

ROYAL CANADIAN AIR FORCE



HANDBOOK WITH PART LIST

BATTERY & STARTER

CIRCUIT RELAY

TYPE B4

(CUTLER-HAMMER)

"REVISION"

NOTICE

**LATEST REVISED PAGES
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15 JUN 54
Revised 14 Aug 59

LIST OF RCAF REVISIONS

DATE	PAGE NO	DATE	PAGE NO
14 Aug 59	3		

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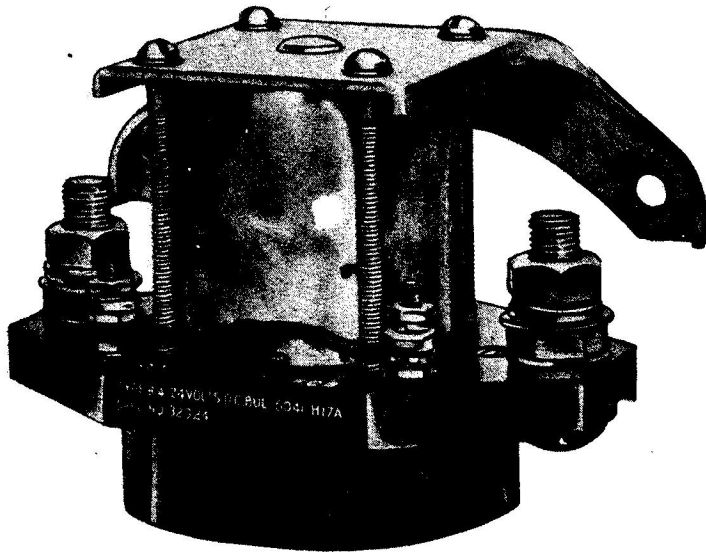


FIG. 1 - TYPE B-4 BATTERY AND STARTER CIRCUIT RELAY

1. Introduction.

a. This Handbook is issued as the basic Engineering Order for the equipment involved.

b. This Handbook contains descriptive data and instructions for the installation, operation, maintenance, and overhaul of the Type B-4 Battery and Starter Circuit Relay (Manufacturer's Model (604LH17A)).

2. General Description and Performance.

a. General Description. - The Type B-4 battery and starter circuit relay, Air Corps Specification No. 32524, is built on a bakelite base. The operating coil is wound on a brass tube, encased in an iron shell, and is impregnated by the Vacuum Pressure Process. The coil core consists of a spring-loaded, movable plunger. A pin in the plunger forms the connecting link between the plunger and the movable contact bar. When the coil is energized, the plunger pulls the movable contact bar against and across the two stationary contacts, closing the circuit.

b. Performance. - (1) The battery and starter circuit relay is designed to provide a means of remotely controlling the opening and closing of the battery or starter circuit and is so designed that it will withstand continuous operation of a 29.0 volt, direct current source of power.

(2) The relay contacts will close firmly with a maximum, direct current potential of 18.0 volts applied to the terminals of the holding coil and will hold closed on 7.0 volts or less, when the closing voltage applied to the holding coil is reduced from 18.0 to 7.0 volts, after one hour of continuous operation on 18.0 volts. The current consumed by the relay holding coil, when operated on 29.0 volts direct current, does not exceed 0.5 amperes.

3. Installation and Operation.

a. Installation. - (1) Battery Circuit Current Relay: The relay can be installed in any position by means of the bracket provided, as close to the battery as is practical. Refer to the wiring (figure 3) for electrical connections and wire sizes. See Airplane Wiring Diagram for the particular airplane on which this equipment is to be installed.

(2) Control Switch: A suitable control switch should be installed in the pilot's compartment to permit remote control of the relay, when desired. Make electrical connections as shown in wiring diagram (figure 3).

b. Operation. - The operation of the relay is dependent on the voltage of the battery and is performed by closing the control switch in the pilot's compartment. The control switch opens and closes the holding coil circuit which, in turn, causes the opening and closing of the main contacts.

4. Inspection, Maintenance, Lubrication, Equipment Troubles, and Repairs.

a. Inspection

Minor. - Inspect for security of mounting and condition of wiring.

b. Maintenance - When properly installed and operated, the starter and battery circuit control relay should require little attention. In the event the circuit controlled by the relay becomes inoperative, the relay is to be checked as follows:-

(i) Disconnect the wiring from the cold terminal of the main contacts.

