Westinghouse

DESCRIPTION MAINTENANCE

INSTRUCTIONS

I. L. 16-200-2

TYPE K-430 CONTACTOR

HIGH VOLTAGE OIL IMMERSED

DESCRIPTION

APPLICATION

THE TYPE K-430 OIL IMMERSED CONTACTOR is designed for starting and controlling A-C motors on 2300, 4160 and 4800 volt power systems, and is suitable for use with motors up to 3000 HP maximum. (See Table No. 2). It has a continuous NEMA rating of 400 amperes, but it can also be used in applications requiring continuous NEMA ratings of 100 and 200 amperes without any change in design.

When used in NEMA Class E1 controllers where the contactor contacts will have to interrupt short circuit currents, the contactor KVA interrupting capacity is as shown in Table No. 1, column 3. When used in NEMA Class E2 controllers where current limiting fuses limit and interrupt short circuit currents, the contactor may be used on circuits having maximum available KVA capacity as shown in Table No. 1, column 4.

GENERAL DESCRIPTION (See Figs. 3 & 4)

The basic three pole contactor is built around three stationary contact assemblies (1) mounted on an insulating base (2), which is supported between two sheet steel end plates (3). These end plates are bolted to the top casting (4). The three moving contact assemblies (5) are supported by insulating material (6) molded directly to a round steel shaft (7). This shaft assembly is supported, in turn, by bearings mounted in the sheet steel end plates, and is operated by a D-C solenoid (8). The unsupported lower ends of the end plates are stabilized by an insulating cross member (9), which also supports the junction (10) between the moving contact shunts and the load bushings.

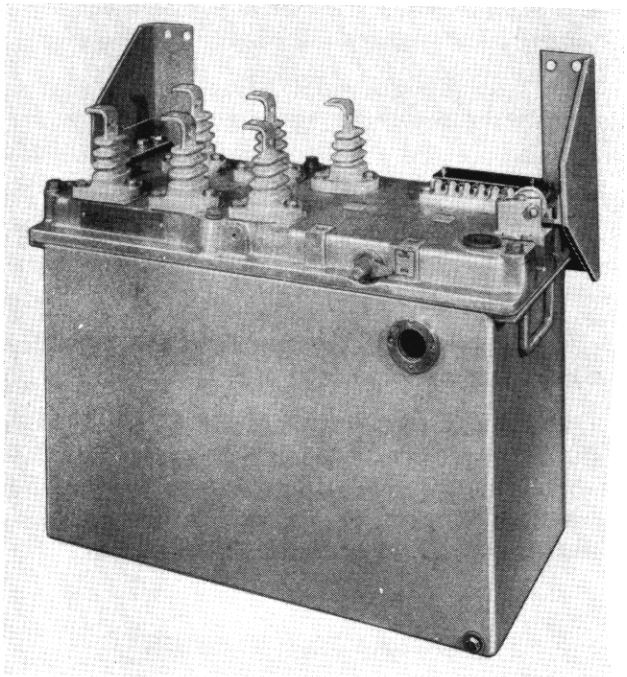


FIG. 1

Table No. 2.

CONTACTOR 8-HOUR RATING (AMPERES)	HORSEPOWER RATING					
	2200-2500 Volts			4000-5000 Volts		
	Synchronous Motor		Induction Motor	Synchronous Motor		Induction Motor
	100% Power Factor	80% Power Factor		100% Power Factor	80% Power Factor	
100	450	350	350	.....	.....	.....
200	900	700	700	1500	1250	1250
400	1750	1500	1500	3000	2500	2500

The top casting is made from a high strength aluminum alloy. Bolted to its top surface are:

(a) Power bushings (11). The high voltage power connections are brought out through bushings which pass through openings in the top casting.

(b) Control circuit terminal board (12). This is made of a molded material and it provides 12 terminal studs for interlock and coil connections.

(c) Tank lifter assembly. This comprises a worm gear with associated wire rope and removable handle. The tank lifter assembly may be either removed, or left in place during contactor operation.

(d) Two pulleys (13)—one at each end of the casting—are arranged to coordinate with the tank lifter assembly.

(e) Two mounting brackets (14) for wall mounting when required.

The top casting also carries a shaft and pointer (15), connected by mechanical linkage (16) to the magnet, to give visual indication of whether the contactor is "Open" or "Closed", and to provide a connecting point for a mechanical interlock.

