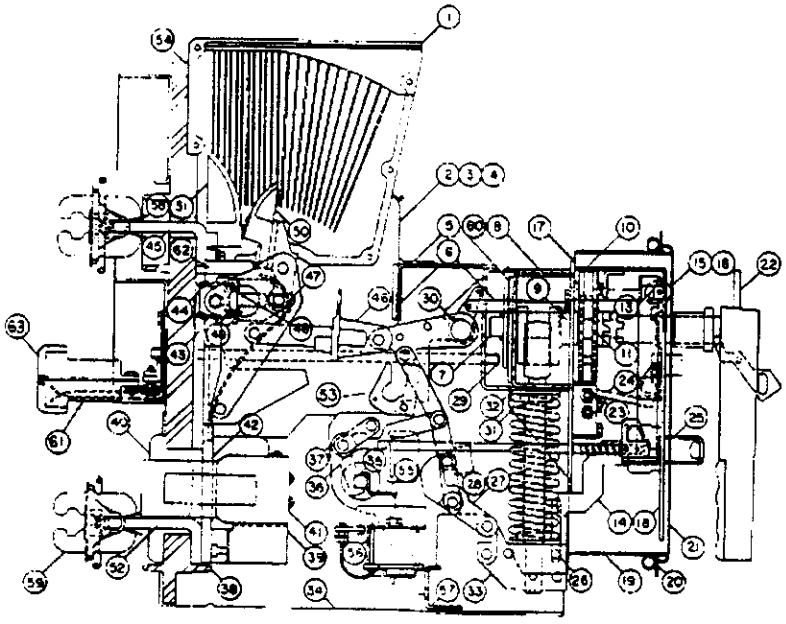
FEDERAL PIONEER

INSTRUCTIONS FOR THE CARE AND MAINTENANCE OF H-3 AND HL-3 CIRCUIT BREAKERS



CONTENTS

2.5
POWER TERMINAL CONNECTIONS

THE H-3 POWER TERMINALS ARE PLATED FOR MAXIMUM JOINT EFFICIENCY AND CABLE OR BUS CONNECTORS MUST BE CLEAN AND FREE FROM DENTS OR BURRS, AND BOLTED SECURELY TO THE TERMINALS. POOR JOINTS LEAD TO OVERHEATING, SUBSEQUENT CONTACT DETERIORATION, AND AN EVENTUAL FAILURE. CONNECTIONS SHOULD BE PROPERLY SUPPORTED SO AS NOT TO TRANSFER ANY UNNECESSARY MECHANICAL OR SHORT CIRCUIT STRESS TO THE TERMINALS. ANY STRAIN WHICH MAY HAVE NO APPARENT EFFECT INITIALLY MAY AFTER PROLONGED PERIODS OF VIBRATION AND SHOCK FROM NORMAL OPERATION, CAUSE POOR CONTACT ALIGNMENT.

2.6
SECONDARY CONTROL CIRCUITS

CONTROL CIRCUIT WIRING, WHERE APPLICABLE, SHOULD BE MADE IN STRICT ACCORDANCE WITH DETAILED WIRING DIAGRAMS. FIXED MOUNTED BREAKERS ARE PROVIDED WITH TERMINAL BLOCKS FOR CONNECTIONS TO REMOTELY LOCATED CONTROL AND INDICATING DEVICES. REMOTE WIRING SHOULD BE BUNDLED TOGETHER, PROPERLY SUPPORTED AWAY FROM PRIMARY CONNECTIONS.

CONTROL WIRING FROM CRADLE MOUNTED SECONDARY CONTACTS OF DRAWOUT TYPE BREAKERS MUST BE PASSED THROUGH THE HOLES PROVIDED IN THE CRADLE BACKPAN AND SECURED ON THE INSIDE IN SUCH A MANNER THAT IT IS KEPT AWAY FROM THE PATH OF THE BREAKER MAIN DRAWOUT CONTACTS AND SHUTTERS IF PROVIDED.

METER SHUNTS, RESISTORS AND SIMILAR DEVICESWHICH OPERATE AT RELATIVELY HIGH TEMPERATURE SHOULD BE MOUNTED AWAY FROM THE CIRCUIT BREAKER SO THEY DO NOT CONTRIBUTE TO THE HEATING OF THE UNIT.

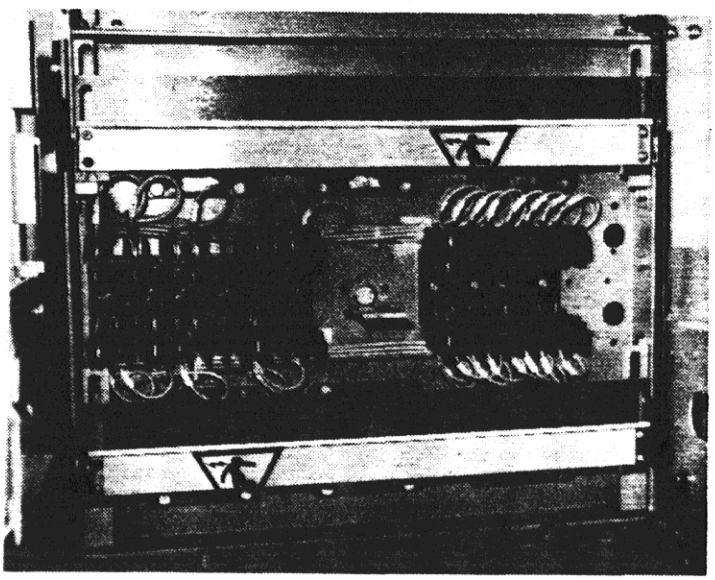
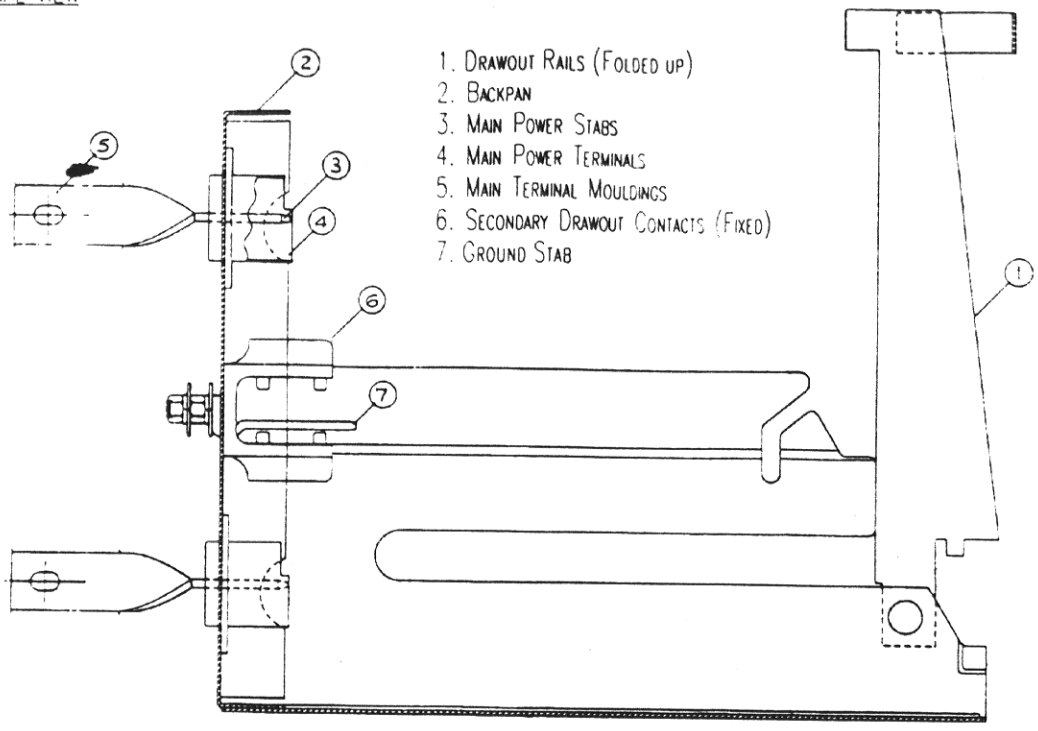


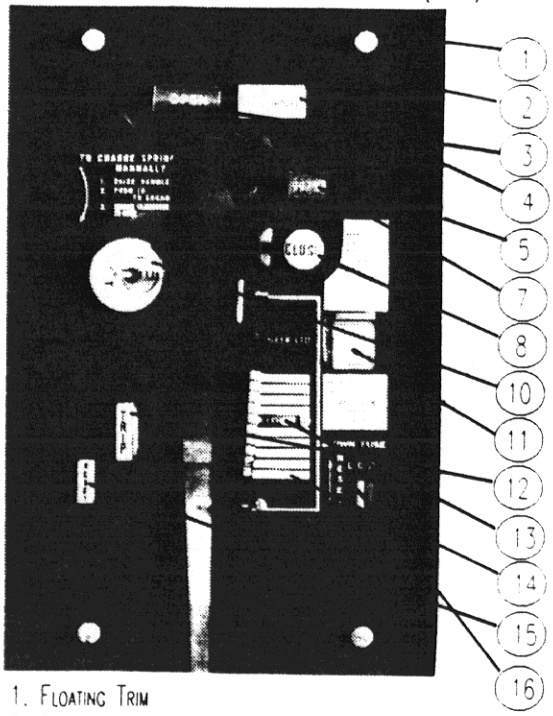
FIG. 2.6 CRADLE WIRING

3.2 CRADLE SECTIONAL VIEW



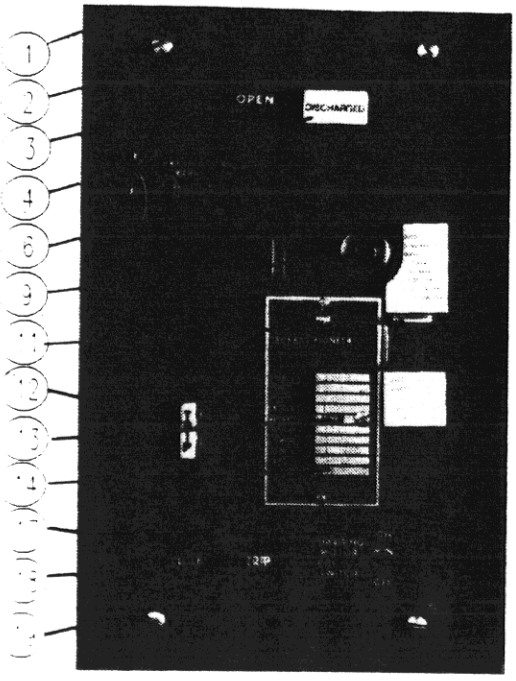
3.3 BREAKER FACEPLATE AND CONTROLS

FIG. 3.3.1 Faceplate for Manually Operated (M.O.) Unit



1. Floating Trim
2. Faceplate
3. Contact Position Indicator
4. Main Spring Charged/Discharged Indicator
5. Manual Charging Handle (M.O. units only)
6. Opening for Emergency Charging Handle (E.O. units only)
7. Operations Counter (Optional)
8. Manual Close (M.O. units only)
9. Aperture for Emergency Manual Close (E.O. units only)
10. Faceplate Key Interlock (optional)

FIG. 3.3.2 Faceplate for Electrically Operated (E.O.) Unit



11. Gate for Drawout Crank (drawout mounted units only)
12. Manual Trip
13. Sensor Tap Setting Indicator
14. Serial Number
15. Overload Lockout Reset (optional)
16. Blown Fuse Indicator and Reset (type HL-3 units only)
17. Electrical Close (E.O. units only)
18. Electrical Trip (E.O. units only)
19. Charging Motor On-Off Switch