(ii) Connect a voltmeter (30 volt range) across the two terminals of the coil circuit. Close the pilot switch. Line voltage should be indicated or the relay will not close.

(iii) Connect a voltmeter between the hot terminal of the main contacts and ground on the airframe. Line voltage should be indicated.

(iv) Connect a voltmeter between the cold terminal of the main contacts and ground on the airframe. The voltage reading should be identical to the voltage indicated on the hot side of the relay. If any difference in voltage is shown the relay is to be replaced.

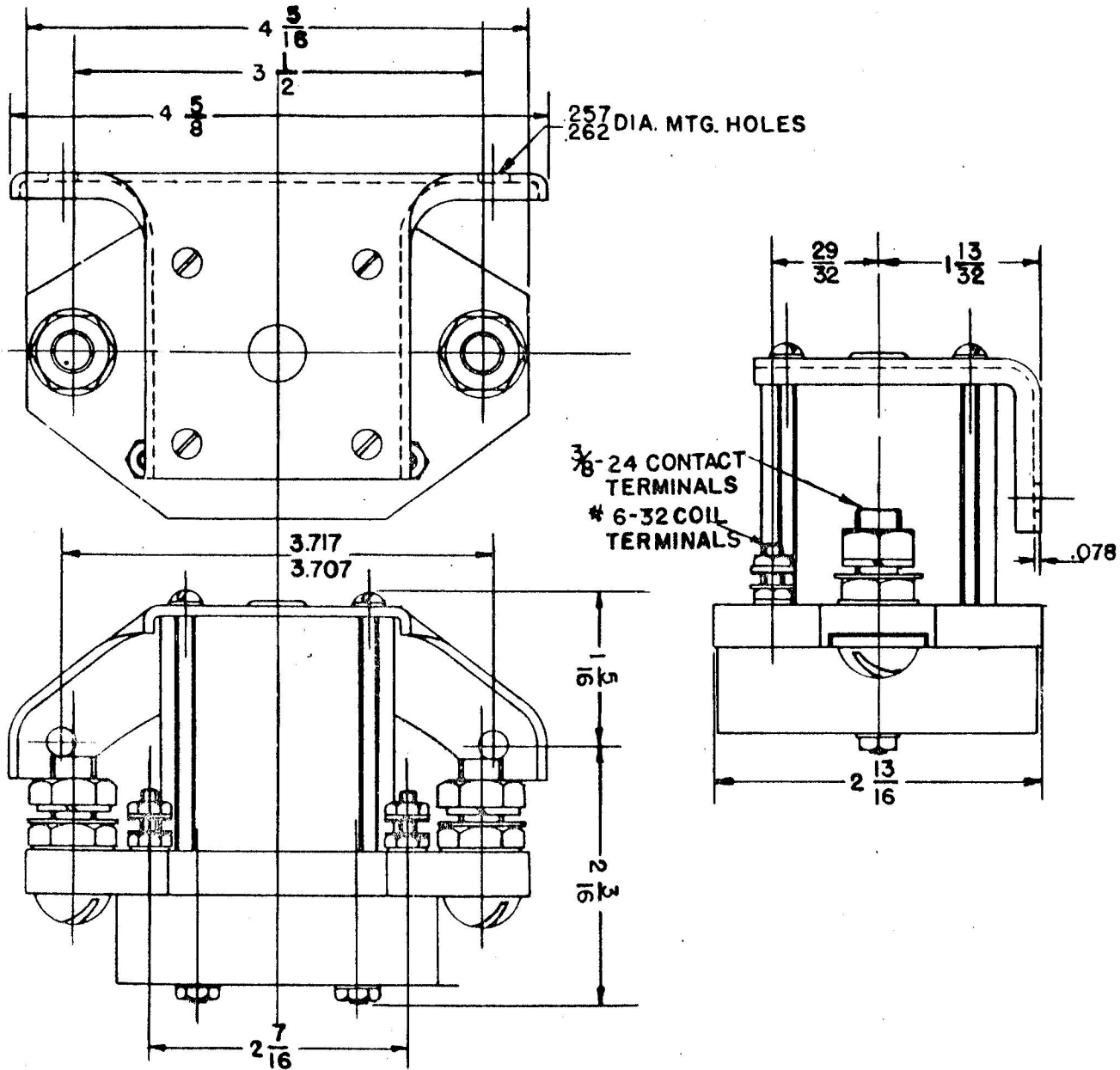
(v) Reconnect the wiring to the cold terminal of the main contacts and repeat steps (ii) (iii) and (iv).

c. Lubrication. - No lubrication of this relay is required at any time.

d. Preparation for Use After Storage. - Prior to installing these units, after removal from storage, they should be checked as instructed in paragraph 5, sub-paragraph e.

e. Equipment Troubles and Repairs.

