



ELECTRONIC TUBE REFERENCE

15QR40

Specialized - Thyatron electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

THYRATRON

Mercury-vapor thyatron for high-voltage controlled rectification and industrial switching. Its heavy heater and grid control support substantial power conversion.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	3
NOMINAL HEATER	5 V / 15 A	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Thyatron	
MAXIMUM PLATE VOLTAGE	15000 V
MAXIMUM CATHODE CURRENT	40 A
PEAK FORWARD CURRENT	40 A
<i>Mercury-vapor thyatron section; canonical SectionType has no Thyatron value, so Other is used.</i>	

15QR40 — High-Voltage Mercury-Vapor Thyatron

The **15QR40** (also written as **15 QR 40**) is a mercury-vapor filled, hot-cathode thyatron equipped with a control grid. It is designed primarily for use as a controllable rectifier tube in the high-voltage half-wave rectifier stages of radio transmitters and industrial generators. Additionally, its grid-controlled switching characteristics make it suitable for use as a switching and control tube in industrial regulation systems.

Construction, Heater, and Physical Specifications

The 15QR40 features an indirectly heated oxide cathode designed for robust thermal emission. The physical structure is optimized for high-voltage isolation and vertical operation.

Parameter	Value
Nominal Heater Voltage (U_f)	5 V \u00b1 5%
Nominal Heater Current (I_f)	15 A to 20 A
Normal Preheating Time (t_h / t_A)	Minimum 300 s (5 minutes)
Post-Transport Preheating Time	Minimum 3600 s (60 minutes)
Anode Warm-up Time (t_{anl})	Minimum 10 minutes
Approximate Weight	1000 g (1 kp)
Mounting Position	Vertical, base down

The preheating requirements are critical for the safe operation of mercury-vapor tubes. Under normal operating conditions, the cathode must be heated for at least 300 seconds before anode voltage is applied. Following transport or prolonged shutdown, the preheating time must be extended to at least 3600 seconds (1 hour) to ensure that any condensed mercury on the electrodes is completely vaporized and redistributed to the lower portion of the envelope.

Physically, the tube has a maximum envelope diameter of 150 mm. The maximum overall height is specified between 440 mm and 450 mm, with a base height of up to 30 mm.

Base, Connections, and Socketing

The tube utilizes a specialized 4-pin base and a top anode cap to maximize electrical isolation between the high-voltage anode and the low-voltage grid and cathode connections.

- **Base Designation:** Special 4-pin base (4-35, TGL 70-76)
- **Socket Designation:** 4-35, TGL 68-5
- **Anode Cap Connection:** Type E (TGL 70-123) or clip-on Type C 20 (TGL 4520)

The pin connections, viewed from the bottom of the base, are assigned as follows:

Pin / Terminal	Connection
Pin 1	Heater (f)
Pin 2	Cathode (k)
Pin 3	Heater and Cathode (f, k)
Pin 4	Control Grid (g)

Pin / Terminal	Connection
Top Cap (5)	Anode (<i>a</i>)

Electrical Characteristics and Capacitances

The electrical behavior of the 15QR40 is defined by its gas-discharge properties and interelectrode capacitances:

- **Grid-to-Cathode Capacitance (C_{gk}):** 40 pF
- **Anode-to-Grid Capacitance (C_{ag}):** 15 pF
- **Arc Drop Voltage (U_{arc} / U_i):** 16 V (measured at an anode current of 12.5 A)
- **Ignition Voltage (U_z):** 2 kV
- **Ignition Time (t_{ign}):** Maximum 10 \u03bcs
- **Deionization Time (t_e):** Maximum 1000 \u03bcs

Absolute Maximum Ratings

Operating the 15QR40 beyond its maximum ratings can lead to arc-back, cathode damage, or envelope failure. The limiting values are specified as follows:

