



INSTRUCTIONS

GEI-50272A
SUPERSEDES GEI-50272

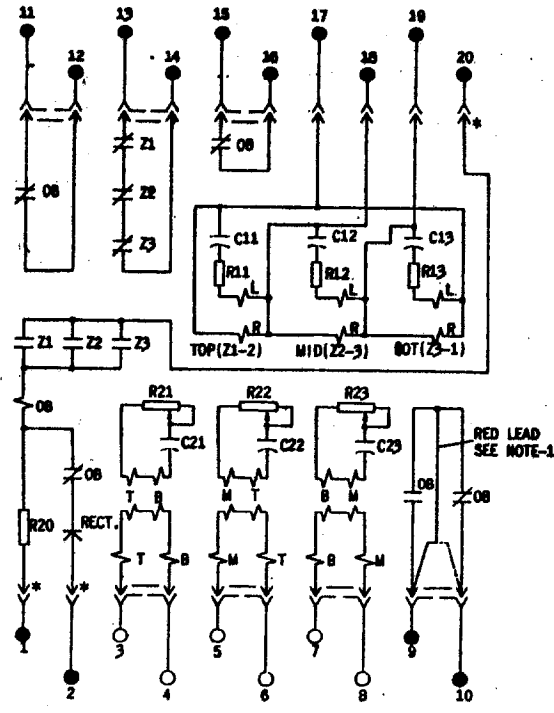
IMPEDANCE RELAY

TYPE CFZ16A

LOW VOLTAGE SWITCHGEAR DEPARTMENT

GENERAL  ELECTRIC

GEL-50272 Impedance Relay Type CFZ16A



NOTE 1: COMMON CONNECTION OF "OB" AVAILABLE TO OBTAIN A N.O. OR N.C. CONTACT BY ITS CONNECTION TO STUD 9 OR 10.
 IF N.O. CONTACT IS USED, REMOVE SHORTING BAR.
 *—SHORT FINGER

Fig. 1 Internal Connections for Type CFZ16A Relay

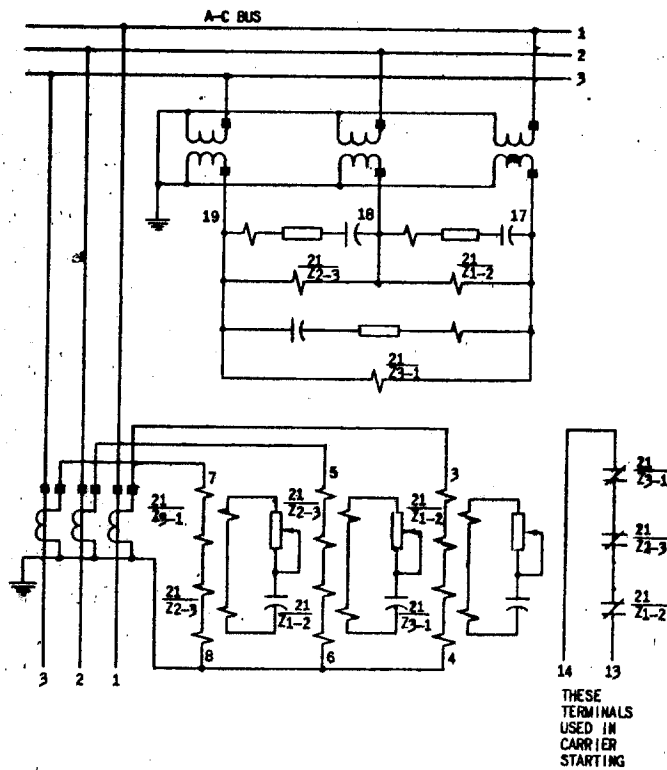


Fig. 2 External Connections for Type CFZ16A Relay

Fig. 1 (418A767)

Fig. 2 (418A882)

IMPEDANCE RELAY

TYPE CFZ16A

INTRODUCTION

APPLICATION

The Type CFZ16A Relay is an induction cylinder type impedance relay. The most common application of this type relay is its use as a fault detector in a Carrier-Current Pilot Relaying Scheme. This entire scheme, including the operation of the Type CFZ relay, is described in instruction book GEI-25363. However, it may be used in any application requiring a high-speed fault detector.

