2+ ATTACHMENT

Electronic Industries Association

Announcement

of

Electron Device Type Registration

Release No. 7104

May 19, 1987

The Electronics Industries Association announces the registration of the following electron device designations:

A51ACG55X
A51ABU55X

according to the ratings and characterisics found on the attached data sheets on the application of:

RCA Tube Div.

Lancaster, PA

2001 Eye Street, N.W. · Washington, D. C. 20006 · (202) 457-4900 · TWX: 710-822-0148

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

- **Neodymium Faceplate — Enhanced Contrast**
- **COTY-FS — Full Square — Rectilinear Screen — Straight Sides and Square Corners**
- **Designed for a Miniaturized Saddle/Toroidal Yoke — Lower Deflection Power Pincushion Corrected**
- **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 A51ACG55X is a 51 cm (20V) 90° COTY-FS Precision In-Line Color Picture Tube with a neodymium faceplate which has a selective light transmittance (See **Figure 1**). The faceplate has a greater absorption for light having wavelengths between 560 and 600 nanometers. Contrast is enhanced because reflections from room light are reduced. 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 A51ACG55X 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. Correction for pincushion distortion has been provided by front cross arms in this saddle/toroidal yoke.

A bipotential precision in-line electron gun featuring an XL (expanded diameter lens) has been incorporated in the A51ACG55X. 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
Direct Interelectrode Capacitances (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 cathode to all other electrodes	14	pF

Formerly RCA Developmental Type C77278

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Electrical Data (Cont'd)

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	KME No.TLY25334F, or Equivalent
Integral Magnetic Shield	Internal

Optical Data

Faceplate	Selective Transmittance
Light transmittance at center (approx.)	65%[1]
Surface	Polished
Screen	Matrix
Phosphor, rare-earth (red), sulfide (blue & green)	Type X[2]
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	550.65 ± 2.36 mm
Horizontal	455.57 ± 2.36 mm
Vertical (including tension-band clip)	366.39 ± 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.J542B
Bulb Panel Designation	EIA No.F545
Anode Bulb Contact Designation	EIA No.J1-21
Base and Pin Connection Designation[3]	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.)	14 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	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:[4]		
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:		
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	22 to 26% of Anode Voltage		
Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot	See CUTOFF DESIGN CHART in **Figure 4**		
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[4]	6.3 V		
Grid-No.3 Current[5]	± 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	40	31	%
Blue	23	29	%
Green	37	40	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.30	0.73	
Typical	1.80	1.06	
Maximum	2.28	1.37	
Red/green:			
Minimum	0.84	0.54	
Typical	1.10	0.76	
Maximum	1.35	0.96	
Blue/green:			
Minimum	0.46	0.55	
Typical	0.61	0.72	
Maximum	0.76	0.89	
Raster Centering Displacement Measured at Center of Screen:[6]			
Horizontal	-1.5 ± 6.0 mm		
Vertical	0 ± 6.0 mm		

With any color picture tube, maximum product reliability is obtained through 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 conductive coating and grounds of the main chassis or 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 11**). 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 significantly changing in resistance value 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 another 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. Printed circuit board and socket designs which inherently provide spark gaps for both heater leads are also satisfactory.

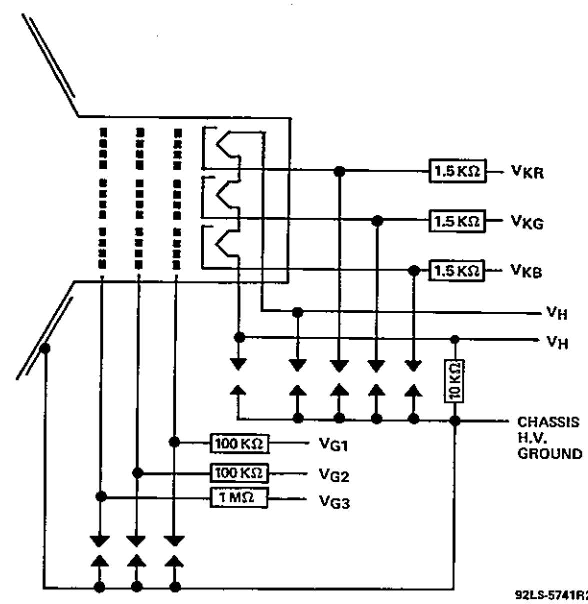

Figure 11 - Picture-Tube Connections Showing Spark-Gap Recommendations and Typical Isolation-Resistor Values

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 to the panel-to-funnel seal.

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.

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 picture tube 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. It is recommended that this take place in a magnetic field having a 470 mG vertical component and a zero horizontal component. If this field is not available, it is essential that the tube be degaussed in the specific earth's magnetic field (strength and orientation) in which it is to be set up. Proper degaussing will assure satisfactory performance for field purity.

Degaussing Coil

The recommended degaussing system utilizes a single tilted coil placed on the tube as shown in **Figure 8** 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. Small holes are provided in the four mounting lugs to facilitate mounting the degaussing coil to the tube funnel.

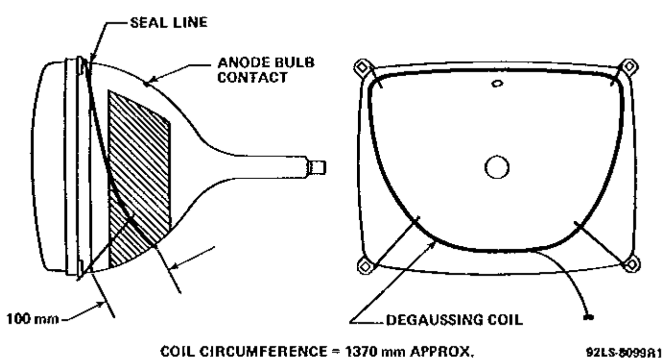

Figure 8 - Relative Placement of Typical Degaussing Coil

Degaussing Circuit

The goal of the degaussing circuit is to provide a minimum of 1200 peak-to-peak ampere turns (AT) in the degaussing coil. This current must decay in a gradual manner such that 50% of the initial amplitude still flows after 5 cycles. In addition, at the completion of the degaussing cycle the residual current in the coil must not exceed 1.0 peak-to-peak AT.

