TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 6080WA

SEPTEMBER, 1962

RUGGED, RELIABLE TWIN POWER TRIODE

DESCRIPTION— The 6080WA is a rugged version of the popular 6080, manufactured under the reliable tube program. In this program, tubes are handled in lots with many destructive tests performed on randomly selected samples. Thus a tube may pass all required tests and still be rejected if it is from an unsatisfactory lot.

With the mount shock isolated from the bulb by nine metal spring clips, and by the use of heavy duty parts, the tube will withstand a shock impulse of 450 G and vibration at 50 cps (D = .08″). Additional features are higher altitude and higher bulb temperature limits, and longer life tests with many more life test end points than on the prototype. Plate current and tranconductance are held to closer limits to provide greater balance between tube sections. This is especially advantageous when many tube sections are to be used in parallel.

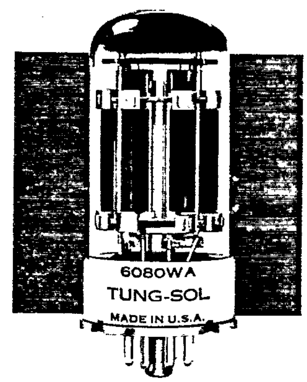
This tube can be used in any application requiring high plate current at low plate voltages. It has found wide use in electronically regulated power supplies.

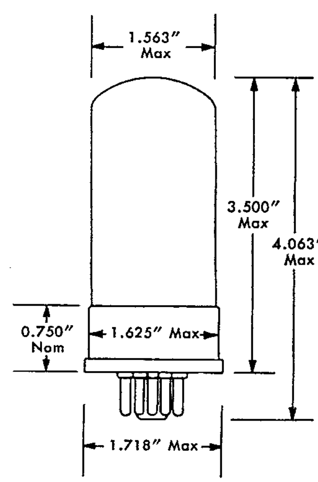
TYPE 6082WA

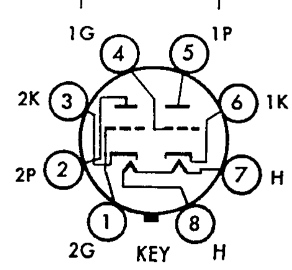
is similar in all respects to the 6080WA but employs a 26.5 volt, 0.60 ampere heater. Heater current range at 26.5 volts is 0.55 to 0.65 ampere. Heater voltage limits are 25.2 to 27.8 volts.

TYPE 7105

is similar in all respects to the 6080WA but employs a 12.6 volt, 1.25 ampere heater. Heater current range at 12.6 volts is 1.15 to 1.35 amperes. Heater voltage limits are 12.0 to 13.2 volts.







BASING DIAGRAM
BOTTOM VIEW
8BD

ELECTRICAL DATA

Heater Voltage	6.3 ±5%	Volts
Heater Current (E_f = 6.3 Volts)	2.5	Amperes
Cathode Heating Time-Minimum	30	Seconds
Transconductance-per Section	7000	Micromhos
Amplification Factor	2.0	
Interelectrode Capacities-per Section		
Grid to Cathode	6.2	Micromicrofarads
Grid to Plate	8.4	Micromicrofarads
Cathode to Plate	2.2	Micromicrofarads
Heater to Cathode	6.3	Micromicrofarads
Interelectrode Capacities-Between Sections		
1 Grid to 2 Grid	0.5	Micromicrofarad
1 Plate to 2 Plate	2.2	Micromicrofarads

MECHANICAL DATA

Mounting Position (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)	Any
Bulb	T12
Base	Large water octal with metal sleeve, 8 pin, B8-98
Maximum Net Weight	3 ounces
Maximum Shock Rating Navy High-Impact Shock Machine	450 G
Maximum Vibration Rating D-.08″ @ 50 cps	10 G

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Heater Voltage	6.0	6.6	Volts
Plate Voltage	—	250	Volts dc
Heater-Cathode Voltage	−300	+300	Volts dc
Grid Current per Grid	—	5	Milliamperes
Plate Current per Plate (If several tube sections are to be used in parallel with each other, it is recommended not to exceed 100 milliamperes per plate)	—	125	Milliamperes dc
Power Dissipation per Plate	—	13	Watts
Envelope Temperature	—	230	Degrees Centigrade
Altitude for Full Ratings	—	60,000	Feet
Circuit Values			
Grid Circuit Resistance for Cathode Bias Operation	—	1.0	Megohm
Grid Circuit Resistance for Fixed Bias or Combination Fixed and Cathode Bias Operation	—	0.1	Megohm