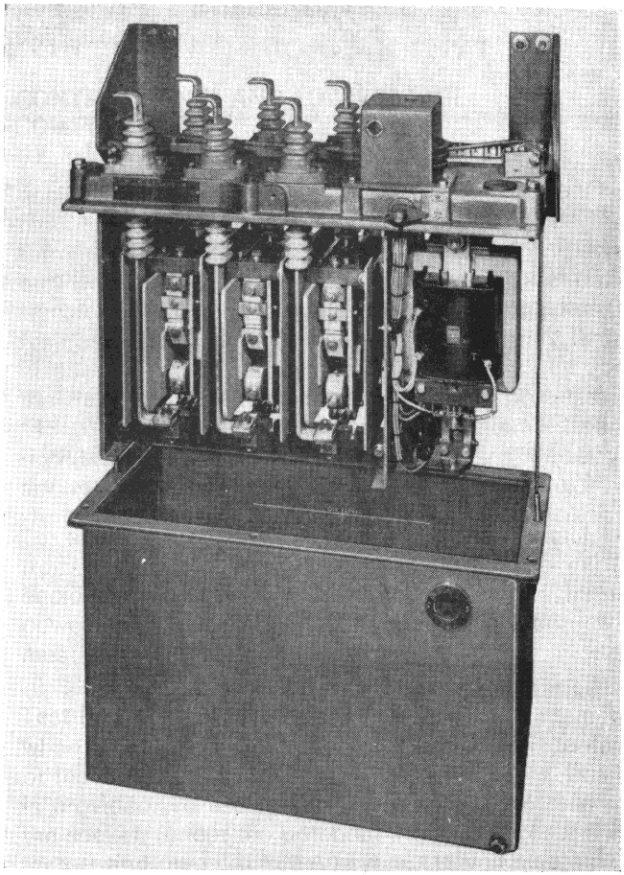


FIG. 2

OPERATING MAGNET

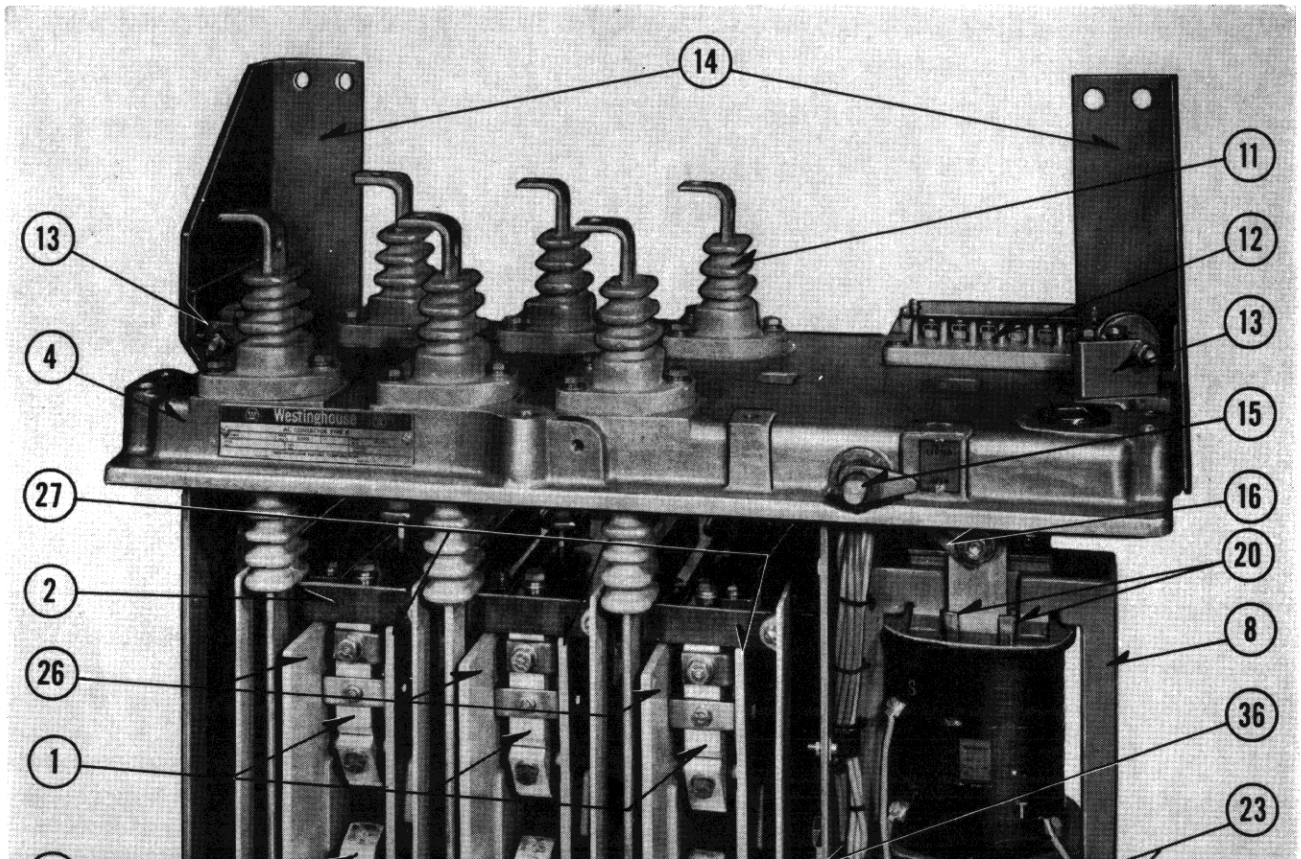
In order to shield the low voltage control circuits

