TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7242

FEBRUARY 1963

MEDIUM MU HIGH POWER TRIODE FOR SERIES REGULATOR SERVICE

DESCRIPTION The 7242 is a long life, high power triode developed especially for use as a passing tube in series regulated power supplies. For this service, a tube must be able to pass large currents over a wide voltage range and still exhibit a low intrinsic voltage drop when operated "wide open". The 7242 not only meets these requirements but possesses the additional advantage of requiring little grid voltage swing to control these currents. This permits the use of simpler control amplifier circuits in the regulated supply.

The 7242 features one large zirconium coated graphite anode, with three separate grid-cathodes structures. This anode, while lighter in weight than similar metal anodes, remains warp free during life and provides one of the best gas "gettering" means known. The anode is supported by ceramic insulators. The use of these insulators and the hard glass envelope permit the tube to be outgassed at high temperatures during the manufacturing exhaust process. This allows the tube to be run at high temperatures during operation, without the evolution of harmful gas from the tube parts.

Massive cathodes provide adequate emission current reserve. Gold plated molybdenum wires are employed in the rugged grid structure. The tube mount is built on a rugged button stem, and is supported from the bulb by means of flexible metal vibration snubbers.

In many circuits, one 7242 can replace four type 5998 regulator tubes. For even higher levels of current or power, several 7242 tubes can be paralleled as explained in the application notes.

ELECTRICAL DATA

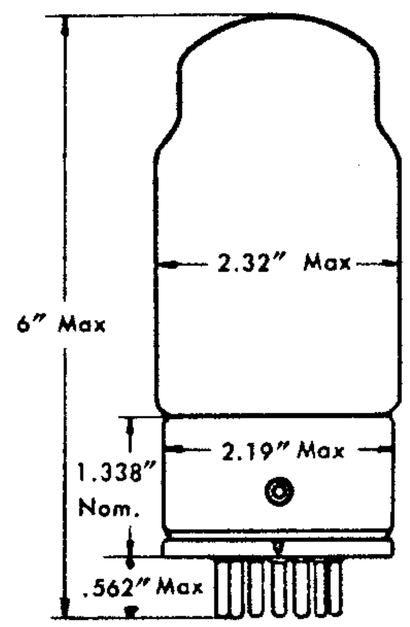
Heater Voltage	6.3 ±10% volts	Transconductance	111,000 umhos
Heater Current (E_f = 6.3 volts)	7.5 amperes	Amplification Factor	9.0
Minimum Cathode Heating Time	30 seconds	Plate Resistance	82 ohms

INTERELECTRODE CAPACITANCE

Grid to Plate	85.0 picofarads	Output, Single Cathode to Plate	4.0 picofarads
Input, Single Cathode to Grid	20.0	Output, Total	12.0
Input, Total	60.0	Heater to Cathode	46.0

MECHANICAL DATA

Mounting Position (If tube is to be mounted in a horizontal position it is recommended that it be mounted so that the bayonet pin points either directly up or directly down)	Any
Bulb	T18 Nonex
Base	Giant 7 pin with Ceramic insert, JEDEC #A7-17
Socket	E. F. Johnson #122-237 or Equivalent
Average Net Weight	6.0 ounces
Maximum Shock Rating (Navy Hi Impact Shock Machine)	450 G
Maximum Vibration Rating (10 to 25 cps)	2.5 G

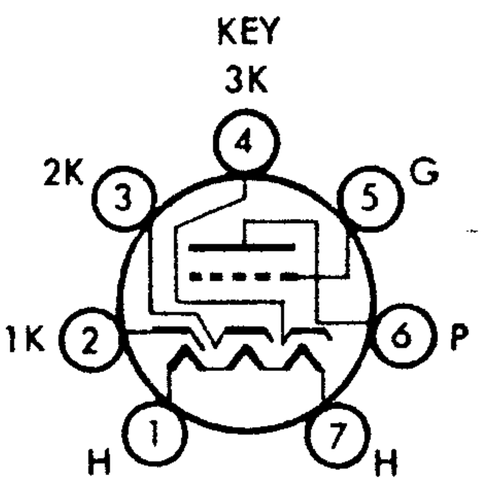


OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Total Plate Dissipation	—	100	watts
Total Plate Current	—	0.9	amperes dc
If tube voltage drop is to be swung more than 6 volts, this current cannot be realized. See Plate Characteristics Curve.			
Current per Cathode	—	300	milliamperes dc
Plate Voltage	0	400	volts dc
Heater-Cathode Voltage	−300	+300	volts dc
Grid Voltage	−300	0	volts dc
Grid Current	—	0	milliamperes
Heater Voltage	5.7	6.9	volts
Envelope Temperature	—	300	°C.
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.			
Circuit Values			
Total Grid Circuit Resistance in Regulator Service or with fixed bias	500	20,000	ohms
Total Grid Circuit Resistance with cathode bias only	500	200,000	ohms
Resistance per grid leg when tubes 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.



