INSTRUCTIONS

GEK-26483C

OVERPOWER AND UNDERPOWER RELAY

TYPE CFW11E

FORMS 21 AND UP

GENERAL ELECTRIC

CONTENTS

	PAGE
INTRODUCTION	3
APPLICATION	3
RATINGS	3
HOLDING COILS	4
BURDENS	4
RECEIVING, HANDLING AND STORAGE	4
DESCRIPTION	5
CASE	5
CONTACTS	5
INSTALLATION	5
LOCATION	5
MOUNTING	5
CONNECTIONS	5
ADJUSTMENTS	6
CONTACT GAP	6
CONTACT TRAVEL AND SPRING TENSION	6
TESTS	6
MAINTENANCE	7
BEARINGS	7
CONTACT CLEANING	7
RENEWAL PARTS	8

OVERPOWER AND UNDERPOWER RELAY
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INTRODUCTION

The Type CFW11E relay is a high speed overpower and underpower induction-cup type relay. The relay unit consists of a stator with eight laminated magnetic poles projecting inward and arranged symmetrically around a central magnetic core. The poles are fitted with current and potential coils; four current coils which are internally connected forming a single circuit as well as four potential coils similarly connected. The cylindrical part of cup-like aluminum rotor turns freely in the annular air gap between the poles and the central core. The rotor carries the moving contacts.

This construction provides higher torque and lower rotor inertia than the induction-disk construction, making these relays faster and more sensitive.

APPLICATION

The Type CFW11E relay is used primarily as a control relay in alternating current circuits. A typical application being to operate auxiliary relays which regulate the field current of a motor as its load varies.

RATINGS

The Type CFW11E relay is available with potential circuits rated 115, 230, or 460 volts, 50 or 60 hertz. The current coils are rated 5 amperes continuous or 200 amperes for one second. Relays for 115 volt circuits can be calibrated to close the left contact at any value of three phase watts between zero and 800 watts. The right contact can be adjusted to close when the three phase watts are 5 to 40 watts below the setting of the left contact. If the potential circuit is rated 230 volts then the left contact can be adjusted to close at any value of three phase watts from zero to 1600 watts, and the right contact can be adjusted to close 10 to 80 watts below the setting of the left contact. If the potential circuit is rated 460 volts then the left contact can be adjusted to close at any value of three phase watts from zero to 3200 watts, and the right contact can be adjusted to close 20 to 160 watts below the setting of the left contact.

The relay will be set at the factory to the settings specified on the requisition. If no settings are specified on the requisition then the following factory settings will be made:

POTENTIAL RATING	3 PHASE WATTS	
	CLOSE LEFT	CLOSE RIGHT
115	250	220
230	500	440
460	1000	880

The relay develops maximum torque when the current thru the current circuit (studs 5-6) leads the voltage on the potential circuit (studs 7-8) by 30 degrees. If the relay is connected as shown in Fig. 3 then the current in the relay (Phase One current) will lead the voltage on the relay (Phase One-to-Three voltage) by 30 degrees when the Phone One current is in phase with the Phase A to neutral voltage (unity power factor).

Holding Coils

There are two ratings of these coils available. The choice between them depends on the current taken by the tripping circuit.

The 0.2-ampere coil is for use with trip coils that operate on currents ranging from 0.2 to 1.0 ampere at the minimum control voltage. If this coil is used with trip coils that take 1.0 ampere, or more, there is a possibility that the seven-ohm resistance will reduce the tripping current to so low a value that the breakers will not be tripped.

The 1.0-ampere coil should be used with trip coils that take 1.0 ampere or more at the 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 must be used to control the trip coil circuit, the connections being such that the tripping current does not pass through the holding coil of the Type CFW11E relays.

When it is desirable to adopt one type of relay as standard to be used anywhere on a system, relays with the 1.0-ampere holding coil should be chosen. These relays should also be used where it is impossible to obtain trip coil data.

The ratings of the two forms of holding coils are as follows:

FUNCTION	Amperes, AC or DC	
	1 Amp (0.25 Ohm) Coil	0.2 Amp (7 Ohm) Coil
Carry for Tripping Duty	30	5
Carry Continuously	2.5	0.4

BURDENS

The volt-ampere burden of relay windings are given in the following tables.

CURRENT CIRCUIT

FREQ.	AMPS.	VOLT AMPS.	P.F.
60	5	13.0	0.38
50	5	11.3	0.40

POTENTIAL CIRCUITS

FREQ.	VOLTS	VA	WATTS	P.F.
60	115	15.0	7.7	0.51
60	230	15.7	7.8	0.50
60	460	15.1	7.6	0.50
50	100	20.2	10.0	0.50
50	115	9.0	4.7	0.52

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

CASE

The case is suitable for either surface or semiflush panel 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 HAVING CONTACTS WHICH ARE CLOSED WHEN DE-ENERGIZED, BUT OPEN UNDER NORMAL OPERATING 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.

