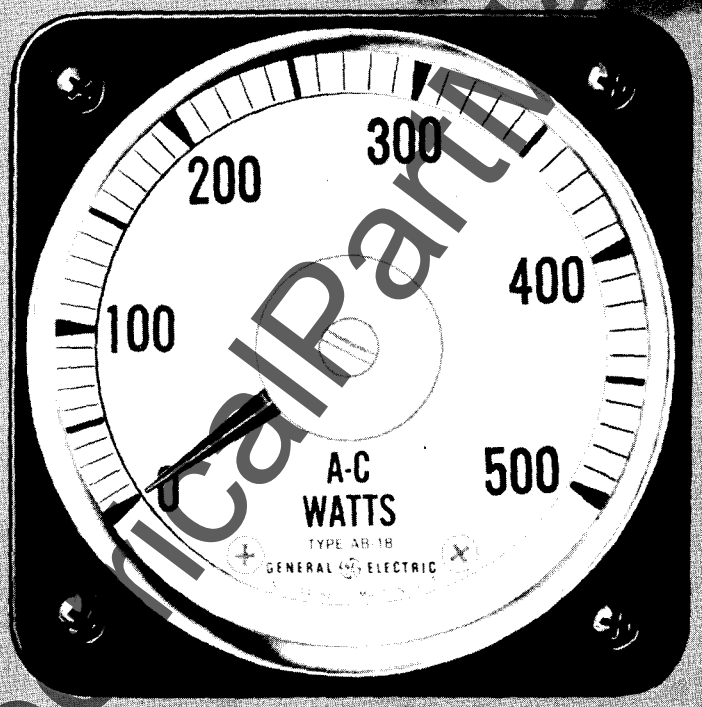
# INSTRUCTIONS

GEH-1456B
*Supersedes* GEH-1456A

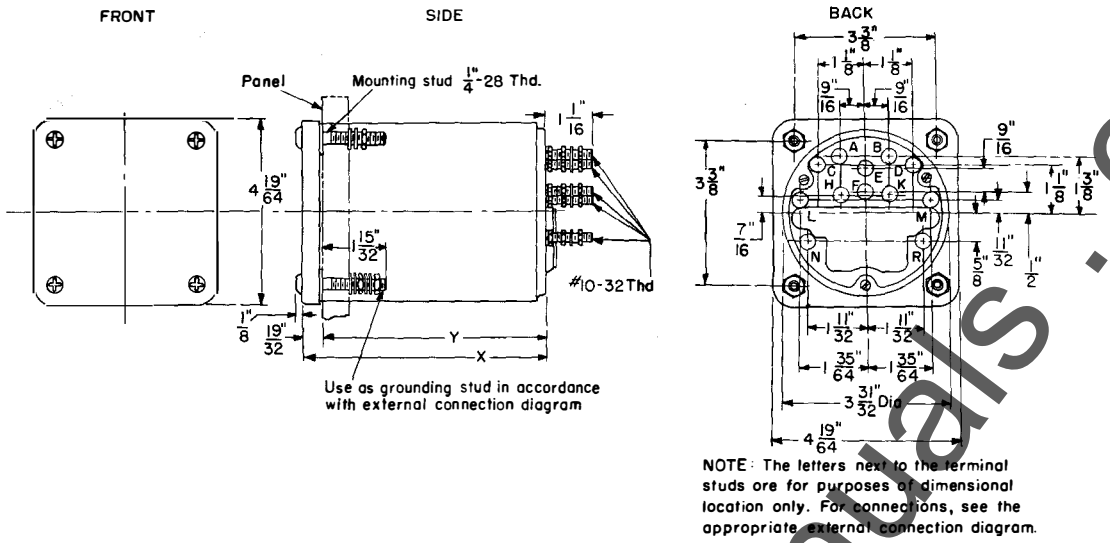
## TYPES AB-14,-15,-16,-18 AND-19

# SINGLE- AND POLYPHASE WATTMETERS



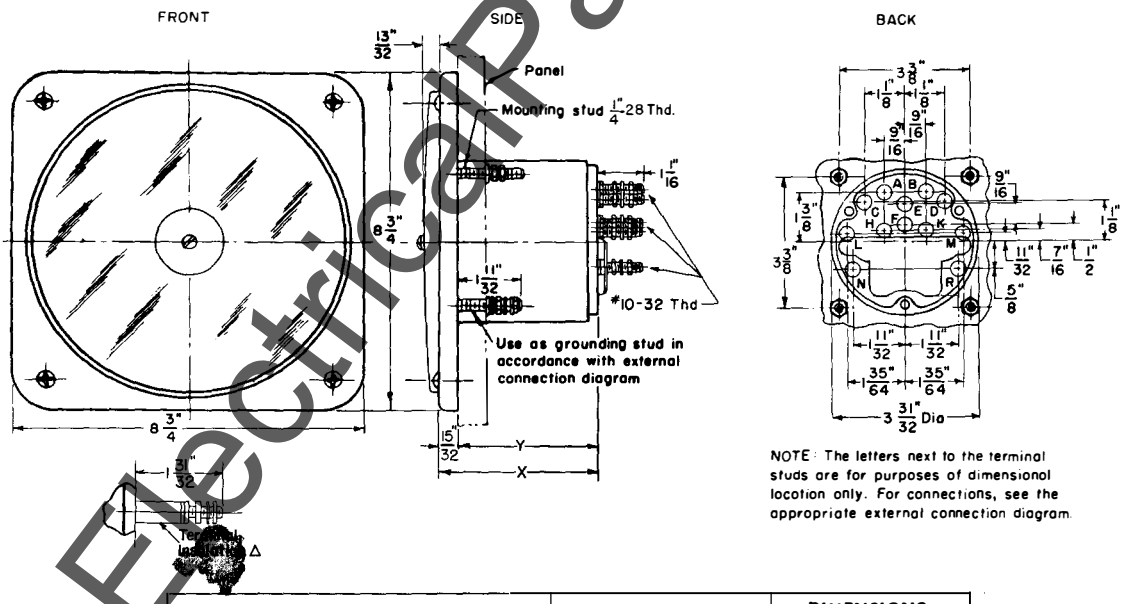



GENERAL ELECTRIC




| DESCRIPTION | STUD LOCATION | DIMENSIONS | |
|---|---|---|---|
| | | X | Y |
| Single-phase | CD NR | 4-15/32" | 3-7/8" |
| Polyphase 3-wire, 2- and 3-phase; and 4-wire, 2-phase | AB HKLMNR | 5-29/32" | 5-5/16" |
| Polyphase 4-wire, 3-phase | AB EFHKLMNR | 5-29/32" | 5-5/16" |

*Fig. 1. Dimensions of Types AB-14, -15, and -19 wattmeters.*




| DESCRIPTION | STUD LOCATION | DIMENSIONS | |
|---|---|---|---|
| | | X | Y |
| Single-phase | CD NR | 4-7/32" | 3-3/4" |
| Polyphase 3-wire, 2- and 3-phase; and 4-wire, 2-phase | AB HKLMNR △ | 5-21/32" | 5-3/16" |
| Polyphase 4-wire, 3-phase | AB E FHKLMNR △ | 5-21/32" | 5-3/16" |

*Fig. 2. Dimensions of Type AB-16 wattmeters.*

# TYPES AB-14,-15,-16,-18, AND -19 WATTMETERS

## INTRODUCTION

These instructions cover the installation of the Types AB-14, -15* -16, -18, and -19* single- and polyphase wattmeters. These wattmeters are long-scale, rectangular-pattern, switchboard instruments designed for flush mounting. The instruments, as supplied, are intended for use on the circuit specified by the customer. Burden data of the wattmeters are given in the table below.

Two-element wattmeters are supplied for use on balanced or unbalanced two-phase, three- or four-wire circuits and on balanced or unbalanced three-phase, three-wire circuits. A modified two-element wattmeter is furnished for use on three-phase, four-wire circuits.

A rating plate, located on the back of each wattmeter, gives the instrument serial number, instrument rating, and other important data. If the instrument is to be used on a circuit of higher voltage or current value than that stamped on this rating plate, an instrument transformer (or transformers) of the ratio indicated must be used. When the circuit exceeds 625 volts, a current transformer as well as a potential transformer must be used for purposes of insulation. A current or potential transformer, if used, must have a frequency rating which corresponds to that stamped on the instrument rating plate.

