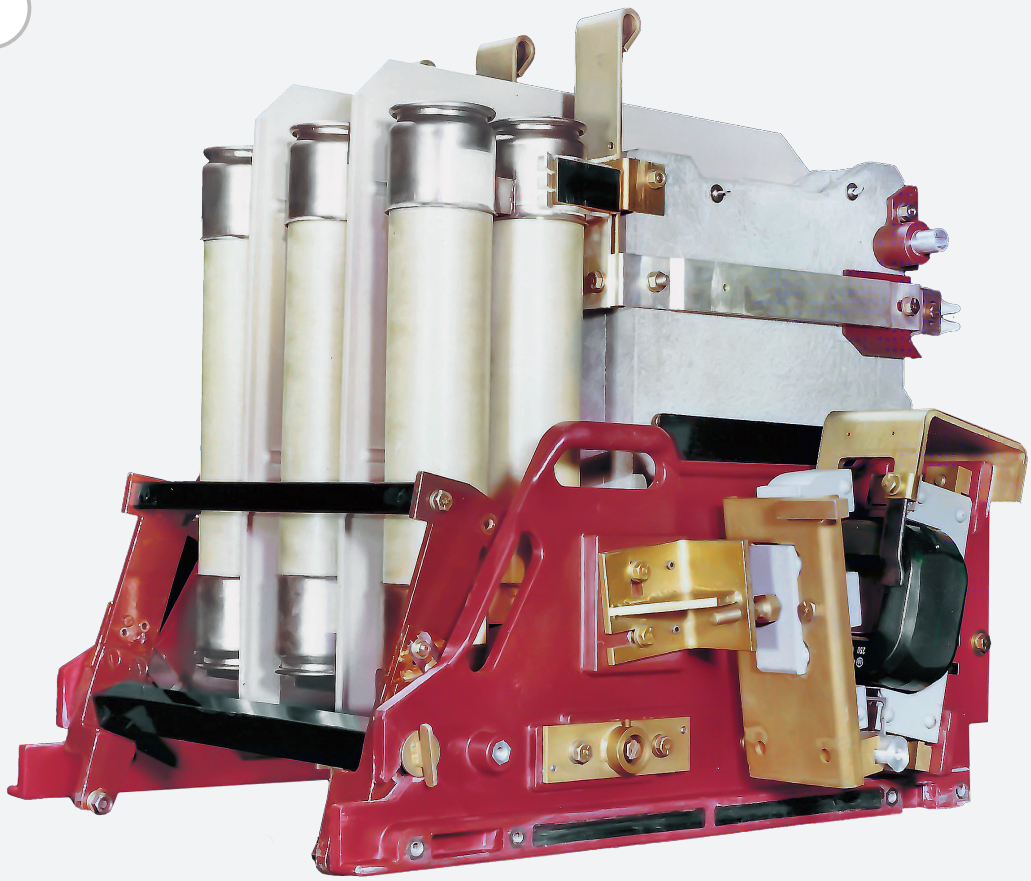
MANUAL

High-Voltage Limitamp® Contactors

AC Air-Break Type IC2814 *)

GE legacy product
documentation



Forms -E110, -E111, -E120, -E121, -E130, -E131, -E140, -E141, -E150, -E151, -F111, -F151, -X111 and -X151

*) Has also been designated IC2812 all forms

In 2018 ABB acquired GE Industrial Solutions. These contactors were manufactured by GE. They are now owned and supported by ABB. The contactors themselves are no longer available, but some spare parts are available. Additionally, modern vacuum contactors are available to directly replace the IC2814 contactor. These are the 193V and 193W contactors. See related documentation here:

CR193V & CR193W Draw-Out Vacuum Limitamp® Contactors

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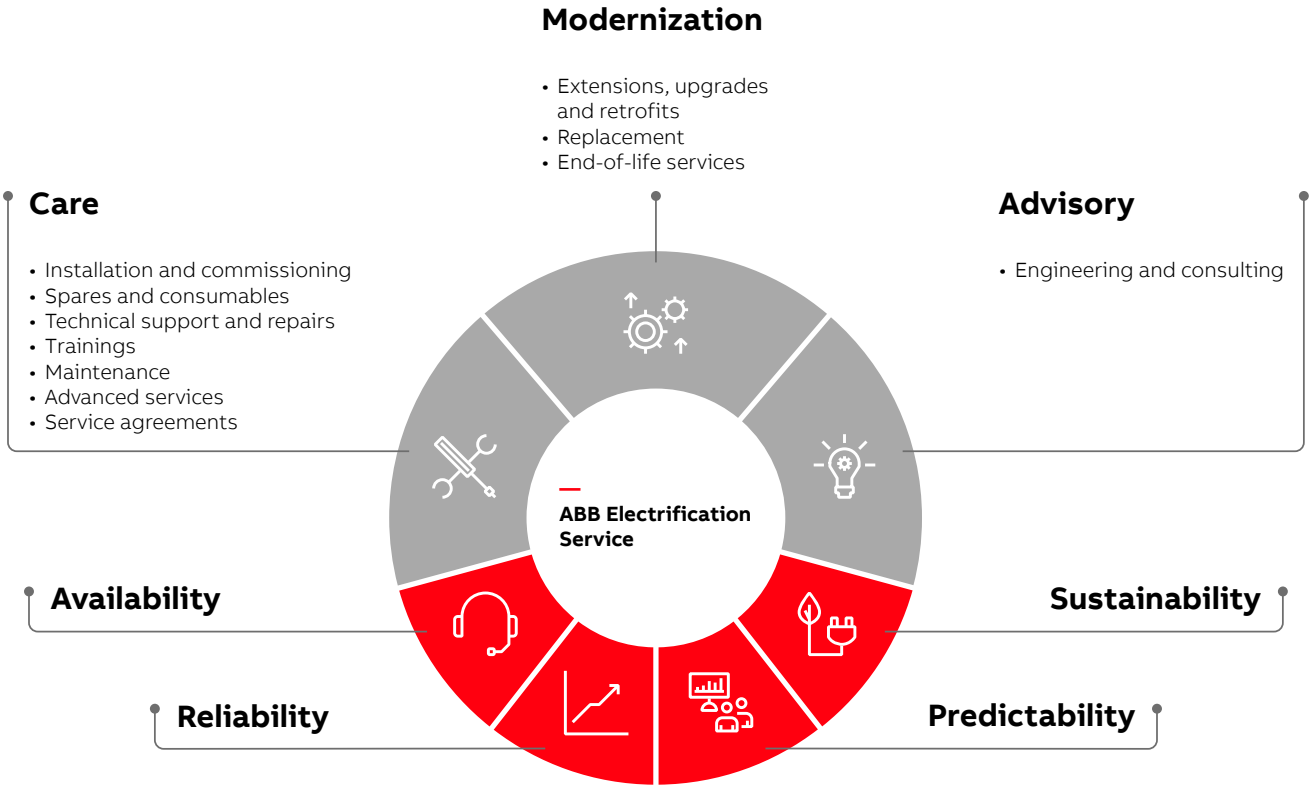


Model numbers

IC2814-E110
IC2814-E131

IC2814-El20
IC2814-E151

IC2814-E121
IC2814-F111
IC2814-X111

IC2814-E150
IC2814-E140
IC2814-X151

IC2814-E111
IC2814-E141

IC2814-El30
IC2814-F151

Introduction

These instructions cover high-voltage, a-c air-break contactors – outlined in Table 1. The contactors are designed for equipment used in starting a-c motors with a line voltage from 600 volts to a maximum of 5200 volts. Formerly available contactors are listed in Tables 1 and 2.

Table 1. Contactors without Fuse-Disconnect Shelf

Model IC2814	Magnet	Normally Open Poles	Normally Closed Poles	Dimension Figure No.	Connections *)
-E110	AC	3	None	5	Stab
-E111	DC	3	None	5	Stab
-F111	DC	5	None	6	Stab
-X111	DC	3	3	7	Stab
-E150	AC	3	None	8	Bolted
-E151	DC	3	None	8	Bolted
-F151	DC	5	None	9	Bolted
-X151	DC	3	3	10	Bolted

*) Stab connections are provided for power with heavy spring-backed fingers, Control-stab connections are provided with extra flexible-spring temper leaf springs.

Table 2. Contactors with Fuse-Disconnect Shelf

Model IC2814	Magnet	Normally Open Poles	Normally Closed Poles	Voltage Rating of Fuses	Dimension Figure No.	Connections *)
-E120	AC	3	None	4, 800	5	Stab
-E130	AC	3	None	2, 400	5	Stab
-E140	AC	3	None	Fuses Omitted	5	Stab
-E121	DC	3	None	4, 800	5	Stab
-E131	DC	3	None	2, 400	5	Stab
-E141	DC	3	None	Fuses Omitted	5	Stab

*) Stab connections are provided for power with heavy spring-backed fingers, Control-stab connections are provided with extra flexible-spring temper leaf springs.

General

Ratings

The contactors of Tables 1 and 2 (see Figure 1, 2, 3 and 4) with three normally open poles are furnished in 200 A and 400 A continuous ratings with a maximum interrupting capacity of 50,000 kVA.
These contactors with fuses are suitable for use in circuits having a maximum "let-through" current of 60,000 A for 1 cycle or less.

Contactors with 100-ampere continuous rating are available for use in circuits having a maximum "let-through" current of 6,000 A for one cycle or less.

Description

IC2814-E110, -E120, -E130, -E140 contactors

These contactors have three normally open poles with an a-c magnet and additional features per Tables 1 and 2. All contactors have 5” diameter roll-out wheels for moving the contactors easily in and out of enclosures. When the contactors are rolled into the enclosures, ail power and control connections are automatically made. After the grounding strap (see Figure 1) is securely bolted to the contactor frame and enclosure, the contactor is ready for operation. With forms employing the fuse-disconnect shelf, power can be completely removed from the contactor by moving the power-disconnect fingers of the shelf (see Figure 2) out of engagement by rotation of the shelf operating handle if the contactor is first de-energized, so that the shelf disconnects will not interrupt the power. (See Figure 1.) Grounding springs and fingers (see Figure 1) are provided for additional safety.

These contactors are designed for linkage-type mechanical interlocks which operate through a brainbox. (See Figure 19A.) Linkages connecting the contactors are supported by the enclosure.

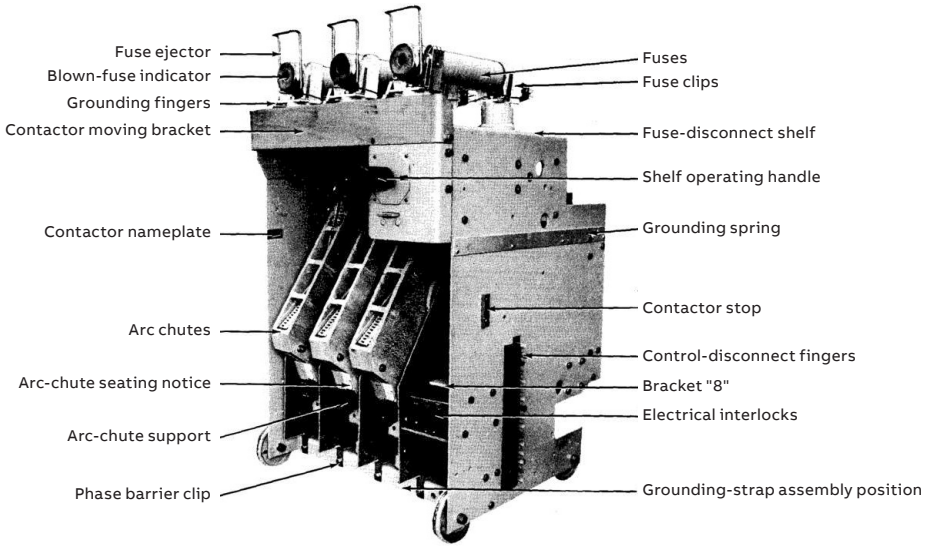


Figure 1. Front view of IC2814-E120 high-voltage contactor with fuse-disconnect shelf.

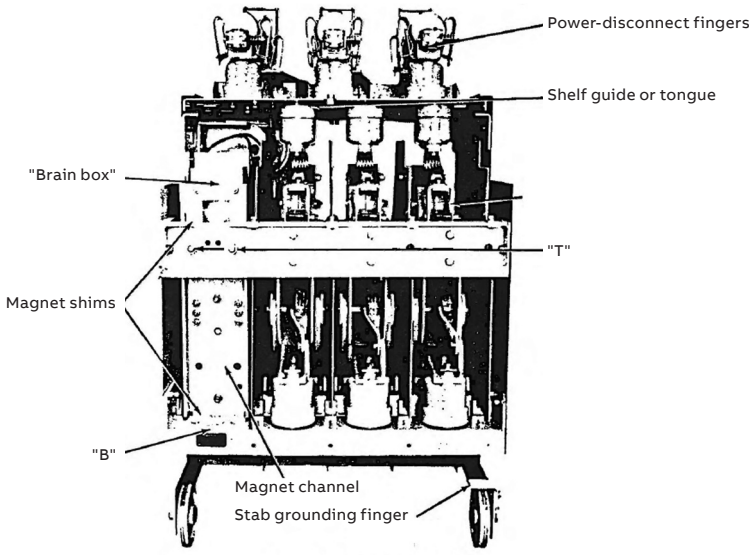


Figure 2. Rear view of IC2814-E120 high-voltage contactor with fuse-disconnect shelf.

IC2814-E111, -E121, -E131, -E141 and -F111 contactors

These contactors are identical in construction to those described above with the exception o! numbers of poles and magnet construction, which are listed in Tables 1 and 2. To operate these contactors, d-c magnets are used with intermittently rated coils and an economy resistor. The magnet can be energized by straight dc or from dc obtained through rectifiers. Rectifiers and resistors must be mounted on the enclosure.

IC2814-E150, -E151, -F151, and -X151 contactors

The power-pole, magnet, electrical-interlock, and arc-chute assemblies of these contactors are identical to that of the IC2814-E110, -E111, -F111 and -X111 contactors, respectively. These contactors, however, have 2.5” diameter wheels for providing a roll-out contactor, which, will replace the IC2814-E100, -E101, -F100 and-G100 contactors of an earlier design. (See GEH-1937). All power cables and control wires must be bolted to the contactor after it is rolled into the enclosure.

These contactors are designed for push-pull cable mechanical interlocks, which mount entirely on the contactors. The cables must be disconnected before a contactor can be rolled out of an enclosure. A door-interlock finger is extended toward the right (front view) of the contactor, when the contactor is energized, so that door interlocking can be effected.

IC2814-X111 contactor

The IC2814-X111 contactor consists of three normally open poles which are identical to the IC2814E111 contactor and are mechanically interlocked tb three normally closed poles, so that the normally closed poles must be opened before the normally open contacts can close. The description given previously for the -E111 contactor applies to the -X111 contactor, with the following exceptions:

The normally open poles and normally closed poles of the -X111 each have their own d-c magnet. The normally closed part has ho blowouts or arc chutes and, therefore, has no interruption rating. These contacts establish the circuit only and should not be opened with current flowing.

The closing magnets for the IC2814-X111 normally open contacts are the same as the d-c magnets (previously described) of the -E111 contactors, The contacts are operated by intermittent-rated magnets, A resistor is added to the coil circuit alter the contactor has closed, to reduce the current in the coils. The magnet of the normally closed contacts is, in general, of the same construction as that of the -E111 contactors but operates against counterweights and a spring which close the contacts when the magnet is de-energized.

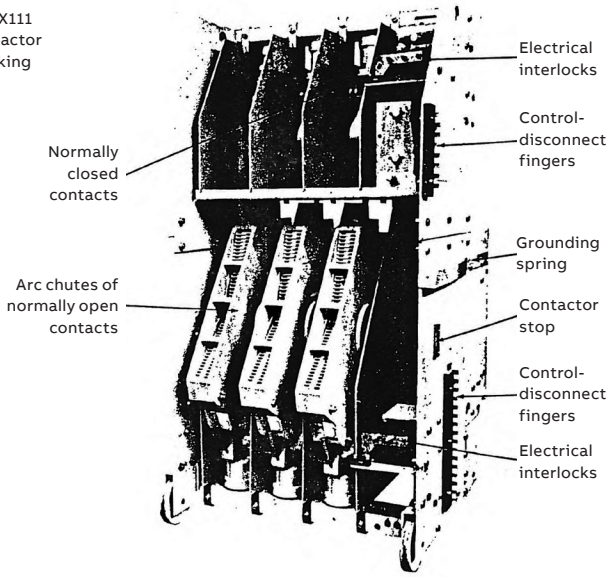


Figure 3. IC2814-X111 high-voltage contactor with dynamic braking normally closed contacts.

