TYPE LF-50V430 CONTACTOR

HIGH VOLTAGE

VACUUM

DESCRIPTION

APPLICATION

The Type LF-50V430 vacuum contactor is a NEMA size H3 contactor designed for starting and controlling three phase, 50-60 Hertz AC motors on 2200-2500 volt and 4000-5000 volt systems and has horsepower ratings up to 3,000 HP as shown in Fig. 1 . The Type LF-50V430 contactor has a continuous open rating of 400 amperes, but may also be used where NEMA ratings of 100 or 200 amperes are required.

The Type LF-50V430 contactor has an interrupting rating of 50,000 KVA, but when used in NEMA class E2 controllers, where current limiting fuses limit and interrupt short circuit current, the Type LF-50V430 contactor may be used on circuits having short circuit capacities up to 350,000 KVA as shown in Fig. 1 .

Contactor Continuous Rating in Amperes		System Voltage	Horsepower Rating			Controller Interrupting Capacity — 3 Phase Symmetrical KVA	
			Synchronous Motor		Induction Motor		
Open	Enclosed		100% P.F.	80% P.F.		NEMA E1	NEMA E2
400	360	2200-2500	1750	1500	1500	50,000	200,000
400	360	4000-5000	3000	2500	2500	50,000	350,000

Fig. 1 Ratings

GENERAL

The Type LF-50V430 contactor is a three pole DC magnet closed device employing individual vacuum interrupters for each pole. The interrupter assemblies are actuated through contact springs by means of molded insulators attached to a rectangular steel crossbar. The crossbar is supported at both ends by steel operating arms pinned to a round steel operating shaft. The operating shaft is supported by self-aligning ball bearings mounted in the contactor end plates.

Arc resistant barriers are mounted between phases and also between the two outside poles and the contactor end plates.

This contactor can be used interchangeably in an Ampgard starter with the conventional 400 ampere air break contactor.

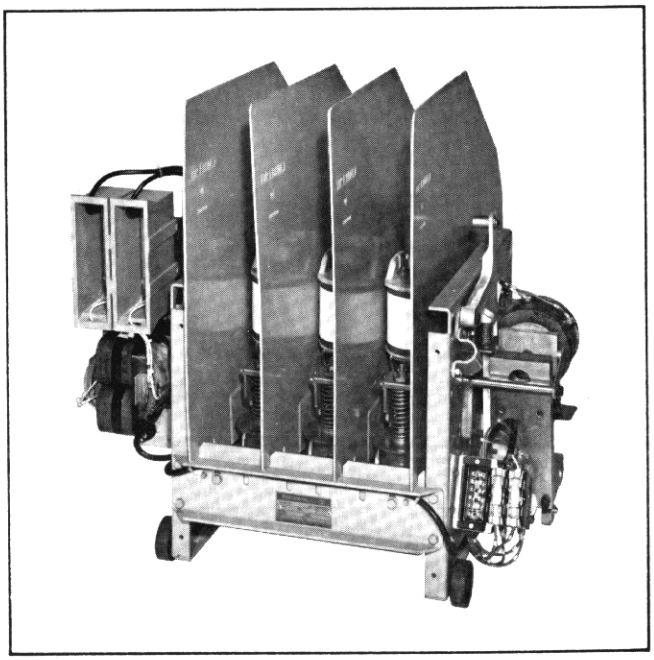

Fig. 2 Type LF-50V430 Contactor *(Photo BD 72-0253)*

CONTACTOR ASSEMBLY

The contactor assembly consists of two steel end plates, a steel channel in front, and an insulating cross member in the rear which support the following components;

(a) Operating magnet

(b) Electrical interlocks

(c) Contact actuating mechanism

(d) Interrupter assemblies

(e) The fuse jaw or support for the load side of current limiting fuses when the contactor is to be built into a fused controller.

(f) Bolt-on or stab type line terminals when the contactor is to be used without fuses.

(g) Stab type load connectors

(h) High voltage control transformer and fuses when used in an Ampgard starter.

