EO 40-95AA-3

ROYAL CANADIAN AIR FORCE

REPAIR AND OVERHAUL INSTRUCTIONS

AIRCRAFT FIRE DETECTION SYSTEM TYPE A

EDISON

This EO replaces Interim Publication

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

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FOREWORD

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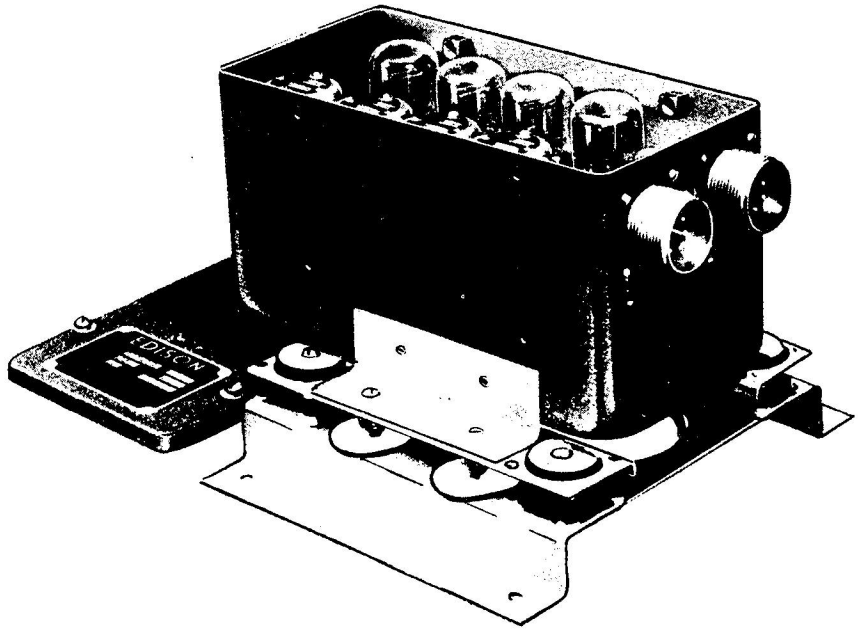

CONTROL ASSEMBLY

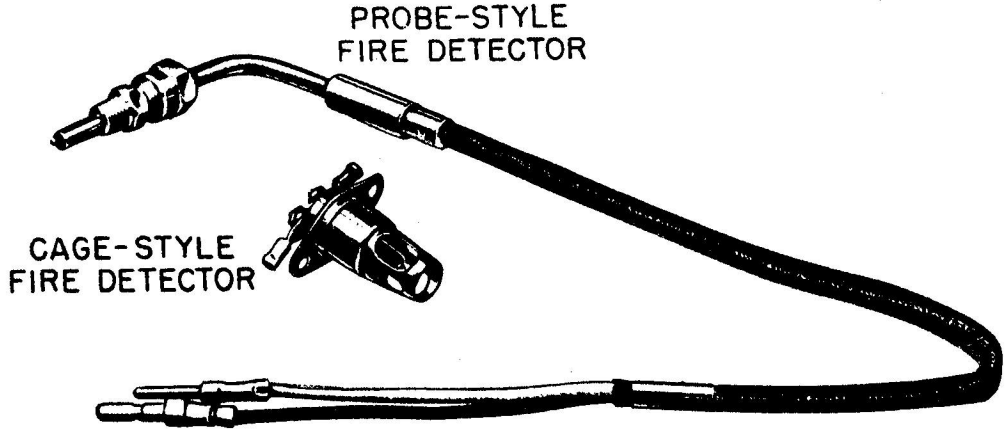

Figure 1-1 Typical Components of the Edison Type A Aircraft Fire Detection System

SECTION I

INTRODUCTION

1-1. This handbook is issued as the basic technical instructions for the Overhaul of Edison Type A, Aircraft Fire Detection Systems employing a combination of the components listed below. These parts are manufactured by the Instrument Division, Thomas A. Edison, Incorporated, West Orange, N. J.

COMPONENT	STYLE	USAF TYPE	USAF SPEC.	MFR'S PART NO.	REMARKS
DETECTOR (THERMOCOUPLE)	CAGE	--	--	33786 series	Has two No. 6 terminals
		--	--	35155 series	Has No. 6 and No. 8 terminals
		--	--	35534 series	Replaces No. 35155 and, with wiring terminal change, No. 33786
		F-1	41447	35534-2	
	PROBE	--	--	34606	Grounded
		--	--	34606-2	Ungrounded
		F-2	45001	810911	Replaces 34606-2
CONTROL ASSEMBLY (RELAY PANEL)*	1 CIRCUIT	A-1	45002	34368	
	2 CIRCUIT	--	--	34362-2	
		--	--	34974	
		--	--	34974-3	
		A-2	45003	34974-6	
		--	--	34974-7	
	4 CIRCUIT	--	--	33896-2	
		--	--	34399	
		--	--	34399-2	Use No. 34606 grounded detector.
		--	--	34726-2	
		A-3	45004	34726-4	
		--	--	34726-6	
	6 CIRCUIT	--	--	34958	
		--	--	35213	

* Control Assemblies are called Relay Panels under Edison nomenclature.

1-2. This system is designed to detect the presence of fire in aircraft power plants and other potential fire zones such as combustion heaters and hydraulic and electrical equipment compartments.

1-3. The system is a rate-sensitive device having a low time-constant. In a properly engineered installation no safe operating temperature can cause an alarm since the electrical characteristics of the detectors provide compensation for ambient temperature and for gradual rises due to engine warm-up or power runs.

1-4. Detectors are designed to operate in flame for two successive one minute periods and still produce an alarm when again subjected to fire. They are essentially unaffected by extreme vibration, oil, chemical action of aromatic fuels, or exposure to climatic conditions.

1-5. No current from the aircraft power supply ever flows through the detector circuit to become an additional hazard in the potential fire zone.

1-6. When the fire is out the alarm ceases and the system is immediately ready to give an alarm in case of reignition.

1-7. The integrity of the entire system, including the detectors, may be tested at any time by operating a simple test switch.

SECTION II

DESCRIPTION

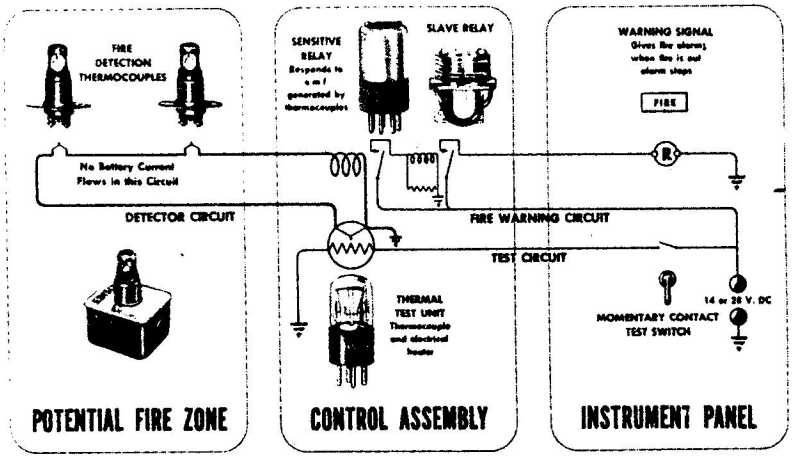

Figure 2-1 Basic Circuits of the System

2-1. GENERAL DESCRIPTION.

2-2. CIRCUITS. The Edison Type A Aircraft Fire Detection System is made up of three simple circuits; detector circuit, fire warning circuit, and test circuit. (See figure 2-1.) The detector circuit, which is permanently closed, consists of the detector thermocouples and a test thermocouple connected in series with the coils of the sensitive relay. The contacts of this relay, a slave relay, and such warning signal and other devices as may be required for the given installation, constitute the fire warning circuit which is energized by the aircraft power supply. The test circuit is made up of a momentary contact switch which sends current from the aircraft power supply to heating coils adjacent to the test thermocouple.

2-3. DETAILED DESCRIPTION.

2-4. DETECTOR THERMOCOUPLES. The fire sensing unit of the system consists essentially of two wires of dissimilar metals with their outer ends twisted and welded together. They are furnished in two designs; each for a specific application.

2-5. Cage-style detectors are used at strategic locations in potential fire zones where pressure sealed detectors are not required. The thermocouple wires are mounted in a heat-resistant insulator and surrounded by a stainless steel cage. (See figures 1-1, 2-1, and 2-2.) The cage is provided with openings to permit heat to reach the exposed "hot" junction with minimum interference while furnishing maximum mechanical protection. The reference junctions or points where the thermocouple wires are attached to terminal screws, lie within the insulator.

2-6. Probe-style detectors are used where a pressure sealed detector is required as in aircraft engine fuel induction systems, (See figure 1-1.) The "hot" junction is at the end of a supporting stem which extends through a pressure tight fitting into the potential fire zone. The connection between the leads and the circuit furnish reference junctions outside the fire zone. Probe-style detectors are made in both grounded and ungrounded models which can not be used interchangeably.

2-7. CONTROL ASSEMBLY. A control assembly, also known as a relay panel, which is mounted in any accessible location, furnishes a suitable housing for the sensitive relay, slave relay, and thermal test unit. (See figure 1-1.) These panels have been supplied in models to serve one to six detector circuits.

2-8. The sensitive relay is an entirely enclosed unit provided with a seven-pin base for plug-in mounting in the panel.

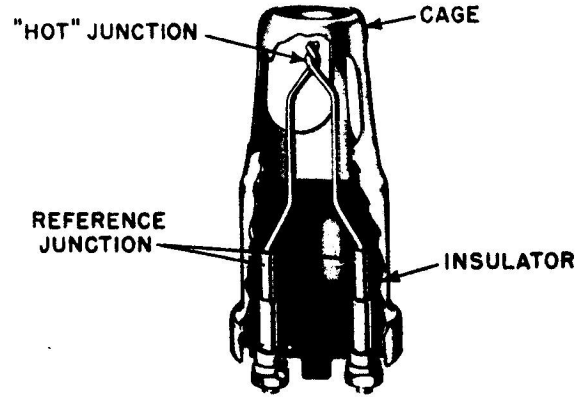

Figure 2-2 Cut-away of Cage-Style Detector (Thermocouple)

(See figures 2-1 and 2-3.) The moving element is a small permanent magnet which is pivoted between two stationary field coils.

2-9. Since the load-carrying ability of the sensitive relay is necessarily limited, a slave relay is employed. (See figure 2-1.)

2-10. The thermal test unit consists of a thermocouple with a pair of heating coils adjacent to its "hot" junction. (See figure 2-1.). In order to secure uniformity of operation and to insure long service life, these parts are sealed within a glass bulb. A four-pin base provides for plug-in mounting in the relay panel.

2-11. WARNING DEVICES AND TEST SWITCHES. These devices, which are not supplied by the manufacturer of the fire detection system, vary with the installation involved. Warning lights for each detector circuit as well as a master visual warning signal actuated by all circuits is usual. However, in some installations two or more circuits are connected to operate a single warning device.

