Instructions

IC2812B107

Synchronous-Motor Field Contactors

275 Volts Maximum 100 Amperes Maximum

IC2812B107

SYNCHRONOUS-MOTOR FIELD CONTACTORS

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.

GENERAL

These contactors are used for applying and removing d-c power from the fields of synchronous motors. Their closing time is short so that field can be applied at the correct time and assist the motor in accelerating to synchronous speed.

Two normally open poles are included which have a continuous rating of 100 amperes. The normally closed pole has a continuous rating of 15 amperes and a one-minute rating of 80 amperes. During the operation of the contactor, the normally open and normally closed poles do not overlap on Forms A through C, and Forms AA through AE. On Forms BA through BE, the normally open and normally closed poles do overlap. Three normally open and three normally closed electrical interlocks are included with each contactor.

Contactors are operated by a-c or d-c solenoids. A-c solenoids use continuous coils while d-c solenoids have intermittent coils with an economy resistor.

INSTALLATION

Contactors should be carefully inspected before installation to see that parts and adjustments, as indicated in these instructions, are in proper operating condition. All packing material or other foreign material should be removed, especially from contact tip and armature assemblies.

Grease or other foreign material must be removed from the solenoid mating faces which determine "S" solenoid gap of Fig. 1. The solenoid can then operate positively and be quiet in the closed position. Solenoid should be closed completely by hand by pushing on the link of Fig. 1 to be sure that the contactor operates without excessive friction or binding.

The shaft must rotate freely or the bearings will have to be aligned properly. Shaft and bearings combine to give a self-aligning characteristic which minimizes this alignment problem.

When mounting this contactor, the proper NEMA standard for electrical clearance and creepage to conducting parts, and to ground must be maintained.

To obtain the maximum interruption rating of the electrical interlock mounted on the right-hand side of the base, an air gap of $\frac{3}{4}$ inch must be maintained between the open face of the interlock and any conducting part or ground.

Maintain a minimum arcing clearance of 2 inches in front of the arc chutes when mounting the contactor in an enclosure not lined with insulation. This dimension can be reduced to 1 inch when the enclosure is lined with insulation.

Never operate the contactor with power on the contacts unless the arc chutes are in place.

Observe first few interruptions of the contactor to see that reasonably short arcs exist. If not, check for proper adjustment and discharge resistor.

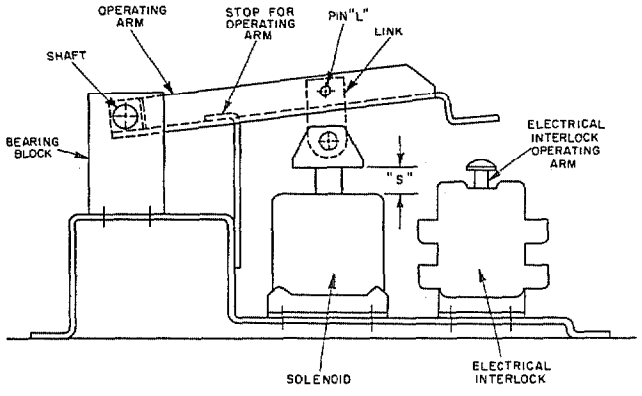


Fig. 1. Arrangement of solenoid and operating arm

ADJUSTMENTS

SOLENOID

The stationary-magnet frame must be aligned with its moving plunger so that the plunger can seat completely with the mating surfaces mentioned above, laying flatly against each other without side thrust on the plunger. The solenoid must be assembled to the base so that the link is approximately centered in the window of the operating arm. The link should also be approximately parallel to the sides of the window in the operating arm. See Fig. 1. Any rolling action between these two surfaces or any appreciable side thrust on the solenoid plunger will cause the solenoid to be noisy after operation. This noise must be eliminated through proper alignment, as the solenoid will only get noisier from wearing unevenly.

