

ELECTRONIC TUBE REFERENCE

12ABP7

Specialized - Cathode Ray electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
CATHODERAY

Twelve-inch cathode-ray display tube with electrostatic focusing and magnetic deflection. Its P7 screen provides blue-white fluorescence with long persistence, a combination suited to direct-view radar and other applications where displayed information must persist.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	1
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	100
MAXIMUM PLATE VOLTAGE	13200 V
Values promoted from published ratings/characteristics where identifiable.	

12ABP7 — Electrostatic-Focus Magnetic-Deflection Cathode-Ray Tube

A 12-inch, round glass, direct-viewed cathode-ray tube designed primarily for radar indicator applications, featuring a low-voltage electrostatic focusing system and high-resolution electron gun.

Overview

The **12ABP7** is a specialized 12-inch cathode-ray tube (CRT) engineered 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 (or collector) voltage. The tube is equipped with a high-resolution electron gun and a spherical faceplate made of gray filter glass, which provides a light transmittance of approximately 74 percent to enhance contrast under ambient light.

The [12ABP7A](#) is a direct variant of the 12ABP7. It is identical in all electrical and mechanical characteristics except that it utilizes an aluminized (metallized) screen. This aluminized layer provides greater light output, improved image contrast, and minimizes screen charging effects during operation.

The underlying design of the 12ABP- family also supports other phosphor configurations, such as the [12ABP14](#) (and its aluminized counterpart [12ABP14A](#)) and the [12ABP19](#) (and its aluminized counterpart [12ABP19A](#)), to meet different persistence and spectral requirements.

Phosphor and Screen Characteristics

The 12ABP- tube family is available with three distinct phosphor types, each tailored to specific radar and indicator requirements:

- **P7 ([12ABP7](#) / [12ABP7A](#)):** Features a blue fluorescence and a yellow phosphorescence. It provides a long persistence, making it highly suitable for slow-scan radar applications where target trails must remain visible between antenna sweeps.
- **P14 ([12ABP14](#) / [12ABP14A](#)):** Features a blue (or purple) fluorescence and an orange (or yellow) phosphorescence. It provides a medium-long persistence.
- **P19 ([12ABP19](#) / [12ABP19A](#)):** Features an orange fluorescence and an orange phosphorescence. It provides a long persistence.

The "A" suffix designates the presence of a metallized backing on the phosphor screen. This aluminization reflects backward-emitted light toward the viewer, increasing the useful light output and preventing the accumulation of negative electrostatic charges on the screen surface.

Mechanical Specifications and Physical Dimensions

The physical envelope of the 12ABP7 is a round glass bulb with a spherical faceplate. The mechanical dimensions and installation parameters are standardized as follows:

Parameter	Value
Overall Length	18 $\pm$ 3/8 Inches
Greatest Diameter of Bulb	12-7/16 $\pm$ 1/8 Inches
Minimum Useful Screen Diameter	11 Inches
Bulb Contact	Recessed small cavity cap (J1-21)
Base	Small shell duodecal 6-pin (B6-63)
Basing Designation	12M

Parameter	Value
Mounting Position	Any

Bulb Contact and Alignment

The J1-21 recessed small cavity cap serves as the electrical connection for the high-voltage collector (anode). To facilitate proper orientation of the deflection yoke and external components, the bulb contact is aligned such that the J1-21 contact aligns with the vacant pin position No. 3 on the base within a tolerance of ± 10 degrees.

Reference Line and Handling

The reference line of the tube's neck is mechanically defined by the position where a standardized ring gauge with a 1.500 (+0.003 / -0.000) inch internal diameter and a length of 2 inches will stop when slid down the bulb cone.

An anti-corona coating is applied to the neck and cone area, extending to a minimum radius of 1-1/2 inches concentric with the high-voltage contact. Because of the delicate nature of this conductive coating, the tube must never be handled by the portion of the bulb carrying the anti-corona coating.

