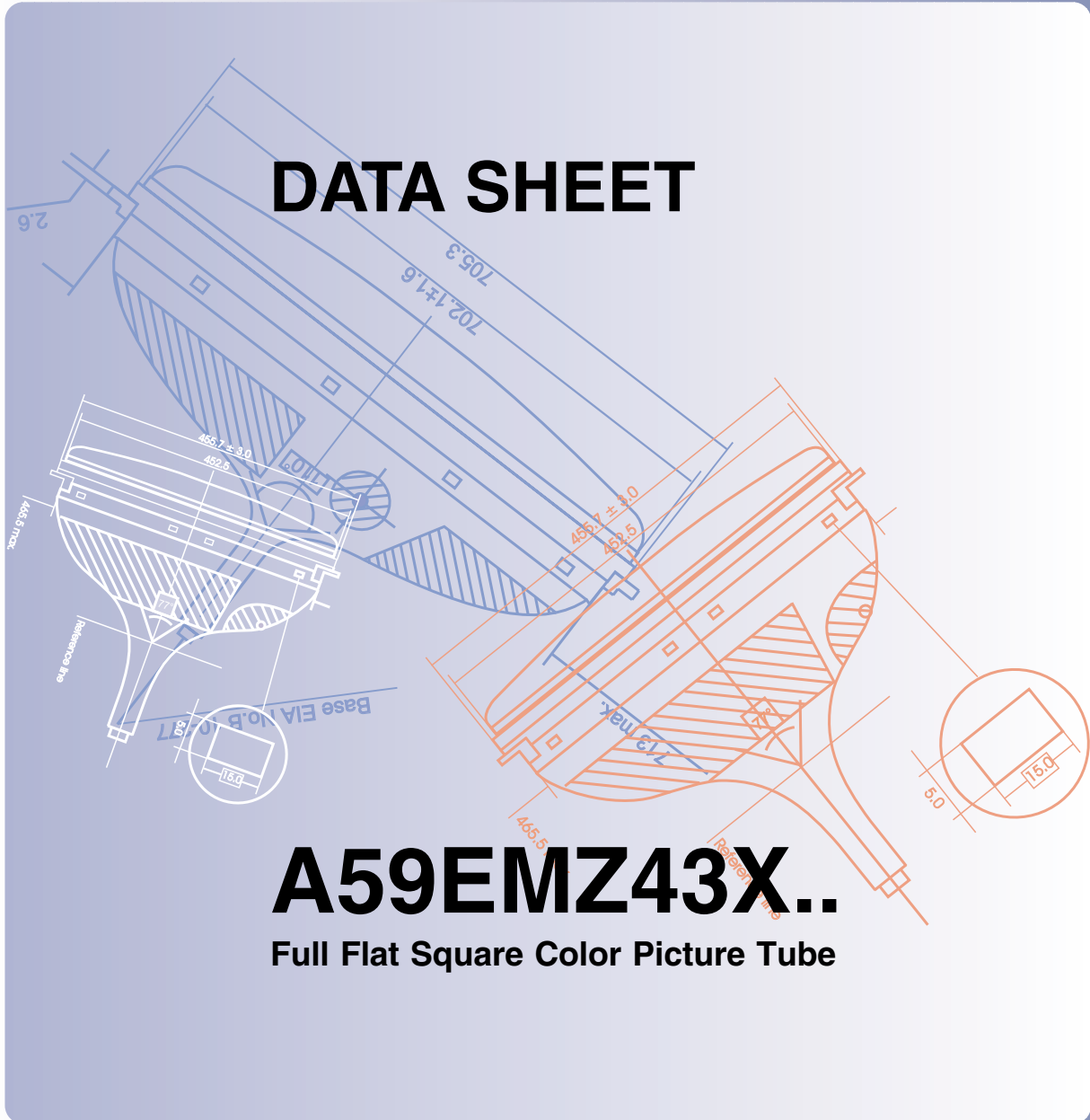




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DATA SHEET

A59EMZ43X..

Full Flat Square Color Picture Tube

Product specification

August 1999



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The technical data of this book refer to the specification of products, but do not represent any guarantee of the characteristic.

A59EMZ43X..

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1. General

1.1. Designation System

The designation for TV tubes shall consist of:

A59EMZ43X..

two (three) digits, deflection yoke definition
two (three) digits, the version of CPT within the family

1.2. Short Description

The picture tube A59EMZ43X.. type was designed for use in color TV sets and has the following features:

- Full Flat Square Design
- „Tint“ glass screen with light transmission 49.5%
- Semi-toroidal deflection yoke
- Deflection angle 110°
- Dynamic convergence free
- N/S Pincushion Correction free
- QPF – Quadru Potential Focus Electron Gun (I-LAT 29), Perma convergence system
- Quick start cathodes with reduced input 6.3V / 300mA
- Pigmented phosphors, Cd-free
- Black Stripe Screen
- Soft Flash technology, protection against Flashover Damage
- Frit Mask technology to improve the mask stability
- Internal magnetic Shield
- Optimized for minimum Moiré effect on 525 & 625 Line System
- Banded with Integrated Mounting Lugs
- Cathode ray tube intrinsically save according to appendix III Röntgenverordnung, New issue dated 8th January, 1987

1.3. Documentation System

Documentation system includes specifications of two levels:

- basic technical specification
- approval specification

2. Electrical Data

2.1. Maximum and Minimum Ratings

Maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable condition. TV set in which color picture tube is used, manufacturer should design so that, initially and through life time, no absolute maximum value is exceed with respect to supply voltage variation, component variation, control adjustment, load variation, signal variation, environmental conditions, and variations in characteristics of electronic tube under consideration.

Unless otherwise specified, values are for each gun and voltage positive with respect to Grid No.1

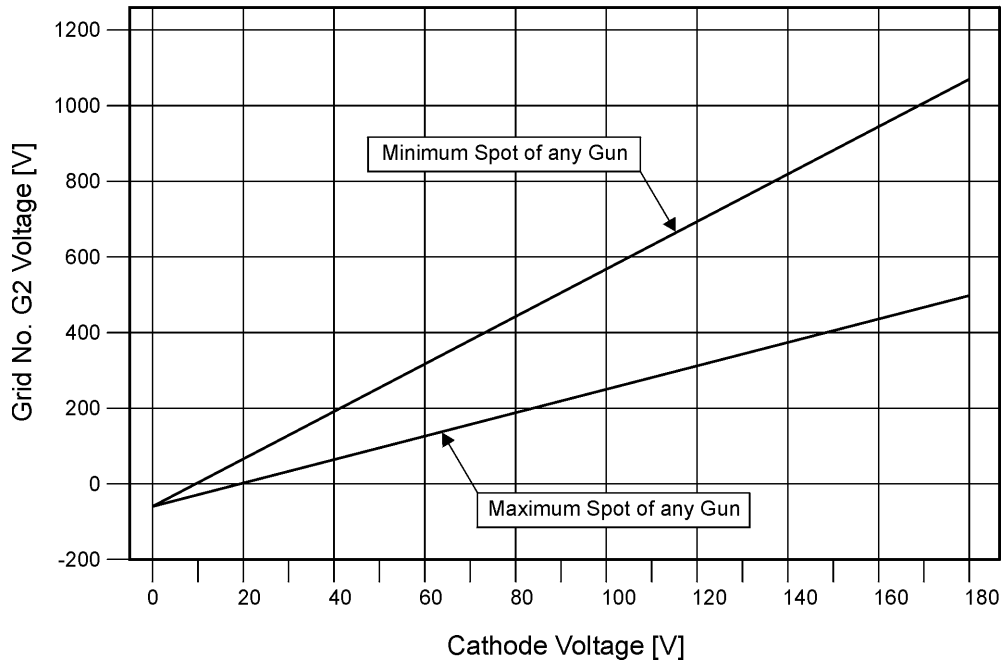
		Unit	Symbol	Min.	Typic.	Max.
1	Anode voltage	kV	U_a	20	27.5	29.9
2	Total Anode current					
	Long-Term average	μA	I_a			1000
	Short Duration	μA	I_a			1300
3	Grid No.3 Focus voltage					
	Absolute maximum	V	$U_{g3\text{max}}$			11000
	Range of Focus voltage	$\%U_a$		30.4		33.6
4	Grid No.2 Peak voltage including video signal	V				1000
5	Cathode voltage					
	Positive bias value	V	U_{g2}			400
	Positive operating cutoff value	V	U_{g2}			200
	Negative bias value	V	U_{g2}			0
	Negative peak value	V	U_{g2}			2
	Cutoff design characteristic			(See graph No.1)		
	Typical drive characteristic			(See graph No.2)		
	Ratio of cathode voltage, the highest to lowest gun					1.25
6	Heater					
	Heater voltage (at zero beam current)	V	U_f	5.7	6.3	6.6
	Heater current	mA	I_f	270	300	330
7	Heater – Cathode voltage					
	Heater negative with respect to cathode: - during warm-up period, not exceeding max. 15s - after equipment warm-up period	V				350 200
	Heater positive with respect to cathode: - AC component value - DC component value	V				200 0
8	Leakage current					
	Leakage current Cathode - Heater	μA	I_{k-f}			± 30
	Leakage current Grid No. 1	μA	I_{1g1}			± 5
	Leakage current Grid No. 2	μA	I_{1g2}			± 5
	Leakage current Grid No. 3 (Focusing)	μA	I_{1g3}			± 15
	Leakage anode current	μA	I_{1a}			45
9	Capacitance					
	Capacitance Anode to External Conductive Coating	pF		1800		2200
	Capacitance All Cathodes to All other Electrodes	pF			13.6	
	Capacitance Grid No.1 to All other Electrodes	pF			11.5	
	Capacitance Grid No.3 to All other Electrodes	pF			11.7	
10	Resistance between Metal hardware and External conductive coating	M Ω			50	
11	X-Radiation at limiting values U_a , I_a at a distance 0.1m in front of the bulb	$\mu\text{Sv/h}$				1