SHAFT

The shaft bearings must be assembled to allow the shaft to turn freely and to have an end play of 1/64 in. to 1/32 in. Proper alignment of the movable and stationary contact tips can then be maintained.

ELECTRICAL INTERLOCK

Electrical interlocks are rated as follows:

Interlock Ratings in Amperes

Number of Contacts	Carry	Make	Interrupt						
			D-c Inductive*			A-c**			
			125V	250V	600V	110V	220V	440V	600V
One Set	10	60	1.8	0.5	0.2	6	3	1.5	1.2
Two Sets in Series	10	60	4.0	1.2	0.35				

* Non-inductive d-c interrupting rating is 1.5 times inductive.
**Capable of interrupting inrush current of 60 amperes at 110 volts, 30 amperes at 220 volts, 15 amperes at 440 volts, and 12 amperes at 600 volts a limited number of times.

Interlock tip gap, when new, should conform to the values shown in the following table.

Contact Tip Gap and Wipe (See Fig. 1A)

Contacts			Maximum	Minimum
Not Operated	(NO)	Tip Gap	$\frac{7}{64}$"	$\frac{5}{64}$"
	(NC)	Tip Wipe	$\frac{5}{64}$"	$\frac{3}{64}$"
Operated	(NO)	Tip Wipe	$\frac{1}{8}$"	$\frac{1}{16}$"
	(NC)	Tip Gap	$\frac{5}{32}$"	$\frac{3}{32}$"

These contactors use an interlock block having internal parts which can be rearranged to give different contact arrangements. Should this be necessary the parts should be reassembled in accordance with Figs. 1A, 1B, or 1C.

Spring ends must not protrude into holes (A), slots (B), or keys (C), which serve as guides for operating arm. See Fig. 1A.

Interlock blocks with two normally closed circuits require a spring spacer (D) as shown in Fig. 1A to assure that the center spring is properly in place. Because of the circuit rearrangement feature, a spring spacer is supplied with all other two-circuit contact blocks, as shown in Fig. 1B and 1C.

When circuits are rearranged to obtain one normally open and one normally closed circuit, the normally closed circuit must be located at the bottom as shown in Fig. 1C.

The interlocks must be assembled to the base so that their interlock operating arms are approximately centered under the operating arm of the contactor. Bend the end of the operating arm near the interlocks, if necessary, to obtain above requirement. See Fig. 1. The interlock should be positioned on its bracket so that with the contactor in its energized position, the interlock plunger, see Fig. 1B, should not bottom, and with the contactor in its de-energized position, there should be some clearance (C) between the plunger and the operating arm. See Fig. 1B.

Tip gaps and wipes, when new, should be as shown in the above table. Replace contact tips when the wipe reaches one-half of minimum specified.

