Specification

M 51EDF290WB60P

51 cm / 21 inch rectangular monochrome CRT

Portrait format

Status: Preliminary
Modifications may be agreed upon after evaluation of about 200 products.

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1 View of changes

- The first release will be "01" .
- Changes and supplements to this specification during the development require the agreement of all persons responsible.

Responsible for the contents of this document are:

Company/Department *Name* *Tel.* *Date* *Signature*

ChangeNr.	01			
Date	16-7-2004			
Release	01	02	03	04

ChangeNr.				
Date				
Release	05	06	07	08

Changed pages:

Release: 01 Pages: 09 : Added Potting faults.

2 Application

CRT for displays in medical and alphanumerical applications

3 Characteristics

- High resolution
- 90° -deflection
- Flat & square color bulb (low browning glass)
- Multicoated
- Conductive coating against charging
- Intrinsically safe
- High contrast
- High luminance
- Long life time
- Low phosphor noise
- Low drift
- Protected against internal flash over

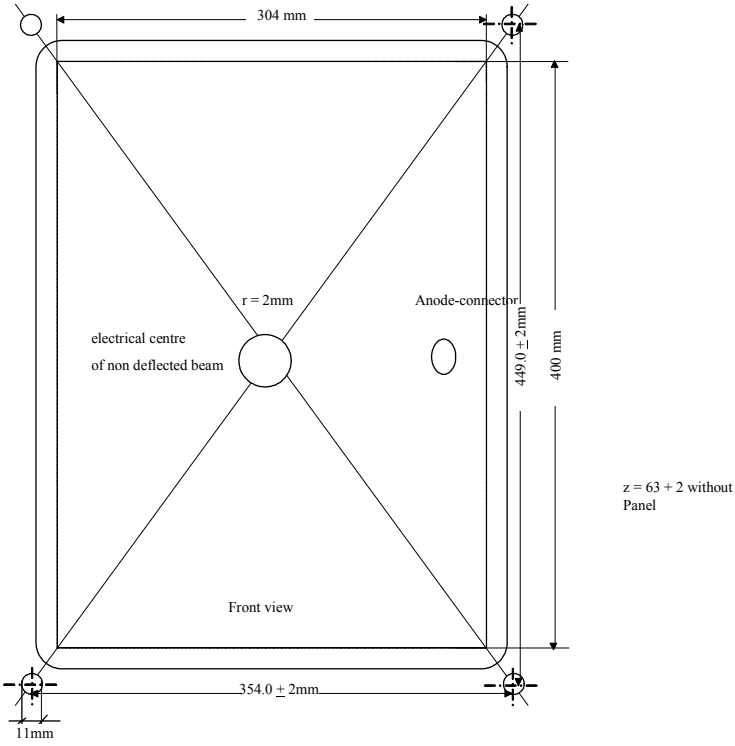
4 Important notes

Implosion hazard	CRT is evacuated. In case of mechanical damage (e.g. by shock or scratches) implosion may occur.
CRT is labeled according:	UL 1418 MPR II
High voltage	Because of the CRT's capacities the anode connection can maintain it's high voltage for an extended period after high voltage is switched off.
X-ray emission	When operating the tube within the limits, the X-ray dose rate will be under the allowed value of 1 µSv/h (equivalent to: 0,1 mR/h) The tube is an intrinsic CRT type according the RöV (German Röntgenverordnung) dated Jan, 8th 1987, Part I; Attechment III, paragraph 6.

5 Mechanical Data

Screen	rectangular, R = 1370 mm	
Useable screen	• Screen diagonal • Screen width • Screen height	min. 508,0 mm min. 304,8 mm min. 406,4 mm
Position of operation	anode connector on the right (front view)	
Socket	JEDEC B10-277 or equal	
Neck diameter	29,1 mm	± 0,7 mm
Anode connector	Bulb contact 7,92	DIN 41543
Deflection yoke	Drawing nmbr. THOMSON-Yoke 9288.xx	
Weight	Approx. 17,0 kg incl. Deflection yoke	
Mechanical outlines	see attachment 1	

6 Maximum of not deflected spot landing



- The CRT is mounted by angle brackets with pick-up holes that meet those of the monitor chassis. (see schematic in attachment 1)

- The CRT has to be moved in its fitting ears in such a way, that the centre of the glass bulb matches the mechanical centre of the jig ± 1 mm.

- Phosphor material must be everywhere within a window of 304 × 380 mm. The centre of that phosphor window matches the mechanical centre of the CRT.

- The beam alignment and the deflection yoke will be adjusted in a way that a symmetrical and equally distributed sharpness is obtained over the entire screen.

