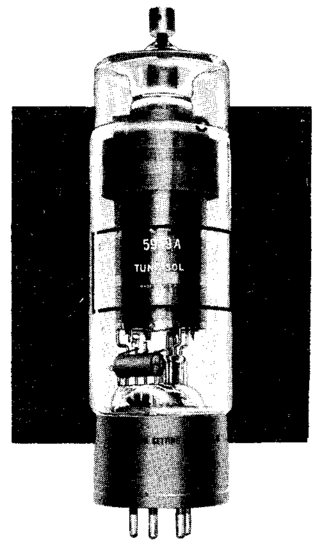
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE
TYPE 5949A
DECEMBER, 1962

HIGH POWER HYDROGEN THYRATRON

DESCRIPTION—The 5949A is a three electrode, hydrogen filled, zero bias thyratron designed for the generation of high power pulses. The primary application of the tube is in high power, high voltage radar modulators. The 5949A is capable of supplying 6.25 megawatt pulses in this service. An internal hydrogen reservoir promotes long life and permits optimum pressure adjustment for various conditions of operation. The cathode is unipotential and is connected to the electrical center of the cathode heater circuit in order to minimize time jitter.

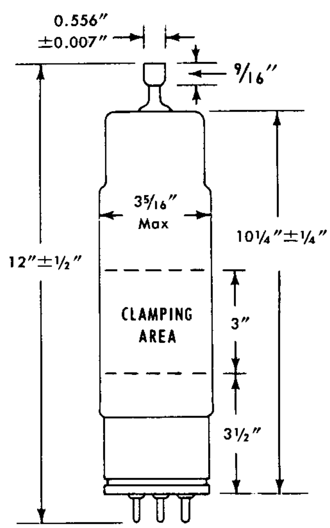


ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	6.0	6.3	6.6	Volts
Heater Current—Ef = 6.3 Volts	15	18.5	22	Amperes
Reservoir Voltage—See Application Notes	3	Marked on base	5.5	Volts
Reservoir Current—Considering all reservoir conditions	3	—	5	Amperes
Cathode and Reservoir Heating Time	3	—	—	Minutes
Tube Voltage Drop	75	125	250	Volts

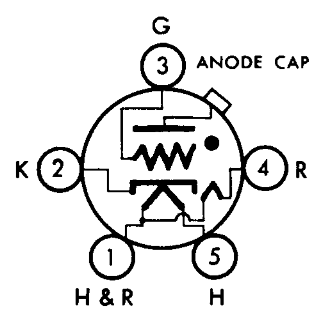
MECHANICAL DATA

Type of Cooling	Convection
Mounting Position	Any
Net Weight—Maximum	2 pounds 4 ounces
Dimensions	See outline drawing
Base	JEDEC No. A5-98
Socket	E. F. Johnson Co. No. 122-275 or equivalent
Anode Connector	Eitel-McCullough, Inc. No. HR-8 or equivalent



RATINGS, ABSOLUTE VALUES

	Min	Max	
Peak Anode Voltage			
Forward—See Application Notes for starting procedure	10	25	Kilovolts
Inverse—Note 1	Note 2	25	Kilovolts
Cathode Current			
Peak	—	500	Amperes
Average	—	0.5	Ampere
RMS—For square pulse applications $Ip = \sqrt{Ib \times ib}$	—	16	Amperes
D-C Anode Voltage	5000	—	Volts
Pulse Repetition Rate—Note 3	—	2000	Pulses-per-second
Peak Grid Voltage			
Forward—Note 4	550	1500	Volts
Inverse	—	450	Volts
Trigger Pulse Width—at 70.7% Point	2	—	Microseconds
Trigger Pulse—Time of Rise—Note 5	—	0.25	Microsecond
Heating Factor—epy × ib × prr—See page 4	—	6.25×10^9	
Current Rate of Rise—Note 5	—	2500	Amperes-per-microsecond
Anode Delay Time—Note 6	—	1	Microsecond
Time Jitter—Note 7	—	0.005	Microsecond
Ambient Temperature	−55	+75	Degrees Centigrade

