

ELECTRONIC TUBE REFERENCE

19VBRP22

Specialized - Cathode Ray electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
CATHODERAY

P22 color television picture tube with electrostatic focusing and magnetic deflection, designed for high-voltage color display service.

GENERAL CHARACTERISTICS

BASE DESIGNATION	46E	BASE PINS	12
NOMINAL HEATER	6.3 V / 900 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Cathode Ray	
MAXIMUM PLATE VOLTAGE	27500 V
Cathode-ray electron-gun/screen system; anode/ultor maximum promoted to MaxPlateVoltage when explicitly published. Explicit X-ray warning/precaution or X-radiation characteristic is present in the supplied source.	

19VBRP22 — Ultra-Rectangular Color Picture Tube

The **19VBRP22** is an ultra-rectangular color picture tube featuring a 4x3 aspect ratio, designed for television display applications. It incorporates a Hi-Lite Matrix Screen with an aluminized backing and a black opaque matrix material, providing a light neutral screen appearance. The screen utilizes a P22 phosphor system consisting of rare-earth red and sulfide blue and green phosphors, which exhibit medium-short persistence. The phosphor array is composed of approximately 382,000 dot trios with a spacing of 0.024 inches (0.61 mm) between adjacent trios.

The tube is equipped with three electron guns (red, green, and blue) arranged in a Delta configuration, with their axes tilted toward the tube axis. It utilizes electrostatic focusing via a bipotential focus lens, while convergence and deflection are achieved magnetically. The deflection angles are 90° diagonally, 78° horizontally, and 60° vertically. Implosion protection is provided by integrated rim bands and a tension band.

Mechanical and Physical Specifications

The physical construction of the 19VBRP22 is defined by standardized JEDEC designations for its envelope components and electrical interfaces:

- **Bulb Funnel:** JEDEC No. J510A06
- **Bulb Panel:** JEDEC No. FP161-3/4 W1
- **Base:** Small-Button Diheptar 12-Pin (JEDEC No. B12-244)
- **Basing Arrangement:** JEDEC No. 14BE
- **Anode Contact:** JEDEC No. J1-21
- **Operating Position:** The preferred operating position is with the anode bulb contact positioned on top.
- **Weight:** Approximately 25 lb (11.4 kg)
- **Minimum Projected Screen Area:** 185 sq in (1194 sq cm)

Heater Ratings and Standby Operation

The 19VBRP22 heater is designed for both standard and standby operation modes. Under typical operating conditions without standby, the nominal heater voltage is 6.3 V with a current draw of 900 mA.

When standby operation is utilized, a standby voltage of 5.0 V is recommended (with a Design-Maximum limit of 5.5 V). When this 5.0 V standby mode is employed, the active operating voltage is reduced to 6.0 V. The heater surge voltage must be limited to a maximum of 9.5 V rms.

Pinout and Interelectrode Capacitances

The JEDEC No. 14BE basing arrangement provides the following electrical connections, viewed from the bottom of the base:

Pin	Connection
1	Heater
2	Cathode (Red Gun)
3	Grid No. 1 (Red Gun)
4	Grid No. 2 (Red Gun)
5	Grid No. 2 (Green Gun)

Pin	Connection
6	Cathode (Green Gun)
7	Grid No. 1 (Green Gun)
9	Grid No. 3 (Focusing Electrode)
11	Cathode (Blue Gun)
12	Grid No. 1 (Blue Gun)
13	Grid No. 2 (Blue Gun)
14	Heater
Bulb Contact	Anode (Grid No. 4, Screen, Collector)

The external conductive coating forms a capacitor with the internal anode structure. The interelectrode capacitances and associated electrical characteristics are:

Parameter	Value
Grid No. 1 (any gun) to all other electrodes	6 pF (approx.)
Grid No. 3 to all other electrodes	6.5 pF (approx.)
All cathodes to all other electrodes	15 pF (approx.)
Anode to external conductive coating	1800 pF min, 2300 pF max
Hardware to external conductive coating resistance	50 MΩ min

Design-Maximum Ratings

The Design-Maximum ratings represent the limiting values of operating and environmental conditions for each gun of the 19VBRP22:

- **Anode Voltage:** 20 kV min, 27.5 kV max
- **Anode Current (Long-Term Average):** 1000 μA max (short-term average is limited to 1500 μA)
- **Grid-No. 3 (Focus) Voltage:** 6000 V max
- **Peak Grid-No. 2 Voltage (including video signal):** 1000 V max
- **Grid-No. 1 Voltage:**
 - Negative bias value: 400 V max
 - Negative operating cutoff value: 200 V max
 - Positive bias value: 0 V max
 - Positive peak value: 2 V max
- **Heater Voltage (AC or DC):**