With any degaussing circuit it is necessary to eliminate interactions which occur between the deflection yoke fields and the degaussing coil. The induced current can be minimized by careful positioning of the degaussing coil. For this reason, and in order to achieve optimal degaussing recovery, coil placement is critical and should follow the recommendations shown in **Figure 8**.

The typical single PTC circuit shown in **Figure 9** is capable of producing the required current; however, this circuit often leaves too much residual current flowing after the degaussing cycle is complete. Two alternatives are suggested to reduce this residual and give a corresponding improvement in purity performance.

One alternative is the dual PTC circuit shown in **Figure 10**. In this arrangement, component parameters and the number of turns in the degaussing coil must be carefully selected to minimize the residual current while still achieving the specified initial value of 1200 AT.

Another alternative is to add a cut-off relay to the single PTC circuit in **Figure 9**. The purpose of this relay is to open the circuit after the degaussing current has decayed to a low level. Such a relay is often already available in remote control receivers. This arrangement is superior in two respects. First, it forces the residual current to be zero, and second, there is no horizontal yoke field coupling affect.

In addition to the improvement in degaussing performance that can be achieved as described above, another incremental improvement can be made by eliminating the interactions between the vertical deflection yoke fields and the degaussing field. To achieve this improvement, it is necessary to delay the "turn-on" of the vertical deflection circuit until after the completion of the degaussing cycle.

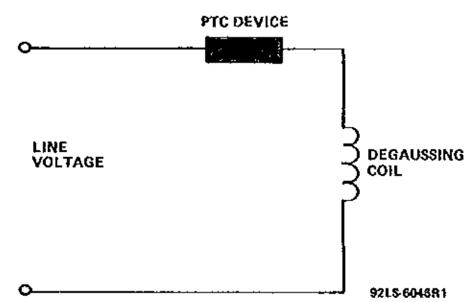

Figure 9 - Typical Degaussing Circuit

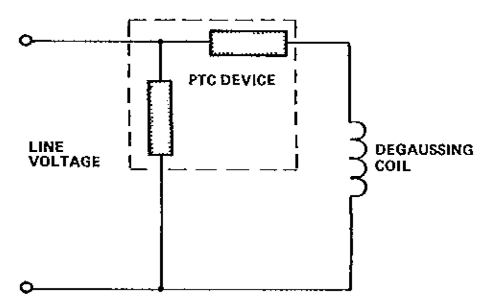

Figure 10 - Typical Degaussing Circuit

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.

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[7] (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

X-Radiation Characteristics

These measurements are made in accordance with the procedure of EIA Standard RS-503.

A picture tube should not be operated beyond its Absolute-Maximum Ratings (such operation may shorten tube life or have other permanent adverse effects on its performance).

The x-radiation emitted from this picture tube will not exceed 0.5 mR/h for anode voltage and current combinations given by the isoexposure-rate limit curves as shown in **Figure 2**. Operation above the values shown by the curves may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Part 1020 of Code of Federal Regulations, Title 21, Chapter I, Subchapter J. Maximum x-radiation as a function of anode voltage at 300 μA anode current is shown by the curves in **Figure 3**. X-radiation at a constant anode voltage varies linearly with anode current.

From These Curves Maximum Anode Voltage at Which the X-Radiation Emitted Will Not Exceed 0.5 mR/h at an Anode Current of 300 μA:

For entire tube .... *36 kV

For tube face only .... 36.5 kV

WARNING: If the value for the tube face only is used as design criterion, adequate shielding must be provided in the receiver for the anode bulb contact and/or certain portions of the tube funnel and panel skirt to insure that the x-radiation from the receiver is attenuated to a value equal to or lower than that specified for the face of the tube.

Maximum Voltage Difference Between Anode and Focus Electrode at Which the X-Radiation Emitted Will Not Exceed 0.5 mR/h .... 30 kV

WARNING: If the voltage value shown above can be exceeded in the receiver, additional attenuation of the x-radiation through the tube neck may be required.

* This rating applies only if the anode connector used by the receiver manufacturer provides the necessary attenuation to reduce the x-radiation from the anode bulb contact by a factor equivalent to the difference between the anode bulb contact isoexposure-rate limit curve (**Figure 2**) and the isoexposure-rate limit curve for the entire tube.

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1 The neodymium glass panel used in this tube has selective transmittance with a greater absorption for light having wavelengths between 560 and 600 nanometers (see **Figure 1**). When the light output from the X type phosphor is adjusted to produce white light output having CIE coordinates of x = 0.313, y = 0.329, the transmittance is 65% and is equivalent to the light output with a neutral glass panel having a transmittance of 65%.

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

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

4 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 heater voltage should be the **Typical Design Value** (within a measurement accuracy of ± 0.1 V). 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 heater voltage is the **Typical Design Values** (within a measurement accuracy of ± 0.1 V) 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. Long-term operation at or near the Absolute-Maximum limit will substantially reduce tube life.

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

5 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.

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

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

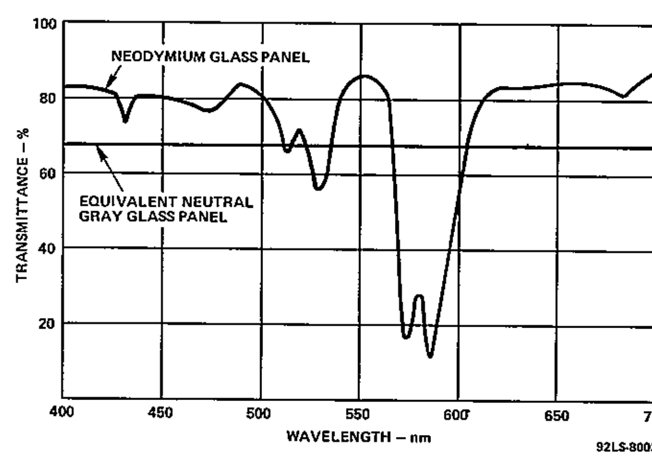


Figure 1 – Typical Light Transmittance for the Neodymium Glass Panel and the Equivalent Neutral Gray Glass Panel

