



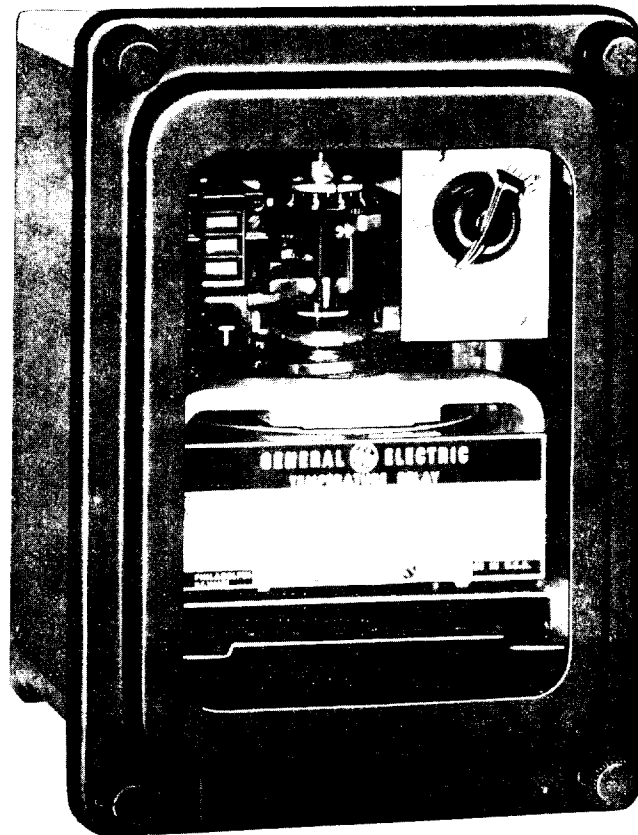
## INSTRUCTIONS

GEI-44244D  
Supersedes GEI-44244C

# TEMPERATURE RELAY

### Types

IRT51A  
IRT51B  
IRT51C  
IRT51D  
IRT53C



GENERAL  ELECTRIC

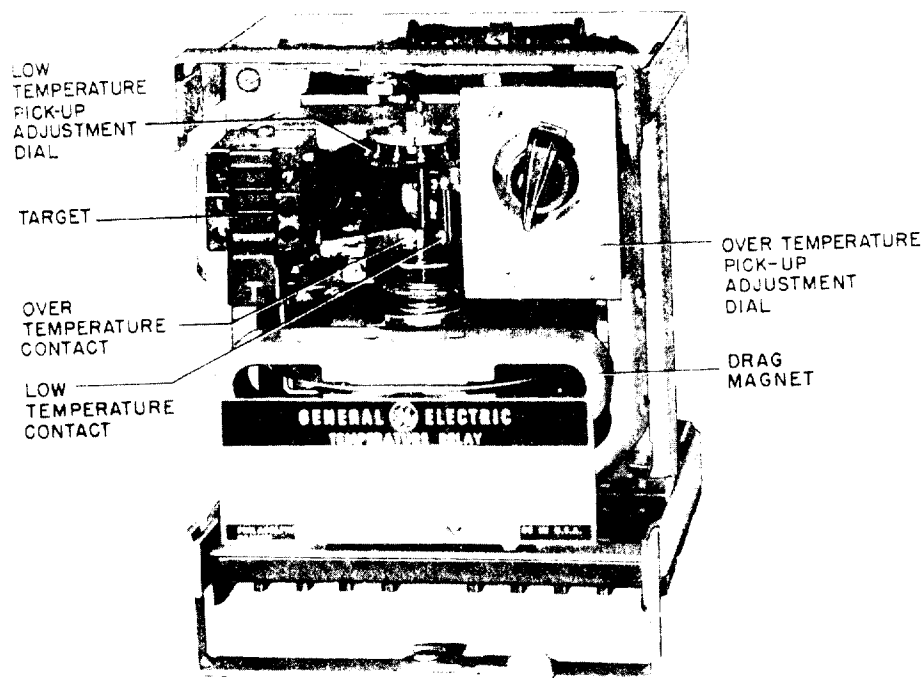


Fig. 1 (8020475) Type IRT51A Relay. Unit in Cradle (Front View)

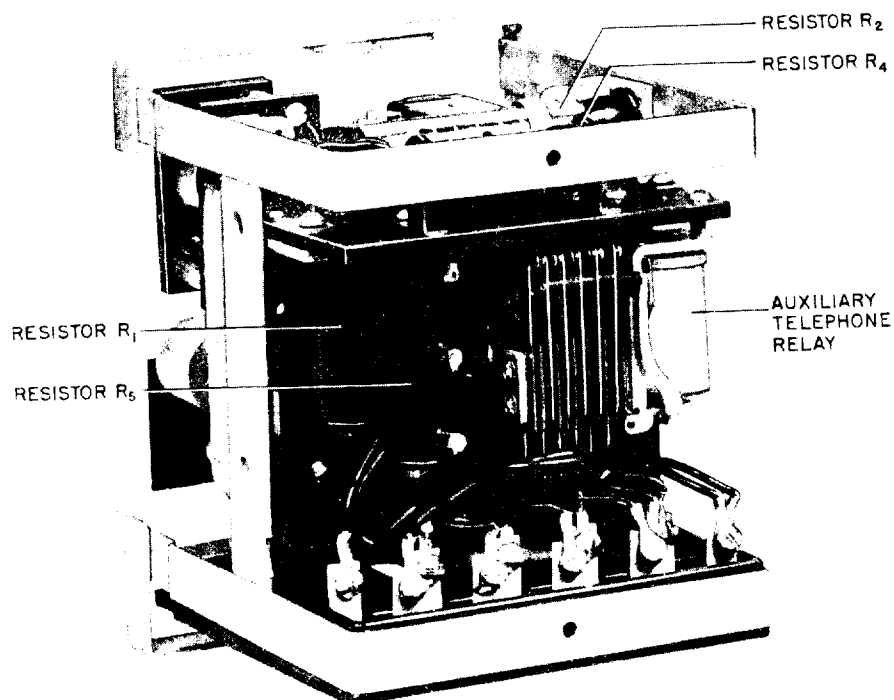


Fig. 2 (8020473) Type IRT51A Relay, Unit in Cradle (Rear View)