Table No. 3.

A-C CONTROL VOLTAGE	NOMINAL COIL VOLTAGE (D-C)	RECTIFIER UNIT STYLE NO.	COIL STYLE NO.	AGEING RESISTOR STYLE NO.
110	80	579D522G01	432C030G01	209A929G04
220	160	579D522G02	432C030G02	209A929G07
440	320	579D522G03	432C030G03	209A929G08
550	400	579D522G04	432C030G04	209A929G08
....	125	.....	432C030G05	.....

coil heating to a normal value. This arrangement results in a relatively small magnet assembly with fast pick up and drop out characteristics.

When an A-C control circuit is used, rectifiers (24) to convert the A-C control power to D-C power for the coil, and an ageing resistor (25) to provide voltage adjustment may be mounted on the right hand end plate behind the solenoid. Mounting holes are provided to accommodate any of the four rectifier units available.



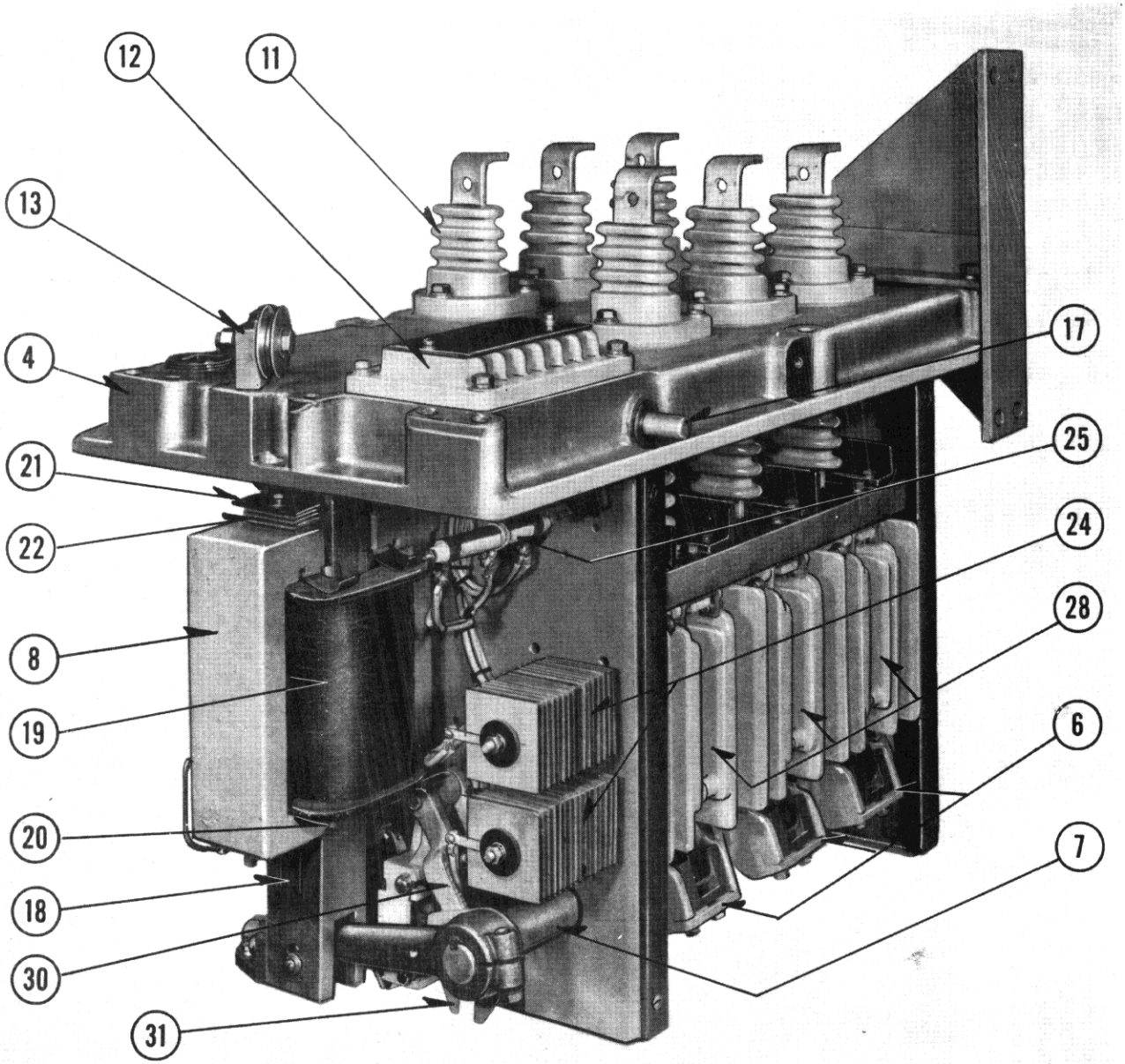


FIG. 4

CONTACT STRUCTURE

