Type M D-C Magnetic Contactors

Frames 011, 111 and 211

One Pole Normally-Open and One Pole Normally-Closed

INSTRUCTIONS

APPLICATION

Type M contactors are general-purpose magnetically operated contactors suitable for use in motor controllers and other switching applications.

RATINGS

The contactors have the ratings listed in Fig. 1.

Contactor Type	M-011-2H	M-111-H	M-111-2H	M-211-2H
Voltage Rating	600	600	600	600
8 Hour Ampere Rating	*	25	25	50
1 Hour Ampere Rating	*	33	33	67

* The current rating of this contactor is less than 25 amperes, and depends on the blowout coil rating.

Fig. 1—Rating Table

The contactors whose type designations terminate in "-2H" are alike in every respect except their blowout coils. The Type M-111-H contactor, however, employs a smaller operating coil, and smaller arc shields, contacts, springs and shunts.

In addition to the contactors listed above, related contactors have been built and since retired as obsolete. They are tabulated in Figure 2 (and included in Figures 5 and 6) for the accommodation of their users.

Obsolete Contactor Type	M-011-H	M-211-L	M-211-HØ
Voltage Rating	600	250	600
8 Hour Ampere Rating	*	50	50
I Hour Ampere Rating	*	67	67
Superseded By	M-011-2H	M-211-2H	M-211-2H

* The current rating of this contactor is less than 25 amperes, and depends on the blowout coil rating.

Ø This contactor is now the M-211-2H contactor. The designation has been changed without any physical alteration of the contactor.

Fig. 2—Ratings of Obsolete Contactors

The operating coils are rated for continuous duty and will operate the contactor 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.

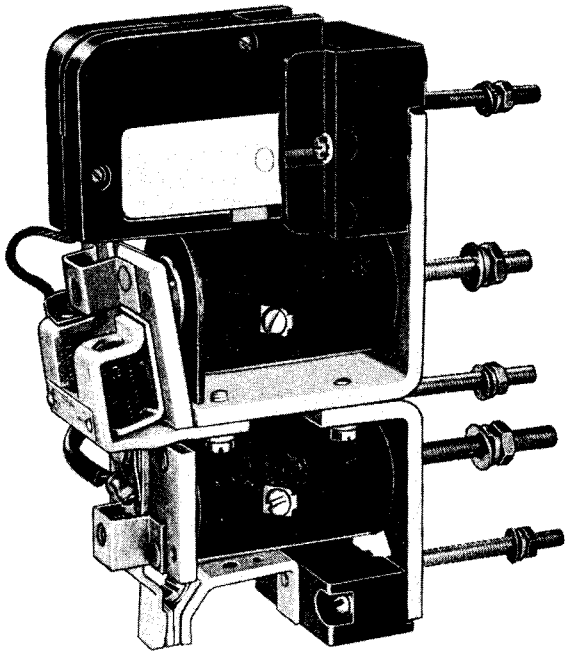

Fig. 3—Type M-211-2H rear-connected contactor with magnetic blowout on normally-open pole only.

The contactor is equipped with two operating coils, the upper coil being used to close the normally-open contact, and the lower coil serving to produce a complete sealing of the normally-closed contact. When neither operating coil is energized the kickout springs hold the lower, or normally-closed, contacts together. Because the kickout spring is not sufficiently strong to produce full contact pressure, the lower coil should be energized at all times that the lower contacts are required to carry rated current continuously. For certain intermittent duty applications the lower coil is sometimes omitted.

An arc shield and blowout structure are always provided on the normally-open pole. They are optional on the normally-closed pole, and should always be provided when this pole is to be required to interrupt a circuit. The arc shield is held in place by the blowout pole-pieces and a pair of spring clips, and may be removed by pulling it directly forward. An arc horn in the arc shield relieves the moving contact of excessive burning. The arc, which is drawn between the contacts as they separate, moves outward under the influence of the magnetic blowout field and transfers from the moving contact to the arc horn. A flexible connection which is provided to maintain the arc horn at the same potential as

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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 contacts are hinged on the armature in such a way that sliding or rubbing of the surfaces when the contacts meet is practically non-existent, a provision essential to the long life of silver contacts.

Plates of non-magnetic steel are secured to the underside of the armature to insure against a sticking closed of the armature against either pole-face due to residual magnetism following the interruption of voltage to an operating coil.