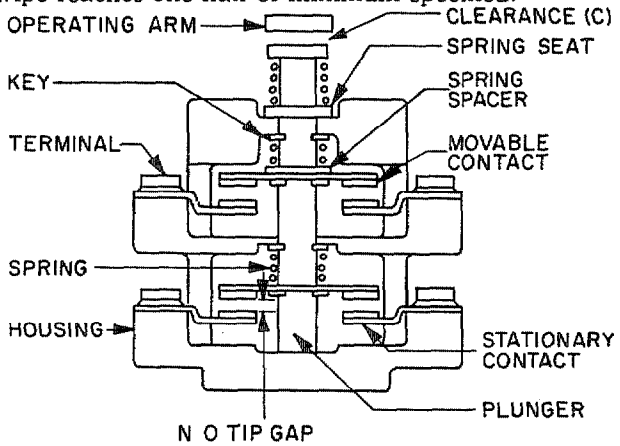


Fig. 1A. Contact block with normally closed contacts in unoperated position

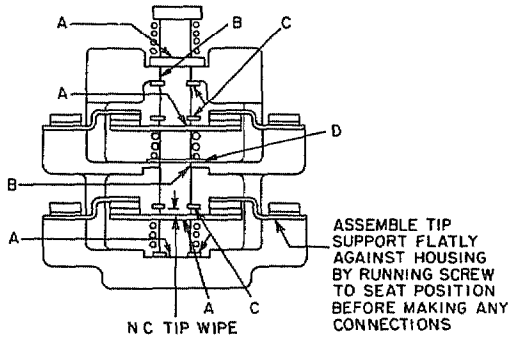


Fig. 1B. Contact block with normally open contacts in unoperated position

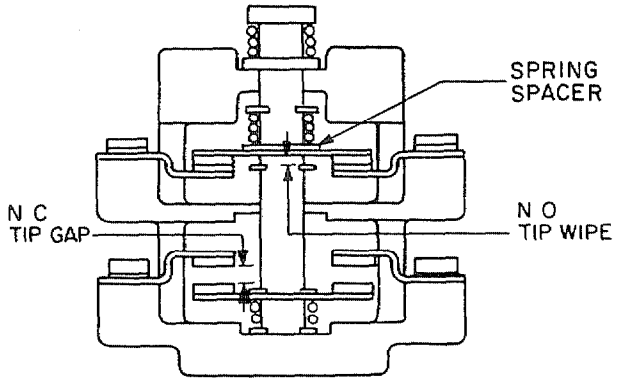


Fig. 1C. Contact block with one set of normally open contacts and one set of normally closed contacts in operated position

ADJUSTMENTS IN GENERAL

NOTE: The following order is recommended for making adjustments. Adjustments are for all forms unless otherwise indicated.

1. *Operating arm*—The operating arm must be assembled to the shaft so that it is approximately perpendicular to the shaft. See Fig. 1.

2. *Stop for operating arm (See Fig. 1)*—Bend the stop for the operating arm of the contactor so that the solenoid stroke (S) is 0.530 in. ±.010 in.

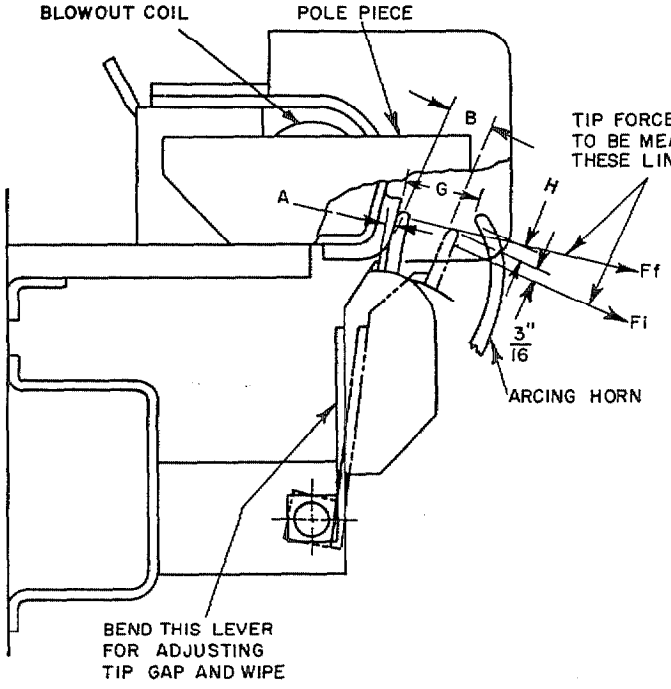
3. *Power contact tips*—Movable and stationary contacts must line up laterally within 1/32 in. Movable contact tip assemblies must not touch their respective arc chutes during the operation of the contactor. Normally open contact tips must also make at the same time within 1/32 in.

4. *Stop M and normally closed power contacts (See Fig. 3)*—Stop (M) must be adjusted, if necessary, so that the movable tip support for the NC contact is approximately perpendicular to its base bracket and minimum NC contact tip wipe is obtained with the operating lever not touching the movable contact tip support.

