector.

3.5 TRIP DEVICE

To provide automatic opening of the protector, a capacitor trip actuator produces a mechanical force to trip the breaker upon receiving a tripping signal from the master relay, or from any other source.

The actuator (refer to Fig. 24) is a solenoid which has a 250 volt DC coil and uses a compression spring as its reset mechanism. A 550 micro-farad capacitor rated at 450 volts is charged through a type IN3671 diode. As long as source power is available from the transformer side of the breaker wiring harness, the capacitor will charge. When the master relay or the MPCR relay calls for a trip, the capacitor discharges through the now

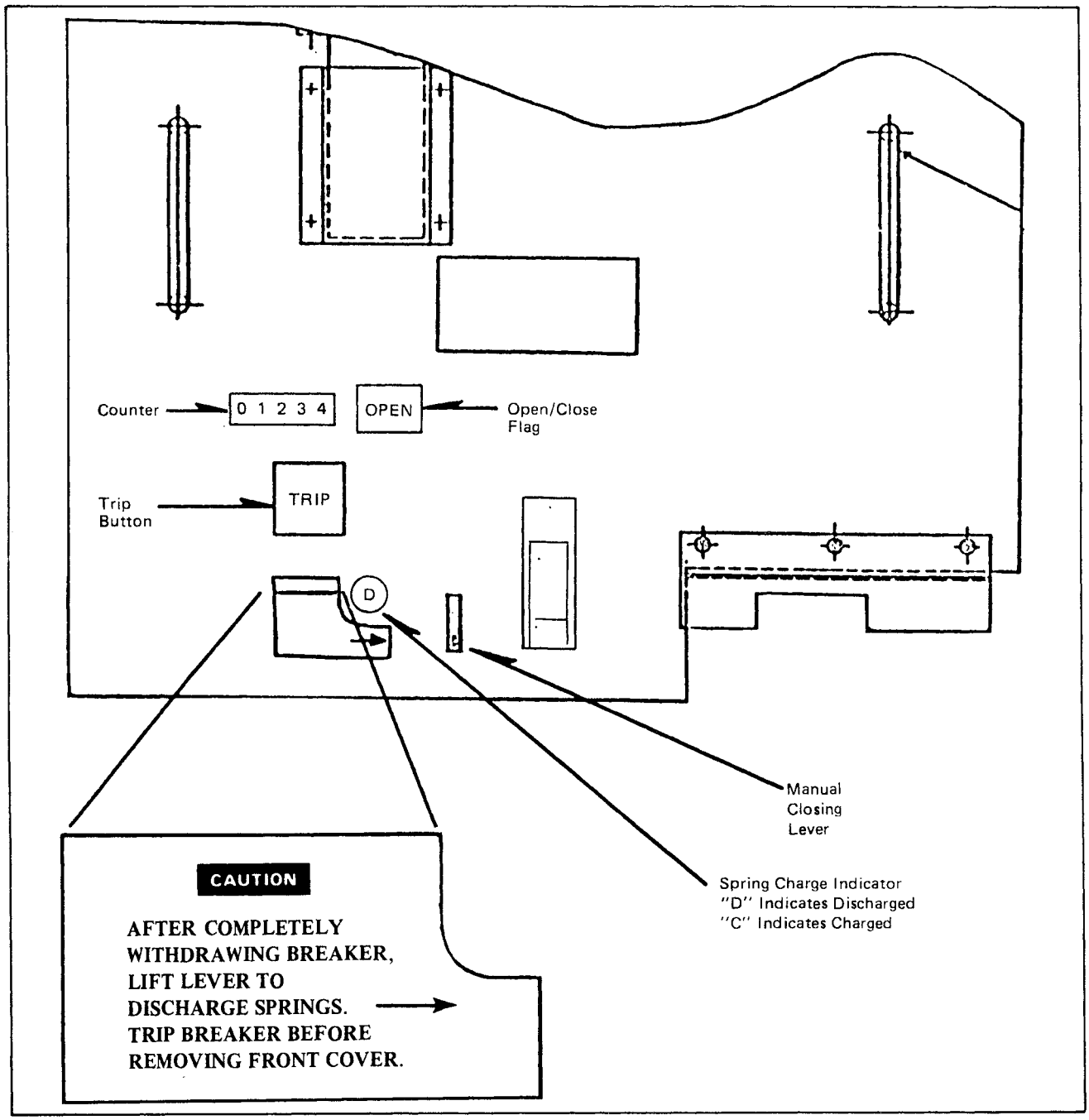


Fig. 25 *Stored-Energy Mechanism, Front Cover*

closed relay trip contact and energizes the Capacitor Trip Actuator (CTA), which in turn trips the breaker main contacts by rotating the trip shaft which permits the release of the trip latch. The capacitor will immediately begin to recharge once the "A" contact in the breaker trip circuit is opened. Without power being supplied to the trransformer side of the network protector, the capacitor stores enough energy to attempt four electrical trips before the capacitor requires to be recharged.

DANGER - AFTER THE BREAKER HAS BEEN WITHDRAWN OUT ON ITS RAILS FOR MAINTENANCE AND TEST, DISCHARGE THE CAPACITOR BY DEPRESSING THE RED PUSH BUTTON LOCATED ON THE MECHANISM PLUG AND SOCKET BRACKET. THE LIGHT WILL REMAIN ILLUMINATED UNTIL THE CAPACITOR IS COMPLETELY DISCHARGED. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN DEATH, SEVERE PERSONAL INJURY OR PROPERTY DAMAGE.

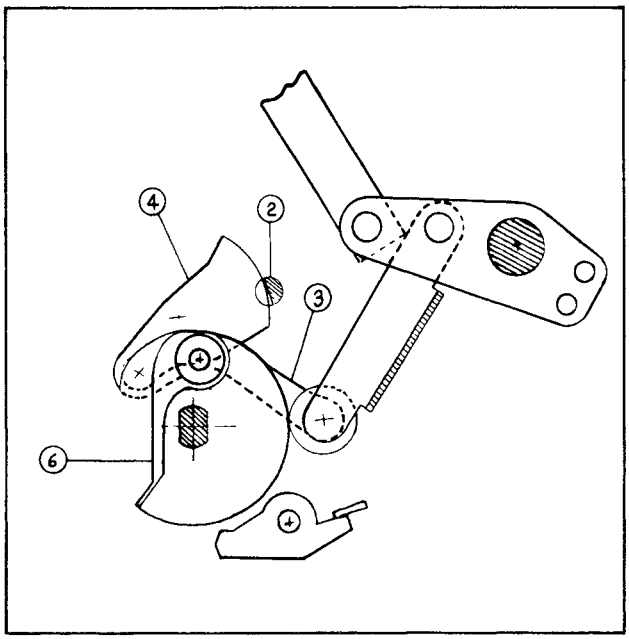


Fig. 26 *Stored-Energy Mechanism: Breaker Open, Springs Discharged*

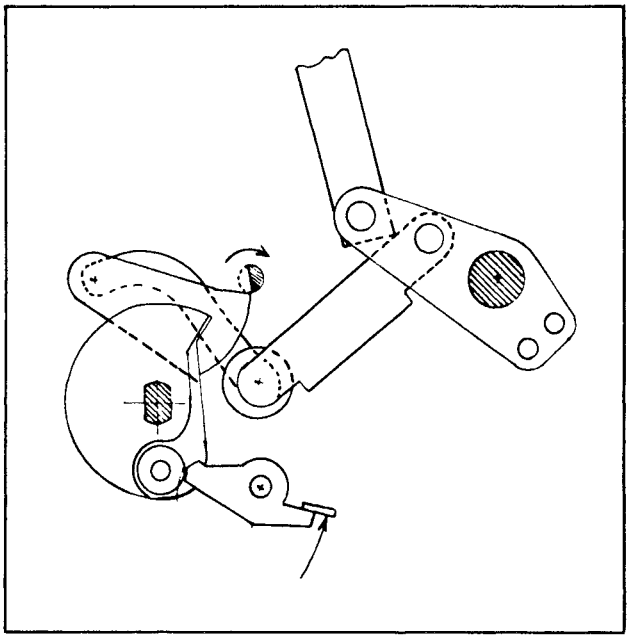


Fig. 27 *Stored-Energy Mechanism: Breaker Open, Springs Charged*

With the breaker in the "CLOSE" position it is imperative that an air gap exist between the trip bar lever and the underside of the adjustable nut on the top of the CTA (refer to Setting Drawings, Fig. 43, No. 1). This air gap can be as small as .031 inches. If an air gap does not exist, the reset spring may have taken a set or the adjustable nut requires some minor adjustment.

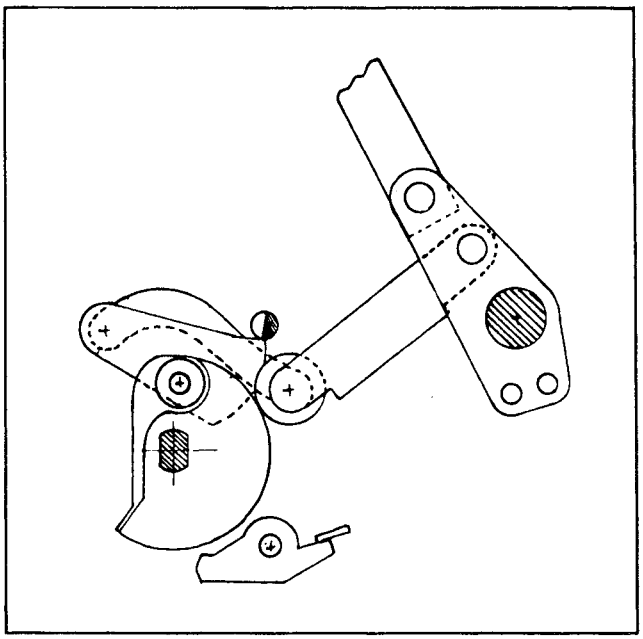


Fig. 28 *Stored-Energy Mechanism: Breaker Closed, Springs Discharged*

The capacitor trip actuator is designed for an intermittent duty cycle of short pulse duration which is normally controlled by an "A" contact on the auxiliary switch. Continuous duty will certainly destroy the trip coil, preventing electrical tripping of the breaker and the capacitor trip actuator should be replaced immediately.

Mounted on the left hand side sheet of the mechanism module is a solenoid operated anti-close device (see Fig. 14). Should the master relay call for "trip", while the protector is open, the anti-close device will deenergize the closing motor thus preventing electrical operation, while mechanically holding the breaker trip free, preventing a closing operation by the manual closing handle. The anti-close device is a continuously rated device. If the coil should be faulted, the intended safety feature of holding the breaker trip free is lost and the coil should be replaced.

It should be noted that the capacitor trip actuator (CTA) and the anti-close device are two distinct entities and perform two separate functions.

3.6 SEQUENCE OF OPERATION, TYPE CMD NETWORK PROTECTOR

The CMD Network Protector operates in the following sequences in these modes:

1. To Close Protector by Relays with Door Closed

Place door handle in AUTO position; CNJ, CN-33 or MPCR call for a close. If the handle is in the AUTO posi-

tion the JA contact is closed. BF1 relay energizes; BF1 contacts close, BF1 relay seals in and motor operates. The closing springs charge and W contact close during initial charge of closing springs. Closing is now independent of closing relays. Protector closes, B contact and W contact open, motor and BF1 are de-energized.

2. Manual Close with Door Closed

Hold door handle in CLOSE position; CN33 is not in trip mode. (See anti-close device, Fig. 14.)

JC contact is closed. BF1 relay energizes, seals in and motor charges closing springs. Handle can be released (spring returned to auto position) when W contact closes.

3. Emergency Close

Door is open. CN33 not in trip mode (see anti close device). Charge closing springs manually with the ratchet. Protector closes.

WARNING

EMERGENCY CLOSE DO NOT MANUALLY CLOSE A PROTECTOR TO CONNECT AN ENERGIZED TRANSFORMER TO AN ENERGIZED NETWORK SYSTEM, IF THERE HAS BEEN ANY MALFUNCTION OF THE PROTECTOR CLOSE OR TRIP CIRCUIT. A CN-33 OR MPCR RELAY MUST BE INSTALLED TO PERMIT THE ANTI-CLOSE DEVICE TO PROTECT THE OPERATOR.

IT IS EXTREMELY HAZARDOUS TO MANUALLY CONNECT A DISABLED PROTECTOR TO AN ENERGIZED SYSTEM. THE RESULTS OF SUCH ACTION CAN BE EXTREMELY DESTRUCTIVE TO PROPERTY AND COULD RESULT IN DEATH OR SERIOUS INJURY TO THE OPERATOR.

NOTE

EMERGENCY CLOSE IS NOT RECOMMENDED EXCEPT FOR MAINTENANCE OPERATIONS.

4. Anti-Close Device

This device prevents closure, either electrically or manually, when the Master Relay trip contact is closed. With the protector open and Master Relay trip contact closed the BF2 relay is energized.

a. A close by relays is prevented because the master relays share a common contact element in both close and trip mode.

b. A manual close is prevented by the now open BF2 contact in the JC circuit.

c. An emergency close is prevented by the anti-close device which holds the protector mechanically trip free. Manual charging of the closing springs closes the W contact and energizes the A-C device through the now closed BF2 contact and the rectifier. The protector is in a trip-free mode. The A-C contact opens and reduces the volt amperes across the A-C relay.

An attempted emergency close will result in a free discharge of the closing springs. The W contact will open and de-energize the anti-close circuit.

5. Normal Trip

Master relay trip contact closes and energizes trip device. Protector trips.

6. Trip with Time Delay (BN Relay)

CN33 trip contact is closed. The heating transformer P heats the bimetallic elements. BM1 opens and after a predetermined interval BM2 closes. The SG relay energizes. SG3 contact seals in relay. SG2 contact de-energizes the heating transformer. SG1 prepares the trip circuit.

BM2 opens and after a time interval BM1 closes. The trip circuit energizes. The protector trips.

7. Instantaneous Trip

The BN relay is equipped with three instantaneous overcurrent relays in parallel with the thermal time delay. Fault currents in excess of the pickup of the instantaneous elements (adjustable up to 250% ampere rating of the protector) will close the instantaneous trip contacts. However, unless it is a reverse fault, the protector will not trip as the CN33 trip contacts will not be made.

8. Stored-Energy Mechanism – Sequence of Operation

Refer to page 48.

SECTION 4 – INSPECTION

4.0 GENERAL

The CMD Network Protectors are designed to have a long "in-service" life with a minimum of maintenance when their operating duty is fairly ordinary or average. Because of the variability of application conditions, the dependence placed upon these protectors for protection, and the demand the continuity of power service, inspection and maintenance checks should be made on them on regular schedules.

The different operating conditions under which the protectors will operate, makes it impractical to specify a standard maintenance schedule that would be appropriate for all applications. However, a few maintenance recommendations are given below.

