

IB 6.2.10.7-1C

Installation/Maintenance Instructions

Medium-Voltage

Outdoor Vacuum Power Circuit Breakers Element

*Type 15VKB
1200/2000 Amperes
15000 Volts*

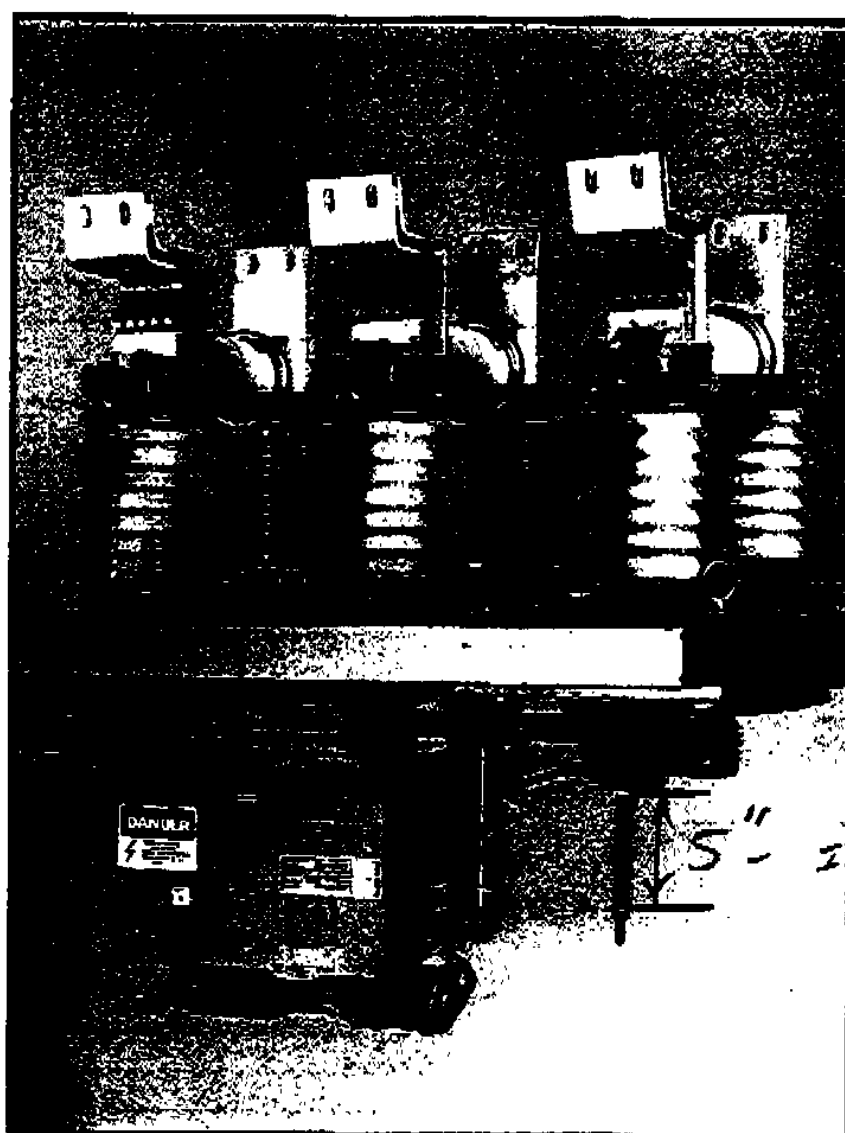


ABB Power Distribution, Inc.
Circuit Breaker Division

ABB
ASEA BROWN BOVERI

IB 6.2.10.7-1C

Page 2



TABLE OF CONTENTS

	PAGE
INTRODUCTION AND RATINGS	3
RECEIVING AND STORAGE	3
CIRCUIT BREAKER INSTALLATION	3
General	3
Installation Inspection	3
Vacuum Interrupter Examination	3
Insulation Structure	3
Manual Operation of Electrically Operated Models	3
MAINTENANCE: ADJUSTMENTS AND TESTS	5
General Information	5
Millivolt Drop Test	5
Insulation Cleaning	6
Circuit Breaker Operation, Contact Adjustment and Timing	6
Contact Adjustment	6
Closing and Opening Times and Speeds	9
Operating Mechanism	9
Latch Engagement (Bite)	9
Control Relay Adjustment	9
LUBRICATION	9
DIELECTRIC TESTS	11
ELECTRICAL CHARACTERISTICS	11
ELECTRICAL OPERATING SEQUENCE	11
DC Operating Sequence	12
DC Schematic Diagram of Control Circuit	13
AC Operating Sequence	14
AC Schematic Diagram of Control Circuit	15
RENEWAL PARTS	16

These instructions do not purport to cover all details or variations nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes the matter should be referred to the nearest District Office.



INTRODUCTION AND RATINGS

Instructions for installation, operation and maintenance of the 15VKB are furnished with each shipment of equipment. These instructions are intended as a guide during installation and initial setup and operation. Use of these instructions will facilitate proper maintenance of the equipment and prolong its life and usefulness.

RECEIVING AND STORAGE

Immediately upon receipt of the circuit breaker, examine to determine if any damage or loss was sustained during transit. If abuse or rough handling is evident, file a damage claim at once with the carrier and promptly notify the nearest District Office. The company is not responsible for damage of goods after delivery to the carrier, however, we will lend assistance if notified of claims.

Unpack the circuit breakers as soon as possible after receipt. If unpacking is delayed, difficulty may be experienced in making a claim for damages not evident upon receipt. Use care in unpacking in order to avoid damaging any of the circuit breaker parts. Check the contents of each device against the packing list before discarding any packing material. If any shortage of material is discovered, promptly notify the nearest District Office. Information specifying the purchase order number and part numbers of the damaged or missing parts should accompany the claim.

Circuit breakers should be installed in their permanent location as soon as possible. If the breakers are not to be placed in service for some time, it is advisable to provide adequate means of protection. This may be done by keeping the breaker in its original shipping frame and storing in a warm, dry and uncontaminated atmosphere. If the circuit breaker cannot be stored properly due to circumstances, it must be thoroughly checked before going into service to insure it has not absorbed moisture, rusted or become generally contaminated in any way.

CIRCUIT BREAKER INSTALLATION

General

Prior to initial installation of the circuit breaker into the enclosure, certain preliminary inspections should be made to insure proper operation. The inspection procedures for this are given in this section.

The circuit breaker is shipped with contacts closed, closing springs discharged and opening springs charged.

WARNING WARNING WARNING WARNING

Prior to any disassembly or inspection of the circuit breaker, the closing springs should be discharged, and the breaker should be open.

Installation Inspection

Inspect condition of circuit breaker vacuum interrupters and electrical connections prior to installing the circuit breakers into the switchboard. Even though each circuit breaker is completely adjusted and tested at the factory, shipping and handling conditions could cause defects.

Vacuum Interrupter Examination (Refer to Figure 1)

CAUTION CAUTION CAUTION CAUTION

A grounding stick should be used to discharge the mid-band ring, on the vacuum interrupters (2) so equipped, before any work is done on the interrupters.

The insulated vacuum envelope (3) should be examined carefully for cracks in the area of the metal-to-insulation seals on both ends and around the mid-band ring. Since a certain amount of transmitted light is usually required to detect cracks, the inspection should be done in a well lighted area. If the mid-band ring, when so equipped, has been bent by an accidental impact, that area should be specially scrutinized for seal damage. Small external chips will not impair the useful life of the interrupter.

