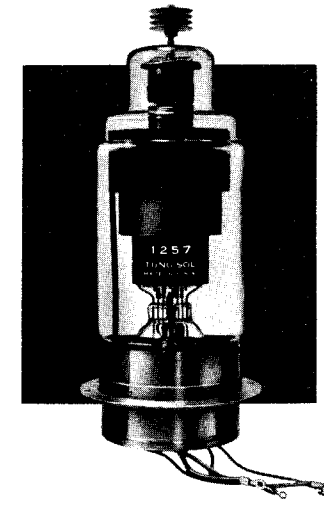
# TUNG-SOL

# PRODUCT BULLETIN

# INDUSTRIAL ELECTRON TUBE TYPE 1257

JANUARY 1963

## HIGH POWER HYDROGEN THYRATRON




DESCRIPTION — The 1257 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 1257 is capable of supplying 33 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.

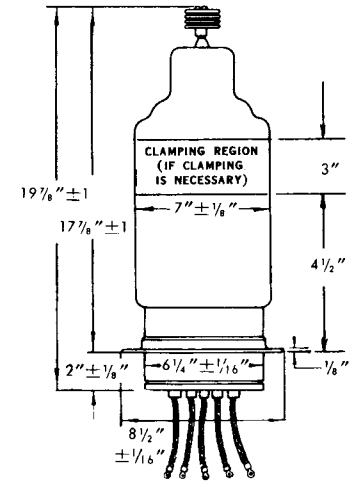
Firm electrical connections are made to the cathode heaters, grid and reservoir by means of flexible cables fitted with lugs. The tube is rigidly supported by a base with a flange containing bolt holes. The cathode connection is made through the base flange.

### ELECTRICAL DATA

| | Min | Bogey | Max | |
|---|---|---|---|---|
| Heater Voltage | 6.0 | 6.3 | 6.6 | Volts |
| Heater Current — $E_f$ = 6.3 volts | 20 | 23 | 40 | Amperes |
| Cathode Heating Time | 15 | — | | Minutes |
| Reservoir Voltage (See application notes) | 3.5 | Marked on base | 6.0 | Volts |
| Reservoir Current | — | — | 12 | Amperes |
| Reservoir Heating Time | 15 | — | | Minutes |
| Anode Voltage Drop | 100 | 200 | 400 | Volts |

### MECHANICAL DATA

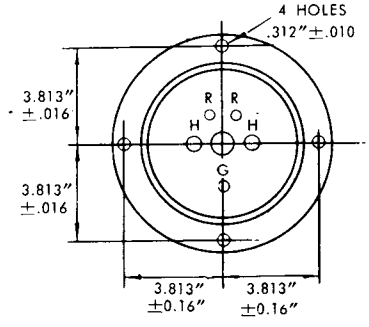
| | |
|---|---|
| Type of Cooling | Convection |
| (Forced air cooling across the radiator is recommended for maximum tube life) | |
| Mounting Position | Vertical, base down |
| Maximum Net Weight | 10 pounds |
| Dimensions | See outline drawing. |




LEAD AND LUG DIMENSIONS ARE GIVEN WITH BASE CONNECTION INFORMATION ON PAGE 4

### RATINGS, ABSOLUTE VALUES

| | Min | Max | |
|---|---|---|---|
| Peak Anode Voltage | | | |
| Inverse — Note 1 | 0.5 | 33 | Kilovolts |
| Forward (See Application Notes for starting procedure) | 7 | 33 | Kilovolts |
| Cathode Current | | | |
| Peak | — | 2000 | Amperes |
| Average | — | 2.6 | Amperes |
| RMS (For square pulse applications $I_p = \sqrt{lb \times ib}$) | — | 60 | Amperes |
| D-C Anode Voltage | 3.5 | — | Kilovolts |
| Operating Frequency | — | 1500 | Pulses-per-second |
| (This is not necessarily the upper operating frequency limit of the tube but represents the highest repetition rate extensively tested to date.) | | | |
| Peak Grid Voltage — Note 2 | 1300 | 2500 | Volts |
| Peak Inverse Grid Voltage | — | 650 | Volts |
| Time of Rise of Grid Pulse — Note 5 | — | 0.35 | Microseconds |
| Grid Pulse Width at 70.7% Point | 2.0 | — | Microseconds |
| Heating Factor (epy x ib x prr. — See page 4) | — | $20 \times 10^9$ | |
| Current Rate of Rise — Note 5 | — | 10,000 | Amperes per microsecond |
| Anode Delay Time — Note 3 | — | 0.5 | Microsecond |
| Time Jitter — Note 4 | — | 0.01 | Microsecond |
| Ambient Temperature | −55 | +75 | Degrees Centigrade |




Note 1: In pulsed operation, the peak inverse voltage, exclusive of a spike of 0.05 microseconds maximum duration, shall not exceed 5.0 kilovolts during the first 25 microseconds following the anode pulse.

