

GL-874 SEE SUPPLEMENT No. 20
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GENERAL  ELECTRIC

Supersedes ETI-176 dated 4-45

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, GL-OB3 GL-OC3, GL-OD3	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 $\frac{9}{16}$ inches	4 $\frac{3}{4}$ inches
Maximum diameter	1 $\frac{9}{16}$ 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 Min Bogey Max	GL-OB3 Min Bogey Max	GL-OC3 Min Bogey Max	GL-OD3 Min Bogey Max	GL-874 Min Bogey Max	
Electrical Data						
D-c anode-supply voltage*	105 — —	130 — —	133 — —	185 — —	130 — —	volts
D-c operating voltage	— — —	— — —	— — —	— — —	— 90 —	volts
Anode voltage drop	68 75 85	77 90 104	103 108 116	142 153 165	— — —	volts
Anode breakdown voltage	— 100 105	— 105 130	— 115 133	— 160 185	— 115 130	volts
Regulation	— 5 6.5	— 5 9	— 2 4	— 4 5.5	— 7 —	volts
Mechanical Data						
Mounting position						any
Net weight, maximum	1.3	1.3	1.3	1.3	1.3	ounces
Maximum Ratings, Absolute Values						
Maximum average starting current	100	100	100	100	—	milliamperes
Maximum averaging time	10	10	10	10	—	seconds
D-c Cathode Current						
Maximum	40	30	40	40	50	milliamperes
Minimum	5	5	5	5	10	milliamperes
Maximum frequency	0†	0	0	0	—	
Ambient temperature limits	— 55 to +90	— 55 to +90	— 55 to +90	— 55 to +90	— 55 to +90	C

* To assure starting throughout tube life not less than the specified supply voltage should be provided.

† C operation only.

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

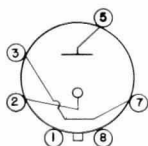
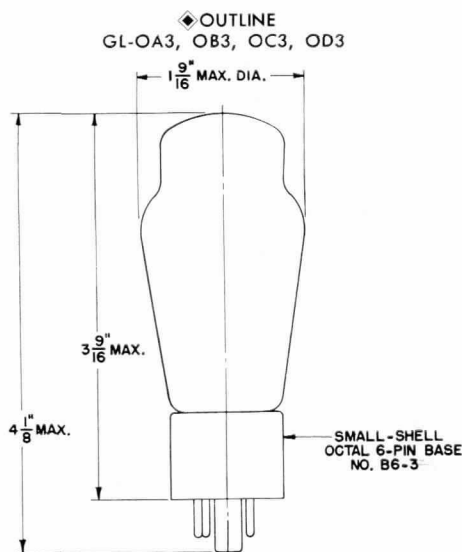
These values of maximum and minimum current indicate the range over which the glow tube will operate satisfactorily. Operation below the minimum current will cause erratic regulation and operation above maximum current will result in short life and erratic regulation.

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.

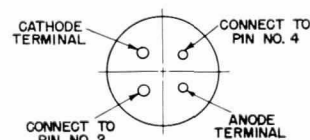
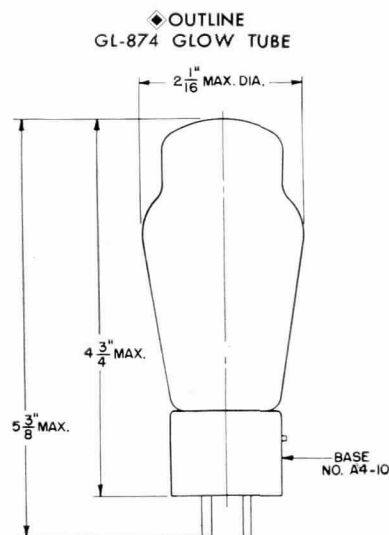
Ambient Temperature Range

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



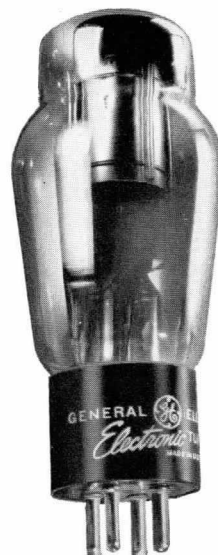
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APPLICATION CIRCUITS

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

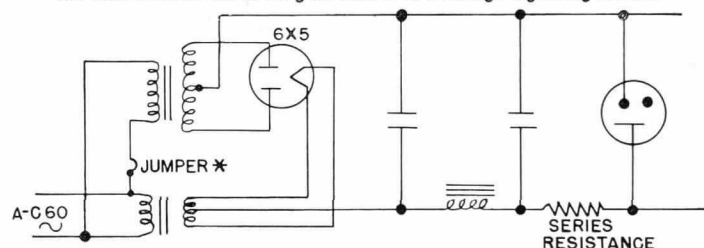


Fig. 1—Voltage-Regulated Power Supply Circuit 9-25-44

*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.

Fig. 1 above illustrates a voltage-regulated power supply circuit incorporating a glow tube as a voltage stabilizer.

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 current. 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 and a GL-OB3 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.

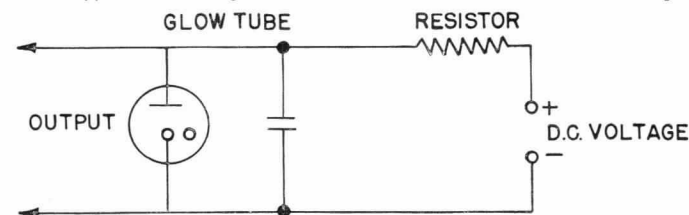


Fig. 2—Relaxation Oscillator Circuit 9-25-44

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 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.

Tube Divisions, Electronics Department

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