



MARINE SERVICE

D-C MAGNETIC CONTACTORS

TYPE M—SIZES 0, 1 AND 2

SECTION NO. 6112
I.L. 6100-M 010/110/210-1

PAGE
1

FRAMES 010 (*), 110 (25 AMPS.), AND 210 (50 AMPS.) • SINGLE POLE • NORMALLY OPEN

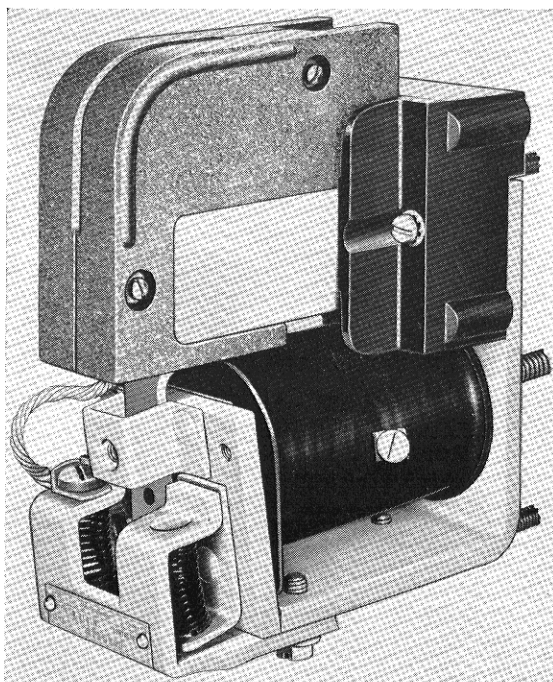


Fig. 1—Type M-210-H Rear Connected Contactor

APPLICATION

The Type M Contactors are d-c general purpose magnetically operated contactors suitable for motor starting and switching applications.

RATING

The contactors have d-c ratings as listed in Fig. 2.

CONTACTOR TYPE	M-010-H	M-110-S	M-110-H	M-210-S	M-210-L	M-210-H
Frame size.....	deep	small	deep	small	deep	deep
Voltage Rating.....	600	250	600	250	250	600
8 Hour Ampere Rating	*	25	25	50	50	50
1½ Hour Ampere Rating	*	33	33	67	67	67

*The current rating of this contactor depends on the blow-out coil rating. The contactor is similar to the Type M-110-H Contactor except that its blow-out coil has a greater number of turns and a smaller current rating.

Fig. 2—Rating Table

The small frame contactors are limited to applications in which the coil voltage and the voltage of the circuit being interrupted do not exceed 250 volts. The deep frame contactors, which provide greater winding space for the operating coil, are suitable for voltages up to

600 volts. (The related multipole Type M Contactors are built on the deep frame exclusively and employ operating coils common to the single pole deep frame contactors. It is well to consider this feature in the stocking of renewal parts.)

The operating coils are rated for continuous duty and will operate the contactors at 80% to 110% of their rated voltage. The contactors are insulated for a maximum potential difference of 600 volts among parts.

CONSTRUCTION

The contactors are of unit construction with all parts assembled on a common frame. The armature hinges on a knife-edge bearing which has an extremely long life and requires little maintenance.

Strong kickout springs minimize the risk of accidental closing of the contactor armature.

The contactor may be supplied with or without the magnetic blow-out assembly. The arc shield, which is held in place by the blow-out pole-pieces and a pair of spring clips, may be removed by pulling it directly forward. An arc horn is provided in the arc shield to relieve the moving contact of excessive burning. A flexible connection which is provided to maintain the arc horn at the same potential as the moving contact serves also to prevent loss or misplacement of the arc shield when the latter is removed for inspection of the contacts.

The moving and stationary contacts are faced with solid silver. The moving contact is hinged on the armature in such a way that sliding or rubbing of the surfaces when the contacts meet is practically non-existent. This is a characteristic essential to the long life of silver contacts.

A plate of non-magnetic steel is secured to the underside of the armature to insure against the sticking closed of the armature due to residual magnetism following the interruption of voltage to the operating coil.

Rear connected contactors are held to the panel by three mounting studs, the upper and lower of which make provision for the electrical connections.



Front connected contactors are provided with pressure-type solderless terminals and are held to the panel by two mounting studs.

The contactors are suitable for mounting only on insulating panels up to 2 inches thick. As the frame is at the same potential as the moving contact, special insulating precautions must be taken if a contactor is to be mounted on a conducting surface.

ELECTRICAL INTERLOCKS

The contactors will accommodate a total of two Type L-46 or L-47 Electrical Interlocks, which may be selected in any combination which does not exceed the maximum allowable quantities listed in Fig. 3 below.