Trouble	Possible Cause	Remedy
(1) Switch Inoperative	(a) Discharged Battery (b) Improper Connections	(a) Recharge Battery (b) Check Wiring (see figure 3)



**FIG. 2 - DIMENSIONAL VIEW - TYPE B-4 BATTERY AND STARTER
CIRCUIT RELAY**

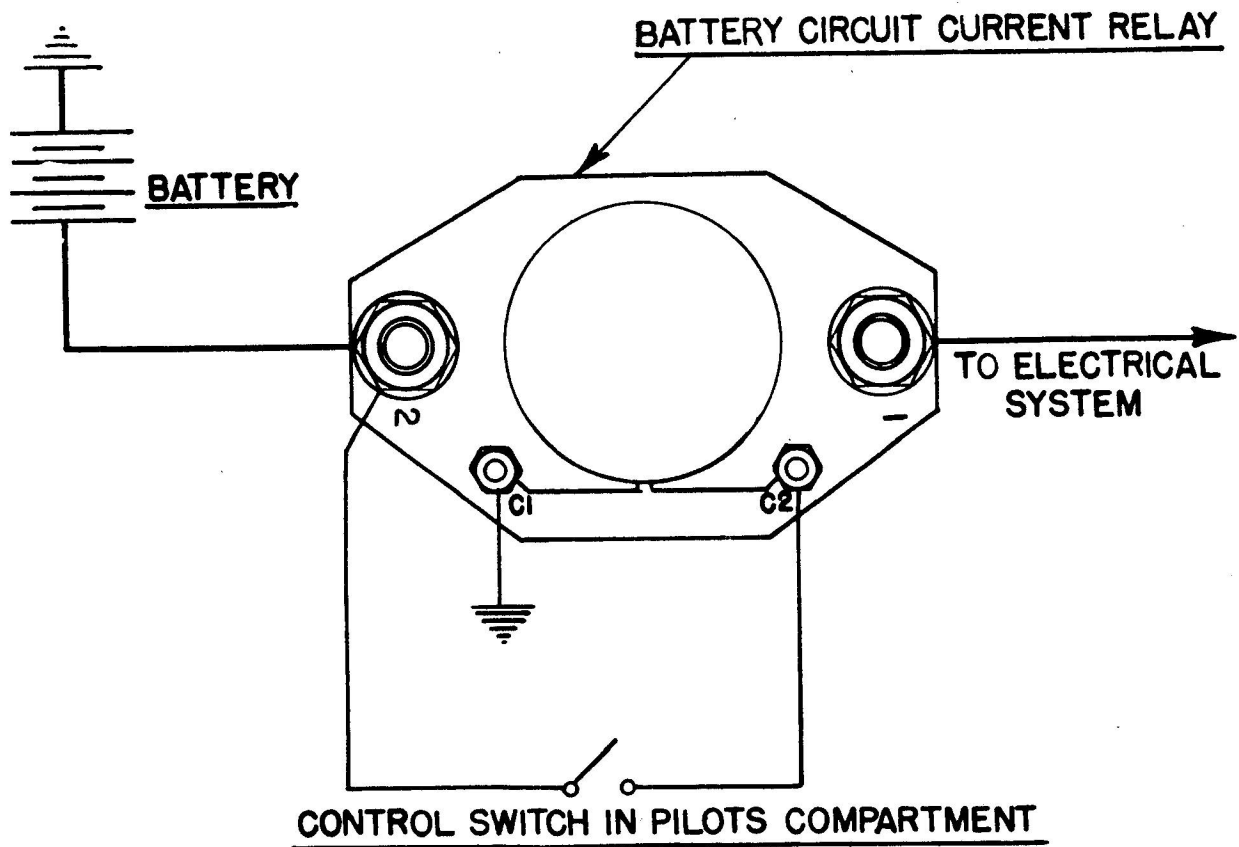


FIG. 3 - WIRING DIAGRAM - TYPE B-4 BATTERY AND STARTER
CIRCUIT RELAY

<u>Trouble</u>	<u>Possible Cause</u>	<u>Remedy</u>
	(c) Defective Control	(c) Test control switch and replace, if necessary.
	(d) Defective Wiring	(d) Check for open control circuit, wiring, defective insulation, or grounding.
	(e) Relay holding coil shorted, burned out, or grounded	(e) Check as instructed in paragraph 5.

