INSTRUCTIONS

GEK-1266E

SUPERSEDES GEH-1812

and GEK-1266D

RECLOSING RELAYS

TYPES

HGA18E21 AND UP

HGA18F31 AND UP

GENERAL ELECTRIC

CONTENTS

RECLOSING RELAYS

TYPES

HGA18E21 AND UP

HGA18F31 AND UP

DESCRIPTION

The relays covered by these instructions are self-resetting, "single-shot" reclosing relays which are intended to initiate immediate reclosure of a power circuit breaker that has been tripped by protective relays. The relays will operate to initiate a reclosure following tripping of the breaker only if a predetermined time has elapsed since a previous successful reclosure.

These relays are designed for use where a single immediate reclosure of circuit breakers is desired. In the event that the breaker reopens immediately after reclosure, indicating a continuation of abnormal conditions, the apparatus remains locked out. The relays are suited for use in applications where the requirements of continuity of service do not justify subsequent time reclosures, such as the Type ACR and Type NLR relays provide.

The basic operating elements of the HGA18E and HGA18F relays, which are designed for operation from a d-c voltage source, are a type HGA hinge-type unit with a two-winding coil, a timing capacitor, and two resistors.

The operation of the relays is best understood from the typical external connections in Fig. 1. With the breaker closed the auxiliary switch 52/b will be open and the timing capacitor (79/CAP) will be charged, through the closed contact of 52/CS and the charging resistor, to full rated d-c source voltage. When the breaker trips, closure of the 52/b contact will discharge the capacitor through the operating coil of the HGA unit (79/OC) causing the unit to pick up and seal in by means of its holding coil (79/HC), and to energize the breaker closing circuit via the 79 contact between terminals 1 and 2.

When the breaker recloses, the 52/b contact will open deenergizing the holding coil and causing the relay to reset. The timing capacitor will then commence to recharge. The reset time of the relay is defined as the time required for the capacitor to recharge to the point where its stored energy will be sufficient to pick up the HGA unit if the 52/b contact should again discharge the capacitor through the 79/OC coil. If the breaker remains closed for a time longer than the reset time, the relay will be ready to initiate a reclosure if the breaker is again tripped. However, if a subsequent opening of the breaker occurs in a time shorter than the reset time of the relay, the stored energy in the capacitor will not be sufficient to pick up the HGA unit and the reclosing relay will be locked out.

APPLICATION

The type HGA18E and HGA18F reclosing relays are usually applied with transmission line circuit breakers where a single high-speed reclosure is desired, and where, if this single reclosure attempt is unsuccessful, it is desired to lock out the breaker. The external connections for such an application are shown in Fig. 1 where two 52/b contacts are available, or in Fig. 2 where only one 52/b contact is available. Note in Fig. 2 that if a single 52/b contact is used, an external blocking diode is required to avoid a sneak circuit.

A capacitor discharge resistor is provided between terminals 6 and 9 of the relay case to provide a means of disabling the reclosing relay by means of an external contact if desired. For example, the user may wish to permit a reclosure following a high-speed pilot trip but cancel reclosing following a delayed back-up trip. This external reclose-cancel contact should be an electrically separate contact (i.e., "dry" contact) to avoid the possibility of a sneak circuit introduced by the protective relay circuits.

GENERAL CONSIDERATIONS

The following general points must be considered when applying automatic reclosing relays:

1. Interrupting Rating of Power Circuit Breaker - The derating factor applying to the interrupting rating of the power circuit breaker should be checked prior to the application of a reclosing relay or the selection of a reclosing cycle.

2. Closing Control Circuits - When automatic reclosing is used, it is essential that the closing circuits with solenoid mechanisms ensure complete closure of the breaker even though the auxiliary switch on the breaker mechanism opens before the closure is complete.

