



ELECTRONIC TUBE REFERENCE

10AKP7

Specialized - Cathode Ray electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
CATHODERAY

Magnetically focused and deflected P7 cathode-ray display tube with blue-white fluorescence and long yellow phosphorescence, typically operated at about 8 kV anode voltage.

GENERAL CHARACTERISTICS

BASE DESIGNATION	12D	BASE PINS	2
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	
AMPLIFICATION FACTOR	9
<i>Values promoted from published ratings/characteristics where identifiable.</i>	

10AKP7 — High-Resolution Cathode Ray Tube

The **10AKP7** is a 10-inch round glass, magnetic-focus and magnetic-deflection cathode ray tube designed for applications requiring high resolution, a small spot size, excellent depth of focus, and a long-persistence display. It is primarily employed in radar indicators and oscillographs. The tube features a spherical faceplate made of gray glass and an aluminized screen utilizing the P7 phosphor.

Overview

The 10AKP7 is characterized by its high-resolution electron gun capabilities, which provide a smaller spot size and superior depth of focus. It is documented by manufacturers such as Raytheon and Sylvania. Sylvania notes that the tube can also be supplied with alternative screen phosphors under the broader **10AKP-** designation.

Construction and Mechanical Specifications

The 10AKP7 is constructed with a round glass bulb designated as **J84C** (ASA designation) and features a gray glass faceplate with an approximate light transmission of **76% to 77%** at the center. The screen is aluminized and utilizes a **P7 phosphor**, which provides a long-persistence characteristic. The fluorescence of this phosphor is blue-white, and its phosphorescence is yellow.

Physical Dimensions

The physical envelope of the tube is defined by the following dimensions:

- **Overall Length:** Sylvania specifies a nominal length of **17 13/16 ± 3/16 inches**, while Raytheon lists **17 5/8 ± 3/8 inches**.
- **Bulb Diameter:** **10 1/2 ± 1/16 inches** maximum, with a minimum useful screen diameter of **9 inches**.
- **Neck Diameter:** **1 7/16 ± 1/16 inches**.
- **Deflection Angle:** Approximately **50 degrees**.

The reference line of the tube is determined by the plane where a standard **JEDEC No. 112** reference-line gauge seats against the bulb cone. The distance from this reference line to the seal line is **9 7/16 ± 3/16 inches**. The distance from the reference line to the base is specified as **8 3/16 ± 3/16 inches** by Raytheon and **8 3/8 inches nominal** by Sylvania.

Base and Terminal Connections

The tube uses a **Small-shell Duodecal 5-pin base (JEDEC No. B5-57)** or a **Small-shell Duodecal 7-pin base (JEDEC No. B7-51)**, with a **12D** JEDEC basing designation. The high-voltage anode connection is made via a recessed small-cavity cap (**JEDEC No. J1-21**) located on the cone of the bulb. This anode contact is aligned with the vacant pin position No. 3 within ±10 degrees.

The terminal connections are assigned as follows:

Pin / Cap	Connection
Pin 1	Heater
Pin 2	Grid No. 1
Pin 10	Grid No. 2
Pin 11	Cathode
Pin 12	Heater
Cap	Grid No. 3, Anode

The tube can be mounted in **any position**.

Heater and Electrical Ratings

The 10AKP7 operates with an indirectly heated cathode. The heater requirements and electrical limits are defined under two rating systems: Raytheon's **Design Center Maximum Ratings** and Sylvania's **Absolute Maximum Ratings**.

Heater Characteristics

- **Heater Voltage:** 6.3 Volts
- **Heater Current:** $0.6 \pm 10\%$ Ampere
- **Cathode Connection:** The cathode should be returned to the center tap or to one side of the heater transformer winding.

Direct Interelectrode Capacitances

The approximate direct interelectrode capacitances of the tube are:

- **Cathode to all other electrodes:** 5 μf (pF)
- **Grid No. 1 to all other electrodes:** 8 μf (pF)

Maximum Ratings Comparison

The maximum ratings differ depending on the rating system applied by the manufacturer:

Parameter	Design Center Max (Raytheon)	Absolute Max (Sylvania)
Anode Voltage (Grid No. 3)	10,000 V DC	11,000 V DC
Grid No. 2 Voltage	1,000 V DC	1,100 V DC
Grid No. 1 Negative Bias Value	180 V DC	200 V DC
Grid No. 1 Positive Bias Value	0 V DC	0 V DC
Grid No. 1 Positive Peak Value	2 V	2 V
Peak Grid No. 1 Drive from Cutoff	65 V	65 V
Heater-Cathode Voltage (Heater Negative to Cathode)	180 V	200 V
Heater-Cathode Voltage (Heater Positive to Cathode)	180 V	200 V

Raytheon notes that its Design Center ratings incorporate a **10% safety factor**. Under this system, if the maximum design-center values are not exceeded by more than 10%, the tube can sustain the combined effects of line voltage and component variation.