Outline dimensions

Dimensions of the contactors are given in Figures 3 through 10.

Contacts

The contacts are provided with a special facing which will give additional life and will assist the contactor in properly making, carrying, and interrupting electrical power. It is imperative that the contacts be replaced before part of one contact is contacting the base material of the other contact. The special facing reduces losses effacing material during making and breaking electrical power.

Blowout-coil rating

Most of the contactors will use 400 A blowout coils connected in series with the contacts, 100 A and 200 A blowout coils may be necessary for certain applications and are available. Nameplates of contactors are located on the inside of the left frame (Figure 1) and will list the maximum ampere rating as determined by the blowout structure.

The blowout rating will determine the continuous rating of the contactor. Contactors cannot, therefore, be interchanged unless their nameplates have identical nameplate stampings. For example, a 100 A contactor cannot carry as much continuous current as a 400 A contactor, while a 400 A contactor does not have the same blowout and arc interrupting effect as a 100 A contactor. The 100 A blowout contactor is more effective on low-current loads such as magnetizing currents of transformers, etc.

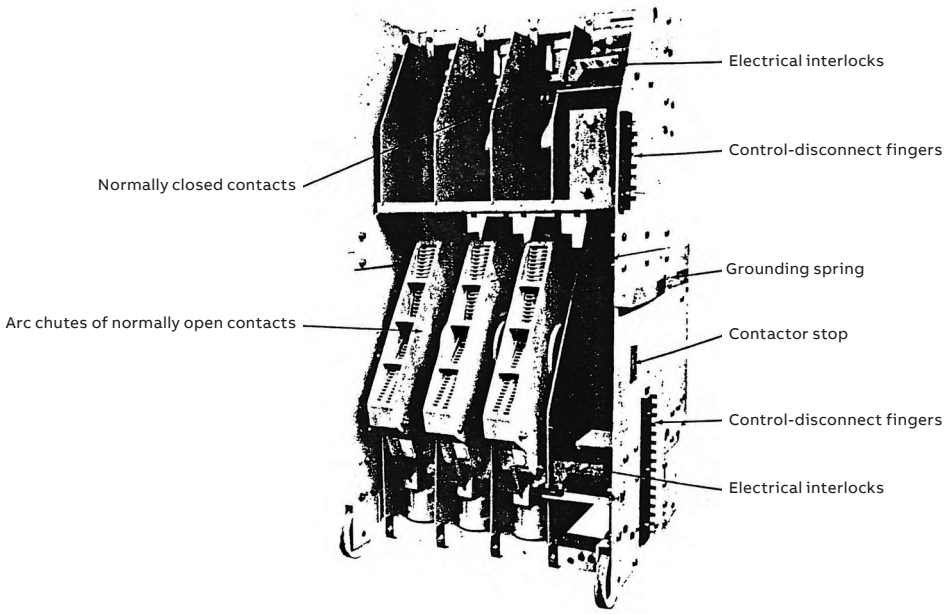
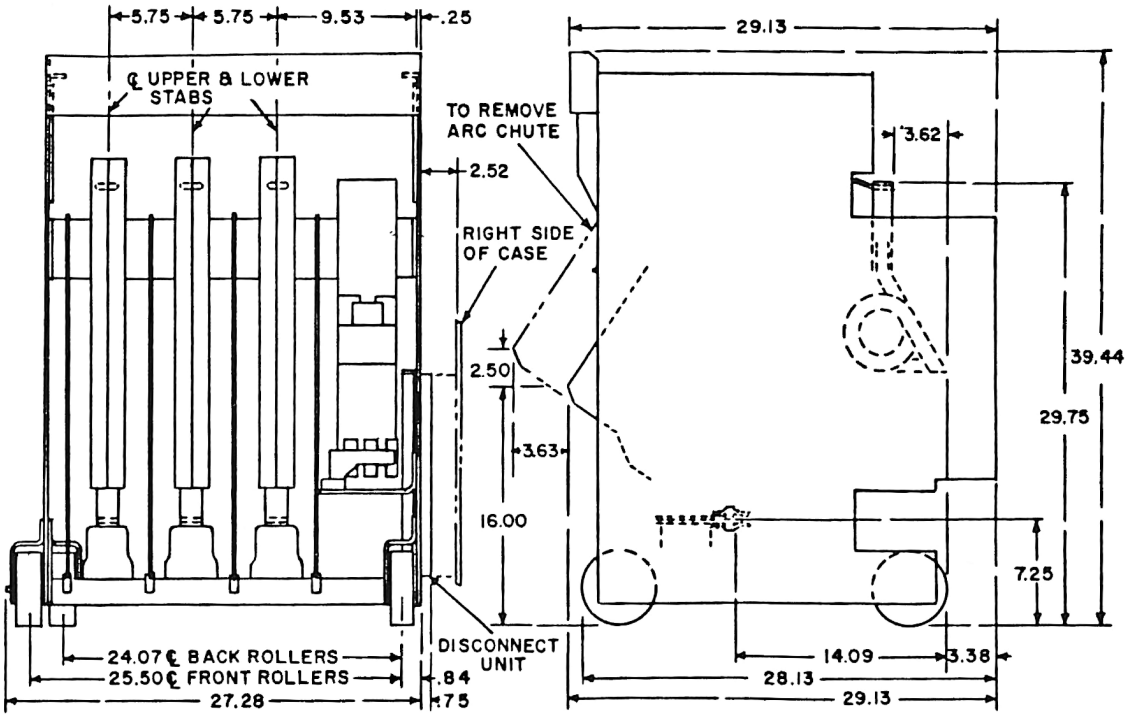
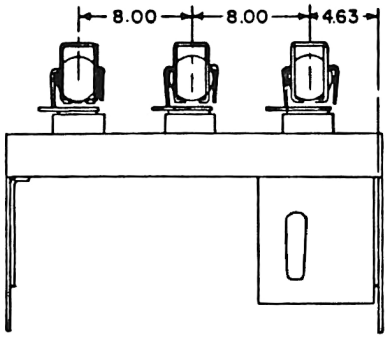
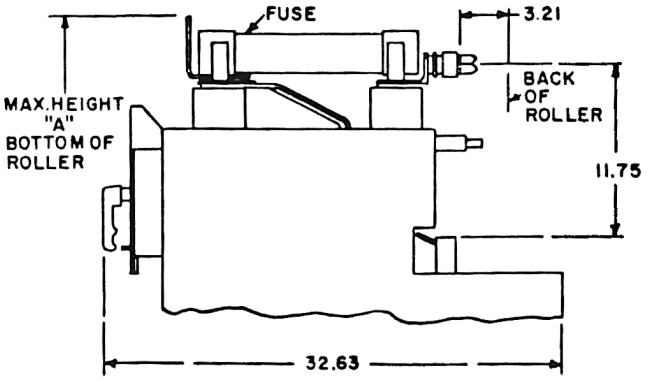


Figure 4. IC2814-E150 high-voltage contactor.

Figure 5.







OTHERWISE SAME AS P-1

PT.NO.	A	DESCRIPTION
2	47.38	SINGLE FUSE
	47.94	DOUBLE FUSE
3	43.25	NO FUSE

Dimensions of high-voltage contactors as follows:

- P1-IC2814-E110 and -E111 contactors
- P2-IC2814-E120, -E121, -E130 and -E131 contactors
- P3-IC2814-E140 and -El41 contactors

Figure 6. Dimensions of JC2814-F111 high-voltage contactor.

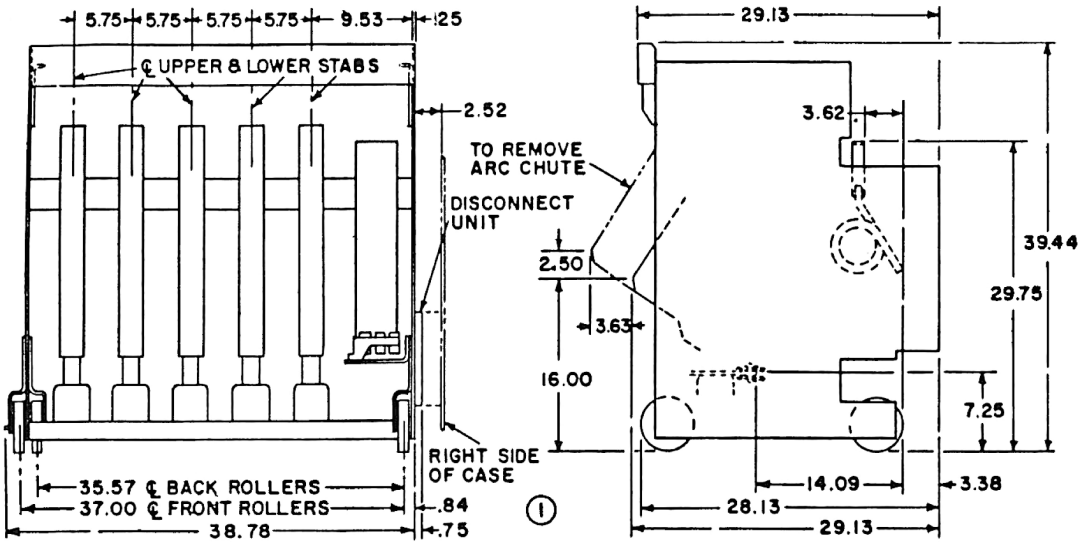
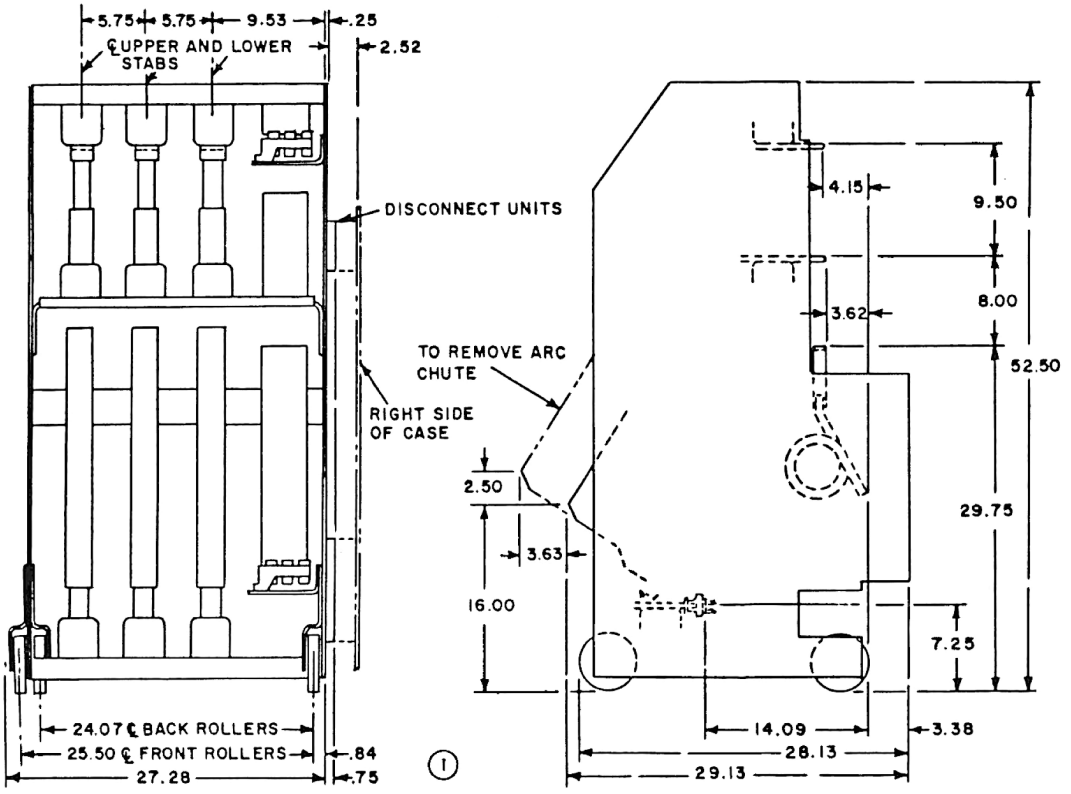


Figure 7. Dimensions of IC2814-X111 high-voltage contactor.



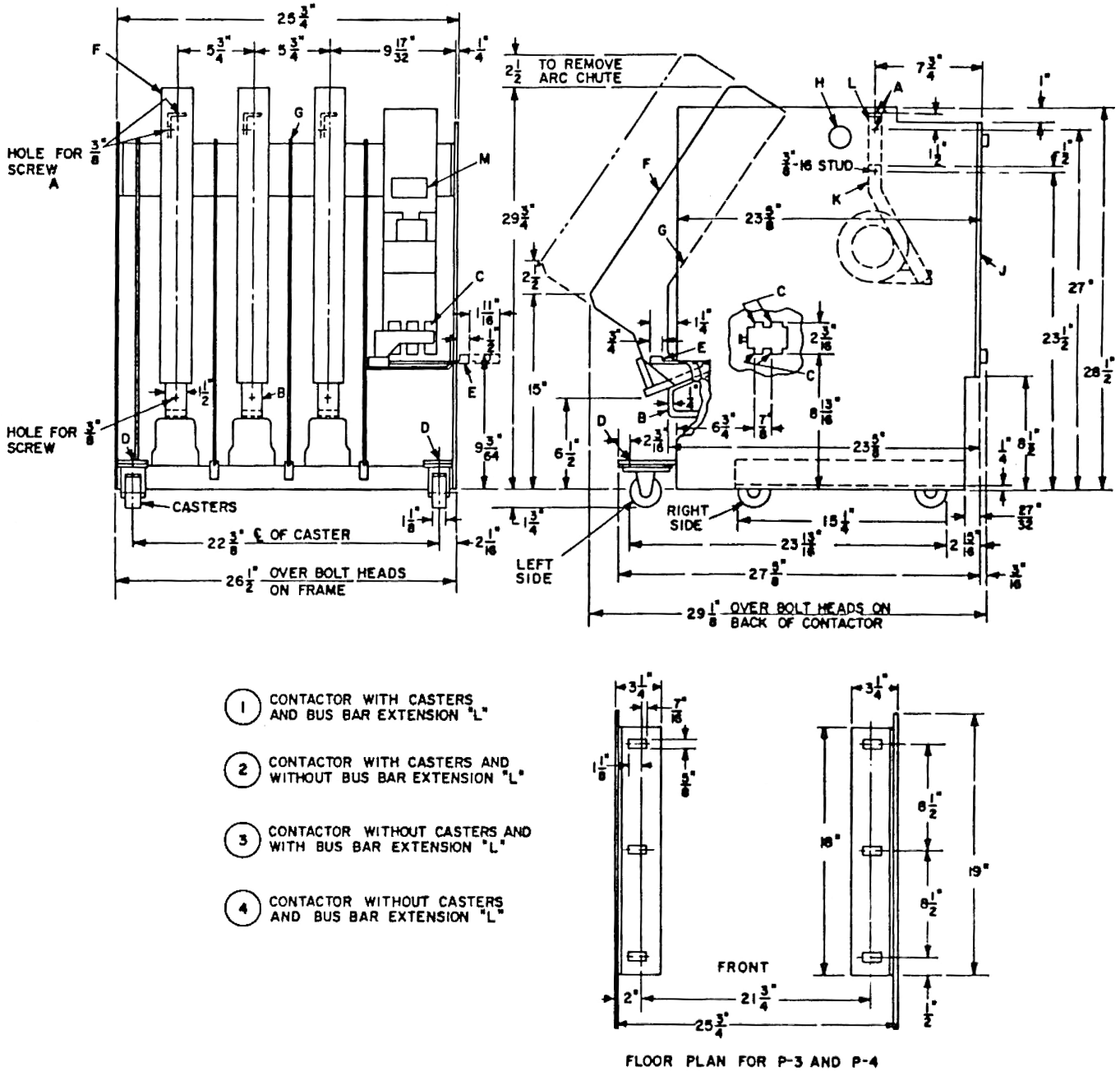


Figure 8. Dimensions of IC2814-E150 and -E151 high-voltage contactor.

