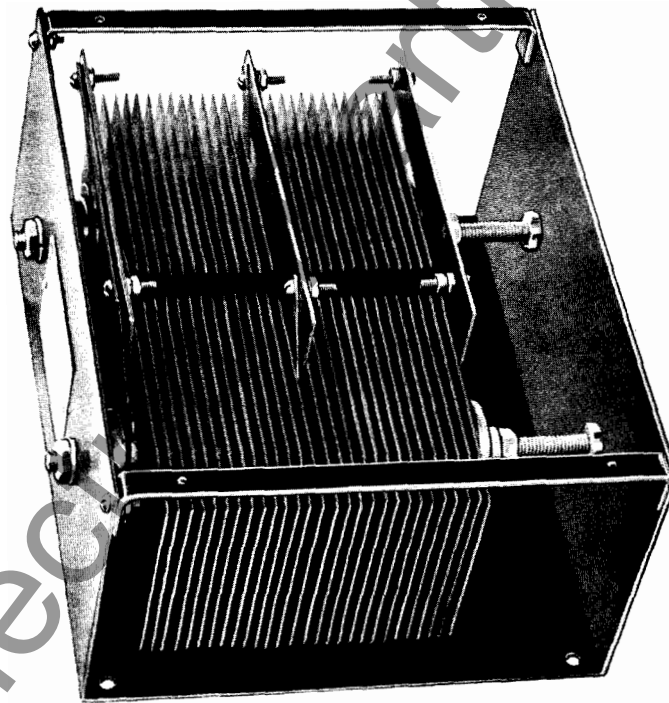




**INSTRUCTIONS**

**GEI-11306G**

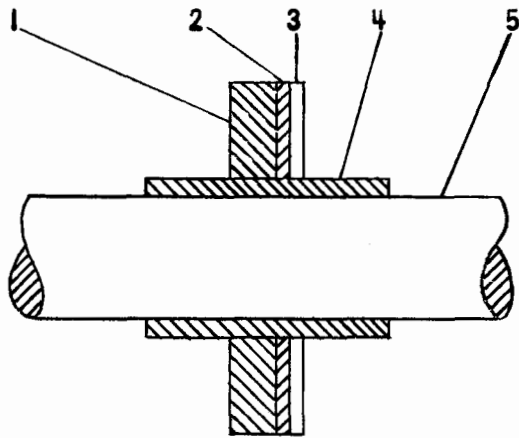
**COPPER - OXIDE RECTIFIERS FOR  
CIRCUIT BREAKER CLOSING SERVICE**



**MEDIUM VOLTAGE SWITCHGEAR DEPARTMENT**

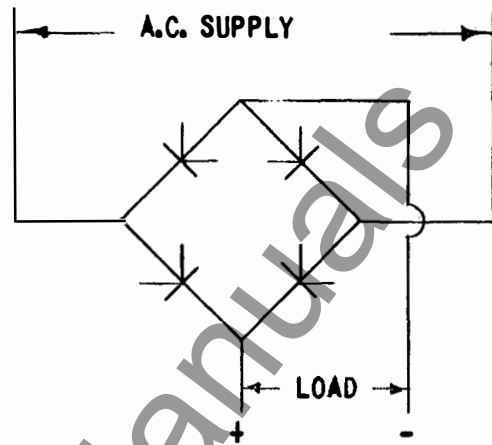
**GENERAL  ELECTRIC**

**PHILADELPHIA, PA.**



- 1. Copper Disk
- 2. Copper-Oxide Coating
- 3. Soft Metal Coating (In Contact with Oxide Surface)
- 4. Insulating Sleeve
- 5. Bolt