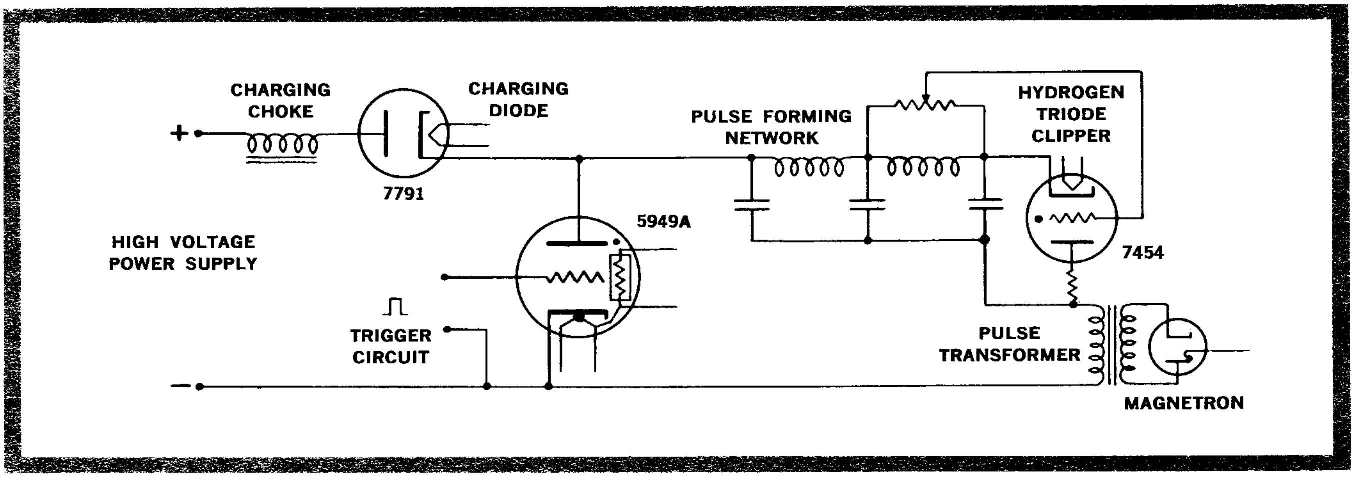


BASING DIAGRAM BOTTOM VIEW 5 CH

Note 1: In pulsed operation, the peak inverse voltage, exclusive of a 0.05 microsecond maximum duration spike, shall not exceed 5 kilovolts during the first 25 microseconds following the anode pulse.
Note 2: Five percent of Foward Anode Voltage.
Note 3: This is not necessarily the upper operating frequency limit of this tube, but it represents the highest repetition rate extensively tested to date.
Note 4: The grid drive requirements of this tube change considerably during the first few minutes the tube is in operation. In order to reliably trigger a cold tube, the grid pulse voltage and duration and the grid circuit impedance should be chosen according to the limiting curves on page 3.
Note 5: Measurement made between 26 and 70.7 percent points.
Note 6: Anode delay time is defined as the time interval between the point on the rising portion of the grid voltage pulse which is 26 percent of the maximum unloaded pulse.
Note 7: Time jitter is measured at 50 percent of pulse amplitude after the tube has been operating for at least one minute. Maximum time jitter of 0.005 microseconds applies at a peak forward anode voltage of 18 kilovolts or greater.

APPLICATION NOTES

The 5949A hydrogen thyratron is designed primarily for use in high power radar modulator service. A basic circuit for such service is illustrated below. In such a circuit, the hydrogen thyratron serves as a switch to release into the magnetron or other radio frequency generator, the energy stored in the pulse forming network. The 5949A is admirably suited for such service by its ability to hold off high voltage, and to pass high peak currents with relatively low tube voltage drop. The tube will operate over a wide range of pulse repetition rates, pulse widths and peak currents, thus providing a very flexible circuit element. Triggering requirements are simplified since the tube operates with zero bias.



