HY-5
Hydrogen Filled Tetrode Thyratron

Description

The HY-5 is a hydrogen filled triode thyratron. Relatively high pulse currents are achievable using only free or forced air convection cooling. The tube may be mounted by its cathode mounting flange in any position.

Specifications

Absolute Ratings
(Nonsimultaneous)

epy, Peak Forward Anode Voltage *(Notes 1,2 & 3)*.. 40 kv
ib, Peak Forward Anode Current *(Notes 4,5 & 6)*..10,000 A
ibx, Peak Reverse Anode Current *(Note 5)*.. 0.1 ib
epx, Peak Reverse Anode Voltage *(Note 8)*.. 25 kv
epy, Min., Minimum Anode Supply Voltage...3500v DC
tp, Anode Current Pulse Duration, *(Note 5)*... 10 µsec.
Ib, Average Anode Current... 8 Adc
Pb, Anode Dissipaton Factor (Vx A x pps) *(Note 10)*.................................... $160x10^9$
tr, Maximum Anode Current Rise Rate..$1x10^{11}$a/sec

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Typical Operating Conditions *(Note 11)*
(Simultaneous)

epy, Peak Forward Voltage	35 kv
ib, Peak Forward Anode Current *(Note 6)*	5000 A
tp, Anode Current Pulse Duration	2.0 µsec.
Prr, Pulse Repetition Rate	500 Hz
Ib, Average anode current	0.66 Adc
Ip, RMS Average Current *(Note 9)*	90 Aac
Pb, Anode Dissipation Factor (V x A x pps)	$77x10^9$
tr, Maximum Anode Current Rise Rate	$1x10^{11}$a/sec

General Electrical Data

Ef, Cathode Heater Voltage, (Vac)	6.3±8%
If, Maximum Cathode Heater Current @ Ef=6.3 Vac, Aac	29
Er, Reservoir Heater Voltage, Nominal Vac *(Note 12)*	4.5
Ir, Maximum Reservoir Heater Current @ Er=6.3 Vac, Aac	10
tk, Tube Warm-Up Time, Minimum Minutes	15

Trigger Requirements

	MIN.	TYP.	MAX.
Control Grid Egy, Peak Open Circuit Trigger Voltage (Forward) (V)	2,500	3,500	4,500
Zg, Driver Circuit Output Impedance, Ohms	---	30	50
Driver Pulse Rise Time, ns	---	100	150
Driver Pulse Width, µs	2	4	---
Peak Reverse Grid Voltage (v)	---	---	500
Bias Voltage (Negative) (v)	---	50 to 150	300

Triggering Characteristics

	MIN.	TYP.	MAX.
Anode Delay Time, µs *(Note 14)*	---	---	1.0
Anode Delay Time Drift, nS *(Note 14)*	---	---	150
Time jitter, nS *(Note 14)*	---	1	5

Notes

1. The dwell time at the peak anode voltage should be minimized in order to minimize prefiring. For operation at the rated epy, the dwell time must not exceed 1 millisecond.

2. After thyratron anode current stops flowing and before voltage must stay between a and –500 volts for at least 300 µs to allow the gas to deionize.

3. This tube may be operated in air at up to 40kv. Some of the more important derating factors that determine the safe operating voltage in air are the cleanliness of the tube's ceramic insulators, the rate of rise of anode voltage, the dwell time at the operating peak anode voltage, the pulse repetition rate, and ambient pressure, temperature, humidity and contaminant level. This tube may also be operated while immersed in an insulating gas or liquid.

4. The peak current capability of 10,000 A applies to, short pulse (tp<0.2 µs) duration applications.

5. The current pulse width is measured on the discharge current waveform at the half peak current level.

Notes: (cont.)

6. The current pulse width is measured on the discharge current waveform at the half peak current level.

7. For anode current pulse widths greater than 0.2 microseconds but less than 10 microseconds, a useful formula for estimating the allowable peak current is ib=ib0 (3/tp)Á×ª amps, where tp is the pulse width in microseconds, and ib0, the peak current rating at tp = 3 microseconds, is 5,200 amps for this tube.

8. This tube is not designed to conduct current in the reverse direction. The tube will have a tendency to cut-off conduction in the reverse direction but may not be able to stop reverse conduction if the reverse voltage across the thyraton is high enough. In the case where there is conduction in the reverse direction, the absolute value of the reverse peak current must be limited to no more than 10% of the peak value of the previous positive half cycle of the thyratron current waveform.

9. The reverse anode voltage shown applies for a previously nonconducting tube. Exclusive only of a spike not longer than 25 nanoseconds, the peak reverse anode voltage must not exceed 5 kv during the first 50 microseconds after conduction.

9. Ip is the true root mean square (RMS) current. For relatively rectangular shaped current pulses without a reverse current, the RMS anode current may be approximated as the square root of the product of the peak current and the average current.

10. Forced air or liquid immersion cooling should always be used in any situation where cooling by natural convection is insufficient to keep the temperature of the tube's envelope below 200°C. Typically, a room temperature flow of 50 to 150 cfm directed into the anode cup will be sufficient. When the tube is cooled by immersion in a forcecirculated liquid coolant, the anode dissipation factor may be doubled provided that the envelope temperature does not exceed 200 °C.

11. Typical, simultaneous operating conditions other than the example shown in this data sheet might also be acceptable. The conditions shown herein produce a discharge current waveform of the peak forward anode current shown. The pulse width is measured at the half peak current level on the thyratron current waveform. The RMS current is approximated per note 9. The average current is the product of the stored charge (in the pfn being switched by the thyratron) and the pulse repetition rate.

12. The optimum reservoir heater voltage is that which provides the best overall compromise among anode heating, anode voltage holdoff and holdoff recovery, anode current rise rate, and the tube's overall triggering characteristics. For most applications, the optimum reservoir heater voltage lies between 90% and 110% of the nominal value. Operation at voltages below 90% of nominal can result in permanent damage from anode overheating; operation at high reservoir heater voltages degrades anode holdoff and holdoff recovery, and can permanently damage the reservoir itself.

13. The anode delay time is measured from the 25% point on the rise of the unloaded grid voltage pulse to the 10% point on the rise of the anode current pulse.

14. Delay time, delay time drift and time jitter may be simultaneously minimized by applying the maximum driver voltage (egy) at a high rate of rise of voltage from a source of low impedance (Zg).

15. All data and specifications are subject to change without notice.

16. Data sheet origination date is shown on the front page. This data sheet becomes obsolete when more recent revisions are published.