CONTACTS

The contacts (see Fig. 1) are especially constructed to suppress bouncing. The stationary contact (G) is mounted on a flat spiral spring (F) backed up by a thin diaphragm (C). These are both mounted in a slightly inclined tube (A). A stainless steel ball (B) is placed in the tube before the diaphragm is assembled. When the moving contact hits the stationary contact, the energy of the former is imparted to the latter and thence to the ball, which is free to roll up the inclined tube. Thus, the moving contact comes to rest with substantially no rebound or vibration.

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

Internal connections are shown in Fig. 2. Fig. 3 shows a typical external wiring diagram. 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.

ADJUSTMENTS

The relay was properly adjusted at the factory to obtain the desired characteristics, and it is advisable not to disturb these adjustments. If for any reason, the adjustments must be disturbed, the following should be observed.

Contact Gap

The contact gap may be adjusted by loosening slightly the screw at the front of the contact block. The screw should be loose enough only to allow the contact barrel to rotate in its sleeve.

Contact Travel and Spring Tension

The travel from contact to contact determines the difference between the overpower and underpower settings. The greater the travel, the greater the difference between the value at which the left-hand contacts (front view) close (overpower) and the right-hand contacts close (underpower). The contact travel is adjusted by turning the stationary contact barrels; the left-hand one to change the overpower and the right-hand one to change the underpower setting.

Readjustment of both overpower and underpower setting can be readily obtained, within the range of the relay, while maintaining the same increment between them by turning the spring adjusting ring. This can be accomplished after loosening the hexagonal-headed locking screw toward the rear of the adjusting ring support at the top of the relay unit. The spring adjusting ring must be locked securely in place after the proper adjustment is obtained.

TESTS

The overpower and underpower settings may be checked by using the test connections shown in Fig. 4 or 5. The relay normally operates on line voltage and line current. The relay has maximum torque when the relay current leads the relay potential by 30 degrees. Therefore, when tested on the single-phase circuit shown in Fig. 4, the current will be 30 degrees from the angle of maximum torque. The three-phase secondary watt setting for the connections shown in Fig. 4 is given by the following formula:

$$\text{Watts } 3\,\emptyset = \sqrt{3}\cos 30 \text{ degrees } W = \frac{3W}{2}$$

where W is the wattmeter reading. Thus, if it is desired to set the relay to close at 300 watts secondary, the relay should be adjusted to just operate when the wattmeter reads 200 watts.

The primary watts at which the relay will operate is given by the following formula:

$$3\,\emptyset \text{ primary watts} = 3\,\emptyset \text{ secondary watts X PT ratio X CT ratio.}$$

In addition to the tests already mentioned, time tests may be desired. Because of the speed of the relay, mechanical timers are unsatisfactory, and it is necessary to use an oscillograph or an electronic timer. Fig. 4 may be used for making the timing connections.

If a wattmeter is not available but a three phase test source is available then the relay can be calibrated as follows:

1. Connect the relay as shown in Fig. 5, Test A.

2. Calculate current required to close contacts for setting desired.

$$I = \frac{\text{watt setting desired}}{\sqrt{3} \times \text{volts} \times \cos 30} = \frac{2}{3}\,\frac{\text{watt setting desired}}{\text{volts}}$$

   The cos 30 is in the equation because this test connection is 30 degrees off the angle of maximum torque. The value for volts is the magnitude of the voltage applied across studs 7-8.

3. Set the current to the current value calculated for the watt setting for the left contact. Then adjust the upper control spring until the left contact will just close. Lock the control spring in this position.

4. Reduce the current to the current value calculated for the watt setting for the right contact. Adjust the contact gap by adjusting the right fixed contact until the right contact just makes. Lock the right contact barrel in this position.

5. Change the relay potential connection to those shown for Fig. 5, Test B. Adjust the current until the left contact just closes. This should be the current set in Test 3 above plus or minus six percent.

6. If the test value in Test 5 is more than six percent different than the current value used in Test 3 then the angle of maximum torque is not correct. If the current in Test 5 is greater than the current in Test 3 then the angle of maximum torque is less than 30 degrees and the resistor in the potential circuit should be changed to increase its ohms. If the current in Test 5 is less than the current in Test 3 then the angle of maximum torque is more than 30 degrees and the resistor in the potential circuit should be changed to decrease its ohms.