Pinout and Terminal Connections

The 12ABP7 utilizes the **12M** basing arrangement. The terminal connections, viewed from the bottom of the base, are assigned as follows:

Pin Number	Element Connection
Pin 1	Heater
Pin 2	Grid No. 1 (Control Grid)
Pin 6	Grid No. 4 (Focusing Electrode)
Pin 10	Grid No. 2
Pin 11	Cathode
Pin 12	Heater
Cap	Grids No. 3 and No. 5 (Collector / Anode)

For proper circuit operation, the cathode must be returned to either one side or the center-tap of the heater transformer secondary winding.

Electrical Characteristics and Operating Points

The 12ABP7 operates with a standard 6.3 V heater supply and utilizes magnetic deflection with a nominal deflection angle of 55 degrees.

Direct Interelectrode Capacitances

The approximate capacitances between the internal electrodes are:

- **Cathode to all other electrodes:** 5 pF
- **Grid No. 1 to all other electrodes:** 6 pF

Typical Operating Conditions

Under typical operating conditions, the tube is set up with the following electrical parameters:

- **Collector (Anode) Voltage:** 10,000 Volts D-C
- **Grid No. 4 (Focusing Electrode) Voltage:** 0 to 300 Volts D-C
- **Focusing Electrode Current:** -15 to +15 A D-C
- **Grid No. 2 Voltage:** 300 Volts D-C
- **Grid No. 1 Voltage (for Cutoff):** -28 to -72 Volts D-C
- **Alignment Magnet Field Strength:** 0 to 4 Gauss
- **Undelected Spot Position:** Within a circle of 5/8-inch radius concentric with the center of the tube face (measured with the tube properly shielded from external magnetic fields).

Maximum Ratings and Safety Constraints

The maximum ratings for the 12ABP7 family are defined under two different rating systems depending on the manufacturer's specifications: the Design Center system and the Absolute Maximum system. Designers must adhere strictly to these limits to prevent premature tube failure or hazard.

Parameter	Design Center Maximums	Absolute Maximums
Collector / Anode Voltage	12,000 Volts D-C	13,200 Volts D-C
Grid No. 4 (Focusing Electrode) Voltage	-500 to +1,000 Volts D-C	-550 to +1,100 Volts D-C
Grid No. 2 Voltage	700 Volts D-C	770 Volts D-C
Grid No. 1 Negative Bias Value	180 Volts D-C	200 Volts D-C
Grid No. 1 Positive Bias Value	0 Volts D-C	0 Volts D-C
Grid No. 1 Positive Peak Value	0 Volts	0 Volts
Peak Heater-Cathode Voltage (Heater negative wrt cathode)	180 Volts D-C	200 Volts D-C

Parameter	Design Center Maximums	Absolute Maximums
Peak Heater-Cathode Voltage (Heater positive wrt cathode)	180 Volts D-C	200 Volts D-C
Grid No. 1 Circuit Resistance	1.5 Megohms Max.	1.5 Megohms Max.

Power and Screen Protection

At or near the maximum collector voltage rating, the effective resistance of the high-voltage supply must be high enough to limit the continuous collector input power to a maximum of **6 watts**.

The phosphor screens of the long-persistence variants, particularly the [12ABP19](#) and [12ABP19A](#), are highly susceptible to permanent thermal damage and burning if the electron beam current density is allowed to rise too high. To prevent screen burning, circuits must be designed to employ the minimum practical beam current densities.

Operating Voltage Limits

The brilliance and definition of the displayed image degrade rapidly as the collector voltage is decreased. To maintain acceptable focus and resolution, the collector voltage should not be operated below a minimum limit of **8,000 volts**.

X-Ray Radiation Warning

When the 12ABP7 is operated at voltages near or exceeding its maximum ratings, it can produce soft X-rays. X-ray radiation shielding may be necessary to protect personnel 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.

Performance and Focus Standards

Line Width and Resolution

The resolution of the 12ABP7 is characterized by its line width under standardized test conditions. The nominal line width is **0.019 inch** maximum for the P7 and P14 phosphor versions. For the P19A phosphor version, the maximum line width is **0.018 inch** when measured with a reduced screen current of no more than 50 μ A to prevent screen damage.