3. Latch-checking Switches - In order to ensure successful operation of a breaker reclosed by a Type HGA18 relay, it is necessary that the breaker mechanism be equipped with a latch-checking switch if the mechanism is trip-free. This switch ensures that the mechanism latch is properly set for reclosure before the closing circuit is completed. Latch-checking switches are not required for non-trip-free mechanisms.

4. Control Switches - A control switch (typically Model 16SB1B9) should be provided with automatic reclosing schemes using the Type HGA18 reclosing relays. This switch includes contacts to prevent the breaker from being automatically reclosed after it has been tripped by the control switch. The breaker must be reclosed by means of the switch before the automatic reclosing feature will be restored.

5. Undervoltage Devices - Where undervoltage devices are involved on the circuit fed by the breaker, it is usually necessary to coordinate the reclosing time and the trip time of the undervoltage device to ensure that the desired results are obtained. Where the UVD is involved in a throwover scheme, the initial reclosure usually should be faster. Where motor control is involved, it may or may not be desirable for the initial reclosure to be faster. Each application should be checked to determine the required co-ordination.

6. Associated Protective Relays - If high-speed reclosing is to be successful, the protective relays that tripped the breaker obviously must reopen their contacts before the breaker recloses. Some of the superseded types of induction time-overcurrent relays are not suitable for use with high-speed reclosing. If distance relays are supplied from line-side potential, their contacts should be supervised by contacts of instantaneous fault detectors to ensure that the trip circuit is open before the breaker recloses.

RATINGS

The Type HGA18E and HGA18F relays are available in standard voltage ratings between 24 and 250 volts d-c. Reset times from 3 to 30 seconds are available. The HGA18F has a single rated target coil with ratings from 0.1 to 2.0 amperes.

Current closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The contacts have a current-carrying rating of 12 amperes continuously or 30 amperes for one minute. Interrupting ratings (non-inductive circuits) for various voltages are given in the table below:

	D-C				A-C	
Volts	24	48	125	250	115	230
Amps	3	1.5	0.6	0.25	20	10

* TARGET RATINGS

	AMPERES AC OR DC				
Min. Target Release	0.05	0.10	0.20	1.0	2.0
Carry for 1 Second	1.8	3.6	7.2	45	60
Carry continuously	0.13	0.25	0.50	2.5	5.0
D.C. Resistance (ohms)	128	30	8.0	0.25	0.10

* Indicates revision

CHARACTERISTICS

After the relay has operated to reclose a breaker, the relay will not operate again if the breaker does not remain closed for at least the "reset time". This is the resetting time of the relay and is explained more thoroughly under ACCEPTANCE TESTS.

Normal burden data is not applicable to the HFA18 as the operating coil is energized only momentarily during the reclosing operation.

CONSTRUCTION

Type HGA18E relay consists of a Type HGA unit, a capacitor, and one or two resistors mounted in a drawout case.

The single ended, S1, drawout 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 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. 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 voltage, 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.

Contact circuits of the Type HGA unit are closed or opened by moving contact arms controlled by a hinge-type armature, which in turn is actuated by the operating coil and restrained by an adjustable control spring. The lengths of contact and armature gaps are adjusted by means of screw contacts and locknuts in the front fixed contact positions. Armature gap (and back contact wipe) can also be controlled by the screws and locknuts located on the moving contact arms. The latter features make it possible to reduce the pickup energy and pickup time to relatively low values. Only one normally closed contact (not electrically connected) is used since the weak control spring tension would not give sufficient contact pressure on two normally closed contacts. The coil consists of an operating and a holding winding which is connected in separate circuits. The holding winding is connected in series with a normally open contact of the relay.

Type HGA18F relay is similar to the Type HGA18E relay except for the addition of an electric target.

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.

ACCEPTANCE TESTS

MECHANICAL CHECK

Check that all screws are tight, for loose or damaged parts, that the armature operates freely and that the nameplate information agrees with the requisition.

In it normal position the control spring will be anchored in the front hole of the anchor pin and in the next to the top notch of the armature tail; however, see directions for adjusting the spring under SERVICING.