4.1 WHEN TO INSPECT

Since maintenance of these breakers will consist mainly in keeping them clean, the frequency of maintenance will depend to some extent on the cleanliness of the surroundings. If there is much dust, lint or other foreign matter present obviously more frequent maintenance will be required.

Inspection of the CMD Network Protectors should be made at one month after installation and six months after installation. Subsequent inspections should be made yearly, or more (at user's discretion) depending on environmental conditions, the number of operations including unaccounted-for operations.

If these recommended inspections show no maintenance requirements, the period may be extended to a more economical point. Conversely, if the recommended inspection shows, for instance, heavy accumulations of dirt or other foreign matter that might cause mechanical, insulation or other electrical damage, the inspection and maintenance interval should be decreased.

When a breaker opens a heavy fault, at or near its rating, give it a visual inspection withdrawn from its enclosure and with insulating barriers and arc chutes removed.

4.2 WHAT TO INSPECT

First withdraw the breaker from the enclosure. Remove barriers. Remove arc chutes. If there is a deposit of dust, blow clean with compressed air, if available. Wipe accessible areas with a clean dry cloth. Inspect contacts.

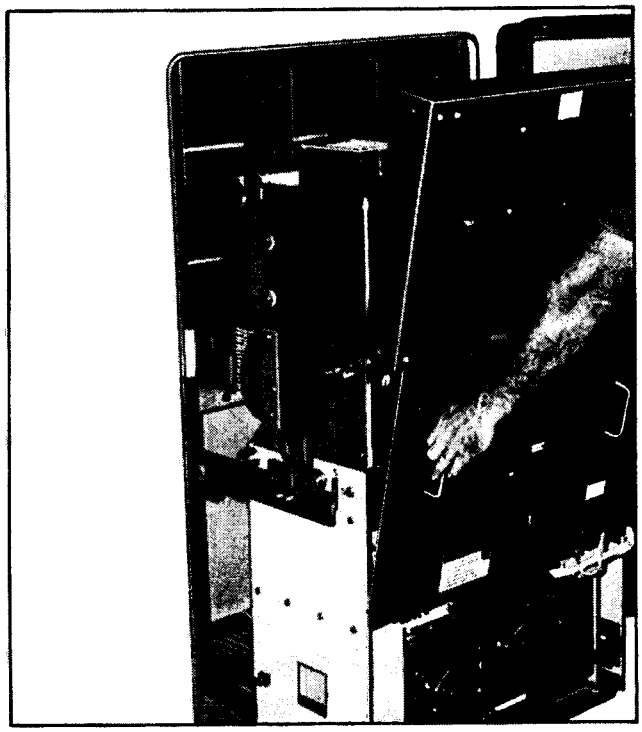


Fig. 29 *Removing Protective Cover on CMD Network Protectors*

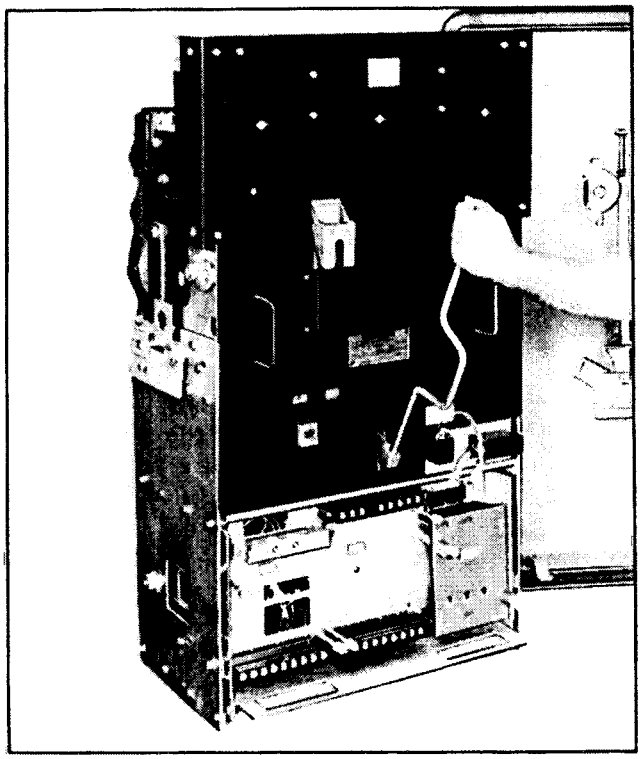


Fig. 30 *Manual Closing of Breaker on CMD Network Protectors*

NOTE: Fault interruptions will cause some pitting of the breaker contact parts. A large accumulation of operations will give the contacts, especially the arcing contacts, a mottled, dirty, eroded appearance. This appearance is the normal result of arc burning and in itself is no cause for concern.

4.3 PROCEDURE TO INSPECT CONTACTS

1. With the breaker out on extension rails (as discussed in Section 3) a steel cover prevents access to the circuit breaker and mechanism compartments. This cover is interlocked to prevent its removal when the drawout unit is in the connected position.

2. To remove the cover; place the drawout unit in the disconnect position and give the three thumbscrews a quarter turn counterclockwise, grasp the handles and tilt the cover clear of the mechanism components and lift cover. See Fig. 29.

3. With the protective cover removed, the arc chutes, contact modules, and mechanism module are exposed for further maintenance.

4. Remove the three arc chutes by loosening one fillister head screw for each arc chute. The screw is captive in the front bracket of the arc chute molded case. Lift arc chute up and forward.

5. Inspect the contact system as follows:

Close the protector manually by inserting the 7/16" diameter end of the levering crank into the manual close actuator, located in the mechanism module (refer to Fig. 30). Pump the crank about 12 times, the springs will charge and close the protector. **THIS FUNCTION IS INTENDED FOR MAINTENANCE OPERATIONS.**

CAUTION

ONCE THE BREAKER HAS BEEN CLOSED, BLOCK THE TRIP PLATE SO THAT THE PROTECTOR CANNOT BE UNINTENTIONALLY TRIPPED DURING MAINTENANCE. WITHOUT A BLOCK ON THE PLATE BODILY INJURY COULD RESULT. BECAUSE THERE IS NO RESTRAINT TO PREVENT THE BREAKER FROM OPENING IF THE TRIP PLATE IS HIT. REFER TO SEC. 4.3-6 (a).

6. Referring to Fig. 31, check dimension A on the CMD-1875 amp units. This should be adjusted between 0.09 minimum and 0.12 inch maximum using setting

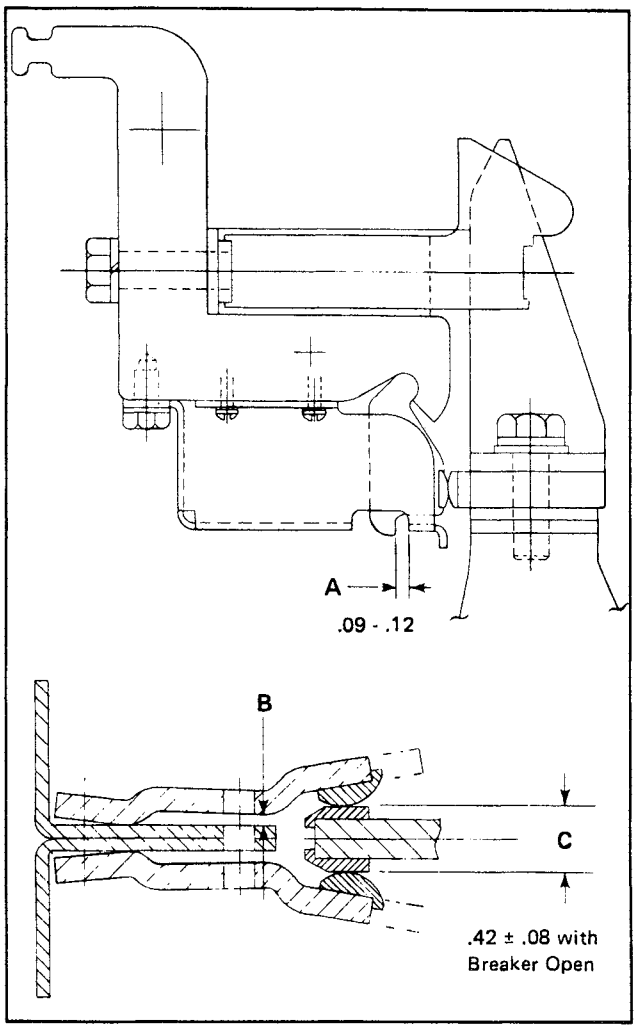


Fig. 31 *Contact Setting: CMD-1875 Network Protector*

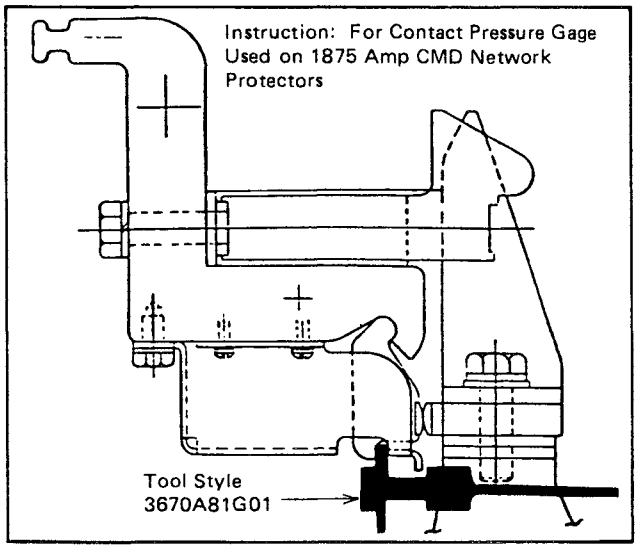


Fig. 32 *Setting Gauge*

gauge tool S/N 3670A81G01 (Fig. 32). This dimension can be adjusted on the individual pole units by means of the stopnuts on the insulated push rods (see Fig. 34). Loosen the upper stopnut and adjust the main contact setting by turning the lower stopnut. Retighten the upper stop nut.

Using The Setting Gauge

a. With the network protector withdrawin on its rails and the front protective cover removed, manually close the breaker contacts.

CAUTION: Block the "push to trip" button using the blocking bar, tool S/N 3670A85H01, preventing unintentional contact separation while working on the contact structure.

b. Insert the smaller machined tip (0.09) of the tool between the front edge of the main contact stop surface and the back edge of the stainless steel contact cage assembly.

NOTE: The bent down angle of the cage assembly, which is seen more readily as viewed from the front, serves as a guide for the tool. The angle should always be forward of the rear machined edge of the tool.

c. If the 0.09 tip of the tool cannot be inserted correctly, the contact pressure needs increased. Do this by loosening the top push rod nut and tighten or raise the bottom push rod nut.

d. Insert the larger machined tip (0.12) as in step b. If the large tip does not seat properly, but the small tip does, the contact pressure is set correctly within standards.

e. If the large tip can be moved front to rear, the contact pressure is excessive and must be reduced. Do this by loosening the bottom push rod nut and tighten or lower the top push rod nut.

f. The unit is also set correctly if the larger tip (0.12) can be inserted without any perceivable free play, front to rear.

g. Be certain to check all three phases when performing this task.

h. Remove the blocking bar when completed with this operation or prior to closing the housing cover.

Dimension B (Fig. 31) must be a minimum of 0.020 inch between both stationary contacts and the center section. If this dimension cannot be maintained, the arcing contacts, both moving and stationary, must be replaced.

When the breaker is open, dimension C (Fig. 31) should be 0.42 ± .08 inch.

7. On the CMD-2000/3000 amp unit the main contacts must be parallel with the face of the contact retainer. (See A on Fig. 33.)

Dimension B on CMD-2000/3000 amp (Fig. 33) must be a minimum of 0.020 inch between both stationary contacts and the center section. If this dimension cannot be maintained, the arcing contacts, both moving stationary, must be replaced.

When the breaker is open, dimension C (Fig. 33) should be 0.38 ± .03 inch.

