

Instructions

Utilization Voltage—
2300, 4000 & 4600 Vac

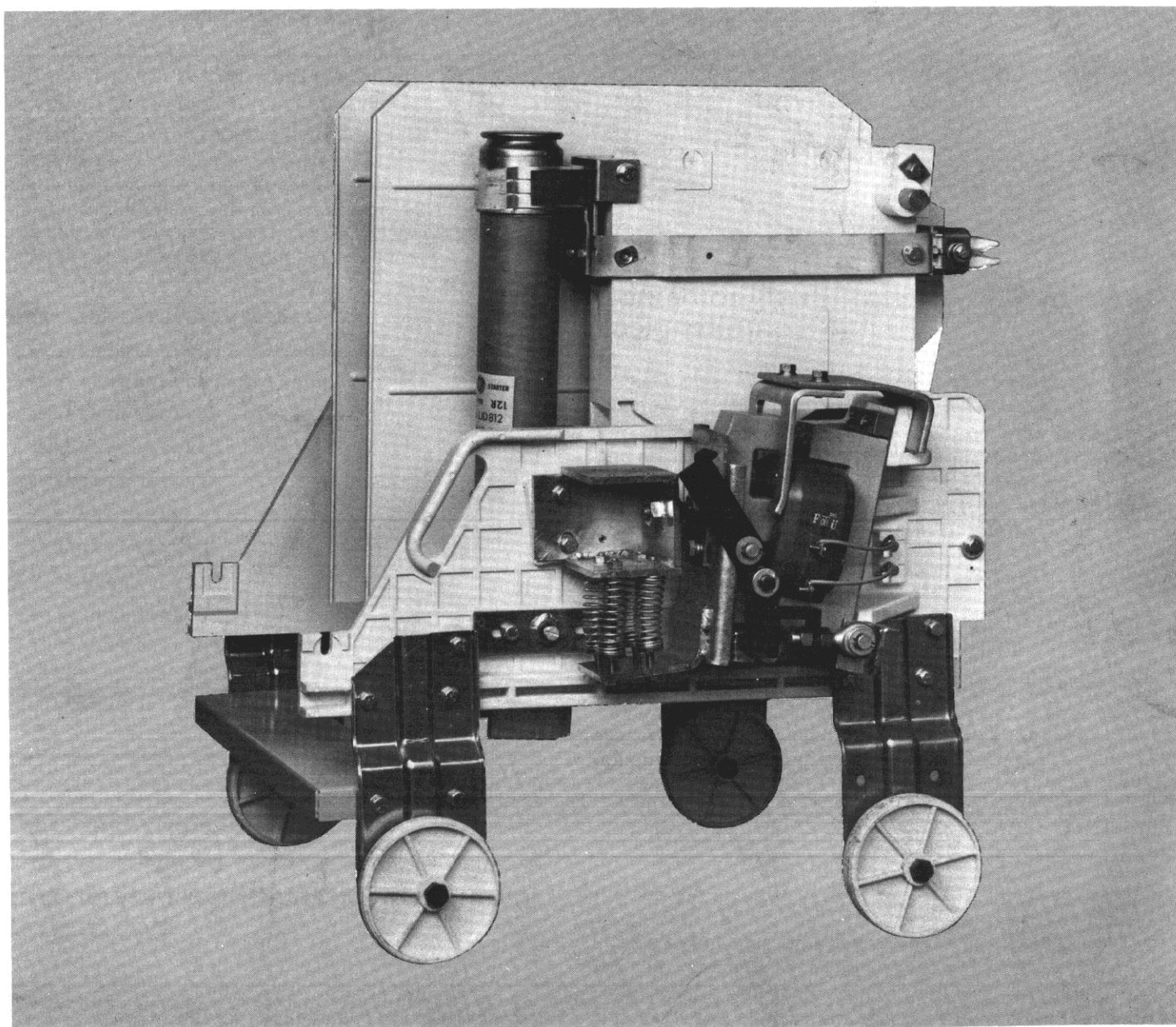
Distribution Voltage—
2400, 4160 & 4800 Vac



IC7160 Limitamp®

Controllers with Draw-out Vacuum Contactor

CAUTION: Before installing in a nuclear application, determine that the product is suitable for such use.



GENERAL  ELECTRIC

Horsepower and current ratings

One-high Construction

System Distribution Voltage	Maximum Motor Hp Approximate	
	Induction, Wound- rotor, Synchro- nous 0.8 PF	Synchro- nous 1.0 PF
Limitamp 400		
2400	1500*	1750*
4800	2500*	3000*

* Based on 360 amperes maximum, enclosed, NEMA 1, vented, one-high enclosure. For non vented enclosure, 320 amperes maximum.