5. *Operating lever. (See Fig. 3)*
A. Forms A thru C, and Forms AA thru AE (See Fig. 3)—Bend the operating lever, if necessary, to set "E" clearance at 0.005 to 0.010 inches. Do not bend NC movable tip support.
B. Forms BA thru BE—With the NO power tips fully adjusted and the operating solenoid in its fully energized position, adjust the operating bolt "R" (Fig. 3A) to needed length to obtain the NC tip gap per tip-gap table of Fig. 3. Lock nuts must be tightened to maintain adjustment.

6. *Lever. (See Fig. 2)*—Adjust the lever supporting the NO contact tips so that the tips just touch with a solenoid gap "S" of 0.250 in. Tips at this solenoid gap can have 0.010 gap to 0.010 in. wipe as measured by eye. Hold the solenoid against 0.250-in. gage or fully closed by pushing directly on the solenoid plunger—not on the link or operating arm. (See Fig. 1.).

7. *NC power contact tips*
A. Forms A thru C, and Forms AA thru AE—NC tips must have a gap of 0.125 ±0.030 in. with a solenoid gap "S" of 0.250 in. See Item 6 above.
B. Forms BA thru BE—With NO tips just touching when solenoid gaps "S" is 0.250 in., the NC power tips must have 0.320- to 0.090-in. wipe (Dimension A of Fig. 3).



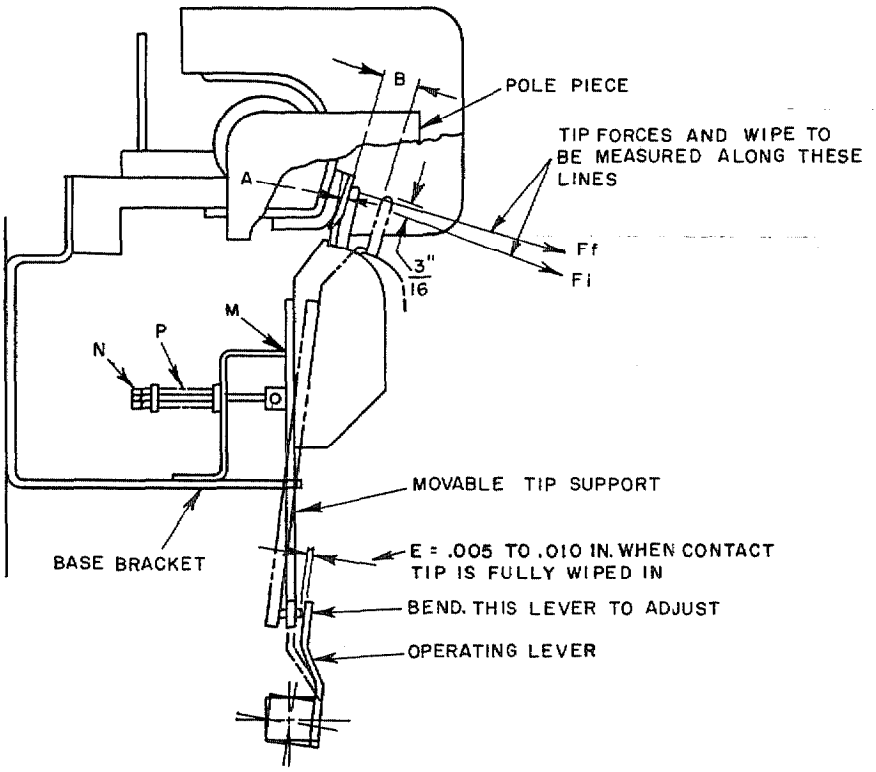
Tip Wipe		Tip Gap	Tip Forces		"S" Solenoid* Gap (Tips Just Touch)
A	AW	B	Initial Fi-oz.	Final Ff-oz.	
.090 min.	.062	.266 min.	18½ ±2	23 ±2	.250

When "A" measures "AW" it is recommended that tips be renewed.

*** Solenoid gap measured between frame and core head, as shown in Fig. 1.**

When A, B and 0.25 solenoid gap for tips just touching are correct, other dimensions need not be checked except to locate test trouble.