MAINTENANCE

If for any reason it becomes necessary to disassemble the unit the following procedure should be followed:

1. Remove the cradle from the case as described under CASE.

2. Disconnect the leads to the inner contact block (be sure all leads are positively identified for reconnection).

3. Remove the screws holding the mounting plate to the cradle and remove the cradle intact with its mounting plate.

4. Remove the top (flat head) screw holding the unit to the mounting plate.

5. Avoiding any disturbance to the top bearing plate, remove the entire top molded structure and rotor assembly from the stator by removing the four corner screws. This gives access to the rotor and stator assembly, and all parts will be aligned by the dowel pins when replaced.

Use care in handling the rotor while it is out of the relay and see that the air gap and rotor are kept clean.

In reassembly, the rotor will go into the air gap easily without forcing if the parts are held in proper alignment.

BEARINGS

The lower jewel bearing should be screwed all the way in until its head engages the end of the threaded core support. The upper bearing should be adjusted to allow about 1/64 inch end play to the shaft.

To check the clearance between the iron core and the inside of the rotor cup, press down on the contact arm near the shaft and thus depress the spring-mounted jewel until the cup strikes the iron. The shaft should move about 1/16 inch.

When checking the lower jewel for fractures, an examination under a microscope is preferable. However, if a microscope is not available, satisfactory results can generally be obtained by exploring the surface of the jewel with a fine needle. If it is necessary to replace the jewel, a new pivot should be screwed into the bottom of the shaft at the same time.

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 insures the cleaning of the actual points of contact.

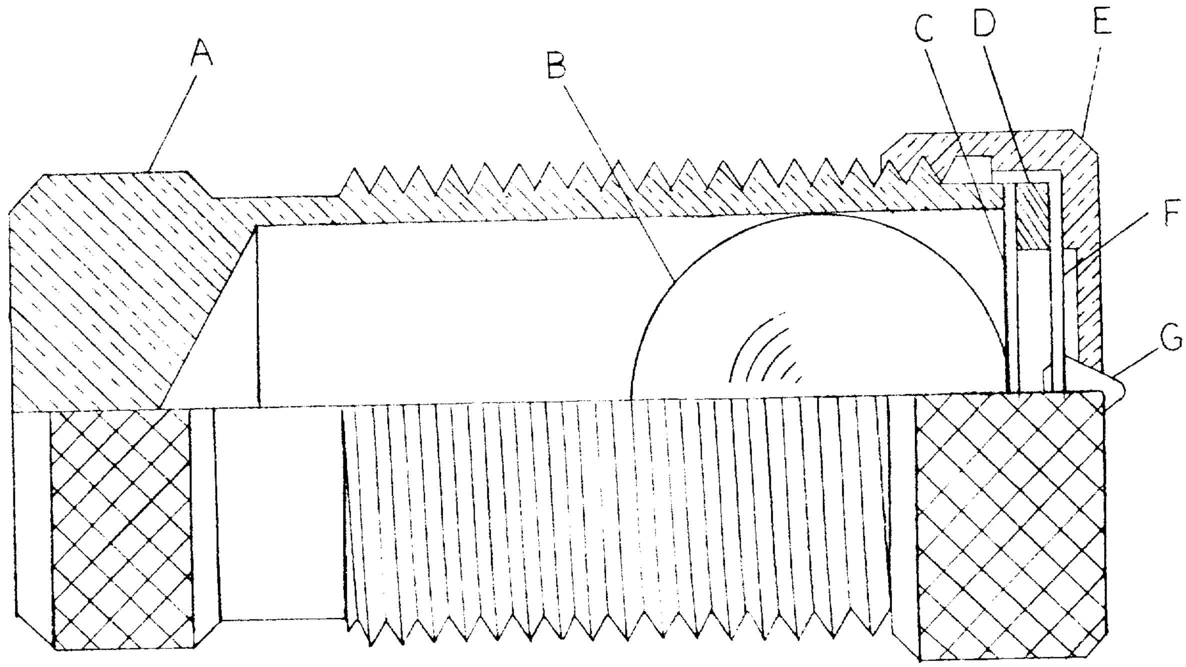
Fine silver contacts should not be cleaned with knives, files, or abrasive paper or cloth. Knives or files may leave scratches which increase arcing and deterioration of the contacts. Abrasive paper or cloth may leave minute particles of insulating abrasive material in the contacts and thus prevent closing.

The burnishing tool described 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, 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.