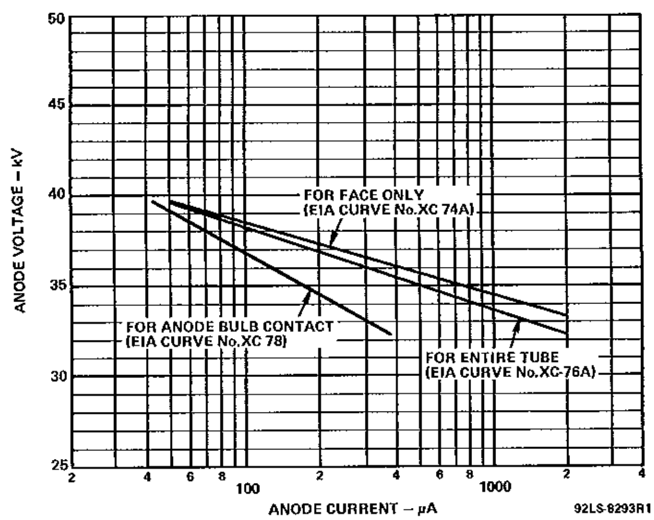


Figure 2 - 0.5 mR/h Isoexposure-Rate Limit Curves

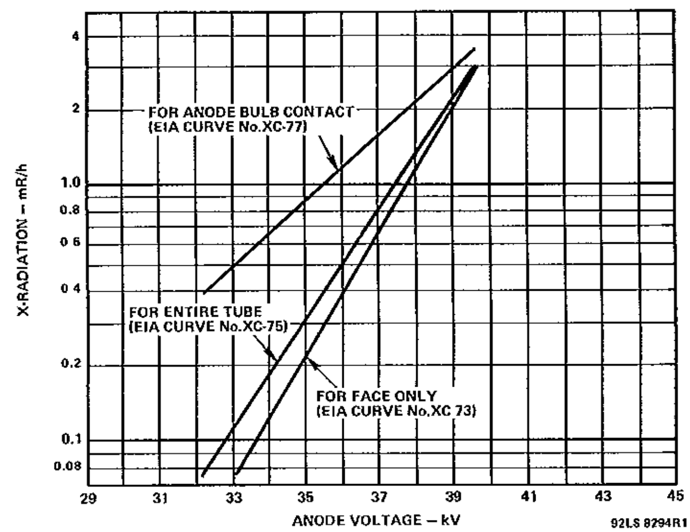


Figure 3 - X-Radiation Limit Curves at a Constant Anode Current of 300 μA (X-radiation at a constant anode voltage varies linearly with anode current)