Typical Operating Conditions and Characteristics

For typical operation, both manufacturers specify an anode voltage of **8,000 Volts DC** and a Grid No. 2 voltage of **700 Volts DC**. Under these conditions, the operating parameters are:

- **Anode Voltage:** 8,000 Volts DC. In general, the anode voltage should not be less than 5,000 Volts, as decreasing anode voltage results in a reduction of both brightness and focus quality.
- **Grid No. 2 Voltage:** 700 Volts DC.
- **Grid No. 1 Voltage Required for Cutoff:** Raytheon lists this range as **-20 to -80 Volts DC**, while Sylvania lists it as **-35 to -80 Volts DC** (for visual extinction of an undeflected focused spot).
- **Focusing Coil Current:** Approximately **105 mA DC** when using a JEDEC/RETMA No. 106 focusing coil positioned such that the distance from the yoke reference line to the center of the air gap is **3 1/4 inches**.
- **Line Width: 0.30 mm maximum**, measured in accordance with MIL-E-1, paragraph 4.12.6.2, at an anode current of 200 μ A.
- **Spot Position (Undeflected):** Raytheon specifies that the center of the unfocused, undeflected spot will fall within an **18 mm circle** concentric with the tube face. Sylvania specifies that it will fall within a circle of **18 mm radius** concentric with the tube face.
- **Maximum Grid No. 1 Circuit Resistance: 1.5 Megohms.**

Operational Precautions and Safety

Because the 10AKP7 operates at high voltages, Sylvania provides an explicit warning regarding X-ray radiation.

X-Ray Radiation Warning

X-ray radiation shielding may be necessary to protect against possible danger of personal injury from prolonged exposure at close range if the tube is operated at voltages higher than the manufacturer's Maximum Rated Anode Voltage or **16,000 volts**, whichever is less.

Technical Summary

The **10AKP7** is a high-resolution, 10-inch round glass cathode ray tube featuring magnetic focus, magnetic deflection (50-degree deflection angle), and a long-persistence P7 aluminized screen. Operating with a standard **6.3 V, 0.6 A** heater, it is optimized for radar indicators and oscillographs where high resolution, small spot size, and deep focus are critical. Typical operating conditions utilize an anode voltage of **8,000 V DC** and a Grid No. 2 voltage of **700 V DC**, with a Grid No. 1 cutoff voltage ranging from **-20 V to -80 V DC** (or **-35 V to -80 V DC** depending on the specification standard). The tube is housed in a J84C bulb with a small-shell Duodecal base and a J1-21 anode cap, and it can be operated in any mounting position.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1938 Raytheon

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

1938 RAYTHEON

Section 1 · Cathode Ray

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heoter Yoltage	6.3 volts	Heoter Yoltage 6.3 volts
Anode Voltage Grid #	0 volts	Anode Voltage Grid #3 10,000 volts DC max.
Grid	1000 volts	Grid 2 Voltage 1000 volts DC max.
Negative Bias Value	180 volts	Negative Bias Value 180 volts DC max.
Positive Bias Value	0 volts	Positive Bias Value 0 volts DC max.
Positive Peak Value	2 volts	Positive Peak Value 2 volts max.
Peak Grid #	65 volts	Peak Grid #1 Drive from Cutoff 65 volts max.
Heater Negative with Respect to Cathode	180 volts	Heater Negative with Respect to Cathode 180 volts max.
Heater Positive with Respect to Cathode	180 volts	Heater Positive with Respect to Cathode 180 volts max.
Note	5000 volts	Note 3: Anode voltage, in general, should not be less than 5000 volts. With decreasing anode voltage, brightness and focus quality decrease.

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode Voltage (Note	8000 volts	Anode Voltage (Note 3) 8000 volts DC
Grid #	700 volts	Grid #2 Voltage 700 volts DC
Grid #	80 volts	Grid #1 Voltage (Note 4) —20 to ~80 volts DC
Focusing~Coil Current, Approx. (Note	105 mAdc	Focusing~Coil Current, Approx. (Note 5) 105 mAdc

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	—
Phosphor	P7 text	—
Fluorescence	Blue-White text	—
Phosphorescence	Yellow text	—
Persistence	Long text	—
Maximum Line Width	0.3 mm	—
Maximum Undelected Spot Radius	18 mm	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Anode Voltage	11000 V	—
Maximum Grid2 Voltage	1100 V	—
Maximum Grid1 Negative Bias	200 V	—
Maximum Grid1 Positive Peak	2 V	—
Maximum Peak Grid1 Drive From Cutoff	65 V	—
Maximum Heater-Cathode Voltage	200 V	EitherPolarity
Anode Voltage	8000 V	—
Grid2 Voltage	700 V	—
Grid1 Cutoff Voltage Minimum	-80 V	—
Grid1 Cutoff Voltage Maximum	-35 V	—
Focusing Coil Current	105 mA	Approximate

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Grid1 Circuit Resistance	1.5 Mohm	—

TUBE TINKER

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