NOTE – For maximum cathode life, it is recommended that the heater supply should be stabilized in the value range $U_h=(6.3 \pm 0.2)\text{V}$ at anode current $I_a=0 \mu\text{A}$.

Graph 1

Condition: U_f 6.3 V, U_a 20.0 – 29.9 kV, U_{g3} adjusted at focus

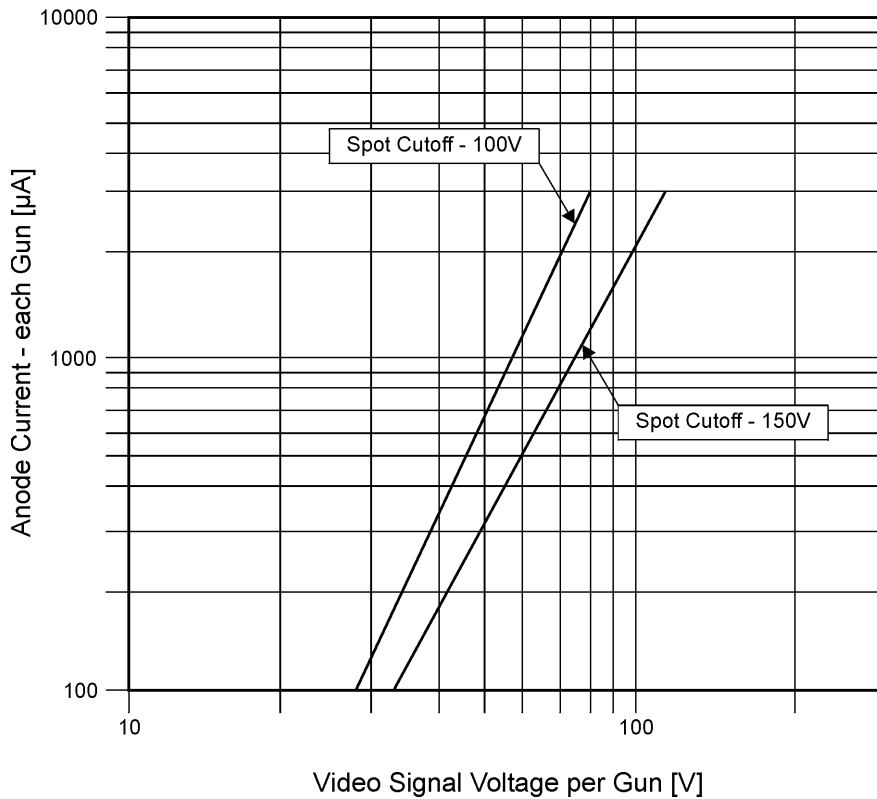
Cutoff Design Characteristic



Graph 2

Condition: U_f 6.3 V, U_a 20.0 – 29.9 kV, U_{g3} focused

Typical Drive Characteristic



2.2. Additional Information and Recommendation

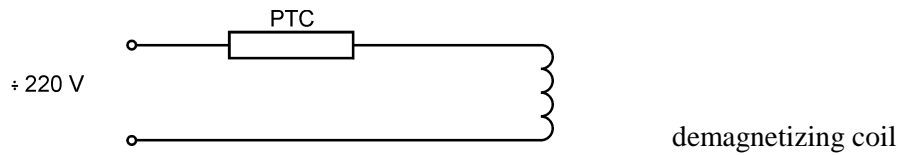
2.2.1. Power Supply Requirements

- a) Anode and Grid No.3 (Focusing electrode) power source:
In order to minimize the possibility of damage caused by momentary internal arc, it is recommended that the Grid No.3 power supply should be of the limited energy type.
Grid No.3 circuit resistance max. 30.0 MΩ
- b) Low Voltage Circuits:
Grid No.1 to Cathode Circuits (Each gun) max. 0.75 MΩ

2.2.2. Design Recommendations

- a) Mounting:
Support for the tube should be provided by a mounting system which supports the tube in the area in front of the seal line together with a pull-up ring of similar support on the tube funnel. The mounting system should not place mechanical stress on or cause abrasion on the tube funnel.
The color receiver mounting system should incorporate sufficient cushioning so that under normal condition of shipment or handling an impact force of more than 294.4 m/s² (35G) parallel to the tube axis or more than 343.2 m/s² (30G) perpendicular to the tube axis is never applied to the picture tube.
Notes:
- The socket, including it is associated, physically attached hardware and circuitry, must weight no more than 0.5 kg. The forces applied on the base pins should be as small as possible.
 - Socket for this base should not be rigidly mounted, should have flexible leads and be allowed to move freely.
 - The picture tube lug hole tolerances allow using the fastening bolts within the 8.5 mm diameter provided that they are placed in stated distances.
 - Deviation of one of the lug from the plane traversing through the rest three lugs shall be no more than 2 mm.
- b) Grounding:
Contact to the external conductive coating should be made by multiple fingers to prevent possible damage to the tube from localized overheating due to poor contact. It is recommended that the tension band should be connected to the chassis. The contact with the external conductive coating shall be carried out to prevent possible damage of the picture tube by the local overheat effect.
This connection can be made directly or through a suitable RC network depending upon the particular chassis and cabinet design.
- c) Protection from arcing:
It is recommended to insert spark gaps and series resistors between each electrode terminal and chassis ground to prevent the possible damage of the picture tube and other receiver components caused by internal arcing in the picture tube.
Spark gaps are recommended to be placed from Heater, Cathode, Grid No.1, Grid No.2 and Grid No.3 socket leads to ground and resistors are recommended to be connected in series with all other socket leads except Heater.
Recommended breakdown voltage value of spark gaps is 1 to 2 kV for Heater, Cathode, Grid No.1 and Grid No.2, and 10 to 12 kV for Grid No.3 and the value of series resistors is determined according to design of circuits.
Both spark gaps and series resistors should be mounted as close as possible to the common connection to the ground which ought to be the shortest.
- d) If self CTV set chassis and loudspeaker should cause the displacement 10 μm and more of electron beam impact on the screen, this change makes a decrease of optimum picture tube setting-up adjusted by the producer.
Color TV set housing should be designed to transfer the loudspeaker vibration as least as possible.

- e) The screen area may be cleaned by soft and dry cloth only which does not leave fibers.
f) The recommended demagnetizing circuits



Recommended demagnetizing energy value is min. 1500 Ampere-turns peak to peak. The current value over five cycles should not exceed 2 Ampere-turns value peak to peak.

- g) Sagittal height:

The distance „Z“ from any point on the screen to the center can be calculated using the following formula:

$$R = \sqrt{X^2 + Y^2}$$

$$\text{if } R \leq 152 \text{ then } Z \cong 1607 - \sqrt{1607^2 - R^2} \text{ else } Z \cong 1417 + 0.845 - \sqrt{1417^2 - (R - 17.9)^2}$$

Warning:

To maintain the preset adjustment of the neck components, the picture tube assembly should never be handled by the neck, yoke or other components.

