RENEWAL PARTS AND INSTRUCTION PUBLICATION

No. 935 — Normally Open Single Pole D-c Ltl Contactor 8 Hour Current Rating — 300 Amperes

Care

Description

This is an inductive time limit (LTL) Contactor. It employs a closing coil (upper) and a holdout coil (lower). Factory adjustment is made with shims to obtain maximum timing in the holdout coil magnetic circuit. Fine adjustment is obtained with the knurled adjusting screw, item 29, located between the two coils.

For complete description of operation and adjustment see Page 5.

Adjustment

To change the closing time, loosen the lock screw, Item D Page 5 between the two coils and turn the knurled screw clockwise to reduce the closing time, counterclockwise to increase the closing time. Tighten the lockscrew after adjusting.

A further reduction in timing is possible by removing one or two shims item 1.

Main Contacts

Main contacts should not be lubricated. Grease, dust or copper oxide have insulating qualities which increase the contact resistance and result in unnecessary heating. Dust and grease can be wiped off. A fine file should be used to remove copper oxide, or to dress rough or pitted contacts. Care should be taken to remove as little copper as necessary.

Renewal of Contacts

Contacts should be renewed when the dimension "A" for the closed position of the contacts in Fig. 1 decreases to 2.625 inches, or when one contact measures 1.312 inches. For one contact, the minimum distance to the contact surface should be taken for this dimension. To insure satisfactory operation, both contacts should be replaced together.

Failure to renew the contacts at the proper time may cause serious damage to the contactor.

Silver faced contacts should be replaced as soon as the silver is worn off.

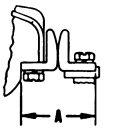


Fig. 1

Contact Spring Pressure

The contact pressure spring item 22 is made of stainless steel. It is designed for long life and will retain its operating characteristics under heavy service conditions. Should excessive contact temperatures occur the spring may be checked as described below. It is only necessary to check the initial contact pressure. The final contact pressure may be checked only if equipped with new contacts.

The illustration below, figures 3 and 4, provide the spring pressure range of values and the means of measuring. If the spring pressures are measured and found to be within the values given, the contact pressure spring is satisfactory. If the measured spring pressures are less than the values given, the spring should be replaced.

Contact Heating and Application of Silver Contacts

Copper oxide forms very rapidly at excessive contact tip temperatures. If this condition occurs, check the remaining wear allowance (see Fig. 1 and paragraph "Renewal of Contacts") and the current carried by the contactor. If these are satisfactory, it is advisable to check the contact pressures (see Figs. 2 and 3 and paragraph "Contact Spring Pressure"). Copper contacts that are operated fairly often within their rating and wear allowance and with sufficient spring pressure seldom form oxide or require dressing.

Silver faced contacts are used where the contactor remains closed for long periods of time and is not subject to frequent operation, (nominally eight hours or more). Do not use silver faced contacts unless the contactor was so equipped originally. Silver faced contacts should **not** be filed or dressed unless sharp projections, caused by heavy arcing, extend beyond the contact surface. Such projections should be filed down to the surface only.

Armature Lever and Magnet Core

Keep the surface of the magnet core, item 26, and the armature lever, item 45, which come together when the contactor closes, clean and free of dirt and oil.

The contact lever and armature lever shafts, items 23 and 27 respectively, should be lubricated occasionally with a drop or two of SAE No. 20 oil. Lubricate at oil holes in the above levers.

Wipe off excess oil.

Arc Shields

The arc shields, items 13 and 34, should be replaced before they wear through so that the arc will not touch the metal pole pieces, item 17.

The arc shields can easily be raised for inspection or renewal of the contact parts. However, be sure that they are lowered to their normal position before the contactor is allowed to operate. If this is not done, no blowout effect is obtained and the contacts will wear very rapidly.

Magnetic Air Gap

These contactors are shipped from the factory with a magnetic gap of .343 inch nominal. This is measured along the centerline of the core item 26 to the armature lever item 45 in a straight line.

The holdout magnetic gap for this contactor is nominally .015 inch measured at "AA". (See Page 5).

For adjustment of this Ltl contactor see Page 5.

