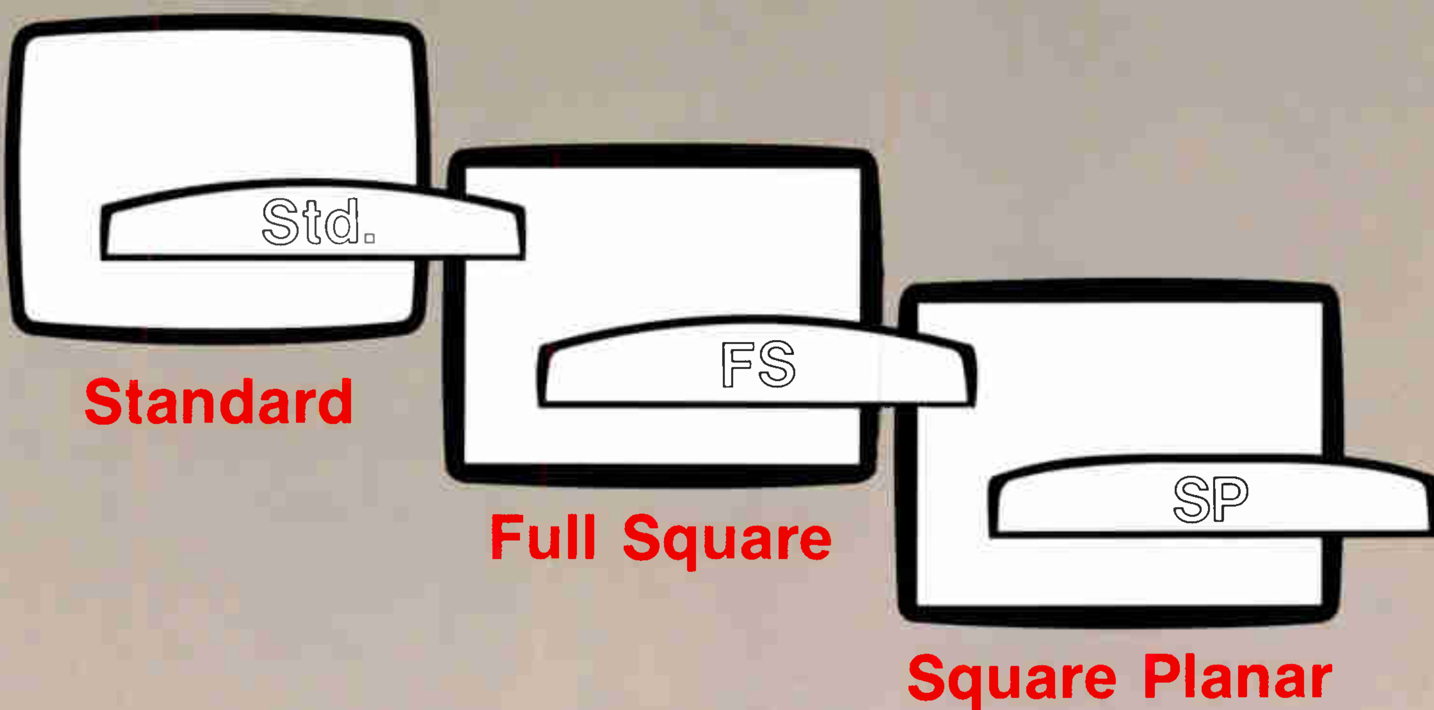
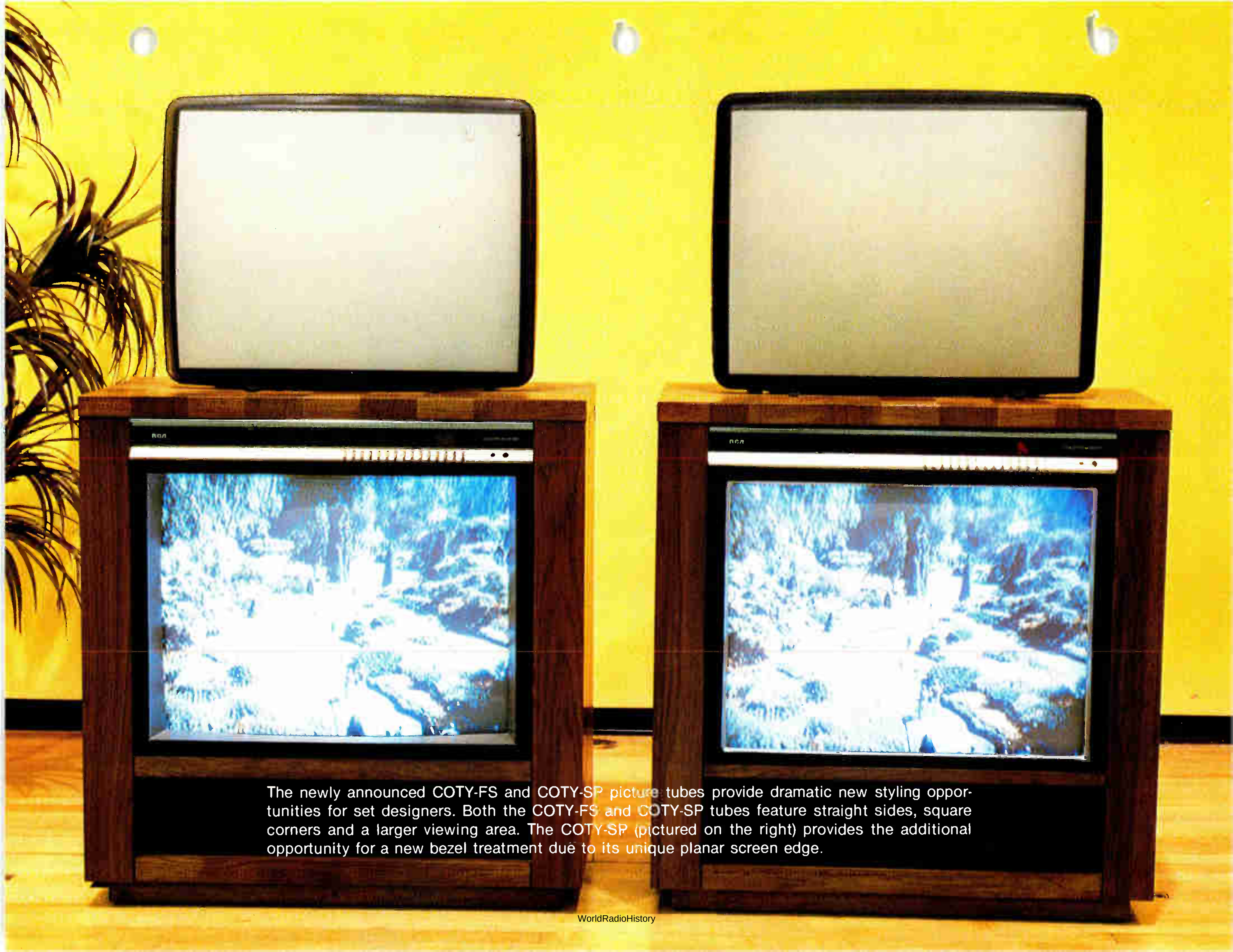
The New Look For COTY-29



RCA
Video Component
and Display Division



The newly announced COTY-FS and COTY-SP picture tubes provide dramatic new styling opportunities for set designers. Both the COTY-FS and COTY-SP tubes feature straight sides, square corners and a larger viewing area. The COTY-SP (pictured on the right) provides the additional opportunity for a new bezel treatment due to its unique planar screen edge.

The New Look For COTY-29

Technology Trends

The television and video display industry stands at the threshold of a new era of market expansion. Consumer demand for improved, more versatile video displays results from the:

- Increased use of the computer in the home
- Growth of videotext and information broadcasts
- Explosion of Videodisc and videotape options

RCA is addressing the emerging high-tech information age with direct involvement in all of these areas.

This leadership is reflected in the continuing advances in color picture tube technology at the RCA Video Component and Display Division. Significant improvements and innovations are coming with:

- Rectilinear screen and flatter glass faceplate formats for better styling and information display
- Wider use of 110° deflection angles and shorter tube lengths for more compact instruments
- Better focus performance, both center and corners, through improved electron guns
- Finer pitch mask structures for higher picture resolution capability
- Better color tube quality and reliability
- Increased automation in design and manufacturing

RCA will remain at the forefront of technology advances in shadow-mask color picture tubes as they continue to be the major force in the color TV and display markets for the foreseeable future.

The New Look For COTY-29

COTY-FS (Full Square)

COTY-SP (Square Planar)

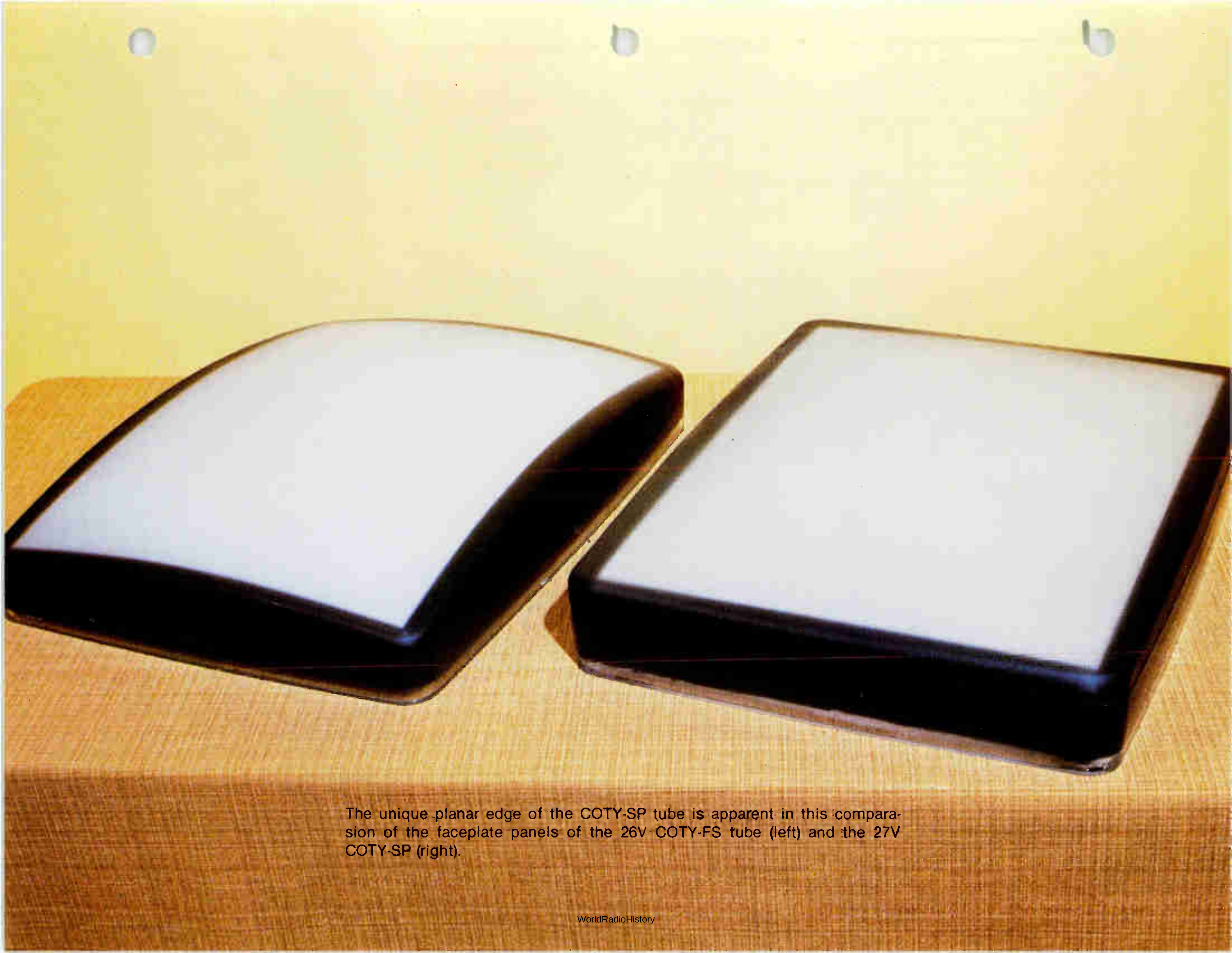
The Video Component and Display Division of RCA has developed two new color picture tube formats. The new-look **COTY-FS** and **COTY-SP** tubes provide a "picture frame" appearance with sharply defined corners and straight sides. Receiver stylists are taking advantage of this feature to design instruments with a "high-tech" look. This innovation is immediately noticeable by the consumer and represents a major change in picture tube appearance.

It is appropriate that RCA Video Component and Display Division announces these major improvements in color picture tube technology at this time since it is the 30th anniversary of the introduction by RCA of the first commercial color TV receiver. Modern picture tube performance shows radical improvements over color picture tubes of thirty years ago as a result of a continuing evolution and performance innovation.

The newly announced **COTY-FS** and **COTY-SP** picture tubes are an extension of the **COTY-29** development announced by RCA in early 1982. This new generation of tubes retains all the advantages of the **COTY-29** development while providing the additional features announced today. The name **COTY-29** stands for **c**ombined **o**ptimum **t**ube and **y**oke in a **29**-millimeter neck, and that development is becoming the U.S. industry standard for 1984. **COTY-29** permits a substantially smaller yoke which results in lower manufacturing cost of the TV receiver while providing sharper pictures and improved reliability.

The **COTY-FS** (Full Square) system provides the picture frame format with its more pleasing viewing at optimum cost, minimum weight increase over previous types, and minimum chassis/system modification. It provides more picture information than previous tube types.

The **COTY-SP** (Square Planar) system has a flatter faceplate and a nearly planar screen edge in addition to the square picture corners. These features provide a dramatic styling improvement, a wider viewing angle, and minimum viewing distortion for use in high performance receivers. The **COTY-SP** color picture tubes will be used in top-of-the-line receivers designed to meet the increased consumer demand for deluxe/prestige merchandise.



The unique planar edge of the COTY-SP tube is apparent in this comparasion of the faceplate panels of the 26V COTY-FS tube (left) and the 27V COTY-SP (right).

The New Look For COTY-29

Programs

RCA is announcing two new families of color picture tubes in order to provide two alternatives for the set manufacturer. The **COTY-FS** family provides a new look and permits implementation quickly and at low or no chassis cost premium. New cabinet decorative masks are required to fit the newly styled picture shape. **BOTH** families have the following features:

- Larger Viewing Area
- New Styling/Appearance
- Picture Frame Appearance
- Straight Sides, Square Corners
- Minimum Weight Premium

The **COTY-FS** family uniquely features the following:

- Optimum Cost/Performance
- Easiest to Upgrade to Higher Resolution
- Applicable to All Sizes
- Compatible with Existing Chassis

The **COTY-SP** family provides even more dramatic instrument styling opportunities but requires both chassis and cabinet modification. The **COTY-SP** family has these superior features:

- Optimum Styling—Distinctive/Dramatic
- Wider Viewing Angle
- Minimum Viewing Distortion at Wide Angle
- **27V** has 104 cm^2 more viewing area than the **26V COTY-FS**

The New Look For COTY-29

Continuing Features

The new **COTY-FS** and **COTY-SP** color tube families retain all of the features and benefits announced for **COTY-29** in early 1982. The new concepts are an extension of the **COTY-29** development. A list of these features of **COTY-29** retained in **COTY-FS** and **COTY-SP** tubes are shown below along with their benefits:

FEATURE	BENEFITS
■ Extended Lens (XL) Gun	Improved Focus
■ Close-spaced Beams	Improved Convergence
■ Focus Uniformity	Better Character Readability
■ Standard 29 mm Neck Proven Socket/Stem	Reliability
■ Black Matrix	Brightness and Contrast
■ Super Arch Mask	Thermal Mask Stability
■ Pigmented Phosphor	Contrast Enhancement
■ Internal Magnetic Shield (IMS)	Styling/Cost Reduction
■ Metallized Bead Arc Suppressor (MBS)	High Voltage Stability

The New Look For COTY-29

COTY-FS (Full Square)

26V 110° | 20V 110° | 20V 90° | 14V 90°

Major Features and Benefits

- Minimum chassis redesign required—**COTY-29** chassis-ready
- Optimum Cost/Performance—Lowest Cost for Mass Market
- **COTY** Deflection Yoke—Low Cost and Weight
- Straight sides, Square Corners
- Minimum Weight Premium
- Distinctive Appearance

Technical Features

- **26V 110°: Horizontal and vertical screen dimensions same as 25V**

  Compared with 25V 100° HIPI

  — 35 mm shorter
  — 57 cm^2 additional screen area
  — only 0.7 kg additional weight
  — 15% Improved center focus
  — N-S pinfree: E-W pin correction required

- **20V 110°: Horizontal and vertical screen dimensions nearly same as 19V**

  Compared with 19V 90° HIPI

  — 45 cm^2 additional screen area
  — 74 mm shorter
  — 1.9 kg additional weight
  — 22% Improved center focus
  — Fully pinfree N-S and E-W

- **20V 90°: Horizontal and vertical screen dimensions nearly same as 19V**

  Compared with 19V 90° HIPI

  — 45 cm^2 additional screen area
  — 8.1 mm longer
  — 2.4 kg additional weight
  — Fully pinfree N-S and E-W

- **14V 90°: Horizontal and vertical screen dimensions nearly same as 13V**

  Compared with 13V 90° HIPI:

  — 26 cm^2 additional screen area
  — 3.4 mm longer
  — 1.4 kg additional weight
  — Fully pinfree N-S and E-W

Availability

	26V 110°	20V 90°	20V 110°	14V 90°
Light-and-Play Samples:	11-83	2-84	4-84	6-84
Production Start:	7-84	11-84	4-85	3-85

The New Look For COTY-29

COTY-SP (Square Planar)

27V 110° | 20V 110°

Major Features and Benefits

- Screen Center-to-Edge Depth is Half That of Any Previous Design
- Rectilinear Screen — Straight Sides and Square Corners
- Optimum Styling — Nearly Planar Screen Edge
  Distinctive, Dramatic
  Shorter Cabinet Depth
- Minimum Viewing Distortion
- Wider Viewing Angle

Technical Features

- **27V 110°: Screen area substantially larger than 25V**
  — 161 cm^2 or 7.9% additional screen area
  — 56 mm shorter than 25V 100° HiPI
  — 16 mm shorter than 25V 110° HiPI

- **20V 110°: Screen area larger than 19V**
  — 45 cm^2 or 3.8% additional screen area
  — 94 mm shorter than 19V 90° HiPI

- **Flatness**
  — Sagittal height (dimension from plane of center face to diagonal corner) is reduced to 1/2 that of standard bulb
  — Design is flatter than that of any competitive design
  — 27V edge is within ± 4 mm of a perfect plane
  — 20V edge is within ± 3 mm of a perfect plane

- **Circuit considerations**
  — Customized circuit is required for raster shaping and linearity associated with the flatter aspherical panel contour

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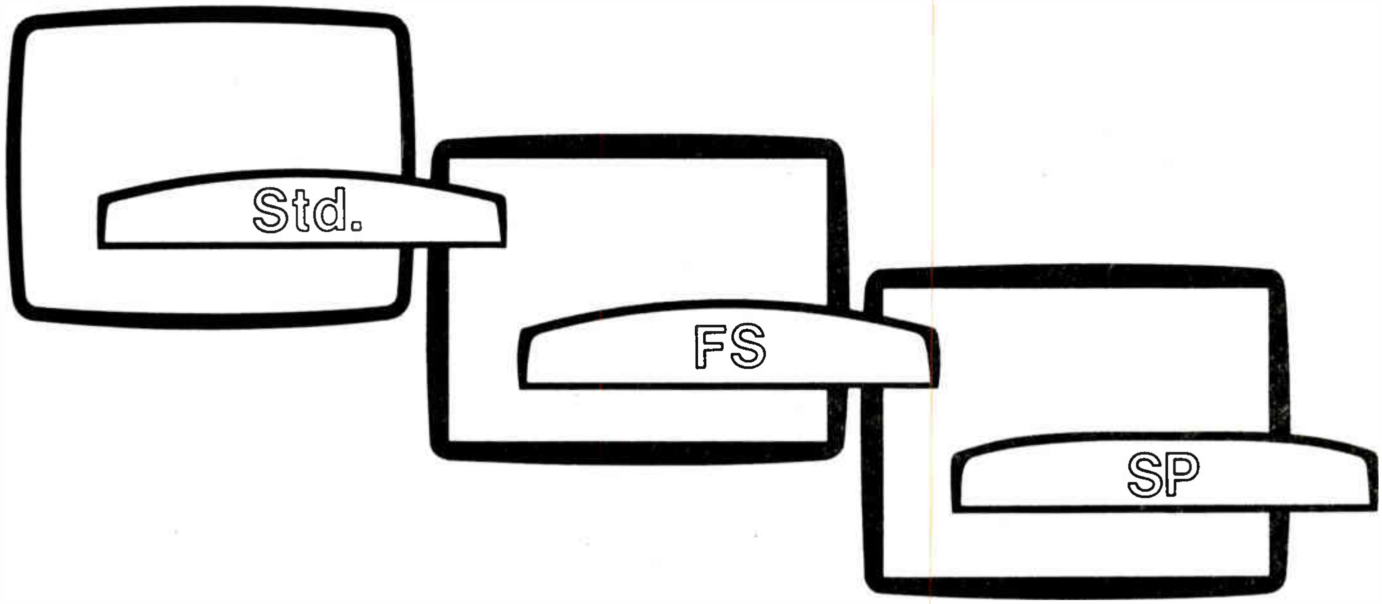
Availability

	27V 110°	20V 110°
Light-and-Play Samples:	3-84	11-84
Production Start:	7-85	3-86

25V, 26V, 27V



Standard Hi PI

Size — 25V/100°

Screen Dimensions:

Diagonal — 626.31 mm
Horizontal — 527.71 mm
Vertical — 395.78 mm
Area — 2032 cm²

Sagittal Heights at Screen Edge:

Diagonal — 46.09 mm
Horizontal — 32.18 mm
Vertical — 17.10 mm

Tube Dimensions:

Overall Length — 473.02 mm
Overall Dimensions at Tension Bands:

Diagonal — 675.01 mm
Horizontal — 576.76 mm
Vertical — 446.23 mm

Tube Weight — 23.0 kg

COTY Full Square

Size — 26V/110°

Screen Dimensions:

Diagonal — 659.64 mm
Horizontal — 527.71 mm
Vertical — 395.78 mm
Area — 2089 cm²

Sagittal Heights at Screen Edge:

Diagonal — 52.66 mm
Horizontal — 33.05 mm
Vertical — 17.34 mm

Tube Dimensions:

Overall Length — 438.35 mm
Overall Dimensions at Tension Bands:

Diagonal — 716.89 mm
Horizontal — 593.90 mm
Vertical — 466.14 mm

Tube Weight — 23.7 kg

COTY Square Planar

Size — 27V/110°

Screen Dimensions:

Diagonal — 676.00 mm
Horizontal — 540.80 mm
Vertical — 405.60 mm
Area — 2193 cm²

Sagittal Heights at Screen Edge:

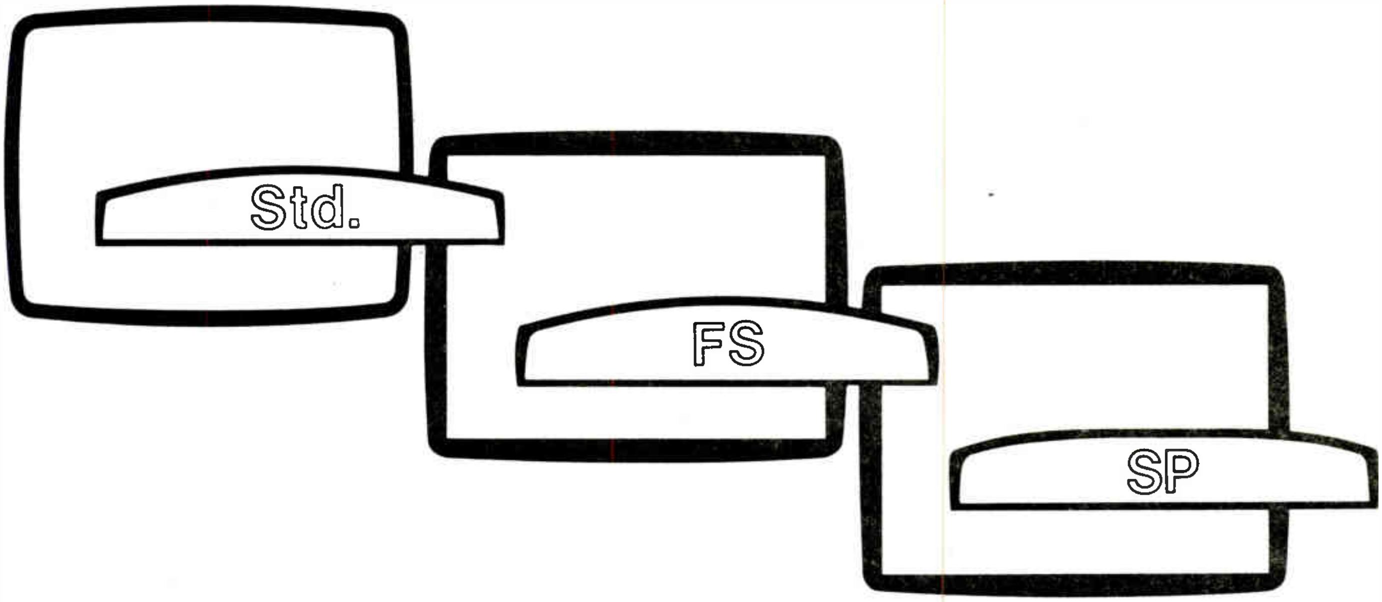
Diagonal — 25.54 mm
Horizontal — 21.16 mm
Vertical — 17.54 mm

Tube Dimensions:

Overall Length — 417.25 mm
Overall Dimensions at Tension Bands:

Diagonal — 732.56 mm
Horizontal — 606.96 mm
Vertical — 475.72 mm

Tube Weight — 26.0 kg



Standard Hi PI

Size — 19V/90°

Screen Dimensions:

Diagonal — 479.98 mm
Horizontal — 404.42 mm
Vertical — 303.30 mm
Area — 1194 cm^2

Sagittal Heights at Screen Edge:

Diagonal — 36.70 mm
Horizontal — 25.66 mm
Vertical — 14.18 mm

Tube Dimensions:

Overall Length — 443.64 mm
Overall Dimensions at Tension Bands:

Diagonal — 518.90 mm
Horizontal — 442.04 mm
Vertical — 350.16 mm

Tube Weight — 12.3 kg

COTY Full Square

Size — 20V/90°/110°

Screen Dimensions:

Diagonal — 508.00 mm
Horizontal — 406.40 mm
Vertical — 304.80 mm
Area — 1239 cm^2

Sagittal Heights at Screen Edge:

Diagonal — 36.70 mm
Horizontal — 22.63 mm
Vertical — 12.13 mm

Tube Dimensions:

Overall Length — 451.71/369.26 mm
Overall Dimensions at Tension Bands:

Diagonal — 552.74 mm
Horizontal — 459.60 mm
Vertical — 376.04 mm

Tube Weight — 14.7 / 14.2 kg

COTY Square Planar

Size — 20V/110°

Screen Dimensions:

Diagonal — 508.00 mm
Horizontal — 406.40 mm
Vertical — 304.80 mm
Area — 1239 cm^2

Sagittal Heights at Screen Edge:

Diagonal — 19.19 mm
Horizontal — 15.90 mm
Vertical — 13.18 mm

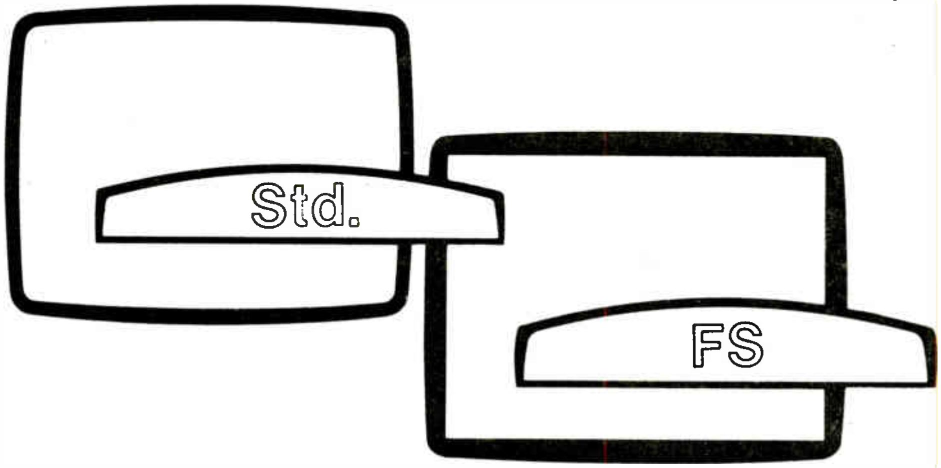
Tube Dimensions:

Overall Length — 349.65 mm
Overall Dimensions at Tension Bands:

Diagonal — 552.74 mm
Horizontal — 459.60 mm
Vertical — 376.04 mm

Tube Weight — 13.1 kg

13V, 14V



Standard Hi Pl

Size — 13V/90°

Screen Dimensions:

Diagonal — 334.77 mm
Horizontal — 282.04 mm
Vertical — 211.53 mm
Area — 581 cm^2

Sagittal Heights at Screen Edge:

Diagonal — 25.56 mm
Horizontal — 18.01 mm
Vertical — 10.06 mm

Tube Dimensions:

Overall Length — 358.78 mm
Overall Dimensions at Tension Bands:

Diagonal — 372.57 mm
Horizontal — 317.60 mm
Vertical — 255.85 mm

Tube Weight — 5.8 kg

COTY Full Square

Size — 14V/90°

Screen Dimensions:

Diagonal — 355.60 mm
Horizontal — 284.48 mm
Vertical — 213.36 mm
Area — 607 cm^2

Sagittal Heights at Screen Edge:

Diagonal — 25.02 mm
Horizontal — 15.34 mm
Vertical — 8.16 mm

Tube Dimensions:

Overall Length — 362.17 mm
Overall Dimensions at Tension Bands:

Diagonal — 396.44 mm
Horizontal — 328.38 mm
Vertical — 269.81 mm

Tube Weight — 7.2 kg

Evolution of Color TV Picture Tubes at RCA

For the past 30 years, RCA color TV picture tubes have been in the forefront of the industry for performance and reliability. In that time span, RCA and its affiliates in the Americas and in Europe have produced over 80 million color TV picture tubes. Some important RCA milestones and innovations are reviewed in this article.