3. Electron – Optical Data

	Parameter	Value
1	Focus method	Electrostatic
2	Deflection method	Magnetic
3	Deflection angles	
	Diagonal	110°
	Vertical	97°
	Horizontal	77°
4	Magnetic Shield	Internal

4. Optical Data

	Parameter	Value
1	Useful screen dimension	
	Diagonal axis	590 min
	Vertical axis	363.3 min
	Horizontal axis	478 min
2	Light transmission of glass at center of screen	49.5%
3	Screen	Vertical phosphor stripes with „Black stripe“
4	Phosphors (Cd-free)	P(22)
	- Red (Rare Earth)	X = 0.645, Y = 0.345
	- Green (Sulfide)	X = 0.310, Y = 0.610
	- Blue (Sulfide)	X = 0.149, Y = 0.056
5	Approximate spacing between the same color phosphor stripes	in center 0.8 mm
		in corners 1.0 mm
6	White Color CIE Coordinates: 6500 K \pm 7 MPCD	x = 0.313 y = 0.329
	Percentage of Total Anode Current:	39%
	Red – Green	36%
	Red – Blue	25%
	Cathode Current Ratio:	
	Red – Green	~1.1
Red – Blue	~1.8	
	Blue – Green	~0.6
7	Luminance at center of the screen	(See Graph No.3)

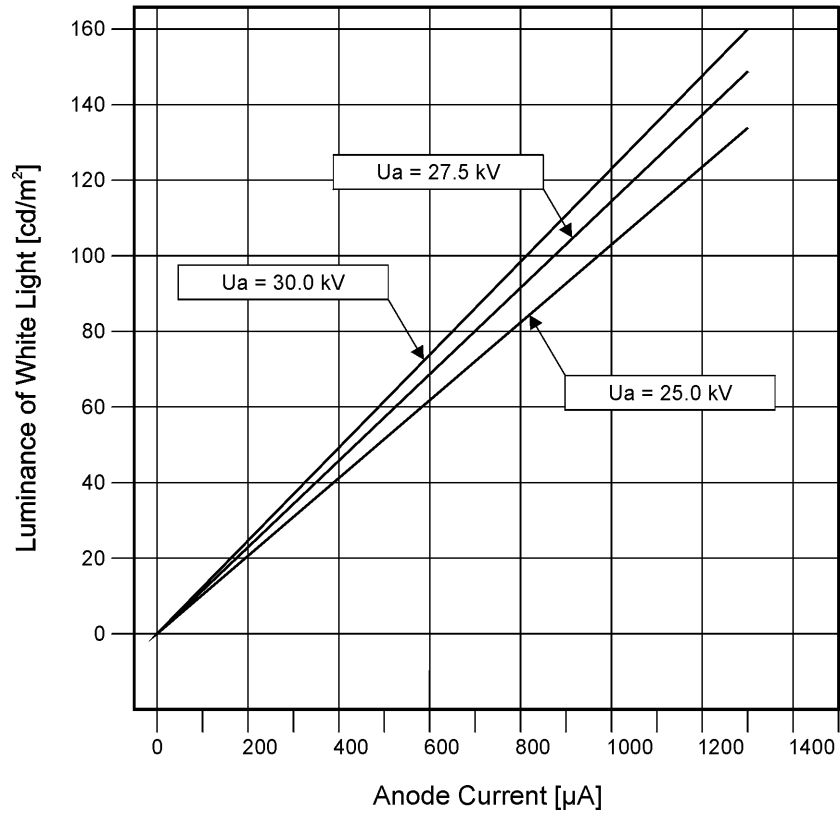
5. Mechanical Data

	Parameter	Value
1	Neck diameter	29.1 +1.5 / -0.7 mm
2	Base	JEDEC B10 – 277 (See Fig. No.4)
3	Anode Contact	JEDEC J1 – 21
4	Mass	aprox. 20 kg
5	Mounting position	Anode contact on top

Graph 3

Condition: U_f 6.3 V, U_{g3} adjusted at focus, Color White 6500 K ± 7 MPCD
 Raster Size 100%
 Measured at Circle Area of Diameter 90 mm at Screen Center

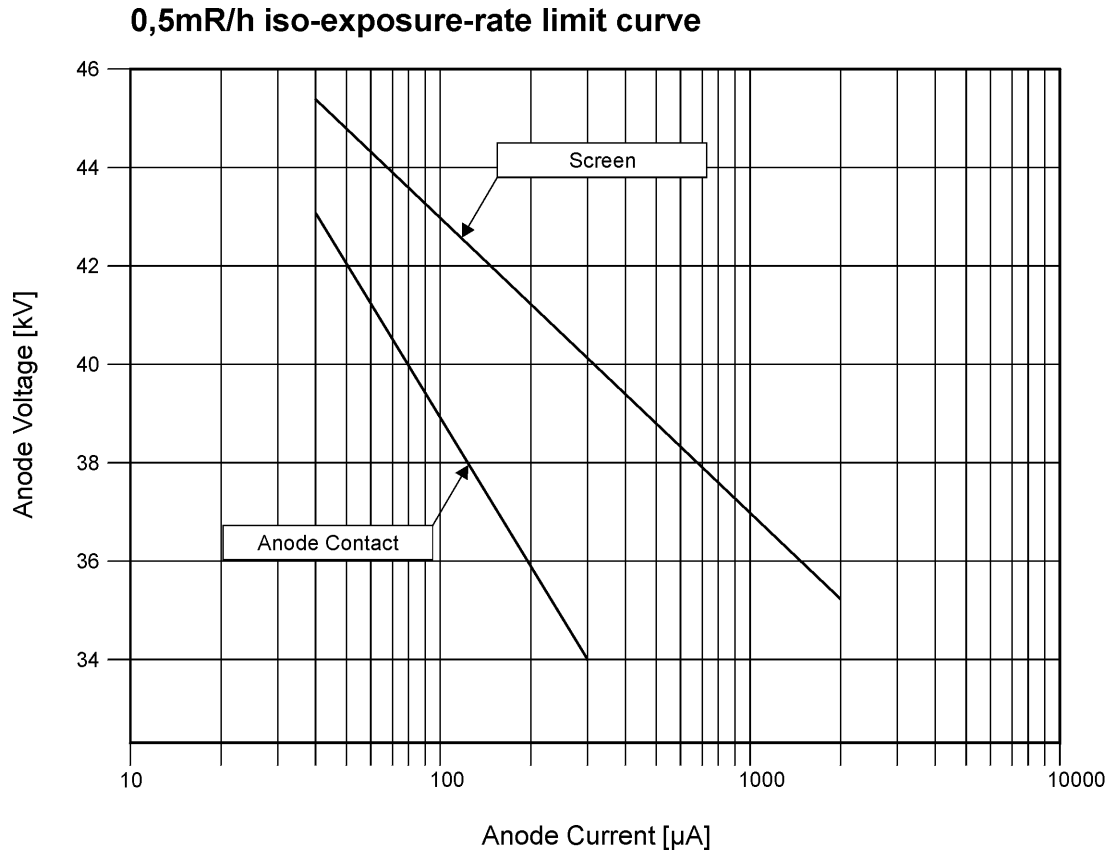
Typical Light Characteristic



6. X – Radiation

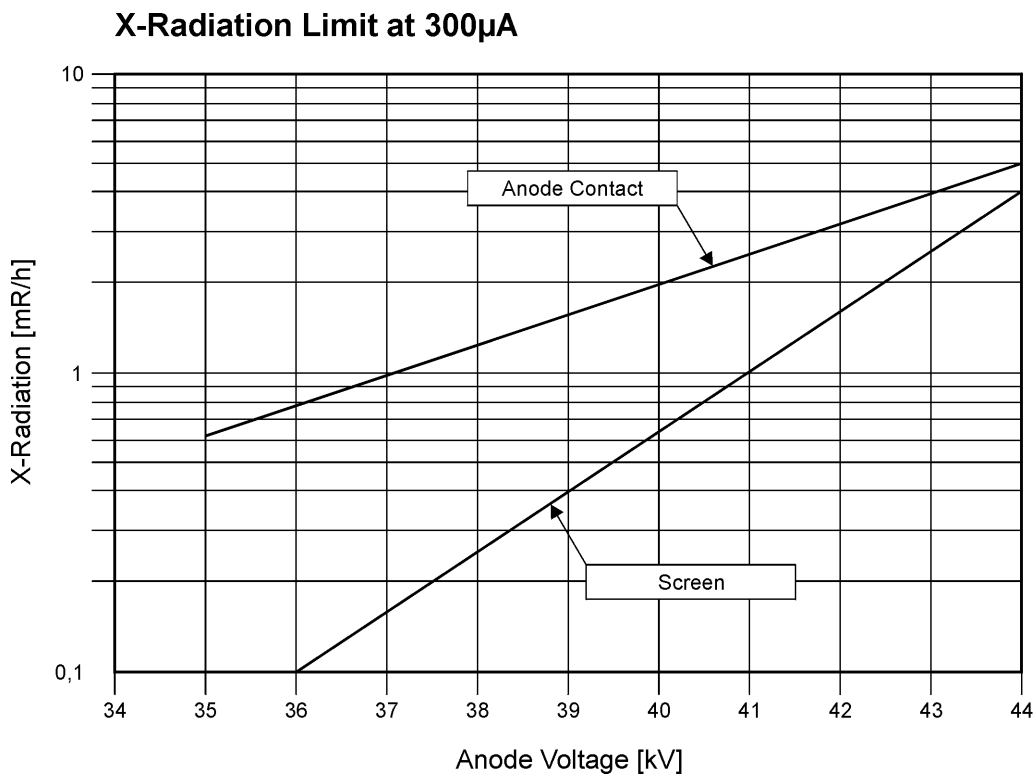
The X-radiation emitted from the color picture tube will not exceed 0.5 mR/h for the anode voltage and current combinations given by the iso-exposure-rate limit characteristic as shown in Graph No.4