Electrical Interlocks

See page 4 for electrical interlocks. These are unit electrical interlocks which can accommodate two electrically isolated circuits. The addition of an electrical interlock to a connector requires the addition of a mounting plate and operating bar. (See Page 4).

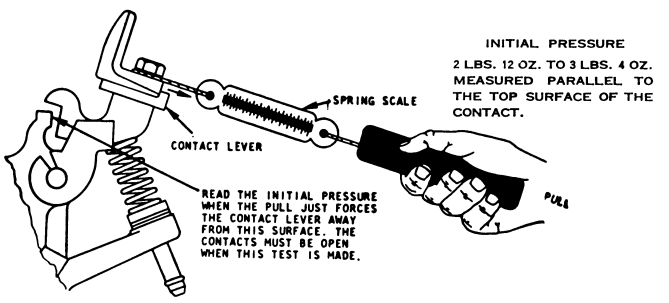


Fig. 2 (Initial Contact Pressure)

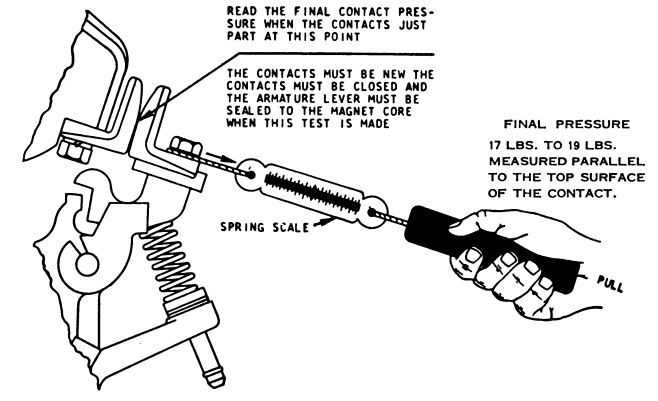
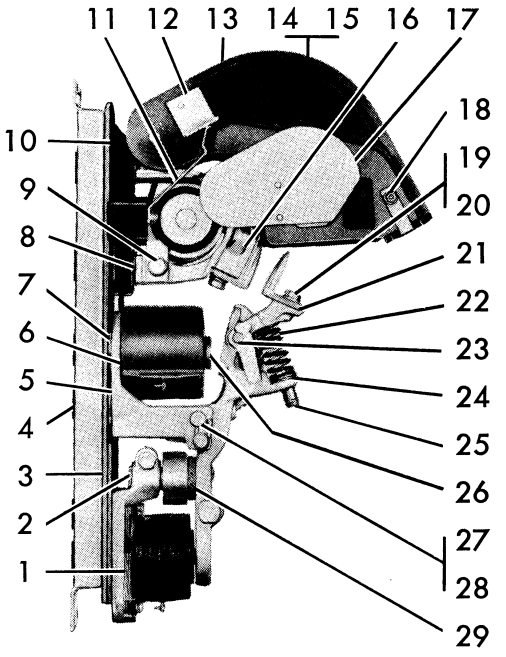
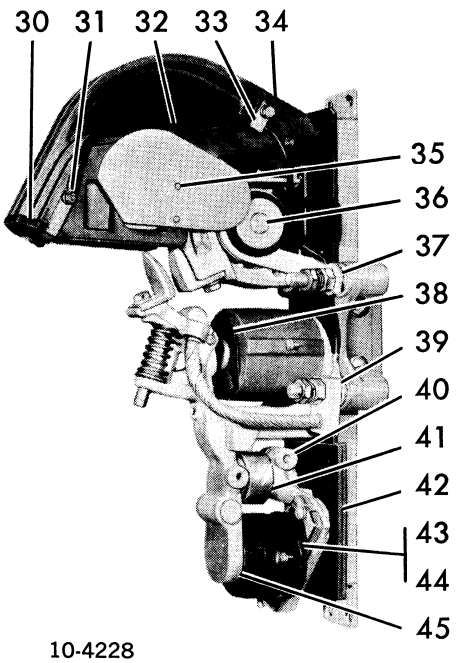


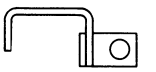
Fig. 3 (Final Contact Pressure)





10-4228

Connector Item 37 used without blowout.



