

ELECTRONIC TUBE REFERENCE

# 16BAP4

Specialized - Cathode Ray electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION  
CONSTRUCTION  
CATHODERAY

Sixteen-inch P4 direct-view picture tube with high-voltage anode operation. National Video specifies roughly 12-18 kV anode range, about 15 kV typical, together with an external conductive coating and adjustable focusing electrode.

## GENERAL CHARACTERISTICS

|                     |                   |                      |               |
|---------------------|-------------------|----------------------|---------------|
| BASE DESIGNATION    | B7-208            | BASE PINS            | —             |
| NOMINAL HEATER      | 6.3 V / 600 mA    | PARALLEL HEATER      | — / —         |
| HEATING             | Indirect          | SERIES OPERATION     | Not specified |
| CATHODE ARRANGEMENT | Separate cathodes | SECTION CONSTRUCTION | Similar       |

## SECTION RATINGS

|                                                                                                |
|------------------------------------------------------------------------------------------------|
| SECTION1 Cathode Ray                                                                           |
| No fixed ratings recorded.                                                                     |
| CRT maximum anode voltage 18000 V; CRT-specific electrode ratings retained in parameter table. |

## 16BAP4 Television Picture Tube

### Overview

The **16BAP4** is a 16-inch, 114-degree lightweight cathode-ray tube (CRT) designed primarily for television receiver applications. It features a space-saving design with a short 4 3/8-inch neck length and is laminated with a protective Pittsburgh facepanel. The tube incorporates an electrostatic focusing system and a straight electron gun that does not require an external ion trap magnet. Optimized for cathode-drive circuitry, the 16BAP4 is designed to operate with a low Grid No. 2 potential of 50 volts, simplifying the associated video output stage design. Its electrical system is powered by a 6.3-volt, 600-milliampere filament.

## Mechanical and Optical Construction

The 16BAP4 is built using a lightweight glass envelope with a J125 A1 A (or equivalent FP125 A1) bulb designation. The physical dimensions of the tube are highly compact for its screen size, featuring an overall length of  $10 \frac{11}{16} \pm \frac{5}{16}$  inches and a neck length of  $4 \frac{3}{8} \pm \frac{1}{8}$  inches.

The external dimensions of the bulb assembly, measured at the mold-match line, are:

- **Diagonal:**  $15 \frac{5}{8} \pm \frac{1}{8}$  inches
- **Width:**  $13 \frac{23}{32} \pm \frac{1}{8}$  inches
- **Height:**  $11 \frac{3}{32} \pm \frac{1}{8}$  inches

The screen utilizes a JEDEC P4-Aluminized phosphor, which provides a bright, high-contrast white display suitable for television pictures. The light transmittance at the center of the facepanel is approximately 59%. The projected minimum useful screen dimensions are:

- **Diagonal:**  $14 \frac{7}{8}$  inches
- **Horizontal Axis:**  $12 \frac{15}{16}$  inches
- **Vertical Axis:**  $10 \frac{1}{4}$  inches
- **Total Useful Area:** 125 square inches

The electrical connection to the high-voltage anode (ultor) is made via a recessed small cavity cap (JEDEC designation J1-21) located on the funnel of the bulb. This contact is aligned with pin position No. 4 within an angular tolerance of  $\pm 30$  degrees, placing the ultor terminal on the same side of the neck as pin No. 4.

## Electrical Connections, Basing, and Capacitances

The tube utilizes a JEDEC 8HR base with a B7-208 JEDEC basing configuration, also described as a Small Button Neoeightar 7-pin base arrangement. The pin connections, viewed from the bottom of the base, are assigned as follows:

| Pin   | Connection                                |
|-------|-------------------------------------------|
| Pin 1 | Heater                                    |
| Pin 2 | Grid No. 1                                |
| Pin 3 | Grid No. 2                                |
| Pin 4 | Grid No. 4 (Focusing Electrode)           |
| Pin 6 | Grid No. 1                                |
| Pin 7 | Cathode                                   |
| Pin 8 | Heater                                    |
| Cap   | Ultor (Grid No. 3, Grid No. 5, Collector) |

To prevent mechanical stress on the glass-to-metal seals, the associated socket must not be rigidly mounted. It should feature flexible leads and be allowed to move freely so that the wiring does not exert lateral forces on the base pins. The bottom circumference of the base wafer is designed to fit within a 1 3/4-inch diameter circle concentric with the bulb axis.

## Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 16BAP4 are relatively low, minimizing loading on the drive circuitry:

- **Cathode to all other electrodes:** approximately 5  $\mu\text{F}$
- **Grid No. 1 to all other electrodes:** approximately 6  $\mu\text{F}$
- **External conductive coating to Anode:** 1000  $\mu\text{F}$  minimum, 1500  $\mu\text{F}$  maximum

The external conductive coating must be connected to a reliable system ground, as it forms a high-voltage filter capacitor in conjunction with the internal anode coating. To maintain the insulating properties of the non-coated glass areas, they should only be cleaned by wiping with a soft, dry, lint-less cloth.

## Heater Characteristics and Calculations

The heater is designed for operation from a nominal 6.3-volt supply.

- **Nominal heater voltage:** 6.3 V
- **Heater current at 6.3 Volts:**  $600 \pm 30 \text{ mA}$
- **Heater warm-up time:** 11 seconds
- **Calculated heater power:** 3.78 Watts (derived from the calculation: 6.3 Volts  $\times$  0.6 Amperes)

## Deflection and Focusing Systems

The 16BAP4 employs electrostatic focusing, where the focusing electrode (Grid No. 4) is operated at a relatively low voltage to focus the electron beam onto the phosphor screen. Wide-angle magnetic deflection is used to sweep the beam across the screen, with approximate deflection angles of:

- **Horizontal:** 103 degrees
- **Vertical:** 87 degrees
- **Diagonal:** 114 degrees

The straight electron gun design eliminates the need for an ion trap magnet, simplifying receiver setup and alignment.

## Design-Maximum Ratings

The ratings of the 16BAP4 are established under the Design-Maximum System. Unless otherwise specified, all voltage values are positive and measured with respect to Grid No. 1.

| Parameter                               | Minimum Value | Maximum Value |
|-----------------------------------------|---------------|---------------|
| Anode Voltage                           | 12,000 V      | 18,000 V      |
| Grid No. 4 (Focusing Electrode) Voltage | -500 V        | +1100 V       |
| Grid No. 2 Voltage                      | 25 V          | 60 V          |
| Cathode Voltage (DC)                    | 0 V           | 100 V         |
| Cathode Voltage (Peak Positive)         | —             | 150 V         |
| Cathode Voltage (Peak Negative)         | —             | 2 V           |
| Heater Voltage                          | 5.8 V         | 6.9 V         |
| Grid No. 1 Circuit Resistance           | —             | 1.5 MΩ        |

## Heater-Cathode Voltage Ratings

The heater-to-cathode insulation is rated to withstand significant potential differences, which vary depending on the operating state:

- **Heater negative with respect to cathode:**
  - During the equipment warm-up period (not to exceed 15 seconds): **450 Volts** maximum
  - After the equipment warm-up period: **200 Volts** maximum
- **Heater positive with respect to cathode: 200 Volts** maximum

## Typical Operating Conditions (Cathode Drive Service)

In typical cathode-drive applications, the video signal is applied to the cathode while Grid No. 1 is held at a reference potential. Under these conditions, all voltages are specified as positive with respect to Grid No. 1:

- **Anode Voltage:** 15,000 Volts DC
- **Grid No. 2 Voltage:** 50 Volts DC
- **Grid No. 4 (Focusing Electrode) Voltage:** 250 Volts DC
- **Cathode Voltage (for visual extinction of focused raster):** 35 to 55 Volts DC

The focusing electrode voltage of 250 Volts is a typical value. Individual tubes will exhibit satisfactory focus at some value between 0 and 400 Volts when the combined Grid No. 1 bias and video-signal voltage are adjusted to produce an anode current of 100 microamperes. This focus characteristic is evaluated on a 12 5/16-inch by 10 1/4-inch raster pattern, such as that produced by a standard monoscope signal source.