# TEMPERATURE RELAYS

## TYPE IRT

### INTRODUCTION

The Type IRT relays are intended for use with Resistance Temperature Detectors to protect a-c power equipment against overheating due to excessive load. The relays will provide either an alarm or direct trip action.

A change in RTD resistance is reflected in disk movement, and a sufficient change initiates protective action. The relay torque reverses when the resistance of the temperature detector varies from a value below to a value above that necessary to cause the bridge to be balanced. This balance point is generally 5°C below that necessary to close the left-hand or high temperature contact. The high temperature trip point of the relay is adjustable.

The Type IRT51A relay has a high temperature contact whose pickup is adjustable over a range of 80 to 120°C. Its low temperature contact is generally set to drop out 10°C below that temperature necessary to pick up the high temperature contact. This type has a d-c auxiliary control circuit.

The Type IRT51B relay is similar to the Type IRT51A except that its auxiliary control circuit is operated from the same a-c source which energizes the wattmetric unit.

Type IRT51C relay is similar to the Type IRT51A except that the auxiliary telephone relay A, and the low temperature contact are omitted. In this relay the target mechanism also acts as a seal-in relay to short around the overtemperature contact.

Type IRT51D relay is similar to the IRT51C except for use with 7.75 ohm RTD's.

Type IRT53C is similar to the IRT51C except that it has a temperature range of 100 to 160°C.

### APPLICATION

The function which a temperature relay performs depends on the type of equipment to be protected, its importance to the system, and its location. In unattended stations the relay may be used to reduce or remove load automatically, and to prevent increase in load until machine temperature has decreased to normal. Under no circumstances, however, should the relay be used to determine machine load, since operating temperature is not necessarily a reliable indication of maximum permissible load. Other design limitations may place

more stringent restrictions on machine rating.

In attended stations, the function of the relay is generally to give warning of an overtemperature condition, particularly in the case of major units and essentially auxiliary-power equipment. The circuit may be arranged to sound an alarm, and at the same time initiate a timing device which causes delayed automatic corrective action if the station operator has not responded to the alarm within a reasonable time. The temperature relay may also be applied directly to the trip circuit of circuit breakers associated with a power transformer. An overtemperature condition will then cause the transformer to be removed from service.

The Type IRT51 relay is arranged to respond to an adjustable temperature which represents the alarm or trip point for the protected apparatus. The relay detects actual temperature, not rise above ambient. The limit of this temperature should be set to meet long term trends in ambient temperature. Where extremes between ambient and operating temperature might cause damaging mechanical stresses, the relay operating point can be set to a lower level. Fig. 3 illustrates the IRT relay calibrated so that its trip temperature is adjustable over the range of 80°C to 120°C. With this range, pickup may be set to meet temperature rise limitations in low ambient areas, or maximum temperature limits in areas of controlled ambient for either Class A or Class B insulation.

### RATINGS

The wattmetric unit of the Type IRT51A relay is available for 120 and 240 volt a-c power for frequencies of 25, 50, and 60 cycles. Its auxiliary control circuit is available for ratings of 125 and 250 volts d-c.

The wattmetric unit of the Type IRT51B relay is available for 120 and 240 volt a-c power for frequencies of 25, 50, and 60 cycles. Its auxiliary control circuit is operated from the same a-c power source as the wattmetric unit.

The wattmetric unit of the Type IRT51C relay is available for 120 and 240 volt a-c power for frequencies of 25, 50, and 60 cycles. Its target and seal-in unit is available in ratings of 0.2 and 2 ampere ratings. The 2-ampere tap has a d-c resistance of 0.13 ohms and a 60 cycle impedance of 0.53 ohms while the 0.2 ampere tap has a 7-ohm d-c resistance and a 52 ohm, 60 cycle impedance. The tap setting used on the seal-in unit is determined by the current drawn by the trip coil.