Fig. 2. Adjustment for normally open contact tips



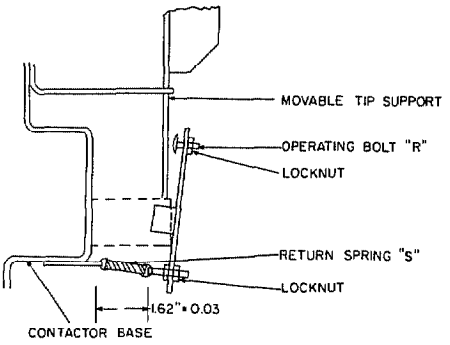


Fig. 3A. Forms BA through BE

Tip Wipe		Tip Gap	Tip Forces	
A	AW	B	Initial Fi-oz.	Final Ff-oz.
.060 to .090	.031	.344 min.	7½ ±1	14 ±1

When "A" measures "AW" it is recommended that the tips be renewed.

When A and B and spring "P" tension are correct, other dimensions need not be checked except to locate test troubles.

Tighten spring "P" until tip support touches stop "M," then further tighten nut "N" three additional turns.

Fig. 3. Adjustment for normally closed contact tips

8. *Normally open and normally closed power contact tips—Contactor energized. See Fig. 2*—With the solenoid in the energized position (See 6 above) the minimum wipe of the NO tips must be maintained in accordance with the table of Fig. 2. With the solenoid in this same position, the minimum tip gap of the NC tips should be in accordance with the table of Fig. 3.

9. *Normally open power contact tips. See Fig. 2*—With the solenoid in the de-energized position the minimum gap of the NO tips must be maintained in accordance with the table of Fig. 2.

10. *Solenoid leads*—Solenoid leads must be connected to the solenoid terminal closest to it for a-c solenoids and for connecting from d-c solenoid to the external device. Terminals of solenoid coils are not connected electrically to their leads.

11. *Base bracket. (See Fig. 3)*—The base bracket must not bend during the full operation of the NC power contact tips.

12. *Spring P. (See Fig. 3)*—Spring P, which closes the NC power contact tips, must be set in accordance with Fig. 3 and must not go solid during full operation of the contactor. The movable tip support must hit solidly on point M when the contactor is de-energized. Two lock nuts, N, must be used to lock the spring adjustment.

13. *Return Spring*—Forms BA thru BE. Return spring "S" must be adjusted to a 1.62 ±0.03 in. working length by adjusting the length of eyebolt "T" (See Fig. 3A). Locknuts should be tightened securely to maintain adjustment. The NO shaft assembly, when slightly operated in the closing direction, must be positively returned to the fully open position by return spring "S." If this action is not positive, the length of return spring "S" must be slightly increased. Shaft bearings must be accurately aligned with shaft to allow proper action of the return spring. The contactor must be mounted in a vertical position with arc chutes up to obtain these adjustments.

13. *Arcing horns.* (*See Fig. 2*)—"G" dimension between the NO arcing horns and the stationary contact tips must be 15/32 in. ±1/16. "H" for the NO poles between the arcing horn and the movable contact tip must be 1/64 in. minimum.

14. *Blowout coils.* (*See Figs. 2 & 3*)—Blowout coils must not touch the pole pieces at any point.

The above adjustments will be present on contactors shipped from our factory unless they have been damaged in shipment. These adjustments will also not be disturbed by normal operation.

OPERATION SEE FIG. 4A, 4B AND 4C

POWER CONTACTS

The normally open poles FC of this contactor are usually wired to a field in accordance with Fig. 4A so that they will apply and remove power from the field of the synchronous motor and also isolate the field from the d-c power source. The normally closed power pole FC interrupts the a-c induced power that flows in the field while the motor is accelerating and inserts the discharge resistor A when power is removed from the field. Resistor A, which is not supplied when the contactor is shipped alone to the purchaser, limits this a-c induced current and also limits the d-c field-discharge current which continues to flow after the normally open poles are again opened up when the contactor is de-energized. Resistance of resistor A must be supplied by the motor designer. N is a motor-protective device which also is not supplied with contactor shipments mentioned above.