## Technical Summary

The **16BAP4** is a specialized 16-inch television picture tube utilizing a 114-degree magnetic deflection angle and electrostatic focusing. Its design is optimized for compact, lightweight television receivers, featuring a short 4 3/8-inch neck, a laminated Pittsburgh facepanel, and a straight electron gun requiring no ion trap. Operating with a nominal 6.3-volt, 600-milliampere heater, the tube is tailored for cathode-drive service with a low Grid No. 2 rating of 50 volts. By providing a 125-square-inch viewing area in a highly compact physical envelope, the 16BAP4 represents an efficient solution for mid-sized television displays of its era.

## SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

# 1956 National Video

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

## 1956 NATIONAL VIDEO

## Section 1 · Cathode Ray

| OTHER                                              |                 |                                                         |
|----------------------------------------------------|-----------------|---------------------------------------------------------|
| PARAMETER                                          | PUBLISHED VALUE | CONDITION / NOTE                                        |
| no ion trap and                                    | 50 V            | no ion trap and 50 volt Gz for cathode drive design.    |
| Cathode to all other electrodes, approximate       | 5 pF            | Cathode to all other electrodes, approximate 5 uuf      |
| Grid # [1]                                         | 1 pF            | Grid #1 to all other electrodes, approximate 6 uuf      |
| Grid # [2]                                         | 6 pF            | Grid #1 to all other electrodes, approximate 6 uuf      |
| External Conductive Coating to Anode               | 1500 pF         | External Conductive Coating to Anode 1500 max. uuf      |
| Heater Current at [1]                              | 6.3 V           | Heater Current at 6.3 Volts 600 + 30ma                  |
| Heater Current at [2]                              | 600 V           | Heater Current at 6.3 Volts 600 + 30ma                  |
| Heater Current at [3]                              | 30 V            | Heater Current at 6.3 Volts 600 + 30ma                  |
| Heater Warm-up Time                                | 11              | Heater Warm-up Time 11 Seconds                          |
| Light Transmittance at Center, Approximate         | 59              | Light Transmittance at Center, Approximate 59%          |
| and measured with respect to Grid #                | 1               | and measured with respect to Grid #1                    |
| Maximum Anode Voltage                              | 18000 V         | Maximum Anode Voltage 18,000 Volts                      |
| Minimum Anode Voltage                              | 12000 V         | Minimum Anode Voltage 12,000 Volts                      |
| Maximum Grid #U (Focusing Electrode) Voltage + [1] | 1100 V          | Maximum Grid #U (Focusing Electrode) Voltage +1100 -500 |
| Maximum Grid #U (Focusing Electrode) Voltage + [2] | -500 V          | Maximum Grid #U (Focusing Electrode) Voltage +1100 -500 |
| Maximum Grid # [1]                                 | 2 V             | Maximum Grid #2 Voltage 60 Volts                        |
| Maximum Grid # [2]                                 | 60 V            | Maximum Grid #2 Voltage 60 Volts                        |

