

# Specification

## M 51EDF240WB50P

**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:

<i>Company/Department</i>	<i>Name</i>	<i>Tel.</i>	<i>Date</i>	<i>Signature</i>
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Siemens  
A&D SE BT E

<b>ChangeNr.</b>	<b>1</b>			
<b>Date</b>	March 10 2006	June 21 2006	July 23 2007	
<b>Release</b>	<b>01</b>	<b>02</b>	<b>03</b>	<b>04</b>

<b>ChangeNr.</b>				
<b>Date</b>				
<b>Release</b>	<b>05</b>	<b>06</b>	<b>07</b>	<b>08</b>

**Changed pages:**

**Release: 01** Pages: 11, changed blemish specification < 0,2mm.  
**Release: 02** Pages:15, heater voltage specification, brightness variation. 20 : stray emission. 24 : drawing.  
**Release :03** Page 15: heater voltage specification. 16: Grid drive characteristics.

## 2 Application

CRT for displays in medical and alphanumeric applications

## 3 Characteristics

high resolution  
90° -deflection  
flat & square colour bulb (low browning glass)  
multicoated  
conductive coated against charging  
intrinsically safe  
high contrast  
high luminance  
long life time

## 4 Important notes

Implosion hazard

CRT is evacuated. In case of mechanical damage (e.g. by shock or scratches) implosion can occur.

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CRT is labeled according:

UL 1418  
MPR II

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High voltage

For reasons of the CRT's capacities the anode connection can conduct high voltage for a long time after high voltage is switches off.

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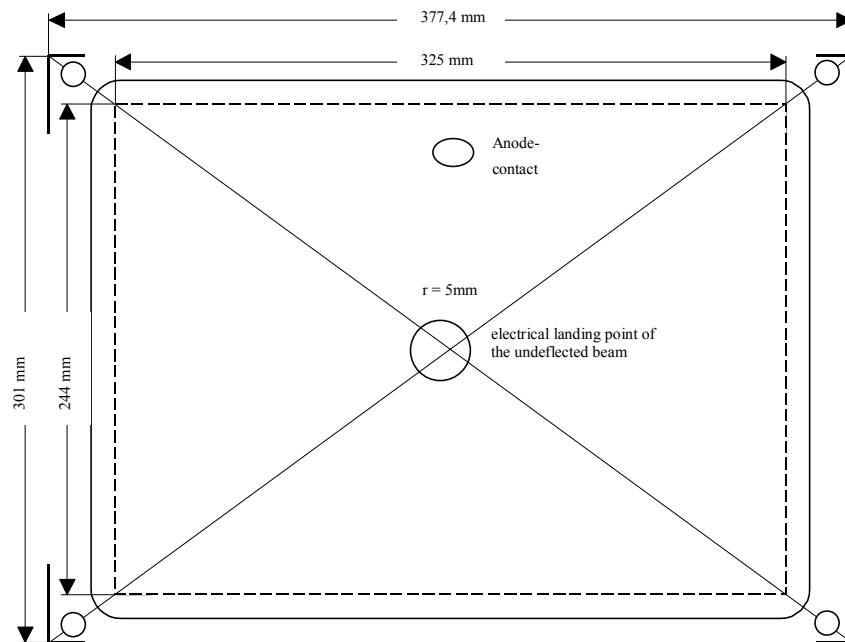
X-ray emission

Operating the tube within the limits the x-ray dose rate will be under the allowed value of 1 µSv/h (adequate to: 0,1 mR/h)

The tube is an intrinsic CRT type according the RöV (German Röntgenverordnung) dated Jan, 8<sup>th</sup> 1987, Part I; Attachment III, paragraph 6.



## 6 Maximum of not deflected spot landing



- The CRT is mounted by angle brackets to a jig (see schematic) whose pick-up holes meet those of the monitor chassis.
- The CRT has to be moved in its fitting ears in such a way, that finally the centre of the glass bulb matches the mechanical centre of the jig  $\pm 1$  mm.
- Phosphor material must be everywhere within a window of  $300 \times 400$  mm. The centre of that phosphor window matches the mechanical centre of the CRT.
- The spot or the deflection yoke will be adjusted, so that equal and symmetrical focus exists.
- The non-deflected spot landing must be within a circle with a radius of 2 mm around a point 3 mm left and 2 mm down from 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  $0.2^\circ$ .