Instruments of certain voltage ratings are designed to be used with external resistors. The appropriate resistor is supplied with the wattmeter and has a serial number which corresponds to that of the instrument. Only this resistor should be used with the instrument. The table of EXTERNAL RESISTORS, given below, indicates the number of tubes in the resistors supplied for the various voltage ratings. The dimensions of these resistors are given in Fig. 4.

**EXTERNAL RESISTORS**

| Description | Volts | External Resistor |
|---|---|---|
| Single-phase | 100–125 | None |
| Single-phase | 200–250 | One 1-tube |
| Single-phase | 400–500 | One 2-tube |
| Single-phase | 501–625 | One 2-tube |
| Polyphase | 100–125 | None |
| Polyphase | 200–250 | One 2-tube |
| Polyphase | 400–500 | One 4-tube |
| Polyphase | 501–625 | One 4-tube |

## CALIBRATING WATTS

The value of calibrating watts (indicated CAL. WATTS on the rating plate) is the power required for full scale deflection of the instrument when connected in the calibrating circuit without current or potential transformers.

In the calibration of all wattmeters, it is customary to utilize a single-phase, unity-power-factor source. During calibration of a two-element wattmeter, the potential coils are connected in parallel across the single-phase circuit and the field coils are connected in series. The deflection of the polyphase instrument is then the sum of the torques produced by the two elements.

**BURDEN DATA**

| TYPE | Impedance in Ohms | Effective Resistance in Ohms | Inductance in Henries | Volt-amperes | Watts | Vars | Power Factor |
|---|---|---|---|---|---|---|---|
| **120-volt, 60-cycle Potential Circuit** | | | | | | | |
| Single-phase Wattmeters | 6790 | 6790 | 0 | 2.12 | 2.12 | 0 | 1.0 |
| Polyphase Wattmeters | 7340 | 7340 | 0 | 1.96 | 1.96 | 0 | 1.0 |
| **5-ampere, 60-cycle Current Circuit** | | | | | | | |
| Single-phase Wattmeters | 0.063 | 0.019 | 0.00016 | 1.58 | 0.48 | 1.51 | 0.30 |
| Polyphase Wattmeters | 0.063 | 0.019 | 0.00016 | 1.58 | 0.48 | 1.51 | 0.30 |

* Discontinued type; no longer available.

*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.*

When a wattmeter is intended for high-power measurements, requiring the use of a transformer (or transformers), the scale is usually graduated in terms of primary power; and therefore, the transformer ratio must be considered.

The following formulas give the relation for calibrating watts when the instrument is calibrated on a single-phase system as described above:

For a single-phase instrument, calibrating watts

$$= \frac{\text{full-scale watts}}{\text{CT ratio X PT ratio}}$$

For 3-wire, 3-phase and 2-phase instruments, calibrating watts

$$= \frac{\text{full-scale watts}}{\text{CT ratio X PT ratio X 2}}$$

For a 4-wire, 3-phase instrument, calibrating watts

$$= \frac{\text{full-scale watts}}{\text{CT ratio X PT ratio X 4}}$$

## INSTALLATION

### MOUNTING

Follow the appropriate dimension drawing in this book when drilling the switchboard. Complete all wiring on the switchboard before installing the instrument. Supporting studs are provided for mounting the wattmeters on the switchboard. Mount the instruments in a level position.

These instruments are practically unaffected by stray fields, but it is advisable to follow the general practice of keeping transformers and wires carrying heavy currents as far as possible from all indicating instruments.

When no current is flowing through the instrument, the pointer should indicate zero. If the pointer does not indicate zero, correction should be made by inserting a small screwdriver in the zero set screw, located at the front of the instrument, and turning until a zero indication is obtained.

### TERMINAL CONNECTIONS

The threads on the terminal studs and nuts should be clean and bright. The contact surfaces of nuts, busbars, and cable terminals must be thoroughly clean to insure good contact. If a nut turns hard, it should be run over a tap of the proper dimensions; otherwise the threads on the stud may be ruined or the stud turned in the instrument, thereby breaking the connection. After the instrument has been connected, tighten the nuts sufficiently to insure good contact. Do not overtighten.

The nuts and studs used in these instruments are U. S. standard.

The connections for single-phase wattmeters are shown in Fig. 5 and 6. Connections for polyphase wattmeters are shown in Fig. 7-13.