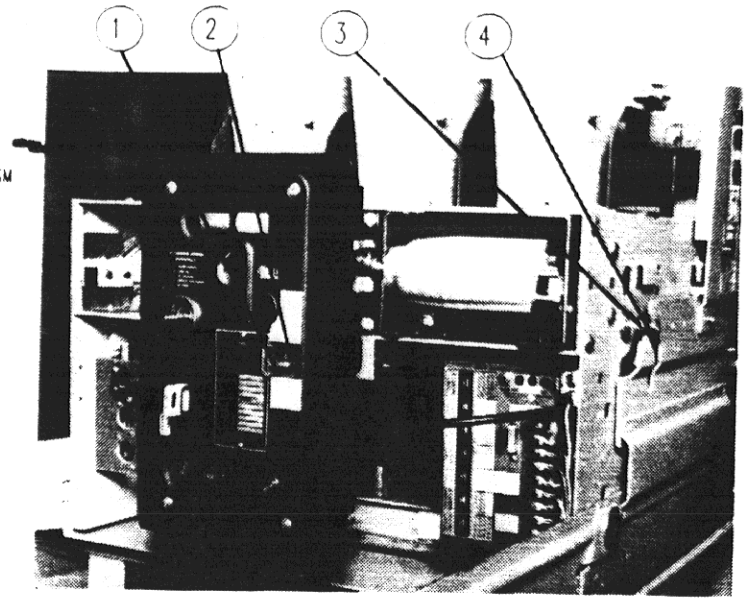


Fig. 4.1.4 Drawout Mechanism

1. Gate
2. Crank Socket
3. Drawout Lever Bushings
4. Cradle Drawout Slots

To operate the drawout mechanism, the gate is lowered to expose the crank socket, and the drawout crank inserted. The gate is interlocked to both the charging and tripping mechanisms of the breaker, such that if the main spring is charged, it will be discharged and if the contacts are closed, the breaker will be tripped. As long as the gate is down, the contacts cannot be closed. An additional interlocking mechanism will not allow the gate to be raised if the breaker is part way between test and operation positions.

This way the main spring will always be discharged and the contacts open when the breaker is being drawn in or out or when it is left between test and operating position.

Note that lowering the gate with the main spring charged, or manually charging the spring with the gate lowered will result in a "dry run", that is, the spring discharges without closing the contacts. This is a safety feature and dry runs during drawout operation may sometimes be unavoidable, but because they stress the mechanism to a greater extent than normal operations, dry runs should be avoided if possible. Refer to Section 4.8.

To install a breaker proceed as follows:

- Open the cubicle door and fold down the rails
- Place breaker on the rails and roll it into the cradle
- Fold the rails up and fully close the door
- Insert the drawout crank and turn clockwise until the breaker is in the test position as shown in Fig. 4.1.2 or in the operating position as shown in Fig. 4.1.3 and remove the crank. When cranking the breaker into the operating position, continue cranking until the mechanism comes to a firm stop.

To remove a breaker, the procedure is just the opposite to the above. Before inserting the drawout crank, refer to Section 4.8 to avoid unnecessary dry runs.

For drawout gate adjustment refer to Section 8.4.

4.2 GROUNDING CONTACT

Grounding continuity is established 1/8" (3.2 mm) before secondary control contacts are engaged in the "Test" position. It is maintained throughout breaker positioning in the enclosure until the secondary control contacts have been separated again by the same dimension. Grounding continuity is established when the moving ground contact on the breaker (Fig. 3.1 Item 61) mates with the stationary ground stab located on the cradle (Fig. 3.2 Item 7).

4.3 SECONDARY CONTROL CONTACTS

Secondary control contacts automatically connect or disconnect control circuits as the breaker moves through its drawout positions. A total of 40 contacts can be provided on 14" wide breakers (maximum 1600 amps) and 21" wide breakers equipped with mechanical interlock (maximum 2000 amps). All other breakers can be provided with 48 contacts. Each contact has a continuous current rating of 30 amps. In applications where a control voltage supply in excess of 250V is to be used, the secondary contacts are double spaced, (ie. adjacent contacts are omitted).

The fixed (cradle mounted) contact assemblies may be supplied with electrically separated or jumpered "TEST" and "OPERATING" position contacts to provide a variety of optional control functions, ie. isolation, bypass, etc.

4.5 CLOSING MANUALLY OPERATED BREAKER

To charge the main spring, rotate the charging handle counter clockwise to the upright position and push in to engage the handle with the ratchet wheel clutch. On frame sizes 1600 amps and above, the handle is a pullout extension type for ease of operation.

Rotate the handle clockwise 180 degrees to fully charge the spring. A multi-tooth ratchet wheel and holding pawl prevent recoil and permit spring charging to be performed in several short strokes if desired.

As the ratchet wheel rotates the internal crank to a position 13 degrees past top-dead-centre, the charging stroke is stopped. A bearing within the ratchet wheel comes to reset again the close latch and the force of the compressed main spring is held by the latch in readiness to close.

Operation of the close latch by pushing the manual close button (fig. 3.3.1, item 8) in the faceplate, releases the spring energy to close the breaker.

Only a rapid trip-reclose operation is required should the spring be recharged at this time. This will avoid unnecessary dry runs when operating the drawout mechanism.

4.6 CLOSING ELECTRICALLY OPERATED BREAKER

The electrically operated breaker is equipped with charging motor to charge the main spring and a closing coil to release the close latch.

Begin by placing the motor isolating switch (Fig. 3.3.2 Item.19) to the "on" position. The motor operated oscillating lever will rotate the ratchet wheel until the main spring is fully charged. At this point a cam behind the crankbox operates the spring limit switch lever and the spring limit switch cuts off the motor. Rotation is stopped and the ratchet wheel is held in position by the close latch. Pushing the "close" button on the faceplate (Fig..3.3.2, Item 17) energizes the close coil which releases the close latch. The main spring discharges and the main contacts close.

Depending on control requirements, internal breaker wiring will provide for either charge after closing or charge after opening operation. (Refer to 4.18).

A removable handle is provided to permit emergency manual charging of the spring. A mechanical close button like that on the manually operated unit is not included. Emergency operation of the close latch is accomplished by insertion of a pin attached to the upper end of the emergency charging handle, through a small aperture in the face plate (Fig. 3.3.2, Item.17). Push the pin gently through the aperture until the breaker closes.

4.7 MECHANICAL CLOSING INTERLOCKS AND PADLOCKING

Breakers may be equipped with mechanical devices which trip the breaker and prevent the contacts from being reclosed until these devices have been reset. Such devices act on the trip shaft of the breaker, holding it in the tripped position. If the main spring is charged and released, a dry run will occur but the contacts will not close. The following optional devices serve this function. The action required to reset them is also indicated.

Undervoltage Trip (ref. section 5.3)
-resets automatically when control power is applied.

Overload Lockout (ref. section 5.5)
-push the manual reset button on faceplate to reset

Door Interlock (ref. section 5.6)
-resets when compartment door is closed

Key Interlocks (ref. section 5.7)
-resets when key is inserted and turned (key will be trapped in this position)

Mechanical Interlocks (ref. section 5.8)
-resets automatically when alternate breaker is opened

Anti-Single-Phase Device and Blown Fuse Indicator (ref. Section 4.11)
-resets by pushing indicators up and in to the locked position

In addition to these devices, the manual trip button and drawout mechanism gate are equipped with provisions for padlocking for the purpose of locking breaker in open position or to prevent operation of drawout mechanism. The safest method to prevent accidental breaker closing and energization of a bus or feeder which must remain de-energized, is to withdraw breaker from "OPERATING" position and to secure a padlock through the drawout mechanism gate padlocking hasp.

For breakers left in "OPERATING" position, accidental breaker closing can be prevented by leaving breaker with closing spring discharged and ensuring that is remains discharged.

Electrically operated breakers can be prevented from charging by turning off motor cutoff switch, or by removing control power fuse and by keeping the emergency charging handle removed.

Manually operated breakers with the non-removable charging handle have handle padlocking provision. A lock secured through the hasp prevents encagement with ratchet wheel clutch.

In addition a padlock through the manual trip button and hasp with the button depressed will provide further assurance the manually or electrically operated breaker remains open.

4.9 REJECTION FEATURE

A REJECTION FEATURE IS PROVIDED ON ALL BREAKERS. IT PREVENTS ENTRY OF A BREAKER INTO A CRADLE OF THE SAME WIDTH BUT DIFFERENT RATING. PINS ON BOTH SIDES OF THE BREAKER FRAME MATCH SLOTS IN BRACKETS MOUNTED ON BOTH SIDES OF THE CRADLE. IF THE CRADLE IS A DIFFERENT RATING THAN THE BREAKER, THE BREAKER PINS WILL NOT MATCH THE SLOTS AND ENTRY OF THE BREAKER IS PREVENTED.

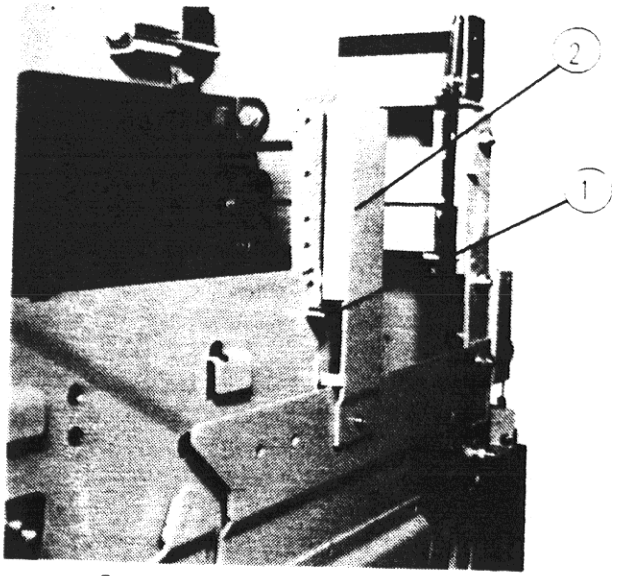


FIG. 4.9 REJECTION FEATURE
1. BREAKER REJECTION PIN
2. CRADLE REJECTION BRACKET

4.10 CLOSING SPRING DISCHARGE AND DRY RUNS

DISCHARGING THE MAIN SPRING WITHOUT CLOSING THE MAIN CONTACTS IS REFERRED TO AS A DRY RUN. THIS TYPE OF OPERATION CREATES MUCH MORE STRESS IN THE BREAKER MECHANISM THAN NORMAL CLOSING OPERATIONS AND SHOULD BE AVOIDED IF POSSIBLE.

TO LIMIT THE NUMBER OF DRY RUNS, THE FOLLOWING METHOD OF SPRING DISCHARGE SHOULD ALWAYS BE USED WHEN BREAKER IS IN "TEST" OR "DISCONNECTED" POSITION OR WHEN REMOVED FROM CRADLE. IT SHOULD ALSO BE USED WHEN IN "OPERATING" POSITION IF POSSIBLE:

1. IF BREAKER IS ELECTRICALLY OPERATED, TURN OFF MOTOR ISOLATING SWITCH.

2. IF BREAKER IS OPEN AND MAIN SPRING CHARGED: CLOSE – THEN TRIP BREAKER.

3. IF BREAKER IS CLOSED: TRIP BREAKER BY USING ELECTRICAL OR MECHANICAL TRIP BUTTONS ON FACEPLATE (DO NOT USE THE DRAWOUT MECHANISM GATE). IF THE MAIN SPRING IS CHARGED, RECLOSE, THEN TRIP BREAKER.

4.11 FAULT PROTECTION

TYPE H–3 AND HL–3 BREAKERS ARE SUPPLIED WITH THE TYPE USD SOLID STATE OVERCURRENT RELAY AS A STANDARD FEATURE. THE USD RELAY PROTECTS LOW VOLTAGE POWER SYSTEMS AGAINST DAMAGE CAUSED BY SHORT CIRCUITS, OVERLOADS AND GROUND FAULTS. THE RELAY MAY HAVE UP TO FOUR PICK UP ELEMENTS: INSTANTANEOUS, SHORT–TIME, LONG–TIME AND GROUND FAULT. LOCAL AND REMOTE INDICATION ARE AVAILABLE. IN ADDITION, ZSI(R) (ZONE SELECTIVE INSTANTANEOUS PROTECTION) IS AVAILABLE FOR THE SHORT–TIME AND GROUND FAULT ELEMENTS.