Rear-connected contactors are held to the panel by five mounting studs, three of which make provision for the electrical connections (the moving contacts of the two poles are connected at a common stud). Front-connected contacts 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 two moving contacts, special insulating precautions must be taken if a contactor is to be mounted on a conducting surface.

ELECTRICAL INTERLOCKS

The Type L-46 normally-open electrical interlock and the Type L-47 normally-closed electrical interlock may be applied to the contactors in numbers limited according to the table in Fig. 4. It is to be noted that a contactor having magnetic blowouts on both poles can accommodate a total of four interlocks, whereas a contactor having a magnetic blowout on its normally-open pole only is limited to two interlocks.

Electrical Interlock Type	Maximum Allowable No. of Interlocks to be Applied to a Contactor	
	Blowouts on both poles	Blowout only on normally-open pole
L-46 Normally open L-47 Normally closed	4 2	2 2
Total No. of interlocks of both types that can be applied to one contactor.	4	2

Fig. 4—Electrical Interlock Application Table

The stationary contact assembly of either type of interlock is mounted on one of the molded bases of the contactor beside the arc shield. A molded insulating detail occupies this location when the contactor is assembled without interlocks at the factory, and this must be discarded at the time an interlock is mounted. The moving arm of the interlock 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 interlock Instruction Leaflets: I.L. 15-829-L46-1 and I.L. 15-829-L47-1.

The sequence in which the various switching operations occurs as the contactor magnet closes is as follows:
(1) the main normally-closed contacts open, (2) the main normally-open contacts close, (3) the Type L-46 normally-open interlock closes, and (4) the Type L-47 normally-closed interlock opens.

MECHANICAL INTERLOCK

A Type M-25 mechanical interlock (style # 1257474) may be employed to safeguard a pair of contactors against the closing of one if the other is already closed. The contactors are mounted side-by-side on $4\frac{3}{16}$ inch centers.

INSTALLATION AND MAINTENANCE

Arc Shield—The arc shield and its arc horn are essential to the 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 the frame. The arc shield may be removed by pulling it directly forward, allowing the blowout pole-pieces (which act as its fixed supports) to guide it in its sliding movement. In replacing the arc shield care must be taken 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 apart so that they no longer grip the arc box firmly, remove the arc box 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 molded base by the spring grips.

Armature and Bearing—The knife-edge bearing requires no maintenance other than the removal of accumulated dirt. Oil should not be used, as it hastens the collection of dust.

The upper 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 that the parts maintain proper alignment, and particularly that the bolt-head be accurately centered in the armature hole. Dirt should not be allowed to accumulate.

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 either of the operating coils are: (a) remove the arc shield, or shields, as described previously, (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 position, (c) allow the self-contained assembly comprising the armature, armature stop, moving contacts and springs to hang by the shunt, (d) re-

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move the screw holding the pole-face to the magnet core on which the coil is mounted, and (e) disconnect the coil leads and slide the coil forward until it is clear of the contactor frame.

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 consequently no filing or dressing is necessary.

When the contacts are new they should meet sufficiently in advance of the final sealing of the armature against either the upper or the lower pole face, that a gap of approximately 1/8 inch appears between the underside of the contact and the edge of the fully-sealed armature, as indicated in Fig. 7. As the contacts wear, the amount of this overtravel diminishes, and when at length it decreases to 1/32 inch, the contacts should be replaced.

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

When the contacts are new, the open gap of the normally-open contact, with the armature sealed against the lower pole-face, should be 11/32 to 13/32 inch. The open gap of the normally-closed contact, when the armature is sealed against the upper pole-face, should be 5/16 to 3/8 inch, as shown in Fig. 7.

If after applying new contacts it is found that the overtravels and contact gaps do not conform to the dimensions given, it may be necessary to bend the moving contact straps slightly.

The contact pressures of both the normally-open and normally-closed contacts, when they are new should be as indicated in the table in Fig. 5.

Contactor Type	Contact Pressure in Ounces	
	Initial	Final
*M-011-H & M-111-H	4 to 7	9 to 13
M-011-2H M-111-2H M-211-L & M-211-H M-211-2H	6 to 9	11 to 15

* Contactors shown in light face are obsolete.