| PARAMETER                               | PUBLISHED VALUE | CONDITION / NOTE                                         |
|-----------------------------------------|-----------------|----------------------------------------------------------|
| Minimum Grid # [1]                      | <b>2 V</b>      | Minimum Grid #2 Voltage 25 Volts                         |
| Minimum Grid # [2]                      | <b>25 V</b>     | Minimum Grid #2 Voltage 25 Volts                         |
| Maximum Heater Voltage                  | <b>6.9 V</b>    | Maximum Heater Voltage 6.9 Volts                         |
| Minimum Heater Voltage                  | <b>5.8 V</b>    | Minimum Heater Voltage 5.8 Volts                         |
| During warm-up period not to exceed [1] | <b>15 V</b>     | During warm-up period not to exceed 15 seconds 450 Volts |
| During warm-up period not to exceed [2] | <b>450 V</b>    | During warm-up period not to exceed 15 seconds 450 Volts |
| After equipment warm-up period          | <b>200 V</b>    | After equipment warm-up period 200 Volts                 |
| Heater positive with respect to cathode | <b>200 V</b>    | Heater positive with respect to cathode 200 Volts        |
| positive with respect to Grid #         | <b>1</b>        | positive with respect to Grid #1.                        |
| Anode Voltage                           | <b>15000 V</b>  | Anode Voltage 15,000 Volts DC                            |
| Grid #                                  | <b>4 V</b>      | Grid #4 Voltage (Focusing Electrode)                     |
| Grid # [1]                              | <b>2 V</b>      | Grid #2 Voltage 50 Volts DC                              |
| Grid # [2]                              | <b>50 V</b>     | Grid #2 Voltage 50 Volts DC                              |
| Cathode Voltage (Note [1])              | <b>1 V</b>      | Cathode Voltage (Note 1) 35 to 55 Volts DC               |
| Cathode Voltage (Note [2])              | <b>35 V</b>     | Cathode Voltage (Note 1) 35 to 55 Volts DC               |
| Cathode Voltage (Note [3])              | <b>55 V</b>     | Cathode Voltage (Note 1) 35 to 55 Volts DC               |
| Maximum Grid # [1]                      | <b>1</b>        | Maximum Grid #1 Circuit Resistance 1.5 Megohms           |
| Maximum Grid # [2]                      | <b>1.5</b>      | Maximum Grid #1 Circuit Resistance 1.5 Megohms           |
| Pin [1]                                 | <b>1</b>        | Pin 1 Heater Pin 6 Grid No. 1                            |
| Pin [2]                                 | <b>6</b>        | Pin 1 Heater Pin 6 Grid No. 1                            |
| Pin [3]                                 | <b>1</b>        | Pin 1 Heater Pin 6 Grid No. 1                            |
| Pin [1]                                 | <b>2</b>        | Pin 2 Grid No. 1 Pin 7 Cathode                           |
| Pin [2]                                 | <b>1</b>        | Pin 2 Grid No. 1 Pin 7 Cathode                           |
| Pin [3]                                 | <b>7</b>        | Pin 2 Grid No. 1 Pin 7 Cathode                           |
| Pin [1]                                 | <b>3</b>        | Pin 3 Grid No. 2 Pin 8 Heater                            |
| Pin [2]                                 | <b>2</b>        | Pin 3 Grid No. 2 Pin 8 Heater                            |
| Pin [3]                                 | <b>8</b>        | Pin 3 Grid No. 2 Pin 8 Heater                            |
| Pin [1]                                 | <b>4</b>        | Pin 4 Grid No. 4                                         |

| PARAMETER                            | PUBLISHED VALUE | CONDITION / NOTE                                                   |
|--------------------------------------|-----------------|--------------------------------------------------------------------|
| Pin [2]                              | <b>4</b>        | Pin 4 Grid No. 4                                                   |
| Published value [1]                  | <b>2</b>        | 2(3) (6)°! - IPIN4 GRID                                            |
| Published value [2]                  | <b>3</b>        | 2(3) (6)°! - IPIN4 GRID                                            |
| Published value [3]                  | <b>6</b>        | 2(3) (6)°! - IPIN4 GRID                                            |
| FIN4: GRID NO                        | <b>4</b>        | FIN4: GRID NO.4                                                    |
| CAP ULTOR (GRID NO                   | <b>3</b>        | CAP ULTOR (GRID NO.3 GRIDNO.S                                      |
| Published value                      | <b>1</b>        | 1. Visual extinction of focused raster.                            |
| Published value [1]                  | <b>2 V</b>      | 2. With the combined grid #1 bias voltage and video-signal voltage |
| Published value [2]                  | <b>1 V</b>      | 2. With the combined grid #1 bias voltage and video-signal voltage |
| adjusted to give an anode current of | <b>100 A</b>    | adjusted to give an anode current of 100 microamperes on a         |
| Published value                      | <b>3</b>        | 3. Individual tubes will have satisfactory focus at some value     |

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