Graph 4 (Evaluated at the distance 5 cm in front the tube)



The maximum X-radiation as a function of anode voltage at 300 µA anode current is shown by the curve in Graph No.5. Radiation at the constant anode voltage varies linearly with anode current.

Graph 5 (Evaluated at the distance 5 cm in front the tube)



From these curves, maximum anode voltage at which the X-radiation emitted will not exceed 0.5 mR/h and an anode current 300 µA.

For entire tube _____ *38.5 kV

Maximum voltage difference between anode and focus electrode at which the X-radiation emitted will not exceed 0.5 mR/h _____ **30.0 kV

WARNING:

- * This rating applies only if the anode connector used by the TV set provides the necessary attenuation to reduce the X-radiation from the anode contact.
- ** If the voltage values above can exceeded in TV set, additional attenuation of the X-radiation through the neck may be required.

NOTE:

Picture tube satisfies the requirements of German instruction *) in terms of radiated X-radiation also under limit of the operation mode. (Maximum dosage rate – 1µSv/h).

*) Federal Republic’s digest of laws 1/1987 Z 5702A No.3, amendment III to paragraph 8, sub-clause 6.2, Federal Republic Germany.

7. Deflection Yoke

Following deflection yokes were designed for color picture A59EMZ43X..., any other special version can be prepared.

7.1. Conception of Deflection Yokes

Special self convergence with semitoroidal deflection yoke is used for this color picture tube. (Saddle coil for horizontal part, toroidal coil for vertical part).

7.2. Deflection Coil Data

Parameter	Unit	Min.	Max.
1	Peak pulse voltage between Horizontal and Vertical coil		
	Long-Term average	V	1300
	Peak pulse voltage across Horizontal coils at 15 625 Hz	V	1300
2	Peak pulse voltage across Vertical coils at 50 Hz	V	200
3	Vertical Raster shift *)	mm	5
	Horizontal Raster shift *)	mm	5

NOTE *)

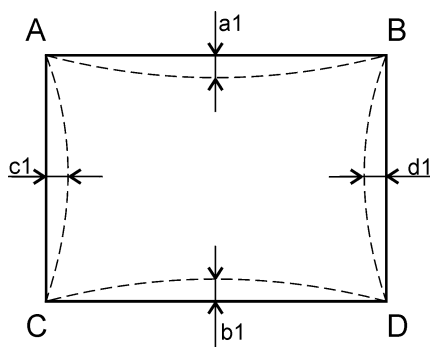
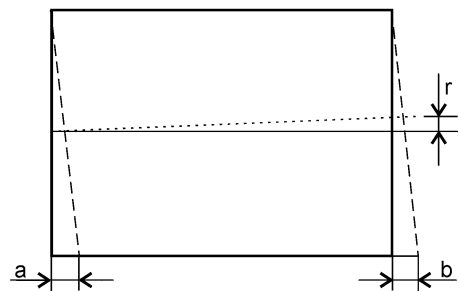
Measured between geometric center of the screen and the spot of the beam which is falling during detached deflection yoke and set convergence magnets.

7.3. Data of deflection Yokes

Item	Unit	Tol.	Version						
			X01	X02	X03	X04	X05	X06	X07
Horizontal part									
L_H	mH	8%	1.85	1.50	1.50	1.85	1.50	1.85	1.50
R_H	Ω	8%	1.89	1.50	1.50	1.89	1.50	1.89	1.50
$I_{P.P}$	A		4.17	4.63	4.63	4.17	4.63	4.17	4.63
Vertical part									
L_V	mH	8%	18.00	24.60	11.00	11.00	18.00	14.80	14.80
R_V	Ω	8%	5.70	9.60	5.40	5.40	5.707	6.00	6.00
$I_{P.P}$	A		1.69	1.43	1.98	1.98	1.69	1.86	1.86

7.4. Raster Distortion

- Pincushion distortion
 - North – South $2(a_1+b_1) / (AC+BD) * 100 = \text{max. } 2.0\%$ (See Fig.A)
 - East – West $2(c_1+d_1) / (AB+CD) * 100 = \text{max. } 5.0\%$ (See Fig.A)
- Trapezoid distortion
 - Horizontal $(AC-BD) / (AC+BD) * 100 = \text{max. } 2.5\%$ (See Fig.A)
 - Vertical $(AB-CD) / (AB+CD) * 100 = \text{max. } 2.5\%$ (See Fig.A)
- Parallelogram distortion
 - a or b** max. 6.0mm (See Fig.B)
- Raster rotation **r** max. 4.0mm (See Fig.B)

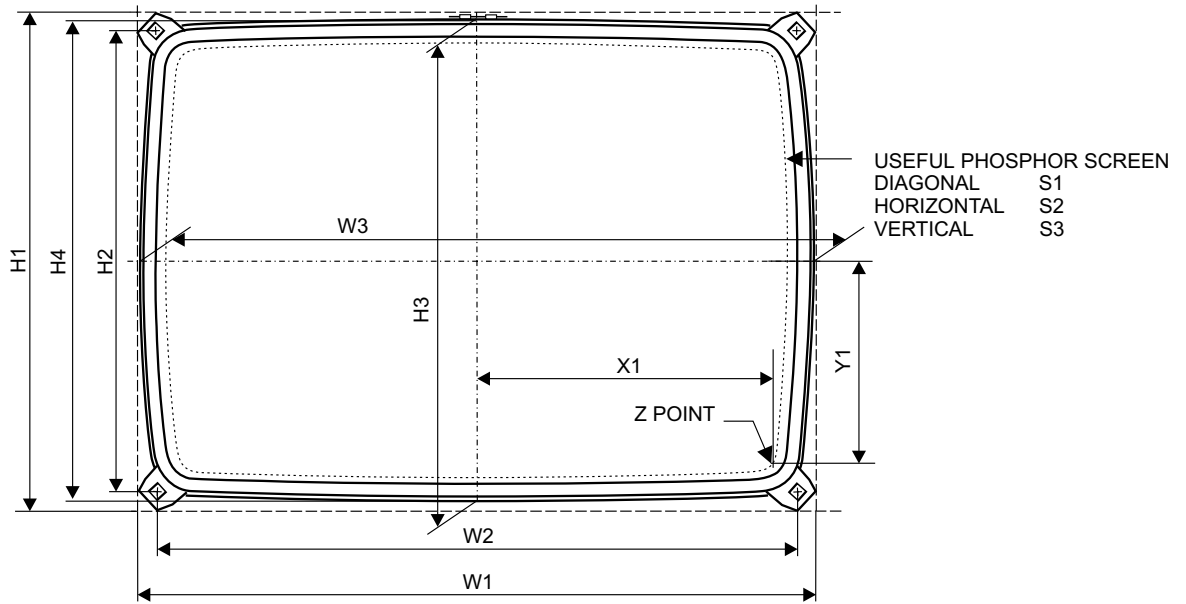
Fig. A**Fig. B****7.5. Method of Measurement**

- inductivity at signal 1V / 1kHz
- resistance at 20°C
- peak-peak deflection current value is measured at typical operating conditions at $U_a = 25\text{kV}$ and raster size 100%

