GEI-28826A

INSTRUCTIONS

*Switchgear*

# THERMAL OVERCURRENT RELAY


**Type TMC11A**

GENERAL ELECTRIC

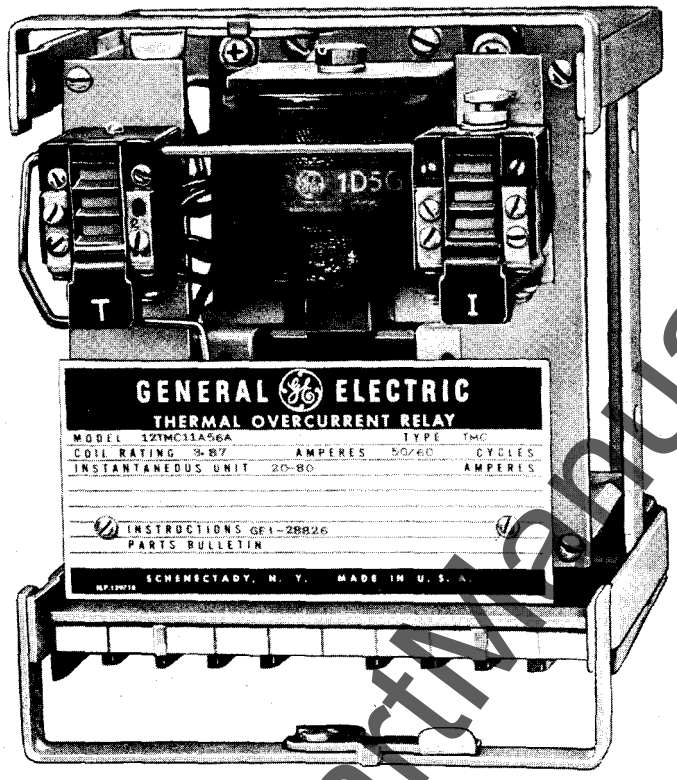



Fig. 1 Type TMC11A Relay Removed from Case

TABLE "A"

| Model | Frequency | Coil Rating Amperes | Full Load Amperes For 40°C Rise Cont. Rated Motor Min. | Max. | Instantaneous Unit Ampere Calibration Min. | Max. |
|---|---|---|---|---|---|---|
| 12TMC11A51A | 50/60 | 2.42 | 2.01 | 2.20 | 10 | 40 |
| 12TMC11A52A | 50/60 | 2.65 | 2.21 | 2.40 | 10 | 40 |
| 12TMC11A53A | 50/60 | 2.92 | 2.41 | 2.65 | 10 | 40 |
| 12TMC11A54A | 50/60 | 3.20 | 2.66 | 2.90 | 10 | 40 |
| 12TMC11A55A | 50/60 | 3.52 | 2.91 | 3.20 | 10 | 40 |
| 12TMC11A56A | 50/60 | 3.87 | 3.21 | 3.51 | 20 | 80 |
| 12TMC11A57A | 50/60 | 4.25 | 3.52 | 3.86 | 20 | 80 |
| 12TMC11A58A | 50/60 | 4.68 | 3.87 | 4.25 | 20 | 80 |
| 12TMC11A59A | 50/60 | 5.15 | 4.26 | 4.68 | 20 | 80 |
| 12TMC11A60A | 50/60 | 5.60 | 4.69 | 5.09 | 20 | 80 |
| 12TMC11A61A | 25 | 2.42 | 2.01 | 2.20 | 10 | 40 |
| 12TMC11A62A | 25 | 2.65 | 2.21 | 2.40 | 10 | 40 |
| 12TMC11A63A | 25 | 2.92 | 2.41 | 2.65 | 10 | 40 |
| 12TMC11A64A | 25 | 3.20 | 2.66 | 2.90 | 10 | 40 |
| 12TMC11A65A | 25 | 3.52 | 2.91 | 3.20 | 10 | 40 |
| 12TMC11A66A | 25 | 3.87 | 3.21 | 3.51 | 20 | 80 |
| 12TMC11A67A | 25 | 4.25 | 3.52 | 3.86 | 20 | 80 |
| 12TMC11A68A | 25 | 4.68 | 3.87 | 4.25 | 20 | 80 |
| 12TMC11A69A | 25 | 5.15 | 4.26 | 4.68 | 20 | 80 |
| 12TMC11A70A | 25 | 5.60 | 4.69 | 5.09 | 20 | 80 |

