

GENERAL  ELECTRIC

# GLOW TUBES



## DESCRIPTION

A glow tube is a cold-cathode, gas-discharge tube in which no means is provided for controlling the unidirectional current flow. (NEMA definition). This type of tube is also known as a voltage-regulator tube, a name which describes its principal application.

Fundamentally, a glow tube consists of two electrodes, an anode and a cold cathode, in a partial

atmosphere of inert gas or vapor. The emission is obtained from the cold cathode by virtue of a potential gradient at the cathode surface. This gradient literally pulls electrons out of the cathode. For this reason cathodes are sometimes coated with some material which has a low work function so that electrons are given off with comparative ease.

## GENERAL OPERATION

Two types of discharge are possible in a glow tube. A glow discharge, which is a uniform glow covering all or part of the cathode surface, will occur when the current carried by the tube is low. Under these conditions the tube drop is essentially independent of the current. This is the condition under which glow tubes normally operate. The exact voltage drop across the tube depends upon the electrode spacing and the type and amount of gas used.

If the current through the tube is increased be-

yond a certain point the tube will go into a so-called arc discharge. Under these conditions a cathode spot rather than a uniform cathode glow appears on the cathode and the tube drop decreases to a rather low value (10-20 volts). Although some glow tubes are designed to operate as arc-discharge tubes, the majority of glow tubes must not be operated so that an arc discharge takes place, as the life of the tube will be materially shortened.

## TECHNICAL INFORMATION

*These data are for reference only. For design information refer to specifications.*

### GENERAL CHARACTERISTICS

Tube Type Number.....	GL-OA3/VR-75, GL-OB3/VR-90 GL-OC3/VR-105, GL-OD3/VR-150	GL-874
Type of voltage-regulator tube.....	Glow discharge	Glow discharge
Cathode.....	Cold type	Cold type
Maximum over-all length.....	4 $\frac{1}{8}$ inches	5 $\frac{3}{8}$ inches
Maximum seated height.....	3 $\frac{3}{16}$ inches	4 $\frac{3}{4}$ inches
Maximum diameter.....	1 $\frac{1}{16}$ inches	2 $\frac{1}{16}$ inches
Base.....	Small shell octal 6-pin	Medium 4-pin bayonet
Net weight, approx.....	2 ounces	2 ounces
Shipping weight, approx.....	3 pounds	3 pounds

### MAXIMUM RATINGS

Tube Type Number.....	GL-OA3/VR-75	GL-OB3/VR-90	GL-OC3/VR-105	GL-OD3/VR-150	GL-874
Minimum d-c anode supply voltage..	105	125	133	185	125 volts
D-c operating Current:					
Maximum*.....	40	30	40	40	50 milliamperes
Minimum.....	5	10	5	5	10 milliamperes
D-c starting voltage, approx.....	100	110	115	160	125 volts
D-c operating voltage, approx.....	75	90	105	150	90 volts
D-c operating current, continuous...	5 to 40	5 to 30	5 to 40	5 to 40	10 to 50 milliamperes
Regulation 5 to 30 milliamperes.....	3	4	1	2	volts
Regulation 5 to 40 milliamperes.....	5	-	2	4	volts
Ambient temperature range.....	-55 to +90	-55 to +90	-55 to +90	-55 to +90	centigrade

\*Sufficient resistance must always be used in series with the tube to limit the current through it to this value.

## DEFINITIONS OF RATINGS

### D-c Anode Supply Voltage, Minimum

This is the minimum value of voltage that the voltage supply must be capable of applying to the glow tube.

### D-c Operating Current

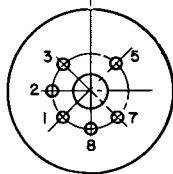
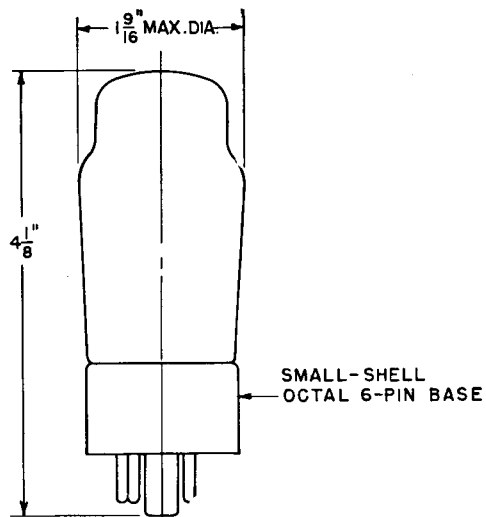
These values of maximum and minimum current indicate the range over which the glow tube will operate satisfactorily. Operation below the minimum current will cause erratic regulation and operation above maximum current will result in short life and erratic regulation.