On instruments manufactured prior to 1951, the terminal studs are stamped with letters instead of numbers. For such instruments, the connection diagrams in this book may be followed by observing the pictorial positioning of the terminals, rather than the stud markings.

**Warning:** Care must be exercised in handling high tension wires when installing instruments on such circuits.

Follow the appropriate diagram and make the connections carefully. Be sure that the current and voltage connections are made as indicated. The numbers in these connection diagrams correspond to the numbers stamped on the instrument terminals.

### POLARITY MARKINGS OF TRANSFORMERS

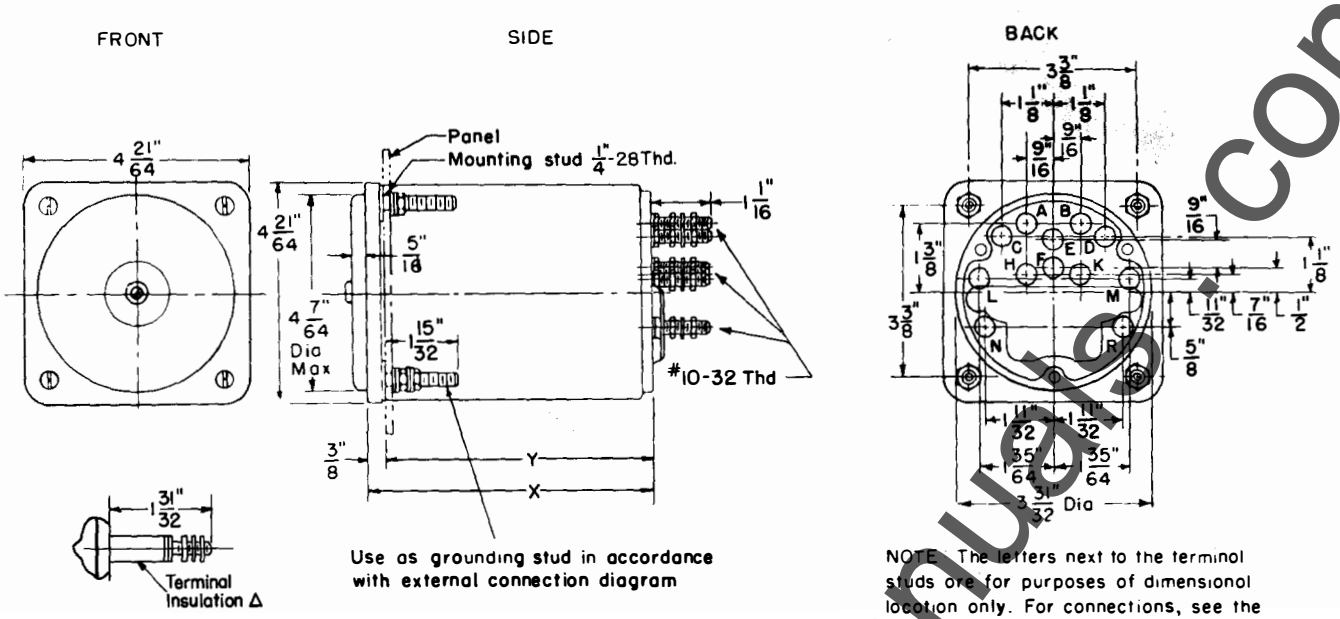
Transformers of present manufacture have polarity markings of white paint or markers, $H_1$ for primary and $X_1$ for secondary, on or near the proper terminal. These markings denote the relative polarity and facilitate the making of proper connections for correct direction of deflection of instruments. The relation of the marked leads is such that instantaneous direction of the current in them is the same; namely, toward the transformer in the marked primary lead and from the transformer in the marked secondary lead, or vice versa. These polarity markings are indicated in the connection diagrams and should be followed irrespective of their physical location on the transformers.

### GROUNDING INSTRUMENT CASES

The cases of wattmeters which are used with instrument transformers should be connected to the grounded side of the secondary circuits of such transformers. No. 12 Awg copper wire is suitable for this purpose. Grounding connections from the grounded side of the secondary circuits to earth should be made in accordance with the provisions of the National Electric Code.

