INSTRUCTIONS

GEK-31192B

SUPERSEDES GEK-31192A

THERMAL OVERCURRENT RELAY

TYPE THC30A

GENERAL ELECTRIC

CONTENTS

DESCRIPTION

The Type THC30A three phase thermal overcurrent relays provide short circuit, stalled rotor and running overload protection for motors, and these relays incorporate compensation for change in relay ambient temperature. The Type THC30A relay consists of a thermal overload unit, three instantaneous units and a universal target and seal-in unit. The thermal unit consists of a thermal overload relay and three heaters which are connected across the secondary of current limiting transformers. The thermal unit has one normally open contact and an associated target and seal-in unit. The instantaneous units each have separate targets, but their normally open contacts are wired in parallel. See Figure 1 for the internal connections of the THC30A. The thermal unit contact is hand reset while the instantaneous unit contacts are self-reset. All four targets are reset by the same mechanism. A separate mechanism is provided to reset the thermal unit contact. The Type THC30A relays are mounted in single ended S2-size drawout cases. See Figure 4 for outline and dimensions.

APPLICATION

The Type THC30A three-phase thermal overcurrent relays provide short circuit, stalled rotor, and running overload protection for motors. The Type THC30A relays have a time current curve as shown in Fig. 3 and are suitable for use with general purpose a-c motors for which this curve will provide adequate overcurrent protection. A typical external connection diagram is shown in Fig. 2. The Type THC30A relays are not intended for use in primary circuits, but instead they should always be applied with current transformers. These relays are designed to be self protecting on a primary short circuit.

The relay rating should be selected so that the maximum full load motor current on a secondary basis falls between the minimum and maximum values of current shown in the RELAY SELECTION TABLE. The full load motor current is determined as the nameplate current multiplied by the correction factor given in the following table depending upon the type of motor being used:

TEMPERATURE RATING OF MOTOR	CORRECTION FACTOR
Continuous, 1.15 service factor	1.0
Continuous, 1.0 service factor	0.9
Short time, 60 minutes	0.8
Short time, 30 minutes	0.75
Short time, 15 minutes	0.7
Short time, 5 minutes	0.6

The relay thermal units have three trip control settings, 90 percent, 100 percent and 110 percent. y are designed to insure that in a 40°C ambient and on the 100 percent setting they operate to trip if current is between 90 and 100 percent of the nominal rating. In other words, the heater with a 3 ampere nominal rating will pick up some place between 2.37 and 2.63 amperes when on the 100 percent ting. On the 90 percent or 110 percent setting, it will pick up at 90 or 110 percent respectively, he current for which it operates on the 100 percent setting.

If the motor full load current (with correction factor applied) is near the maximum of the current selection for the chosen relay, unnecessary tripping may occur because of the negative tolerance for the calibration current. If such unnecessary tripping should occur, the thermal unit tripping current should be increased to 110% of coil rating to eliminate the problem.

The instantaneous unit should be set about 1.6 times the maximum (110 percent normal voltage) locked rotor current of the motor.

RELAY SELECTION TABLE

MODEL	FREQUENCY	AMPERES ONE SEC. RATING RELAY	NOMINAL HEATER RATING	FULL LOAD MOTOR CURRENT AMPS CORRECTED		INSTANTANEOUS UNIT AMPERE CALIBRATION	
				MIN.	MAX.	MIN.	MAX.
12THC30A1A	50/60	180 A	2.43	1.94	2.09	10	40
12THC30A2A	50/60	180 A	2.63	2.10	2.33	10	40
12THC30A3A	50/60	180 A	2.93	2.34	2.52	10	40
12THC30A4A	50/60	180 A	3.16	2.53	2.85	10	40
12THC30A5A	50/60	180 A	3.58	2.86	3.38	10	40
12THC30A6A	50/60	270 A	4.24	3.39	3.77	20	80
12THC30A7A	50/60	270 A	4.73	3.78	4.14	20	80
12THC30A8A	50/60	270 A	5.19	4.15	4.56	20	80
12THC30A9A	50/60	270 A	5.71	4.57	5.05	20	80
12THC30A10A	50/60	270 A	6.33	5.06	5.60	20	80
12THC30A11A	50/60	270 A	7.01	5.61	6.03	20	80

CALCULATION OF SETTINGS

Assume a 4160V motor with a unity service factor that has a full load (nameplate) current of 145 amperes. The maximum locked rotor current is 600% and the current transformers are 300/5.

$$I_{sec} = 145 \times 5/300 = 2.42 \text{ amperes}$$

Applying correction factor

$$I_{sec} (0.9) = 2.42 (0.9) = 2.18 \text{ amperes}$$

From the selection table, a 12THC30A2A would be used The THC30A2A has a nominal heater rating of 2.63 amperes. If it is assumed that the heater operates to trip at the 90 percent point of 2.37 amperes, then the THC30 will trip on approximately a 2% motor overload. If this leads to nuisance tripping, the trip control can be set at 110% which will then require a 12% overload before tripping occurs.