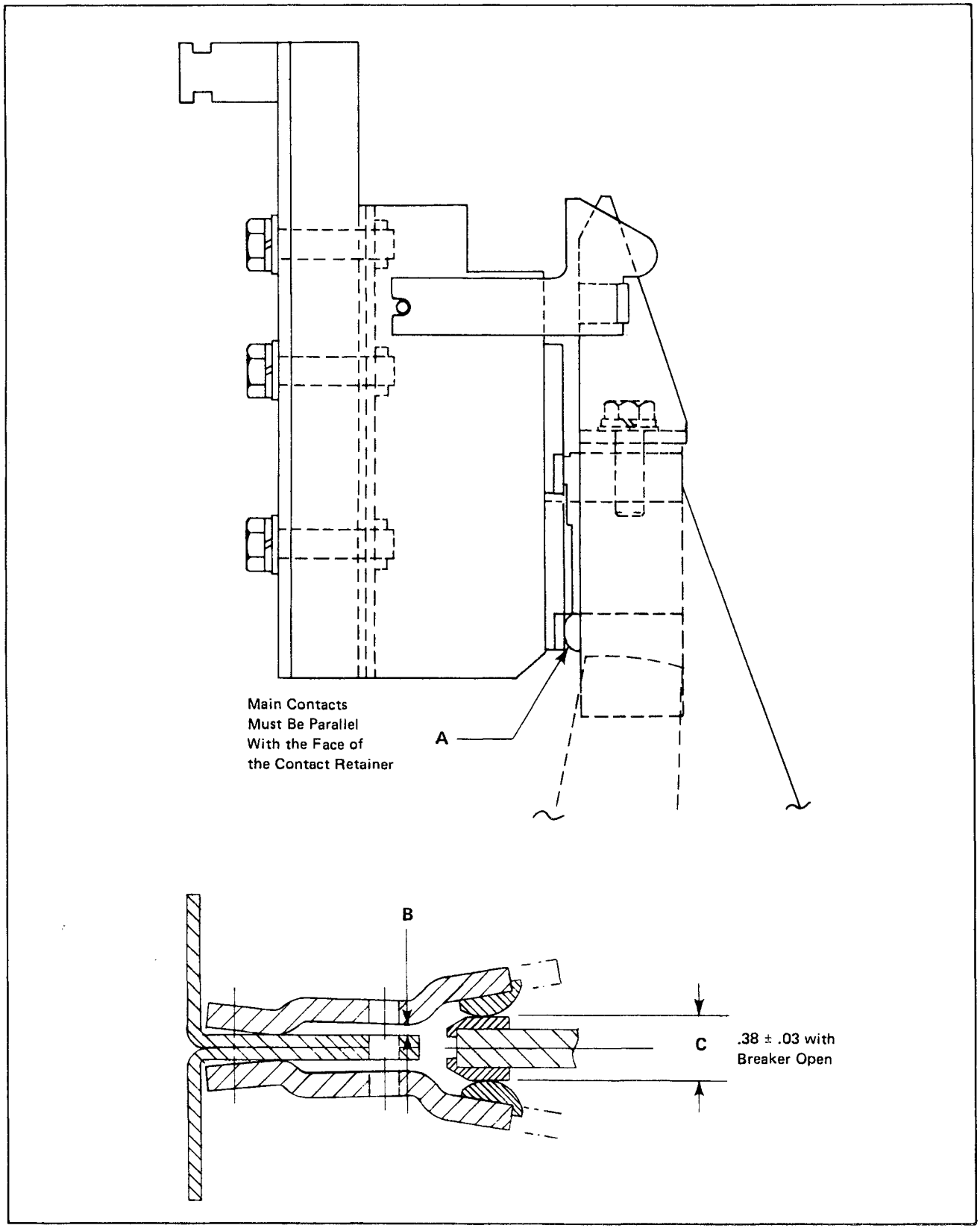


Fig. 33 *Contact Setting: CMD-2000/3000 Amp Network Protector*

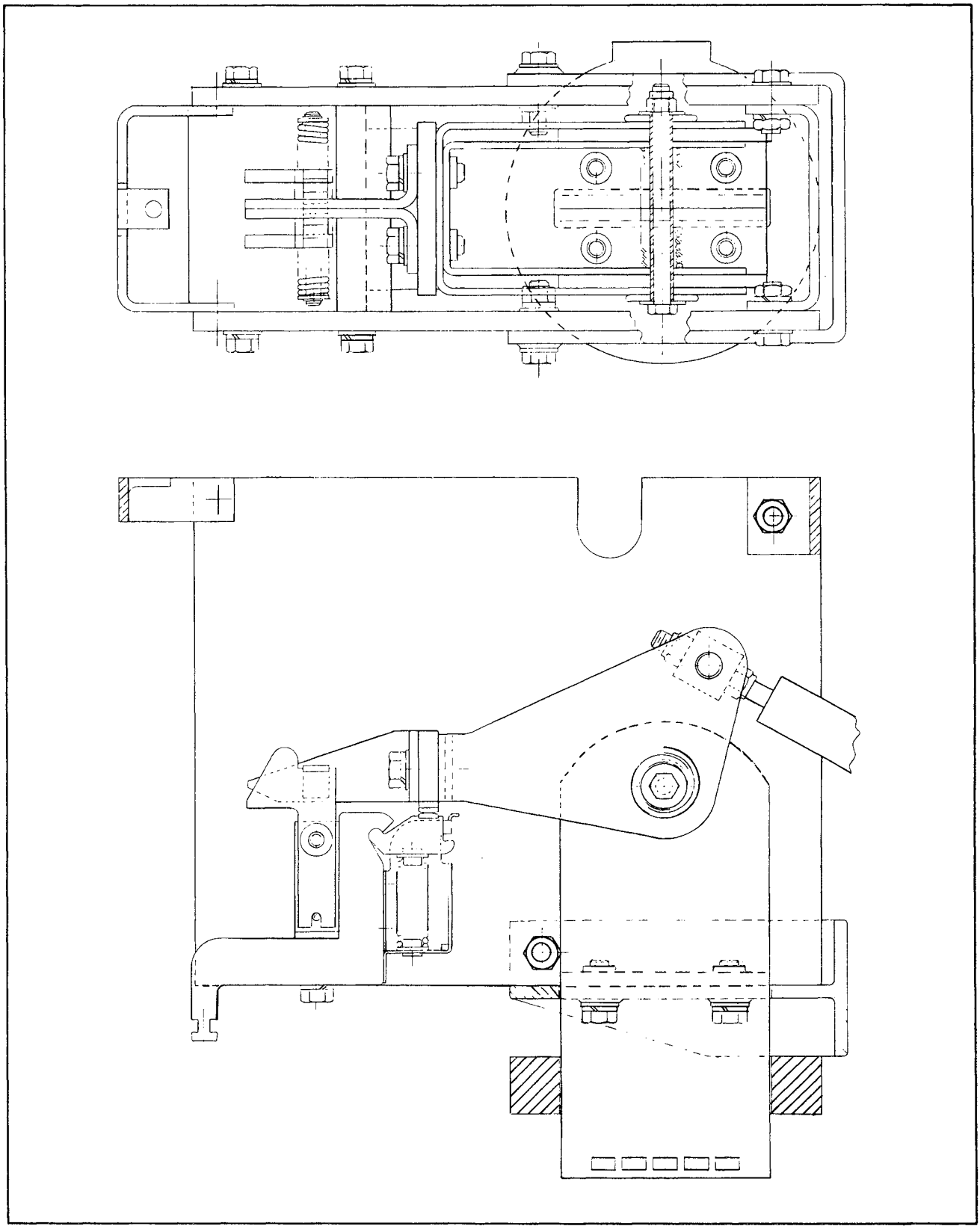


Fig. 34 *Pole Unit: CMD-1875 Network Protector*

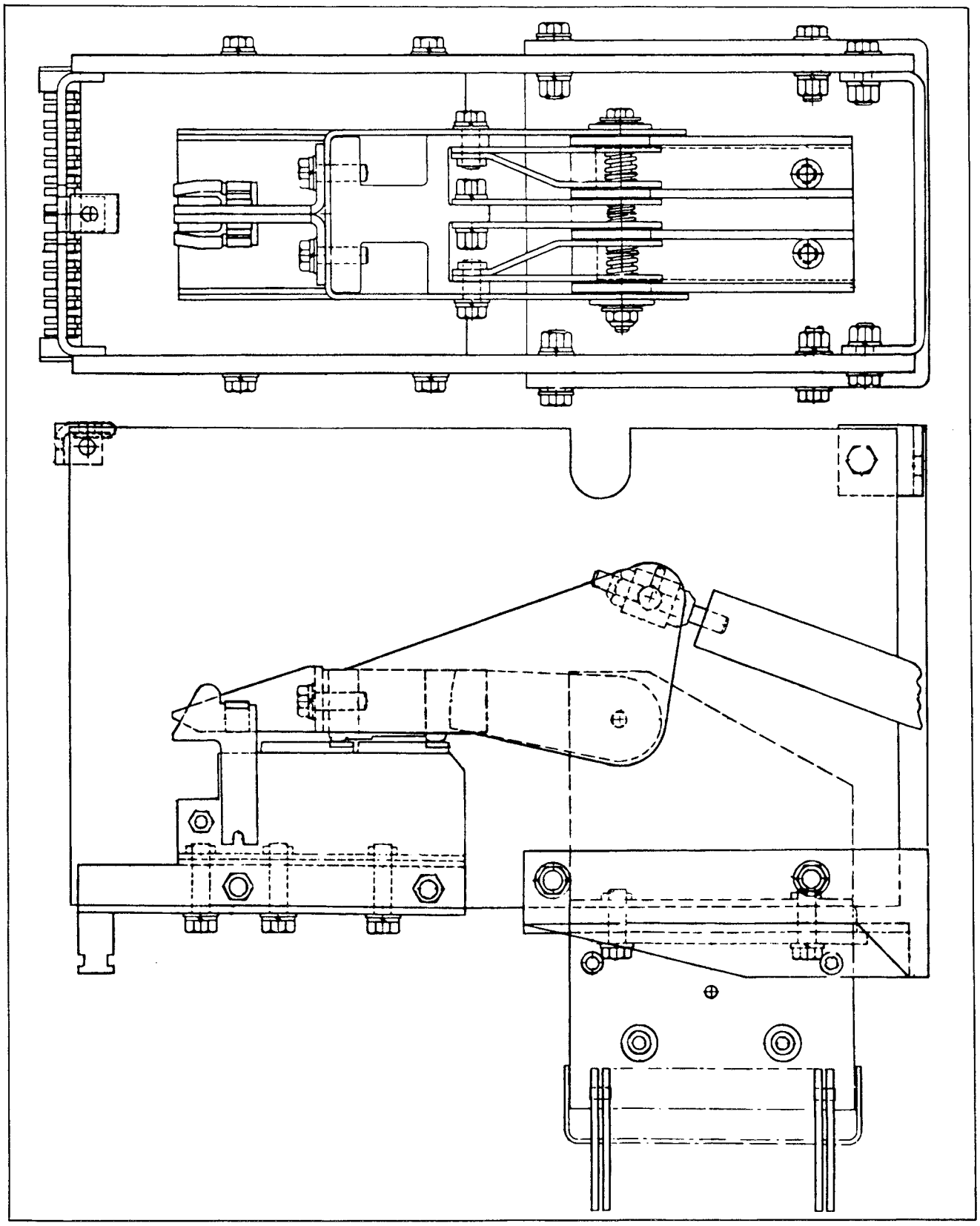


Fig. 35 *Pole Unit: CMD-2000/3000 Amp Network Protector*

SECTION 5 – MAINTENANCE

5.1 MAINTENANCE SCHEDULE

A routine maintenance schedule for CMD network protectors should be observed. The most desirable frequency of inspection may vary widely depending on location, environment and frequency of operation of the protector.

Newly installed network protectors should be inspected one month after installation and six months after installation. Subsequent inspections should be made yearly, or more often (at user's discretion) depending on environmental conditions and the number of operations.

5.2 MAINTENANCE RECORD

A record of maintenance on each protector should be kept and should include "date", "operation counter reading", "condition found", and "work performed".

WARNING

ANY MECHANICAL OR ELECTRICAL MODIFICATION TO ANY NETWORK PROTECTOR REQUIRES THAT THE NETWORK PROTECTOR BE GIVEN APPROPRIATE ELECTRICAL TESTS, USING PROPERLY MAINTAINED TESTING DEVICES, BEFORE PLACING INTO SERVICE. FAILURE TO PERFORM SUCH ELECTRICAL TESTS CREATES CONDITIONS LEADING TO THE POSSIBILITY OF DEATH, SEVERE PERSONAL INJURY OR PROPERTY DAMAGE.

5.3 MAINTENANCE INSPECTION PROCEDURE

Maintenance inspection should include:

1. Place door handle in "open" position.

Observe that breaker opens or is already open. If breaker does not open, **DO NOT PROCEED**; abnormal condition exists and must be resolved. See Section 3.3.2.

2. Put extension rails in place.

3. Lever unit out on extension rails.

4. Remove front barrier.

5. Remove arc chutes.

6. Record in notes, condition of arc chutes and appearances of contacts.

7. Operate manual close device to close protector.

Block the mechanism trip device to prevent personal injury while inspecting and measuring contact pressure.

8. Visually check gap behind stationary main contacts and record. Trip breaker by pushing trip plate.

9. Make thorough visual inspection looking for any abnormal conditions such as excessive dirt or accumulation of metal filings, loose hardware, or missing retaining rings on pins in mechanisms.

10. If any abnormalities are found or suspected, it may be advisable to further disassemble the protector.

11. After complete visual inspection, and assuming no defects have been found, it is wise to clean all loose dirt out of the enclosure. Clean "housekeeping" is good for electrical insulation reasons and also helps make future wear filings or fallen small parts readily apparent.

12. After re-assembly of protector but before levering back into enclosure, try manual close and trip. If a test kit is available, electrical operation should also be checked.

13. Lever protector into enclosure.

14. Store extension rails and levering crank.

15. If fuses are to be replaced in units with external fuse housings:

NOTE

LOCK PROTECTOR IN OPEN POSITION, AND VERIFY THAT THE PROTECTOR IS OPEN BEFORE REMOVING FUSE COVER.

a. Remove 8 (1/4-20) screws from housing cover.

b. Using insulated gloves and a 3/4 inch insulated wrench, remove the fuse nuts.

c. Replace fuse and fuse housing cover. Torque the 1/4-20 cover bolts to 2 pounds feet torque. If a torque wrench is not available tighten bolts just enough to lightly compress the cover gasket. The seal should be tested by pressure testing the unit.

NOTE

FUSE MUST BE TYPE NPL; DO NOT EXCHANGE WITH CLASS L.

16. Close door, tighten door gasket clamps on submersible units to 15 pounds feet torque.

17. Lastly, operate outside handle to "auto" position.

5.4 MINOR REPAIRS

If above inspection indicates that contacts have been roughened by arc burning, they may be smoothed with light filing. Place a cloth rag below contacts while doing this to avoid getting grit into hinge joint or mechanism below. It is not necessary that contacts be perfectly smooth, but it is desirable to remove any high sharp points. If much filing is done on main contacts, recheck contact pressure gap afterwards. Some burning of arcing contacts is normal particularly if large fault currents are interrupted. Original thickness of tungsten alloy insert on arcing contacts is 1/8 inch. Replacement will not normally be required until half of the insert thickness is gone. Main contacts are not normally eroded away but are merely roughened by wear.

Replacement of main contacts is not normally required, but slight smoothing with a file may be necessary.

Any loose bolts, screws, nuts, etc. should, of course, be tightened. Careful inspection should be made to try to find cause of loosening.

5.4.1 Maintenance Electrical Test

Periodically, two tests should be performed on the CMD network protectors, particularly if the unit has been rewired or re-built in any manner. These tests are the dielectric and ductor tests.

Dielectric Test – Drawout Unit

The CN-33, CNJ and BN or MPCR relays must not be installed. Remove the jumpers at the secondary disconnects and release the "auto" button. Remove all other test connections. Disconnect both motor leads and ground connection on the relay panel (upper right-hand side). With shooting wire, tie the relay socket terminals together, but avoid touching any grounded area with the shooting wire. Also, tie the four terminals of both rectifiers together.

Apply 2200 volts 60 hz for 1 minute between:

A. All poles and ground, breaker open.
B. All poles and ground, breaker closed.
C. Outside poles and ground, center pole grounded, breaker open.
D. Outside poles and ground, center pole grounded, breaker closed.

NOTE: The above value of 2200 Vac is meant to be applied to breakers of new manufacture. All other breakers, regardless of age, apply 75 percent of that value, which is 1650 Vac.

Dielectric Test – Enclosure

Disconnect the ground connection at the stationary disconnect contacts. Tie all the secondary contacts together with shooting wire. Apply 5000 volts, 60 hz, for 1 minute between:

A. All poles, secondary disconnects and ground.
B. Outside poles and ground, center pole grounded.

NOTE: The above value of 5000 Vac is meant to be applied to enclosures of new manufacture. All other enclosures, regardless of age, apply 75 percent of that value, which is 3750 Vac.

Ductor Test – Drawout Unit Only

Measure and record the resistance of each phase of the drawout unit, excluding disconnects. The maximum value per phase is:

1875 Amp	25 Microhms
2000/3000 Amp.	17 Microhms

NOTE: Ductor readings may be affected by amperage output of ductor as well as atmospheric relative humidity.

5.5 TROUBLESHOOTING

Possible failures of the protector can be classified under two general headings. (1) Failure to close and (2) Failure to trip. All checks should be performed with a three-phase, network-protector test kit and multimeter with the breaker rolled out on its rails.

5.5.1 Failure to Close

Check the position of the master relay trip contact. If the trip contact is made, the anti-close device will prevent the closing springs from being charged electrically, and also prevents a manual-close operation of the protector.

If the CNJ, CN-33 or MPCR close contacts are made-up and the network protector fails to close, check the following symptom against its probable cause.