RCA has played a prominent role in the development of color TV picture tubes. To say otherwise would be compromising recorded history. By virtue of many RCA technological accomplishments, color picture tubes have advanced to true marvels of the twentieth century. Color TV picture tubes have changed radically over the years, for example:

1. Tube screen shapes changed from round to rectangular;
2. Screen sizes, initially available in only small sizes, are now available in various sizes up to 27 inches;
3. Deflection angles increased from 45° up to 110°;
4. Tube overall lenghts have been drastically reduced;
5. Video images, initially displayed only in black and white may now be displayed in full color; and
6. Light output increased by a factor of 10 from an average brightness of 68.5 cd/m^2 (20 fL) to well over 685 cd/m^2 (200 fL) in recent color screens.

Some important milestones in the evolution of RCA color TV picture tubes are as follows:

1930 RCA initiated research of color television broadcasting systems.

1941 RCA successfully telecast color television signals from the Empire State Building in New York City.

1947 A.C. Schroeder's patent application was filed for a "Picture Reproducing Apparatus" with three electron beams in one tube deflected by a single deflection yoke.

1949 Dr. Harold B. Law at RCA Laboratories, Princeton, N.J., made the first shadow-mask tube. It featured a 3-by 3-inch color display enclosed in a 9-inch tube envelope.

1950 RCA demonstrated the first compatible color and black-and-white electronic TV system to the FCC. It featured a 12-inch direct-view tricolor phosphor-dot screen enclosed in a 16-inch round glass-metal envelope.

1951 H.B. Law filed a patent application on "Photographic Methods of Making Electron Sensitive Mosaic Screens." RCA sampled shadow-mask color tubes to TV set manufacturers.

1953 RCA commenced commercial production of the first shadow-mask color picture tube. It was used for viewing NBC's first compatible TV colorcast on December 17, 1953 (type 15GP22).

1954 The first 21-inch direct-view color tube was produced in quantity featuring 70° deflection, a phosphor-dot viewing screen on the inside surface of the curved faceplate, a triple-beam gun assembly in a delta array with a magnetic convergence assembly and a round glass-metal envelope. Deposition of the phosphor dots was done by a photographic exposure process which employed an apparatus called a "lighthouse" (type 21AXP22).

1957 RCA introduced the first 21-inch round 70° shadow-mask tube, featuring an all-glass envelope, a steel mask with tapered apertures and increased beam transmission (type 21CYP22).

1961 RCA commercially introduced tubes featuring an all-sulfide luminescent screen and a laminated safety window of filter glass producing pictures with 50 percent more light output and improved contrast (type 21FJP22).

1964 RCA announced industry's first 25-inch, 90° deflection, rectangular tube (type 25AP22).

1965 RCA introduced a 19-inch, 90° deflection, rectangular tube (type 19EYP22).

1966 RCA introduced a family of tubes featuring "Perma-Chrome," a temperature-compensated shadow-mask tube construction for improved locked-in color purity.

1967 RCA introduced a "Hi-Lite" tube having a new high-brightness viewing screen featuring europium-activated yttrium oxysulfide rare-earth red-emitting phosphor, and sulfide blue-and green-emitting phosphors (type 25XP22).

Introduced RCA's first 22-inch 90° deflection, rectangular tube (type 22JP22).

The first 15-inch 90° deflection, rectangular color tube was introduced by RCA featuring an einzel-focus lens gun to permit simplified circuitry (type 15LP22).

1968 RCA introduced a 17-inch, 90° deflection, rectangular color tube (type 17EZP22).

1969 RCA commenced production of color picture tubes employing black opaque matrix around the phosphor dots to double the brightness of the viewing screen (type 25BCP22).

RCA produced 21-inch, 90° deflection, color tubes with Ultra-Rectangular viewing screens. This UR tube featured a 4 by 3 aspect ratio which matched the rectangular rasters televised, thereby, displaying more picture-viewing information (type A56-120X).

1970 RCA produced and shipped the first wide-angle 110° deflection color picture tube (type 18VANP22) for use in RCA-CE's Argosy I model TV receiver. The tube featured a 29-millimeter narrow neck to reduce deflection power requirements and a 4-inch shorter overall length to allow more pleasing portable model cabinet styling.

RCA produced 25V-90° Ultra-Rectangular color tubes for European customers (type A67-120X).

RCA commenced production of 25V-90° Ultra-Rectangular Hi-Lite matrix color tubes for U.S. domestic customers (type 25VABP22).

1971 RCA produced the 19V-110° Ultra-Rectangular, wide-angle deflection tube (type 19VBLP22).

RCA produced tubes with 25V-110° wide-angle deflection 29-mm narrow-neck diameter for customers in Europe (type A67-150X).

1972 RCA completed development work, produced and commenced shipment of the first 15V-90° Hi-Lite precision in-line color tube assembly with a precision static toroid (PST) deflection yoke and a convergence/purity permanent magnet (PM) system. The new system was adjusted at the tube factory and eliminated the need for convergence magnetic pole pieces in the gun and external electromagnetic pole-piece exciters and associated dynamic convergence circuits. Setup of the new color system in a receiver required only a black-and-white picture tracking adjustment. It eliminated the need for twelve dynamic convergence adjustments normally required for the delta-dot system (types 15VADTC01 and A42-100X).

1973 RCA produced 17V-90° and 19V-90° precision in-line matrix color tube assemblies with PST deflection yokes and PM devices attached (types 17VANTC01 and 19VDKTC02).

1974 RCA produced a 13V-90° precision in-line matrix color tube assembly with PST yoke and PM device attached (type 13VAKTC02).

1975 RCA introduced a 25V-110° self-converging color picture tube system featuring a line screen, a triple-beam in-line gun, an internal magnetic shield, quick-heat cathodes and a PST yoke and permanent magnet device attached (type A67-610X).

RCA introduced a 25V-90° matrix tube featuring a pigmented phosphor screen which selectively filters room light and improves picture contrast (type 25VEHP22).

RCA started commercial production of a 25V-90° high resolution color display tube with center resolution capability of 900 lines for use in high-resolution industrial and military display equipment (type 1909P22).

1976 RCA introduced a 21V-110° self-converging color picture tube system with a PST yoke and permanent magnet device attached (type A56-610X).

1977 RCA introduced the 13V-90° matrix precision in-line color picture tube designed to operate with saddle-shaped horizontal coils and toriodal vertical deflection coils. The new tube and saddle-toroidal yoke resulted in a more efficient, energy-saving color TV system (type 13VAUP22).

1978 RCA introduced 21V-110° and 25V-110° high-brightness "Sunshine" tubes for the European market featuring higher transmission shadow masks and glass panels (type A56-615X).

RCA introduced 15V-90°, 17V-90° and 19V-90° precision in-line matrix color tubes designed for use with saddle-toroidal deflection yokes. The 19V-90° tube also featured a high-focus-voltage bipotential triple beam precision in-line electron gun to improve picture resolution (types A42-268X, 17VBLP22, and 19VHYP22 respectively).

1979 RCA added 19V-100° and 25V-100° color tubes to the product line for U.S. domestic customers. The tubes featured high-focus voltage bipotential triple-beam precision in-line guns for use with saddle-toroidal deflection yokes. In addition, a 25V-100° tube employing a tripotential gun was added to the line (types 19VJWP22, 25VEYP22 and 25VEMP22 respectively).

1982 RCA announced its entrance into the color data display CRT market. A broad line of 13V/90° high-resolution color tube/yoke/component assemblies are available. They incorporate a fine-pitch dot screen (types M33AAA02A11-17 and M33AAA02X11-17).

RCA announced the COTY-29 concept (**C**ombined **O**ptimum **T**ube and **Y**oke in a **29** mm neck diameter). This new generation of color picture tubes was designed for a miniaturized yoke for cost savings in material and deflection power. Improved focus and convergence performance are achieved through an XL (expanded diameter lens) electron gun. It is available with a 90° deflection angle in 13V and 19V sizes and with 110° deflection in the 25V size (types A33AAB10X, A48AAB10X and A63ABP10X).

1983 RCA announced COTY-FS and COTY-SP, the "New Look for COTY-29". COTY-FS (Full Square) features a rectilinear screen - straight sides and square corners. COTY-SP (Square Planar) features a nearly planar screen edge, a much flatter faceplate, and a rectilinear screen. COTY-FS will be available with a 90° deflection angle in 14V and 20V sizes and with 110° deflection in 20V and 26V sizes (types A36ACG10X, A51ACG20X, A51ABU10X, and A66ABU10X). COTY-SP will be available with a 110° deflection angle in 20V and 27V sizes (types A51ACC10X and A68ACC10X).

The evolution in the physical appearance of RCA color TV picture tubes is summarized on the following pages in a pictorial form.

Conclusions

RCA continues to adopt significant process and design changes to further improve performance and/or reduce system costs.

RCA plans to continue its leadership in developing new generations of color picture tubes. Engineering effort will also continue on other types of display devices; however, it is expected that the shadow-mask color picture tube will dominate this market for some time to come.

1953
15GP22
12V/45°
Round Glass

1954
21AXP22
19V/70°
Round Metal

1957
21CYP22
19V/70°
Round Glass

1964
25AP22
23V/90°
Rectangular Glass

This format was extended to 14V, 16V, 18V, and 20V sizes.

1970
25VABP22
25V/90°
Ultra-rectangular

This format was extended to 17V, 19V and 21V sizes.

1972
15VADTC01
15V/90°
Precision In-Line
(Includes Yoke)

This format was extended to 13V, 17V, 19V, and 21V sizes.

1975
A67-610X
25V/110°
Precision In-Line
(Includes Yoke)

This format was extended to the 21V size.

1979
25VEYP22
25V/100°
Hi PI

1983
A66ABU10X
26V/110°
COTY-FS

This format will also be available in 20V/110°, 20V/90°, and 14V/90° sizes.

1983
A68ACC10X
27V/110°
COTY-SP

This format will also be available in a 20V size.

36 cm (14V) 90° COTY-FS Precision In-Line Color Picture Tube

- **COTY-FS — Full Square — A New Faceplate Shape — Rectilinear Screen — Straight Sides and Square Corners**
- **Designed for a Miniaturized Pin Free Saddle/Toroidal Yoke — Lower Deflection Power**
- **XL Bipotential Precision In-Line Gun — Optimized Beam-Forming Region for Excellent Focus Uniformity and Good Resolution**
- **Standard 29 mm Neck Diameter — Proven Reliability**
- **Excellent Convergence Performance**
- **Internal Magnetic Shield**
- **Other Features —**
  - **Matrix Line Screen**
  - **Tinted Phosphor**
  - **Super-Arch Mask**
  - **Soft-Arc Technology**
  - **Integral Mounting Lugs**

RCA A36ACG10X is a 36 cm (14V) 90° COTY-FS Precision In-Line Color Picture Tube. COTY-FS features a rectilinear screen and a faceplate radius of curvature similar to 13V types. The screen edges are straight and form square corners - a true rectangle. The horizontal and vertical axial screen dimensions are nearly the same as for 13V tubes.

The A36ACG10X incorporates the same improved features as earlier RCA COTY-29 tubes. It is designed for a miniaturized yoke which provides a savings in material and deflection power. The tube features an XL electron gun with close beam-to-beam spacing for excellent focus and convergence performance, and a standard 29 mm neck diameter for proven reliability. Optimum system cost and performance result from these combined features.

The pin free deflection yoke is similar to those used on the earlier 13V/90° COTY-29 types. Miniaturization of the yoke was made possible by reducing the beam spacing in the electron gun and by optimizing both the funnel glass contour and the yoke contour to match the path of the deflected electron beams.

A bipotential precision in-line electron gun featuring an XL (expanded diameter lens) has been incorporated in the A36ACG10X. In this feature, an expanded lens field encompasses all three beams. This expanded field when combined with the fields from the individual apertures produces a superior lens for focus performance and with less aberrations than in a standard gun. Only the neck diameter, not the beam spacing, limits the focusing ability. This focusing principle allows the reduction of beam spacing without the usual loss in focus quality. Convergence performance has also been improved by the reduction in the beam spacing.

Electrical Data

Heater:		
Voltage	6.3	V
Current	700	mA
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Angles (approx.):		
Diagonal	90	deg
Horizontal	74	deg
Vertical	57	deg

Formerly RCA Developmental Type C76940

Electrical Data (Cont'd)

Direct Interelectrode Capacitance (approx.):

Grid no.1 to all other electrodes	10	pF
Grid no.3 to all other electrodes	5.0	pF
Each cathode to all other electrodes	6.5	pF
All cathodes to all other electrodes	14	pF

Capacitance Between Anode and External Conductive Coating (including metal hardware) ... 1350 max. pF; 675 min. pF

Resistance Between Metal Hardware and External Conductive Coating ... 50 min. MΩ

Typical Deflection Yoke ... RCA XD5352, or Equivalent

Integral Magnetic Shield ... Internal

Optical Data

Faceplate:
- Light transmittance at center (approx.) ... 85.5%
- Surface ... Polished

Screen:
- Matrix ... Black Opaque Material
  - Type ... Negative Guard Band
- Phosphor, rare-earth (red), sulfide (blue & green) ... Type X[1]
  - Type ... Selectively Absorbent
  - Persistence ... Medium Short
- Array ... Vertical Line Trios
- Spacing between corresponding points on line trios at center (approx.) ... 0.66 mm

Mechanical Data

Tube Dimensions:
- Overall length ... 362.17 ± 6.35 mm
- Reference line to center of face ... 215.43 ± 4.78 mm
- Neck length ... 146.74 ± 4.78 mm
- O.D. at tension band:
  - Diagonal ... 396.44 ± 2.36 mm
  - Horizontal ... 328.38 ± 2.36 mm
  - Vertical (including tension-band clips) ... 269.81 ± 2.36 mm
- Minimum screen dimensions (projected):
  - Diagonal ... 355.60 mm
  - Horizontal ... 284.48 mm
  - Vertical ... 213.36 mm
  - Area ... 607 sq cm

Bulb Funnel Designation ... EIA No.J389

Bulb Panel Designation ... EIA No.F391

Anode Bulb Contact Designation ... EIA No.J1-21

Base and Pin Connection Designation[2] ... EIA No.B8-295-AA

Pin Position Alignment ... Ridge Separating Pins 9 and 10 Aligns Approx. with Anode Bulb Contact

Operating Position, Preferred ... Anode Bulb Contact on Top

Gun Configuration ... Horizontal In Line

Weight (approx.) ... 7.2 kg

Implosion Protection

Type ... Tension Band

Maximum and Minimum Ratings, Absolute-Maximum Values

Absolute-Maximum Ratings are specified for reliability and performance purposes. X-radiation characteristics should also be taken into consideration in the application of this tube type.

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Anode Voltage	30 max. / 17 min.	kV
Anode Current, Long-Term Average	2000 max.	μA
Grid-No.3 (focusing electrode) Voltage	12 max.	kV
Peak Grid-No.2 Voltage	1850 max.	V
Cathode Voltage:		
Positive bias value	400 max.	V
Positive operating cutoff value	200 max.	V
Negative bias value	0 max.	V
Negative peak value	2 max.	V
Heater Voltage:[3]		
AC (rms) or DC value	6.9 max. / 5.7 min.	V
Peak pulse value	50 max.	V
Surge value, during 15-second warm-up period (rms)	9.5 max.	V
Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
DC component value	200 max.	V
Peak value	300 max.	V
Heater positive with respect to cathode:		
DC component value	100 max.	V
Peak value	200 max.	V

Typical Design Values (for anode voltage of 25 kV)

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Grid-No.3 (focusing electrode) Voltage ... 24 to 28% of Anode Voltage

Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot ... See CUTOFF DESIGN CHART in **Figure 1**
- At cathode voltage of 100 V ... 265 to 535 V
- At cathode voltage of 150 V ... 420 to 820 V
- At cathode voltage of 200 V ... 575 to 1105 V

Maximum Ratio of Cathode Cutoff Voltages, Highest Gun to Lowest Gun (with grid no.2 of gun having highest cathode voltage adjusted to give 150 V spot cutoff) ... 1.25

Heater Voltage[3] ... 6.3 ± 0.1 V

Grid-No.3 Current[4] ... ± 10 μA

Grid-No.2 Current ... ± 5 μA

Grid-No.1 Current ... ± 5 μA

To Produce White Light Output Having CIE Coordinates of:

X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each beam (average):			
Red	37	24	%
Blue	26	34	%
Green	37	42	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.00	0.49	
Typical	1.38	0.71	
Maximum	1.75	0.92	
Red/green:			
Minimum	0.75	0.41	
Typical	0.98	0.58	
Maximum	1.20	0.73	
Blue/green:			
Minimum	0.54	0.62	
Typical	0.71	0.81	
Maximum	0.88	1.00	

Raster Centering Displacement
Measured at Center of Screen:[5]

Horizontal	-0.7 ± 6.0 mm
Vertical	0 ± 6.0 mm
Center Convergence Displacement Between the Blue and Red Beams	4.0 mm
Center Convergence Displacement Between the Green Beam and the Converged Blue and Red Beams	1.4 mm
Maximum Required Correction for Register[6] (including effect of earth's magnetic field when using recommended components) as Measured at the Center of the Screen in the Horizontal Direction	0.10 max. mm

---

[1] The X phosphor designation in the WTDS is equivalent to P22 in the EIA type designation system.

[2] For mating socket considerations, see Note 1 under **Notes for Dimensional Outline**.

[3] For maximum tube life, the heater supply voltage should be regulated to minimize heater voltage changes due to variations in line voltage, beam current, and other parameters. The design center value of the heater voltage should be the **Typical Design Value**; however, in some applications it may be desirable to operate at a voltage slightly below this value.

Cost considerations may suggest that the heater voltage be obtained from an unregulated source. If this option is chosen and the unregulated voltage varies with beam current, the circuit parameters should be selected so that the design center value of the heater voltage is equal to the **Typical Design Value** when the beam current is one-half of the **Long-Term Average Anode Current** as shown in the tabulated data. The **Absolute-Maximum and Minimum Ratings** should not be exceeded when including all variations.

For specific considerations, consult your RCA Video Component and Display Division representative.

[4] A high source impedance in the focus circuit can result in a change in the focus voltage with a change in the grid no.3 leakage current.

[5] The design-center values are the values obtained when the tube is operated with recommended components and procedures in an earth's magnetic field having a 470 mG vertical component and a zero cross-axial horizontal component..

[6] Register is defined as the relative position of the beam trios with respect to the associated phosphor-line trios.

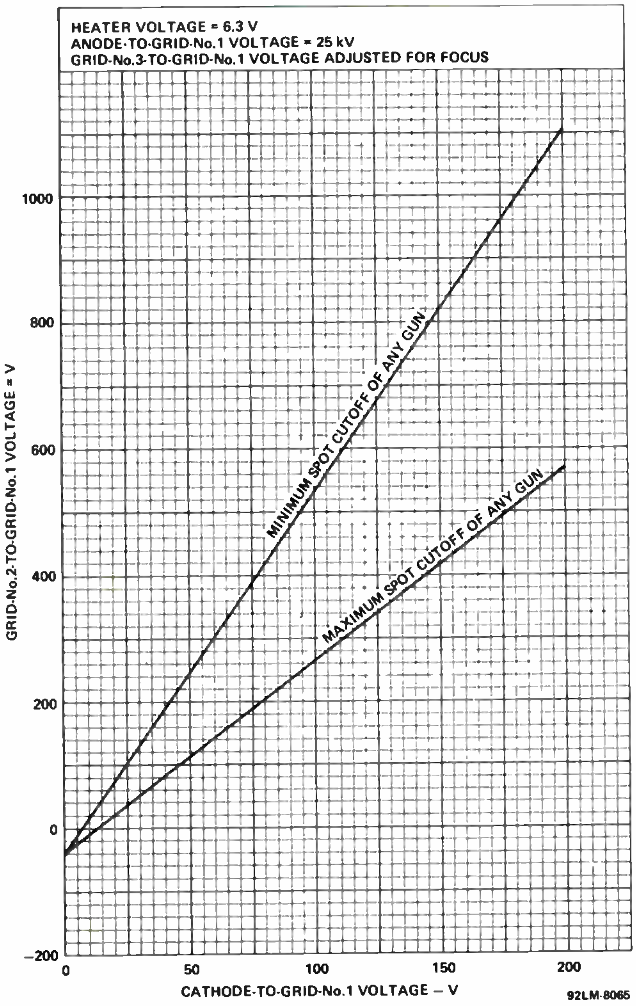


Figure 1 - Cutoff Design Chart

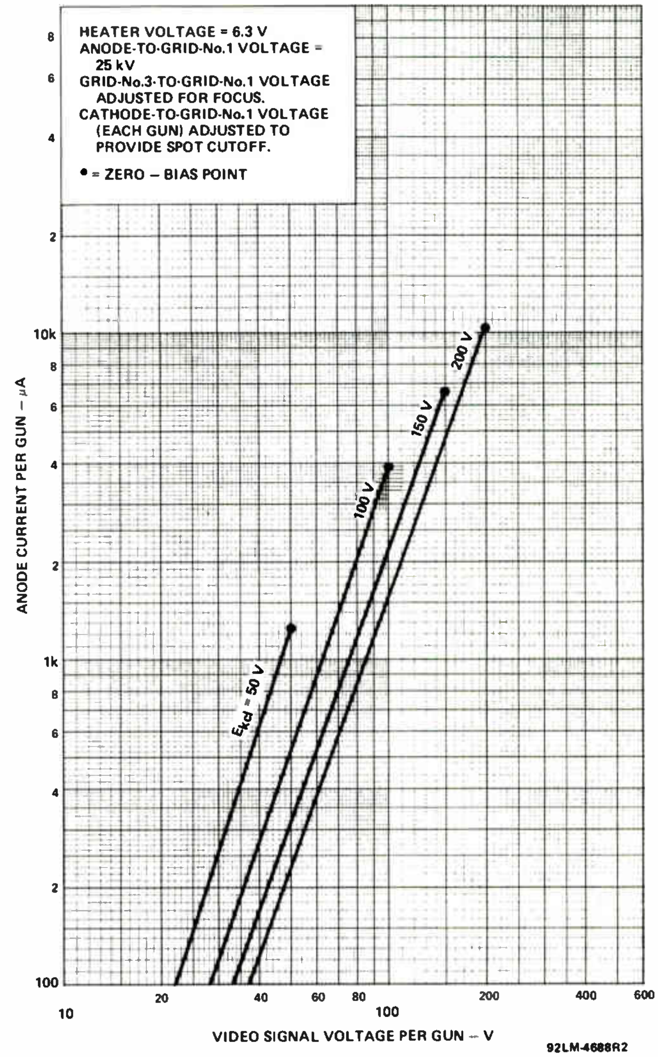


Figure 2 - Typical Drive Characteristics, Cathode-Drive Service

Notes for Dimensional Outline

Note 1 - The mating socket assembly with associated circuit board and mounted components must not weigh more than 0.5 kg. To minimize the torsional forces on the tube base pins, the center of gravity of this assembly should be located on the vertical plane through the picture-tube axis. Caution should also be exercised so that connecting leads to the assembly do not exert excessive torsional forces.

