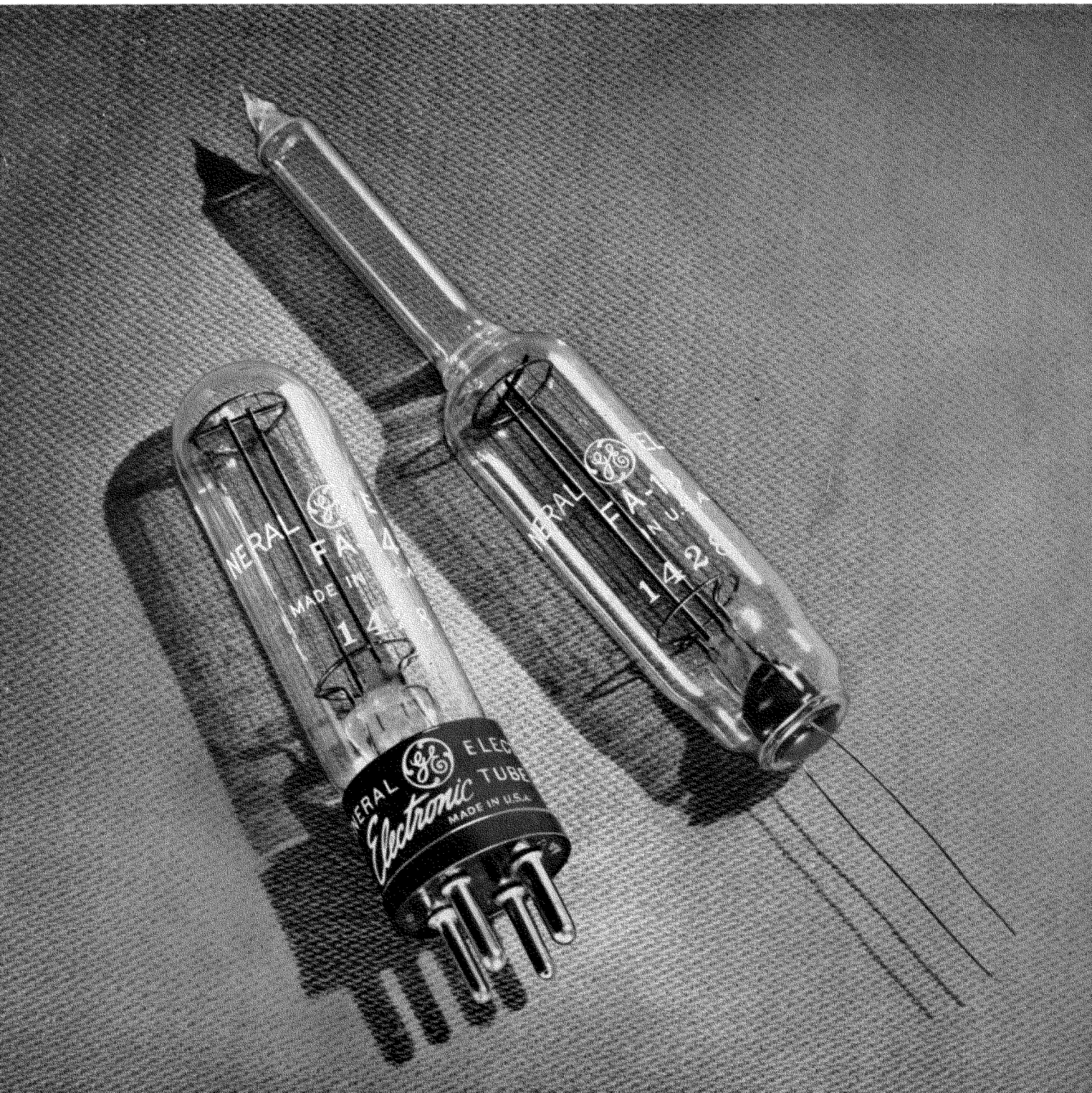
GENERAL ELECTRIC

RESISTANCE VACUUM GAGES



DESCRIPTION

The FA-13 and 14, used in a resistance vacuum gage possess features especially useful in providing a convenient method for measuring low gas pressures. With suitable associated apparatus, these tubes will provide a fast, continuous, direct reading. As the vacuum system is pumped down, a meter in the bridge circuit reads the unbalancing of the bridge, thus providing an uninterrupted and instantaneous reading and enabling the observer to determine at all times the exact conditions in the system.

