

ELECTRONIC TUBE REFERENCE

CONSOLIDATED TECHNICAL DATA

10KP7

Specialized - Cathode Ray electronic tube

1 SECTION
CONSTRUCTION
CATHODERAY

Magnetically focused and deflected P7 cathode-ray display tube with blue-white fluorescence and long yellow phosphorescence, approximately 50-degree deflection, and typical 9 kV anode operation.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	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.
Cathode-ray display/electron-gun section.

10KP7 — Magnetically Focused and Deflected Cathode-Ray Tube

Overview

The **10KP7** is a 10-inch, direct-viewed, round glass cathode-ray tube (CRT) designed primarily for radar indicators, oscillographs, and specialized display systems requiring long image persistence. It features magnetic focusing and magnetic deflection with a nominal deflection angle of approximately 50 degrees. The tube incorporates a spherical faceplate made of gray filter glass to enhance contrast and uses the long-persistence Phosphor No. 7 (P7).

The 10KP7 family includes the standard **10KP7**, as well as the **10KP7A** and **10KP7B** variants. While the standard 10KP7 and **10KP7A** utilize non-aluminized screens, the **10KP7B** is an aluminized version. Additionally, the **10KP7A** and **10KP7B** are high-resolution types.

Mechanical Construction and Physical Dimensions

The 10KP7 is constructed with a round glass bulb (J-84, J84C, or J84D) and a spherical faceplate. The faceplate is composed of gray filter glass with a light transmittance of approximately 76% to 77%, which improves viewing under ambient light conditions.

The physical dimensions and mechanical characteristics of the tube are:

- **Overall Length:** 17-5/8 inches $\pm$ 3/8 inch
- **Greatest Diameter of Bulb:** 10-1/2 inches $\pm$ 1/8 inch (with a maximum diameter at the seal of 10-5/8 inches)
- **Minimum Useful Screen Diameter:** 9 inches
- **Weight:** Approximately 9 to 10 pounds
- **Operating Position:** Any

Installation and Support

For proper installation, the socket should not be rigidly mounted; instead, it must have flexible leads and allow free movement. The tube support structure must be kept at least 2 inches away from the high-voltage anode (ultor) cap to prevent electrical breakdown or corona discharge.

Base, Pinout, and Electrical Connections

The tube utilizes a small-shell duodecal base, which can be either a 5-pin (B5-57) or 7-pin (B7-51) configuration, adhering to the **12D** basing arrangement. High-voltage anode connection is made via a recessed small cavity cap (J1-21) located on the side of the bulb. This bulb contact aligns with the vacant pin position No. 3 within $\pm$ 10 degrees, on the same side of the bulb as pin position No. 3.

Pin Connection Table (Basing 12D)

Viewed from the bottom, the pin connections are assigned as follows:

Pin / Cap	Connection	Description
Pin 1	H	Heater
Pin 2	G1	Grid No. 1 (Control Grid)
Pin 10	<u>G2</u>	Grid No. 2 (Screen Grid)
Pin 11	K	Cathode
Pin 12	H	Heater

Pin / Cap	Connection	Description
Cap	A / Ultor	Anode (Grid No. 3, Collector)

Heater Ratings

The heater is designed for either AC or DC operation:

- **Heater Voltage:** 6.3 Volts
- **Heater Current:** 0.6 $\pm$ 10% Ampere

Interelectrode Capacitances

The direct interelectrode capacitances are approximately:

- **Cathode to all other electrodes:** 5 pF
- **Grid No. 1 to all other electrodes:** 6 to 8 pF (with specific measurements of 6 pF, 6.5 pF, or 8 pF depending on the variant and test conditions)

Screen and Phosphor Characteristics

The 10KP7 utilizes **Phosphor No. 7 (P7)**, which is a cascade-type screen designed for radar applications where a long-persistence image is required to track targets between antenna scans.

- **Fluorescence (Primary emission):** Blue or Blue-White
- **Phosphorescence (Secondary emission):** Yellow or Greenish-Yellow
- **Persistence:** Long

The non-aluminized screen of the 10KP7 and [10KP7A](#) provides standard long-persistence characteristics, whereas the aluminized screen of the [10KP7B](#) offers increased brightness and protection against ion burn.

Absolute Maximum Ratings

The maximum ratings are defined under the design-center system. Operating the tube beyond these limits may cause permanent damage or shorten its operating life.