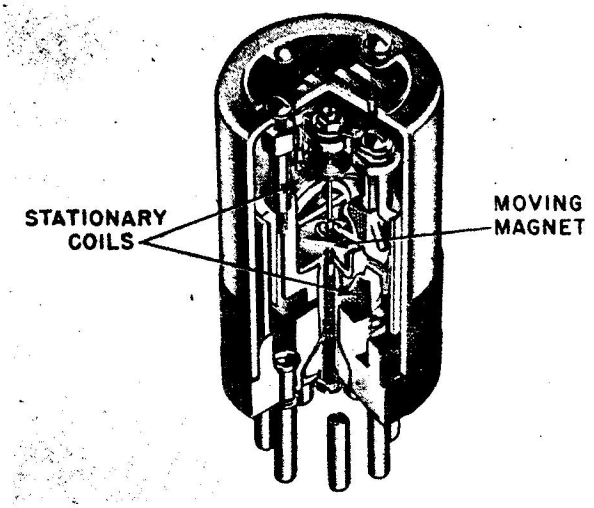

Figure 2-3 Cut-away of Sensitive Relay

SECTION III

OPERATION

3-1. PRINCIPLES OF OPERATION.

3-2. The Edison Type A Aircraft Fire Detection System is unique in that thermocouples are used as the fire sensing units. An alarm occurs only when temperature rises at an abnormal rate, and not because it has reached any fixed value. A thermocouple may be considered a simple power generator whose output results from a difference in temperature between its "hot" and reference junctions. The operation of the Edison fire detector thermocouple, however, must not be confused with that of the more conventional thermocouple used to actuate certain types of temperature indicators. In the latter, the object is to compare a variable temperature with a fixed standard. For that reason only the hot junction is exposed to the critical temperature, the reference junctions being completely isolated from its zone of influence.

3-3. The fire detection thermocouple, on the other hand, is designed to produce an e.m.f. proportional to rate of rise of temperature. Both junctions are located in the zone of influence of the variable temperature, with the reference junctions so insulated that their response to a change in ambient temperature will lag behind the response of the "hot" junction by a fixed time interval. The more rapid the change in ambient temperature, therefore, the greater will be the temperature difference between the "hot" and reference junction and the higher the output of the detector. (See figure 3-1.)

3-4. The fire detection system installation is so planned that the total output of all of the series-connected thermocouples of a detector circuit is insufficient to close the sensitive relay under normal operating conditions. Where necessary a resistor is included in the detector circuit to achieve this adjustment. However, under fire conditions the rate of temperature rise is so rapid that the output of any one detector will cause an alarm. Since only current generated by thermocouples ever flows through the detector circuit, grounded or broken wires can neither prove a fire hazard nor give a false alarm.

3-5. Operation of the test switch allows current from the plane's power supply to energize the heating coils adjacent to the thermocouple in the thermal test unit. The heat thus produced causes this test thermocouple to energize the detector circuit, of which it is a part, in the same manner as would a detector thermocouple under fire conditions. If all parts of the system are operating properly, an alarm results thus completely checking the integrity of the system.

3-6. OPERATING INSTRUCTIONS.

3-7. After turning on the power supply, and at any other time deemed necessary, operate the test switch to obtain a test alarm. Failure of any circuit to alarm within 15 seconds indicates a defect which might or might not prevent a fire signal.

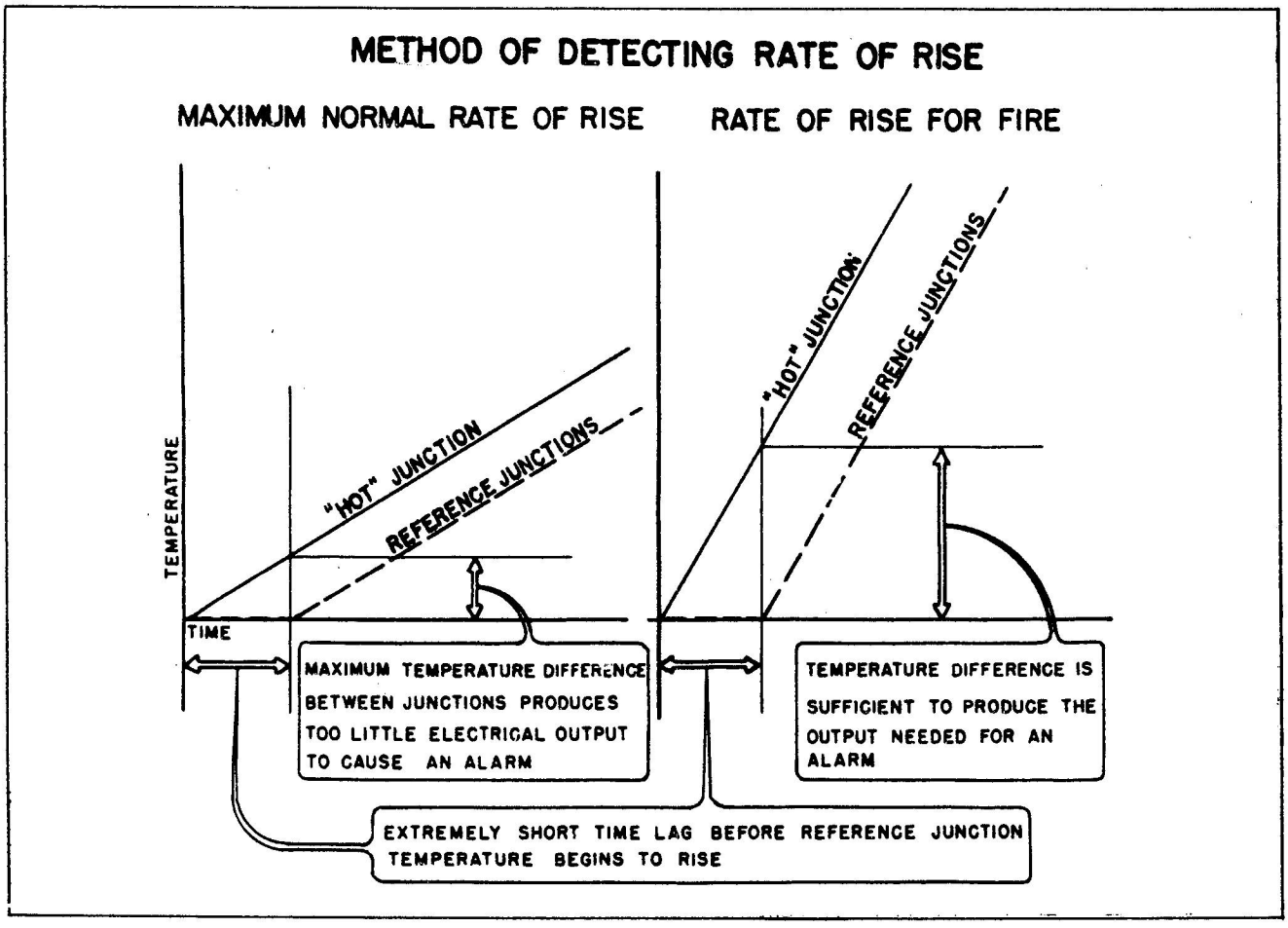

Figure 3-1 Principle of Operation

3-8. All other operation of the system is entirely automatic.

WARNING

Never endanger life or risk destruction of aircraft by ignoring an alarm indication! Inability to obtain an alarm during test proves only that system is not in perfect condition, but not necessarily that it is completely inoperative.

SECTION IV

DISASSEMBLY, INSPECTION, REPAIR AND REASSEMBLY.

4-1. OVERHAUL TOOLS REQUIRED.

4-2. Standard instrument tools are required for the overhaul of this equipment with the following exception! (See figure 5-1.)

Part No.	Nomenclature	Application
48D8129	Fire Detection System Tester	Checking operation of control assembly (relay panel), sensitive relay, and thermal test unit.
No Number	Detector Circuit Test Plug	Used with above tester for checking operation of control assembly.

4-3. A Detector Circuit Test Plug is made up to fit each model control assembly which is to be tested. This consists of the proper AN3106 plug with each pair of detector circuit terminals connected together through a 5 ohm resistor. See applicable control assembly wiring diagram for receptacle contact layout.

4-4. DISASSEMBLY OF DETECTOR.

4-5. A detector which has proved faulty when tested by the method specified in paragraph 5-6 must be replaced, since disassembly and repair of these devices is not practical.

4-6. DISASSEMBLY OF CONTROL ASSEMBLY.

4-7. Before beginning disassembly of a control assembly, (relay panel), perform the tests outlined in paragraph 5-7 to determine the condition of the device.

4-8. Complete control assemblies which are functioning properly in all respects need be disassembled only to the extent of removing sensitive relays, thermal test units, and the chassis in order to permit normal overhaul. Thermal test units and sensitive relays can then be individually tested.

4-9. Disassemble control assembly as follows:

a. Loosen fasteners (39) and separate panel assembly from shock mount assembly.

b. Loosen cover screws (1, figure 4-1) and remove the cover assembly.

c. Remove the plug-in sensitive relays (11) and thermal test units (12).

d. Remove the receptacle mounting screws (8) and push the receptacles (13 and 14) into the box (42).

e. Remove screws (9) and lock washers (10), then tip the chassis assembly and remove it from the box.

f. Unsolder connecting wiring from receptacles (13 and 14) thus freeing same.

g. Unsolder connecting wiring from relays (16 or 17), then remove screws (18) and lock washers (19), or nuts (20), lock washers (21), and spacing washers (22) thus freeing relay.

h. Unsolder resistor leads from socket terminals then remove resistors (23)

i. Mark on the under side of chassis (31) opposite the position indicator dot on the under side of each socket (24 and 25)

j. Unsolder connecting wiring from sockets then remove retaining rings (26) and sockets.

k. Drill out rivets (37 or 38) and remove fasteners (39)

l. Remove nuts (43), lock washers (44), and crash washers (45 and/or 46) and screws (47).

m. Drill out rivets (50 or 51 and 58) and remove vibration isolators (48) or notched shock mounts (49) and vibration isolators (57)

4-10. CLEANING, INSPECTION, TESTING, AND REPAIR OF CONTROL ASSEMBLY.

a. Blow accumulated dust from chassis and case.

b. If case is provided with shock mounts inspect condition of rubber and replace mount if necessary.

c. Check all wiring for loose connections and misplaced wires or worn insulation which might cause short circuits.

d. Check condition of receptacle pins and of test unit and sensitive relay sockets. Replace parts if defective.

e. Disconnect resistors and check their resistances with values shown on applicable panel wiring diagram. Replace defective resistors.

f. Inspect and clean slave relay contacts. Test operation of relays by energizing their windings directly, using the proper voltage. Replace defective relays.

4-11. REASSEMBLY OF CONTROL ASSEMBLY.

4-12. Reassemble control assembly as follows:

a. Attach fasteners (39, figure 4-1) by means of rivets (37 or 38).

b. Attach vibration isolators (48) or notched shock mounts (49), and vibration isolators (57) by means of rivets (50 or 51 and 58), position of isolator or shock mount to be with the word "LORD" in the load bearing direction.

c. Secure strap assembly to base assembly by means of screws (47), crash washers (45 and/or 46), lock washers (44), and nuts (43).

d. Install sockets (24 and 25) in chassis (31), observing position of indicator dot with reference to mark placed on chassis (31) in disassembly step, paragraph 4-9 i.

e. Secure sockets with retaining rings (26).

f. Secure relays (16 or 17) to chassis by means of screws (18) and lock washers (19), or nuts (20), lock washers (21), and spacing washers (22).

g. Install all wiring following applicable schematic. (See figures 4-7 through 4-15.)

h. Install resistors (23).

i. Install receptacles (13 and 14).

j. Tip the chassis assembly and slip it into the box (42), then slide receptacles into position in holes in box.

k. Secure chassis assembly to box assembly by means of screws (9) and lock washers (10).

l. Secure receptacles to box by means of screws (8).

m. Install sensitive relays (11) and thermal test units (12).

n. Place cover assembly on box and secure by means of cover screws (1).

o. Place panel assembly on shock mount assembly and secure by means of the fasteners (39).