**7**      **Optical data**

**Total transmission of bulb including coating/panel:**      **32 % ± 3 % at 546 nm**

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**Phosphor**      **P45**

**7.1**      **Noise Power (see fig.)**

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**Colour coordinates: (during operation)**      **P45-Phosphor**

**at a luminance of 250 Cd/m<sup>2</sup> (Nit) with CL60-Filter, (measured with LMT Colour meter or Minolta CA100)**      **X = (0,250 ± 0,01)      Y = (0,305 ± 0,01)**

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**Front panel**      **Transmission at 546 nm ca.60% Coating Flabeg OEL-65.  
Direct coating alternative after agreement with customer. The connection with the mounting device aluminium strips are mounted on front panel.**

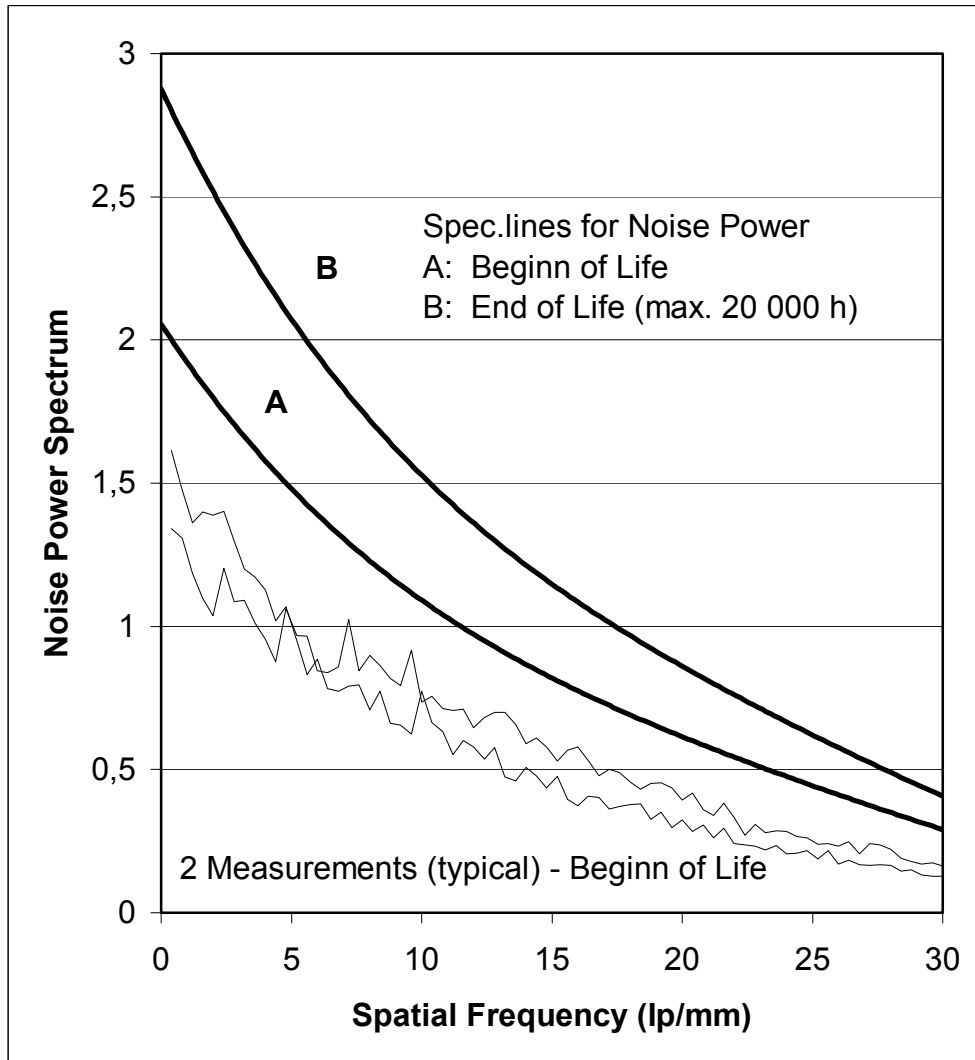
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**Uniformity of luminance from centre to any corner**      **At a luminance of 50 Nit the overall deviation of luminance from centre to any corner may not exceed 12 Cd/m<sup>2</sup> (Nit) at any point of the screen.**