Should the motor always be run below the full load nameplate current it may be possible to select the 90% trip control setting to provide more sensitive thermal protection.

If the same motor had a service factor of 1.15 the correction factor would be 1.0 and a 12THC30A3A would be selected, and similar considerations to those given for selecting the trip control setting would apply.

CONSTRUCTION

The thermal unit consists of a thermal overload relay and three heaters which are connected across the secondary current limiting transformers. A bimetallic compensating strip in the contact operating mechanism provides ambient compensation so that the relay time curve matches the allowable overload time of the motor at an ambient temperature range of -20°C to +55°C. The thermal unit is available for hand reset only.

The instantaneous units are small hinged armature type relays. They operate over a continuously adjustable 4 to 1 range and have their calibrations stamped on a scale mounted beside the adjusting pole piece. The armature of each instantaneous unit carries a "T" shaped moving contact which carries the two stationary contacts and mechanically operates its hand reset target.

The target seal-in unit is also a small hinged armature type unit with a tapped coil. The armature carries a "T" shaped member which operates its hand reset target.

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 mechanisms for the thermal overload unit and all the targets.

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 connot 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.

RATINGS

THERMAL AND INSTANTANEOUS UNITS:

THC relays are available for 50 or 60 cycles operation in current ratings from 2.43 to 3.58 amperes with 10/40 amperes instantaneous units and from 4.24 to 7.01 amperes with 20/80 amperes instantaneous units. See "Relay Selection Table"

The ratings for the Target and Seal-in Unit is given in the table below

CHARACTERISTIC	TAPS	
	0.2	2.0
DC Resistance ± 10% (ohms)	7.0	0.13
Min. Operating (amperes)	0.2	2.0
Carry Cont. (amperes)	0.3	3.0
Carry 30 Amps For (sec.)	0.03	4.0
Carry 10 Amps For (sec.)	0.25	30.0
60 H Z Impedance (ohms)	52	0.53
Minimum Dropout (amps)	0.05	0.5

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 thermal overload unit NO contact is rated 25VA carry, 250VA make.

CHARACTERISTICS

BURDEN

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

COIL	FREQ.	AMP	VOLT AMP	OHMS	PF
10-40	60	5	0.83	0.033	0.95
	50	5	0.80	0.032	0.95
20-80	60	5	0.21	0.008	0.95
	50	5	0.20	0.008	0.95

The burden of the thermal overload unit and its current limiting transformer is approximately 5 volt-amperes at rated current 50 or 60 cycles. The burden in Volt-Amperes at 5 amperes is approximately equal to 25 divided by the heater rating.

OPERATION

The bi-metal strips of the thermal overload unit deflect under the influence of the motor current flowing through the thermal overload unit heaters. As the current increases sufficient heat will be generated to deflect the bi-metal strips.

The current limiting transformers are a one to one ratio current transformers which start to saturate at approximately six times heater rating thus protecting the heater from high short circuit currents. The relay can be subject to fifteen times heater current rating for a period long enough to cause the thermal unit to operate. Once the thermal overload unit operates, the current through the heaters should be removed immediately otherwise damage to the unit will result.

The thermal unit time curve is shown in Figure 3. It is suitable for most general purpose AC motors.

The target seal-in unit has its coil in series and its contacts in parallel with the N.C. contact of the thermal unit such that when the thermal unit contact closes, the seal-in unit picks up and seals in. Both the seal-in and instantaneous units show a target when operated. The targets remain exposed until reset by the reset rod at the lower left corner of the relay.

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 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 damaged 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.

ACCEPTANCE TESTS

Immediately upon receipt of the relay an inspection and acceptance test should be made to insure that no damage was sustained in shipment and that the relay calibrations have not been disturbed.

VISUAL INSPECTION

Check the nameplate stamping to insure that the model number, rating and calibration range of the relay received agree with the requisition.