Insulation Structure

All insulated parts should be checked for damage. Any dust or dirt should be removed by air or wiped with a clean lintless cloth saturated with an oil-free solvent.

Manual Operation of Electrically Operated Models

Electrically operated circuit breakers may be charged manually by a removable maintenance handle for bench tests or emergency operation. Position the maintenance handle hooked section on the long slot on the pawl carrier (refer to Figure 6). The small tab on the maintenance handle will fit the small hole of the pawl carrier. Using a pumping motion, rotate the pawl carrier until the ratchet wheel no longer rotates. At this point, the spring charge indicator will indicate SPRINGS CHARGED. The circuit breaker can be closed manually with the manual close lever. NOTE: Occasionally

IB 6.2.10.7-1C

Page 4

ABB
ASEA BROWN BOVERI

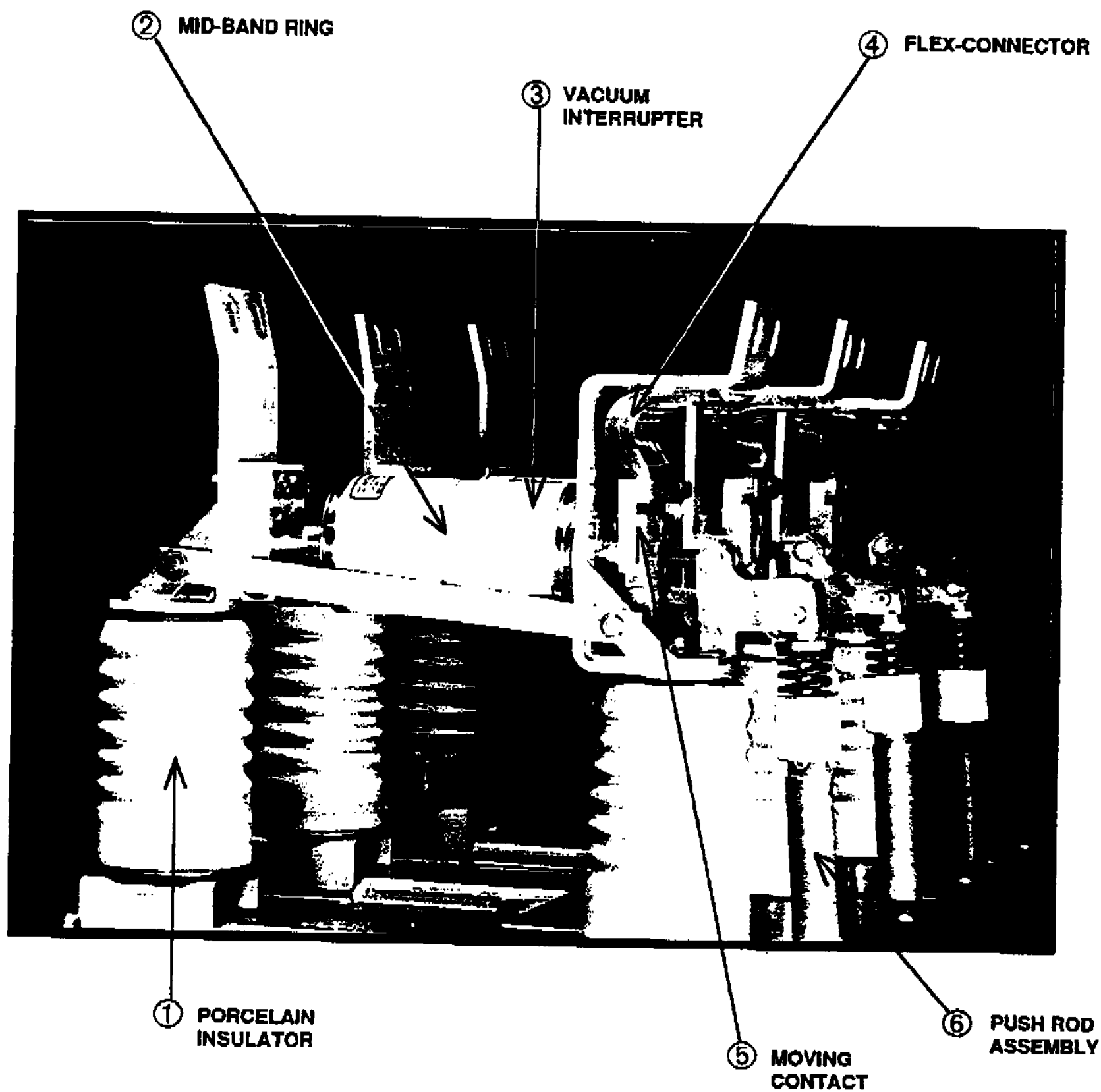


Figure 1 - General Arrangement



the motor crank arm will stop in a position that will not allow manual spring charging. When this happens, the motor crank arm must be rotated manually by using a screw driver to rotate the crank arm sufficiently so that the springs may then be manually charged with the maintenance handle.

MAINTENANCE, ADJUSTMENTS AND TESTS

General Information

The 15VKB circuit breaker is designed for minimum maintenance and tested to insure that only minimum maintenance will be required. The few adjustments that are noted are required only when an operational check indicates a problem. Of course, during the maintenance checks, all accessible bolts, units and screws should be routinely checked to insure that they are tight.

It is recommended that the circuit breaker be normally inspected after the first 2000 operations, regardless of its type of duty. These operations can be either no-load mechanical, load current switching, bulk capacitor or reactor switching operations, or for motor starting applications.

Vacuum interrupters, as used on the 15VKB circuit breakers, have an inherently long contact life and will provide trouble-free service under varied application conditions, as long as the circuit breaker is applied within its rating. The wear condition of the individual vacuum interrupters will vary, depending on circuit conditions and such variables as single phase versus three-phase interruption, X/R ratio (asymmetry) and relay delay times. Of course, interrupting high short-circuit current will cause contact erosion to occur faster than load current interruptions. The 15VKB circuit breaker has been tested up to 2000% KSI. It is unlikely that a circuit breaker will be subjected to this much duty during the life of the breaker and it is not expected that the interrupters will have to be replaced due to excessive erosion of contacts. There is, however, a check for contact wipe (contact pressure) which is also a measure of contact erosion. This check is covered under "Circuit Breaker Operation and Contacts". When contact wipe is less than the minimum specified and there is not a mechanical problem, then the interrupter should be replaced due to contact erosion.

If, however, after the first inspection period there is no indication of any problems, actual operating experience with specific circuits will indicate the future amount of maintenance needed for the various circuit breakers and the procedure can be modified as required.

Where unusual service conditions exist, as covered by ANSI Standard C37.04, it must be presumed that these conditions were considered at the time of order and that the equipment supplied was designed for the special application and that an appropriate supplemental maintenance program has been developed. These maintenance instructions only cover circuit breakers used under the standard service conditions.

At the selected maintenance period, the following tests and adjustments should be made:

NOTE: The following tabulated tests and adjustments are all that are normally necessary for proper maintenance and operation of the 15VKB circuit breaker. The remaining portions of the breaker -- close coil assembly, shunt trip device, control relay, auxiliary switch and motor -- require no maintenance during the standard life of the circuit breaker regardless of the operating duty.