The resistance vacuum gage differs from the McLeod gage in that it gives an electrical, rather than mechanical, indication. Unlike the McLeod gage, it is also possible with this gage to take readings of condensable vapor, such as water vapor.

These tubes should be used in pairs since in combination they provide a much more stable and reliable reading than if the FA-13 is used alone.

TECHNICAL INFORMATION

GENERAL CHARACTERISTICS (Indicator Tube FA-13*)

Number of Electrodes	1

Electrical

Recommended range	0–600 microns
Maximum d-c voltage	6 volts
Resistance of average tube at 25 C	7 ohms

Characteristics of an average tube at 3 volts—25 C, ambient temperature:

0 microns pressure, dry air	180 milliamperes
75 microns pressure, dry air	226 milliamperes
195 microns pressure, dry air	271 milliamperes
1000 microns pressure, dry air	327 milliamperes
Atmospheric pressure	353 milliamperes

Mechanical

Splice tubing	3/8 inches diam. lime glass
Net weight, approx.	1 ounce
Shipping weight, approx.	3 pounds

**It is recommended that this tube be used in a bridge circuit in combinations with the FA-14 Compensator Tube.*

GENERAL CHARACTERISTICS (Compensator Tube FA-14)

Number of Electrodes	1

Electrical

Maximum d-c voltage	6 volts
Resistance of average tube at 25 C	7 ohms

Characteristics of an average tube at 25 C, ambient temperature:

1 Volt	90 milliamperes
2 Volts	140 milliamperes
3 Volts	180 milliamperes
4 Volts	218 milliamperes

Mechanical

Base	4101
Net weight, approx.	1 ounce
Shipping weight, approx.	3 pounds

OPERATING NOTES

The FA-13 is used to measure the gas pressure. The FA-14, which has a filament identical with that of the FA-13, is sealed off under very high vacuum and is used to compensate for temperature and voltage changes.

The FA-13 and FA-14 are usually sold in matched pairs since there is some variation from time to time in manufacture. For this reason single tubes purchased separately and at different times may not match.

With the FA-13 the pressure indication is obtained as a function of the change in resistance of a heated tungsten filament caused by the cooling, by convection current, of the gas being measured. Since different gases have different factors for convection cooling, the calibration of the gage will not be the same for all gases. For example, the gage is much more sensitive to hydrogen than to nitrogen. Since the response of the gage is a current change, it may be used for recording and for control—to start and stop a pump—as well as for indication.

INSTALLATION

The FA-13 and FA-14 may be mounted in any position, but should be protected from excessive shock or vibration. It is recommended that the connection to the base of the FA-14 be clamped solidly or soldered to avoid difficulty with contact resistance. The FA-13 is provided with connection leads instead of a base and glass connection tubing for splicing to the exhaust system. This connection may be cemented on, or sealed to, another glass tube.

Greater stability will be obtained if tubes are protected from heat and direct light rays. If used in pairs it is advisable to place the tubes together so that their temperatures will vary simultaneously.