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 G/msec)

Fatigue: 25 cps (0.08" total displacement) at 2.5 G for 32 hours in each of three mutually perpendicular planes

Post Shock and Fatigue Limits:

Vibration (R_p = 2000 ohms, E_c = —7vdc, Tie 1k to 2k, 1g to 2g, 1p to 2p), Generated Plate Voltage	100 mVac max
Heater-Cathode Leakage (E_{hk} = ±100 Vdc)	50 uAdc max
Change in Transconductance from Initial Value	10% max
Grid Current	—3 uA max

Heater Cycling Life Test (E_f = 7.5v, E_{hk} = 300 Vdc. Duration of 2000 cycles of 1 minute on and 1 minute off)

End Point (E_{hk} = ± 100v),	50 uAdc max

Stability Life Test (1 hour) End Point:

Change in Transconductance from Initial Value	10% max

Survival Rate Life Test (100 hours) End Point:

Transconductance	5800 umhos min

Intermittent Life Test (1000 hours) End Points:

Grid Current	—10 uAdc max
Transconductance	5500 umhos min
Change in Transconductance by reducing E_f to 5.7v	10% max
Heater-Cathode Leakage E_{hk} = ±100 Vdc	25 uAdc max
Heater Current	2.35 min 2.75 max amperes
Insulation of Electrodes: Grid to all others and Plate to all others	100 megohm min

RANGE OF VALUES

Test Conditions: E_f = 6.3 V, E_b = 135 V, E_c = 0, R_k/k = 250 ohms

Both sections operating, each section read separately

	Min	Max
Individual Section Plate Current	100	150 Milliamperes dc
Lot Average Plate Current	115	135 Milliamperes dc
Plate Current, Difference between Sections	—	25 Milliamperes dc
Heater Current @ 6.3 v	2.35	2.65 Amperes

	Min	Max
Individual Section Transconductance	6000	8200 Micromhos
Lot Average Transconductance	6600	7400 Micromhos
Amplification Factor	1.5	2.5

APPLICATIONS NOTES

The 6080WA 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 third the value $\left(\frac{R}{u+1}\right)$ of a plate resistor, and therefore will dissipate only one third 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 10 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 (below 250 volts), it will 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, during warmup the amplifier tube draws little current, there is little IR drop across the resistor, 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 7.5 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 stranded pair feeding individual sockets.