4-13. After thermal test units and sensitive relays have been installed, test the control assembly as directed in paragraph 5-7.

4-14. DISASSEMBLY OF THERMAL TEST UNIT.

4-15. A thermal test unit which has proved faulty when tested by the method specified in paragraph 5-10 must be replaced, since disassembly and repair of these devices is not practical.

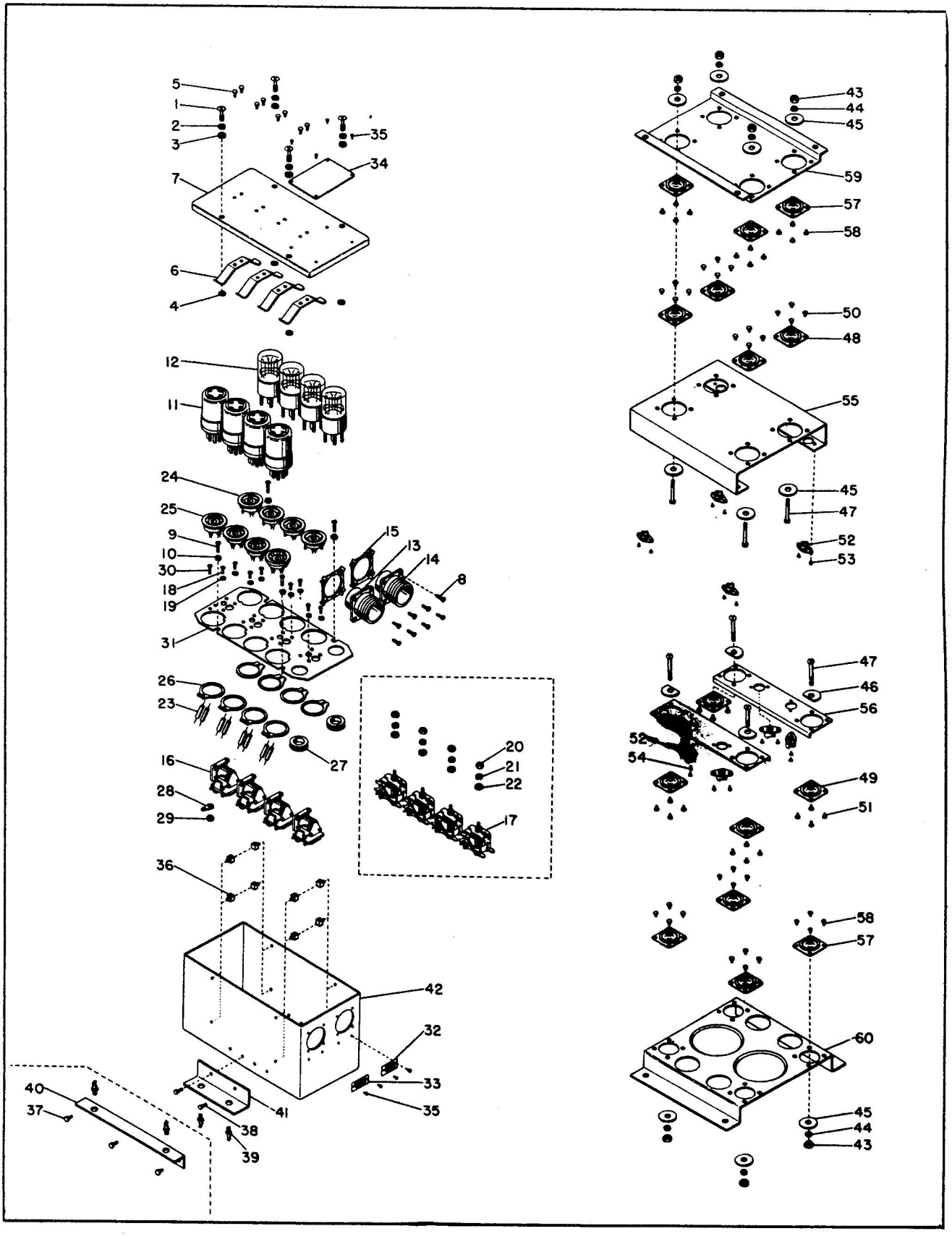

Figure 4-1 Exploded View of Typical Control Assembly

Index Number Key for Figure 4-1.

1 Cover Screw
2 Helical Lock Washer
3 Plain Washer
4 Fiber Washer
5 Round Head Rivet
6 Spring
7 Machined Cover
8 Round Head Sheet Metal Screw
9 Round Head Machine Screw
10 External Teeth Lock Washer
11 Sensitive Relay
12 Thermal Test Unit
13 Electrical Connector Receptacle
14 Electrical Connector Receptacle
15 Retainer Ring
16 Double Pole, Single Throw Relay
17 Double Pole, Single Throw Relay
18 Round Head Machine Screw
19 External Teeth Lock Washer
20 Hex Nut
21 Lock Washer
22 Spacing Washer
23 Resistor
24 Four-contact Socket
25 Seven contact Socket
26 Retaining Ring
27 Grommet
28 Locking Terminal
29 Hex Nut
30 Round Head Machine Screw
31 Chassis
32 Alarm Circuit Nameplate
33 Detector Circuit Namplate
34 Blank Nameplate
35 Flat Head Rivet
36 Machined Nut Plate
37 Flat Head Rivet
38 Round Head Rivet
39 Fastener
40 Angle
41 Angle
42 Machined Box
43 Hex Nut
44 Helical Lock Washer
45 Crash Washer
46 Slotted Crash Washer
47 Round Head Machine Screw
48 Vibration Isolator
49 Notched Shock Mount
50 Flat Head Rivet
51 Round Head Rivet
52 Receptacle
53 Countersunk Head Rivet
54 Countersunk Head Rivet
55 Bracket
56 Strap
57 Vibration Isolator
58 Flat Head Rivet
59 Base
60 Base

4-16. DISASSEMBLY OF SENSITIVE RELAY.

NOTE
This work should be accomplished only in an instrument repair shop.

4-17. Before beginning disassembly of a sensitive relay, perform the tests outlined in paragraph 5-11 to determine the condition of the device.

4-18. In repairing a relay, proceed to disassemble the instrument to the point required to make the necessary inspections and additional tests outlined in paragraph 4-20 to determine the cause of the trouble and permit application of the remedy specified in the trouble chart, paragraph 4-41.

4-19. Disassemble relay as follows:

a. Prepare a support block to hold the sensitive relay by boring a 1-3/16 inch hole through the center of a 4 inch square piece of wood 1 inch thick.

b. Reduce the diameter of the head of a 5-44 NF 2 x 3/16 inch screw to not over .165 in. (An AN501-5-3 screw is suggested.)

c. Place the relay base up in the support block.

d. Replace the housing nut lock screw (1, figure 4-2) and its lock washer (2) with the special screw prepared in step b.

NOTE
Early relays originally had a stop screw (32) in the stud behind the housing nut lock screw, thus the special screw is not required to hold the jewel plug assembly and jewel setting spring in place during disassembly of such relays.

e. If relay has a plastic seal covering the joint between the base and pin assembly (4) and the cover assembly, break and remove same.

f. Remove housing nut (3) from center of base and pin assembly without disturbing special screw installed in step d.

g. Dip the base contact pins into a pot of hot solder and gently lift the cover assembly, with the relay mechanism attached, from the base and pin assembly (4) as leads are loosened from pins.

h. Remove the cover gasket (5), if used, and with the solder on the pins softened by again dipping into solder pot, blow solder out of pins by means of compressed air.

i. Remove the two cover screws (7) and lock washers (8) or the self-locking cover screws (6) and withdraw cover assembly from relay mechanism.

j. Remove posts (13) from coil housing assembly (38).

k. Slide shield (14) off lower end of mechanism.

CAUTION
Avoid distorting the shield.

l. Lift coil assemblies (15) off of coil housing assembly (38) and pull coil side springs (16) out of coils.

m. Unsolder hairspring (30) from setting lever (18).

n. Unsolder flexible insulated leads from contact wire terminal and setting lever (18) or setting lever lug (20).

o. Remove jewel lock shoulder nut (17), setting lever (18), jewel clamping lock washer (19), and setting lever lug (20) or flat washer.

p. Remove jewel screw assembly (21).

q. Remove the two bridge mounting screws (22), lock washers (23), and flat washer (24).

r. Lift off bridge assembly, being careful not to damage contact wire (25).

s. Remove stop plate assembly (27) and

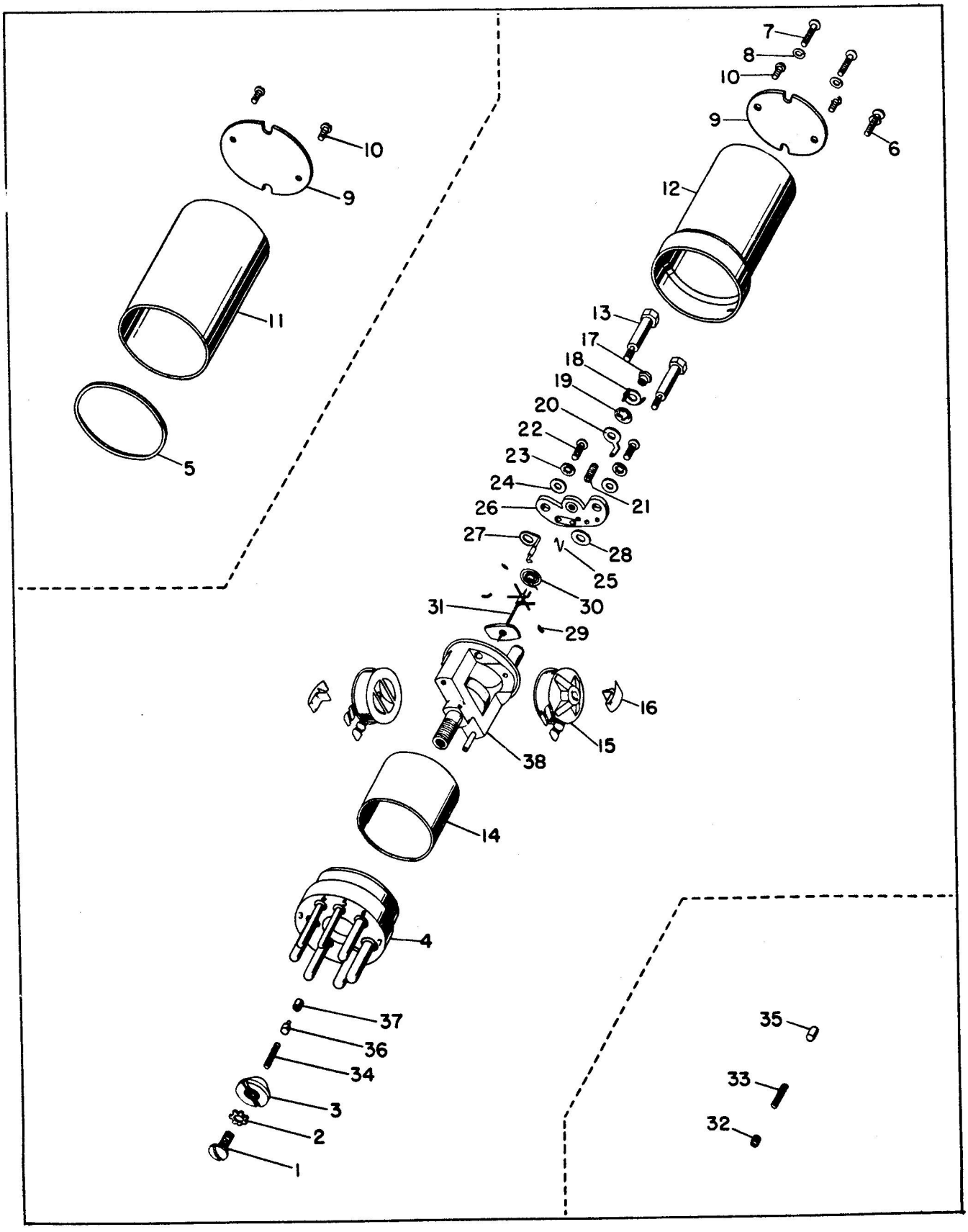

Figure 4-2. Exploded View of Sensitive Relay

Index Number Key for Figure 4-2.