BOTTOM VIEW

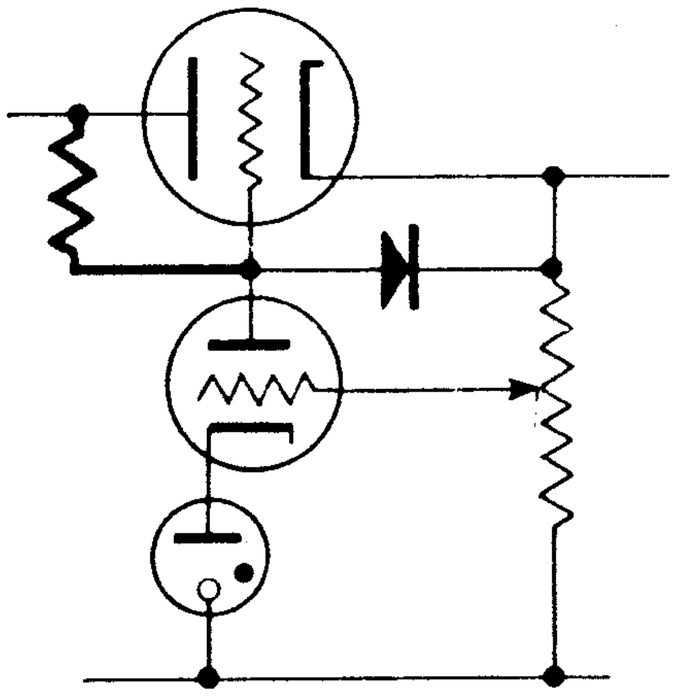


FIGURE 1

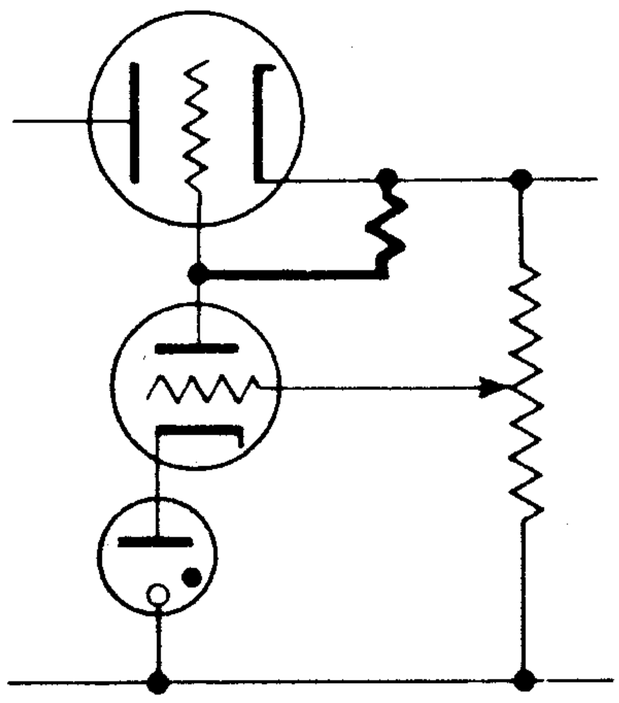


FIGURE 2

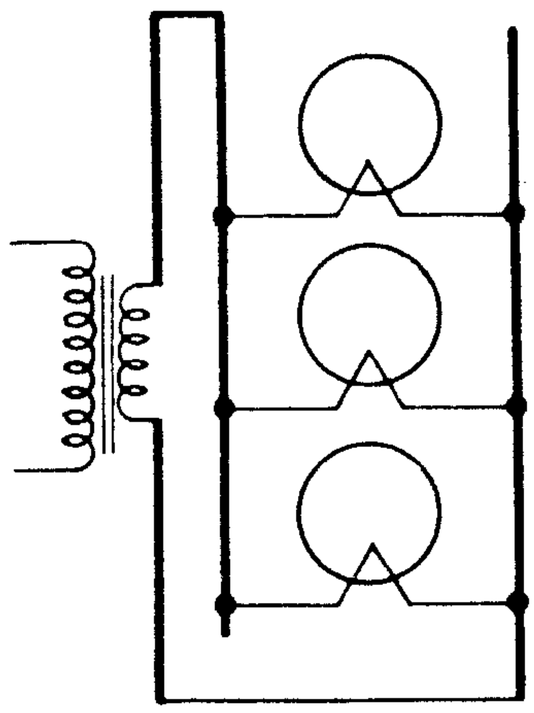
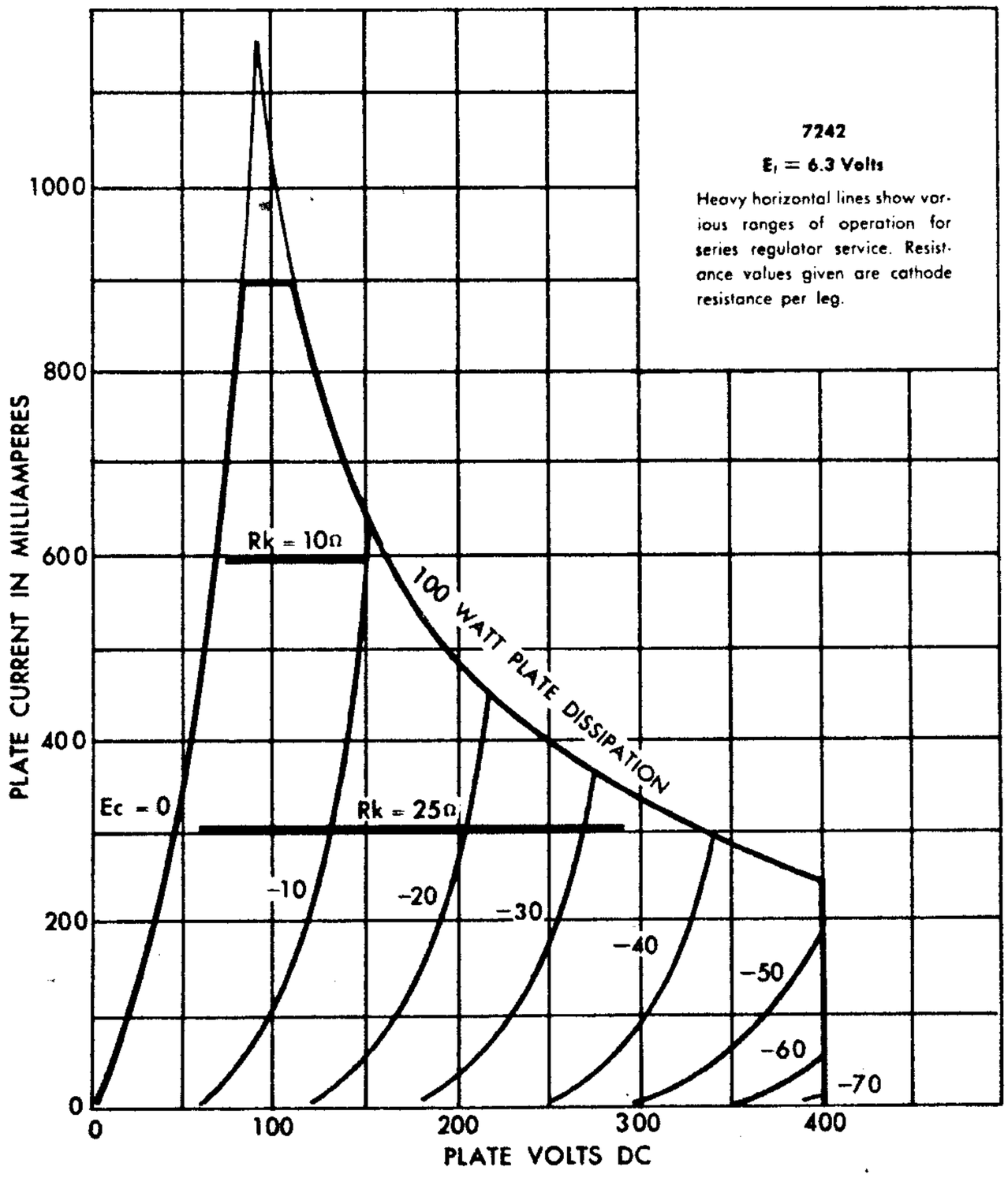


FIGURE 3



AVERAGE PLATE CHARACTERISTICS

ADDITIONAL TESTS TO INSURE RELIABILITY

Randomly Selected Samples are Subjected to the Following Tests

Shock: 30° Hammer Angle in Navy, Flyweight, High Impact Machine (450/Gmsec)

Life Test: 1000 hours under plate current test conditions (R_g = .05 Meg.)

Post Shock and Life Test End Points:

Plate Current	335 mA min
Transconductance	65,000 umho min
HK Leakage	150 uA max
Grid Current	−12 uA max

RANGE OF VALUES

Conditions: E_f = 6.3 V, E_b = 100 V
E_c = −4, R_g = 500 Ω

Readings taken after 2 min. preheating under conditions of E_f = 6.3, E_{bb} = 190 V, E_c = 0, R_k = 200 ohms.