The contact wipe, measured by the gap between the armature and the pole piece when the normally open contacts just make, should be 0.02 inch. The minimum recommended contact gap is 1/16 inch.

Check wiring against the internal connections diagram, Fig. 3. Use a bell set or ohmmeter to check that the contact circuits make in the picked up position.

TIME CHECK

These relays are designed to close the contacts only if a predetermined time interval has elapsed since the previous closure of the contacts. This time interval is determined by the time required to charge the capacitor to a high enough voltage to pick up the relay operating coil.

A convenient test circuit for the Type HGA18 relay is shown in Fig. 4.

Rated voltage should be applied to terminals 8 and 10 for all time checks as the applied voltage will have considerable effect on the resetting time of the relay.

Starting with zero charge on capacitor C, close switch S-2 starting the timer and charging capacitor C.

When the timer indicates the resetting time S-1 is closed and the relay should pick up. The timer will record the exact charging time.

If it is permissible to open the controlled circuit breaker momentarily, the relay resetting time may be determined by the "cut and try" method. That is, it should reclose the breaker immediately when it is first tripped and again after waiting for the number of seconds equal to the "reset time" of the relay under test.

TARGET UNITS

For models with target units check that the target operates at 80 percent or less of its rating.

HOLDING COIL

Check the resistance of the holding coil with an ohmmeter. Holding coil resistance for relays rated 48 volts d-c and below should be 270 $\pm$15 percent ohms. The resistance of all other holding coils should be 7250 +15 percent ohms.

Check that the holding coil holds the armature closed after the relay is operated electrically.

INSTALLATION PROCEDURE

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. 5.

CONNECTIONS

The internal connection diagram is shown in Fig. 3. Typical wiring diagrams are shown in Figs. 1 and 2. Note that terminals #3 and #10 must have the same polarity of applied voltage. If this polarity is reversed, the holding coil will not hold in the armature of the relay unit.

Unless mounted on a steel panel that adequately grounds the relay case, it is recommended that the case be grounded through a mounting stud or screw with a conductor not less than #12 B&S gage copper wire or its equivalent.

PERIODIC CHECKS AND ROUTINE MAINTENANCE

OPERATION

These relays should be checked for operation at regular intervals, preferably at the same time that the associated protective devices are inspected. Operation can be checked using the circuit and procedures described under ACCEPTANCE TESTS. The settings should not require readjustment, but if changes are necessary the points discussed under SERVICING should be observed.

CONTACT CLEANING

For cleaning fine silver contacts, a flexible burnishing tool should be used. This consists of a 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 ensures the cleaning of the actual points of contact.

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.

SERVICING

The relay has been adjusted at the factory but if a check shows that the adjustments have been disturbed, the following adjustments may be made to restore the desired operation.

The contact wipe, measured by the gap between the armature and the polepiece when the normally open contacts just make, should be 0.02 inch. This gap may be obtained by means of the adjusting screws in the moving contact arms. Locknuts on these screws should be tightened after any adjustment.

Minimum recommended contact gap is 1/16 inch. This can be conveniently set by turning the right-hand contact screw in until the normally open contacts are just making, and then backing it off 3 3/4 turns and locking it securely in position by means of the locknuts. If the contact gaps are made shorter, the interrupting ratings listed no longer apply.

Resetting time of the relay is the time required for the capacitor to absorb sufficient energy to operate or pick up the relay unit. Steady state d-c voltage required to pick up the relay unit is considerably less than the capacitor voltage required. Control spring tension of the relay may be changed for slight adjustments of resetting time. This is done by changing the position of the spring in the notches on the armature tail or by shifting it from one hole to the other of the anchor pin. If it is not possible to increase reset time to 15 seconds by adjusting the spring, it is permissible to increase the armature gap by means of the back contact until the required charging time is obtained. The contact gap in this case will be approximately 1/8 inch.