1 Binder Head Machine Screw
2 External Teeth Lock Washer
3 Housing Nut
4 Base and Pin Assembly
5 Cover Gasket
6 Round Head "Sems" Machine Screw
7 Round Head Machine Screw
8 Helical Lock Washer
9 Blank Nameplate
10 Drive Screw
11 Aluminum Cover
12 Iron Cover
13 Post
14 Shield
15 Coil Assembly
16 Side Spring
17 Jewel Lock Shoulder Nut
18 Setting Lever
19 Jewel Lock Clamping Washer
20 Setting Lever Lug
21 Jewel Screw Assembly
22 Round Head Machine Screw
23 Internal Teeth Lock Washer
24 Plain Washer
25 Contact Wire
26 Bridge Assembly less Contact Wire
27 Stop Plate Assembly
28 Plain Washer
29 Balance Weight
30 Hairspring
31 Rotor Assy. less Weights and Hairspring
32 Set Screw
33 Jewel Setting Spring
34 Jewel Setting Spring
35 Jewel Plug Assembly
36 Jewel Plug Assembly
37 Adapter Collar
38 Coil Housing Assembly

spacing washer (28).

t. Lift out rotor assembly being careful not to damage hairspring (30).

u. Remove balance weights (29) by sliding off of balance cross. If grasped lengthwise with tweezers they will be straightened so that they slide freely.

v. Unsolder inner end of hairspring (30) and remove hairspring.

w. Remove special screw installed in step d, or stop screw (32) if originally in relay.

x. Remove jewel setting spring (33 or 34) and jewel plug assembly (35 or 36). If relay was equipped with a stop screw and short compression spring, it will probably be necessary to drive out the plug and spring by means of a narrow punch.

4-20. CLEANING, INSPECTION, TESTING AND REPAIR OF SENSITIVE RELAY.

4-21. BASE AND PIN ASSEMBLY.

a. Check for cracked plastic and loose or bent contact pins.

b. Replace if defective.

4-22. COIL ASSEMBLIES.

a. Check coil to be sure resistance is 1.7 ±0.1 ohms.

b. Replace if out of tolerance.

4-23. HAIRSPRING.

a. Check hairspring to be sure its convolutions are approximately equidistant and in plane at right angles to the rotor shaft.

b. Check for corrosion.

c. Correct slight misalignment by bending gently with tweezers.

d. Replace if defective.

4-24. JEWELS. - In cases of excessive friction, first attempt correction by inspecting, cleaning, and if necessary replacing the jewel plug assembly. If this does not correct the trouble, check jewel screw assembly, pivots, and rotor assembly.

a. Using a No. 10 steel needle, whose point has been stoned until it appears sharp under a microscope with 40X magnification, explore the lower portion of the jewel cavity for cracks or roughspots.

b. Examine the jewel with 40X magnification for cracks which extend into the cavity or have the appearance of possibly continuing through the jewel to that point. Small cracks around the edges of the jewel will not cause interference with operation of the relay.

c. Replace the jewel plug assembly or jewel screw assembly if defective.

d. Before reassembly, clean the jewel with a sharp pointed orange stick.

4-25. JEWEL SETTING SPRING.

a. Examine the jewel setting spring to be sure it has not been distorted. Its free length should be .600 ± .030 in.

b. If spring is defective, or if of old short type formerly used in conjunction with a stop screw (see note paragraph 4-19, step d) replace with new type spring No. NA20596 and discard the stop screw.

4-26. PIVOTS.

a. With the rotor assembly removed from the coil housing assembly, inspect pivots with 40X magnification.

b. Replace rotor assembly if pivots are rusty, worn, or distorted.

c. Before reassembly, clean pivots by inserting them in a piece of fernwood or pith.

4-27. ROTOR ASSEMBLY.

a. When the rotor assembly has been removed, inspect both it and the coil housing assembly to see that they are free from dust, lint, and iron filings.

b. If balance cross or magnet vane is loose on shaft, replace rotor assembly.

c. Remagnetize the magnetic vane using a magnetic field of at least 2400 ampere turns. South magnetic pole of vane is end on contact wire side of rotor. (See figure 4-4.)

4-28. CONTACT WIRE.

CAUTION

Do not touch contact wire (25) with fingers.

a. Inspect hollow rivet which attaches contact wire to bridge.

b. If rivet is loose, solder it to the metal plate through which it passes.

c. Inspect contact wire for evidence of arcing or distortion.

d. If contact wire is defective, or if relay has had 3000 hours of service, unsolder wire. Solder new wire (Edison No. NA20817) in its place and bend to shape. (See figure 4-6.)

4-29. BALANCE WEIGHTS. If balance weights are loose on balance cross, remove them and bend them slightly.

4-30. REASSEMBLY OF SENSITIVE RELAY.

4-31. REASSEMBLY PROCEDURE.

NOTE

It is recommended that the procedure outlined below be followed for all relays regardless of the fact that in older types some parts may be replaced in positions differing from those in which they were originally installed.

a. Holding coil housing assembly (38, figure 4-2) in upright position with hole for lead wires away from observer, place the stop plate assembly (27) on the left bridge support stud and the spacing washer (28) on the right stud.

b. Place the bridge assembly upon the studs with the contact wire on the same side of the studs as the lead wire hole.

c. Pass the two bridge mounting screws (22) through their lock washers (23) and flat washers (24) and secure the bridge to the studs therewith.

d. Screw the jewel screw assembly (21) into the bridge assembly until the jewel is flush with the lower side of the insert in the bridge.

e. Install the adjusting lever lug (20) on the jewel screw assembly with its terminal end projecting downward through the mating hole in the bridge. (See figure 4-3.) If a flat adjusting lever washer is used in place of the lug, install it on the jewel screw assembly.

f. Install the jewel clamping lock washer on the jewel screw assembly with its small face toward the bridge. (See figure 4-3.)

g. Place the setting lever on the jewel screw with the end which forms a 90 degree angle downward. (See figure 4-3.)

h. Place the jewel lock shoulder nut on the jewel screw assembly. (See figure 4-3.)

i. Solder the blue lead to the terminal of the left stationary contact wire. (See figure 4-3.)

j. Solder the orange lead to the setting lever lug terminal or, if none is used, to the upturned end of the setting lever. (See figure 4-3.)

k. Twist together blue, and orange wires, and pass them downward through the lead wire hole in the coil housing assembly. If orange lead is soldered directly to setting lever, allow sufficient lead length to permit lever to reach extreme adjustment position without tightening the wire. (See figure 4-3.)

l. Place the coil assemblies (15, figure 4-2) in position upon the coil housing assembly (38).

m. Press the coil side spring (16) into place with the bent ends away from the bridge assembly.

n. Slide the shield (14) up over the coil end of the housing assembly until it seats against the flange.

o. Straighten the coil assembly leads so that each projects straight downward one inch below the lower edge of the shield. If necessary, unwind leads from anchor lugs of coil assembly, but leave at least two turns around each lug. Leads that are too short may be spliced.

p. Remove insulation from ends of all six leads to within 1/2 inch of shield.

q. With base and pin assembly (4) positioned so that hole between No. 1 and No. 7 contact pins lines up with brass guide pin in bottom of coil housing assembly (38), slip base and pin assembly (4) over hollow threaded stud, allowing leads to pass into and through their respective contact pins. (See figure 4-4.)

r. Place housing nut (3, figure 4-2) on hollow threaded stud and tighten.

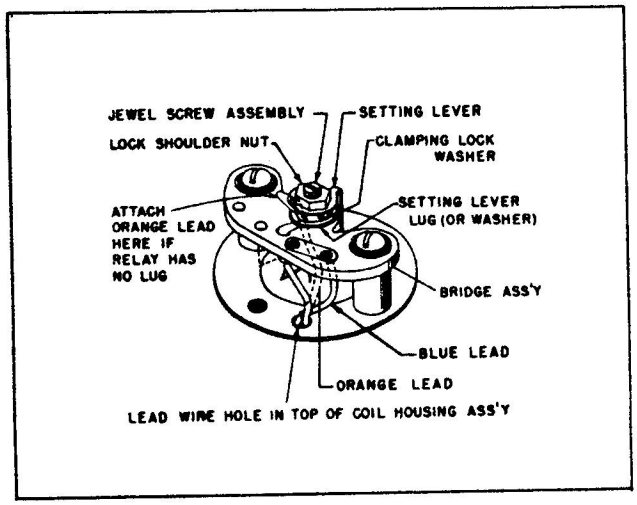

Figure 4-3 Detail of Relay Bridge Region

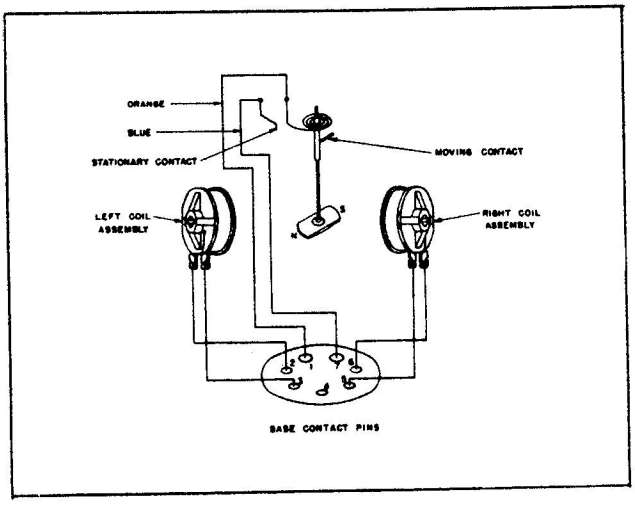

Figure 4-4 Relay Pin Connections

s. Clip leads off flush with ends of contact pins.

t. Place cover assembly over mechanism to protect same from fumes then dip base contact pins 1/8 inch into hot solder in solder pot, thus securing leads to pins.

u. With cover assembly still in place, stand relay base-up in support block prepared in paragraph 4-19, step a.)

v. Drop jewel plug assembly (35 or 36), jewel down, into hollow threaded stud of coil housing assembly (38)

NOTE

The following components of the Model 103 relay have been redesigned.