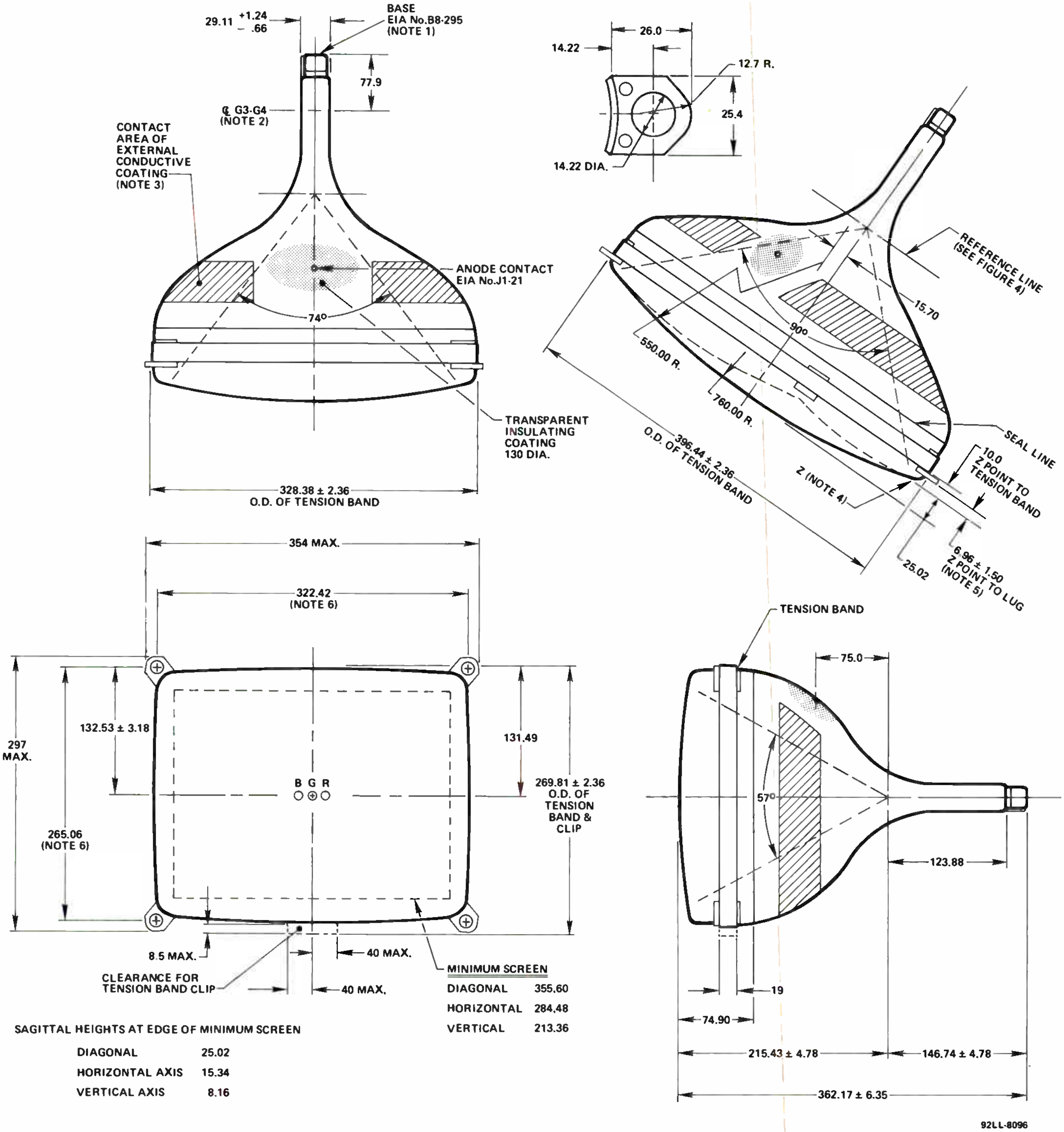
Note 2 - The purity magnets should be centered over or forward of the G3-G4 gap. Consideration should be given when selecting a convergence/purity device to assure adequate performance and axial adjustment of the yoke while meeting this location requirement.

Note 3 - The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be connected to the chassis with multiple contacts.

Note 4 - "Z" is located on the outside surface of the faceplate on the screen diagonal at the edge of the minimum published screen. This point is used as a reference for the mounting lugs.

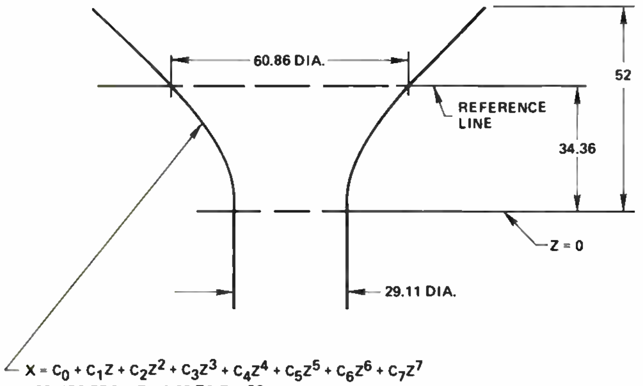
Note 5 - None of the four mounting lugs will deviate from the plane of the other three by more than 1.6 mm.

Note 6 - The tolerance of the mounting lug holes will accommodate mounting screws up to 9.5 mm in diameter when positioned on the true hole centers.



Dimensions in mm unless otherwise noted.

Figure 3 - Dimensional Outline



$X = C_0 + C_1Z + C_2Z^2 + C_3Z^3 + C_4Z^4 + C_5Z^5 + C_6Z^6 + C_7Z^7$

APPLIES FROM Z = 9.35 TO Z = 52

WHERE:

$C_0 = 15.1049059$	$C_4 = -3.87722896\times10^{-5}$
$C_1 = -0.158224021$	$C_5 = 7.24922652\times10^{-7}$
$C_2 = 1.16255308\times10^{-2}$	$C_6 = -6.72385142\times10^{-9}$
$C_3 = 8.88052299\times10^{-4}$	$C_7 = 2.48277616\times10^{-11}$

Figure 4 - Funnel Contour in Yoke Region

Pin 1: Grid No.3
Pin 5: Grid No.1
Pin 6: Cathode of Green Beam
Pin 7: Grid No.2
Pin 8: Cathode of Red Beam
Pin 9: Heater
Pin 10: Heater
Pin 11: Cathode of Blue Beam
Cap: Anode (Grid No.4, Screen, Collector)
C: External Conductive Coating

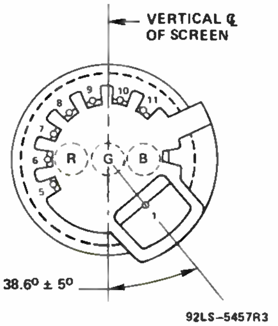


Figure 5 - Pin Connections and Rear View of Base - EIA No.B8-295-AA

WARNING

X-Radiation

This color picture tube incorporates integral x-radiation shielding and must be replaced with a tube of the same type number or an RCA-recommended replacement to assure continued safety.

Operation of this color picture tube at abnormal conditions which exceed the 0.5 mR/h isoexposure-rate limit may produce soft x rays which may constitute a health hazard on prolonged exposure at close range unless adequate external x-radiation shielding is provided. Therefore, precautions must be exercised during servicing of TV receivers employing this tube to assure that the anode voltage and other tube voltages are adjusted to the recommended values so that the Absolute-Maximum Ratings will not be exceeded.

Implosion Protection

This picture tube employs integral implosion protection and must be replaced with a tube of the same type number or an RCA-recommended replacement to assure continued safety.

Shock Hazard

The high voltage at which the tube is operated may be very dangerous. Design of the TV receiver should include safeguards to prevent the user from coming in contact with the high voltage. Extreme care should be taken in the servicing or adjustment of any high-voltage circuit.

Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture-tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode contact button, located in the funnel of the picture tube, to the external conductive coating before handling the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard. Also see Tube Mounting on page 8.

Tube Handling

Picture tubes should be kept in the shipping box or similar protective container until just prior to installation. Wear heavy protective clothing, including gloves and safety goggles with side shields, in areas containing unpacked and unprotected tubes to prevent possible injury from flying glass in the event a tube breaks. Handle the picture tube with extreme care. Do not strike, scratch or subject the tube to more than moderate pressure. Particular care should be taken to prevent damage to the seal area.

It is the sole responsibility of the manufacturer of television receivers and other equipment utilizing this color picture tube to provide appropriate design and circuitry that will limit the possible effects of failure of the color picture tube.

The equipment manufacturer should provide a warning label in an appropriate position on the equipment to advise the serviceman of all safety precautions.

Magnetic Shield and Degaussing

An internal magnetic shield is provided in this tube. When properly degaussed this shield in conjunction with the shadow-mask assembly provides compensation for the effects of the earth's magnetic field on the electron beams. After installation of the picture tube into the receiver cabinet, it is recommended that the complete receiver be externally degaussed by a minimum degaussing field of 20 gauss measured at the faceplate of the tube. The external degaussing procedure should be followed by the receiver's internal degaussing in the normal manner. In order for this action to be effective, it is essential that the tube be degaussed in the specific earth's magnetic field (strength and orientation) in which it is to be operated. Proper degaussing will assure satisfactory performance for field purity.

Degaussing Coils

The recommended degaussing system utilizes a single tilted coil placed on the tube as shown in **Figure 6** with the top edge on the panel in front of the seal line and the bottom edge on the funnel about 40 mm behind the seal line. Small holes are provided in the four mounting lugs to facilitate mounting the degaussing coil to the tube funnel.

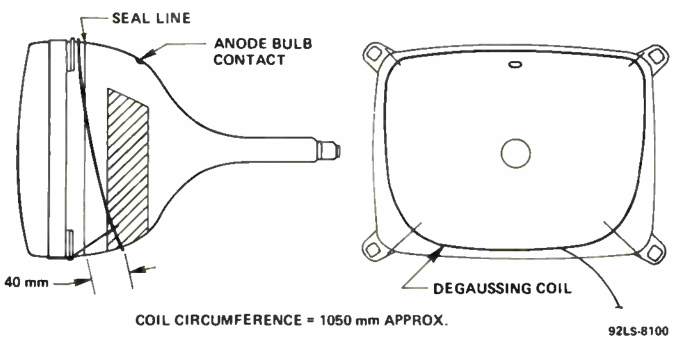


Figure 6 - Relative Placement of Typical Tilted "Z" Degaussing Coil

Degaussing Circuit

A recommended degaussing circuit as shown in **Figure 7** uses a conventional single PTC device. For proper degaussing, a minimum value of 600 peak-to-peak ampere-turns is required. It is essential to reduce the degaussing current in a gradual manner (50 percent amplitude in a minimum of 5 cycles). The residual value in the coil due to the degaussing power source should not exceed 1.0 peak-to-peak ampere-turns.

For optimum performance the degaussing coil should always be connected to a very low source impedance at the horizontal frequency. If the circuit used does not have an inherent low impedance at the horizontal frequency, the degaussing coil should be shunted with a suitable capacitor. If the addition of a short across the coil increases the horizontal frequency currents in the degaussing coil by more than 20%, the inherent source impedance offered by the PTC and associated circuitry is indicated to be too high to provide satisfactory performance. Therefore a capacitor should be be added across the degaussing coil to satisfy this requirement.

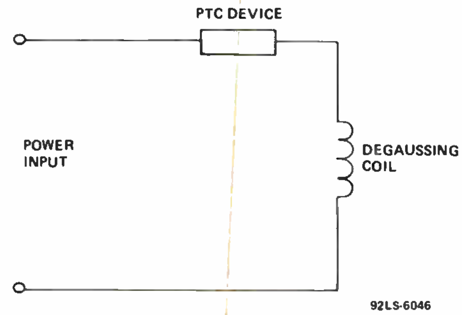


Figure 7 - Typical Degaussing Circuit

High-Voltage Discharge Protection

The high-resistance internal coating incorporated in soft-arc picture-tube designs significantly reduces the peak energy during a high-voltage discharge. In spite of this and other improvements, high-voltage discharges are still capable of initiating ionized paths, both internal and external to the tube, that can couple high-energy low-voltage sources to the picture tube and associated circuit elements. These high-energy sources can cause varying degrees of picture-tube and/or circuit damage.

With any color picture tube, maximum product reliability is obtained by the use of spark gaps with proper grounding, series isolation resistors, and good printed circuit board layouts. Spark gaps to ground should be connected to all socket contacts except as noted below for heater circuits. The ground points for the focus-electrode spark gap and the low-voltage spark gaps should be connected with a heavy noninductive strap to a good grounding contact on the picture-tube external conductive coating. The focus-electrode spark gap should be designed to break down at a dc value of approximately 1.5 times the maximum design voltage of the focus circuit. The low-voltage spark gaps should be designed for a dc breakdown voltage of 1.5 to 3.0 kV. The high-voltage circuit chassis ground point should be connected to the low-voltage spark-gap ground at the picture-tube socket. It is recommended that no other connections be made between the picture-tube external coating and the grounds of the main chassis or the spark gaps. This will minimize circulating currents in the chassis during high-voltage discharge.

Isolation resistors should be used in series with each grid and cathode lead. The resistance values should be as high as possible without degrading circuit performance (see **Figure 8**). These resistors should be capable of withstanding an instantaneous application of 12 kV for the low-voltage circuits and 20 kV for the focus circuit without arcing over, arcing through the body, or changing in resistance significantly during repeated applications of these voltages. Most half-watt carbon composition resistors are suitable for the low-voltage circuits and most one-watt carbon composition resistors are suitable for the focus circuit. Use of these resistors reduces the possibility of circulating currents in the chassis and excessive currents in the picture-tube elements.

For best reliability, the heater circuit should be isolated from chassis ground and/or voltage sources by a minimum resistance of 10 kΩ. Spark gaps should be connected to both heater-socket contacts. These spark gaps should have the same characteristics as the other low-voltage spark gaps. When the heater voltage is supplied from an isolated source, such as the horizontal deflection circuit or other high-frequency pulse source, a capacitor may be required between one side of the heater and ground to eliminate undesirable interference on the picture-tube screen. If a capacitance value in excess of 0.01 μF is required, the spark gaps to the heater leads should not be used.

Very reliable performance can also be obtained with non-isolated heater circuits. In these cases, only the high side of the heater circuit needs a spark gap. However, printed circuit board and socket designs which inherently provide spark gaps for both heater leads are also satisfactory.

Tube Mounting

Integral mounting lugs are provided to facilitate mounting the picture tube in the receiver. To prevent a possible shock hazard, it is recommended that the integral mounting lugs and other metal hardware of the tube be connected to the receiver chassis through one of the mounting lugs. If the chassis is not at ground potential, the connection should be made through a 1 MΩ current-limiting resistor. The mounting system and other receiver hardware should not place mechanical stress on, or cause abrasion of, the tube particularly in the panel-to-funnel seal area.

The TV receiver mounting system should incorporate sufficient cushioning so that under conditions of shipment or handling the impact force applied to the picture tube does not exceed 35 g's.

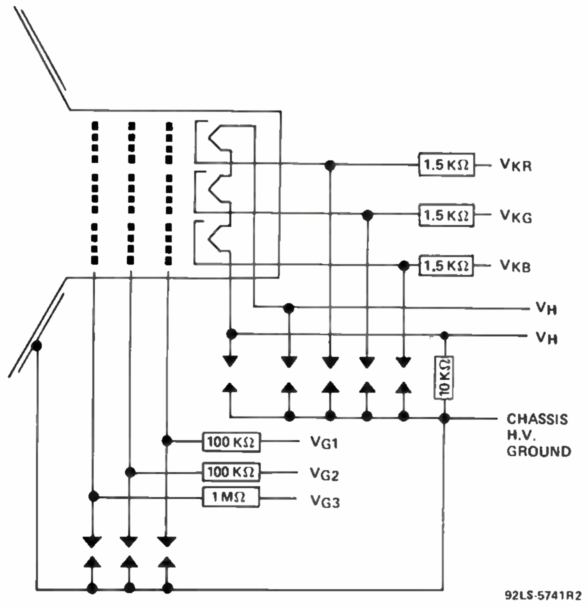


Figure 8 - Picture-Tube Connections Showing Spark-Gap Recommendations and Typical Isolation-Resistor Values

51 cm (20V) 90° COTY-FS Precision In-Line Color Picture Tube

- **COTY-FS — Full Square — A New Faceplate Shape — Rectilinear Screen — Straight Sides and Square Corners**
- **Designed for a Miniaturized Pin Free Saddle/Toroidal Yoke — Lower Deflection Power**
- **XL Bipotential Precision In-Line Gun — Optimized Beam-Forming Region for Excellent Focus Uniformity and Good Resolution**
- **Standard 29 mm Neck Diameter — Proven Reliability**
- **Excellent Convergence Performance**
- **Internal Magnetic Shield**
- **Other Features —**
  - **Matrix Line Screen**
  - **Tinted Phosphor**
  - **Super-Arch Mask**
  - **Soft-Arc Technology**
  - **Integral Mounting Lugs**

RCA A51ACG20X is a 51 cm (20V) 90° COTY-FS Precision In-Line Color Picture Tube. COTY-FS features a rectilinear screen and a faceplate radius of curvature similar to 19V types. The screen edges are straight and form square corners - a true rectangle. The horizontal and vertical axial screen dimensions are nearly the same as for 19V tubes.

The A51ACG20X incorporates the same improved features as earlier RCA COTY-29 tubes. It is designed for a miniaturized yoke which provides a savings in material and deflection power. The tube features an XL electron gun with close beam-to-beam spacing for excellent focus and convergence performance, and a standard 29 mm neck diameter for proven reliability. Optimum system cost and performance result from these combined features.

The pin free deflection yoke is similar to those used on the earlier 19V/90° COTY-29 types. Miniaturization of the yoke was made possible by reducing the beam spacing in the electron gun and by optimizing both the funnel glass contour and the yoke contour to match the path of the deflected electron beams.

A bipotential precision in-line electron gun featuring an XL (expanded diameter lens) has been incorporated in the A51ACG20X. In this feature, an expanded lens field encompasses all three beams. This expanded field when combined with the fields from the individual apertures produces a superior lens for focus performance and with less aberrations than in a standard gun. Only the neck diameter, not the beam spacing, limits the focusing ability. This focusing principle allows the reduction of beam spacing without the usual loss in focus quality. Convergence performance has also been improved by the reduction in the beam spacing.

Electrical Data

Heater:		
Voltage	6.3	V
Current	700	mA
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Angles (approx.):		
Diagonal	90	deg
Horizontal	74	deg
Vertical	57	deg

Formerly RCA Developmental Type C76953

Printed in U.S.A./10-83

Electrical Data (Cont'd)

Direct Interelectrode Capacitance (approx.):

Grid no.1 to all other electrodes	10	pF
Grid no.3 to all other electrodes	5.0	pF
Each cathode to all other electrodes	6.5	pF
All cathodes to all other electrodes	14	pF

Capacitance Between Anode and External Conductive Coating (including metal hardware) ... 2600 max. pF / 1500 min. pF

Resistance Between Metal Hardware and External Conductive Coating ... 50 min. MΩ

Typical Deflection Yoke ... RCA XD5347, or Equivalent

Integral Magnetic Shield ... Internal

Optical Data

Faceplate:
- Light transmittance at center (approx.) ... 85%
- Surface ... Polished

Screen:
- Matrix ... Black Opaque Material
  - Type ... Negative Guard Band
- Phosphor, rare-earth (red), sulfide (blue & green) ... Type X[1]
  - Type ... Selectively Absorbent
  - Persistence ... Medium Short
- Array ... Vertical Line Trios
- Spacing between corresponding points on line trios at center (approx.) ... 0.84 mm

Mechanical Data

Tube Dimensions:
- Overall length ... 451.71 ± 6.35 mm
- Reference line to center of face ... 304.97 ± 4.78 mm
- Neck length ... 146.74 ± 4.78 mm
- O.D. at tension band:
  - Diagonal ... 552.74 ± 2.36 mm
  - Horizontal ... 459.60 ± 2.36 mm
  - Vertical (including tension-band clips) ... 376.04 ± 2.36 mm
- Minimum screen dimensions (projected):
  - Diagonal ... 508.00 mm
  - Horizontal ... 406.40 mm
  - Vertical ... 304.80 mm
  - Area ... 1239 sq cm

Bulb Funnel Designation ... EIA No.J542

Bulb Panel Designation ... EIA No.F545

Anode Bulb Contact Designation ... EIA No.J1-21

Base and Pin Connection Designation[2] ... EIA No.B10-276-AB

Pin Position Alignment ... Space Separating Pins 9 and 10 Aligns Approx. with Anode Bulb Contact

Operating Position, Preferred ... Anode Bulb Contact on Top

Gun Configuration ... Horizontal In Line

Weight (approx.) ... 14.3 kg

Implosion Protection

Type ... Rimbands and Tension Bands

Maximum and Minimum Ratings, Absolute-Maximum Values

Absolute-Maximum Ratings are specified for reliability and performance purposes. X-radiation characteristics should also be taken into consideration in the application of this tube type.

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Anode Voltage	32 max. / 17 min.	kV / kV
Anode Current, Long-Term Average	2000 max.	μA
Grid-No.3 (focusing electrode) Voltage	12 max.	kV
Peak Grid-No.2 Voltage	1850 max.	V
Cathode Voltage:		
Positive bias value	400 max.	V
Positive operating cutoff value	200 max.	V
Negative bias value	0 max.	V
Negative peak value	2 max.	V
Heater Voltage:[3]		
AC (rms) or DC value	6.9 max. / 5.7 min.	V / V
Peak pulse value	50 max.	V
Surge value, during 15-second warm-up period (rms)	9.5 max.	V
Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
DC component value	200 max.	V
Peak value	300 max.	V
Heater positive with respect to cathode:		
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Peak value	200 max.	V

Typical Design Values (for anode voltage of 25 kV)

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Grid-No.3 (focusing electrode) Voltage ... 24 to 28% of Anode Voltage

Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot ...... See CUTOFF DESIGN CHART in **Figure 1**
- At cathode voltage of 100 V ... 265 to 535 V
- At cathode voltage of 150 V ... 420 to 820 V
- At cathode voltage of 200 V ... 575 to 1105 V

Maximum Ratio of Cathode Cutoff Voltages, Highest Gun to Lowest Gun (with grid no.2 of gun having highest cathode voltage adjusted to give 150 V spot cutoff) ... 1.25

Heater Voltage[3] ... 6.3 ± 0.1 V

Grid-No.3 Current[4] ... ± 10 μA

Grid-No.2 Current ... ± 5 μA

Grid-No.1 Current ... ± 5 μA

To Produce White Light Output Having CIE Coordinates of:

X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each beam (average):			
Red	37	24	%
Blue	26	34	%
Green	37	42	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.00	0.49	
Typical	1.38	0.71	
Maximum	1.75	0.92	
Red/green:			
Minimum	0.75	0.41	
Typical	0.98	0.58	
Maximum	1.20	0.73	
Blue/green:			
Minimum	0.54	0.62	
Typical	0.71	0.81	
Maximum	0.88	1.00	

Raster Centering Displacement
Measured at Center of Screen:[5]
Horizontal .... -1.5 ± 6.0 mm
Vertical .... 0 ± 6.0 mm

Center Convergence Displacement
Between the Blue and Red Beams .... 4.0 mm

Center Convergence Displacement
Between the Green Beam and the
Converged Blue and Red Beams .... 1.4 mm

Maximum Required Correction for Register[6]
(including effect of earth's magnetic field
when using recommended components) as
Measured at the Center of the Screen in
the Horizontal Direction .... 0.10 max. mm

---

1 The X phosphor designation in the WTDS is equivalent to P22 in the EIA type designation system.

2 For mating socket considerations, see Note 1 under **Notes for Dimensional Outline**.

3 For maximum tube life, the heater supply voltage should be regulated to minimize heater voltage changes due to variations in line voltage, beam current, and other parameters. The design center value of the heater voltage should be the **Typical Design Value**; however, in some applications it may be desirable to operate at a voltage slightly below this value.

Cost considerations may suggest that the heater voltage be obtained from an unregulated source. If this option is chosen and the unregulated voltage varies with beam current, the circuit parameters should be selected so that the design center value of the heater voltage is equal to the **Typical Design Value** when the beam current is one-half of the **Long-Term Average Anode Current** as shown in the tabulated data. The **Absolute-Maximum and Minimum Ratings** should not be exceeded when including all variations.

For specific considerations, consult your RCA Video Component and Display Division representative.

4 A high source impedance in the focus circuit can result in a change in the focus voltage with a change in the grid no.3 leakage current.

5 The design-center values are the values obtained when the tube is operated with recommended components and procedures in an earth's magnetic field having a 470 mG vertical component and a zero cross-axial horizontal component..

6 Register is defined as the relative position of the beam trios with respect to the associated phosphor-line trios.

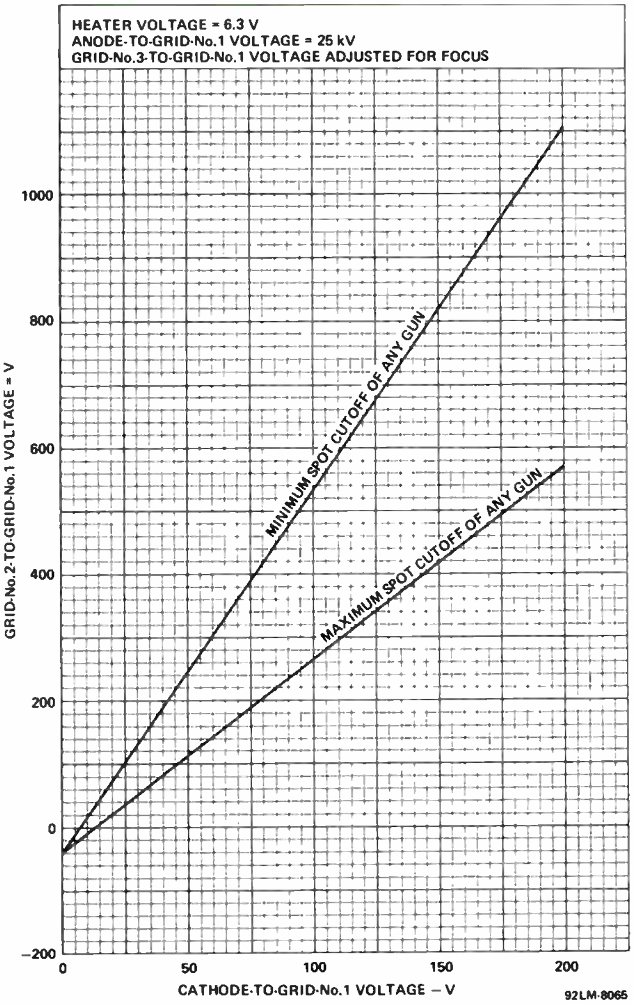


Figure 1 - Cutoff Design Chart

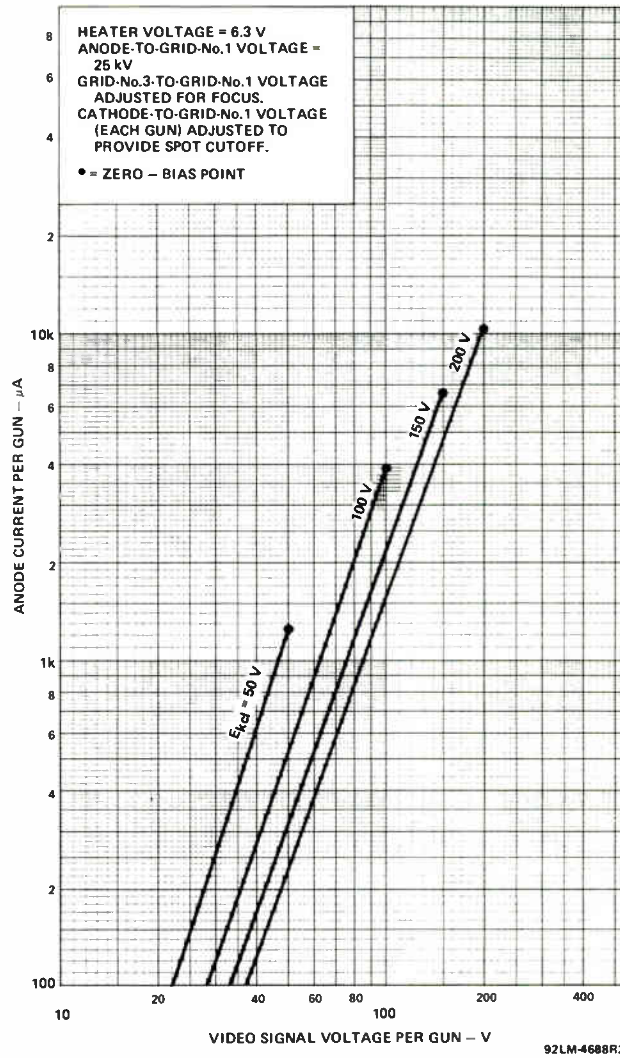


Figure 2 - Typical Drive Characteristics, Cathode-Drive Service

Notes for Dimensional Outline

Note 1 - The mating socket assembly with associated circuit board and mounted components must not weigh more than 0.5 kg. To minimize the torsional forces on the tube base pins, the center of gravity of this assembly should be located on the vertical plane through the picture-tube axis. Caution should also be exercised so that connecting leads to the assembly do not exert excessive torsional forces.