A - INCLINED TUBE
B - STAINLESS STEEL BALL
C - DIAPHRAM
D - SPACER
E - CAP
F - FLAT SPIRAL SPRING
G - CONTACT

Fig. 1 (K-6077069 [4]) Cutaway View of Stationary Contact Assembly

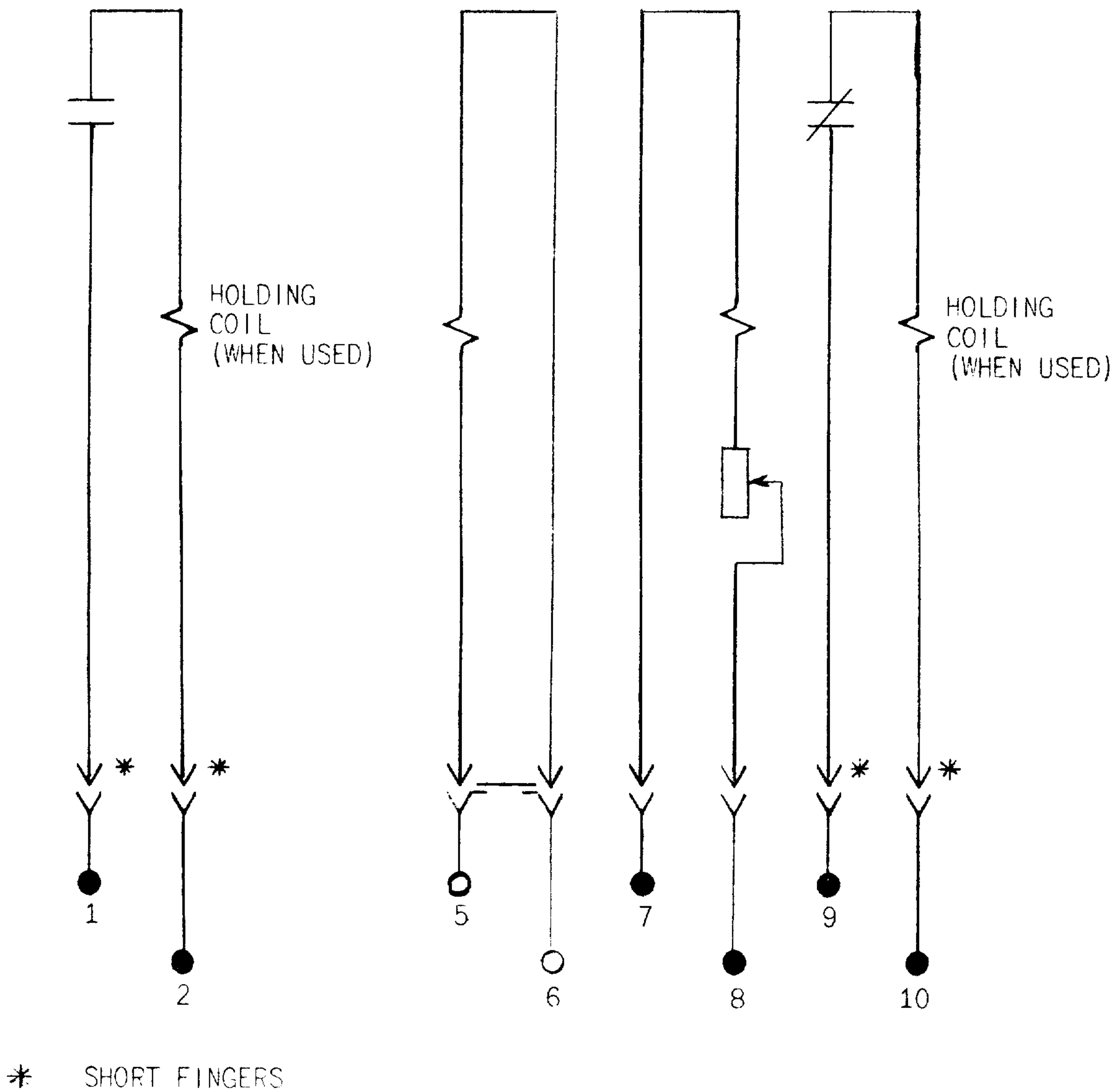
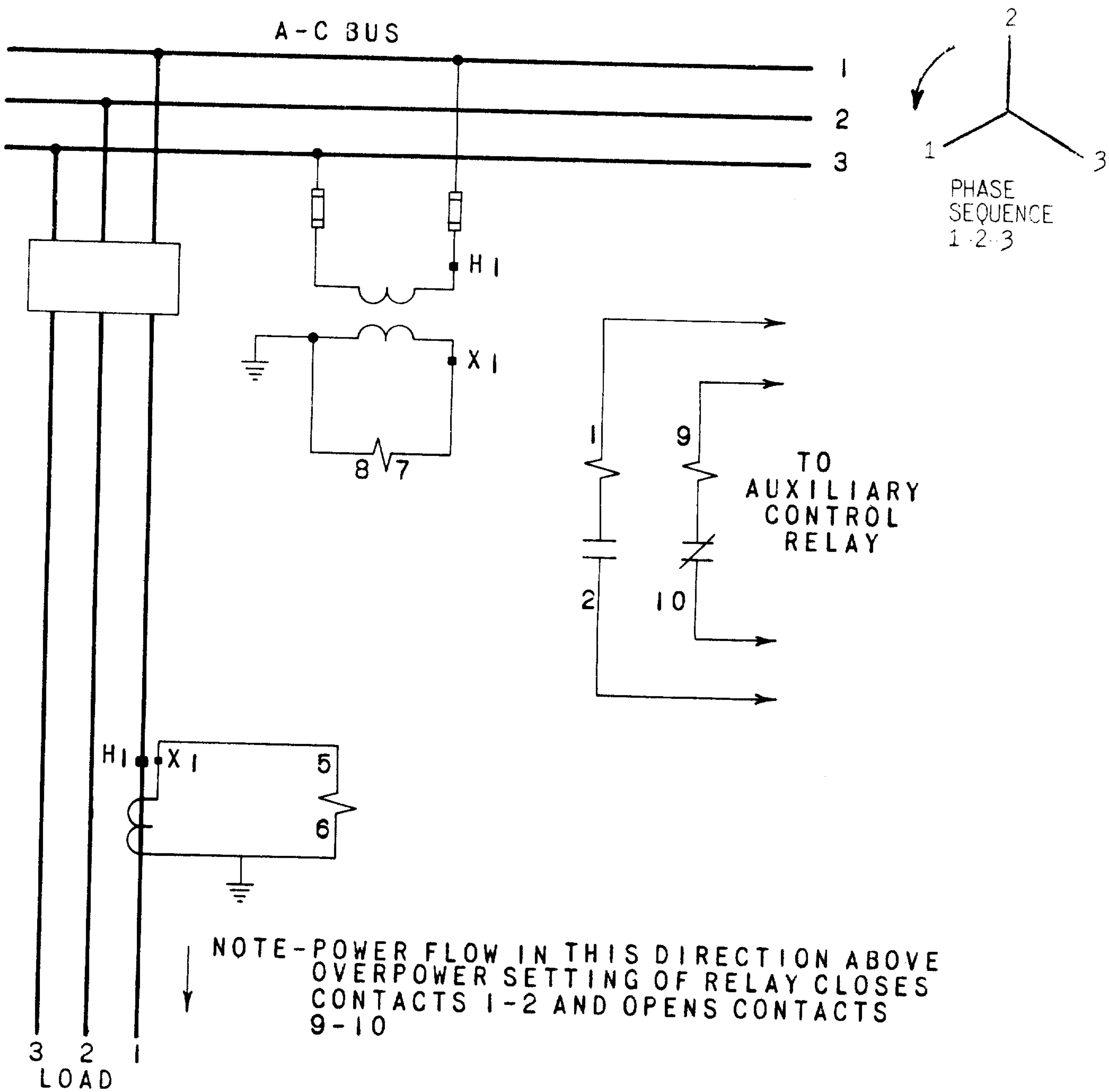


