SPECIFIC INFORMATION FOR TYPE 5HV-50 REMOVABLE ELEMENTS

DESCRIPTION, MAINTENANCE, ADJUSTMENTS AND ELECTRICAL TESTS

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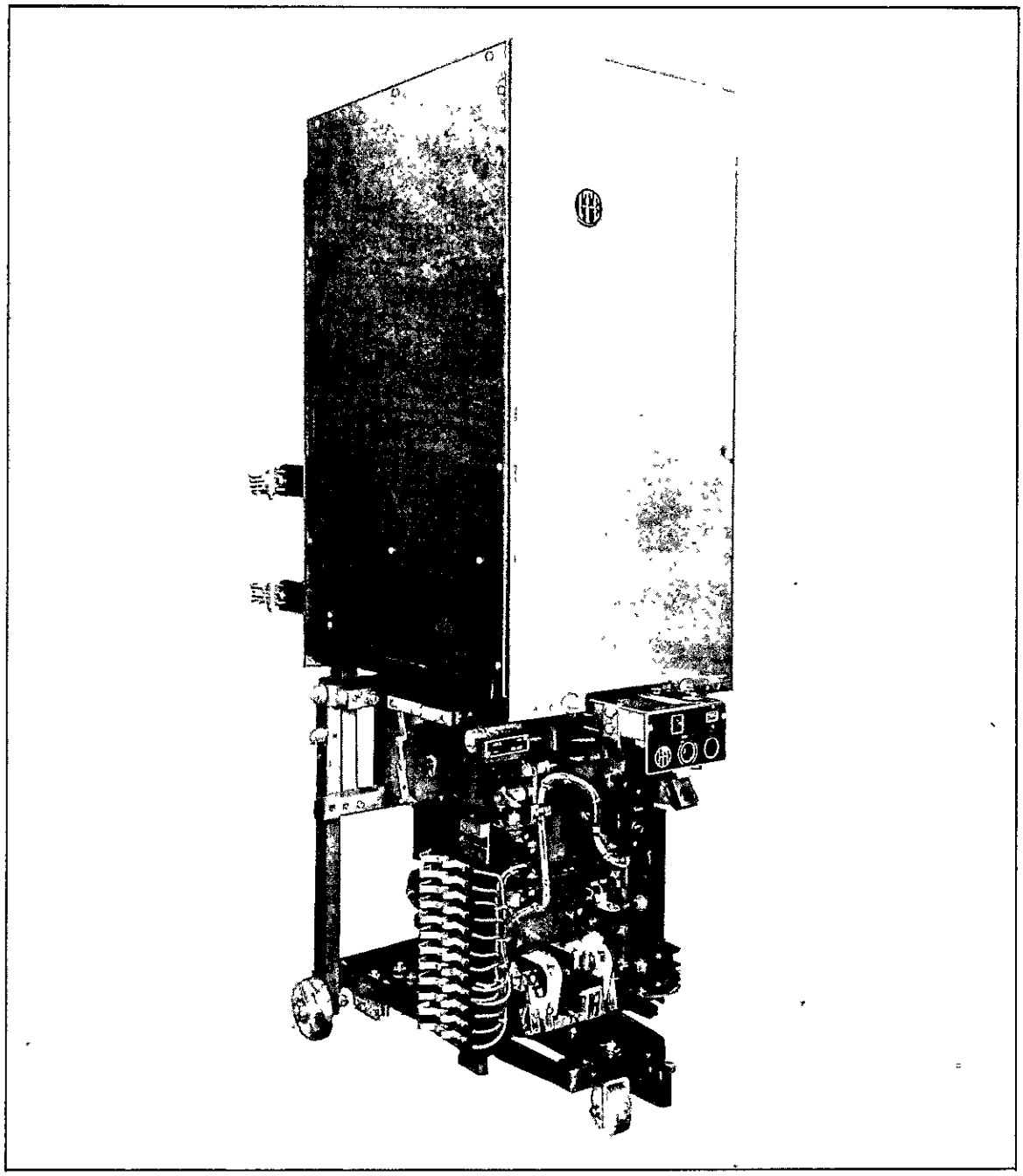

Photo 16865

FIG. 1—Type 5HV-50 Removable Element

INTRODUCTION

It should not be necessary to make any adjustments on the removable element shown in Figure 1 before installation, since adjustments for proper operation were made at the factory.