The contact arrangement is essentially horizontal, so that the arc movement during interruption is

for the lower ends of the line bushings, to prevent both the arc and large bubbles of vaporized oil from emerging to the surface of the oil, where they could result in flashovers between the lower ends of the

On the 25 cycle version only, the stationary contact arc horn is provided with an arc resisting inlay at the point where the arc terminates, to minimize erosion of the copper arc horn.

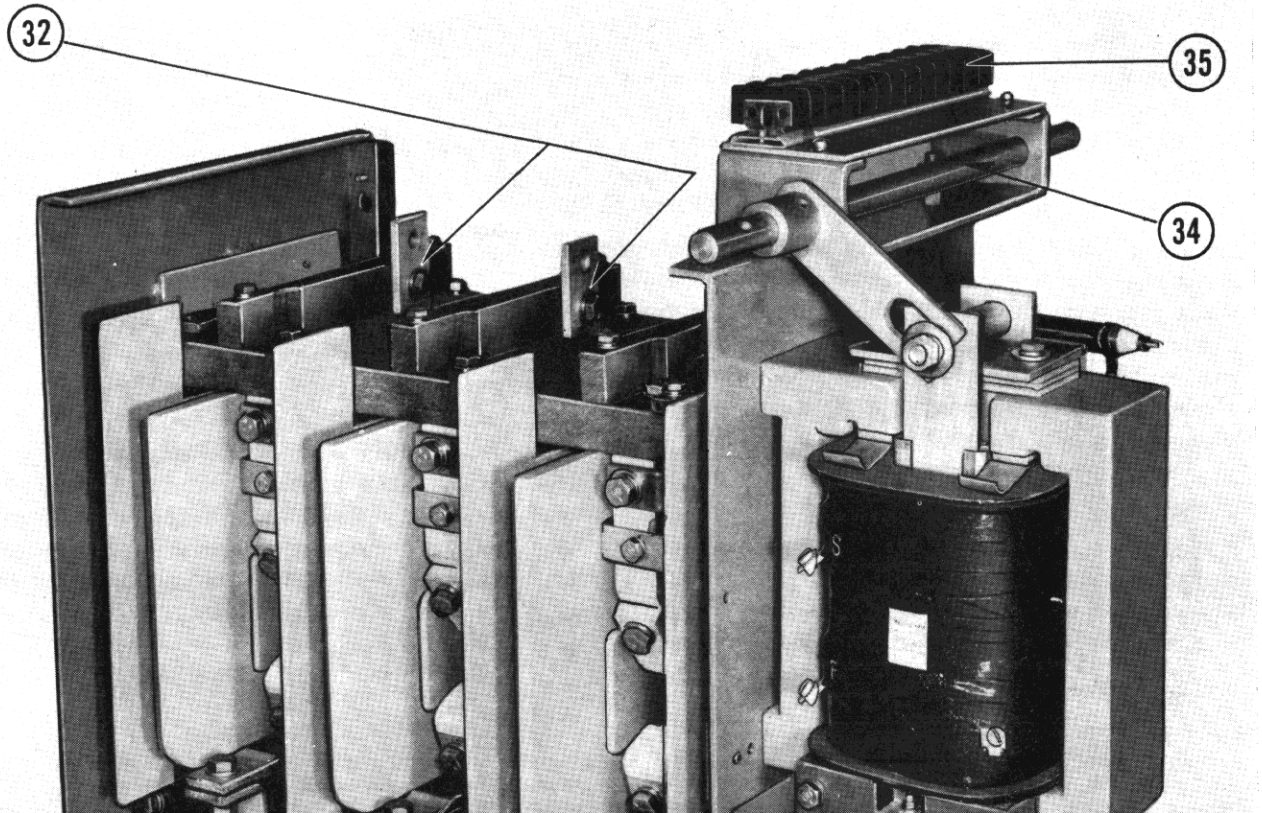
The contacts are a heavy extruded copper section provided with weld resisting alloy faces. The area in front of the contacts is entirely free of obstruction, making it simple to inspect or replace contacts without disturbing the arc box, arc horn, grid assemblies (in the 25 cycle version) or any other detail.