Note 2 - The purity magnets should be centered over or forward of the G3-G4 gap. Consideration should be given when selecting a convergence/purity device to assure adequate performance and axial adjustment of the yoke while meeting this location requirement.

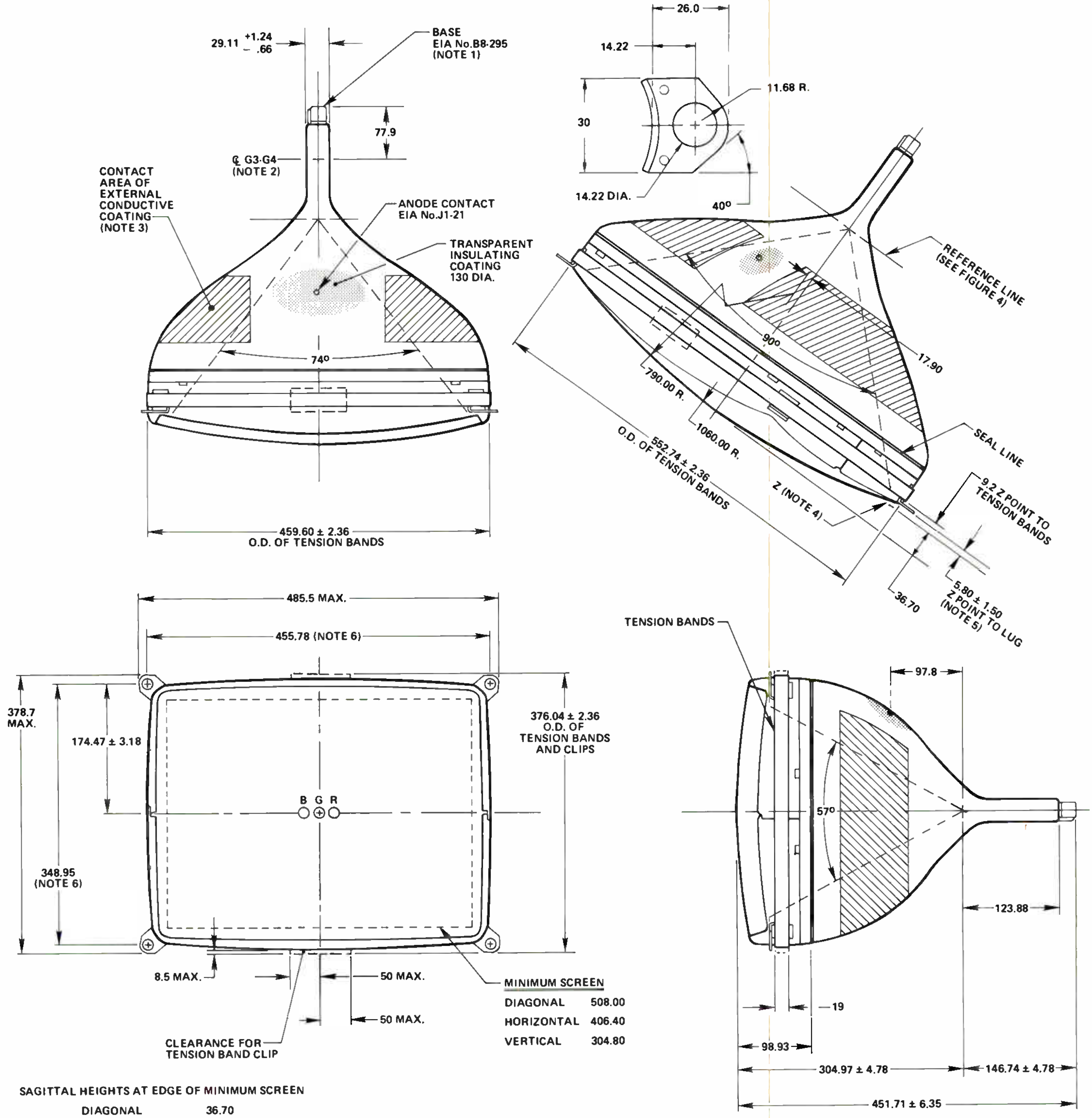
Note 3 - The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be connected to the chassis with multiple contacts.

Note 4 - "Z" is located on the outside surface of the faceplate on the screen diagonal at the edge of the minimum published screen. This point is used as a reference for the mounting lugs.

Note 5 - None of the four mounting lugs will deviate from the plane of the other three by more than 1.6 mm.

Note 6 - The tolerance of the mounting lug holes will accommodate mounting screws up to 9.5 mm in diameter when positioned on the true hole centers.

Note 7 - Clearance dimensions for mounting the degaussing coils: 3.2 mm x 8.0 mm.

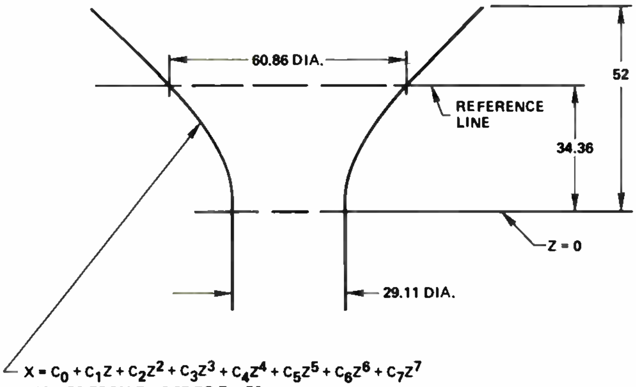


SAGITTAL HEIGHTS AT EDGE OF MINIMUM SCREEN

DIAGONAL	36.70
HORIZONTAL AXIS	22.63
VERTICAL AXIS	12.13

Dimensions in mm unless otherwise noted.

Figure 3 - Dimensional Outline



$$X = C_0 + C_1Z + C_2Z^2 + C_3Z^3 + C_4Z^4 + C_5Z^5 + C_6Z^6 + C_7Z^7$$

APPLIES FROM Z = 9.35 TO Z = 52

WHERE:

$C_0 = 15.1049059$	$C_4 = -3.87722896 \times 10^{-5}$
$C_1 = -0.158224021$	$C_5 = 7.24922652 \times 10^{-7}$
$C_2 = 1.16255308 \times 10^{-2}$	$C_6 = -6.72385142 \times 10^{-9}$
$C_3 = 8.88052299 \times 10^{-4}$	$C_7 = 2.48277616 \times 10^{-11}$

92LS-7046R1

Figure 4 - Funnel Contour In Yoke Region

Pin 1: Grid No.3
Pin 4: IC (Do Not Use)
Pin 5: Grid No.1
Pin 6: Cathode of Green Beam
Pin 7: Grid No.2
Pin 8: Cathode of Red Beam
Pin 9: Heater
Pin 10: Heater
Pin 11: Cathode of Blue Beam
Pin 12: IC (Do Not Use)
Cap: Anode (Grid No.4, Screen, Collector)
C: External Conductive Coating

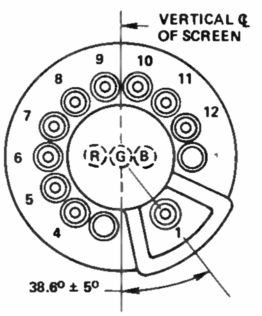


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Figure 5 - Pin Connections and Rear View of Base - EIA No.B10-276-AB

WARNING

X-Radiation

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Operation of this color picture tube at abnormal conditions which exceed the 0.5 mR/h isoexposure-rate limit may produce soft x rays which may constitute a health hazard on prolonged exposure at close range unless adequate external x-radiation shielding is provided. Therefore, precautions must be exercised during servicing of TV receivers employing this tube to assure that the anode voltage and other tube voltages are adjusted to the recommended values so that the Absolute-Maximum Ratings will not be exceeded.

Implosion Protection

This picture tube employs integral implosion protection and must be replaced with a tube of the same type number or an RCA-recommended replacement to assure continued safety.

Shock Hazard

The high voltage at which the tube is operated may be very dangerous. Design of the TV receiver should include safeguards to prevent the user from coming in contact with the high voltage. Extreme care should be taken in the servicing or adjustment of any high-voltage circuit.

Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture-tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode contact button, located in the funnel of the picture tube, to the external conductive coating before handling the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard. Also see Tube Mounting on page 8.

Tube Handling

Picture tubes should be kept in the shipping box or similar protective container until just prior to installation. Wear heavy protective clothing, including gloves and safety goggles with side shields, in areas containing unpacked and unprotected tubes to prevent possible injury from flying glass in the event a tube breaks. Handle the picture tube with extreme care. Do not strike, scratch or subject the tube to more than moderate pressure. Particular care should be taken to prevent damage to the seal area.

It is the sole responsibility of the manufacturer of television receivers and other equipment utilizing this color picture tube to provide appropriate design and circuitry that will limit the possible effects of failure of the color picture tube.

The equipment manufacturer should provide a warning label in an appropriate position on the equipment to advise the serviceman of all safety precautions.

Magnetic Shield and Degaussing

An internal magnetic shield is provided in this tube. When properly degaussed this shield in conjunction with the shadow-mask assembly provides compensation for the effects of the earth's magnetic field on the electron beams. After installation of the picture tube into the receiver cabinet, it is recommended that the complete receiver be externally degaussed by a minimum degaussing field of 20 gauss measured at the faceplate of the tube. The external degaussing procedure should be followed by the receiver's internal degaussing in the normal manner. In order for this action to be effective, it is essential that the tube be degaussed in the specific earth's magnetic field (strength and orientation) in which it is to be operated. Proper degaussing will assure satisfactory performance for field purity.

Degaussing Coils

The recommended degaussing system utilizes a single tilted coil placed on the tube as shown in **Figure 6** with the top edge on the panel in front of the seal line and the bottom edge on the funnel about 100 mm behind the seal line. Eight slots and bosses are provided in the rimband of the tube to facilitate mounting the degaussing coil to the tube funnel.

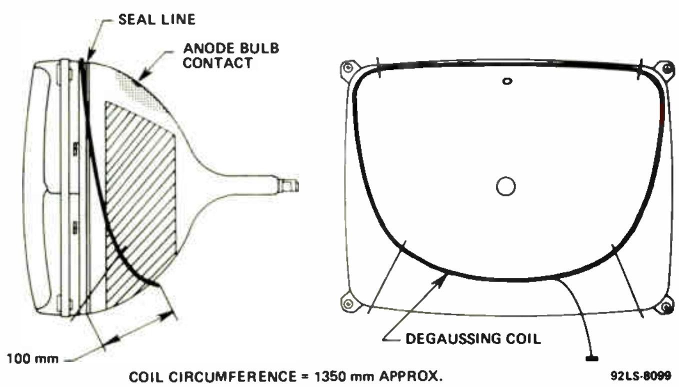


Figure 6 - Relative Placement of Typical Tilted "Z" Degaussing Coil

Degaussing Circuit

A recommended degaussing circuit as shown in **Figure 7** uses a conventional dual PTC device. For proper degaussing, a minimum value of 1000 peak-to-peak ampere-turns is required. It is essential to reduce the degaussing current in a gradual manner (50 percent amplitude in a minimum of 5 cycles). The residual value in the coil due to the degaussing power source should not exceed 1.0 peak-to-peak ampere-turns.

For optimum performance the degaussing coil should always be connected to a very low source impedance at the horizontal frequency. If the circuit used does not have an inherent low impedance at the horizontal frequency, the degaussing coil should be shunted with a suitable capacitor. If the addition of a short across the coil increases the horizontal frequency currents in the degaussing coil by more than 20%, the inherent source impedance offered by the PTC and associated circuitry is indicated to be too high to provide satisfactory performance. Therefore a capacitor should be be added across the degaussing coil to satisfy this requirement.

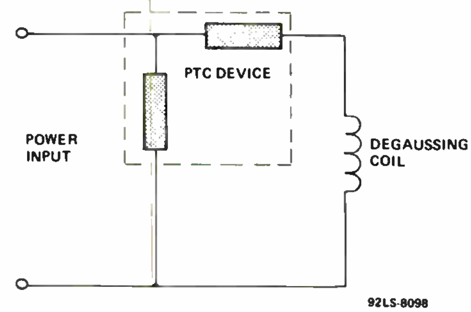


Figure 7 - Typical Degaussing Circuit

High-Voltage Discharge Protection

The high-resistance internal coating incorporated in soft-arc picture-tube designs significantly reduces the peak energy during a high-voltage discharge. In spite of this and other improvements, high-voltage discharges are still capable of initiating ionized paths, both internal and external to the tube, that can couple high-energy low-voltage sources to the picture tube and associated circuit elements. These high-energy sources can cause varying degrees of picture-tube and/or circuit damage.

With any color picture tube, maximum product reliability is obtained by the use of spark gaps with proper grounding, series isolation resistors, and good printed circuit board layouts. Spark gaps to ground should be connected to all socket contacts except as noted below for heater circuits. The ground points for the focus-electrode spark gap and the low-voltage spark gaps should be connected with a heavy noninductive strap to a good grounding contact on the picture-tube external conductive coating. The focus-electrode spark gap should be designed to break down at a dc value of approximately 1.5 times the maximum design voltage of the focus circuit. The low-voltage spark gaps should be designed for a dc breakdown voltage of 1.5 to 3.0 kV. The high-voltage circuit chassis ground point should be connected to the low-voltage spark-gap ground at the picture-tube socket. It is recommended that no other connections be made between the picture-tube external coating and the grounds of the main chassis or the spark gaps. This will minimize circulating currents in the chassis during high-voltage discharge.

Isolation resistors should be used in series with each grid and cathode lead. The resistance values should be as high as possible without degrading circuit performance (see **Figure 8**). These resistors should be capable of withstanding an instantaneous application of 12 kV for the low-voltage circuits and 20 kV for the focus circuit without arcing over, arcing through the body, or changing in resistance significantly during repeated applications of these voltages. Most half-watt carbon composition resistors are suitable for the low-voltage circuits and most one-watt carbon composition resistors are suitable for the focus circuit. Use of these resistors reduces the possibility of circulating currents in the chassis and excessive currents in the picture-tube elements.

For best reliability, the heater circuit should be isolated from chassis ground and/or voltage sources by a minimum resistance of 10 kΩ. Spark gaps should be connected to both heater-socket contacts. These spark gaps should have the same characteristics as the other low-voltage spark gaps. When the heater voltage is supplied from an isolated source, such as the horizontal deflection circuit or other high-frequency pulse source, a capacitor may be required between one side of the heater and ground to eliminate undesirable interference on the picture-tube screen. If a capacitance value in excess of 0.01 μF is required, the spark gaps to the heater leads should not be used.

Very reliable performance can also be obtained with non-isolated heater circuits. In these cases, only the high side of the heater circuit needs a spark gap. However, printed circuit board and socket designs which inherently provide spark gaps for both heater leads are also satisfactory.

Tube Mounting

Integral mounting lugs are provided to facilitate mounting the picture tube in the receiver. To prevent a possible shock hazard, it is recommended that the integral mounting lugs and other metal hardware of the tube be connected to the receiver chassis through one of the mounting lugs. If the chassis is not at ground potential, the connection should be made through a 1 MΩ current-limiting resistor The mounting system and other receiver hardware should not place mechanical stress on, or cause abrasion of, the tube particularly in the panel-to-funnel seal area.

The TV receiver mounting system should incorporate sufficient cushioning so that under conditions of shipment or handling the impact force applied to the picture tube does not exceed 35 g's.

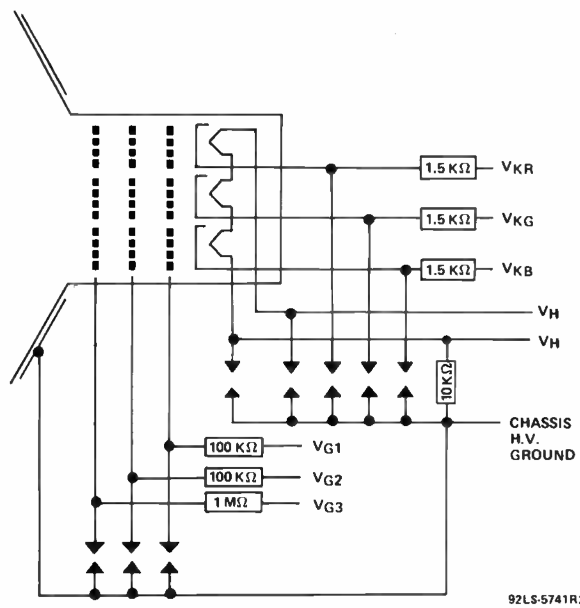


Figure 8 - Picture-Tube Connections Showing Spark-Gap Recommendations and Typical Isolation-Resistor Values

51 cm (20V) 110° COTY-FS Precision In-Line Color Picture Tube

- **COTY-FS — Full Square — A New Faceplate Shape — Rectilinear Screen — Straight Sides and Square Corners**
- **Designed for a Miniaturized Pin Free Saddle/Toroidal Yoke — Lower Deflection Power**
- **XL Bipotential Precision In-Line Gun — Optimized Beam-Forming Region for Excellent Focus Uniformity and Good Resolution**
- **Standard 29 mm Neck Diameter — Proven Reliability**
- **Excellent Convergence Performance**
- **Internal Magnetic Shield**
- **Other Features —**
  - **Matrix Line Screen**
  - **Tinted Phosphor**
  - **Super-Arch Mask**
  - **Soft-Arc Technology**
  - **Integral Mounting Lugs**

RCA A51ABU10X is a 51 cm (20V) 110° COTY-FS Precision In-Line Color Picture Tube. COTY-FS features a rectilinear screen and a faceplate radius of curvature similar to 19V types. The screen edges are straight and form square corners - a true rectangle. The horizontal and vertical axial screen dimensions are nearly the same as for 19V tubes.

The A51ABU10X incorporates the same improved features as earlier RCA COTY-29 tubes. It is designed for a miniaturized yoke which provides a savings in material and deflection power. The tube features an XL electron gun with close beam-to-beam spacing for excellent focus and convergence performance, and a standard 29 mm neck diameter for proven reliability. Optimum system cost and performance result from these combined features.

The pin free deflection yoke is similar to those used on the earlier 110° COTY-29 types. Miniaturization of the yoke was made possible by reducing the beam spacing in the electron gun and by optimizing both the funnel glass contour and the yoke contour to match the path of the deflected electron beams.

A bipotential precision in-line electron gun featuring an XL (expanded diameter lens) has been incorporated in the A51ABU10X. In this feature, an expanded lens field encompasses all three beams. This expanded field when combined with the fields from the individual apertures produces a superior lens for focus performance and with less aberrations than in a standard gun. Only the neck diameter, not the beam spacing, limits the focusing ability. This focusing principle allows the reduction of beam spacing without the usual loss in focus quality. Convergence performance has also been improved by the reduction in the beam spacing.

Electrical Data

Heater:		
Voltage	6.3	V
Current	700	mA
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Angles (approx.):		
Diagonal	110	deg
Horizontal	93	deg
Vertical	74	deg

Formerly RCA Developmental Type C76931

Electrical Data (Cont'd)

Direct Interelectrode Capacitance (approx.):

Grid no.1 to all other electrodes	10	pF
Grid no.3 to all other electrodes	5.0	pF
Each cathode to all other electrodes	6.5	pF
All cathodes to all other electrodes	14	pF

Capacitance Between Anode and External Conductive Coating (including metal hardware) .... {1700 max. pF; 1300 min. pF}

Resistance Between Metal Hardware and External Conductive Coating .... 50 min. MΩ

Typical Deflection Yoke .... RCA XD5349, or Equivalent

Integral Magnetic Shield .... Internal

Optical Data

Faceplate:
- Light transmittance at center (approx.) 85%
- Surface .... Polished

Screen:
- Matrix .... Black Opaque Material
  - Type .... Negative Guard Band
- Phosphor, rare-earth (red), sulfide (blue & green) ... Type X[1]
  - Type .... Selectively Absorbent
  - Persistence .... Medium Short
- Array .... Vertical Line Trios
- Spacing between corresponding points on line trios at center (approx.) .... 0.84 mm

Mechanical Data

Tube Dimensions:
- Overall length .... 369.26 ± 6.35 mm
- Reference line to center of face .... 228.83 ± 4.78 mm
- Neck length .... 140.43 ± 4.78 mm
- O.D. at tension band:
  - Diagonal .... 552.74 ± 2.36 mm
  - Horizontal .... 459.60 ± 2.36 mm
  - Vertical (including tension-band clips) .... 376.04 ± 2.36 mm
- Minimum screen dimensions (projected):
  - Diagonal .... 508.00 mm
  - Horizontal .... 406.40 mm
  - Vertical .... 304.80 mm
  - Area .... 1239 sq cm

Bulb Funnel Designation .... EIA No.J542

Bulb Panel Designation .... EIA No.F545

Anode Bulb Contact Designation .... EIA No.J1-21

Base and Pin Connection Designation[2] .... EIA No.B8-295-AA

Pin Position Alignment .... Ridge Separating Pins 9 and 10 Aligns Approx. with Anode Bulb Contact

Operating Position, Preferred .... Anode Bulb Contact on Top

Gun Configuration .... Horizontal In Line

Weight (approx.) .... 13.9 kg

Implosion Protection

Type .... Rimbands and Tension Bands

Maximum and Minimum Ratings, Absolute-Maximum Values

Absolute-Maximum Ratings are specified for reliability and performance purposes. X-radiation characteristics should also be taken into consideration in the application of this tube type.

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Anode Voltage	32	max.	kV
	17	min.	kV
Anode Current, Long-Term Average	2000	max.	µA
Grid-No.3 (focusing electrode) Voltage	12	max.	kV
Peak Grid-No.2 Voltage	1850	max.	V
Cathode Voltage:			
Positive bias value	400	max.	V
Positive operating cutoff value	200	max.	V
Negative bias value	0	max.	V
Negative peak value	2	max.	V
Heater Voltage:[3]			
AC (rms) or DC value	6.9	max.	V
	5.7	min.	V
Peak pulse value	50	max.	V
Surge value, during 15-second warm-up period (rms)	9.5	max.	V
Heater-Cathode Voltage:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	450	max.	V
After equipment warm-up period:			
DC component value	200	max.	V
Peak value	300	max.	V
Heater positive with respect to cathode:			
DC component value	100	max.	V
Peak value	200	max.	V

Typical Design Values (for anode voltage of 25 kV)

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Grid-No.3 (focusing electrode) Voltage .... 24 to 28% of Anode Voltage

Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot ...... See CUTOFF DESIGN CHART in **Figure 1**
- At cathode voltage of 100 V .... 265 to 535 V
- At cathode voltage of 150 V .... 420 to 820 V
- At cathode voltage of 200 V .... 575 to 1105 V

Maximum Ratio of Cathode Cutoff Voltages, Highest Gun to Lowest Gun (with grid no.2 of gun having highest cathode voltage adjusted to give 150 V spot cutoff) 1.25

Heater Voltage[3] .... 6.3 ± 0.1 V

Grid-No.3 Current[4] .... ± 10 µA

Grid-No.2 Current .... ± 5 µA

Grid-No.1 Current .... ± 5 µA

To Produce White Light Output Having CIE Coordinates of:

X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each beam (average):			
Red	37	24	%
Blue	26	34	%
Green	37	42	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.00	0.49	
Typical	1.38	0.71	
Maximum	1.75	0.92	
Red/green:			
Minimum	0.75	0.41	
Typical	0.98	0.58	
Maximum	1.20	0.73	
Blue/green:			
Minimum	0.54	0.62	
Typical	0.71	0.81	
Maximum	0.88	1.00	

Raster Centering Displacement
Measured at Center of Screen:[5]

Horizontal	-1.5 ± 6.0 mm
Vertical	0 ± 6.0 mm
Center Convergence Displacement Between the Blue and Red Beams	4.0 mm
Center Convergence Displacement Between the Green Beam and the Converged Blue and Red Beams	1.4 mm
Maximum Required Correction for Register[6] (including effect of earth's magnetic field when using recommended components) as Measured at the Center of the Screen in the Horizontal Direction	0.10 max. mm

1 The X phosphor designation in the WTDS is equivalent to P22 in the EIA type designation system.

2 For mating socket considerations, see Note 1 under **Notes for Dimensional Outline.**

3 For maximum tube life, the heater supply voltage should be regulated to minimize heater voltage changes due to variations in line voltage, beam current, and other parameters. The design center value of the heater voltage should be the **Typical Design Value**; however, in some applications it may be desirable to operate at a voltage slightly below this value.

Cost considerations may suggest that the heater voltage be obtained from an unregulated source. If this option is chosen and the unregulated voltage varies with beam current, the circuit parameters should be selected so that the design center value of the heater voltage is equal to the **Typical Design Value** when the beam current is one-half of the **Long-Term Average Anode Current** as shown in the tabulated data. The **Absolute-Maximum and Minimum Ratings** should not be exceeded when including all variations.

For specific considerations, consult your RCA Video Component and Display Division representative.

4 A high source impedance in the focus circuit can result in a change in the focus voltage with a change in the grid no.3 leakage current.