Fig. 2 (0178A8199-1) Internal Connections Diagram for Relay Type CFW11E (Forms 21 and Up)


A-C BUS
1
2
3
PHASE SEQUENCE 1-2-3
H1
X1
8
7
1
2
9
10
TO AUXILIARY CONTROL RELAY
H1
X1
5
6
NOTE-POWER FLOW IN THIS DIRECTION ABOVE OVERPOWER SETTING OF RELAY CLOSES CONTACTS 1-2 AND OPENS CONTACTS 9-10
3 2 1
LOAD

[illegible] Type CFW11E [illegible]

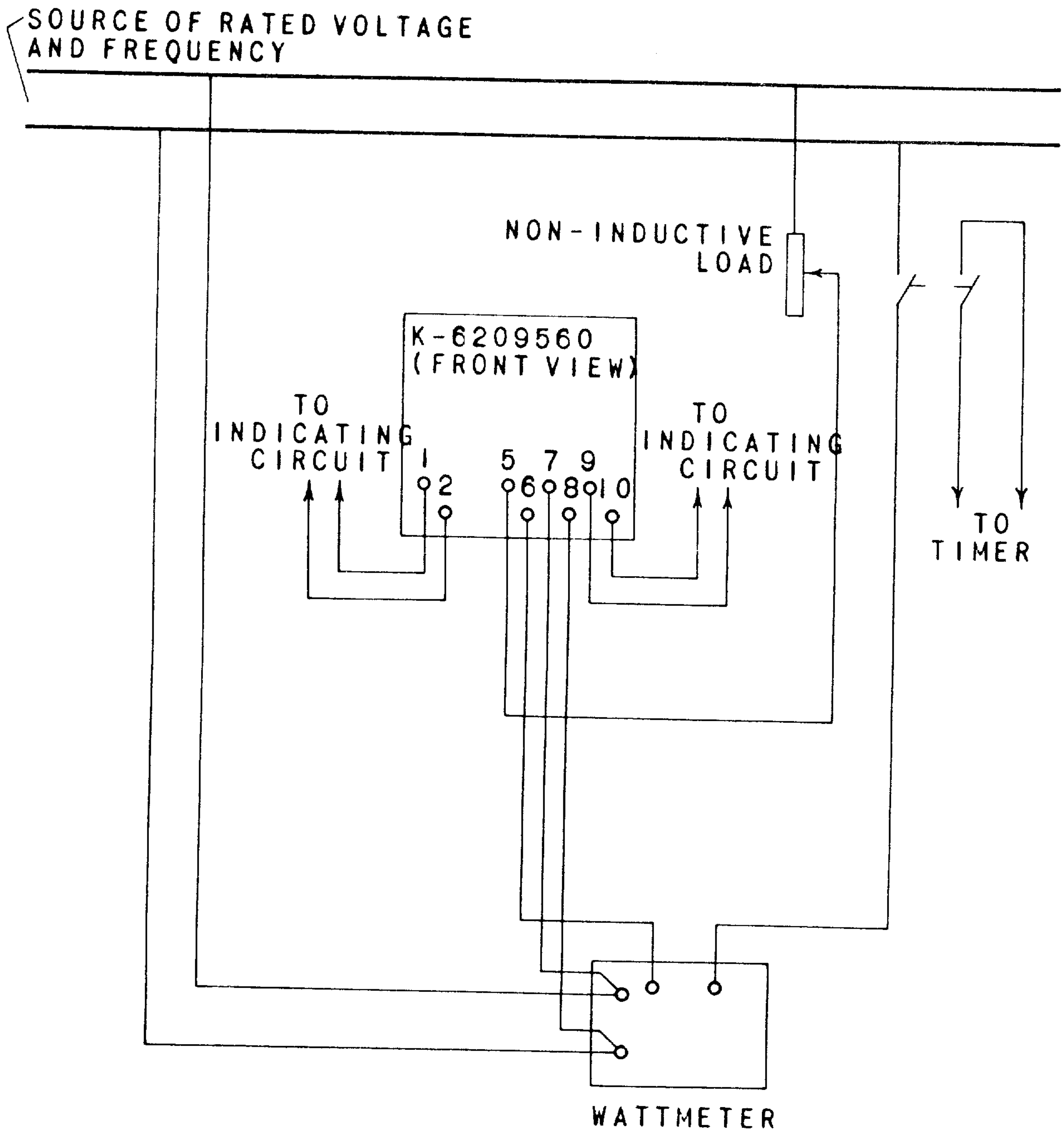