1. Verify that the "JA" switch is depressed.

2. Check the jumper required on the secondary disconnect from wires 44A and 52A. Refer to the wiring diagram supplied with each unit for details of the remote trip and lockout circuitry.

3. Disconnect the motor leads from the harness and measure the voltage on the harness side of the plugs. You should read approximately 125 volts only if you can hear the "BF1" motor-closing relay operate. If this voltage is not present at the motor plugs and an audible clicking sound cannot be heard from the relay module, withdraw the module drawer and check the "BF1" relay for a damaged coil, loose connection, or burned contacts. At the same time check the control transformer for possible damage, loose wires, or shorted turns (on 480 volt units only).

4. If the "BF1" relay does not respond when the "JA" switch is depressed, try the "JC" switch. If the "JC" switch works, either the "JA" switch is faulty or the close contacts of the CNJ and CN-33 relays require light burnishing to remove a developed oxide layer. If the "JA" switch functions properly as a component, inspect for faulty circuitry in the "AUTO" circuit.

5. If voltage is present at the motor disconnects, but the motor fails to operate, replace the defective motor.

6. If the protector motor operates but the breaker trips free, check:

a. Capacitor Trip Actuator (CTA) fails to reset (reset spring is damaged or the CTA plunger is stuck in the downward position.)

b. Sneak trip circuit to CTA.

5.5.2 Failure to Trip

Again with the protector on the rails, check:

1. That the red discharge light illuminates once the capacitor has been charged. The capacitor can be charged by energizing the network breaker (contacts open) through a three phase test set. Turn the test set "OFF" prior to discharging the capacitor. The discharge light should be brightest immediately upon making its contacts and should take approximately one and one half seconds to diminish to no light output.

2. If the capacitor fails to charge, check that the diode is intact by removing it from the capacitor and checking its resistance in both directions. If the diode is good replace the capacitor. If the diode is found to be faulty, replace the diode and attempt to recharge the capacitor and retest the discharge light.

3. Check the coil resistance for broken or shorted turns in its windings. The dc resistance of the CTA coil is 150 ohms at 25 degrees C. The allowable tolerance is +/-10%. If the coil is outside this range, replace the coil.

4. The CTA has tripping motion but does not rotate the trip bar. (The bearing plate supporting the trip bar requires adjustment.)

Directly below the mechanism module is the control module. The withdrawable control module contains the network relays, motor control relay, phasing resistors, transformers, secondary disconnects and auxiliary switches necessary for the control and operation of the protector. It is mounted on slides and can be withdrawn for access to the components, after two 3/8" screws, mounted on the main frame side sheets, are backed off and the plugs and sockets are disconnected. When replacing the module, take care that the auxiliary switch drive link engages the roller of the auxiliary switch. This engagement can be monitored through a cutout on the lower left hand side sheet of the breaker (see Fig. 36).

Complete module removal is possible by:

1. Disconnecting the plugs and sockets.

2. Withdrawing the module from breaker on sliding extension rails.

3. Remove mounting hardware which holds sliding extension rails to module (both left and right sides), while supporting module from underside to prevent accidental droppage.

4. Lift module free from sliding extension rails.

A new or rebuilt control module, of the same service voltage as the original, may be installed by reversing the above sequence.

5.6 GASKET REPLACEMENT

1. The cover may be removed from the housing so that the work may be done more readily since no centering adjustments are disturbed by removing the cover. Referring to Fig. 38, take out the cotter pins and the stop nuts "A" on the bolts "C" on the hinged side. The hinge bolts should be loosened first about ½ inch so

that when the bolts "D" on the opening side are loosened, all gasket pressure is released before any bolts are completely removed. The removal of the clamping and hinge bolts from the blocks "E" will then free the cover from the housing.

2. Remove the old gasket and clean the steel bearing surfaces on the cover and housing so that these surfaces are free from dirt, lumps of paint and particles of old gasket.

3. Cut the gasket length 8 to 10 inches oversize. Cut the ends of the gasket in a smooth plane at right angle to the axis of the gasket. Start by applying a light coating of lubriplate 130A to the gasket retainer channel. The gasket is initially tacked into position at about 10 points on the 4 corners and 4 sides with some excess between each point. Each loop should be about the same length. The two ends of the gasket should be located near the center of one of the long sides of the cover and inserted last. The gasket is inserted at each tacking point preferably with the aid of a tool such as wide nosed pliers.

Take care when inserting the gasket so that in its final position the gasket is free from twist, waves or tool marks. Continue by inserting the center points only of each loop around the circumference of the door. Repeat this procedure 2 or 3 times as necessary to completely insert the gasket into the retainer. The ends of the gasket are inserted last. Take about 8 to 10 inches at each end of the gasket so the flat ends can be butted together and inserted into the retainer. No cement or seal is necessary on the ends. The gasket length is 8 to 10 inches in excess of the door circumference and is in compression to ensure a reliable seal. After the gasket is completely inserted as described above, pound it around the entire circumference with a heavy rubber mallet to ensure it is securely in place in the retainer channel.

4. Cover the exposed portion of the gasket with zinc oxide paste to keep the gasket from sticking to the housing.

5. Reassemble the cover on the housing and tighten bolts "C" and "D" until the housing is watertight. Take the bolts down evenly to obtain a uniform deflection of the gasket. A torque of 300 pound inches on the bolts should be sufficient to obtain a water-tight seal on the cover gasket.

6. On the hinged and opening sides of the housing, stop nuts "B" are run against the support block "E" on the housing and the two nuts are jammed together to act as a stop for the bolts. Stop nuts "A" are now assembled on the hinge bolts "C" allowing space between nuts and block "E" so that there is sufficient bolt movement available to release the gasket pressure on the hinged side.

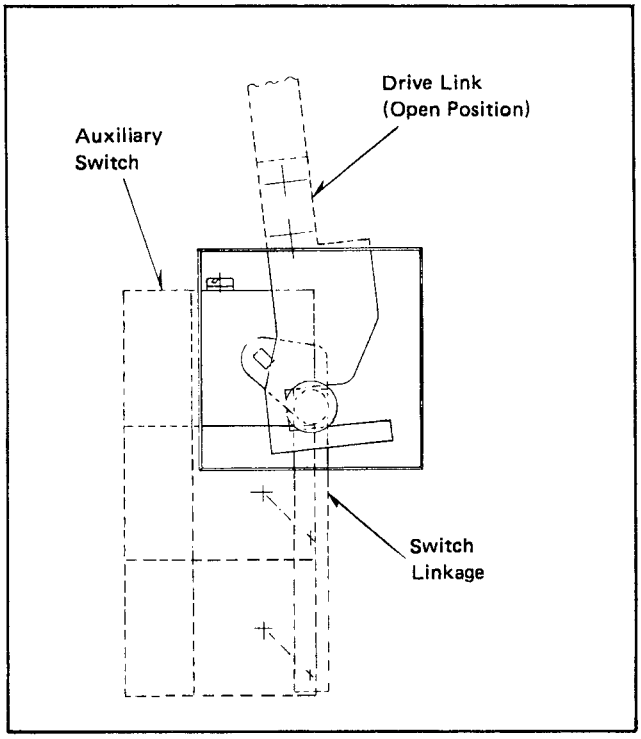


Fig. 36 *Auxiliary Switch Drive Link Engagement: CMD Network Protectors*

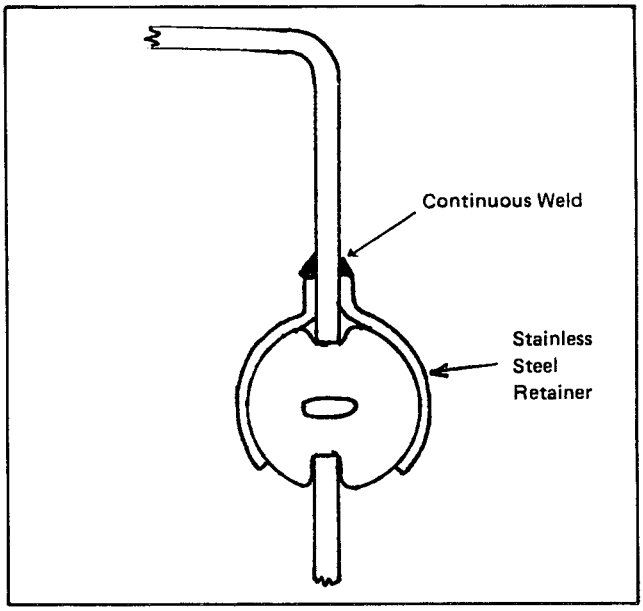


Fig. 37 *Submersible Gasket Configuration: CMD Network Protectors*

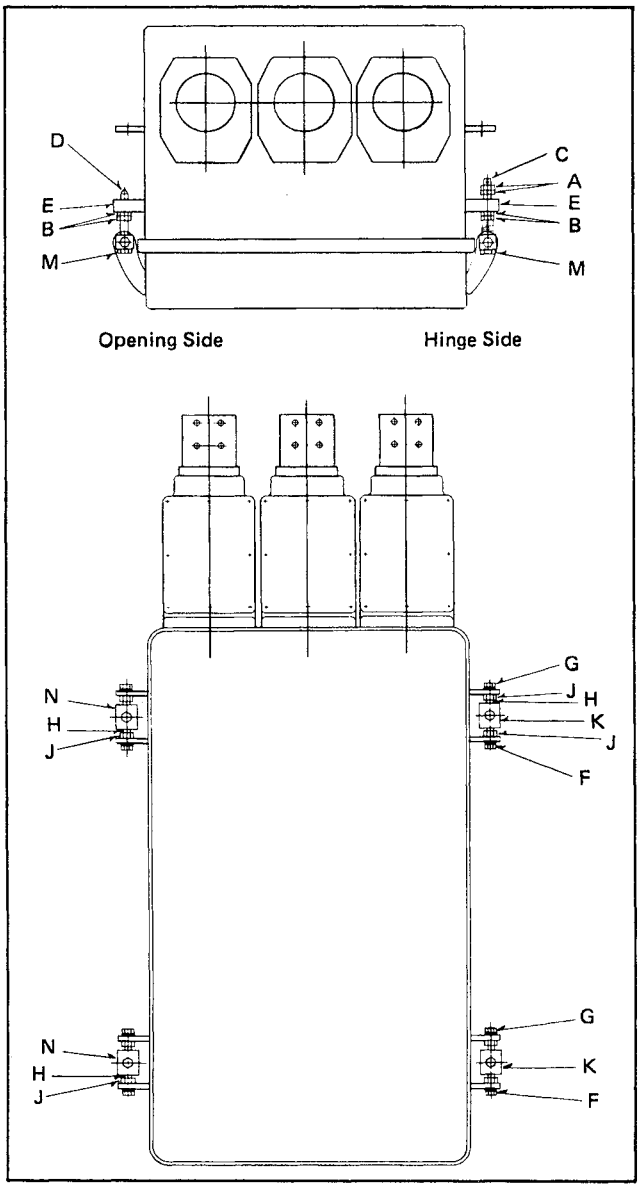


Fig. 38 *Sliding Hinge Details: CMD Network Protectors*

7. Replace the cotter pins on hinge bolts "C" to prevent accidental removal of these bolts.

5.6.1 Adjustment of Gasket

When a cover needs additional tightening for watertightness, loosen the stop nuts "A" and "B" and proceed as 5 and 6 above.

5.6.2 Centering the Cover on the Housing

If for any reason it becomes necessary to center the cover on the housing proceed as follows:

1. Set the cover guides inside the housing so they will support the cover in the correct vertical position.

2. Slide the cover horizontally until it is in the correct position.

3. On the hinged side of the housing subassemblies, each consisting of the hinge bolt "C", the hinge block "K", the spring and the two stop nuts "B", are threaded into support blocks "E" on the housing until lower pivot pins "F" can be inserted. The upper pivot pin "G" must have the correct number of spacing washers "H" between nut "J" and hinge block "K" to support the cover in the correct position vertically. The pivot pins "F" and "G" are now clamped in place by tightening nuts "J". With all pivot pin assemblies on the hinged side in place and securely tightened, the cover may be swung several times to see that its location is correct on the housing. If necessary the pivot pins "F" and "G" can be moved horizontally by sliding these pins in the slot in the hinged bracket "M". Vertical adjustment is provided by the spacing washers "H".

4. The clamping bolts on the opening side of the housing may now be assembled in a manner similar to the one used on the hinged side. The bolts should be positioned to enter the tapped hole in the housing support block "E" as freely as possible. Vertical adjustment of these bolts is obtained by means of washers inserted at the lower end of swivel block "N".

5. The stop nuts may now be set as previously described.

5.7 LEAK TESTING CMD PROTECTOR HOUSING

It is recommended that each submersible protector be inspected regularly for leaks. For the usual installation a yearly inspection is recommended, with more frequent inspections for those locations subjected to frequent submersion.

On new installations and after a gasket has been replaced a retightening of bolts should be made in about six or eight weeks, followed immediately by a test for leaks. Further tightening of gasket joints should be unnecessary.

1. The test for leaks is an internal air pressure test from three to seven pounds per square inch, depending on the method of procedure. A test pressure of three pounds may be placed in a cold protector and allowed to stand for twenty-four hours with the protector placed in service during the test period. The twenty-four hour load-cycle may generate sufficient heat to raise the internal pressure

an additional three pounds, making the total pressure approximately six pounds per square inch. Pressures much greater than seven pounds should not be allowed to remain in the housings for any appreciable length of time. Leaks are evidenced by drops in pressure during the twenty-four hour period. The short time test at seven pounds pressure, using soap-water as a leak indicator at all joints, is more satisfactory.

2. Usual pressure testing outfit consists of the following:

Bottled nitrogen.
Pressure reducers, gauges and connections.
Soap-water and brush.

3. Each submersible housing is equipped either with an air test device or a tapped hole to receive a pressure test connection. There are four types of test valves which can be supplied with the protector namely; Belknap 993, Belknap 994, Waterbury 325 or a Schrader valve. The Belknap 993 valve is opened by removing the plug cap and screwing a Belknap fitting type 993-0 in place. This fitting has a coarse thread and must be held in place manually during the pressure test. The Belknap 994 test valve is operated by a Belknap 994-0 valve which automatically opens the valve as it is screwed in place. The 994 valve is equipped with a fine screw thread and remains locked in place automatically. The Belknap 993-0 connector is equipped with an outlet for rubber hose connection.

The Waterbury 325 valve is sealed by means of two tapered surfaces, one in the plug cap and one in the main body of the valve. To unseal, unscrew the large hexagonal nut until it backs up tightly onto the underside of the small hexagonal cap nut. A further careful backward turn will then release the tapered seal and remove the plug cap assembly. When reassembling the cap nut assembly to the main body of the valve, all threads must be clean and the tapered sealing surfaces must be clean and well lubricated. The plug cap is then hand tightened onto the main valve and a further one-eighth to one-quarter turn with a wrench will then seal the valve. The operating device for the Waterbury 325 test valve is a Waterbury 315 valve which is screwed on to the 325 test valve.