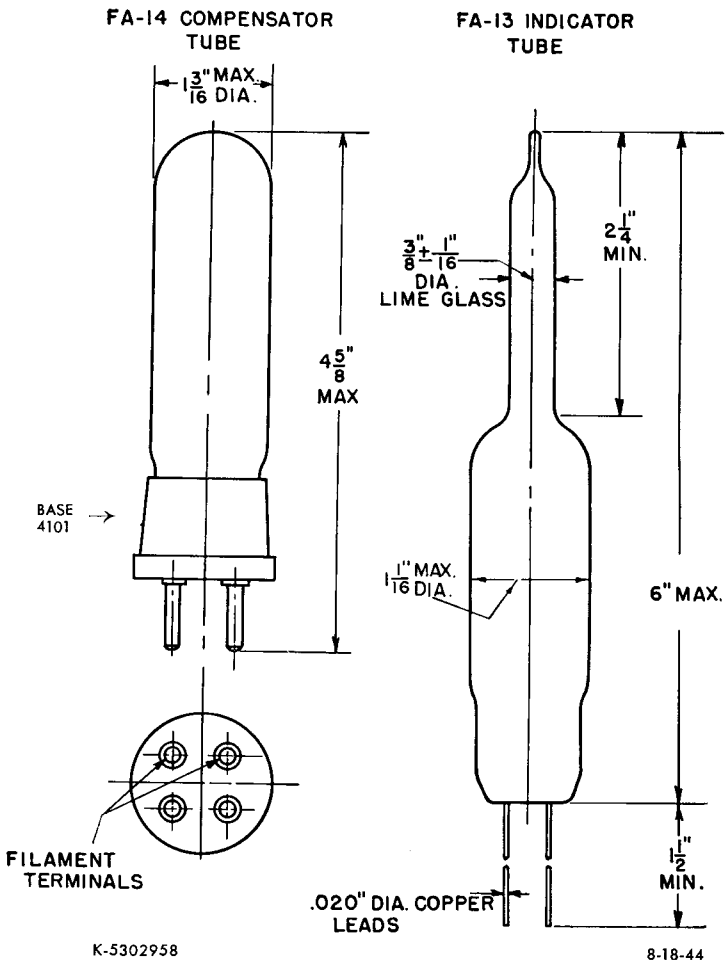
OPERATION

Although the FA-13 connected in series with a milliameter, may be used for rough measurements, it is recommended that an ordinary bridge circuit be provided with the FA-13 in one arm, the FA-14 compensator tube in the opposite arm, and variable resistances in the two adjacent arms. The bridge arrangement gives greater sensitivity than the FA-13 alone and the use of a compensator tube results in substantial independence from ordinary voltage variation.

The characteristics shown by the curves are approximate. Where a high degree of accuracy is required, the individual gage must be calibrated against a standard. In Fig. 2, of page 4, the dotted curves are the compensator characteristics plotted in reverse. The distance between the origins represents the total voltage on the bridge; the intersections give the voltage division for various pressures.

With the bridge balanced at zero pressure, the horizontal distances between the zero intersection and the intersection for other pressures furnishes a rough calibration for corresponding measurement taken on the bridge with a high-resistance voltmeter.

These curves supply a convenient method for estimating the bridge sensitivity at various voltages. The calibration may change with wide variations in ambient temperature. Fig. 1 on page 4 illustrates the variation in current with pressure for two different voltages.