Legend

A – Line terminal connections with bus bar "L"
B – Load terminal connections
C – Electrical interlock terminals
D – 3/8-16 tapped hole for connecting grounding strip
E – Door interlock (if used)
F – Arc chutes
G – Barriers
H – Lifting hole (one each side)
J – Insulation on back of contactor
K – Line terminal connection without bus bar "L"
L – Bus bar extension

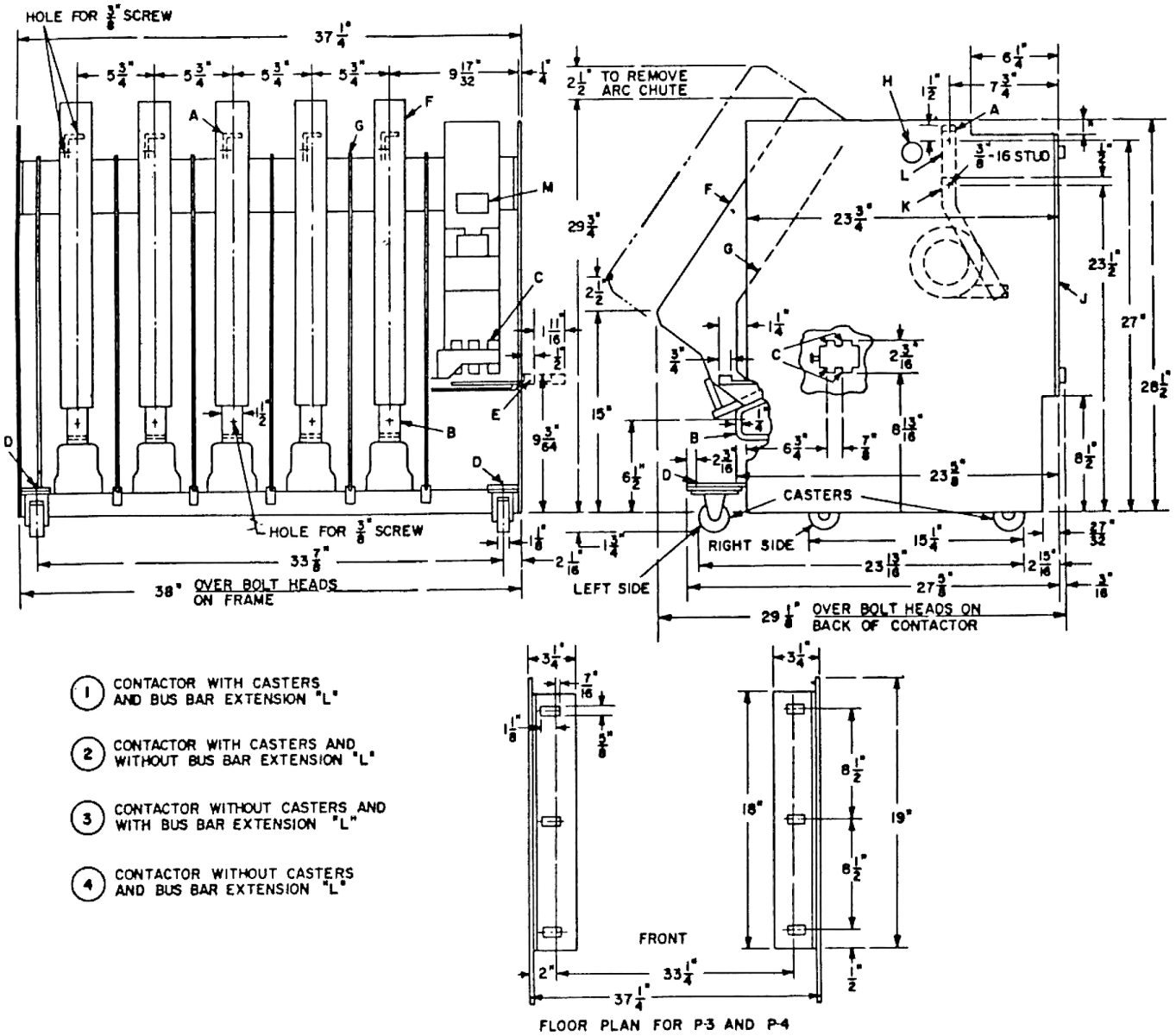


Figure 9. Dimensions of IC2814-F151 high-voltage contactor.

Legend

A – Line terminal connections with bus bar "L"
B – Load terminal connections
C – Electrical interlock terminals
D – 3/8-16 tapped hole for connecting grounding strip
E – Door interlock (if used)
F – Arc chutes
G – Barriers
H – Lifting hole (one each side)
J – Insulation on back of contactor
K – Line terminal connection without bus bar "L"
L – Bus bar extension
M – Terminal board for control-voltage connections

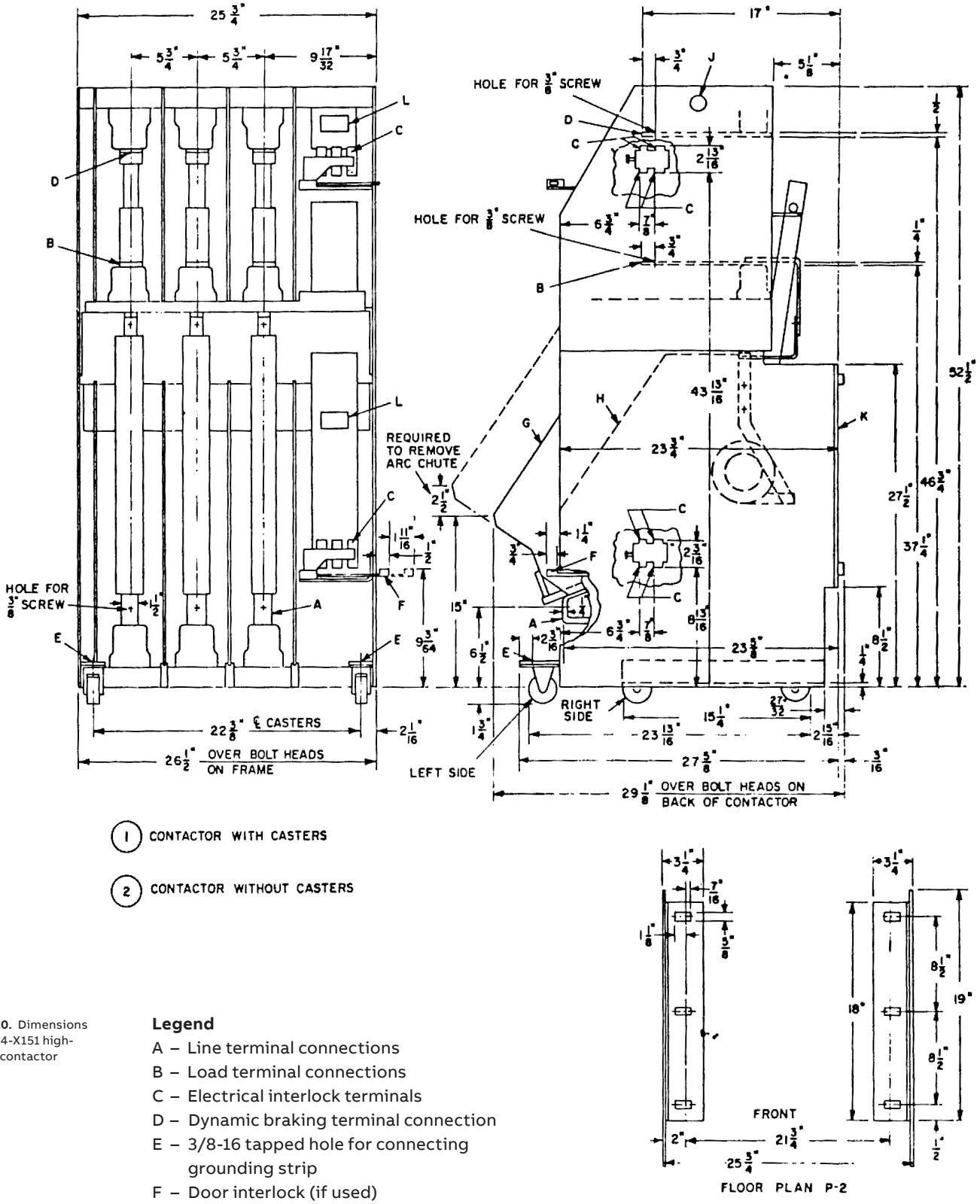


Figure 10. Dimensions of IC2814-X151 high-voltage contactor

Legend

- A – Line terminal connections
- B – Load terminal connections
- C – Electrical interlock terminals
- D – Dynamic braking terminal connection
- E – 3/8-16 tapped hole for connecting grounding strip
- F – Door interlock (if used)
- G – Arc chutes
- H – Barriers
- J – Lifting hole (one each side)
- K – Insulation on back of contactor
- L – Terminal board for control-voltage connections

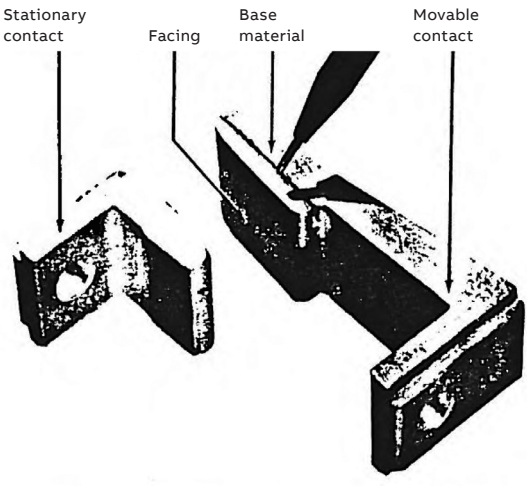


Figure 11. Movable and stationary contacts.

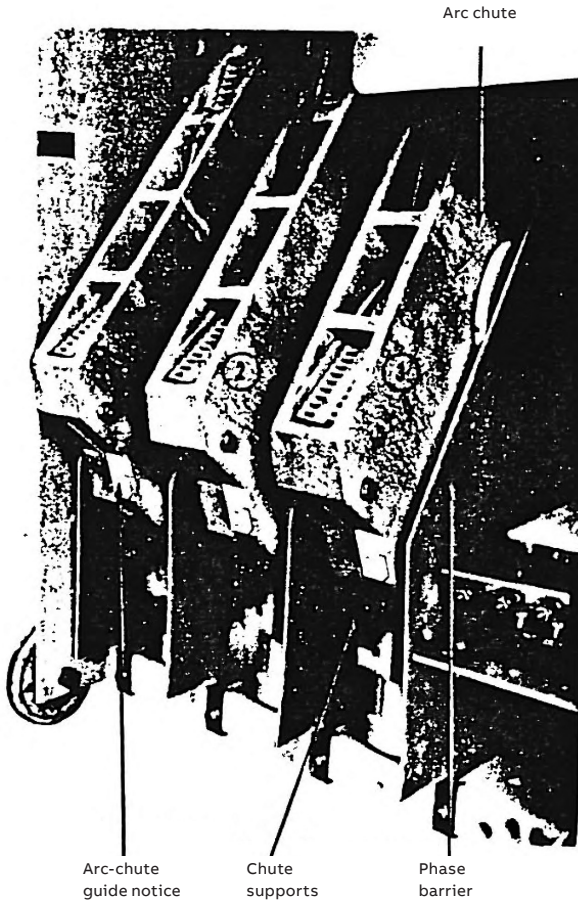


Figure 12. View showing arc chutes 1 and 2 improperly seated with bottom of chute not pushed down into place on arcing horn and behind chute supports. View also shows ore chute 3 properly seated with the edges of the chute parallel with the phase barrier. Note the arc-chute guide notice.

Operating magnets

These contactors are provided with magnets as listed in Tables 1 and 2. The a-c magnets have continuously rated coils. The d-c magnets have intermittently rated coils with an economy resistor.

Control voltage for energizing the coils should be within 85% - 110% of the control voltage rating of a-c coils or 80% - 110% of the control voltage rating of d-c coils.

Voltage less than the minimum will result in poor pickup and perhaps contact welding; voltage higher than the maximum will greatly decrease the coil life and, in the case of a-c magnets, pound the magnet severely if operated frequently. The pounding will result in misalignment, overheating, decreased contact life, etc.

Magnets and coils are designed for a 40 °C ambient and coil life is greatly reduced if operated at much higher temperature. Special coils for higher voltages and temperatures can be supplied, if required.

Arc chutes

The arc chutes are usually shipped in their operating position on the contactors. When removing or reassembling the arc chutes, handle them carefully to prevent damage. See that there is no packing material or other foreign matter inside or around the chutes; and make certain that they are dry. Mount the chutes by easing them initially onto the upper and then over the lower arcing-horn extensions as far as they will go with the chute finally resting behind the arc-chute supports per Figure 1. Observe the notice on the front of the chute, shown in Figure 1 and Figure 12. Figure 12 also shows the difference between properly and improperly seated chutes.

The weight of the arc chute itself holds the chute in place when correctly seated. The chute may be mounted with either end at the top. Seat the chute so that this top line (lower label only) rests flush with the top of the support pin or bracket. (See Figure 12.)

If the contactor is used in a humid atmosphere, or if moisture ls present in its vicinity, space heaters are recommended to keep the arc chutes dry. Moisture limits the interruption ability of the arc chutes.

If the vanes inside the chute are broken, either the broken vanes or the entire chute should be replaced. Broken vanes will reduce the length of the arc between the tips and can interfere with proper interruption.

Arc chutes will have the vanes inside the chutes much closer to the contact tips at the center of the chute than at the ends of the chute. These chutes will have a 50,000 kVA interrupting capacity.

These arc chutes can be used on similar contactors of the IC2812M13 and IC2812E100 variety, which ADJUST were built during the period 1949-1950. Chutes of these early contactors cannot be used on contactors listed in this instruction book.

Electrical interlocks

The electrical interlock (see Figure 1) consists of three contact units, each with contacts for two circuits in various combinations of normally open and normally closed contacts. These contacts are mechanically connected to the main shaft of the contactor and move when the contactor operates. A bracket "B" (see Figure 1) ls provided above the electrical interlocks to protect them from mechanical damage. This bracket should be removed when inspection of electrical interlocks is required.

Adjustment of these interlocks is critical to the operation of the contactor. Figures 13A, 13B and 13C should be followed in making this adjustment. Also, see Table 3.

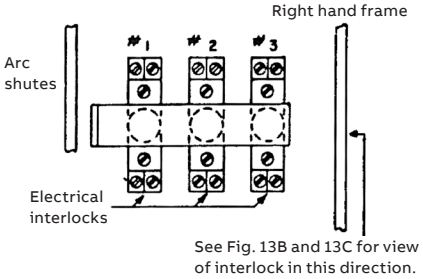


Figure 13A. Electrical interlock arrangement viewed from front of contactor.

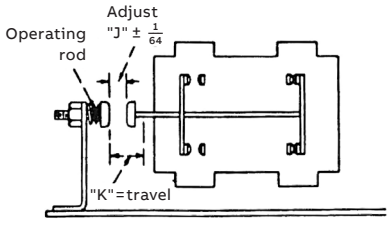


Figure 13B. Electrical interlock with magnet energized.

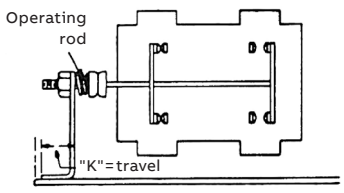


Figure 13C. Electrical interlock with magnet deenergized.

Table 3. Electrical Interlocks (Adjustments). Refer to Figure 13A for Interlock Number.

Interlock Number	Main Contacts Fully Closed Magnet Energized			Main Contacts Fully Open IC2814-X111 or -X151 Magnet Energized		
	Dimension in Inches Interlocks for N.O. Contacts			Dimension in Inches Interlocks for N.C. Contacts		
	1	2	3	1	2	3
Dimension J ± 1/64	1/8	1/8	1/32	1/32	1/32	1/32
Travel “K”	17/32	17/32	17/32	17/32	17/32	17/32
N.O. Tip Wipe	1/16	1/16	1/16	1/16	1/16	1/16
N.C. Tip Wipe	3/32	3/32	3/32	3/32	3/32	3/32

The electrical rating of the interlock is 10A, continuous; 60 amperes, "make'' current; with current interrupting values, as listed in Table 4.

Interlock contacts should be applied in circuits consistent with the make, break, and interruption ratings of Table 4, Contacts applied outside of these ratings will have reduced life and may not operate satisfactorily. Check the adjustments of Table 3 (IC2814-X111 and -X151) with the magnet picked up electrically.

Power and control disconnects and shelf tongue

Contactors with stab connections – see Table 1 and 2

Power disconnects (see Figure 2) are provided so that contactors so equipped can be removed or installed in enclosures without having to disconnect or connect cables. Flexible control-disconnect fingers (see Figure 1) are also provided for the same purpose.

