

TUNG-SOL

PRODUCT BULLETIN

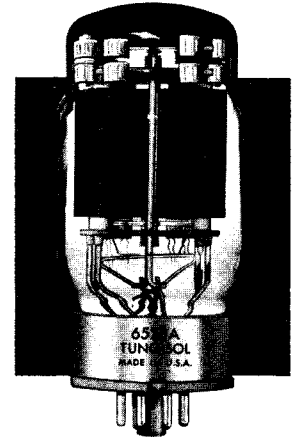
**INDUSTRIAL
ELECTRON
TUBE
TYPE 6528A**
JUNE 1965

MEDIUM MU TWIN POWER TRIODE FOR SERIES REGULATOR SERVICE

DESCRIPTION The 6528A is a rugged twin power triode well suited for use as a pass tube in series regulated power supplies. Tubes of this design will meet all the requirements of MIL-E-1/1479.

The 6528A is capable of withstanding prolonged exposure to continuous vibration. This performance extra is achieved by using ceramic spacers, rather than mica, to hold electrodes in position. Also, gold plated strap frame grids are used for extra mechanical stiffness.

The 6528A will replace the 6528 in any application.

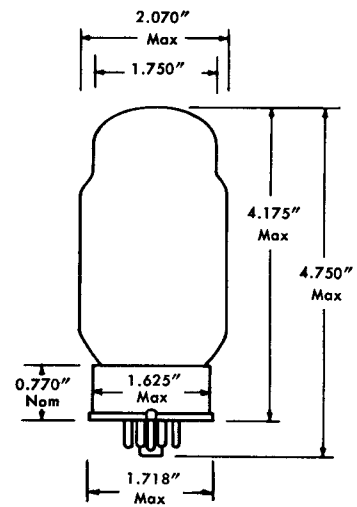


ELECTRICAL DATA

Heater Voltage	6.3 ± 10% Volts	Inter Electrode Capacities per Triode Section
Heater Current (E _r = 6.3 volts)	5.0 Amperes	Grid to Cathode
Minimum Cathode Heating Time	30 Seconds	Grid to Plate
Transconductance (per section)	37,000 Micromhos	Cathode to Plate
Amplification Factor	9.0	Heater to Cathode
Plate Resistance	245 Ohms	Inter Electrode Capacities Between Triode Sections
		Section 1 Plate to Section 2 Plate 0.6 uuf

MECHANICAL DATA

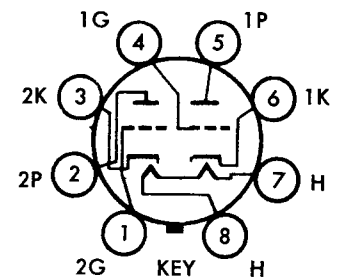
Mounting Position	Any
If tube is to be mounted in a horizontal position it is recommended that it be mounted so that the base lug key be either directly up or directly down.	
Bulb	T-16 Nonex
Base	Large wafer octal 8 pin with metal sleeve, JEDEC type B8-98



RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Plate Dissipation per Plate	—	30	Watts
Plate Current per Plate	—	300	Milliamperes d. c.
If tube voltage drop is to be swung more than 6 volts, this current cannot be realized. See Plate Characteristics Curve.			
Plate Voltage	0	400	Volts d. c.
Heater-Cathode Voltage	—300	+ 300	Volts d. c.
Grid Voltage	—300	0	Volts d. c.
Grid Current per Grid	—	0	Milliamperes
Heater Voltage	5.7	6.9	Volts
Envelope Temperature	—	250	Degrees Centigrade
Altitude for Full Ratings	—	10,000	Feet
If cooling is provided to keep bulb temperature within ratings, altitude rating can be extended to 60,000 feet.			
Grid Circuit Resistance Values			
For Fixed Bias, or Cathode and Fixed Bias Operation	500	50,000	Ohms
For Cathode Bias Operation	500	500,000	Ohms
Resistance per grid leg when triode sections are paralleled	500	—	Ohms
Cathode Resistance: Minimum cathode resistance per cathode leg shall be 10 ohms or that resistance necessary to provide 10% of the grid bias voltage, whichever is greater.			