Note 2: The grid drive requirements of a 1257 change considerably during the first few minutes of tube 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.

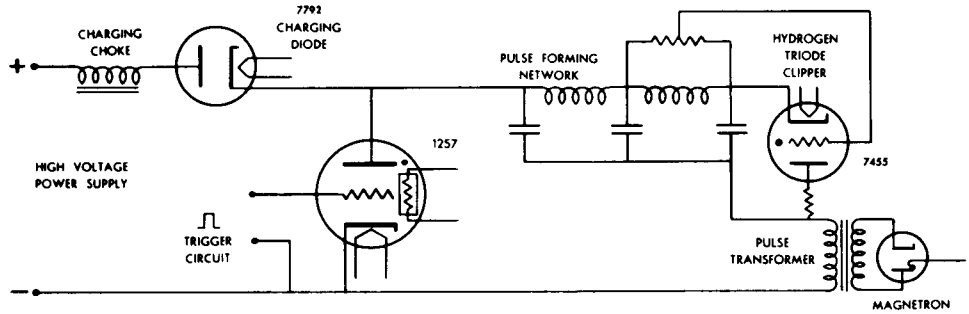
Note 3: Anode delay time is defined as the time interval between the point on the rising portion of the grid voltage pulse which is 26 percent of the maximum unloaded pulse amplitude and the point where anode conduction takes place.

Note 4: Time jitter is measured at 50 percent of the pulse amplitude after the tube has been operating for at least 60 seconds. The limit of 0.01 microseconds shown is the maximum allowable under specified unfavorable operating conditions. With sufficient grid drive and with anode voltages of 20 kilovolts and above, jitter not exceeding 0.005 microseconds can be easily achieved.

Note 5: Measurement made between 26 percent and 70.7 percent points.

## APPLICATION NOTES

The 1257 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 magnatron or other radio frequency generator, the energy stored in the pulse-forming network. The 1257 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 1257 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 1257 is operated at or near maximum ratings, the reservoir voltage regulation should not exceed ±2.5 percent. If the 1257 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 forward peak anode voltage is 22 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 one of the following starting methods be used:

a) *Step starting.* Apply no more than 22 kilovolts epy initially. Do not increase in steps greater than 5 kilovolts per minute.

b) *Reduced Reservoir Voltage.* This method is suitable for automatic control. During warm-up and standby periods, the reservoir voltage is held at 92.5 percent of the nominal value. After initial anode voltage application of not greater than 22 kilovolts, the anode voltage may be increased at a maximum rate of one kilovolt per second. After 7.5 minutes of anode operation at maximum voltage, the reservoir voltage is increased to its nominal value. Other starting methods can be supplied to meet various particular applications.