Figure 14 shows the location of the power stabs and fingers as well as the control-disconnect fingers with reference to the enclosure track or wheels of the contactor. These requirements with listed tolerances are necessary to allow any contactor to properly assemble into any enclosure.

No lubrication is required on any of these disconnects, but if desired, General Electric Contact Lubricant D50 H47 can be applied to the power-disconnect stabs. Do not apply this lubricant to the control-disconnect fingers.

The tongue for the fuse-disconnect shelf is located as shown in Figure 14 so that the power fingers or the shelf will make proper contact with the power stabs on the enclosure. This guide also facilitates proper in and out operation of the fuse shelf.

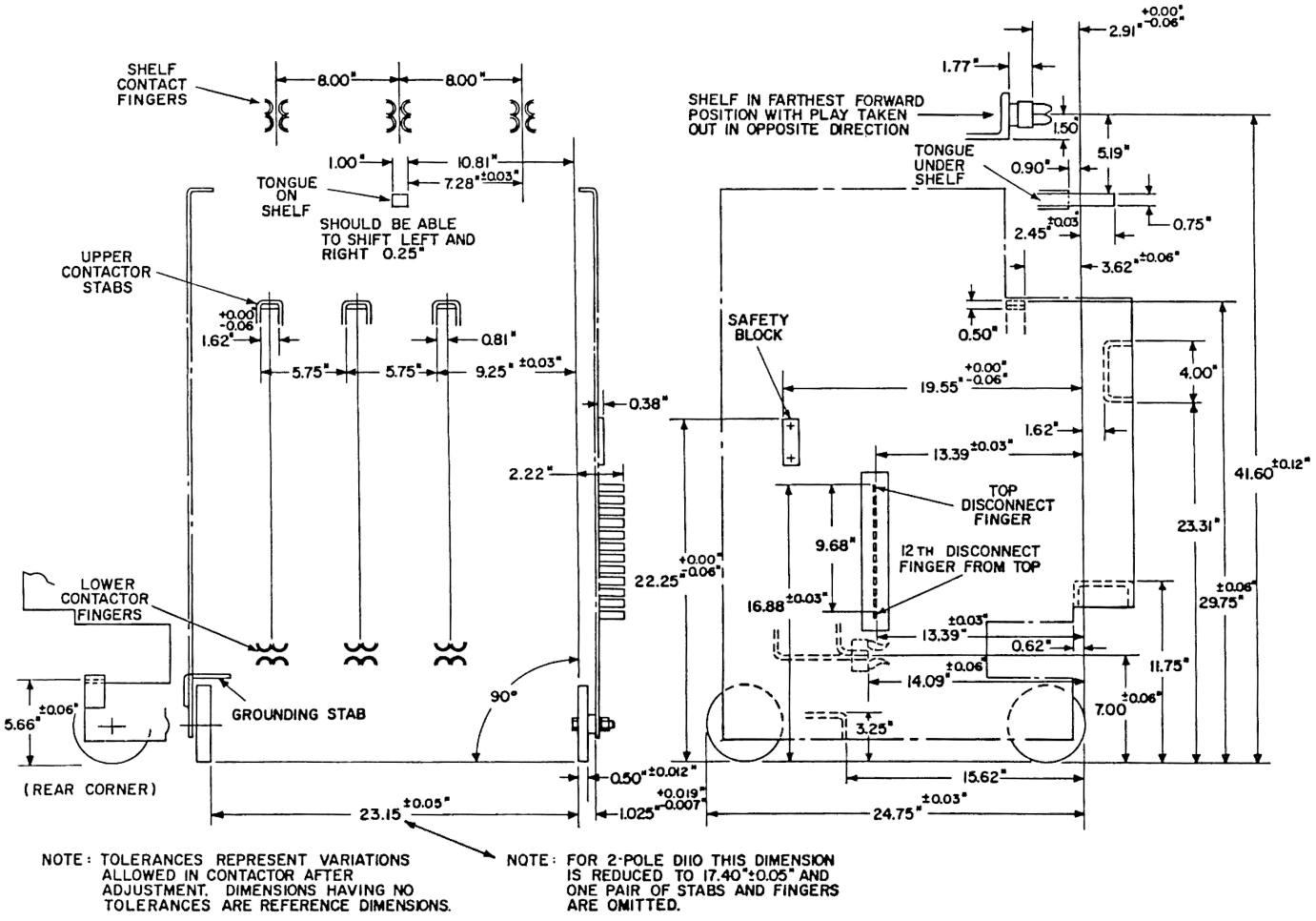
Figure 14 shows the location of the top edge of the top control-disconnect finger 16 7/8” ± 1/32” from the track for the contactor wheels.
The control-disconnect fingers are assembled to a molded block, each of which assembles four fingers. The top edges of the top finger of each block are 3.5”. or multiples thereof apart.

Table 4. Inductive Ratings

A-C Inductive Ratings			D-C *) Inductive Ratings		
Volts	N.O. or N.C.		Volts	One Interlock Amperes	Two Interlocks in Series Amperes
	One Interlock – Amperes				
	Normal	Inrush **)			
110	6	60	125	1.8	4.0
220	3	30	250	0.5	1.2
440	1.5	15	600	0.2	0.35
550	1.2	12	–	–	–

*) Non-inductive d-c interrupting rating is 1.5 times inductive rating
**) Capable of interrupting inrush currents

Figure 14. Outline of high-voltage contactor showing location of power stabs and control-disconnect fingers.



Fuse-disconnect shelf

Contactors with stab connections – see Table 1 and 2

The fuse-disconnect shelf is provided to serve as an isolating switch and allow maintenance and inspection work on the contactor without removing it from the enclosure. A padlocking facility (see Figure 15) is provided to positively lock the shelf in the "closed" or "open" position. (Fuses connected or disconnected respectively.) This is accomplished by not permitting the pushing in of the shelf operating handle (see Figure 1). This pushing in of the handle is necessary before one can rotate the handle from "open" to ''closed'' position or vice versa.

The fuse shelf disconnect should move freely on its rollers when the shelf operating handle is pushed and turned. Free action is necessary for positive connecting and disconnecting of the power fingers and will be present unless the contactor has suffered from extremely rough handling.

When the shelf operating handle (see Figure 1) is in "open" position (shelf power fingers are disconnected) and shelf is retracted toward the back of the contactor to remove all slack in its mechanism and reduce the grounding finger flexing to a minimum, the grounding fingers are still flexed 7/64” to 9/64”. Steel backing for the grounding finger can be bent to maintain this adjustment. See Figure 16. The grounding fingers must also not be misaligned with the fuse mounting that contacts them (left to right) by more than 3/16”.

When the shelf operating handle is pushed in and then turned clockwise to the "close" position, the shelf will advance toward the back of the contactor. With this handle in the "close'' position, the shelf can be moved backward and forward approximately 1/8”.

Figure 15. Padlocking facility for locking the shell in "closed" or "open" position.

Figure 16. Fuse-shelf grounding fingers.

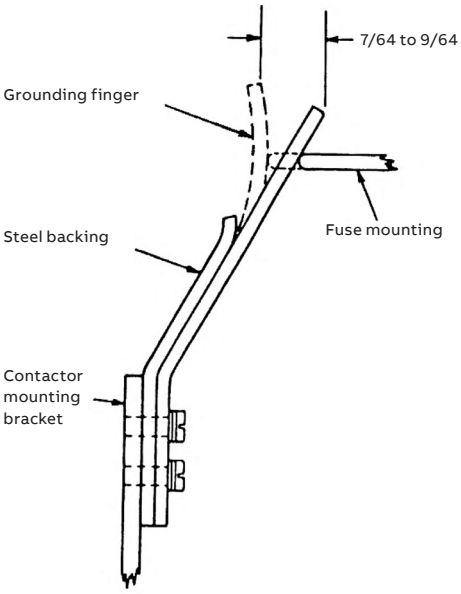
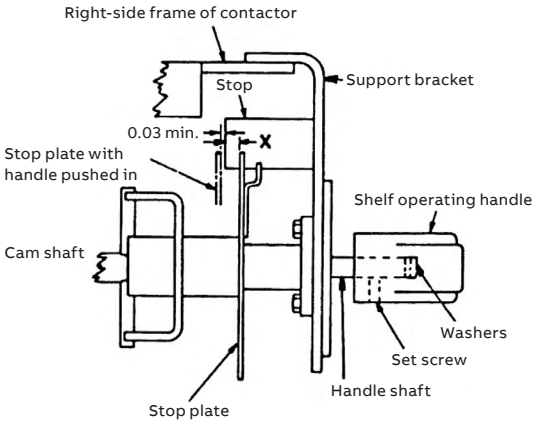


Figure 17. Shell operating handle location – top view.



When the shelf operating handle ls fully pushed in for turning, the stop plate (see Figure 17) clears its stop by 1/32” minimum and the cam should turn freely without binding, The shelf operating handle must also return from the action of its spring if its .support bracket has been properly adjusted to align the cam and handle shafts. "X" must be ¼” to 3/8” with the control-power interlock operator Just touching the control-power interlock plunger (see Figure 20).

This adjustment is obtained by locating the shelf operating handle properly on its shaft when the handle was located along the shaft with washers on end of the shaft inside the handle. It will be important to replace all the washers in reassembling the handle to the shaft at the proper position. Early handles were attached to their shafts with two setscrews one assembled tightly on top of the first one to lock it in position, It is, therefore, very important that the first setscrew bearing on the shaft be tightened very securely, Later handles were attached with one long setscrew and washers inside the handle were not necessary.

Fuse clips of the shelf must also hold the fuses very securely. Fuses must just enter a fuse clip with a downward force of 20 pounds. This can be assured by maintaining the setting of the "U" clip of the fuse clips to 3 5/8”, +1/32”, -1/8”, (see Figures 18B and 18C).

When pushing the fuses down into the clips, keep fingers clear of the end of the fuse since the ejector bracket snaps upward and would pinch the fingers.

Fuses, shipped in place in the shelf, will be cord tied in place at the ejector end. This also keeps the ejector bracket from wearing against the underside of the fuse during shipment. Before operating, check the fuses to be sure that the fuse barrel has not been damaged by a loose ejector during shipment.

Fuse-ejector brackets (see Figures 1 and 18A) are provided for easing the power fuses out of their brackets. This fuse pulling is accomplished by moving the fuse-puller bracket toward the front of the contactor as shown in Figure 18A.

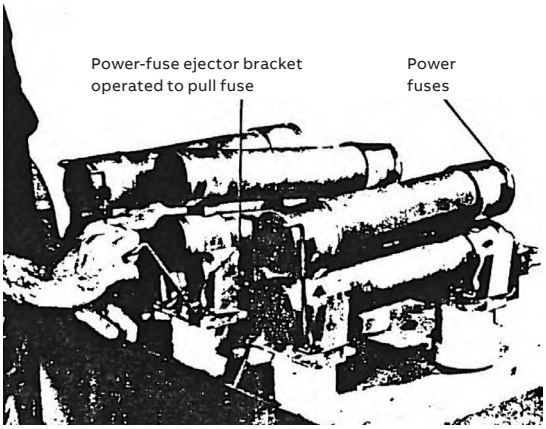


Figure 18A. Power fuses-power-fuse ejector brackets.

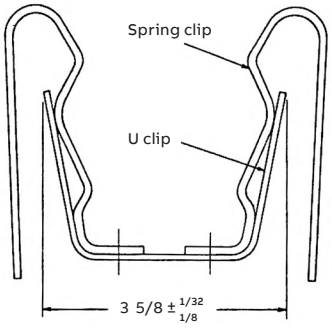


Figure 18B. Fuse clip or fuse-disconnect shelf.

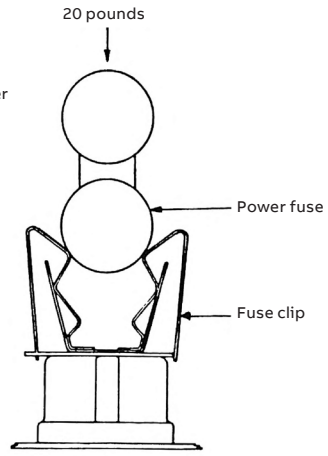


Figure 18C. Force for inserting power fuses in fuse clips.

Mechanical and electrical interlocks and “brainbox”

Contactors with stab connections – see Table 1 and 2

The contactor stop (see Figure 1) on the right-hand side of contactor is provided so that, combining with the enclosure mechanical interlocks, the contactor cannot be rolled out if the shelf ls in the "Close" position with its power fingers engaging the power stabs of the enclosure. This contactor stop combines with the enclosure mechanical interlocks to prevent the contactor and shelf from being pushed into the enclosure if the shelf is accidentally in the advanced or "Closed" position.

The "brainbox" (see Figures 2 and 19A) also mechanically interlocks the fuse shelf with the contactor to accomplish the following:

1. The fuse shelf cannot be moved from "Open" to "Closed" position or from "Closed" to ''Open" position with the contactor picked up mechanically or electrically with its own magnet. The shelf disconnects cannot break or make load power. It can break a maximum magnetizing current of the control transformers as follows: 25 kVA – 3Φ – 4,160 V – 0.173 A.

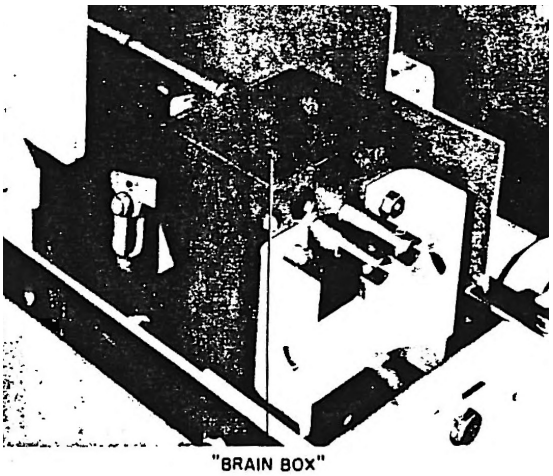


Figure 19A. View of the "brainbox".

2. One reversing contactor is kept mechanically from picking up when the other ls picked up. Any three contactors of the 3-or 5-pole varieties can also be interlocked with each other so that only one contactor can be picked up at a time or any two contactors can be picked up at the same time with the third contactor locked in open position.

   Different styles of the "brain box" are applied to offer the various special functions just mentioned. Since these operate with specific inter-contactor mechanical linkages, it is obvious that such contactors can only be interchanged between control panels which are functional duplicates, and then only in the particular panel section corresponding to that contactor function. Contactors interchanged should also have identical nameplate stamping.

3. The control-power interlock (see Figure 20) which is operated each time the shelf operating handle is pushed in, opens the control power of the transformer secondary, when operated, so that the shelf disconnects break only the magnetizing current of the transformer.

   The adjusting bolt (see Figure 19B) which operates the "brainbox" is set and locked with a locknut to give a 0.15” – 0.18” gap between it and the "brainbox" plunger with the magnet armature fully dropped out against its backstop. When the magnet armature ls fully picked up, the plunger in the "brain box" should have a minimum of 1/16” additional travel remaining. These adjustments assure that the magnet is free to move through its full stroke without binding. All adjustments can be accomplished with the adjusting bolt.

   The control-power interlock operator (see Figure 20) is located on this same horizontal rod with washers so that, with the magnet armature fully picked up, the clearance between the control-power interlock plunger and the dump-switch operator is 1/16” 1/8”. This adjustment allows positive operation of the dump switch but does not allow the control power interlock to be operated unnecessarily.

Figure 19B. "Brainbox" plus mechanical linkage.