D.C. Millivolt Drop Test

During Maintenance periods, the condition of the breaker current circuit can easily be determined by performing a millivolt drop test. This test should be performed regardless of whether the circuit breaker had interrupted low or high currents or has minimum operations.

The following table lists the millivolt drop and resistance values for the circuit breakers covered by this instruction book, from terminal to terminal of vacuum interrupter, not from terminal of interrupter to bushing terminal.

Circuit Breaker	Maximum Mv Drop*	Maximum Micro-Ohms
1200/2000 Amperes	8	40
* Millivolt drop with 200 amperes DC flowing		

IB 6.2.10.7-1C

Page 6

**Insulation Cleaning**

Any dirt, dust or grease should be removed from the surfaces of the entire current carrying structure and vacuum interrupter*. Wiping the surface with a clean lint free cloth is normally sufficient for this purpose.

* Remember to discharge mid-band ring on interrupters so equipped.

Circuit Breaker Operation, Contact Adjustment and Timing**Contact Adjustment (See Figure 2)**

1. Fully closed breaker test. Charge the closing springs and turn the motor switch off. Close the breaker. Engage manual charge handle with charging lever. During the initial portion of the downward stroke of the handle check to see which direction the closing spring guides move. If the spring guides start to move out then the breaker did not fully close. If the spring guides begin to move in and with additional pumping moves in until the mechanism can be heard to "snap in", then the breaker did not fully close originally. Excess contact pressure or friction can cause this condition and if it cannot be relieved then the factory should be consulted.

2. Contact wipe (contact pressure) test. The contact gap and contact wipe is set at the factory. These parts should not be repositioned in the field unless a pushrod change is required to correct contact sequence as described elsewhere. Contact wipe is set .093 minimum. Contact erosion and wear in mechanical parts will cause a reduction in contact wipe over the life of the breaker and a check should be made to insure that the wipe is not less than .020". The measurement is made as follows for the three poles:

- Open the breaker and discharge the closing springs.
- In this position there should be no space between the spring base pivot and the adjusting nut.
- Close the breaker and measure the gap between the spring base pivot and adjusting nut. The dimension should be a minimum of .093 inches on a new breaker.
- The measurement can decrease to .020" on a breaker that has been in service.

e. When contact wipe is less than the .020 and it has been determined that the breaker closes fully and there is not a mechanical problem, then the interrupter should be replaced.

3. Contact Gap (See Figure 3). The contact gap is set at the factory at the nominal dimension of .40. This value will normally increase as the contacts erode. A check of the contact gap checks that the breaker does open fully and that the gap is sufficient to withstand the applied voltage. The measurement is made as follows for the three poles:

- Open the breaker and discharge the closing springs.
- Measure the distance between the moving contact clamp and the stationary support bus. Record this dimension as Y2.
- Close the breaker and measure the same dimension. Record this as Y1.
- The gap is the difference between the two measurements. The acceptable limits are .375 - .54, with the upper limit being approached as contact wipe approaches the minimum. $Y2 - (Y1) = \text{GAP}$.

4. Contact sequence. All three poles should touch within 2 milliseconds at normal closing speeds. An oscilloscope, oscillograph or other timing method may be used to establish the 2 millisecond timing.

Before checking contact sequence, check that the contact wipe and gaps are correct. It is not expected that the contact sequence should exceed the 2 millisecond limit; therefore, before attempting to readjust, check that the test equipment and procedure are correct. Also consider, especially when testing with electronic equipment, that .002 seconds vacuum interrupter contact bounce is permissible during normal closing and this bounce can influence the contact touch measurements.

If it is determined that the contact sequence is not within the 2 milliseconds, then adjustment is required. Usually, readjustment of one pole should be sufficient so that all three poles touch within 2 milliseconds. The gap of the pole to be changed should be decreased if the contacts of that pole are touching after the other two poles, or increased if the contacts are touching before the other two poles. The gap is decreased by turning pushrod clockwise, viewing from the top of the breaker, and increased by turning counterclockwise.