*These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.*

*To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.*

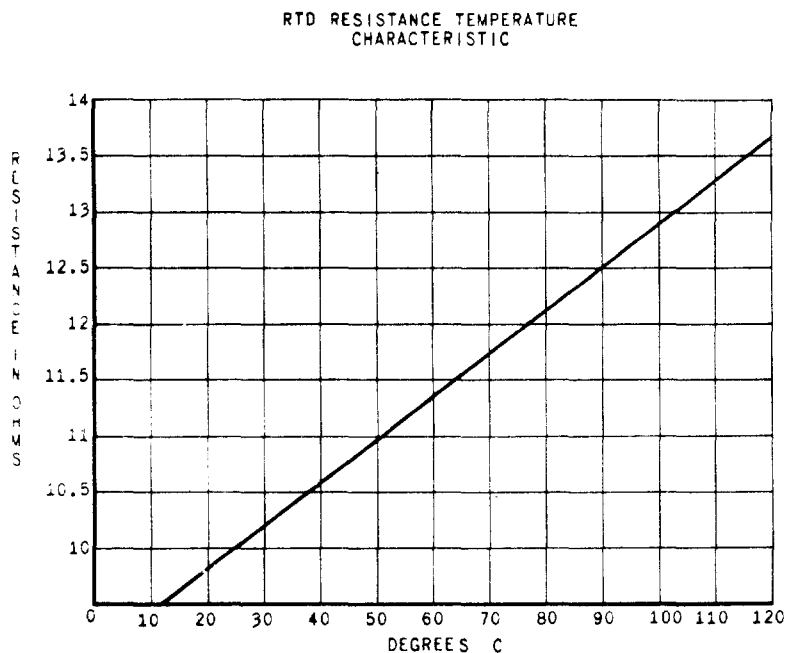


Fig. 3 (6209136-2) Characteristics Curves for Resistance Temperature Detectors

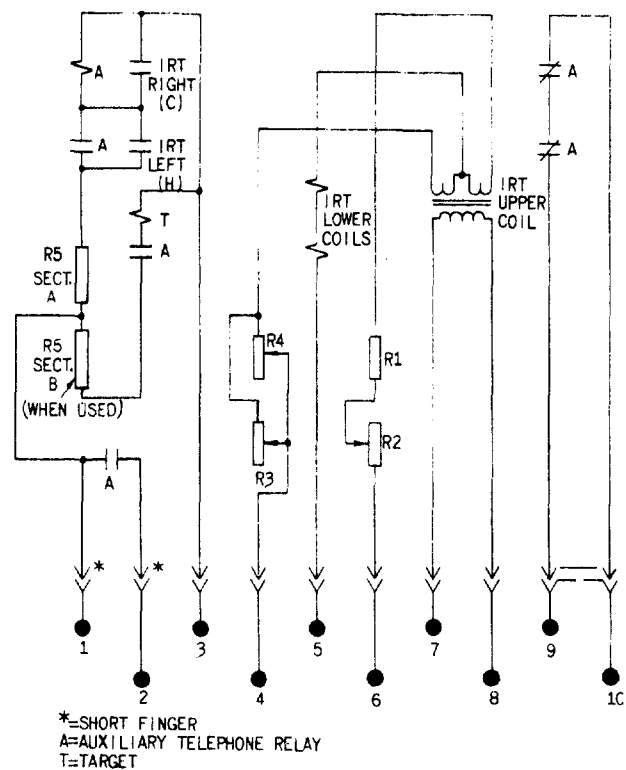


Fig. 4 (403A170-3) Internal Connections of Type IRT51A Relay

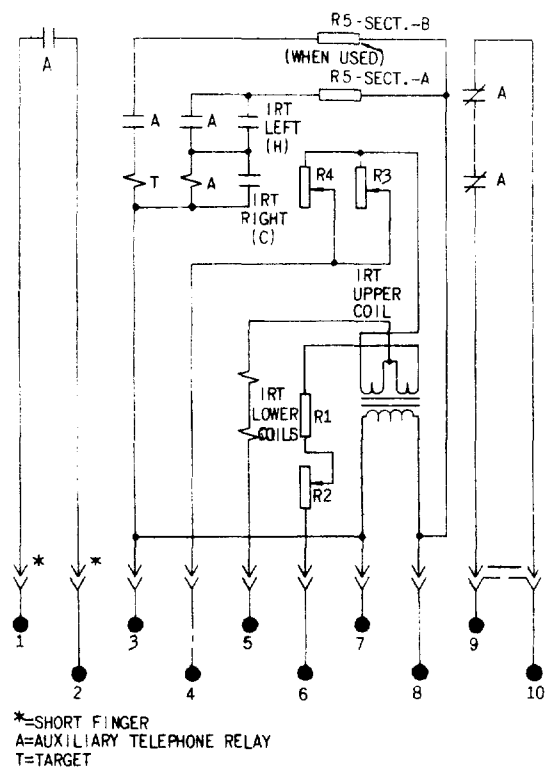


Fig. 5 (403A171-2) Internal Connections of Type IRT51B Relay

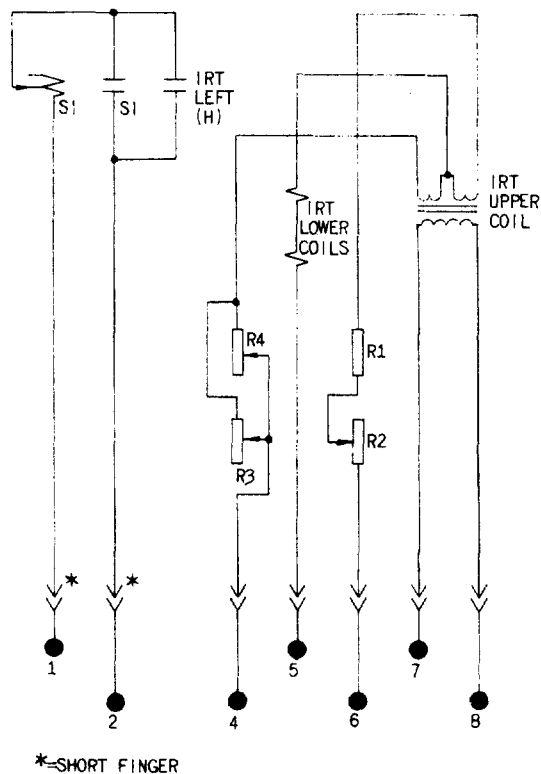


Fig. 6 (403A172-0) Internal Connections of Type IRT51C, IRT51D and IRT53C

The 0.2-ampere tap is for use with trip coils that operate on currents ranging from 0.2 to 2.0 amperes at the minimum control voltage. If this tap is used with trip coils requiring more than 2.0 amperes, there is a possibility that the 7-ohm resistance will reduce the current to so low a value that the breaker will not be tripped.