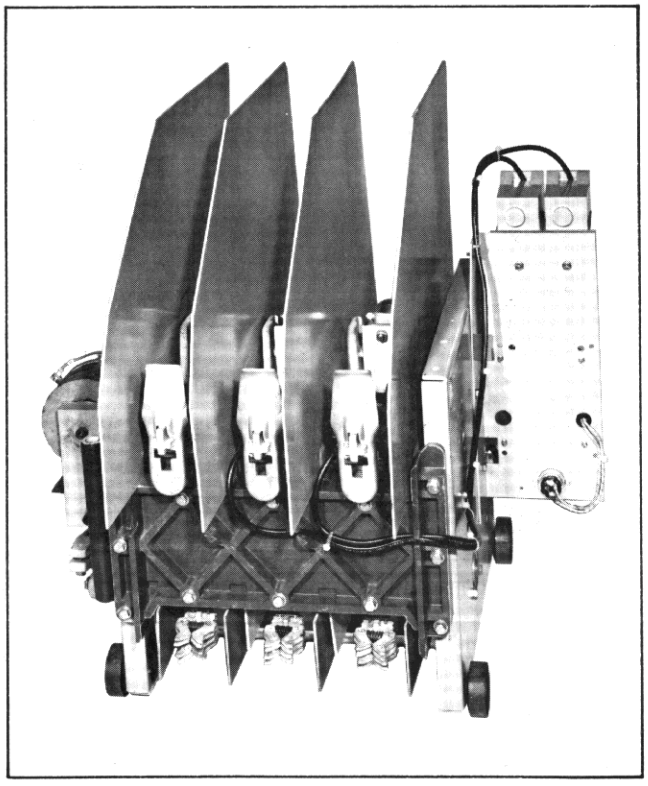

Fig. 3 Rear View of Type LF-50V430 Contactor

(Photo BD 72-0252)

INTERRUPTER ASSEMBLY

Each interrupter assembly may be installed or removed from the contactor as an individual sub-assembly so that it may conveniently be assembled or maintained at a workbench rather than in the contactor. This sub-assembly is comprised of the interrupter unit, interrupter supports, moving contact actuating arms and moving contactor shunt.

The interrupter unit is rigidly supported at its upper end containing the interrupter stationary contact, so as to avoid transmitting contact forces through the walls of the interrupter unit. The moving contact end of the interrupter is, in addition, clamped in place to provide lateral stability. Since the location of the upper ends of the interrupter units is fixed, the manufacturing tolerances on the interrupter units and their support members will result in variations in the locations of the lower ends of the various interrupter units of a multi-pole contactor.

In order to maintain proper alignment of the contact actuating mechanism under this condition, the actuating mechanism is mounted on the moving contact end of the interrupter unit rather than on some part of the contactor frame.

To obtain maximum interrupter bellows life, it is important that no rotational torque be applied to the moving contact shaft of the interruper unit since this will stress the bellows and shorten its life. The contact operator and shoulder bolt designs are coordinated in a manner that the shoulder bolt does not clamp the contact operator to the contact shaft, but instead permits the contact operator to rotate freely on the contact shaft when the contact operator is being lined up with the contact actuating arms. The shoulder bolt, in addition, is only tightened finger tight to prevent damage to the bellows during shoulder bolt installation. After the contact drive pin is installed, the contact actuating arm is depressed to take up the play between the contact drive pin and contact shaft following which the contact operator is clamped to the contact shaft. In service, the contact shaft will be actuated through the clamped joint between it and the contact operator, but should this joint loosen, the contacts will still be closed by compression of the parts between the drive pin and the end of the contact shaft, and pulled open by the shoulder bolt.

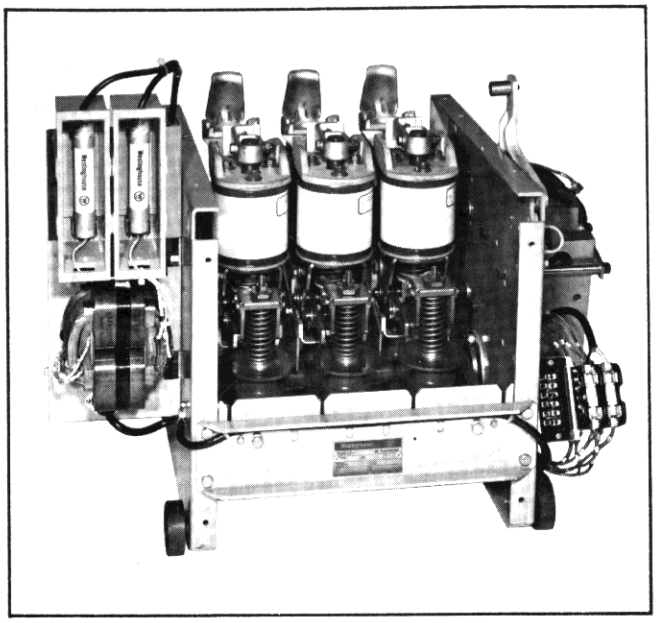

Fig. 4 Type LF-50V430 Contactor with Phase Barriers removed

(Photo BD 72-0254)

OPERATING MAGNET

In order to isolate the low voltage control circuits from parts energized by high voltages and to achieve maximum accessibility, the DC clapper type operating magnet is mounted on the outside of the right hand end plate. The magnet armature is clamped to a round steel shaft which projects through the right hand contactor end plate. The magnet armature is adjusted and locked in position by means of an adjusting bolt, with locknut, which engages an operating arm clamped and keyed to the same shaft. This adjustment controls the main contact over-travel so that both measurement and adjustment of contact over-travel is made simply, and in a most accessible location.