PART	OLD P/N	NEW P/N
Rotor Assy.	NA45026	NA45048-1
Bridge Assy.	NA40426	NA40490-1
Jewel Screw Assy.	NA40425	NA49514
Coil Housing Assy.	NA40221	NA45047
Jewel Plug Assy.	NA40428	NA49513
Adapter Collar	-----	NA20754

Interchangeability of rotor, bridge, and jewel screw assemblies is unaffected. New coil housing assembly, identified by "A" stamped inside of damping cup, requires new jewel plug assembly. New jewel plug assembly plus adapter collar (supplied therewith as a spare part) can be used in old coil housing assembly.

w. Install jewel setting spring (33 or 34). Replace old type short spring with No. NA20596.

x. Insert housing nut lock screw (1) fitted with its lock washer (2) in hollow stud and screw tight.

y. Grasp balance weights (29) with tweezers in the position which will straighten them. Slide them onto arms of balance cross.

z. With hairspring (30) spiraling outward in a clockwise direction, solder its inner end to the outside of the upturned end of the balance cross and .015 in. below top of same. (See figure 4-5.)

aa. Turn relay base down in support block and remove cover assembly.

ab. Using care to avoid damaging hairspring, place the rotor (31, figure 4-2) in the coil housing assembly (38).

ac. Using tweezers seat the lower pivot in the lower jewel, then tighten the jewel screw (21) just sufficiently to seat the upper pivot within the jewel cavity.

ad. Solder the outer turn of the hairspring to the setting lever, keeping the hairspring parallel to the bridge. (See figure 4-6.)

ae. Screw the two posts (13, figure 4-2) into the flange of the coil housing assembly (38).

af. Place cover gasket (5), if used, on flange of base and pin assembly (4).

NOTE

It is recommended, but not mandatory, that cover No. NA40240 be substituted for cover No. NA40220 and gasket No.NA13116 for inproved magnetic shielding.

ag. Slip cover assembly down over mechan — ism.

ah. Secure cover in place by means of self-locking cover screws (6) or screw (7) and lock washers (8).

4-32. ADJUSTMENT OF SENSITIVE RELAY.

4-33. STABALIZATION. Place reassembled relay in a cold chamber having a temperature of -65°C for at least one hour, after which heat to 70°C to dry. Allow to return to room temperature.

4-34. JEWEL SCREW.

a. Remove cover assembly from relay.

b. Loosen jewel lock shoulder nut (17, figure 4-2) sufficiently to permit turning of jewel screw assembly (21).

c. Turn jewel screw down just far enough to cause interference with free rotor

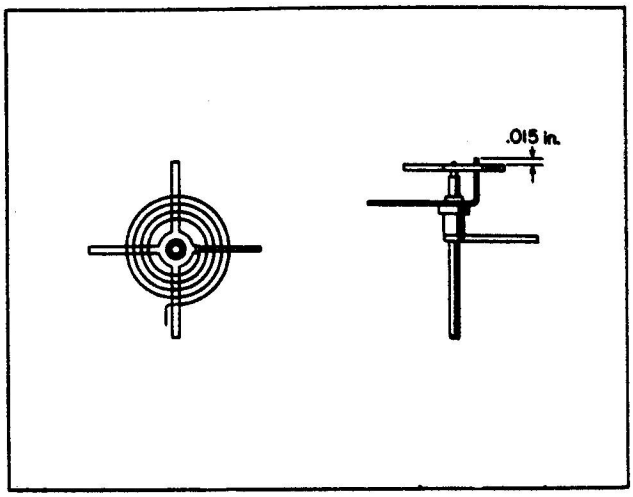

Figure 4-5 Position of Hairspring on Rotor

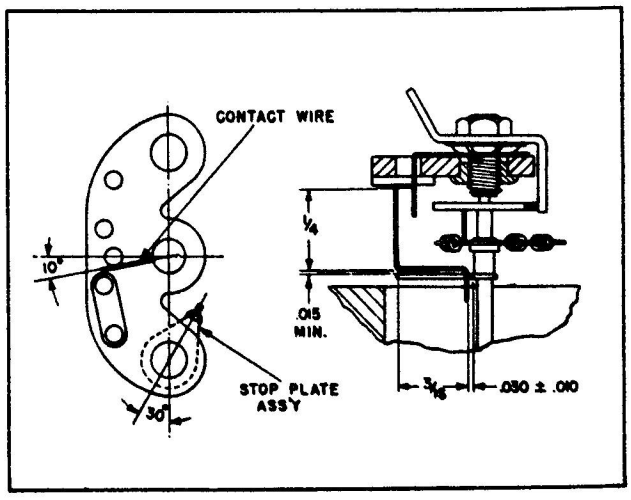

Figure 4-6 Position of Stationary Contact Wire and Stop Plate Assembly

motion, then back screw off 1/8 turn.
d. Tighten jewel lock shoulder nut (17).

4-35. CONTACT WIRE.
a. Bend the stationary contact wire (25) to the proper position. (See figure 4-6.)
b. Clean both stationary and moving contacts with toluene, specification No. AN-T-541, or naphtha, specification No. AN-N-3.

4-36. STOP PLATE ASSEMBLY.
a. Loosen bridge mounting screw (22, figure 4-2) just enough to permit stop plate assembly (27) to be rotated.
b. Adjust position of stop plate assembly to cause rotor balance cross arm to strike ceramic bushing 10 to 15° beyond point where contact wires first touch.
c. Tighten screw (22).

4-37. HAIRSPRING POSITION. Adjust hairspring so that its convolutions are approximately equidistant and in a plane at right angles to the rotor shaft.

4-38. HAIRSPRING TENSION.
a. Place the relay in the socket of the Fire Detection System Tester.
b. With the socket resting on the table so that the relay is in a vertical position, adjust current to 4.3 ma.
c. Move setting lever until relay just closes.

4-39. ROTOR BALANCE.
a. With relay still in test stand socket, adjust the current to turn the rotor until balance cross side arms are in line with bridge supporting studs.
b. Tip the relay 90 degrees forward to horizontal position, and holding socket stand upon top of test stand cabinet or other solid support, adjust side balance weights to cause rotor to assume position with side arms in line with studs.
c. With relay still in horizontal position, rotate it 90 degrees.
d. Adjust center balance weight to cause rotor to resume above position.

4-40. FINAL ADJUSTMENT AND TESTS.
a. Apply the tests specified in paragraph 5-11, adjusting hairspring tension and rotor balance until calibrated to tolerance specified.
b. After cover has been installed, repeat above tests.

4-41. SENSITIVE RELAY TROUBLE CHART.

TROUBLE	PROBABLE CAUSE	REMEDY
RELAY FAILS TO RETURN CIRCUIT TO NORMAL CONDITION WHEN NOT ENERGIZED	Incorrect hairspring adjustment.	Adjust hairspring.
	Upper jewel screw too tight.	Adjust jewel screw.
	Dirty or defective jewel.	Clean jewels or replace jewel screw or jewel plug assembly.
	Defective pivot.	Clean pivot or replace rotor assembly.
	Foreign matter on rotor.	Clean rotor and housing assembly.
	Bent contact wire.	Reshape oontact wire.
	Deformed hairspring.	Reshape or replace hairspring.
	Welded contacts.	Replace bridge assembly.
	Shorted blue and orange leads.	Insulate or replace leads.
RELAY FAILS TO FUNCTION WITH MAXIMUM SAFE TEST CURRENT	Incorrect hairspring adjustment.	Adjust hairspring.
	Upper jewel screw too tight.	Adjust jewel screw.
	Dirty or defective jewel.	Clean jewels or replace jewel screw or jewel plug assembly.
	Defective pivot.	Clean pivot or replace rotor assembly.
	Foreign matter on rotor.	Clean rotor and housing assembly.
	Bent contact wire.	Reshape contact wire.
	Open coil.	Replace coil.
	Open coil lead or pin connection.	Resolder or repair lead.
	Coil to pin connection reversed.	Correct the connection.
	Open blue or orange lead.	Resolder or replace lead.

TROUBLE	PROBABLE CAUSE	REMEDY
RELAY FAILS TO OPERATE WITH RATED CURRENT	Incorrect hairspring adjustment. Upper jewel screw too tight. Dirty or defective jewel. Defective pivot. Rotor demagnetized.	Adjust hairspring. Adjust jewel screw. Clean jewels or replace jewel screw or jewel plug assembly. Clean pivot or replace rotor assembly. Remagnetize rotor.

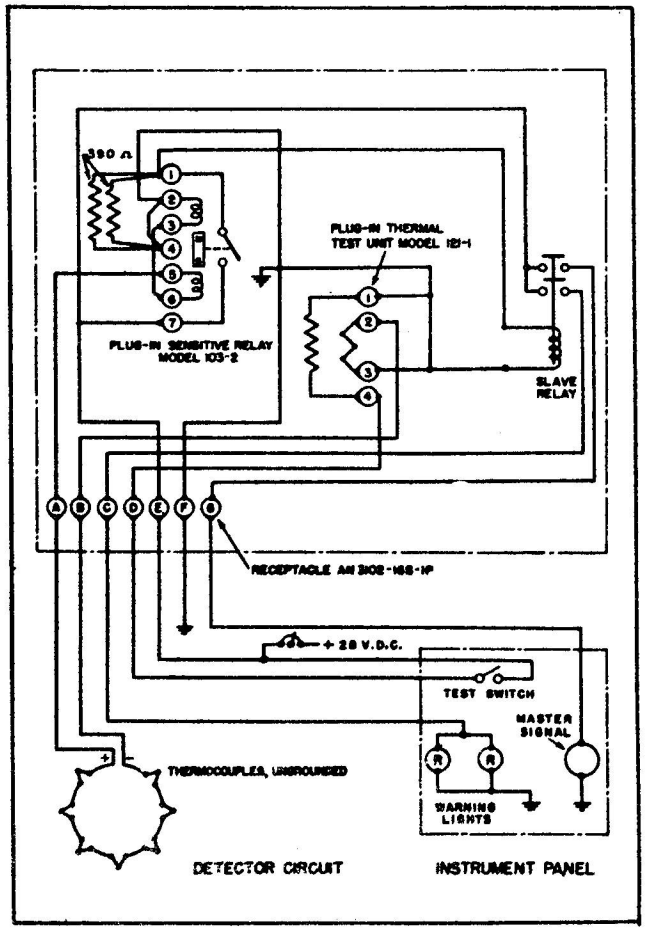

Figure 4-7 Wiring Diagram for Control Assembly, Part No. 34368

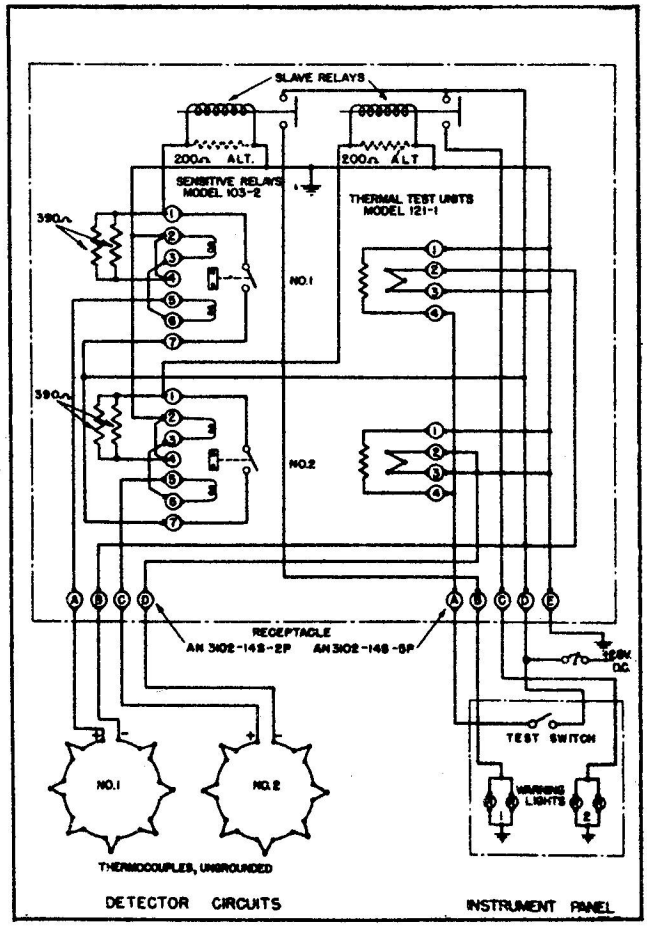

Figure 4-8 Wiring Diagram for Control Assemblies, Part No. 34362-2 and 34974. (used in North Star Aircraft)