5.8 REPLACEMENT OF FUSE HOUSING

NOTE

THE DRAWOUT UNIT MUST BE WITHDRAWN FROM ITS ENCLOSURE BEFORE THE FUSE HOUSINGS CAN BE REMOVED.

CAUTION

WHEN FUSE HOUSINGS ARE REPLACED IN THE FIELD, EXTREME CARE MUST BE TAKEN TO PREVENT FAULTS ON THE ENERGIZED NETWORK CABLES OR BUS; AND THE TRANSFORMER CONNECTION INSIDE THE HOUSING SHOULD BE DE-ENERGIZED IF POSSIBLE. IF NOT, THE CONNECTIONS MUST BE PROTECTED AGAINST FAULTS DUE TO FALLING TOOLS, ETC., BY A RUBBER BLANKET OR OTHER PROTECTIVE MEANS.

Available on the CMD units is a cast epoxy fuse housing which is externally mounted on the network body. The epoxy is molded around the current carrying conductors producing an airtight interface. The epoxy mixture is specially formulated so the thermal coefficient of the housings will match the thermal coefficient of the copper conductor, thereby eliminating any chance of copper to epoxy separation while in service. The housing cavity is made watertight through a cover which has a Nitrile gasket adhesively bonded to one surface. Removal of the cover is accomplished by removing the 8 (1/4-20) bolts on the covers periphery. A second cork-neoprene gasket, located on the fuse housing base, makes the entire network protector an integral watertight unit. A vent is provided through the base of the fuse housing enabling both the submersible tank and fuse housing to be pressure tested as one unit.

Each epoxy housing is located through four (1/2-13) studs welded on the enclosure top. If housing replacement becomes necessary, all mounting hardware should be removed and the defective housing lifted straight up until the finger contact stab is clearly in view; then tilt the unit forward and remove.

NOTE

CAST EPOXY HOUSINGS MUST BE HANDLED WITH THE SAME RESPECT AS PORCELAIN.

The replacement housing must be started over the mounting studs and secured with the proper hardware. Refer to Fig. 39. Make certain the nylon washer is placed between the mounting hardware and the fuse housing and the hardware is set to 20 pounds-feet torque.

5.9 REMOVAL OF POLE UNITS

The circuit breaker consists of three identical pole unit assemblies consist of a hinged contact, a fixed contact

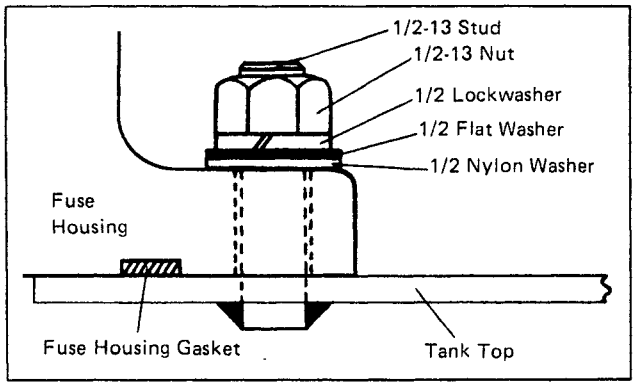


Fig. 39 *Fuse Housing Mounting*

assembly, an arc chute, disconnect fingers and a current transformer. See Figs. 34 and 35.

The pole units may be removed individually by:

1. Removing the wiring from both the current transformer and copper conductor.

2. Remove the top push rod lock nut (3/8-16.)

3. Remove the four mounting bolts: two are located on the back side of the breaker through the molded support member and two are located on the front of the breaker through the side sheet support bracket.

4. Lift the pole unit straight up, until the push rod drops clear, then forward.

5. The disconnect finger clusters may be removed by using tool S#591C901G01 as shown in Fig. 40.

5.10 REPAIR OF CMD HOUSING FINISH

All external hardware, handle, and gasket retainer are manufactured from corrosion resistant materials, as are many internal components. All internal corrosive items are plated so as to minimize corrosion. The body and covers of all submersible protectors are bonderized, primed, and painted with two coats of air dry enamel. The frames and dust covers of all open type network protectors are bonderized, primed and painted with one coat air dry enamel or lacquer.

The finish on the housing should at all times be kept in good condition to prevent corrosion. In case the finish becomes noticeably marred or removed, it should be suitably repaired with rust resisting paint.

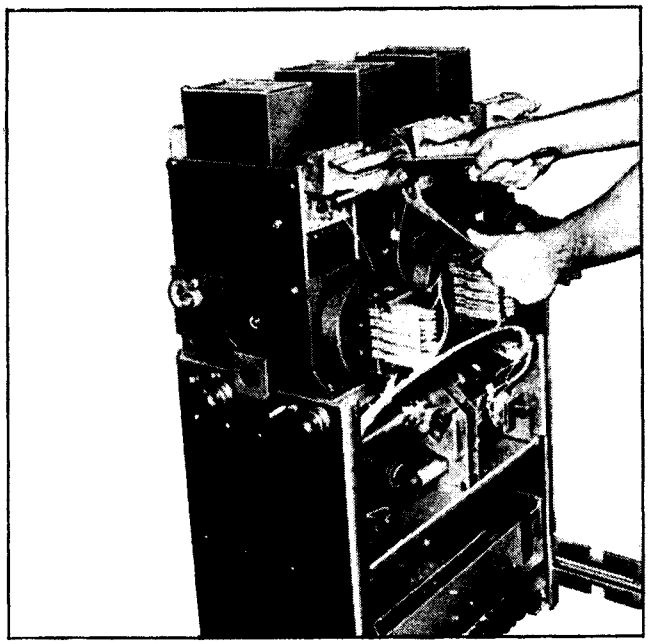


Fig. 40 *Disconnect Finger Removal on CMD Network Protectors*

5.11 LUBRICATION OF MECHANISM

All the roller bearings have been greased at original assembly. They will not normally require any additional grease for life of protector or 10,000 operations. The motor gear case is packed with grease to last 10,000 operations, unless overheated. Therefore, under normal conditions no greasing will be required during 10,000 operations. If inspection indicates abnormal friction or wear, bearings should be checked for free running and if dry, add automobile type "high pressure" grease.

5.12 Instructions to Retrofit Control Autotransformer With Two-Winding Control Transformer on Type CMD Network Protector

NOTE: These instructions are intended to cover the most common types of CMD wiring harness. If your harness deviates from this standard, and/or problems occur, please contact your local Cutler-Hammer office for help.

1. Only qualified personnel (as defined in the NEC) familiar with this equipment shall perform this replacement procedure. Follow I.B. 35-552 for safe practices and any other questions.

2. Trip the protector by turning the operating handle on the enclosure door to the left.

3. Open the enclosure door by first loosening hinge bolts until they come against stops and opening side bolts all the way. Follow the procedure outlined in sections 3.1.3 and 3.1.4 of I.B. 35-552 to position the extension rails and lever out the draw out unit on extension rails in normal maintenance position. Remove the front panel by removing three quick disconnect screws.

4. Unscrew the control module locking screws on both sides. Pull out plugs, withdraw the control module all the way out.

A. Changes Made Within Relay and Control Module:

1. Remove T3 Leads from Control Transformer
2. Remove 125 Leads from Control Transformer
3. Remove 208 Leads from Control Transformer
4. Remove T1 Leads from Control Transformer
5. Remove Control Autotransformer (Typical Style No. 1802466)
6. Install, with same hardware, in same location, (delete glasspoly mounting board) new two-winding Transformer (Typical Style No. 7526A13G01)
7. Connect T1 Leads to Terminal T1
8. Connect 208 Leads to Terminal 208
9. Connect 125 Leads to Terminal 125
10. Connect T3 Leads to Terminal T3

CAUTION: One T3 lead which goes from the control transformer to the BF2 relay should not be connected to the T3 tap. Temporarily let this wire unconnected at T3. Do not remove at BF2.

11. Remove T3 lead at fuse block located behind CNJ relay. Temporarily leave wire unconnected.
12. Remove T3 lead from CN-33 relay (Point 1) which connects to the 12 point plug. Temporarily leave this wire unconnected. Tag remaining lead, which is marked T3, located on CN-33 (Point 1) to Read "G".
13. Tag leads at BF2, which were marked T3 and change to "G".
14. Wire marked T3, which was temporarily left unconnected at the control transformer, should be marked "G" and connected to "COM" of the control transformer.
15. Splice wire, marked T3, once located on fuse block with wire T3 removed from CN-33 (Point 1) location.
16. Add new wire from CN-33 (Point 1) to fuse block opposite wire marked T3A. This new wire should be marked "G".
17. Wire marked T3A, at fuse block terminating at 8 point moving secondary contact, should be marked "G1", at both ends.
18. Add jumper on stationary secondary contact, located in housing, from PT-1 marked G to PT-7 old T3A terminal.

B. Wiring Changes Made Within Mechanism Module:

1. Remove wires T3 from transformer side bus which connects to motor and "W" microswitch. Connect these wires to current transformer terminal "X2" with other "G" leads. These transposed T3 wires should be now tagged "G".

This concludes the necessary wiring changes. The unit should be retested with a network protector test kit for complete operation with and without relays (mech. test).

WARNING

ANY MECHANICAL OR ELECTRICAL MODIFICATION TO ANY NETWORK PROTECTOR REQUIRES THAT THE NETWORK PROTECTOR BE GIVEN APPROPRIATE ELECTRICAL TESTS, USING PROPERLY MAINTAINED TESTING DEVICES, BEFORE PLACING INTO SERVICE. FAILURE TO PERFORM SUCH ELECTRICAL TESTS CREATES CONDITIONS LEADING TO THE POSSIBILITY OF DEATH, SEVERE PERSONAL INJURY OR PROPERTY DAMAGE.

5.13 Watt to Watt-Var Wiring Changeover on the Type CMD Network Protector Equipped With Master Relay Style 691B509A10

NOTE: PLEASE READ INSTRUCTIONS COMPLETELY BEFORE PROCEEDING.

In switching the tripping characteristics from watt to watt-var on the CMD network protector, you need to

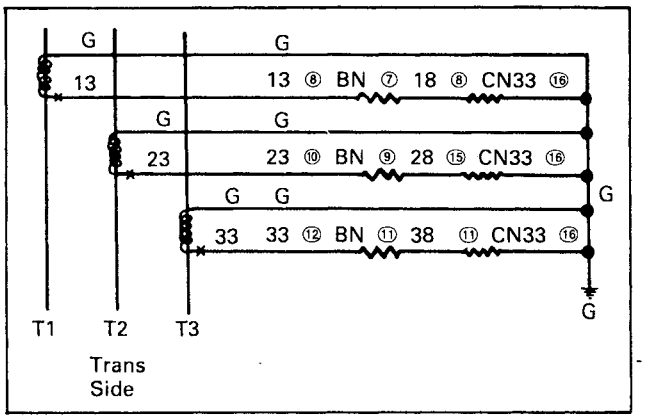


Fig. 41 *Standard Watt Connected Wiring Scheme*

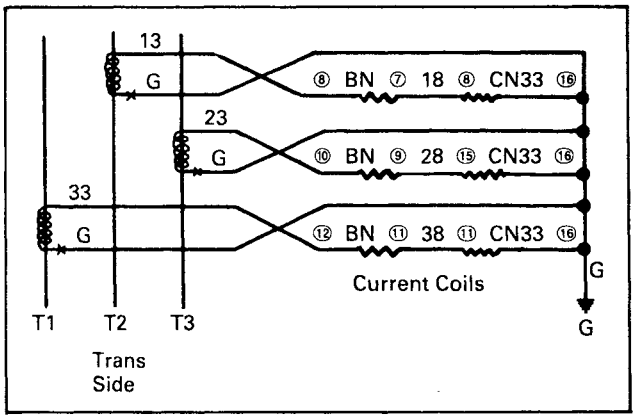


Fig. 42 *Watt-Var Connected Wiring Scheme*

change only six (6) leads. These leads are the sensor leads themselves, and we recommend that you change them at their respective wiring junction of the sensors.

You will need for this operation several in-line splices, several feet of teflon #16 wire, and a network protector test kit. The splices and extra teflon wire are used on those wiring schemes where a direct lead for lead change-over cannot be accomplished due to a short length of wire.

Fig. 41 shows the standard watt connected wiring scheme. Note that these sensors are not "hot" and do not connect to the transformer potential as do the CM-22 sensors. Also, note that the "X" on the leads 13, 23, and 33 are shown to mark polarity.

Starting with a watt wired unit denotes that it is wired per Fig. 41 in the sensor tripping circuit.

You now must flop the leads to agree with Fig. 42.

In the watt wired scheme, the sensor on T1 or Ø1 read left to right from front has wire G and wire 13 with wire 13 tying to the polarity mark on the sensor. To be changed to watt-var, this same sensor on T1 must have the leads from T3 or Ø3 moved or extended with splices to physically reach the sensor at T1, plus the polarity must be reversed. That is, the 33 wire which moved from T3 having been mounted on the sensor polarity mark now must be located on the T1 sensor opposite that mark. It is a good idea to paint new polarity marks on each sensor prior to removing any leads as the old marks may have faded or discolored over the years. These new polarity marks should agree with those marked on Fig. 41. Be particularly careful on phase two or "B" as the sensor faces the opposite direction to the outside phases.

You now must repeat the same procedure on T2 and T3 sensors extending leads where necessary and flopping the polarity on each lead.

After you are satisfied that all the connections are secure and correct use the network protector test kit to electrically test the watt-var tripping characteristic. Be certain your test kit has a 120^{o} position. The 120^{o} position is the maximum torque position of the watt-var relay. Refer to I.B. 35-580 for relay instructions and calibration. The watt-var tripping curve Fig. 8A.

We suggest you check the tripping at both the 120^{o} and the 180^{o} position. It would be best to plot the curve with these two points to insure the curve has been shifted into proper position. Phase rotation input to the test kit is of particular importance. It must be A.B.C. left to right looking from the network protector front.

We also suggest that the trip setting be .16% of the sensor ratio at 120^{o}. Check the value of trip again at 180^{o}. The 180^{o} value should be approximately double the 120^{o} setting.

The overvoltage close setting should be approximately 1 volt in phase (0^{o}) for 120/208 volt systems. Check the overvoltage close value at 60^{o}, it should approximately double the in-phase value. The overvoltage close setting for 277/480 volt systems should be 2.5 to 3.0 volts in phase.

CAUTION

USE OF THE MPCR RELAY REQUIRES THAT THE UNIT BE WIRED FOR "WATT" OPERATION.

SECTION 6 – RENEWAL PARTS

6.1 ORDERING RENEWAL PARTS

Renewal Parts Data, listing by name and style number the recommended renewal parts to be kept in stock, are supplied separate from this book. When ordering parts, always specify the part name and style number, if known, from the Renewal Parts Data, RPD 35-552. If the style number is not known, refer to the Figure number, name and item number as shown in this book, along with the Network Protector type and shop order number or style number as shown on the nameplate on the front cover of the Network Protector.