When an AC control circuit is used, a rectifier to convert the AC control power to DC power for the coils, must be provided. No provision is made for mounting this detail on the contactor. Silicon rectifiers for this purpose may be ordered by referring to the appropriate style number as listed in Fig. 5 . The operating coil and electrical interlock wiring is terminated at a plug mounted on the right hand end-plate. Contactors which are to be used as part of an Ampgard starter may in addition be supplied with control transformer, fuses, and miscellaneous mechanical details to provide mechanical interlocking with the isolating switch, with other contactors, and to latch the contactor in place within the starter enclosure.

AC Control Voltage	Nominal Coil Voltage (DC)	Rectifier Unit S #	Coil S #	Protective Resistor S #
115	100	2018A40G01	3489C96G01	443A328H30 (36 ohms) Req. 1
230	200	2018A40G02	3489C96G02	443A335H35 (75 ohms) Req. 2

Fig. 5 Operating Coils

ELECTRICAL INTERLOCKS

Two type L-64 electrical interlocks are mounted in front of the magnet to provide a maximum of four auxiliary circuits for use in the starter control circuits. Any combination of normally open or normally closed circuits are made available by selection of the appropriate style of interlock assembly from Fig 6 .

Actuation of the interlocks is by a pushrod attached to the armature adjusting casting mounted on the steel operating shaft. The pushrod carries an adjustable operating disc that operates the type L-64 interlock plungers.

A third type L-64 electrical interlock with two normally closed contacts is mounted on the lower magnet core and is reserved for use in the coil circuit to insert a protective resistor in series with the magnet coil when the armature is picked up.

Interlock Style	Circuit Combination Provided By One Interlock Assembly
843D943G04	One normally open, One normally closed
843D943G05	Two normally open
843D943G06	Two normally closed

Fig. 6 Type L-64 Electrical Interlocks

MAINTENANCE AND REPAIR

GENERAL

This industrial type control is designed to be installed, operated, and maintained by adequately trained workmen. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operation, or maintenance. Care must be exercised to comply with local, state, and national regulations, as well as safety practices, for this class of equipment.

A maintenance program should be established as soon as the contactor is installed and put into operation. After the contactor has been inspected a number of times at monthly intervals, and the condition noted, the frequency of inspection can be increased or decreased to suit the conditions found, since this will depend upon the severity of the contactor duty.

All work on this contactor should be done with the main circuit disconnect device open, and using a separate source of control power to operate the magnet.

HANDLING

Lifting holes are provided at the top edge of both right and left hand end plates for use with lifting hooks or ropes. Remove the outer phase barriers to obtain full access.

Contactors which are to be used in Ampgard starters are supplied with wheels and provision for inserting a short length of standard ¾" pipe in the contactor end plate to aid in moving the contactor about.

For further Ampgard starter details see I.L. 11-202-8.

INSULATION LEVEL

After installation, and before energizing the contactor for the first time, the insulation resistance between poles and from each pole to ground should be measured and recorded. It is not practical to specify an absolute value for this reading since it is dependent on other connected apparatus, and conditions of service. However, any unusually low reading or abrupt reduction in this reading would indicate a possible source of trouble, and the cause should be established and corrected.

The dielectric strength of interrupters must be checked before the contactor is energized for the first time and regularly thereaftetr to detect at the earliest possible date any deterioration in the dielectric strength of the contact gap since this may result in an interruption failure. A good interrupter will withstand a 14KV - 60 Hertz test across a .125" contact gap.

Periodic dielectric tests across open contacts should not be omitted on the basis of satisfactory contactor performance since under certain operating conditions the contactor may perform satisfactorily even though one vacuum interrupter is defective.