## PRINCIPLES OF OPERATION

Single-phase wattmeters utilize a mechanism of the electrodynamic type. The field coil of the mechanism is connected in series with the line, and the moving coil is connected across the line. Therefore, the field flux is proportional to the line current, the moving-coil flux is proportional to the line voltage, and the instantaneous torque of the instrument is proportional to the instantaneous product of the current and voltage. The instrument reads the average of the power pulses.




| DESCRIPTION | STUD LOCATION | DIMENSIONS | |
|---|---|---|---|
| | | X | Y |
| Single-phase | CD NR | 4-1/4" | 3-7/8" |
| Polyphase 3-wire, 2- and 3-phase; and 4-wire, 2-phase | AB HKLMNR (Δ) | 5-11/16" | 5-5/16" |
| Polyphase 4-wire, 3-phase | AB E FHKLMNR (Δ) | 5-11/16" | 5-5/16" |

*Fig. 3. Dimensions of Type AB-18 wattmeters.*

Polyphase wattmeters utilize two single-phase mechanisms with the moving coils mounted on a common shaft. Polyphase wattmeters supplied for three-phase, four-wire measurements are designed with four current (field) coils and two potential (moving) coils. In this modification two current coils interact with each potential coil.

## SERVICING

If at any time you find it necessary to repair, recondition, or rebuild your G-E apparatus, there are 30 G-E service shops whose facilities are available day and night for work in the shops or on your premises. Factory methods and genuine G-E renewal parts are used to maintain the original performance of your G-E apparatus. If you need parts only, immediate shipment of many items can be made from warehouse stock.

The services of our factories, engineering divisions, and sales offices are also available to assist you with engineering problems. For full information about these services, contact the nearest General Electric service shop or sales office.

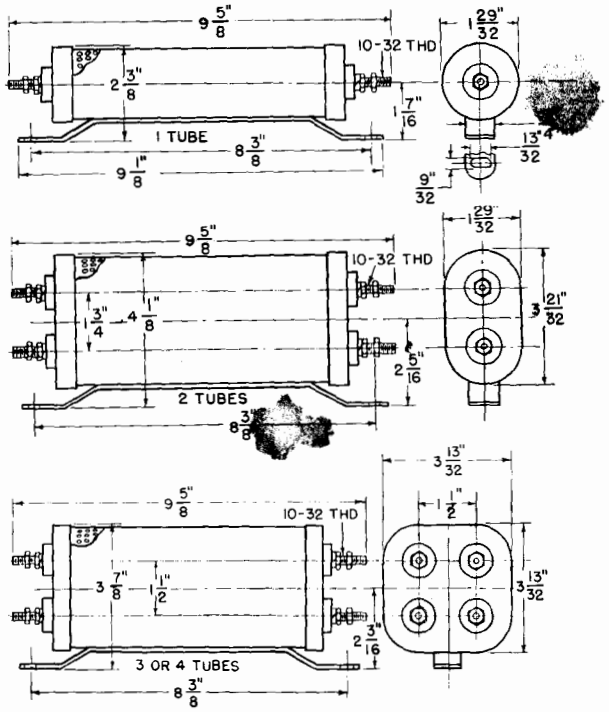
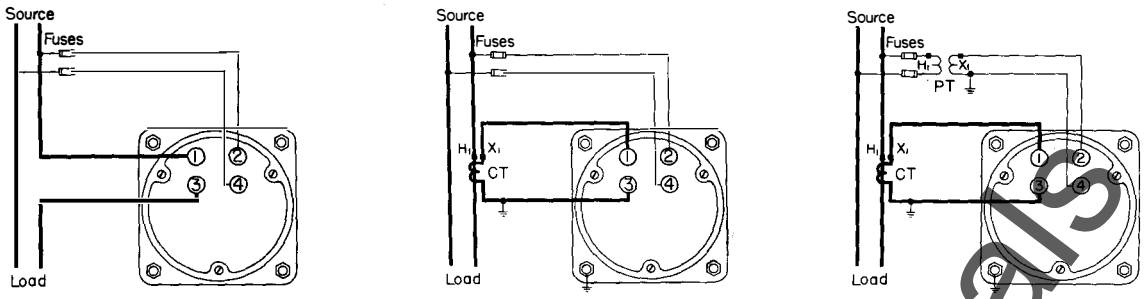



