TUNG-SOL

PRODUCT BULLETIN

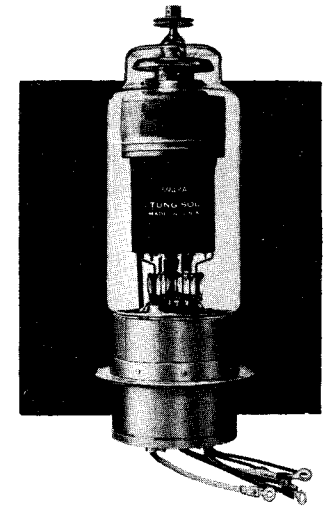
INDUSTRIAL ELECTRON TUBE TYPE 5948A

DECEMBER, 1962

HIGH POWER HYDROGEN THYRATRON

DESCRIPTION — The 5948A 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 5948A is capable of supplying 12 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.

Firm electrical connections are made to the cathode, cathode heaters, grid and reservoir by means of flexible cables fitted with lugs. The tube is rigidly supported by a base with a flange containing bolt holes.

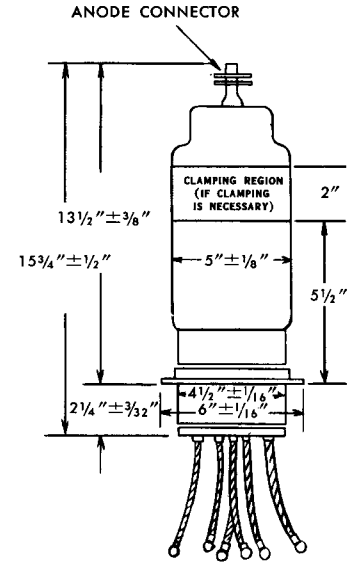


ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	6.0	6.3	6.6	Volts
Heater Current — Ef = 6.3 Volts	25	29	33	Amperes
Reservoir Voltage — See Application Notes	2.5	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	100	200	400	Volts

MECHANICAL DATA

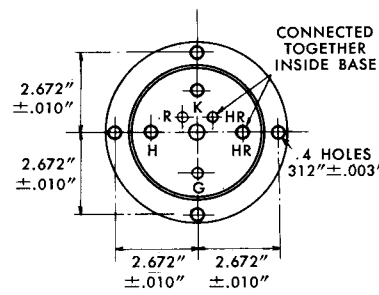
Type of Cooling — Forced air cooling across radiator is recommended for maximum tube life	Convection
Mounting Position	Vertical, base down
Net Weight — Maximum	4 pounds 10 ounces
Dimensions	See outline drawing
Anode Connector	Eitel-McCullough, Inc. No. HR-8 or equivalent



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	—	1000	Amperes
Average	—	1	Ampere
RMS — For square pulse application Ip = $\sqrt{lb \times ib}$	—	33	Amperes
D-C Anode Voltage	5000	—	Volts
Pulse Repetition Rate — Note 3	—	1500	Pulses-per-second
Peak Grid Voltage			
Forward — Note 4	700	1800	Volts
Inverse	—	650	Volts
Trigger Pulse Width — at 70.7% Point	2	—	Microseconds
Trigger Pulse — Time of Rise — Note 5	—	0.35	Microseconds
Heating Factor — epy × ib × prr — See page 4	—	9×10^9	
Current Rate of Rise — Note 5	—	5000	Amperes-per-microsecond
Anode Delay Time — Note 6	—	1	Microsecond
Time Jitter — Note 7	—	0.005	Microsecond
Ambient Temperature	−55	+75	Degrees Centigrade