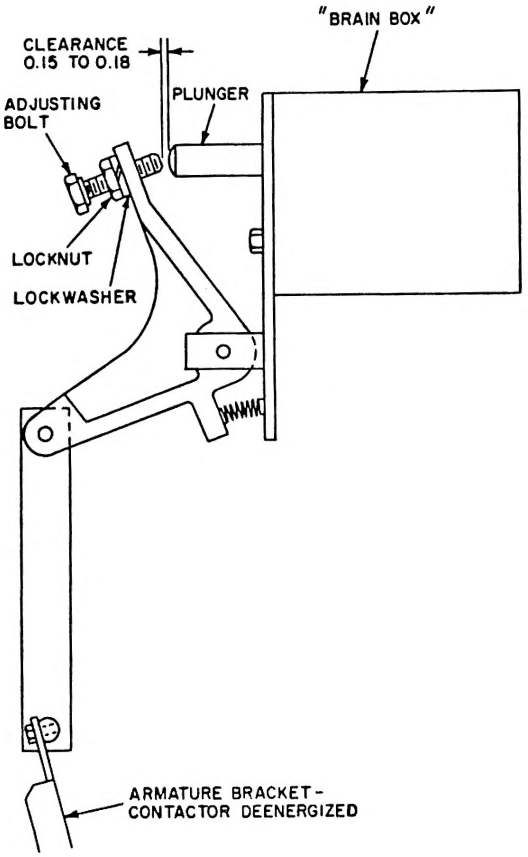
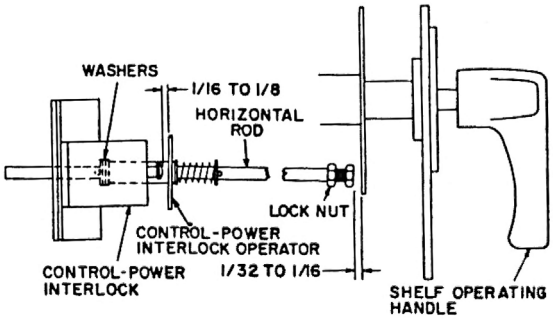


Figure 20. Shelf operating handle adjustment.



Length of horizontal rod is adjusted and locked with lock nut so that the shelf operating handle has free travel of 1/32” - 1/16" as determined by plunger in "brainbox", This adjustment is made with contactor armature fully picked up.

Installation

For convenience and safety in moving the contactor, use the lifting holes at the top of the steel side plates, and an equalizer bar or spreader for the cable sling. Lifting holes are in the main side plates of the contactor below the fuse-disconnect shelf and toward the back of the contactor. See Figures 5, 6, 7, 8, 9 and 10.

CAUTION: If the contactor is not installed in a metal enclosure, at least eight to ten feet of arcing clearance in front of the unit is advised for protection of personnel.

Observe the following precautions before applying power to the contactor for the first time.

1. Remove the shipping supports, blocks, or ties used for protecting the contactor in transit, Remove the arc chutes.

2. Carefully inspect all parts of the contactor. Operate it by hand to see that all parts work freely. Be sure that the contacts strike squarely with their sides in line within 1/32”. Remove foreign objects or matter which may have collected in the magnet or tip gaps during transit or storage.

3. Remove any protective grease or oil which may be on the magnet face, as the grease could collect dust and dirt, thus causing a sticking of the magnet.

4. See that all parts of the contactor are clean, High-voltage equipment fails if too much dirt accumulates.

5. Check the arc chutes according to the "Arc Chute" sections of "Description" and "Maintenance" instructions before installing them on the contactor.

6. It is of the utmost importance that the arc chutes be in proper position on the contactor before applying power to the contactor, since the arc chutes are essential to confine and extinguish the arcs, Without the chutes, the arcs may cause serious damage. Refer to the section on "Arc Chutes'' of "Description" instructions and to Figure 12. Operate the contactor by hand again to see that all parts operate freely and that moving shaft parts do not rub on the arc chutes.

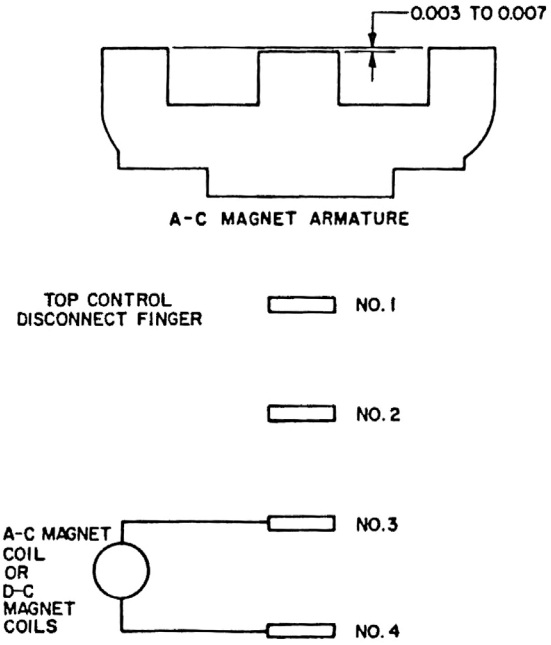


Figure 21. Magnet-coil wiring to control-disconnect fingers.

7. Operate the contactor electrically with the fuse-disconnect shelf in the open position. This is accomplished by connecting rated control power to the coil leads. The coil leads are connected to the third and fourth control disconnect fingers, See Figure 21, The proper picking up of the contactor can thus be checked. At rated coil voltage it should pick up completely until the stationary and movable magnets hit and should be quiet. A-c magnets will have an a-c hum but should not make an appreciable noise which would indicate magnet misalignment from rough handling. If noise is present, the magnets should be aligned according to the "Magnet Alignment" section of "Maintenance'' instructions.

8. Check the fuse-disconnect shelf for free and positive operation. Adjustments according to the "Fuse Disconnect Shelf" section of "General" instructions should not have to be checked unless the contactor has received extremely rough handling.

9. Contactors without stab connections – Power cable connecting lugs must be rigidly maintained with adequate spacing between them for the voltages involved. If the spacings are inadequate, taping with proper Material for the voltages involved must be applied.

Maintenance

GENERAL
This electrical apparatus will provide maximum trouble-free service if given the benefit of preventive maintenance, inspection, and periodic cleaning. It is important that a definite inspection schedule be maintained. The frequency of the inspection periods will depend upon the operating conditions.

Contact life depends on the severity of service required for the device. The contactor should be thoroughly inspected after every 50,000 operations, or more often if operated very infrequently.

CAUTION: All power should be disconnected from the contactor before any inspection is made.

Inspections

In these routine inspections, check for the following per the reference instruction: (Reference instructions are in the parenthesis and can be found in later pages of these instruction under the same heading.)

1. Loose screws, nuts, and bolts.

2. Loose electrical interlocks – (“Electrical Interlocks”)

3. Accumulation of dust and foreign matter such as coal dust, cement dust or lamp black. This material must be periodically blown off the contactor if inspection shows an accumulation. The stand off insulations must be wiped off clean at regular intervals, as dust collects moisture, and can cause a voltage breakdown. Dust accumulation on the arc chutes is detrimental for the same reason.

4. Contacts should be checked for general condition and replaced if necessary – (“When to Replace Contacts” and “Contact Alignment”)

5. A-c magnets (Item 1, 2, 3, 4 and 7 of “A-c magnet assembly”)

6. Control disconnect finger alignment – (“Control disconnect fingers”)

7. Grounding straps of fuse shelf and right side of contactor – (“Grounding straps”)

8. Loose bolted connections – hardware at connection points must be always assembled securely.

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

1. Contact forces must be measured directly per Tables 5 and 6 and the springs replaced if the forces are not within limits. (Figure 22. “Replacing Contact Springs”)

2. Contacts should be inspected. (“When to replace contacts” and “Contact alignment”)

3. Arcing-horn assemblies -and pole pieces on normally open poles")

4. Arc chutes -("Arc Chutes")

5. D-c Magnets -("D-c Magnet")

6. Electrical interlocks -("Electrical Interlocks")

7. Power disconnects ("Power Disconnects")

8. Fuse Clips -("Fuse Clips")

9. Brainbox -("Brainbox")

10. Shaft bearings (with grease fittings) – Lubricate bearings once a year with a good grade of ball-bearing lubricant. Check for loosened ball-bearing screws at this same time. These setscrews keep the shaft positioned laterally and therefore maintain contacts in alignment. See Figure 26. Bearings of later contactors do not require more lubricant during the life of the contactor.

11. Shelf adjustments – ("Fuse-disconnect Shelf')

Table 5. AC Magnets (Adjustments)

Contactor IC2814 or IC2812	"A" Dimension per Figure 23 contacts fully open (Inches)	"A" dimension (WIPE) per Figure 23 Contacts just touching See Note 1		New Contacts in open position Measurement "C" Figure 22 (inches)	Contact Force See Note 2	
		New Contacts (Inches)	Replace when measurement "A" reaches (inches)		Initial Contacts open (pounds)	Final Contacts fully closed (pounds)
-E110	2 5/32 ± 1/32	9/16 ± 1/8	9/32	7/8 min	9 to 11.5	12.5 to 16
-E120						
-E130						
-E140						

Note 1. Measure per Section on "When to Replace Contacts".

Note 2. Measure per Figure 22 – 5/8" down from top of contacts. Initial force is the force in direction of arrow at "D" that will just start movable contact in motion. Final force is force in same direction at "D" that will just part contacts when contacts are fully closed. Force measurements will only be required if contact springs have been damaged physically or thermally.

Figure 22. Movable and stationary contact structure.

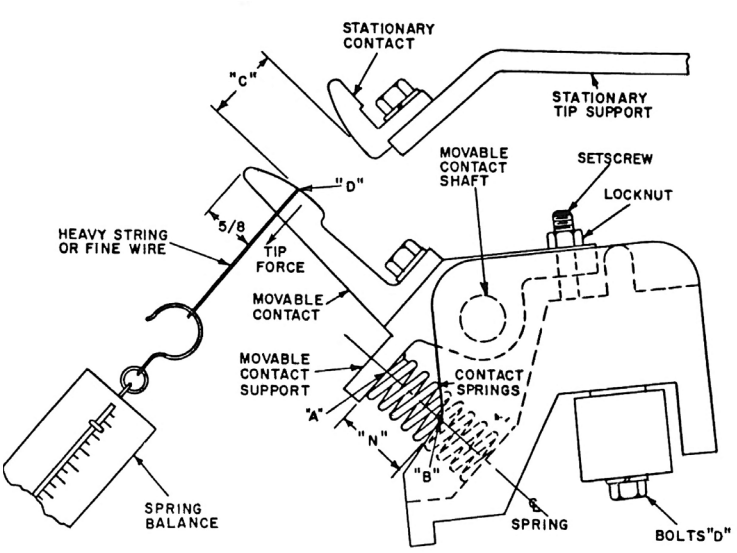


Table 6. D-C Magnets (Adjustments)

Contactor IC2814 or IC2812	"B" Dimension per Figure 25 Contacts fully closed – -X111 (N.C. poles) (inches)	"B" Dimension per Figure 25 Contacts fully open (inches)	"B" dimensions (WIPE) per Figure 25 Contacts just touching		New Contacts in open position measurement "C" (Inches)	Contact Force	
			New Contacts (Inches)	Replace when "B" reaches (inches)		Initial Contacts open (pounds)	Final Contacts fully closed (pounds)
-E121		29/32 + 0.03 - 0.000	¼ ± 1/32	1/8	7/8 min	9 to 11.5	12.5 to 16
-E131							
-E141							
-E111							
-F111							
-X111 (N.O. poles)							
-X111 (N.C. poles)	11/16 ± 0.005		19/64 min.	9/64	17/32 min *)	9 to 11.5	13.5 ± 2

*) Measure with magnet picked up with power.

When to replace contacts

The contacts will be pitted and show various shades of black after considerable usage. The pitted contact surfaces are characteristic of a-c applications and will not interfere with proper operation if proper contact pressures are maintained per Tables 5 and 6. If the contacts are wearing away with the contacts misaligned more than 1/16” the contacts should be replaced, as the misaligned condition can only get worse and accentuate the wear of the bearing hole in the bronze movable-contact support.

Outlined below is the proper method for determining when it is necessary to replace contacts:

1. See Figures 22 and 23, With the contacts in the "kiss" (just touching) position, measure the magnet gap "A" per Figure 23. If the gap is less than 9/32”, replace both the movable and stationary contacts. Contacts not replaced at this time may overheat or weld together. Wedge the top of the armature away from its supporting bracket as far as it will go per Figure 23, when measuring the "A" dimension.

2. The contacts must also be replaced if misalignment as mentioned above exists.

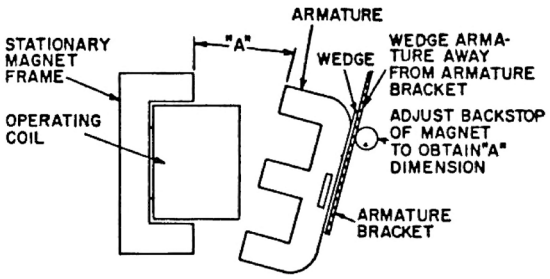


Figure 23. A-c magnet structure.

Contact alignment

The contacts are adjusted to make at the same time within 1/64”. When replacing the contacts, check this adjustment by picking up the contactor mechanically until the contacts of the first pole to touch are just touching each other. The maximum gap between the contacts of any other pole of a contactor must not exceed 1/64” Adjust the movable contact position to obtain this requirement as well as the wipe per Tables 5 and 6 by means of the setscrew in each movable tip support. The setscrews should be locked in their final position by means of their lockouts. (See Figure 22.)

The angular position of one contact with reference to the other, when they first touch each other and with the contactor fully closed, is not critical as the special facing for each contact substantially assists the contacts in making, carrying, and interrupting electrical power. Their relative positions with reference to each other may also change considerably during the life of the contacts. Alignments per Figures 24A and 24B, however, must be maintained to obtain maximum life of the contact facing material.

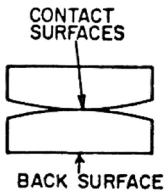


Figure 24A. Contacts with their back surfaces parallel.

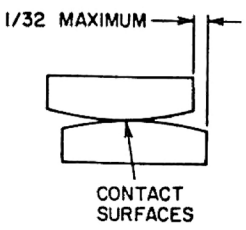


Figure 24B. Maximum sidewise misalignment of contact surfaces.

The angular positions of the contacts were properly set at the factory through accurate tooling of the parts and assembly. Side frames are precision tooled and can be used effectively in the field for complete reassembly. Shaft bearings must be centered over the holes in the side frames. The channel supporting the stationary contacts must be assembled centered over the holes in the side frames. Supports for the stationary contacts should then be assembled to align the contacts left to right and to obtain the above-mentioned requirements.

The contacts of a pole must also make with the back surfaces approximately parallel per Figure 24A. The contacts must also be aligned from left to right within 1/32” maximum per Figure 24B. These requirements must be met to increase the life of the contacts and movable-contact supports. These requirements will be present also with replacement contacts unless the alignment of the pole assembly has been disturbed. The movable- and stationary-contact supports can be moved slightly, if necessary, to obtain these requirements. The movable contact support can be moved slightly with reference to the shaft by loosening bolts "D" and turning the shaft insulator and retightening bolts ''D" (see Figure 22).

Measuring contact forces

One lower horn assembly can be removed at a time after removing the shunt and carefully recording the stab position left to right and front to back. The stand-off insulator should be removed along with the whole lower horn assembly. After the contact pressures of one set of contacts have been measured, the lower horn assembly should be again secured accurately and tightly in its exact previous position by again assembling the bolts from the support channel to the stand-off insulator. Other stab locations will assist in relocating the lower horn assembly at its previous position, The horn spacings with reference to the movable contact and upper horn must also be maintained per Figure 29. Forces of other poles can be measured in the same manner.

Initial contact force will be maintained if the "Z" dimension between ''A" and ''B" on the spring's centerline is 1” ± 1/32”, Final forces will be maintained if the ''A" dimensions of Table 5 are maintained. This "Z" dimension applies to all d-c and a-c magnets. See Figure 22.

The hardware for assembling the stationary tip support (see Figure 22) to the stand-off insulators can be loosened and the assembly rotated, and then the hardware should be tightened securely.

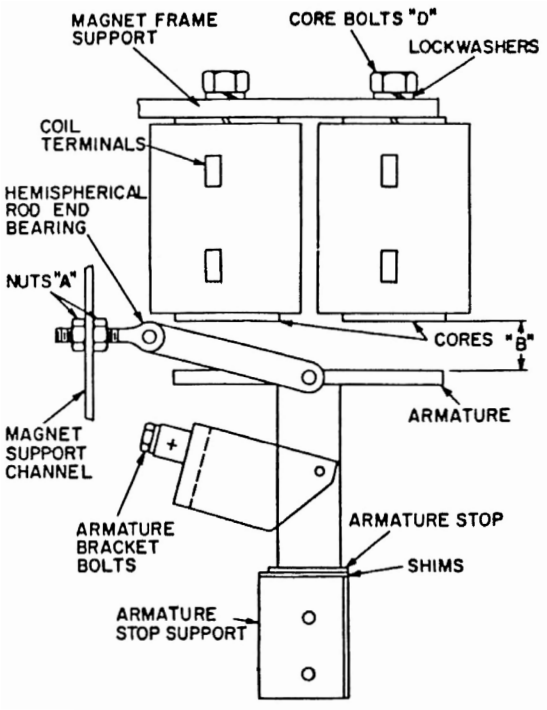


Figure 25. D-c magnet structure (left side view).