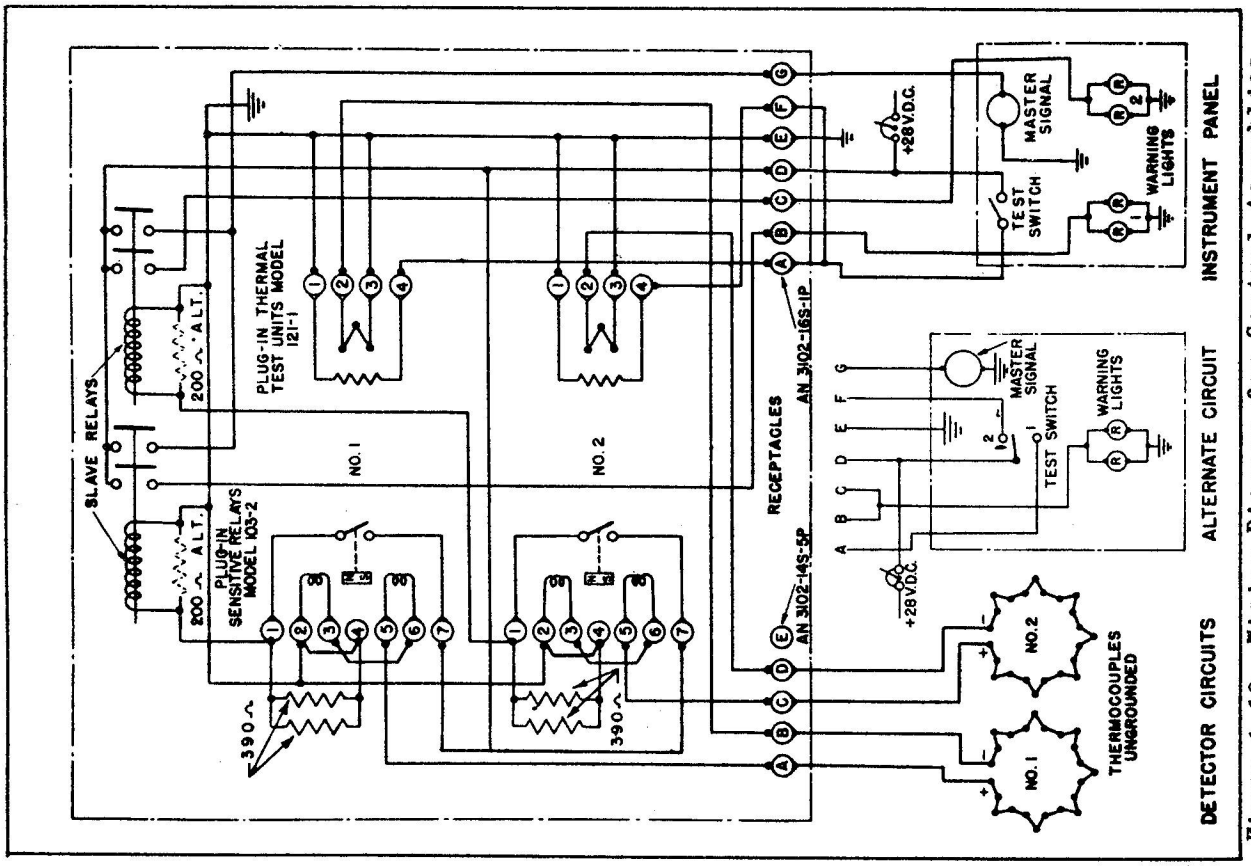

Figure 4-10 Wiring Diagram for Control Assemblies, Part No. 34974-6 and 34974-7

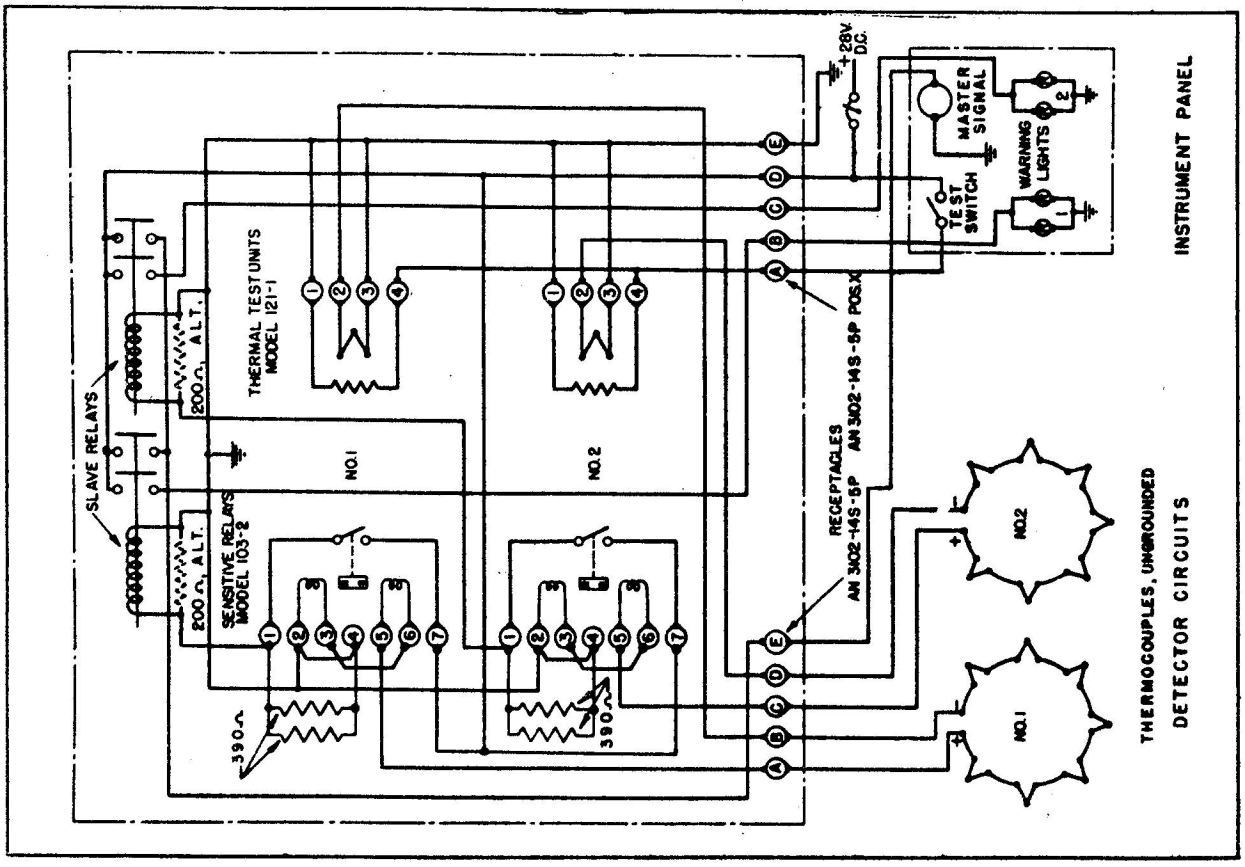

Figure 4-9 Wiring Diagram for Control Assembly, Part No. 34974-3 and 35884 (used in Dakota and Expeditor Aircraft)

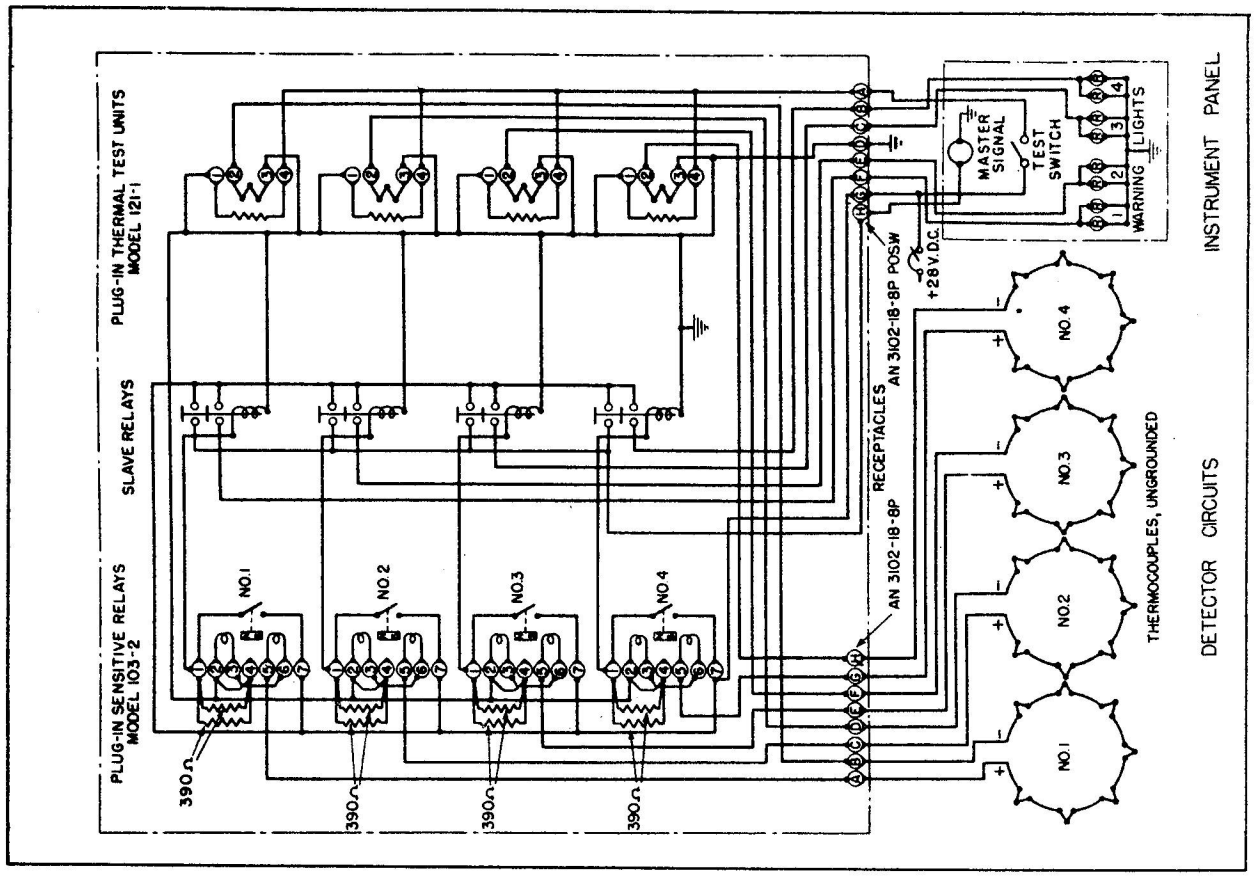

Figure 4-12 Wiring Diagram for Control Assemblies, Part No. 34399 and 34726-2 (used in Mitchell Aircraft)

