



ELECTRONIC TUBE REFERENCE

15GP22

Specialized - Cathode Ray electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

CATHODERAY

P22 cathode-ray picture tube documented by General Electric with a 6.3 V, 1.8 A heater; available extracted data is otherwise limited.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	6.3 V / 1.8 A	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Cathode Ray

No fixed ratings recorded.

15GP22 — Three-Gun Tri-Color Picture Tube

A direct-view, electrostatic-focus, electrostatic-convergence, and magnetic-deflection tri-color picture tube for full-color or black-and-white television receivers.

Overview

The **15GP22** is a 15-inch round glass picture tube designed for direct-view color television applications. It features three separate electron guns and a metal-backed phosphor-dot screen capable of reproducing both full-color and black-and-white transmissions. The tube utilizes electrostatic focusing and electrostatic convergence to align the three independent electron beams, while deflection is achieved magnetically. The physical screen provides an 11 1/2 by 8 5/8-inch picture with rounded sides, offering a total useful screen area of approximately 88 1/2 square inches.

Construction and Optical Characteristics

The internal structure of the 15GP22 is engineered to facilitate precise color reproduction through a shadow-mask system. The tube contains three separate electron guns, each aligned to project an independent beam corresponding to one of the primary colors.

Phosphor-Dot Screen and Mask Assembly

The screen consists of a metal-backed phosphor-dot array deposited on a spherical, clear glass faceplate. The phosphors are designated collectively as P22, exhibiting medium persistence. The individual phosphors produce blue, green, and red fluorescent and phosphorescent colors.

- **Phosphor Groups:** Approximately 195,000 triangular groups, containing three dots each (one of each primary color), totaling approximately 585,000 individual phosphor dots.
- **Aperture Mask:** A perforated mask is positioned between the electron guns and the phosphor screen. This mask is aligned so that the electron beam from any single gun can only strike the phosphor dots of its corresponding color.
- **Metal Backing:** The screen is backed with a thin metal layer to prevent ion-spot blemishes and to increase light output by reflecting back-emitted light toward the viewer.
- **Faceplate and Screen Plate:** The faceplate is clear and spherical. The screen plate is gray, with an approximate light transmission of 70 percent.

External Conductive Coating

The outer surface of the tube features an external conductive coating. When properly connected to ground, this coating forms a filter capacitor in conjunction with the internal anode coating (which includes the internal aquadag coating, aperture mask, and metal screen-backing).

Mechanical Specifications and Basing

The 15GP22 is a physically substantial device designed to be mounted in any position.

Physical Dimensions

- **Over-all Length:** 26 1/8 inches maximum
- **Greatest Bulb Diameter:** 14 5/8 ± 5/32 inches
- **Greatest Metal-Flange Diameter:** 15 3/4 inches maximum
- **Neck Length:** 10 3/8 inches
- **Net Weight:** Approximately 25 pounds

Base and Pin Connections

The tube utilizes a **Small-shell Bidecal 14-Pin** base (designation B14-103) with a JETEC 20A basing arrangement. The anode connection is made via a prominent metal flange on the bulb.

Pin Number	Connection
Pin 1	Heater
Pin 2	Cathode (Red Gun)
Pin 3	Grid No. 1 (Red Gun)
Pin 4	Grid No. 2 (Red Gun)
Pin 5	No Connection
Pin 6	Grids No. 3 (Focusing Electrode, common to all three guns)
Pin 7	Cathode (Green Gun)
Pin 8	Grid No. 1 (Green Gun)
Pin 9	Grid No. 2 (Green Gun)
Pin 13	Grid No. 4 (Converging Electrode, common to all three guns)
Pin 17	Grid No. 2 (Blue Gun)
Pin 18	Grid No. 1 (Blue Gun)
Pin 19	Cathode (Blue Gun)
Pin 20	Heater
Flange (A)	Anode (Aquadag, mask, and screen-backing)
Coating (C)	External Conductive Coating

Direct Interelectrode Capacitances

The approximate capacitances of the electrode structures are as follows:

- **Cathodes (all three guns tied together externally) to all other electrodes:** 17.5 uuf
- **Grid-No. 1 (of any gun) to all other electrodes except Grid-No. 1 of the other two guns:** 7.5 uuf
- **Grid-No. 3 (all three guns tied together internally) to all other electrodes:** 12 uuf
- **Grid-No. 4 (common to the three guns) to all other electrodes:** 7 uuf
- **External conductive coating to anode:** 1500 uuf minimum to 3000 uuf maximum

Electrical Characteristics and Operating Range

The 15GP22 operates with high anode potentials and requires precise auxiliary voltages for focusing and convergence.

Heater Ratings

The heater is designed for AC or DC operation:

- **Heater Voltage:** 6.3 V
- **Heater Current:** $1.8 \pm 10\%$ A
- **Calculated Nominal Heater Power:** 11.34 W (derived from 6.3 V multiplied by 1.8 A)

Deflection and Raster Alignment

- **Deflection Method:** Magnetic
- **Approximate Deflection Angles:** Horizontal 45 degrees, Vertical 35 degrees
- **Raster Centering:** Centering is accomplished by passing a direct current of the required value through each pair of deflecting coils. This compensates for any raster shift (up to a maximum of 1 1/4 inches in any direction from the screen center) resulting from adjustments for convergence, color purity, and concentricity.