- Operating: 5.7 V min, 6.9 V max
- Standby: 5.5 V max
- **Heater-Cathode Voltage:**
 - Heater negative to cathode: 450 V max during warm-up (≤ 15 s); 200 V max DC / 200 V max peak after warm-up
 - Heater positive to cathode: 0 V max DC, 200 V max peak

Typical Characteristics and Equipment Design Ranges

The operating characteristics and alignment parameters for the 19VBRP22 are detailed below:

- **Focusing Voltage:** Grid-No. 3 voltage ranges from 16.8% to 20% of the applied anode voltage.
- **Grid-No. 2 Voltage for Visual Extinction:**
 - At Grid-No. 1 voltage (V_{g1}) of -75 V: 80 to 280 V
 - At V_{g1} of -125 V: 215 to 550 V
 - At V_{g1} of -175 V: 355 to 820 V
- **Grid-No. 2 Voltage Ratio:** The ratio of the highest to lowest gun Grid-No. 2 voltage is 1.86 max (at a Grid-No. 1 spot cutoff of -100 V).
- **Electrode Currents:** Grid-No. 3 total current is ± 15 μ A; Grid-No. 2 and Grid-No. 1 currents are each ± 5 μ A.
- **Typical Light Output:** 80 fL (274 Nit) measured within a 4-inch diameter area under the following conditions: anode voltage of 25 kV, anode current of 1000 μ A, Grid-No. 3 adjusted for focus, and a color temperature of 9300 K + 27 M.P.C.D.

White Light Color Coordinates and Gun Currents

The tube can be set up for different white points, which alter the required anode current distribution and cathode current ratios:

1. Illuminant D (6550 K + 7 M.P.C.D.):

- Coordinates: $x = 0.313$, $y = 0.329$
- Anode Current Distribution: Red 41%, Blue 24%, Green 35%
- Cathode Current Ratios:
 - Red/Blue: 1.35 min, 1.70 typ, 2.20 max
 - Red/Green: 0.95 min, 1.15 typ, 1.70 max
 - Blue/Green: 0.50 min, 0.70 typ, 0.95 max

2. Color Temperature 9300 K + 27 M.P.C.D.:

- Coordinates: $x = 0.281$, $y = 0.311$
- Anode Current Distribution: Red 30%, Blue 31%, Green 39%
- Cathode Current Ratios:
 - Red/Blue: 0.75 min, 0.96 typ, 1.25 max
 - Red/Green: 0.60 min, 0.75 typ, 1.10 max
 - Blue/Green: 0.60 min, 0.80 typ, 1.10 max

Beam Displacements (at Screen Center)

- Raster centering: ± 0.45 in (± 1.4 mm) horizontal and vertical
- Lateral blue beam displacement relative to converged red/green: ± 0.25 in (± 6.4 mm)
- Radial convergence (each beam): ± 0.37 in (± 9.4 mm)
- Maximum register correction: 0.005 in (0.13 mm) max

Limiting Circuit Values and Safety

To ensure stable operation and prevent damage, the following maximum circuit resistances must be maintained:

- **Grid-No. 3 Circuit Resistance:** 7.5 M Ω max
- **Effective Grid-No. 1-to-Cathode Circuit Resistance (each gun):** 0.75 M Ω max

X-Radiation Characteristics

The 19VBRP22 complies with safety standards regarding X-radiation. Under Design-Maximum ratings (anode voltage of 27.5 kV and anode current of 1000 μ A), X-radiation does not exceed 0.5 mR/h. The maximum anode voltage permitted to guarantee X-radiation levels at or below 0.5 mR/h at an anode current of 300 μ A is 33 kV.

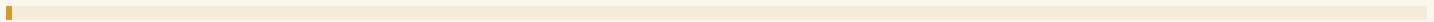
Qualitative Analysis of Characteristics and Curves

The performance and safety boundaries of the 19VBRP22 are illustrated by several key relationships:

- **Isodose-Rate Limit:** The 0.5 mR/h X-radiation boundary exhibits a downward slope, indicating that the maximum safe anode voltage decreases as the anode current increases. Specifically, the safe limit drops from 35 kV at 100 μ A to approximately 30.5 kV at 1100 μ A.
- **X-Radiation vs. Voltage:** At a constant anode current of 300 μ A, X-radiation emission increases sharply and non-linearly once the anode voltage exceeds 31 kV.
- **Drive Characteristics:** Both grid-drive and cathode-drive characteristics display a typical power-law increase of anode current per gun in response to the video signal voltage. These relationships are plotted across spot cutoffs ranging from 50 V to 200 V.
- **Cutoff Design Chart:** The relationship between Grid-No. 1-to-Cathode voltage (0 to -200 V) and Grid-No. 2-to-Cathode voltage (-120 to 1000 V) is bounded by linear minimum and maximum spot cutoff limits for any given gun.