Remove the relay from its case and check by visual inspection that there are no broken or cracked molded parts or other signs of physical damage, and that all screws are tight.

Check that the shorting bars are in the correct location as indicated in the internal connections diagrams shown in Figure 1.

MECHANICAL INSPECTION

Make the following checks on the targets, instantaneous units and thermal unit.

Manually operate the target to see that the target will latch before the total armature travel is exhausted. See that it resets freely again with some travel of the reset arm after resetting has occurred.

Operate the instantaneous unit for target response as indicated above. Then check to see that the contacts make at approximately the same time and indicate wipe-in action before the travel is exhausted.

Manually depress the operator (trip bar) located at the top of the thermal overload unit contact housing. When the relay is in the reset condition, an audible "click" will be heard when the operator is depressed indicating that the contacts are operating normally.

The relays are shipped from the factory arranged for hand reset.

WARNING

EVERY CIRCUIT IN THE DRAWOUT CASE HAS AN AUXILIARY BRUSH. IT IS ESPECIALLY IMPORTANT ON CURRENT CIRCUITS AND OTHER CIRCUITS WITH SHORTING BARS THAT THE AUXILIARY BRUSH BE BENT HIGH ENOUGH TO ENGAGE THE CONNECTING PLUG OR TEST PLUG BEFORE THE MAIN BRUSHES DO. THIS WILL PREVENT CT SECONDARY CIRCUITS FROM BEING OPENED.

DRAWOUT RELAYS GENERAL

Since all drawout relays in service operate in their case, it is recommended that they be tested in their case or an equivalent steel case. In this way any magnetic effects of the enclosure will be accurately duplicated during testing. A relay may be tested without removing it from the panel by using a 12XLA13A test plug. This plug makes connections only with the relay and does not disturb any shorting bars in the case. Of course, the 12XLA12A test plug may also be used. Although this test plug allows greater testing flexibility, it also requires C.T. shorting jumpers and the exercise of greater care sir connections are made to both the relay and the external circuitry.

POWER REQUIREMENTS GENERAL

All alternating current devices are affected by frequency. Since non-sinusoidal waveforms can be analyzed as a fundamental frequency plus harmonics of the fundamental frequency, it follows that alternating current devices (relays) will be affected by the applied waveform.

Therefore, in order to properly test alternating current relays it is essential to use a sine wave of current and/or voltage. The purity of the sine wave (i.e. its freedom from harmonics) cannot be expressed as a finite number for any particular relay, however, any relay using tuned circuit, R-L or RC networks, or saturating electromagnets (such as time overcurrent relays) would be essentially affected by non-sinusoidal wave forms.

ELECTRICAL TESTS

The electrical tests will consist of checking one point on the time-current characteristic of the * thermal unit at about 300% of rated heater current with the three heater coils connected in series. The minimum pickup values of the several auxiliary units such as the targets and instantaneous units should also be checked.

THC UNIT

Tests on the thermal unit should be made with the cover on and mounted vertically. In order to prevent some pre-heating of the unit,(such as would occur while adjusting the current in the test circuit to the desired level with the thermal unit in the circuit), set the current level without the thermal unit in the circuit. When the thermal unit is included in the circuit the magnitude of current will be somewhat less, but its value can be determined during the timing period to check the level of percentage overload. The resulting time should be within the band of the published time curves.

TARGET AND SEAL-IN

The target and seal-in units should pick-up at a current shown in table below:

TAP	PICK-UP CURRENT	DROPOUT CURRENT
0.2	0.15 - 0.195	0.05 OR MORE
2.0	1.50 - 1.95	0.5 OR MORE

INSTANTANEOUS UNIT

Set the core on the instantaneous unit at one of the values stamped on the calibrating plate. The pick-up current should be within $\pm$ 15% of this value. If a specific pick-up value is required the core may be adjusted to this value by loosening the locknut and turning the pole piece toward the desired setting.

* Indicates revision

CAUTION:

THE INSTANTANEOUS UNIT IS RATED 1.5 TIMES MINIMUM PICK-UP. IF THE MINIMUM PICK-UP CURRENT DESIRED IS GREATER THAN THE MAXIMUM RATED CURRENT INSURE THAT THE UNIT IS DE-ENERGIZED ONCE IT PICKS UP OR DAMAGE MAY RESULT TO THE UNIT IF THE CURRENT IS LEFT ON.