5 The design-center values are the values obtained when the tube is operated with recommended components and procedures in an earth's magnetic field having a 470 mG vertical component and a zero cross-axial horizontal component..

6 Register is defined as the relative position of the beam trios with respect to the associated phosphor-line trios.

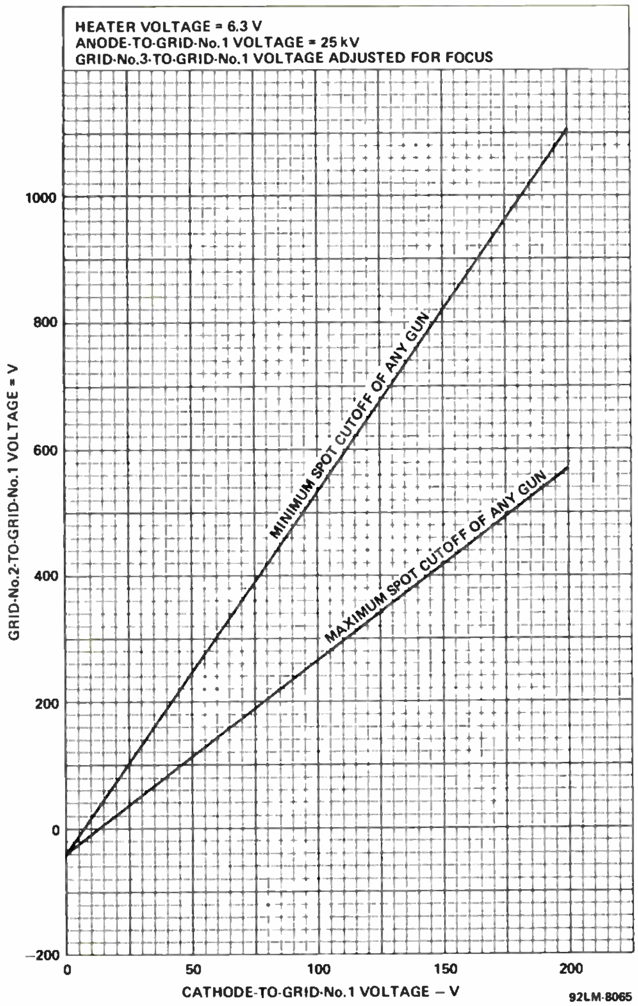


Figure 1 - Cutoff Design Chart

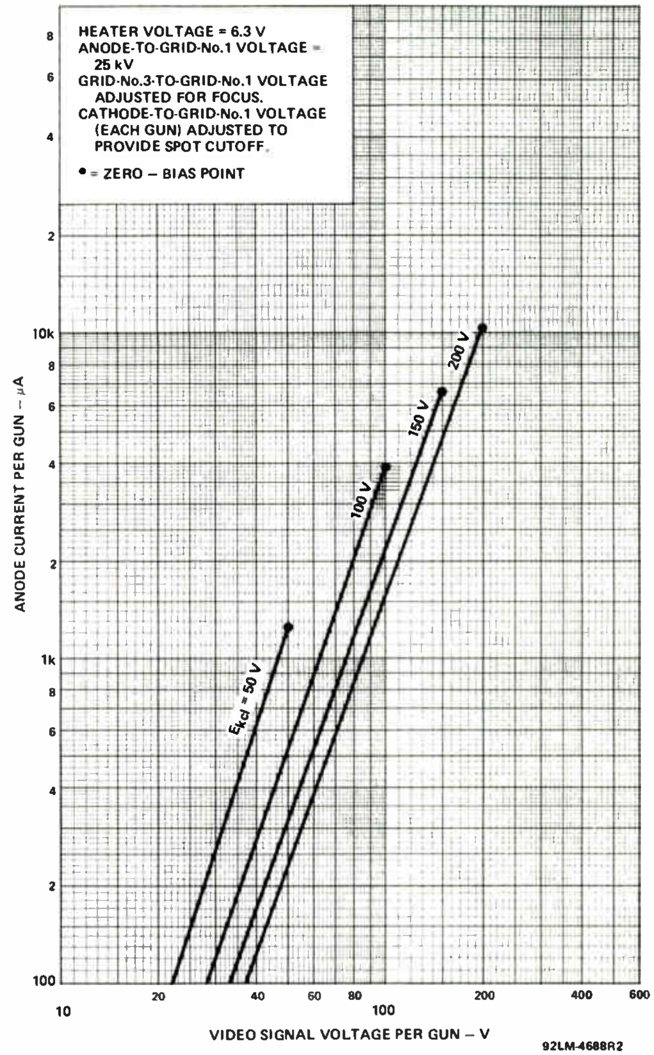


Figure 2 - Typical Drive Characteristics, Cathode-Drive Service

Notes for Dimensional Outline

Note 1 - The mating socket assembly with associated circuit board and mounted components must not weigh more than 0.5 kg. To minimize the torsional forces on the tube base pins, the center of gravity of this assembly should be located on the vertical plane through the picture-tube axis. Caution should also be exercised so that connecting leads to the assembly do not exert excessive torsional forces.

Note 2 - The purity magnets should be centered over or forward of the G3-G4 gap. Consideration should be given when selecting a convergence/purity device to assure adequate performance and axial adjustment of the yoke while meeting this location requirement.

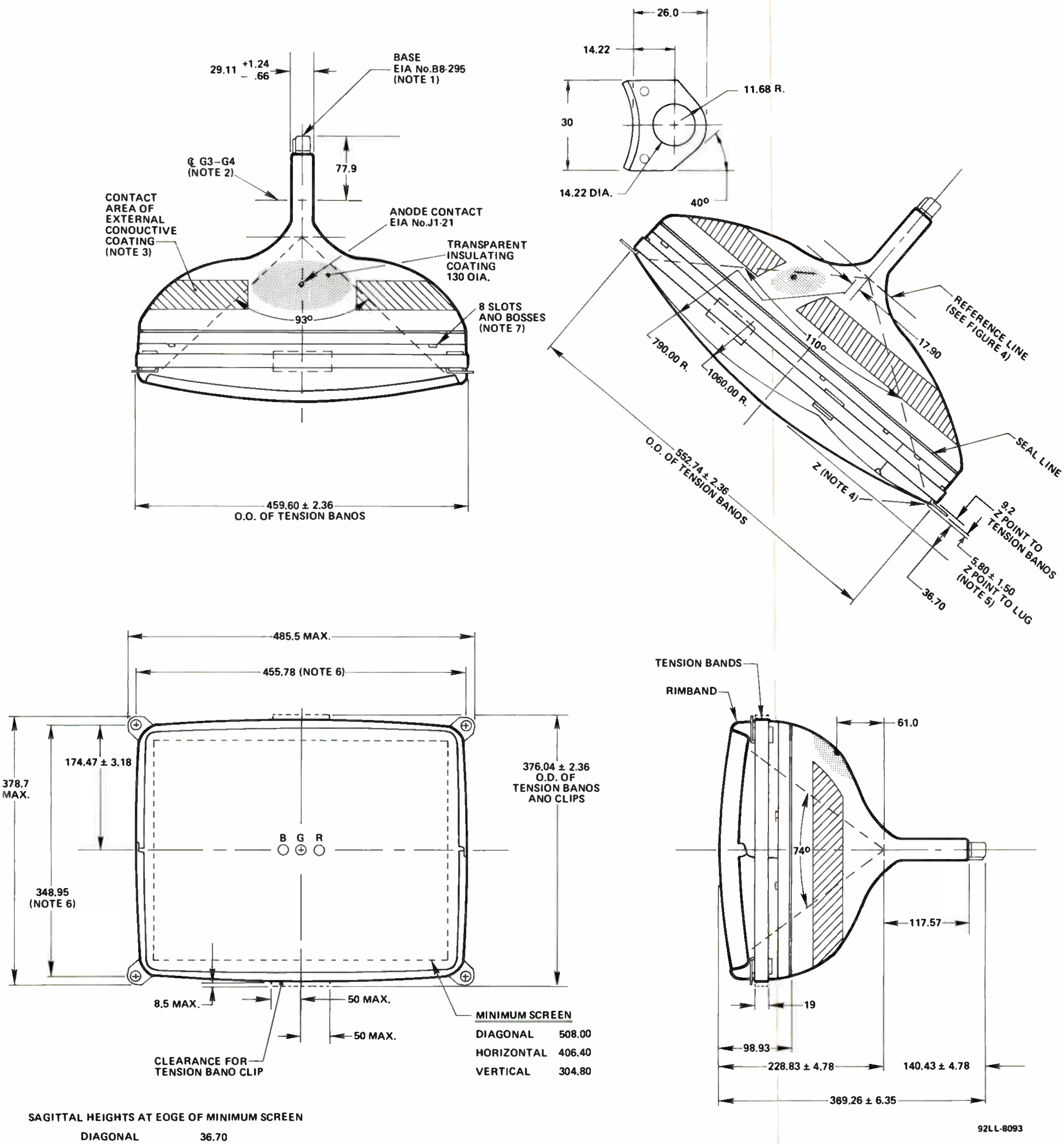
Note 3 - The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be connected to the chassis with multiple contacts.

Note 4 - "Z" is located on the outside surface of the faceplate on the screen diagonal at the edge of the minimum published screen. This point is used as a reference for the mounting lugs.

Note 5 - None of the four mounting lugs will deviate from the plane of the other three by more than 1.6 mm.

Note 6 - The tolerance of the mounting lug holes will accommodate mounting screws up to 9.5 mm in diameter when positioned on the true hole centers.

Note 7 - Clearance dimensions for mounting the degaussing coils: 3.2 mm x 8.0 mm.



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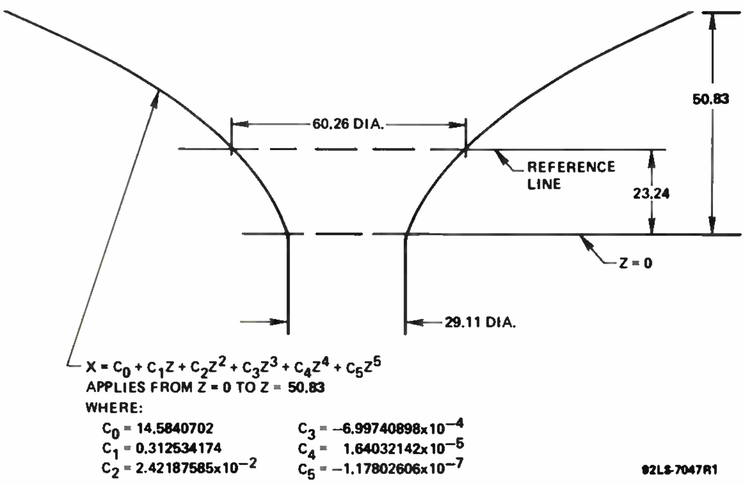

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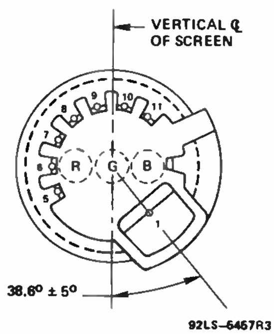

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Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture-tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode contact button, located in the funnel of the picture tube, to the external conductive coating before handling the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard. Also see Tube Mounting on page 8.

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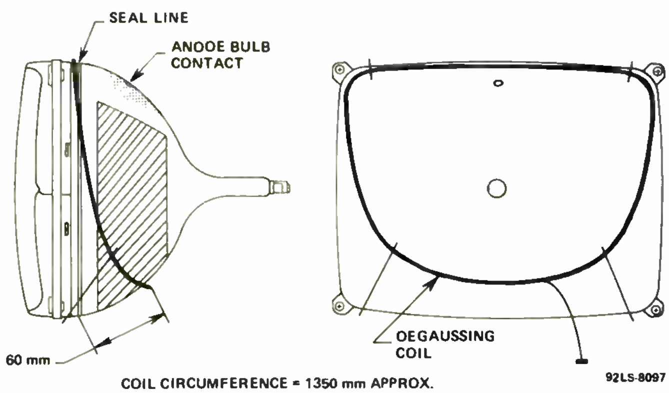

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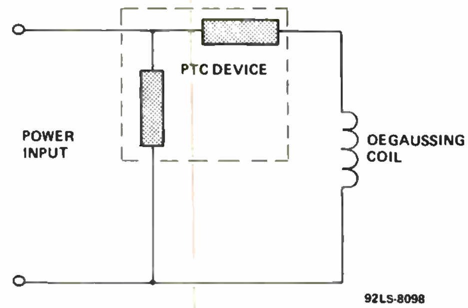
For optimum performance the degaussing coil should always be connected to a very low source impedance at the horizontal frequency. If the circuit used does not have an inherent low impedance at the horizontal frequency, the degaussing coil should be shunted with a suitable capacitor. If the addition of a short across the coil increases the horizontal frequency currents in the degaussing coil by more than 20%, the inherent source impedance offered by the PTC and associated circuitry is indicated to be too high to provide satisfactory performance. Therefore a capacitor should be be added across the degaussing coil to satisfy this requirement.



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High-Voltage Discharge Protection

The high-resistance internal coating incorporated in soft-arc picture-tube designs significantly reduces the peak energy during a high-voltage discharge. In spite of this and other improvements, high-voltage discharges are still capable of initiating ionized paths, both internal and external to the tube, that can couple high-energy low-voltage sources to the picture tube and associated circuit elements. These high-energy sources can cause varying degrees of picture-tube and/or circuit damage.

With any color picture tube, maximum product reliability is obtained by the use of spark gaps with proper grounding, series isolation resistors, and good printed circuit board layouts. Spark gaps to ground should be connected to all socket contacts except as noted below for heater circuits. The ground points for the focus-electrode spark gap and the low-voltage spark gaps should be connected with a heavy noninductive strap to a good grounding contact on the picture-tube external conductive coating. The focus-electrode spark gap should be designed to break down at a dc value of approximately 1.5 times the maximum design voltage of the focus circuit. The low-voltage spark gaps should be designed for a dc breakdown voltage of 1.5 to 3.0 kV. The high-voltage circuit chassis ground point should be connected to the low-voltage spark-gap ground at the picture-tube socket. It is recommended that no other connections be made between the picture-tube external coating and the grounds of the main chassis or the spark gaps. This will minimize circulating currents in the chassis during high-voltage discharge.

Isolation resistors should be used in series with each grid and cathode lead. The resistance values should be as high as possible without degrading circuit performance (see **Figure 8**). These resistors should be capable of withstanding an instantaneous application of 12 kV for the low-voltage circuits and 20 kV for the focus circuit without arcing over, arcing through the body, or changing in resistance significantly during repeated applications of these voltages. Most half-watt carbon composition resistors are suitable for the low-voltage circuits and most one-watt carbon composition resistors are suitable for the focus circuit. Use of these resistors reduces the possibility of circulating currents in the chassis and excessive currents in the picture-tube elements.

For best reliability, the heater circuit should be isolated from chassis ground and/or voltage sources by a minimum resistance of 10 kΩ. Spark gaps should be connected to both heater-socket contacts. These spark gaps should have the same characteristics as the other low-voltage spark gaps. When the heater voltage is supplied from an isolated source, such as the horizontal deflection circuit or other high-frequency pulse source, a capacitor may be required between one side of the heater and ground to eliminate undesirable interference on the picture-tube screen. If a capacitance value in excess of 0.01 μF is required, the spark gaps to the heater leads should not be used.

Very reliable performance can also be obtained with non-isolated heater circuits. In these cases, only the high side of the heater circuit needs a spark gap. However, printed circuit board and socket designs which inherently provide spark gaps for both heater leads are also satisfactory.

Tube Mounting

Integral mounting lugs are provided to facilitate mounting the picture tube in the receiver. To prevent a possible shock hazard, it is recommended that the integral mounting lugs and other metal hardware of the tube be connected to the receiver chassis through one of the mounting lugs. If the chassis is not at ground potential, the connection should be made through a 1 MΩ current-limiting resistor The mounting system and other receiver hardware should not place mechanical stress on, or cause abrasion of, the tube particularly in the panel-to-funnel seal area.

The TV receiver mounting system should incorporate sufficient cushioning so that under conditions of shipment or handling the impact force applied to the picture tube does not exceed 35 g's.

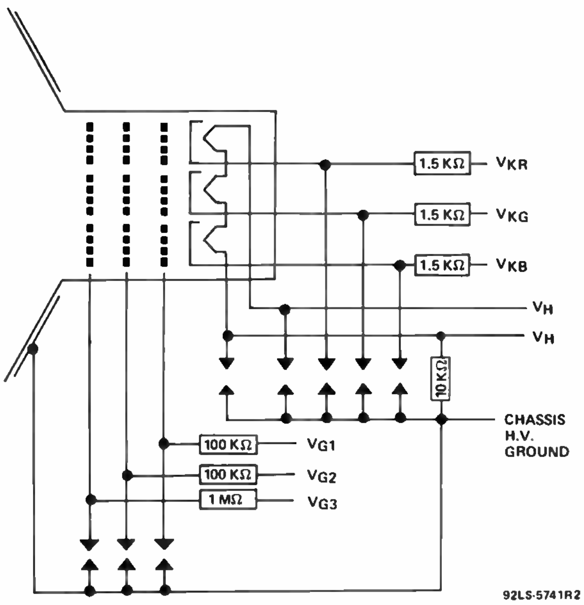


Figure 8 - Picture-Tube Connections Showing Spark-Gap Recommendations and Typical Isolation-Resistor Values

RCA Video Component and Display Division

Color Picture Tube

A66ABU10X

66 cm (26V) 110° COTY-FS Precision In-Line Color Picture Tube

- **COTY-FS — Full Square — A New Faceplate Shape — Rectilinear Screen — Straight Sides and Square Corners Horizontal and Vertical Dimensions Same as for 25V**
- **Designed for a Miniaturized Saddle/Toroidal Yoke — Lower Deflection Power**
- **XL Bipotential Precision In-Line Gun — Optimized Beam-Forming Region for Excellent Focus Uniformity and Good Resolution**
- **Standard 29 mm Neck Diameter — Proven Reliability**
- **Excellent Convergence Performance**
- **Internal Magnetic Shield**
- **Other Features —**
  - **Matrix Line Screen**
  - **Tinted Phosphor**
  - **Super-Arch Mask**
  - **Soft-Arc Technology**
  - **Integral Mounting Lugs**

RCA A66ABU10X is a 66 cm (26V) 110° COTY-FS Precision In-Line Color Picture Tube. COTY-FS features a rectilinear screen and a faceplate radius of curvature similar to 25V types. The screen edges are straight and form square corners - a true rectangle. The horizontal and vertical axial screen dimensions are the same as for 25V tubes. Because the diagonal deflection angle is 110°, the horizontal and vertical deflection angles are less than for current 25V/110° tubes. This results in lower deflection power requirements.

The A66ABU10X incorporates the same improved features as earlier RCA COTY-29 tubes. It is designed for a miniaturized yoke which provides a savings in material and deflection power. The tube features an XL electron gun with close beam-to-beam spacing for excellent focus and convergence performance, and a standard 29 mm neck diameter for proven reliability. Optimum system cost and performance result from these combined features.

The deflection yoke is similar to those used on the earlier 25V/110° COTY-29 types. Miniaturization of the yoke was made possible by reducing the beam spacing in the electron gun and by optimizing both the funnel glass contour and the yoke contour to match the path of the deflected electron beams.

A bipotential precision in-line electron gun featuring an XL (expanded diameter lens) has been incorporated in the A66ABU10X. In this feature, an expanded lens field encompasses all three beams. This expanded field when combined with the fields from the individual apertures produces a superior lens for focus performance and with less aberrations than in a standard gun. Only the neck diameter, not the beam spacing, limits the focusing ability. This focusing principle allows the reduction of beam spacing without the usual loss in focus quality. Convergence performance has also been improved by the reduction in the beam spacing.

Electrical Data

Heater:		
Voltage	6.3	V
Current	700	mA
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Angles (approx.):		
Diagonal	110	deg
Horizontal	93	deg
Vertical	73	deg

Formerly RCA Developmental Type C76941

Electrical Data (Cont'd)

Direct Interelectrode Capacitance (approx.):

Grid no.1 to all other electrodes	10	pF
Grid no.3 to all other electrodes	5.0	pF
Each cathode to all other electrodes	6.5	pF
All cathodes to all other electrodes	14	pF

Capacitance Between Anode and External Conductive Coating (including metal hardware) ..... 2700 max. pF; 2200 min. pF

Resistance Between Metal Hardware and External Conductive Coating ..... 50 min. MΩ

Typical Deflection Yoke ..... RCA XD5395I, or Equivalent

Integral Magnetic Shield ..... Internal

Optical Data

Faceplate:
- Light transmittance at center (approx.) 84%
- Surface ..... Polished

Screen:
- Matrix ..... Black Opaque Material
  - Type ..... Negative Guard Band
- Phosphor, rare-earth (red), sulfide (blue & green) ..... Type X[1]
  - Type ..... Selectively Absorbent
  - Persistence ..... Medium Short
- Array ..... Vertical Line Trios
- Spacing between corresponding points on line trios at center (approx.) ..... 0.82 mm

Mechanical Data

Tube Dimensions:
- Overall length ..... 438.35 ± 6.35 mm
- Reference line to center of face ..... 297.92 ± 4.78 mm
- Neck length ..... 140.43 ± 4.78 mm
- O.D. at tension band:
  - Diagonal ..... 716.89 ± 2.36 mm
  - Horizontal ..... 593.90 ± 2.36 mm
  - Vertical (not including tension-band clips) ..... 466.14 ± 2.36 mm
- Minimum screen dimensions (projected):
  - Diagonal ..... 659.64 mm
  - Horizontal ..... 527.71 mm
  - Vertical ..... 395.78 mm
  - Area ..... 2089 sq cm

Bulb Funnel Designation ..... EIA No.J703

Bulb Panel Designation ..... EIA No.F708

Anode Bulb Contact Designation ..... EIA No.J1-21

Base and Pin Connection Designation[2] ..... EIA No.B8-295-AA

Pin Position Alignment ..... Ridge Separating Pins 9 and 10 Aligns Approx. with Anode Bulb Contact

Operating Position, Preferred ..... Anode Bulb Contact on Top

Gun Configuration ..... Horizontal In Line

Weight (approx.) ..... 24.5 kg

Implosion Protection

Type ..... Rimbands and Tension Bands

Maximum and Minimum Ratings, Absolute-Maximum Values

Absolute-Maximum Ratings are specified for reliability and performance purposes. X-radiation characteristics should also be taken into consideration in the application of this tube type.

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Anode Voltage ..... 32 max. kV; 17 min. kV

Anode Current, Long-Term Average ..... 2000 max. μA

Grid-No.3 (focusing electrode) Voltage ..... 12 max. kV

Peak Grid-No.2 Voltage ..... 1850 max. V

Cathode Voltage:
- Positive bias value ..... 400 max. V
- Positive operating cutoff value ..... 200 max. V
- Negative bias value ..... 0 max. V
- Negative peak value ..... 2 max. V

Heater Voltage:[3]
- AC (rms) or DC value ..... 6.9 max. V; 5.7 min. V
- Peak pulse value ..... 50 max. V
- Surge value, during 15-second warm-up period (rms) ..... 9.5 max. V

Heater-Cathode Voltage:
- Heater negative with respect to cathode:
  - During equipment warm-up period not exceeding 15 seconds ..... 450 max. V
  - After equipment warm-up period:
    - DC component value ..... 200 max. V
    - Peak value ..... 300 max. V
- Heater positive with respect to cathode:
  - DC component value ..... 100 max. V
  - Peak value ..... 200 max. V

Typical Design Values (for anode voltage of 25 kV)

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Grid-No.3 (focusing electrode) Voltage ..... 24 to 28% of Anode Voltage

Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot ..... See CUTOFF DESIGN CHART in **Figure 1**
- At cathode voltage of 100 V ..... 265 to 535 V
- At cathode voltage of 150 V ..... 420 to 820 V
- At cathode voltage of 200 V ..... 575 to 1105 V

Maximum Ratio of Cathode Cutoff Voltages, Highest Gun to Lowest Gun (with grid no.2 of gun having highest cathode voltage adjusted to give 150 V spot cutoff) 1.25

Heater Voltage[3] ..... 6.3 ± 0.1 V

Grid-No.3 Current[4] ..... ± 10 μA

Grid-No.2 Current ..... ± 5 μA

Grid-No.1 Current ..... ± 5 μA

To Produce White Light Output Having CIE Coordinates of:

x	0.313	0.281	
y	0.329	0.311	
Percentage of total anode current supplied by each beam (average):			
Red	37	24	%
Blue	26	34	%
Green	37	42	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.00	0.49	
Typical	1.38	0.71	
Maximum	1.75	0.92	
Red/green:			
Minimum	0.75	0.41	
Typical	0.98	0.58	
Maximum	1.20	0.73	
Blue/green:			
Minimum	0.54	0.62	
Typical	0.71	0.81	
Maximum	0.88	1.00	

Raster Centering Displacement Measured at Center of Screen:[5]	
Horizontal	-1.2 ± 6.0 mm
Vertical	0 ± 6.0 mm
Center Convergence Displacement Between the Blue and Red Beams	4.0 mm
Center Convergence Displacement Between the Green Beam and the Converged Blue and Red Beams	1.4 mm
Maximum Required Correction for Register[6] (including effect of earth's magnetic field when using recommended components) as Measured at the Center of the Screen in the Horizontal Direction	0.10 max. mm

[1] The X phosphor designation in the WTDS is equivalent to P22 in the EIA type designation system.

[2] See Dimensional Outline Note 1 for mating socket consideration.

[3] For maximum tube life, the heater supply voltage should be regulated to minimize heater voltage changes due to variations in line voltage, beam current, and other parameters. The design center value of the heater voltage should be the **Typical Design Value**; however, in some applications it may be desirable to operate at a voltage slightly below this value.

Cost considerations may suggest that the heater voltage be obtained from an unregulated source. If this option is chosen and the unregulated voltage varies with beam current, the circuit parameters should be selected so that the design center value of the heater voltage is equal to the **Typical Design Value** when the beam current is one-half of the **Long-Term Average Anode Current** as shown in the tabulated data. The **Absolute-Maximum and Minimum Ratings** should not be exceeded when including all variations.

For specific considerations, consult your RCA Video Component and Display Division representative.

[4] A high source impedance in the focus circuit can result in a change in the focus voltage with a change in the grid no.3 leakage current.

[5] The design-center values are the values obtained when the tube is operated with recommended components and procedures in an earth's magnetic field having a 470 mG vertical component and a zero cross-axial horizontal component..

[6] Register is defined as the relative position of the beam trios with respect to the associated phosphor-line trios.

