

ELECTRONIC TUBE REFERENCE

12AGP7

Specialized - Cathode Ray electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
CATHODERAY

Twelve-inch round metal-envelope cathode-ray tube intended for radar applications. It combines electrostatic focusing with magnetic deflection and high-voltage operation to provide a direct-view radar display.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	6
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	
MAXIMUM PLATE VOLTAGE	14000 V
CRT accelerator/final-anode maximum mapped to MaxPlateVoltage.	

12AGP7 — Electrostatic-Focus Magnetic-Deflection Cathode-Ray Tube

A 12-inch round metal-envelope cathode-ray tube featuring low-voltage electrostatic focus and magnetic deflection, designed specifically for radar indicator applications.

Overview

The **12AGP7** is a specialized 12-inch round cathode-ray tube designed for radar display systems. It incorporates a low-voltage electrostatic focus lens and a magnetic deflection system. The electrostatic focus lens is designed to operate at or near cathode potential, which provides substantially automatic focus that remains stable and independent of variations in the accelerator voltage.

To optimize display quality and accuracy, the tube features an electrostatic straight gun that eliminates the need for an ion trap, and an almost completely flat faceplate that minimizes parallax errors. The faceplate is constructed from a gray filter glass (known as luxide) to enhance image contrast under ambient light.

A closely related variant, the **12AGP7A**, utilizes a metal-backed (aluminized) screen to achieve greater light output and minimize screen charging effects. In all other mechanical and electrical aspects, the 12AGP7A is identical to the standard 12AGP7.

Screen and Optical Characteristics

The 12AGP7 is equipped with a **No. 7 phosphor** screen, which is optimized for radar applications where target traces must remain visible between antenna sweeps. The screen characteristics are as follows:

- **Fluorescence:** Blue
- **Phosphorescence:** Yellow
- **Persistence:** Long

The gray filter glass faceplate has a light transmission value of approximately 66%, which significantly improves contrast by reducing the reflection of ambient light. The faceplate is designed with a very large radius of curvature of 125 inches, resulting in an almost flat surface that minimizes visual distortion and parallax errors for operators. The minimum useful screen diameter is 11-3/8 inches, providing a large active viewing area within the 12-7/16 inch envelope diameter.

For applications requiring higher brightness and reduced screen charging, the aluminized **12AGP7A** variant is employed. The metal backing reflects light forward that would otherwise be lost inside the tube, increasing the overall light output and protecting the phosphor from charge accumulation.

Mechanical Design and Basing Connections

The 12AGP7 is housed in a round metal envelope with a glass faceplate and neck. The electrical connections to the internal gun electrodes are made through a **Small Shell Duodecal 6-pin base (B6-63)**, which uses the **12M** basing configuration. The high-voltage anode connection is made via a metal cone lip on the envelope.

Physical Dimensions

- **Overall Length:** 17-7/8 ± 7/16 inches (with a maximum limit of 18-5/16 inches)
- **Greatest Envelope Diameter:** 12-7/16 ± 1/8 inches
- **Minimum Useful Screen Diameter:** 11-3/8 inches
- **Faceplate Radius of Curvature:** 125 inches
- **Deflection Angle (Approximate):** 54 degrees

Pin Connections

The 12M basing arrangement provides the following pin connections, viewed from the bottom of the base:

- **Pin 1:** Heater
- **Pin 2:** Grid No. 1 (Control Electrode)
- **Pin 6:** Grid No. 4 (Focus Anode)
- **Pin 10:** Grid No. 2
- **Pin 11:** Cathode
- **Pin 12:** Heater

The physical reference line of the tube, which determines the proper positioning of deflection components, is established by the location where a standard reference line gauge rests on the glass funnel.

Electrical Characteristics and Ratings

The 12AGP7 operates with a standard indirect heater supply. The electrical specifications and absolute maximum ratings (under the Design Center system) are detailed below.