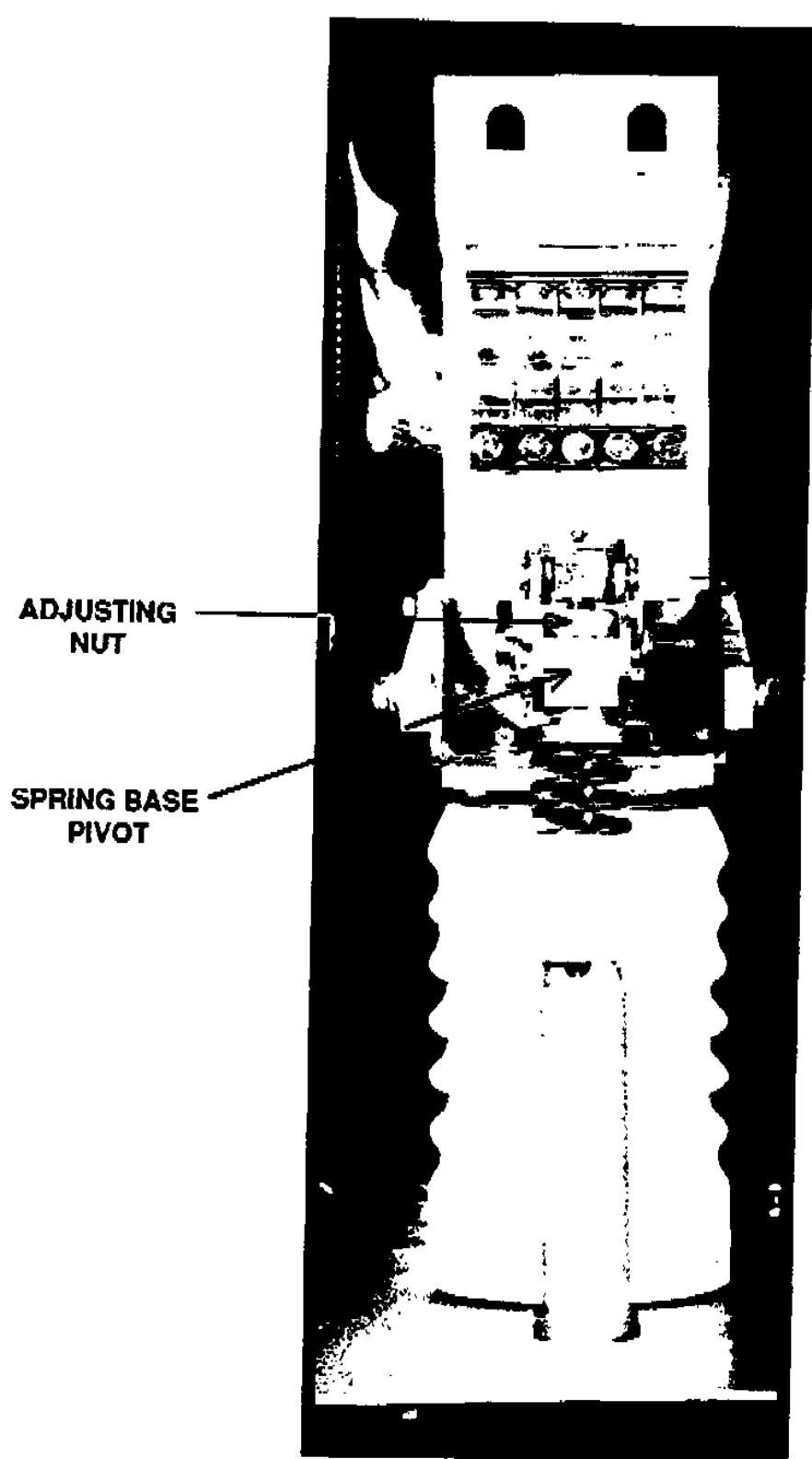


Figure 2 - Contact Wipe

IB 6.2.10.7-1C
Page 8

ABB
ASEA BROWN BOVERI

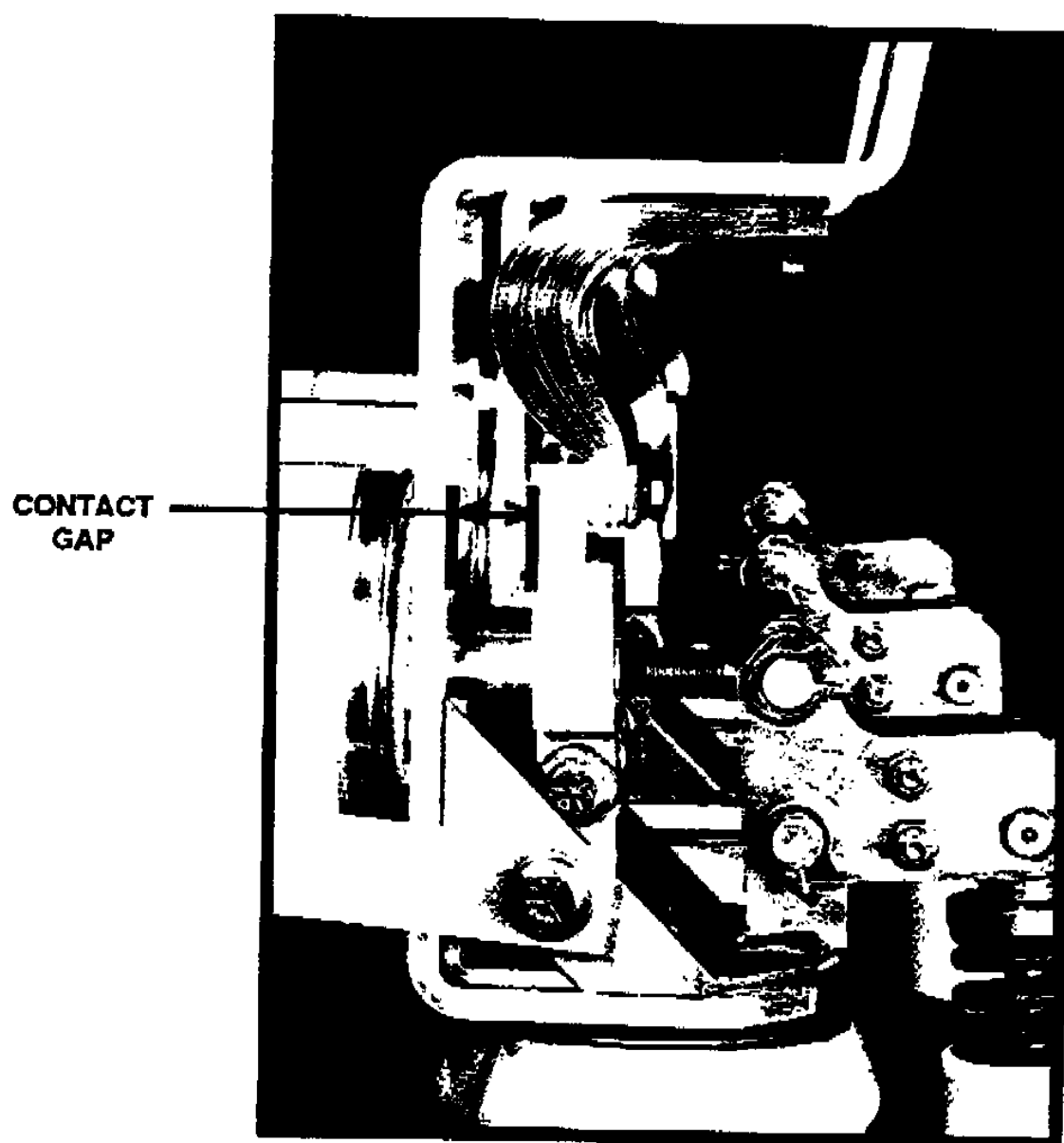


Figure 3 - Contact Gap



Before the pushrod can be turned, the breaker must be open, closing springs discharged and pin removed. With the breaker open, the vacuum in the interrupter maintains a constant upward force of approx. 25 lbs. on the moving contact and pushrod. Therefore, before removing pin, the contact must be held down in the open position by temporary spacers. After removing retaining ring and pin, rotate pushrod as required.

One quarter (1/4) turn of the pushrod will change the gap by approx. .019. After rotating the pushrod, carefully reposition the moving contact and pushrod vertically to align the pin holes. Replace the pin and retainer and remove the temporary spacer. During the readjustment procedure note that the contact wipe and gap dimensions, specified previously, must be maintained. Also, note that no more than one half (1/2) turn total of the pushrod should be required when readjusting for contact sequence.

After completing the contact sequence procedure, recheck the contact wipe and gaps.

Closing and Opening Times and Speeds

After the operation intervals noted previously, it is recommended checking the closing and opening times by use of a cycle counter, travel recorder*, oscillograph, etc. to monitor the time from energizing to contacts touch or part.

* A potentiometer with mounting support, used in conjunction with an oscilloscope or oscillograph, and instructions are available on special order for specifically checking opening and closing speeds.

The circuit breaker closing and opening times should be within the following time ranges for normal operation:

Closing Time Range - MS	Opening Time Range - MS
40 - 60	25 - 35

NOTES:

- Below 0°C, the closing times will increase (but with no reduction in closing force); and opening times will be within the limits.
- Adjustments to correct speeds, if found to be outside limits, are critical and the nearest District Office should be contacted for recommendations.

Operating Mechanism

The various mechanism adjustments described in the following sections apply to all circuit breakers covered by this instruction bulletin.

Latch Engagement (Bite) (Refer to Figure 4)

The latch engagement adjusting screw (3) is located to the right of the right-hand mechanism housing (1). It can be reached easily from the top of the circuit breaker.

To adjust the latch (2) engagement, proceed as follows:

- Back off adjusting screw (3) to assure excessive latch engagement.
- Close the circuit breaker.
- Turn adjusting screw (3) down slowly until the latch just releases, tripping the circuit breaker.
- Back off the adjusting screw (3) 2 turns.

Control Device (See Figure 5)

The control device is adjusted before leaving the factory. It is recommended that no attempt be made to adjust the internal relays and contacts of this device in the field. If replacement of the control device is required, the close latch release rod (5) overtravel may be adjusted as described below.

- Back off on close latch release rod (5) and check that the circuit breaker will not close by attempting to close it electrically or manually pushing up on close latch release rod (5) to the full extent of its travel.
- Charge the closing springs. Push up on close latch release rod (5) to the full extent of its travel. While holding the close latch release rod in its position, turn up on close latch release rod (5) until the circuit breaker closes. Turn the close latch release rod (5) up an additional 1 1/2 turns.