The Type L-46 Electrical Interlock is obtainable as a normally open or a normally closed interlock, and either combination can be furnished as a front connected or a rear connected assembly. For more complete information refer to Instruction Leaflet 6100-L46-1.

	MAXIMUM ALLOWABLE NO. OF INTERLOCKS TO BE APPLIED TO TYPE M CONTACTORS			
	M-110-S	M-010-H M-110-H	M-210-S	M-210-L M-210-H
L-46 Normally Open . . .	2	2	2	2
L-46 Normally Closed . . .	1	1	2	2
L-47 Normally Closed . . . (delayed-break)	0	2	0	2
Total no. of interlocks of all the above types that can be applied to one contactor.	2	2	2	2

Fig. 3—Electrical Interlock Application Table

The Type L-47 Electrical Interlock is a normally closed delayed-break interlock available in both front connected and rear connected assemblies. It differs from the normally closed Type L-46 Interlock in that its contacts separate late, rather than early, in the closing cycle of the magnet, and it should be applied only where such a delayed-break action is required. For all ordinary applications the Type L-46 Interlock should be used. For more complete information refer to Instruction Leaflet 6100-L47-1.

The stationary contact assembly of the interlock is mounted on the phenolic base of the contactor,

occupying a space beside the arc shield. A phenolic insulating shield occupies this location when the contactor is assembled without interlocks at the factory, and this part must be discarded at the time an interlock is mounted. The moving contact assembly is secured to the contactor armature by means of a single screw. Care should be taken when installing an interlock to make certain that its moving parts function freely and that the contact gaps and overtravels conform to the information given in the instruction leaflet for the particular interlock assembly.

The sequence in which the various switching operations occur as the contactor armature closes is as follows: (1) the normally closed Type L-46 Interlock opens, (2) the main contacts close, (3) the normally open Type L-46 Interlock closes, and (4) the normally closed Type L-47 Interlock opens. (Note: a single contactor can accommodate only two of the three varieties of interlocks at one time).

MECHANICAL INTERLOCK

A Type M-25 Mechanical Interlock may be employed to safeguard a pair of contactors against the closing of one if the other is already closed. For mechanically interlocking a pair of small-frame (25 or 50 ampere) contactors use interlock Style 1257473, and for deep-frame contactors use interlock Style 1257474. The contactors are mounted side by side on $4\frac{3}{16}$ inch centers.

OPERATION

When a d-c voltage that is within the operating limits is applied to the coil, the armature, which carries the moving contact, is attracted to the magnet core. The contacts meet before the armature is fully sealed against the magnet pole-face, the final motion of the armature serving only to compress the contact spring. This arrangement insures that sufficient contact pressure is maintained even when the contacts are worn.

The meeting of the contacts completes a circuit from the upper contactor terminal through the blow-out coil, provided that a blow-out structure exists on the contactor, the stationary contact, the moving contact and the flexible shunt to the lower contactor terminal. The current flowing through the blow-out coil creates a magnetic field in the region of the contacts, which remains in readiness to assist in the extinction of the arc when the contacts open.



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When the operating coil is de-energized, the force exerted by the kickout and contact springs, assisted by gravity, causes the armature to open. The contacts then separate, drawing an arc between them which is acted upon by the magnetic blow-out field in such a way that it is caused to move outward from the contacts. The arc transfers to the two arc horns and travels outward along them. This arc transfer relieves the contacts of further burning. The magnetic blow-out field continues to stretch the arc, forcing it into the narrow slot of the arc shield, where it is cooled and extinguished.

INSTALLATION—MAINTENANCE— REPLACEMENT OF PARTS

1. GENERAL—General instructions and suggestions for installation and maintenance may be found in Instruction Leaflet 6100-1. A periodic inspection should be made to insure that all screws, bolts and nuts of this contactor are tight. All joints between current carrying parts should be kept clean and tight.

Any loose wires or parts that might interfere with the movement of the armature or other moving parts should be securely fastened down.

2. ARC SHIELD—The arc shield and its arc horn are essential to the satisfactory performance of the contactor and these parts should always be in place. The flexible connection leading from the arc horn should always be securely fastened to and in good electrical contact with the frame. The arc shield may be removed by pulling it directly forward, allowing the magnetic blow-out pole-pieces (which act as its fixed supports) to guide it in its sliding movement. In replacing the arc shield care must be taken to see that the guiding recesses in its sides locate themselves properly on and be gripped firmly by the supporting guides. If the guides are found to be spread so far apart that they no longer grip the arc shield firmly, remove the arc shield and spring the guides together slightly by squeezing them with the fingers. The arc shield should be pushed back as far as it will go, until it is held securely against the phenolic base by the spring clips.