### Regulation

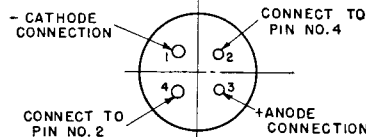
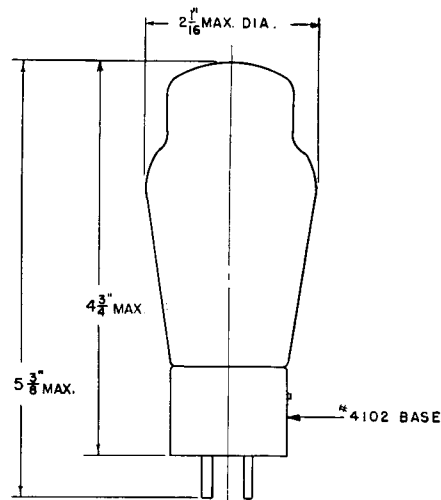
The regulation voltage is the maximum variation in voltage drop across the glow tube. It is calculated as the difference between the voltage drop obtained at the maximum current and the voltage drop obtained at the minimum current.

### Ambient Temperature Range

This temperature range indicates the maximum and minimum temperatures at which satisfactory operation may be obtained.

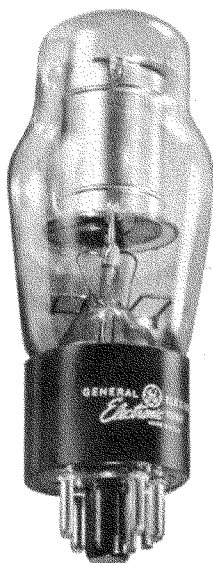


PIN	CONNECTION
1	NO CONNECTION
2	CATHODE
3	JUMPER
5	ANODE
7	JUMPER
8	NO CONNECTION



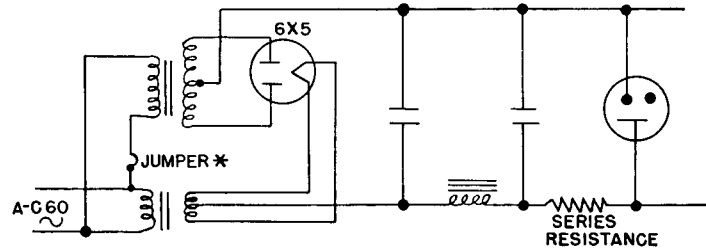
K-8065596 OUTLINE 8-10-44  
GL-874 GLOW TUBE 11-8-44

K-8065597 Outline 8-10-44  
GL-OA3/VR75 OB3/VR90  
OC3/VR105, OD3/VR150



### APPLICATION CIRCUITS #

The most common use of the glow tube is as a voltage regulating device.



K-8639684

Fig. 1—Voltage-Regulated Power Supply Circuit

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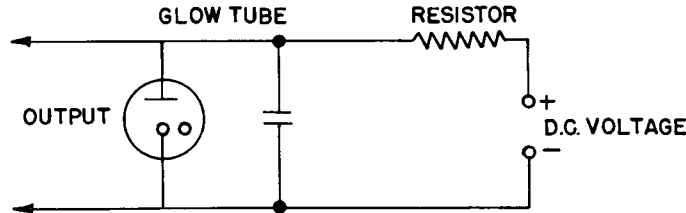
Fig. 1 above illustrates a voltage-regulated power supply circuit incorporating a glow tube as a voltage stabilizer. (\*Most glow tubes are provided with a jumper wire connected internally. This is usually employed as a switch, and is wired in series with the primary of the transformer supplying power to the glow tube. When the tube is removed from the socket the power supply circuit is automatically shut off.)

Such a circuit is an inexpensive means of providing a regulated voltage within the capabilities of a tube for such applications. The series resistance must be of a value that will limit the current through the glow tube to the maximum rated cur-

rent. It is also desirable to furnish a high enough voltage from the d-c supply so that the current through the glow tube does not drop below the minimum rating.

Glow tubes may be used in series to provide higher regulated voltages than are available from one tube. These tubes need not be the same type, the only requirement being that the current must be limited so that it falls within the operating range of the combination. For example, if a GL-OA3/VR75 and a GL-OB3/VR90 are used in series, the current must be limited to 30 milliamperes maximum. Operation of glow tubes in parallel is not recommended.

A second application of the glow tube is the relaxation oscillator illustrated in Fig. 2.



K-8639685

Fig. 2—Relaxation Oscillator Circuit

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In this type of circuit, a current charges a capacitor. In parallel with the capacitor is a glow tube, which will break down when the voltage on the capacitor reaches the voltage breakdown point of the glow tube. The frequency of this action may

be varied by changing the capacitance or type of glow tube.

#Circuits shown in ETI-176 are examples of possible tube applications and the description and illustration of them does not convey to the purchaser of tubes any license under patent rights of General Electric Company.

### INSTALLATION AND OPERATION

Sufficient resistance must always be used in series with each of these tubes to limit the current through the tube to the maximum rated value under continuous (steady state) operating conditions. During the interval of 5 to 10 seconds which may be required for the regulated tubes in associated equipment to warm up and draw plate current, a maximum current of 100 milliamperes is permissible provided each such starting period is followed by a steady-state operating period of at least several minutes. Unless this pre-

caution is observed, tube performance will be impaired.

In voltage-regulator tubes of the glow-discharge type, regulation is somewhat dependent on past operating conditions. For example, the regulation value of a tube operated for a protracted period at 5 milliamperes and then changed to 35 milliamperes may be somewhat different from the value that will be obtained after a long period of operation at 35 milliamperes. Likewise, the regulation value may change somewhat after a long idle period.

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