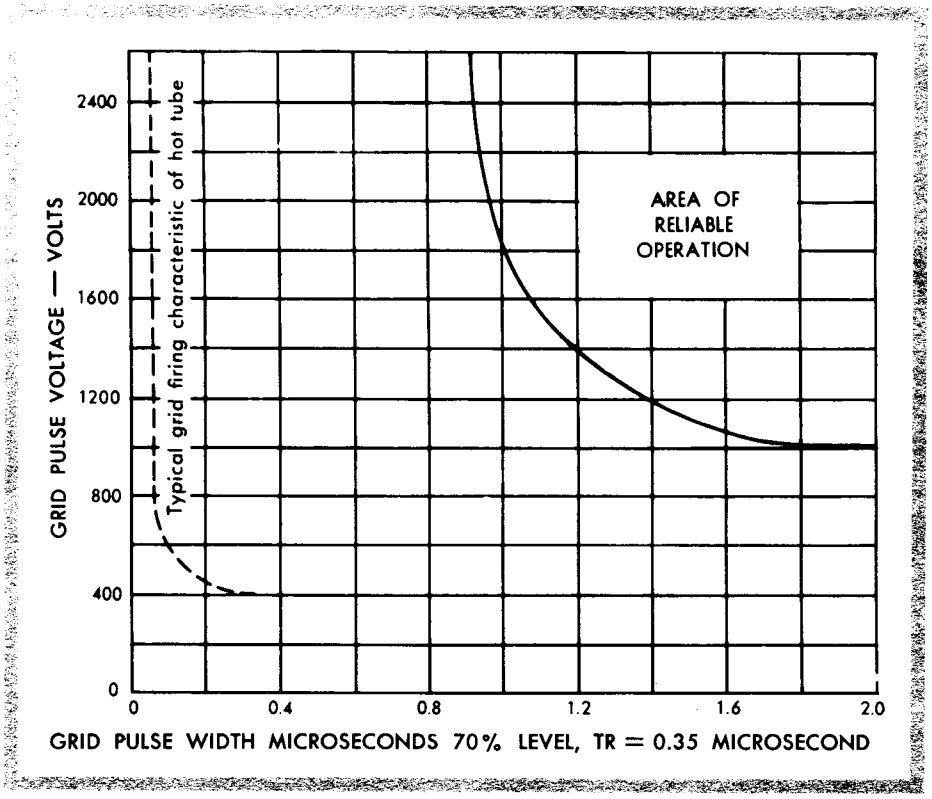
## TYPICAL OPERATION

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 1257 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.

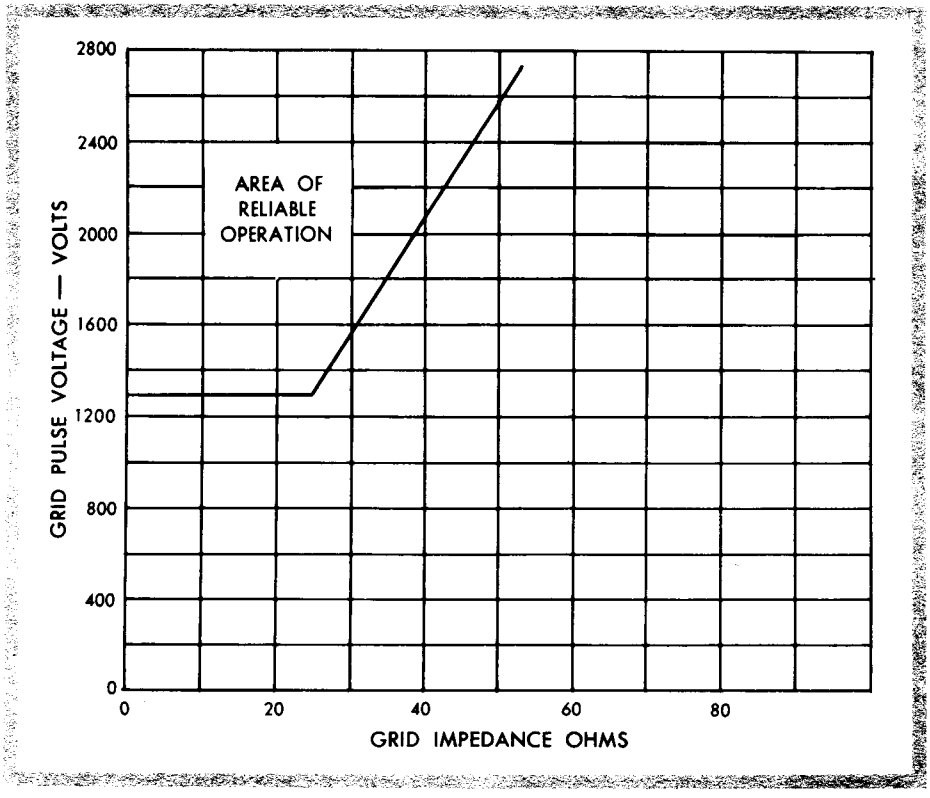
| | Peak Anode Voltage | | Peak | Pulse Width | |
|---|---|---|---|---|---|
| Prr | Forward | Inverse | Current | 70% Point | di/dt |
| pps | kv | kv | amp | μs | amps/μs |
| 310 | 33 | 5 | 2000 | 2.5 | 10000 |
| 500 | 30 | 1.7 | 1250 | 3.6 | 3400 |
| *900 | 30 | 1.6 | 1250 | 1.0 | 4200 |
| 1500 | 20 | 5 | 667 | 1.3 | 6670 |

*Operation made possible by use of hydrogen triode clipper.

