TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 6901

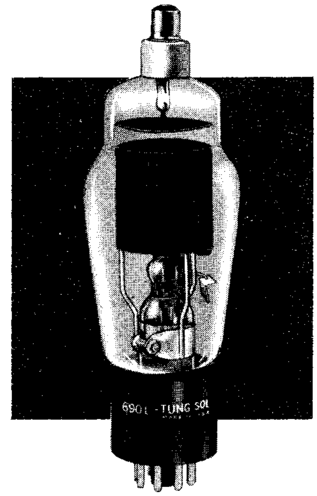
JANUARY, 1963

GAS AND MERCURY-VAPOR THYRATRON

DESCRIPTION — The 6901 is a three electrode, inert-gas and mercury-vapor filled thyratron with negative control characteristics. This tube is similar to the type 393A except that the design and test schedule have been modified to provide long life at low temperatures.

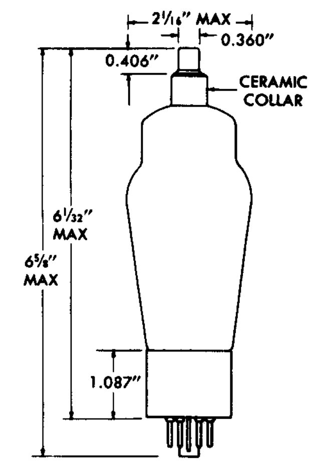
In some applications, the 6901 provides many times the useful tube life of the 393A. In addition, the peak voltage and frequency limits have been raised. The 6901 finds use as a grid-controlled rectifier and a relay tube especially where many "starts" at extremely low temperatures are anticipated.

The 6901 employs a 7-pin octal base.



ELECTRICAL DATA

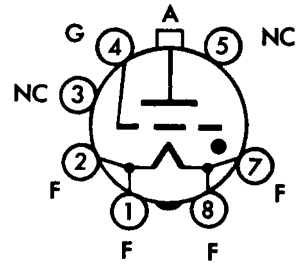
Filament Voltage	2.5 ± 0.125	Volts
Filament Current @ E_f = 2.5 Volts	7	Amperes
Cathode Heating Time — From −40 to +70°C	15	Seconds minimum
— From −55 to −40°C	30	Seconds minimum
Anode to Control Grid Capacitance	1.8	Micromicrofarads
De-ionization Time—Approximate		
Anode Volts = 120, Anode Current = 1.5 Amperes		
Grid Volts = −20, Grid Resistor = 10,000 Ohms	180	Microseconds
Anode Volts = 120, Anode Current = 1.5 Amperes		
Grid Volts = −500, Grid Resistor = 100,000 Ohms	30	Microseconds
Anode Voltage Drop—Approximate		
Initial	10	Volts
End fo Life	20	Volts



OUTLINE DRAWING

MECHANICAL DATA

Mounting Position	Vertical, base down
Type of Cooling	Convection
Bulb	ST16
Base	B7-12 Medium shell octal
Cap	C1-1 Small with ceramic collar
Net Weight	3 Ounces maximum
Socket	Octal