Multi-high Construction

Induction	3 Starters			
	2400 Volts		4000-4800 Volts	
	Amperes (per Starter)	Hp Approximate	Amperes (per Starter)	Hp Approximate
Vented	250	1000	250	1750
Non-vented	150	625	150	1000
	2 Starters			
	310	1250	310	2500
	210	875	210	2000

Voltage and interrupting ratings

Voltage	Three-phase Symmetrical System MVA	
	Unfused	Fused
2400	24	200
4160	40	350
4800	40	400

Interchangeability with air-break contactors

CR 193, 400-ampere, Vacuum Contactors are interchangeable with existing 400-ampere air-break contactors beginning with the 1966 Limitamp design. However, replacing air-break contactors with vacuum contactors requires minor control circuit modifications. For example, the vacuum contactor coil is dc operated whereas the air-break contactor coil could be either ac or dc operated. Even if an existing air-break contactor has a dc coil the economizing resistors are different than the resistors required for the vacuum contactor. Therefore, before replacing an air-break contactor with a vacuum contactor refer details (catalog and diagram numbers of existing Limitamp controller which can be obtained from panel data nameplate located below the starter handle on the outside of high voltage door) to the General Electric Company for review and recommendations.

Adjustments, servicing, and inspection

A properly adjusted vacuum contactor requires very little maintenance. Inspection should be made during installation and annually thereafter to verify proper adjustments.

The 400-ampere Vacuum Contactor co-ordinates with motor-starting, current-limiting power fuses up to size EJ2-24R. However, it is recommended that the vacuum interrupters be replaced after three short-circuit interruptions in which any of the contactor's motor-starting, current-limiting power fuses opens.

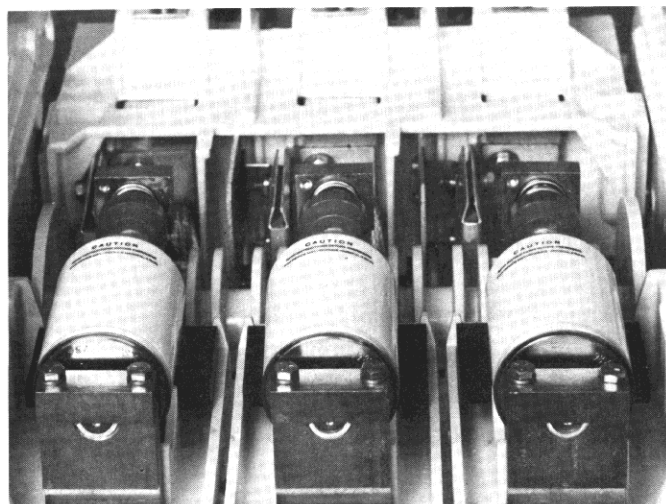


Figure 1. Fast and simple vacuum interrupter inspection

There are several important adjustments and assemblies required on the vacuum contactor that are different from the adjustments and assemblies required on the air-break contactor. Those differences can be categorized as follows.

1. Magnet and armature adjustment.
2. Amplifier adjustment.
3. Return spring adjustment.
4. Coil replacement.
5. Vacuum interrupter integrity test.
6. Contact wear inspection.
7. Vacuum interrupter replacement and adjustment.

Detailed description of adjustment, servicing, and inspection procedures are included in these instructions.

4. Remove the two (2) armature assembly mounting bolts ("G" Figure 7).
5. Remove the coil retainer mounting bolts ("H", Figure 7).
6. Disconnect the coil leads at the coil and remove the coil (Figure 8).
7. Replace coil and reassemble parts in reverse order (Step 6-1).

Note that new cotter pins should be installed at locations "A" and "B" (Figure 5).

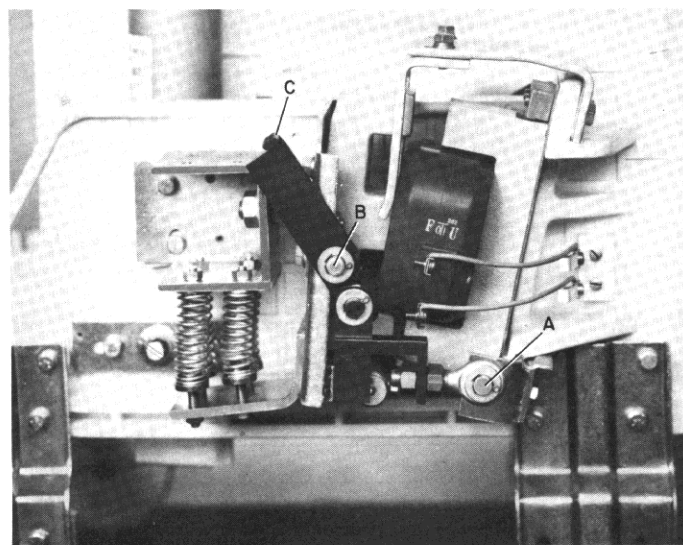


Figure 5. Coil replacement Step 1 and Step 2 — removal of cotter pins, flat washers, and amplifier assembly