TABLE FOR SELECTING PROPER MODEL NO. OF TYPE TMC11A RELAY

# THERMAL OVERCURRENT RELAY
# TYPE TMC

## INTRODUCTION

Type TMC11A single pole thermal overcurrent relay provides both instantaneous and thermal overload protection for motors with compensation for changes in relay ambient temperature. It consists of an induction thermal unit, an instantaneous unit and a universal seal-in unit and target coil (see Fig. 1). Both the thermal and instantaneous units have independent normally open contacts with separate targets (the seal-in unit is energized by the closing of the thermal unit contacts). The thermal unit contacts are hand reset while the instantaneous unit contacts are self-reset. The two targets are reset by the same mechanism which resets the thermal unit contacts.

The thermal unit consists of a current coil placed over a bi-metal helix that acts as the short-circuited secondary of a transformer. The current heats the helix causing it to rotate in a direction to close the hand reset contacts. Tripping current is adjustable from 90 to 110 percent of coil rating. The contacts cannot be reset until the unit has cooled for a time.

The instantaneous unit is the small hinge-type unit mounted on the right front side of the relay. It operates over a 4 to 1 range and has its calibration stamped on a scale mounted beside the adjustable pole piece.

The relay 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. Each cover screw has provision for a sealing wire.

The case has studs or screw connections 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 block, attached to the case, has the studs for the external connections, and the inner block has 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 case and cradle 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.

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, or from other sources. Or, the relay unit can be drawn out and replaced by another which has been tested in the laboratory.

The cover is provided with a mechanical interlock which prevents replacing the cover unless the connecting plug is in place.

## APPLICATION

The Type TMC11A relay is not intended for use directly in primary circuits. It should always be used with current transformers. It is self-protecting on primary short-circuits because the CT will saturate before excessive secondary currents are reached.

For standard 40°C continuous-rated motors (which have 115 percent service factor), the relay should be selected so that the full load current of the motor falls between the minimum and maximum values of full load amperes on Table "A".

For 50°C or 55°C continuous-rated motors (which do not have 115 percent service factor), multiply the motor full-load amperes by 0.9 and use this value to select the relay.

For 0.8 power factor synchronous motors with constant field excitation and driving d-c generators rated 150 percent load for two hours, obtain the motor armature current at 150 percent load on the generator from the motor data sheet, multiply by 0.9, and use the value to select the relay. If

the data is not available, take the motor full load armature current, multiply by 1.16, and use this value to select the relay. (The motor current at 150 percent load will be about 133 percent of full load value. Division of 133 percent by 115 percent gives 1.16).

For 0.8 power factor synchronous motors with constant field excitation and driving d-c generators rated 125 percent load for two hours, obtain the motor armature current at 125 percent load on the generator from the motor data sheet, multiply by 0.9, and use this value to select the relay. If the data is not available, select a relay the same as for standard 40°C continuous-rated motors (the motor current at 125 percent load will be about 115 percent of the full load value).

For intermittent rated motors, or for motors designed for use in higher temperature or altitudes, relays should be selected in accordance with the characteristics of the motor and the application.

Table "A" gives the permissible application range in full-load amperes for 40°C rise motors with 115 percent service factor and the corresponding rated coil amperes. The coil rating is the approximate value at which the relay will ultimately trip in a 40°C ambient, with the relay calibration set at 100 percent, and is equal to 110 percent of the maximum full-load amperes. If the motor full-load amperes are equal to the minimum value in the application range, then the nominal trip value of the relay will be approximately 120 percent of full-load. If the full-load amperes are equal to the maximum value, the nominal trip value will be approximately 110 percent of full-load. The relay can be adjusted from 90 percent to 110 percent of these values.