Contact gap "C" (see Figure 22) must be 7/8” minimum. The phase-barrier clip (see Figure 1) can be used as a gage for "C" contact gap, as it is 7/8” wide, "C" dimension can be obtained by moving the backstop slightly, if necessary – (a-c magnets through the sliding backstop (see Figure 23); d-c magnets through shimming the armature stop (see Figure 25). When the A and B dimensions with the contacts fully open are set per Table 5 and Table 6 respectively, "C" contact gap should be available without further adjustment.

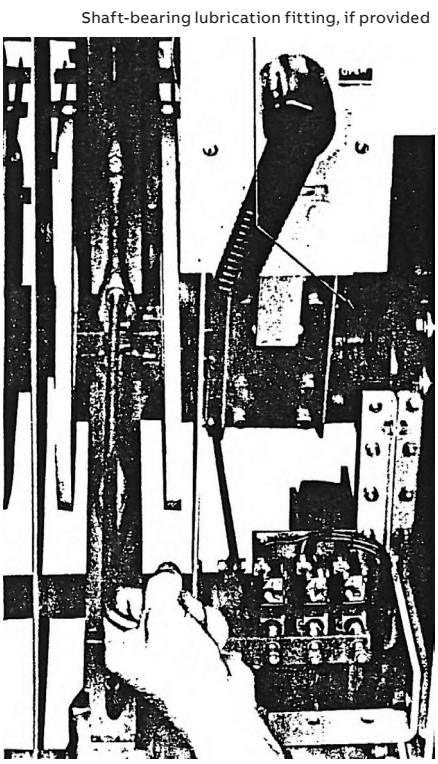
If the A and B dimensions are maintained with the contacts just touching (N.O. contacts), initial and final contact forces should be properly set without further adjustment. Similar "B" dimensions for the N.C. contacts of the IC2814-X111 set the contact gaps and pressures properly. These adjustments will set the contact forces properly unless the contactor's contact supports have been misaligned through rough handling.
The initial and final contact forces or a contact spring compression of 3/16” between the initial and final positions of each spring must be maintained after final adjustments following rough handling.

Replacing normally open contacts

In replacing the normally open contacts, work from the front of the contactor following the steps described below:

1. Remove the arc chute by lifting gently from the upper and lower arcing-horn extensions. Exercise care in handling the chutes so that they will not be damaged by tipping or accidental blows.

Figure 26. Method of replacing contacts.



2. See Figure 26, Using the socket wrench provided, remove the upper arcing horn along with its insulation backing. The socket of the wrench contains a permanent magnet for picking up the hardware after it has been completely loosened.

3. The stationary contact can then be removed after removing its assembly hardware with the wrench mentioned in item 2 above.

4. The new stationary contact should then be placed in its proper position with its machined projection seated in the machined groove of its support. The arcing horn should then be reassembled maintaining its position per the section on "Arcing-horn assemblies and pole pieces on normally open poles".

5. The movable contacts can be removed with the same wrench without removing the lower arcing horn. The wrench can be inserted between the stationary and movable contacts for removing hardware for movable contacts. New movable contacts must be installed in the same manner as the new stationary contacts, as they also have similar machined projections in their bases.

6. It is recommended that both contacts of a pole be replaced at one time. If only one contact (movable or stationary) is replaced, the electrical current make and carry ability of the pair of contacts will be impaired.

Replacing normally closed contacts

Contacts for the normally closed contacts of the IC2814-X111 contactor can be replaced by blocking its magnet (upper magnet) in the closed position and proceeding as outlined for ''Replacing Normally Open Contacts". This operation is simplified, as the contacts do not have arc chutes or arcing horns.

Replacing contact springs (see Figure 22)

The contact springs must be replaced if they have been overheated from interruptions above the contactor ratings or damaged from rough handling. Contactors having contact springs with a grayish-black color should have the contact pressures checked per Table 5 and 6 as they have probably been overheated. Any initial and final contact forces outside of those of Table 5 or 6 will require that the springs be replaced.

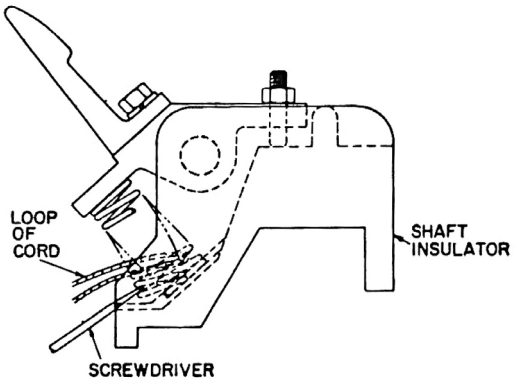


Figure 27. Method of replacing contact spring.

These spring forces are necessary to allow the contactor to properly make, carry, and interrupt electric power.

To replace the contact springs, first remove the interphase barriers by removing the bolts in the front of the contactor and sliding the barrier forward. Reach under the lower arcing-horn assembly with a screwdriver as shown in Figure 27 and pry the spring forward, out of its lower seat.

Thread a length of heavy cord around the top of the spring and drop the cord down to the bottom. Pull the spring out with the cord (refer to Figure 27). To replace the spring, slide one end of the spring into the recess formed by the shaft insulator and the contact holder. Compress the spring with the thumbs and insert the spring in the top seat. The bottom then can be seated by prying with a screwdriver. Replace the barriers.

Arcing-horn assemblies and pole pieces on normally open poles (see Figures 28 and 29)

Arcing-horn assemblies should never have to be replaced except for mechanical damage from rough handling. Spatter of arcing-horn material on its insulation strip should be removed after every 50,000 operations or more often if the contactor is frequently interrupting high currents. Spatter can be effectively removed from insulation material with a chisel.

The clearance between the arcing-horn insulation strip and the pole pieces should be balanced to provide room for inserting the arc chute, "X" dimension of Figure 28 should be ½" minimum. ''Y" dimension should be 3 1/16" ± 1/8". These dimensions will allow the arc chute to be moved into position without forcing. Adjustments will not be necessary in replacing the arcing-horn assemblies unless the pole pieces are changed in position.

The arc chutes can be properly assembled, and the contactor can be assisted in proper operation by maintaining the arcing horn spacings with reference to each other and the contacts per Figure 29. These adjustments will be maintained even when the arcing horn assemblies are replaced unless the main structural members of the con tac tor are disturbed in position from extremely rough handling or major disassembly and reassembly operations. Spacings between the arcing horns must be maintained per Figure 29 to allow proper assembly of the arc chute and proper interruption of electrical current. The spacings between the horns and contacts per Figure 29 are also necessary to assure proper physical operation (keep the movable contact from catching on the lower arc horn) and proper electrical functioning of the contactor.

Any spatter on the ends of the arc horns near the contacts must be removed to maintain the 1/16" minimum spacing between the contacts and arc horns. A chisel or file is a satisfactory tool for this cleaning operation. Salient points formed on the arc-horn ends near the contacts are also objectionable from the standpoint of allowing electrical charge build-ups which can cause objectionable voltage breakdowns across the horns and should be removed.

Figure 28. Arcing-horn and pole-piece assembly.

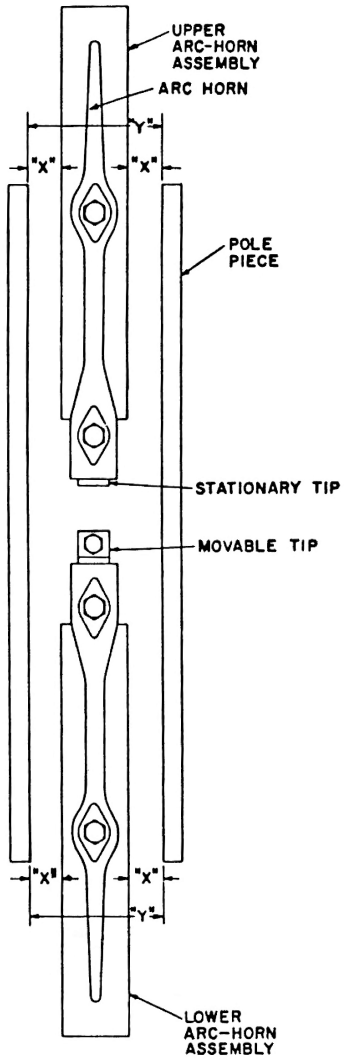
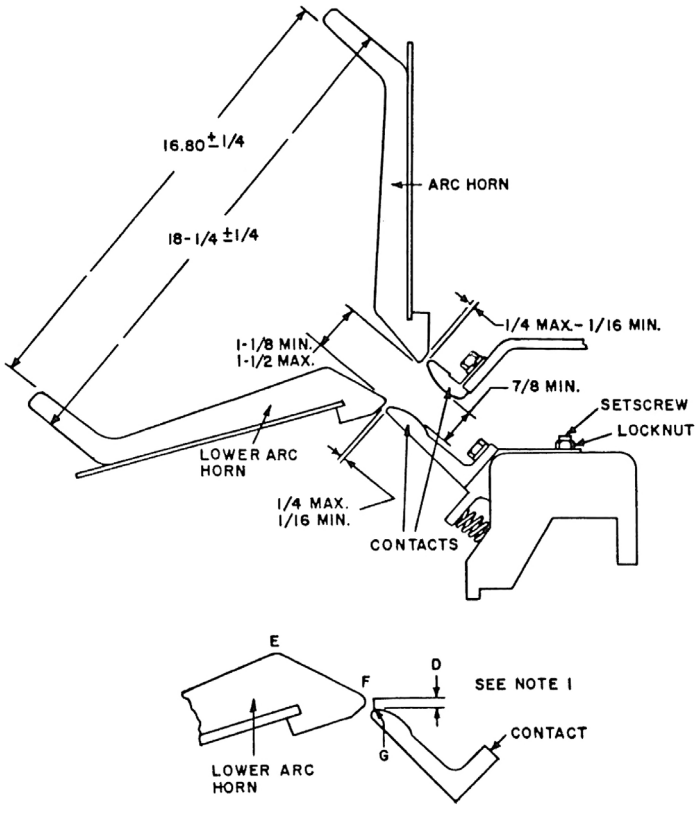


Figure 29. Arcing-horn and contact assembly.



NOTE: Vertical clearance (D) of highest point (G) of movable tip below plane (E-F) of lower arcing horn should be 1/16" – ¼".

Arc-chute assembly

The contactor should be checked periodically to be sure that all personnel, in reassembling arc chutes, have maintained their position per "Arc chutes" section of "General" instructions. Arc chutes should also be inspected periodically in accordance with this same section.

After the contactor has been required to interrupt power above its rated interruption capacity, or has interrupted power without proper pertinent adjustments in accordance with these instructions, the following checks must be made:

1. The arc barriers or vanes inside the arc chutes must be checked for excessive gutting from the arcing at the "V" notches. Excessively gutted vanes must be replaced, (see Figure 30B.)

2. The vanes should be checked for continuous beads resulting from the gutting which makes a continuous path across more than a few vanes (5) of the arc chute. (See Figure 30C) These beads offer a current-conducting path which reduces the length of the interrupting arc. Any vanes with the continuous bead between them must be replaced.

Vanes inside the arc chute have been given special treatment to allow the proper interruption of all power within its ratings. These vanes will, therefore, vary considerably in over-all width, the first six vanes assembled near the bolted sides of the arc chute must sometimes, therefore, be selected so that the bolting together of the arc chute will not crush the end vanes, This condition ls a rare occurrence. Vanes other than these six vanes on either side of the arc chute can be assembled at random. A thick fiber spacer which looks like an arc barrier must be assembled on each end of the arc chute before the remainder of the inside of the arc chute is filled with regular arc barriers as shown in Figure 30A.

Spacings "(Z)" between the arc chute sides (see Figure 30A) must not exceed 1/16”. Side play of the arc barriers must not exceed "X" dimension of 1/32” for more than four adjacent arc barriers.

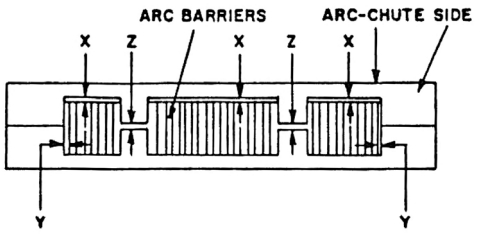


Figure 30A. Arc-chute assembly.

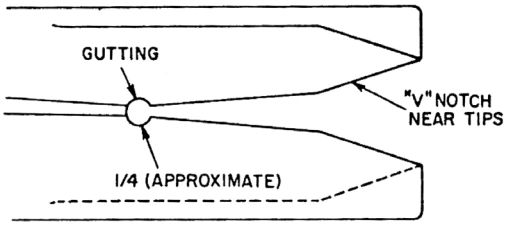


Figure 30B. Arc barrier with excessive gutting at "V" notch.

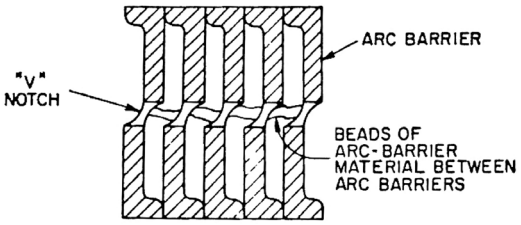


Figure 30C. Arc barriers with connecting beads.

Clearance at "Y" must also not exceed 1/32”. These dimensions will be held on arc-chute assemblies shipped from the factory but can be exceeded if the contactor interrupts current above the limits or without proper adjustments. "Z" and "X" dimensions outside the requirements can only be corrected with new arc-chute sides and/ or new arc barriers or by replacing the complete chutes, "Y" dimension can be maintained by adding fiber spacers as mentioned above. If the limits of these dimensions are exceeded, hot gases at high power interruptions will bypass the arc barriers and limit the arc extinguishing ability.

A-c magnet assembly

1. The top and side surfaces of the armature and stationary magnet (see Figure 32) frame must be aligned within 1/32". Excess misalignment will allow the magnets to wear unevenly and must be corrected to give the proper alignment if quiet operation ls to be achieved. If the magnet contact surfaces are worn and misaligned more than 1/16" and the magnet is noisy, both the armature and stationary magnet frame must be replaced. Magnets operating with excessive noise will reduce the life of their operating coils because the picked-up magnet will eventually draw excessive magnetizing current.

2. The contact faces of the armature and magnet frame (See Figure 31) must seat flush against each other without any rolling action or the magnet will be noisy in operation. Magnet shims between the magnet channel and contactor frame at "T" or "B" (see Figure 2) can be changed to obtain proper seating of the magnets. Usually, a noisy magnet can be made to operate quietly by not shimming equally at left and right at "T". This unequal shimming removes any twisting of the magnet channel in assembly. Shims at "S" at the top or bottom or the magnet frame between the magnet frame and magnet channel (see Figure 31) can be varied as a last resort to obtain proper magnet seating.

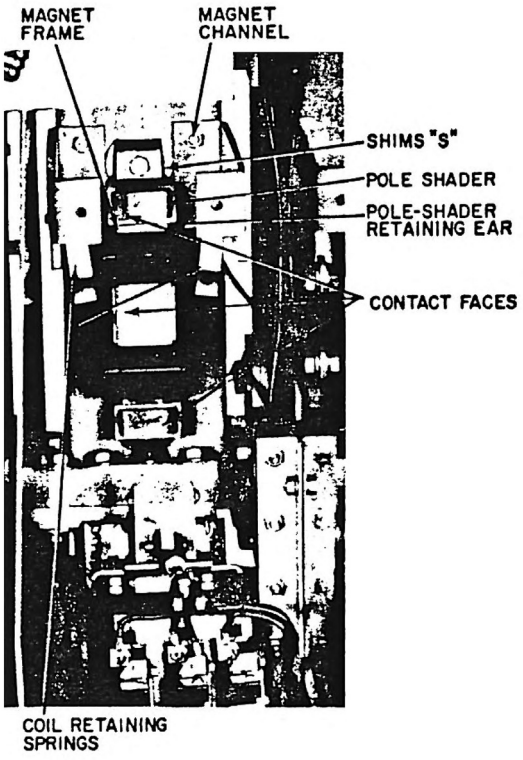


Figure 31. A-c magnet assembly.

3. The armature in picked-up position must have a minimum of 1/64" spacing between it and its armature bracket. (See Figure 32.) The fulcrum plate must always be assembled with its' emboss toward its armature bracket per Figure 32.