Parameter	Maximum Rating
Operating Frequency (<i>f</i>)	150 Hz
Peak Inverse Anode Voltage ($-U_{as}$)	15 kV
Peak Forward Anode Voltage (U_{as})	15 kV
Average Anode Current (I_a)	12.5 A (averaged over $t_{av} = \text{max } 15 \text{ s}$)
Peak Anode Current (I_{as})	40 A
Surge Anode Current ($I_{a \text{ stoss}}$)	600 A (for $t = \text{max } 0.1 \text{ s}$)
Peak Forward Grid Voltage ($+U_{gs}$)	600 V
Peak Negative Grid Voltage ($-U_{gs}$)	600 V
Average Grid Current (I_g)	200 mA to 250 mA (averaged over $t_{av} = \text{max } 15 \text{ s}$)
Peak Grid Current (I_{gs})	1 A
Grid Resistor (R_g)	30 k\u03a9
Condensed Mercury Temperature (T_{Hg})	25 to 50 °C

Parameter	Maximum Rating
Ambient Temperature (T_{amb} / T_{ugb})	15 to 35 °C

Rectifier Operating Configurations

In practical high-voltage rectifier applications, multiple 15QR40 tubes are arranged in various circuit configurations. At a maximum peak inverse anode voltage of 15 kV, the typical operating parameters for configurations (excluding transformer and tube losses) are detailed below:

Configuration	Transformer Secondary Voltage ($U_{tr\ eff}$)	DC Output Voltage (U_o)	DC Output Current (I_o)	DC Output Power (N_o)
a	10.6 kV	4.8 kV	12.5 A	60 kW
b	5.3 kV	4.8 kV	25.0 A	120 kW
c	10.6 kV	9.6 kV	25.0 A	240 kW
d	6.1 kV	7.2 kV	37.5 A	270 kW
e	6.1 kV	14.4 kV	37.5 A	540 kW
f	6.1 kV	7.2 kV	75.0 A	540 kW
g	5.3 kV	6.9 kV	40.0 A	276 kW
h	5.3 kV	13.5 kV	40.0 A	540 kW
i	5.3 kV	7.2 kV	40.0 A	288 kW
k	5.3 kV	7.4 kV	40.0 A	296 kW

Ignition Characteristics

The ignition characteristic of the 15QR40 defines the relationship between the negative grid bias voltage (U_g) and the forward anode voltage (U_{as}) required to initiate conduction. Because of manufacturing tolerances and operating conditions, this relationship is expressed as a spread band ("Streubereich") rather than a single curve.

At a nominal heater voltage of 5 V, the ignition threshold varies with the applied anode voltage:

- At high anode potentials near 15 kV, a strong negative grid bias between approximately -7 V and -33 V is required to prevent the tube from firing.
- At lower anode potentials, such as 2 kV, the ignition threshold shifts to a less negative range, typically between -3 V and -10 V. Once the tube ignites, the grid loses control over the anode current, and conduction can only be stopped by reducing the anode voltage below the ionization threshold.

Related Designations and Equivalents

The 15QR40 is electrically and physically compatible with several industry-standard high-voltage thyratrons. It corresponds directly to the following designations:

- ASG 5830
- DCG 7/100
- F 941
- HF 3415
- WL 41

Additionally, the 15QR40 is a direct replacement for the older S 15/40 i tube.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1953 RFT Rundfunk Technik

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1953 RFT RUNDFUNK TECHNIK

Section 1 · Thyatron

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HeaterVoltageNominal	5 V	Nominal
HeaterCurrentNominal	20 A	Nominal
Maximum Plate Voltage	15000 V	—
Maximum Cathode Current	12.5 A	—
PeakForwardCurrent	40 A	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

195X Tunsgram

Published test conditions and operating points. Values on this page are preserved as reported by this source.

195X TUNSGRAM

Section 1 · Thyatron

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Cathode-grid capacitance	40 pF	—
Anode-grid capacitance	15 pF	—
Arc voltage	16 V	At anode current 12.5 A

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Ignition delay maximum	10 us	—
Deionization time maximum	1000 us	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum frequency	150 Hz	—
Peak anode voltage	15 kV	—
Average anode current	12.5 A	—
Surge anode current	40 A	—
Peak overload anode current	600 A	—
Peak reverse voltage	600 V	—
Grid current	250 mA	—
Peak grid current	1 A	—
Grid resistor	30 k0hm	—
Warmup time minimum	300 s	—

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