For 50°C and 55°C rise motors, application of the 0.9 multiplier essentially reduces the nominal trip point another 10 percent.

## RATINGS

Type TMC11A relay is available for 25 and 50/60 cycles in current ratings from 2.42 to 3.52 amperes with 10/40 ampere instantaneous unit and from 3.87 to 5.60 amperes with 20/80 ampere instantaneous unit. See Table "A".

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 seal-in unit coil as indicated in the following table:

| Function | Amperes, AC or DC | |
|---|---|---|
| | 2-Amp Tap | 0.2 Amp Tap |
| Tripping Duty | 30 | 5 |
| Carry Continuously | 4 | 0.8 |

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 52 ohm 60 cycles impedance. The tap setting used on the seal-in element is determined by the current drawn by the trip coil.

The 0.2-ampere tap is for use with trip coils that operate on currents ranging from 0.2 up to 2.0 amperes at the minimum control voltage. If this tap is used with trip coils requiring more than 2 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 coil of the protective relay.

## BURDENS

INSTANTANEOUS UNIT

Burden data on the instantaneous unit coils are given in the following table:

| Coil | Freq. | Amp | Volt Amp | Imp. Ohms | PF |
|---|---|---|---|---|---|
| 10-40 | 60 | 5 | 0.83 | 0.033 | 0.95 |
| | 50 | 5 | 0.80 | 0.032 | 0.95 |
| | 25 | 5 | 0.65 | 0.027 | 0.98 |
| 20-80 | 60 | 5 | 0.21 | 0.008 | 0.95 |
| | 50 | 5 | 0.20 | 0.008 | 0.95 |
| | 25 | 5 | 0.15 | 0.007 | 0.98 |

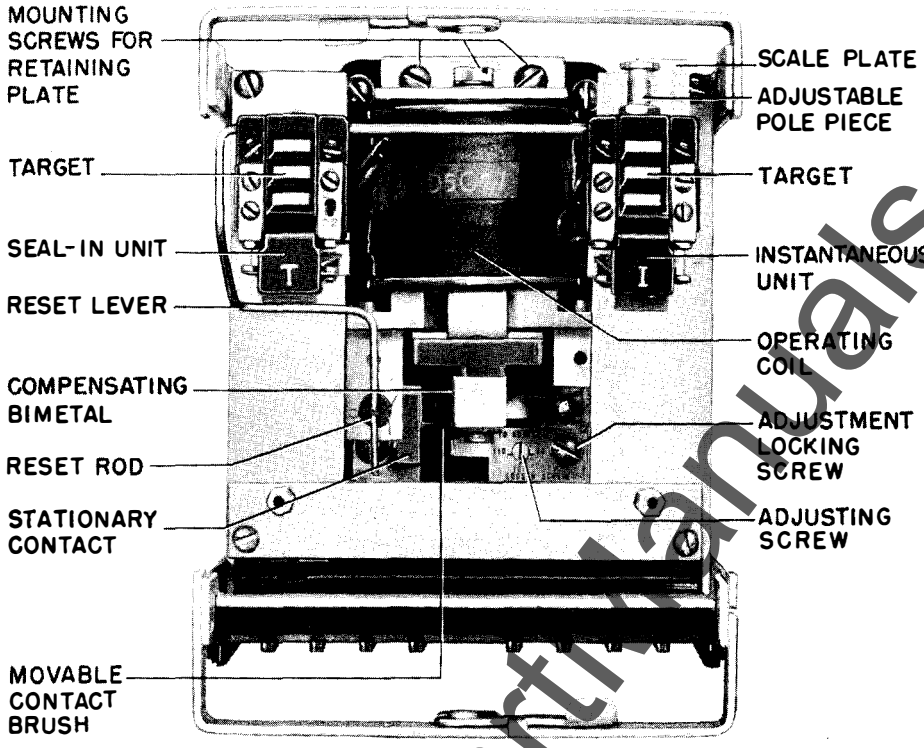
THERMAL UNIT

At rated current the burden of the thermal unit is approximately 13.5 volt-amperes and 12 watts for 25 and 60 cycle operation or approximately 12.5 volt-amperes and 11 watts for 50 cycle operation.