4. The armature bracket must be assembled to its shaft supporting bracket in such a manner that the armature has a vertical end play in its armature support of 1/32" minimum. (See Figure 32.) The armature width is such that a side play of 1/32" exists. This freedom of the armature in all directions is necessary to allow it to seat properly against the magnet frame. The armature bracket legs "L" must be assembled toward the armature and straddling the shaft supporting bracket per Figure 32.

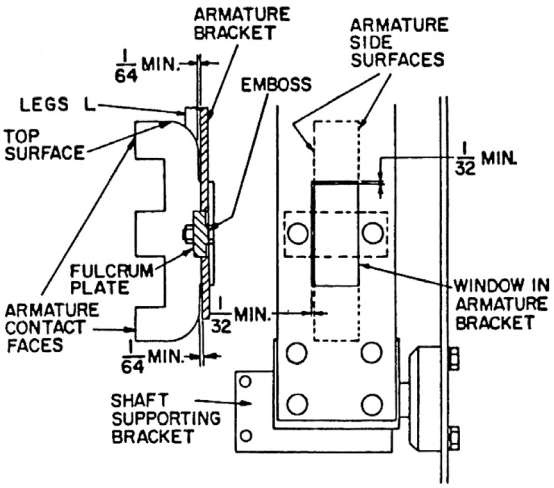


Figure 32. A-c magnet assembly shown with contactor closed.

5. The pole shaders must be assembled tightly to the magnet frame so that the pole shader retaining ears and the pole shader itself are appreciably below the machined faces contacting the armature. Bend the pole shader retaining ears down over the pole shader to hold it tightly and keep it from rattling. The machined faces of the armature and magnet frame must be free of all foreign material including grease. (See Figure 31.)

6. All three contact faces (see Figure 31) of the magnet frame are machined in the same plane. The outside contact faces of the armature are machined in the same plane. All these contact faces are machined very accurately with a good finish to allow satisfactory operation. The armature's middle leg is machined 0,003” to 0.007” below the plane of the outside leg. This machining was done to give magnet life without magnet operating noise,

7. Both magnets should be replaced when the armature legs are worn so that the center leg hits on the center leg of the magnet frame. Both magnets which are worn at all with the misalignment present of item 1 must also be replaced, as magnets when realigned will have some rolling action present and will be very noisy.

8. Check to see if one side on the top and bottom of the movable magnet armature is worn more than the other side. This shows that it does not have correct clearances per Item 3 and 4 and must be readjusted.

9. Check to be sure that the armature doesn’t hit on the coil spool and that the coil leads and retaining springs haven't been left in the way so that armature hits them when it closes.

Replacing a-c magnet coils

In replacing a-c coils, refer to Figures 33A, 33B, and 33C and follow the steps outlined below:

1. Remove cotter pin "B" in the pin at "A" of Figures 33B and 33A with a screwdriver or similar tool; remove the pin from linkage "C'' by prying linkage "D" and linkage "C" apart to allow linkage "D" to drop down out of the way.

2. Remove the cotter pin and the pin at ''E" of Figure 33C and allow the linkage "F" to be rotated down against the armature stop bracket at "G" of Figure 33A.

3. Remove the armature stop bracket by removing the six bolts "H" per Figure 33A with the wrench provided with the contactors and ease the armature assembly down until it is supported only by the movable tip shunts.

4. Loosen the hardware for the two coil retaining springs with the contactor wrench (except on early contactors) and rotate them up out of the way of the operating coil, (See Figure 31.)

5. Remove the coil leads from the terminal board (see Figure 33A) and let them hang free.

6. Remove the coil, threading the leads by the brackets supporting the coil retaining springs and through the wire clamps.

7. Replace the coil, being sure to connect the leads to the terminal board in the same positions as the first coil was connected. (See Figure 21.)

8. Return the coil retaining springs to their former positions being careful to keep them well away from the hole in the coil. The coil can be assembled either side up if the leads are toward terminal board, (See Figure 33A.) This assembly keeps the leads off mating surfaces of the armature and magnet frame.

9. Reassemble the armature stop bracket with bolts "H" high on the armature stop assembly, taking care to keep linkage "F" in such a position that it can be reassembled to the pin at "E".

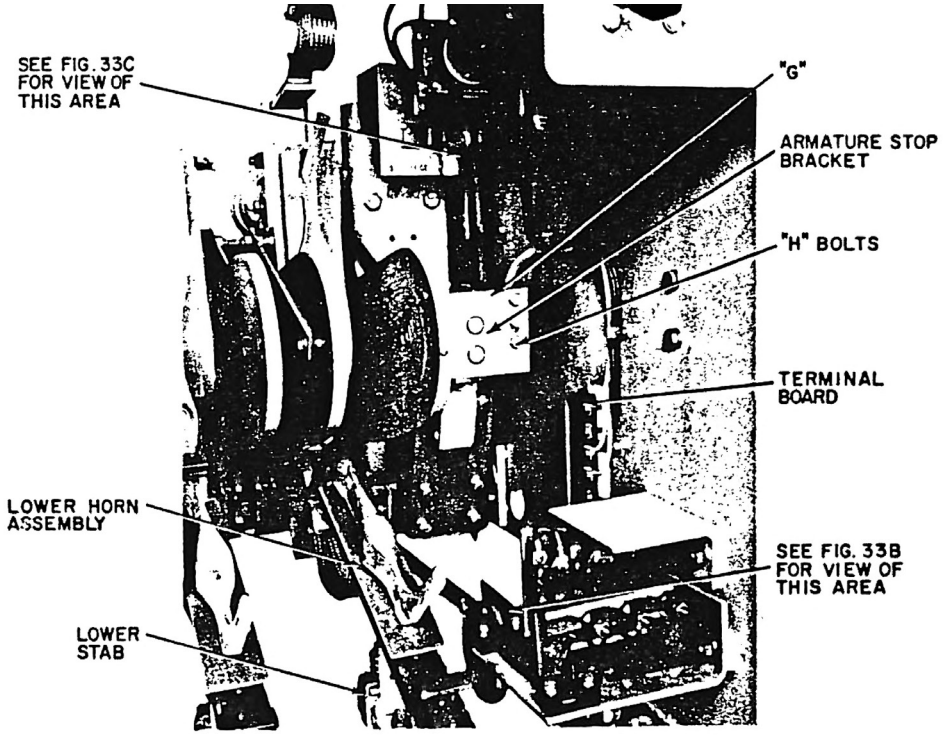


Figure 33A. IC2814-E120 high-voltage contactor with arc-chute removed.

10. Reassemble linkage "D" to linkage "C" and linkage "F" to the "brainbox" assembly.

11. All the hardware removed in the above operations should be tightened securely,

12. The movable contact shunts must again assume their approximate original shape with the shunts extending straight from their terminals without sharp bends at edge of their terminals.

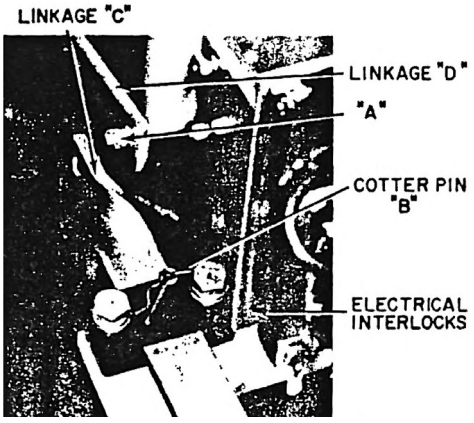


Figure 33B. See Figure 33A for location of this closeup view.

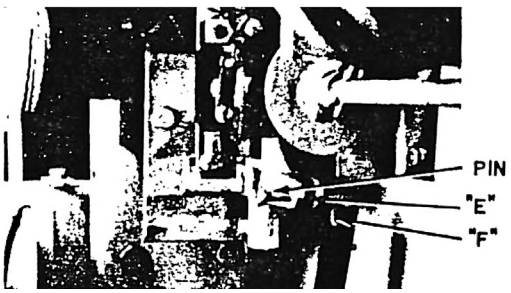


Figure 33C. See Figure 33A for location of this closeup view.

D-c magnet assembly (magnets for normally open contacts)

The armature of the d-c magnet must be aligned so that it will touch both cores. (See Figure 25.) The armature can have a maximum clearance at other points with cores of 1/64".

Alignment with the cores parallel to the shalt can be obtained by loosening the armature bracket bolts which assemble the armature assembly to the shalt, shifting the armature and then reassembling the bolts to full tightness. Alignment from front to back can be obtained by adjusting the bolt of the hemispherical-rod end bearing that attaches the armature through a linkage to the magnet-support channel. The nuts "A" of Figure 25 assembling this adjusting means should be thoroughly tightened to lock the adjustment in its final position.

Alignment of the d-c magnet as mentioned above is necessary to give an appreciable spread between the pick-up and drop-out voltages of the contactor. This is necessary to prevent the contactors from dropping out from slight dips in control voltage, Realignment of the magnet will only be necessary if the contactor was mishandled or dropped.

The helper springs shown in Figure 34C were included only on a few early contactors. These springs have since been removed, since the help of these springs is not required. These springs are adjusted to give 63% pickup with cold coils but should not be so strong that the contactor rebounds on dropping out.

Coarse alignment of the magnet can be obtained by leaving the armature-stop and magnet-frame support bolts loose and rotating the shaft to close the armature completely. The magnet frame will then rotate slightly and align itself with the armature, The loosened bolts should then be tightened securely. The armature-stop and magnet-frame support shims can be varied to obtain the "C" and "B" dimensional requirements of Table 6 of "Maintenance" instructions.

Replacing d-c coils (d-c magnet assembly)

The coils of these contactors can be replaced by the following procedure:

1. For easier replacement, remove the phase barrier clip (see Figure 34A) and remove the barrier closest to the magnet.

2. Referring to Figure 34A, disconnect the control wiring and Jumpers from the coil terminals after marking the wires so that they can be connected to the same terminals of the new coil.

3. Disassemble the core bolts "D" completely from the coil cores, being careful to allow the coil assemblies to settle gently down on the magnet armature (see Figure 34C).

4. The core assembly, including the coil, can then be removed, The Kantlink lock washer should be saved for the new coil (see Figure 34D).

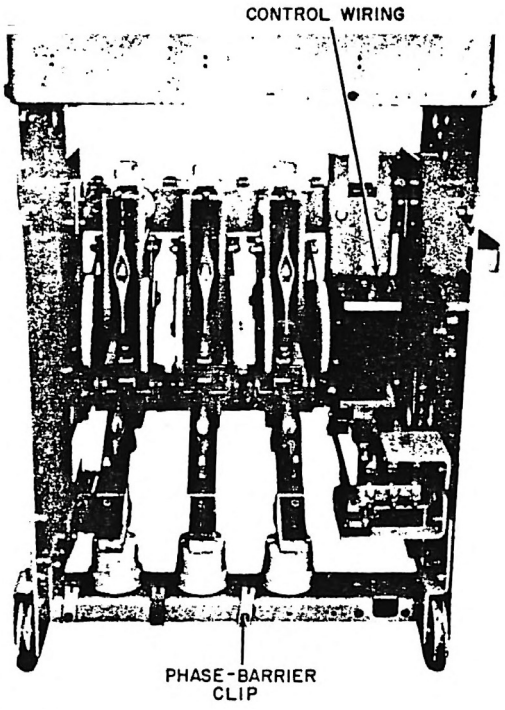


Figure 34A. IC2814-E111 high-voltage contactor with d-c operating magnet. See Figure 34B, C, D, E and F for closeup views.

Assemble the New Coil as Follows:

1. Assemble the large Kantlink lock washer on the core per Figure 34E.

2. Place the new coil over the core, with the coil end washer with its flat side on the inside diameter near the core end containing the groove pin, (See Figure 34E.) The coil should be pushed on gently with the milled flat of the core aligned with the flat of the coil inside hole. This procedure will prevent breakage of the coil end washer.

3. Raise each core assembly into position with the groove pin inserted in the small hole "H" in the magnet frame, The core bolts "D" then can be assembled and tightened completely. The d-c magnet alignment requirements of these "Maintenance" instructions. “D-c Magnet Assembly" also should be maintained.

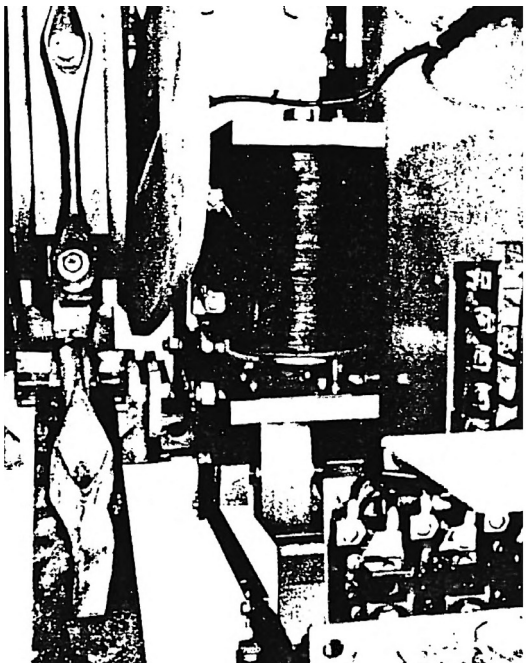
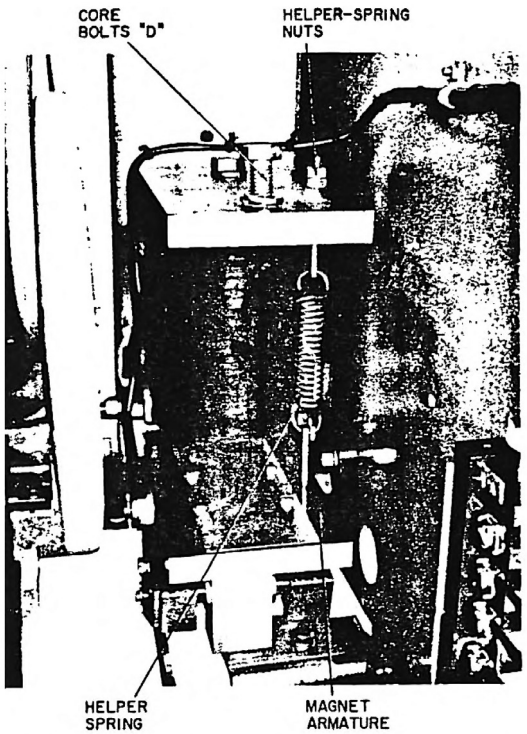


Figure 34B. D-c magnet structure.

Figure 34C. One coil removed.



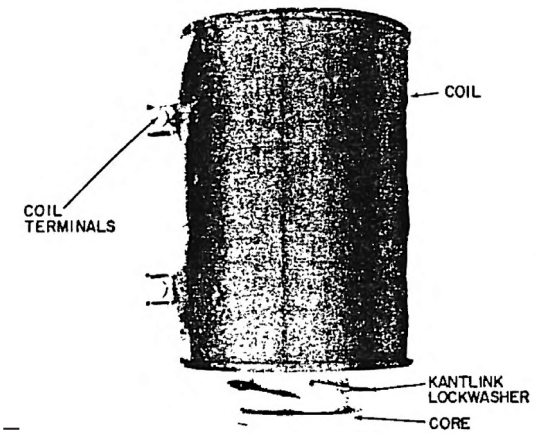


Figure 34D. Core plus coil assembly.

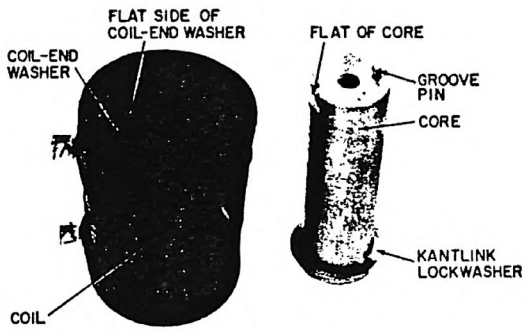


Figure 34E. D-c magnet core and coil.

Electrical interlocks

The location of the electrical interlocks with reference to the assembly which operates them must be maintained in accordance with the "Electrical Interlocks" section of "General" instructions. If the hardware has not loosened due to abnormal handling, these adjustments will be maintained.

In the de-energized position of the contactors, the electrical interlocks have their operating arms (see Figures 35B and 35C) fully operated and bottomed in the molded housing of the interlock. Gaps and wipes of the interlocks in the de-energized position will, therefore, not have to be checked during periodic inspections unless the hardware has loosened or parts have been damaged.