LUBRICATION

The 15VKB circuit breakers are lubricated during factory assembly as follows:

- All mechanism parts, bearings, pins, etc., have been lubricated with Anderol 757 manufactured by Nuodex, Inc. (formerly Tenneco Chemical, Inc.). (ABB No. 712994A, 4 oz. tube).

If the grease should become contaminated or unduly oxidized (hardened and darkened) or if parts are replaced, any relubrication should be done with the lubricants noted.

NOTES:

- The mechanism should be periodically inspected for lubrication contamination; frequency of inspection is dependent on operating environment.

IB 6.2.10.7-1C

Page 10

ABB
ASEA BROWN BOVERI

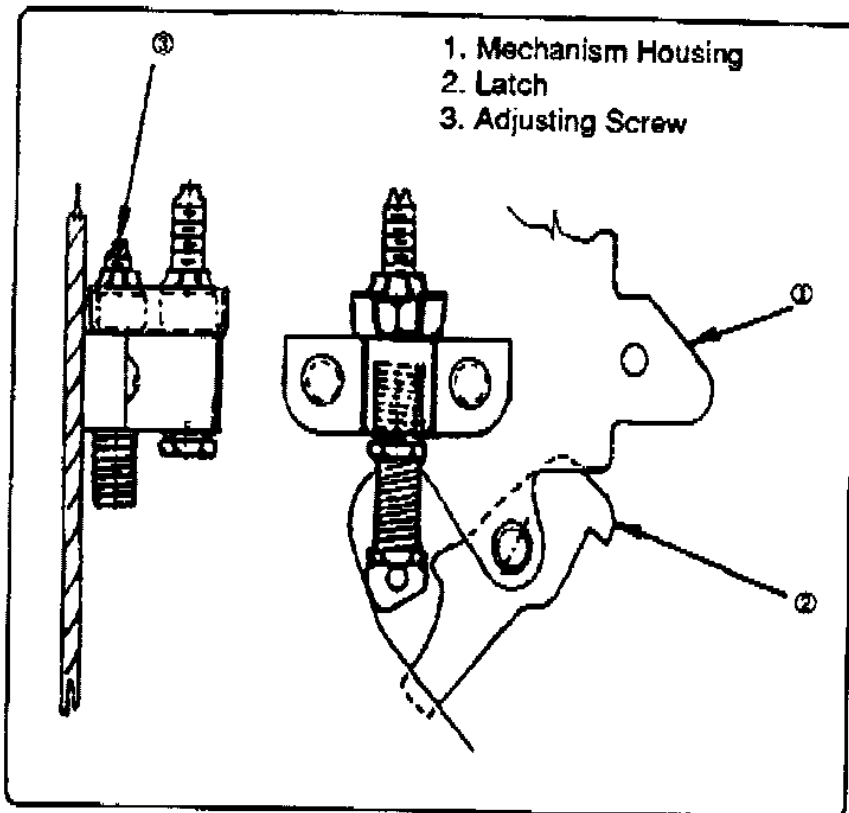


Figure 4 - Latch Adjustment

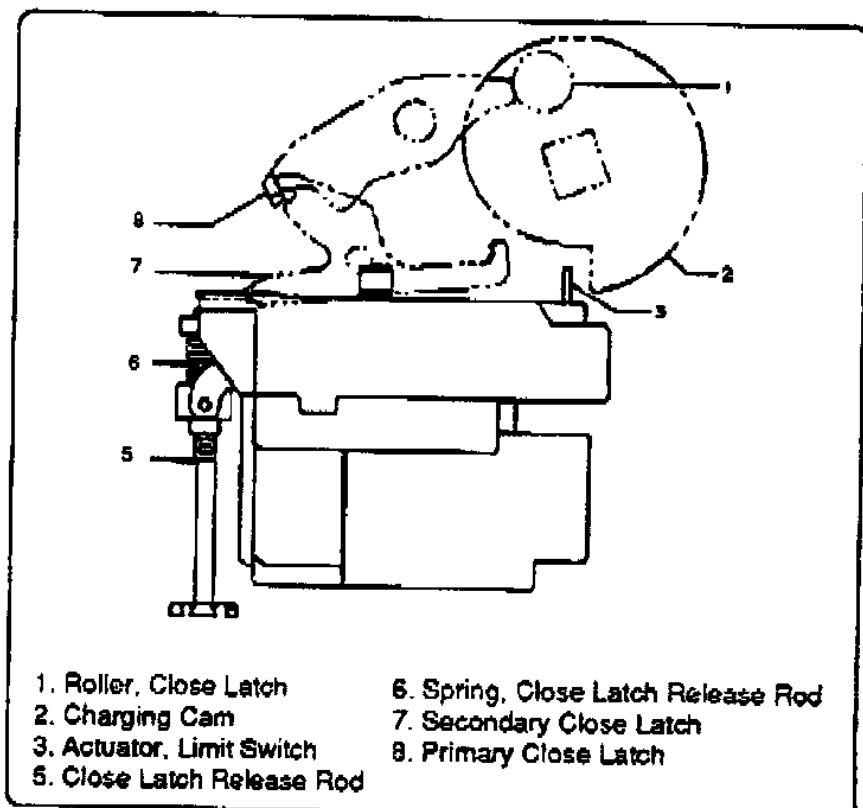


Figure 5 - Control Device Adjustment

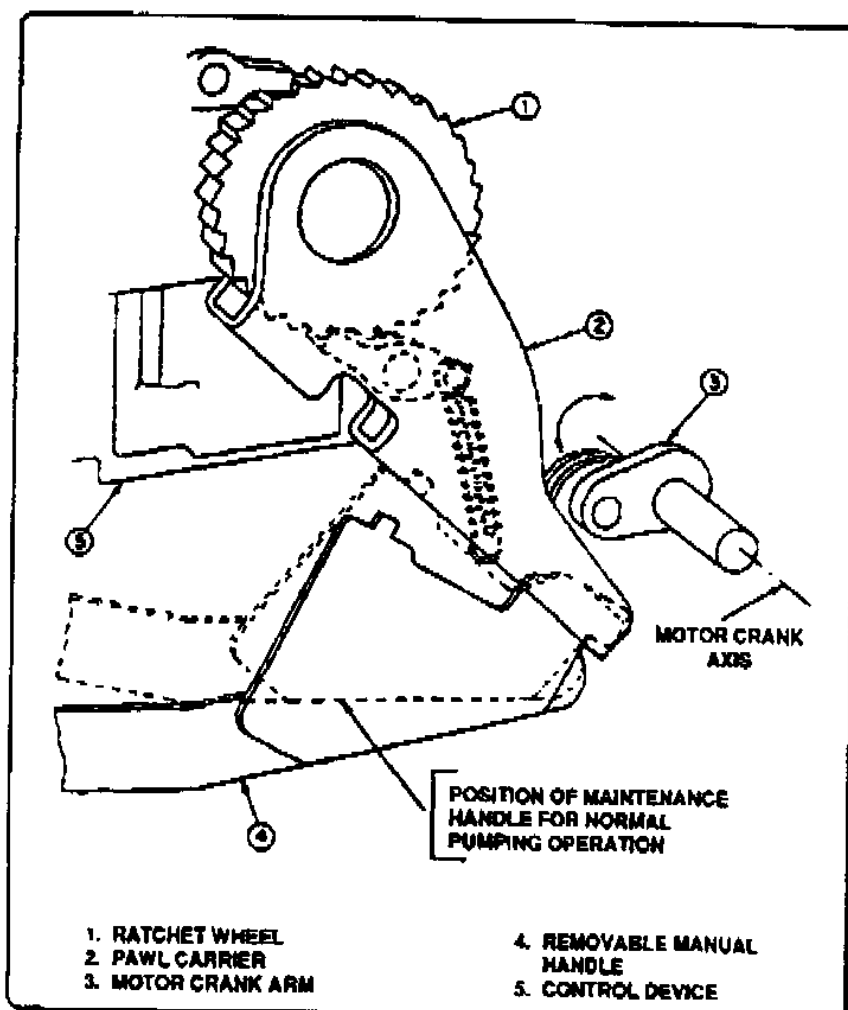


Figure 6 - Manual Charging Of Electrically Operated Circuit Breakers

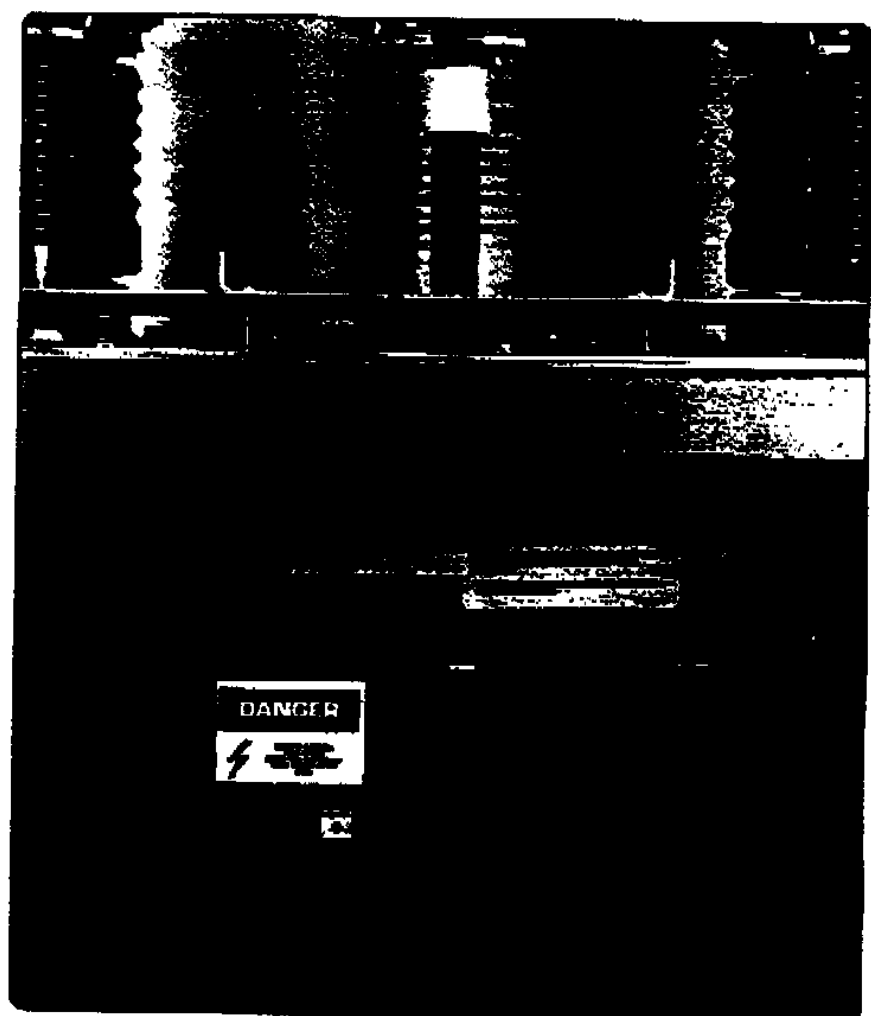


Figure 7 - Control Panel



2. Do not use light oil to lubricate any mechanism parts. In emergency situations, Anderol 732 may be used as a temporary lubricant. In these cases, allow time for the solvents to evaporate prior to any mechanical operations. It is mandatory that the breaker undergo thorough lubrication with Anderol 757 at the next maintenance interval. Use of solvents to free contaminated lubricant is strictly forbidden without immediate relubrication using Anderol 757. Note that bearing surfaces must be repacked and this will require disassembly of the mechanism. Do not operate the circuit breaker without completing this procedure.
3. The charging motor is sealed and no lubrication is required.

DIELECTRIC TESTS

It is recommended that dielectric withstand tests be made prior to use and then at routine maintenance periods to verify the integrity of vacuum interrupters. If, during the dielectric withstand test, the required test voltage cannot be sustained across the open contacts of the vacuum interrupter, the interrupter is faulty and must be replaced. Always insure that the contact air gap is correct before conducting primary circuit dielectric tests.

CAUTION CAUTION CAUTION CAUTION

The procedure for dielectric testing a vacuum breaker is similar to that for any other type breaker; there are two areas which require extra CAUTION in handling.