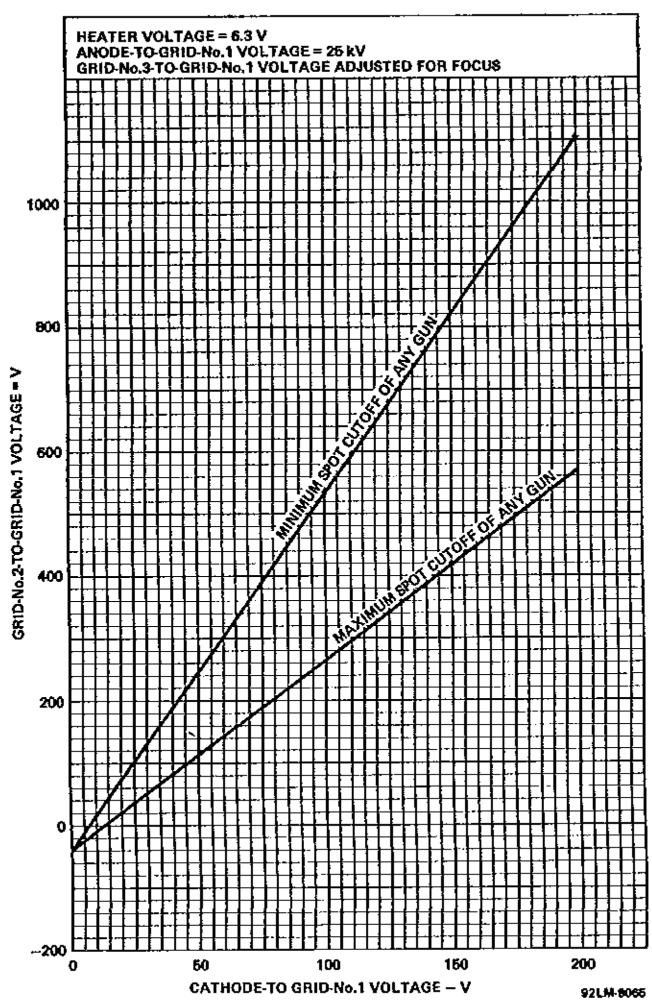


Figure 4 - Cutoff Design Chart

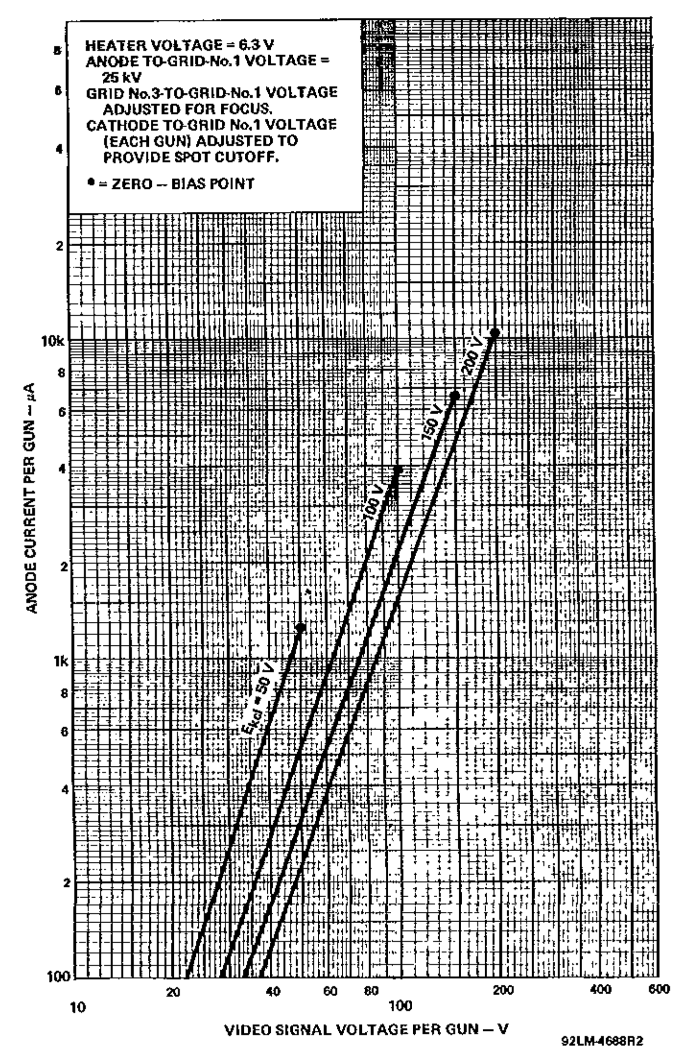


Figure 5 - Typical Drive Characteristics, Cathode-Drive Service

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 horizontal 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 in order to provide the required capacitance. The 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 - These dimensions locate the true geometric hole centers for the mounting screws in the receiver. The tolerance of the tube mounting lug holes will accommodate mounting screws up to 10.5 mm in diameter when the screws are positioned at these locations.

Pin 1: Grid No.3
Pin 5: Grid No.1
Pin 6: Cathode for Green Beam
Pin 7: Grid No.2
Pin 8: Cathode for Red Beam
Pin 9: Heater
Pin 10: Heater
Pin 11: Cathode for Blue Beam

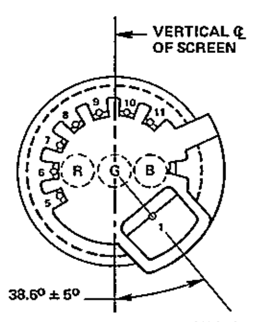


Figure 7 - Pin Connections and Rear View of Base - EIA No.B8-295-AA

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 curves shown in **Figure 2** 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.

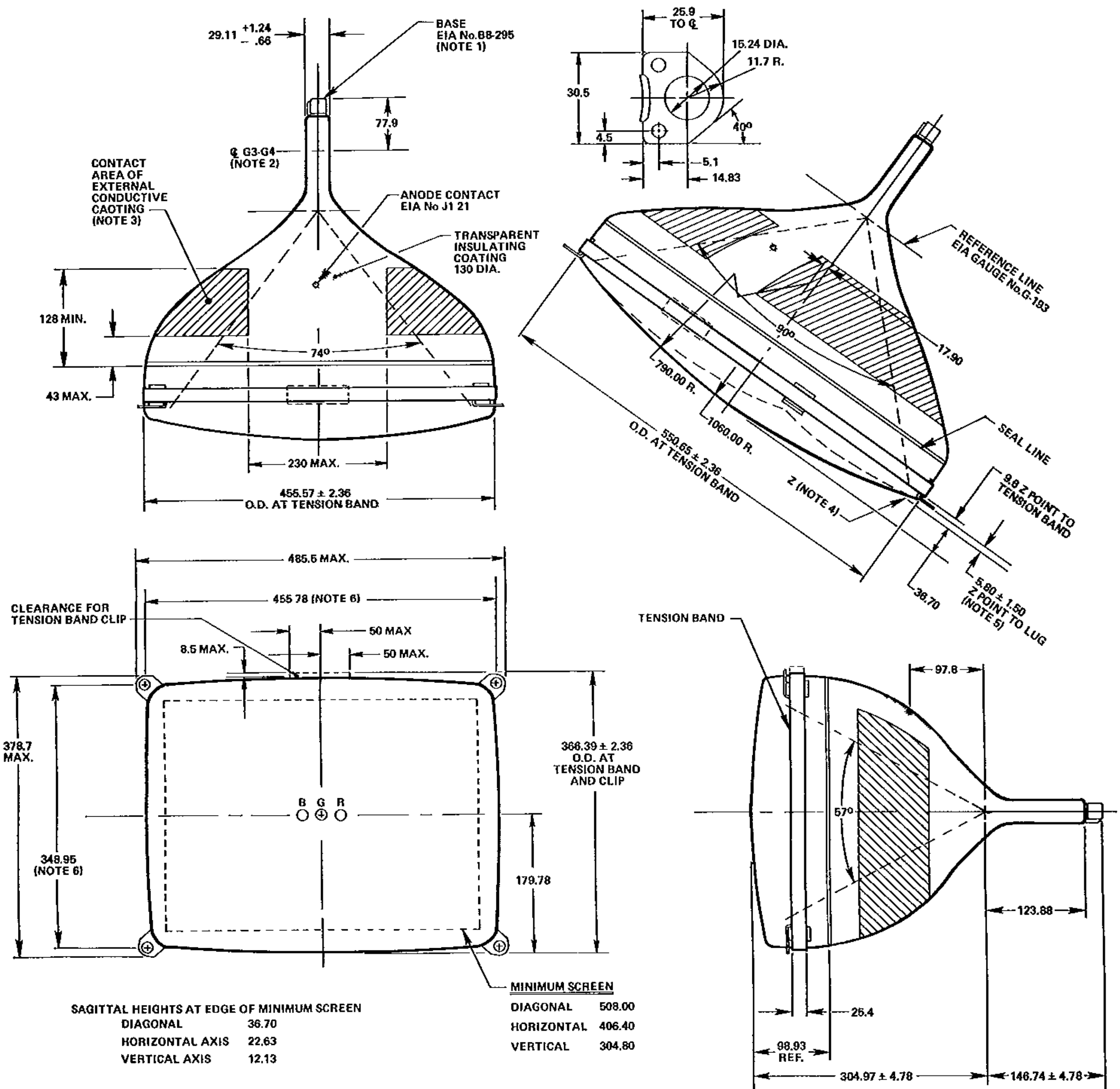
Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture-tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode bulb contact, 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 panel-to-funnel seal.