The 2-ampere tap should be used with trip coils that take 2 amperes or more at minimum control voltage, provided the tripping current does not exceed 30 amperes at the maximum control voltage. If the tripping current exceeds 30 amperes, an auxiliary relay should be used, the connections being such that the tripping current does not pass through the contacts or the target and seal-in coils of the protective relay.

The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The current-carrying ratings are affected by the selection of the tap on the target and seal-in coil as indicated in the following table:

Function	Amperes, A-C or D-C	
	2 Amp Tap	0.2 Amp Tap
Tripping Duty	30	5
Carry Continuously	4	0.8

The following is the interrupting capabilities of the telephone relay contacts, which in some instances are used in the control circuit.

#### CONTACT INTERRUPTING ABILITY

Volts	Interruption Current (Amps)	
	Inductive *	Non-Inductive
48 D-C	1.0	3.0
125 D-C	0.5	1.5
250 D-C	0.25	0.75
115 60 Cyc.	0.75	2.0
230 60 Cyc.	0.5	1.0

\* Inductance of Average Trip Coil

#### BURDENS

The total potential burden of the wattmetric unit of the Type IRT relay is as follows:

Volts	Freq.	Amps	Volt-Amps	Watts
120	60	0.066	7.92	2.18
240	60	0.033	7.92	2.18
120	50	0.076	9.12	2.82
240	50	0.038	9.12	2.82
120	25	0.066	7.8	3.9
240	25	0.033	7.8	3.9

The control circuits of the Type IRT51B relay imposes an additional burden as follows:

Volts	Freq.	Amps	Volt-Amps	Watts
120	60	0.061	7.3	5.5
240	60	0.047	11.3	8.9
120	50	0.072	8.7	6.1
240	50	0.051	12.2	9.8
120	25	0.092	11.0	9.5
240	25	0.058	13.9	13.0

#### RECEIVING, HANDLING AND STORAGE

These relays, when not included as a part of a control panel will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are injured or the adjustments disturbed.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed and cause trouble in the operation of the relay.

#### DESCRIPTION

These relays are of the wattmetric induction disk type. They provide both open and closed contacts. The contacts are actuated when the relay detects an overtemperature in the protected equipment and remain in the operated position until the equipment temperature has decreased to a safe value. The most desirable differential between these temperatures appears to be 10°C, and the Type IRT relay is so calibrated. The high temperature trip point of the relay is adjustable. The adjustment can be accomplished by merely positioning a pointer located on a calibration dial in the front of the relay.

The measuring circuit is similar to a Wheatstone Bridge except that two adjacent legs of the conventional bridge are replaced by transformer secondary windings. The primary of this transformer is the relay polarizing coil. A voltage is induced in each of these windings which acts as a driving voltage for the bridge circuit.

#### CASE

The case is suitable for either surface or semiflush panel mounting and an assortment of hardware is provided for either mounting. The cover attaches to the case and also carries the reset mechanism when one is required. Each cover screw has provision for a sealing wire.

The case has studs or screw connections at both ends or at the bottom only for the external connections. The electrical connections between the relay units and the case studs are made through spring backed contact fingers mounted in stationary molded inner and outer blocks between which nests a removable connecting plug which completes the circuits. The outer blocks, attached to the case, have the studs for the external connections, and the inner blocks have the terminals for the internal connections.

The relay mechanism is mounted in a steel framework called the cradle and is a complete unit with all leads being terminated at the inner block. This cradle is held firmly in the case with a latch at the top and the bottom and by a guide pin at the back of the case. The cases and cradles are so constructed that the relay cannot be inserted in the case upside down. The connecting plug besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is fastened to the case by thumbscrews, holds the connecting plug in place.

To draw out the relay unit the cover is first removed, and the plug drawn out. Shorting bars are provided in the case to short the current transformer circuits. The latches are then released, and the relay unit can be easily drawn out. To replace the relay unit, the reverse order is followed.

**NOTE:** Care must be taken to insert the connecting plug slowly on relays that have contacts which are closed when de-energized but open under normal operation conditions.

A separate testing plug can be inserted in place of the connecting plug to test the relay in place on the panel either from its own source of current and voltage, or from other sources. Or, the relay unit can be drawn out and replaced by another which has been tested in the laboratory.

#### TERMINAL BOARD FOR RESISTANCE TEMPERATURE DETECTORS

The terminal board for resistance temperature detectors is employed on installations in which temperature devices are energized from an ungrounded direct-current supply circuit. It serves to connect the temperature detectors with the temperature devices and to prevent the latter from receiving an excessive potential in the event of a failure of the stator coil insulation adjacent to a detector. This protection is accomplished through connecting each detector permanently with the ground.

The terminal board consists essentially of a moulded base with cover in which are arranged the connections for joining together the leads from the temperature detectors and temperature meter. The center row of connections is connected with the grounding strip. Support attaching stud serves as a ground connection and also a stud for attaching the terminal board to its grounded support on the stator frame.

The "A" (red) lead from the temperature detector and the proper lead from the temperature relay should be connected on the bottom (A) row of the terminal board connection studs, while one of the two remaining black leads from the selected detector should be connected to its proper relay lead on the middle (B) row of connection studs. The other black lead from the detector and the relay lead should be connected on the top (C) connection stud.