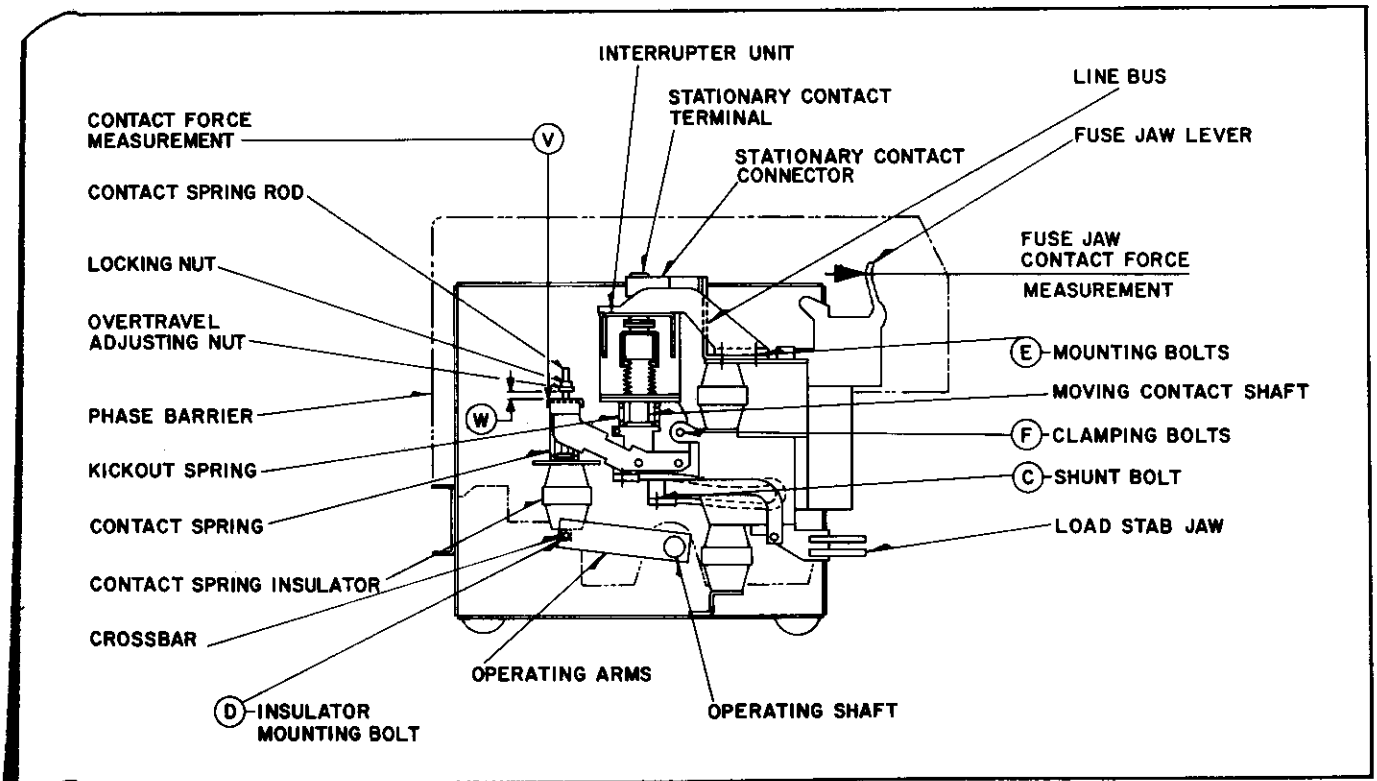

FIG. 7 General Assembly (Dwg. 6376D76)

MAIN POWER CIRCUIT

The general condition of the connectors, shunts and load plug assemblies should be noted, especially any discoloration which would indicate excessive heating due to loose hardware, high current or low contact force. To obtain maximum access to these details for tightening or replacement, the contactor phase barriers may be removed.

Check, and if necessary, adjust the contact forces and overtravel, and see that all contacts touch simultaneously using the following procedure:

1) Move the contacts to the contact touch position by hand and check to see that all contacts touch within .016" measured at the interrupter contact shaft or within .032" measured at the overtravel adjusting nut.

2) Check contact overtravel and final forces with the magnet armature sealed in. When the interrupters are new, overtravel at point "W" of Fig. 7 should be from .312" to .344", average contact spring length approximately 3" and contact force 34 to 44 lbs. at point "V". After the contactor has been placed in service, contact erosion will result in a gradual decrease in overtravel and final contact force. When overtravel is reduced to .125" interrupter contact material will have been used up and the interrupter must be replaced. Contact forces with .125" overtravel will be 25 to 32 lbs.

   An abrupt 5 to 8 lb. reduction in final contact force with no corresponding change in overtravel or contact spring length will in most instances be due to a loss of interrupter vacuum, but could also be a result of defective kickout or contact springs.

3) Average contact spring length and final contact forces are adjusted by varying the angular relationship between the magnet armature and operating shaft as follows:

   (a) Loosen the two bolts at "A" in Fig. 8 which clamp the magnet armature to the operating shaft.

   (b) Block the magnet armature closed.

   (c) Adjust bolt "B" in Fig. 8 as required to provide correct contact spring length and final contact force.

   (d) Re-tighten the two bolts at "A" locking nut on bolt "B".

4) Initial contact force should be checked with the magnet armature blocked approximately .032" from the contact touch point. Force at point "V" of Fig. 7 should be 22 to 28 lbs.

5) In the event initial contact forces or contact touch points are not within allowable limits, the overtravel adjusting nuts may be re-adjusted to provide the necessary corrections. This adjustment will affect overtravel, initial contact force and contact touch point simultaneously so all three must be rechecked following an adjustment of the overtravel nut.