The charging resistor R_1 and capacitor were selected to provide the normal resetting time at rated voltage, however, longer or shorter resetting time may be obtained by changing the values of these components. For longer times use the capacitor; for shorter times change the resistor. The new value of resistance or capacitance may be selected using the following formulas:

$$R_{1A} = \frac{T_2}{T_1} R_1 \qquad C_2 = \frac{C_1}{T_1} (T_2 - T_1)$$

where

R_1 = Resistance (in ohms) in relay as shipped.

R_{1A} = Resistance (in ohms) required for desired resetting time

T_1 = Rated resetting time (in seconds) of relay

T_2 = Desired resetting time (in seconds)

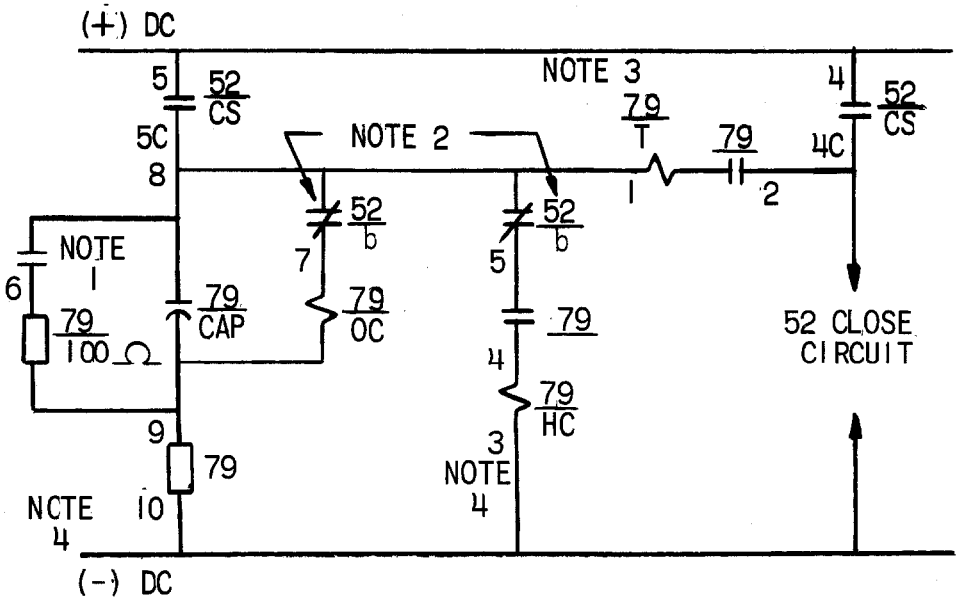
C_1 = Capacitance in farads in relay as shipped

C_2 = Added capactiance in farads across terminals 8 and 9.

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 catalog numbers as shown in Renewal Parts Bulletin No. GEF-2623.