Fig. 4 (K6209602 [2]) Testing Connections for Type CFW11E Relay Using Wattmeter

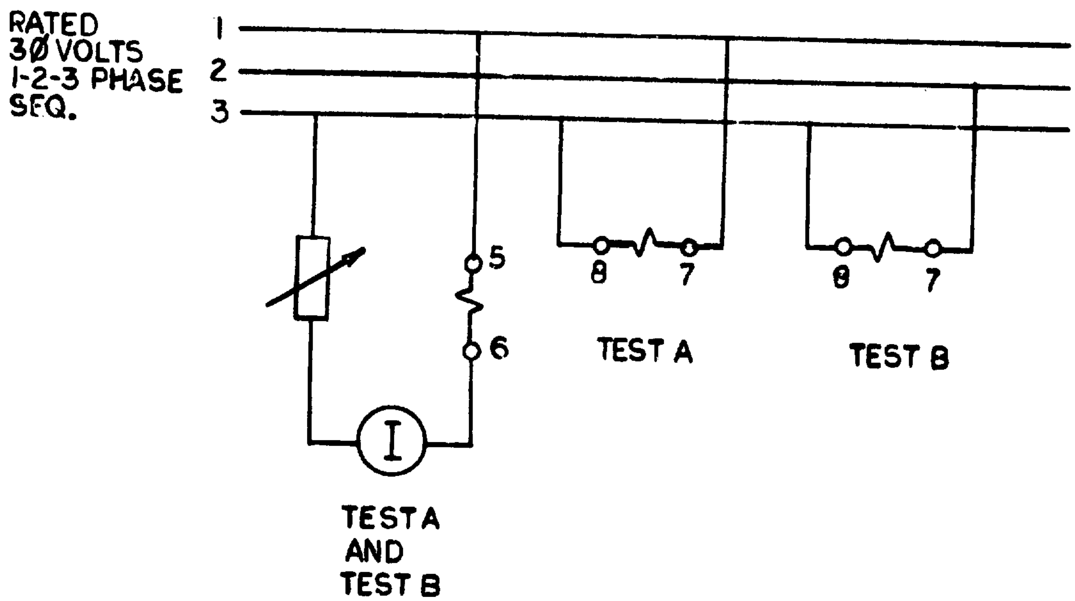
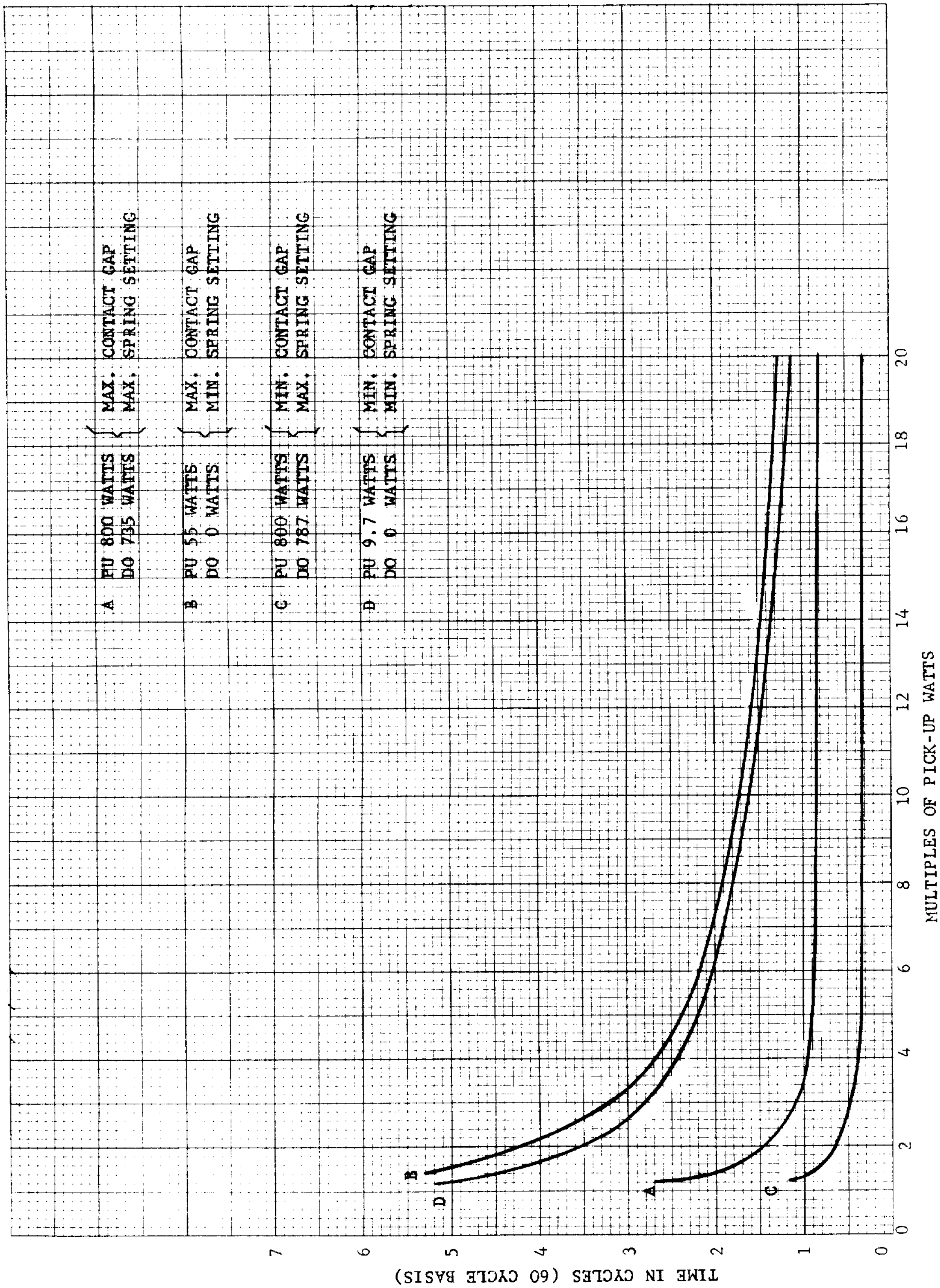


Fig. 5 (0275A3258-0) Testing Connections for Type CFW11E Relay Using Three Phase Voltage Source



NOTE: PU refers to level at which the left contacts close (overpower).
DO refers to level at which the right-hand contacts close (underpower).