Under normal operating conditions, adjustments or replacements of parts will not be required.

The factory adjustments, as stated, are those which should be followed when removable elements are periodically inspected, and when installation of renewal parts are needed.

Periodic inspection depends entirely on the amount of usage to which the removable elements are subjected. However, it is recommended that an inspection be made every six months.

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DESCRIPTION

Current Studs

The current studs, Figure 2, are constructed of bare copper and insulated with a rectangular bakelite tube having a conductive inner surface lining to which the bar copper is pressed.

The rear ends of the removable element current studs carry the finger contact parts of the disconnecting device. Multi-finger parts are mounted on the withdrawal portion, and when removed from the housing are easily inspected.

The front end of the upper current stud carries the stationary main and arcing contact. The moving contact assembly is pivoted on the lower current stud. Lower contact inserts are brazed on the lower studs. The lower stud also supports the contact pressure spring.

Bridge

The bridge assembly, Figure 2, is comprised mainly of parallel copper bars to carry the load current with the arcing contacts supported between them. No pig tails are used, and contact springs are located close to the pivot stud.

Operation through an insulated pivot pin located above the physical center of the bridge arm produces a "blow-on" action. At higher currents magnetic forces tend to increase contact pressure at all points. Spring biased pivoting in an inclined, elongated bushing at the stud connection end raises the bridge at the end of the closing stroke, wiping contacts and imparting positive contact pressure.

Contact Arm

The arcing contact arm, Figure 2, with an arc resistant elbow contact brazed on its upper leading edge is mounted between the two bridge members, and insulated at its pivot pin which is supported at the upper end of the bridge bars. The lower end is connected to two copper links which ride on a flat sided pin capable of following their angular motion while supported by the bridge bars. A strong spring located between the bars provides high pressure contact between all the parts making up the current path plus contact pressure for the arcing contact. The effective length of current path below the pivot pin is about twice that above it, thus making a corresponding difference in magnetic forces.

Blowout Structure

The blowout structure, Figure 2, is supported directly on the back panel supports and located directly above the main contacts and consists of a blowout coil and its iron core. The core plates directly above the main contacts completely cover the field of the arc and serve as supports for the arc chute.

The side blowout iron plates form rails supporting the arc chute which is latched when fully in place.

Arc Chute

The arc chute, Figure 2, mounted above the contacts provides a positive and efficient arc interruption. It consists of insulation side walls, front and back arc runners, and a series of ceramic plates mounted in spaced relation, transverse to the arc path, all in a strong magnetic blow-out field which forces the arc into the arc chute.

Specially located plates, below the outside arcing horn, combined with the long travel of arcing contact, effectively interrupt low magnetizing currents and low arc charging currents.

The complete arc chute assembly is removable for inspection without the use of any tools.

Interphase Barrier

The interphase barrier, Figure 1, provides ample insulation between phases in the element and is interlocked so as to make removal impossible with the element in the operating position. This barrier is a complete structure which can be handled by one man.

Operating Mechanism

The operating mechanism is located below the contact structure. The mechanism is conventional, having the usual toggle system for transmitting the closing force of the solenoid.

The mechanism is designed to require very little force to trip the element. This is necessary for some needs which might require a transformer trip. The transformer trip works directly from the current transformers without relays.

The elements are mechanically trip free, making it impossible to close on a fault when provided with an overcurrent protective device. As soon as the contacts touch under such conditions, the trip coil energizes the trip mechanism releasing the tripping toggle to allow the partly compressed opening springs to return the contacts to fully open position.

Solenoid

The solenoid is attached directly below the operating mechanism and uses the same system of levers. The solenoid plunger through the push rod actuates the toggles of the operating mechanism when the solenoid coil is energized.

A solenoid "bb" switch operates at the end of the plunger stroke. This switch in turn opens the solenoid coil circuit.

Control Panel

The control panel as shown in Figures 2 and 4 serves as a shelf on which are mounted various trip units. The shunt trip is mounted on the left hand side. Transformer trip units may also be supplied with time delay.

A type R-14 trip free control relay used in the closing circuit, protects against pumping or repetition of the closing strokes and any damage to the closing coil which is not designed for continuous service. Further information for this control relay can be found in Bulletin IB-1003-R14.

An associate resistor is also mounted on the control panel. On the back of the panel is a six contact auxiliary switch. A second six contact switch may be added when necessary. Further information on this auxiliary switch is found in Bulletin IB-1003-AUX.

The separable control contacts as shown in Figures 2 and 4 are mounted on each side of the control panel. A maximum of 24 contacts can be supplied on each removable element.

In addition to the above units, a latch checking switch can be furnished for the use of reclosing relays.

Ninety percent of all the wiring required on the removable element is done on the panel, which is drilled to receive any or all of the units mentioned above. Any additions to the breaker can be made without the necessity of additional drilling.

Ground Connection

The ground connection mounted to the bottom rear cross frame bracing, provides a positive clamping action upon engagement with the stationary ground bus in the housing.

Racking and Visual Indicator Assembly

The assembly as shown in Figure 4 is located at the front directly above the control panel. The visual indicator plate fastens to a supporting bracket. On this plate is an opening for the visual indicator, an operation counter, a center opening for racking the element from test to operating position, or vice versa. Whenever the element is in the closed position the racking opening is closed automatically by a shutter, thus preventing racking in the element until opened.

The manual trip button is also found on this indicator plate.

Indicator plates have been installed for the purpose of showing the position of the locking bar.

For electrical operation of the element, the close and trip buttons found on the plate adjacent to the racking and indicator plate are used to operate the element when in the test position, but will not operate element when in the closed position.

The name plate of the removable element is attached to the top of the racking and indicator assembly and contains all the information concerning the interrupting rating and serial number identification. Position of the pointer indicates when the removable element has been fully racked in to operating position.

When the element has been racked to test position, it has been moved four inches forward from operating position. In this position the element has been completely disconnected from the bus. However, the control separable contacts are still in engagement, permitting the element to be electrically operated while being tested.

REMOVABLE ELEMENT TRIPPING EQUIPMENT

The removable element tripping equipment is designed to fit the various applications of such a device. Tripping is normally accomplished through overcurrent relays and a shunt trip attachment, which may be supplied for either d-c or a-c operation without rectifiers.

Provision is also made for mounting 5 ampere transformer trip coils for tripping the removable element directly from the secondary of current transformers.

Capacitor tripping may be used with the shunt trip coil when no separate tripping source is available. Another tripping scheme that may be used in tripping reactors with 3 ampere coils and circuit closing protective relays.

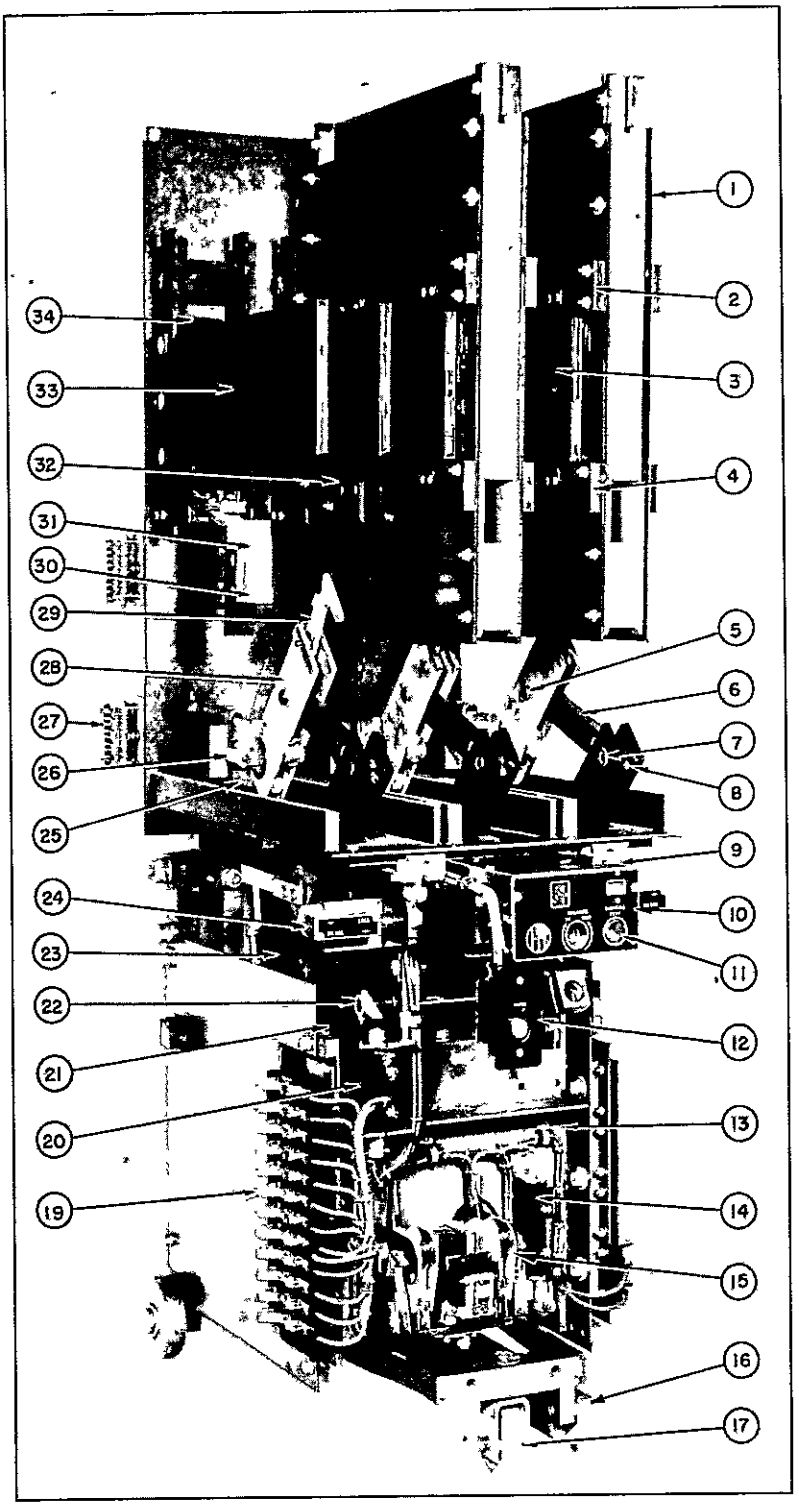
INTERLOCKS

Interlocks are provided to protect the operator and the removable element mechanism under all known conditions. The interlocks prevent movements of the element into or out of the operating position while in the closed position.

These interlocks consist of two parts:

1. One prevents the insertion of the racking handle unless the element is in the open position.
2. The other is such, that at all positions of the removable element between the "TEST" and connected "OPERATING" positions, the latch of the element is held in the disengaged position; so that, the element may not be closed either manually or electrically. This interlock which holds the latch in the disengaged position is mounted on the element and operated by the racking bar as shown in Figure 3.

A key interlock which is not standard equipment is available, and only used when specified. The key is removable only when the removable element is in the disconnect or "TEST" position.



1 ARC CHUTE
2 SUPPORT STRIP (upper)
3 SPRING CLIP
4 SUPPORT STRIP (lower)
5 INNER LINK PIN
6 INSULATING LINK
7 OUTSIDE LINK PIN
8 ADJUSTING SCREW
9 NAME PLATE (element)
10 NAME PLATE (indicator)
11 MANUAL TRIP BUTTON
12 TEST SWITCH
13 CONTROL PANEL
14 RESISTOR
15 CONTROL RELAY (R14)
16 GUIDE BAR
17 FRONT WHEEL
18 GROUND CONNECTION (not shown)
19 SECONDARY DISCONNECTING DEVICE
20 SHUNT TRIP
21 AUXILIARY SWITCH
22 TRIPPER BAR
23 OPERATING MECHANISM
24 LOCKING BAR
25 CURRENT STUD (lower)
26 BRIDGE SPRING
27 PRIMARY DISCONNECTING DEVICE
28 BRIDGE (main contact)
29 ARC CONTACT ARM
30 MAIN CONTACT (stationary)
31 ARC CONTACT (stationary)
32 AUXILIARY BLOWOUT IRON PLATE
33 BLOWOUT IRON PLATE
34 BLOWOUT COIL

Photo 14562-A

FIG. 2—Type 5HV-50 Removable Element
Barrier and Arc Chute Removed to Show Contact Structure