Fig. 5—Table of Contact Pressures

To measure the final pressure of one of the contacts, first close the contactor mechanically in a direction producing full closing of the contact. Then by means of a spring scale hooked to a loop of fine wire measure the force necessary to separate the moving from the stationary contact.

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

Failure of the magnet to operate 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 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-011-H & M-111-H		M-011-2H & M-111-2H M-211-L & M-211-H M-211-2H	
	Upper Coil Style No.	Lower Coil Style No.	Upper Coil Style No.	Lower Coil Style No.
115	1 289 407	1 289 394	1 289 375	1 289 394
230	1 289 408	1 289 395	1 289 376	1 289 395
250	560D747G16	44A6366G23	560D746G30	44A6366G23
550	1 289 377	1 289 384	1 289 377	1 289 384

* Contactors shown in light face are obsolete.

Fig. 6—Style Numbers of Commonly-used Operating Coils

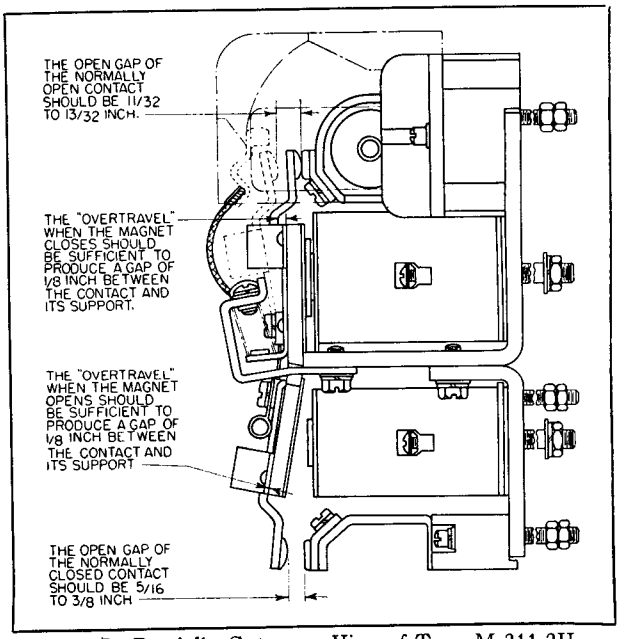

Fig. 7—Partially Cut-away View of Type M-211-2H Contactor

RENEWAL PARTS

Renewal parts may be obtained from the nearest Westinghouse Sales Office. Be sure to describe the part or parts required and give complete nameplate reading on the contactor for positive identification.

Westinghouse Electric Corporation
Buffalo 5, N. Y.

Printed in U.S.A. (Rep. 11-59)

Type M D-C Magnetic Contactors

Frames 011, 111 and 211

One Pole Normally-Open and One Pole Normally-Closed

INSTRUCTIONS

APPLICATION

Type M contactors are general-purpose magnetically operated contactors suitable for use in motor controllers and other switching applications.

RATINGS

The contactors have the ratings listed in Fig. 1.

Contactor Type	M-011-2H	M-111-H	M-111-2H	M-211-2H
Voltage Rating	600	600	600	600
8 Hour Ampere Rating	*	25	25	50
1 Hour Ampere Rating	*	33	33	67

* The current rating of this contactor is less than 25 amperes, and depends on the blowout coil rating.

Fig. 1—Rating Table

The contactors whose type designations terminate in "–2H" are alike in every respect except their blowout coils. The Type M-111-H contactor, however, employs a smaller operating coil, and smaller arc shields, contacts, springs and shunts.

In addition to the contactors listed above, related contactors have been built and since retired as obsolete. They are tabulated in Figure 2 (and included in Figures 5 and 6) for the accommodation of their users.

Obsolete Contactor Type	M-011-H	M-211-L	M-211-HØ
Voltage Rating	600	250	600
8 Hour Ampere Rating	*	50	50
I Hour Ampere Rating	*	67	67
Superseded By	M-011-2H	M-211-2H	M-211-2H

* The current rating of this contactor is less than 25 amperes, and depends on the blowout coil rating.

Ø This contactor is now the M-211-2H contactor. The designation has been changed without any physical alteration of the contactor.

Fig. 2—Ratings of Obsolete Contactors

The operating coils are rated for continuous duty and will operate the contactor 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.