ARC BOX (See Figs. 3 & 4)

The arc box construction is extremely simple and rugged. It requires only a left hand (26) and a right hand (27) molded side. There is no complicated sub-assembly, and since it need not be disturbed to change or examine contacts, it is bolted in place permanently. For 25 cycle operation only, a small de-ion grid sub-assembly (28) is bolted inside each arc box. This in no way affects accessibility of contacts.

OIL TANK

The oil tank is of welded sheet steel construction with a 1¼" wide, reinforced, gasketed flange around the top, which mates with the machined flange on the underside of the top casting when the tank is raised into the operating position. A porthole type oil level gauge and an oil drain plug are mounted on the front side, at the top and lower right hand corners.



Since the gasketed flange is turned inwards, the flow of oil up the tank walls during interruption (due to the instantaneous vaporization of oil at the arc core), is deflected by the flange towards the center of the tank, and away from the gasket. Thus, oil leakage at the gasket is held to a minimum even though the tank fit may not be perfect, and gasket sealing forces are low.

OIL

"WEMCO C" oil is recommended. Seventeen gallons are required for the Type K-430 contactor, the proper level being indicated by the gage on the front of the tank. Oil may be added by removing the plug from the hole in the top casting.

The dielectric strength of "WEMCO C" oil is from 22 to 26 KV test, when new. Deterioration of insulating oil by reduction in dielectric strength is affected primarily by the presence of water and carbon. Contamination by water is generally due to the entrance of moist air, and the subsequent condensation on the walls of the tank and on the surface of the oil. On rare occasions, it may occur by direct leakage. Carbonization is due to the arcing between contacts whenever an interruption occurs.

"WEMCO C" oil has a very high resistance to emulsification, so that water and carbon are thrown out of suspension promptly. Thus, while very finely divided carbon particles may have a tendency to remain in suspension in the oil, lowering its dielectric strength, most of the carbon settles on the bottom of the tank and on the mechanism, especially on horizontal surfaces where it may eventually reduce insulation resistance.

It is therefore essential to carry out periodic inspections and tests, and to purify the oil when necessary. The frequency of inspection and test depends upon service conditions. Contactors called upon to open circuits frequently under heavy load, require more frequent inspection and reconditioning than those subjected to lighter duty.

ELECTRICAL INTERLOCKS (See Figs. 3 & 4)

Two Type L-61 electrical interlocks (29) are mounted below the magnet to provide a total of up to four auxiliary circuits. Any combination of normally open or normally closed circuits are made available by selection of the appropriate style of interlock assembly in each instance.

Actuation of the interlocks is by a cast aluminum lever (30) which has adjustable interlock operating screws and a cam follower. A cam (31) secured to the main shaft engages this cam follower and operates the lever by rotation of the main shaft.