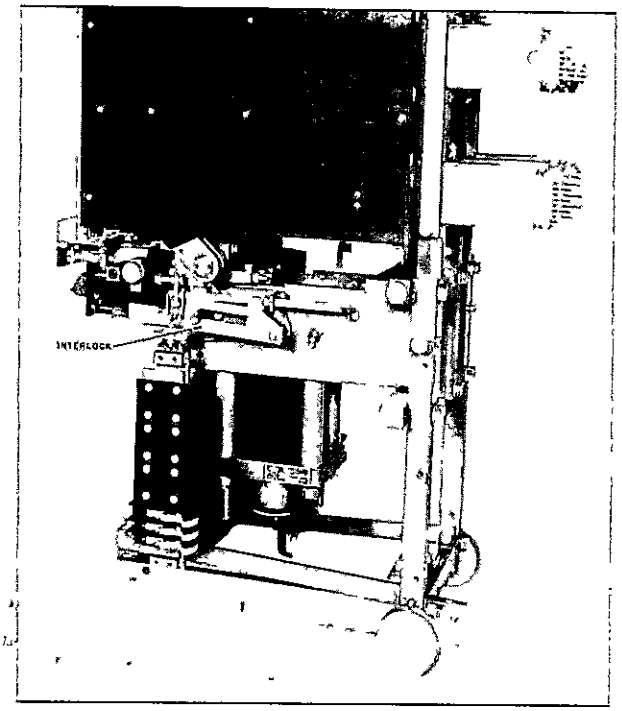


Photo 14561-A

FIG. 3—Type 5HV-50 Interlock

INTERRUPTING CAPACITY

In addition to the usual temperature, operation, potential and life tests made in the development of this removable element, a comprehensive series of interrupting tests have been made. These have been conducted at various operating voltages and under conditions that may be encountered in service. They prove that the interrupting ability of the element is well above the stated interrupting rating.

MAINTENANCE

Inspection should be made to determine the contacts and electrical connections of the removable element. This inspection can be made by measuring the drop across the removable element. To obtain accurate reading, pointed terminals of a low direct current voltage should be used. The measured d-c drop between the ends of the main studs, at the rear of the removable element should be less than 20 millivolt at rated current.

All mounting screws, supporting assemblies such as operating mechanism and operating accessories, should be tight against their supporting members.

1 AUXILIARY SWITCH
2 ADJUSTING NUT (shunt trip)
3 COIL (shunt trip)
4 ARMATURE (shunt trip)
5 SEPARABLE CONTROL CONTACTS (moving)
6 RESISTOR
7 CONTROL RELAY (Type R-14)
8 CONTROL PANEL