TRIPPING ENERGY FOR THE OPERATION OF THE RELAY IS OBTAINED SOLELY FROM THE CIRCUIT BEING PROTECTED.

THREE MULTIPLE–TAP CURRENT SENSORS, MOUNTED ON THE BREAKER PROVIDE THE INPUT TO THE USD RELAY FROM THE PROTECTED CIRCUIT. A FOURTH SENSOR, CAN ALSO BE USED WHERE FOUR–WIRE GROUND FAULT PROTECTION IS REQUIRED. AN ADJUSTABLE SENSOR TAP SETTING INDICATOR IS PROVIDED ON THE BREAKER FACEPLATE (SEE SECTION 8.10).

A DEDICATED DIRECT ACTING SOLENOID TYPE TRIP COIL PROVIDES POSITIVE ACTIVATION OF THE TRIP LATCH ON THE BREAKER, AND POSITIVE RESETTING AFTER OPERATION.

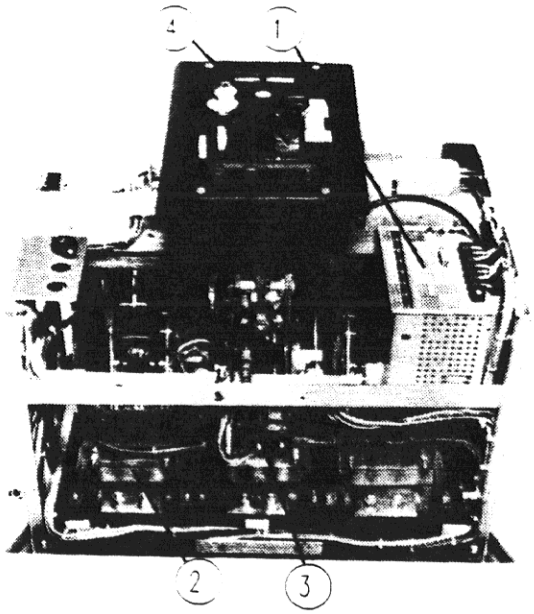


FIG. 4.11 OVERCURRENT PROTECTION
1. USD RELAY
2. CURRENT SENSOR
3. TRIP COIL
4. CURRENT SENSOR TAP INDICATION

4.14 SHUNT TRIP COIL

THERE MAY BE TWO SHUNT TRIP COILS INSTALLED ON A BREAKER. BREAKERS EQUIPPED WITH A USD RELAY ARE FITTED WITH A SHUNT TRIP COIL OPERATED EXCLUSIVELY BY THE RELAY. THIS DEVICE IS A CYLINDRICAL SOLENOID MOUNTED BELOW THE TRIP SHAFT BETWEEN THE LEFT AND RIGHT HAND MECHANISM SIDEPLATES. THE SECOND, SHUNT TRIP COIL IF NEEDED FOR COMMON TRIPPING REQUIREMENTS IS MOUNTED ON THE OUTSIDE OF THE LEFT HAND MECHANISM SIDE PLATE. IF A BREAKER IS EQUIPPED WITH UNDERVOLTAGE TRIP DEVICE (NV) AS WELL AS SHUNT TRIP COIL,THE "NV" OCCUPIES THE SHUNT TRIP COIL LOCATION WHILE THE SHUNT TRIP COIL IS MOUNTED ON THE LOWER CROSS CHANNEL TO THE LEFT OF THE "NV". EACH SHUNT TRIP COIL ACTS VERTICALLY ON ITS OWN TRIP SHAFT LEVER. BECAUSE THE COILS ARE NOT CONTINUOUSLY RATED, A NORMALLY OPEN AUXILIARY SWITCH CONTACT IS WIRED IN SERIES WITH THE COIL TO OPEN THE TRIP CIRCUIT WHEN THE BREAKER IS OPEN. A.C. OR D.C. POWERED COILS WILL OPERATE TO TRIP AT APPROXIMATELY 50% OF RATED VOLTAGE.

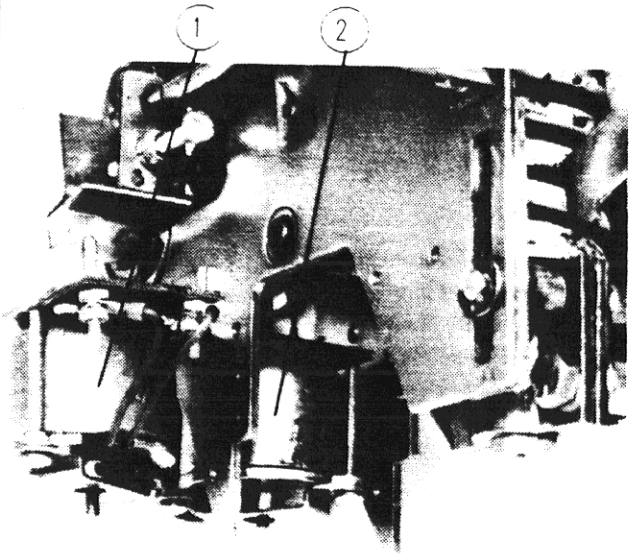


FIG. 4.14 SHUNT TRIP COILS

1. SHUNT TRIP COIL
2. USD RELAY TRIP COIL

4.15 AUXILIARY SWITCH

ON ALL H-3 UNITS A MULTI-SECTION ROTARY TYPE AUXILIARY SWITCH CAN BE PROVIDED (FIG. 4.4.1, ITEM 13). IT IS COUPLED DIRECTLY TO THE CLOSING SHAFT AND OPERATES ON A SNAP-ACTION PRINCIPLE WHICH PROVIDES QUICK BREAK SWITCHING. NO ADJUSTMENT IS REQUIRED AND THE SWITCH IS AVAILABLE IN THE FOLLOWING CONTACT ARRANGEMENTS.

4 POLE, PROVIDING 2 NORMALLY OPEN AND 2 NORMALLY CLOSED.
8 POLE, PROVIDING 4 NORMALLY OPEN AND 4 NORMALLY CLOSED.
12 POLE, PROVIDING 6 NORMALLY OPEN AND 6 NORMALLY CLOSED.
16 POLE, PROVIDING 8 NORMALLY OPEN AND 8 NORMALLY CLOSED.
20 POLE, PROVIDING 10 NORMALLY OPEN AND 10 NORMALLY CLOSED

NOTE THAT CONTACTS AVAILABLE FOR EXTERNAL USE WILL BE REDUCED BY THE NUMBER OF CONTACTS REQUIRED FOR VARIOUS INTERNAL BREAKER CONTROL SCHEMES.

THE FOLLOWING CONTACT RATINGS APPLY:

10 AMPERES UP TO 254V A.C.
1 AMPERE AT 250V D.C.
2 AMPERES AT 125V D.C.

DUE TO SPACE LIMITATIONS, A DIFFERENT MODEL IS USED FOR 20 POLE AUXILIARY SWITCHES, AND 12 POLE SWITCHES ON 14" WIDE BREAKER. THESE SWITCHES ARE NOT RATED FOR D.C. SWITCHING FUNCTIONS.

NORMALLY OPEN AUXILIARY SWITCH CONTACTS ARE IDENTIFIED BY THE SYMBOL "a" ON THE WIRING DIAGRAM, NORMALLY CLOSED BY "b".

4.16 CLOSING COIL (CC)

THIS DEVICE IS SUPPLIED ON ELECTRICALLY OPERATED CIRCUIT BREAKERS AND CONSISTS OF A RECTANGULAR LAMINATED SOLENOID FRAME MOUNTED WITHIN THE FRONT MECHANISM COMPARTMENT (FIG. 4.4.2, ITEM 8). ITS FUNCTION IS THAT OF ROTATING THE CLOSE LATCH THEREBY INITIATING THE CLOSING STROKE. IT MAY BE ENERGIZED BY THE CLOSE BUTTON ON THE FACEPLATE OR BY A REMOTE CONTROL DEVICE.

FOR THE CLOSING COIL TO BE OPERATIVE THE FOLLOWING CONDITIONS MUST BE MET:

(A) BREAKER OPEN
(B) CLOSING SPRING FULLY CHARGED (SPRING LIMIT SWITCH CLOSED).
(C) TRIP LATCH AND LATCH ROLLER ENGAGED. LATCH CHECKING SWITCH CLOSED. (REFER TO 4.20).
(D) ANTIPUMP RELAY RESET. (IF PROVIDED REFER TO 5.3).

THE CLOSING COIL IS IDENTIFIED ON THE WIRING DIAGRAM BY THE SYMBOL "CC".

4.17 CLOSING COIL LIMIT SWITCH AND ANTIPUMPING FEATURE

ALL ELECTRICALLY OPERATED BREAKERS ARE PROVIDED WITH AN ANTIPUMPING FEATURE. ITS PURPOSE IS TO PREVENT REPEATED CLOSING ATTEMPTS WHEN BREAKER IS TRIPPED WHILE THE CLOSING CIRCUIT REMAINS ENERGIZED. (MAINTAINED AUTOMATIC CONTROL CONTACT, ETC.).

FOR BREAKERS CONTROLLED BY LONG TIME OR PERMANENTLY MAINTAINED CLOSE CONTACTS, THE OPTIONAL ANTIPUMP RELAY MUST BE USED. REFER TO SECTION 5.3 FOR DETAILS.

THE STANDARD FEATURE, FOR BREAKERS CONTROLLED BY MOMENTARY, OR SHORT TIME MAINTAINED CLOSE CONTACTS AND REQUIRING CLOSING SPRING CHARGED BREAKER OPEN POSITION ONLY, DOES NOT INCORPORATE THE ANTIPUMP RELAY

THE ANTIPUMPING FUNCTION IS PROVIDED BY THE CLOSE COIL (CC) LIMIT SWITCH MOUNTED BELOW THE COIL (FIG. 4.4.2, ITEM 14). WHEN THE CLOSING SPRING IS CHARGED NORMALLY CLOSED "CC" SWITCH CONTACT IN THE SPRING CHARGING MOTOR CIRCUIT OPENS AND REMAINS OPEN UNTIL THE CLOSE COIL IS ENERGIZED

5. OPTIONAL COMPONENTS

5.1 MECHANICAL OPERATIONS COUNTER

A FIVE DIGIT MECHANICAL COUNTER CAN BE SUPPLIED, MOUNTED IN THE FACEPLATE OF THE BREAKER (FIG. 3.3.2, ITEM 7).

THIS DEVICE IS MECHANICALLY DRIVEN BY THE "CHARGED/DISCHARGED" INDICATOR. THE COUNTER OPERATES ONCE FOR EACH CHARGING OF THE BREAKER MAIN SPRING. NO ADJUSTMENT OR MAINTENANCE IS REQUIRED FOR SUCCESSFUL COUNTER OPERATION.

OPERATIONS COUNTERS ARE RECOMMENDED WHERE BREAKERS WILL BE SUBJECTED TO FREQUENT OPERATIONS AS AN INDICATOR OF THE RECOMMENDED MAINTENANCE INTERVALS.

5.2 CELL SWITCHES

CELL SWITCHES MOUNTED IN THE CRADLE CAN BE PROVIDED WHEN REQUIRED TO SERVE AS POSITION INDICATORS OR AS INTERLOCK BYPASSES. THE SWITCHES ARE OPERATED BY A BRACKET ATTACHED TO THE BREAKER FRAME WHEN BREAKER IS CRANKED INTO THE "OPERATING" POSITION.

EACH SWITCH CONTAINS ONE NORMALLY CLOSED AND ONE NORMALLY OPEN ELECTRICALLY SEPARATE CONTACT. A TOTAL OF SIX SWITCHES CAN BE SUPPLIED. THESE CONTACTS ARE RATED 10 AMPERES UP TO 300V A.C.