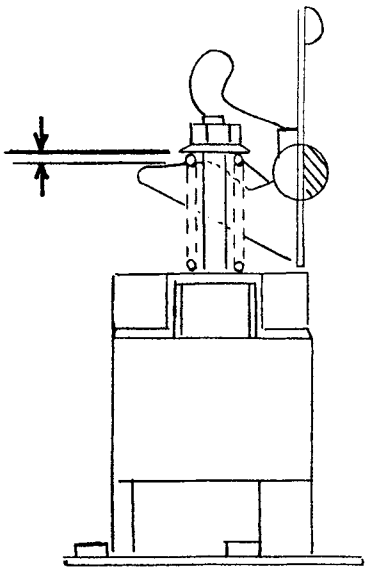
Some of the detail parts shown in the figures in this book will be available only as part of a sub-assembly. The detail parts in the figures are illustrated to show their function and location in the assembly; but certain parts, due to manufacturing procedures or installation procedures, are recommended and furnished as part of a sub-assembly. The renewal parts data indicates which parts are available as individual items or in a sub-assembly. When inquiring about or ordering parts, refer to the figures in this book and the renewal parts data for identification of the part or sub-assembly in question.

SECTION 7 – SETTING DRAWINGS

The following sets of drawings cover various setting dimensions which should be maintained if any repair work or rebuilding is performed on the Type CMD Network Protectors. These drawings were originally produced for the Quality Inspection Department; to be used as a guide for the checking of the various mechanical components.

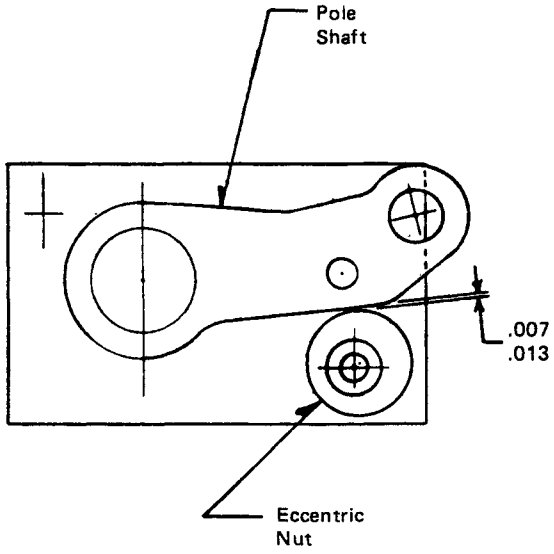
It is recommended that every component item depicted in Figs. 43-46 be checked, as a minimum, during major rebuilding or repair. However, it should be noted that several of the items are covered within the main body of this booklet and should be checked during the regular maintenance inspection periods.

Must be .031 min. with breaker closed.



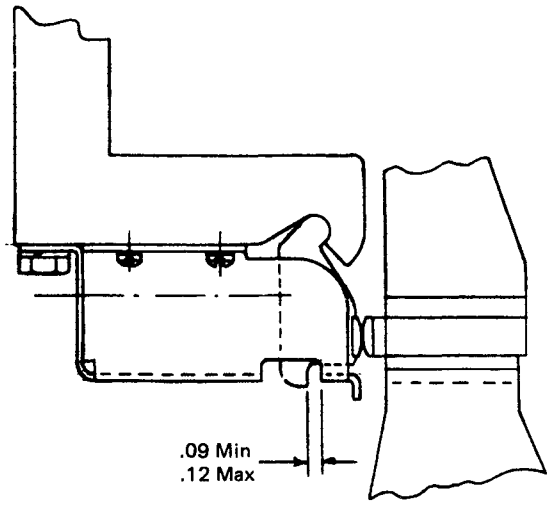
CTA and Trip Bar | 1

Adjust Eccentric Stops Until .007-.013 Clearance Between Stops and Pole Shaft Levers.



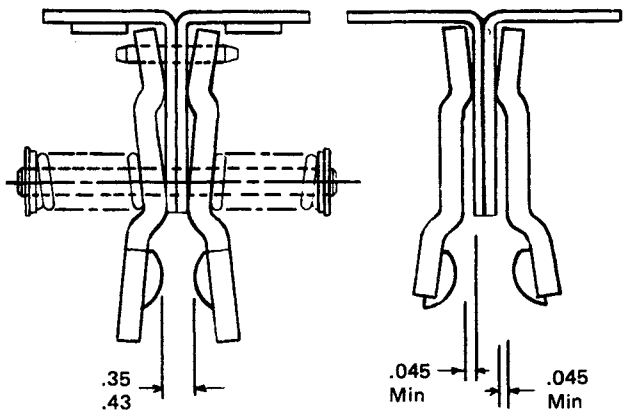
Out Board Stops | 2

With Protector Closed, Adjust Drive Link Adjusting Nuts to Obtain Contact Compression Specified.



Main Contacts | 3

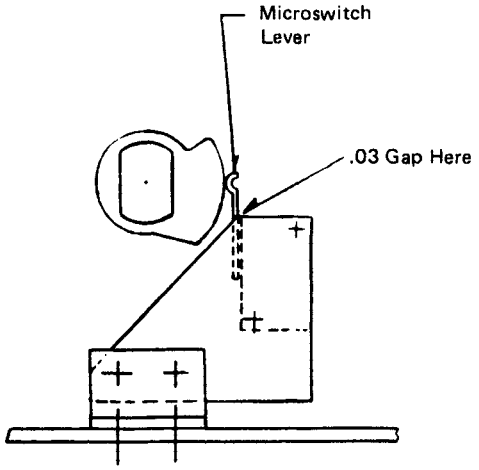
With Protector Open, Adjust Contacts to Give Dimension Shown. With Protector Closed Adjust Contact System to Obtain the Minimum Dimension Shown.



Arcing Contacts | 4

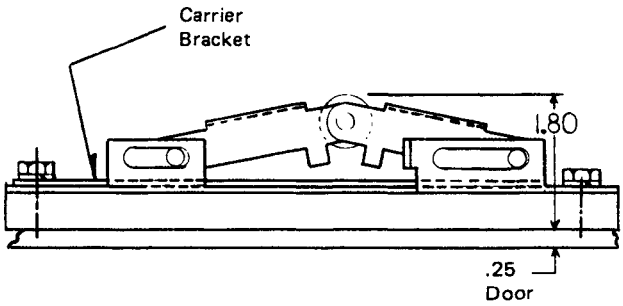
Figs. 43, 44 *Setting Procedures for 1875 Amp Network Protector*

Microswitch Must Switch Contacts When on Lobe of Cam. A .03 Gap Between the Microswitch Lever and Body Must Exist in this Position.

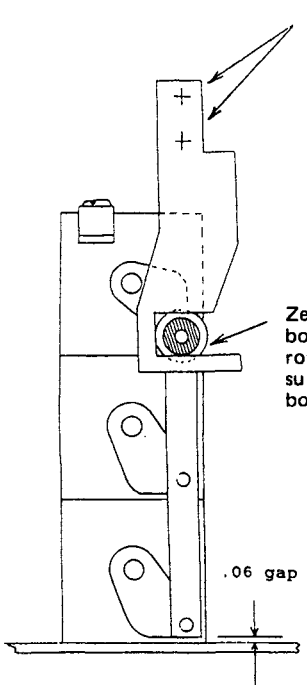


Crankshaft Microswitch | 5

Adjust Carrier Bracket in 'Auto' Position such that 1.8" Dimension from Inside of Door to Tip of Roller is Obtained.

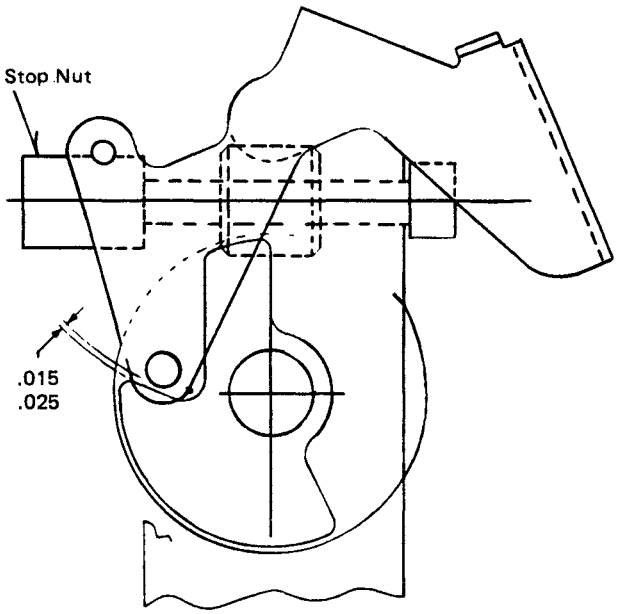


Door Trip | 6



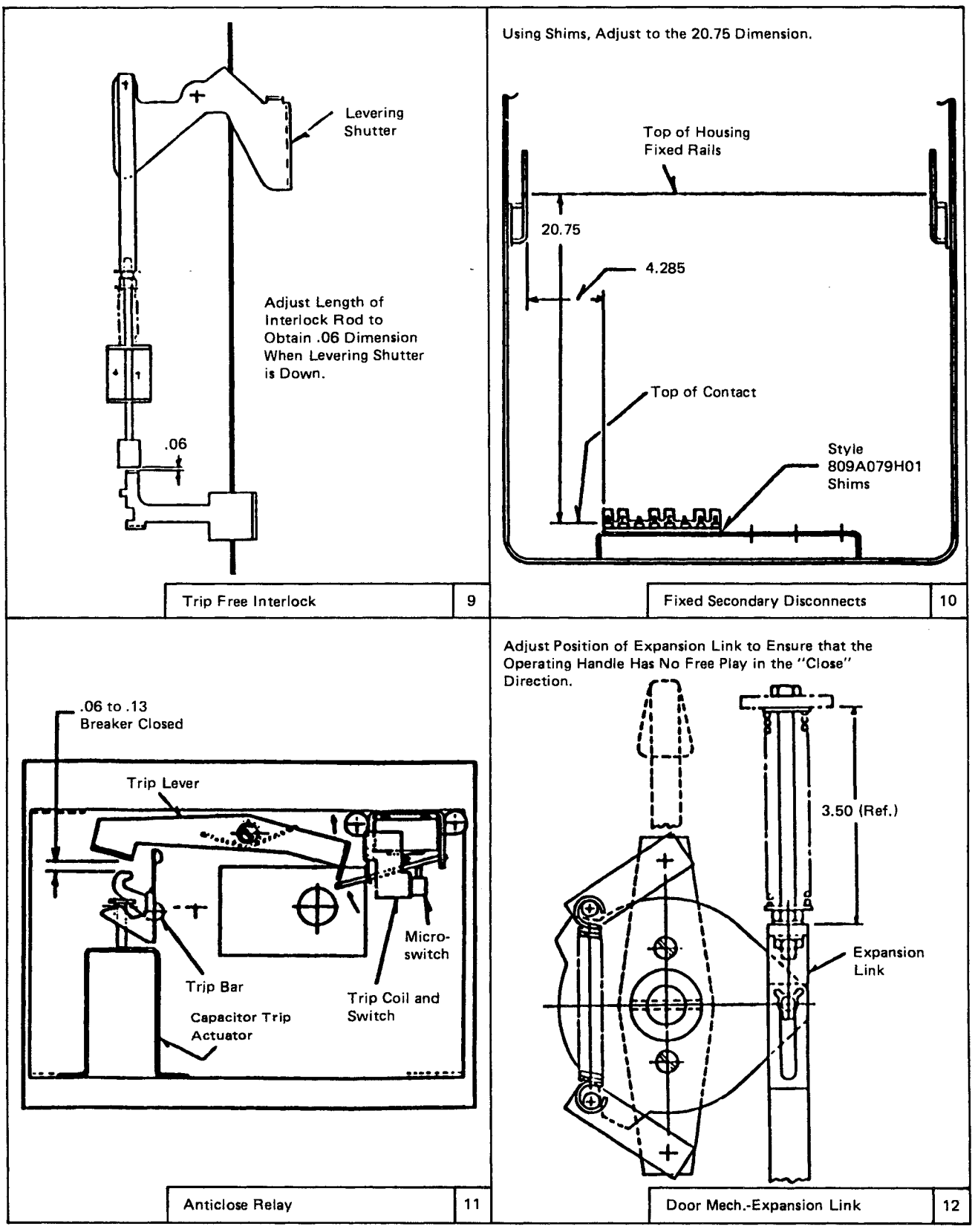
Auxiliary Switch Drive | 7

In Connected Position, Set Stop Nut to Obtain this Dimension Between Interlock Cam and Pin.