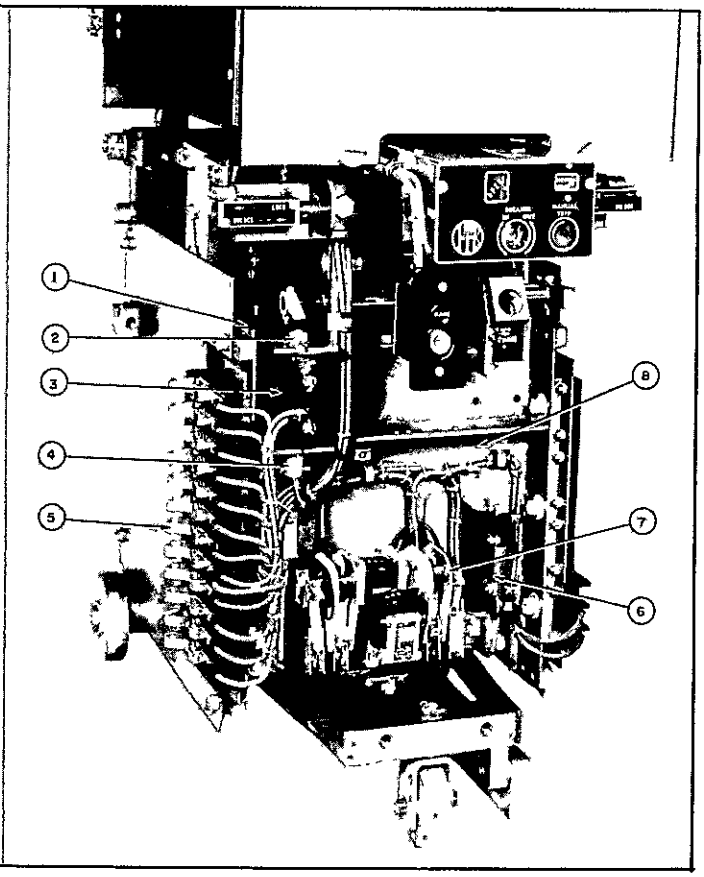


FIG. 4—Control Panel for Type 5HV-50 Removable Element

Photo 14560-A

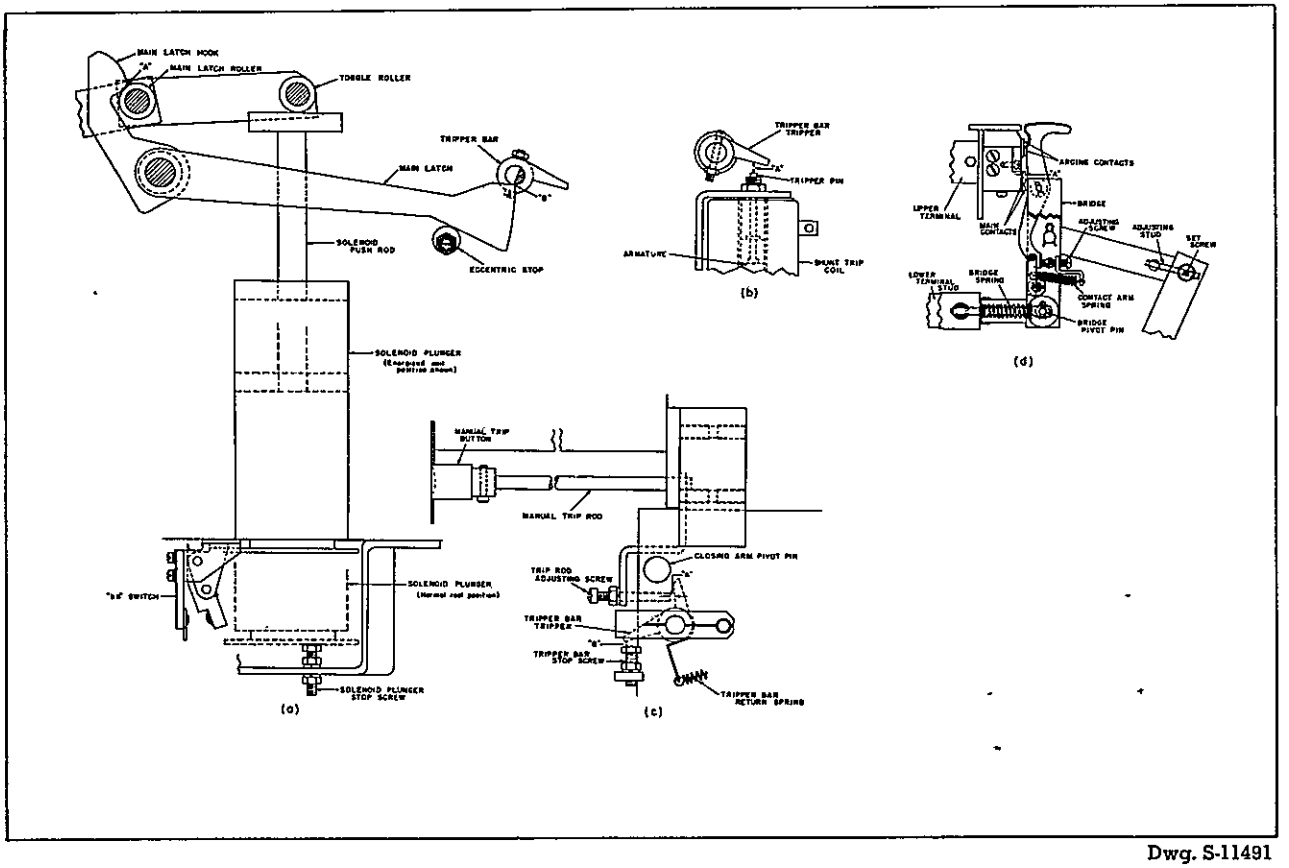


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FIG. 5—Mechanical Schematic of Adjustment Points
Type 5HV-50 Removable Element

The interrupting contacts can be exposed for inspection by removing the interphase barrier and arc chutes from the removable element. Remove the barrier by loosening two screws, Figure 1, enough to allow them to be swung out of engagement with barrier, then lift off barrier.

The arc chute, Figure 2, can be removed by lifting the spring clip, then pull arc chute from the blowout iron plates that support it.