Total Plate Current	420	690	Milliamperes, dc
Amplification Factor	7.0	11.0	
Transconductance	87,000	135,000	Micromhos
Heater Current per Tube	7.12	7.88	Amperes

Conditions: E_f = 6.3 V, E_b = 400 V
E_c = −75 V, R_k = 0

Total Plate Current	0	9	Milliamperes

APPLICATIONS NOTES

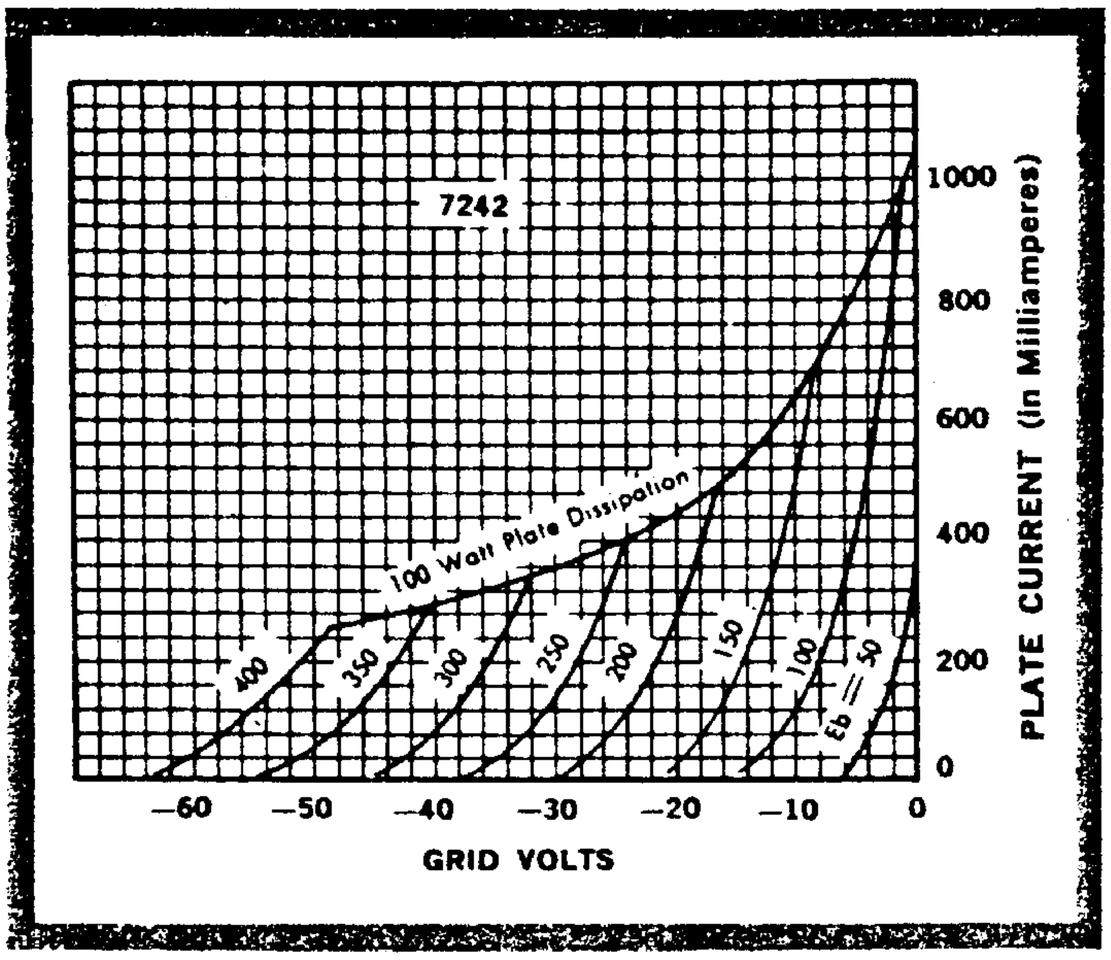
The 7242 is admirably suitable for use as a "passing" tube or series regulator in electronically controlled power supplies because of its ability to pass large currents and to easily control them. For even greater current, several tubes can be paralleled. If tubes are to be paralleled, however, the designer 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 provides more bias on the sections taking greater plate current. A cathode resistor 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. Sufficient bias excursion should be allowed for overcoming ripple. The amplifier circuit should be able to counteract the effect of unbalance due to tube aging.

If two or more tubes are to be used in parallel a grid resistor should be used for each tube. This should be 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 stranded pair feeding individual sockets.

TRANSFER CHARACTERISTICS



AVERAGE CHARACTERISTICS