6) Examine the lower fuse finger mounted at the rear of the stationary contact support. The contact surface should be clean, and the fuse finger should pivot smoothly. Check the initial spring force. Measured at the point of contact with the fuse, this initial force should be 30 to 40 lbs.

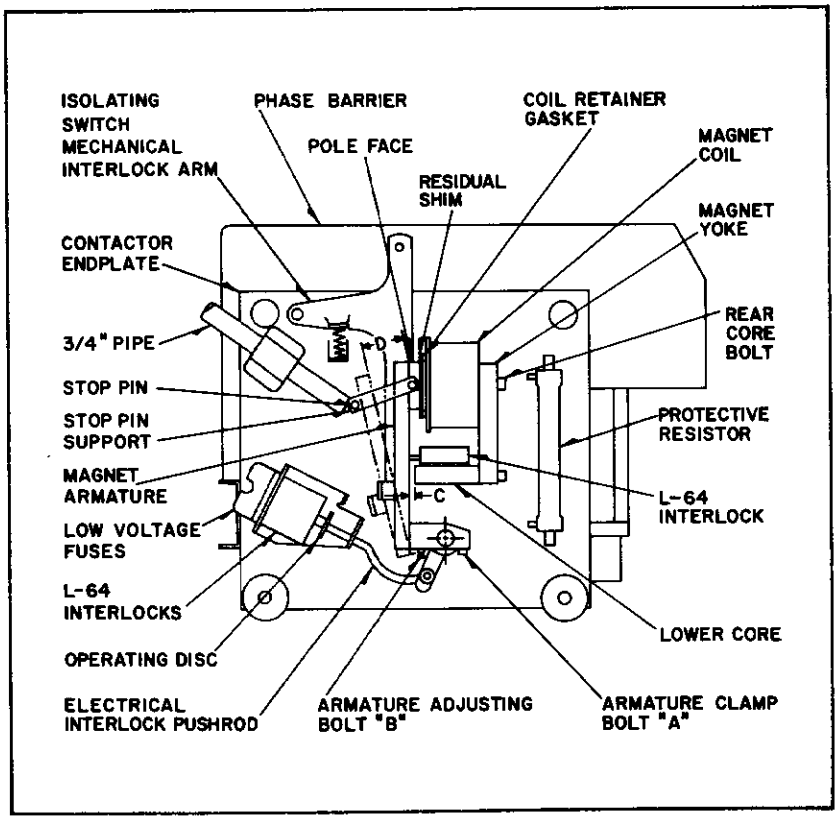

Fig. 8 Magnet Assembly *(Dwg. 6376D77)*

INTERRUPTER ASSEMBLY

The vacuum interrupter requires no maintenance other than cleaning its outside insulating surfaces if necessary, but open gap dielectric tests must be performed periodically to ascertain operating conditions within the sealed intrerrupter. In the event the interrupter develops a leak or the atmosphere within the interrupter becomes contaminated, it will not be capable of interrupting load currents within its rating and in addition may not even be capable of withstanding rated line voltage so, therefore, must not be used under any circumstances.

In the event the interrupter bellows or bottle develops a leak, there will be little or no atmospheric pressure acting on the moving contact assembly to close the contacts, so this type of defect can readily be detected by measuring the atmospheric closing force acting on the moving contact shaft. Without the kickout spring, the closing force for a good interrupter will be from 10 to 20 lbs., but when the kickout spring is in place, a force of 20 to 31 lbs. at the contact shaft or a force of 7 to 11 lbs. at point "V" of Fig. 10 will be required to close the contacts.

In the event the atmosphere within the interrupter becomes contaminated but the interrupter has not lost vacuum, it will be necessary to perform a dielectric test across the interrupter contact gap to ascertain this condition. If the interrupter does not withstand 14 KV across a .125" contact gap it should be replaced.

When the vacuum interrupter units are to be replaced, they are removed from the contactor as a part of the interrupter assembly as shown in Fig. 9 as follows:

1) Remove bolt "C" of Fig. 7 from the lower leg of the shunt.

2) Remove locking nut and overtravel nut from contact spring rod.

3) Remove bolt "D" attaching the contact spring insulator to the steel cross bar and then remove the contact spring assembly.

4) Remove stationary contact connector.

5) Remove the two stationary contact support bolts "E".

6) Loosen but do not remove the two bolts "F" clamping the lower end of the interrupter assembly in place.

7) Pull the lower end of the interrupter assembly forward to disengage it from clamping bolts "F", and then lift the assembly vertically to clear the line bus.

Fig. 9 Interrupter Assembly *(Photo BD 72-0251)*

To remove the interrupter support and operating details for re-use with the replacement interrupter, proceed as follows:

1) Remove the bolt from the upper leg of the shunt.

2) Remove the contact drive pin.