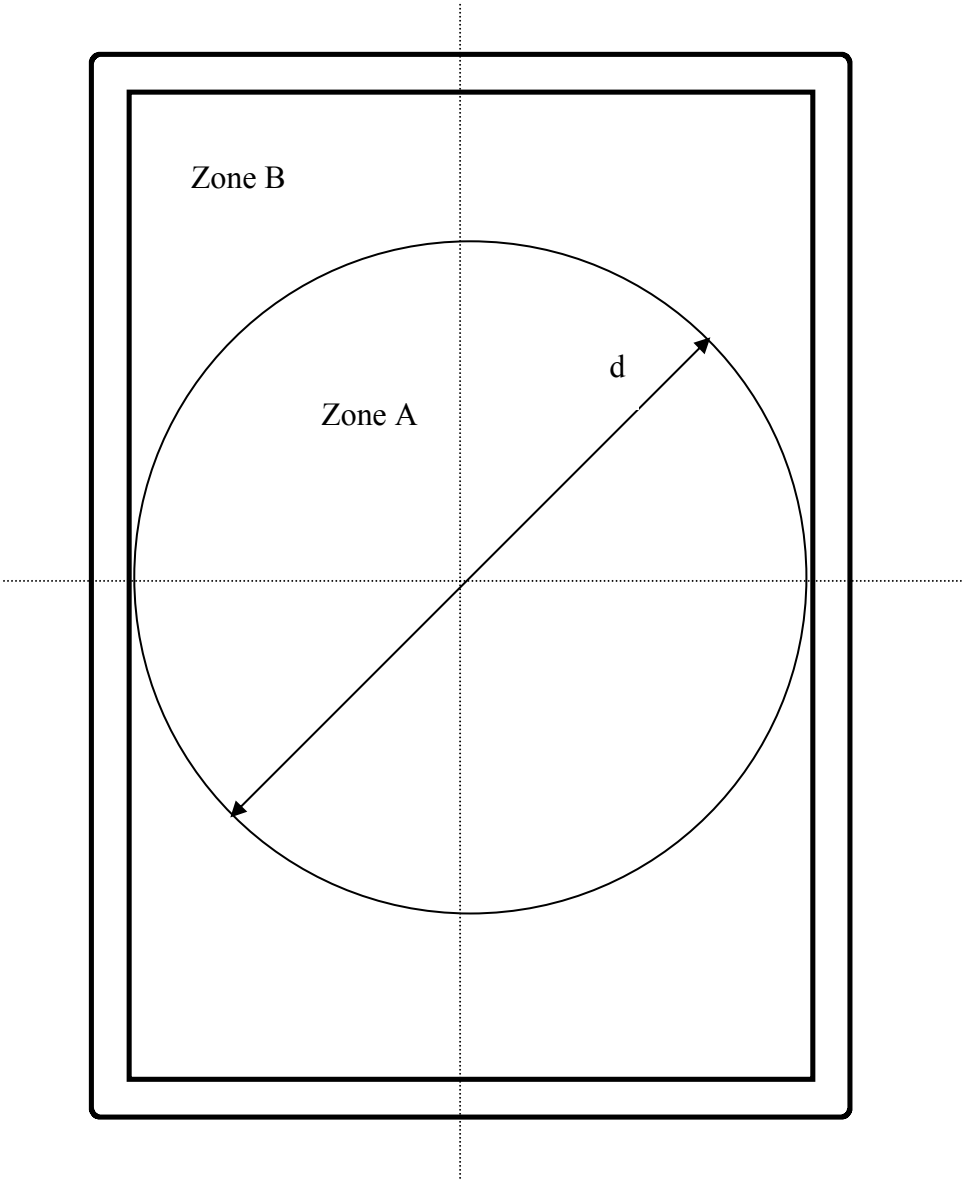
- The non-deflected spot landing must be within a circle with a radius of 2 mm around the mechanical centre of the CRT, provided that:
  - the CRT axis is in east-west direction and the front panel is facing east,
  - the anode connector is located on the right,
  - the deflection unit has been mounted to the tube,
  - there is a metal shield behind the deflection unit around the tube's neck

- The maximum rotation angle of the deflection unit may not exceed 0.2°.

7 Optical data

Total transmission of bulb including coating/panel:	32 % ± 3 % at 546 nm	
Phosphor	P45	
Color coordinates: (during operation)	P45-Phosphor	
at a luminance of 250 Cd/m^2 (Cd/m2) with CL60-Filter, (measured with LMT Color meter or Minolta CA100)	X = (0,250 ± 0,01)	Y = (0,305 ± 0,01)
Front panel	Transmission 65% at 546 nm. Unaxis Iralin 185. Anti-static , 2kΩ/□ Direct coating alternative after agreement with customer. The connection with the mounting device copper strips are mounted on front panel.	
Uniformity of luminance from centre to any corner	At a luminance of 50 Cd/m^2 the overall deviation of luminance from centre to any corner may not exceed 12 Cd/m^2 (Nit) at any point of the screen.	
Glass bulb	Panel : NEG 51 FS 4:3 or equivalent Funnel : Schott 51FS/90/H29/11 or equivalent	

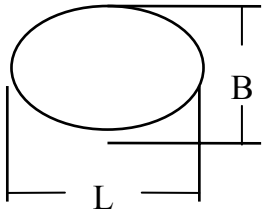
8 Permissible Glass and screen defects



d = 300 mm

L: max. length of defects

B: max. width of defects



Defect size G for the screen and glass specification

for a side ratio of $L/B < 3$ $G = ½ (L + B)$

for a side ratio of $L/B \geq 3$ $G = L/20 + 2\ B$

Permissible defect

Blemish Size G (mm)	Zone A	Zone B	Sum
< 0,2	disregard, but no accumulation *		-
0.2 < G < 0.4	2	3	4
0.4 < G < 0.6	-	3	3
Blemish Distance	> 50 mm	> 50 mm	

* max. 5 defects in a circle of Ø 15 mm.

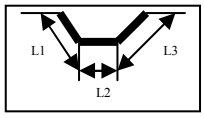
Viewing distance 0.5 m.

Scratches

Sum ≤ 2 , max. width < 30 µm independent from its length.

Not allowed defects:
Open holes, stones, faults, cracks, accumulated defects, 'cloud'.

Hairs, fuzz or similar particles in potting



Length = L1+L2+L3

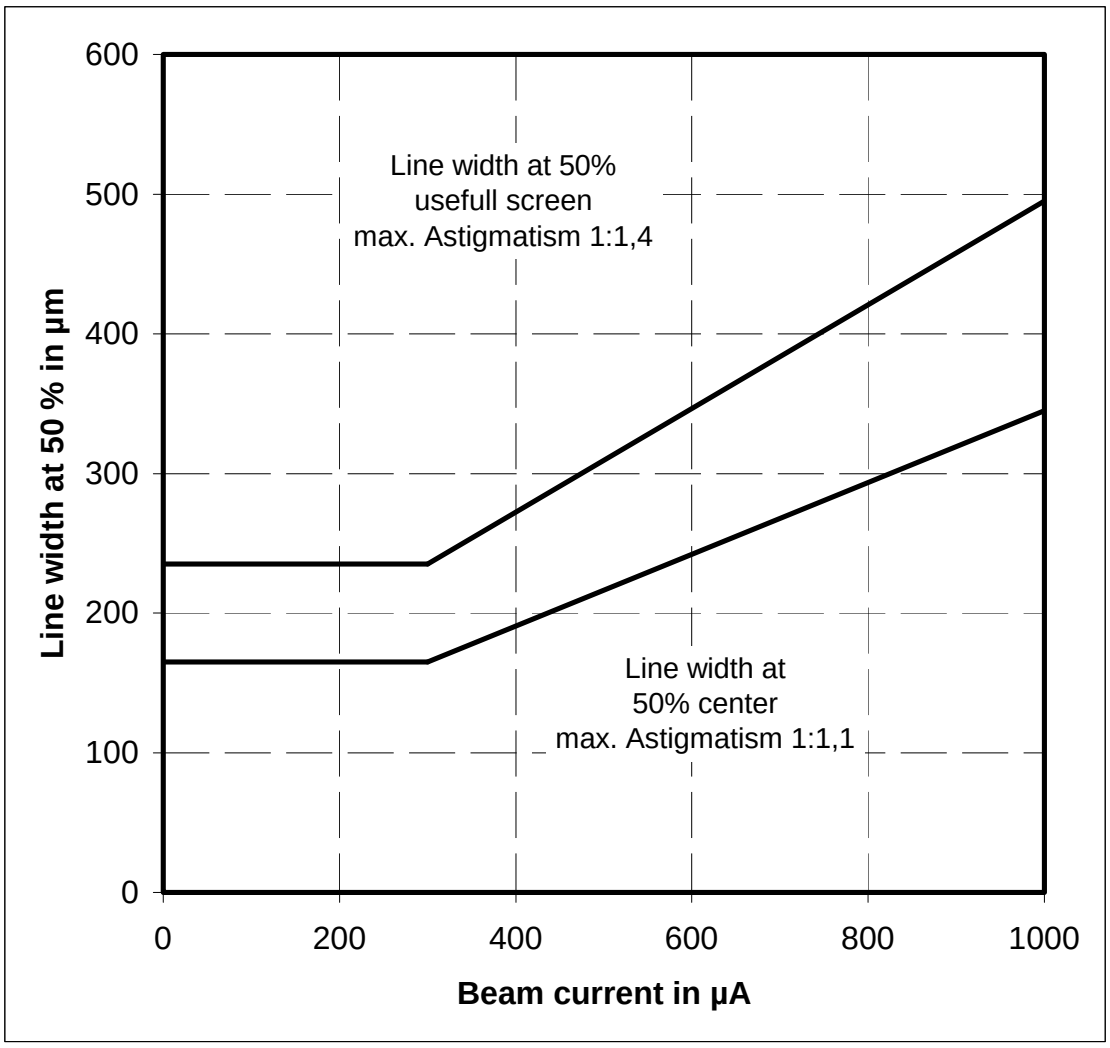
Lenght(L) of hairs,fuzz or similar particles in potting (mm)	Zone A	Zone B	Sum
L< 0,2	disregard, but no accumulation *		-
0.3 ≤ L ≤ 0.6	3	3	4
0.6 < L ≤ 0.8	0	1	1
L > 0.8	0	0	0
Distance	> 50 mm	> 50 mm	

Zone C requirements: L < 0.8mm disregard , but no accumulation*

* max. 5 defects in a circle of Ø 15 mm.

9 Resolution

50 % of peak value
Optimal focus: 300µA
Duty cycle 100 %

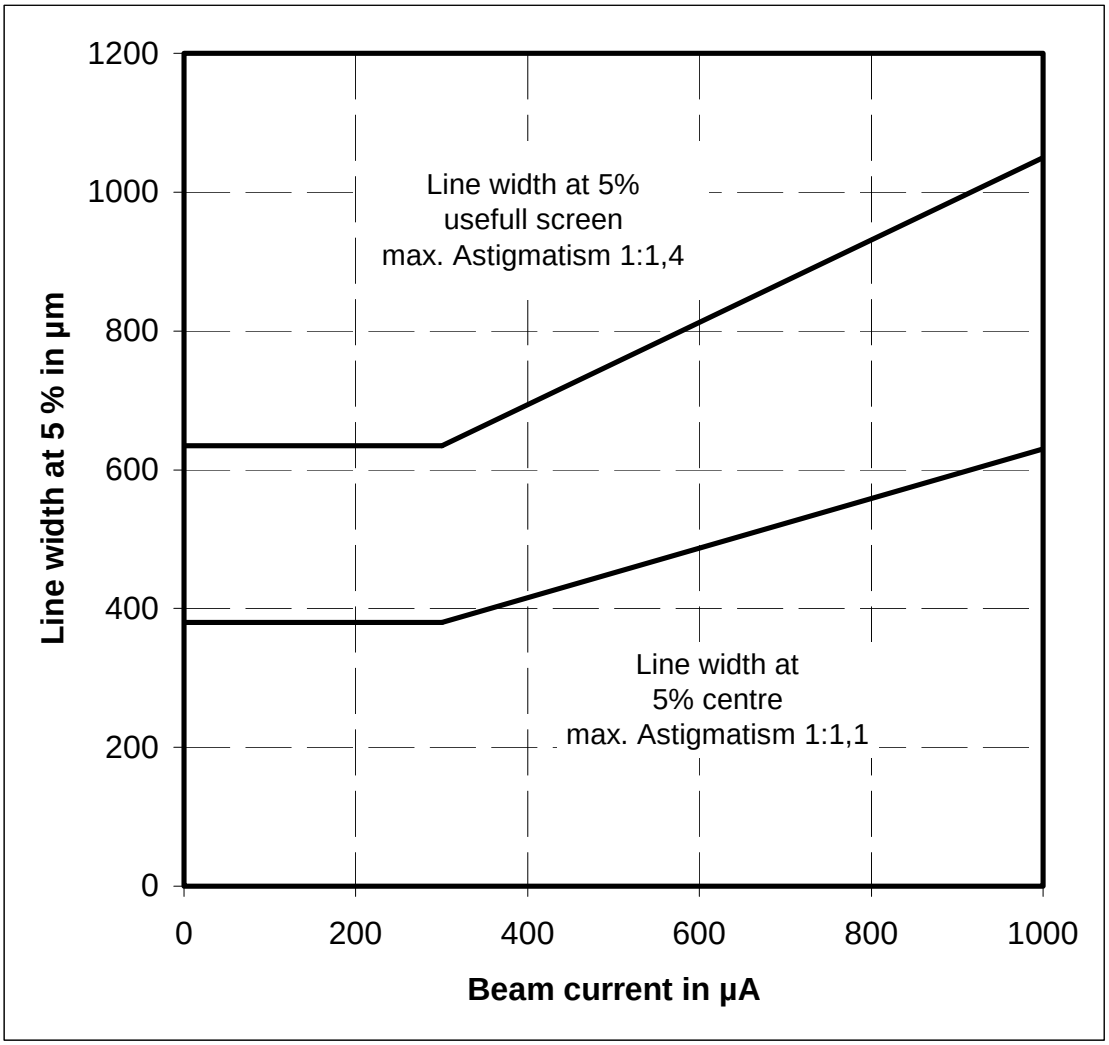


Measured with Microvision Superspot SS200 or PDS spotvision system.

- Astigmatism at 5% and 50%-line width must have the same shape.
- Astigmatism is not allowed to rotate with increased beam current
- Spotprofile approximates gaussian profile

Resolution

5 % of peak value
Duty cycle 100 %



Measured with Microvision Superspot SS200 or PDS spotvision system.

10 Electrical Data

Deflection	magnetically, deflection angle		
		- horizontal	ca. 60°
		- vertical	ca. 78°
		- diagonal	ca. 90°
Focussing	electrostatic		
Maximum currents (leakage)	I_{G1}	$\pm$ 1µA	
	I_{G2a}	$\pm$ 1µA	
	I_{G2b}	$\pm$ 1µA	
	I_{G3}	$\pm$ 2µA	
Capacity (Grid 1 to all other electrodes)	$C_{G1\text{-}all}$	5,3 pF ± 1 pF	
Capacity (Cathode to all other electrodes)	C_K	3.5 pF ± 1 pF	
Capacity (Grid1 to cathode)	$C_{G1\text{-}K}$	2,3 pF ± 0,7 pF	
Capacity (Anode to outher coating)	$C_{A\text{-}M1}$	1600 ... 3000 pF	

Electrical Data from THOMSON-Coil	Drawing #. THOMSON-YOKE Nr. 9288.00	
Horizontal deflection	Lx : 30 µH ± 5%	Rx : 0.56 Ω ± 10%
Vertical deflection	Ly : 2.6 mH ± 5%	Ry : 5.1 Ω ± 10%
Rotationcoil	Rr : 78 Ω ± 10%	Ir : < 55 mA/°
Astigmatism Axial	La : 9.9 µH ± 10%	Ra : 2.1 Ω ± 10%
Astigmatism Diagonal	Ld : 9.9 µH ± 10%	Rd : 2.1 Ω ± 10%

*) measured with PHILIPS RLC Bridge PM6303

11 Absolute limiting values

Cathode is reference point for all voltage values

First accelerating voltage	$U_{G2\ I\&II}$	max. 1300 V min. - 400 V	
Second accelerating voltage	U_A	max. 29,9 kV	
Focus voltage	U_{G3}	max. 9 kV	
Grid 1 voltage	$-U_{G1}$	max. 150 V (200 V for 5 sec. after switch off) min. 3 V	
Heating against cathode	U_{HC}	negative negative peak positive positive peak	255 V 300 V 3 V 50 V
	I_{HC}	max. 15 µA	
Grid 1 leakage resistance	R_{G1}	1,5 MΩ	
Damping of deflection field:	The power consumption of the horizontal deflection is allowed to increase by max. 2,3W when yoke is mounted to the CRT. (at 200 kHz horizontal frequency, a retrace time of $\leq$ 1,2 µs and a horizontal width of 300 mm at U_A 29,0 kV).		

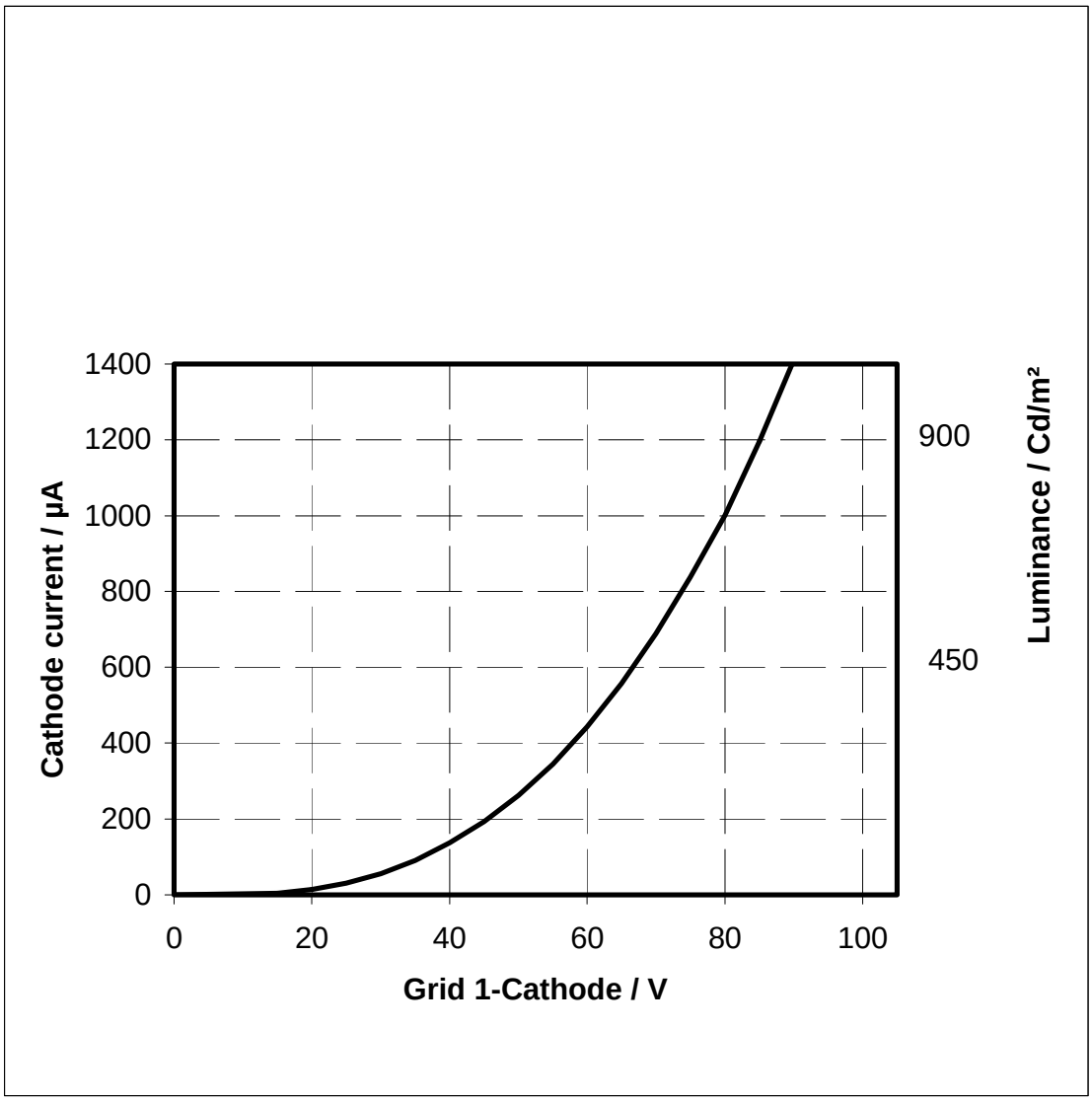
12 Operating values

Cathode heating	- indirect		
	- Heating voltage	U_H	6,1 V + 5 % / -5 %
	- Heating current,	I_H	approx. 100 mA
		I_{Hmax}	0,5 A (cold state)

Cathode is reference point vor all voltage values following

First accelerating voltage	$U_{G2\ I}$	600 - 930 V
Halo suppression voltage	$U_{G2\ II}$	-200 - 0 V
Grid 1 voltage (for spot suppression)	U_{G1}	- 105 V
second accelerating voltage	U_A	29,0 kV
Drive voltage (grid drive) (from I_c = 0 µA to I_c = 1200 µA	ΔU_{G1}	max. 85 V
Luminance drift over time		max. 18 minutes after switch on (an overshoot of max 10% of the cutoff voltage is allowed during this time)
Focus voltage (at centre of screen at I_c = 300 µA)	U_{G3}	min. 6,80 kV nom. 7,15 kV max. 7,50 kV
Dynamic focus voltage (with reference to Thomson-yoke Nr. 9288.00)	$U_{G3\ dyn.}$	max. = 850 V

13 Grid drive characteristics

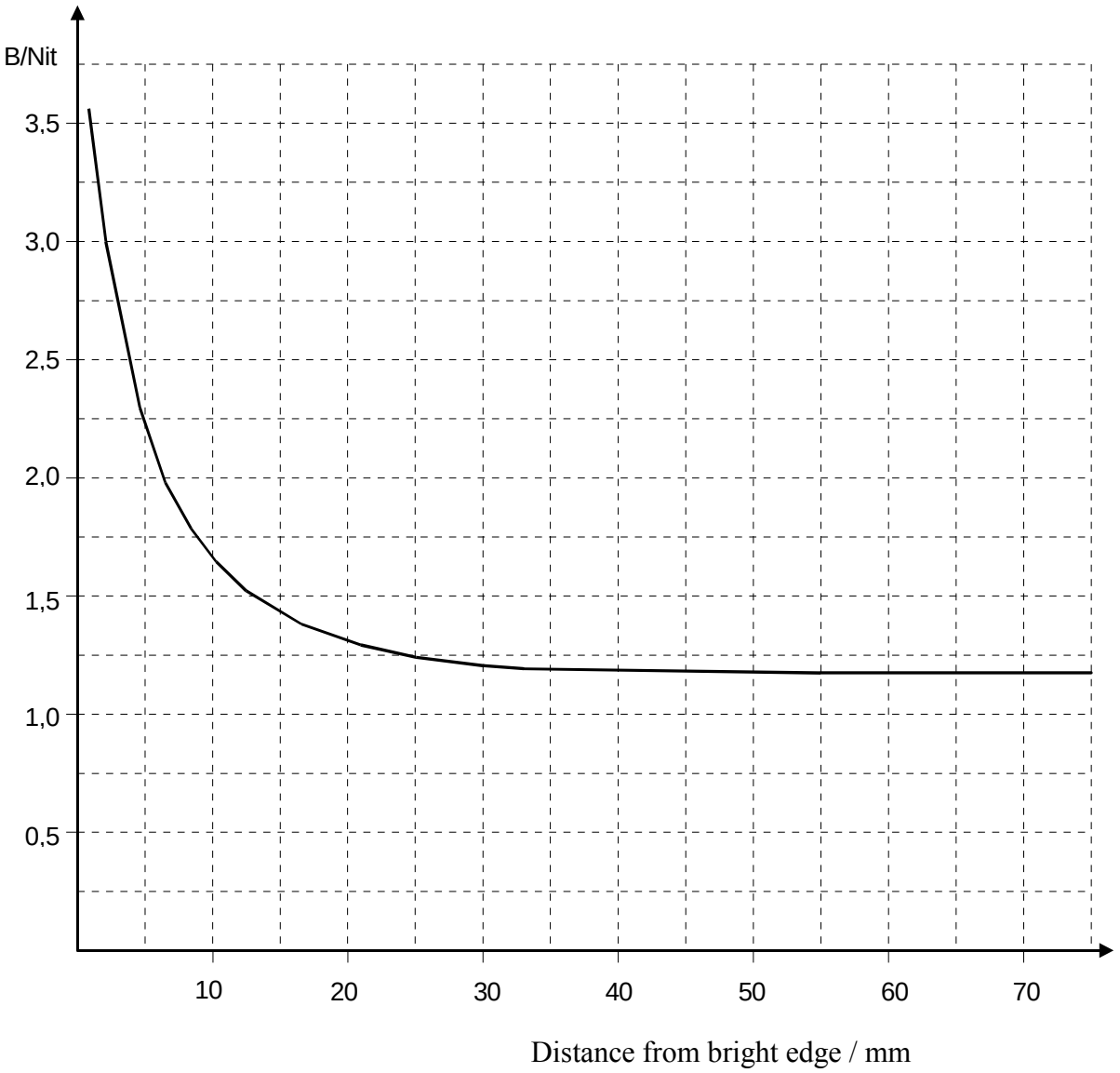


Luminance at 100% Duty Cycle

Scan area 300*400 mm

14 Large area contrast

Max. values



To measure the large area contrast, a bright rectangle is displayed on one half of the sreen. This area must be 50% of the total screen area with an aspect ratio of x : y = 2 : 3, and a luminance of 400 Cd/m^2.
The luminance of the black area is adjusted in such way that no lines can be seen in dark room conditions (optical cut-off value).
With the Microvisionsystem Superspot (or similar equipment) the brightness is measured in relation to the distance from the black/with edge.
The bright rectangle must be totally covered with a non reflecting cover during measuring.

15 Environmental conditions

Temperature range:

Operation	0 to + 70 °C relative humidity 75 % non condensing
Storage	- 40 to 70 °C
Temperature gradient	20 °C/h
Air pressure	400 hPa to 1060 hPa

16 Estimated life time

Decrease of the cathode current of 800 µA at 100 % duty cycle and constant Cut-Off Voltage (Grid 2-voltage readjusted)

after	20.000 hrs. < 20 %

Burning conditions:
Maximum cathode current during testing is 500 µA at 100 % duty cycle over total scan area.

During life time of the CRT (20 000 hours) G2A voltage may be increased to max. 1250 V, to maintain G1-Cut-Off voltage of –105V.

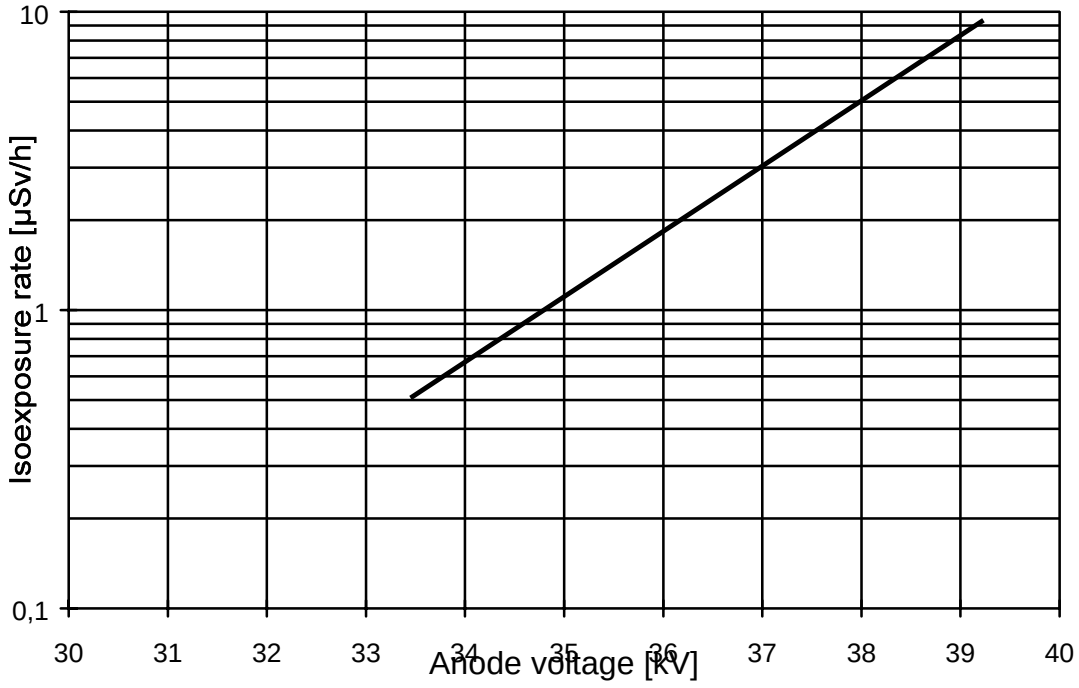
At a maximum luminance level of 350 Cd/m^2 ,after 20.000 hours of operation , the maximum decrease in phosphor luminance is 15 %.

17 X-radiation

X-Radiation Limit Curve

Conditions:

Cathode current I_c = 250 µA

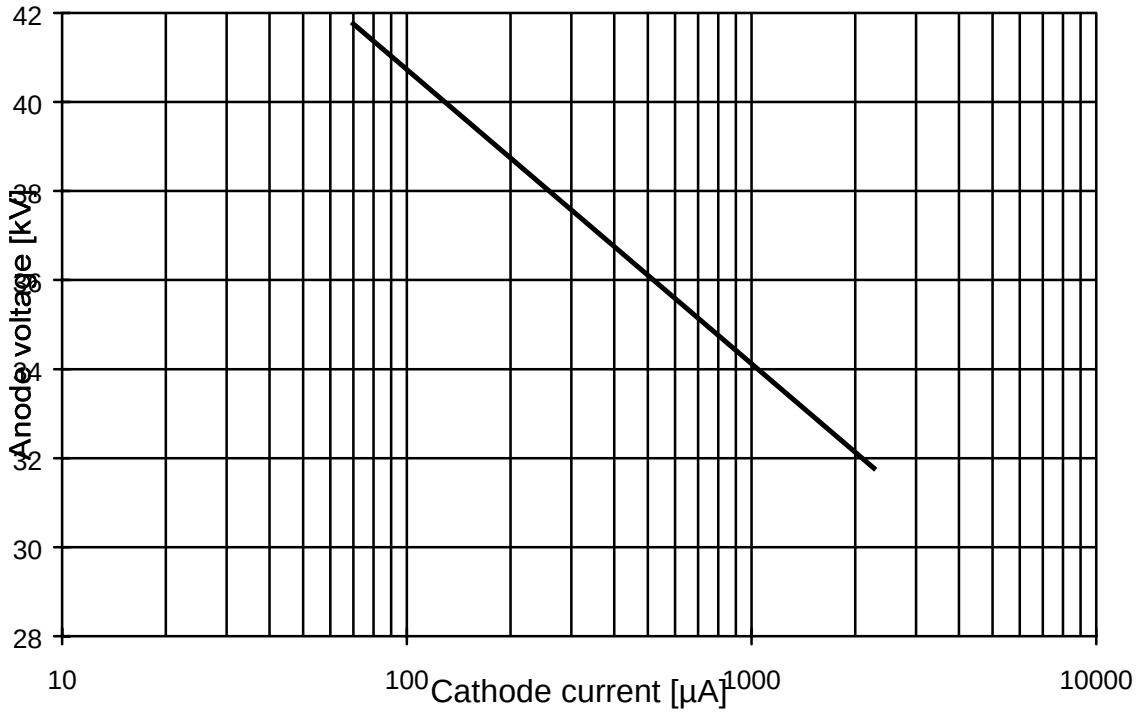


X-Radiation exposure rate vs. anode voltage at constant value of cathode current measured at 5 cm from the CRT.

The measurement is according:
"Röntgenverordnung der Bundesrepublik Deutschland vom 8. Januar 1987"

Isoexposure - Rate Limit Curve

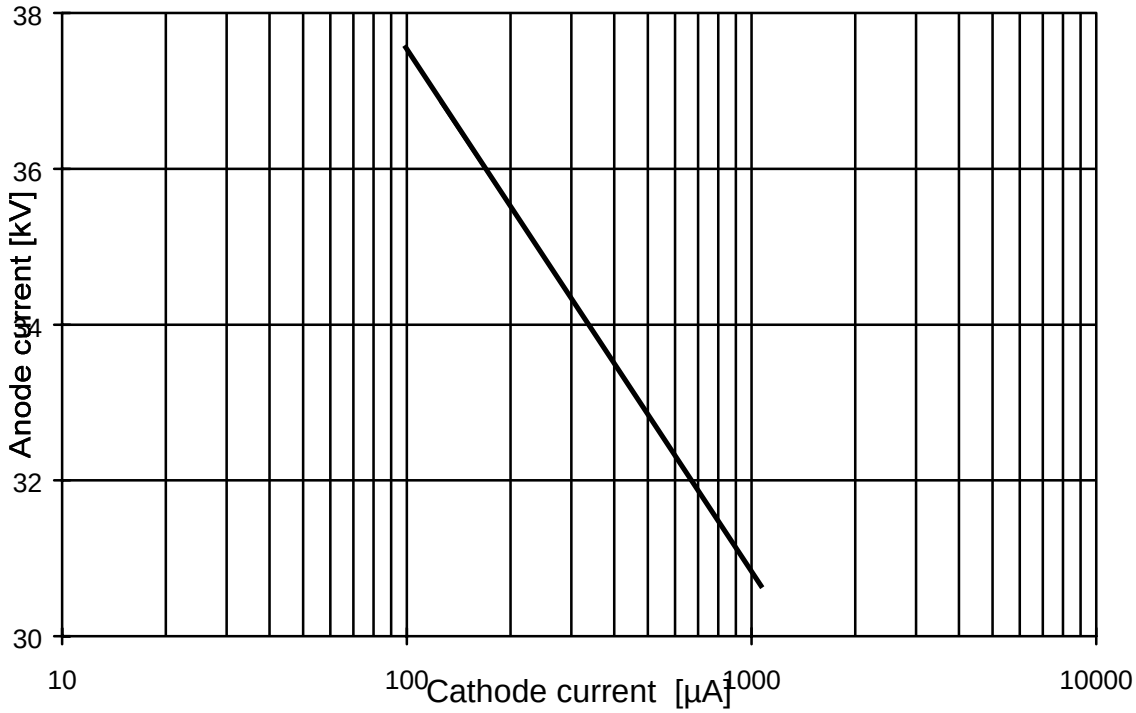
Calculated for 5 µSv/h



This limit curve is plotted at an isoexposure rate of 5 µSv/h (0,5 mR/h) measured at 5 cm from the CRT.

Isoexposure - Rate Limit Curve

Calculated for 1 µSv/h



This limit curve is plotted at an isoexposure rate of 1 µSv/h (0,1 mR/h) measured at 5 cm from the CRT.

Attachment 1

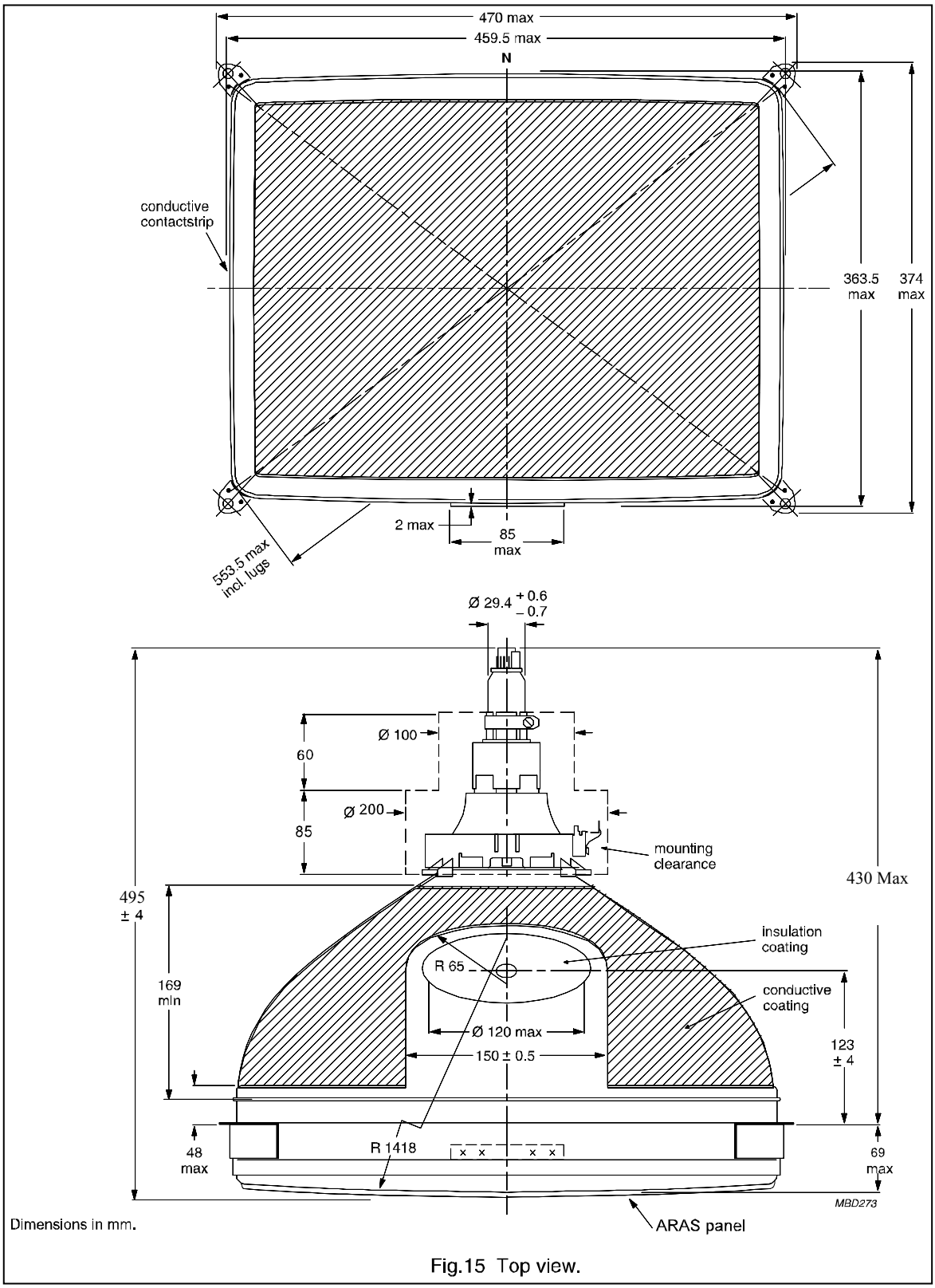
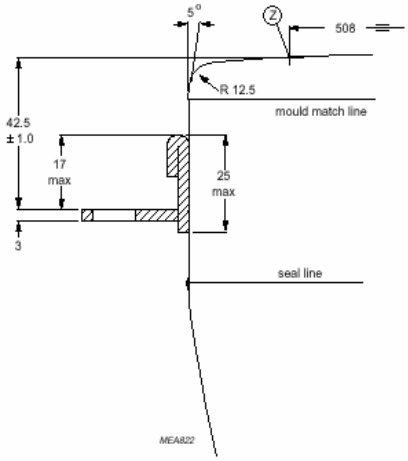


Fig.15 Top view.

Lug Position

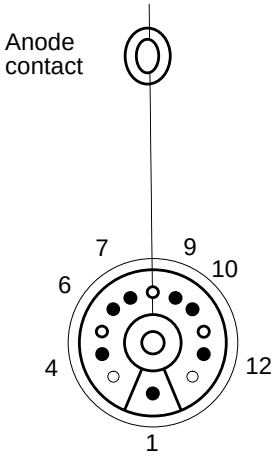


Dimensions in mm.

The displacement of any lug with respect to the plane through the three other lugs is max. 1.3 mm. This deviation is incorporated in the tolerance of ±1.8 mm.

Lug position .

Base Configuration



1	: Focus
4	: Grid 1
6,7	: Heater
9	: Grid 21
10	: Grid 22
12	: Cathode
5,8,11	: not connected