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 service personnel of all safety precautions.



Dimensions in mm unless otherwise noted.

Figure 6 - Dimensional Outline

A51ABU55X

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

- **Neodymium Faceplate**
  Enhanced Contrast
- **COTY-FS — Full Square —**
  Rectilinear Screen —
  Straight Sides and Square Corners
- **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**
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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
Direct Interelectrode Capacitances (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	14	pF

Formerly RCA Developmental Type C77279

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Electrical Data (Cont'd)

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 No.2842022-502, or Equivalent

Integral Magnetic Shield .... Internal

Optical Data

Faceplate .... Selective Transmittance
- Light transmittance at center (approx.) .... 63.5%[1]
- Surface .... Polished

Screen .... Matrix
- Phosphor, rare-earth (red), sulfide (blue & green) .... Type X[2]
  - 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 .... 550.65 ± 2.36 mm
  - Horizontal .... 455.57 ± 2.36 mm
  - Vertical (including tension-band clip) .... 366.39 ± 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.J542C

Bulb Panel Designation .... EIA No.F545

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

Base and Pin Connection Designation[3] .... 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.) .... 13.6 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	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:[4]		
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:		
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 .... 22 to 26% of Anode Voltage

Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot .... See CUTOFF DESIGN CHART in **Figure 4**
- 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[4] .... 6.3 V

Grid-No.3 Current[5] .... ± 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	40	31	%
Blue	23	29	%
Green	37	40	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.30	0.73	
Typical	1.80	1.06	
Maximum	2.28	1.37	
Red/green:			
Minimum	0.84	0.54	
Typical	1.10	0.76	
Maximum	1.35	0.96	
Blue/green:			
Minimum	0.46	0.55	
Typical	0.61	0.72	
Maximum	0.76	0.89	

Raster Centering Displacement Measured at Center of Screen:[6]
- Horizontal .... -1.5 ± 6.0 mm
- Vertical .... 0 ± 6.0 mm

With any color picture tube, maximum product reliability is obtained through 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 conductive coating and grounds of the main chassis or 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 11**). 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 significantly changing in resistance value 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 another 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. Printed circuit board and socket designs which inherently provide spark gaps for both heater leads are also satisfactory.

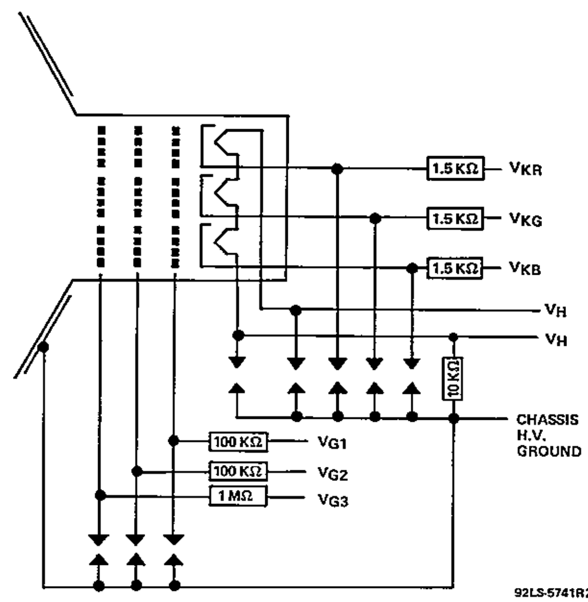

Figure 11 - Picture-Tube Connections Showing Spark-Gap Recommendations and Typical Isolation-Resistor Values

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 to the panel-to-funnel seal.

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.

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 picture tube 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. It is recommended that this take place in a magnetic field having a 470 mG vertical component and a zero horizontal component. If this field is not available, it is essential that the tube be degaussed in the specific earth's magnetic field (strength and orientation) in which it is to be set up. Proper degaussing will assure satisfactory performance for field purity.

Degaussing Coil

The recommended degaussing system utilizes a single tilted coil placed on the tube as shown in **Figure 8** 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. Small holes are provided in the four mounting lugs to facilitate mounting the degaussing coil to the tube funnel.

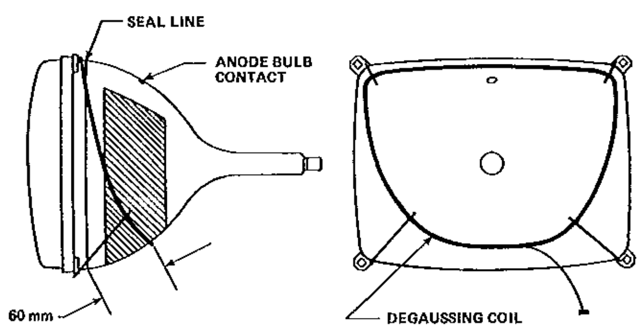

Figure 8 - Relative Placement of Typical Degaussing Coil

Degaussing Circuit

The goal of the degaussing circuit is to provide a minimum of 1300 peak-to-peak ampere turns (AT) in the degaussing coil. This current must decay in a gradual manner such that 50% of the initial amplitude still flows after 5 cycles. In addition, at the completion of the degaussing cycle the residual current in the coil must not exceed 1.0 peak-to-peak AT.

With any degaussing circuit it is necessary to eliminate interactions which occur between the deflection yoke fields and the degaussing coil. The induced current can be minimized by careful positioning of the degaussing coil. For this reason, and in order to achieve optimal degaussing recovery, coil placement is critical and should follow the recommendations shown in **Figure 8**.

The typical single PTC circuit shown in **Figure 9** is capable of producing the required current; however, this circuit often leaves too much residual current flowing after the degaussing cycle is complete. Two alternatives are suggested to reduce this residual and give a corresponding improvement in purity performance.