NOTE: Pictures show arc shields in raised position. Lower before operating.

NOTE: Pictures show power terminal block for surface mounting front connection in place. For other types of mounting see page 3

RENEWAL PARTS — Information Required

To insure prompt handling of renewal parts orders, please include the following: **DESCRIPTION, PART NO., AND QUANTITY REQUIRED.**

▲Recommended Spare Parts:

PARTS LIST

A Renewal Set of Contacts W/Copper Contacts, Part No. 6-189-3 (includes items 19, 20 and 22).
A Renewal Set of Contacts W/Silver Contacts, Part No. 6-189-7 (includes items 19, 20 and 22).

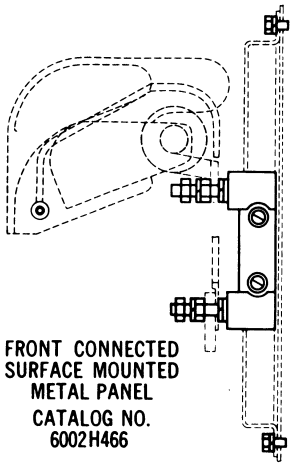
Item No.	Description of Part	No. Req.	Part No.
1	Shim		
	.010 Thick	5	19-1367
	.062 Thick	4	19-1366
2	Adjusting Screw	1	11-1062
	Pin	1	13-1079-17
3	Insulator	1	56-3685
4	Mounting Insulators		
	Insulator for 5/16 Screw	2	56-2698
	Disc	2	16-1837
	Insulator for 3/8 Screw	4	56-2698-2
	Disc	4	16-1837
5	Magnet Frame	1	17-7193
▲ 6	Coil (give number on coil)	1	.....
	Insulating Washer	1	56-3482
7	Washer (under magnet frame)	2	16-2315
8	Shim Washer	4	16-1879
9	Blowout Coil Mounting Screw		
	3/8-16 x .875 Long Hex. Screw	1	911-373
	3/8 Helical Lockwasher	1	916-231
10	Moulded Base	1	17-7589
11	Latch (used with blowout)	1	52-880
12	Hasp	1	52-879
▲13	Arc Shield (left hand)	1	62-454-2
14	Blowout Complete (includes items 9, 15, 16 and 36)		
	With Copper Contact	1	62-564
15	Arc Shield Complete (includes items 12, 13, 17, 18 and 30 through 35)	1	62-564-2
16	Contact Post (includes one of quantity shown under items 19 and 20)		
	With Copper Contact	1	18-1410
17	Pole Piece	2	62-452
	Strap	2	19-945-6
	Inner Arc Shield	2	62-451
18	Arc Horn	1	62-561
	#10 Helical Lockwasher	2	916-484Z
	#10-32 Hex. Nut	2	915-322Z
▲19	Contact (stationary and movable)		
	Copper	2	23-435
*	Silver Faced	2	23-1042-2
20	Contact Mounting Screw		
	3/8-16 x .750 Long Hex. Screw	2	911-5646Z
	3/8 Helical Lockwasher	2	916-231