Fig. 6 (403A145-1) Time Characteristic Curve for Type CFW11E Relay

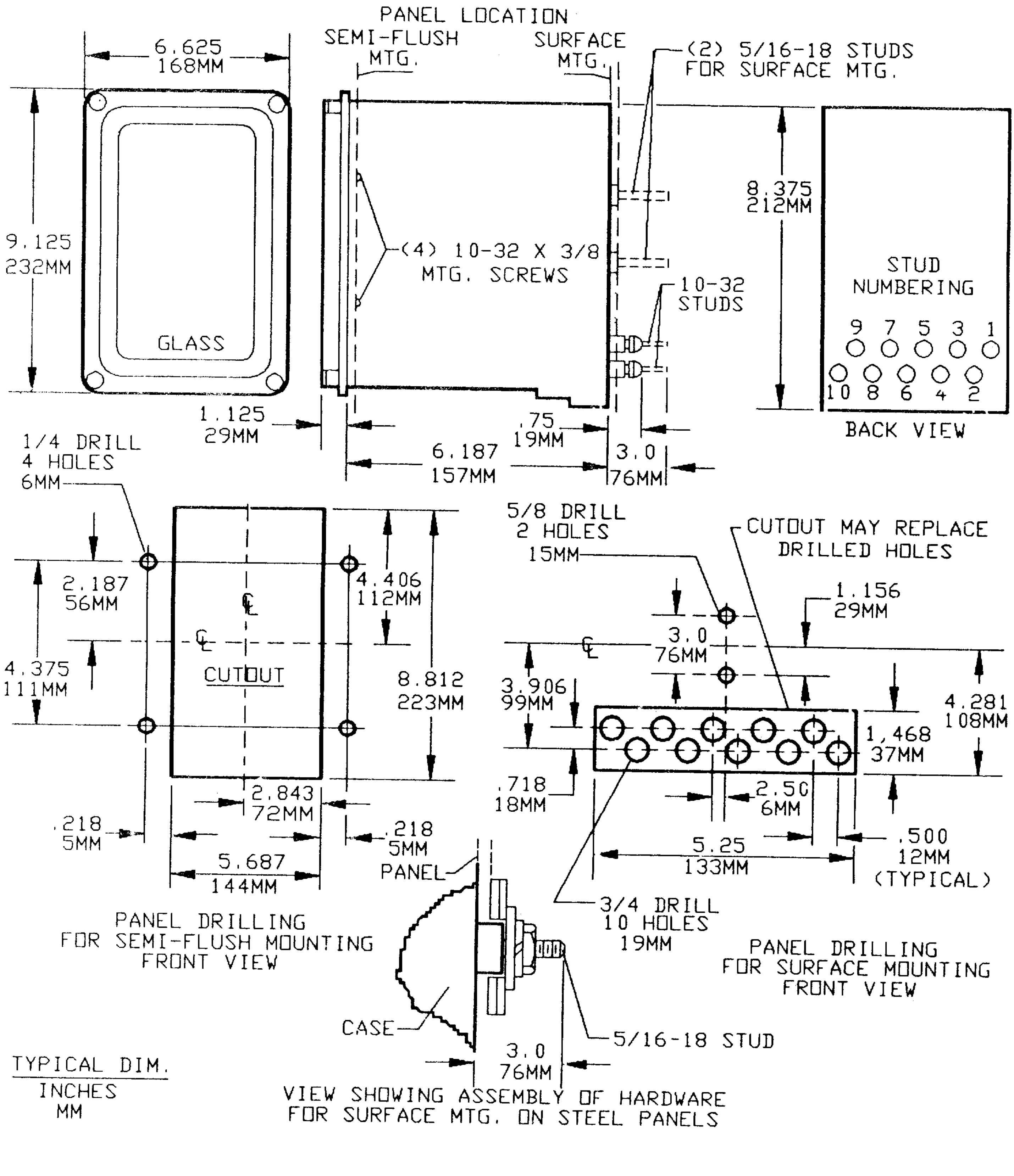


Fig. 7 (6209271 [8]) Outline and Panel Drilling for Type CFW11E Relay

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