OPERATING CHARACTERISTICS

The pick-up current of the impedance units is virtually independent of the phase angle between the current and voltage. This characteristic is due to the induction cylinder construction which produces a constant torque throughout the current cycle.

The pick-up current of the three units can be adjusted by means of rheostats over a 2 to 1 range. With the minimum setting, the units pickup at one ampere at zero volts, and 6 amperes at 100 volts. The corresponding maximum values are 2 amperes and 12 amperes respectively. The pick-up and reset characteristics of the impedance units, with the minimum setting, are shown in Fig. 3. The change of pick-up current at other voltages will be proportional to that for 100 volts. For example, with the maximum setting, the unit will operate at approximately 7.6 amperes at 60 volts.

The auxiliary telephone relay for power swing blocking is designated as OB. This element has a time-delay pickup of 4 cycles (60 cycle base) so that it cannot operate inadvertently on fault conditions. The drop-out time is not usually of importance in the control circuits, but it is set at the factory for 15 cycles.

DESCRIPTION

RELAY TYPES

The Type CFZ16A relay is a three unit, high-speed fault detector or impedance relay. It contains an auxiliary time delay relay suitable for

RATINGS

The relay is available for 60 cycle operation; rated for continuous operation at 120 volts and 5 amperes.

The auxiliary element, OB, can be furnished for operation at either 125 volts or 250 volts, d-c. The contacts of this element will make, break, or carry 110 watts at either control voltage with a non-inductive circuit. The contacts of the impedance units will carry continuously and interrupt currents as follows:

Circuit Volts	Amperes	
	D-C	A-C
125	0.5	1.25
250	0.3	0.75

CONTACTS

The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The current-carrying rating is limited by the two forms of target and holding coils. Relays with 1.0 ampere target and holding coils, have a rating of 30 amperes for tripping duty, hence they will trip any circuit breaker with trip coil current within this rating.

BURDENS

The burden imposed on the potential transformer by each unit at 120 volts, 60 cycles, is 6.5 volt-amperes at unit power factor.

The burden imposed on the current transformer by each unit at 5 amperes, 60 cycles, is 16 volts-amperes at 0.6 power factor.

blocking the operation of the tripping function of a pilot system during power swing conditions.

This relay has a germanium blocking rectifier to prevent improper operation of the OB unit by formation of external sneak circuits.

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.

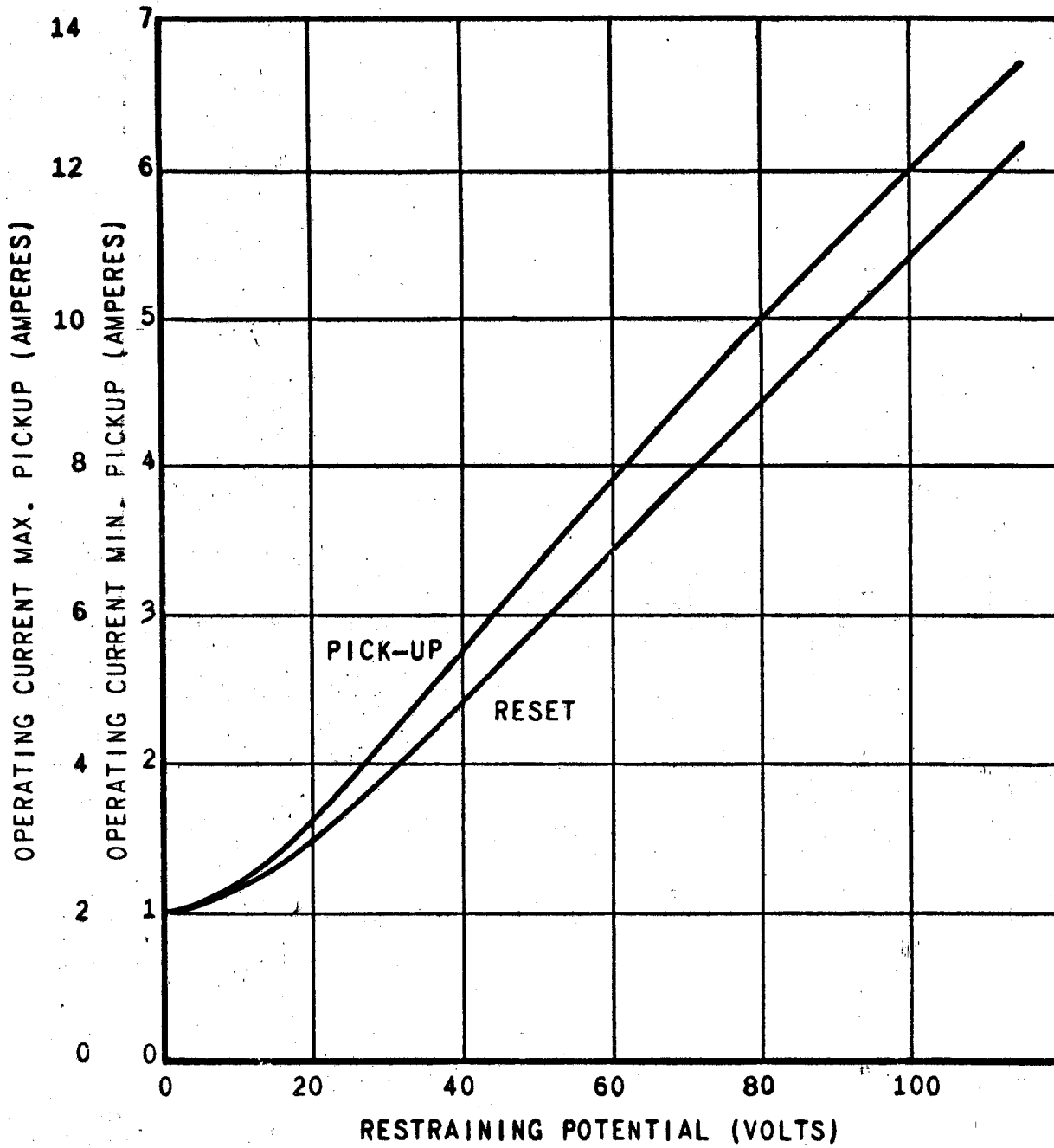


Fig. 3 (K-6306575)

Fig. 3 Pick-up and Reset Characteristics of Impedance Units with Minimum Setting

RELAY UNITS

The removable unit consists of three relay units and two aluminum plates. The plates are mounted beside the relay units to provide a low resistance path for the conduction of heat from the relay units to the case.

The relay units are induction cylinder devices for alternating current circuits. The principle by which torque is developed is the same as that employed in an induction disk relay with a watt-hour meter unit, though in arrangement of parts they are more like split-phase induction motors.

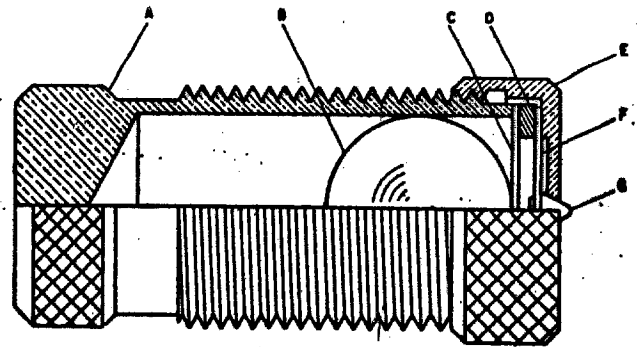
The stator has eight laminated magnetic poles projecting inward and arranged symmetrically around a central magnetic core. The poles are fitted with current coils. The cylindrical part of the cup-like aluminum rotor turns freely in the annular air gap between the poles and the central core. The central core is fixed to the stator frame; the rotor alone turns.

All eight poles on the induction cylinder unit have current coils which produce a closing torque proportional to the square of the current flowing through them. The current coils of the three units are interconnected in such a manner that the closing torque of the top unit is proportional to I_1-I_2 , that of the middle unit to I_2-I_3 , and that of the bottom unit to I_3-I_1 , with external connections as shown in Fig. 2. Such operation on delta currents insures that the relay will have the same reach on either phase-to-phase or three phase faults. The induction cylinder units are painted red to indicate the utilization of high-temperature insulation, class-H, in the current coils.

The restraint element consists of two coils, which also utilize high temperature insulation. These coils are mounted on top of each unit in a place where holding coils are normally mounted. The two coils are connected in parallel, and the power factor of the two coil circuits is such as to make the two coil fluxes 90 degrees apart. This produces a constant pull on the holding armature that is proportional to the square of the voltage applied to the coil circuits.