GRID PULSE REQUIREMENTS

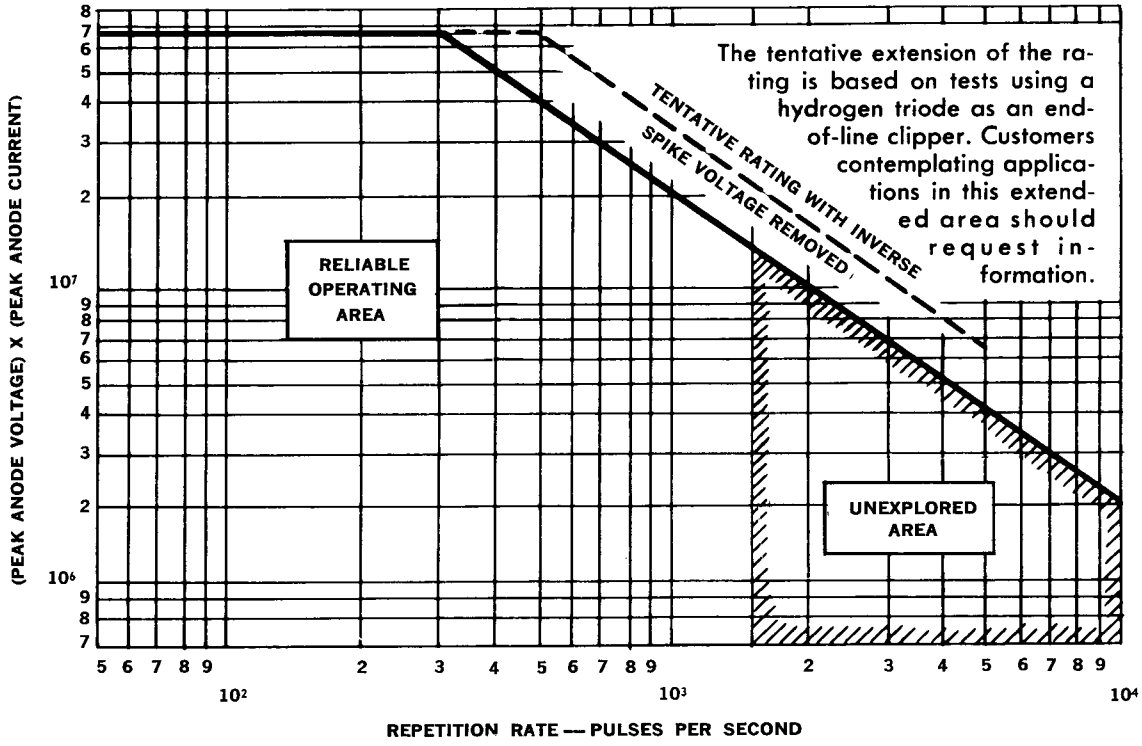



GRID IMPEDANCE REQUIREMENTS

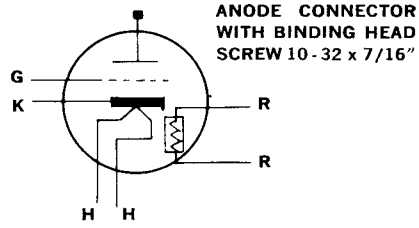


# TYPE 1257

## GRAPHICAL REPRESENTATION OF HEAT FACTOR




## BASING CONNECTIONS

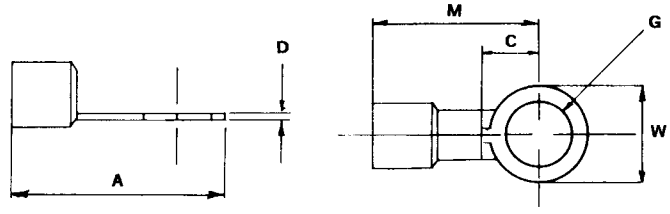



## LEAD CONNECTIONS

| Lead | Function | Lead Color | Lug Color | Lug |
|---|---|---|---|---|
| G | Grid | Green | Green | S |
| H | Heater | Yellow | Yellow | L |
| H | Heater | Yellow | Yellow | L |
| R | Reservoir | Red | Red | S |
| R | Reservoir | Red | Red | S |
| K | Cathode | Tube Base Flange | | |

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.

## 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" |