8. Outline Drawings

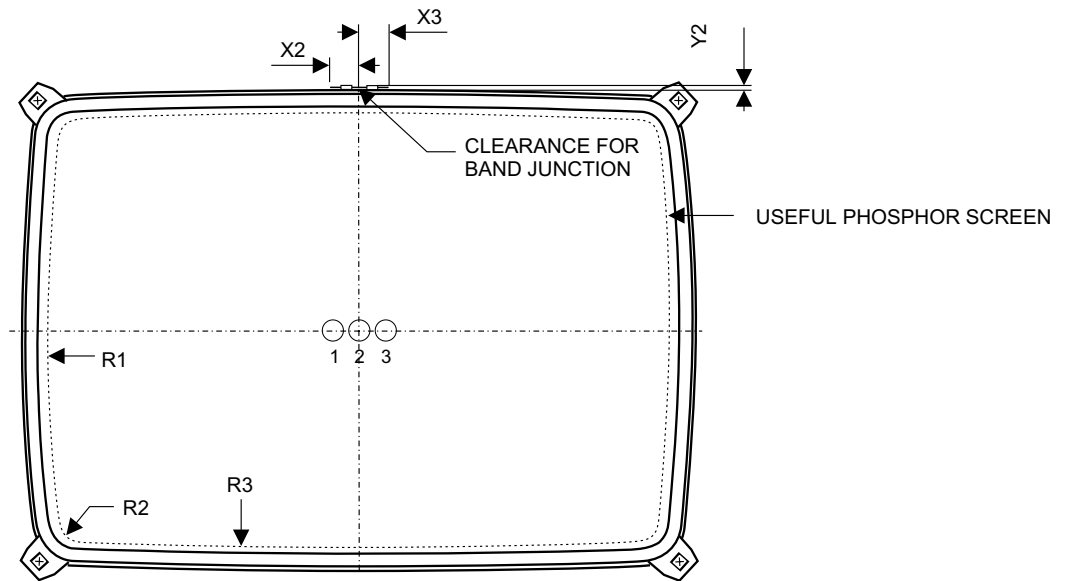
Fig. 1a	Front View of the CRT	14
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Figure 1a - FRONT VIEW OF CATODE RAY TUBE



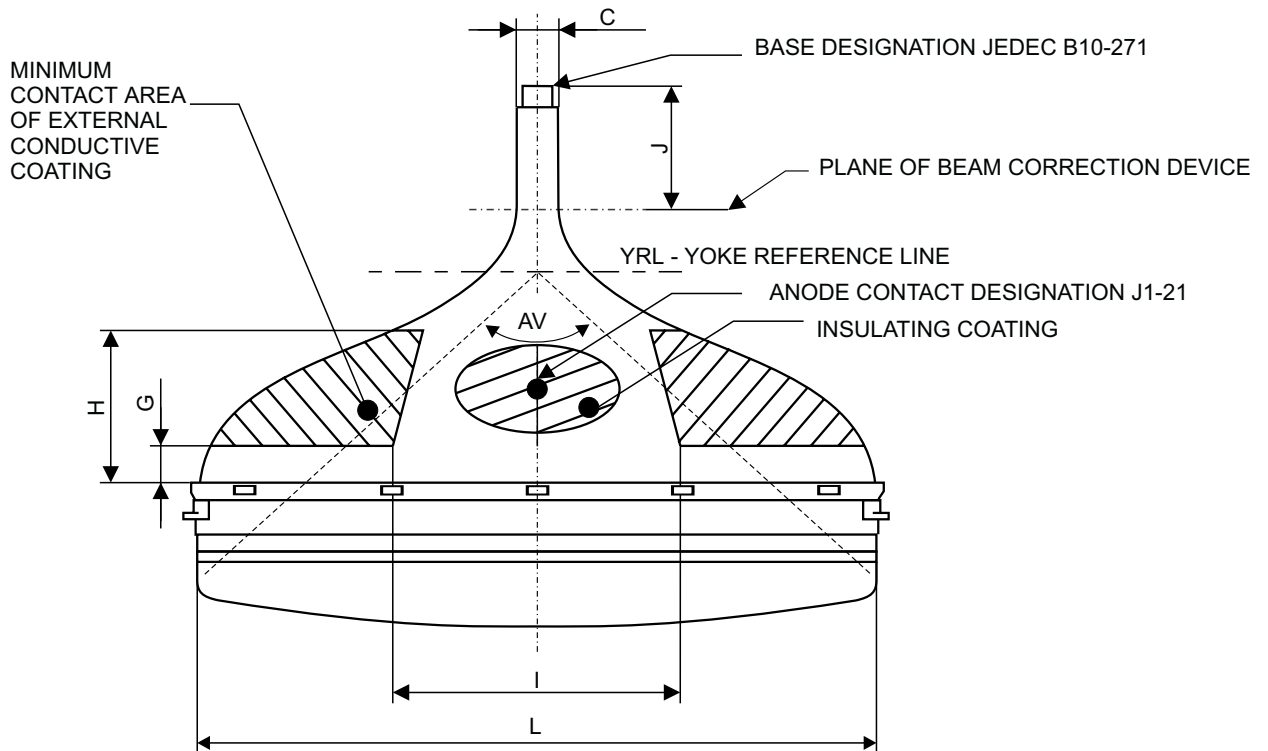
Designation	Description	Dimension type
Dimension of the CRT including mounting system		
W1	Width	max 545
H1	Height	max 430
W3	Width including band	max 533
H3	Height including band but excluding junction	max 418
H4	Height of tube including band junction	max 421
Dimension of the centres of the CRT mounting holes		
W2	Width	nom 524.0
H2	Height	nom 406.5
Dimension of the useful phosphor screen		
S1	Diagonal	min 590.0
S2	Horizontal	min 478.0
S3	Vertical	min 363.3
Location of the "Z-point"		
X1	Horizontal co-ordinate	nom 236
Y1	Vertical co-ordinate	nom 177

Figure 1b - FRONT VIEW OF CATODE RAY TUBE



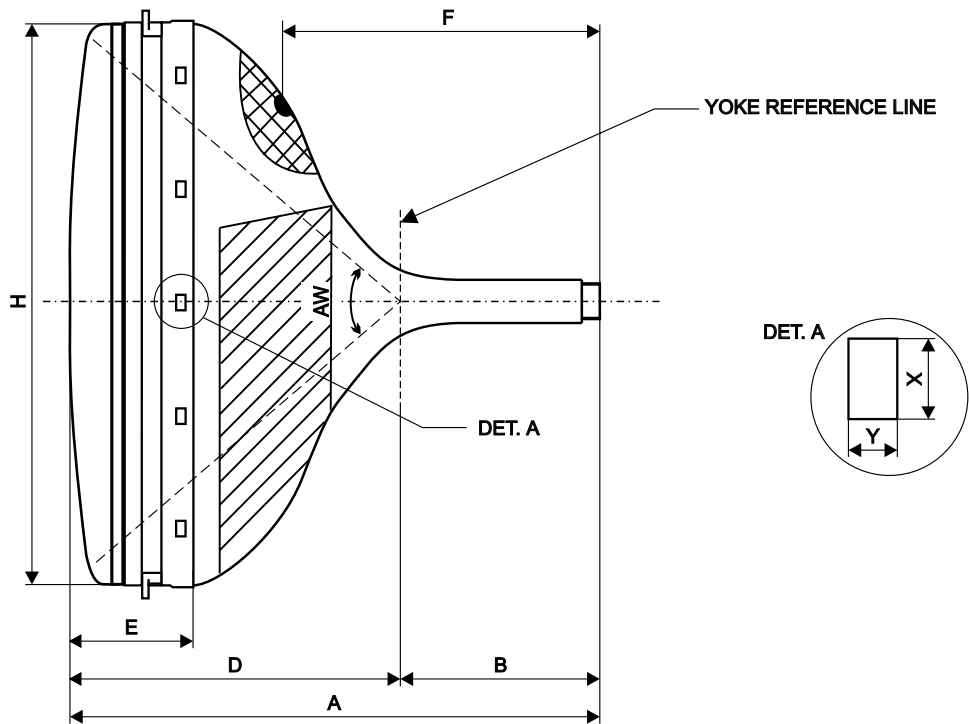
Designation	Description	Dimension type
Curvatures of the screen edge		
R1	Side radius	nom
R2	Corner radius	nom
R3	Bottom radius	nom
Clearance for band junction		
X2	Axis to nearest edge	min 33
X3	Axis to farthest edge	max 37
Y2	Thickness	max 3.0
Orientation of electron guns		
123	Electron gun sequence (left-to-right order)	RGB