ON BREAKER FRAME SIZES 14 INCH AND 21 INCH (UP TO 2000 AMP), CELL SWITCHES MOUNT ON TOP OF THE CRADLE BACKPAN. ON LAGER FRAME BREAKERS THEY MOUNT IN LINE WITH THE SECONDARY DRAWOUT CONTACTS.

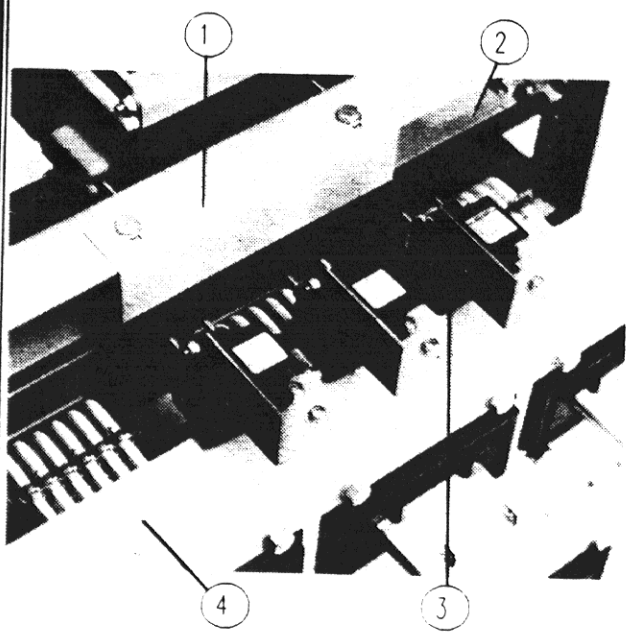


FIG. 5.2.1 CELL SWITCHES
1. CELL SWITCH OPERATING BRACKET
2. BREAKER FRAME
3. CELL SWITCH
4. CRADLE BACKPAN

5.3 ANTIPUMP RELAY

BREAKERS CONTROLLED BY LONG TIME OR PERMANENTLY MAINTAINED CLOSE CONTACTS INCORPORATE TWO CLOSE COIL (CC) LIMIT SWITCHES AND AN ANTIPUMP RELAY (A.P.R.). WHEN THE CLOSING COIL IS ENERGIZED, BOTH "CC" SWITCHES ARE OPERATED. A CLOSING CONTACT OF ONE "CC" SWITCH NOW ENERGIZES THE A.P.R. COIL. ONE OF THE CLOSING A.P.R. CONTACTS PARALLELS THE "CC" SWITCH CONTACT PROVIDING A.P.R. SEAL IN FUNCTION. A CLOSING CONTACT OF THE SECOND "CC" SWITCH PARALLELS A NORMALLY CLOSED A.P.R. CONTACT IN THE CLOSING COIL CIRCUIT MAINTAINING CONTROL POWER TO THE CLOSING COIL UNTIL THE CLOSING SPRING IS FULLY RELEASED AND THE BREAKER CLOSED. SPRING RELEASE CAUSES DE-ENERGIZATION AND RESET OF THE CLOSING COIL AND "CC" SWITCHES WHILE THE A.P.R. REMAINS ENERGIZED AND ITS HELD OPEN CONTACT IN THE CLOSING COIL CIRCUIT BLOCKS RE-ENERGIZATION OF THE SAME UNTIL THE MAINTAINED CLOSING CONTACT IS OPENED. THIS OPTION ALLOWS SPRING CHARGING MOTOR RE-ENERGIZATION IMMEDIATELY AFTER CLOSING SPRING DISCHARGE REGARDLESS OF OPEN OR CLOSED BREAKER POSITION THEREBY PROVIDING FOR FAST TRIP - RECLOSE OPERATION.

THE ANTIPUMP RELAY AND ITS CONTACTS ARE IDENTIFIED ON THE WIRING DIAGRAM BY THE SYMBOL "Y".

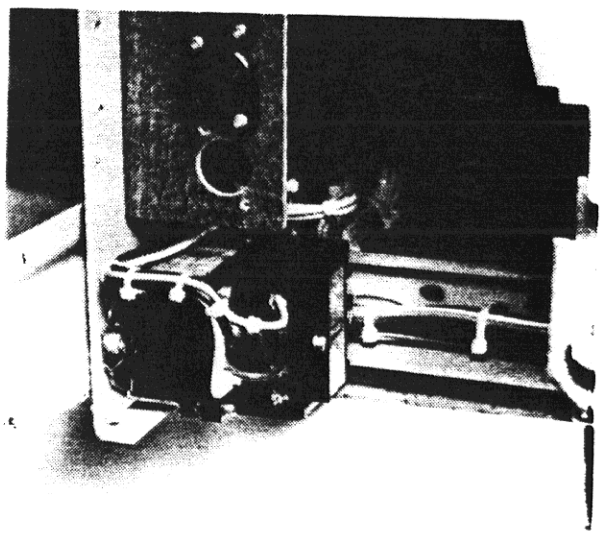


FIGURE 5.3 ANTIPUMP RELAY

5.4 UNDERVOLTAGE TRIP DEVICE

THE UNDERVOLTAGE TRIP DEVICE IS A SPRING LOADED RECTANGULAR SOLENOID WHICH WILL TRIP THE BREAKER WHEN ITS SUPPLY VOLTAGE TO THE SOLENOID DROPS BELOW A PREDETERMINED LEVEL AND HOLDS THE BREAKER IN A TRIP FREE STATE UNTIL SUPPLY VOLTAGE RETURNS. THE UNDERVOLTAGE TRIP WILL DROP TO TRIP THE BREAKER WHEN SUPPLY VOLTAGE DROPS BELOW APPROXIMATELY 50% AND WILL PULL IN OR RESET WHEN VOLTAGE RISES ABOVE 85%.

THIS DEVICE CAN BE SUPPLIED TO OPERATE INSTANTANEOUSLY OR WITH THE ADDITION OF A MECHANICAL ESCAPEMENT MECHANISM, CAN HAVE AN ADJUSTABLE 0 TO [illegible] SECOND DELAY.

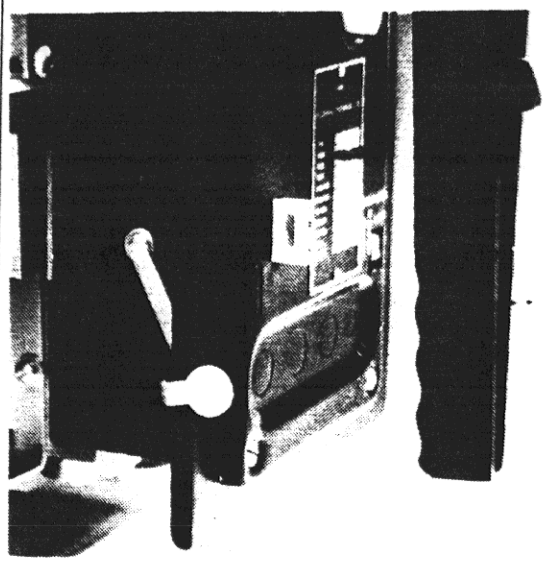


FIG. 5.7 DOOR INTERLOCK

5.8 FACEPLATE KEY INTERLOCK AND CELL KEY INTERLOCK

A SINGLE OR DOUBLE FACEPLATE MOUNTED KEY INTERLOCK CAN BE PROVIDED ON ALL BREAKERS. THE PLUNGER OF THE LOCK ACTS INTERNALLY ON THE MANUAL TRIP BUTTON TO HOLD THE BREAKER TRIP FREE AND PREVENT CLOSING WHEN THE KEY HAS BEEN TURNED AND REMOVED. ON ELECTRICALLY OPERATED BREAKERS, THIS ACTION ALSO OPERATES THE LATCH CHECK SWITCH WHICH ISOLATES THE CLOSE COIL CIRCUIT.

THE FACEPLATE KEY INTERLOCK USES A TYPE VF LOCK WITH A $^{3}/_{8}$ INCH PROJECTION.

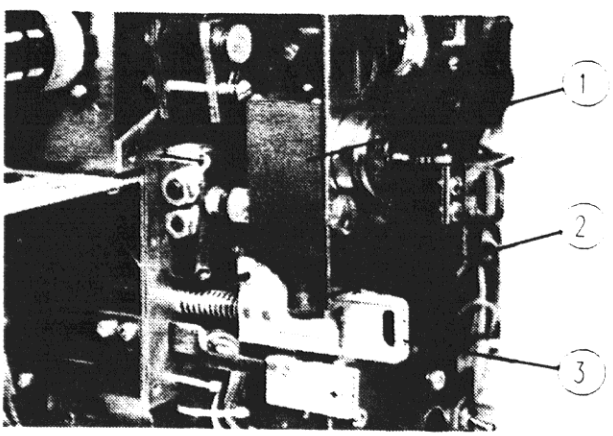


FIG. 5.8.1 FACEPLATE KEY INTERLOCK (SHOWN WITH THE BREAKER HELD TRIP-FREE AND THE KEY FREE FOR REMOVAL).

1. LOCK
2. PLUNGER
3. MANUAL TRIP BUTTON

WHEN IT IS MORE DESIRABLE TO HAVE THE KEY INTERLOCK MOUNTED ON THE BREAKER CUBICLE RATHER THAN ON AN INDIVIDUAL BREAKER, A CELL KEY INTERLOCK CAN BE PROVIDED. THIS IS A CABLE OPERATED DEVICE WHICH EMPLOYS A LOCK MOUNTED ON BREAKER CUBICLE DOOR. A CABLE CONNECTS THE LOCK TO A SHAFT AND LEVER ASSEMBLY MOUNTED ON THE CRADLE. A SEPARATE CABLE SYSTEM ON THE BREAKER IS OPERATED BY THE CRADLE LEVER TO TRIP THE BREAKER, AND HOLD IT TRIP-FREE WHEN THE KEY HAS BEEN REMOVED FROM THE LOCK. THIS INTERLOCK IS ONLY FUNCTIONAL WHEN THE BREAKER IS IN THE "OPERATING" POSITION.

5.9 MECHANICAL INTERLOCK

MECHANICAL INTERLOCKS ARE AVAILABLE ON ALL H-3 BREAKER FRAME SIZES (EXCEPT FOR 14 INCH SIZE). THEY ARE USED TO MECHANICALLY INTERLOCK BREAKERS IN A TRANSFER SCHEME. MECHANICAL INTERLOCKS ENSURE ONLY ONE BREAKER IS CLOSED WHILE THE OTHER IS HELD IN A TRIP FREE POSITION.

MECHANICAL INTERLOCKS CONNECT WITH FLEXIBLE CABLE THE CLOSING SHAFT OF ONE BREAKER TO THE TRIP SHAFT OF A SECOND BREAKER, AND VICE VERSA. DRAWOUT BREAKERS ARE INTERLOCKED BY CABLE CONNECTIONS BETWEEN THE TWO CRADLES. THERE ARE NO PERMANENT CONNECTIONS BETWEEN THE BREAKER AND MATCHING CRADLE WHEN INTERLOCKING IS SUPPLIED, SO THE BREAKER CAN BE FREELY WITHDRAWN FROM THE CELL. MECHANICAL INTERLOCKS ARE OPERABLE ONLY WHEN THE BREAKER IS IN THE "OPERATING" POSITION. WHEN WITHDRAWN TO THE "TEST" POSITION, BREAKERS ARE NOT INTERLOCKED AND CAN BE TEST OPERATED IN THE NORMAL MANNER.

MECHANICAL INTERLOCKS ARE PRESET AT THE FACTORY AND REQUIRE NO ADJUSTMENT.

