HY-53
Hydrogen Tetrode Thyratron

Description

The HY53 is a hydrogen filled tetrode thyratron. The auxiliary grid, G1, allows the user to reduce the total anode delay time and time jitter. 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
(Maximum)(Non-Simultaneous)

epy, Peak Forward Anode Voltage *(Notes 1,2 & 3)*.. 40 kv
ib, Peak Forward Anode Current *(Notes 4,5 & 6)*...5,000 A
ibx, Peak Reverse Anode Current *(Note 7)*.. 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)*... 10µ sec.
Ib, Average Anode Current... 4 Adc
Ip, RMS Average Current *(Note 9)*.. 90 Aac
Pb, Anode Dissipaton Factor (Vx A x pps) *(Note 10)*.................................... $100x10^9$
tr, Maximum Anode Current Rise Rate..$1x10^{11}$a/sec

HY-53

Hydrogen Tetrode Thyratron

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

epy, Peak Forward Voltage	35 kv
ib, Peak Forward Anode Current	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	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, Cathode Heater Current @ Ef=6.3 Vac, Aac	29
Er, Reservoir Heater Voltage, Vac *(Note 12)*	4.5
Ir, Reservoir Heater Current @ Er=6.3 Vac, Aac	10
Tk, Minimum Tube Warm-up Time, Minutes	15

Trigger Requirements

	MIN	TYP	MAX.
Control Grid Egy, Peak Open Circuit Trigger Voltage (Forward) (V)	1300	2000	2500
Zg, Driver Circuit Output Impedance, Ohms	---	30	100
Driver Pulse Rise Time, ns	---	150	300
Driver Pulse Width, µs	2	4	---
Peak Reverse Grid Voltage (v)	---	---	500
Bias Voltage (Negative) (v)	---	50 to 150	300
Auziliary Grid *(Note 13)*	---	---	---

Triggering Characteristics

	MIN	TYP	MAX.
Anode Delay Time, µs *(Notes 14, 15)*	---	---	500
Anode Delay Time Drift, ns *(Note 15)*	---	---	150
Time jitter, ns *(Note 15)*	---	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 is reaplied to the anode, the anode voltage must stay between 0 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.

Note: (cont.)

6. 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) 1/2 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.

7. 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.

8. 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 auxiliary grid may be referenced to ground by connecting a 1000-ohm resistor between the auxiliary grid flange and the cathode mounting flange. Or the auxiliary grid may be operated in the DC primed mode by drawing a current of 100 to 150 milliamperes in that circuit. Or the auxiliary grid may be operated in the pulsed mode at a peak current of up to 5 ampere just prior to and overlapping the control grid pulse. Or, a combination of DC primed and pulse modes may be used depending on the enhanced triggering characteristic that is needed for the intended application.

14. 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.

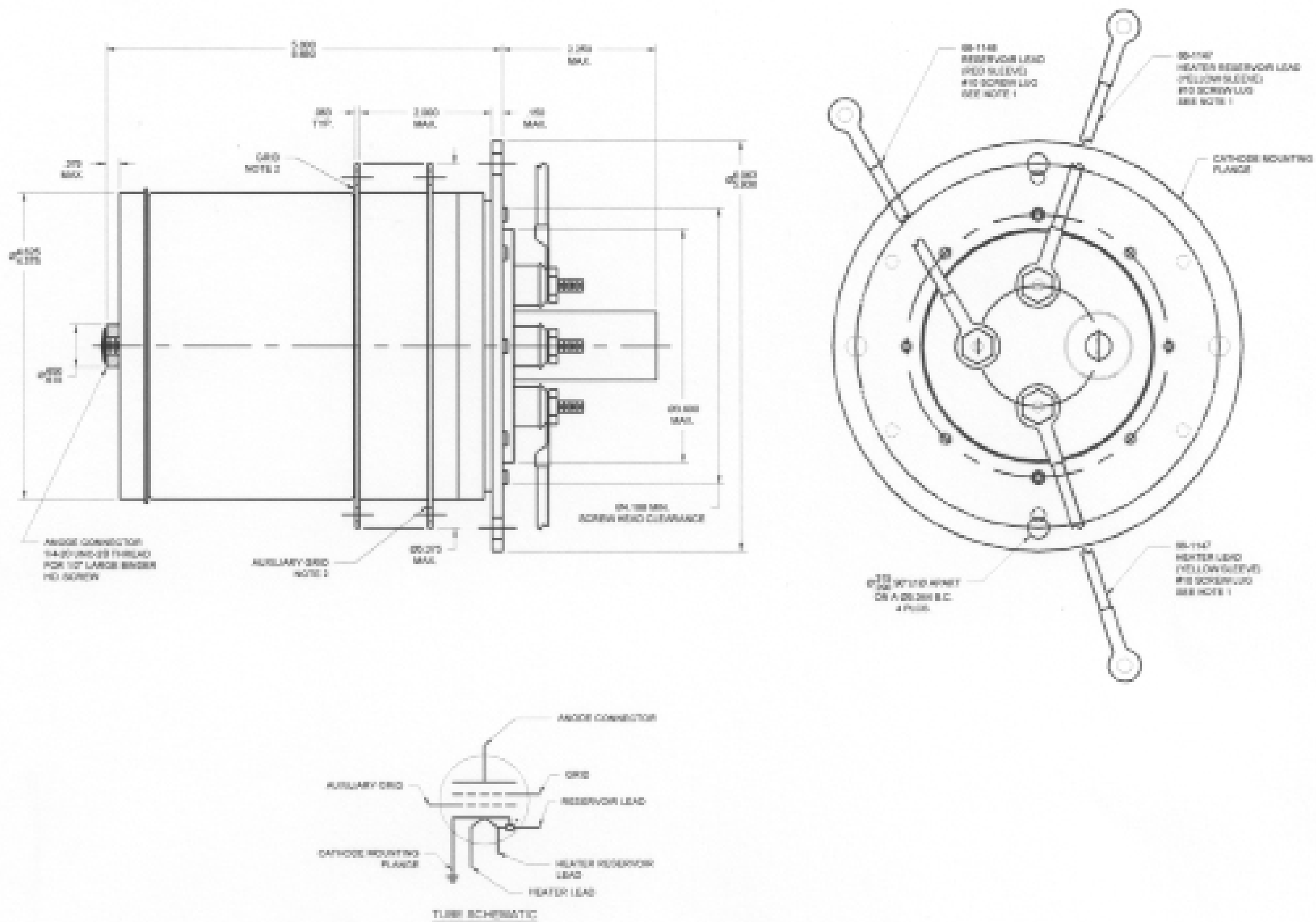
15. Delay time, delay time drift and time jitter may be simultaneously minimized by applying the maximum driver voltage (egy) at a high rate of rise of voltage from a source of low impedance (Zg).

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

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

Hydrogen Tetrode Thyratron

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.

About Excelitas Technologies

Excelitas Technologies is a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection, energetic, frequency standards and high-reliability power needs of OEM customers.

From aerospace and defense applications to industrial, safety and security, medical lighting, analytical instrumentation, and clinical diagnostics, Excelitas Technologies is committed to enabling our customers' success in their specialty end-markets. Excelitas Technologies has approximately 3,000 employees in North America, Europe and Asia, serving customers across the world.

AES@excelitas.com
www.excelitas.com

Excelitas Technologies
Energetic Systems
1100 Vanguard Blvd.
Miamisburg, Ohio 45432
USA
Telephone: (+1) 937.865.3800
Toll Free: (+1) 866.539.5916
Fax: (+1) 937.865.5170

Excelitas Technologies
Power Supplies
1330 East Cypress Street
Covina, California 91724 USA
Telephone: (+1) 626.967.6021
Toll Free: (+1) 800.363.2095
Fax: (+1) 626.967.3151

Excelitas Technologies
Frequency Standards
& Switching
35 Congress Street
Salem Massachusetts 01970
USA
Telephone: (+1) 978.745.3200
Toll Free: (+1) 800.950.3441
Fax: (+1) 978.745.0894

Excelitas Technologies
Lighting & Radiant Sources
44370 Christy Street
Fremont, California 94538-3180
USA
Telephone: (+1) 510.979.6500
Toll Free: (+1) 800.775.6786
Fax: (+1) 510.687.1140

Excelitas Technologies
Sensors
22001 Dumberry Road
Vaudreuil-Dorion, Quebec
Canada J7V 8P7
Telephone: (+1) 450.424.3300
Toll Free: (+1) 800.775.6786
Fax: (+1) 450.424.3345

Excelitas Technologies
International Sales Office
Bat HTDS BP 246, 91882
Massy Cedes, France
Telephone: +33 (1) 6486 2824

For a complete listing of our global offices, visit www.excelitas.com/Locations