Item No.	Description of Part	No. Req.	Part No.
▲21	Contact Lever Complete (includes one of quantity shown under items 19, 20 and 39)		
	With Copper Contact	1	24-4175
▲22	Spring	1	69-58
23	Shaft (includes 2 retaining rings)	1	13-4330-2
	Retaining Ring	2	28-42
24	Shim Washer		
	Washer .004 Thick	2	916-225
	Washer .016 Thick	2	916-1164Z
	Washer .032 Thick	1	16-319
25	Adjusting Pin	1	13-587
	Retaining Ring	1	29-541
26	Core	1	51-896
27	Shaft	1	13-3859-3
28	Pin	1	13-3860
	1/4-20 x .750 Long Hex. Screw	1	911-5446Z
	1/4 Helical Lockwasher	1	916-682Z
	1/4 Flat Washer	1	916-641Z
29	Adjusting Screw	1	911-679
30	Arc Deflector	1	73-1632
31	Bracket	2	79-9197-3
32	Connector	1	25-1927-3
33	Clamp	1	19-1248-3
▲34	Arc Shield (right hand)	1	62-454
35	Pole Piece Mounting Screw		
	#10-32 x .750 Long Flathead Screw	4	811-1664
	#10 External Tooth Washer	4	916-101
36	Blowout Coil	1	9-460-437
37	Connector (used without blowout)	1	25-1816
	3/8-16 x .875 Long Hex. Screw	1	911-373
	3/8 Helical Lockwasher	1	916-231
38	Coil Clamp	1	55-1451
39	Contact Lever with Connector	1	24-4175-2
40	Base	1	17-7625
	3/8-16 x 1.500 Long Hex. Screw	1	911-5652Z
41	Shunt Nut	1	1315-1
42	Insulator	1	56-3674
▲43	Hold Out Coil (give number on coil)	1	.....
44	Hold Out Coil Post	1	18-1342-2
45	Armature Lever	1	24-4182

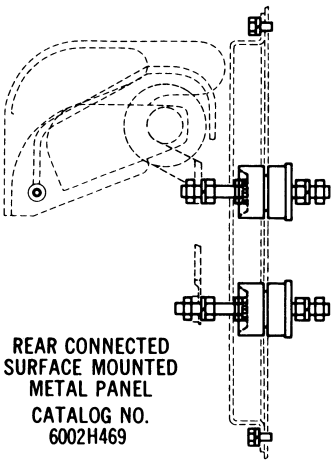
*Silver faced contacts are used only where the contacts remain closed for long periods, (nominally eight hours or more). Do not use silver faced contacts unless the contactor was so equipped originally.

▲We recommend that these items be stocked. The quantity to be stocked will depend on the total number in use.

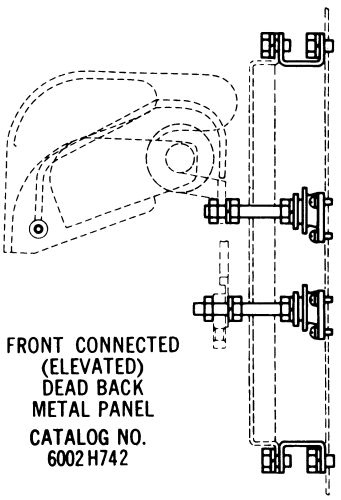
CONTACTOR MOUNTING MATERIAL



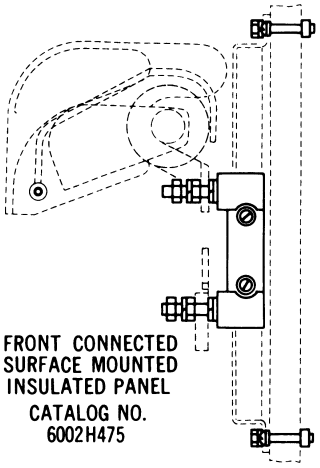
FRONT CONNECTED
SURFACE MOUNTED
METAL PANEL
CATALOG NO.
6002H466



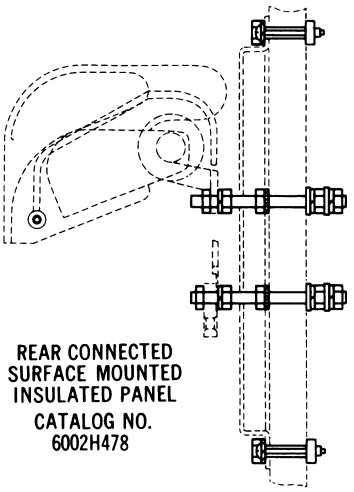
REAR CONNECTED
SURFACE MOUNTED
METAL PANEL
CATALOG NO.
6002H469