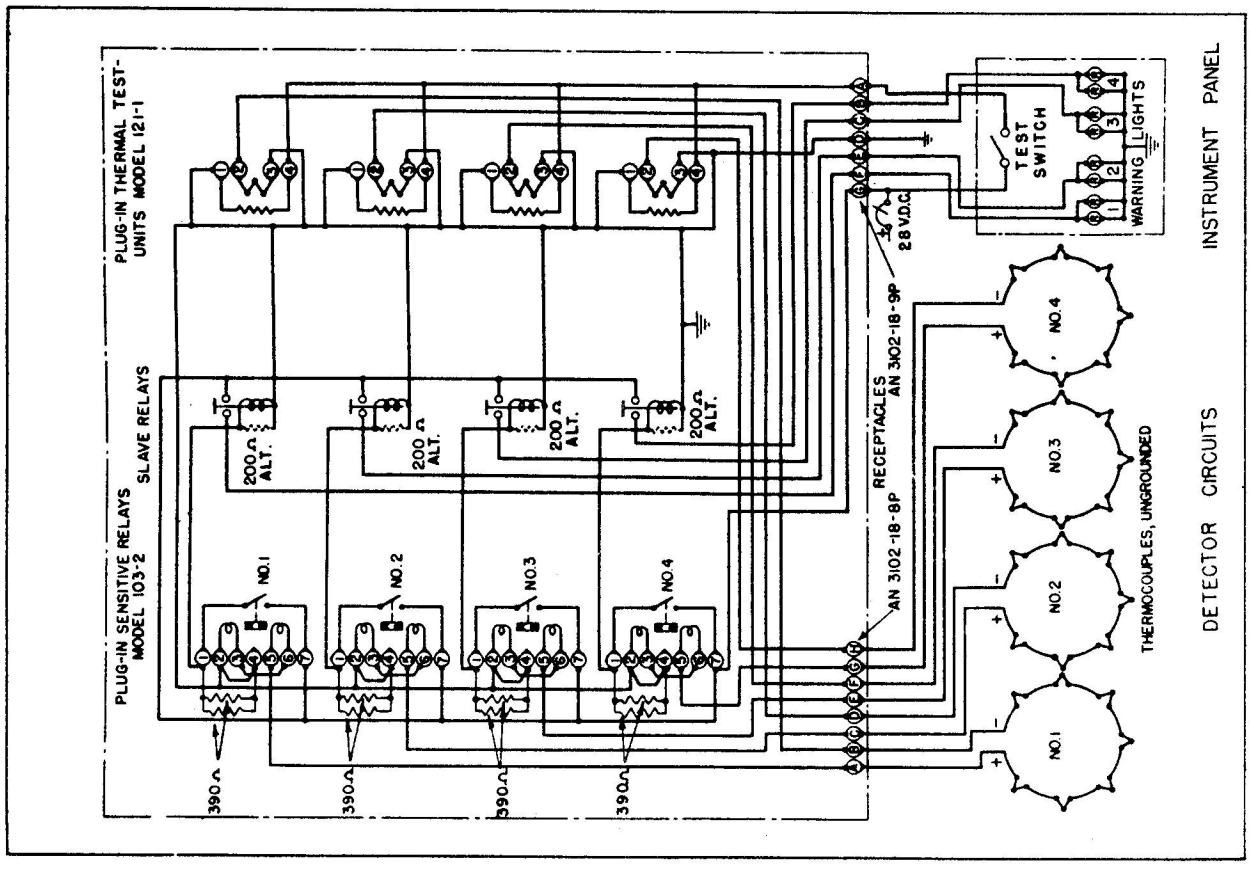

Figure 4-11 Wiring Diagram for Control Assembly, Part No. 33896 and 34364-2 (used in North Star Aircraft)