Parameter	10KP7	10KP7A	10KP7B
Anode / Ultor Voltage (Max)	10,000 V to 11,000 V DC	11,000 V DC	13,200 V DC
Grid No. 2 Voltage (Max)	700 V to 770 V DC	770 V DC	770 V DC
Grid No. 1 Negative Bias (Max)	180 V to 200 V DC	200 V DC	200 V DC

Parameter	10KP7	<u>10KP7A</u>	<u>10KP7B</u>
Grid No. 1 Positive Bias (Max)	0 V DC	0 V DC	0 V DC
Grid No. 1 Positive Peak (Max)	2 V	2 V	2 V
Peak Grid No. 1 Drive from Cut-off	65 V	—	—
Grid No. 1 Circuit Resistance (Max)	1.5 MΩ	1.5 MΩ	1.5 MΩ

Peak Heater-Cathode Voltage Ratings

The maximum allowable voltage between the heater and cathode varies by variant:

- **10KP7:** 140 V (or 125 V in some design-center specifications), heater either positive or negative with respect to the cathode.
- **10KP7A:** 200 V, heater either positive or negative with respect to the cathode.
- **10KP7B:**
 - Heater negative with respect to cathode (during warm-up ≤ 15 seconds): 450 V
 - Heater negative with respect to cathode (after warm-up): 200 V
 - Heater positive with respect to cathode: 200 V

Anode Input Power Limit

To protect the screen from damage at or near the maximum anode voltage rating, the effective resistance of the anode supply must limit the anode input power to a maximum of **6 Watts**.

Typical Operating Conditions and Equipment Design Ranges

The 10KP7 operates typically with an anode voltage of 9,000 V DC. While the tube can operate at lower anode voltages, brilliance and definition decrease significantly. The minimum recommended anode voltage is 5,000 V for the 10KP7 and 10KP7A, and 7,000 V for the 10KP7B.

Typical Operating Point

- **Anode (Ultor) Voltage:** 9,000 Volts DC
- **Grid No. 2 Voltage:** 250 Volts DC
- **Grid No. 1 Voltage (for visual extinction of undeflected focused spot):** -27 to -63 Volts DC
- **Focusing Coil Current:** Approximately 105 to 112 mA DC ($\pm 15\%$)
 - *Focusing Conditions:* Measured using a JEDEC standard focus coil No. 106 (or equivalent), with the center of the air gap positioned 3.25 inches from the reference line, and Grid No. 1 voltage

adjusted to produce an anode current of 200 uA.

- **Line Width A (10KP7A, 10KP7B):** 0.38 mm Maximum (measured per MIL-E-1 at an anode current of 200 uA).

Equipment Design Ranges

For equipment design, when the Ultor Voltage (Ec3) is between 7,000 V and 10,000 V, and the Grid No. 2 Voltage (Ec2) is between 150 V and 700 V, the following design ranges apply:

- **Grid No. 1 Voltage for Visual Extinction:** -10.8% to -25.2% of the Grid No. 2 Voltage (Ec2).
- **Grid No. 2 Current:** -15 to +15 uA.
- **Focusing Coil Current (DC):** Calculated as $[\sqrt{\text{Ec3} / 7000} * 99] \pm 15\%$ mA (using a specimen coil similar to JEDEC No. 106).
- **Spot Position:** The center of the undeflected, unfocused spot falls within an 18-mm radius circle concentric with the center of the tube face.

Focusing Coil Current Calculation

For an Ultor voltage (Ec3) of 9,000 V, the nominal focusing coil current is calculated using the formula:

Current = $\sqrt{\frac{9000}{7000}} \times 99 \approx 1.1339 \times 99 \approx 112.26$ mA Applying the $\pm 15\%$ tolerance yields a design range of approximately 95 mA to 129 mA.

Grid No. 1 Cutoff Voltage Calculation

For a Grid No. 2 voltage (Ec2) of 250 V, the cutoff voltage range is calculated as:

- Minimum: $250 \text{ V} * -10.8\% = -27 \text{ V}$
- Maximum: $250 \text{ V} * -25.2\% = -63 \text{ V}$ This matches the typical operating range of -27 to -63 V DC.