Figure 2 - TOP VIEW OF THE CRT



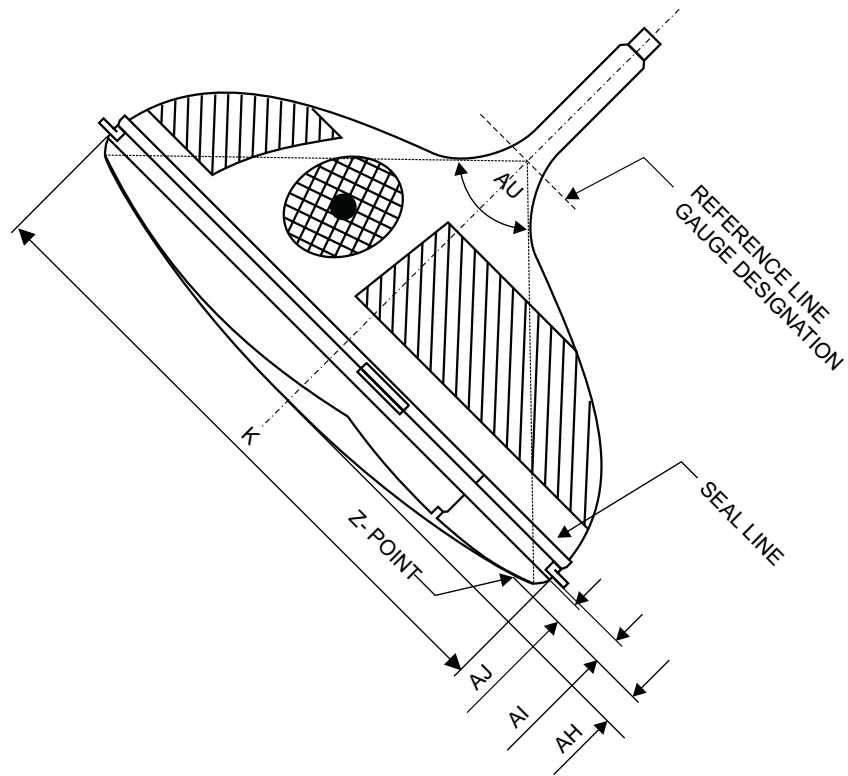
Designation	Description	Dimension type
C	Neck outside diameter	tol 29.1 +1.5/-0.7
J	Distance from the plane for locating the beam correction device to end of base	nom 55
Contact area of external conductive coating		
G	Seal line to the nearest edge	max 35
H	Seal line to the farthest edge	tol 122 ±5
I	Opening for anode contact	max 215
Horizontal dimensions of the implosion protection band		
L	Width at the panel mold-match line including the band	max
Connector type designation		
	Base type designation	B10-277
	Anode type designation	J1-21
Deflection angle		
AV	Horizontal deflection angle	nom 97°

Figure 3 - SIDE VIEW OF THE CRT



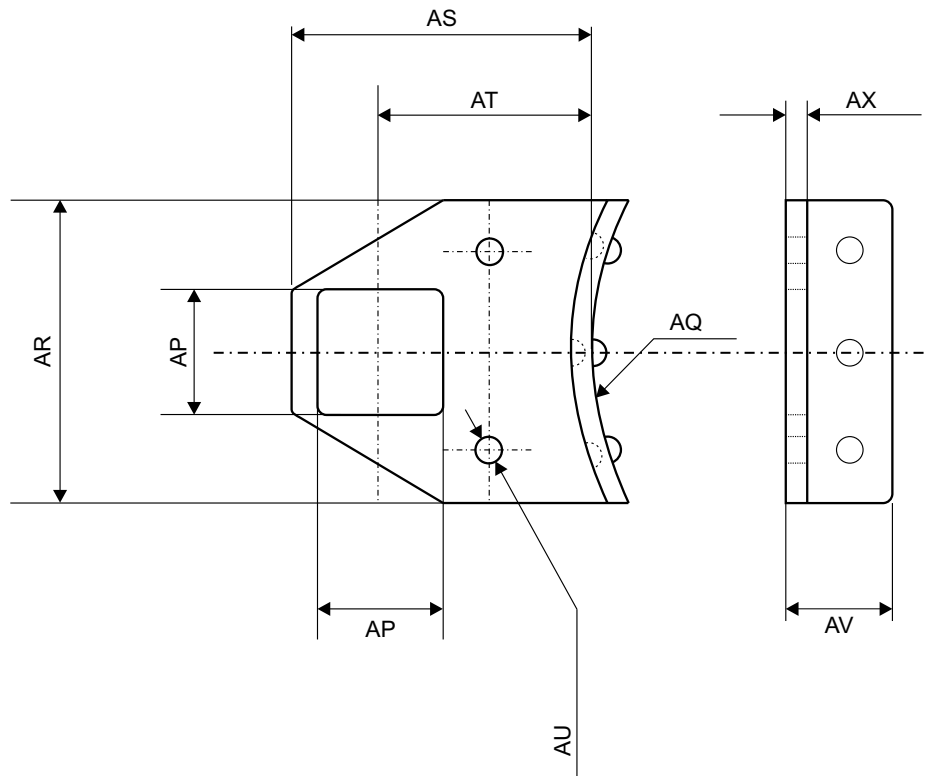
Designation	Description	Dimension type
A	Overall length	min/max 399/412
B	Reference line from end of base	nom 153.4
D	Centre face to reference line	nom 252.0
E	Centre of face to frit seal line	nom 88
F	Anode contact to end of base	nom 238.4
H	Hight at the panel mold match line including the band	max
X	Lenght of window	nom 15.0
Y	Wide of window	nom 5.0
text	Description of the implosion system	Push trough cabinet
AW	Vertical deflection angle	nom 77°

Figure 4 - DIAGONAL VIEW OF THE CATHODE RAY TUBE



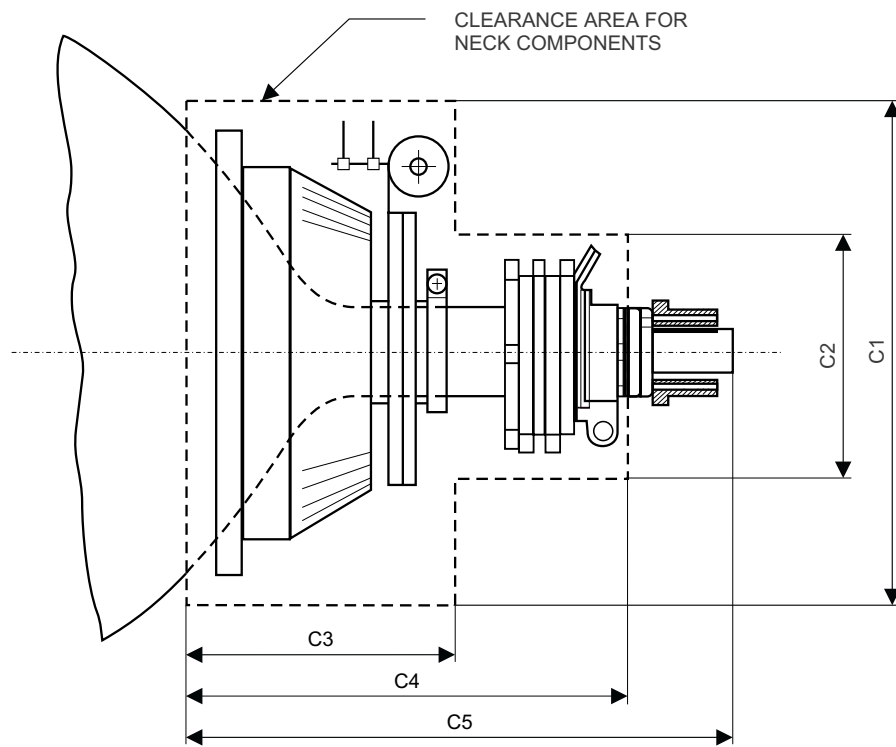
Designation	Description	Dimension type
Sagittal height at minimum screen diagonal and lug location		
AH	Project distance from centre of face to Z-point along the tube axis	nom 28.2
AI	Z-point to front of lug	tol 32 ±2
AJ	Z-point to front edge of band	min 13.8
Dimension at the mold match line including hardware forward of the mouting lug plane		
K	Diagonal axis	max 636
AU	Diagonal deflection angle	nom 110°