52/CS 16SB1B9		CLOSE	NOR AFT CLOSE	NOR AFT TRIP	TRIP
1 2	1				X
	2				X
3 4	3		X	X	
	4	X			
5 6	5	X	X		
	6	X	X		

INTERNAL

79 - HGA18E/F 165A6043

OC - OPERATE COIL

HC - HOLDING COIL

T - TARGET

CAP - CAPACITOR

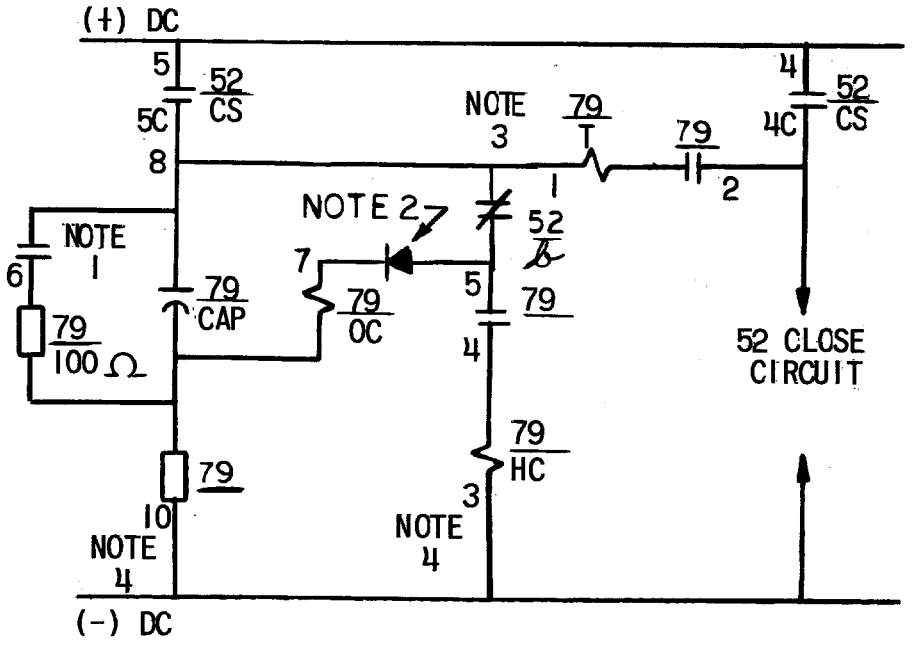
NOTE 1: DISABLING CONTACT, TO BE SUPPLIED BY USER.

NOTE 2: TWO BREAKER b SWITCHES ARE NECESSARY TO AVOID A SNEAK CIRCUIT. WHEN ONLY ONE b SWITCH IS AVAILABLE, SEE DRAWING 257A5080.

NOTE 3: 79/T IS SUPPLIED ON HGA18F ONLY.

NOTE 4: TERMINALS 3 AND 10 MUST BE OF SAME D-C POLARITY.

Fig. 1 (257A5079-0) Typical External Connections of HGA18E and HGA18F Relays Where Two 52/b Contacts are Available



52/CS 16SB1B9		CLOSE	NOR AFT CLOSE	NOR AFT TRIP	TRIP
1 2	1				X
	2				X
3 4	3		X	X	
	4	X			
5 6	5	X	X		
	6	X	X		

INTERNAL

79 - HGA18E, 18F 165A6043
OC - OPERATING COIL
HC - HOLDING COIL
T - TARGET
CAP - CAPACITOR
RECTIFIER 295B233
GI2 48 OR 125V DC
GI3 25CV DC

NOTE 1: DISABLING CONTACT, TO BE SUPPLIED BY USER.

NOTE 2: RECTIFIER IS NECESSARY TO AVOID SNEAK CIRCUIT WHEN USING ONE BREAKER b SWITCH FOR INITIATION. SEE ALSO DRAWING 257A5079.

NOTE 3: 79/T IS SUPPLIED ON HGA18F ONLY.

NOTE 4: TERMINALS 3 AND 10 MUST BE OF SAME D-C POLARITY.

Fig. 2 (257A5080-2) Typical External Connections of HGA18E and HGA18F Relays Using One 52/b Contact and a Blocking Diode