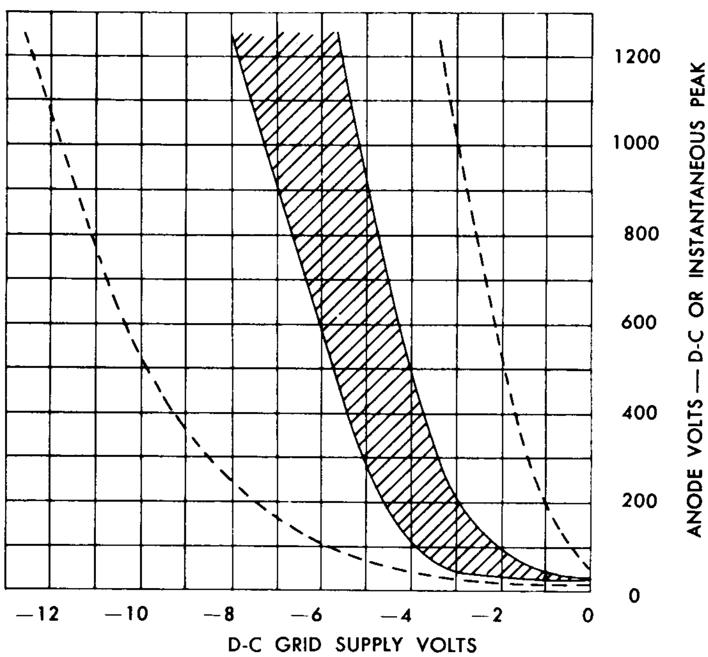
BASING DIAGRAM
BOTTOM
VIEW
5AV

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Peak Anode Voltage			
Forward	—	1700	Volts
Reverse	—	1700	Volts
Grid Voltage			
Peak or DC before tube conduction	—	—500	Volts
Average during tube conduction — Note 1	—	—10	Volts
Anode Current			
Peak	—	6	Amperes
Average—Note 2	—	1.5	Amperes
Fault—for duration of 0.1 second maximum—Note 3	—	120	Amperes
Grid Current			
Average—Note 4	—	+0.01	Ampere
Operating Frequency	—	420	Cycles per second
Altitude	—	10,000	Feet
Temperature Range — Note 5	40	80	Degrees Centigrade
Filament Voltage	2.37	2.63	Volts

NOTES:
1. Averaged over one conducting period.
2. Averaged over any interval of five seconds maximum.
3. The equipment designer should limit the short circuit current to 120 amperes circuitwise. It should be understood that while the tube may stand several faults at this magnitude of current, each fault will adversely affect tube life.
4. Averaged over the period of grid conduction.
5. The recommended operating range for this tube is from 40° to 80° Centigrade. Operation between —55° and +40° Centigrade at reduced ratings, or "starts" in this temperature range are permissible, but will result in considerably shortened life.

Shaded area shows usual control region. Dotted limits show nominal range of grid control voltage taking into consideration differences between individual tubes, and variations due to filament voltage, temperature and changes during life.



OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

APPLICATION NOTES

Thyratron tubes, if correctly used, will give many thousands of hours of reliable service. The correct use of a tube involves among other things adherence to the following rules:

1. Avoid cold starts. The heat shielded, oxide coated filament should be energized before the anode voltage is applied in order to obtain maximum life.
2. Avoid operating the tube outside of the specified filament voltage range.
3. Avoid exceeding the rated peak inverse voltage. Excess inverse voltage can cause either an immediate failure or a rapid decline in useful life.

No clear cut method of foretelling tube failure has been devised. Periodic replacement of a tube as a routine preventive maintenance device is not recommended as a tube that has operated for several thousand hours may be good for several more thousand hours of useful operation. Quite often maintenance personnel can, after some experience with a piece of equipment, anticipate tube failure by observation. Visual checks of tube (arc) drop will indicate tubes approaching end of life. Tube drop voltages considerably higher than that of the last readings, or readings above 20 volts indicate tubes that may soon fail. While such a reading can be taken directly at the tube in the operating equipment, it is a dangerous practice. THE VOLTAGES AT WHICH THIS TUBE NORMALLY OPERATES ARE LETHAL. A more practical and exact measurement is observing the tube voltage drop in a test jig while it passes one or two high current pulses. Such a jig is illustrated in figure 1. The oscilloscope is calibrated by first setting switch S2 to CURRENT CHECK. Momentary contact switch S1 is then tapped while CURRENT SET resistor R2 is adjusted until a pattern 8 volts high appears on the oscilloscope screen. This indicates that a peak current of eight amperes is flowing through the tube under test and through calibrating resistor R3. The tube voltage drop can then be read directly in volts on the oscilloscope scale by setting switch S2 to the TEST position and tapping switch S1. A new tube will have a voltage drop of approximately 10 volts. A tube approaching the end of life may have a voltage drop of 20 volts.

Grid-controlled thyratrons can be incorporated into circuits to provide numerous services including the speed control of d-c motors, dc to ac inversion, ac to dc rectification, and supplying variable a-c power from an a-c source.

Figure 2 illustrates one method of converting ac to dc. The magnitude of the d-c output voltage is controlled by the variable resistor which controls the firing angle, or grid voltage phase, of the thyratrons. The use of thyratrons to supply a variable a-c output from a fixed a-c source is shown in figure 3. Again, the variable resistor serves to control the phase angle of the applied grid voltage and thus the output voltage.