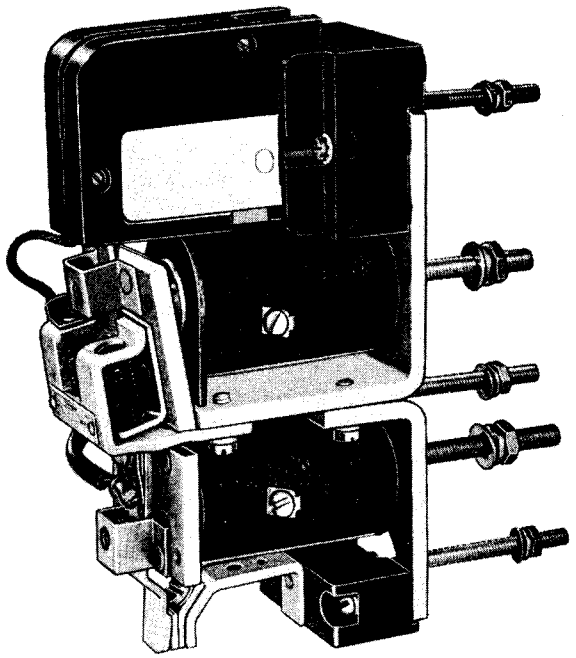

Fig. 3—Type M-211-2H rear-connected contactor with magnetic blowout on normally-open pole only.

The contactor is equipped with two operating coils, the upper coil being used to close the normally-open contact, and the lower coil serving to produce a complete sealing of the normally-closed contact. When neither operating coil is energized the kickout springs hold the lower, or normally-closed, contacts together. Because the kickout spring is not sufficiently strong to produce full contact pressure, the lower coil should be energized at all times that the lower contacts are required to carry rated current continuously. For certain intermittent duty applications the lower coil is sometimes omitted.

An arc shield and blowout structure are always provided on the normally-open pole. They are optional on the normally-closed pole, and should always be provided when this pole is to be required to interrupt a circuit. The arc shield is held in place by the blowout pole-pieces and a pair of spring clips, and may be removed by pulling it directly forward. An arc horn in the arc shield relieves the moving contact of excessive burning. The arc, which is drawn between the contacts as they separate, moves outward under the influence of the magnetic blowout field and transfers from the moving contact to the arc horn. A flexible connection which is provided to maintain the arc horn at the same potential as

Type M D-C Magnetic Contactors—Frames 011, 111 and 211

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 contacts are hinged on the armature in such a way that sliding or rubbing of the surfaces when the contacts meet is practically non-existent, a provision essential to the long life of silver contacts.

Plates of non-magnetic steel are secured to the underside of the armature to insure against a sticking closed of the armature against either pole-face due to residual magnetism following the interruption of voltage to an operating coil.

Rear-connected contactors are held to the panel by five mounting studs, three of which make provision for the electrical connections (the moving contacts of the two poles are connected at a common stud). Front-connected contacts 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 two moving contacts, special insulating precautions must be taken if a contactor is to be mounted on a conducting surface.

ELECTRICAL INTERLOCKS

The Type L-46 normally-open electrical interlock and the Type L-47 normally-closed electrical interlock may be applied to the contactors in numbers limited according to the table in Fig. 4. It is to be noted that a contactor having magnetic blowouts on both poles can accommodate a total of four interlocks, whereas a contactor having a magnetic blowout on its normally-open pole only is limited to two interlocks.

Electrical Interlock Type	Maximum Allowable No. of Interlocks to be Applied to a Contactor	
	Blowouts on both poles	Blowout only on normally-open pole
L-46 Normally open L-47 Normally closed	4 2	2 2
Total No. of interlocks of both types that can be applied to one contactor.	4	2

Fig. 4—Electrical Interlock Application Table

The stationary contact assembly of either type of interlock is mounted on one of the molded bases of the contactor beside the arc shield. A molded insulating detail occupies this location when the contactor is assembled without interlocks at the factory, and this must be discarded at the time an interlock is mounted. The moving arm of the interlock 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 interlock Instruction Leaflets: I.L. 15-829-L46-1 and I.L. 15-829-L47-1.