3. ARMATURE AND BEARING—The knife-edge bearing should not require any maintenance other than

the removal of accumulated dirt. Oil should not be used as it hastens the collection of dust.

The magnet pole-face is secured to the core by means of a bolt having a head that projects forward into a hole in the armature. Care should be taken to see that the parts maintain their proper alignment, and particularly that the bolt-head be accurately centered in the armature hole. Dirt should not be allowed to accumulate in the hole in the armature or on the bolt head.

4. OPERATING COIL—When a new operating coil is installed, the identification label should be examined to make certain that the voltage rating and the coil style number are correct for the application.

The steps to be followed in removing the operating coil are: (a) remove the arc shield by sliding it forward, (b) loosen the two bolts securing the armature stop to the underside of the contactor frame until the armature stop can be lowered clear of the two dowel pins which locate it in the correct position, (c) allow the self-contained assembly comprising the armature, armature stop, moving contact and springs to hang by the shunt, (d) remove the bolt holding the pole-face to the core of the magnet, and (e) disconnect the leads connected to the coil terminals and slide the coil forward until it is clear of the contactor frame.

5. CONTACTS—Oil or other lubricant should not be used on the silver contacts. The discoloration which results from arcing and from exposure to the atmosphere usually is not harmful to their performance, and in general, no filing or dressing is necessary.

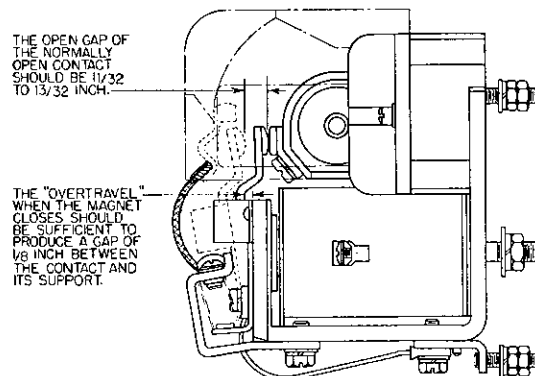


Fig. 4—Partially Cut-away View of a Type M-210-L Contactor with the Armature in the Closed Position (Dwg. 13-B-8710)



When the contacts are new they should meet sufficiently in advance of the final sealing of the armature against the magnet pole-face so that a gap of approximately $\frac{1}{8}$ inch appears between the underside of the contact and the upper edge of the fully-sealed armature, as indicated in Fig. 4. As the contacts wear, the amount of this overtravel will diminish, and when it decreases to $\frac{1}{32}$ inch, the contacts should be replaced.

The moving contact can be removed for replacement by first disconnecting the shunt and then removing the contact spring. The stationary contact is slotted to facilitate removal, and it is necessary only to loosen its mounting screw until the dowel projecting from the back of the contact is free of the locating hole in the stationary arc horn which serves as the contact support.

The contact gap when the contacts are new should be in a range of $1\frac{1}{32}$ to $1\frac{3}{32}$ inch, as shown in Fig. 4.

If, after new contacts are installed, it is found that the overtravel and contact gap do not conform to the dimensions given; first bend the moving contact strap to secure the proper overtravel; then measure the contact gap and, if necessary, bend the armature stop to secure the proper gap.

CONTACTOR TYPE	CONTACT PRESSURE IN OUNCES	
	INITIAL	FINAL
M-010 and M-110	4 to 7	9 to 13
M-210	6 to 9	11 to 15

Fig. 5—Table of Contact Pressures

The contact pressures when the contacts are new should be as indicated in the table in Fig. 5.

To measure the final contact pressure, close the contactor mechanically and by means of a spring scale hooked to a loop of fine wire measure the force necessary to separate the contacts.

If, after new contacts are installed, the pressures are not correct, it may be necessary to replace the contact spring or to adjust the contact overtravel in the manner previously described.

Failure of the magnet to close the contactor may result from an open-circuited operating coil, from a circuit condition in which the voltage is excessively low, or from the presence of friction between the parts. Failure of the contactor to open may be caused by excessive friction or by defective kickout springs.

OPERATING COILS

The more commonly used operating coils are listed in the table in Fig. 6.

COIL VOLTS	TYPE M CONTACTOR COILS			
	M-110-S	M-010-H M-110-H	M-210-S	M-210-L M-210-H
	COIL STYLE NO.	COIL STYLE NO.	COIL STYLE NO.	COIL STYLE NO.
115	1 289 400	1 289 407	1 289 390	1 289 375
230	1 289 401	1 289 408	1 289 391	1 289 376
550	1 289 377	1 289 377

Fig. 6—Style Numbers of Commonly Used Operating Coils

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