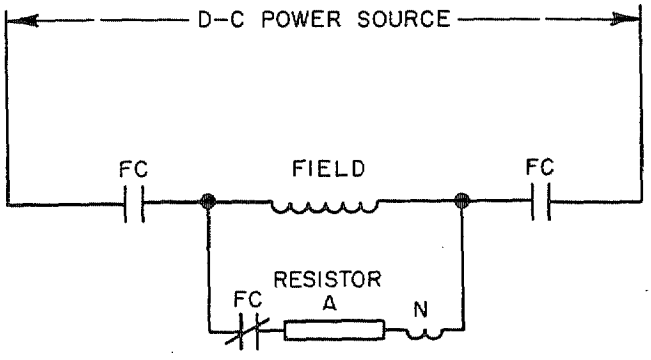


Fig. 4A.

CONTROL CONNECTIONS—A-C SOLENOID

A-c control power should be connected to the a-c solenoid in accordance with Fig. 4B. The contactor should be supplied with the solenoid's rated voltage. The contactor will operate satisfactorily with an a-c control voltage from 85 percent to 110 percent of rated voltage. Voltages below 85 percent should not be used as the closing speed of the contactors will be appreciably reduced and operation can be impaired. Voltages above 110 percent will shorten the life of the solenoid through additional coil heating and solenoid slam.

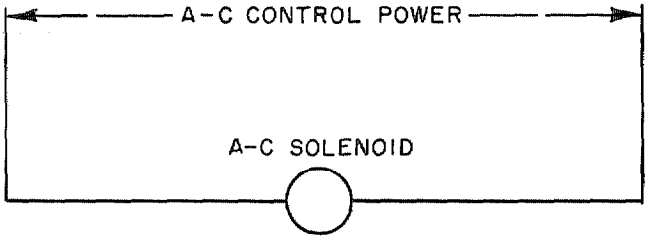


Fig. 4B.

CONTROL CONNECTIONS—D-C SOLENOID

D-c control power should be connected to the d-c solenoid in accordance with Fig. 4C. The contactor should be supplied with the solenoid's rated voltage. The contactor will operate satisfactorily with 80 percent to 110 percent of rated voltage. Voltages outside these limits should not be used for the reasons mentioned previously. These solenoids use intermittently rated coils with an economy resistor B. Section C-D of resistor B is a series pickup resistor

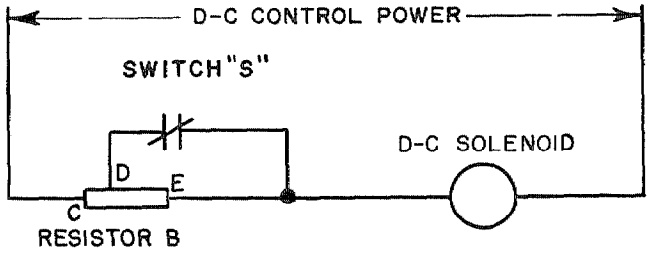


Fig. 4C.

which gives the contactor with the d-c solenoid the same pickup time as the contactor with the a-c solenoid. Section D-E of resistor B is inserted by switch "S" after the contactor is almost completely picked up. On Forms A thru C and Forms AA thru BE, switch "S" is mounted directly on the solenoid and operated by the solenoid plunger. On Forms BA thru BE, switch "S" is one of the 3 normally closed auxiliary electrical interlock circuits supplied with the contactor.

MAINTENANCE

GENERAL

This contactor will provide maximum trouble-free service if given the benefit of preventive maintenance and inspection. It is important that a definite inspection schedule be maintained. Of course, the frequency of the inspection periods will depend upon operating conditions.

Contactor life depends on the severity of the service required. The contactor should be thoroughly inspected after every 25,000 operations, or more often if operated very infrequently.