The sequence in which the various switching operations occurs as the contactor magnet closes is as follows:
(1) the main normally-closed contacts open, (2) the main normally-open contacts close, (3) the Type L-46 normally-open interlock closes, and (4) the Type L-47 normally-closed interlock opens.

MECHANICAL INTERLOCK

A Type M-25 mechanical interlock (style # 1257474) may be employed to safeguard a pair of contactors against the closing of one if the other is already closed. The contactors are mounted side-by-side on 4 3/16 inch centers.

INSTALLATION AND MAINTENANCE

Arc Shield—The arc shield and its arc horn are essential to the 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 the frame. The arc shield may be removed by pulling it directly forward, allowing the blowout pole-pieces (which act as its fixed supports) to guide it in its sliding movement. In replacing the arc shield care must be taken 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 apart so that they no longer grip the arc box firmly, remove the arc box 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 molded base by the spring grips.

Armature and Bearing—The knife-edge bearing requires no maintenance other than the removal of accumulated dirt. Oil should not be used, as it hastens the collection of dust.

The upper 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 that the parts maintain proper alignment, and particularly that the bolt-head be accurately centered in the armature hole. Dirt should not be allowed to accumulate.

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 either of the operating coils are: (a) remove the arc shield, or shields, as described previously, (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 position, (c) allow the self-contained assembly comprising the armature, armature stop, moving contacts and springs to hang by the shunt, (d) re-

Type M D-C Magnetic Contactors—Frames 011, 111 and 211

move the screw holding the pole-face to the magnet core on which the coil is mounted, and (e) disconnect the coil leads and slide the coil forward until it is clear of the contactor frame.

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 consequently no filing or dressing is necessary.

When the contacts are new they should meet sufficiently in advance of the final sealing of the armature against either the upper or the lower pole face, that a gap of approximately 1/8 inch appears between the underside of the contact and the edge of the fully-sealed armature, as indicated in Fig. 7. As the contacts wear, the amount of this overtravel diminishes, and when at length it decreases to 1/32 inch, the contacts should be replaced.

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

When the contacts are new, the open gap of the normally-open contact, with the armature sealed against the lower pole-face, should be 11/32 to 13/32 inch. The open gap of the normally-closed contact, when the armature is sealed against the upper pole-face, should be 5/16 to 3/8 inch, as shown in Fig. 7.

If after applying new contacts it is found that the overtravels and contact gaps do not conform to the dimensions given, it may be necessary to bend the moving contact straps slightly.

The contact pressures of both the normally-open and normally-closed contacts, when they are new should be as indicated in the table in Fig. 5.

Contactor Type	Contact Pressure in Ounces	
	Initial	Final
*M-011-H & M-111-H	4 to 7	9 to 13
M-011-2H M-111-2H M-211-L & M-211-H M-211-2H	6 to 9	11 to 15

* Contactors shown in light face are obsolete.

Fig. 5—Table of Contact Pressures

To measure the final pressure of one of the contacts, first close the contactor mechanically in a direction producing full closing of the contact. Then by means of a spring scale hooked to a loop of fine wire measure the force necessary to separate the moving from the stationary contact.

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

Failure of the magnet to operate 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 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-011-H & M-111-H		M-011-2H & M-111-2H M-211-L & M-211-H M-211-2H	
	Upper Coil Style No.	Lower Coil Style No.	Upper Coil Style No.	Lower Coil Style No.
115	1 289 407	1 289 394	1 289 375	1 289 394
230	1 289 408	1 289 395	1 289 376	1 289 395
250	560D747G16	44A6366G23	560D746G30	44A6366G23
550	1 289 377	1 289 384	1 289 377	1 289 384

* Contactors shown in light face are obsolete.