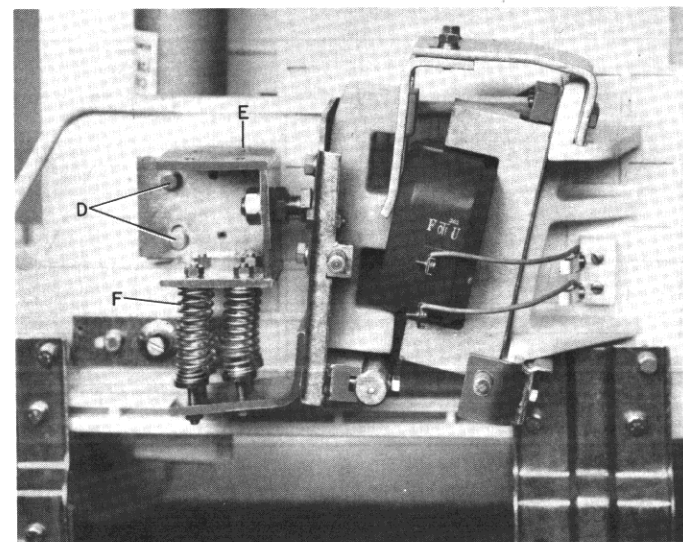


Figure 6. Coil replacement Step 3 — removal of armature stop — mounting bolts, stop bracket, and return springs

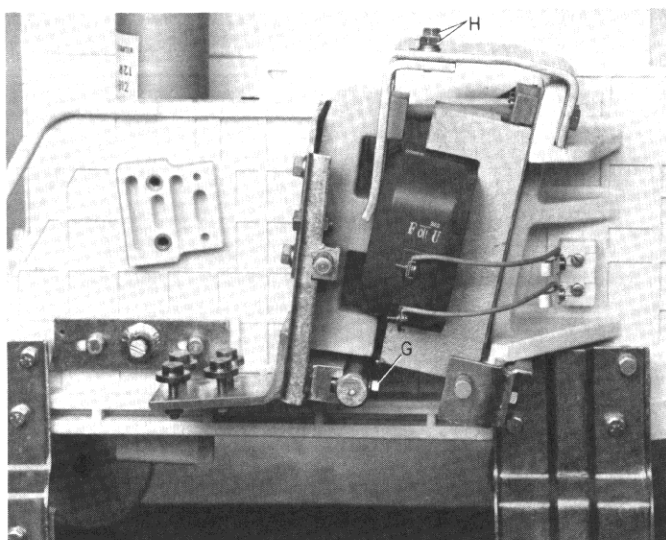


Figure 7. Coil replacement Step 4 and Step 5 — removal of armature assembly and coil retainer bolts

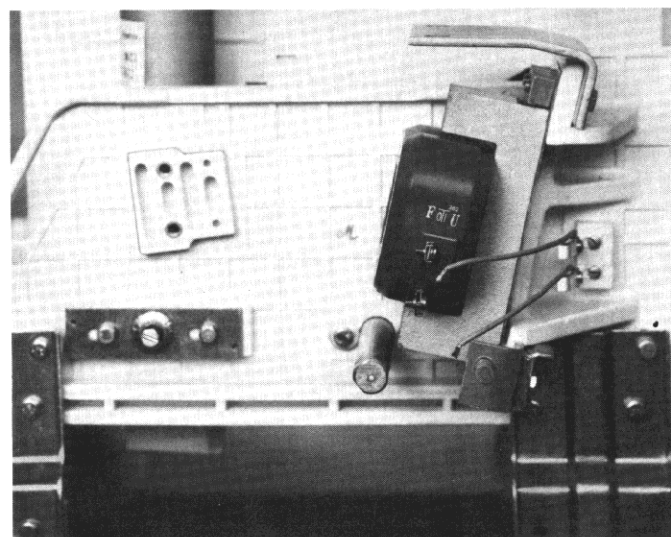


Figure 8. Coil replacement Step 6 — disconnecting the coil leads

Vacuum interrupter integrity test

CAUTION: X-RAY EMISSION MAY BE PRODUCED IF AN ABNORMALLY HIGH VOLTAGE IS APPLIED ACROSS THE OPEN CONTACTS OF A VACUUM INTERRUPTER. DO **NOT** APPLY A VOLTAGE THAT IS HIGHER THAN THE VALUE RECOMMENDED IN THIS TEST INSTRUCTION.