Figure 5 - MOUNTING LUG DETAIL



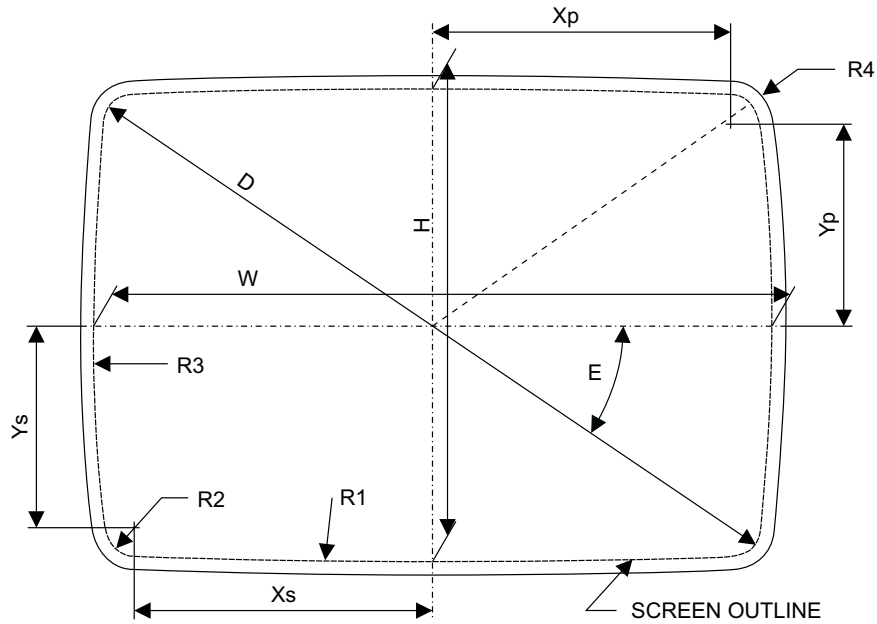
Designation	Description	Dimension type
AP	Hole dimension	tol 12.0 ±0.3
AQ	Heel radius	nom 26.8
AR	Lugs width	tol 35.0 ±0.5
AS	Lugs lenght	nom 25.1
AT	Distance from lugs heel to centre of hole	nom 16.1
AU	Rivet hole diameter	nom 3.0
AV	Heel width	tol 10.5 ±0.3
AX	Thickness	nom 2.6

Figure 6 - CLEARANCE REGION FOR NECK COMPONENTS



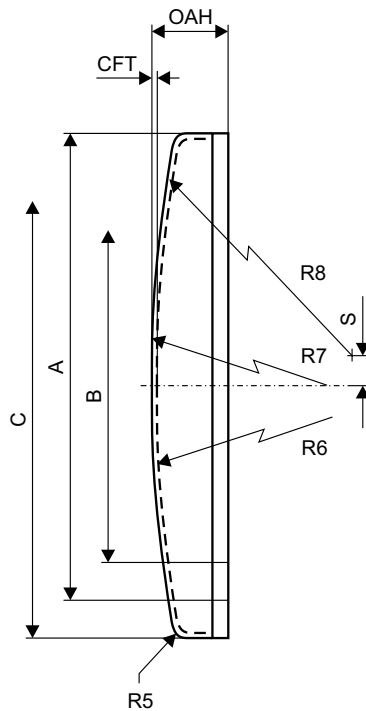
Designation	Description	Dimension type
C1	Diameter of the clearance for deflection yoke	max 245
C2	Diameter of the clearance for purity convergence magnets	max 86
C3	Length of the deflection yoke	max 120
C4	Distance from the nearest to the farthest edge	max 167
C5	Distance from the end of base to the farthest edge	max 205

Figure 7a - CRT PANEL CONTOUR DEFINED BY RADII



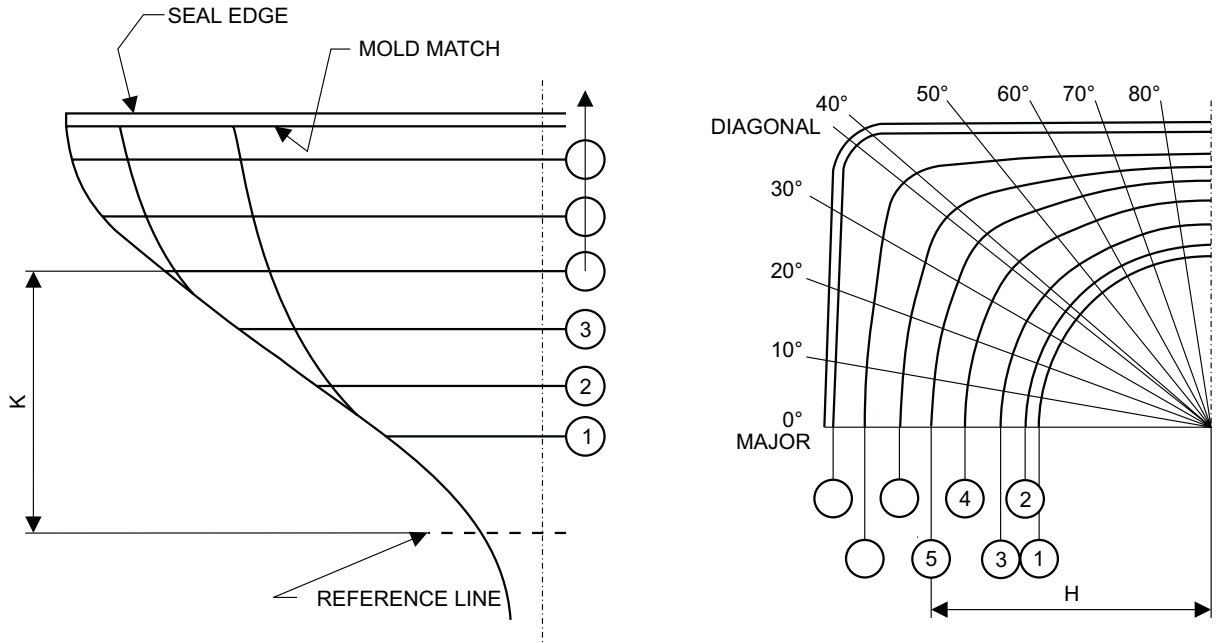
Designation	Description	Dimension type
D	Usefull screen diagonal along the corner angle	min 590.0
E	Corner angle	nom 36°52'12"
H	Usefull screen height	min 363.3
W	Usefull screen width	min 478.0
R1	Top and bottom radii of screen outline	nom
R2	Corner radii of screen outline	nom
R3	Side radii of screen outline	nom
Xs	Horizontal coordinate of the centre of the corner radii of the screen	nom
Ys	Vertical coordinate of the centre of the corner radii of the screen	nom
Xp	Horizontal coordinate of the centre of the corner radii of the panel	nom
Yp	Vertical coordinate of the centre of the corner radii of the panel	nom
R4	Outside corner radii at mold match line	nom 26
R5	Outside heel radius of the panel	nom 8.0

Figure 7b - CRT PANEL CONTOUR DEFINED BY RADII



Designation	Description	Dimension type
A	Dimension of the panel across the major axis at the mold match line	nom 519.0
B	Dimension of the panel across the minor axis at the mold match line	nom 406.5
C	Dimension of the largest diagonal of the panel	nom 629.8
CFT	Centre face thickness	nom 13.2
OAH	Overall height of the panel along the tube axis	nom 88
Inside contour definition using radii		
R6	Radius of curvature of the screen surface	nom
Outside contour definition using radii		
R7	Radius of curvature of the panel at the center	nom 1607
R8	Radius of curvature of the panel at the edge	nom 1417
S	Shift of the center of radius R8 from tube axis	nom 17.9

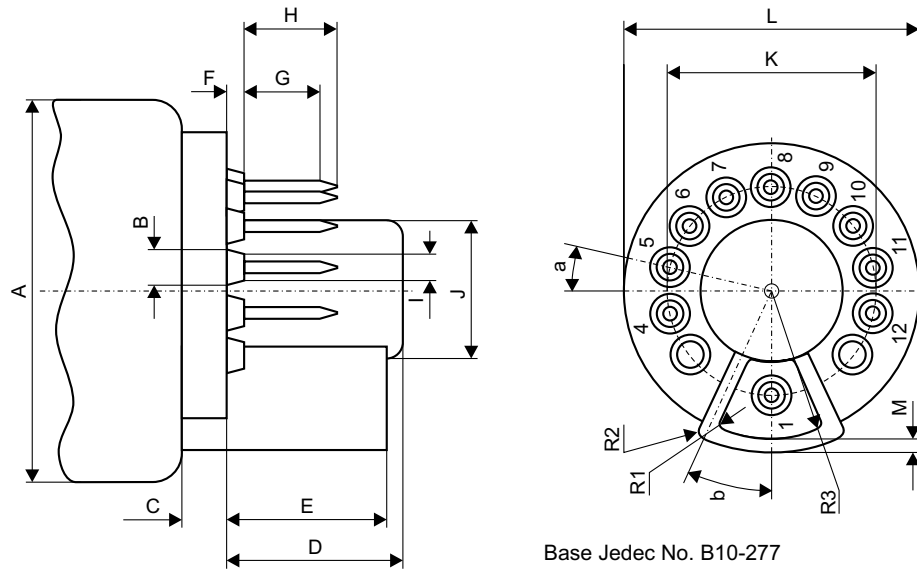
Figure 8 - CRT FUNNEL CONTOUR TABLE



Radial coordinates of the outside funnel contour (H) at the specified elevation from the reference line (K) and angle from the major axis.