* Indicates revision

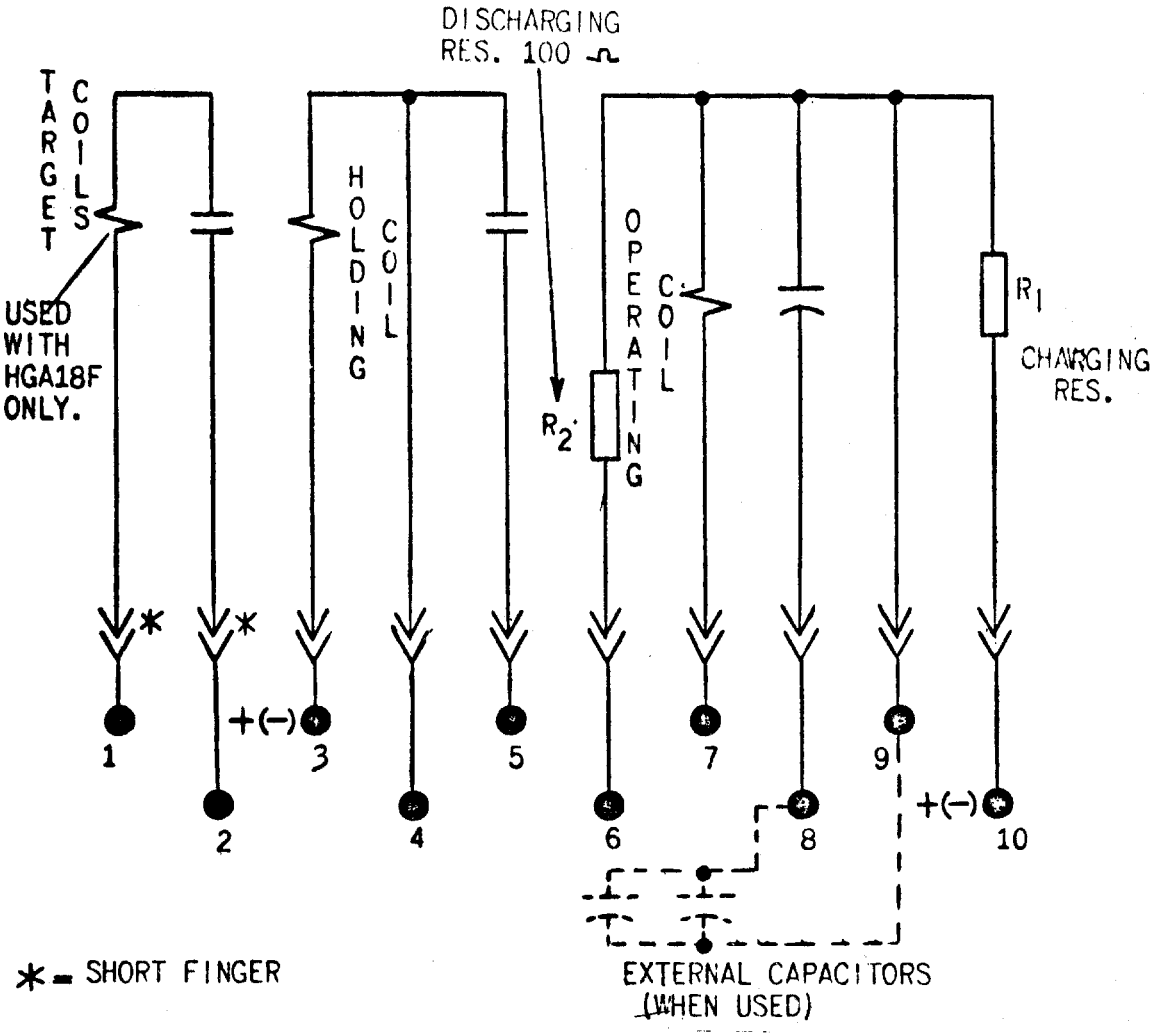