CONTACTS

The contacts are especially constructed to suppress bouncing (Fig. 4). 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. To change the stationary contact mounting spring, remove the contact barrel



A - Inclined Tube D - Spacer
B - Stainless Steel Ball E - Cap
C - Diaphragm F - Flat Spiral Spring
G - Contact

Fig. 4 Stationary Contact Assembly

and sleeve as a complete unit after loosening the screw at the front of the contact block. Unscrew the cap (E). The contact and its flat spiral mounting spring may then be removed.

The contact gap may be adjusted by slightly loosening 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.

The stop screw fastened with a locknut should hold the moving contact arm in a neutral position, i.e., with it pointing directly forward. Then bring the stationary contact up until it just touches the moving contact by rotating the contact barrel. Next, back it away 2/3 turn to obtain approximately 0.020 inch contact gap. Last, tighten the screw which secures the barrel.

The moving contact may be removed by loosening the screw which secures it to the contact arm and sliding it from under the screw head.

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. Each cover screw has provision for a sealing wire.

The case has studs or screw connections at both ends 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.

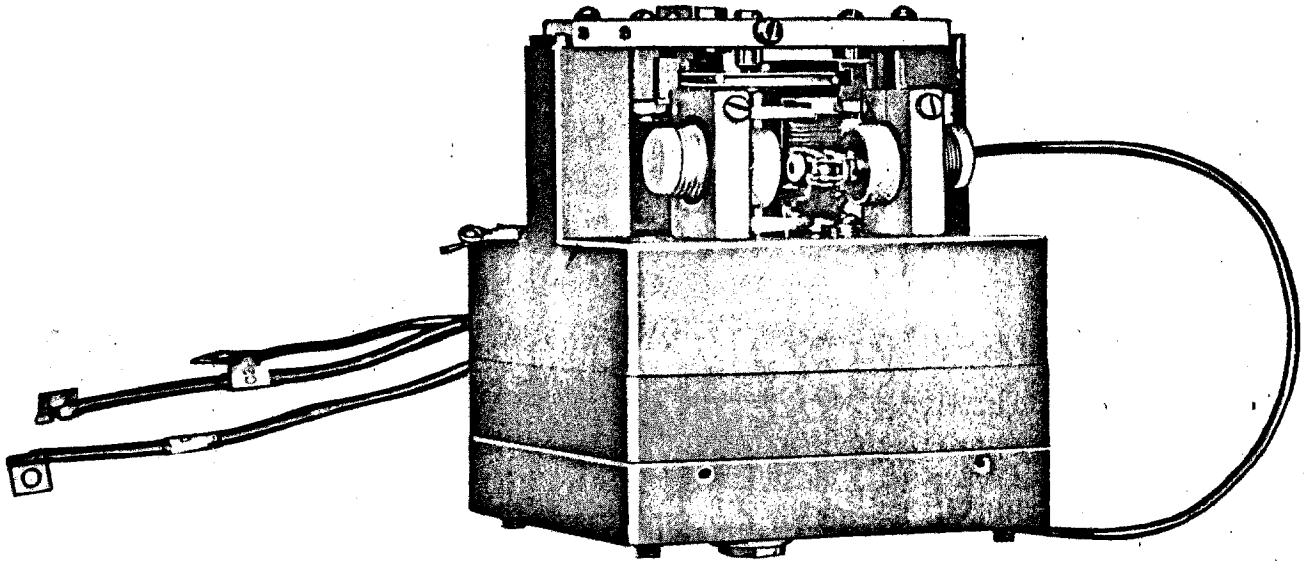


Fig. 5 (8005280)

Fig. 5 Front View of an Impedance Unit Showing the Contacts and Control Spring

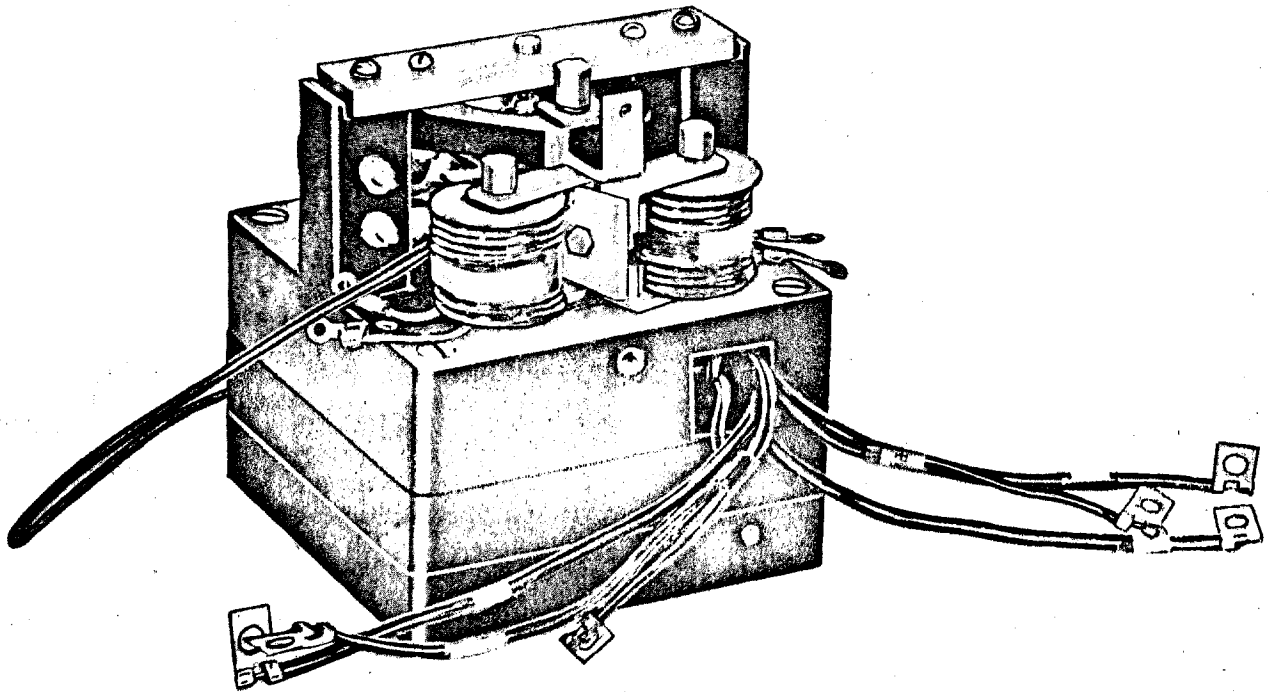


Fig. 6 (8005281)

Fig. 6 Rear View of an Impedance Unit Showing the Potential Coils and Restraint Coils

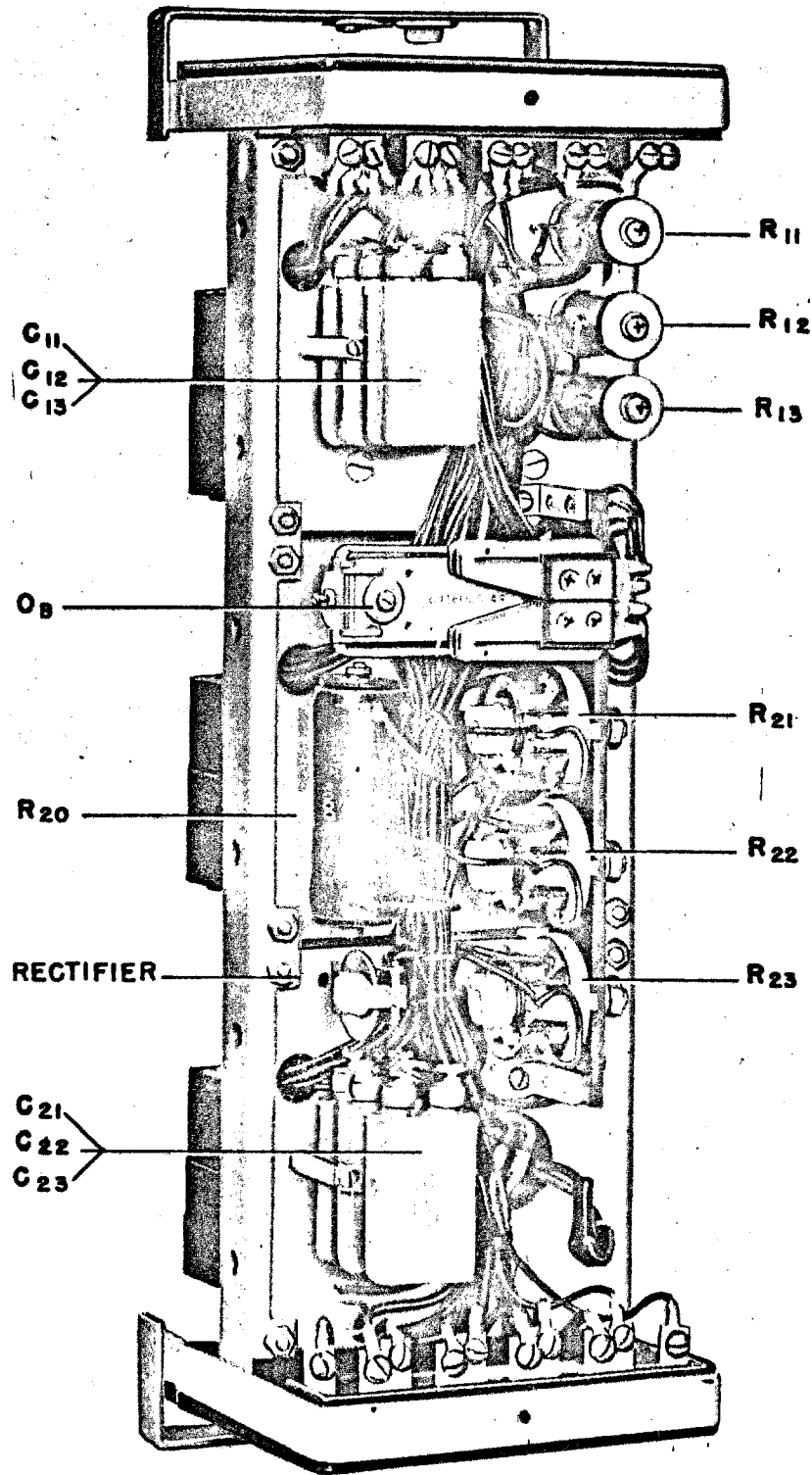


Fig. 7 CFZ16A Relay with Heat Conducting Plates Removed - Rear View

The resistance of the shunt circuit must be kept as near constant as possible so that the relay will operate properly. This is accomplished by using the mechanically secure connections.

The relay mechanism is mounted in a steel framework called the cradle and is a complete unit. 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 fast-

ened to the case by thumb screws, holds the connecting plug in place.

To draw out the relay unit the cover is first removed, and the connecting plug drawn out. The relay unit can be easily drawn out after the latches have been released. 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 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.

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 unpack-

ing 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. 10.

CONNECTIONS

The internal connection diagram for the relay is shown in Fig. 1. A typical wiring diagram is given in Fig. 2.

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 impedance units have been set at the

factory for the minimum pick-up current. The setting is satisfactory for many applications but may have to be increased to avoid operation on heavy load currents. The three rheostats, R21, R22, and R23 control the pickup. (See Fig. 7.) These rheostats are provided with locking nuts to prevent inadvertent changes in their settings. If a change in setting is necessary, refer to section entitled "Recalibrating the Relay".

INSPECTION

At the time the relay is installed, the following points should be checked:

1. There should be no noticeable friction in the operation of the assembly.
2. There should be 1/64 inch to 1/32 inch end play in the shaft.
3. The jewel screw and core locking nut at the bottom of each unit should be tight.

MAINTENANCE

The lower jewel screw can be removed from the unit by means of an offset screw driver or an endwrench. The jewel may be tested for cracks by exploring its surface with the point of 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.

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

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

CONTACTS

The left-hand (front view) stationary contacts on the impedance units have their silver tips mounted on a spiral spring which should be adjusted to allow the contacts to wipe in from 0.005 inch to 0.010 inch before being stopped by the diaphragm behind the spiral. This can be adjusted by removing the contact barrel from its support, after loosening the locking screw at the front of the support, sliding the barrel with its sleeve out of the support, and unscrewing the cap from the end of the barrel.

The contact wipe should be adjusted so that the contact gap is at least 0.010 inch and dropout is maintained at 90 per cent of pickup.

The right-hand stationary contact tip is mounted on a diaphragm and has negligible wipe. The position of this contact determines the pick-up setting of the unit.

If the right-hand moving contact brush and tip is replaced, it should be connected to the portion of the molded contact and armature support directly beneath the tip by a large drop of cement similar to No. 1286 Glyptal cement.

CONTROL SPRING

The upper control spring should be wound in the direction to close the right-hand (front view) contacts until its torque is such that one ampere in the operating circuit will just close the left-hand contacts after the restraining voltage has been slowly reduced to zero. This should be done by turning the adjusting ring, which is locked in position by the hexagonal-headed screw at the rear.

CLUTCH

This type unit is provided with a clutch which

permits the rotor to slip with respect to the contact arm. The clutch is adjusted by means of the set screw on the right side of the molded contact supporting arm. This screw should be tightened to the extent of its adjustment.

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.

DISASSEMBLY

If access is desired to the rotor of a unit, or if a new pivot is to be installed in the shaft of either of the upper units, it is necessary to disassemble the unit as follows:

1. Remove the aluminum side plates.
2. For the top and bottom units, unfasten the capacitors and resistors directly behind the unit but do not disconnect the leads to them. This permits observation of what leads must be removed in order to dismount the unit and gives access to the three flat-head screws which mount the unit on its base plate. Dismounting the string of resistors behind the middle unit by removing the screw at each end of their mounting strap will permit easier tracing of the leads.
3. For the middle unit, dismount the resistors on their mounting strap as described in (1), allowing the connections to remain, and unfasten the plate upon which the auxiliary relays are mounted from its bracket. Without unsoldering the connections, the resistors and auxiliary relays can be turned to permit inspection of what leads must be removed to dismount the unit, and access is given to the three flat-head screws mounting the unit to its base plate.

4. Remove all leads necessary to remove the unit from the relay, tagging them carefully.

5. Remove the three screws holding the unit to its base plate and remove the unit intact from the front of the relay.

6. By removing the four screws in the corners of the unit, the molded head with the contact and restraint structures and the rotor can be lifted straight up. Care should be exercised that the aluminum cylinder is not scratched in coming out from its air gap. This gives access to the rotor and the pivot.

7. The restraint magnets can be removed by proceeding through (4) above and then removing the two screws holding the structure to the molded head and sliding it out. The nuts for these screws are held in two slots inside the head. It will aid in reassembly if these nuts are moved to an end of each slot before attempting to mount the restraint magnets. Then the screw can be used to feel for the proper end of the slot before lowering the screw enough to engage the nut.

8. Caution note for Type CFZ16 relays:

When applying a soldering iron to the blocking rectifier terminals, the terminals should be held by pliers to conduct the heat away from the body of the rectifier during the soldering operation. By not following this procedure, the rectifier may be damaged.

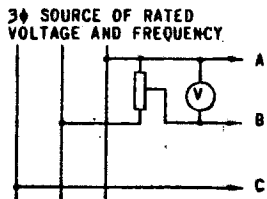
RECALIBRATING THE RELAY

If the calibration of the relay has been disturbed or it becomes necessary to change the pick-up current, the following procedure is recommended:

Before any calibration tests are made, allow the relay to heat for 90 minutes at rated current and voltage. The restraint circuits can be energized as in Fig. 8A; the current circuits, by jumpering terminals 4-5 and 6-7 and connecting 3 and 8 to the current source.

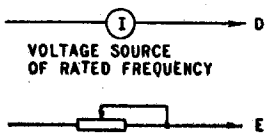
Calibration adjustments on the CFZ16A relay are complicated by the fact that the operating coils, and the floating coils of the three units are interconnected as noted in the description of the units and as shown on the internal connection diagram. Consequently changing any one of the floating circuit resistors (R_{21} , R_{22} , R_{23}) affects the calibration of two units. A scheme is suggested below which permits setting pickup at any desired point within the specified range without the need for extensive cross-adjustment of resistors.

1. Remove restraint voltage and connect the operating circuits as in Fig. 8B for the specific unit being adjusted. Check the pickup at zero volts; it should be 1.0 ampere. If not, it can be restored by a slight change in the upper control spring tension.



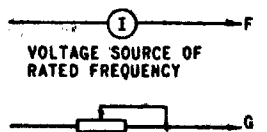
UNIT BEING TESTED	CONNECT A, B, C, TO TERMINALS SHOWN		
	A	B	C
TOP	17	18	19
MIDDLE	18	19	17
BOTTOM	19	17	18

(A)



UNIT BEING TESTED	CONNECT D TO: E TO:		JUMPER TERMINALS
	D TO:	E TO:	
TOP	3	5	4-6
MIDDLE	5	7	6-8
BOTTOM	7	9	8-4

(B)



UNIT BEING TESTED	CONNECT F TO: G TO:		ADJUST. RES.
	F TO:	G TO:	
TOP	3	4	R_{21}
MIDDLE	5	6	R_{22}
BOTTOM	7	8	R_{23}

(C)

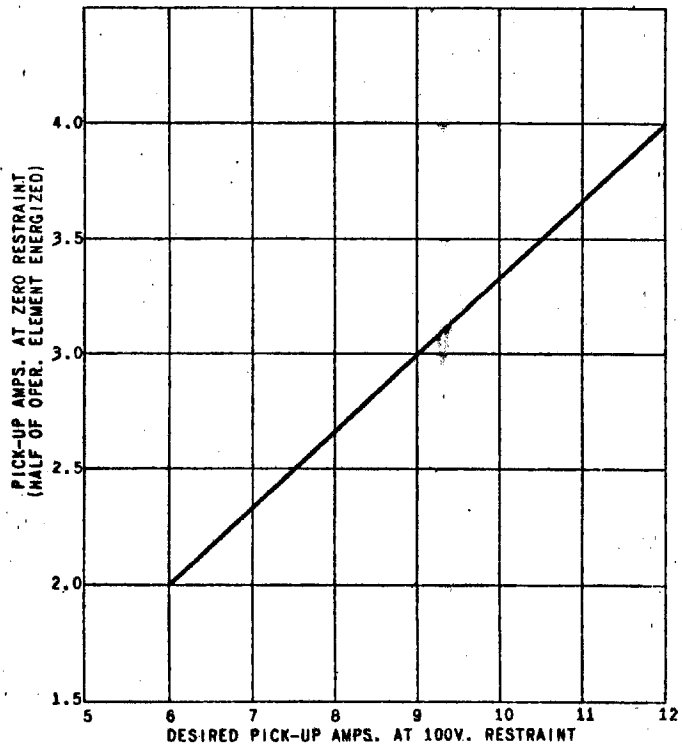


Fig. 9 Calibration Curve

Fig. 8 Test Connections For Type CFZ16A Relay

Fig. 8 (402A909)

Fig. 9 (402A911)

PERIODIC TESTING

An operation test and inspection should be made once every six months.

To check the calibration of the units it is only necessary to apply a known voltage to the potential circuit and to determine the current through the current coils necessary to cause the left contact to close.

If the relay is calibrated for 6 amperes with pickup at 100 volts, the pick-up current required at any restraint voltage can be read directly from the curve shown in Fig. 3. If the pickup has been increased by adjustment of the rheostat, the pickup at any voltage will be the value read from the curve shown in Fig. 3, multiplied by the factor by which the pickup was increased by means of the rheostat. For example: If the pickup at 100 volts is 6 amperes, the pickup at 60 volts is 3.9 amperes. If the pickup at 100 volts is increased to 9 amperes, the pick-up at 60 volts will be 1.5×3.9 or 5.85 amperes.

2. Connect the operating circuit as in Fig. 8C for the specific unit. With this connection only half the operating circuit of the unit will be energized. Refer to Fig. 9 and determine what pickup current at zero volts, with this "half-circuit" connection, is equivalent to the desired pick-up current with normal circuit and 100 volts restraint. Set the unit to pickup at this current by means of indicated resistor. For example if a pickup of 9 amperes at 100 volts is required, the tap unit would be set for 3 ampere pickup at zero volts, using the Fig. 8C connections and adjusting R_{21} .

3. Repeat items 1 and 2 for the remaining units.

4. Now check the pickup of each unit at 100 volts using the circuits in Figs. 8A and 8B. Slight refinements in pickup can now be made by means of R_{21} , R_{22} , and R_{23} to obtain the desired accuracy.

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.