Connections from the terminal board to the Type IRT51 relay should be made in the Installation section.

#### INSTALLATION

##### LOCATION

The location should be clean and dry, free from dust and excessive vibration, and well lighted to facilitate inspection and testing.

##### MOUNTING

The relay should be mounted on a vertical surface. The outline and panel diagram is shown in Fig. 11.

#### CONNECTIONS

Internal connection diagrams for these relays are shown in Fig. 4, Fig. 5, and Fig. 6. Typical external connection diagrams are given in Fig. 7, Fig. 8, and Fig. 9.

The "A" (red) lead from the RTD Terminal Board should be connected to stud No. 4 of the Type IRT51 relay. The "V" (black) lead, or grounded lead, from the middle row of the Terminal Board should be connected to stud #5 of the relay. The remaining black lead, the "C" lead, should be connected to stud #6 of the relay.

Select the hottest spot detector. This is the one which gives the highest resistance with the machine at full load. The temperature detector to be used with the Type IRT51 relay for equipment protection should have a characteristic like that shown in Fig. 3.

The leads coming from the "RTD" are shielded to prevent stray fluxes inducing voltages into the circuit. If an extension of these leads is required, it will be necessary to twist the leads and in addition see that the total lead resistance is balanced and does not exceed 1/4 ohm per leg. Excessive lead runs even though balance tend to de-sensitize the relay. An increase in operating point of 0.7 C can be expected for each ohm of lead run.

Should it become necessary to switch the relay from one RTD to another via a switching scheme, arrange the switching circuit to remove the lead from stud 6 first and restore it last. This procedure will prevent tripping during the switching operation.

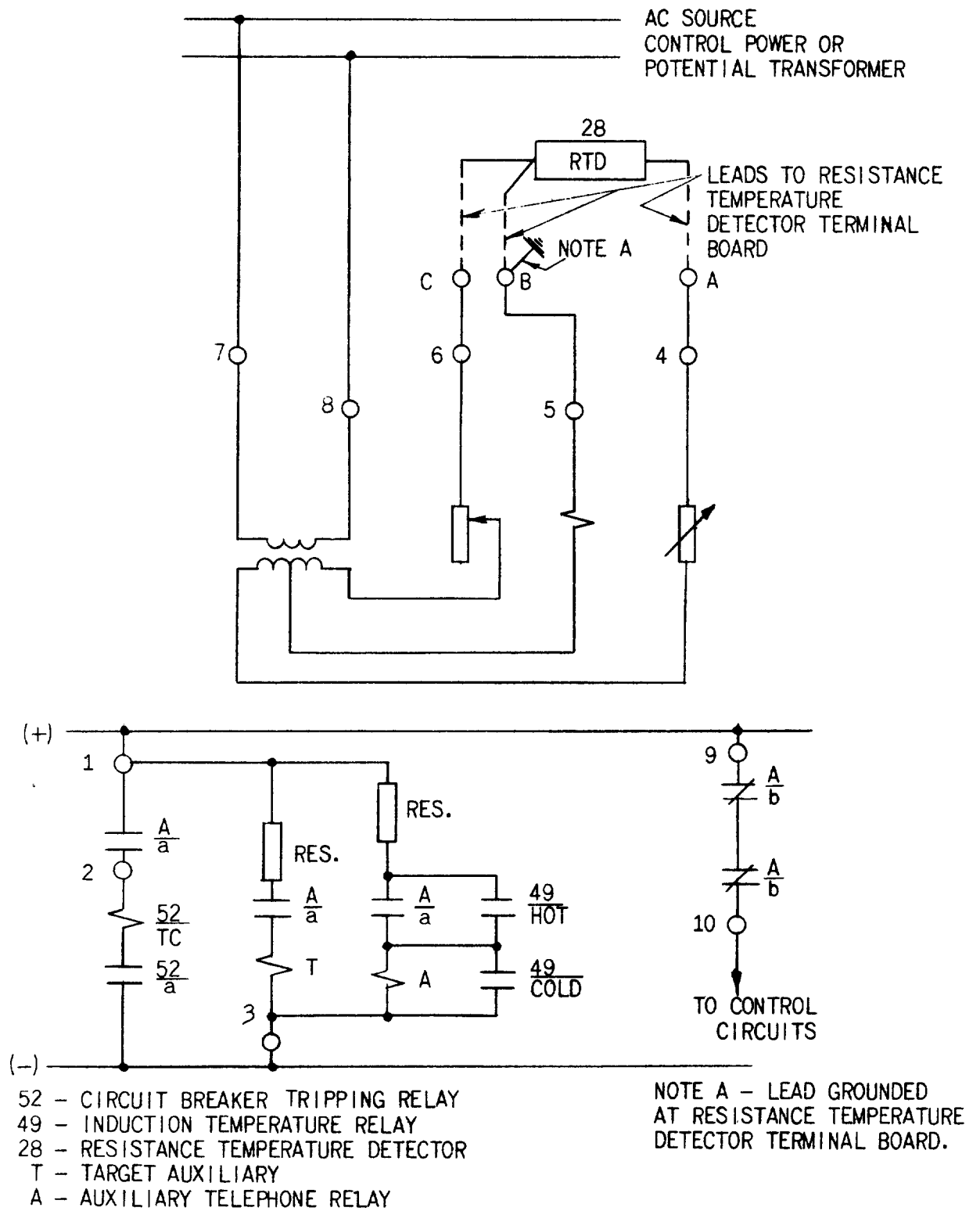


Fig. 7 (418A704-2) External Connections for Type IRT51A Relay

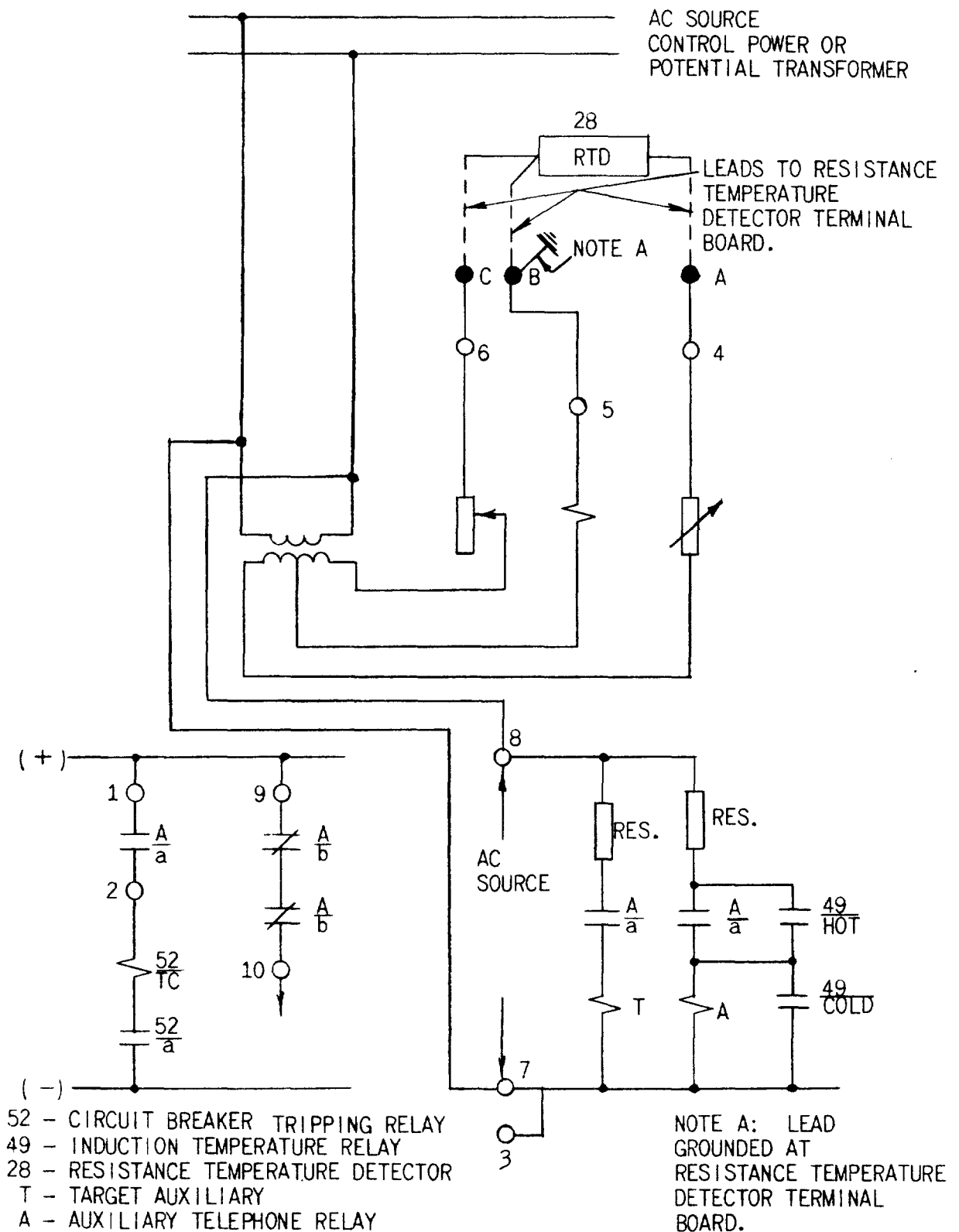


Fig. 8 (418A708-1) External Connections for Type IRT51B Relay



## INSPECTION

At the time of installation, the relay should be inspected for tarnished contacts, loose screws, or other imperfections. If any trouble is found, it should be corrected in the manner described under MAINTENANCE.

## ADJUSTMENTS

### TEMPERATURE SETTINGS

The setting of the Overtemperature Pick-up Adjustment Rheostat determines the temperature at which the left or hot contact of the relay picks up. This adjustment is accomplished by locating a pointer on the Overtemperature Setting dial located at the front of the relay. Fig. 1 illustrates the Type IRT relay, factory calibrated so that its trip temperature is adjustable over the range of 80°C to 120°C.

The right or cold contact of the relay is factory adjusted to close 10°C less than the chosen overtemperature pick-up setting. This 10°C differential is set by adjusting the gap between the two fixed contacts of the double throw contact arrangement.

The relay is properly adjusted at the factory to obtain the above characteristics and it is not advisable to disturb these adjustments. If it becomes necessary to adjust the relay, it should be calibrated as outlined under TESTS.

### IRT51C TARGET AND SEAL-IN UNIT

For trip coils operating on currents ranging from 0.2 up to 2.0 amperes at the minimum control voltage, set the target and seal-in tap plug in the 0.2-ampere tap.

For trip coils operating on currents ranging from 2 to 30 amperes at the minimum control voltage, place the tap plug in the 2-ampere tap.

The tap plug is the screw holding the right-hand stationary contact of the seal-in unit. To change the tap setting, first remove the connecting plug. Then, take a screw from the left-hand stationary contact and place it in the desired tap. Next, remove the screw from the other tap and place it in the left-hand contact. This procedure is necessary to prevent the right-hand stationary contact from getting out of adjustment. Screws should not be in both taps at the same time as pickup for d-c will be the higher tap value and a-c pickup will be increased.

### CONTROL SPRING

The control spring in the relay was adjusted at the factory to the neutral tension position so that both left and right hand contacts are open with the relay de-energized. The tension of the control spring may be changed by turning the control spring adjuster ring, counterclockwise to decrease tension.

## TESTS

To test or adjust this relay connect it according to its particular external connection diagram--Fig. 7,

Fig. 8, or Fig. 9. In place of the resistance temperature detector connect a variable resistor whose range covers 10 to 15 ohms. Adjust the relay for a specific overtemperature pick-up point by positioning the pointer on the Overtemperature Setting Dial Plate. To check the setting, adjust the variable resistor for a RTD resistance equivalent to the Overtemperature Point. This equivalent RTD resistance can be determined from the following equation:

$$R_T = 9.04 + 0.0385T$$

$R_T$  in Ohms

$T$  in Degrees Centigrade

Fig. 3 depicts graphically the 10 ohm RTD resistance variation with temperature. For 7.75 ohm RTD see Fig. 10. Also, the RTD equivalent resistance can be determined from the following equation:

$$R_T = 7.01 + 0.0298T$$

$R_T$  in Ohms

$T$  in Degrees Centigrade

Before these specific checks are made, be sure that the relay is in its case with its cover in place and mounted to be reasonably level. In addition, preheat the potential circuit by applying rated voltage to the relay for 1/2 hour.

The overtemperature contact should close within one degree centigrade of the relay setting. To check the cold temperature contact, set the variable resistor for a RTD resistance equivalent to a temperature of 10°C below the Overtemperature Set Point. The cold temperature contact should close within one degree centigrade of its set point. If it is desirable to increase this temperature differential, the contact gap should be widened by loosening the locking screws of the low temperature contact dial, and rotating the dial in a counterclockwise direction. The low temperature pick-up point should be determined in terms of the overtemperature Set Point and the desired differential. A RTD resistance equivalent to this temperature should be set on the variable resistor, and the low temperature contact adjusted to the point where the contact just closes at this resistance.

## MAINTENANCE

### DISK AND BEARINGS

The lower jewel may be tested for cracks by exploring its surface with the point of a fine needle. The jewel should be turned up until the disk is centered in the air gaps, after which it should be locked in this position by the set screw provided for this purpose.

### CONTACT CLEANING

For cleaning fine silver contacts, a flexible burnishing tool should be used. This consists of a