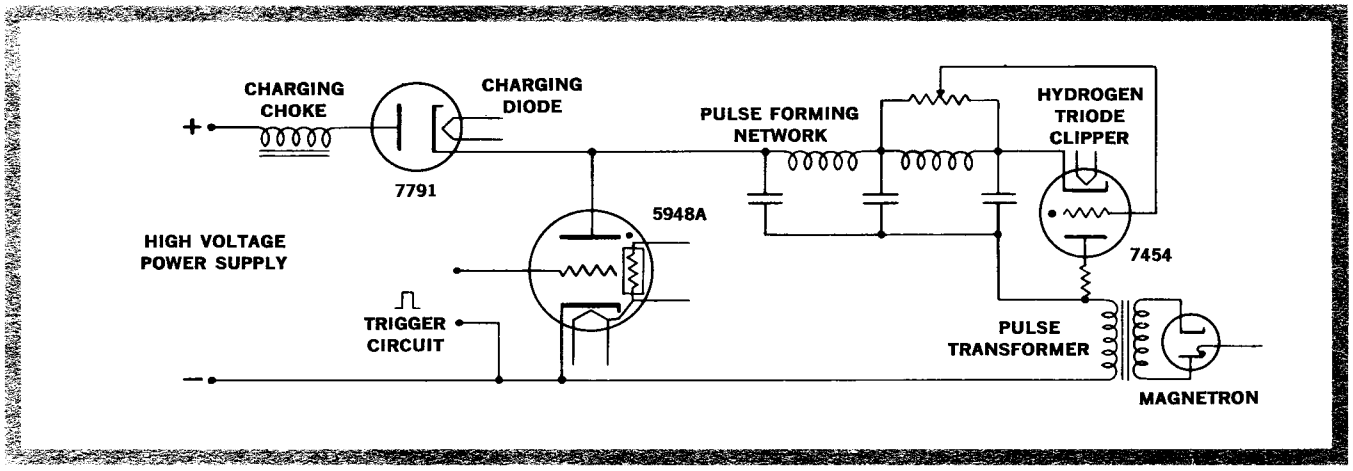
Note 1: In pulsed operation, the peak inverse voltage, exclusive of a 0.05 microsecond maximum duration spike, shall not exceed 5 kilovolts during the first 25 microseconds following the anode pulse.
Note 2: Five percent of Foward Anode Voltage.
Note 3: This is not necessarily the upper operating frequency 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 amplitude and the point where anode conduction takes place.
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 15 kilovolts or greater. At peak forward anode voltages between 10 and 15 kilovolts, the tube has a time jitter rating of 0.01 microsecond.



BASING DIAGRAM
BOTTOM VIEW

APPLICATION NOTES

The 5948A 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 5948A 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.



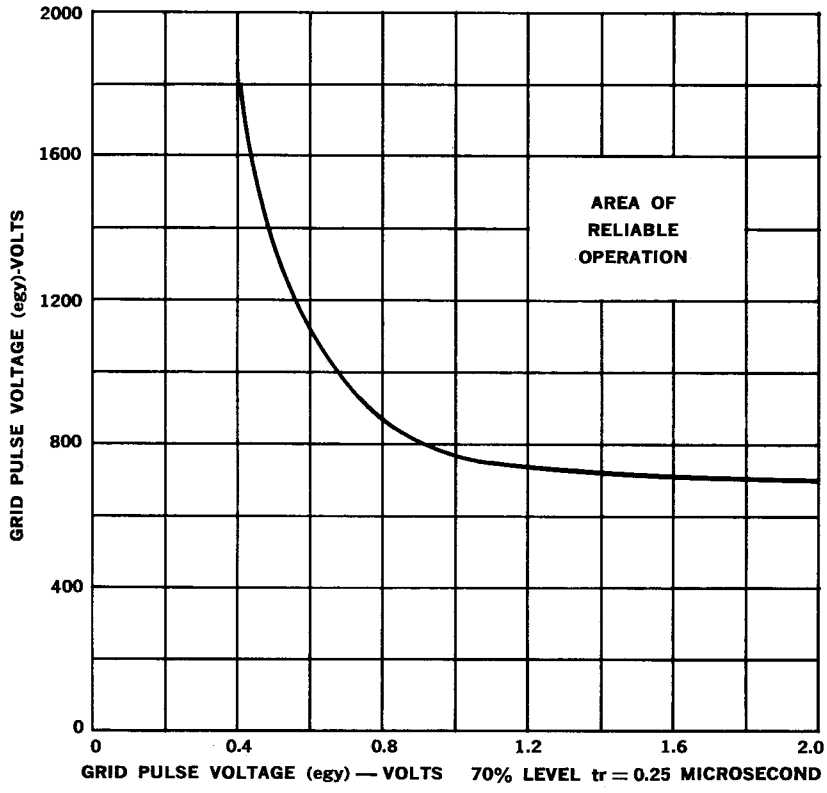
The 5948A contains a hydrogen reservoir that maintains the gas pressure within the tube in accordance with the voltage impressed across it. Since the reservoir can hold many tube volumes of gas, long tube life is insured. In addition it is possible to set the gas pressure at the optimum value for any 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 5948A is operated at or near maximum ratings, the reservoir voltage regulation should not exceed ± 2.5 percent. If the 5948A 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.