Fig. 1 Copper-Oxide Rectifier, Cross Section



Note: Can be Used Either With or Without Transformer

Fig. 2 Full Wave Copper-Oxide Rectifier Bridge Connection

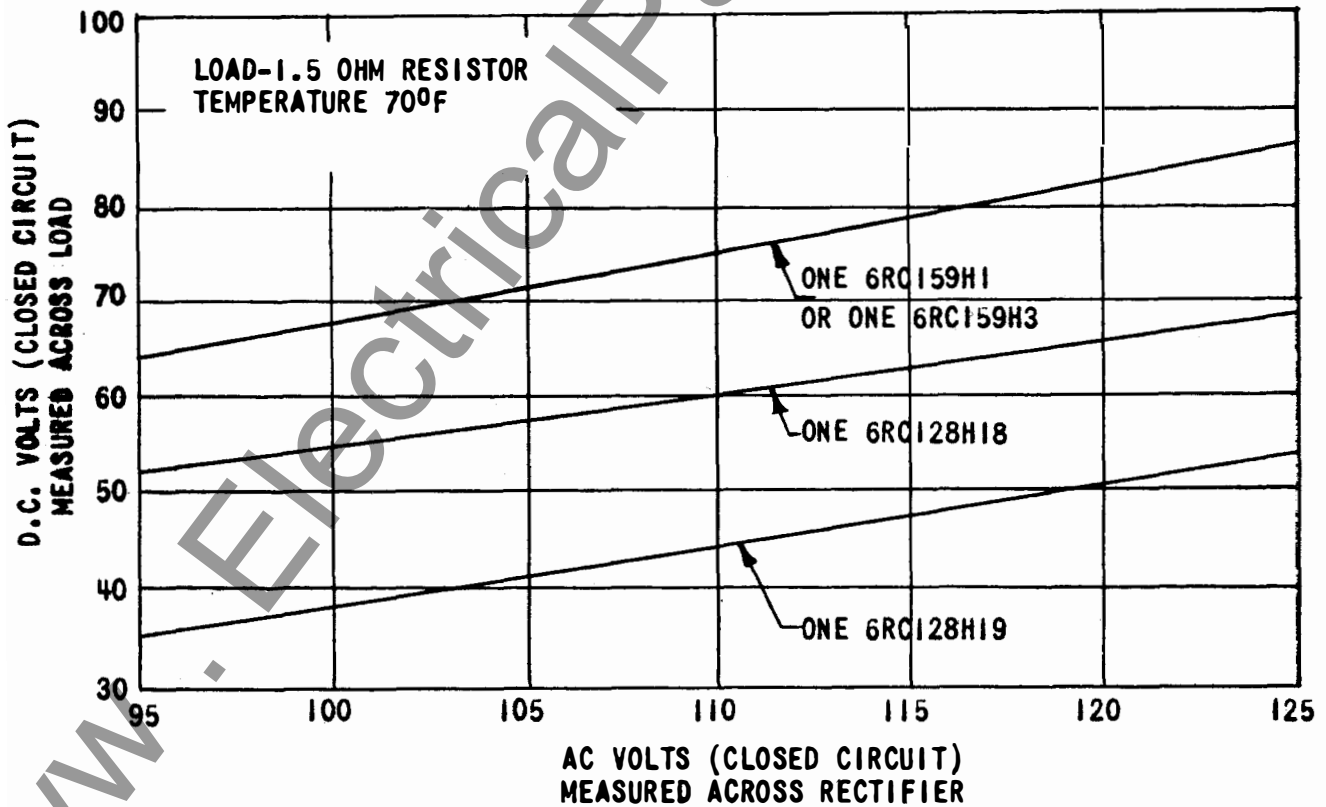


Fig. 3 Rectifier Characteristics

# COPPER-OXIDE RECTIFIERS FOR CIRCUIT BREAKER CLOSING SERVICE

Copper-oxide rectifiers for circuit breaker closing service are made up of one or more full wave rectifier units. The number of full wave rectifier units connected in parallel depends on the current requirements of the solenoid mechanism. When necessary, a small full wave rectifier unit is furnished to supply d-c for the closing control relay.

The 6RC128H18, 6RC128H19, 6RC159-H1, 6RC159H3 rectifiers are designed for intermittent duty and should only be used on the specific circuit application where their characteristics apply.

Where copper-oxide rectifiers are used outdoors, they should be installed in a weatherproof housing. For indoor use they should be installed in a suitable enclosure.

## DESCRIPTION

The copper-oxide rectifier unit for closing service consists of two half wave rectifier stacks each made up of a number of washers. These washers are assembled on a bolt with an insulation sleeve as shown in Fig. 1. Contact is established between the washers by means of a metal coating on the oxidized surface. The washers are held together with a pre-determined pressure. The pressure on the washers should not be disturbed. The individual stacks have two bridges per stack, separated by a terminal connection. There are three terminal connections on each stack. The nameplate end terminal is positive and the opposite terminal negative. The intermediate terminal is for the a-c connection.