One alternative is the dual PTC circuit shown in **Figure 10**. In this arrangement, component parameters and the number of turns in the degaussing coil must be carefully selected to minimize the residual current while still achieving the specified initial value of 1300 AT.

Another alternative is to add a cut-off relay to the single PTC circuit in **Figure 9**. The purpose of this relay is to open the circuit after the degaussing current has decayed to a low level. Such a relay is often already available in remote control receivers. This arrangement is superior in two respects. First, it forces the residual current to be zero, and second, there is no horizontal yoke field coupling affect.

In addition to the improvement in degaussing performance that can be achieved as described above, another incremental improvement can be made by eliminating the interactions between the vertical deflection yoke fields and the degaussing field. To achieve this improvement, it is necessary to delay the "turn-on" of the vertical deflection circuit until after the completion of the degaussing cycle.

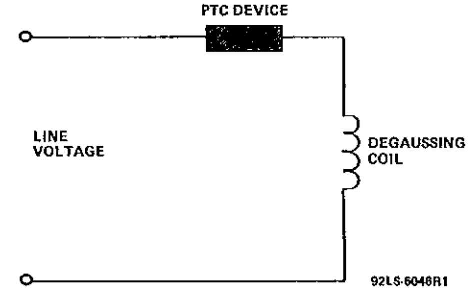

Figure 9 - Typical Degaussing Circuit

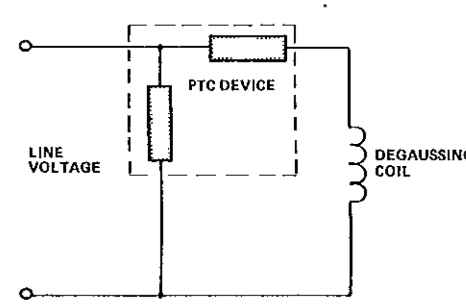

Figure 10 - Typical Degaussing Circuit

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.

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[7] (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

X-Radiation Characteristics

These measurements are made in accordance with the procedure of EIA Standard RS-503.

A picture tube should not be operated beyond its Absolute-Maximum Ratings (such operation may shorten tube life or have other permanent adverse effects on its performance).

The x-radiation emitted from this picture tube will not exceed 0.5 mR/h for anode voltage and current combinations given by the isoexposure-rate limit curves as shown in **Figure 2**. Operation above the values shown by the curves may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Part 1020 of Code of Federal Regulations, Title 21, Chapter I, Subchapter J. Maximum x-radiation as a function of anode voltage at 300 μA anode current is shown by the curves in **Figure 3**. X-radiation at a constant anode voltage varies linearly with anode current.

From These Curves Maximum Anode Voltage at Which the X-Radiation Emitted Will Not Exceed 0.5 mR/h at an Anode Current of 300 μA:

For entire tube .... *36 kV

For tube face only .... 36.5 kV

WARNING: If the value for the tube face only is used as design criterion, adequate shielding must be provided in the receiver for the anode bulb contact and/or certain portions of the tube funnel and panel skirt to insure that the x-radiation from the receiver is attenuated to a value equal to or lower than that specified for the face of the tube.

Maximum Voltage Difference Between Anode and Focus Electrode at Which the X-Radiation Emitted Will Not Exceed 0.5 mR/h .... 30 kV

WARNING: If the voltage value shown above can be exceeded in the receiver, additional attenuation of the x-radiation through the tube neck may be required.

* This rating applies only if the anode connector used by the receiver manufacturer provides the necessary attenuation to reduce the x-radiation from the anode bulb contact by a factor equivalent to the difference between the anode bulb contact isoexposure-rate limit curve (**Figure 2**) and the isoexposure-rate limit curve for the entire tube.

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1 The neodymium glass panel used in this tube has selective transmittance with a greater absorption for light having wavelengths between 560 and 600 nanometers (see **Figure 1**). When the light output from the X type phosphor is adjusted to produce white light output having CIE coordinates of $x = 0.313$, $y = 0.329$, the transmittance is 65% and is equivalent to the light output with a neutral glass panel having a transmittance of 65%.

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

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

4 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 heater voltage should be the **Typical Design Value** (within a measurement accuracy of ±0.1 V). 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 heater voltage is the **Typical Design Values** (within a measurement accuracy of ± 0.1 V) 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. Long-term operation at or near the Absolute-Maximum limit will substantially reduce tube life.

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

5 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.

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

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

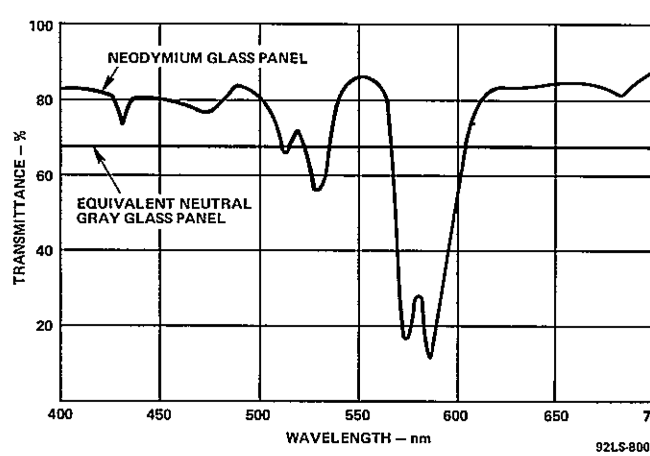


Figure 1 - Typical Light Transmittance for the Neodymium Glass Panel and the Equivalent Neutral Gray Glass Panel