3) Remove the shunt and reverse current loop arm assembly.

4) Remove Allen head shoulder bolt "G" of Fig. 10 .

5) Loosen clamping bolt "H" of Fig. 10 .

6) Remove contactor operator and kickout spring.

7) Remove the supports from both ends of the interrupter unit.

Normally all three interrupters must be replaced at one time to avoid having unequal contact touch points, contact overtravel, and contact forces on different poles of the contactor due to the difference in contact material thickness in the new and used interrupters. In the event one of the interrupters must be replaced before the

remaining interrupters have suffered an appreciable amount of contact erosion, it would be permissible to replace only the defective interrupter provided proper contact adjustment can be made.

New interrupter units are installed using the following procedure:

1) Mount the upper support casting on the stationary contact end of the interrupter, but do not tighten the mounting nuts.

2) Set the assembly down with the moving contact shaft pointing up using the support casting as a base. Check to be sure the contact shaft bushing is in place and then install the steel disc against the end of the interrupter unit. Now mount the lower interrupter support assembly on the moving contact end of the interrupter and tighten all three nuts to a maximum torque of 10 Ft. Lbs.

3) Drop the kickout spring in place over the moving contact shaft.

4) Using standard .062" thick 3/8" flat washers if necessary, build the extension of moving contact shaft up to 1.78 ± .03 as shown in Fig. 11 . This is to compensate for manufacturing tolerances on the interrupter unit and will in most cases require two washers.

5) Slide the copper contact operator over the moving contact shaft, compressing the kickout spring slightly.

6) Install Allen head shoulder bolt "G", but only *tighten finger tight so that unnecessary torque is not applied to the interrupter bellows.* At this point in the assembly, clamping bolt "H" on the contact operator must still be loose and the contact operator must be free to rotate on the contact shaft so that excessive torque cannot be