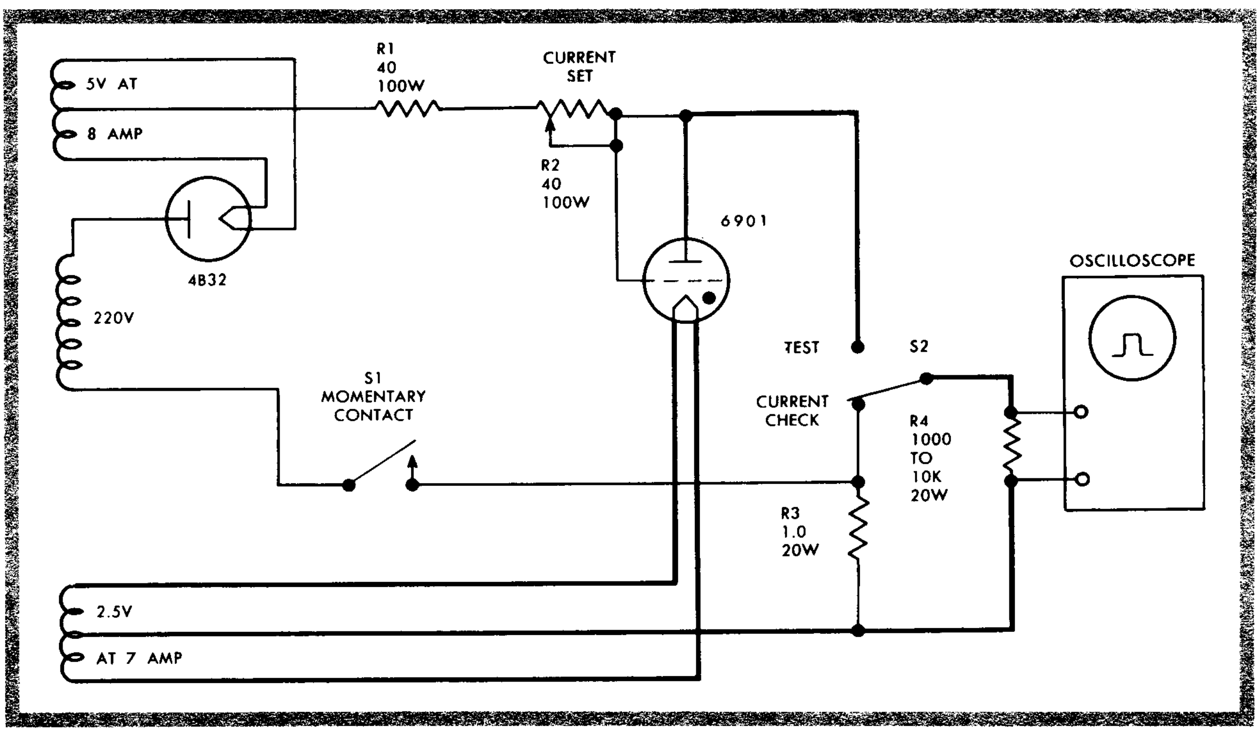


FIGURE 1. TEST JIG FOR MEASURING EMISSION BY TUBE VOLTAGE DROP

TYPE 6901

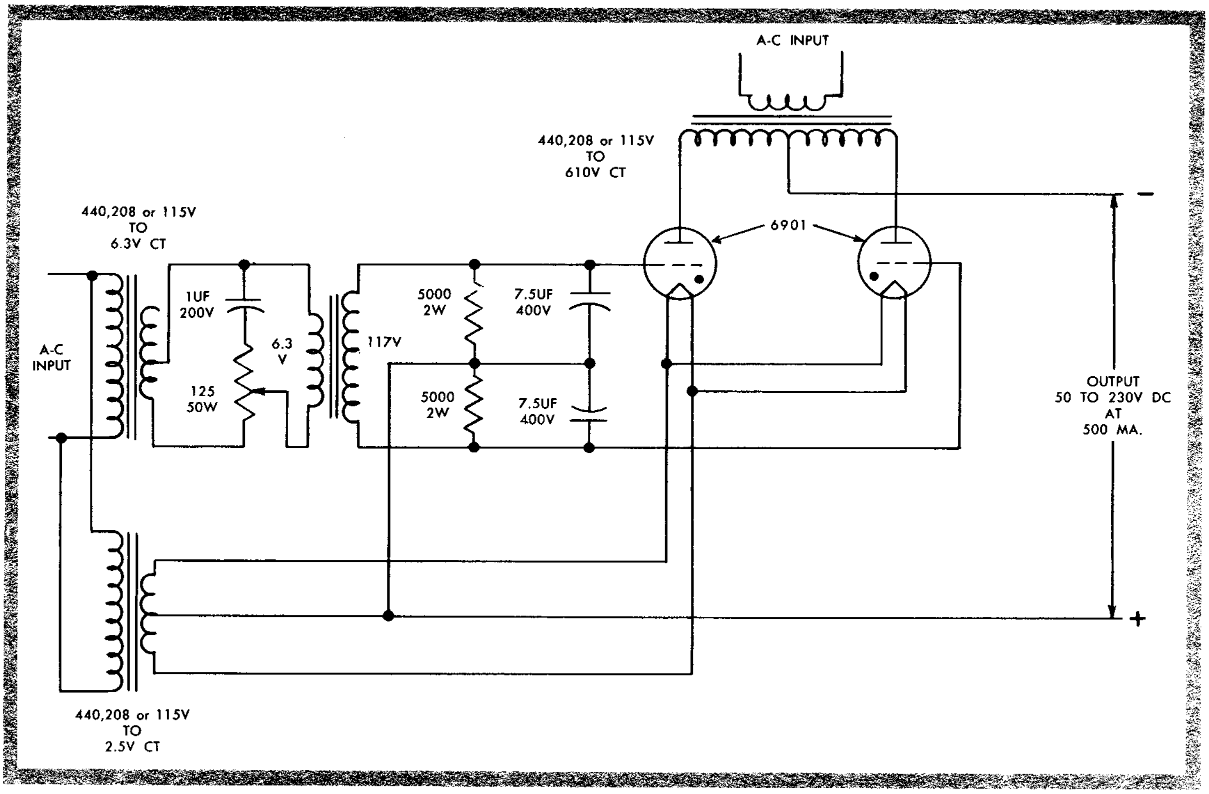