STYLE NO.	CIRCUIT COMBINATION PROVIDED BY ONE INTERLOCK
577D960G01	One Norm. Open
577D960G02	One Norm. Closed
577D960G03	One Norm. Open; One Norm. Closed
577D960G04	2 Norm. Open
577D960G05	2 Norm. Closed

VERSION WITHOUT TANK OR TOP CASTING (See Fig. 5)

For applications where the contactor is to be built into an oil immersed controller, a slightly modified version of the Type K contactor is available. Essentially, it is the Type K mechanism exactly, but built without the top casting and oil tank. Since load and line power bushings are not required, connections are made to copper terminals (32) and (33). A simple bracket supports the mechanical interlock shaft (34) and auxiliary terminal block (35).

MAINTENANCE AND REPAIR

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 contactor solenoid.

INSULATION LEVEL

The insulation resistance between poles, and from each pole to ground should be measured and recorded. It is not feasible to specify an absolute value for this reading since it is dependent on other connected apparatus and conditions of service. However, any abrupt reduction in this reading would indicate a possible source of trouble, and the cause should be established and corrected.

OIL

It is essential to maintain the correct oil level as indicated by the gage on the front of the tank. The level should be maintained at the "NORMAL" mark, and should never be allowed to fall below the "LOW" mark. When necessary, oil may be added through the access hole in the top casting.

When oil is being added with the tank lowered, during installation or after an overhaul for instance, the proper oil level is indicated by a horizontal line on the insulating lining on the rear of the tank wall. When the tank is raised, and the mechanism immersed, the level will rise and become visible in the gage.

Periodic inspections and tests should be made to determine the condition of the oil, and the oil either replaced or purified when necessary. The dielectric strength of "WEMCO C" insulating oil is from 22 to 26 KV test when new. When the dielectric strength of the oil drops to 20 KV in the standard dielectric test, the oil should be looked upon with suspicion. In no case should this value fall below 16.5 KV. Visual inspection of oil samples should be made, and if any appreciable amount of carbon is present, the oil should be reconditioned. distances even with quite heavy carbon deposits, so that removal of these deposits is not essential so long as the insulating levels are maintained. It becomes largely a question of good judgement, and of avoiding contamination of new or purified oil when the oil is changed.

When such an oil change is made, in order to extend the life of the new oil it is recommended that the tank be flushed out and cleaned, and that the following insulating surfaces be wiped clean—

(a) The load and line insulator bushings.

(b) The stationary contact support base.

(c) The insulating cross member supporting the lower ends of the contactor end plates.

—if use of a cleaning fluid is required, use either lead free gasoline or benzene, but note that these fluids evaporate rapidly and have a chilling effect, so that moisture may condense on the cleaned surfaces, especially in a humid atmosphere. Be sure to wipe away any such condensation.

Note in particular, that oil which has been contaminated with fire extinguishing agents such as carbon tetrachloride and soda sulphuric acid, cannot be reclaimed, and must be replaced by new oil.

ELECTRICAL INTERLOCKS

There are two different types of electrical interlocks mounted on the Type K contactor—

(a) Type L-47 Electrical Interlock.

This is an integral part of contactor operation since it controls the solenoid operating coil. It is mounted on the front of the solenoid, just below the coil, and is actuated by the head of a 1/4-20 bolt carried on an insulating angle section bolted to the lower end of the solenoid plunger. It is correctly adjusted when the contact gap at each end of the double break contact is 1/8" with the solenoid energized and the plunger sealed. This 1/8" setting (1/4" total for two gaps) is controlled by adjusting the 1/4-20 actuating bolt either up or down, and then locking it in place.

this plunger does not reach its solid stop before the contactor is fully closed. The plunger travel is correctly set when 1/4" of the plunger protrudes from the molded body of the interlock, with the solenoid energized and the contactor sealed. This adjustment is effected by adjustment of the operating screws and locknuts carried by the aluminum operating lever.

The contact overtravel should be 3/32". With new contacts, this is automatically set when the plunger travel is adjusted as described above. Contacts should be replaced when the overtravel is reduced to less than 1/32". Contacts, and the overtravel, can be examined by removing the two screws holding the interlock to the mounting base and then pulling the interlock forward. By removing the electrical connections, the interlock can be removed altogether.