The measurement is performed using a 525-line interlaced and synchronized raster pattern with interlaced line blanking. The pattern width is adjusted to 90% of the minimum useful screen diameter (11 inches). The test pattern dimensions are 7-1/2 by 10 inches, which represents a calculated aspect ratio of:

$$\text{Aspect Ratio} = \frac{10 \text{ inches}}{7.5 \text{ inches}} = 1.33 \text{ (or 4 : 3)}$$

The beam current (I_b) is set to 100 μ A (measured before applying blanking). The line width is calculated by dividing the merged raster height by the number of active lines (262.5), measured at the center of the tube face.

Focus and Alignment Procedures

To achieve the best overall focus of the 7-1/2 x 10-inch raster pattern, Grid No. 1 voltage is adjusted to produce an anode current of 100 μ A, and the Grid No. 4 voltage is adjusted within its 0 to 300 V range. Visual extinction of the focused raster is used as the reference point for cutoff; achieving complete visual extinction of a stationary focused spot requires the Grid No. 1 bias to be approximately 5 volts more negative than the raster extinction value.

For optimum spot quality, the use of an adjustable beam alignment magnet is highly recommended. The magnet should have a field strength adjustable from 0 to 4 Gauss. Depending on the specific manufacturer's mechanical layout, this magnet must be positioned along the neck of the tube at a distance of approximately **5-3/16 inches** or **5-7/16 inches** from the reference line.

Technical Summary

The **12ABP7** is a **12-inch, electrostatic-focus, magnetic-deflection cathode-ray tube** designed for high-resolution radar indicator service. It features a low-voltage electrostatic focus lens that operates near cathode potential to provide automatic focus tracking independent of anode voltage fluctuations. Operating with a **6.3 V, 0.6 A** heater, the tube utilizes a **12M** duodecal base and a **J1-21** high-voltage cap.

Under typical operating conditions, the tube runs at an anode potential of **10,000 V**, requiring a focusing voltage of **0 to 300 V** and a control grid cutoff bias of **-28 to -72 V**. The 12ABP7 utilizes the long-persistence **P7** phosphor (blue fluorescence, yellow phosphorescence), while the **12ABP7A** variant incorporates an aluminized screen for enhanced brightness and contrast. Designers must observe strict limits on anode input power (6 W maximum) and maintain anode voltage above 8,000 V to preserve image definition, while implementing appropriate X-ray shielding if operating near the absolute maximum anode voltage limit of **13,200 V**.



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

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage	6.3 volts	Heater Voltage 6.3 volts
Heater Current	10 amps	Heater Current 0,6+10% amps.,
Heater Negative with Respect to Cathode	180 volts	Heater Negative with Respect to Cathode 180 volts DC
Heater Positive with Respect to Cathode	180 volts	Heater Positive with Respect to Cathode 180 volts DC
Collector Voltage A	0 volts	Collector Voltage A 10,000 volts DC
Grid #	300 volts	Grid #2 Voltitge 300 volts DC
Grid #	72 volts	Grid #1 Voltage @ -28to =72 volts DC

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Collector Voltage A	0 volts	Collector Voltage A 12,000 volts DC
Grid #	700 volts	Grid #2 Voltage 700 volts DC
Negative —Bias Value	180 volts	Negative —Bias Value 180 volts DC
Positive~ Bias Value *	0 volts	Positive~ Bias Value * 0 volts DC
Positive — Peak Value	0 volts	Positive — Peak Value 0 volts DC



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	Electrostatic text	—
Deflection Method	Magnetic text	—
Phosphor	P7 text	—
Fluorescence	Blue/white text	—
Persistence	Long text	—
Deflection Angle	55 deg	Approximate



SOURCE DATA APPENDIX

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

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	6.3 V	—
Heater current	600 mA	—
Anode voltage maximum	13200 V	—
Grid No. 2 voltage maximum	770 V	—
Grid No. 1 negative bias maximum	200 V	—
Heater-cathode peak voltage	200 V	—