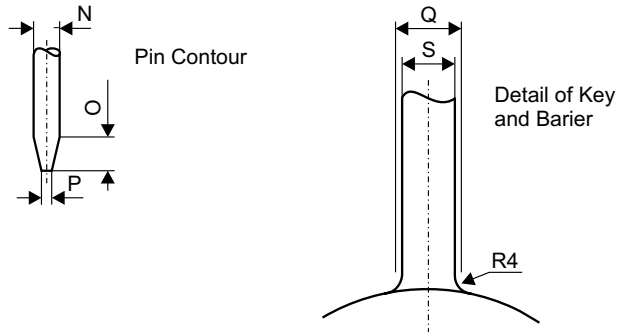
Distance from reference line	Major axis 0°	10°	20°	30°	Diagonal axis 35°33'17"	40°	50°	60°	70°	80°	Minor axis 90°
40.5	90.36	90.36	90.38	90.40	90.42	90.39	90.03	89.65	89.38	89.21	89.15
50.5	115.37	115.47	115.76	116.23	116.56	116.45	114.60	112.33	110.69	109.70	109.37
60.5	137.94	138.21	139.01	140.32	141.19	140.94	136.89	132.02	128.57	126.52	125.84
70.5	158.58	159.07	160.53	162.94	164.52	164.08	157.10	149.36	144.00	140.86	139.82
80.5	177.39	178.15	180.43	184.24	186.72	186.03	175.44	164.75	157.51	153.31	151.94
90.5	193.44	194.61	198.14	204.09	207.91	206.90	192.00	178.26	169.13	163.92	166.22
100.5	207.3	208.96	214.01	222.66	228.19	226.77	206.90	190.08	179.13	172.95	170.95
110.5	219.48	221.67	228.37	240.06	247.66	245.70	220.29	200.44	187.76	180.69	178.42
120.5	230.33	233.04	241.44	256.33	266.39	263.73	232.28	209.50	195.22	187.34	184.82
130.5	240.06	243.22	253.07	270.82	283.42	279.88	242.51	217.19	201.56	193.00	190.28
140.5	248.21	251.75	262.87	283.20	298.36	293.76	251.06	223.63	206.89	197.80	194.91
150.5	253.86	257.68	269.69	291.85	309.03	303.39	257.28	228.57	211.15	201.72	198.73
160.5	257.58	261.42	273.51	295.81	313.43	307.25	260.36	231.35	213.74	204.20	201.18

Figure 9a - CRT BASE MECHANICAL OUTLINE



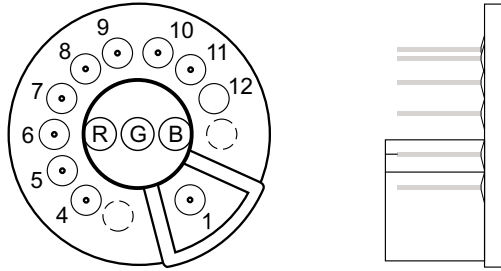
Designation	Description	Dimension type
A	CRT Neck diameter	max 30.61
B	Pin support fillet diameter	max 3.15
C	Base height	nom 3.7
D	Keyway height	max 14.8
E	Silo height	tol 13 ±0.3
F	Pin support fillet height	max 1.7
G	Contact length	min 5.7
H	Exposed pin length	max 8.6
I	Pin support fillet top diameter	max 2.4
J	Keyway diameter	min/max 10.8 / 11.35
K	Pin circle diameter	nom 15.24
L	Wafer diameter	max 25.4
M	Silo wall thickness	tol 1.3 ±0.2
R1	Silo corner inside radius	nom 1.0
R2	Silo corner outside radius	1.0
R3	Silo sidewall radius	tol 1.2 ±0.1
a	Pin spacing half angle	nom 12 6/7°
b	Silo extent half angle	nom 25 5/7°
	Base orientation (pin 1 to major axis of the CRT in degrees)	tol 38.6 ±5°

Figure 9b - CRT BASE MECHANICAL OUTLINE



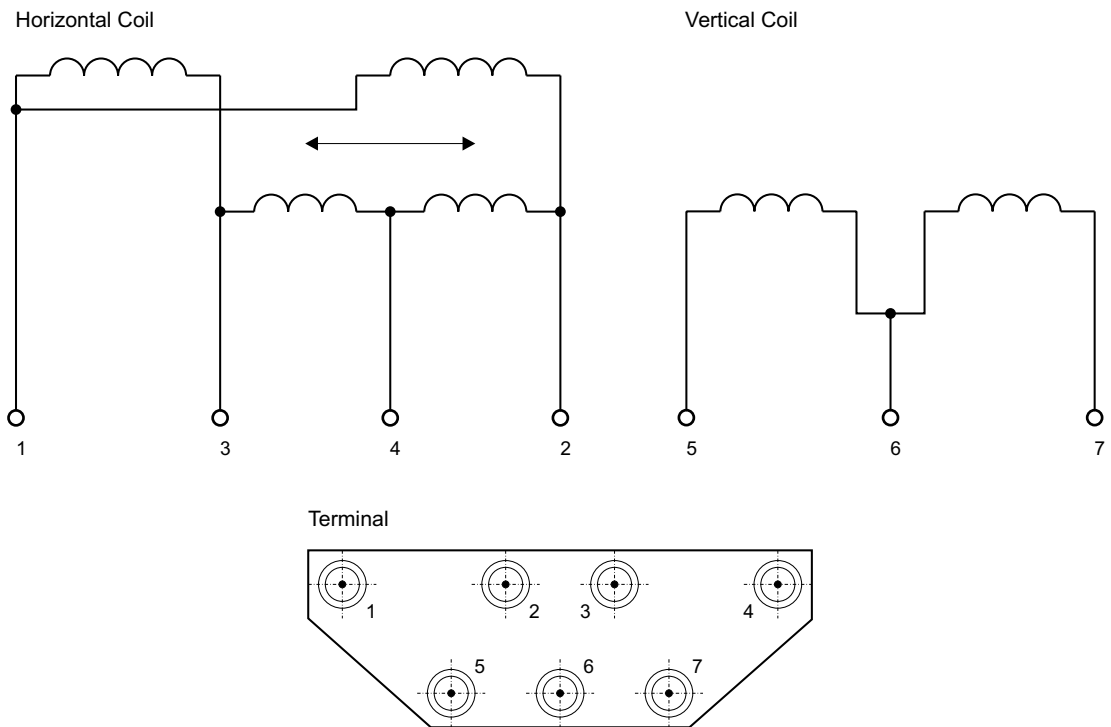
Designation	Description	Dimension type
N	Pin diameter	to. 1.016 ±0.076
O	Pin taper length	min/max 0.4 / 0.9
P	Pin end diameter	max 0.6
Q	Silo wall thickness at base	min/max 1.6 / 2.0
R4	Silo fillet radius	nom 0.25
S	Silo wall thickness	tol 1.5 ±0.2

Figure 10 - CRT BASE CONNECTION TABLE



Designation	Description	Note
Pin 1	Grid number 3	
Pin 4	IC	Do not use
Pin 5	G number 1	
Pin 6	Cathode of Green Beam	
Pin 7	Grid number 2	
Pin 8	Cathode of Red Beam	
Pin 9	Heather	
Pin 10	Heather	
Pin 11	Cathode of Blue Beam	
Pin 12	IC	Do not use

Figure 11 - YOKE TERMINAL



Designation	Description	Note
Pin 1	Horizontal coil - Beginning (High)	
Pin 2	IC	Do not use
Pin 3	IC	Do not use
Pin 4	Horizontal coil - End (Low)	
Pin 5	Vertical coil - End (Low)	
Pin 6	IC	Do not use
Pin 7	Vertical coil - Beginning (High)	

Notes