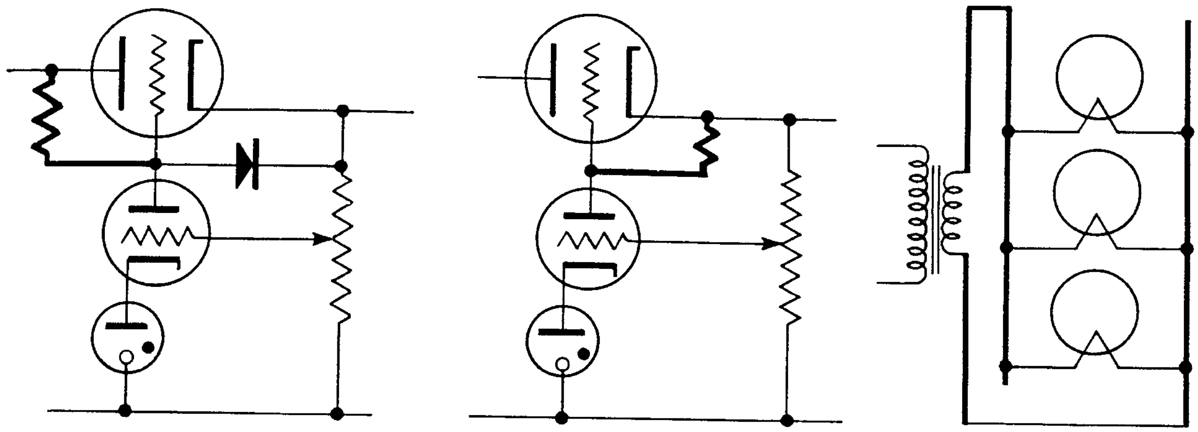


FIGURE 1

FIGURE 2

FIGURE 3

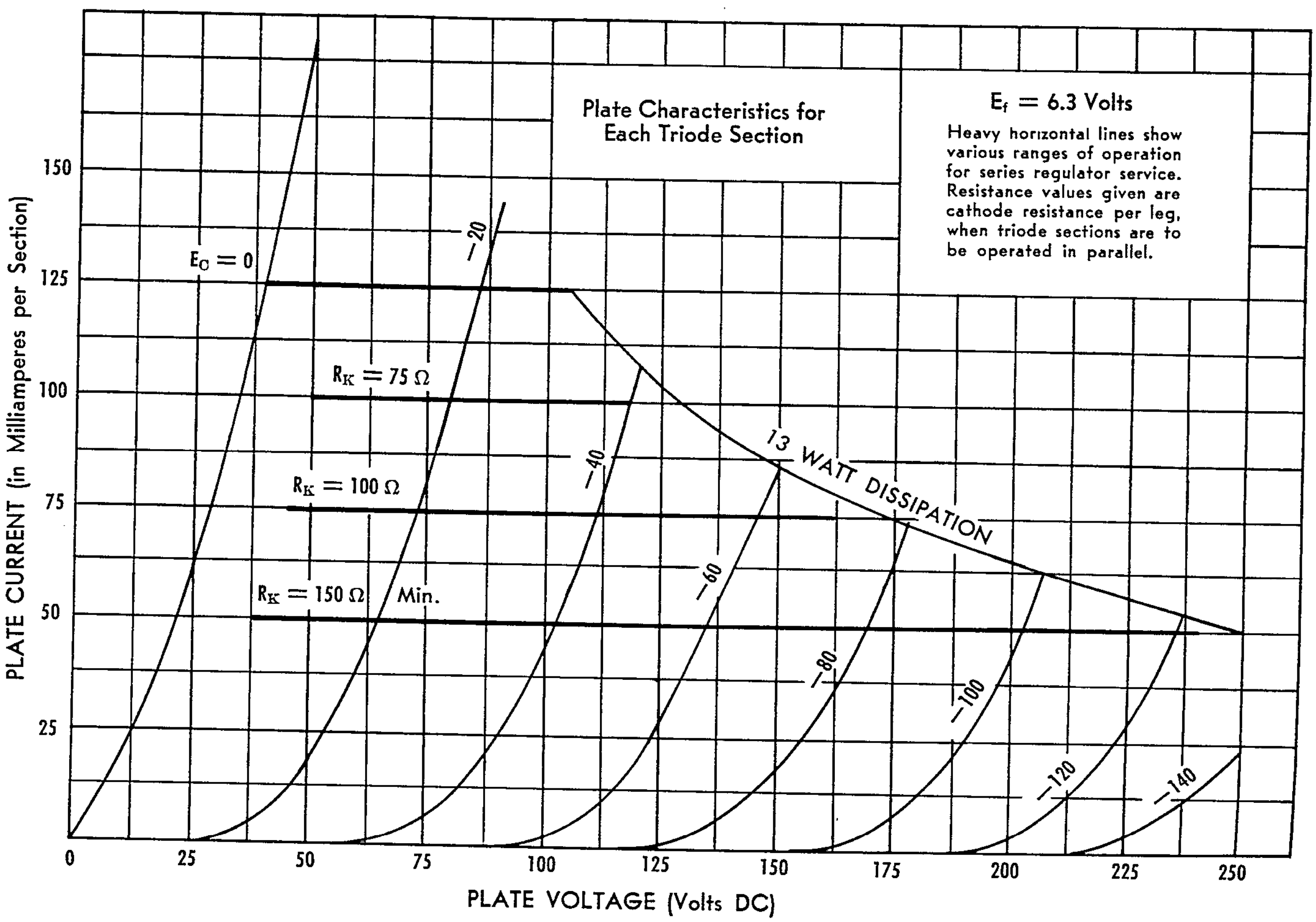
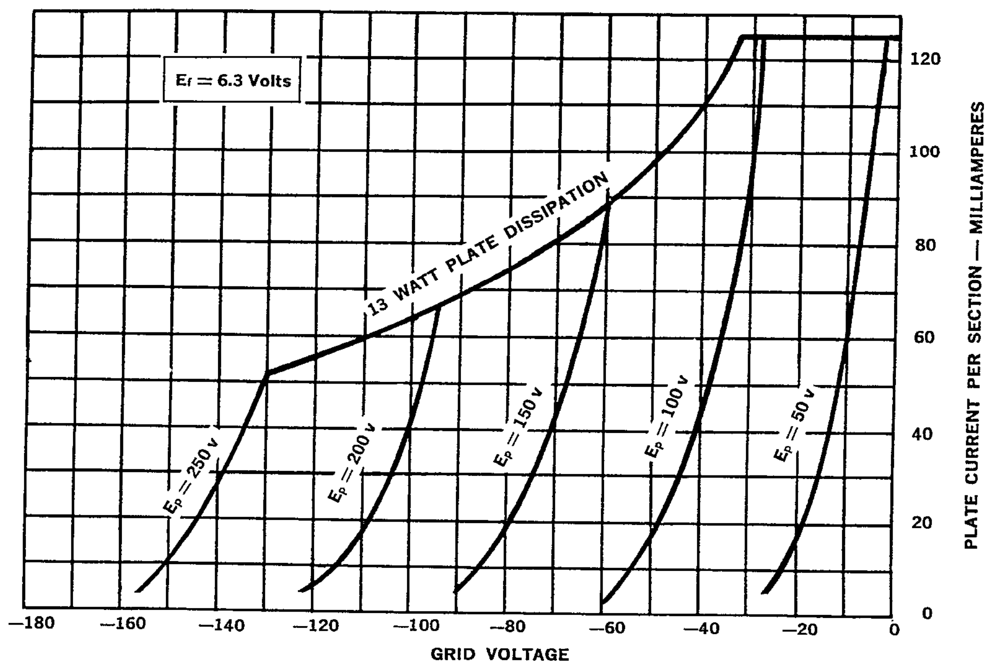
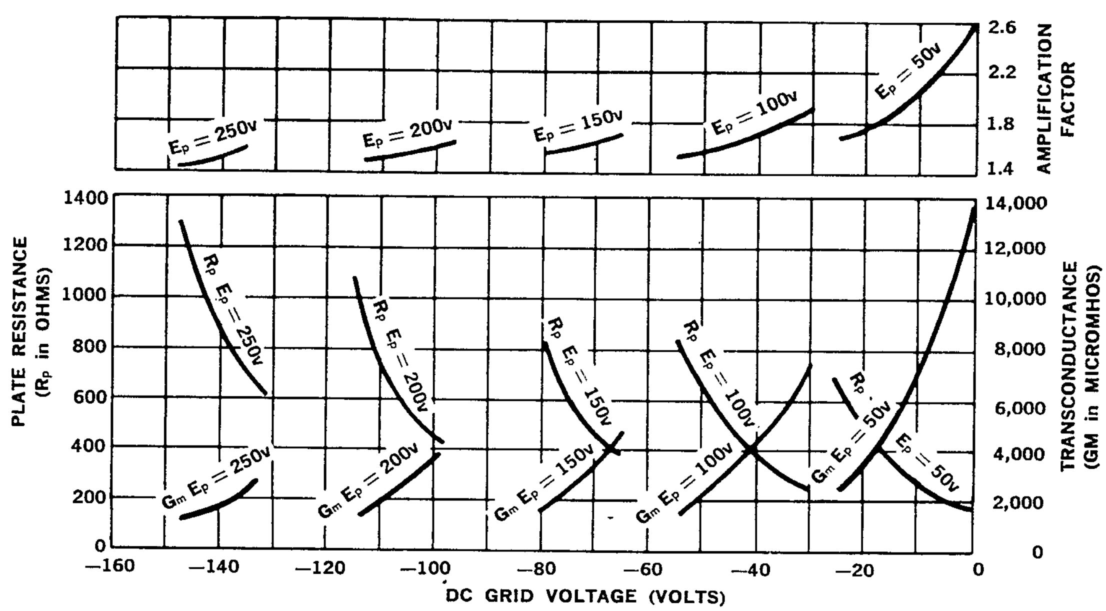


PLATE CHARACTERISTICS FOR EACH TRIODE SECTION



TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION



AMPLIFICATION FACTOR, PLATE RESISTANCE AND TRANSCONDUCTANCE CURVES