Fig. 6—Style Numbers of Commonly-used Operating Coils

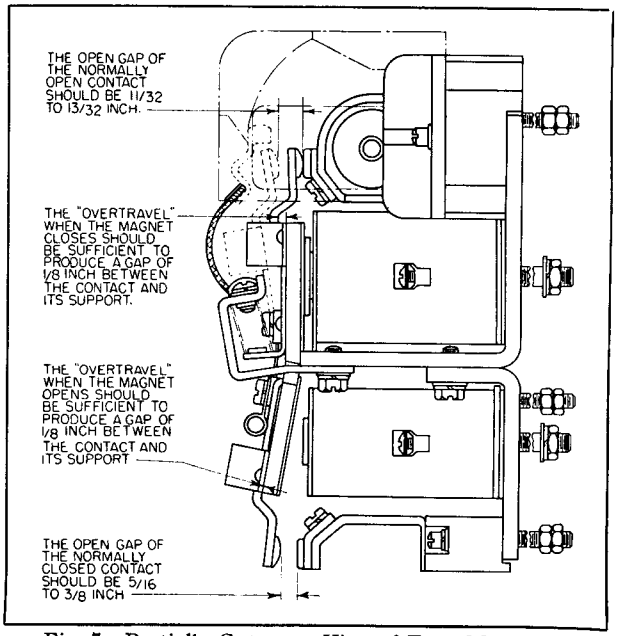

Fig. 7—Partially Cut-away View of Type M-211-2H Contactor

RENEWAL PARTS

Renewal parts may be obtained from the nearest Westinghouse Sales Office. Be sure to describe the part or parts required and give complete nameplate reading on the contactor for positive identification.

Westinghouse Electric Corporation
Buffalo 5, N. Y.

Printed in U.S.A. (Rep. 11-59)

Type M D-C Magnetic Contactors Frames 010, 110 and 210 Single-Pole Magnet Closed

INSTRUCTIONS

APPLICATION

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

RATINGS

The contactors have the ratings listed in Fig. 1.

Contactor Type	M-010-2H	M-110-H	M-110-2H	M-210-2H
Voltage Rating	600	600	600	600
8 Hour Ampere Rating	*	25	25	50
1 Hour Ampere Rating	*	33	33	67

* The current rating of this contactor is less than 25 amperes, and depends on the blowout coil rating.

Fig. 1—Rating Table

The contactors whose type designations terminate in "-2H" are alike in every respect except their blowout coils. The Type M-110-H contactor, however, employs a smaller arc shield and operating coil, and smaller contacts, springs and shunts.

In addition to the contactors listed above, related contactors have been built and since retired as obsolete. They are tabulated in Figure 2 (and included in Figures 4, 5 and 6) for the accommodation of their users.

Obsolete Contactor Type	M-010-H	M-110-S	M-210-S	M-210-L	Ø M-210-H
Frame Size	deep	small	small	deep	deep
Voltage Rating	600	250	250	250	600
8 Hour Ampere Rating	*	25	50	50	50
1 Hour Ampere Rating	*	33	67	67	67
Superseded By	M-010-2H	M-110-H	M-210-2H	M-210-2H	M-210-2H

* The current rating of this contactor is less than 25 amperes, and depends on the blowout coil rating.

Ø This contactor is now the M-210-2H contactor. The designation has been changed without any physical alteration of the contactor.

Fig. 2—Ratings of Obsolete Contactors

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.

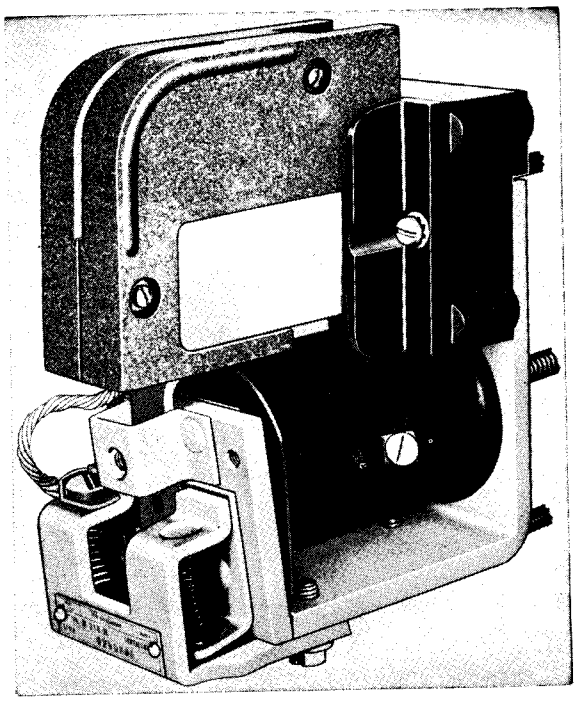

Fig. 3—Type M-210-H Rear-Connected Contactor

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 under conditions of shock or tilt.