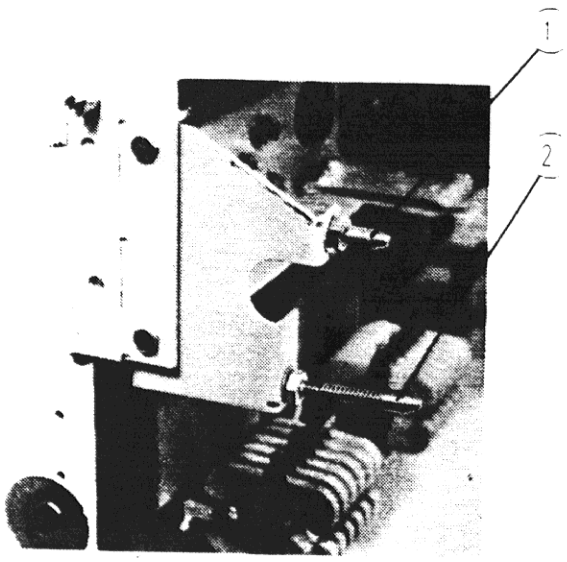


FIG. 5.9.1 BREAKER PORTION OF MECHANICAL INTERLOCK
UPPER PLUNGER CONNECTED TO CLOSING SHAFT
LOWER PLUNGER CONNECTED TO TRIP SHAFT

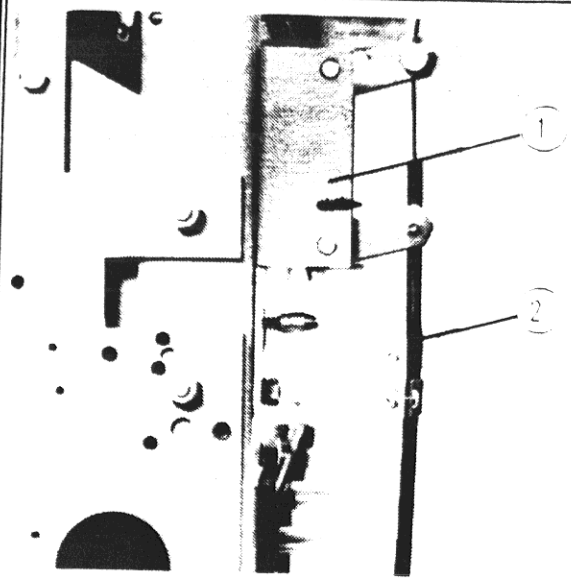


FIG. 5.9.2 CRADLE PORTION OF MECHANICAL INTERLOCK
1. INTERLOCK BRACKET ASSEMBLY
2. CABLES TO OTHER CRADLE

5.10 SHUTTERS

SHUTTERS ARE AVAILABLE ON MOST FRAME SIZES OF BREAKERS TO COVER BOTH LINE AND LOAD MAIN CONTACT STABS INSIDE THE CRADLE.

THEY ARE CLOSED, COVERING THE CONTACTS WHEN BREAKER IS WITHDRAWN FROM THE "OPERATING" POSITION AND ARE OPENED, EXPOSING THE CONTACTS WHEN BREAKER IS CRANKED IN TO THE "OPERATING" POSITION.

A PADLOCK BRACKET IS PROVIDED SO THAT SHUTTERS CAN BE LOCKED IN THE CLOSED POSITION WHEN THE BREAKER IS REMOVED FROM THE CRADLE.

THE SHUTTER MECHANISM IS OPERATED BY THE BREAKER FRAME.

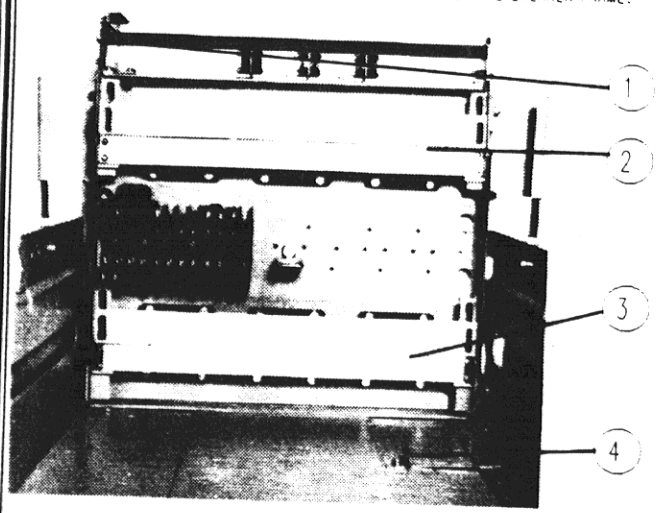


FIG. 5.10.1 SHUTTERS – CLOSED POSITION
1. OPERATING MECHANISM
2. LINE SIDE BARRIER
3. LOAD SIDE BARRIER
4. PADLOCK BRACKET

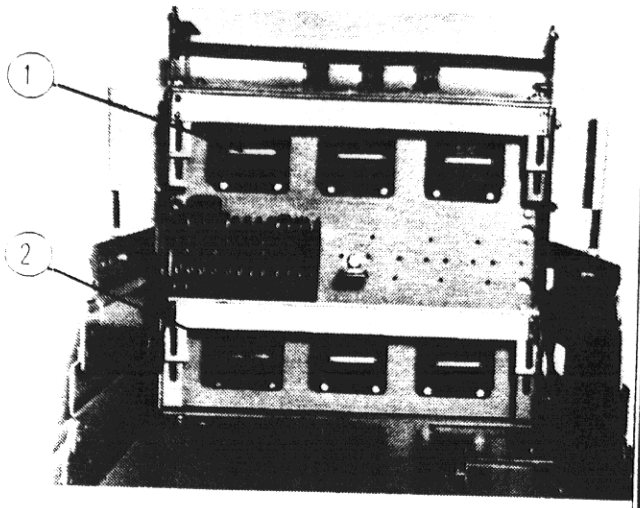


FIG. 5.10.2 SHUTTERS – OPEN POSITION
1. LINE SIDE CONTACT STAB
2. LOAD SIDE CONTACT STAB

6. PRE-SERVICE INSPECTION

THE FOLLOWING ITEMS SHOULD BE SPECIFICALLY CHECKED BEFORE A BREAKER IS PLACED IN SERVICE OR THE CONTROL CIRCUIT IS ENERGIZED.

THE BREAKER SHOULD BE ROLLED OUT OF THE COMPARTMENT ON THE [illegible] DOWN CRADLE RAILS, OR PLACED ON A BENCH FOR BETTER ACCESSIBILITY. [illegible] FIXED MOUNTED BREAKERS, ENSURE THAT THEY ARE ISOLATED FROM BOTH MAIN AND CONTROL POWER.

6.1 MAKE A VISUAL INSPECTION TO ENSURE THAT NO PARTS HAVE BEEN DAMAGED OR FORCED OUT OF ALIGNMENT.

6.2 CHECK ALL THE CONTROL WIRING TO ENSURE THAT IT HAS NOT BEEN DAMAGED.

6.3 CHECK THE DOOR INTERLOCK LEVER, FACE KEY INTERLOCK AND MECHANICAL INTERLOCK MECHANISM FOR FREEDOM OF MOVEMENT IF SUPPLIED.

6.4 ENSURE THAT THE USD RELAY SETTINGS CONFORM WITH THE REQUIRED TRIPPING CHARACTERISTICS.

6.5 OPERATE BREAKER SEVERAL TIMES MANUALLY TO ENSURE CORRECT OPERATION. NOTE THAT IF AN UNDERVOLTAGE TRIP DEVICE IS INSTALLED, ITS MECHANISM MUST BE PHYSICALLY BLOCKED IN THE OPERATED POSITION, SINCE WITHOUT CONTROL POWER, IT WILL HOLD THE CLOSING MECHANISM IN A TRIP STATE AND PREVENT CLOSING. THE SAME APPLIES TO A DOOR INTERLOCK IF INSTALLED. THE MANUAL TRIP BUTTON MUST BE LOCKED IN THE "OUT" POSITION OR THE INTERLOCK LEVER BLOCKED IN THE "IN" POSITION WHEN THE CUBICLE DOOR IS NOT CLOSED.

7. BASIC BREAKER MAINTENANCE

7.1 MAINTENANCE REQUIREMENTS

TYPE H-3 AND HL-5 BREAKERS SHOULD UNDERGO SYSTEMATIC INSPECTION, LUBRICATION AND SERVICING AT THE FOLLOWING INTERVALS:

EVERY 1750 OPERATIONS FOR 600 AND 800 AMP BREAKERS.
EVERY 500 OPERATIONS FOR 1600 AND 2000 AMP BREAKERS.
EVERY 250 OPERATIONS FOR 3000 AMP AND ABOVE.

IN MANY INSTALLATIONS, IT MAY TAKE YEARS FOR A BREAKER TO REACH THESE NUMBERS OF OPERATIONS. FOR THESE CASES ANNUAL MAINTENANCE SHOULD BE PROVIDED. FOR BREAKERS OPERATING IN VERY CLEAN ENVIRONMENTS, THIS INSPECTION PERIOD COULD BE EXTENDED TO 2 YEARS. CONVERSELY, BREAKERS WHICH OPERATE IN VERY DUSTY, CORROSIVE OR OTHERWISE ADVERSE ENVIRONMENTS MAY REQUIRE INSPECTIONS EVEN MORE FREQUENTLY.

SECTION 7.2 CONTAINS A LIST OF THE MAINTENANCE TOOLS AND SUPPLIES THAT WILL BE REQUIRED AND SUMMARY/CHECKLIST OF THE BASIC MAINTENANCE PROCEDURES.

SECTION 7.3 DESCRIBES THE FULL PROCEDURE.

7.2 TOOLS AND CHECKLIST

THE FOLLOWING TOOLS AND SUPPLIES WILL BE VALUABLE FOR BASIC BREAKER MAINTENANCE:

- AN ASSORTMENT OF SLOT AND ROBERTSON HEAD SCREWDRIVERS.
- A WRENCH AND SOCKET SET (IN PARTICULAR, A $^{7}/_{16}$ INCH "DEEP" SOCKET IS USEFUL FOR REMOVING ARC CHUTES).
- A FEELER GAUGE.
- AN EMERGENCY CHARGING HANDLE FOR ELECTRICALLY OPERATED UNITS.
- A DRAWOUT CRANK (IF NONE IS AVAILABLE, A $^{1}/_{2}$ INCH DRIVE RATCHET AND EXTENSION CAN BE USED).
- A SLOW-CLOSE HANDLE, DEFLECTION GAUGE, DEFLECTION AND DIFFERENTIAL SHIMS AND A SMALL PIECE OF BEAR-TEX OR SIMILAR ABRASIVE FIBRE MATERIAL, ALL OF WHICH ARE AVAILABLE FROM FEDERAL PIONEER (SEE SECTION 9.1).
- IF THE MECHANISM IS VERY DIRTY A CLEANING SOLVENT MAY BE REQUIRED.
- FOR LUBRICATION, SAE30 OIL AND LUBRIPLATE LO-TEMP GREASE.

MAINTENANCE SUMMARY/CHECK LIST

1. REMOVE OR ISOLATE BREAKER
2. REMOVE AND INSPECT ARC CHUTES, FLASH SHIELDS, FACEPLATE
3. CLEAN BREAKER
4. CLEAN MAIN AND SECONDARY DRAWOUT CONTACTS
5. INSPECT MOULDINGS AND HARDWARE
6. INSPECT ARCING CONTACTS
7. INSPECT BRAIDS
8. INSPECT MAIN CONTACTS
9. CLEAN CLOSING MECHANISM AND DRAWOUT MECHANISMS
10. CHECK TRIP LATCH
11. CHECK CLOSE LATCH
12. LUBRICATE
13. CHECK CLOSING MECHANISM TOGGLE
14. CHECK DIFFERENTIAL
15. CHECK DEFLECTION
16. CHECK AND OPERATE CONTROL AND TRIP DEVICES
17. REASSEMBLE
18. CLEAN CRADLE MOULDINGS, CONTACTS
19. INSPECT CRADLE
20. LUBRICATE CRADLE
21. PLACE BREAKER BACK IN SERVICE

7.3 BASIC MAINTENANCE PROCEDURE

1. REMOVE OR ISOLATE BREAKER.

FOR FIXED MOUNTED BREAKERS, BEGIN BY ENSURING THAT THE BREAKER IS ISOLATED FROM BOTH MAIN AND CONTROL POWER SOURCES. TRIP THE BREAKER AND OPEN THE COMPARTMENT DOOR.