The arcing contacts as shown in Figure 2 are made of hard non-welding alloy. No cleaning is necessary, but should they become pitted, dress them sparingly with a fine file. Remove any file accumulations.

The main contacts as in Figure 2 are faced with silver alloy blocks. Do not use abrasives on these contacts. Generally the only cleaning necessary can be done by opening and closing the element several times under no load conditions. The wiping action of the contacts dislodges any dirt or film. This also applies to the silver plating on the lower inside of the bridge bearing against the lower stud.

ADJUSTMENTS AND ELECTRICAL TESTS

Freeness of Parts

Check to see if the solenoid plunger, plunger rod, toggle, toggle pins and rollers are free and lubricated. Tripper bar must be free without the use of its return spring.

Tripper Bar Inspection

1. The tripper bar must show some side play, but not more than the thickness of a 1/32 inch washer.
2. The shunt trip device trip pin must have clearance at "A," Figure 5(b).
3. Some clearance should show between the trip rod adjusting screw and the tripper bar tripper at "A," Figure 5(c). Approximately 3/32 inch.

Contact Sequence

When the secondary (arcing) contacts, Figure 5(d), just touch the main contacts should have a gap of 3/16 inch (but not more than a plus 1/32 inch). Make adjustments by screw, Figure 5(d).

Main Contact Pressure

The lower end of the bridge, Figure 5(d), should skid 3/16 inch, plus or minus 1/32 inch after the main contacts touch. The center pole may show slightly more.

Adjustments can be made by the screw, Figure 5(d), at the outer end of the insulation connecting link. This screw has a right and left hand thread. After making adjustments, tighten its set screw.

Bridge Side Pressure

At the bridge pivot pin, Figure 5(d), are two spring washers held in place by two adjusting nuts. Tension of these nuts on the spring washers should be such as to cause a slight pressure of the bridge bars against the lower terminal contact inserts (not shown). After making adjustments, lock nuts by tightening their set screws.

Secondary Latch Stop Adjustment

With the solenoid plunger all the way down there should be clearance between the main latch and the tripper bar at "B," Figure 5(a), of .002 to .005 inch.

If necessary make adjustment by eccentric stop (left hand side of the mechanism). *Important:* Make sure lock nut for eccentric stop is tight after making adjustments.

Main Latch Adjustment

The gap at "A," Figure 5(a), between the main latch hook and roller should be set between .020 to .030 inch.

Make adjustments if needed by the plunger stop screw (under side of solenoid mechanism). *Important:* Securely lock stop screw after making adjustment.

Tripper Bar Latch Bite

This adjustment is accurately made at the factory. However, if adjustment should be necessary proceed as follows:

1. Turn stop screw, Figure 5(c), down to insure sufficient latch bite to close the element.
2. Turn screw slowly up with backward pressure on tripper bar until element trips. Then turn screw down 3 full turns.
3. A check can be made by placing a feeler gauge of .150 inch thickness between the stop screw and the tripper bar tripper at "B," Figure 5(c), and still be able to close the element.

Electrical Trip Adjustments

Shunt Trip Tripper Travel. With the shunt trip armature, Figure 5(b), held all the way up, there should be a clearance between the tripper bar stop screw and the tripper bar tripper at "B," Figure 5(c), of not less than .165 inch minimum.

With removable elements having a capacitor trip (shunt trip) it will be necessary to hold this travel close. Clearance should be .165 minimum to .170 inch maximum.

Solenoid "bb" Switch. The "bb" switch should have approximately ⅜ inch break when the solenoid plunger is at top of stroke.

Capacitor Trip. The capacitor should be tested for normal a-c trip. At normal voltage, the capacitor should have sufficient charge to trip to removable element after control voltage has been discontinued for 60 seconds.

CLEARANCE GAUGE APPLICATION

It is essential to the operation of the 5HV-50 breakers that a clearance be maintained between the moving contact and the arcing horn in the arc chute with the arc chute in place on the breaker and in its normal position. This clearance must be at least 3/16 inch. Greater clearance is permissible.

This clearance is properly set at the factory but it may be destroyed by severe impact in shipment or variation in alignment of parts due to unusual service conditions or rough handling. Failure to maintain this clearance may result in misoperation that is beyond the manufacturers control.

To assist in maintaining this clearance a gauge is available and is supplied as an accessory with each installation.

New breakers should be checked before putting in service and old breakers should be checked at each periodic inspection of the breakers.