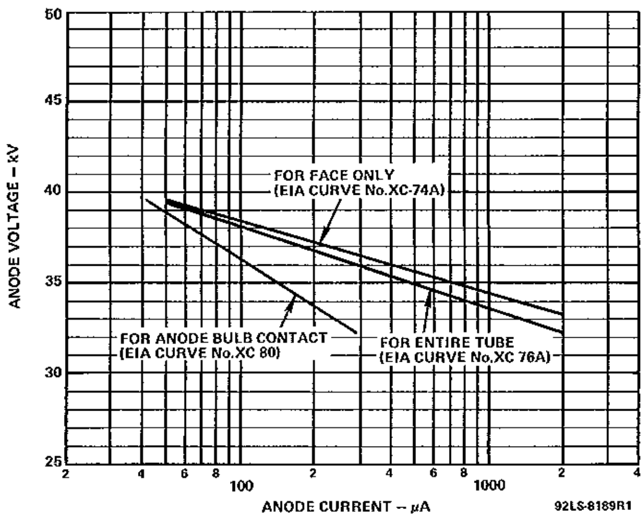


Figure 2 - 0.5 mR/h Isoexposure-Rate Limit Curves

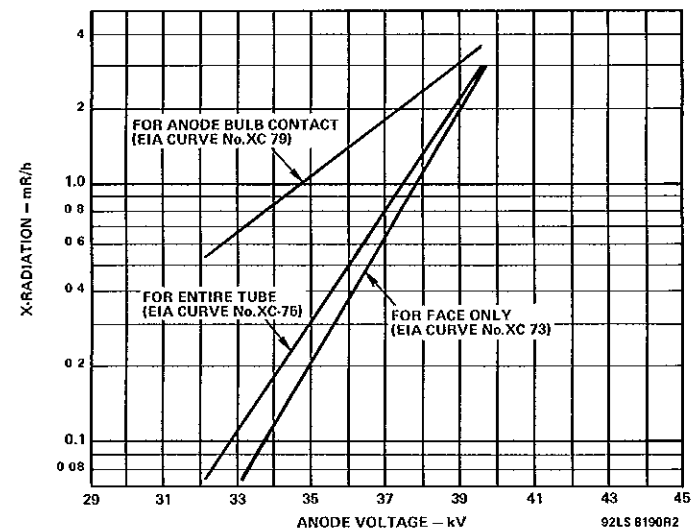


Figure 3 - X-Radiation Limit Curves at a Constant Anode Current of 300 μA (X-radiation at a constant anode voltage varies linearly with anode current)

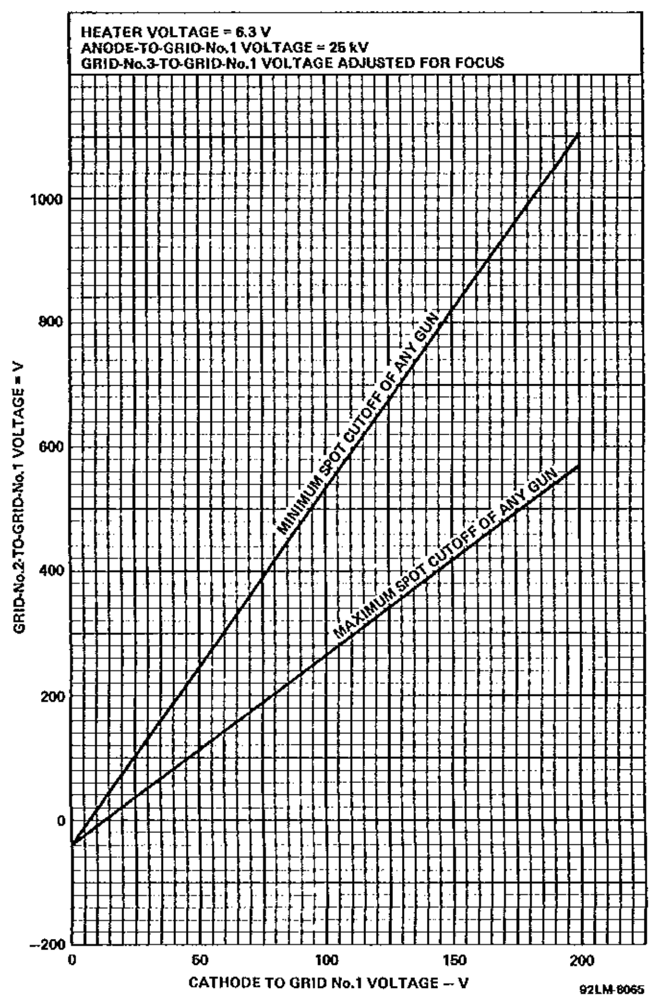


Figure 4 - Cutoff Design Chart

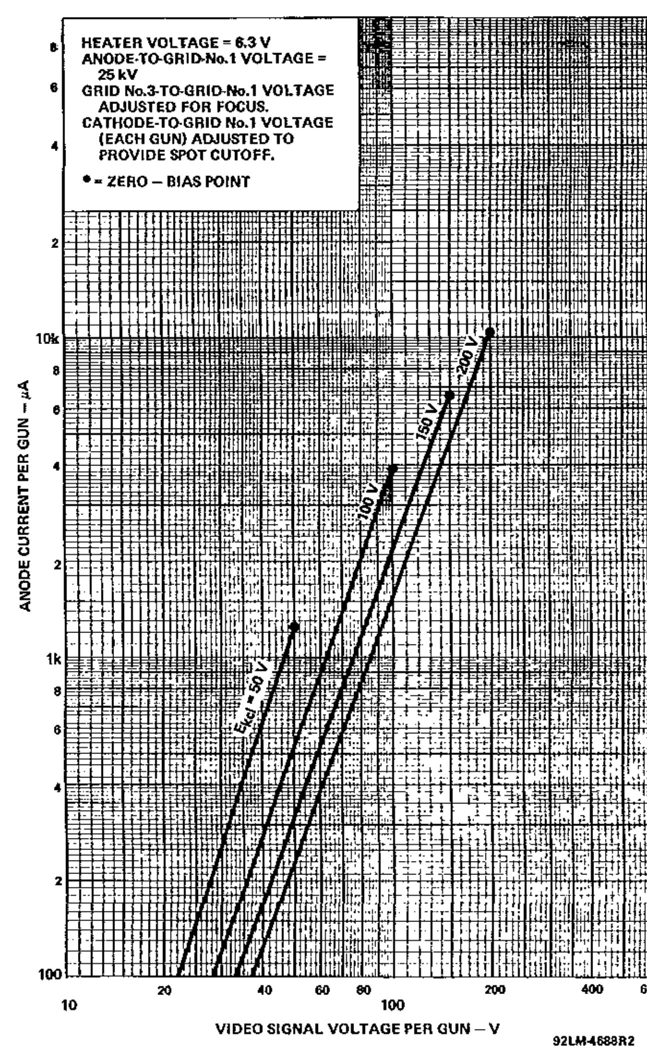


Figure 5 - Typical Drive Characteristics, Cathode-Drive Service

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 horizontal 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 in order to provide the required capacitance. The 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 - These dimensions locate the true geometric hole centers for the mounting screws in the receiver. The tolerance of the tube mounting lug holes will accommodate mounting screws up to 10.5 mm in diameter when the screws are positioned at these locations.