Characteristic Range Values for Equipment Design

For anode voltages between 18,000 and 20,000 Volts and an anode input of 15 Watts, the following range values apply:

- **Grid-No. 4 (Converging Electrode) Voltage:** 42.5 to 51 percent of the anode voltage (excluding the AC component of the dynamic converging voltage).
- **Grid-No. 3 (Focusing Electrode) Voltage:** 12 to 19 percent of the anode voltage.
- **Grid-No. 2 Voltage for Visual Extinction of Focused Raster (with Grid-No. 1 voltage at a fixed value, each gun):** 2 to 4.5 times the Grid-No. 1 voltage.
- **Grid-No. 1 Voltage for Visual Extinction of Focused Raster (with Grid-No. 2 voltage at a fixed value, each gun):** 22.5 to 50 percent of the Grid-No. 2 voltage.
- **Electrode Currents:**
 - Grid-No. 4 Current: -5 to +5 microamperes
 - Grid-No. 3 Current: 300 microamperes maximum
 - Grid-No. 2 Current: -15 to +15 microamperes

White Balance (Illuminant C)

To produce a standard Illuminant C white (6740 K), the beam currents of the three guns must be balanced within the following ratios:

- **Red Gun to Green Gun Current Ratio:** 4:1 to 1:1
- **Blue Gun to Green Gun Current Ratio:** 1.5:1 to 0.5:1

Dynamic Modulation Voltages

To maintain focus and convergence across the entire flat area of the screen during scanning, dynamic AC voltages must be superimposed on the static DC operating potentials:

- **Dynamic Converging Voltage:** Approximately 900 Volts peak-to-peak. This AC voltage is essentially parabolic in waveform, synchronized with scanning, and does not include any voltage developed during blanking time.
- **Dynamic Focusing Voltage:** Approximately 225 Volts peak-to-peak, sharing the same parabolic, synchronized characteristics.

Typical Operating Example

At a nominal anode voltage of 20,000 Volts:

- **Grid-No. 4 Voltage:** 8,500 to 10,200 Volts DC
- **Grid-No. 3 Voltage:** 2,400 to 3,800 Volts DC
- **Grid-No. 2 Voltage (for visual extinction with Grid-No. 1 at -70 V):** 140 to 315 Volts DC
- **Grid-No. 1 Voltage (for visual extinction with Grid-No. 2 at 200 V):** -45 to -100 Volts DC

Maximum Ratings

The following maximum ratings are established under the Design-Center System. This system provides a ten-percent safety factor, meaning the tube can withstand the combined effects of line voltage and component variations as long as the design-center values are not exceeded by more than ten percent under nominal conditions.

Parameter	Maximum Rating	Unit
Anode Voltage	20,000	Max Volts DC
Anode Input	15	Max Watts
Grid-No. 4 (Converging Electrode) Voltage	11,000	Max Volts DC
Grid-No. 3 (Focusing Electrode) Voltage	5,000	Max Volts DC
Grid-No. 2 Voltage (Each Gun)	500	Max Volts DC
Grid-No. 1 Negative-bias Value	200	Max Volts DC
Grid-No. 1 Positive-bias Value	0	Max Volt DC
Grid-No. 1 Positive-peak Value	2	Max Volts
Peak Heater-Cathode Voltage (Each Gun):		

Parameter	Maximum Rating	Unit
— Heater negative to cathode (during warm-up ≤ 15 s)	410	Max Volts
— Heater negative to cathode (after warm-up)	180	Max Volts
— Heater positive to cathode	180	Max Volts

Note: Anode input is defined as the product of the anode voltage and the anode current, with the latter measured at the anode contact using a direct-current ammeter.

Safety and Installation Requirements

X-Ray Radiation Protection

When operated at voltages exceeding 16,000 Volts, the 15GP22 can produce X-rays. Shielding may be necessary to prevent personal injury from prolonged, close-range exposure. The protective face-viewing window of the television receiver or apparatus normally provides adequate protection, provided that the radiation measured in contact with this window does not exceed 6.25 milliroentgens per hour.

High-Voltage Insulation and Grounding

Because the metal flange of the bulb is at the full anode potential (up to 20,000 Volts DC), adequate physical insulation must be provided around this flange to prevent arcing or shock hazards. Additionally, the external conductive coating must be securely connected to the receiver's common ground to function correctly as a high-voltage filter capacitor.

Technical Summary

The **15GP22** is a specialized, high-voltage, three-gun tri-color picture tube utilizing a 14-pin Bidecal base and a metal flange anode contact. It features a 15-inch round glass envelope with a clear spherical faceplate and a gray screen plate. Operating with a 6.3 V, 1.8 A heater, it requires an anode voltage of up to 20,000 V and an anode input of up to 15 W. Precise color registration is achieved through electrostatic convergence (requiring up to 11,000 V DC plus a 900 V peak-to-peak dynamic parabolic voltage) and electrostatic focusing (requiring up to 5,000 V DC plus a 225 V peak-to-peak dynamic parabolic voltage). The tube's design incorporates a P22 phosphor-dot screen with approximately 585,000 dots and an internal aperture mask, providing a high-performance direct-view color display when operated within its design-center limits and with appropriate X-ray and high-voltage safeguards.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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

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Section 1 · Cathode Ray

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HeaterOrFilamentVoltageNominal	6.3 V	—
HeaterOrFilamentCurrentNominal	1.8 A	—