In the energized position of the contactor, the operating rods for the electrical interlocks must not touch the operating arms of the electrical interlocks and be positioned per Figure 13B and Table 3 of "Electrical Interlocks" section of "General" instructions. In this position the tip gaps and wipes must be as follows:

- Tip gap – 5/64", minimum (see Figure 35B)
- Tip wipe – 3/64", minimum (see Figure 35A)

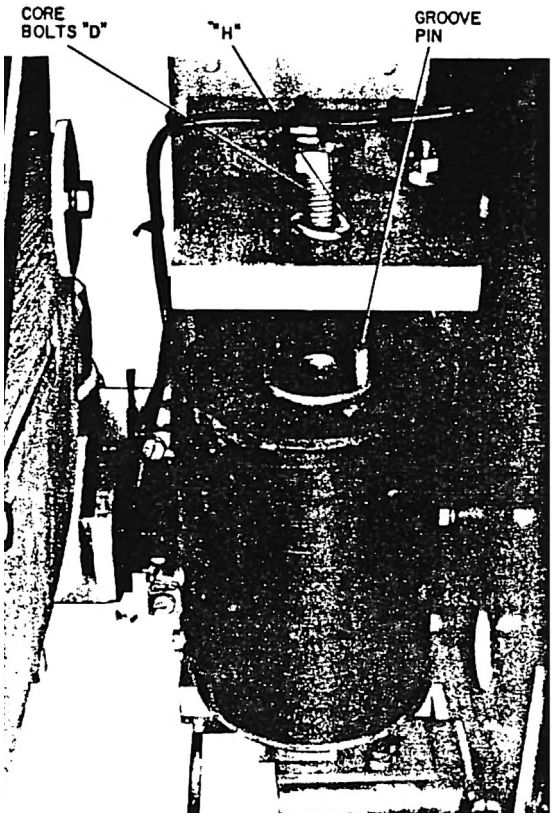


Figure 34F. D-c magnet top view.

Replacing or rearranging movable and stationary contacts of electrical interlocks

This interlock has been designed so that the movable or stationary contacts can be replaced or rearranged to change an individual assembly to give a different number of normally open or closed contacts. When these operations are performed, the parts must be reassembled in accordance with Figures 35A, 35B, and 35C, the previous instructions and the following requirements:

NOTE: If the contacts in an electrical-interlock housing are changed from normally open to normally closed or vice versa, the contactor involved will not agree with its nameplate and will not be identical with another contactor with the same nameplate stamping.

1. The spring ends must not protrude into the holes (A), slots (B), or keys (C), which serve as guides for the operating rod. (See Figure 35A.)

2. The stationary-contact assemblies must be driven down over the molded brass inserts in the molded housings in such a manner that they lay flat against the housing.

3. The normally open and closed contacts of an assembly must be located as shown in Figure 35C to maintain proper electrical clearances between the sets of contacts.

4. On the completed interlock, the operating rod must operate freely without excessive binding or scraping which would indicate improper assembly.

5. The contacts of a movable-contact assembly must also make with their corresponding stationary contacts at the same time within 1/64". Bend the stationary-contact support up or down with the fingers to obtain this requirement.

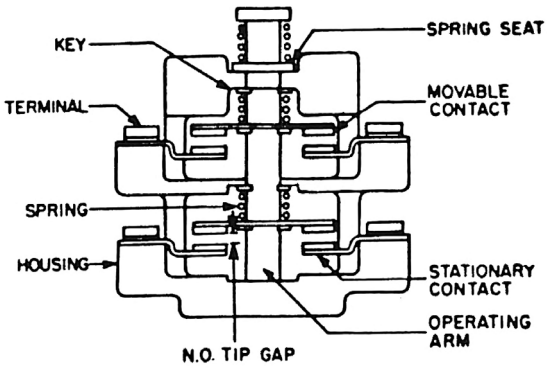


Figure 35B. Electrical interlock with contactor energized and two normally closed contacts.

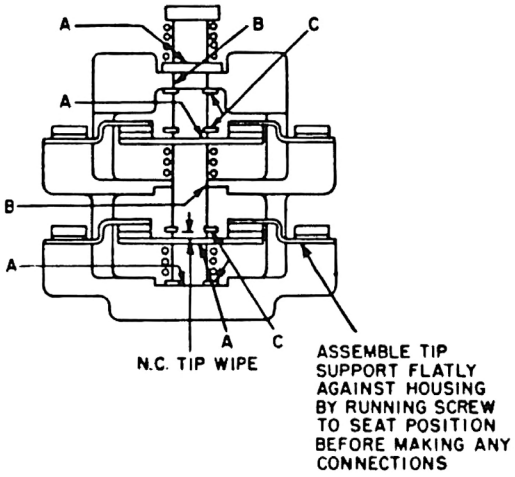


Figure 35A. Electrical interlock with contactor energized and two normally open contacts.

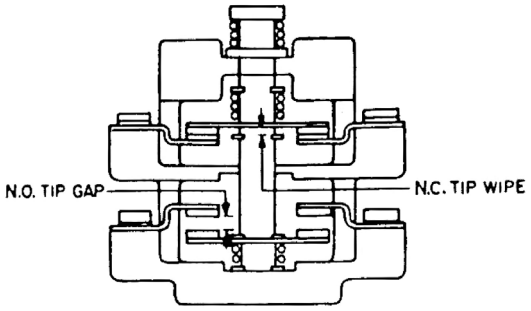


Figure 35C. Electrical interlock with contactor deenergized and one normally open and one normally closed set of contacts.

When to replace or service electrical interlocks

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

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

NOTE: Tarnish on the silver facings does not have to be removed, as with power the tarnish breaks down into products which are conducting.

2. If the contacts are worn so that they 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, the contact assemblies should be replaced to obtain proper pressures to allow the interlock to operate satisfactorily. The wipe is the compression in inches of movable contact spring between the energized and de-energized positions of contactor. See Figures 35A, 35B, and 35C.

Replacing complete electrical interlock assembly

An electrical interlock can be replaced by following the steps outlined below (see Figure 36):

1. Sufficient slack ls available in the wiring to the electrical Interlocks so that bolts "A'' can be removed and tile whole interlock assembly raised up.

2. Tag the wires and then disassemble the wires of the interlock to be replaced.

3. Each interlock, plus its mounting bracket "B", can then be removed through loosening bolts "D".

4. Each interlock assembly can then be removed from its bracket "B" by removing self-tapping screws "C".

5. The interlock can be replaced by following the reverse of the steps outlined above.

6. Interlocks should be adjusted in accordance with Figure 13B, and Table 3 as mentioned previously.

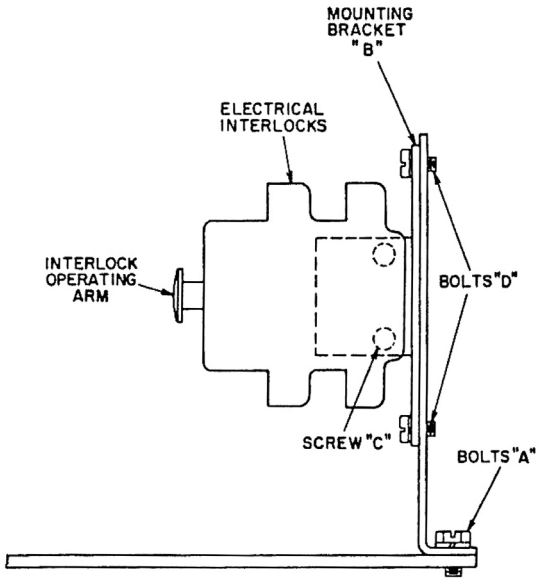


Figure 36. Electrical-interlock assembly.

Power-stab fingers

Power-stab fingers must be maintained in location per "Power and Control Disconnects and Shelf Tongue" section of "General" instructions so that the proper power connections will always be made. Only very rough handling would cause these fingers to change in location. They should be free to rock 1/8”, in each direction.

A pressure of 45 to 55 pounds on a stationary, or male, stab must be maintained to make proper connections. These pressures were properly set at the factory and should not change unless the assemblies have loosened through rough handling, or the power finger springs have been damaged.

These pressures can be set on the power fingers with the following procedure (see Figure 37):

1. Select, for a finger spacer, a piece of metal that is ½” ± 0.002” thick. Cold-rolled steel of this thickness would be very satisfactory as its tolerance is within this range.

2. With the adjusting nut located for weak spring pressure, insert the finger spacer between the pairs of fingers.

3. Tighten the adjusting nut until there is a very slight drag on the finger spacer when trying to pull it out of engagement.

4. Record the position of the nut by placing pencil marks on the nut and finger guide opposite each other. Set proper pressure by turning the adjusting nut through exactly two full turns in a direction to increase the spring pressure. The nut will remain in position as it is a self-locking nut, Earlier contactors used two regular nuts which were thoroughly tightened against each other.

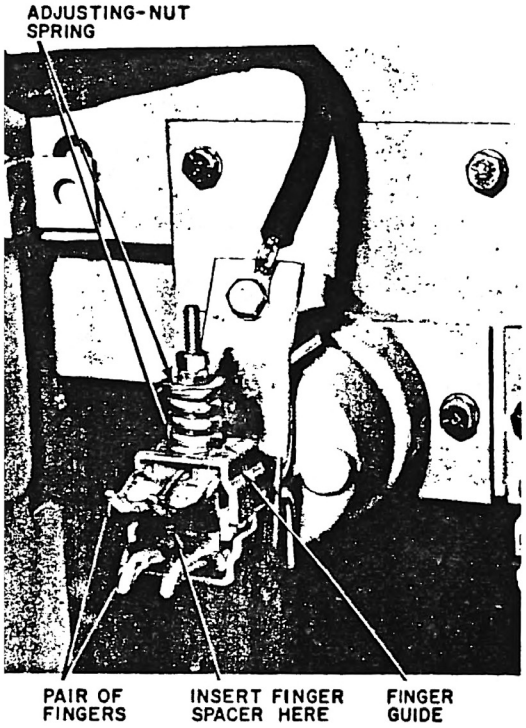


Figure 37. Power-stab fingers.

The power fingers and control-disconnect fingers do not need lubrication, but grease (Nebula No. 1 of Esso or equal) can be added to the power-finger surfaces mating with the stabs, if desired. All fingers have been tested in contaminants such as cement, metal, dust, and paper-mill atmospheres and have been found to function satisfactorily without grease. If foreign matter collects on the stabs or power fingers (condition is worse with grease as it holds dust, etc.), it must be removed by blowing or brushing as it will interfere with the ease of operation of the fuse shelf and stabbing in general.

Control-disconnect fingers

The control-disconnect fingers must be maintained in position per "Power and control disconnects and shelf tongue" section of "General" instructions. Vertical alignment with the mating stationary fingers of the enclosure is set at the factory and must be maintained within 1/16”. Contact will be made with the edge of the stationary linger with the contactor finger flexed considerably if both sets of fingers are maintained in position per the above instructions. The control-disconnect fingers should not be lubricated as it is not necessary and they will only collect dirt, which will interfere with proper contact between the enclosure and contactor fingers.

Fuse clips and grounding straps

Fuse clips and grounding fingers must be maintained in adjustment per "Fuse-Disconnect Shelf” section of "General" instructions, the grounding fingers (see Figures 1and 16) of one fuse assembly must also stay together and align with the fuse mounting sufficiently to make a good contact. The grounding strap (see Figure 1) must also be free to spring the maximum distance away from the contactor side frame. A hook in its front near the shelf operating handle will keep it from springing too far away from contactor side frame on earlier models. Late models have a grounding stab located on the left rear corner. (See Figure 14.)

"Brainbox"

The "brainbox" (see Figure 19A) does not require lubrication or adjustment during the life of the contactor. The precision plungers and permanently lubricated molded housing are designed into the unit for positive trouble-free operation.

It is appropriate, however, to check the mechanical interlocking in general to be sure that it is performing its functions properly. The parts could be damaged from severe handling and would not permit proper operation.

Fuse-shelf adjustments

Check the following of "Mechanical and electrical interlocks and brainbox" section of "General" instructions:

1. The adjusting-bolt adjustment for operating the "brainbox"
2. The horizontal-rod adjustment.
3. The control-power interlock adjustment.

These adjustments will have been maintained unless the parts have been damaged by severe handling.

Adjustments of the fuse-shelf must be maintained so that the following requirements will be met:

1. The shelf should move without excessive friction.
2. The grounding fingers (see Figure 16) must be aligned with the fuse supports.
3. The power stabs of the shelf must have considerable horizontal side play so that they can seek and find the female receptacles on the enclosure.

Requirements of item 1 above are maintained by allowing 1/32", minimum of vertical freedom of the shelf per Figure 38A. This adjustment is maintained by proper assembly of the parts.

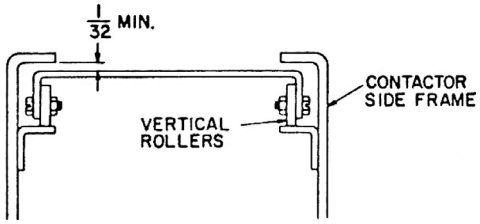


Figure 38A. Fuse-shelf vertical play.

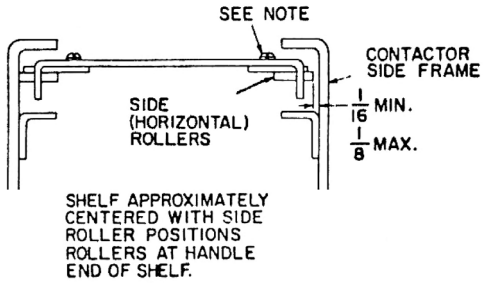


Figure 38B. Fuse-shelf horizontal (side) play. Shelf driven fully by cam toward handles.

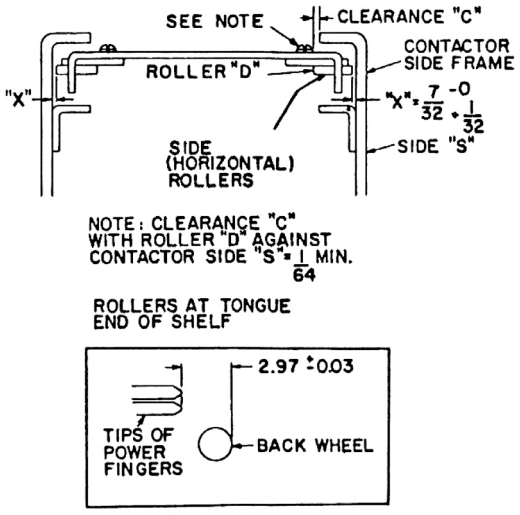


Figure 38C. Fuse-shelf horizontal (side) ploy. Shell driven by cam away from handle until the power-finger ends are 2.97" ± 0.03" from the back of the back wheels. See inset.

Requirements of item 2 above will be maintained if the side-horizontal rollers at the front or handle end of the shelf are always adjusted to keep the shelf approximately centered and to set a total side play of 1/16” to 1/8” per Figure 38B. Clearance "C" of Figure 38C must also be 1/64” minimum so that the bolt heads will not hit the side frames. This adjustment should be made with the shelf fully retracted toward the handle or front end of the contactor.

Requirements of item 3 above will be maintained if the shelf is always adjusted per Figure 38C. With the shelf operated to 2.97” ± 0.03” from the back wheels (wheels closest to shelf power fingers), horizontal rollers at back or the tongue end of the shelf should be adjusted to approximately center the shelf and give a horizontal side play on each side of 7/32” to ¼”.

These adjustments will be maintained unless the contactor has received extremely rough treatment. After such treatment, these adjustments should be checked and readjusted if necessary.

A good grade of heavy oil should be added to the horizontal and vertical rollers of the fuse shelf during each routine inspection. This lubrication will keep the fuse shelf operating satisfactorily and will prevent corrosion of the rollers. The pins through which the shelf ls driven, the stop plate and stop, and handle shaft (Figure 17) and the cam mechanism shaft should also be greased during the same routine inspections with a good grade of heavy grease.

Renewal parts

When ordering renewal parts:

- Address your request to the nearest ABB sales office, authorized distributor, or the Empower online store
- Specify the required quantity of parts
- Give the catalog number or describe the required parts in detail
- Provide a complete nameplate rating of the equipment.

Renewal part bulletin GEF-4164 will give catalog numbers for renewal part items.

ABB Inc.
Electrification Services
305 Gregson Dr.
Cary, NC 27511 USA

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For further information, please visit

www.electrification.us.abb.com/services

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For service, call:
1-888-434-7378 (US)
1-540-387-8617 (International)

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