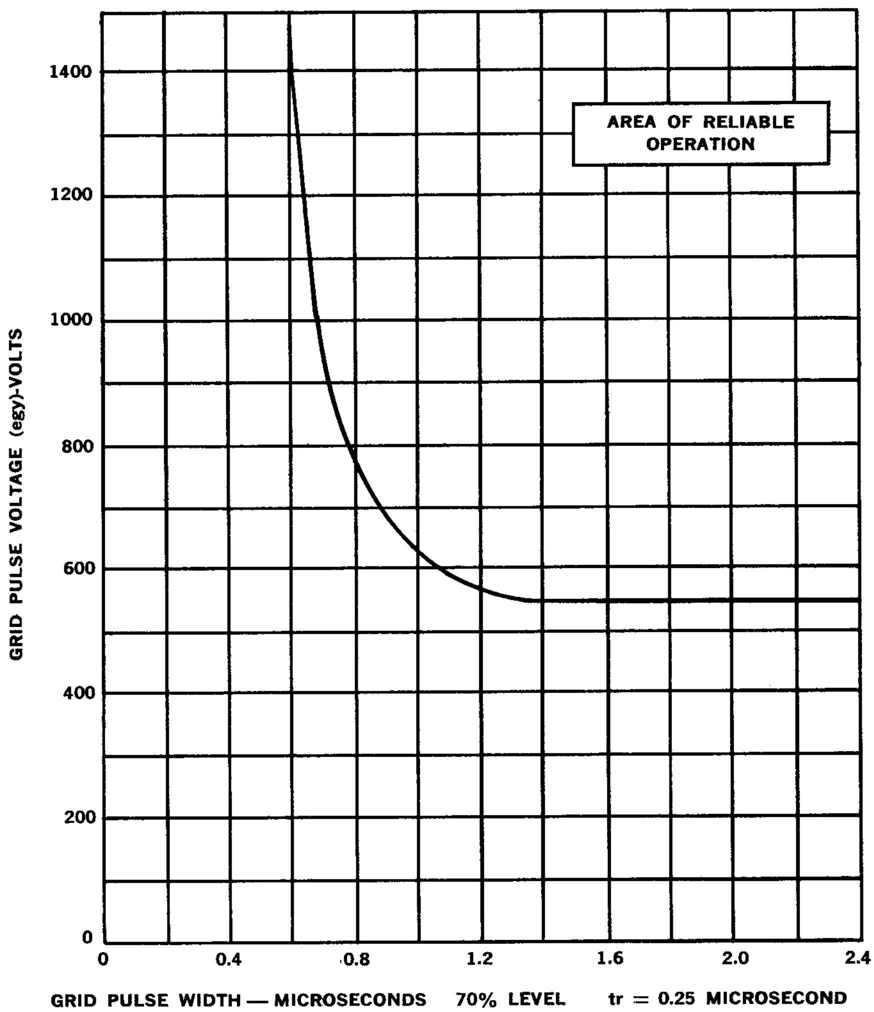
The 5949A contains a hydrogen reservoir that maintains the gas pressure within the tube in accordance with the voltage impressed across it. Since the reservoir can hold many tube volumes of gas, long tube life is insured. In addition it is possible to set the gas pressure at the optimum value for any particular set of operating conditions. The reservoir heater voltage stamped on the tube base has been determined for a particular set of conditions somewhat beyond the maximum tube ratings and will be satisfactory for most applications. In general, it is desirable to operate at as high a reservoir voltage as possible without obtaining spurious discharges in the grid-anode region. When the 5949A is operated at or near maximum ratings, the reservoir voltage regulation should not exceed ±2.5 percent. If the 5949A is operated at reduced duty a wider reservoir operating range can be expected. However, care should be taken when determining the reservoir voltage to insure satisfactory operation with the anticipated reservoir voltage regulation. Under no circumstances should the reservoir voltage be reduced to such an extent that the anode shows color.

The instantaneous application of anode voltage (instantaneous starting or "slap on") is not recommended. When it is absolutely necessary, the maximum permissible epy is 18 kilovolts and this value shall not be attained in less than 0.04 second. For initial application of maximum rated anode voltage, it is recommended that the following starting method be used: Apply no more than 18 kilovolts epy initially. Do not increase in steps greater than 5 kilovolts per minute.

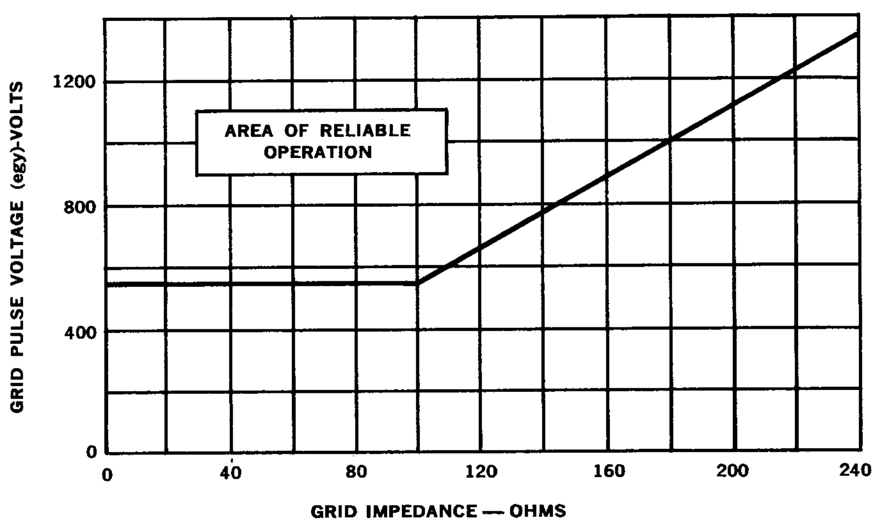
TYPICAL OPERATION

Variations in the operating parameters affect the life expectancy of hydrogen thyratrons; therefore, a simple method of rating for all conditions is difficult. Until such time as sufficient information is available to prepare complete operation rating charts, we list the following typical conditions of operation under which considerable tube life has been obtained. If the 5949A is to be employed in an operation differing widely from these conditions (unless the requirements are obviously less severe) it is suggested that the customer request a recommendation for the specific application.