Fig. 2 shows an elementary connection of a copper-oxide unit for full wave rectification. Typical elementary diagrams for the application of a complete rectifier for oil circuit breaker closing are shown in Fig. 5. Fig. 4 is the connection diagram for a rectifier unit.

## ADJUSTMENTS

The four rectifiers normally used on circuit breaker closing duty are 6RC128H18, 6RC128H19, 6RC159H1 and 6RC159H3. To check the output of these four rectifiers, the following curves, Figure 3, apply: (This check should not be made with the circuit breaker - remove rectifier from mounting or disconnect leads).

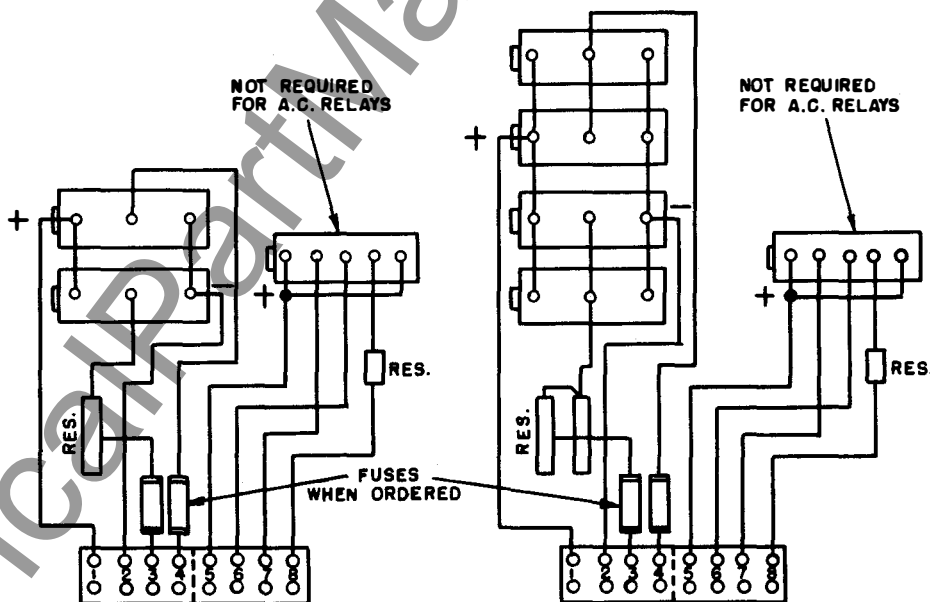
1. A variation of + 10% in d-c volts should be allowed for rectifier manufacture and instrument tolerances.
2. Any 1.5 ohm resistor of sufficient thermal capacity can be used, but a convenient load of 1.5 ohms can be obtained by using resistor K-4332863 G-3. This resistor is supplied on some applications as the adjustable series a-c resistor.

3. When checking the d-c volts output of the rectifier, do not energize the rectifier longer than 3 seconds. If the rectifier is energized longer than 3 seconds, an accelerated rate of aging will occur.
4. The voltage measurements can be made with standard instruments.
5. The curves apply for a temperature of approximately 70°F.

Aging of the rectifiers will occur, but due to the infrequent operation of most circuit breakers, aging will probably be a negligible factor. Copper-oxide rectifiers have a negative temperature co-efficient

which reduces the output as the temperature of the rectifier is lowered. A series resistor is usually provided in the a-c circuit to compensate for excessive line drop and temperature. (See Instruction Book for specific magne-blast breaker in question to determine the a-c resistor setting).

All applications require a minimum of 90 volts d-c closed circuit voltage at the closing coil. The adjustable a-c series resistor should be set to meet the requirements of the particular oil breaker solenoid, the lead resistance, regulation of the a-c supply and temperature. These breakers are adjusted at the factory to obtain a closed circuit d-c voltage between 105 - 110, with closed circuit a-c voltage of 220 volts, at 70°F.