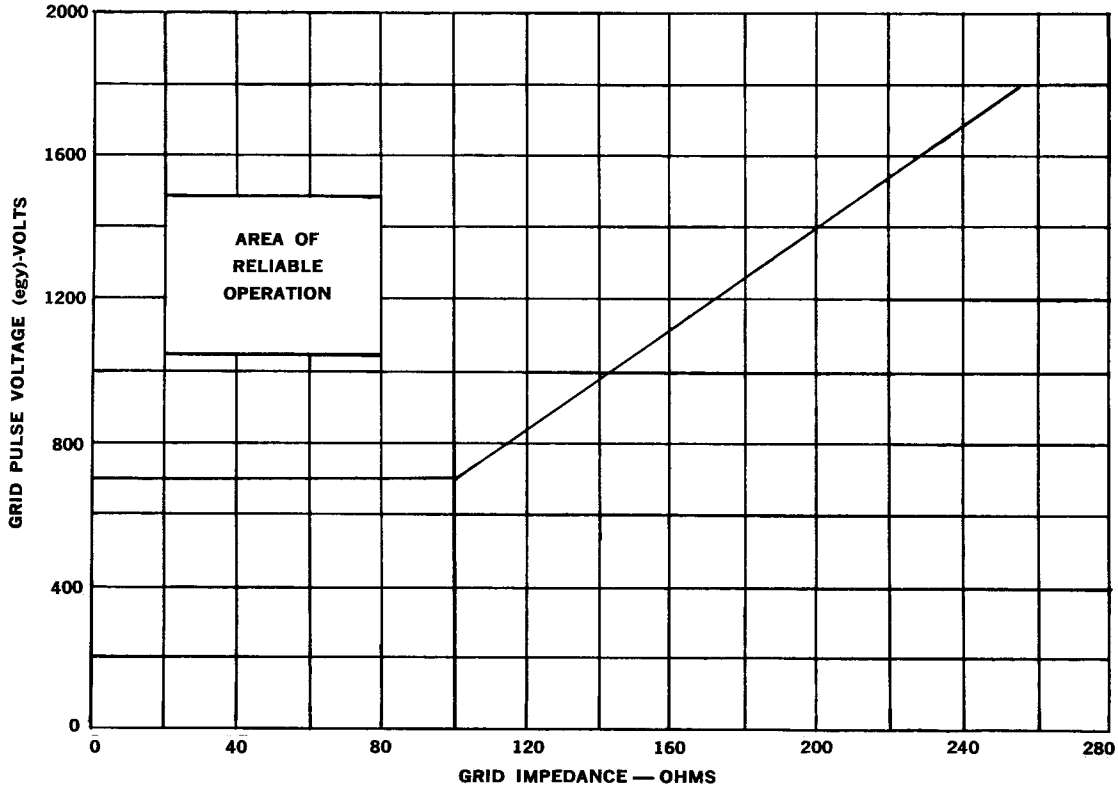
TYPICAL OPERATION

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 5948A 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	μs	amp/μs
360	25	3	1000	2.5	5000
1500	15	5	500	1.3	5000