FOR DRAWOUT MOUNTED BREAKERS, WITHDRAW THE BREAKER FROM THE CUBICLE (REFER TO SECTION 4.10 REGARDING DRY RUNS). MOVE THE BREAKER TO A BENCH FOR BETTER ACCESS AND VISIBILITY IF POSSIBLE.

BEFORE BEGINNING WORK ON THE BREAKER, CHECK THE BOTTOM OF THE CRADLE FOR ANY HARDWARE, RETAINERS OR BROKEN PARTS. THE SOURCE OF THESE ITEMS SHOULD BE LOCATED AND MISSING HARDWARE OR BROKEN PARTS REPLACED.

2. REMOVE AND INSPECT ARC CHUTES, FLASH SHIELDS, FACEPLATE

BEGIN DISASSEMBLY AND INSPECTION. AS EACH PART IS REMOVED, WIPE CLEAN WITH A DRY RAG AND INSPECT FOR CRACKS OR DISTORTION.

INDEPENDENTLY AND EACH HAS EVEN SPRING PRESSURE. LOOK FOR SIGNS OF OVERHEATING ON THE INSULATING SPACERS BETWEEN WAFERS, ON THE WAFER SPRINGS AND ON THE MOLDED SPRING HOLDERS.

GENERALLY SIGNS OF OVERHEATING ON THE MOVING CONTACT ASSEMBLY INDICATES A HIGH RESISTANCE ACROSS THE MAIN CONTACTS OR INADEQUATE CONTACT PRESSURE.

9. CLEAN THE CLOSING MECHANISM AND DRAWOUT MECHANISM.

REMOVE ANY ACCUMULATED DIRT AND GREASE FROM THE CLOSING MECHANISM. THE USE OF CLEANING SOLVENTS IS DISCUSSED IN THE FOLLOWING SECTION.

ALSO CLEAN THE DRAWOUT MECHANISM. INSERT THE DRAWOUT CRANK AND TURN IT CLOCKWISE TO STOP, CLEAN OFF THE GREASE FROM THE SCREW SHAFT, THEN CRANK IT ALL THE WAY BACK, AGAIN CLEANING THE GREASE OFF.

10. CHECK TRIP LATCH

CHECK THE MOVEMENT OF THE TRIP SHAFT AND CLOSING MECHANISM. ROTATE THE TRIP SHAFT BACK AND RELEASE IT. IT SHOULD ROTATE FREELY AND SPRING BACK TO POSITION. CHECK THE CLOSING MECHANISM BY PARTIALLY CHARGING THE MAIN SPRING JUST TO THE POINT WHERE THE TRIP LATCH BEARING HITS THE CLOSE LATCH AND BEGINS TO ROTATE IT BACK. AT THIS POINT THE SPRING IS ONLY PARTIALLY CHARGED . IT IS HELD IN PLACE BY THE HOLDING PAWL AND CONTACTS CANNOT BE CLOSED WITHOUT FURTHER CHARGING THE SPRING. PUSH THE TRIP LATCH BEARING FORWARD AND RELEASE IT. THE LINKAGE SHOULD MOVE FREELY AND SPRING BACK TO ITS ORIGINAL POSITION. FOLLOWING THIS, COMPLETE THE CHARGING STROKE, CLOSE, THEN TRIP THE BREAKER.

IF THE TRIP SHAFT OR MECHANISM SHOWS RESISTANCE TO MOVEMENT OR IF THE MECHANISM IS VERY DIRTY, IT MAY REQUIRE CLEANING WITH A SOLVENT. BE SURE THE SOLVENT LEAVES NO RESIDUE AND WILL NOT AFFECT THE PLASTICS, OR OTHER MATERIALS IN THE BREAKER. BE CAREFUL THAT THE CLEANER DOES NOT CONTACT ANY MOLDED PLASTIC PARTS, IN PARTICULAR, THE SECONDARY DRAWOUT CONTACTS OR THE ANTI-SINGLE-PHASE UNIT ON HL-3 BREAKERS. THIS LAST DEVICE WOULD BE BEST COVERED OR EVEN REMOVED IF CLEANING THE MECHANISM WITH SOLVENTS.

11. CHECK CLOSE LATCH

CHECK THE SECURITY OF THE LOCKNUTS ON THE CLOSE LATCH ADJUSTING SCREWS. IF THESE ARE LOOSE, CHECK CLOSE LATCH ADJUSTMENT (SECTION 8.2). USING THE MANUAL CLOSE BUTTON OR CLOSE LEVER, OPERATE THE CLOSE LATCH. IT SHOULD MOVE DOWN FREELY AND SPRING BACK TO ITS UPPER POSITION.

12. LUBRICATE THE BREAKER

REFERRING TO THE ACCOMPANYING FIGURES RE-LUBRICATE THE BREAKER.

APPLY SAE 30 OIL TO THE FOLLOWING PARTS:

(1) ALL LINKAGE PIVOTS WITHIN THE MECHANISM.
(2) CLOSING AND DRAWOUT SHAFT BEARINGS.
(3) CLOSE LATCH PIVOT.
(4) CLOSE LEVER PIVOT.
(5) HOLDING PAWL PIVOT.
(6) DRAWOUT MECHANISM.
(7) THRUST BEARINGS ON THE DRAWOUT SCREW SHAFT.
(8) DRAWOUT GATE PIVOT.

ON ELECTRICALLY OPERATED BREAKERS, ALSO OIL THE FOLLOWING:

(9) DRIVING PAWL
(10) SPRING LIMIT SWITCH LEVER PIVOT.
(11) ON 14 INCH FRAME BREAKERS, THE TOP PIVOT OF THE CHARGING CAM.

APPLY A LIGHT WIPE OF LUBRIPLATE LOW-TEMP GREASE TO THE FOLLOWING POINTS:

(12) SLOTS FOR THE SPRING GUIDE PIN.
(13) RATCHET WHEEL TEETH.
(14) DRAWOUT SCREW SHAFT.
(15) CONTACT SURFACES OF THE MAIN DRAWOUT CONTACTS.
(16) CONTACT SURFACES OF THE SECONDARY DRAWOUT CONTACTS.
(17) GROUND CONTACT.
(18) CLOSING SHAFT SUPPORTS.
(19) DRAWOUT WHEEL BEARING.

ON ELECTRICALLY OPERATED BREAKERS, ALSO GREASE THE FOLLOWING:

(20) THE SLOT ON THE RIGHT SIDE OF THE OSCILLATING LEVER (AT THE M[illegible]

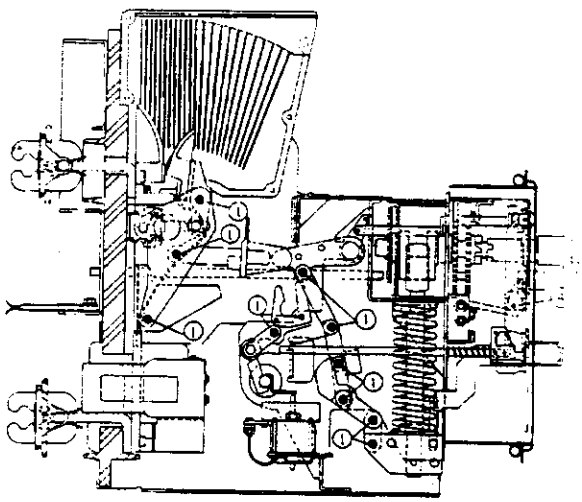


FIG. 7.3.12.1 LINKAGE LUBRICATION

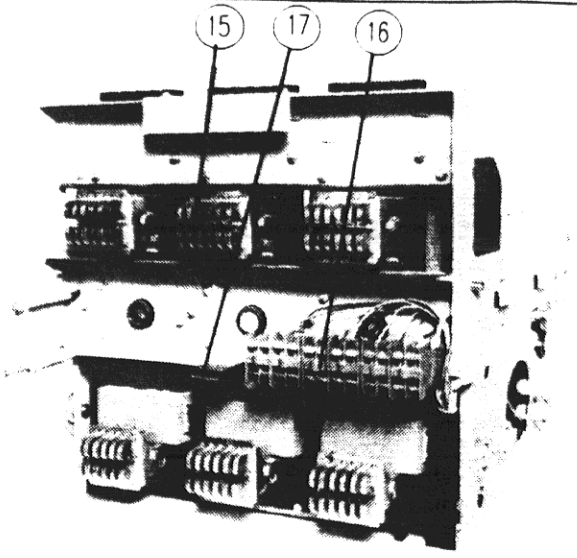


FIG. 7.3.12.6 DRAWOUT CONTACT LUBRICATION

13. CHECK CLOSING MECHANISM TOGGLE

NOW, CHARGE AND CLOSE THE BREAKER AND OBSERVE THE POSITION OF THE TOGGLE PIN. THIS IS BEST DONE BY LOOKING DOWN INTO THE CLOSING MECHANISM FROM ABOVE. IN THE CLOSED POSITION, THE TOGGLE PIN MUST REST AGAINST THE STOPS IN THE MECHANISM SIDEPLATES.

IF THE PIN IS NOT AGAINST THE STOPS, ADJUSTMENT OF THE ECCENTRIC MUST BE DONE BEFORE CONTINUING, REFER TO SECTION.8.1 FOR DETAILED INSTRUCTIONS.

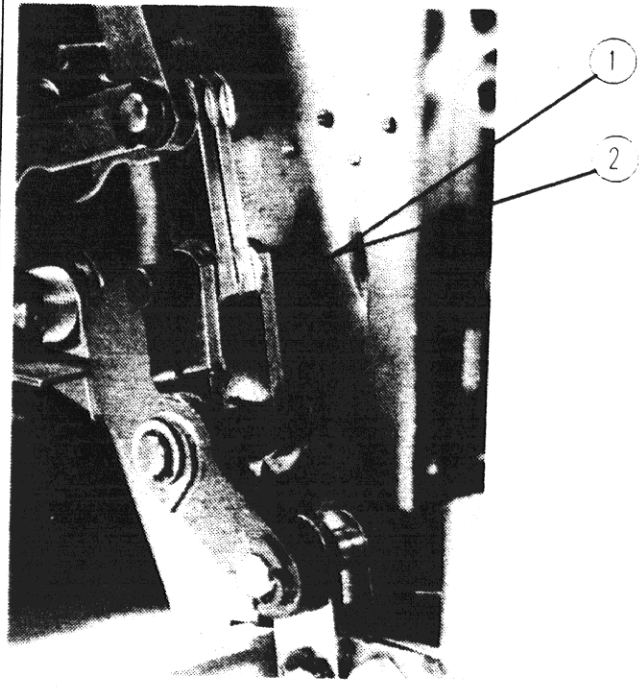


FIG. 7.3.13 TOGGLE PIN.
1. STOP IN MECHANISM SIDEPLATES
2. TOGGLE PIN

14. CHECK DIFFERENTIAL

AS THE MOVING CONTACT CLOSES, THE ARCING CONTACTS TOUCH FIRST. AT THIS POINT, THE UPPER GAP BETWEEN THE MAIN CONTACTS IS TERMED CONTACT DIFFERENTIAL. AS THE MOVING CONTACT CONTINUES, THE ARCING CONTACT BRACKET ROTATES TO BEGIN COMPRESSING THE WAFER SPRINGS. AFTER THE MAIN CONTACTS HAVE TOUCHED, THE FRAME OF THE MOVING CONTACT CONTINUES TO MOVE. THE OVERTRAVEL OF THE FRAME RELATIVE TO THE WAFER CONTACT IS TERMED THE CONTACT DEFLECTION. THIS OVERTRAVEL ALLOWS THE WAFER CONTACTS TO BE FREE FLOATING AND SELF-ALIGNING, HELD AGAINST THE STATIONARY MAIN CONTACTS BY ONLY THE FORCE OF THE WAFER SPRINGS.

BEGIN BY CHECKING THE CONTACT DIFFERENTIAL. WITH THE MAIN SPRING DISCHARGED AND THE CONTACTS OPEN, MANUALLY PUSH THE CONTACTS CLOSED UNTIL THE ARCING CONTACTS TOUCH. THIS IS MOST EASILY DONE USING A SLOW CLOSE DEVICE. THE ARCING CONTACTS OF EACH POLE MAY NOT TOUCH AT EXACTLY THE SAME TIME, SO CHECK EACH POLE SEPARATELY ENSURING THAT THE ARCING CONTACTS ON THAT POLE ARE TOUCHING. USING A FEELER GAUGE, CHECK THE UPPER GAP BETWEEN THE MAIN CONTACTS. NORMAL CONTACT DIFFERENTIAL IS BETWEEN 50 AND 65 THOUSANDTHS OF AN INCH, THOUGH HIGHER DIFFERENTIAL READINGS ARE ACCEPTABLE AS LONG AS TOGGLE PIN IS AGAINST THE STOPS WHEN THE BREAKER IS CLOSED. IF DIFFERENTIAL IS TOO LOW, IT CAN BE INCREASED BY REMOVING THE STATIONARY MAIN CONTACT AND ADDING A SHIM UNDERNEATH IT. CHECK EACH POLE FOR DIFFERENTIAL. IF ANY SHIMS ARE ADDED, BE SURE TO CHANGE AND CLOSE BREAKER AND CHECK THAT THE TOGGLE PIN IS STILL AGAINST THE STOPS.

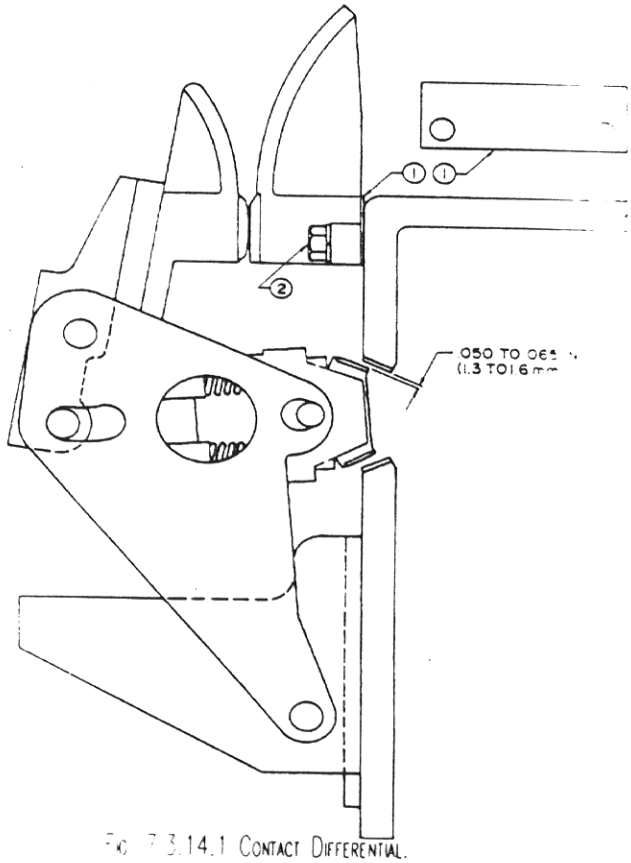


FIG. 7.3.14.1 CONTACT DIFFERENTIAL.
1. ARCING CONTACT MOUNTING SCREW

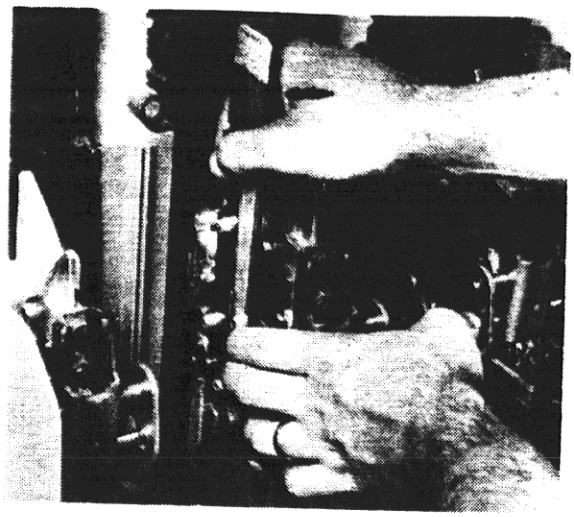


FIG. 7.3.15.4, DEFLECTION READING IN CLOSED POSITION.

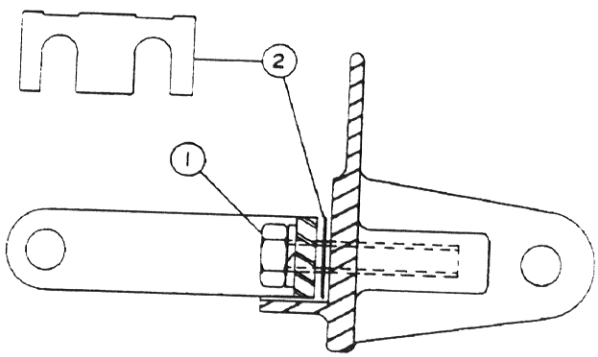


FIG. 7.3.15.5, DEFLECTION ADJUSTMENT.
1. $^{3}/_{8}$–16 HEX BOLT
2. SHIM

16. CHECK AND OPERATE CONTROL AND TRIP DEVICES

CHECK THAT ALL HARDWARE AND RETAINERS ARE SECURE THROUGHOUT THE OPERATING MECHANISM. IN PARTICULAR CHECK THE MOUNTING SCREWS OF SHUNT TRIP COILS, THE CLOSING COIL, UNDERVOLTAGE TRIP OR ANY OTHER DEVICE WHICH MOUNTS ON THE CHARGING OR CLOSING MECHANISMS.

MANUALLY OPERATE THE CLOSE COIL, TRIP COIL AND ANTI–SINGLE–PHASE UNIT, DOOR INTERLOCK, KEY INTERLOCK AND MECHANIC INTERLOCK TO CHECK FOR FREEDOM OF MOVEMENT AND PROPER OPERATION.

17. REASSEMBLE

AFTER CHECKING FOR ANY PARTS OR TOOLS LEFT IN THE BREAKER, BEGIN REASSEMBLING. REMOUNT THE BOX, FLOATING TRIM AND FACEPLATE. BEFORE FULL TIGHTENING THE FACEPLATE SCREWS CHECK THAT THE INDICATORS AND VARIOUS OPERATING BUTTONS MOVE FREELY. IF THE BREAKER IS EQUIPPED WITH A DOOR INTERLOCK, BE SURE THAT THE OPERATING LEVER INSIDE THE BOX IS POSITIONED IN FRONT OF THE OPERATING PIN ON THE MANUAL TRIP BUTTON AND CHECK ITS OPERATION AFTER THE BOX IS MOUNTED.

REINSTALL THE LOWER FLASH SHIELD, THE INTERPHASE BARRIERS, END BARRIERS IF REMOVED AND FRONT FLASH SHIELD. FINALLY, MOUNT THE ARC CHUTES. THE MOUNTING BOLTS FOR THE ARC CHUTES AND LOWER FLASH SHIELDS SHOULD NOT BE TORQUED BEYOND 50 INCH POUNDS. TAKE CARE THAT THE ARC CHUTES ARE PROPERLY SEATED IN THE UPPER BASE MOULDING.

18. CLEAN CRADLE MOULDINGS AND CONTACTS

FOR DRAWOUT BREAKERS, THE CRADLE SHOULD BE CLEANED AND INSPECTED AT THIS TIME IF POSSIBLE. THIS SHOULD ONLY BE CARRIED OUT WHILE POWER, MAIN AND CONTROL, HAS BEEN DISCONNECTED.

WIPE THE MOULDINGS OF THE MAIN POWER STABS. REMOVE GREASE FROM THE MAIN STAB, SECONDARY DRAWOUT CONTACTS AND GROUND STAB.

19. INSPECT CRADLE

CHECK ALL MOLDINGS FOR DAMAGE AND THE MAIN STABS FOR EXCESSIVE WEAR, SCORING OR PITTING. CHECK THE SECONDARY CONTACTS FOR DAMAGE AND CHECK THE SECURITY OF THE WIRING. CLEAN OUT THE BOTTOM OF THE CRADLE. IF A SHUTTER IS INSTALLED, CHECK IT FOR FREEDOM OF OPERATION.

20. CRADLE LUBRICATION

APPLY A LIGHT WIPE OF GREASE TO THE MAIN STABS, THE SECONDARY CONTACTS AND THE GROUND STAB. OIL PIVOT POINTS OF THE SHUTTER MECHANISM, IF PRESENT.

21. PLACE BREAKER BACK IN SERVICE.

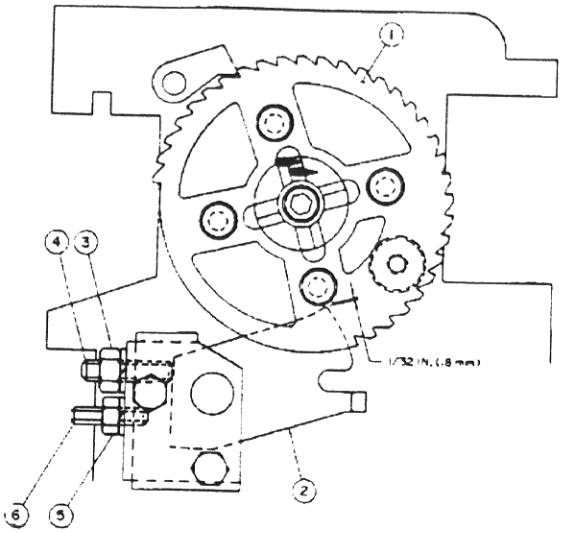


Fig. 8.2.1 Close Latch Adjustment

1. Ratchet Wheel
2. Close Latch
3. Upper Locknut
4. Upper stopscrew
5. Lower Locknut
6. Lower Stopscrew

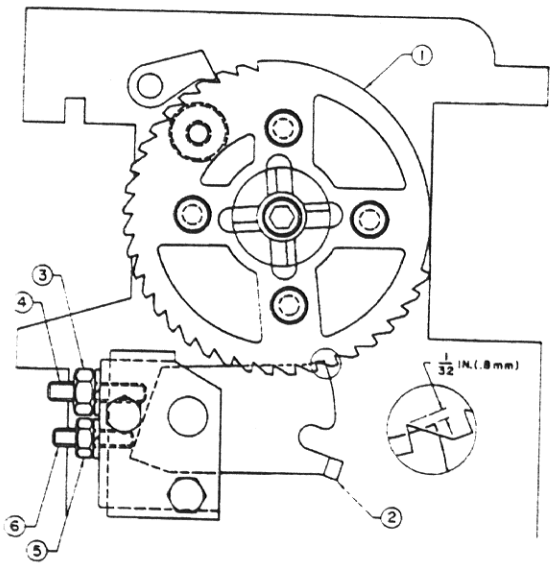


Fig. 8.2.2 Close Latch Adjustment

Referring to Fig. 3.2.1 the adjustment procedure for the upper stopscrew is as follows:

The ratchet wheel assembly is made up of two plates riveted together. The two plates are held apart by spacers located between the plates on the four rivets. Rotate the ratchet wheel until one of the spacers is directly above the nose of the close latch (Item 2). Loosen locknut (Item 3).