5. Disassembly, Inspection, Test, and Reassembly (Depots Only)

a. Disassembly (Figure 4). - This relay has been designed to have an electrical and mechanical life greater than the airplane to which it is applied. Therefore, it should not be necessary to disassemble it unless it has been damaged by electrical short circuit or mechanical abuse. If damage has occurred, proceed as described below.

(1) Removal of Relay Coil: Remove the two coil leads from the coil terminals. Remove the four long screws (2), holding the relay mounting plate, coil assembly, and base together. Separate the parts on a clean surface, taking particular care to note the location and quantity of shim washers (16) between the bakelite base and the coil assembly, and the small shim washers (6) beneath the return spring in the bored hole in the plunger.

(2) Contacts and Solenoid Parts: Disassemble the relay as described above. Remove the two nuts (11) holding the bakelite cover (13) and (14). Remove the cotter key and washer, thus disconnecting the plunger (5) and pin (7) from the movable contact bar (9). The bakelite guide yoke (12) and movable contact bar may be removed. Take particular care to note the location and quantity of shim washers and spacers used between the various parts. It is important that all parts be reassembled with the shims and spacers in the same places from where they were removed. If the contacts need replacing, replace the complete base assembly (17) and the contact bar (9), and then check the stroke and wear allowance as described in this paragraph.

b. Inspection. - (1) Contacts: The silver alloy contacts do not require filing, cleaning or readjustment during the life of the contacts. To determine when the contacts should be replaced due to wear, proceed as follows:

(a) Place the assembled relay on a bench with the bakelite base up.

(b) Remove the bakelite cover.

(c) Connect the holding coil across a 24 volt, direct current supply with a suitable switch for interrupting the circuit.

(d) With the coil circuit open, hold the main contacts closed manually and then close the coil circuit.

(e) If a definite click is heard from within the relay, the contacts still have sufficient material and do not need replacing. If no apparent click can be heard, replace the contacts as described in this paragraph.

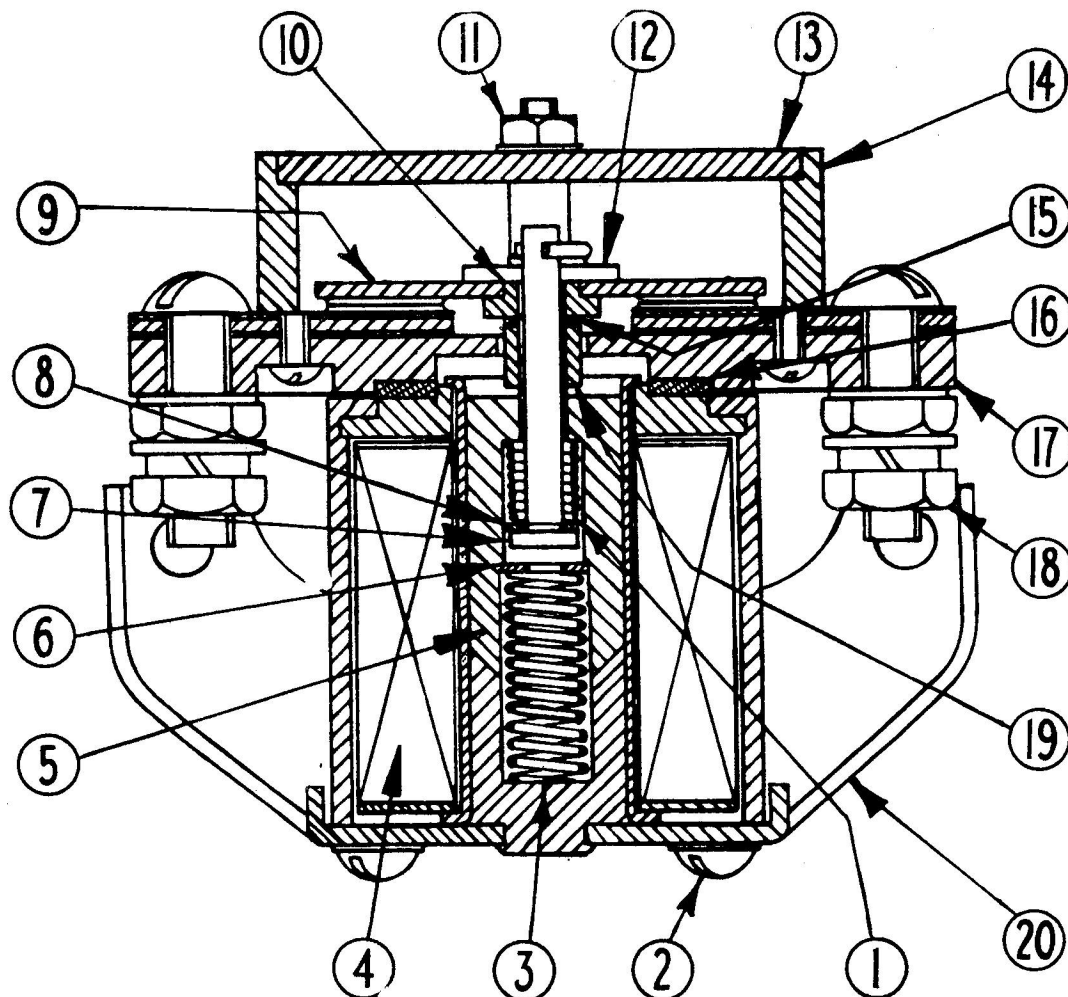
(2) Coil: Test the coil for open circuit, grounds, or shorts in the following manner:

(a) Disconnect the coil leads from the relay terminals.

(b) Connect a 110 volt test lamp circuit across the coil leads. If the lamp fails to light, the coil is open and must be replaced.

(c) Connect one lead of the test lamp circuit to one of the coil terminals and touch the other lead to the metal case around the coil. If the lamp lights, the coil is grounded, and must be replaced.

(d) To test for a shorted coil, measure the resistance between the coil terminals with a wheatstone bridge or some other suitable device. The coil resistance must be 66 ohms \pm 10% at 20° C. (68° F.).



Index No.	Description	No. Req.	Part No.
1	Spring	1	69-858
2	Screw	4	11-839
3	Spring, load	1	69-880
4	Coil	1	1031-1
5	Plunger	1	51-409
6	Washer, plunger	1	16-618
7	Pin	1	13-1463-3
8	Washer, shim	1	16-862-5
9	Bar, contact assembly	1	23-1466
10	Bushing, insulating	1	56-1174-3
11	Nut, cover	2	815-150
12	Guide	1	54-891
13	Cover	1	47-1814-4
14	Insulation	1	56-1207-3
15	Washer, shim	1	16-862-5
16	Washer, shim, below coil	1	16-863-3
17	BASE ASSEMBLY, Includes terminals guide posts and stationary contacts	1	17-1660-7
18	Nut, terminal	4	15-353
19	Spacer	1	29-1532-3
20	Mounting Plate Assembly	1	17-1661-7

FIG. 4 - SECTIONAL VIEW - TYPE B-4 BATTERY AND STARTER CIRCUIT RELAY

c. Measurement of Stroke and Wear Allowance (Figure 4). - Remove the bakelite cover from the relay. Remove the contact bar (9) and reassemble the relay without the contact bar and cover. The allowable travel of the pin (7) must be between .080" to .090". If not within this range, correction can be obtained by removing or adding shim washers (16) between coil and bakelite base. When these tolerances have been met, reassemble the relay with the movable contact bar (9), and again measure the travel of the pin. The difference between the travel of the pin with and without the movable contact should be between .025" and .032". If not within this range, correction can be obtained by adding or removing shim washers (15). This dimension constitutes the wear allowance.

d. Measurement of Contact Pressure. - With the bakelite base down, attach the relay to a suitable support by means of the bracket provided. Connect a 24 volt test lamp circuit across the heavy relay terminals, and connect a 24 volt, direct current supply to the holding coil terminals. By means of a string looped over the movable contact bar, conduct test and suspend weights described as follows:

(1) The contacts should not open when a weight of less than 5 lbs. is suspended and should open when a weight of 7-1/2 lbs. is suspended.

(2) If the contacts open when a weight of less than 5 lbs. is suspended from the contacts, correction may be made by the addition of laminated shim washers (8).