INSTALLATION

LOCATION

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

MOUNTING

The relay should be mounted on a vertical surface. The outline and panel diagrams are shown in Fig. 4.

CONNECTIONS

Internal connections for type THC relays are shown in Fig. 1. A typical wiring diagram is shown in Fig. 2.

MAINTENANCE

The relay has been adjusted at the factory and it is advisable not to disturb the adjustments. The interior of the thermal units should not be tampered with as adjustments to these units cannot be made without the use of factory calibration equipment.

To substitute a new heater in the thermal unit, proceed as follows: Remove relay from its case. Remove the nameplate. Remove the heater mounting screws and lift out the heater. Insert the new heater, being careful to keep the notched corners of the glass support strip to the top and then tighten the mounting screws. The heaters should not be inserted in the thermal overload unit if they are bent, otherwise malfunctions may result.

CLEANING CONTACTS

For cleaning fine silver contacts a flexible burnishing tool should be used. This consists of an etched roughened strip of metal, resembling a superfine file which removes corroded material quickly without scratching the surface. The flexibility of the tool insures the cleaning of the actual points of contact. Never use knives, files, abrasive paper or cloth to clean fine silver contacts. A burnishing tool as 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 the part wanted, and give complete nameplate data, including serial number. If possible, give the General Electric Company requsition number on which the relay was furnished.