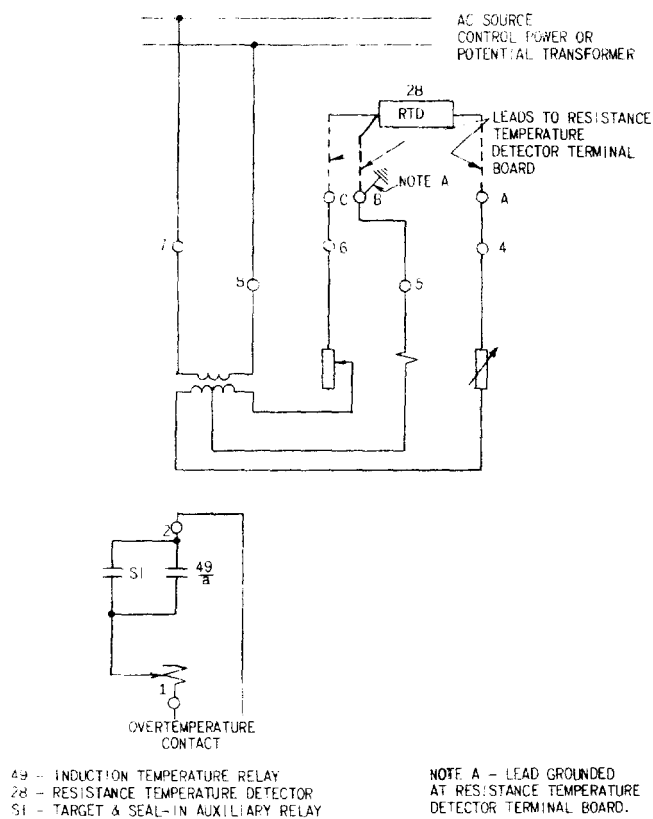


Fig. 9 (418A709-2) External Connections for Type IRT51C Relay

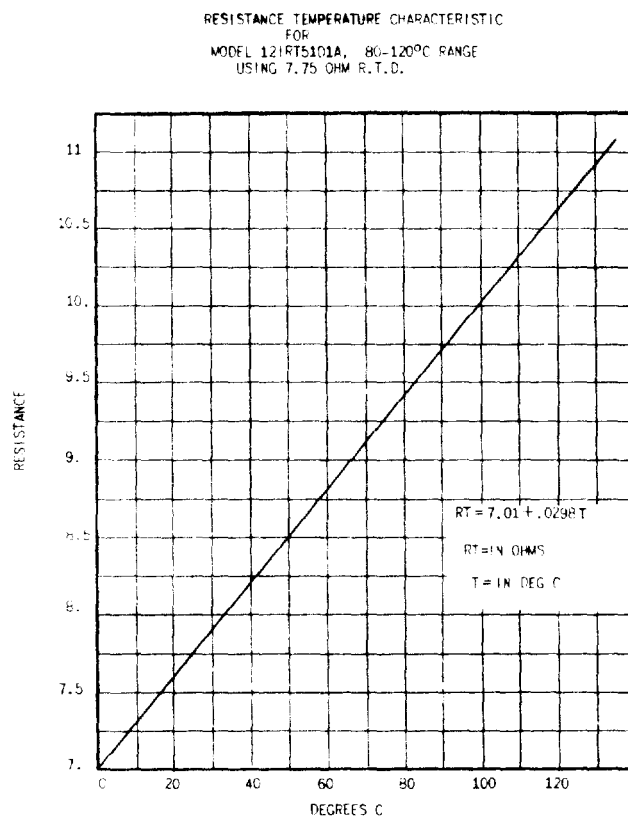


Fig. 10 (0165A7703-0) Characteristic Curve for Resistance Temperature Detector (7.75 Ohm)

flexible strip of metal with an etched roughened surface, resembling in effect a superfine file. The polishing action is so delicate that no scratches are left, yet corroded material will be removed rapidly and thoroughly. The flexibility of the tool insures the cleaning of the actual points of contact. Sometimes an ordinary file cannot reach the actual point of contact because of some obstruction from some other part of the relay.

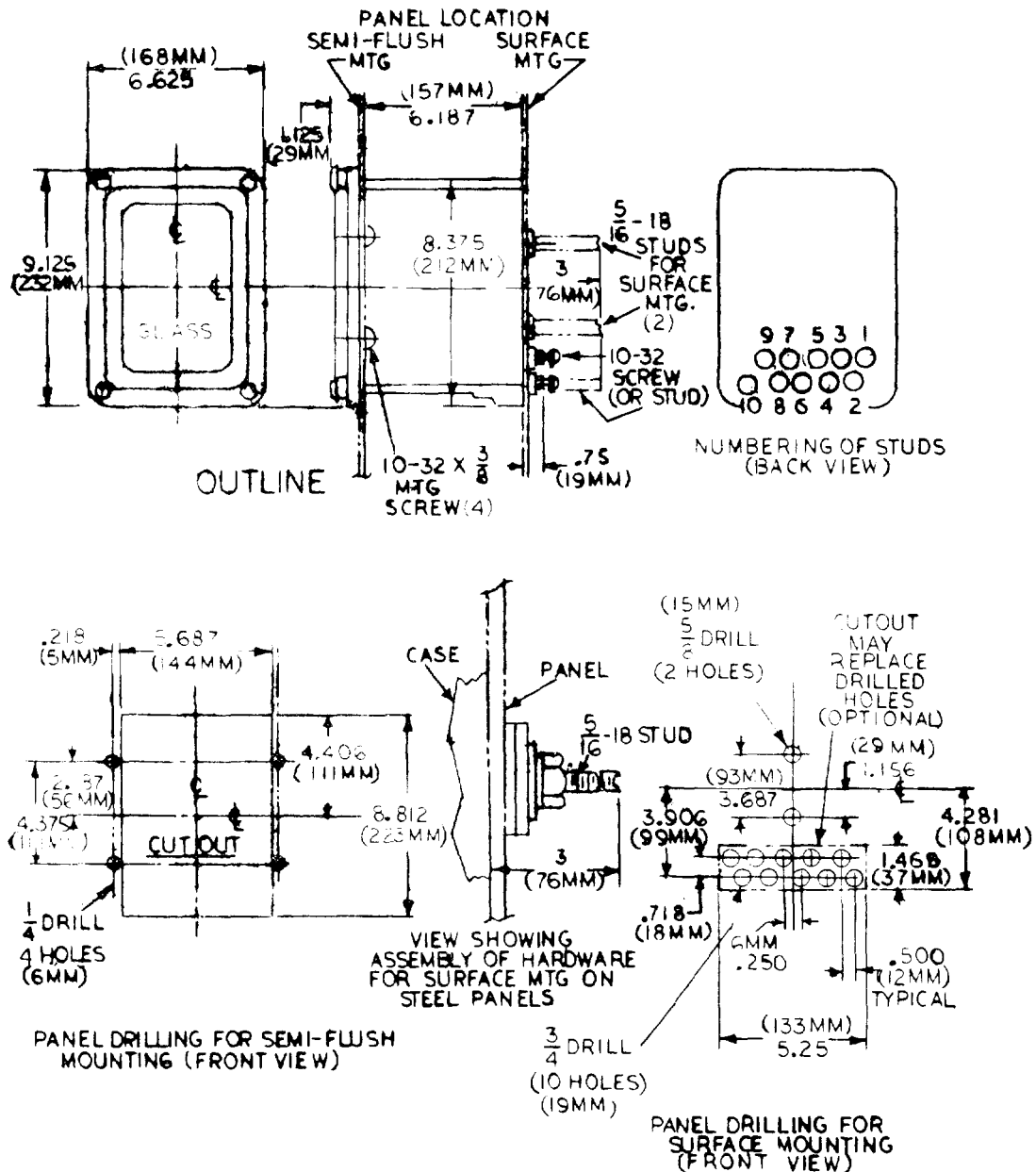
Fine silver contacts should not be cleaned with knives, files, or abrasive paper or cloth. Knives or files may leave scratches which increase arcing and deterioration of the contacts. Abrasive paper or cloth may leave minute particles of insulating abrasive material in the contacts and thus prevent closing.

The burnishing tool described is included in the standard relay tool kit obtainable from the factory.

### RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken, or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specifying the quantity required and describing the parts by catalogue numbers as shown in Renewal Parts Bulletin.





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