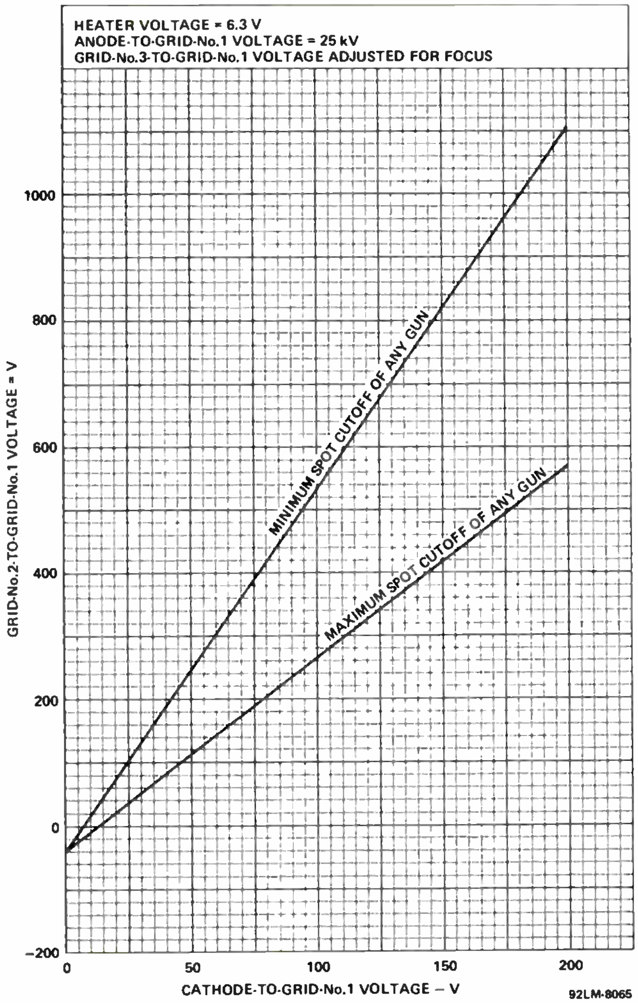


Figure 1 - Cutoff Design Chart

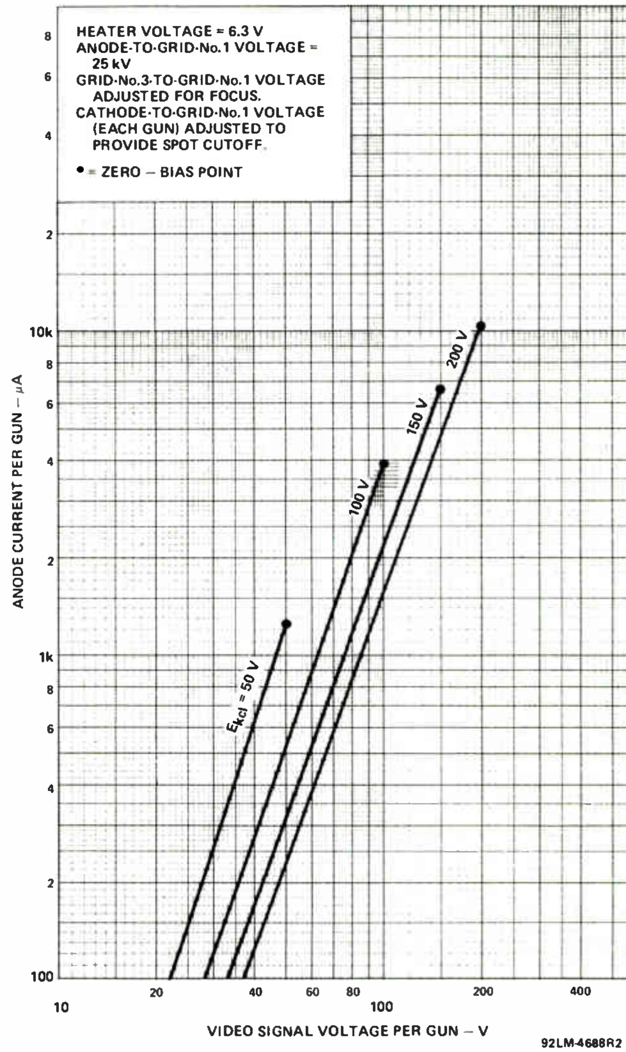


Figure 2 - Typical Drive Characteristics, Cathode-Drive Service

Notes for Dimensional Outline

Note 1 - The mating socket assembly with associated circuit board and mounted components must not weigh more than 0.5 kg. To minimize the torsional forces on the tube base pins, the center of gravity of this assembly should be located on the vertical plane through the picture-tube axis. Caution should also be exercised so that connecting leads to the assembly do not exert excessive torsional forces.

Note 2 - The purity magnets should be centered over or forward of the G3-G4 gap. Consideration should be given when selecting a convergence/purity device to assure adequate performance and axial adjustment of the yoke while meeting this location requirement.

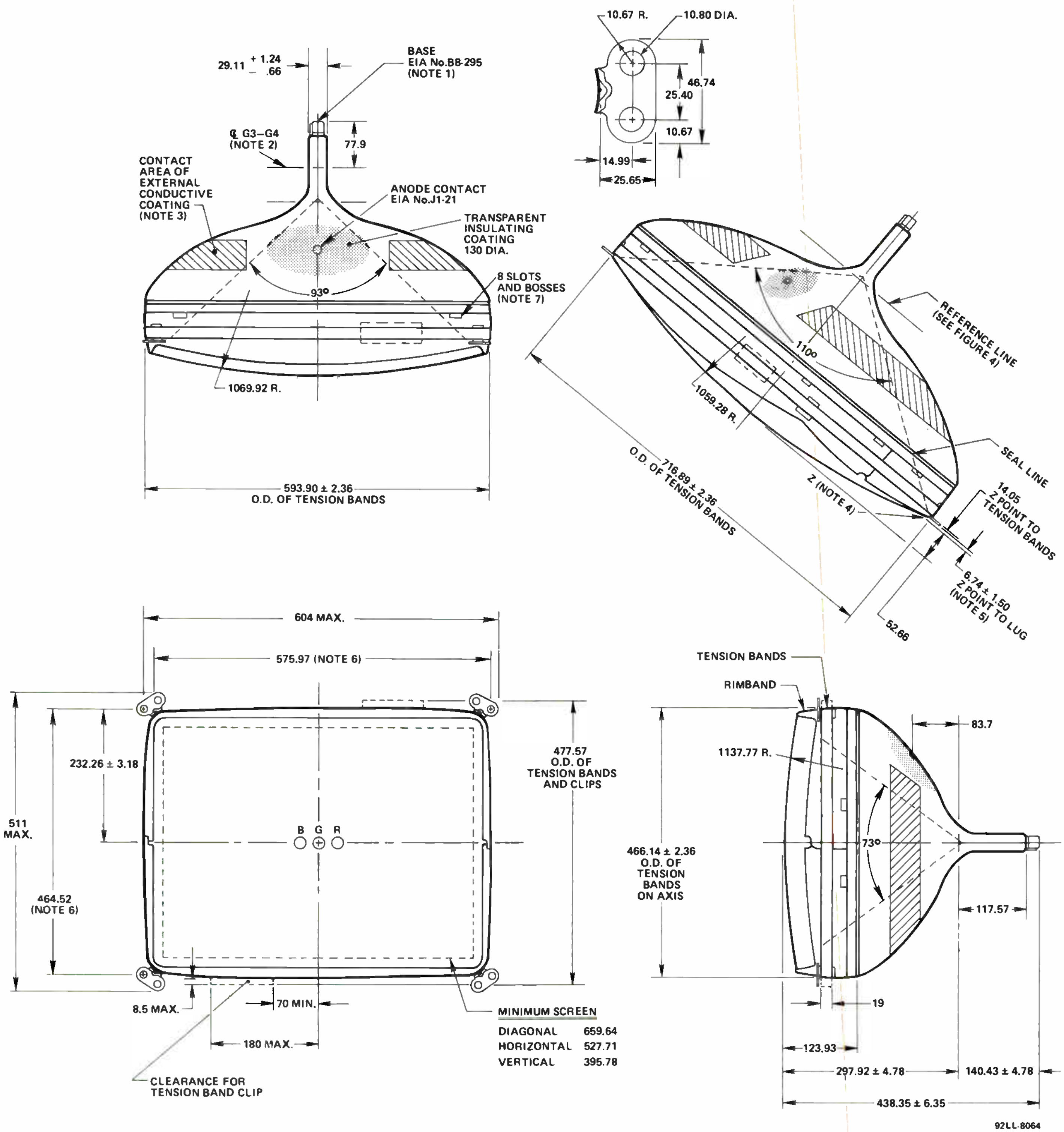
Note 3 - The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be connected to the chassis with multiple contacts.

Note 4 - "Z" is located on the outside surface of the faceplate on the screen diagonal at the edge of the minimum published screen. This point is used as a reference for the mounting lugs.

Note 5 - None of the four mounting lugs will deviate from the plane of the other three by more than 1.6 mm.

Note 6 - The tolerance of the mounting lug holes will accommodate mounting screws up to 7.6 mm in diameter when positioned on the true hole centers.

Note 7 - Clearance dimensions for mounting the degaussing coils: 3.2 mm x 8.0 mm.

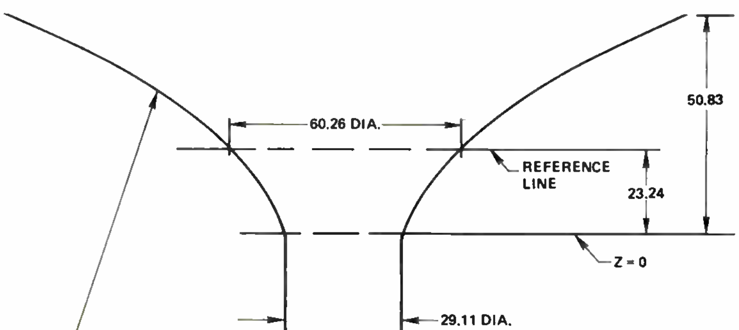


Dimensions in mm unless otherwise noted.

Figure 3 - Dimensional Outline

Sagittal Heights With Reference to Centerface at the Edge of the Minimum Screen.

Point No.	Coordinates X mm	Coordinates Y mm	Sagittal Height mm
1 (Minor Axis)	0.00	197.89	17.34
2	25.40	197.89	17.70
3	50.80	197.89	18.77
4	76.20	197.89	20.53
5	101.60	197.89	22.93
6	127.00	197.89	25.94
7	152.40	197.89	29.56
8	177.80	197.89	33.77
9	203.20	197.89	38.60
10	228.60	197.89	44.04
11	254.00	197.89	50.12
12 (Diagonal)	263.86	197.89	52.66
13	263.86	177.80	48.90
14	263.86	152.40	44.71
15	263.86	127.00	41.16
16	263.86	101.60	38.24
17	263.86	76.20	35.97
18	263.86	50.80	34.34
19	263.86	25.40	33.37
20 (Major Axis)	263.86	0.00	33.05



$X = C_0 + C_1Z + C_2Z^2 + C_3Z^3 + C_4Z^4 + C_5Z^5$

APPLIES FROM Z = 0 TO Z = 50.83

WHERE:

$C_0 = 14.5840702$ $C_3 = -6.99740898 \times 10^{-4}$
$C_1 = 0.312534174$ $C_4 = 1.64032142 \times 10^{-5}$
$C_2 = 2.42187585 \times 10^{-2}$ $C_5 = -1.17802606 \times 10^{-7}$

92LS-7047R1

Figure 4 - Funnel Contour in Yoke Region

Pin 1: Grid No.3
Pin 5: Grid No.1
Pin 6: Cathode of Green Beam
Pin 7: Grid No.2
Pin 8: Cathode of Red Beam
Pin 9: Heater
Pin 10: Heater
Pin 11: Cathode of Blue Beam
Cap: Anode (Grid No.4, Screen, Collector)
C: External Conductive Coating

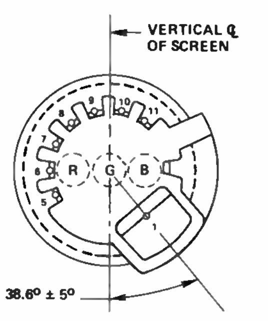


Figure 5 - Pin Connections and Rear View of Base - EIA No.B8-295-AA

WARNING

X-Radiation

This color picture tube incorporates integral x-radiation shielding and must be replaced with a tube of the same type number or an RCA-recommended replacement to assure continued safety.

Operation of this color picture tube at abnormal conditions which exceed the 0.5 mR/h isoexposure-rate limit may produce soft x rays which may constitute a health hazard on prolonged exposure at close range unless adequate external x-radiation shielding is provided. Therefore, precautions must be exercised during servicing of TV receivers employing this tube to assure that the anode voltage and other tube voltages are adjusted to the recommended values so that the Absolute-Maximum Ratings will not be exceeded.

Implosion Protection

This picture tube employs integral implosion protection and must be replaced with a tube of the same type number or an RCA-recommended replacement to assure continued safety.

Shock Hazard

The high voltage at which the tube is operated may be very dangerous. Design of the TV receiver should include safeguards to prevent the user from coming in contact with the high voltage. Extreme care should be taken in the servicing or adjustment of any high-voltage circuit.

Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture-tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode contact button, located in the funnel of the picture tube, to the external conductive coating before handling the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard. Also see Tube Mounting on page 8.

Tube Handling

Picture tubes should be kept in the shipping box or similar protective container until just prior to installation. Wear heavy protective clothing, including gloves and safety goggles with side shields, in areas containing unpacked and unprotected tubes to prevent possible injury from flying glass in the event a tube breaks. Handle the picture tube with extreme care. Do not strike, scratch or subject the tube to more than moderate pressure. Particular care should be taken to prevent damage to the seal area.

It is the sole responsibility of the manufacturer of television receivers and other equipment utilizing this color picture tube to provide appropriate design and circuitry that will limit the possible effects of failure of the color picture tube.

The equipment manufacturer should provide a warning label in an appropriate position on the equipment to advise the serviceman of all safety precautions.

Magnetic Shield and Degaussing

An internal magnetic shield is provided in this tube. When properly degaussed this shield in conjunction with the shadow-mask assembly provides compensation for the effects of the earth's magnetic field on the electron beams. After installation of the picture tube into the receiver cabinet, it is recommended that the complete receiver be externally degaussed by a minimum degaussing field of 20 gauss measured at the faceplate of the tube. The external degaussing procedure should be followed by the receiver's internal degaussing in the normal manner. In order for this action to be effective, it is essential that the tube be degaussed in the specific earth's magnetic field (strength and orientation) in which it is to be operated. Proper degaussing will assure satisfactory performance for field purity.

Degaussing Coils

The recommended degaussing system utilizes a single tilted coil placed on the tube as shown in **Figure 6** with the top edge on the panel in front of the seal line and the bottom edge on the funnel about 130 mm behind the seal line. Eight slots and bosses are provided in the rimband of the tube to facilitate mounting the degaussing coil to the tube funnel.

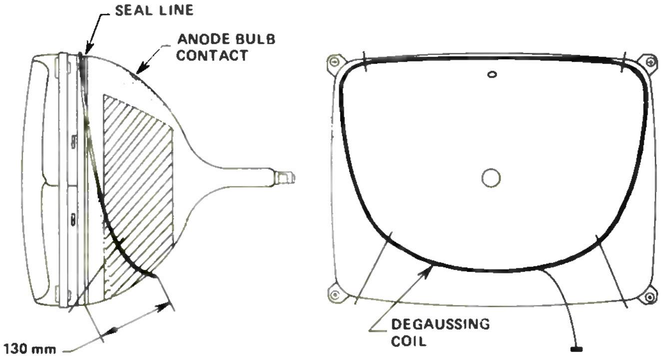


Figure 6 - Relative Placement of Typical Tilted "Z" Degaussing Coil

Degaussing Circuit

A recommended degaussing circuit as shown in **Figure 7** uses a conventional dual PTC device. For proper degaussing, a minimum value of 1500 peak-to-peak ampere-turns is required. It is essential to reduce the degaussing current in a gradual manner (50 percent amplitude in a minimum of 5 cycles). The residual value in the coil due to the degaussing power source should not exceed 1.0 peak-to-peak ampere-turns.

For optimum performance the degaussing coil should always be connected to a very low source impedance at the horizontal frequency. If the circuit used does not have an inherent low impedance at the horizontal frequency, the degaussing coil should be shunted with a suitable capacitor. If the addition of a short across the coil increases the horizontal frequency currents in the degaussing coil by more than 20%, the inherent source impedance offered by the PTC and associated circuitry is indicated to be too high to provide satisfactory performance. Therefore a capacitor should be be added across the degaussing coil to satisfy this requirement.

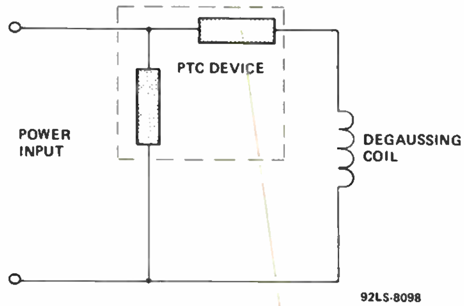


Figure 7 - Typical Degaussing Circuit

High-Voltage Discharge Protection

The high-resistance internal coating incorporated in soft-arc picture-tube designs significantly reduces the peak energy during a high-voltage discharge. In spite of this and other improvements, high-voltage discharges are still capable of initiating ionized paths, both internal and external to the tube, that can couple high-energy low-voltage sources to the picture tube and associated circuit elements. These high-energy sources can cause varying degrees of picture-tube and/or circuit damage.

With any color picture tube, maximum product reliability is obtained by the use of spark gaps with proper grounding, series isolation resistors, and good printed circuit board layouts. Spark gaps to ground should be connected to all socket contacts except as noted below for heater circuits. The ground points for the focus-electrode spark gap and the low-voltage spark gaps should be connected with a heavy noninductive strap to a good grounding contact on the picture-tube external conductive coating. The focus-electrode spark gap should be designed to break down at a dc value of approximately 1.5 times the maximum design voltage of the focus circuit. The low-voltage spark gaps should be designed for a dc breakdown voltage of 1.5 to 3.0 kV. The high-voltage circuit chassis ground point should be connected to the low-voltage spark-gap ground at the picture-tube socket. It is recommended that no other connections be made between the picture-tube external coating and the grounds of the main chassis or the spark gaps. This will minimize circulating currents in the chassis during high-voltage discharge.

Isolation resistors should be used in series with each grid and cathode lead. The resistance values should be as high as possible without degrading circuit performance (see **Figure 8**). These resistors should be capable of withstanding an instantaneous application of 12 kV for the low-voltage circuits and 20 kV for the focus circuit without arcing over, arcing through the body, or changing in resistance significantly during repeated applications of these voltages. Most half-watt carbon composition resistors are suitable for the low-voltage circuits and most one-watt carbon composition resistors are suitable for the focus circuit. Use of these resistors reduces the possibility of circulating currents in the chassis and excessive currents in the picture-tube elements.

For best reliability, the heater circuit should be isolated from chassis ground and/or voltage sources by a minimum resistance of 10 kΩ. Spark gaps should be connected to both heater-socket contacts. These spark gaps should have the same characteristics as the other low-voltage spark gaps. When the heater voltage is supplied from an isolated source, such as the horizontal deflection circuit or other high-frequency pulse source, a capacitor may be required between one side of the heater and ground to eliminate undesirable interference on the picture-tube screen. If a capacitance value in excess of 0.01 μF is required, the spark gaps to the heater leads should not be used.

Very reliable performance can also be obtained with non-isolated heater circuits. In these cases, only the high side of the heater circuit needs a spark gap. However, printed circuit board and socket designs which inherently provide spark gaps for both heater leads are also satisfactory.

Tube Mounting

Integral mounting lugs are provided to facilitate mounting the picture tube in the receiver. To prevent a possible shock hazard, it is recommended that the integral mounting lugs and other metal hardware of the tube be connected to the receiver chassis through one of the mounting lugs. If the chassis is not at ground potential, the connection should be made through a 1 MΩ current-limiting resistor The mounting system and other receiver hardware should not place mechanical stress on, or cause abrasion of, the tube particularly in the panel-to-funnel seal area.

The TV receiver mounting system should incorporate sufficient cushioning so that under conditions of shipment or handling the impact force applied to the picture tube does not exceed 35 g's.

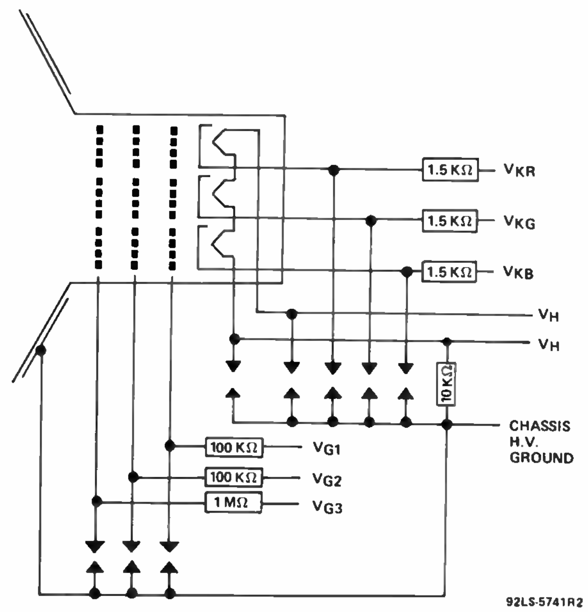


Figure 8 - Picture-Tube Connections Showing Spark-Gap Recommendations and Typical Isolation-Resistor Values

51 cm (20V) 110° COTY-SP Precision In-Line Color Picture Tube

- **COTY-SP — Square & Planar — A New Faceplate Shape —**
  Much Flatter
  Screen Edge Nearly Planar
  Rectilinear Screen
- **Designed for a Miniaturized Saddle/Toroidal Yoke**
- **XL Bipotential Precision In-Line Gun —**
  Optimized Beam-Forming Region for Excellent Focus Uniformity
- **Standard 29 mm Neck Diameter —**
  Proven Reliability
- **Excellent Convergence Performance**
- **Internal Magnetic Shield**
- **Other Features —**
  - **Matrix Line Screen**
  - **Tinted Phosphor**
  - **Super-Arch Mask**
  - **Soft-Arc Technology**
  - **Integral Mounting Lugs**

RCA A51ACC10X is a 51 cm (20V) 110° COTY-SP Precision In-Line Color Picture Tube. COTY-SP features a new faceplate shape with improved geometry. The faceplate is much flatter — sagittal heights are only half that of types having the current standard face contour. The screen edge is within ± 3 millimeters of being planar. Also, the screen edge is rectilinear — the edges are straight and form square corners.

The A51ACC10X incorporates the same improved features as earlier RCA COTY-29 tubes. It is designed for a miniaturized yoke which provides a savings in material and deflection power. The tube features an XL electron gun with close beam-to-beam spacing for excellent focus and convergence performance, and a standard 29 mm neck diameter for proven reliability. Optimum system cost and performance result from these combined features.

Miniaturization of the yoke was made possible by reducing the beam spacing in the electron gun and by optimizing both the funnel glass contour and the yoke contour to match the path of the deflected electron beams.

A bipotential precision in-line electron gun featuring an XL (expanded diameter lens) has been incorporated in the A51ACC10X. In this feature, an expanded lens field encompasses all three beams. This expanded field when combined with the fields from the individual apertures produces a superior lens for focus performance and with less aberrations than in a standard gun. Only the neck diameter, not the beam spacing, limits the focusing ability. This focusing principle allows the reduction of beam spacing without the usual loss in focus quality. Convergence performance has also been improved by the reduction in the beam spacing.

Formerly RCA Developmental Type C76875

Electrical Data

Heater:		
Voltage	6.3	V
Current	700	mA
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Angles (approx.):		
Diagonal	110	deg
Horizontal	97	deg
Vertical	80	deg
Direct Interelectrode Capacitance (approx.):		
Grid no.1 to all other electrodes	11	pF
Grid no.3 to all other electrodes	5.0	pF
Each cathode to all other electrodes	6.5	pF
All cathodes to all other electrodes	15	pF
Capacitance Between Anode and External Conductive Coating (including metal hardware)	1700 max. / 1300 min.	pF
Resistance Between Metal Hardware and External Conductive Coating	50 min.	MΩ
Typical Deflection Yoke	RCA XD5395I, or Equivalent	
Integral Magnetic Shield	Internal	

Optical Data

Faceplate:	
Light transmittance at center (approx.)	85%
Surface	Polished
Screen:	
Matrix	Black Opaque Material
Type	Negative Guard Band
Phosphor, rare-earth (red), sulfide (blue & green)	Type X[1]
Type	Selectively Absorbent
Persistence	Medium Short
Array	Vertical Line Trios
Spacing between corresponding points on line trios at center (approx.)	0.84 mm

Mechanical Data

Tube Dimensions:	
Overall length	349.65 ± 6.35 mm
Reference line to center of face	209.22 ± 4.78 mm
Neck length	140.43 ± 4.78 mm
O.D. at tension band:	
Diagonal	552.74 ± 2.36 mm
Horizontal	459.60 ± 2.36 mm
Vertical (including tension-band clips)	376.04 ± 2.36 mm
Minimum screen dimensions (projected):	
Diagonal	508.00 mm
Horizontal	406.40 mm
Vertical	304.80 mm
Area	1239 sq cm
Bulb Funnel Designation	EIA No.J542
Bulb Panel Designation	EIA No.F545
Anode Bulb Contact Designation	EIA No.J1-21
Base and Pin Connection Designation[2]	EIA No.B8-295-AA
Pin Position Alignment	Ridge Separating Pins 9 and 10 Aligns Approx. with Anode Bulb Contact
Operating Position, Preferred	Anode Bulb Contact on Top
Gun Configuration	Horizontal In Line
Weight (approx.)	13.1kg

Implosion Protection

Type	Rimbands and Tension Bands

Maximum and Minimum Ratings, Absolute-Maximum Values

Absolute-Maximum Ratings are specified for reliability and performance purposes. X-radiation characteristics should also be taken into consideration in the application of this tube type.