Design Range Examples

1. Example 1 (Low Voltage):

- Ultor Voltage: 7,000 V
- Grid No. 2 Voltage: 250 V
- Grid No. 1 Cutoff Voltage: -27 to -63 V
- Focusing Coil Current: $99 \pm 15\%$ mA

2. Example 2 (Standard Voltage):

- Ultor Voltage: 9,000 V
- Grid No. 2 Voltage: 250 V
- Grid No. 1 Cutoff Voltage: -27 to -63 V
- Focusing Coil Current: $112 \pm 15\%$ mA

Operational Characteristics and Curves

The relationship between grid drive and anode current is non-linear. The average characteristics curve shows that with a Grid No. 2 voltage of 250 V and the accelerator voltage set between 7,000 V and 10,000

V, the anode current begins to rise above 0 uA near -30 V on Grid No. 1 (when biased to cutoff). It increases exponentially, reaching approximately 900 to 1,000 uA as the Grid No. 1 voltage approaches 0 V.

The average grid-drive characteristics also map highlight brightness against peak Grid No. 1 drive from spot cutoff. For a raster of 14x14 cm at an Ultor voltage of 9,000 V and Grid No. 2 voltage of 250 V, the highlight brightness rises steeply with grid drive, reaching approximately 100 foot-lamberts at about 45 V of drive.

Safety and Installation Considerations

When operating the 10KP7, safety precautions regarding high voltage and radiation must be observed:

- **X-ray Radiation:** The tube may produce X-rays when operated. Adequate shielding may be necessary if the tube is operated above its maximum rated anode voltage or above 16,000 Volts, whichever is lower.
- **High Voltage:** The anode cap carries lethal voltages up to 13,200 V DC depending on the variant. Proper insulation and physical clearance must be maintained.

Related Designations and Comparisons

The 10KP7 is related in design and application to other magnetically focused and deflected radar CRTs, such as the 5-inch **5FP-**, 7-inch **7BP-**, and 12-inch **12SP-** series. However, these types differ in screen size, deflection angles, and electrical ratings, and are not direct drop-in replacements.

Technical Summary

The **10KP7** is a magnetically focused and deflected cathode-ray tube featuring a 10-inch round glass envelope, a 50-degree deflection angle, and a long-persistence Phosphor No. 7 screen. It operates with a 6.3 V, 0.6 A heater and requires an anode voltage of up to 11,000 V DC (13,200 V DC for the aluminized [10KP7B](#)). Designed for radar and oscillograph applications, it provides high-contrast displays via its gray filter glass faceplate. Proper installation requires flexible socket mounting, adequate clearance from the high-voltage anode cap, and adherence to anode input power limits to prevent screen damage.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1960 Du Mont

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

1960 DU MONT

Section 1 · Cathode Ray

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage	6.3 V	—
Heater Current	600 mA	—
Focusing Method	Magnetic text	—
Deflection Method	Magnetic text	—
Phosphor	P7 text	—
Fluorescence	Blue/white text	—
Persistence	Long text	—
Deflection Angle	50 deg	Approximate



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1965 Sylvania Electronic Tubes Vol3

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

1965 SYLVANIA ELECTRONIC TUBES VOL3

Section 1 · Cathode Ray

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage	6.3 V	—
Heater Current	600 mA	—
Focusing Method	Magnetic text	—
Deflection Method	Magnetic text	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Deflection Angle	50 deg	Approximate
Phosphor	P7 text	—
Fluorescence	Blue-White text	—
Phosphorescence	Yellow text	—
Persistence	Long text	—
Screen Aluminized	No text	—
High Resolution	No text	—
Light Transmittance	77 percent	Approximate
Cathode-to-All Capacitance	5 pF	Approximate
Grid1-to-All Capacitance	8 pF	Approximate
Maximum Line Width	0.38 mm	10KP7A/10KP7B

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Anode Voltage	11000 V	—
Maximum Grid2 Voltage	770 V	—
Maximum Grid1 Negative Bias	200 V	—
Maximum Grid1 Positive Peak	2 V	—
Anode Voltage	9000 V	—
Grid2 Voltage	250 V	—
Grid1 Cutoff Voltage Minimum	-53 V	—
Grid1 Cutoff Voltage Maximum	-27 V	—
Focusing Coil Current	112 mA	Approximate; ±15%
Maximum Grid1 Circuit Resistance	1.5 Mohm	—

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