Pin 1: Grid No.3
Pin 5: Grid No.1
Pin 6: Cathode for Green Beam
Pin 7: Grid No.2
Pin 8: Cathode for Red Beam
Pin 9: Heater
Pin 10: Heater
Pin 11: Cathode for Blue Beam

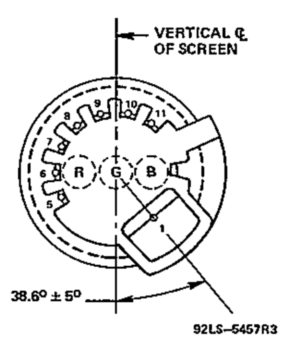


Figure 7 - Pin Connections and Rear View of Base - EIA No.B8-295-AA

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 curves shown in **Figure 2** 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.

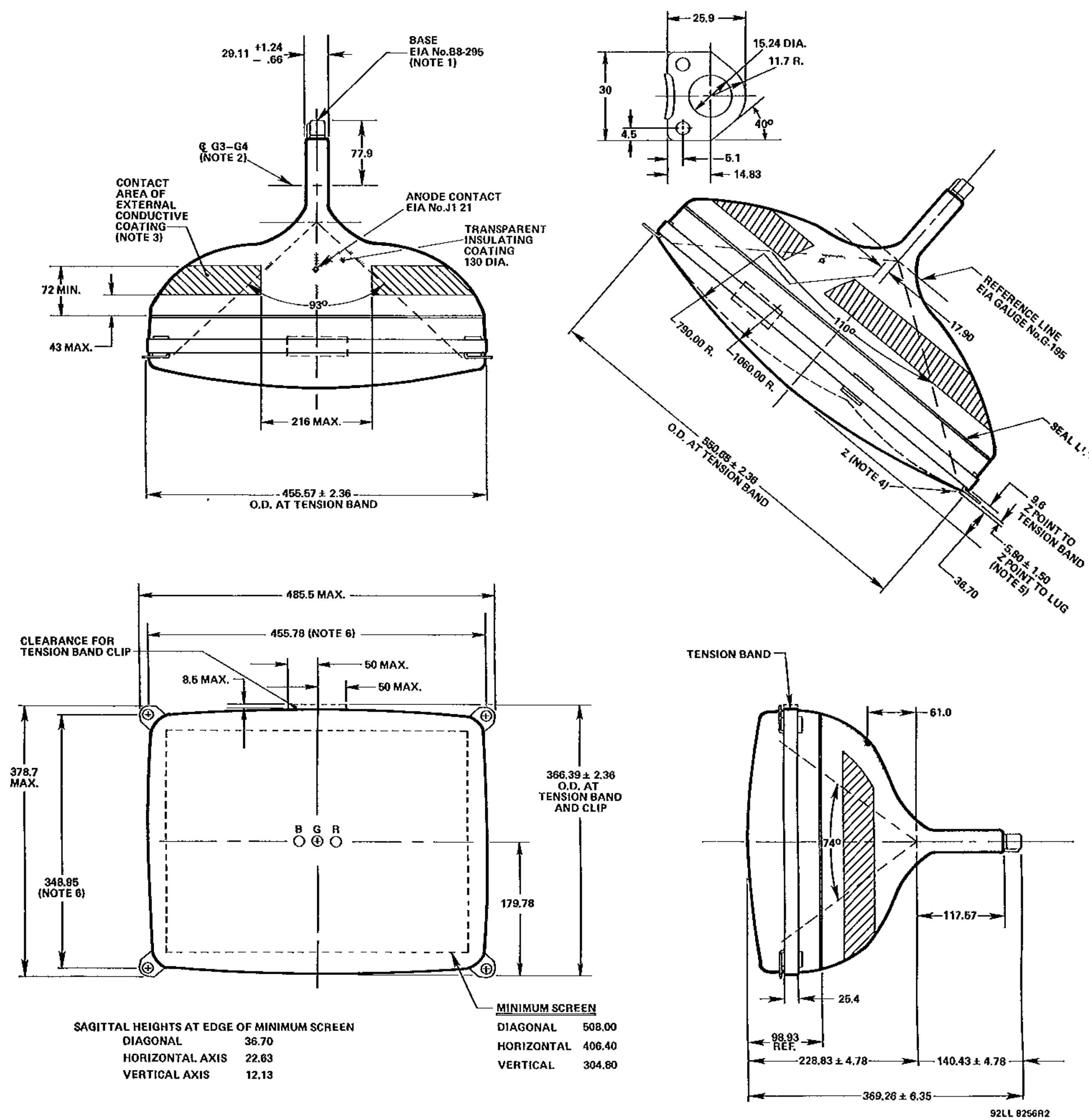
Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture-tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode bulb contact, 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 panel-to-funnel seal.

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 service personnel of all safety precautions.



SAGITTAL HEIGHTS AT EDGE OF MINIMUM SCREEN

DIAGONAL	36.70
HORIZONTAL AXIS	22.63
VERTICAL AXIS	12.13

MINIMUM SCREEN

DIAGONAL	508.00
HORIZONTAL	406.40
VERTICAL	304.80

Dimensions in mm unless otherwise noted.

Figure 6 - Dimensional Outline