*Fig. 4. Dimensions of Form-3 resistor cages.*

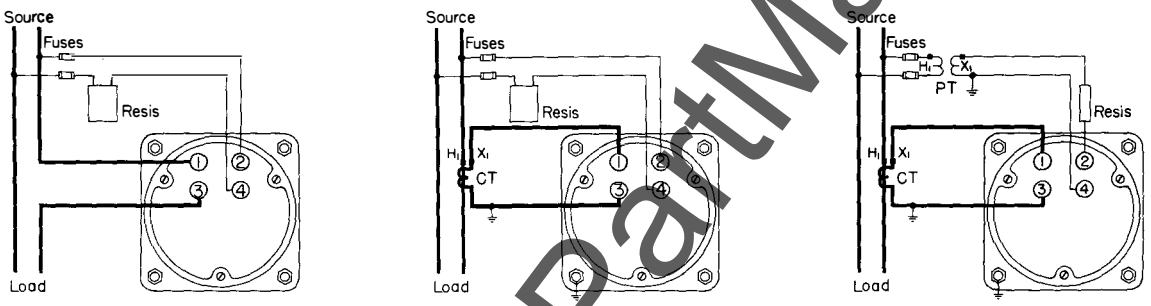
## CONNECTION DIAGRAMS

**(Back Views)**



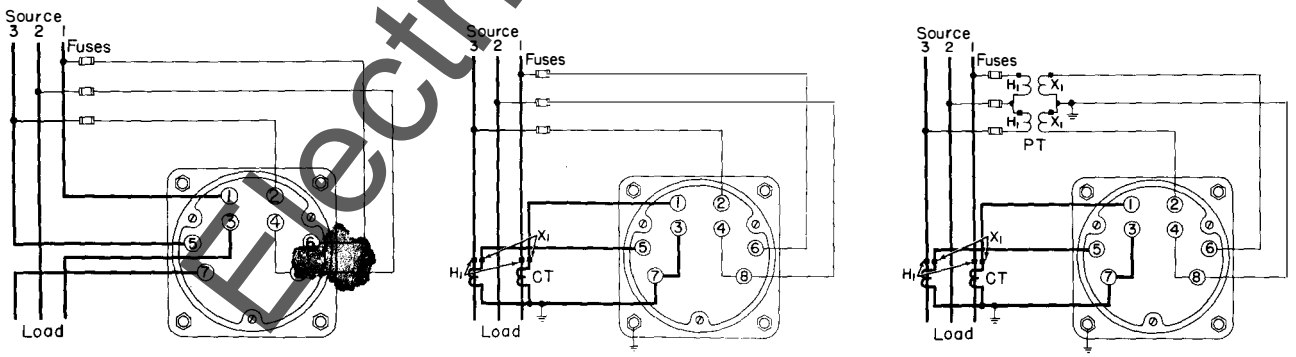

Without transformers | With current transformer | With current and potential transformers

*Fig. 5. Connections for single-phase wattmeters rated 0-125 volts (with internal resistor).*




Without transformers | With current transformer | With current and potential transformers

*Fig. 6. Connections for single-phase wattmeters rated 130-625 volts (with external resistor).*




Without transformers | With current transformers | With current and potential transformers

*Fig. 7. Connections for polyphase wattmeters rated 0-125 volts (with internal resistor) for 3-wire, 3-phase and 3-wire, 2-phase circuits. On 3-wire, 2-phase circuits, line 2 in common.*