OUTLINE DRAWING



**BASING DIAGRAM
BOTTOM VIEW
8BD**

APPLICATION NOTES

The 6528A is widely used as a "passing" tube or series regulator tube in controlled power supplies because of its high transconductance at relatively low plate voltages. To provide the desired output current, many triode sections can be paralleled. If tube sections are to be paralleled however, the designer is strongly urged to use sufficient resistance in each cathode leg to equalize current division among the triode sections. Recommended values for various operating currents are shown on the plate characteristics curve. If the output current of the supply is not fixed, use the resistance indicated for the lowest current that approaches the maximum plate dissipation line. Cathode resistance is superior to anode resistance because it helps to provide increasing bias on the sections taking greater plate current. A cathode resistor too, need be only one tenth the value $\left(\frac{R}{u + 1}\right)$ of a plate resistor, and therefore will dissipate only one tenth the power. In any case, the only losses incurred in using a resistor is the insertion loss of the resistor itself (less than one watt) and the additional voltage (less than 6 volts) necessary from the unregulated supply. A cathode resistor adds a small additional loss by causing the passing tube to work with higher bias and hence with greater tube drop.

The regulator circuit shown in Figure 2 is preferable from the consideration of the safety of the passing tube both during warmup and in the event of trouble in the amplifier circuit or if the amplifier tube is removed from its socket. It has the additional advantage of providing a constant voltage for the amplifier circuit. However, if the regulated output voltage is low, it may be necessary to provide additional negative voltage for the reference tube circuit. Also, if the regulated output voltage is to be variable, it may be necessary to follow Figure 1. If Figure 1 is used, a clamping diode rated at 300 volts piv should be employed to prevent the grid from swinging positive. The use of this diode is of extreme importance for without it there is little IR drop across the resistor during warmup of the amplifier tube and the grid of the passing tube is effectively tied to the plate. The grid then will attempt to draw excessive current from the passing tube's cathode and may seriously impair cathode life.

Passing tube operation conditions should be chosen to provide as low a tube drop as possible. A safety margin of at least 5 volts from the zero bias line should be allowed however, for variations of individual tubes. If the cathode resistors as suggested on the plate characteristic curve are used, a minimum bias of 5.0 volts will be provided. Sufficient bias excursion should be allowed for overcoming ripple. The amplifier circuit should be able to swing the passing tube grid far enough to counteract the effect of unbalance due to tube ageing.

A grid resistor should be used for each triode section. This should be high enough to prevent parasitic oscillation but not large enough to prevent loss of control due to a small amount of "gas" grid current. A value of grid resistance that meets both these conditions is 1,000 ohms. Heater voltage should be kept as close as possible to 6.3 volts as measured on the tube pins. When connecting many high drain tube heaters across a single transformer, bus bars feeding from "alternate ends" (Figure 3) should be used with a pair of stranded wires feeding individual sockets.

