

## Voltage-Reference Tube

7-PIN MINIATURE, GLOW-DISCHARGE TYPE

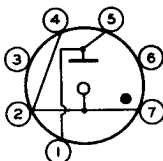
Especially Useful as a Voltage-Reference Tube in DC Power Supplies

## DATA

## General:

Cathode . . . . .	Cold
Operating Position . . . . .	Any
Maximum Overall Length . . . . .	2-1/8"
Maximum Seated Length . . . . .	1-7/8"
Length, Base Seat to Bulb Top (Excluding tip) . . . . .	1-1/2" $\pm$ 3/32"
Diameter . . . . .	0.650" to 0.750"
Dimensional Outline . . . . .	(See <i>General Section</i> ) JEDEC No.5-2
Bulb . . . . .	T5-1/2
Base . . . . .	Small-Button Miniature 7-Pin (JEDEC No.E7-1)
Basing Designation for BOTTOM VIEW . . . . .	5B0

Pin 1 - Anode  
 Pin 2 - Cathode  
 Pin 3 - Do not use  
 Pin 4 - Cathode



Pin 5 - Anode  
 Pin 6 - Do not use  
 Pin 7 - Cathode

## Maximum and Minimum Ratings, Absolute-Maximum Values:

DC OPERATING CURRENT (Continuous) . . . . .	3.5 max. ma
DC OPERATING CURRENT (Continuous) . . . . .	1.5 <del>max.</del> ma $\mu$ W
AMBIENT TEMPERATURE RANGE . . . . .	-55 to 90 °C

## Characteristics and Operation Range Values:

	Min.	Av.	Max.	
DC Starting Voltage . . . . .	-	107	115 <sup>a</sup>	volts
DC Operating Voltage (Variation from tube to tube):				
At 1.5 ma . . . . .	83	85	87	volts
At 2.5 ma . . . . .	83.5	85.5	87.5	volts
At 3.5 ma . . . . .	84.5	86.5	88.5	volts
Regulation (1.5 ma to 3.5 ma) . . . . .	-	-	3	volts
Temperature Coefficient of Operating Voltage (over ambient temperature range of -55 to 90° C) . . . . .	-	-4	-	mv/°C
Percentage Variation of Operating Voltage: <sup>b</sup>				
During first 300 hours of life <sup>c</sup> . . . . .	-	-	0.1	%
During subsequent 1000 hours of life . . . . .	-	-	0.1	%



# 5651A

	Min.	Average	Max.	
Short-term (100 hours) Variation of Operating Voltage after first 300 hours of life <sup>b</sup> . . . . .	-	-	0.05	%
Instantaneous Voltage Fluctuation (Voltage jump) <sup>d</sup> . . . . .	-	-	0.1	volt

## Circuit Values:

Shunt Capacitor . . . . .	-	-	0.02	$\mu$ f
Series Resistor . . . . .		e		

- <sup>a</sup> A dc supply voltage of 115 volts minimum should be provided to insure "starting" throughout tube life.
- <sup>b</sup> DC operating current = 2.5 ma.
- <sup>c</sup> After initial 3-minute warm-up period.
- <sup>d</sup> defined as the maximum instantaneous voltage fluctuation at any current level within the operating current range.
- <sup>e</sup> A series resistor must always be used with the 5651A. The resistance value must be chosen so that (1) the maximum current rating of 3.5 ma is not exceeded at the highest anode-supply voltage employed, and (2) the minimum current rating of 1.5 ma is always exceeded when the anode-supply voltage is at its lowest value.

## SPECIAL TESTS AND PERFORMANCE DATA

### Stability Life Performance:

This test is performed on a sample lot of tubes to assure that the tubes have been properly stabilized. Life testing is performed under the following conditions: DC anode-supply volts = 135, dc operating milliamperes = 2.5, anode-circuit resistance (ohms) = 20000. At the end of 300 hours of operation, tubes will not show a change in dc operating voltage greater than 0.1 per cent from the initial dc operating voltage. At the end of 1300 hours of operation, tubes will not show a change in dc operating voltage greater than 0.1 per cent from the operating voltage at 300 hours. During any 100-hour interval between 300 and 1300 hours of operation, tubes will not show a change in dc operating voltage greater than 0.05 per cent from the dc operating voltage at the start of the interval.

## INSTALLATION AND APPLICATION

*Make no connections to pins 3 and 6.* Any potentials applied to these pins may cause erratic tube performance. The three pin terminals for the cathode (pins 2, 4, and 7) and the two for the anode (pins 1 and 5) offer the equipment designer several different possibilities for connection of the 5651A. Any pair of interconnected pins can be used as a jumper connection to a circuit common to either the cathode or to the anode. The use of such a jumper connection provides a means for opening the circuit to protect circuit components when the 5651A is removed from its socket. *Under no circumstances should the current through any pair of interconnected pins exceed one ampere.*



If the load for the regulated power supply is disconnected either directly or by removing the 5651A from its socket, the rectifier capacitors will charge to the rectifier peak voltage. It is important, therefore, that these capacitors be rated to withstand such voltage.

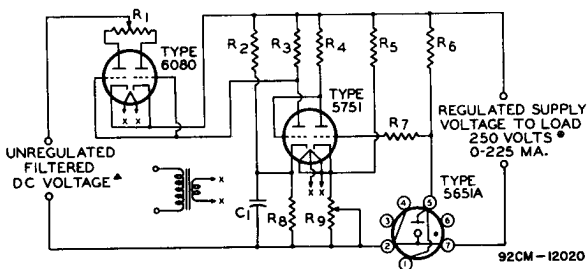
A warm-up period of 3 minutes should be allowed each time the equipment is turned on to insure minimum voltage drift of the 5651A.

When a shunt capacitor is used with the 5651A, its value should be limited to 0.02  $\mu\text{f}$ . A large value of capacitance may cause the tube to oscillate and thus give unstable performance.

Shielding should be utilized for the 5651A to insure maximum stability when the tube is operated in the presence of strong rf or magnetic fields.

### SERIES-TYPE STABILIZED-VOLTAGE SUPPLY-CIRCUIT Using RCA-5651A as Voltage-Reference Tube

The voltage regulation of this supply operated at a fixed line voltage of 117 volts and an output voltage of 250 volts is less than 0.2 volt over the current range of 0 to 225 milliamperes. At full current, the regulation for a variation of  $\pm 10$  per cent in line voltage is less than 0.1 volt.



$C_1$  - 0.1  $\mu\text{f}$ , 400 volts

$R_1$  - Plate current balancing potentiometer, 160 ohms, 10 watts

$R_2$  - 12000 ohms, 2 watts

$R_3$  - 470000 ohms, 1/2 watt

$R_4$  - 470000 ohms, 1/2 watt

$R_5$  - 12000 ohms, 2 watts

$R_6$  - 68000 ohms, 1 watt

$R_7$  - 1 megohm, 1/2 watt

$R_8$  - 15000 ohms, 2 watts

$R_9$  - Output voltage-control potentiometer, 10000 ohms

▲ 375 volts approx. at zero load current; 325 volts approx. at 225 milliamperes load current.

⊕ Socket connections are made so that removal of the 5651A from its socket opens the load.

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