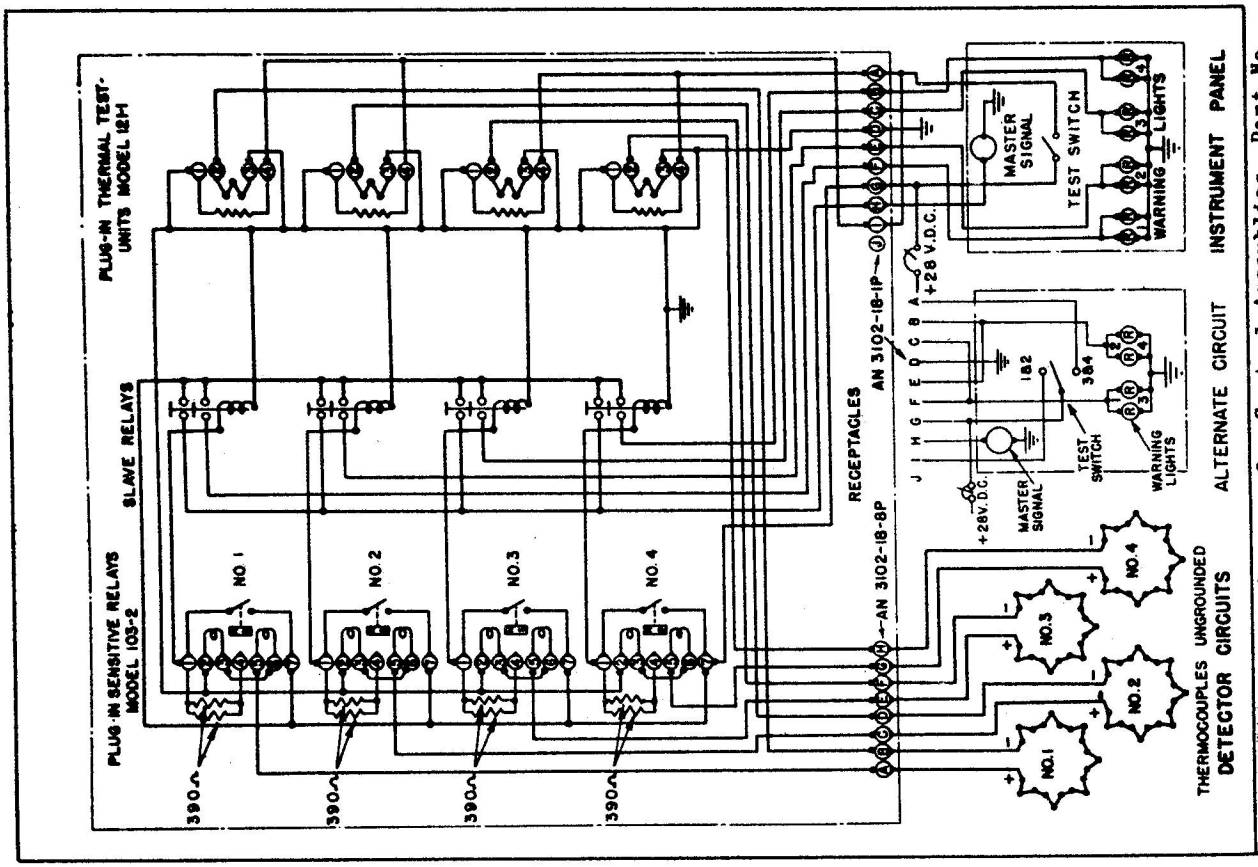

Figure 4-14 Wiring Diagram for Control Assemblies, Part No. 34726-4 and 34726-6

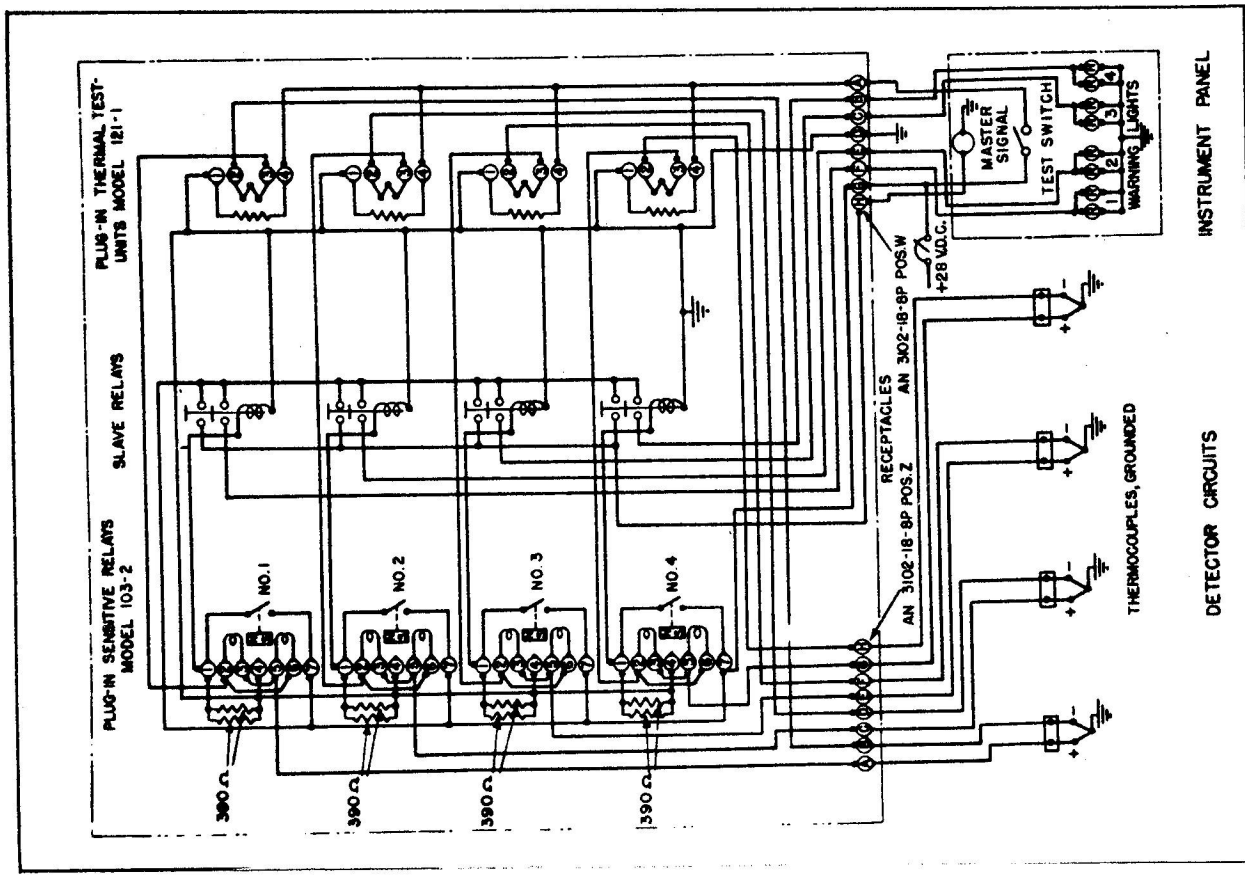

Figure 4-13 Wiring Diagram for Control Assembly, Part No. 34399-2

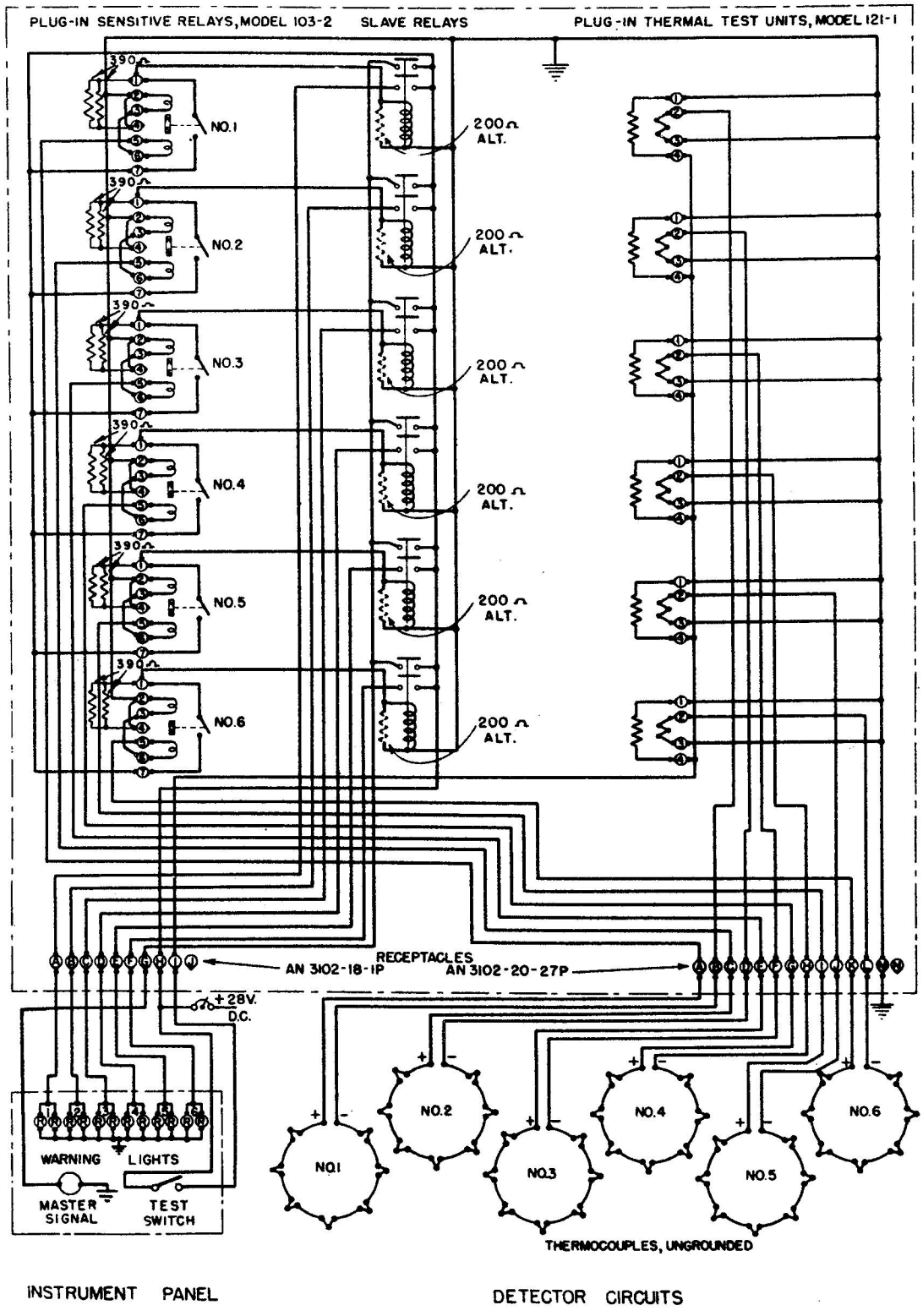

Figure 4-15 Wiring Diagram for Control Assemblies, Part No. 34958 and 35213

SECTION V

TEST PROCEDURE

5-1. TEST EQUIPMENT REQUIRED.

5-2. The following tests can be made with the Fire Detection System Tester, Part No. 48D8129 and Detector Circuit Test Plug referred to in paragraph 4-2. (See figure 5-1.)

5-3. GENERAL.

5-4. Unless otherwise specified, all tests herein described are to be made at normal room temperature, 20°C to 30°C (68°F to 86°F), and normal atmospheric pressure of approximately 30" of mercury.

5-5. To guarantee proper operation of units under low-voltage conditions in the aircraft, it is recommended that the Fire Detection System Tester be operated at 22.5 volts rather than 28 volts as marked.

5-6. DETECTOR TESTS.

a. CONTINUITY TEST. Allow detector to stabilize to room temperature for at least an hour after which measure resistance between terminals. Resistance of probe type thermocouple should be 1.05 ohms ± 15%, while that of cage type should not exceed 0.09 ohms.

b. GROUND TEST. - PART NO. 34606 ONLY.

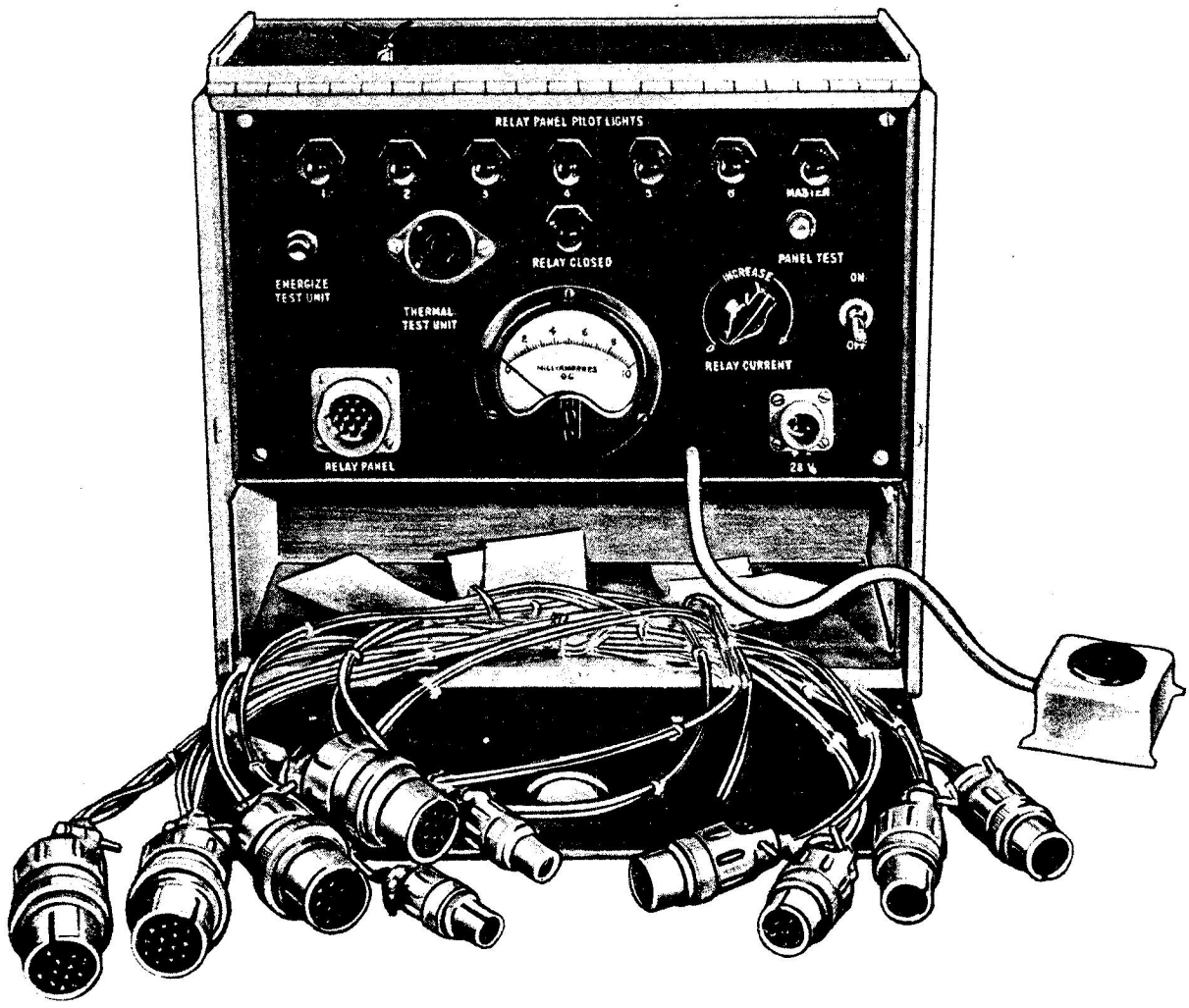

Figure 5-1 Fire Detection System Tester, Part No. 48D8129

Resistance between either terminal and the mounting fitting must be zero.

c. INSULATION TEST. - PROBE TYPE DETECTORS OTHER THAN PART NO. 34606. Apply a potential of 500 volts, RMS, 60 cycle ac or 500 volts dc between either terminal and the mounting fitting. Resistance must not be less than 10 megohms.

d. PRESSURE TEST - PROBE TYPE DETECTORS. Apply a pressure of 90" of mercury for a period of ten minutes to tip and mounting fitting. No leakage shall be indicated.

e. Faulty units should be scrapped since repair is not recommended.

5-7. CONTROL ASSEMBLY TESTS.

5-8. Test control assembly (relay panel) with thermal test units and sensitive relays in place as follows.

a. Insert detector circuit test plug in proper receptacle of control assembly.

b. Connect alarm circuit receptacle of control assembly to the Fire Detection System Tester by means of the proper cable.

c. Connect tester to 22.5 volt power supply observing polarity.

d. Check to be sure "RELAY CURRENT" rheostat is in zero position and "ON-OFF" switch is turned off.

e. Press "PANEL TEST" switch and hold until all pilot lights served by control assembly have come on.

f. Lights should be on within 10 seconds but not before operation of button.

5-9. Test defective circuits as follows:

a. With control assembly still connected to tester, remove sensitive relay and thermal test unit from defective circuit.

b. Short circuit the No. 1 and No. 7 terminals of the sensitive relay socket.

c. Failure of the pilot light to operate when so tested indicates a defective slave relay or wiring.

d. Check resistance between No. 1 contact of each sensitive relay socket and chassis (ground).

e. An open slave relay coil or arc-quenching resistor will result in a resistance of over 175 ohms.

NOTE

An open arc-quenching resistor is likely to cause welding of sensitive relay contacts.

5-10. THERMAL TEST UNIT TESTS.

a. Connect Fire Detection System Tester to 22.5 volt power supply. (See figure 5-1.)

b. Check to be sure "RELAY CURRENT" rheostat is in zero position and "ON-OFF" switch is turned off.

c. Plug thermal test unit into socket marked "THERMAL TEST UNIT".

d. Press button marked "ENERGIZE TEST UNIT" and hold until maximum meter reading is reached.

e. Within 15 seconds output should reach a minimum of 50 millivolts (5 on meter's original scale).

f. Faulty units should be scrapped since repair is not practical.

5-11. SENSITIVE RELAY TESTS.

a. Apply a potential of 500 volts, 60 cycle ac for a period of 10 seconds between each contact pin and the cover of the relay. No failure of insulation should occur.

b. Place relay in socket of Fire Detection System Tester with socket resting on table so that relay is in vertical position.

c. Connect tester to 22.5 or 28 volt power supply observing polarity, and turn "ON-OFF" switch on.

d. Increase the sensitive relay field current from 0 to 10 milliamperes at a rate of approximately 1/2 milliampere per second and note current value at instant relay operates as shown by pilot light.

e. Decrease current at above rate to be sure pilot light goes out before current drops to 3.0 milliamperes.

f. Repeat steps d and e with relay inverted and in each of four horizontal positions.

g. Pilot light should come on without flicker when meter reading is 4.0 to 4.6 milliamperes and no reading should vary from any other reading by more than 0.3 milliamperes regardless of relay position.

h. Failure of relay to operate within tolerances indicates need for adjustment or overhaul.

CAUTION

Do not leave "ON-OFF" switch turned on when tester is not in use.