Technical Summary

The **19VBRP22** is a 90° diagonal color picture tube featuring an ultra-rectangular 4x3 aspect ratio, a Hi-Lite Matrix Screen, and a P22 rare-earth/sulfide phosphor array. It utilizes a three-gun delta configuration with electrostatic bipotential focusing and magnetic deflection. Operating with a typical 6.3 V / 900 mA heater (or a 6.0 V active / 5.0 V standby configuration), it is rated for a maximum anode voltage of 27.5 kV and a long-term average anode current of 1000 μ A. The tube delivers a typical light output of 80 fL at 25 kV and is fully compliant with X-radiation safety limits under its Design-Maximum ratings.



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
Heater Voltage	6.3 V	Nominal heater voltage
Heater Current	900 mA	Nominal heater current
Phosphor	P22	Published phosphor designation
Capacitance Between Anode and External	2300 pF	Capacitance Between Anode and External 2300 max. pF
Minimum Screen Area (Projected)	186 sq in	Minimum Screen Area (Projected). . . . 186 sq in (1194 sq cml
Anode Current, Long-Term Averageb	1000 µA	Anode Current, Long-Term Averageb 1000 max. µA
Grid-No.3 (Focusing Electrode) Voltage	6000 V	Grid-No.3 (Focusing Electrode) Voltage 6000 max. V
Including Video Signal Voltage	1000 V	Including Video Signal Voltage 1000 max. V
Negative operating cutoff value	200 V	Negative operating cutoff value 200 max. V
For anode voltages between	27.5 kV	For anode voltages between 20 and 27.5 kV
/~" At Grid No.t voltage of	80–280 V	/~" At Grid No.t voltage of -75 V 80 to 280 V
At Grid No.1 voltage of -125 V	275–550 V	At Grid No.1 voltage of --125 V 275 to 550 V
At Grid No.i voltage of	365–820 V	At Grid No.i voltage of -175 V 365 to 820 V
voltage of	-100 V	voltage of -100 V) 1.86
Grid-No.1 Current	5 µA	Grid-No.1 Current +5 µA
Anode Voltage	25 kV	Anode Voltage 25 kV
ted within the Design-Maximum ratings	27.5 kV	ted within the Design-Maximum ratings: 27.5 kV anode voltage and

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
curve in Figure	2 A	curve in Figure 2. X-radiation at a constant anode voltage varies
tween	1 MΩ	tween 100 kilohms and 1 megohm. The surge voltage across the
heater must be limited to	9.5 V	heater must be limited to 9.5 volts rms.
~ OF SCREEN	8.5 deg	~ OF SCREEN 8.5° • S°
CURRENT OF	300 A	CURRENT OF 300 μA IX-RADIATION AT A CONSTANT
ANODE VOLTAGE – kV	37 %	ANODE VOLTAGE — kV 91L5.37%XI
NEATER VOLTAGE ~	6.3 V	NEATER VOLTAGE ~ 6.3 V
HEATER VOLTAGE	8.3 V	HEATER VOLTAGE - 8.3 V
ANODE-TO--GRID No.t VOLTAGE	27.6 kV	ANODE-TO--GRID No.t VOLTAGE - 20 m 27.6 kV
HEATER VOLTAGE =	8.3 V	HEATER VOLTAGE = 8.3 V
ANODE—TO—CATHODE VOLTAGE ~	20–27.5 kV	ANODE—TO—CATHODE VOLTAGE ~ 20 TO 27.5 kV
GRID—No.1-10~ATNODE VOLTAGE – V	-10 V	GRID—No.1-10~ATNODE VOLTAGE — V

CONSTRUCTION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Focusing Method	Electrostatic	Published focusing method
Deflection Method	Magnetic	Published deflection method

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Voltage	6.3 V	Voltage 6.3 V
Current	900 mA	Current 900 mA

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid No.t of any gun to all other electrodes	6 pF	Grid No.t of any gun to all other electrodes 6 pF
Grid No.3 to all other electrodes	6.5 pF	Grid No.3 to all other electrodes 6.5 pF
All cathodes to ell other electrodes	15 pF	All cathodes to ell other electrodes 15 pF
Conductive Coating ~	1800 pF	Conductive Coating ~ 1800 min. pF

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