(3) These relays, as shipped from the factory, have a final contact pressure between 5 and 7 lbs. with full wear allowance.

e. Test Procedure. - Connect the coil terminals to a variable direct current supply. Connect a 0-50 scale voltmeter across the coil terminals. A lamp circuit should be connected across the heavy relay terminals to serve as an indicator when the relay operates. Gradually increase the supply voltage and record the voltage at which the relay closes. This value must be 18.0 volts or less at room temperature. If the above value is obtained, gradually reduce the voltage from this closing value and note the voltage at which the relay opens. This value must be 7 volts or less when the contact pressure measures within the tolerance described in this paragraph. If none of these values can be obtained, replace the relay.

f. Reassembly. - To reassemble the relay, follow the disassembly instructions in reverse order, taking particular care that all shim washers are replaced in the same places from where they were removed. If either the contacts or the coil are replaced, measure stroke, wear allowance and contact pressure as instructed above.

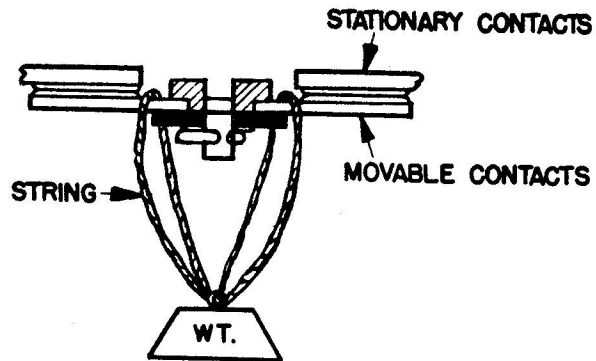


FIGURE 5
TEST STAND FOR MEASUREMENT OF CONTACT PRESSURE

ASSEMBLY PARTS LIST

Type E-4 Battery and Starter Circuit Relay - Cutler-Hammer

Dwg. No.	Part No.		Qty Req.
D10-635	6041H17A	RELAY ASSEMBLY, CURRENT - TYPE E-4	1
B17-1927	17-1660-7	BASE ASSEMBLY	1
E17-1695	17-1695	Base	1
A18-622	18-534-3	Post, guide	2
A62-153	62-153	Piece, post	2
A23-1561	23-1468-2	Plate, contact assembly	2
A23-1562	23-1467	Bar, contact assembly	2
AN-935-616	916-196	Lock Washer, 3/8"	2
N.D.	816-809	Washer, 3/8"	2
N.D.	16-873	Washer, shakeproof 3/8"	2
325B6	15-353	Nut, terminal (hex. #6-32)	4
AN515B6-14	811-59	Screw, round head (#6-32 x 7/8" long)	2
AN340B6	815-150	Nut, cover (hex. #6-32)	2
936A6	16-849	Washer, shakeproof #6	6
AN315B6-4	811-328	Screw, round head (#6-32 x 1/4" long)	2
N.D.	816-93	Washer, 1/4" dia. brass	2
N.D.	915-2422	Nut, hex. #8	4
A56-1306	56-1207-3	Insulation	1
A47-2009	47-1614-4	Cover	1
A13-1607	13-1463-3	Pin	1
A54-891	54-891	Guide	1
A23-1563	23-1466	Bar, contact assembly	1
A56-1298	56-1174-3	Bushing, insulating	1
A16-952	16-862-5	Washer, shim	2
929-1658	29-1532-3	Spacer	1
A16-948	16-863-3	Washer, shim, below coil	1
A69-858	69-858	Spring	1
A16-618	16-618	Washer, plunger	1
A51-409	51-409	Plunger	1
A69-880	69-880	Spring, load	1
A9-1031-1	1031-1	Coil	1
A17-1926	17-1661-7	Plate, mounting assembly	1
A51-403	51-403	Plug, core	1
A17-1698	17-1698	Mounting, plate	1
N.D.	913-919	Pin, cotter (1/16" x 3/8" steel)	1
AN960B10	816-481	Washer #10, brass	1
N.D.	11-839	Screw, #8-32 x 2-3/8" long	4
936AE	16-874	Washer, #8 shakeproof, steel	4
N.D.	815-150	Nut, #6 hex., brass	6
AN936-5	16-328	Lock Washer #6, steel	2
N.D.	816-69	Cup Washer, #6, brass	2
N.D.	816-79	Washer #6, brass	2