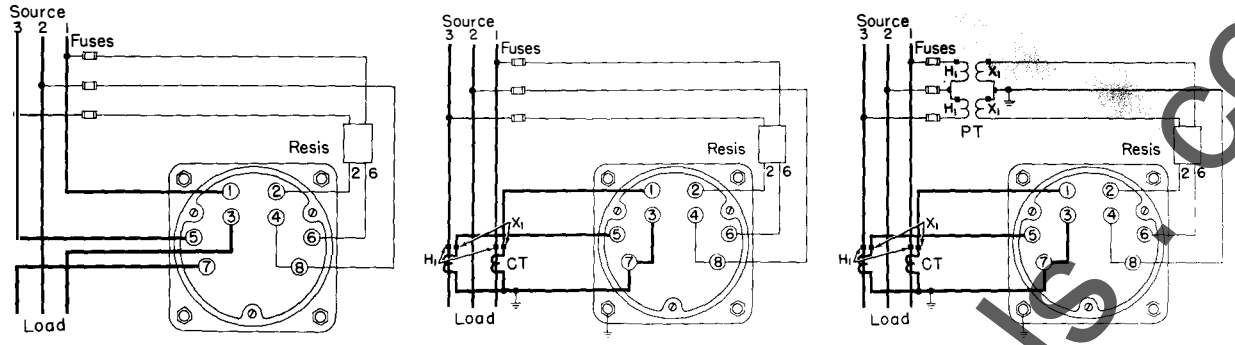



*Fig. 8. Connections for polyphase wattmeters rated 130-625 volts (with external resistor) for 3-wire, 3-phase and 3-wire, 2-phase circuits. On 3-wire, 2-phase circuits, line 2 in common.*

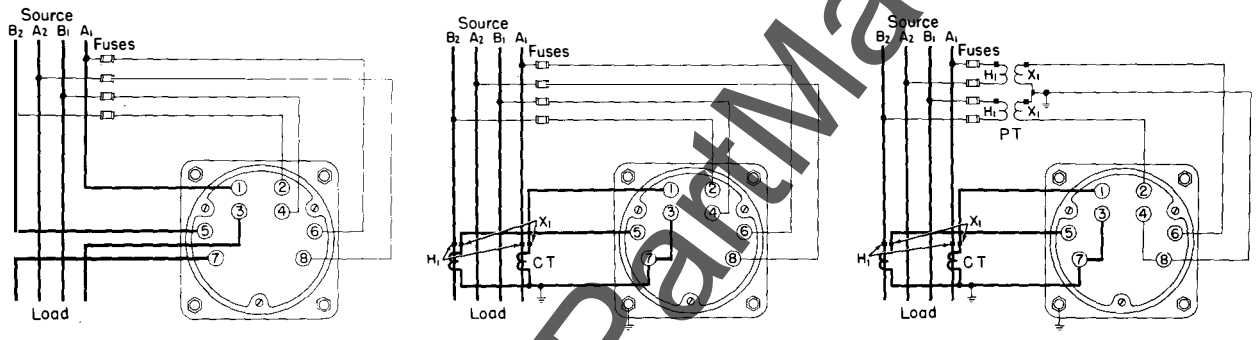



*Fig. 9. Connections for polyphase wattmeters rated 0-125 volts (with internal resistor) for 4-wire, 2-phase circuits.*