FIGURE 2. THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

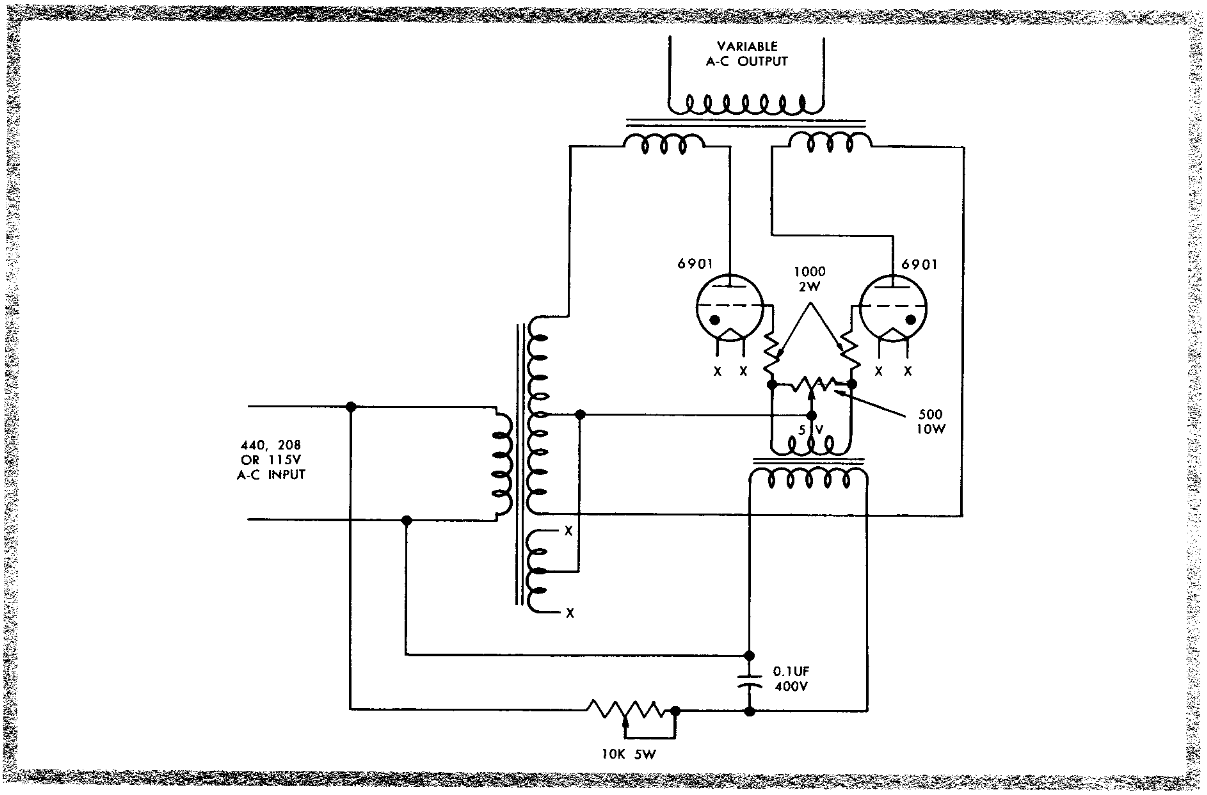


FIGURE 3. THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT