

DESCRIPTION: Hydrogen Thyatron

The type 5C22 Hydrogen Thyatron is a hot-cathode grid-controlled gas rectifier tube especially designed for pulsing service at high repetition frequencies, high peak currents, and high voltages.

An outstanding feature of the Hydrogen Thyatron is the short deionization time required to convert the gaseous ions to neutral molecules when the tube is shut off. This permits the 5C22 to be operated at exceptionally high repetition frequencies. This tube also has the advantage that it may be operated over a wide range of ambient temperatures without significant change in electrical characteristics. For a tube of the same type rated at lower voltage see the Engineering Data Service sheet for type 4C35.

APPLICATIONS:

The type 5C22 may be used in a wide variety of applications which will take advantage of such features as:

1. *Low deionization time, hence rapid switching rates.*
2. *High peak currents.*
3. *High plate voltages (but may be used at lower voltages if it is desired).*
4. *Moderate trigger requirements.*
5. *Ability to be operated at zero bias.*
6. *Operation over a wide ambient temperature range without appreciable effect on the electrical characteristics.*
7. *Low tube voltage drop, with attendant efficiency.*
8. *Relatively low cost.*
9. *Reliability and general flexibility of operation.*

The circuit for which this tube was especially developed is shown below. The output in this case consists of periodic rectangular pulses. These are developed when the thyatron fires and releases electric charge stored in the capacitance of the pulse-forming-network (PFN). This network determines the duration and shape of the pulses. Between pulses, when the thyatron is not conducting, the PFN capacitance charges up through the charging choke L_c in a transient which swings the instantaneous plate voltage of the 5C22 above the power supply voltage.

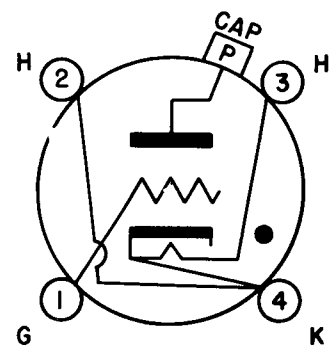
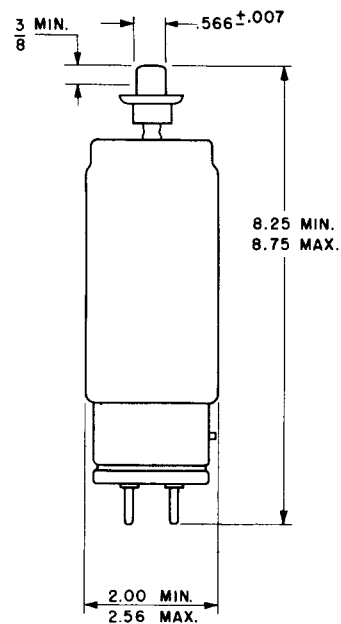
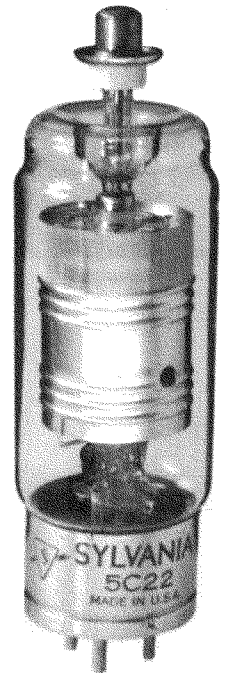
(The value reached is about double the power supply voltage and must be taken into account when applying the peak anode voltage ratings of the tube.)

The peak voltage of the pulse supplied to the pulse transformer is about equal to that of the supply. By means of the pulse transformer, of course, the output to the load may be stepped up to a higher level. This results in a saving in the size and cost of the supply, since components at lower voltage ratings may be used. The SYL-

VANIA 5C22 Hydrogen Thyatron is very well adapted to such voltage step-up by virtue of the very high peak currents it can furnish. Many varieties of short-duration pulses may be produced by different PFN designs.

Other applications suggested by the characteristics of this thyatron are:

1. *Switching in welding circuits, particularly of the capacitor discharge type.*
2. *Shock excitation of tuned circuit.*
3. *Excitation of piezoelectric crystals.*
4. *Use in induction heating circuits to replace spark-gap heaters, resulting in trouble-free and quieter performance.*
5. *Pulser for pulse-time-modulation circuits in which signals are produced by modulating the pulse repetition rate.*
6. *Servomechanisms and control circuits where relatively high A.C. supply frequencies are used.*



ELECTRICAL RATINGS AND OPERATING CONDITIONS

| | |
|---|-----------------------------|
| Heater voltage | 6.3 ± 7.5% volts |
| Heater current at 6.3 volts | 9.6 to 11.6 amps. |
| Cathode heating time | 300 sec. min. |
| Starting anode voltage | 4.5 KV DC min. |
| Peak anode voltage (Note 1) | 16.0 KV max. |
| Peak inverse anode voltage (Note 2) | 16.0 KV max. 5% of epy min. |
| Rate of rise of anode current | 1500 amps./us max. |
| Peak anode current | 325 amps. max. |
| Average anode current | 200 ma. max |
| Dissipation factor | Note 3 |
| Grid drive (Note 4) | |
| a) peak grid voltage | 200 volts min. |
| b) time of rise | 0.5 μ sec. max. |
| c) grid pulse duration | 2.0 μ sec. min. |
| d) impedance of grid drive circuit | 500 ohms max. |
| Peak inverse grid voltage | 200 volts max. |
| Ambient temperature | -50°C. to +90°C. |

Note 1—Where the plate supply voltage is applied instantaneously, the maximum value of the plate voltage shall not reach 13.5 KV in less than 0.04 second.

Note 2—In pulse operation, the peak inverse voltage, exclusive of a spike of 0.05 microsecond maximum duration, should not exceed 5 KV during the 25 microseconds immediately following the pulse.

Note 3—The maximum dissipation factor will depend on the peak forward anode voltage (epy in volts), the peak anode current (ib in amps.), and the pulse repetition frequency (prf in pulses per second) according to the formula:

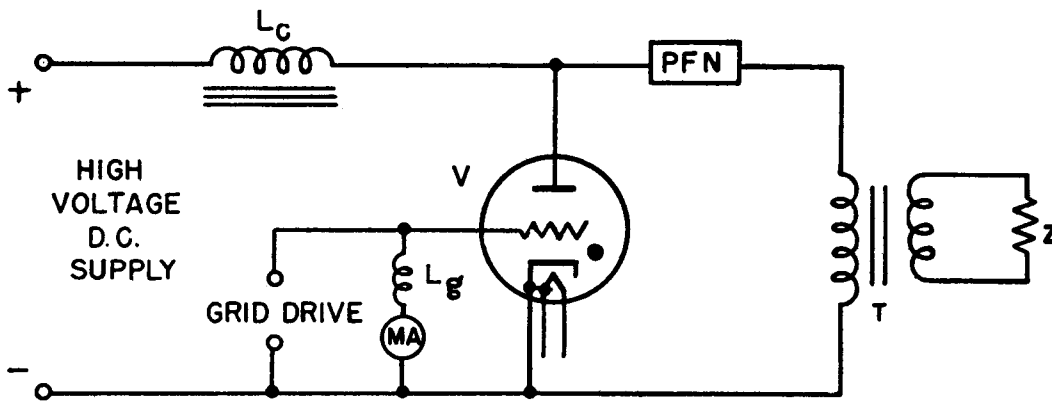
$$epy \times ib \times prf = 3.2 \times 10^9 \text{ max.}$$

This formula is applicable for pulse repetition rates in the neighborhood of the test condition of 1000 pps. For rates far in excess of this, special caution should be exercised.

Note 4—Measurements are at the tube socket with the thyratron grid disconnected.

MECHANICAL SPECIFICATIONS

| | |
|-------------------------|---------------------------------------|
| Envelope | T20 |
| Cap | Special, see outline drawings |
| Base | Super Jumbo 4-pin with Bayonet, AY-18 |
| Mounting Position | Any, See Note 1 |



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|-------------------------------|---------------------------------|
| L _g Grid Choke | T Matching or Pulse-Transformer |
| L _c Charging Choke | Z Load |
| PFN Pulse-Forming-Network | V 5C22 |

- Note 1**—Clamping is permissible by the base and/or by the bulb in the area up to 4¼.
- Note 2**—Return for cathode current should be to Pin No. 4 only.
- Note 3**—No cooling stream of air should be directly applied to the tube envelope.
- Note 4**—Tube should be kept away from strong fields which could ionize gas in the tube.