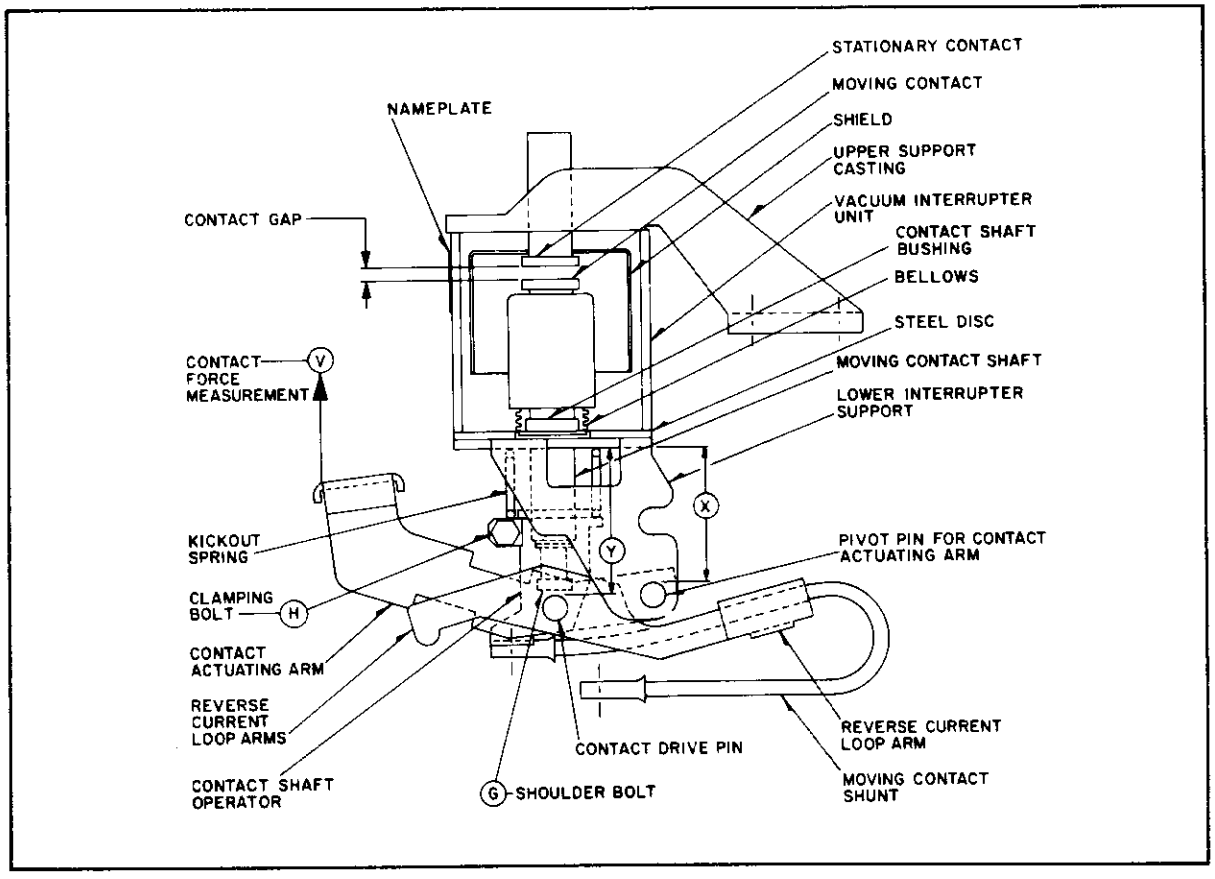

Fig. 10 Interrupter Assembly *(Dwg. 6376D78) Sub. 2*

applied to the contact shaft during the remainder of the assembly procedure.

7) Install the shunt assembly passing the drive pin through reverse current loop arms, contact actuating arms and contact operator and then replace flat washers and cotter pins.

8) Apply sufficient force to the contact actuating arm to close the contacts and also remove play between the end of moving contact shaft, shim washers and contact operator and then tighten clamping bolt "H" to clamp the contact operator in position on the contact shaft. When the contacts are closed, dimensions "X" and "Y" of Fig. 10 should be equal within .032. If this measurement is not within .032, it should be corrected by adding or removing flat washers from the end of the contact shaft.

9) The interrupter assembly is now complete but should be operated several times by hand to check for binding or friction in the operating arms or between the contact shaft and its bushing. If kickout spring and atmospheric closing forces are within acceptable limits, a vertical force of 7 to 11 lbs. applied at point "V" near the end of the contact operating arm will be required to close the contacts.