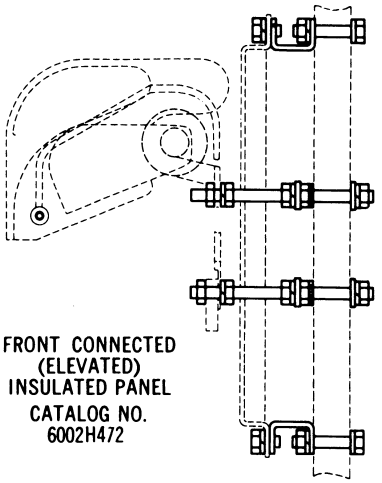
FRONT CONNECTED
(ELEVATED)
DEAD BACK
METAL PANEL
CATALOG NO.
6002H742



FRONT CONNECTED
SURFACE MOUNTED
INSULATED PANEL
CATALOG NO.
6002H475



REAR CONNECTED
SURFACE MOUNTED
INSULATED PANEL
CATALOG NO.
6002H478



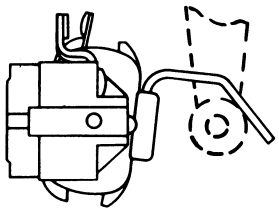
FRONT CONNECTED
(ELEVATED)
INSULATED PANEL
CATALOG NO.
6002H472

The **closing** coil numbers listed in the table at the right are for common d-c voltages on continuous duty applications. Coils for other voltages or intermittent duty are to be ordered by specifying the coil number appearing on the coil together with the complete nameplate data on the controller.

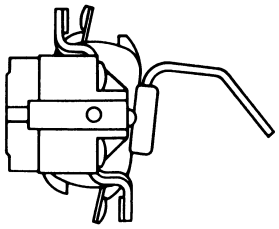
The **holdout** coils are to be ordered by specifying the coil number appearing on the coil together with the complete nameplate data on the controller.