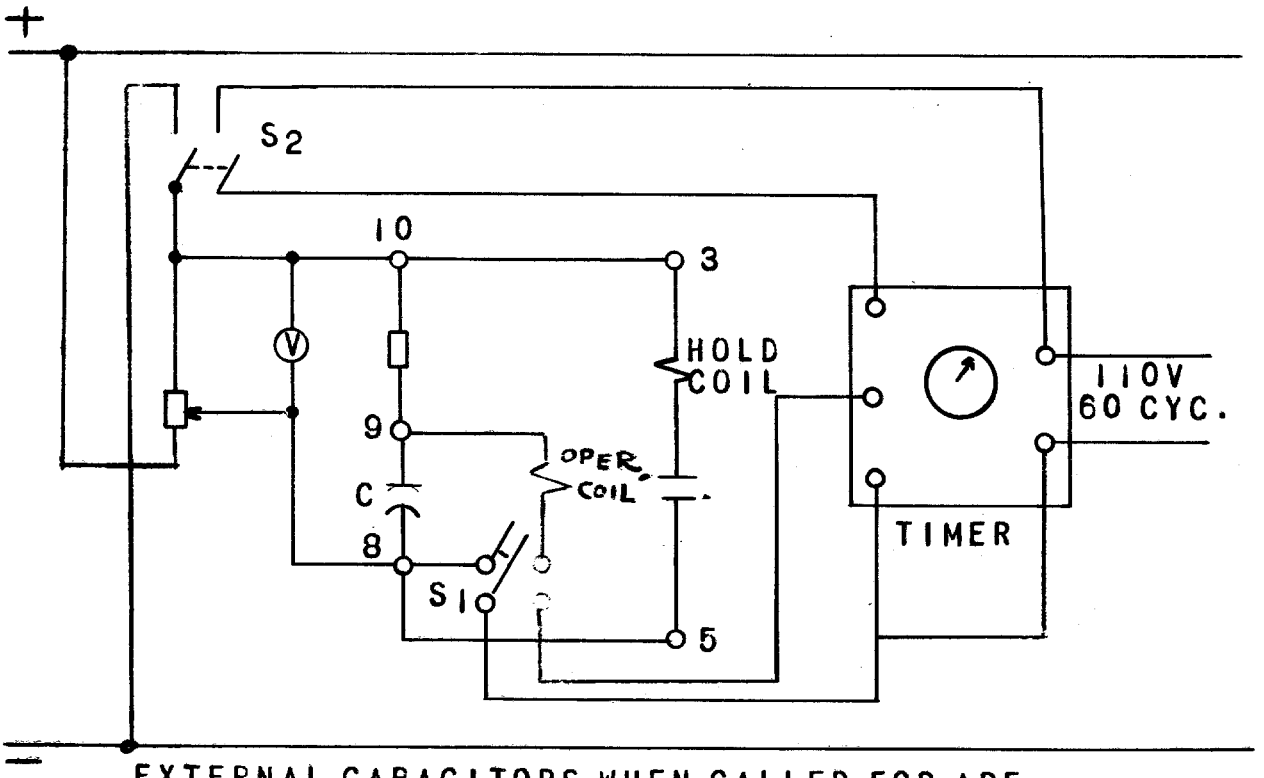
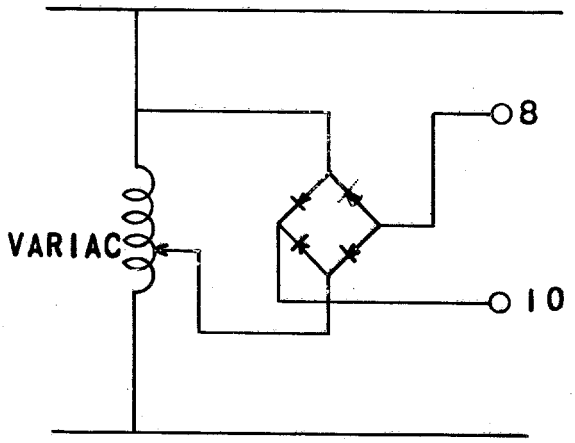