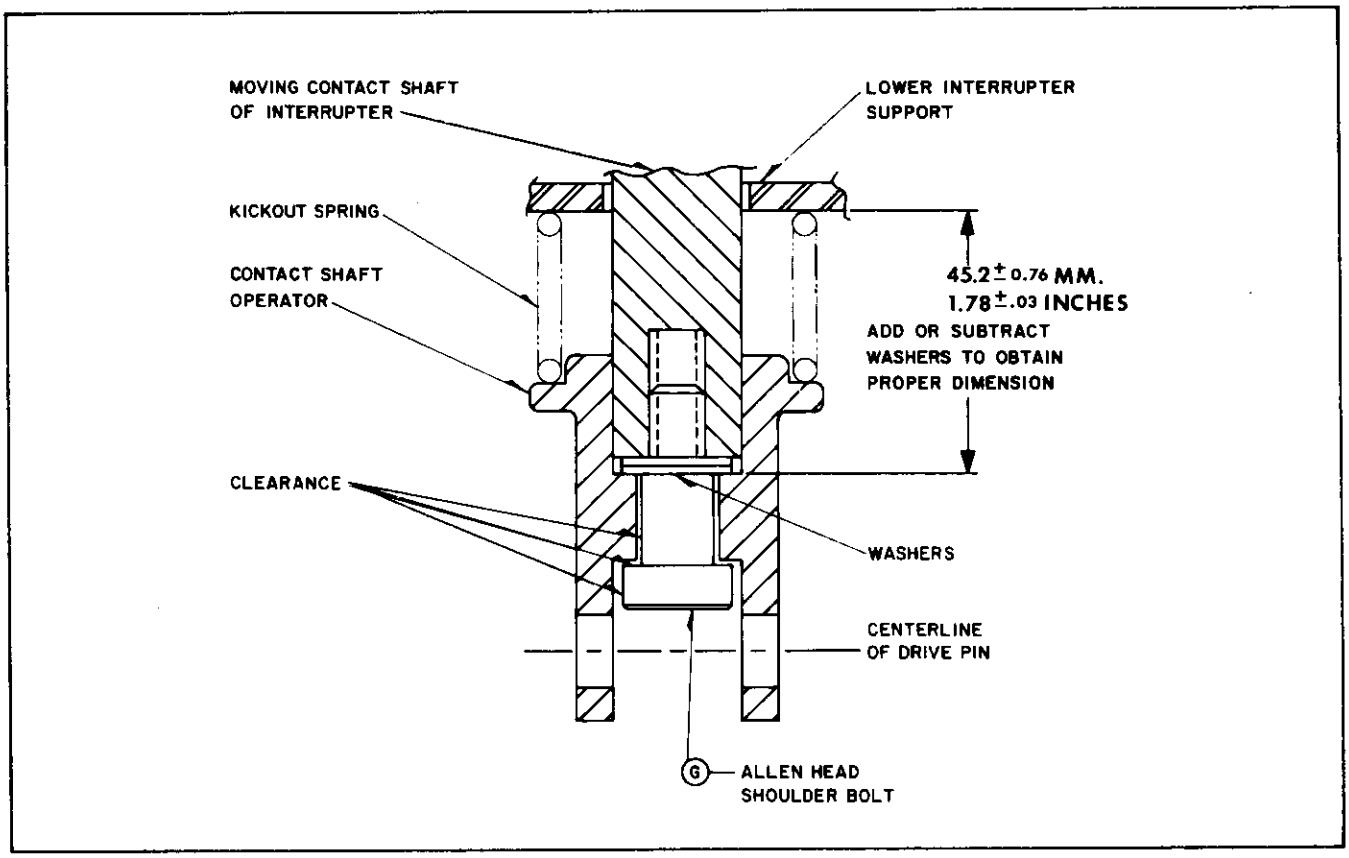

Fig. 11 Contact Operator Assembly *(Dwg. 6460D42 Sub. 2)*

To install the interrupter assembly in the contactor, proceed as follows:

1) Lower the interrupter support casting down over the vertical line bus and at the same time swing the lower end of the assembly into place to engage the two slots in the interrupter support with clamping bolts "F" of Fig. 7.

2) Adjust the upper support castings to provide equal spacing between poles and then tighten the two mounting bolts "E" of Fig. 7.

3) Rotate the interrupter units in their support castings slightly as required to provide approximately 4.38" spacing between the contact spring rod holes in the contact actuating arms and then tighten the three mounting nuts at the upper end of the interrupter unit and the two clamping bolts

"F" of Fig. 7. Torque on the mounting studs at the ends of the interrupter units should not exceed 10 ft. lbs.

4) Replace the connector between the vertical line bus and the stationary contact terminal of the interrupter unit.

5) Reconnect the shunt.

6) Install contact spring assemblies and adjust overtravel nuts and magnet assembly to provide proper contact touch point, contact overtravel and contact forces.

7) Tighten locking nuts for the overtravel nuts and armature adjusting bolt. Also, tighten armature clamp bolts "A" of Fig. 8 .

8) Replace phase barriers.

9) Block contacts at a .125" gap and perform a 14 KV, 60 Hertz dielectric test across the open contacts. A .38" thick block placed between the operating magnet armature and the stop pin will provide a contact gap of .125".

OPERATING MAGNET

The previous section, dealing with main contact overtravel, also covered the principal magnet adjustment since this controls the contact overtravel.

In carrying out general inspections, operate the magnet armature by hand. Any friction should be investigated and corrected. Check that the armature seats squarely without hitting the magnet pole face bolts, and that a .090-.156" gap at point C of Fig. 8 has been maintained.

REPLACING COILS

To change operating coils, proceed as follows:

1) Disconnect the leads from the coil terminals.

2) Remove the two 3/8"-16 Allen head cap screws used to attach the magnet pole face to the contactor end plate and armature stop pin support.

3) Remove the rear core bolt attaching the core to the magnet yoke and lift the core and coil assembly out of the magnet frame in a vertical direction.

4) Install the new coil on the core assembly being sure the residual shim and coil retainer gasket are mounted as shown in Fig. 8 .

5) Re-install the core assembly by reversing the above disassembly procedure.

ELECTRICAL INTERLOCKS

Two type L-64 interlocks for general use in the control circuit are mounted on a steel base which is in turn bolted to the right hand contactor end plate, in front of the magnet. It is very important to be sure the interlock plunger does not reach its solid stop before the contactor is fully closed. The interlock adjustment is properly set when the plunger can be depressed slightly beyond the position it takes when the magnet armature is fully sealed. This adjustment is effected by adjustment of the operating disc mounted on the pushrod.

A third type L-64 interlock which is used in the magnet coil circuit, to insert a protective resistor, is mounted on the lower magnet core and is operated directly by the magnet armature. In this application a "late break" operation is required so the interlock is permanently mounted in a position such that its contacts will open when the armature gap C of Fig. 8 is approximately .188".

For further details of the L-64 interlock see I.L. 15-829-7.

PROTECTIVE RESISTOR

The nominal voltage rating of the magnet coil is the DC voltage which must be applied to the coil to close the main contacts. When the armature picks up, a protective resistor is inserted in series with the coil to reduce the coil voltage to a value which the coil can withstand continuously. The holding voltage applied to the coil should be approximately 25% of nominal rating when the coil is cold and approximately 30% of nominal coil voltage when the coil is hot.

Name of Part	Identification No.	Number Per Unit	
		Two Pole	Three Pole
Vacuum Interrupter	WL 23315	2	3
Moving Contact Shunt	3494C81G01	2	3
Contact Spring	2043A69H08	2	3
Kickout Spring	2043A69H07	2	3
Operating Coil	See Fig. 5	1	1

Fig. 12 Renewal Parts

Westinghouse Electric Corporation
General Control Division
Buffalo, New York 14240

Printed in U.S.A.
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