OUTLINE RESISTANCE VACUUM GAGES FA-13, FA-14

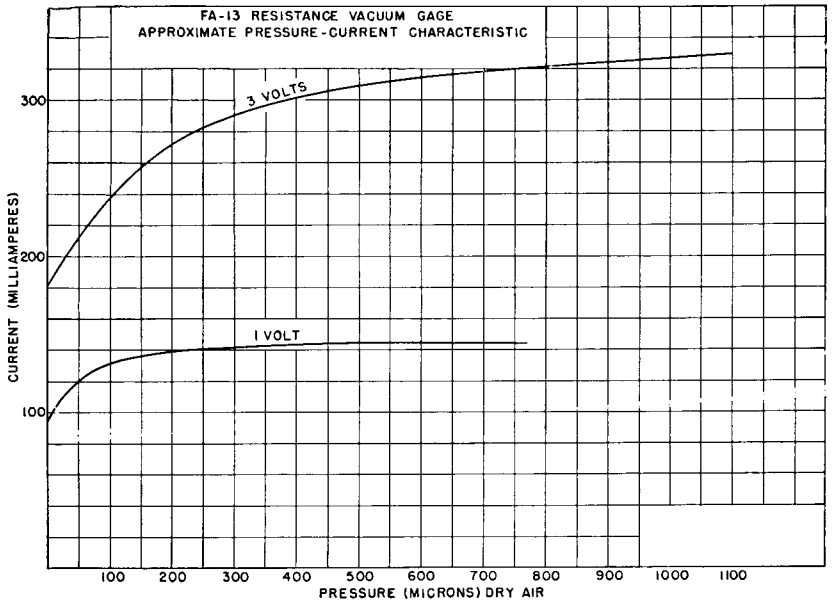


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Fig. 1

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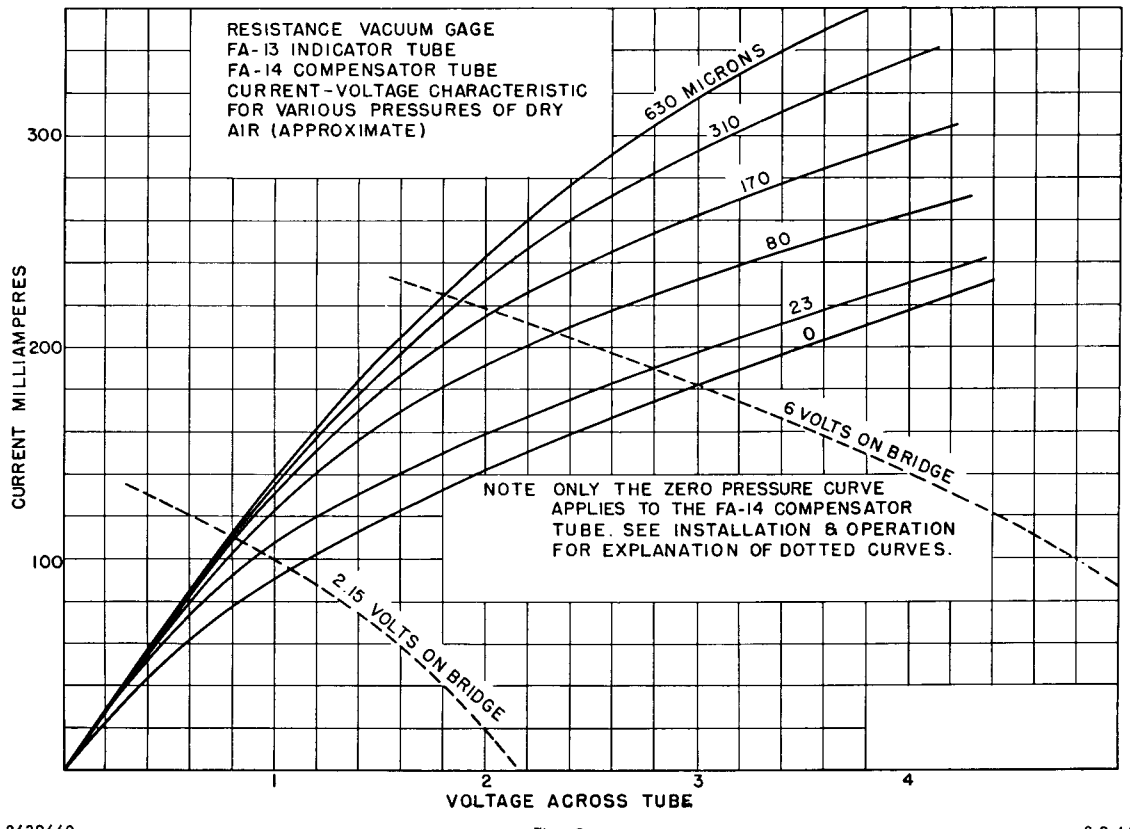

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Fig. 2

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Electronics Department

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