INSPECTION

During routine inspections, check the following in accordance with the procedures described below:

1. Screws, nuts and bolts (must be tight).

2. Electrical interlocks.

3. Power contact wipe, surface condition and alignment.

4. Solenoid.

If the contactor has been required to interrupt power above its rated capacity or has operated without proper pertinent adjustments and/or has been operating for a year since the last thorough inspection, the following checks should be made:

1. Contact forces.

2. Shaft bearings—Lubrication of bearings will not be necessary during the life of the contactor. Alignment of the bearing supports for free operation of the shaft must be maintained.

3. Adjustments—Adjustments should be checked in accordance with the section on Adjustments at the times mentioned in the paragraph above.

ELECTRICAL INTERLOCKS

Gaps, wipes and alignment of electrical interlocks can be changed by loosened hardware or through normal operation of the contactor. It is, therefore, important that contact wipes and alignment be maintained in accordance with the Electrical Interlocks section of Adjustments.

Contact assemblies, or preferably the whole interlock assembly (one assembly includes contacts for two circuits), should be replaced when the following conditions exist:

1. The contacts are badly pitted to the point where the bottoms of the pits are close to touching the steel backing for the silver facings of the contacts. The top of the steel backing is obvious from looking at the side of the contact. The bad buildups on the one contact opposite the pits of the mating contact can be removed and extend the life of the contacts through forcing the contacts to make contact on other areas.

NOTE: Tarnish on the silver facings does not need to be removed, since with power the tarnish breaks down into products which are conductive.

2. If the contacts are worn so that the contacts are thrown very badly out of alignment, the contact assemblies should be replaced to reduce friction between the movable parts of the interlock.

3. When the wipe is reduced to one half of the minimum values shown in the Electrical Interlocks section of Adjustments, the contact assemblies should be replaced to obtain the proper pressures to allow the interlock to operate satisfactorily.

When replacing the contact assemblies of a housing, it is recommended that both movable and stationary assemblies be replaced at the same time for best operation and least maintenance expense. When these replacements are made, the contacts of a movable contact assembly must make with their corresponding stationary contacts at the same time within 1/64 in. Bend the stationary contact supports with the fingers, if necessary, to obtain this requirement.

POWER CONTACT TIPS

Power contact tip material will transfer from one tip to the other at some area of the tip. The bad build-up on the one contact opposite the pit of the mating contact can be removed and extend the life of the contacts through forcing the contacts to make on other areas. If contacts are wearing away with the contacts misaligned more than 1/16 in., the contacts should be replaced, as the misaligned condition can only get worse and accentuate the wear of other mating parts. Contacts should also be replaced if the facing material is nearly completely removed, of if the A dimension is reduced to AW. See Fig. 2 or 3.

Power contact pressures as given in Fig. 2 and 3, should be checked if the contactor has interrupted power beyond its rating or, if it has been operated without proper pertinent adjustments. Contact pressures should also be checked if the springs have a grayish black color which could indicate overheating. Power contact springs must be replaced if weak spring pressures are measured.

Initial pressure is the pressure (See Table Fig. 2 or 3) which just makes the movable contact leave its insulation support. Final pressure is the pressure (Fig. 2 or 3) which will just cause the movable contact to leave the stationary contact when the contactor is completely picked up or dropped out respectively as indicated under Adjustments.

SOLENOIDS

A-c solenoids must be replaced if the solenoid is relatively noisy in the energized condition, as it can only worsen to the point where coil heating will be excessive and burn out the coil.

The switch mounted on the d-c solenoid for Forms A thru C and Forms AA thru AE must be inspected as indicated in the general instructions of electrical interlocks and the contacts replaced where necessary.

RENEWAL PARTS

Renewal parts information is contained in renewal parts bulletin GEF-4156. When ordering renewal parts, specify the quantity required and give catalog number or describe the parts in detail. Also, give the complete nameplate rating of the equipment.