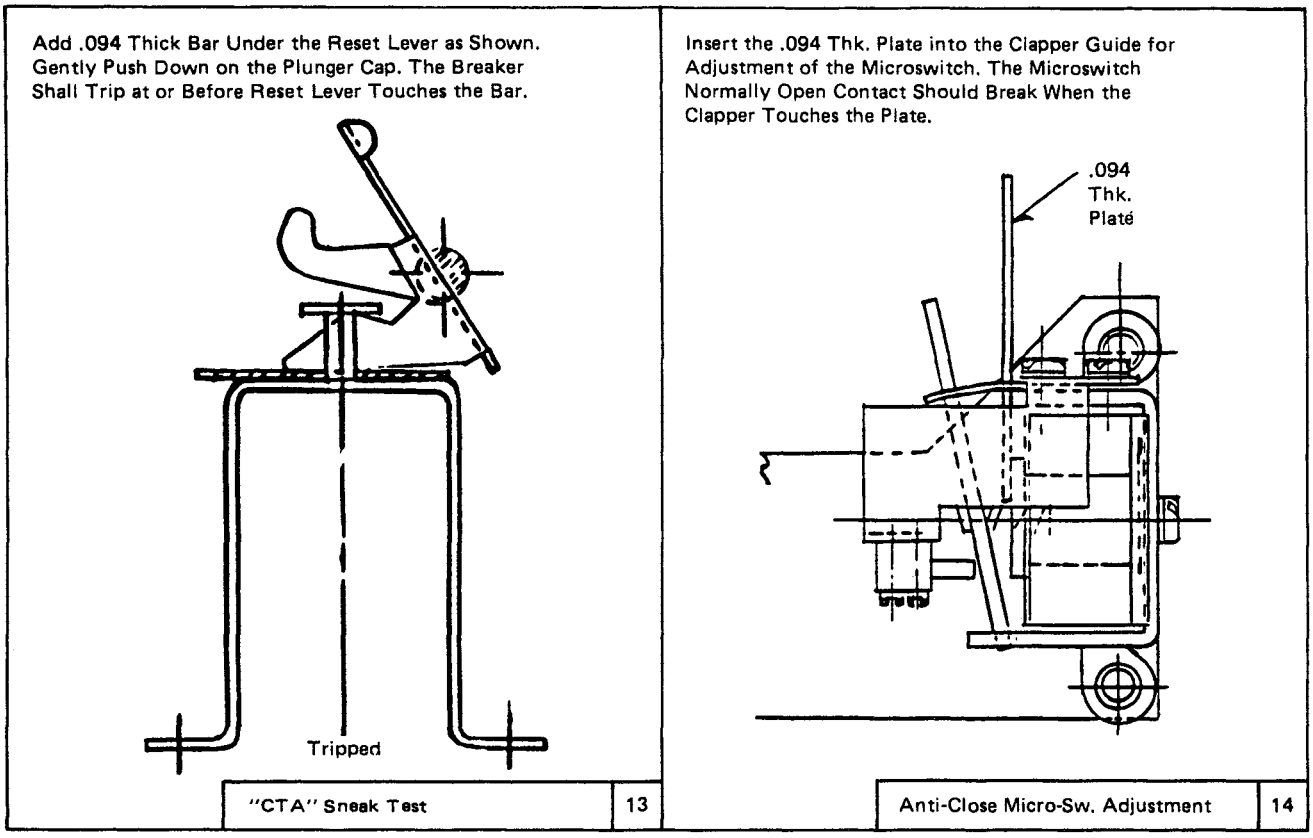


Levering-In Device | 8

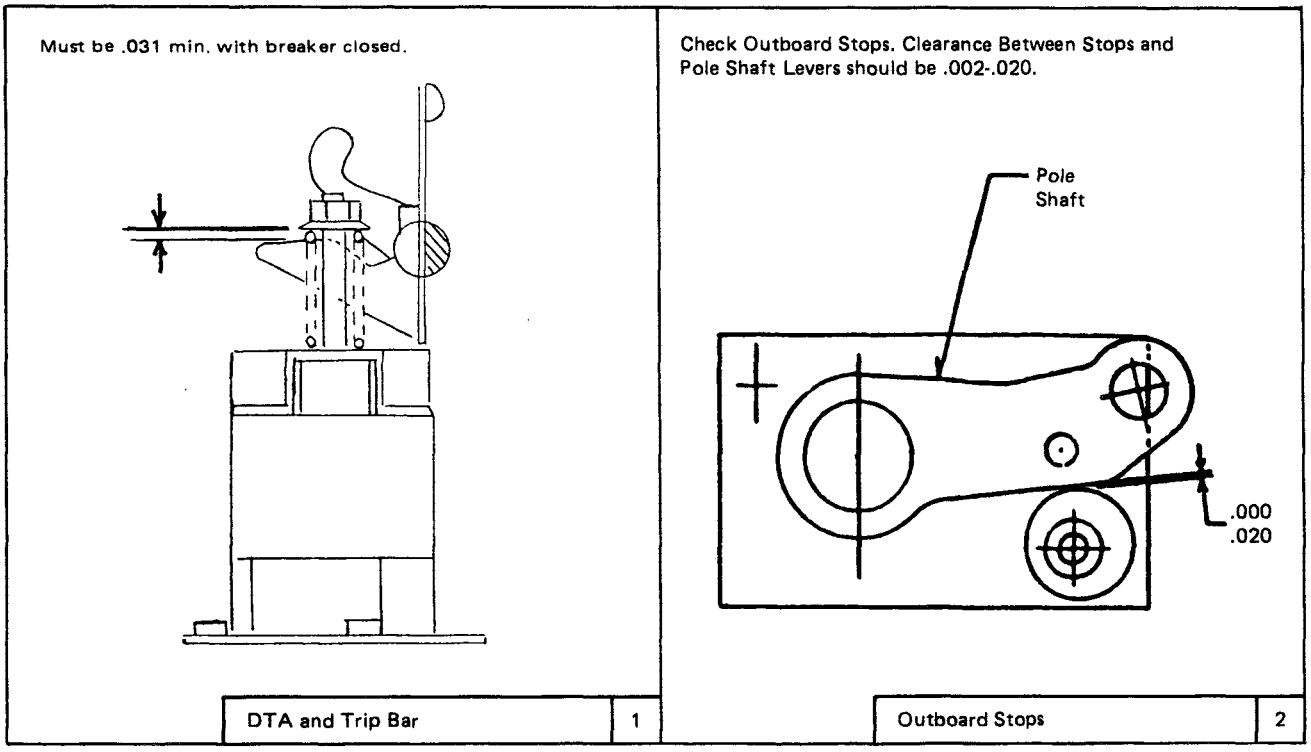
Figs. 43, 44 *Setting Procedures for 1875 Amp Network Protector (Contd.)*



Figs. 43, 44 *Setting Procedures for 1875 Amp Network Protector (Contd.)*

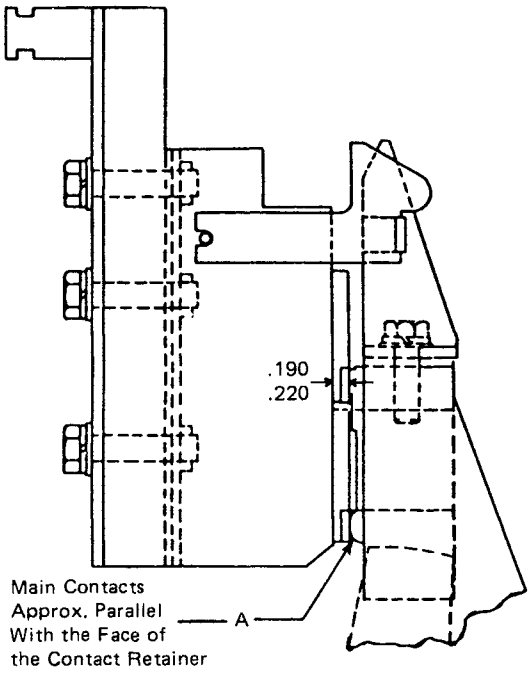


Figs. 43, 44 *Setting Procedures for 1875 Amp Network Protector (Contd.)*



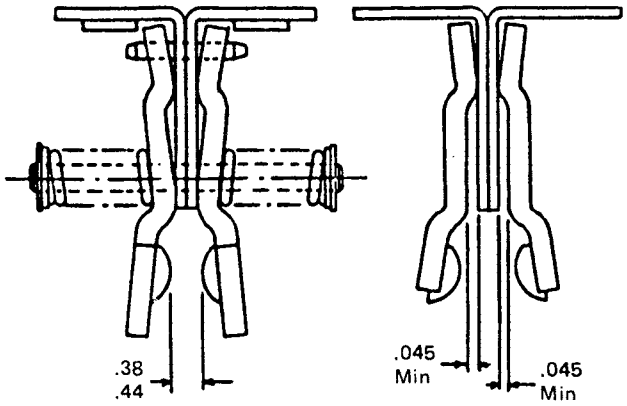
Figs. 45, 46 *Setting Procedures for 2000/3000 Amp Network Protectors*

With Protector Closed, Adjust Drive Link Adjusting Nuts to Obtain Contact Compression Specified.



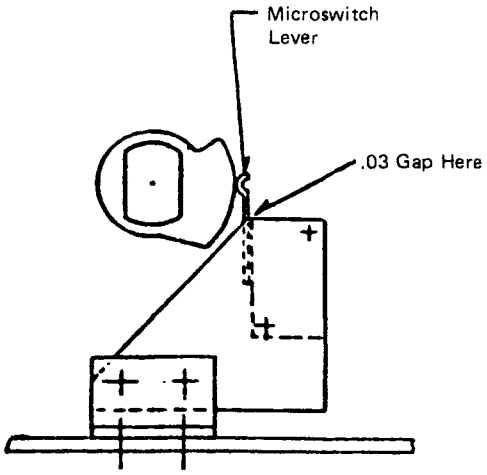
Main Contacts | 3

With Protector Open, Adjust Contacts to Give Dimension Shown. With Protector Closed Adjust Contact System to Obtain the Minimum Dimension Shown.



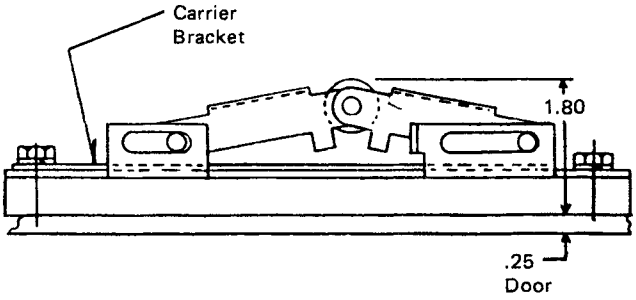
Arcing Contacts | 4

Microswitch Must Switch Contacts When on Lobe of Cam. A .03 Gap Between the Microswitch Lever and Body Must Exist in this Position.



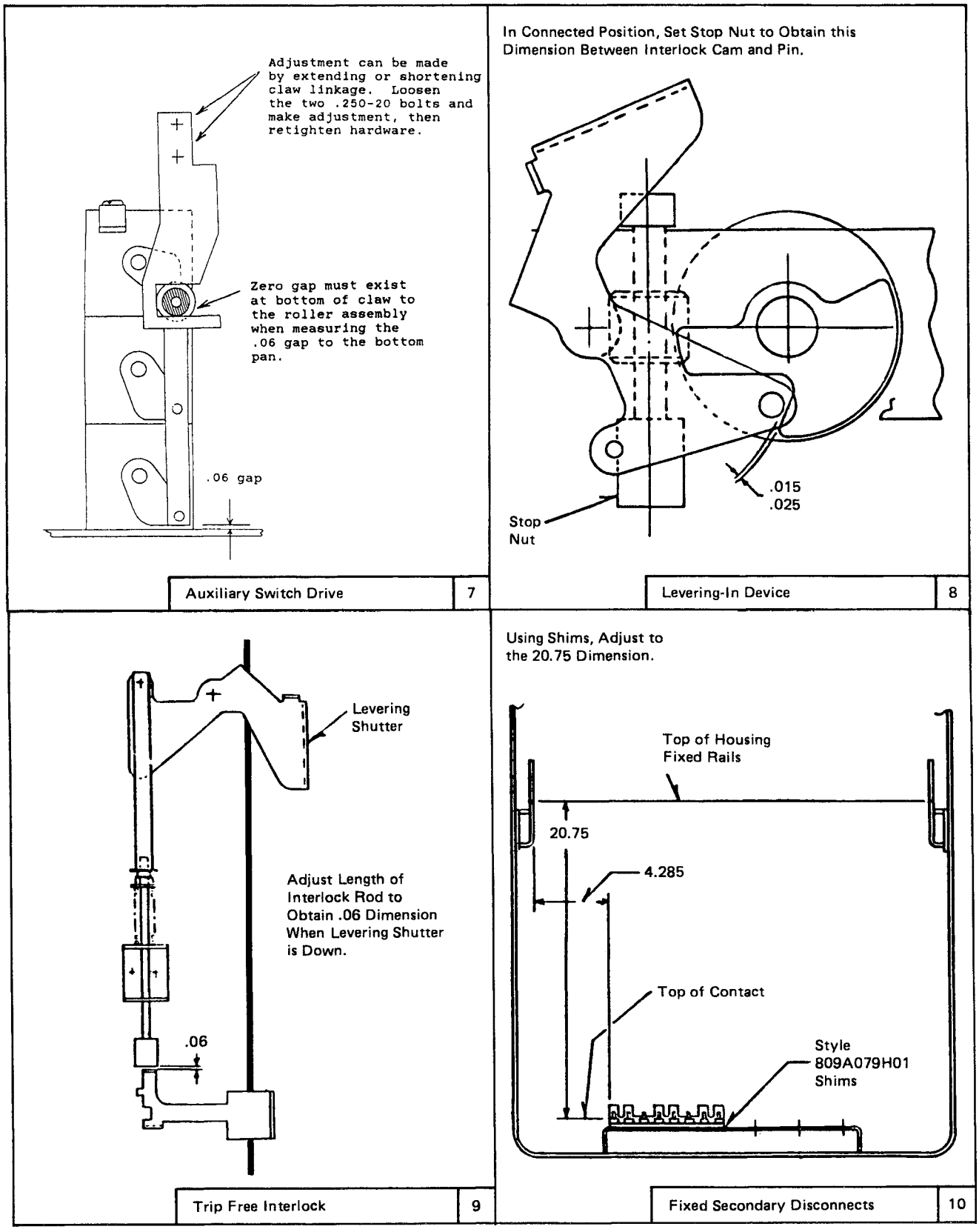
Crankshaft Microswitch | 5

Adjust Carrier Bracket in 'Auto' Position such that 1.8'' Dimension from Inside of Door to Tip of Roller is Obtained.