Procedure for using gauge:

(a) Remove breaker from the structure.

(b) Remove interphase barrier.

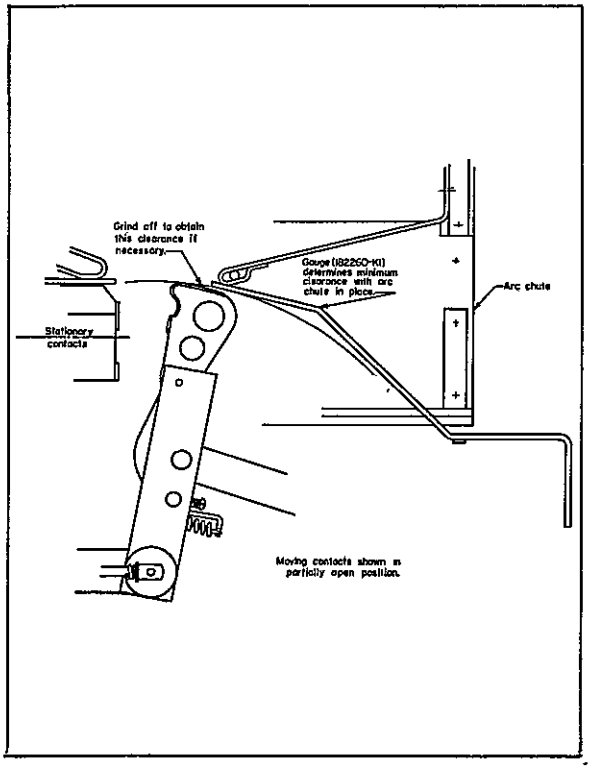

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FIG. 6—Front Arcing Horn Clearance Gauge Application

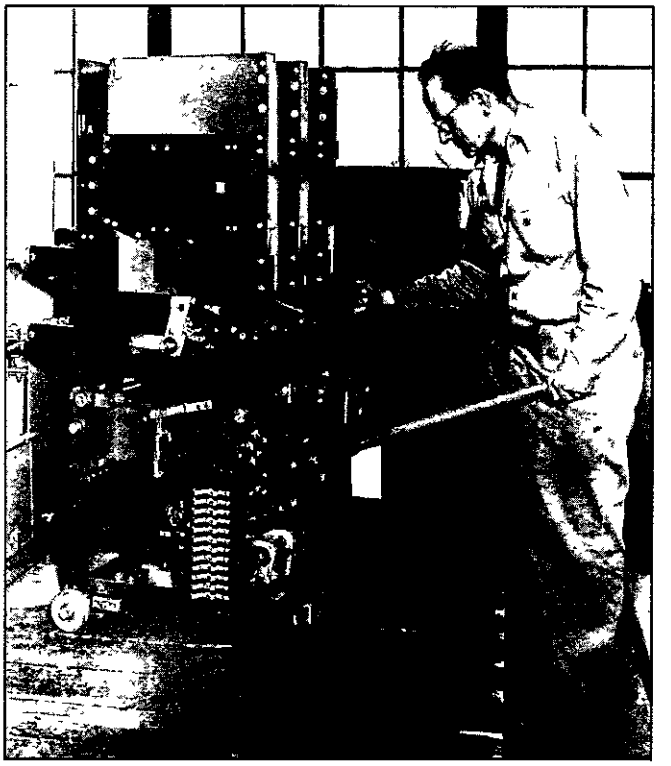

Photo 16868

FIG. 7—Checking Clearance Between Moving Contact and Front Arcing Horn Type 5HV-50

(c) With arc chute in place, insert manual closing handle.

(d) Insert gauge and hold firmly against arc chute arcing horn as shown in Fig. 6. With the gauge in this position manually operate the breaker through all positions between closing and tripped. The moving contact should not strike the gauge during this operation. Fig. 7 shows method of checking this clearance.

(e) If the gauge does not pass between the members, check over circuit breakers to determine the cause of the interference. If necessary modify the moving contact as suggested in Fig. 6.

BIBLIOGRAPHY

Description	Reference
General Instructions for Type 5HV-50 and 5HV-150 Multumite Switchgears	IB-49103-HV
Specific Information for Type 5HV-150 Removable Elements	IB-49105-HV
Specific Information for Type 5HV-250 Removable Elements	IB-50731-HV