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Anode Voltage	32 max. / 17 min.	kV
Anode Current, Long-Term Average	2000 max.	μA
Grid-No.3 (focusing electrode) Voltage	12 max.	kV
Peak Grid-No.2 Voltage	1850 max.	V
Cathode Voltage:		
Positive bias value	400 max.	V
Positive operating cutoff value	200 max.	V
Negative bias value	0 max.	V
Negative peak value	2 max.	V
Heater Voltage:[3]		
AC (rms) or DC value	6.9 max. / 5.7 min.	V
Peak pulse value	50 max.	V
Surge value, during 15-second warm-up period (rms)	9.5 max.	V
Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
DC component value	200 max.	V
Peak value	300 max.	V
Heater positive with respect to cathode:		
DC component value	100 max.	V
Peak value	200 max.	V

Typical Design Values (for anode voltage of 25 kV)

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Grid-No.3 (focusing electrode) Voltage	24 to 28% of Anode Voltage
Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot	See CUTOFF DESIGN CHART in **Figure 1**
At cathode voltage of 100 V	265 to 535 V
At cathode voltage of 150 V	420 to 820 V
At cathode voltage of 200 V	575 to 1105 V
Maximum Ratio of Cathode Cutoff Voltages, Highest Gun to Lowest Gun (with grid no.2 of gun having highest cathode voltage adjusted to give 150 V spot cutoff)	1.25
Heater Voltage[3]	6.3 ± 0.1 V
Grid-No.3 Current[4]	± 10 μA
Grid-No.2 Current	± 5 μA
Grid-No.1 Current	± 5 μA

To Produce White Light Output Having CIE Coordinates of:

X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each beam (average):			
Red	37	24	%
Blue	26	34	%
Green	37	42	%

Ratio of cathode currents:

Red/blue:		
Minimum	1.00	0.49
Typical	1.38	0.71
Maximum	1.75	0.92
Red/green:		
Minimum	0.75	0.41
Typical	0.98	0.58
Maximum	1.20	0.73
Blue/green:		
Minimum	0.54	0.62
Typical	0.71	0.81
Maximum	0.88	1.00

Raster Centering Displacement Measured at Center of Screen:[5]

Horizontal .... -0.9 ± 6.0 mm

Vertical .... 0 ± 6.0 mm

Center Convergence Displacement Between the Blue and Red Beams .... 4.0 mm

Center Convergence Displacement Between the Green Beam and the Converged Blue and Red Beams .... 1.4 mm

Maximum Required Correction for Register[6] (including effect of earth's magnetic field when using recommended components) as Measured at the Center of the Screen in the Horizontal Direction .... 0.10 max. mm

---

1 The X phosphor designation in the WTDS is equivalent to P22 in the EIA type designation system.

2 For mating socket considerations, see Note 1 under **Notes for Dimensional Outline.**

3 For maximum tube life, the heater supply voltage should be regulated to minimize heater voltage changes due to variations in line voltage, beam current, and other parameters. The design center value of the heater voltage should be the **Typical Design Value**; however, in some applications it may be desirable to operate at a voltage slightly below this value.

Cost considerations may suggest that the heater voltage be obtained from an unregulated source. If this option is chosen and the unregulated voltage varies with beam current, the circuit parameters should be selected so that the design center value of the heater voltage is equal to the **Typical Design Value** when the beam current is one-half of the **Long-Term Average Anode Current** as shown in the tabulated data. The **Absolute-Maximum and Minimum Ratings** should not be exceeded when including all variations.

For specific considerations, consult your RCA Video Component and Display Division representative.

4 A high source impedance in the focus circuit can result in a change in the focus voltage with a change in the grid no.3 leakage current.

5 The design-center values are the values obtained when the tube is operated with recommended components and procedures in an earth's magnetic field having a 470 mG vertical component and a zero cross-axial horizontal component..

6 Register is defined as the relative position of the beam trios with respect to the associated phosphor-line trios.

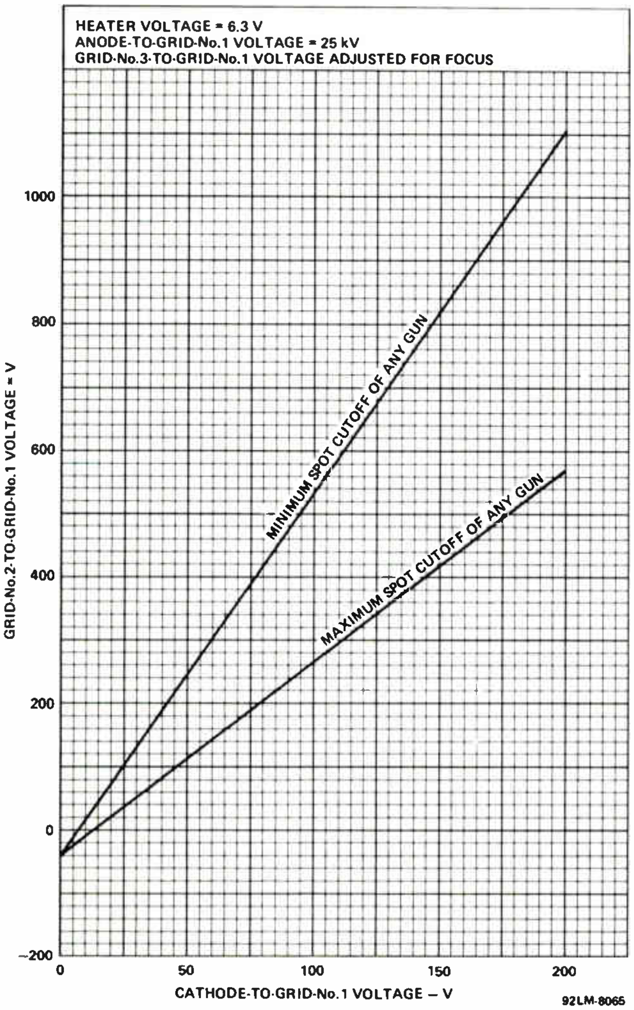


Figure 1 - Cutoff Design Chart

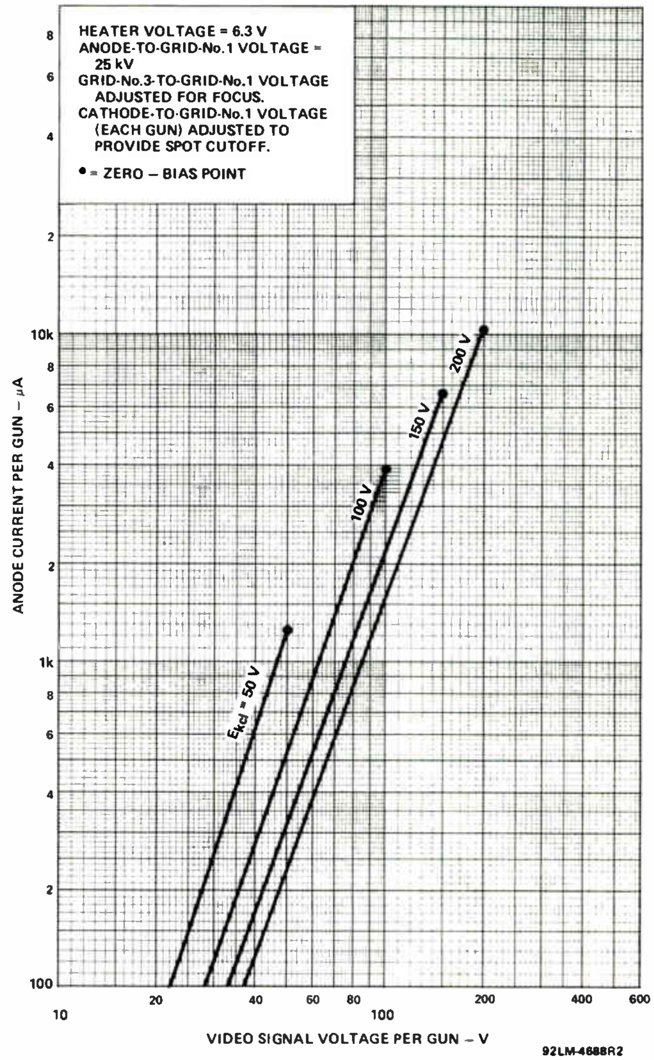


Figure 2 - Typical Drive Characteristics, Cathode-Drive Service

Notes for Dimensional Outline

Note 1 - The mating socket assembly with associated circuit board and mounted components must not weigh more than 0.5 kg. To minimize the torsional forces on the tube base pins, the center of gravity of this assembly should be located on the vertical plane through the picture-tube axis. Caution should also be exercised so that connecting leads to the assembly do not exert excessive torsional forces.

Note 2 - The purity magnets should be centered over or forward of the G3-G4 gap. Consideration should be given when selecting a convergence/purity device to assure adequate performance and axial adjustment of the yoke while meeting this location requirement.

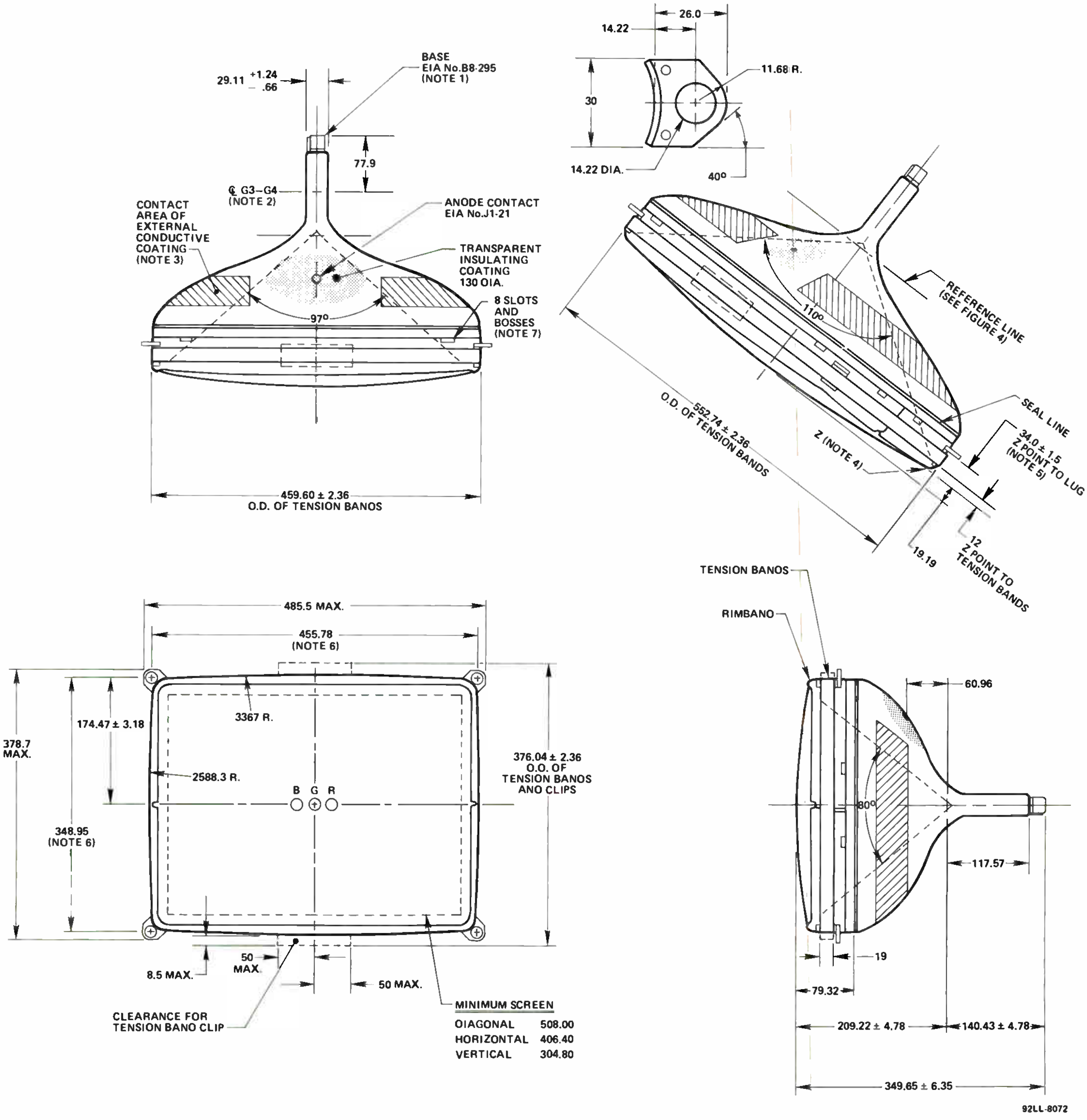
Note 3 - The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be connected to the chassis with multiple contacts.

Note 4 - "Z" is located on the outside surface of the faceplate on the screen diagonal at the edge of the minimum published screen. This point is used as a reference for the mounting lugs.

Note 5 - None of the four mounting lugs will deviate from the plane of the other three by more than 1.6 mm.

Note 6 - The tolerance of the mounting lug holes will accommodate mounting screws up to 7.6 mm in diameter when positioned on the true hole centers.

Note 7 - Clearance dimensions for mounting the degaussing coils: 3.2 mm x 8.0 mm.



Dimensions in mm unless otherwise noted.

Figure 3 - Dimensional Outline

Sagittal Heights With Reference to Centerface at the Edge of the Minimum Screen.

Point No.	Coordinates X mm	Y mm	Sagittal Height mm
1 (Minor Axis)	0.00	152.40	13.18
2	25.40	152.40	13.28
3	50.80	152.40	13.56
4	76.20	152.40	14.03
5	101.60	152.40	14.69
6	127.00	152.40	15.53
7	152.40	152.40	16.57
8	177.80	152.40	17.79
9 (Diagonal)	203.20	152.40	19.19
10	203.20	127.00	18.19
11	203.20	101.60	17.36
12	203.20	76.20	16.72
13	203.20	50.80	16.27
14	203.20	25.40	16.00
15 (Major Axis)	203.20	0.00	15.90

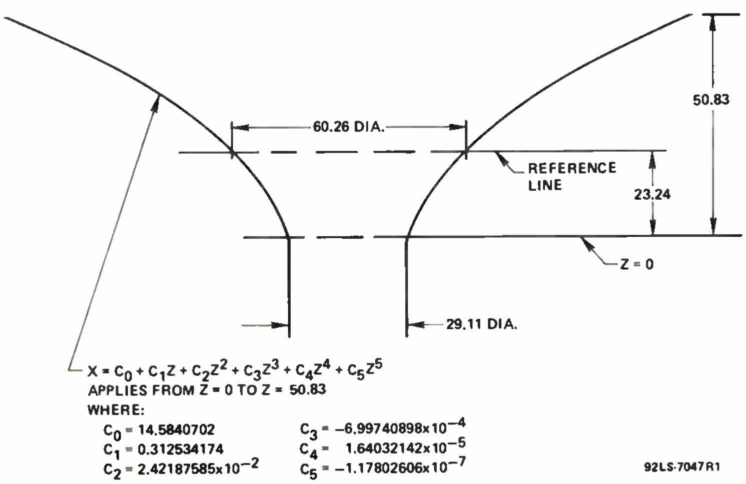


Figure 4 - Funnel Contour In Yoke Region

Pin 1: Grid No.3
Pin 5: Grid No.1
Pin 6: Cathode of Green Beam
Pin 7: Grid No.2
Pin 8: Cathode of Red Beam
Pin 9: Heater
Pin 10: Heater
Pin 11: Cathode of Blue Beam
Cap: Anode (Grid No.4, Screen, Collector)
C: External Conductive Coating

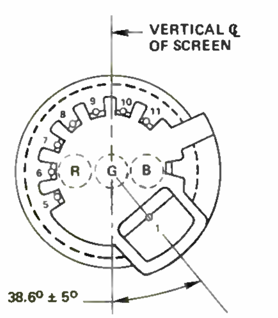


Figure 5 - Pin Connections and Rear View of Base - EIA No.B8-295-AA

WARNING

X-Radiation

This color picture tube incorporates integral x-radiation shielding and must be replaced with a tube of the same type number or an RCA-recommended replacement to assure continued safety.

Operation of this color picture tube at abnormal conditions which exceed the 0.5 mR/h isoexposure-rate limit may produce soft x rays which may constitute a health hazard on prolonged exposure at close range unless adequate external x-radiation shielding is provided. Therefore, precautions must be exercised during servicing of TV receivers employing this tube to assure that the anode voltage and other tube voltages are adjusted to the recommended values so that the Absolute-Maximum Ratings will not be exceeded.

Implosion Protection

This picture tube employs integral implosion protection and must be replaced with a tube of the same type number or an RCA-recommended replacement to assure continued safety.

Shock Hazard

The high voltage at which the tube is operated may be very dangerous. Design of the TV receiver should include safeguards to prevent the user from coming in contact with the high voltage. Extreme care should be taken in the servicing or adjustment of any high-voltage circuit.

Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture-tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode contact button, located in the funnel of the picture tube, to the external conductive coating before handling the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard. Also see Tube Mounting on page 8.

Tube Handling

Picture tubes should be kept in the shipping box or similar protective container until just prior to installation. Wear heavy protective clothing, including gloves and safety goggles with side shields, in areas containing unpacked and unprotected tubes to prevent possible injury from flying glass in the event a tube breaks. Handle the picture tube with extreme care. Do not strike, scratch or subject the tube to more than moderate pressure. Particular care should be taken to prevent damage to the seal area.

It is the sole responsibility of the manufacturer of television receivers and other equipment utilizing this color picture tube to provide appropriate design and circuitry that will limit the possible effects of failure of the color picture tube.

The equipment manufacturer should provide a warning label in an appropriate position on the equipment to advise the serviceman of all safety precautions.

Magnetic Shield and Degaussing

An internal magnetic shield is provided in this tube. When properly degaussed this shield in conjunction with the shadow-mask assembly provides compensation for the effects of the earth's magnetic field on the electron beams. After installation of the picture tube into the receiver cabinet, it is recommended that the complete receiver be externally degaussed by a minimum degaussing field of 20 gauss measured at the faceplate of the tube. The external degaussing procedure should be followed by the receiver's internal degaussing in the normal manner. In order for this action to be effective, it is essential that the tube be degaussed in the specific earth's magnetic field (strength and orientation) in which it is to be operated. Proper degaussing will assure satisfactory performance for field purity.

Degaussing Coils

The recommended degaussing system utilizes a single tilted coil placed on the tube as shown in **Figure 6** with the top edge on the panel in front of the seal line and the bottom edge on the funnel about 60 mm behind the seal line. Eight slots and bosses are provided in the rimband of the tube to facilitate mounting the degaussing coil to the tube funnel.

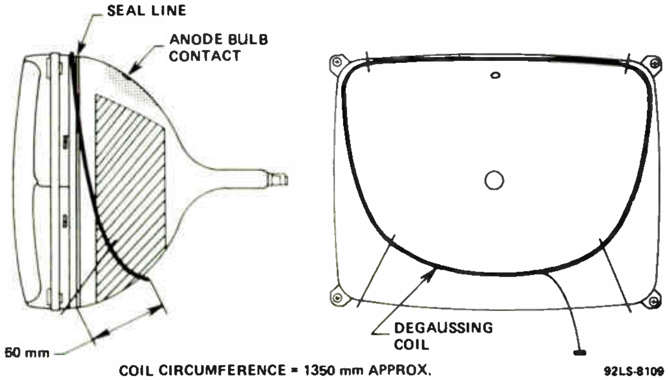


Figure 6 - Relative Placement of Typical Tilted "Z" Degaussing Coil

Degaussing Circuit

A recommended degaussing circuit as shown in **Figure 7** uses a conventional dual PTC device. For proper degaussing, a minimum value of 1300 peak-to-peak ampere-turns is required. It is essential to reduce the degaussing current in a gradual manner (50 percent amplitude in a minimum of 5 cycles). The residual value in the coil due to the degaussing power source should not exceed 1.0 peak-to-peak ampere-turns.

For optimum performance the degaussing coil should always be connected to a very low source impedance at the horizontal frequency. If the circuit used does not have an inherent low impedance at the horizontal frequency, the degaussing coil should be shunted with a suitable capacitor. If the addition of a short across the coil increases the horizontal frequency currents in the degaussing coil by more than 20%, the inherent source impedance offered by the PTC and associated circuitry is indicated to be too high to provide satisfactory performance. Therefore a capacitor should be be added across the degaussing coil to satisfy this requirement.

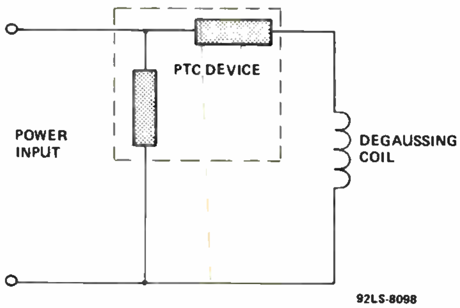


Figure 7 - Typical Degaussing Circuit

High-Voltage Discharge Protection

The high-resistance internal coating incorporated in soft-arc picture-tube designs significantly reduces the peak energy during a high-voltage discharge. In spite of this and other improvements, high-voltage discharges are still capable of initiating ionized paths, both internal and external to the tube, that can couple high-energy low-voltage sources to the picture tube and associated circuit elements. These high-energy sources can cause varying degrees of picture-tube and/or circuit damage.

With any color picture tube, maximum product reliability is obtained by the use of spark gaps with proper grounding, series isolation resistors, and good printed circuit board layouts. Spark gaps to ground should be connected to all socket contacts except as noted below for heater circuits. The ground points for the focus-electrode spark gap and the low-voltage spark gaps should be connected with a heavy noninductive strap to a good grounding contact on the picture-tube external conductive coating. The focus-electrode spark gap should be designed to break down at a dc value of approximately 1.5 times the maximum design voltage of the focus circuit. The low-voltage spark gaps should be designed for a dc breakdown voltage of 1.5 to 3.0 kV. The high-voltage circuit chassis ground point should be connected to the low-voltage spark-gap ground at the picture-tube socket. It is recommended that no other connections be made between the picture-tube external coating and the grounds of the main chassis or the spark gaps. This will minimize circulating currents in the chassis during high-voltage discharge.

Isolation resistors should be used in series with each grid and cathode lead. The resistance values should be as high as possible without degrading circuit performance (see **Figure 8**). These resistors should be capable of withstanding an instantaneous application of 12 kV for the low-voltage circuits and 20 kV for the focus circuit without arcing over, arcing through the body, or changing in resistance significantly during repeated applications of these voltages. Most half-watt carbon composition resistors are suitable for the low-voltage circuits and most one-watt carbon composition resistors are suitable for the focus circuit. Use of these resistors reduces the possibility of circulating currents in the chassis and excessive currents in the picture-tube elements.

For best reliability, the heater circuit should be isolated from chassis ground and/or voltage sources by a minimum resistance of 10 kΩ. Spark gaps should be connected to both heater-socket contacts. These spark gaps should have the same characteristics as the other low-voltage spark gaps. When the heater voltage is supplied from an isolated source, such as the horizontal deflection circuit or other high-frequency pulse source, a capacitor may be required between one side of the heater and ground to eliminate undesirable interference on the picture-tube screen. If a capacitance value in excess of 0.01 μF is required, the spark gaps to the heater leads should not be used.

Very reliable performance can also be obtained with non-isolated heater circuits. In these cases, only the high side of the heater circuit needs a spark gap. However, printed circuit board and socket designs which inherently provide spark gaps for both heater leads are also satisfactory.

Tube Mounting

Integral mounting lugs are provided to facilitate mounting the picture tube in the receiver. To prevent a possible shock hazard, it is recommended that the integral mounting lugs and other metal hardware of the tube be connected to the receiver chassis through one of the mounting lugs. If the chassis is not at ground potential, the connection should be made through a 1 MΩ current-limiting resistor. The mounting system and other receiver hardware should not place mechanical stress on, or cause abrasion of, the tube particularly in the panel-to-funnel seal area.

The TV receiver mounting system should incorporate sufficient cushioning so that under conditions of shipment or handling the impact force applied to the picture tube does not exceed 35 g's.

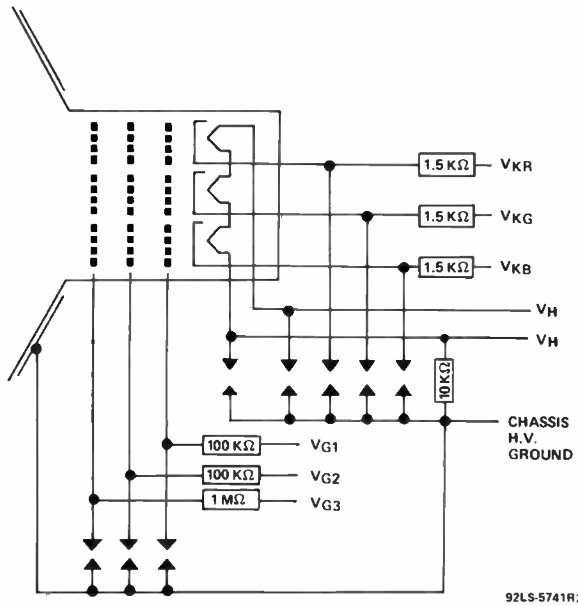


Figure 8 - Picture-Tube Connections Showing Spark-Gap Recommendations and Typical Isolation-Resistor Values

68 cm (27V) 110° COTY-SP Precision In-Line Color Picture Tube

- **COTY-SP — Square & Planar — A New Faceplate Shape —**
  Much Flatter
  Screen Edge Nearly Planar
  Rectilinear Screen
- **Designed for a Miniaturized Saddle/Toroidal Yoke**
- **XL Bipotential Precision In-Line Gun —**
  Optimized Beam-Forming Region for Excellent Focus Uniformity
- **Standard 29 mm Neck Diameter —**
  Proven Reliability
- **Excellent Convergence Performance**
- **Internal Magnetic Shield**
- **Other Features —**
  Matrix Line Screen
  Tinted Phosphor
  Super-Arch Mask
  Soft-Arc Technology
  Integral Mounting Lugs

RCA A68ACC10X is a 68 cm (27V) 110° COTY-SP Precision In-Line Color Picture Tube. COTY-SP features a new faceplate shape with improved geometry. The faceplate is much flatter — sagittal heights are only half that of types having the current standard face contour. The screen edge is within ± 4 millimeters of being planar. Also, the screen edge is rectilinear — the edges are straight and form square corners.

The A68ACC10X incorporates the same improved features as earlier RCA COTY-29 tubes. It is designed for a miniaturized yoke which provides a savings in material and deflection power. The tube features an XL electron gun with close beam-to-beam spacing for excellent focus and convergence performance, and a standard 29 mm neck diameter for proven reliability. Optimum system cost and performance result from these combined features.

Miniaturization of the yoke was made possible by reducing the beam spacing in the electron gun and by optimizing both the funnel glass contour and the yoke contour to match the path of the deflected electron beams.

A bipotential precision in-line electron gun featuring an XL (expanded diameter lens) has been incorporated in the A68ACC10X. In this feature, an expanded lens field encompasses all three beams. This expanded field when combined with the fields from the individual apertures produces a superior lens for focus performance and with less aberrations than in a standard gun. Only the neck diameter, not the beam spacing, limits the focusing ability. This focusing principle allows the reduction of beam spacing without the usual loss in focus quality. Convergence performance has also been improved by the reduction in the beam spacing.