Heater and Capacitance Data

- **Heater Voltage:** 6.3 V
- **Heater Current:** 0.6 A $\pm$ 10%
- **Calculated Heater Power:** 3.78 W
- **Heater Warm-up Time (Approximate):** 11 seconds
- **Direct Interelectrode Capacitances (Approximate):**
 - Cathode to all other electrodes: 5 pF
 - Grid No. 1 to all other electrodes: 6 pF

Maximum Ratings (Design Center Values)

- **Accelerator Voltage:** 14,000 V DC maximum (Note: The accelerator and Grid No. 3 are connected together internally and are collectively referred to as the accelerator).
- **Grid No. 4 Voltage (Focus Anode):** -500 to +1000 V DC maximum
- **Grid No. 2 Voltage:** +1000 V DC maximum
- **Grid No. 1 Voltage (Control Electrode):**
 - Negative bias value: -125 V DC maximum
 - Positive bias value: 0 V DC maximum
 - Positive peak value: +2 V maximum
- **Peak Heater-Cathode Voltage:**
 - Heater negative with respect to cathode: 180 V DC maximum
 - Heater positive with respect to cathode: 180 V DC maximum
 - Heater negative with respect to cathode during the warm-up period (not to exceed 15 seconds): 410 V DC maximum
- **Grid No. 1 Circuit Resistance:** 1.5 Megohms maximum

Typical Operating Conditions and Circuit Integration

Under typical operating conditions, the 12AGP7 is operated with an accelerator voltage of 12,000 V DC. The performance of the tube is highly dependent on maintaining adequate accelerator potential; both brilliance and definition decrease as the accelerator voltage is reduced. In general, the accelerator voltage should not be operated below 8,000 V DC.

Typical Operating Parameters

- **Accelerator Voltage:** 12,000 V DC
- **Grid No. 4 Voltage:** -0.4% to +2.2% of the anode voltage (E_{anode}). For a typical 12,000 V operating point, this calculates to a range of **-48 V to +264 V DC**.
- **Grid No. 4 Current:** -15 to +25 μA DC
- **Grid No. 2 Voltage:** +500 V DC
- **Grid No. 1 Voltage (for visual extinction of the undeflected focused spot):** -33 to -77 V DC
- **Field Strength of Adjustable Centering Magnet:** 0 to 8 Gauss

Circuit Design and Safety Considerations

When designing circuits for the 12AGP7, several critical operational constraints must be observed:

1. **Power Limitation:** When operating at or near the maximum accelerator rating of 14,000 V, the effective resistance of the high-voltage supply must be high enough to limit the accelerator input power to a maximum of 6 watts.
2. **Screen Protection:** The phosphor screen of the 12AGP7 can be permanently damaged (burned) if the electron beam current density is allowed to rise too high. To prevent screen burning, circuits should be designed to employ the minimum necessary beam current densities, and the beam should never be allowed to remain stationary at high intensity.
3. **Cathode Connection:** The cathode should be returned either to one side of the heater transformer windings or to the center tap of the windings to minimize hum and potential differences.
4. **Spot Alignment:** The undeflected focused spot is designed to fall within a circle of 20 mm radius concentric with the physical center of the tube's face. An adjustable centering magnet providing a field of 0 to 8 Gauss can be used to align the spot precisely.

Technical Summary

The **12AGP7** and its aluminized counterpart, the **12AGP7A**, are specialized 12-inch round metal-envelope cathode-ray tubes designed for radar display systems. Utilizing a low-voltage electrostatic focus lens and magnetic deflection, they provide automatic focusing that is highly stable against accelerator voltage variations. With a long-persistence No. 7 phosphor screen, a high-contrast gray filter glass faceplate, and an almost flat face design, these tubes are optimized for clear, parallax-free radar target tracking. Operating typically at an accelerator voltage of 12,000 V DC, they require careful power limiting and beam density management to protect the screen from permanent damage while delivering high-definition displays.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1963 Rauland

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

1963 RAULAND

Section 1 · Cathode Ray

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	6.3 V	—
Heater current	600 mA	—
Maximum heater-cathode voltage	180 V	Heater positive to cathode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Cathode to all other electrodes capacitance	5 pF	—

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