Turning the stopscrew (Item 4) adjust the close latch height until there is approximately 1/32 inch (0.8 mm) clearance between the spacer and the nose of the close latch. Hold the stopscrew securely with the Allen wrench while tightening the locknut.

Referring to figure 8.2.2, the adjustment procedure for the lower stop screw is as follows. Be sure that the closing spring is discharged and that the main contacts are open. Loosen locknut (Item 5). Manually depress the close latch (Item 2) until it stops on the lower stopscrew (Item 6). Turning the stopscrew, adjust the close latch height until there is approximately $^{1}/_{32}$ inch (0.8 mm) clearance between the ratchet wheel tooth valley and the nose of the close latch. Hold the stopscrew securely with the Allen wrench while tightening the locknut.

8.3 TRIP LATCH ADJUSTMENT

This adjustment, located on the outside of the left hand side mechanism side plate controls the engagement of the trip latch roller. If this engagement is insufficient, the roller may release during the closing stroke, resulting in failure to close. The main contacts may move but not complete the travel.

To adjust, the following procedure should be used:

With trip shaft lever (Item 1) resting against adjusting screw (Item 2), loosen locknut (Item 3) and turn adjusting screw counter-clockwise two turns. Close the breaker and slowly turn in screw clockwise until the unit trips. Now turn the screw counter closkwise one and one quarter turns and tighten the locknut.

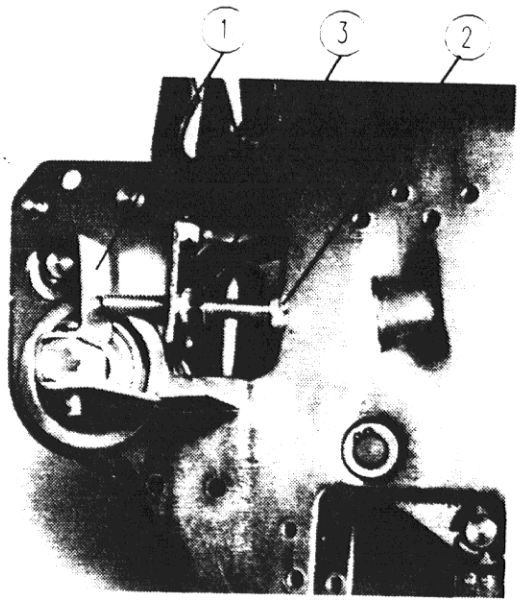


Fig. 8.3.1 Trip Latch Adjustment

1. Trip shaft lever.
2. Adjustment screw
3. Locknut

THE STRIKER AS REQUIRED TO PROVIDE A GAP OF APPROXIMATELY $^{5}/_{16}$ INCH (8.MM) BETWEEN THE STRIKER AND THE TRIP SHAFT LEVER. TIGHTEN THE LOCKNUT FIRMLY.

A VERNIER TIME ADJUSTMENT IN THE FORM OF AN ECCENTRIC IS PROVIDED FOR FINE ADJUSTMENT, INDEPENDENT OF THE SCALE SETTING. IF TRIMMING IS REQUIRED, LOOSEN THE LOCKNUT LOCATED ON THE INSIDE OF THE LEVER AND TURN THE ECCENTRIC COUNTER-CLOCKWISE TO INCREASE TIME, AND CLOCKWISE TO SHORTEN TIME. THE LOCKNUT MUST BE FIRMLY TIGHTENED EACH TIME THE ECCENTRIC IS MOVED.

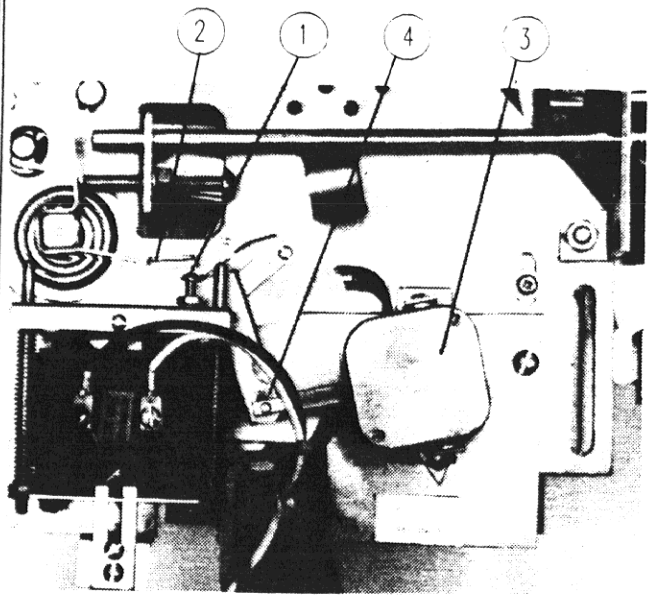


FIG. 8.6.1, UNDERVOLTAGE TRIP DEVICE
1. STRIKER
2. TRIP SHAFT LEVER
3. TIMER
4. VERNIER TIMER ADJUSTMENT

8.7 LATCH CHECK SWITCH

THE LATCH CHECK SWITCH IS ADJUSTED AS FOLLOWS:

WITH THE BREAKER OPEN AND THE CLOSING SPRING DISCHARGED, GENTLY RAISE THE TRIP SHAFT LEVER UNTIL OPERATION OF THE LATCH CHECK SWITCH CONTACTS CAN BE HEARD. RELEASE THE TRIP SHAFT LEVER.

THESE SHOULD BE APPROXIMATELY $^{1}/_{8}$ INCH OVERTRAVEL (AT THE TIP OF THE SWITCH OPERATING LEVER) FROM THE POINT WHEN THE CONTACTS OPERATE, TO THE POINT WHEN THE TRIP SHAFT LEVER IS RELEASED AND RESTS AGAINST ITS STOP SCREW.

IF ADJUSTMENT IS REQUIRED, LOOSEN THE PIVOT SCREW AND LOCKING SCREW AND RAISE OR LOWER THE SWITCH AS REQUIRED. RETIGHTEN BOTH SCREWS FIRMLY.

IN NORMAL OPERATION THE LATCH CHECK SWITCH SHOULD REQUIRE NO READJUSTMENT, BUT IF THE TRIP LATCH ADJUSTMENT IS ALTERED, THE LATCH CHECK SWITCH SETTING MUST BE CHECKED AS ABOVE.

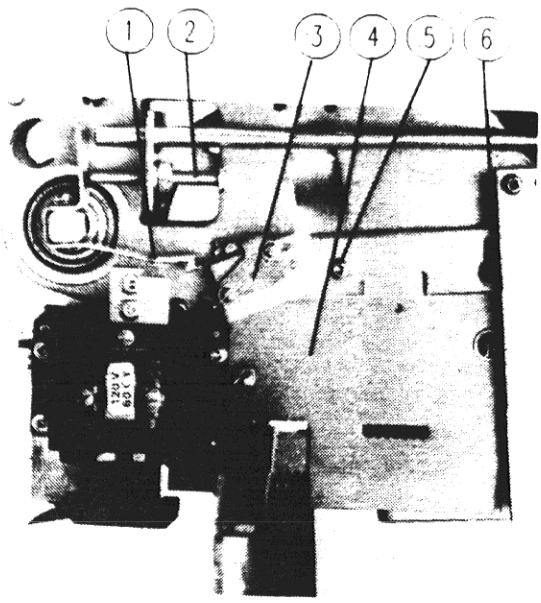


FIG. 8.7, LATCH CHECK SWITCH

1. TRIP SHAFT LEVER
2. TRIP SHAFT STOP SCREW
3. LATCH CHECK SWITCH
4. MOUNTING PLATE
5. PIVOT SCREW
6. LOCKING SCREW

8.8 MECHANICAL INTERLOCK

TO CHECK THE OPERATION OF THE MECHANICAL INTERLOCK MECHANISM, REMOVE THE BREAKER FROM THE CELL. ROTATE THE CLOSING SHAFT USING THE SLOW CLOSE DEVICE. THE UPPER PLUNGER CONNECTED BY THE CLOSING SHAFT SHOULD MOVE FREELY. BY PUSHING THE LOWER PLUNGER CABLE EXTENSION SHOULD PUSH THE TRIP SHAFT LEVER ON RIGHT SIDE MECHANISM AND ROTATE THE TRIP SHAFT TO DISENGAGE TRIP LATCH AND ROLLER. MAKE SURE THE THAT WHEN LOWER PLUNGER IS RELEASED, IT MOVES FREELY TO ITS FULLY RESET POSITION. IN THIS POSITION THERE SHOULD BE APPROXIMATELY $^{1}/_{16}$" (1.6 MM) CLEARANCE BETWEEN TRIP SHAFT LEVER AND CABLE. CLOSE THE BREAKER, THEN PUSH LOWER PLUNGER IN SLOWLY TO MAKE SURE BREAKER TRIPS. IF THE PLUNGERS DO NOT MOVE FREELY, THE CABLE SHOULD BE REMOVED FROM THE SHEATH AND CLEANED TO RESTORE FREE MOVEMENT.

8.9 ANTI-SINGLE-PHASE DEVICE AND BLOWN FUSE INDICATOR

A SIMPLE MECHANICAL CHECK OF PROPER OPERATION OF THE [illegible] CAN BE MADE BY FIRST CLOSING THE BREAKER THEN RAISING EACH PLUNGER [illegible] AND SLOWLY. WHEN THE BREAKER TRIPS, THE PLUNGER SHOULD OVERTRAVEL [illegible] BEFORE REACHING THE END OF ITS STROKE. AN ELECTRICAL TEST [illegible] PERFORMED BY MEANS OF A SINGLE PHASE VARIABLE AC SOURCE, 2[illegible] THE TEST SIGNAL IS APPLIED DIRECTLY TO THE TRIP COIL TERMINALS [illegible] REMOVING THE THREE CONTROL FUSES IN THE CIRCUIT. THIS IS [illegible] THE TRIP COIL FROM THE POWER FUSE. THE COIL SHOULD [illegible] MAXIMUM 70 VOLTS. IN THIS TEST IT SHOULD BE NOTED THAT [illegible] ARE RATED IN NORMAL OPERATION ARE DE-ENERGIZED

9.2 SPARE PARTS

BY THE NATURE OF ITS APPLICATION AND ITS SWITCHING CAPABILITY SPARE PARTS FOR THE CIRCUIT BREAKER SHOULD NORMALLY NOT BE REQUIRED. IF THE UNIT IS GOING TO BE USED FOR FREQUENT LOAD SWITCHING, THEN THE PARTS SHOWN ON THE RECOMMENDED SPARE PARTS LIST SHOULD BE CARRIED IN STOCK. WHEN ORDERING SPARE PARTS, THE COMPLETE NAMEPLATE DATA, ESPECIALLY THE BREAKER SERIAL NUMBER, SHOULD BE PROVIDED TO ENSURE THAT THE CORRECT PARTS ARE SUPPLIED.

9.3 COIL DATA (FIG. 33)

	Rated Control Voltage	Operating Voltage	D.C. OHMS	Minimum Amperes Inrush	Sealed
	120 AC	60	13.0	1.4	
Shunt	240 AC	120	50.0	1.0	
Trip	48 DC	40	13.0	2.0	
	125 DC	40	86.0	2.5	
	250 DC	70	215.0	1.25	
	120 AC	90	30.0	2.45	0.34
	240 AC	180	312.0	1.5	0.15
Shunt	48 DC	40	6.0	8.0	0.2
Close	125 DC	60	50.0	2.2	0.2
	250 DC	150	312.0	0.8	0.1
U/V	120 AC	96	23.0	2.45	0.34
Trip	240 AC	190	312.0	0.8	0.1
	120 AC	85		4	
	240 AC	190		2.5	
Charging	48 DC	40		7	
Motor	125 DC	85		4	
	250 DC	190		2.5	

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