The volt-ampere burden of the thermal unit at 5 amperes is approximately equal to K divided by the square of the current rating, where K is 325 for 25 and 60 cycles and 305 for 50 cycles.

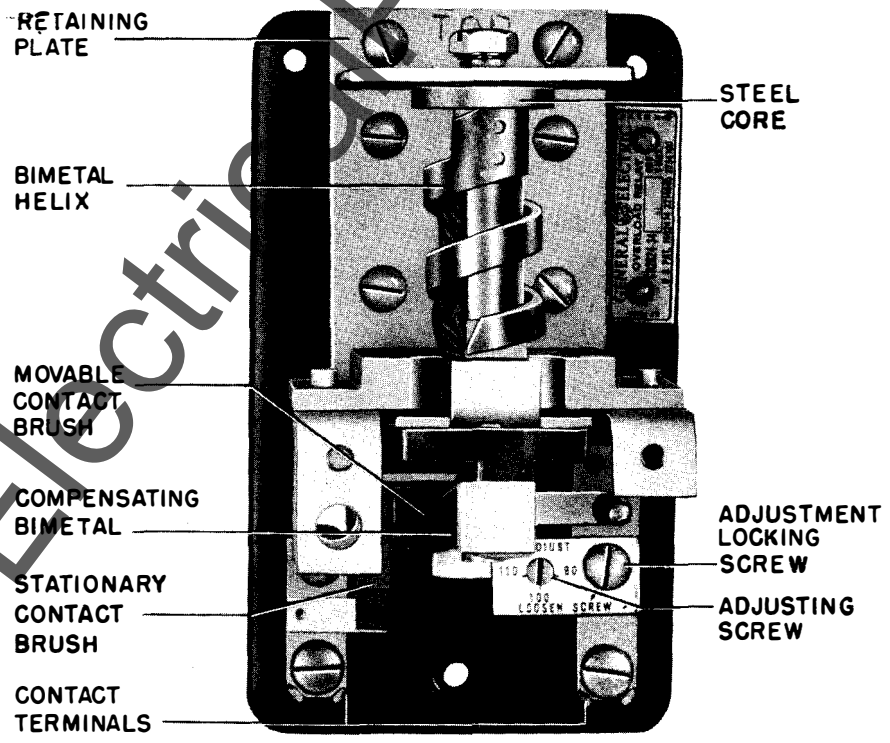
# RECEIVING, HANDLING AND STORAGE

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 Ap-




(8007952) Fig. 2

Fig. 2 Type TMC11A With Nameplate Removed To Show Adjusting Plate Of Thermal Unit




(8007955) Fig. 3

Fig. 3 Thermal Unit with Current Coil and Reset Rod Removed

paratus 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.

# 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. 7.

## CONNECTIONS

The internal connections for Type TMC11A relay are shown in Fig. 4. A typical wiring diagram is shown in Fig. 5. One of the mounting studs or screws should be permanently grounded by a conductor not less than No. 12 B&S gage copper wire or its equivalent.

# OPERATION

The relays are tested at 100 percent calibration. The relay when hot, is tested to hold (non-operative) at 90 percent of its coil rating and trip at 100 percent. Thus, an individual relay may vary as much as 10 percent in its calibration; i. e., an individual relay may trip at 90 percent of its coil rating with the adjustment screw set at 100 percent.