Fig. 3 (0165A6043-1) Internal Connections Diagram for Relay Types HGA18E21 and Up and HGA18F31 and Up (Front View)



EXTERNAL CAPACITORS WHEN CALLED FOR ARE CONNECTED BETWEEN STUDS 8 AND 9.



FOR FULL WAVE RECTIFIED SOURCE OTHERWISE SAME AS ABOVE FIGURE.

Fig. 4 (6400546-4) Testing Connections Diagram for Relay Types HGA18E and HGA18F

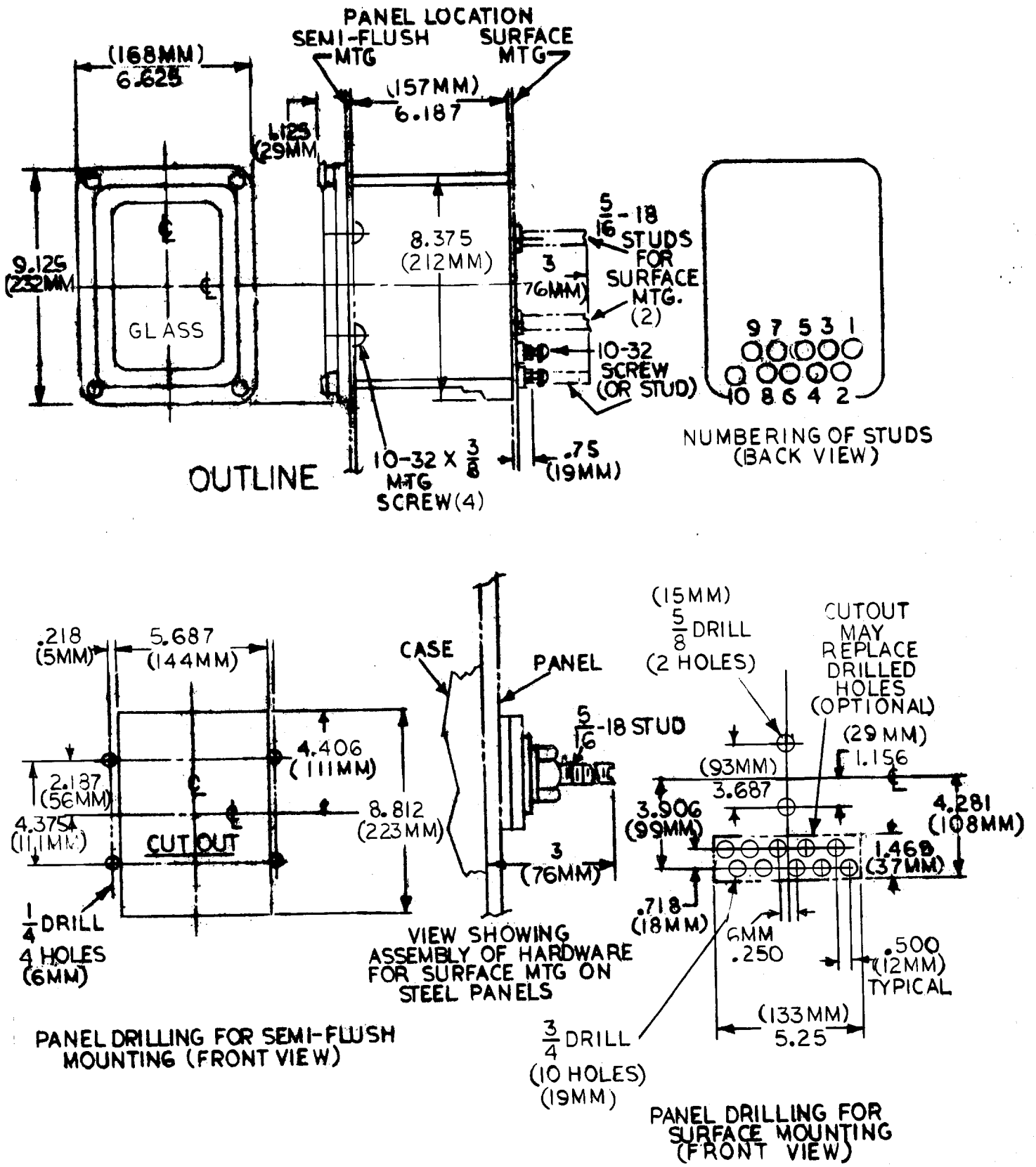


Fig. 5 (6209271-5) Outline and Panel Drilling Dimensions for Relay Types HGA18E and HGA18F

* Indicates revision