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These instructions do not purport to cover all details or variations in equipment 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 General Electric Sales Office.

WARNING: BEFORE ANY ADJUSTMENTS, SERVICING, PARTS REPLACEMENT OR ANY OTHER ACT IS PERFORMED REQUIRING PHYSICAL CONTACT WITH THE ELECTRICAL WORKING COMPONENTS OR WIRING OF THIS EQUIPMENT, THE POWER SUPPLY MUST BE DISCONNECTED.

Introduction

These instructions cover Limitamp controllers with drawout vacuum contactors and must be used as a supplement to the following instruction books.

1. GEH-3091 — Instructions IC7160 Limitamp Controllers with Draw-out, Air-break Contactor.
2. GEH-3102 — High-voltage Contactors, AC, Air-break Type.

The two referenced publications plus these supplementary instructions are prepared as a guide to handling, installation, operation, and maintenance of Limitamp controllers with vacuum contactors. However, certain sections of GEH-3091 and GEH-3102 do **not** apply to vacuum contactors and should be disregarded; such as,

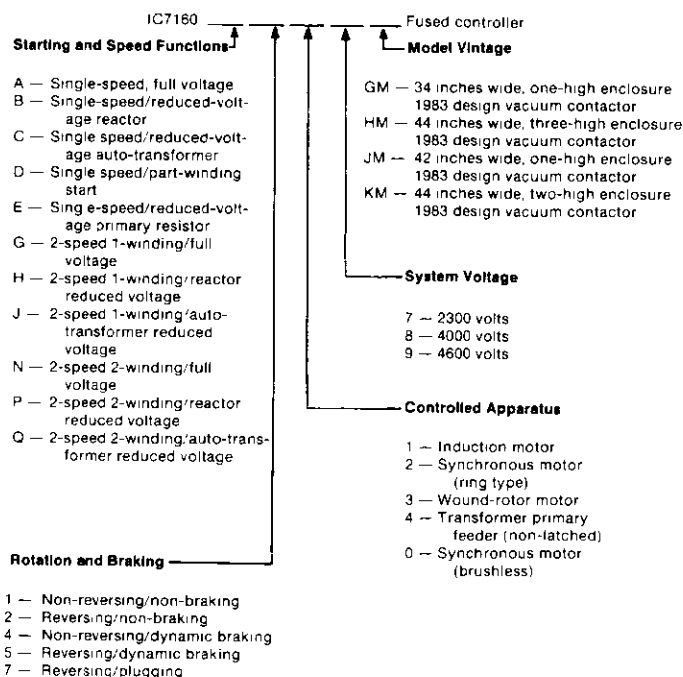
1. Equipment identification numbers.
2. Contactor identification numbers.
3. Arc barriers and arcing horns.
4. Magnet assembly.
5. Coil replacement.
6. Blowout coils.
7. Main contacts.
8. Mechanical latch.
9. Ratings.
10. Contactor adjustments.

The following information and instructions apply exclusively to Limitamp Controllers with vacuum contactors.

Description

Equipment identification—IC number designation

Basic type designation for all Limitamp vacuum equipment is IC7160, with significant alphanumeric suffixes used to define rating, function, and model design vintage.



Contactor identification — CR number designation

The two basic catalog identification numbers for the vacuum contactor are CR193V (includes dc magnet and provisions for clip fuses) and CR193W (includes dc magnet and provisions for bolted fuses). With the exception of the mechanical latch which is not available on vacuum contactors, the remainder of the catalog number is the same as the catalog number for air-break contactors.

Contactor option availability

The mechanical latch option and ac-operated coils are not available for vacuum contactors. Otherwise, the same options as the air-break contactors are available.

Ratings

Refer to the panel data nameplate on front of the enclosure for detailed ratings applicable to a particular controller. Controllers are designed to meet NEMA standards ICS 2-324 for Class E2 controllers, including 60-kV BIL. Equipment basic ratings are summarized below.

CAUTION: DO NOT DEVIATE FROM THE INSTRUCTIONS OUTLINED. DO NOT FORCE MOVEMENT OF THE ARMATURE. OVER-TRAVEL OF THE CONTACTS BEYOND THE LIMITS SPECIFIED COULD CAUSE DAMAGE TO THE VACUUM INTERRUPTER BELLOWS. DO NOT TWIST MOVABLE TERMINAL. ROTATIONAL TWISTING CAN CAUSE PERMANENT DAMAGE TO VACUUM INTERRUPTER BELLOWS. EXERCISE EXTREME CAUTION WHEN REPLACING INTERRUPTER TO PREVENT DAMAGE WHICH CAN REDUCE THE LIFE OF THE EQUIPMENT.