1. The internal shield of a vacuum interrupter can acquire an electrical charge which is usually retained even after the voltage is removed. On certain types of interrupters, this shield is attached to the exposed mid-band ring and a grounding stick should be used to discharge the ring before working on the device.
2. Dielectric test voltages higher than rated voltage, applied across open contacts, may cause a vacuum interrupter to emit some X-radiation which could be a health hazard on prolonged exposure at close range. Accordingly, even though the emission is low and on for such a short period of time, it is considered appropriate to exercise caution.

Therefore, do not run any primary circuit dielectric withstand tests on isolated interrupters with open contacts, above rated voltage unless test personnel are adequately shielded or they are no less than six feet from the test unit.

It is noted that NO hazardous X-radiation is produced with closed contacts at any test voltage or with open contacts at rated voltage and there should be no cause for concern. Further, if the breaker is tested in its switchgear compartment, the enclosure steel provides sufficient shielding to protect personnel from X-radiation at the test voltages recommended below at the normal distances maintained for electrical safety.

The following test values should be used for dielectric testing the new breaker and are to be applied for a one-minute period:

Description	50 Hz
Primary Circuit	50.0kV
* Secondary Circuit (Control)	1100 V

Once the unit is in service, the primary circuit should be tested at 75% of this rating

*If it is desired to make a dielectric test on the secondary control wiring, turn the spring charging motor disconnect switch (1, Fig.7) to the "OFF" position. Apply test voltage (1100V-AC) for one minute to each of the secondary contacts.

If it is desired to make a dielectric test on the spring charging motor, turn the motor disconnect switch (1, Fig.7) to the "ON" position. Apply test voltage (540V-AC) for one minute to the motor circuit.

ELECTRICAL CHARACTERISTICS
OF CONTROL DEVICES

For operating voltage ranges for various nominal control voltages, refer to Table 1.

For average current values at various nominal control voltages, refer to Table 2. The current values given in this table are average, steady state values and momentary inrush currents for all charging motors and AC coils are approximately six to eight times these values.

ELECTRICAL OPERATING SEQUENCE

Please refer to the specific schematic diagrams and other operational information furnished with your order.

Figures 8 and 9 are provided as typical schematics for general information on electrical information.

IB 6.2.10.7-1C

Page 12

**DC CLOSING OPERATING SEQUENCE**

With the circuit breaker open, the closing springs uncharged, and the control power source energized, and motor disconnect switch closed, operation occurs as follows:

1. Immediately upon the availability of control power across terminals "1" and "2", the spring charging motor (motor) is energized, which in turn charges the closing springs. When the closing springs are charged, limit switch contact "LSb" is opened, and limit switch contact "LSa" is closed.
2. Operation of the close control switch, connected at terminals "3" or "6", energizes the latch release coil (X) through the circuit breaker auxiliary switch "b" contact, the normally closed lockout relay contact "Yb", and the limit switch contact "LSa". The latch release coil (X) releases the closing latch. The springs then discharge to close the circuit breaker.
3. When the springs discharge, limit switch contact "LSb" closes and switch contact "LSa" opens.
4. When limit switch "LSb" in the motor circuit closes, the spring charging motor is energized, which in turn recharges the closing springs.
5. When the circuit breaker closes, all auxiliary switch "b" contacts open and all auxiliary switch "a" contacts close.
6. When the limit switch contact "LSb" closes, the lockout relay coil (Y) is energized and opens lockout relay contact "Yb", which deenergizes the latch release coil (X). Lockout relay contact "Ya" closes, which seals-in the lockout relay coil (Y) as long as the "close" contact is maintained. The purpose of the lockout relay coil (Y) is to prevent pumping of the closing mechanism when closing against a faulted circuit.
7. After the breaker has closed and when the "close" switch is released by the operator, the lockout relay coil (Y) is deenergized. This allows the normally-closed lockout relay contact "Yb" to close, and the normally-open lockout relay contact "Ya" to open.
8. The circuit breaker can be tripped by operation of the trip control switch which energizes the circuit breaker trip coil (TC) through the auxiliary switch "a" contact and terminal "7".
9. The undervoltage device, if furnished, provides a direct acting lock-open and undervoltage tripping feature. This device must be energized to initially close the breaker, and also to maintain the breaker in a closed position.
10. The latch check switch, if furnished, insures that the tripping mechanism must be reset prior to energizing the closing latch release coil (X).
11. The stopping device switch, if applicable, prevents electrical reclosing of the circuit breaker after a manual trip until the stopping device has been manually reset.

Table 1 - Operating Voltage Range

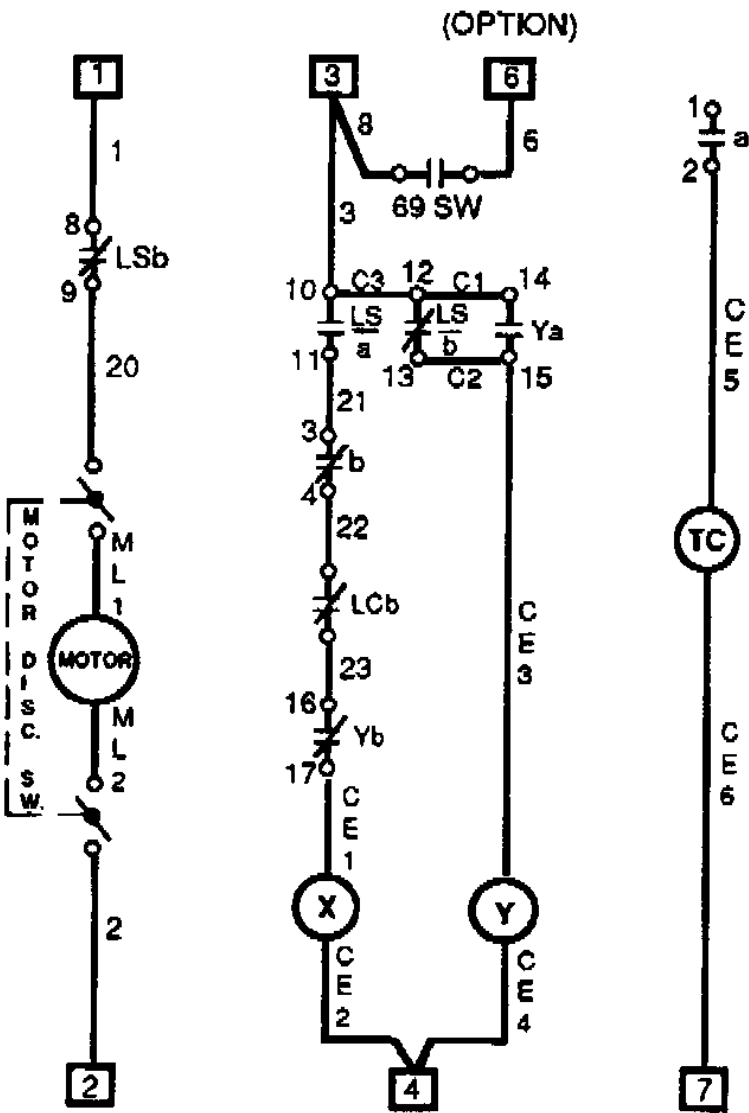
Nominal Control Voltage	Spring Charging Motor	Close Coil	Trip Coil	Undervoltage	
				Pick-Up Maximum	Drop-Out
48 V dc	38 - 56	38 - 56	28 - 56	41	15 - 29
125 V dc	100 - 140	100 - 140	70 - 140	105	38 - 75
250 V dc	200 - 280	100 - 280	140 - 280	212	75 - 150
120 V ac	104 - 127	104 - 127	104 - 127	102	36 - 72
240 V ac	208 - 254	208 - 254	208 - 254	204	74 - 144



Table 2 - Average Current Values

Nominal Control Voltage	Spring Charging Motor	Close Coil	Trip Coil	Lockout Coil	Under Voltage	A.E.C. Fuse
48 V dc	25.0	10.7	3.14	0.15	0.3	30
125 V dc	10.0	5.0	1.3	0.06	0.2	30
250 V dc	5.0	2.2	0.65	0.03	0.1	30
120 V ac	10.0	4.5	6.5	0.40	0.5	30
240 V ac	5.0	2.3	1.15	0.20	0.2	30

LEGEND



- a ----- Auxiliary Switch Contact Closed When Breaker Is Closed.
- b ----- Auxiliary Switch Contact Open When Breaker Is Closed.
- LCb ----- Latch Check Switch Contact Closed When Breaker Operating Mechanism Is Reset. (Option)
- LSa ----- Limit Switch Contact Open When Springs Are Discharged, Closed When Springs Are Charged.
- LSb ----- Limit Switch Contact Closed When Springs Are Discharged, Open When Springs Are Charged.
- TC ----- Shunt Trip Coil.
- X ----- Control Relay Release Coil.
- Y ----- Control Relay Lockout Coil.
- Ya ----- Normally Open Control Relay Contact.
- Yb ----- Normally Closed Control Relay Contact.
- ----- Terminal Block Point.
- ML ----- Motor Lead.
- CE ----- Coil Lead End.
- C1, C2 -- Terminal Jumper (Control Device).

Figure 8 - Typical DC Schematic Diagram Of Control Circuit

IB 6.2.10.7-1C

Page 14

**AC CLOSING OPERATING SEQUENCE**

With the circuit breaker open, the closing springs uncharged, and the control power source energized across terminals "1" & "2" and "aux. switch contact 3", motor disconnect switch closed, operation occurs as follows:

1. Immediately upon the availability of control power at terminals "1" and "2", the spring charging motor (motor) is energized, which in turn charges the closing springs. When the closing springs are charged, limit switch contact "LSa" is closed. Also, upon availability of control power at terminal "4" and "aux. switch contact 3" and after the closing springs have been charged, the lockout relay coil (Y) will be energized through the circuit breaker auxiliary switch "b" contact and the parallel resistors R₁ and R₂. The lockout relay will pick up and close contact "Ya".
2. Connecting terminals "3" or "6" to control via operation of the close control switch energizes the latch release coil (X) through the circuit breaker auxiliary switch "b" contact, the normally open lockout relay contact "Ya", and the limit switch contact "LSa". The latch release coil (X) releases the closing latch. The springs then discharge to close the circuit breaker.
3. When the springs discharge, limit switch contact "LSb" closes and limit switch contact "LSa" opens.
4. When limit switch contact "LSb" in the motor circuit closes, the spring charging motor is energized, which in turn recharges the closing springs.
5. When the circuit breaker closes, all auxiliary switch "b" contacts open and all auxiliary switch "a" contacts close.
6. When the limit switch contact "LSa" opens, both the latch release coil (X) and the lockout relay coil (Y) are deenergized. Contact "Ya" opens the latch release coil (X) circuit. Contact "Yb" closes connecting resistors "R₁" and "R₂" directly to control power as long as the close control switch remains closed. The circuit breaker is prevented from any automatic reclosing in the event "LSa" and auxiliary switch "b" close because "Ya" remains open. The "Yb" contact shorts out the lockout relay coil (Y) through resistors "R₁" and "R₂". The purpose of the lockout relay is to prevent pumping of the circuit breaker's mechanism when closing against a faulted circuit.
7. After the breaker has closed and when the closing control switch is released by the operator, the lockout relay coil (Y) remains deenergized due to the auxiliary switch "b" contact in the closing circuit being open.
8. The circuit breaker can be tripped by operation of the "Remote Trip" switch, which energizes the circuit breaker trip coil (TC) through the auxiliary switch "a" contact.
9. The undervoltage device, if furnished, provides a direct acting lock-open and undervoltage tripping feature. This device must be energized to initially close the breaker, and also to maintain the breaker in a closed position.
10. The latch check switch, if furnished, insures that the operating mechanism must be reset prior to energizing the closing latch release coil (X).
11. The remote mounted capacitor trip feature, if furnished, provides an electrical energy storage network, whereby should a loss of control power occur at the instant of a tripping signal, sufficient energy will be furnished to insure an electrical tripping operation.
12. The stopping device switch, if applicable, prevents electrical reclosing of the circuit breaker after a manual trip until the stopping device switch has been manually reset.

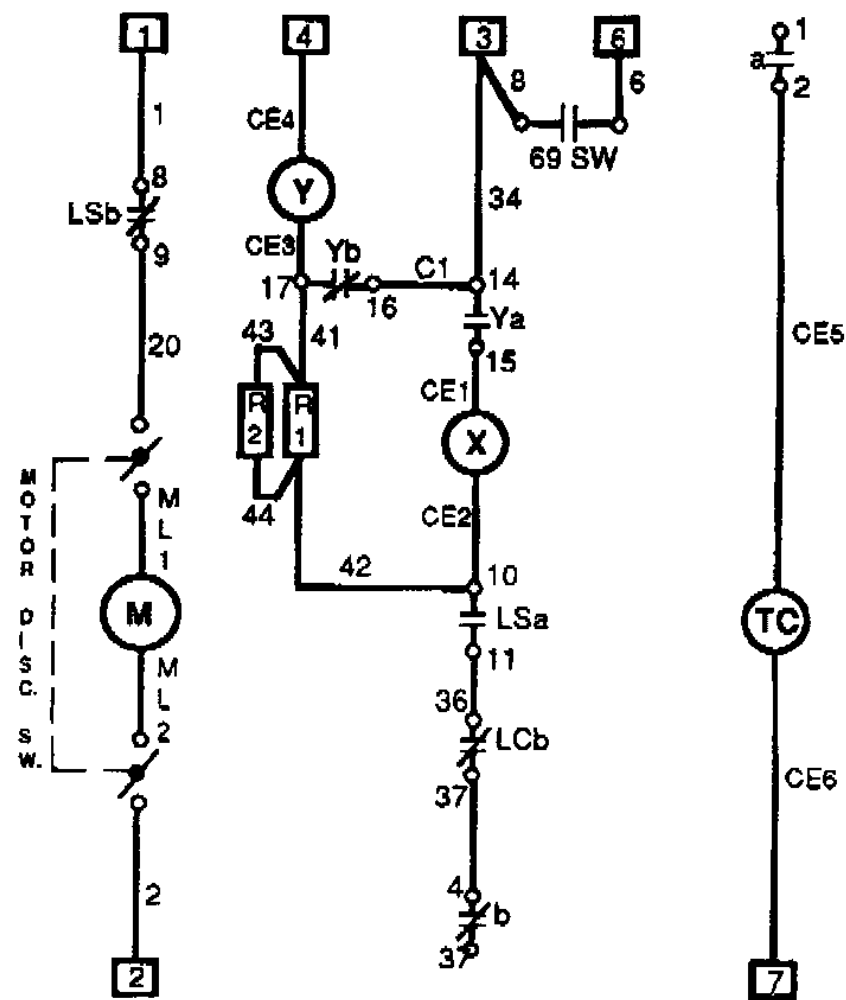


Figure 9 - AC Schematic Diagram Of Control Circuit

LEGEND	
a ----- Auxiliary Switch Contact Closed When Breaker Is Closed.	X ----- Control Relay Release Coil.
b ----- Auxiliary Switch Contact Open When Breaker Is Closed.	Y ----- Control Relay Lockout Coil.
LCb ----- Latch Check Switch Contact Closed When Breaker Operating Mechanism Is Reset. (Option)	Ya ----- Normally Open Control Relay Contact.
LSa ----- Limit Switch Contact Open When Springs Are Discharged. Closed When Springs Are Charged.	Yb ----- Normally Closed Control Relay Contact.
LSb ----- Limit Switch Contact Closed When Springs Are Discharged. Open When Springs Are Charged.	□ ----- Terminal Block Point.
TC ----- Shunt Trip Coil.	ML ----- Motor Lead.
	CE ----- Coil Lead End.
	C1, C2 - Terminal Jumper (Control Device).
	-----<----- Female Secondary Disconnect Contact.
	R1, R2 - Resistors



RENEWAL PARTS

We recommend only those renewal parts that will be required to insure proper and timely maintenance for normal operation of the 15VKB circuit breakers be stocked. Copies of the applicable Renewal Parts Bulletin for specific circuit breakers will be furnished on request to the nearest District Office.

The minimum quantity of assemblies and items recommended in these bulletins are predicated on infrequent replacement of parts based on accumulated tests and operating experience. Total assemblies are recommended for fast replacement, when it is necessary to return the breaker to service as quickly as possible. Replaced assemblies can be returned to the factory for nominal reconditioning. The bulletins contain specific part ordering instructions. If desired, specific instructions regarding replacement of those part assemblies are also available.