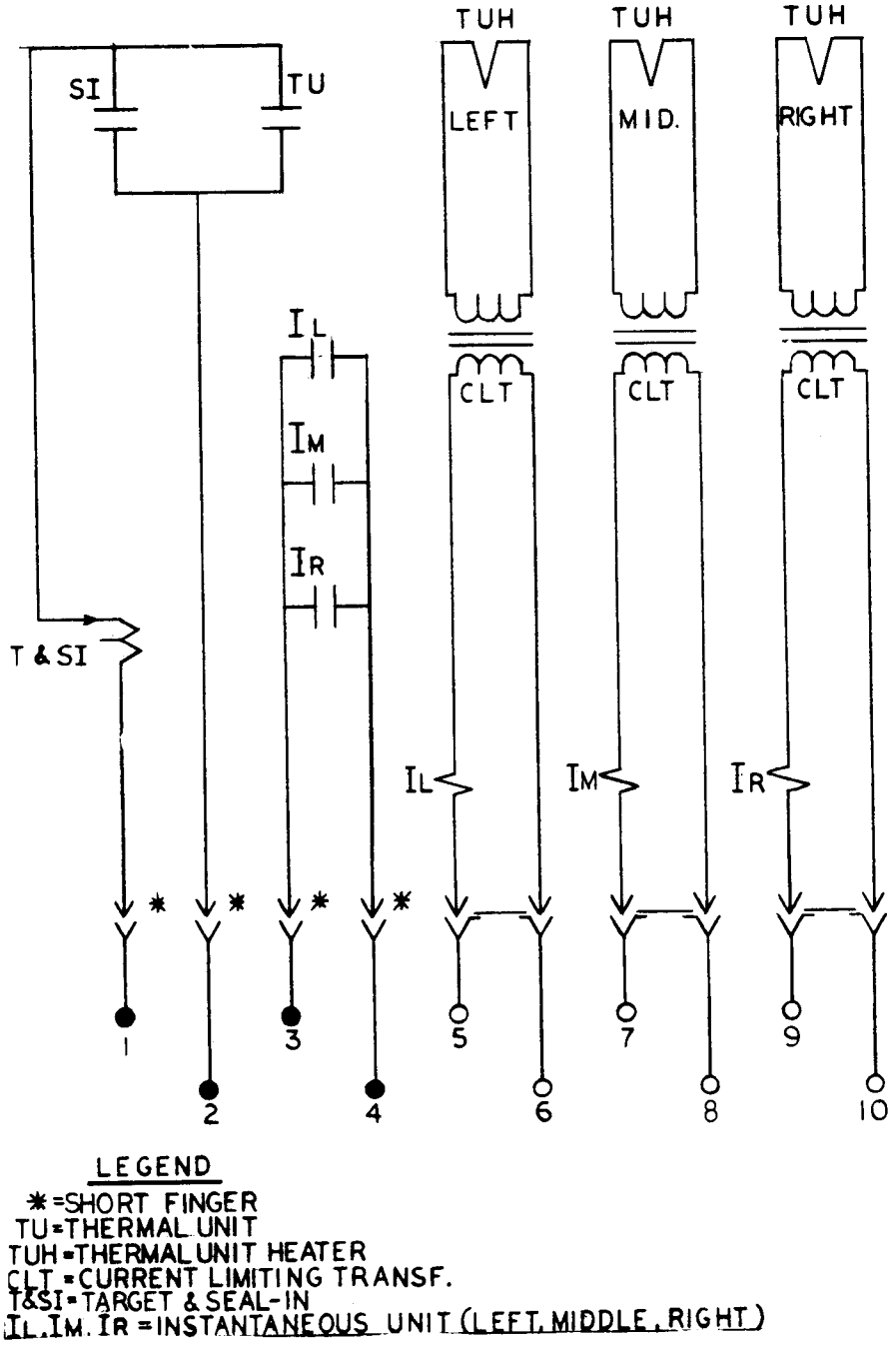
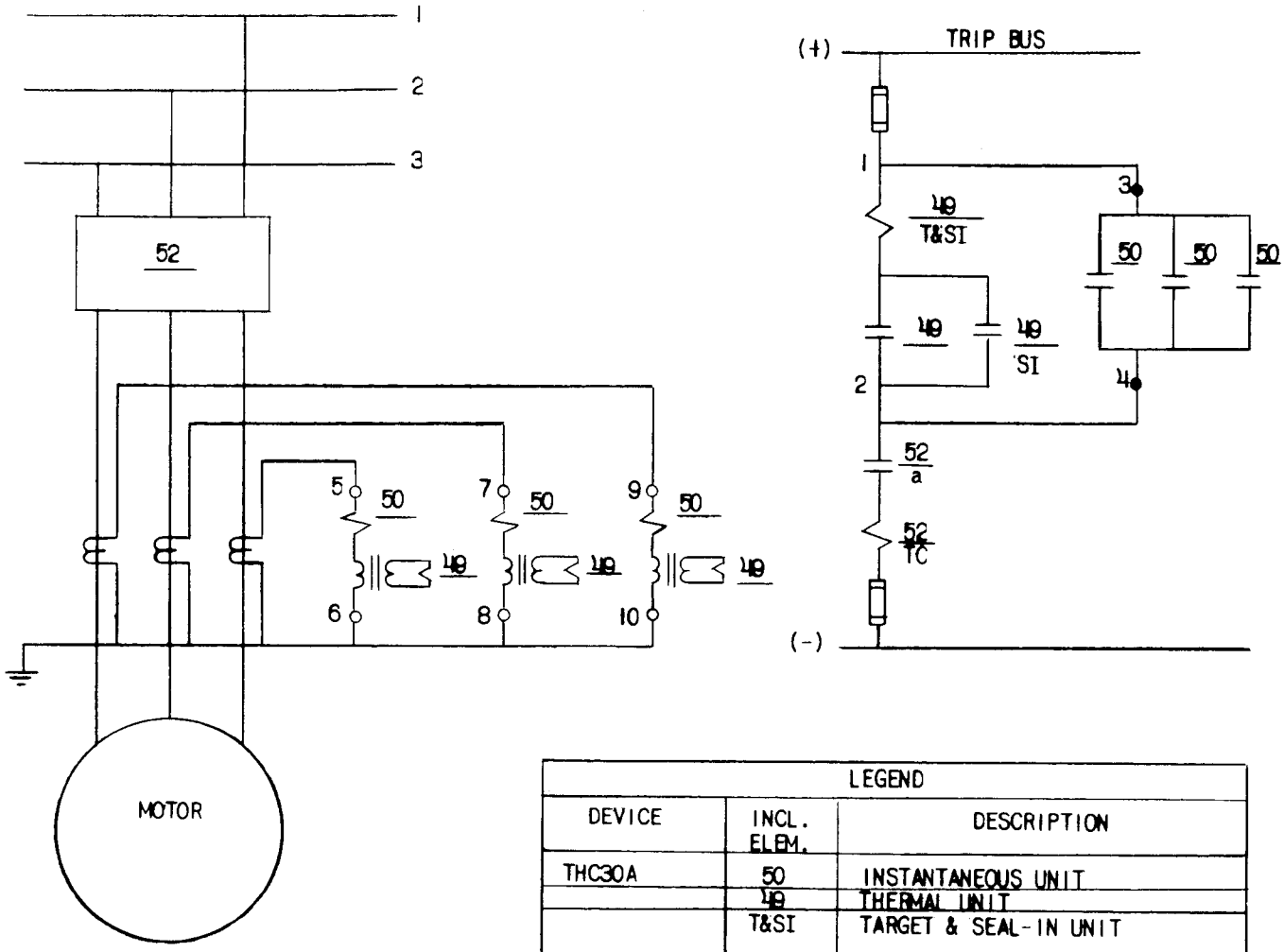