Formerly RCA Developmental Type C76961

Electrical Data

Heater:		
Voltage	6.3	V
Current	700	mA
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Angles (approx.):		
Diagonal	110	deg
Horizontal	97	deg
Vertical	80	deg
Direct Interelectrode Capacitance (approx.):		
Grid no.1 to all other electrodes	10	pF
Grid no.3 to all other electrodes	5.0	pF
Each cathode to all other electrodes	6.5	pF
All cathodes to all other electrodes	14	pF
Capacitance Between Anode and External Conductive Coating (including metal hardware)	2700 max. / 2200 min.	pF
Resistance Between Metal Hardware and External Conductive Coating	50 min.	MΩ
Typical Deflection Yoke	RCA XD5395I, or Equivalent	
Integral Magnetic Shield	Internal	

Optical Data

Faceplate:	
Light transmittance at center (approx.)	84%
Surface	Polished
Screen:	
Matrix	Black Opaque Material
Type	Negative Guard Band
Phosphor, rare-earth (red), sulfide (blue & green)	Type X[1]
Type	Selectively Absorbent
Persistence	Medium Short
Array	Vertical Line Trios
Spacing between corresponding points on line trios at center (approx.)	0.84 mm

Mechanical Data

Tube Dimensions:	
Overall length	417.25 ± 6.35 mm
Reference line to center of face	276.82 ± 4.78 mm
Neck length	140.43 ± 4.78 mm
O.D. at tension band:	
Diagonal	732.56 ± 2.36 mm
Horizontal	606.96 ± 2.36 mm
Vertical (not including tension-band clips)	475.75 ± 2.36 mm
Minimum screen dimensions (projected):	
Diagonal	676.00 mm
Horizontal	540.80 mm
Vertical	405.60 mm
Area	2193 sq cm
Bulb Funnel Designation	EIA No.J720
Bulb Panel Designation	EIA No.F723
Anode Bulb Contact Designation	EIA No.J1-21
Base and Pin Connection Designation[2]	EIA No.B8-295-AA
Pin Position Alignment	Ridge Separating Pins 9 and 10 Aligns Approx. with Anode Bulb Contact
Operating Position, Preferred	Anode Bulb Contact on Top
Gun Configuration	Horizontal In Line
Weight (approx.)	25.7 kg

Implosion Protection

Type	Rimbands and Tension Bands

Maximum and Minimum Ratings, Absolute-Maximum Values

Absolute-Maximum Ratings are specified for reliability and performance purposes. X-radiation characteristics should also be taken into consideration in the application of this tube type.

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Anode Voltage	32 max. / 17 min.	kV
Anode Current, Long-Term Average	2000 max.	μA
Grid-No.3 (focusing electrode) Voltage	12 max.	kV
Peak Grid-No.2 Voltage	1850 max.	V
Cathode Voltage:		
Positive bias value	400 max.	V
Positive operating cutoff value	200 max.	V
Negative bias value	0 max.	V
Negative peak value	2 max.	V
Heater Voltage:[3]		
AC (rms) or DC value	6.9 max. / 5.7 min.	V
Peak pulse value	50 max.	V
Surge value, during 15-second warm-up period (rms)	9.5 max.	V
Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
DC component value	200 max.	V
Peak value	300 max.	V
Heater positive with respect to cathode:		
DC component value	100 max.	V
Peak value	200 max.	V

Typical Design Values (for anode voltage of 25 kV)

Unless otherwise specified, voltage values are positive with respect to grid no.1.

Grid-No.3 (focusing electrode) Voltage	24 to 28% of Anode Voltage
Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot	See CUTOFF DESIGN CHART in **Figure 1**
At cathode voltage of 100 V	265 to 535 V
At cathode voltage of 150 V	420 to 820 V
At cathode voltage of 200 V	575 to 1105 V
Maximum Ratio of Cathode Cutoff Voltages, Highest Gun to Lowest Gun (with grid no.2 of gun having highest cathode voltage adjusted to give 150 V spot cutoff)	1.25
Heater Voltage[3]	6.3 ± 0.1 V
Grid-No.3 Current[4]	± 10 μA
Grid-No.2 Current	± 5 μA
Grid-No.1 Current	± 5 μA

To Produce White Light Output Having CIE Coordinates of:

X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each beam (average):			
Red	37	24	%
Blue	26	34	%
Green	37	42	%

Ratio of cathode currents:

Red/blue:		
Minimum	1.00	0.49
Typical	1.38	0.71
Maximum	1.75	0.92
Red/green:		
Minimum	0.75	0.41
Typical	0.98	0.58
Maximum	1.20	0.73
Blue/green:		
Minimum	0.54	0.62
Typical	0.71	0.81
Maximum	0.88	1.00

Raster Centering Displacement
Measured at Center of Screen:[5]
Horizontal .... -1.2 ± 6.0 mm
Vertical .... 0 ± 6.0 mm

Center Convergence Displacement
Between the Blue and Red Beams .... 4.0 mm

Center Convergence Displacement
Between the Green Beam and the
Converged Blue and Red Beams .... 1.4 mm

Maximum Required Correction for Register[6]
(including effect of earth's magnetic field
when using recommended components) as
Measured at the Center of the Screen in
the Horizontal Direction .... 0.10 max. mm

---

1 The X phosphor designation in the WTDS is equivalent to P22 in the EIA type designation system.

2 For mating socket considerations, see Note 1 under **Notes for Dimensional Outline.**

3 For maximum tube life, the heater supply voltage should be regulated to minimize heater voltage changes due to variations in line voltage, beam current, and other parameters. The design center value of the heater voltage should be the **Typical Design Value**; however, in some applications it may be desirable to operate at a voltage slightly below this value.

Cost considerations may suggest that the heater voltage be obtained from an unregulated source. If this option is chosen and the unregulated voltage varies with beam current, the circuit parameters should be selected so that the design center value of the heater voltage is equal to the **Typical Design Value** when the beam current is one-half of the **Long-Term Average Anode Current** as shown in the tabulated data. The **Absolute-Maximum and Minimum Ratings** should not be exceeded when including all variations.

For specific considerations, consult your RCA Video Component and Display Division representative.

4 A high source impedance in the focus circuit can result in a change in the focus voltage with a change in the grid no.3 leakage current.

5 The design-center values are the values obtained when the tube is operated with recommended components and procedures in an earth's magnetic field having a 470 mG vertical component and a zero cross-axial horizontal component..

6 Register is defined as the relative position of the beam trios with respect to the associated phosphor-line trios.

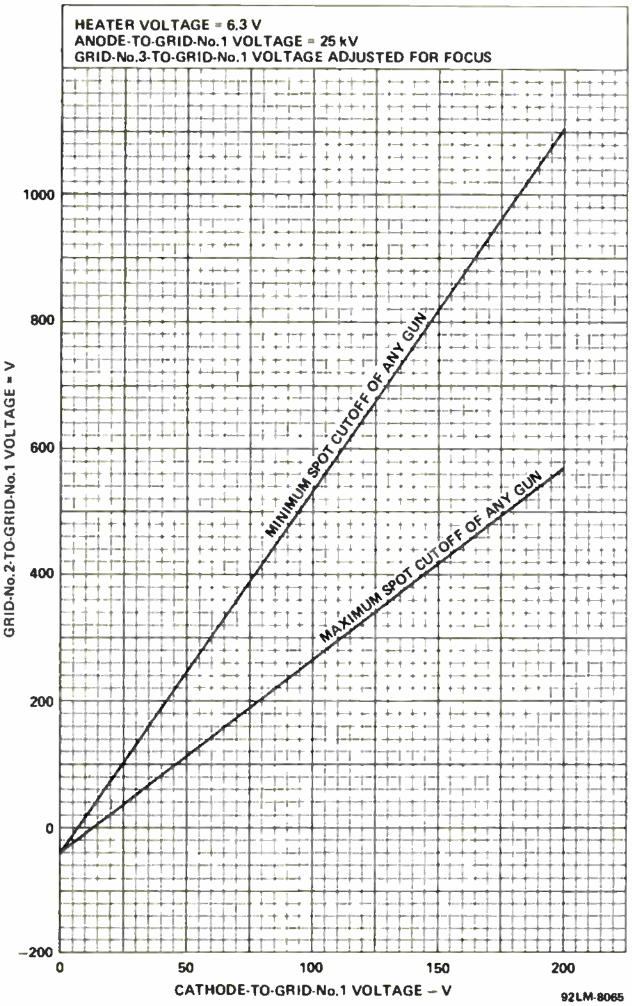


Figure 1 - Cutoff Design Chart

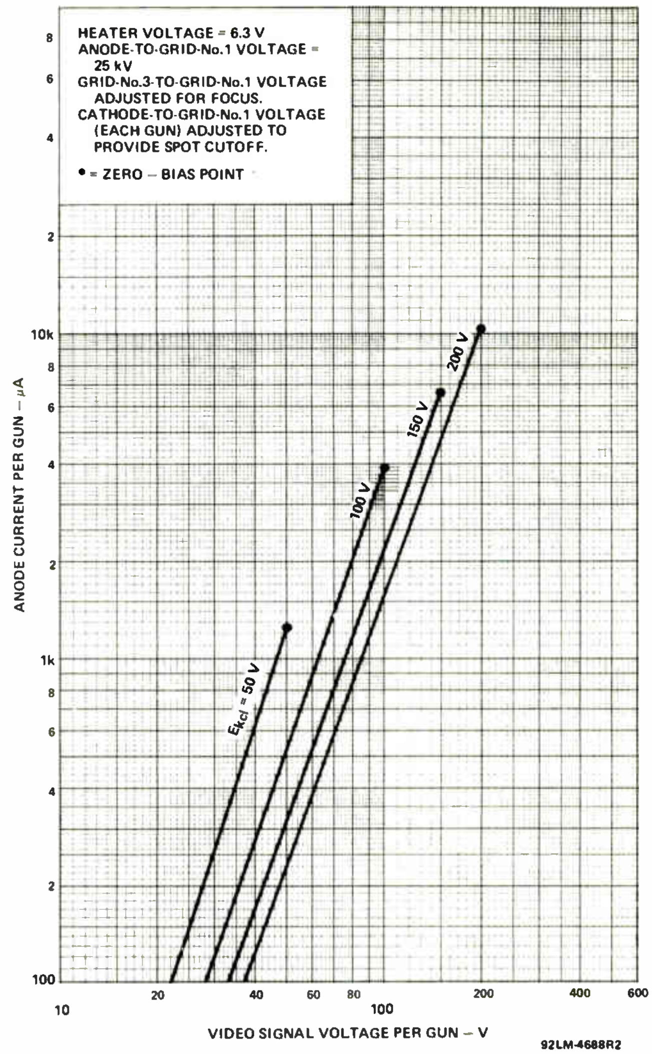


Figure 2 - Typical Drive Characteristics, Cathode-Drive Service

Notes for Dimensional Outline

Note 1 - The mating socket assembly with associated circuit board and mounted components must not weigh more than 0.5 kg. To minimize the torsional forces on the tube base pins, the center of gravity of this assembly should be located on the vertical plane through the picture-tube axis. Caution should also be exercised so that connecting leads to the assembly do not exert excessive torsional forces.

Note 2 - The purity magnets should be centered over or forward of the G3-G4 gap. Consideration should be given when selecting a convergence/purity device to assure adequate performance and axial adjustment of the yoke while meeting this location requirement.

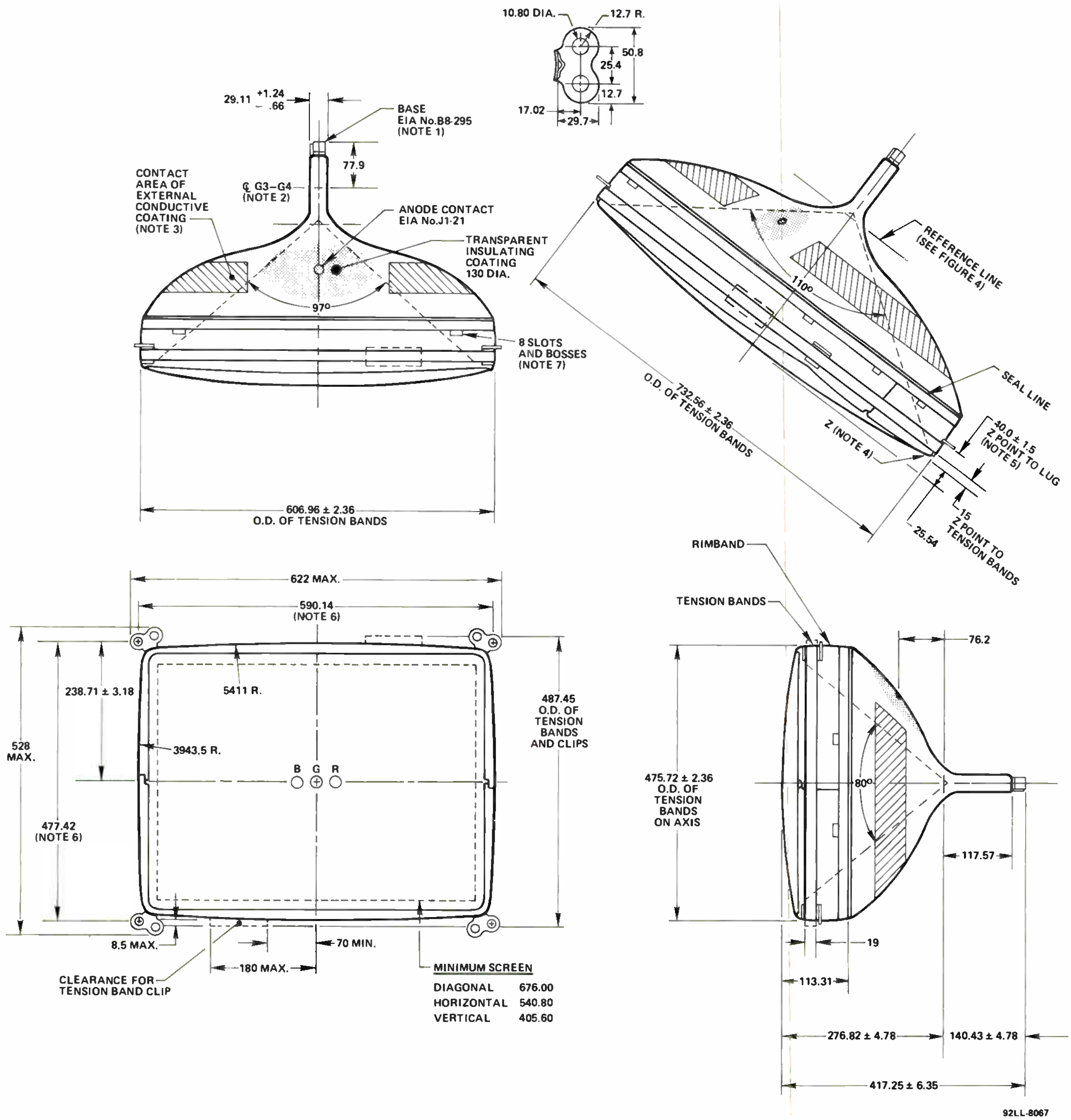
Note 3 - The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be connected to the chassis with multiple contacts.

Note 4 - "Z" is located on the outside surface of the faceplate on the screen diagonal at the edge of the minimum published screen. This point is used as a reference for the mounting lugs.

Note 5 - None of the four mounting lugs will deviate from the plane of the other three by more than 1.6 mm.

Note 6 - The tolerance of the mounting lug holes will accommodate mounting screws up to 7.6 mm in diameter when positioned on the true hole centers.

Note 7 - Clearance dimensions for mounting the degaussing coils: 3.2 mm x 8.0 mm.



Dimensions in mm unless otherwise noted.

Figure 3 - Dimensional Outline

Sagittal Heights With Reference to Centerface at the Edge of the Minimum Screen.

Point No.	Coordinates X mm	Coordinates Y mm	Sagittal Height mm
1 (Minor Axis)	0.00	202.80	17.54
2	25.40	202.80	17.61
3	50.80	202.80	17.83
4	76.20	202.80	18.18
5	101.60	202.80	18.67
6	127.00	202.80	19.31
7	152.40	202.80	20.09
8	177.80	202.80	21.00
9	203.20	202.80	22.06
10	228.60	202.80	23.06
11	254.00	202.80	24.60
12 (Diagonal)	270.40	202.80	25.54
13	270.40	177.80	24.53
14	270.40	152.40	23.63
15	270.40	127.00	22.88
16	270.40	101.60	22.26
17	270.40	76.20	21.78
18	270.40	50.80	21.44
19	270.40	25.40	21.23
20 (Major Axis)	270.40	0.00	21.16

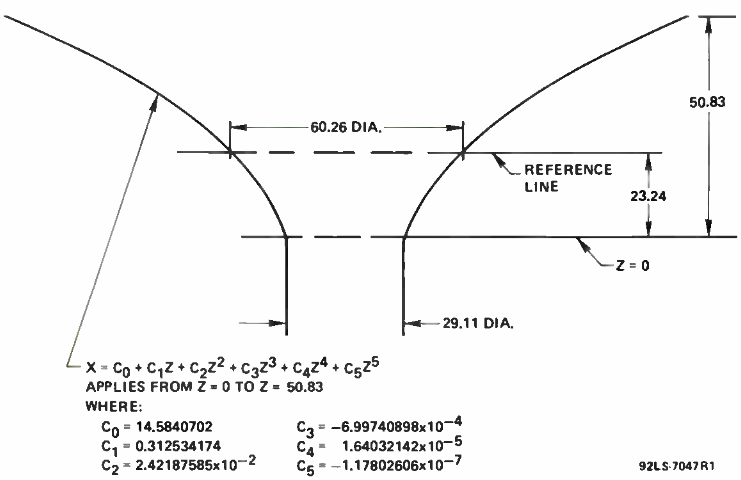


Figure 4 - Funnel Contour in Yoke Region

Pin 1: Grid No.3
Pin 5: Grid No.1
Pin 6: Cathode of Green Beam
Pin 7: Grid No.2
Pin 8: Cathode of Red Beam
Pin 9: Heater
Pin 10: Heater
Pin 11: Cathode of Blue Beam
Cap: Anode (Grid No.4, Screen, Collector)
C: External Conductive Coating

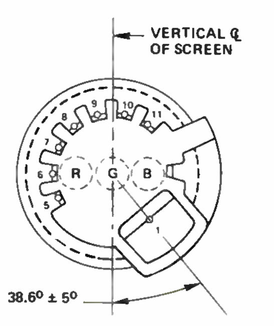


Figure 5 - Pin Connections and Rear View of Base - EIA No.B8-295-AA

WARNING

X-Radiation

This color picture tube incorporates integral x-radiation shielding and must be replaced with a tube of the same type number or an RCA-recommended replacement to assure continued safety.

Operation of this color picture tube at abnormal conditions which exceed the 0.5 mR/h isoexposure-rate limit may produce soft x rays which may constitute a health hazard on prolonged exposure at close range unless adequate external x-radiation shielding is provided. Therefore, precautions must be exercised during servicing of TV receivers employing this tube to assure that the anode voltage and other tube voltages are adjusted to the recommended values so that the Absolute-Maximum Ratings will not be exceeded.

Implosion Protection

This picture tube employs integral implosion protection and must be replaced with a tube of the same type number or an RCA-recommended replacement to assure continued safety.

Shock Hazard

The high voltage at which the tube is operated may be very dangerous. Design of the TV receiver should include safeguards to prevent the user from coming in contact with the high voltage. Extreme care should be taken in the servicing or adjustment of any high-voltage circuit.

Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture-tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode contact button, located in the funnel of the picture tube, to the external conductive coating before handling the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard. Also see Tube Mounting on page 8.

Tube Handling

Picture tubes should be kept in the shipping box or similar protective container until just prior to installation. Wear heavy protective clothing, including gloves and safety goggles with side shields, in areas containing unpacked and unprotected tubes to prevent possible injury from flying glass in the event a tube breaks. Handle the picture tube with extreme care. Do not strike, scratch or subject the tube to more than moderate pressure. Particular care should be taken to prevent damage to the seal area.

It is the sole responsibility of the manufacturer of television receivers and other equipment utilizing this color picture tube to provide appropriate design and circuitry that will limit the possible effects of failure of the color picture tube.

The equipment manufacturer should provide a warning label in an appropriate position on the equipment to advise the serviceman of all safety precautions.

Magnetic Shield and Degaussing

An internal magnetic shield is provided in this tube. When properly degaussed this shield in conjunction with the shadow-mask assembly provides compensation for the effects of the earth's magnetic field on the electron beams. After installation of the picture tube into the receiver cabinet, it is recommended that the complete receiver be externally degaussed by a minimum degaussing field of 20 gauss measured at the faceplate of the tube. The external degaussing procedure should be followed by the receiver's internal degaussing in the normal manner. In order for this action to be effective, it is essential that the tube be degaussed in the specific earth's magnetic field (strength and orientation) in which it is to be operated. Proper degaussing will assure satisfactory performance for field purity.

Degaussing Coils

The recommended degaussing system utilizes a single tilted coil placed on the tube as shown in **Figure 6** with the top edge on the panel in front of the seal line and the bottom edge on the funnel about 135 mm behind the seal line. Eight slots and bosses are provided in the rimband of the tube to facilitate mounting the degaussing coil to the tube funnel.

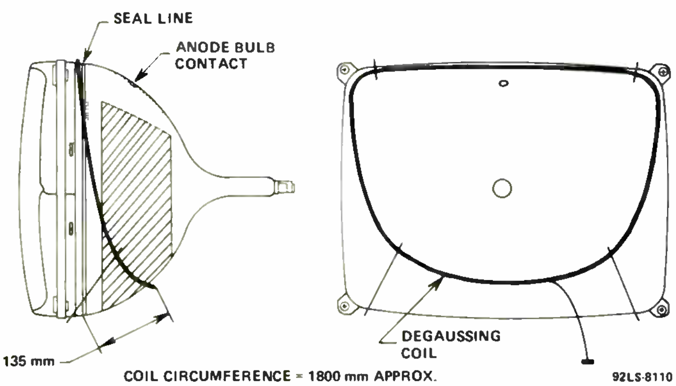


Figure 6 - Relative Placement of Typical Tilted "Z" Degaussing Coil

Degaussing Circuit

A recommended degaussing circuit as shown in **Figure 7** uses a conventional dual PTC device. For proper degaussing, a minimum value of 1500 peak-to-peak ampere-turns is required. It is essential to reduce the degaussing current in a gradual manner (50 percent amplitude in a minimum of 5 cycles). The residual value in the coil due to the degaussing power source should not exceed 1.0 peak-to-peak ampere-turns.

For optimum performance the degaussing coil should always be connected to a very low source impedance at the horizontal frequency. If the circuit used does not have an inherent low impedance at the horizontal frequency, the degaussing coil should be shunted with a suitable capacitor. If the addition of a short across the coil increases the horizontal frequency currents in the degaussing coil by more than 20%, the inherent source impedance offered by the PTC and associated circuitry is indicated to be too high to provide satisfactory performance. Therefore a capacitor should be be added across the degaussing coil to satisfy this requirement.

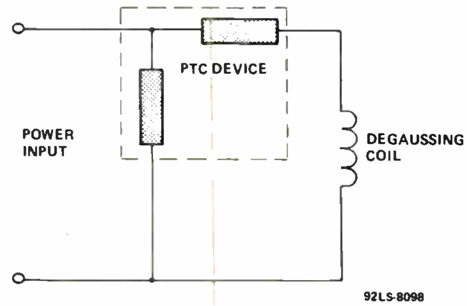


Figure 7 - Typical Degaussing Circuit

High-Voltage Discharge Protection

The high-resistance internal coating incorporated in soft-arc picture-tube designs significantly reduces the peak energy during a high-voltage discharge. In spite of this and other improvements, high-voltage discharges are still capable of initiating ionized paths, both internal and external to the tube, that can couple high-energy low-voltage sources to the picture tube and associated circuit elements. These high-energy sources can cause varying degrees of picture-tube and/or circuit damage.

With any color picture tube, maximum product reliability is obtained by the use of spark gaps with proper grounding, series isolation resistors, and good printed circuit board layouts. Spark gaps to ground should be connected to all socket contacts except as noted below for heater circuits. The ground points for the focus-electrode spark gap and the low-voltage spark gaps should be connected with a heavy noninductive strap to a good grounding contact on the picture-tube external conductive coating. The focus-electrode spark gap should be designed to break down at a dc value of approximately 1.5 times the maximum design voltage of the focus circuit. The low-voltage spark gaps should be designed for a dc breakdown voltage of 1.5 to 3.0 kV. The high-voltage circuit chassis ground point should be connected to the low-voltage spark-gap ground at the picture-tube socket. It is recommended that no other connections be made between the picture-tube external coating and the grounds of the main chassis or the spark gaps. This will minimize circulating currents in the chassis during high-voltage discharge.

Isolation resistors should be used in series with each grid and cathode lead. The resistance values should be as high as possible without degrading circuit performance (see **Figure 8**). These resistors should be capable of withstanding an instantaneous application of 12 kV for the low-voltage circuits and 20 kV for the focus circuit without arcing over, arcing through the body, or changing in resistance significantly during repeated applications of these voltages. Most half-watt carbon composition resistors are suitable for the low-voltage circuits and most one-watt carbon composition resistors are suitable for the focus circuit. Use of these resistors reduces the possibility of circulating currents in the chassis and excessive currents in the picture-tube elements.

For best reliability, the heater circuit should be isolated from chassis ground and/or voltage sources by a minimum resistance of 10 kΩ. Spark gaps should be connected to both heater-socket contacts. These spark gaps should have the same characteristics as the other low-voltage spark gaps. When the heater voltage is supplied from an isolated source, such as the horizontal deflection circuit or other high-frequency pulse source, a capacitor may be required between one side of the heater and ground to eliminate undesirable interference on the picture-tube screen. If a capacitance value in excess of 0.01 μF is required, the spark gaps to the heater leads should not be used.

Very reliable performance can also be obtained with non-isolated heater circuits. In these cases, only the high side of the heater circuit needs a spark gap. However, printed circuit board and socket designs which inherently provide spark gaps for both heater leads are also satisfactory.

Tube Mounting

Integral mounting lugs are provided to facilitate mounting the picture tube in the receiver. To prevent a possible shock hazard, it is recommended that the integral mounting lugs and other metal hardware of the tube be connected to the receiver chassis through one of the mounting lugs. If the chassis is not at ground potential, the connection should be made through a 1 MΩ current-limiting resistor. The mounting system and other receiver hardware should not place mechanical stress on, or cause abrasion of, the tube particularly in the panel-to-funnel seal area.

The TV receiver mounting system should incorporate sufficient cushioning so that under conditions of shipment or handling the impact force applied to the picture tube does not exceed 35 g's.

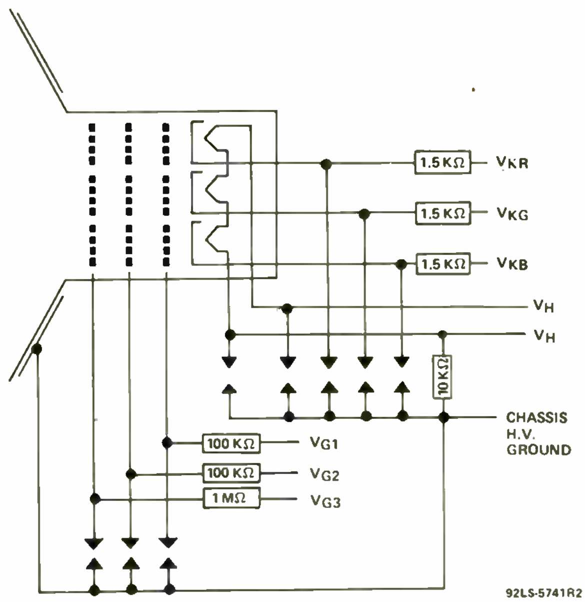


Figure 8 - Picture-Tube Connections Showing Spark-Gap Recommendations and Typical Isolation-Resistor Values