OPERATING COILS			
VOLTS DC	115	230	550
COIL PART NO.	9-1589-2	9-1589-1	9-1589-3

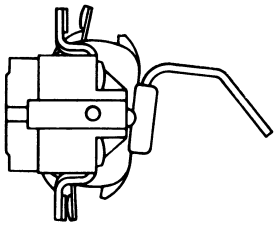
UNIT TYPE ELECTRICAL INTERLOCKS



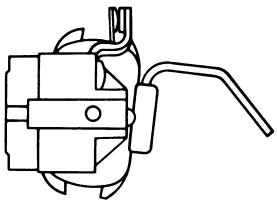
ONE NORMALLY OPEN
CATALOG NO.
10923H1



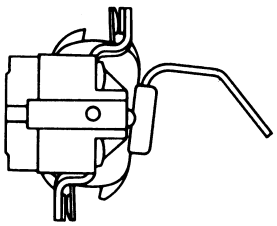
TWO NORMALLY OPEN
CATALOG NO.
10923H2



ONE NORMALLY OPEN
ONE NORMALLY CLOSED
CATALOG NO.
10923H3

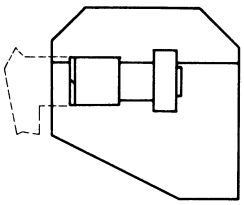


ONE NORMALLY CLOSED
CATALOG NO.
10923H4



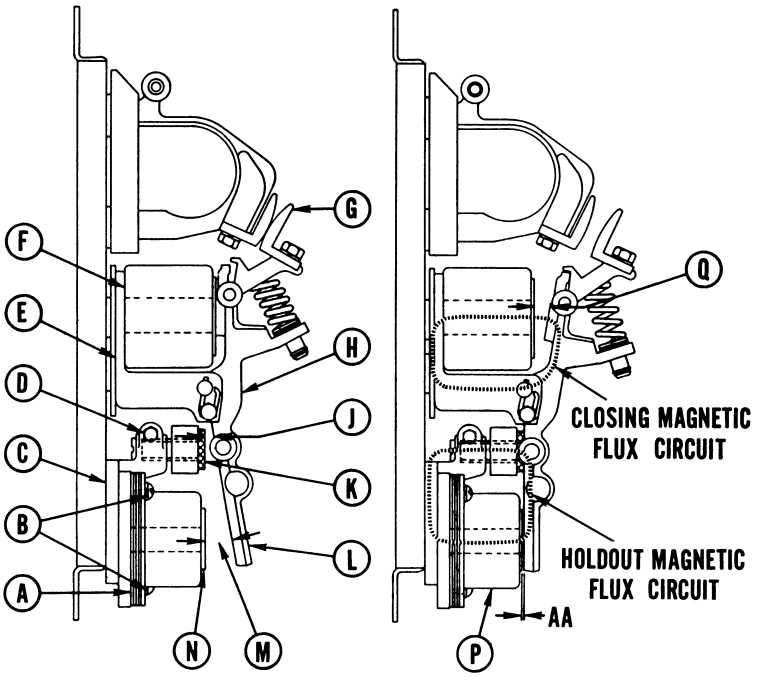
TWO NORMALLY CLOSED
CATALOG NO.
10923H5

MOUNTING MATERIAL FOR ELECTRICAL INTERLOCKS



MOUNTING MATERIAL FOR
ONE UNIT INTERLOCK
CATALOG NO.
10923H20

Operation and Adjustment of Ltl Contactor



Contactor Closed — Contactor Open

Item No.	Description	Item No.	Description
A	Adjusting shims	J	Upper magnetic gap in holdout coil circuit
B	Round head screws	K	Adjusting screw
C	Frame for holdout coil	L	Armature for holdout coil
D	Locking screw	M	Lower magnetic gap in holdout coil circuit
E	Steel frame for closing coil	N	Brass stop
F	Closing coil	P	Holdout coil
G	Main contacts	Q	Magnetic gap for closing coil magnetic circuit
H	Steel armature		

Inductive time limit contactors have two coils, a closing coil, and a holdout coil. Each has its own magnetic circuit. The relative strength of the coils is such that with full voltage applied to the closing coil, one per cent of full voltage applied to the holdout coil will keep the contactor open. As actually used, a considerably higher voltage is applied to the holdout coil. The coil is then short circuited. The magnetic circuit for the holdout coil is highly inductive, so that the current in the coil does not drop to zero at once, but requires a certain time to do so. When this time has elapsed, the coil is no longer able to hold the contactor open, and the contactor closes. Since the pull of the holdout coil depends to a large extent on the fact that the magnetic gaps at (M) and (J) are small and since these gaps increase rapidly as the contactor closes, the pull of the holdout coil is ineffective as soon as the contactor starts to close, and closure is rapid and positive.

The flux path for the closing coil is from the core inside coil (F), across the gap (Q), through the armature (H) and the frame (E), and back to the core. This path requires no adjustment.

The flux path for the holdout coil is from the core inside coil (P), across the gap (M), through the armature (L), across the gap (J), through the adjusting screw (K), the frame (C), adjusting shims (A), and back to the core. This path is adjustable at two points.

Coarse adjustment is obtained by removing or inserting shims (A) to vary the air gap (M). Contactors are usually sent from the factory with the maximum number of shims installed, which gives the longest time delay. The number of shims which can be used is limited to the number which will provide a small gap at (M) and still permit the armature (L) to seat against the brass stop (N) and not against the steel core of the holdout coil. Removing shims will make the timing shorter, and inserting shims will increase the timing.

Fine adjustment is obtained from the adjusting screw (K). It is usually possible to obtain sufficient adjustment from this screw without changing the number of shims. To turn the adjusting screw, it is first necessary to loosen the lock screw (D), and after adjustment of the timing the lock nut should be tightened again. Moving the screw (K) out, toward the armature (L), will increase the timing, and moving it in, away from the armature, will decrease the timing. Maximum timing will be obtained when the screw is almost, but not quite, touching the armature with the contactor open. It should be possible to insert a thin sheet of paper between the face of the screw and the armature. In no case should the face of the screw touch the armature, as this will partially close the main contacts (G), and will result in decreasing their life.

Note — Reversing plugging controllers may use the Ltl contactor for the plugging contactor as well as for the timed accelerating contactors. The plugging contactor holdout coil is connected in a circuit which will permit the contactor to close without delay when the motor is started from rest, but when the motor is plugged the contactor will open and not reclose until just before the motor reverses its rotation. The plugging contactor is provided with a two winding holdout coil connected in combination with a rectifier in the motor armature reversing circuit.