The contactor may be supplied with or without the magnetic blowout. The arc shield, which is held in place by the blowout pole-pieces and a pair of spring clips, may be removed by pulling it directly forward. An arc horn in the arc shield relieves the moving contact of excessive burning. The arc, which is drawn between the contacts when the contactor opens, moves outward under the influence of the magnetic blowout field and transfers from the moving contact to the arc horn. 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

Type M D-C Magnetic Contactors—Frames 010, 110 and 210

of the surfaces when the contacts meet is practically non-existent, a provision 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 a 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 the table in Fig. 4.

Electrical Interlock Type	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-010-2H** **M-110-2H** M-210-L M-210-H **M-210-2H**
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

* Contactors shown in light face are obsolete.

Fig. 4—Electrical Interlock Application Table

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 15-829-L46-1.

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 Type L-46 normally-closed 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 15-829-L47-1.

The stationary contact assembly of either type of interlock is mounted on the molded base of the contactor beside the arc shield. A molded insulating detail occupies this location when the contactor is assembled without interlocks at the factory, and this 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 its Instruction Leaflet.

The sequence in which the various switching operations occur as the contactor magnet closes is as follows: (1) the Type L-46 normally-closed interlock opens, (2) the main contacts close, (3) the Type L-46 normally-open interlock closes, and (4) the Type L-47 normally closed 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 S-1257473, and for deep-frame contactors use interlock S-1257474. The contactors are to be mounted side by side on $4\frac{3}{16}$ inch centers.

INSTALLATION AND MAINTENANCE

Arc Shield—The arc shield and its arc horn are essential to the 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 the frame. The arc shield may be removed by pulling it directly forward, allowing the magnetic blowout pole-pieces (which act as its fixed supports) to guide it in its sliding movement. In replacing the arc shield care must be taken 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 apart so that they no longer grip the arc box firmly, remove the arc box 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 molded base by the spring clips.

Armature and Bearing—The knife-edge bearing requires no 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 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.

Type M D-C Magnetic Contactors—Frames 010, 110 and 210

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 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 and slide the coil forward until it is clear of the contactor.

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 consequently no filing or dressing is necessary.

When the contacts are new they should meet sufficiently in advance of the final sealing of the armature against the magnet pole-face, 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. 7. As the contacts wear, the amount of this overtravel diminishes, and when at length 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 the 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 $\frac{11}{32}$ to $\frac{13}{32}$ inch, as shown in Fig. 7.

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-H M-110-S **M-110-H**	4 to 7	9 to 13
M-010-2H, M-110-2H M-210-S, M-210-L M-210-H, **M-210-2H**	6 to 9	11 to 15

* Contactors shown in light face are obsolete.

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 described previously.

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 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-010-2H** **M-110-2H** M-210-L M-210-H **M-210-2H**
	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
250		560D747G16	1 289 406	30B4265G17
550		1 289 377		1 289 377

* Contactors shown in light face are obsolete.

Fig. 6—Style Numbers of Commonly-Used Operating Coils

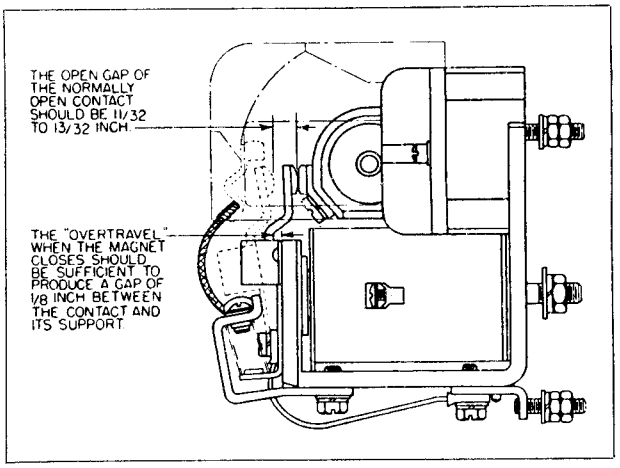

Fig. 7—Partially Cut-away View of Type M-210-2H Contactor with Armature in Closed Position

RENEWAL PARTS

Renewal parts may be obtained from the nearest Westinghouse Sales Office. Be sure to describe the part or parts required and give complete nameplate reading on the contactor for positive identification.

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