MAIN CONTACTS AND SHUNTS

The main contacts and shunts are very accessible, and may be either inspected or removed without disturbing any other parts. The general condition of the contacts and shunts should be noted, especially any discoloration (other than on the contact faces themselves) which would indicate excessive heating due to loose hardware, high current, or low contact force.

Since a perfectly smooth contact surface is not necessary, dressing or filing of the contacts is rarely required. After a severe interruption metal beads may appear around the contacts, but these do no harm unless they occur on the contact face proper, and are quite large (1/16" dia. or more). Such beads should be removed with a file, but it is not necessary to reshape the contact face or even clean the entire face down to bright metal. Do not use emery cloth under any circumstances since the abrasive particles will become embedded in the contact faces.

When replacing contacts, make sure that they sit flat against the contact supports and tighten the

(3) De-energize the solenoid, close the contacts by hand, and check that all contacts touch at the same time, the allowable variation is 1/32". Carry out any slight adjustment of the FLEX LOC nuts to satisfy this condition.

Note that main contacts should be replaced when the 13/64" gap shown in Fig. 6 has reduced to less than 1/16" when the contactor is closed.

The procedure outlined above, provided that it is done when new contacts are fitted, will automatically set the contact forces, however, the contact forces should be checked as a matter of routine. They are most conveniently measured by pulling on the moving contact bolt head in a direction perpendicular to the moving contact face. Measured at this point, the contact forces with new contacts should be—

11.5—15 lbs. Initial Per Contact

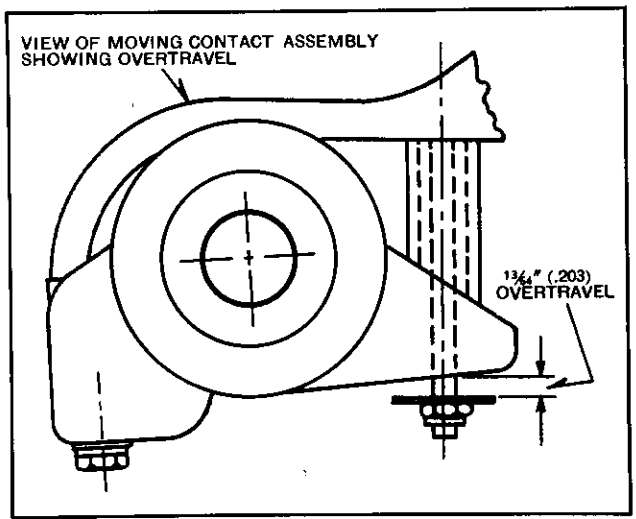
17.5—21 lbs. Final Per Contact

Failure to fall within these limits would indicate one of the following faults—

(a) An incorrect over-travel adjustment.

(b) Weak, broken or incorrect contact springs.

(c) An incorrect magnet adjustment. (See the next section.)



The solenoid frame is held to the end plate by two bolts fitted through elongated holes, and is locked in place by selecting one of three positions for adjusting bar (36) which is on the inside of the end plate. (See Fig. 3.) This allows the solenoid frame to be raised and lowered 1/8" about a median position, and is provided to accommodate manufacturing tolerances. Once made at the factory, this adjustment remains fixed and is normally never used again. However, if for any reason, the solenoid frame is removed, and this adjustment is inadvertantly lost, it will be necessary to reset the magnet position since it affects the main contact forces and over-travel.

If the over-travel adjustment is correct, but the contact forces are low—then the solenoid frame should be raised 1/8" by—

(a) Loosening the frame and adjusting bar bolts.

(b) Removing adjusting bar bolt "A". (See Fig. 3)

(c) Raising the frame 1/8".

(d) Replacing bolt "A" in the lower of the three locking holes.

(e) Retightening all hardware.

—conversely, if the contact forces are too high, then the magnet should be lowered 1/8" by the same method, but using the upper of the three locking holes in the adjusting bar.

REPLACING COILS

This involves dismantling the solenoid, the following step by step method is recommended:

(1) Disconnect the leads from the coil terminals.

(2) Remove the main hinge pin at the bottom of the plunger to disengage the main operating lever. This hinge pin is removed by removing the retaining screw and washer and pushing the opposite end of the pin.

(3) Raise the plunger by hand and place a suitable block underneath the stop bar at the top of the plunger—to hold the plunger up.