## RECTIFIER COLOR CODE

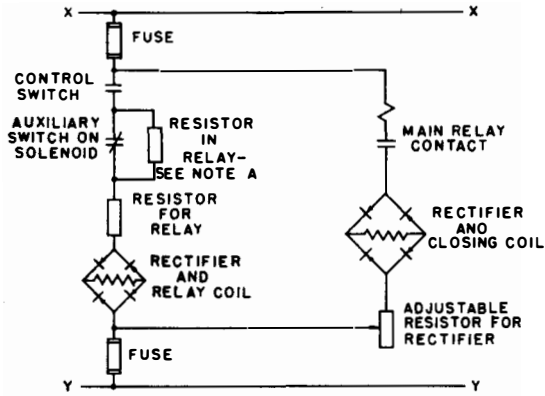
RED - POSITIVE D.C. TERMINAL  
BLACK - NEGATIVE D.C. TERMINAL  
YELLOW - A.C. TERMINALS

## TERMINAL CONNECTIONS

1 & 2 TO SOLENOID COIL  
3 TO A.C. VOLTAGE POLARITY Y  
4 THROUGH CONTROL RELAY CONTACTS TO A.C. VOLTAGE POLARITY X  
5 & 6 TO RELAY COIL  
7 THROUGH CLOSE BUTTON TO A.C. VOLTAGE POLARITY X  
8 TO A.C. VOLTAGE POLARITY Y

Fig. 4 Connection Diagram for Copper-Oxide Rectifiers

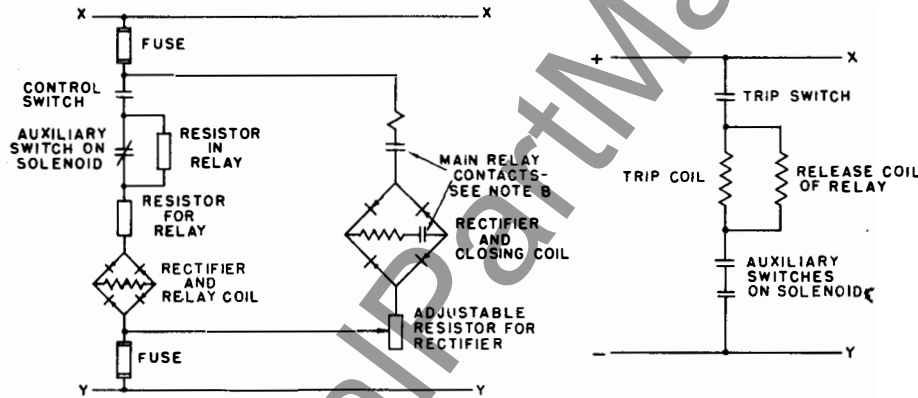
*These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.*



**NOTE A**  
SOME TYPES OF RELAYS DO NOT HAVE THIS RESISTOR, IN WHICH CASE THE AUXILIARY SWITCH MAY BE OMITTED OR USED WITHOUT THE RESISTOR.

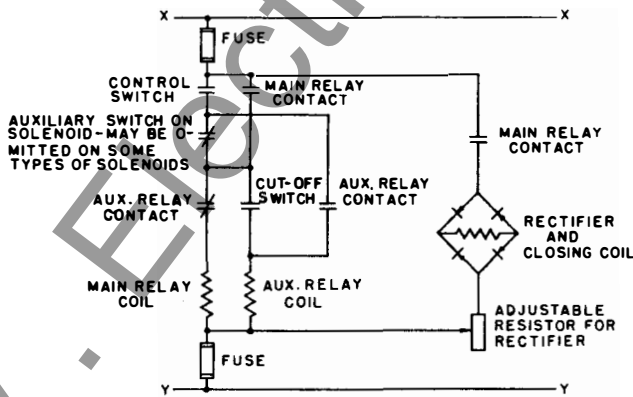
**ELEMENTARY DIAGRAM**

TYPICAL APPLICATION OF RECTIFIER ON TRIP FREE SOLENOID MECHANISMS WITH TIME DELAY RELAY



**ELEMENTARY DIAGRAM**

TYPICAL APPLICATION OF RECTIFIER ON NON TRIP FREE SOLENOID MECHANISMS WITH TRIP FREE RELAY



**NOTE B**  
ALTHOUGH DOUBLE POLE RELAYS ARE RECOMMENDED FOR NON TRIP FREE SOLENOIDS, A SINGLE POLE RELAY MAY BE USED. IN THIS CASE THE CONTACT IN THE D.C. SIDE OF THE RECTIFIER IS OMITTED.

**ELEMENTARY DIAGRAM**

TYPICAL APPLICATION OF RECTIFIER ON TRIP FREE SOLENOID MECHANISMS WITH AUTOMATIC CUT OFF RELAY

Fig. 5 Elementary Diagram

Fig. 5 (H-6081550)