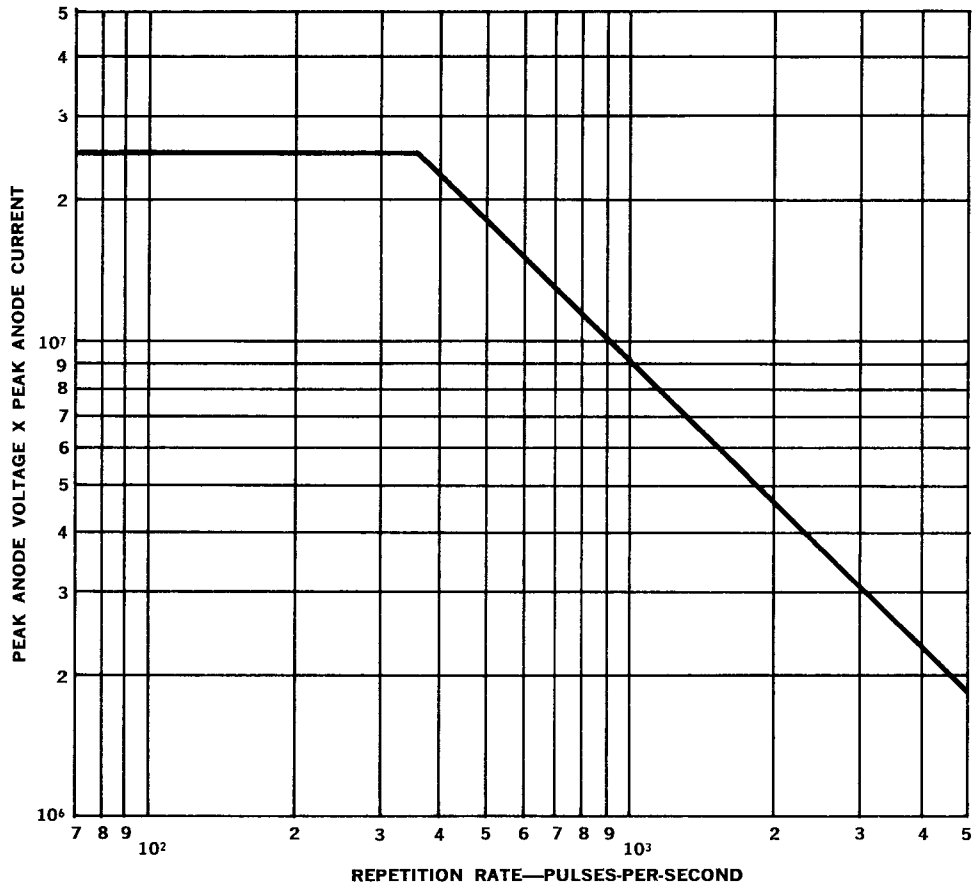


GRID PULSE REQUIREMENTS

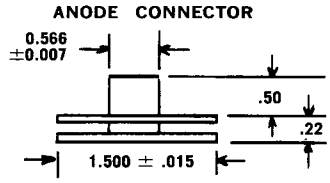


GRID IMPEDANCE REQUIREMENTS

TYPE 5948A



GRAPHICAL REPRESENTATION OF HEATING FACTOR

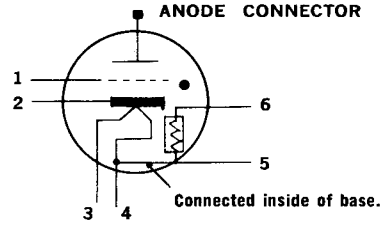


LEAD CONNECTIONS

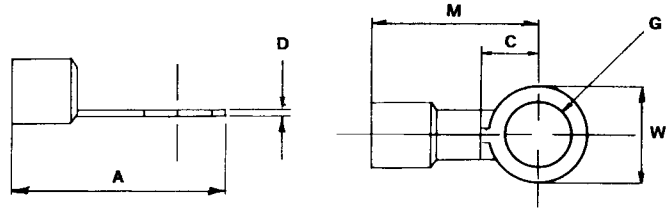
Lead	Function	Lead Color	Lug Color	Lug
1	Grid	Green	Green	S
2	Cathode & Heater C-T	Black	Black	L
3	Heater	Yellow	Yellow	L
4	Heater	Yellow	Black	L
5	Reservoir	Red	Yellow	S
6	Reservoir	Red	Red	S

Leads are flexible 8″ ±¾″ long from bottom of base to center of lug hole. Color coding as well as base marking identifies the leads.

BASING CONNECTIONS



LUG DIMENSIONS



LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	¼″	1.21″	.53″	.41″	.04″	.94″
S	#10	.90″	.31″	.30″	.03″	.74″