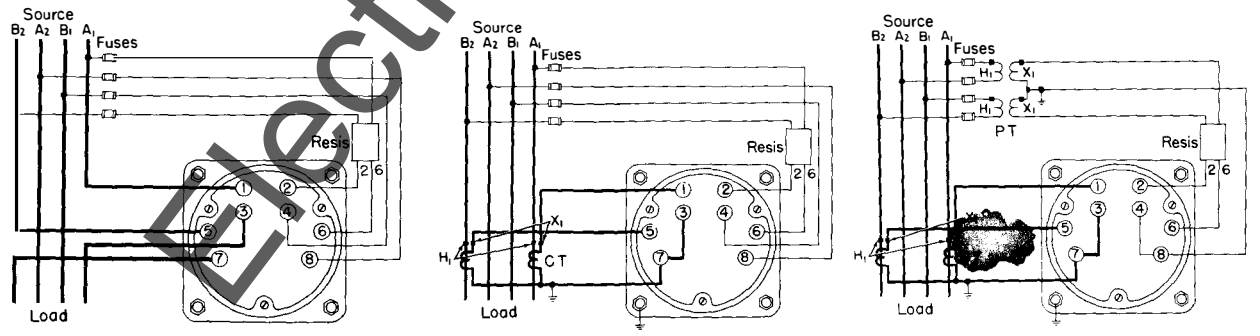
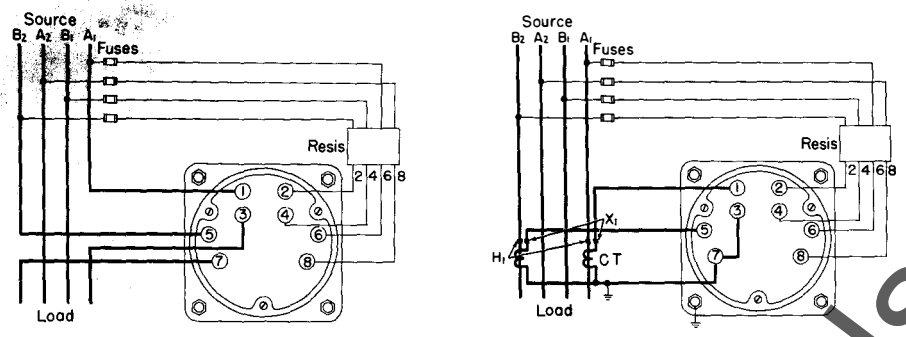
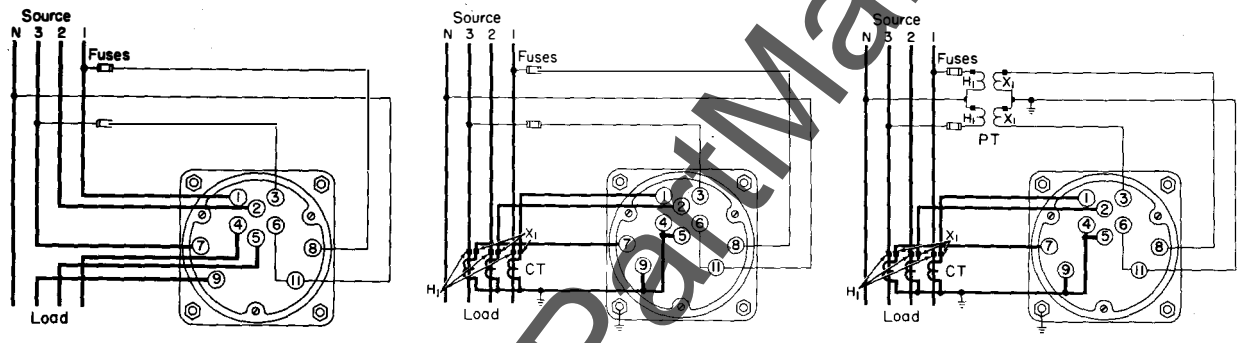



*Fig. 10. Connections for polyphase wattmeters rated 130-250 volts (with external resistor) for 4-wire, 2-phase circuits.*



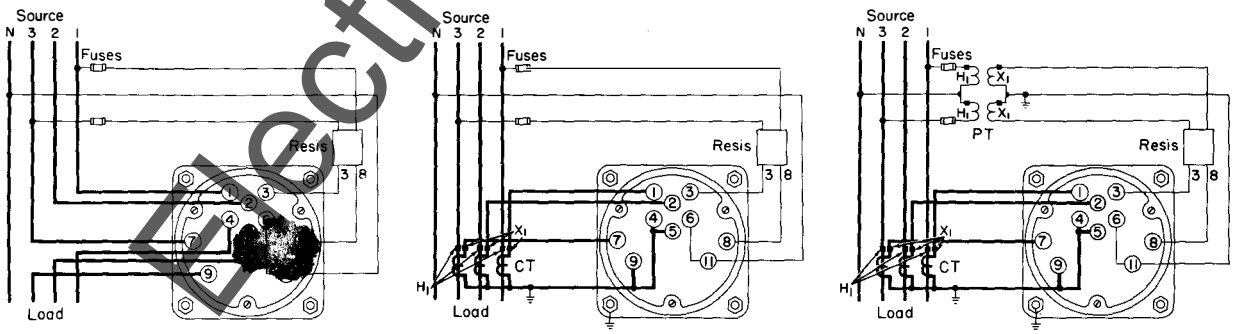

**Without transformers** **With current transformers**

*Fig. 11. Connections for polyphase wattmeters rated 260-625 volts (with external resistor) for 4-wire, 2-phase circuits.*




**Without transformers** **With current transformers** **With current and potential transformers**

*12. Connections for polyphase wattmeters rated 0-125 volts (with internal resistor) for 4- wire, 3-phase circuits.*




**Without transformers** **With current transformers** **With current and potential transformers**

*Fig. 13. Connections for polyphase wattmeters rated 130-625 volts (with external resistor) for 4-wire, 3-phase circuits.*

**INSTRUMENT DEPARTMENT, GENERAL ELECTRIC COMPANY, WEST LYNN, MASS.**

5-56 (5200)

PRINTED IN U.S.A.