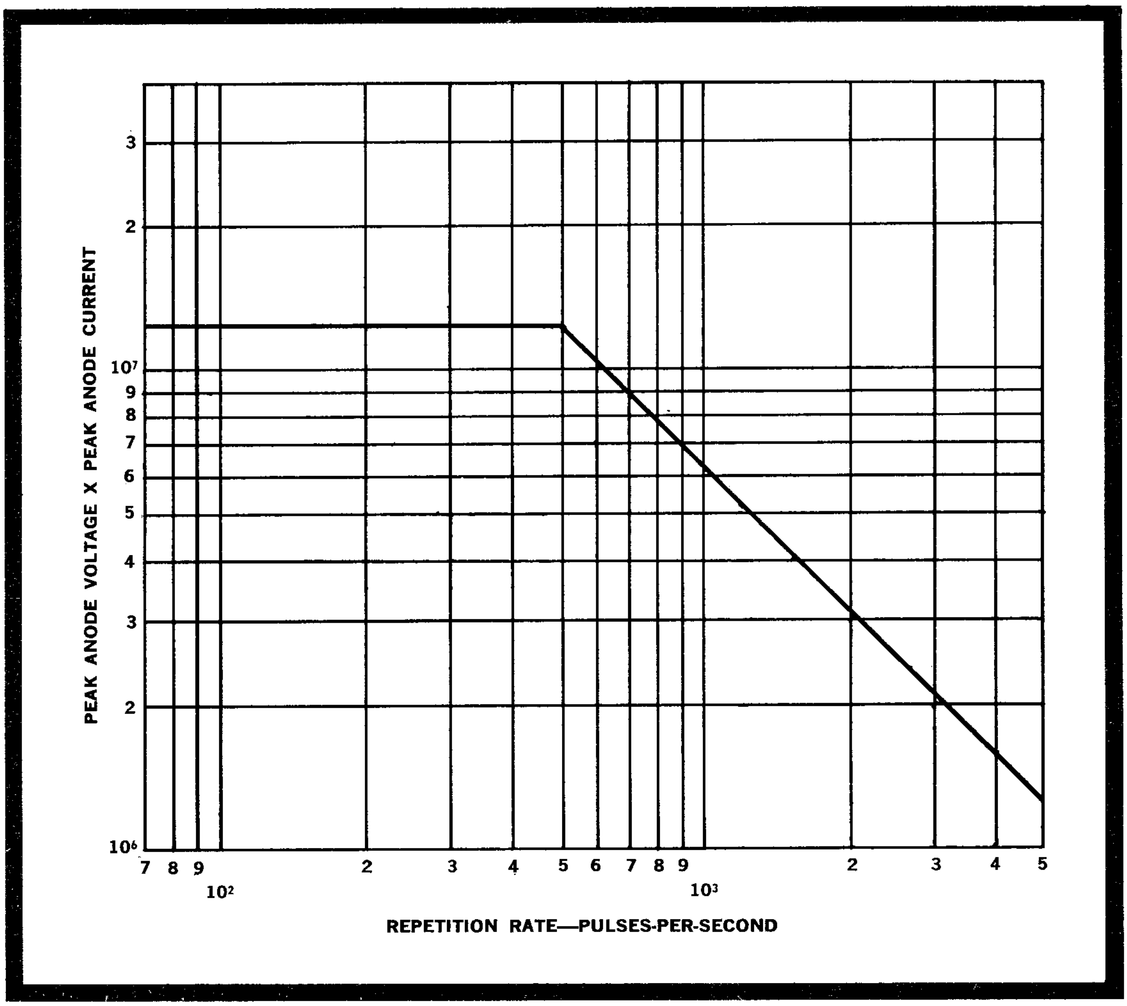
Pulse Repetition Rate	Peak Anode Voltage		Peak Current	Pulse Width 70% Point	di/dt
	Forward	Inverse			
pps	kv	kv	amp	μsec	amp/μsec
360	25	1.25	500	2	2500
1500	20	7.0	200	1	2500



GRID PULSE REQUIREMENTS



GRID IMPEDANCE REQUIREMENTS



GRAPHICAL REPRESENTATION OF HEATING FACTOR