Magnet and armature adjustment

Wedge the armature "X" away from the bracket "Y", as shown in Figure 2, and adjust stop screw to obtain the 1.00 inch gap.

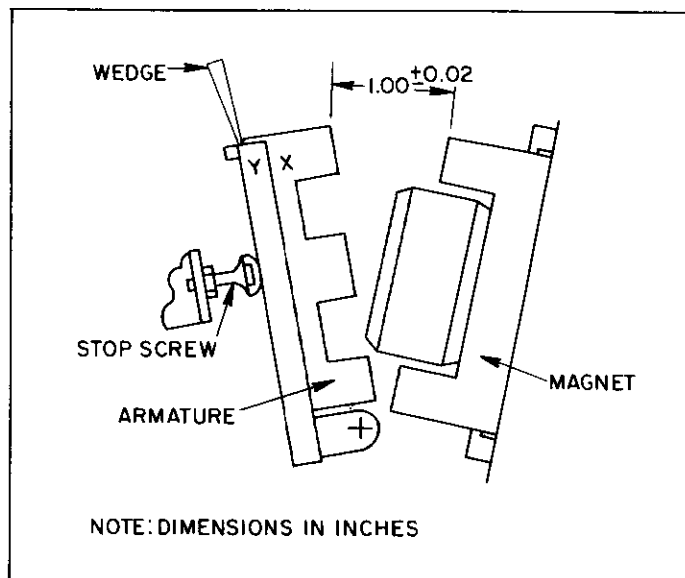


Figure 2. Adjustment of magnet and armature

Amplifier adjustment

Refer to Figure 3. Block the armature in the full closed position and install the wedge as shown in Figure 2. Align the arm "A" with the bracket "B" by means of the adjusting nuts "D". Once adjusted, tighten the adjusting nuts to 185 to 215 in-lbs.

Return—spring adjustment

Block the armature in the full open position. Return springs should be adjusted to the following lengths. See Figure 4.

Position A.....2.60 inches
Position B.....2.40 inches

Tighten the locking nuts "X" after spring adjustment.

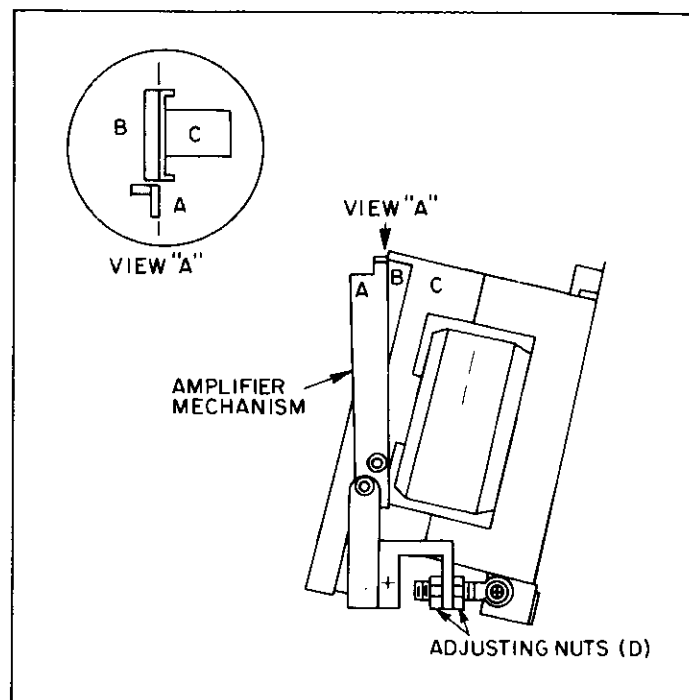


Figure 3. Adjustment of amplifier

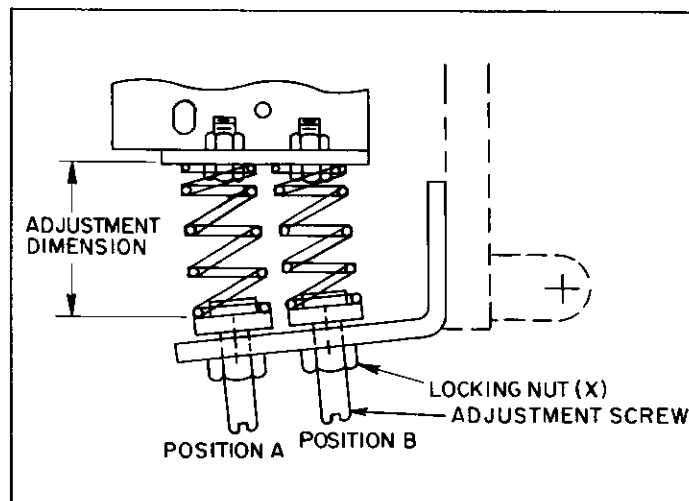


Figure 4. Adjustment of return spring

Coil replacement

To replace an operating coil, the following steps are recommended:

1. Remove the cotter pins and the flat washers at locations "A" and "B" (Figure 5).
2. Remove the Amplifier assembly "C" (black parts and bearing) by pulling at locations "A" and "B".
3. Remove (2) 5/16 - 18 armature stop mounting bolts ("D" Figure 6) and remove armature stop bracket and return springs ("E" and "F" Figure 6).

This test determines the internal dielectric condition and vacuum integrity of the vacuum interrupters.

Prior to performing this test the outside surface of the vacuum interrupter should be wiped clean of any contaminants with a non-linting cloth or industrial type wiper. During this test each vacuum interrupter should be checked individually.

WARNING: CAUTION SHOULD BE EXERCISED DURING THIS TEST SINCE HIGH-VOLTAGE TESTING IS POTENTIALLY HAZARDOUS.

1. Block the armature in the open position.
2. Connect the "hot" lead and the "ground" lead to the contactor as shown in Figure 9. Apply 20-kV (RMS) 60-Hz power and hold for a minimum of five seconds.
3. Reverse the leads and repeat the test.
4. If no breakdown occurs the interrupter is in an acceptable condition. If a breakdown occurs, the interrupter should be replaced.
5. After the high POTENTIAL voltage is removed from the vacuum interrupters the metal end caps of the interrupters should be discharged with a grounding rod to remove any residual electrical charge.

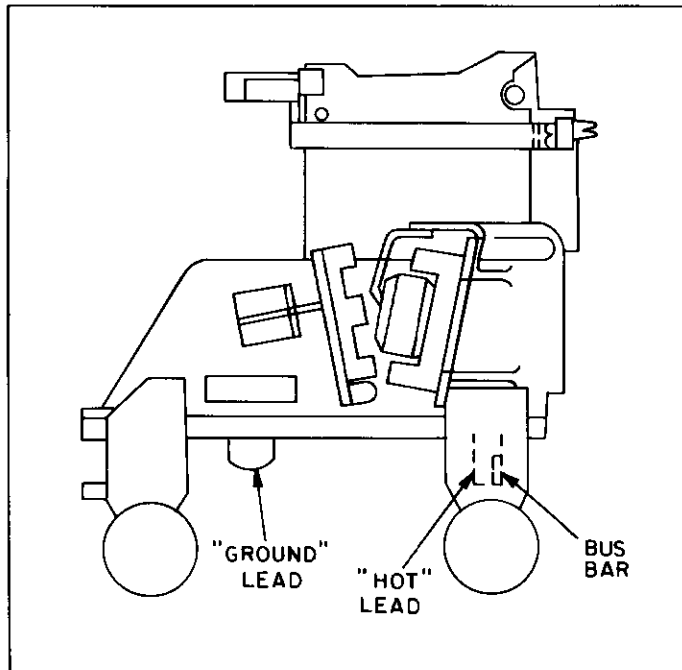


Figure 9. Vacuum interrupter integrity test

Contact wear inspection

Outlined below is the method for determining when it is necessary to replace a vacuum interrupter due to contact wear. See Figure 10.

1. Block the armature in the closed position.
2. On each of the vacuum interrupters there is a scribed line which indicates the allowable wear on the interrupter contacts. This line is identified as scribe line "Y" in Figure 10.
3. If the edge of this scribe line is in line with the edge of the guide bushing on the interrupter the interrupter must be replaced.

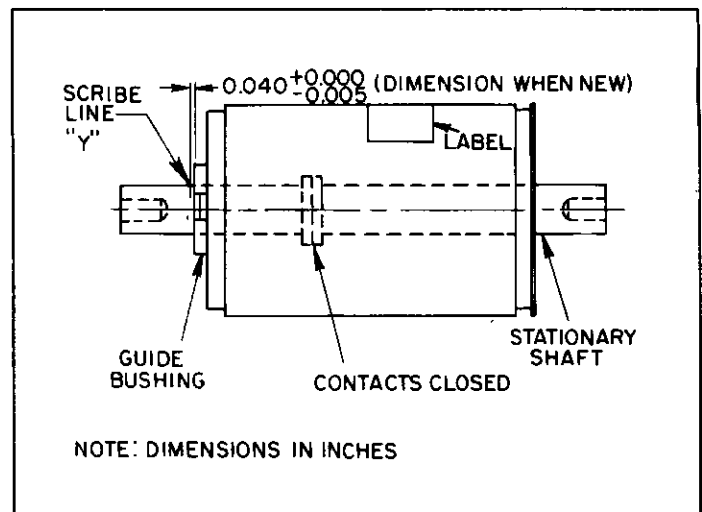


Figure 10. Inspection of vacuum interrupter for contact wear

Vacuum interrupter replacement and adjustment

To replace and adjust the Vacuum Interrupter, the following steps are recommended. See Figure 11.

1. Block the armature in the open position.
2. Remove the two (2) adjusting nuts "E".
3. Remove the bolt "F" that attaches the flexible shunt to the fuse base.
4. Loosen the interrupter clamp mounting bolts "C".
5. Remove the movable interrupter support mounting bolts "D".
6. Lift the movable interrupter support and interrupter assembly out of the contactor frame.
7. Slide the movable interrupter support off the insulator shaft.

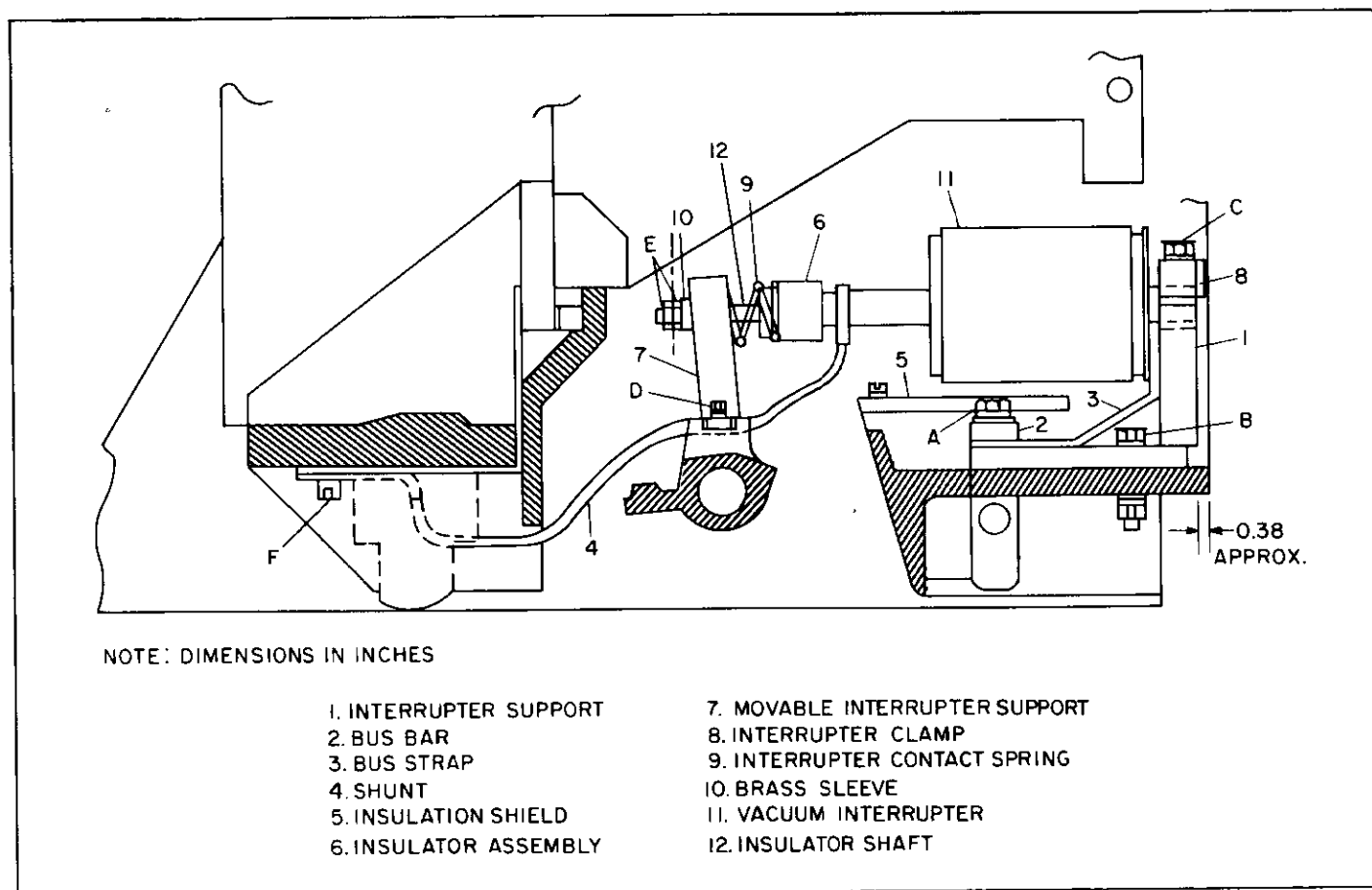


Figure 11. Adjustment and replacement of the vacuum interrupter

8. Reassemble and adjust the new interrupter and shunt assembly per the following interrupter assembly and adjustment procedures.

- A. Position shunt of interrupter assembly in the recess in the contactor shaft. Insert shaft of insulator assembly thru movable interrupter support and position assembly in contactor, as shown in Figure 11.
- B. Place interrupter clamp over stationary shaft of vacuum interrupter and push the interrupter against the stop in the clamp. Tighten two bolts "C" on the interrupter clamp.
- C. Tighten the two bolts "D" that hold the movable interrupter support to the shaft. Make sure to install a flat washer and a lock washer on each bolt before tightening bolts. Also check that the interrupter contact springs are properly seated in the movable interrupter support.
- D. Install the brass sleeve over insulator shaft and into spherical bearing. Apply lubriplate (272A5509PN) to inside and outside diameters of the brass sleeve before assembly.
- E. Attach loose end of the flexible shunt to the fuse base and tighten bolt "F".

F. Interrupter contact gap adjustment. See Figures 11 and 12.

CAUTION: EXTREME CARE SHOULD BE EXERCISED DURING THIS ADJUSTMENT IN ORDER TO AVOID DAMAGE TO THE BELLOWS OF THE VACUUM INTERRUPTER. APPLYING EXCESSIVE TIGHTENING FORCE TO THE NUT MAY PINCH THE BELLOWS AND RESULT IN LOSS OF VACUUM.

- (1) Starting with the interrupter in the center phase, install one nut "E" on insulator shaft. Tighten the nut until the scribe line "Z" (Figure 12) is in line with the edge of the guide bushing.
- (2) While holding nut "E" in place install a second nut "E" and tighten it against the first nut "E". **Special care must be exercised during this step to prevent the application of rotational forces to the movable shaft of the vacuum interrupter.**
- (3) Once adjustment of the center phase interrupter is complete move to each of the outer phases in

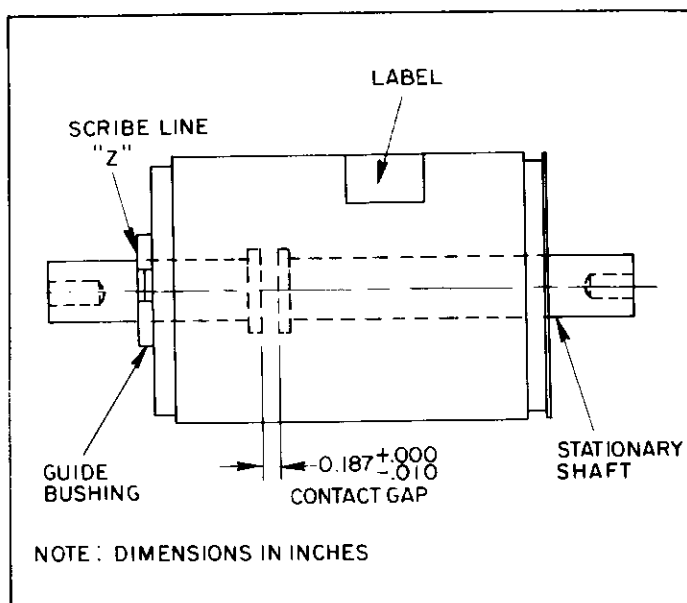


Figure 12. Contact gap adjustment of the vacuum interrupter

succession. Adjust each of these interrupters in the same manner as that used for the center phase except do not install the locking nut.

- (4) After adjustment of the interrupters in the two outer phases, block the armature in a position where the contacts on the center interrupter are just touching (kiss position). This position is best gaged by means of a continuity tester. Now proceed to adjust the interrupter in the two outer phases by means of the adjusting nut "E" to provide for contact touch on each interrupter. After adjustment install a second nut "E" and tighten it against the first nut "E" on each of the outer interrupters.
- (5) Remove the block from the armature and manually open and close the armature while gaging all three vacuum interrupters simultaneously to verify that all three interrupter contacts close at the same instant. If all contacts are not closing simultaneously, readjust the interrupters in the outer phases as required.

For further information
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