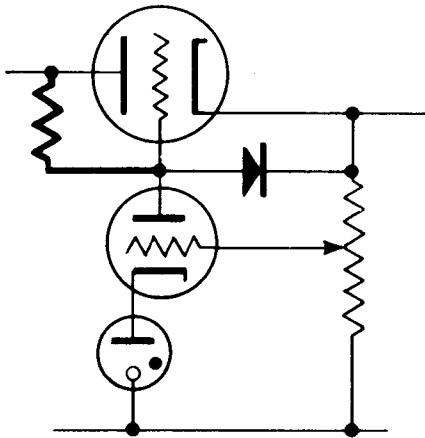


FIGURE 1

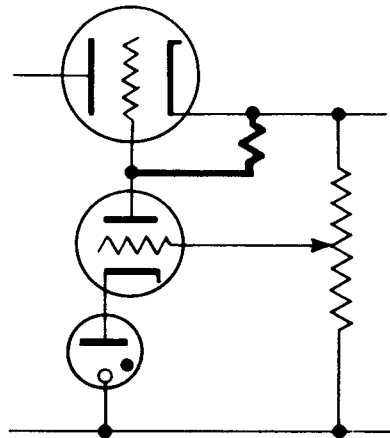


FIGURE 2

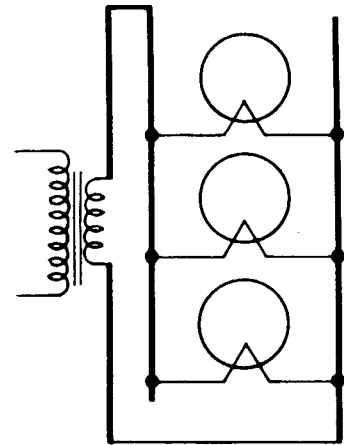
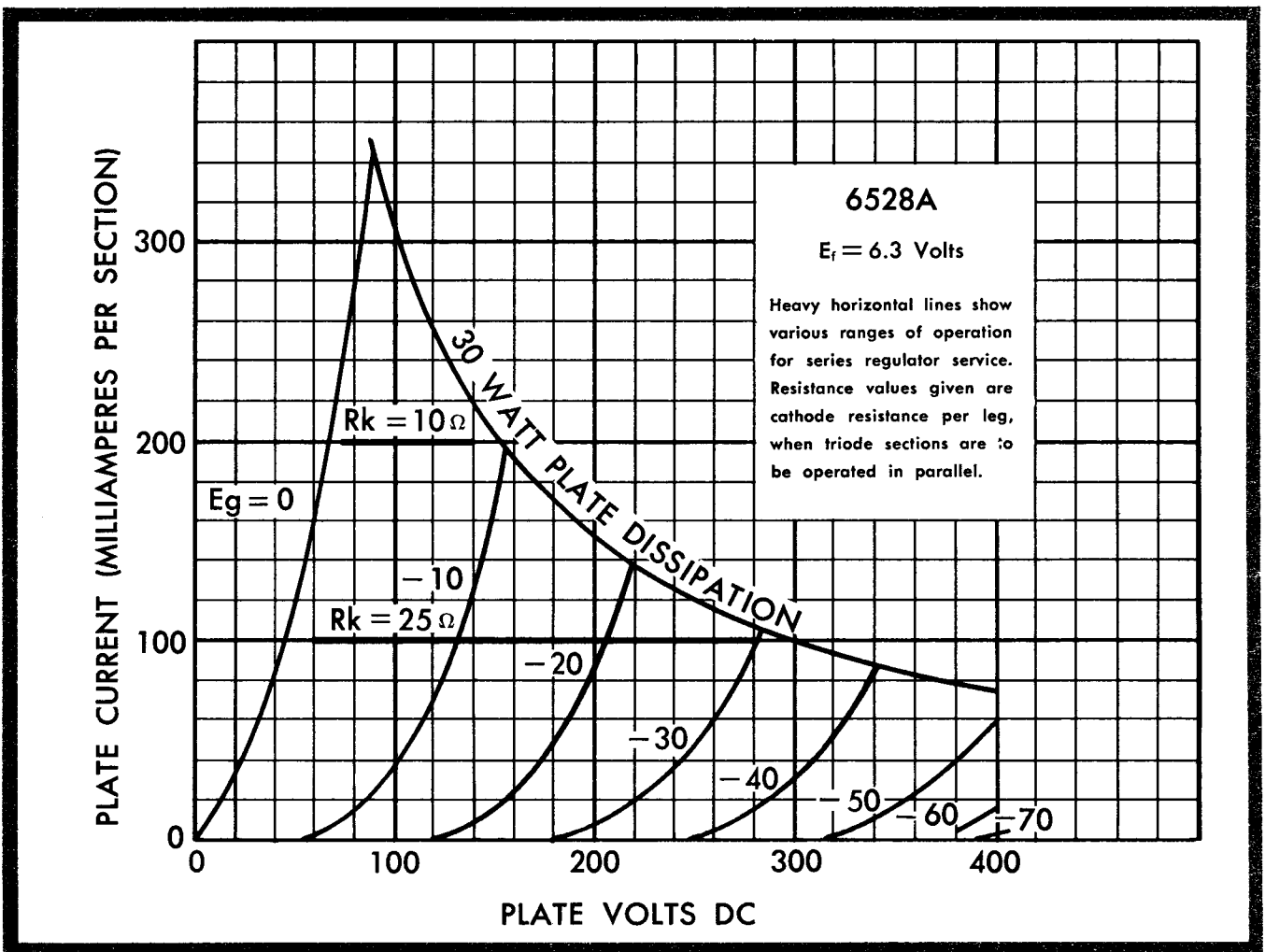


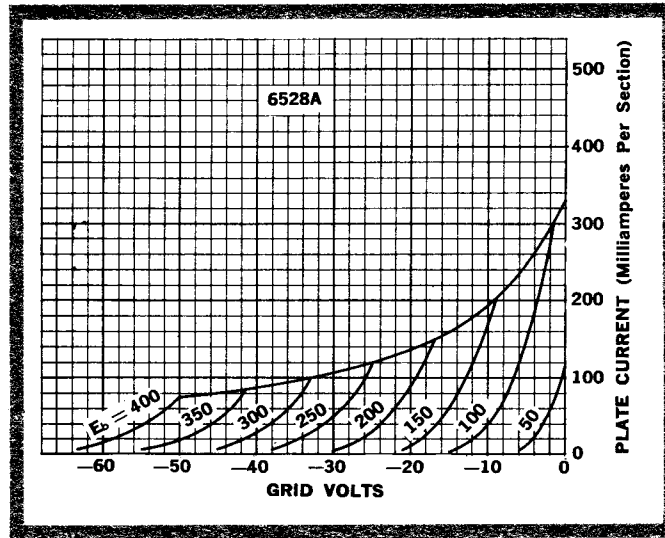
FIGURE 3

AVERAGE PLATE CHARACTERISTICS FOR EACH TRIODE UNIT



TYPE 6528A

TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION



AVERAGE CHARACTERISTICS