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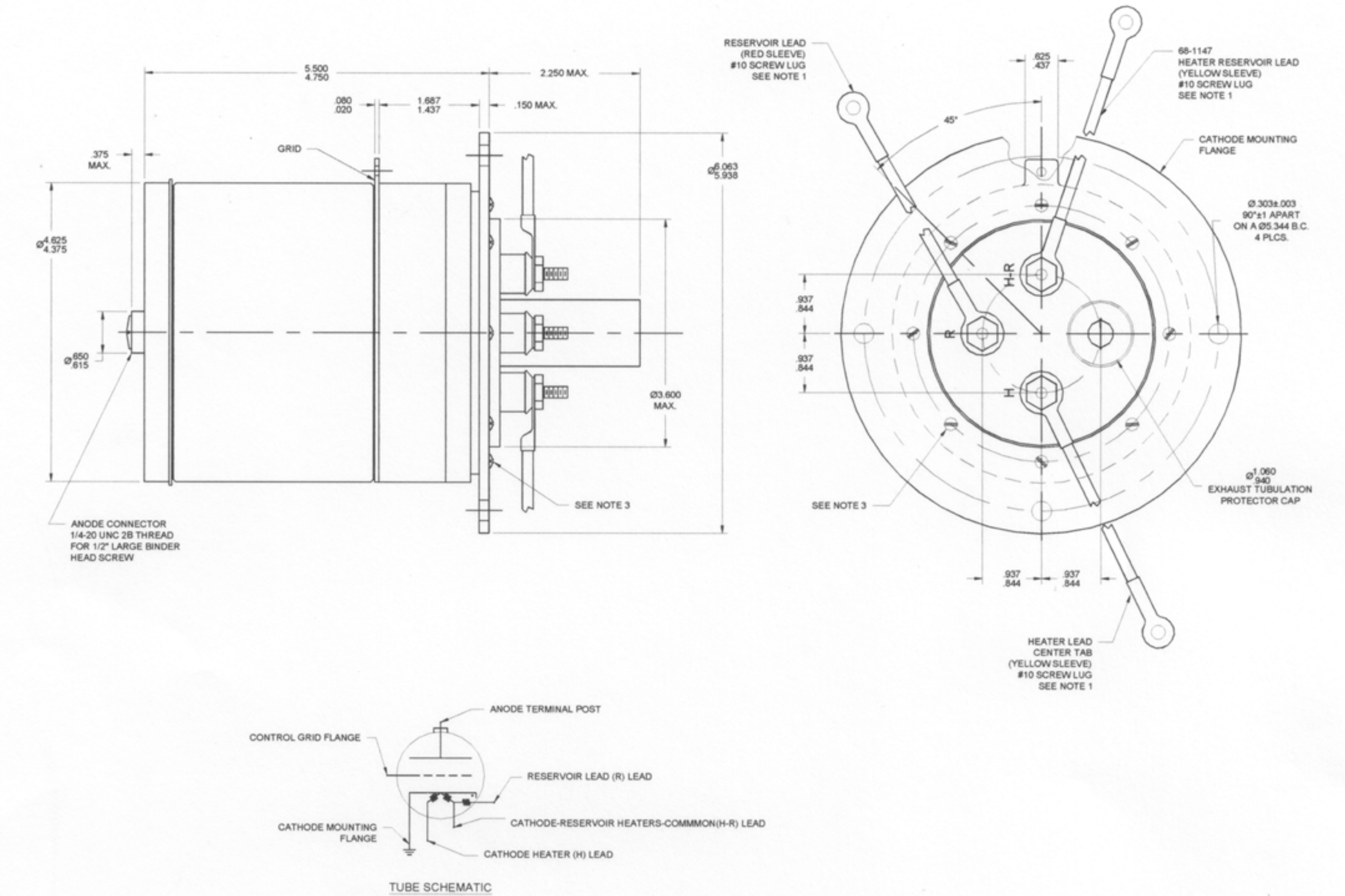
FIGURE 1 Schematic



Notes

1. 4 mounting holes, .303± .013 dia. Thru, equally spaced on a 5.344 dia b.c. on the cathode mounting flange as shown.

2. The cathode mounting flange will seat flush to the system mounting surface provided that there is a hole in the system mounting surface to clear the retaining screw heads.

3. Flexible heater leads are 10±1 inches long from the heater connection stud on the tube to the center of the #10 round hole terminal lug at the end of the lead. The reservoir heater (R) lead is red and has wire of at least 5,000 c.m. (circular mils). The cathode-reservoir heater common (H-R) lead is yellow and has wire of at least 10,000 c.m. The cathode heater (H) lead is yellow and has wire of at least 10,000 c.m. The angular orientation of the leads with respect to any other tube feature is arbitrary.

4. The maximum safe torque to be applied to the heater lead feed-through studs is 20 inch-pounds. The angular orientation of the feed-throughs with respect to the mounting flange holes is held to within 10°.

5. The 5/8 OD anode terminal post is tapped for ¼-20 UNC 5/8 min. DP. Do not exceed 35 inch-pounds of torque when attaching the anode lead.

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