Figure 1. (0227A7136-0) Internal Connection Diagram Front View



LEGEND		
DEVICE	INCL. ELEM.	DESCRIPTION
THC30A	50	INSTANTANEOUS UNIT
	49	THERMAL UNIT
	T&SI	TARGET & SEAL-IN UNIT

Figure 2. (0246A3683-0) Typical External Connections for Type THC30A Relay

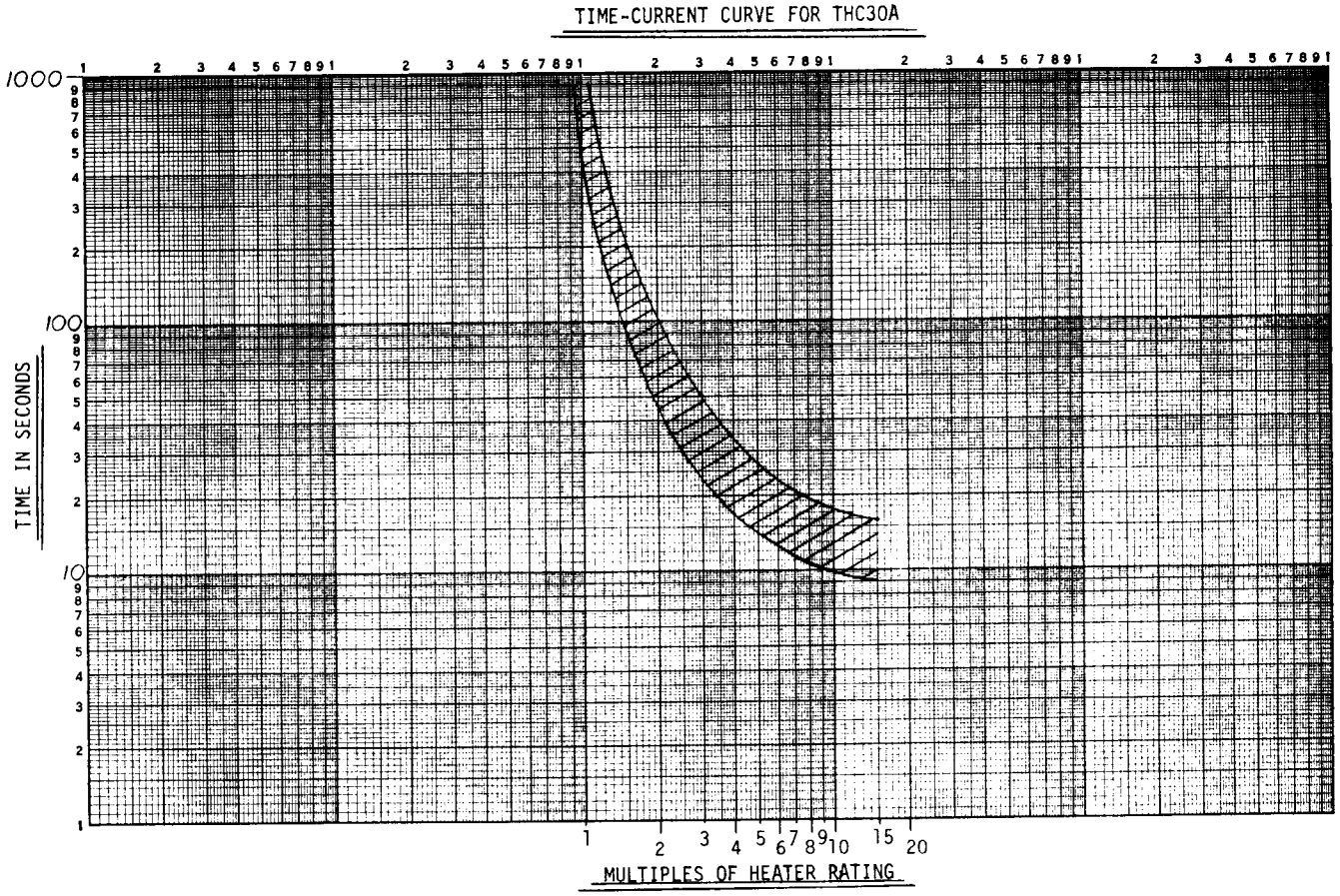


Figure 3. (0246A3824-0) Time Current Curve for THC30A

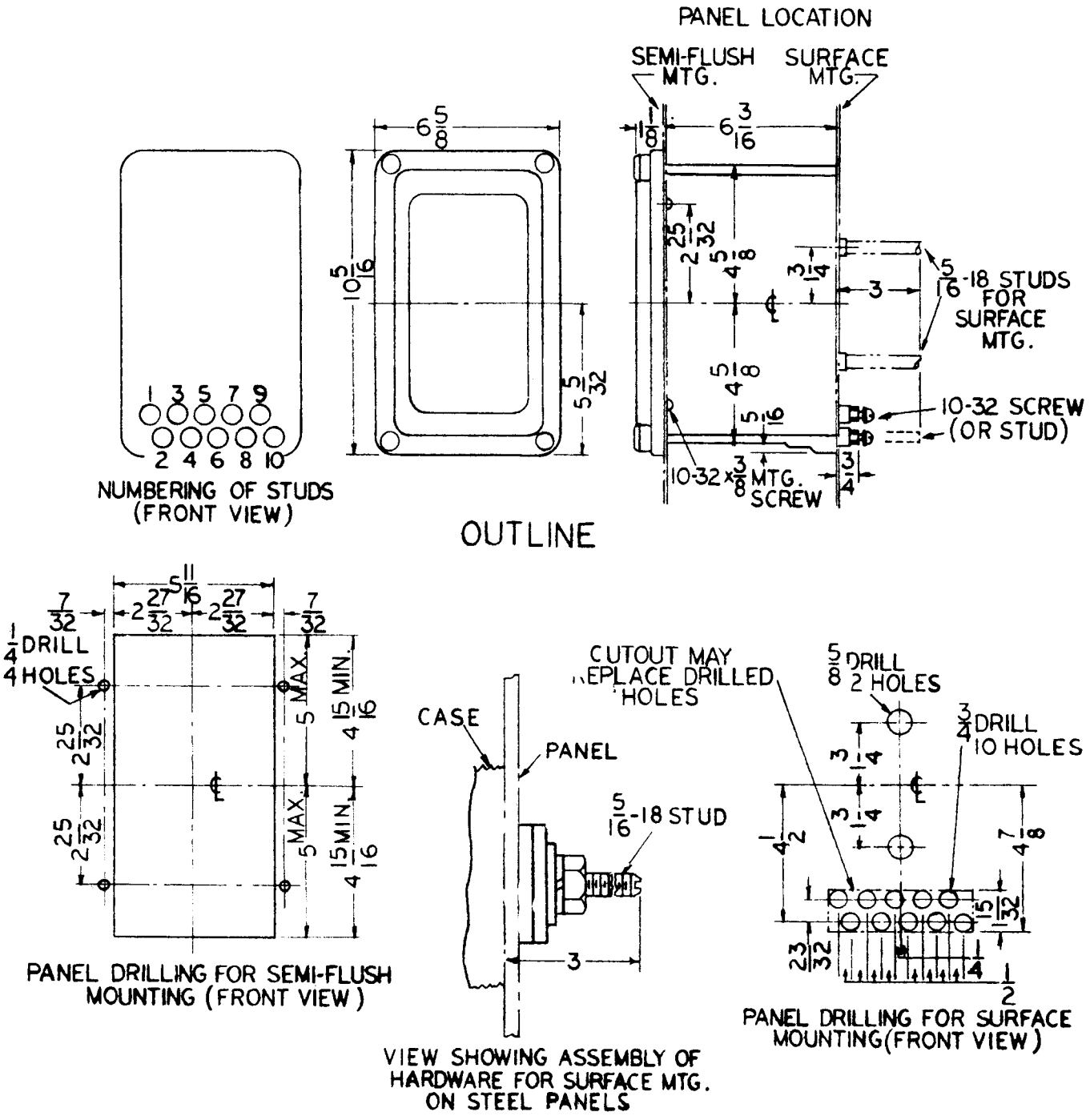


Figure 4. (0227A8541-0) Outline and Panel Drilling for THC30A Relay

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