

High-voltage P7 cathode-ray display tube with magnetic focusing, designed around a 20 kV collector supply and grid-controlled beam intensity for direct visual display.

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	9
Values promoted from published ratings/characteristics where identifiable.	

10QP7 — Magnetic Focus and Deflection Cathode Ray Tube

The **10QP7** is a specialized magnetic focus and magnetic deflection cathode ray tube (CRT) designed for applications requiring a high-intensity, finely focused spot. It features a 10.5-inch nominal diameter faceplate and is equipped with a long-persistence cascade fluorescent screen.

Overview

The 10QP7 is designed for precision display applications where image retention and high spot resolution are critical. The tube utilizes magnetic fields for both focusing the electron beam and deflecting it across the screen. A key performance feature of the 10QP7 is its ability to produce a small, high-intensity spot, making it suitable for detailed radar, medical, or industrial imaging systems. The tube operates with a

relatively narrow deflection angle of 50 degrees, which helps minimize deflection distortion and maintain spot uniformity across the useful screen area.

Screen and Phosphor Characteristics

The tube is constructed with a **#7 (P7) phosphor** screen, which is a cascade-type screen designed for long persistence. This phosphor configuration exhibits the following characteristics:

- **Fluorescence:** Blue (initial excitation color)
- **Phosphorescence:** Yellow (afterglow color)
- **Persistence:** Long

The cascade structure of the P7 phosphor allows the initial high-energy electron impact to excite a short-persistence blue light, which in turn excites a secondary phosphor layer that emits a long-persistence yellow glow. This behavior is highly advantageous for displaying slow-scan or non-repetitive sweep information.

Mechanical Specifications and Physical Dimensions

The 10QP7 is housed in a glass envelope with specific physical dimensions and external treatments to ensure proper electrical insulation and mechanical fit:

- **Maximum Bulb Diameter:** 10 1/2 ± 1/16 inches
- **Minimum Useful Screen Diameter:** 9 inches
- **Overall Length:** 17 5/8 ± 3/8 inches
- **Neck Diameter:** 1 7/16 ± 1/16 inches
- **Faceplate Curvature Radius:** 42 inches
- **Inner Cone Radius:** 20 inches
- **Face Corner Radius:** 7/16 inch
- **Deflection Angle:** 50°
- **Mounting Position:** Any

Reference Line Determination

The reference line, which serves as the datum point for positioning external deflection and focusing components, is determined by the position where a ring gauge with an internal diameter of 1.5000 inches (+0.003", -0.000") and a length of 2 inches rests on the bulb cone.

External Coatings and Handling

The envelope incorporates specialized external coatings to manage electrical fields and prevent corona discharge:

- **Dri-Film Coating:** Dri-Film #9987 is applied to the bulb cone in the region between the faceplate and the reference line.

- **Conductive Coating:** A conductive coating is applied to the neck, extending 5 inches from the reference line toward the base.
- **Handling Caution:** Due to the delicate nature of the anti-corona treatment, the tube must not be handled by the portion of the bulb coated with the anti-corona material.

Base, Cap, and Terminal Connections

The 10QP7 utilizes a duodecal base configuration for low-voltage connections and a separate high-voltage cap for the collector.

- **Base Type:** Designated as a **Small Shell Duodecal 6-Pin** base in electrical specifications, and also identified as a **Small Shell Duodecal 5-Pin Base (B5-57)** in mechanical drawings.
- **Anode/Collector Cap:** A **Recessed Small Cavity Cap (J1-21)** is located on the side of the bulb cone to provide a secure, high-voltage connection.

Pinout Configuration

When viewed from the bottom of the base, the terminal connections are assigned as follows:

Pin / Terminal	Connection
Pin 1	Heater
Pin 2	Grid #1 (Control Grid)
Pin 11	Cathode
Pin 12	Heater
Cap	Grid #2 & Collector

Electrical Characteristics and Ratings

The electrical parameters of the 10QP7 are divided into heater characteristics, interelectrode capacitances, and design-center maximum ratings.

Heater Characteristics

The tube's electron gun uses an indirectly heated cathode with the following heater specifications:

- **Heater Voltage:** 6.3 V
- **Heater Current:** $0.6 \pm 10\%$ A
- **Maximum Peak Heater-Cathode Voltage:**
 - Heater negative with respect to cathode: 175 V DC
 - Heater positive with respect to cathode: 175 V DC

Direct Interelectrode Capacitances

The approximate capacitances between the internal electrodes, measured without external shielding, are:

- **Grid #1 to all other electrodes:** 4.0 pF
- **Cathode to all other electrodes:** 3.5 pF

Design Center Maximum Ratings

These ratings represent the limiting values above which the serviceability and safety of the tube may be impaired:

- **Collector Voltage (including Grid #2):** 20,000 V DC
- **Grid #1 Voltage:**
 - Negative-Bias Value: 350 V DC
 - Positive-Bias Value: 0 V DC
 - Positive-Peak Value: 2 V DC
- **Maximum Grid #1 Circuit Resistance:** 1.5 MΩ

Typical Operation and Focusing Setup

Under typical operating conditions, the 10QP7 is configured with a high collector voltage to maximize spot brightness and resolution.

- **Collector Voltage (including Grid #2):** 20,000 V DC
- **Grid #1 Voltage (for visual extinction of deflected focus spot):** -63 to -147 V DC
- **Undelected Spot Position:** 0.590 inch maximum deviation from the physical center.

Focusing and Deflection Operation

To achieve the specified high-intensity small spot, the tube requires precise alignment of the external focusing coil:

- **Focus Coil Specification:** Designed for use with a standard focus coil #106 or an equivalent magnetic focusing assembly.
- **Focus Coil Current:** Approximately 190 mA DC.
- **Focus Coil Position:** The focus coil must be positioned such that the distance from its air gap to the bulb's reference line is exactly 3.25 inches.
- **Calibration Condition:** During setup, the Grid #1 bias voltage and the video signal voltage are adjusted to maintain an anode current of 100 microamperes.

Technical Summary

The **10QP7** is a **10.5-inch magnetic focus and magnetic deflection cathode ray tube** featuring a **long-persistence #7 cascade phosphor screen** (emitting blue fluorescence and yellow phosphorescence). It operates with a **6.3 V, 0.6 A heater** and is rated for a maximum **collector voltage**

of 20,000 V DC. The tube is designed to produce a highly concentrated, high-intensity spot when paired with a standard focus coil #106 operating at approximately 190 mA DC. Its physical construction includes a **Small Shell Duodecal base**, a **recessed small cavity anode cap**, and specialized **Dri-Film and conductive bulb coatings** to ensure stable high-voltage operation.

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 6:3+10% amps.
Heater Negative with Respect to Cathode	175 volts	Heater Negative with Respect to Cathode 175 volts DC
Collector Voltage (including Grid #	0 volts	Collector Voltage (including Grid #2) 20,000 volts DC
Grid #	147 volts	Grid #1 Voltage ® —63 to =147 volts DC

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Collector Voltage (including Grid #	0 volts	Collector Voltage (including Grid #2) 20,000 volts DC
Negative —Bias Value	350 volts	Negative —Bias Value 350 volts DC
Positive —Bias Value	0 volts	Positive —Bias Value 0 volts DC
Positive — Peak Value	2 volts	Positive — Peak Value 2 volts DC
Grid #	1.5 meg	Grid #1 Circuit Resistance 1.5 meg, max.
For standard focus coil #	1 MA	For standard focus coil #106 or equivalent, the focus coil current is approximately 190 MA, D.C. Grid #1 bias voltage and video

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