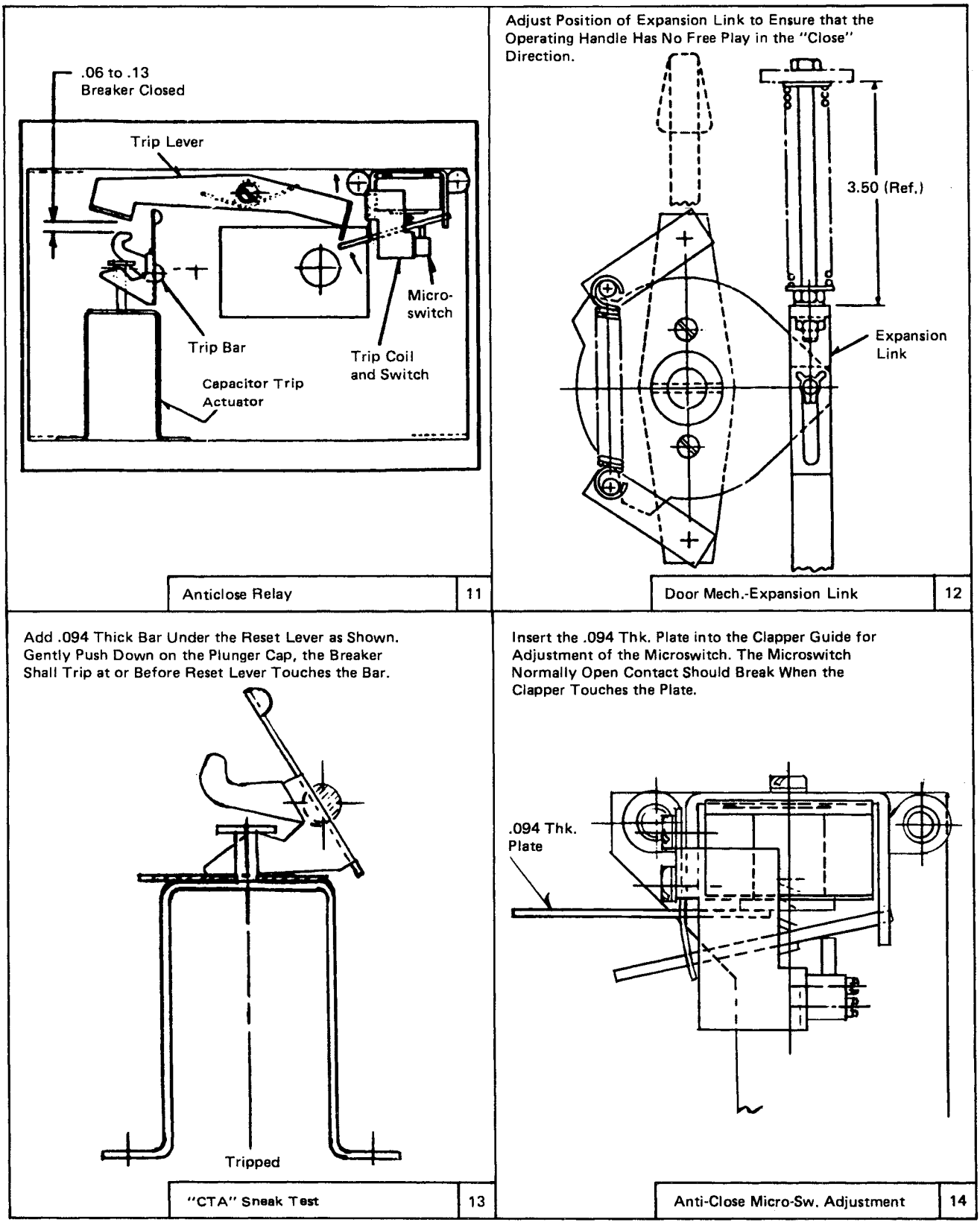


Door Trip | 6

Figs. 45, 46 *Setting Procedures for 2000/3000 Amp Network Protectors (Cont.)*



Figs. 45, 46 *Setting Procedures for 2000/3000 Amp Network Protectors (Cont.)*



Figs. 45, 46 *Setting Procedures for 2000/3000 Amp Network Protectors (Cont.)*

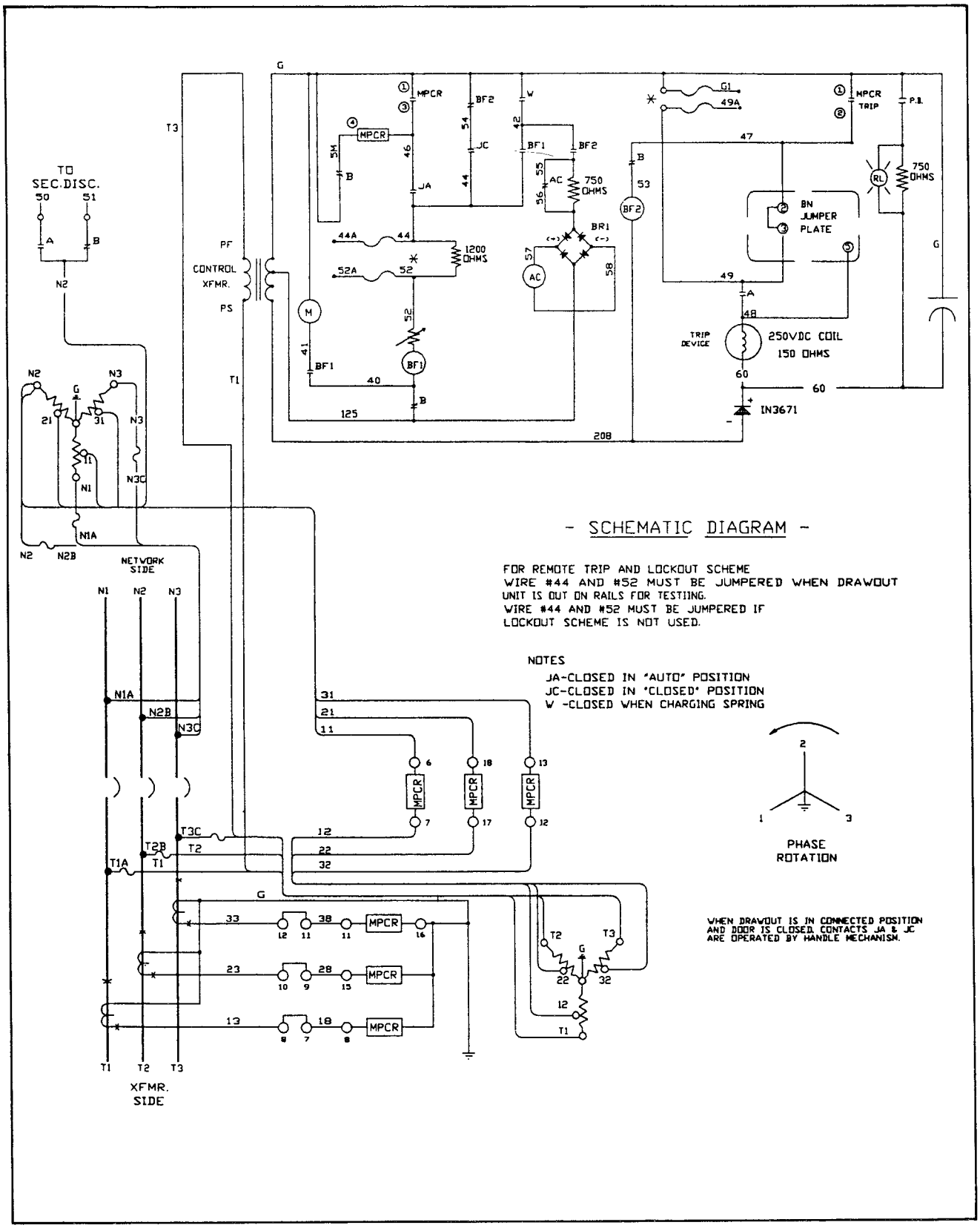


Fig. 47 *Typical 277/480 Volt Schematic Diagram*

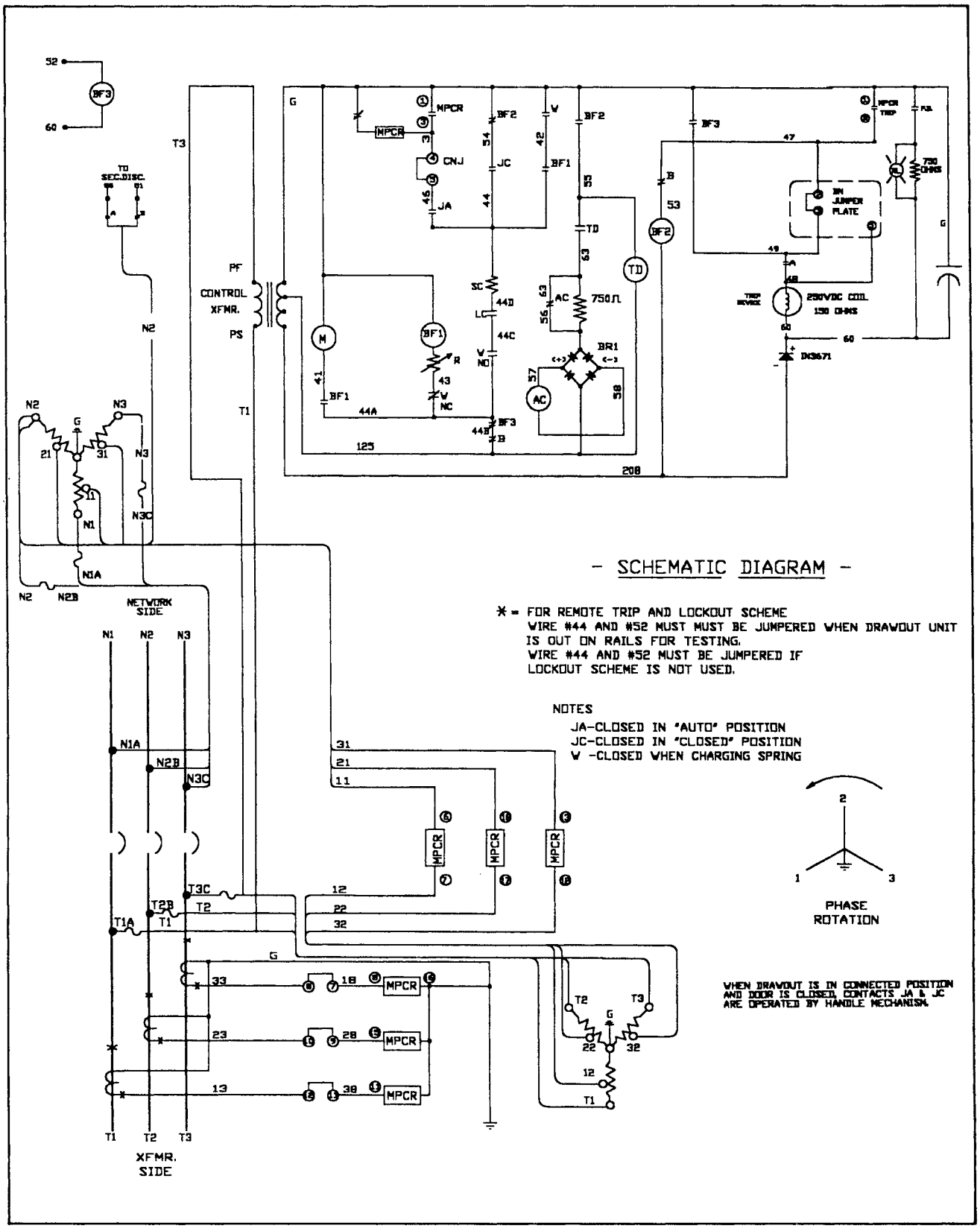


Fig. 48 *Typical Stored Energy Mechanism Schematic Diagram*

Sequence of Operation, Type CMD Network Protector Equipped with A Stored Energy Mechanism (Refer to Fig. 48)

1. When the CN-33 or MPCR master relay calls for the breaker to trip, the direct trip actuator (DTA) is energized and the breaker opens. The action of the breaker's main contacts opening causes auxiliary switch "A" contacts to open and conversely closes the auxiliary switch "B" contacts as well as opens the "LC" contact.

2. Also upon the breaker opening, the "W" contacts reverse position closing the "W" contact in series with the "BF1" relay coil.

3. With the "BF1" coil energized the "BF1" contact make, allowing the motor to charge the closing springs.

4. When the charging action of the springs is complete, the "W" contact in the motor circuit opens dropping out the "BF1" relay, stopping the motor. This action closes the "W" contact in the closing circuit aligning the closed "B" , "BF3", the now closed "LC" contact.

5. The closing cycle can now be complete by closing the "JC" contact, or allowing the master and phasing relay closing contacts to make. The shunt close coil then is energized, closing the breaker.

6. The closing operation of the breaker closes auxiliary switch "A" contacts, also opens the auxiliary switch "B" contacts.

7. The unit is ready for the next tripping cycle.

The "BF3" relay operation. (Remote trip and lockout.)

1. The "BF3" relay may also be used as a tripping method. However, when the "BF3" trip contact is closed the "BF3" close contact opens to function as the lockout feature.

2. Once the remote trip and lockout is de-energized the "BF3" contact makes closing the circuit to the motor charging the springs.

3. The breaker operation is returned to item 4 in the sequence described above.

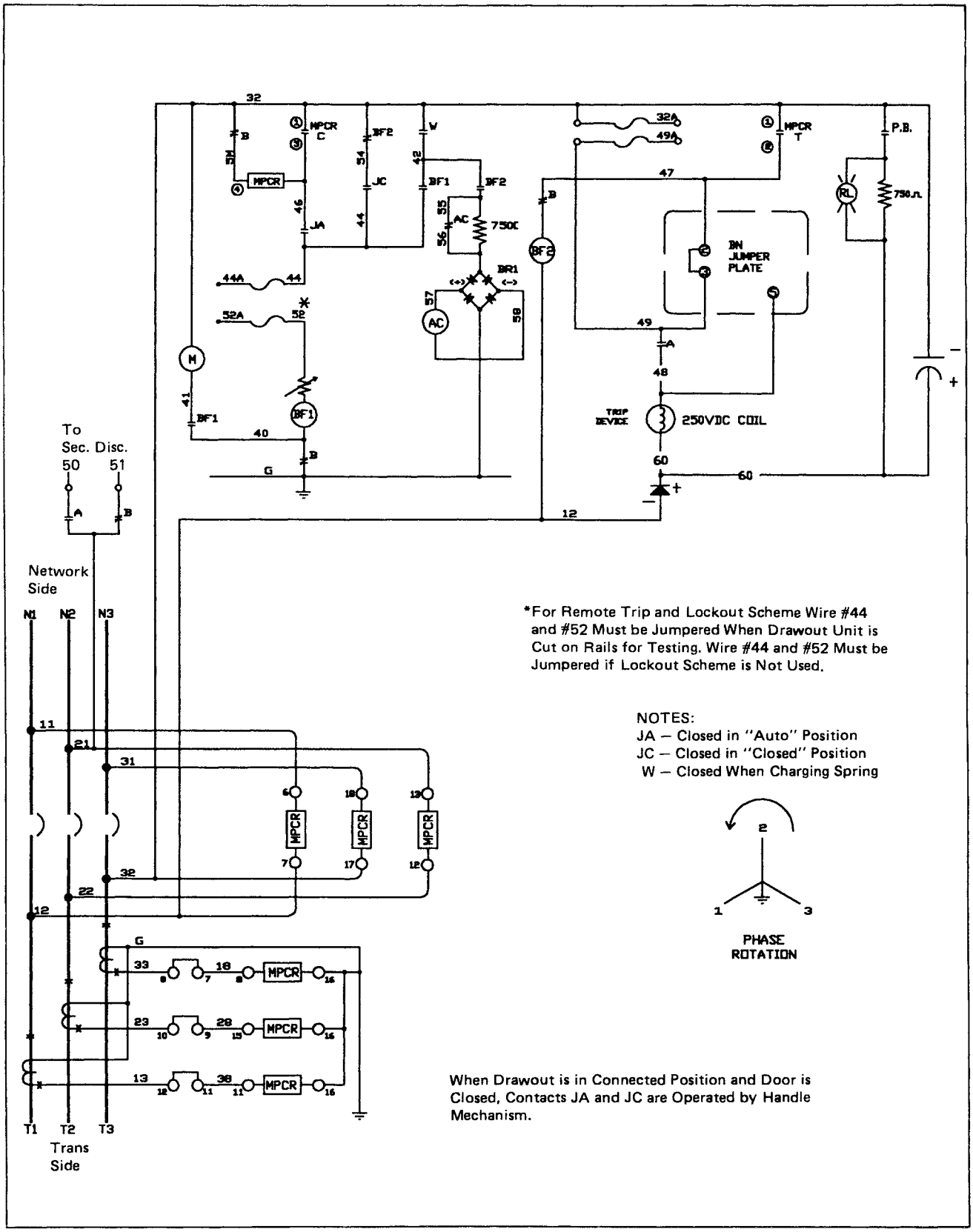


Fig. 49 *Typical 125/216 Volt Schematic Diagram*

Notes:

Notes:

Type CMD Network Protectors
1875 to 3000 Amperes

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