(4) Loosen the bolt holding the main operating lever to the shaft—then remove the lever from the

—when installing a new coil, check that the style number is correct, and install it with the single center tap terminal on the right. To assemble the solenoid, simply reverse the above procedure, but check the following details while doing so—

(9) The plunger guides pass through the coil and locate around the plunger strike plate bolted to the top/inside of the solenoid frame.

(10) When replacing the main operating lever, push it along the shaft until it stops against the tubular stop provided, and at the same time, re-engage the cam follower on the end of the L-61 electrical interlock operating lever, by inserting it into the cam carried on the main lever. Be sure to replace the hinge pin retaining washers and screw.

(11) When replacing the stop assembly at the top of the plunger, re-engage the mechanical interlock operating lever.

(12) Check the solenoid for free and smooth operation.

ARC CHUTES

(a) 50-60 Cycle Version.

The 50-60 cycle version does not use a "De-Ion" grid assembly, and since the arc chutes need not be disturbed to examine, maintain, and even change contacts, they are bolted permanently in position. Thus, there is rarely any need to remove them. However, if after prolonged use, there is sufficient arc erosion to require replacement, the arc chutes may be removed as follows:

(1) Remove the 4 "between phase" barriers by removing the single screw holding each barrier to the stationary contact insulating base plate.

(2) Remove the laminated blow out pole pieces. One bolt holds each pole piece to the blow out core. Remove the thin insulating washer from between each pole piece and the blow out core.

—each half of the arc chute is held in position by two studs bolted to the stationary contact structure, and spaced apart by an insulated stud located near the shunt

(6) The left hand half of the arc chute can now be removed.

To replace the arc chutes, reverse this procedure, but in doing so, check the following points:

(7) Having replaced each arc chute half, but before tightening the 10-32 nuts, make sure that the insulating tube surrounding the blow out iron core is located in the clearance hole in the center of each chute half.

(8) When replacing the laminated blow out pole pieces, note that they will fit one way only, and be sure to replace the thin insulating washer between each pole piece and the iron core.

(b) 25 Cycle Version. The only difference between a 25 and 60 cycle pole assembly is the addition of a "De-Ion" grid assembly in each arc chute. These fit one way only, and are held in position by two studs which project into holes in each arc chute half. The method of removing arc chutes is generally the same as for the 60 cycle version except that two more 10-32 nuts per side have to be removed before removing each chute half.

TO REPLACE ARC CHUTES—

(9) Fit the left hand half and front "U" shaped bracket—leave hardware loose.

(10) Fit the 25 cycle stack assembly to this half, and the stud and spacer near the shunt. Leave hardware loose.

(11) Fit the right hand half of the arc chute locating all the studs.

(12) Finally, observe points (7) and (8) above.

AGEING RESISTOR

The rectifier ageing resistor in the rectifier/coil circuit will rarely require adjustment. However, the adjustment should be checked whenever a routine contactor inspection is made. To do this, apply nominal A-C control voltage to energize the rectifier/ connection slightly and then recheck the nominal D-C voltage at the coil terminals. Repeat this procedure until the adjustment is satisfactory.

GENERAL

(a) Power Bushing Terminals. To avoid damage to the bushings, use reasonable care when bolting cables or bus bars to the load and line bushing terminals, and avoid applying undue load or torque.

(b) Gaskets. A high grade gasket material is used under the power bushings and auxiliary terminal block so there is no need to tighten the bolts excessively. Tighten the bolts evenly, and if a torque wrench is available, a torque of from 130 to 150 inch pounds is ideal.

(c) Tank Lifter. The oil tank lifter used on the Type K contactor is not an integral part of the contactor, but is supplied as a separate unit. It comprises a simple frame enclosing a wire rope, drum and worm gear.

To use it on the Type K contactor, the following procedure is recommended:

(1) Fit the tank lifter to the contactor top casting, with the handle at the front. (See Fig. 2).

(2) Place the long end of the wire rope over the left hand pulley, through the hole in the top casting, and through the hole in the tank flange. Fit a nut and lock nut to the threaded end of the wire rope.

(3) Place the short end of the wire rope on the right hand pulley and continue as (2) above.

(4) Crank the handle and adjust the nuts on the ends of the wire rope until both the left hand and right hand sides of the rope are taut across the top of the contactor top casting.

(5) Remove the bolts holding the tank to the top casting.

(6) Crank the tank lifter handle to lower the tank.

The tank lifter may be left in place, if required,