The instantaneous unit should be set at about 1.6 times the maximum (110 percent normal voltage) locked rotor current of the motor. Since the required setting would seldom be less than 5 times or more than 12 times full load current, the relays rated from 2.42 to 3.52 amperes are provided with 10/40 ampere units and the 3.87 to 5.60 ampere relays are provided with 20/80 ampere units.

Example: Standard 40° C motor, full voltage started, 60 cycle, full load current 3.92 amperes (CT sec.) maximum locked rotor current 500 percent. Use Model 12TMC11A58A rated 4.68 amperes 50/60 cycles thermal unit, 20/80 amperes instantaneous unit. The thermal unit has a nominal trip point of 4.68 amperes adjustable from 90 percent to 110 percent or 4.21 to 5.15 amperes. This corresponds to 108 percent to 131 percent of full-load allowing operation at 115 percent continuously if desired.

If this were a 55° C motor, the current value to be used for selecting the relay would be 3.92 x .9 or 3.53 amperes. Use model 12TMC11A57A rated 4.25 amperes. The nominal trip point is adjustable from 98 percent to 119 percent of full load allowing operation at 100 percent continuously.

For both motors, the instantaneous unit setting would be 3.92 x 5 x 1.6 x 1.1 = 35 amperes.

The average time-current characteristic curve for this relay is shown in Fig. 6.

# MAINTENANCE

The relay has been adjusted at the factory and it is advisable not to distrub the adjustments. It is most important that the bimetal helix and the compensating bimetal should never be tampered with at any time.

Upon leaving the factory, the relay is set for the 100 percent calibration. If it is desired to adjust the relay to trip at a slightly higher or lower value of current, loosen the adjustment locking screw (see Fig. 3.) Then the adjusting screw can be turned to provide the desired adjustment. Be sure to tighten the adjustment locking screw.

To substitute a new current coil in the thermal unit, the procedure should be as follows:

1. Remove coil leads from terminals 5 & 6.
2. Loosen the three mounting screws and remove the retaining plate (see Fig. 2).
3. Lift out the present coil and substitute the replacement taking care that the coil is mounted with the two locating pins on the lower side.
4. Replace the retaining plate so that it rests squarely against the end of the core.
5. Tighten the three mounting screws.
6. Connect coil leads to terminals 5 & 6.

## CONTACT CLEANING

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

(K-6375681) Fig. 4

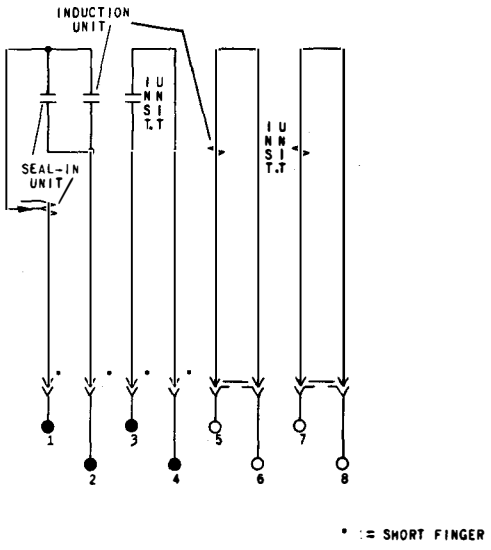



Fig. 4 Internal Connections for Type TMCIIA Relay

(K-6375737) Fig. 5

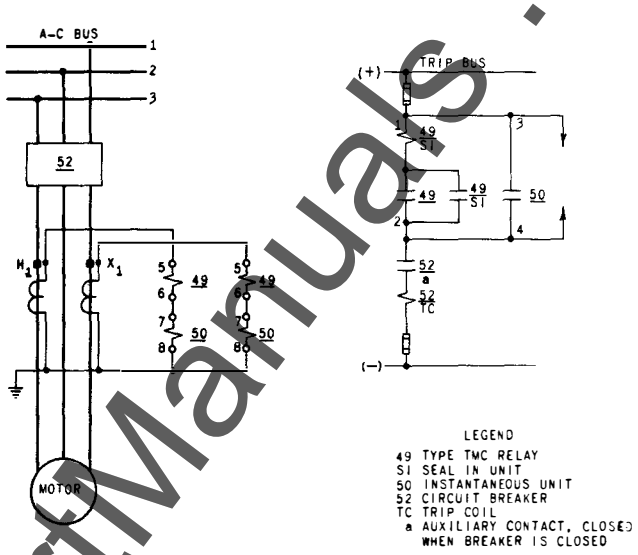



Fig. 5 Typical External Connections for Type TMCIIA Relay

(K-6375736) Fig. 6

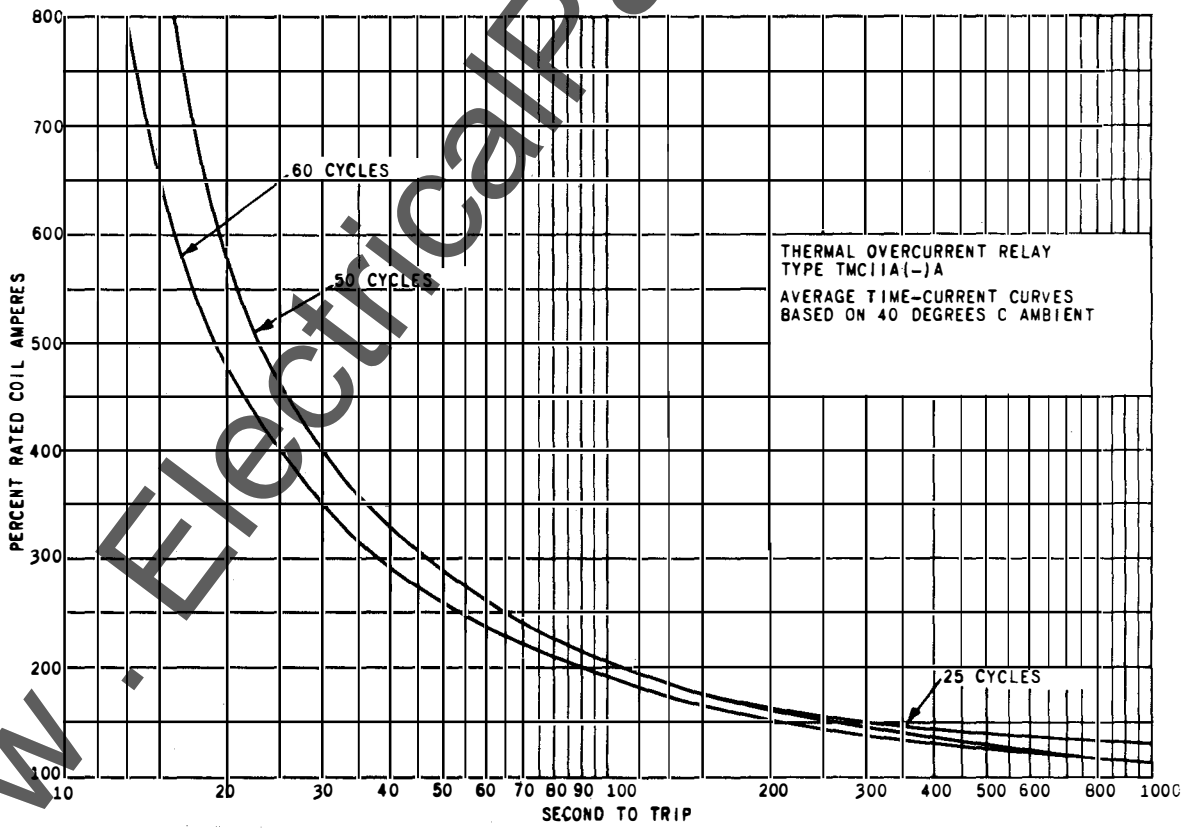



Fig. 6 Average Time-Current Characteristic Curve for Type TMCIIA Relay

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 points 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 above can be obtained 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, specify quantity required, name of part wanted, and give complete nameplate data, including serial number. If possible, give the General Electric Company requisition number on which the relay was furnished.

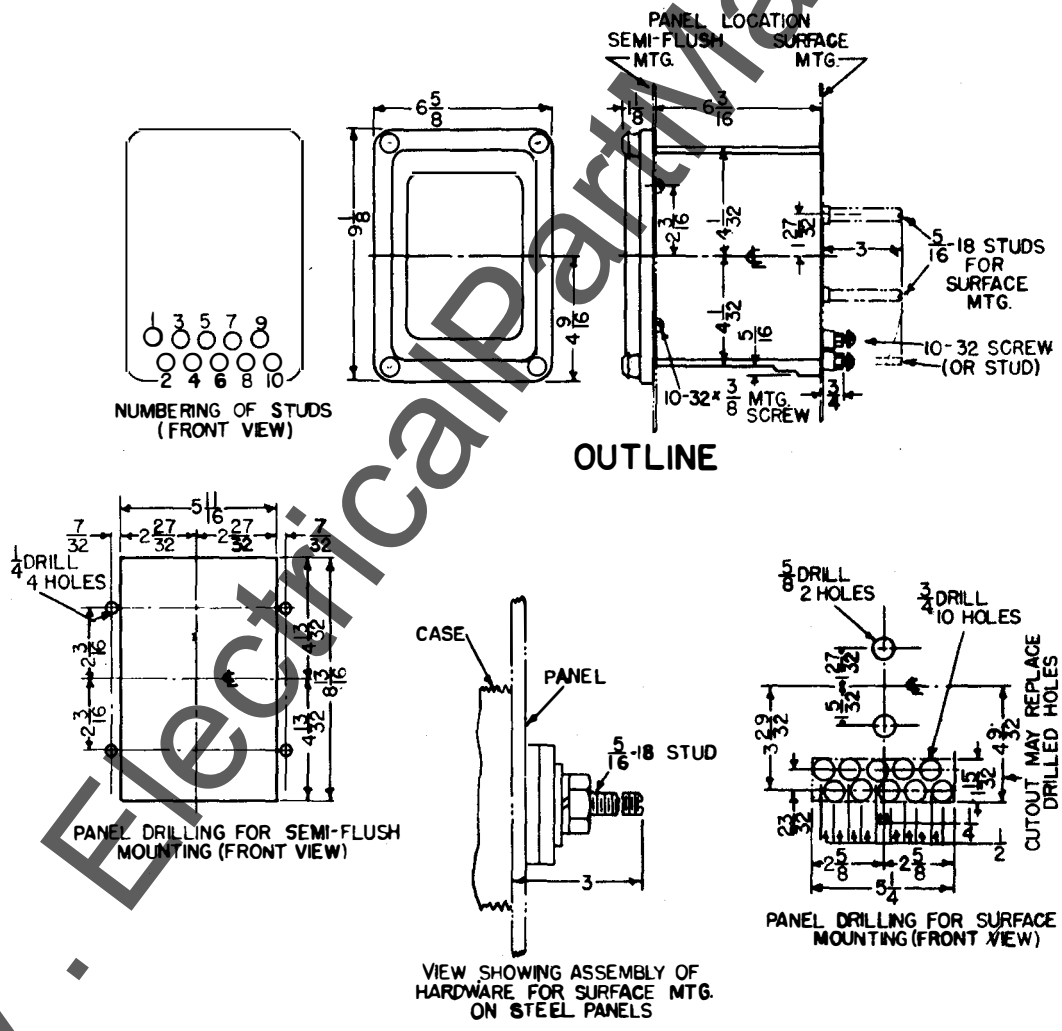



Fig. 7 (K-6209271)

Fig. 7 Outline and Panel Drilling for Type TMC11A Relay