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**Glass bulb**      **Drawing nr. 252 907.GZ or equivalent bulb after agreement with customer.**

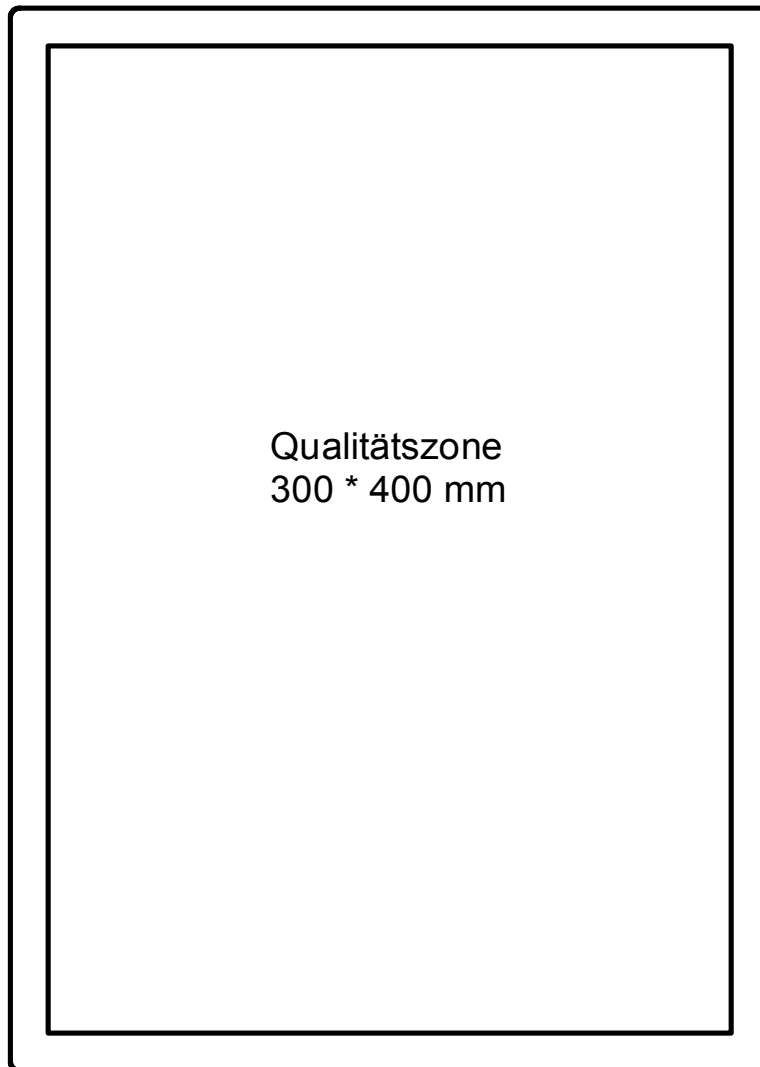
**7.1 Noise power**



Noise Power measured with SIEMENS Measurement system.

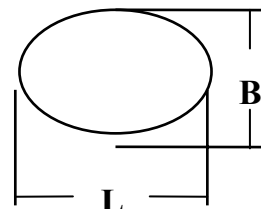


**8**      **Permissible Glass and screen defects**



**L:** max. length of defects

**B:** max. width of defects



**d = 300 mm**

**Defect size G for the screen and glass specification**

for a side ratio of  $L/B \leq 3$        $G = \frac{1}{2} (L + B)$   
 for a side ratio of  $L/B > 3$        $G = L/20 + 2 B$

**Permissible defect ( inclusive Panel)**

<b>Defect size G in mm</b>	<b>Quality zone 400 x 300 mm</b>
$\leq 0,2^*$	<b>Within an area of 30x30mm there are allowed 3 defects with size 0,1- 0,2mm.</b>
$0,2^* < G \leq 0,4^*$	<b>4</b>
<b>Distance between defects</b>	<b>&gt; 50 mm</b>

**Scratches**

**Sum  $\leq 2$**   
**distance > 50 mm**  
**max. length < 10 mm**  
**max. width < 50  $\mu$ m**

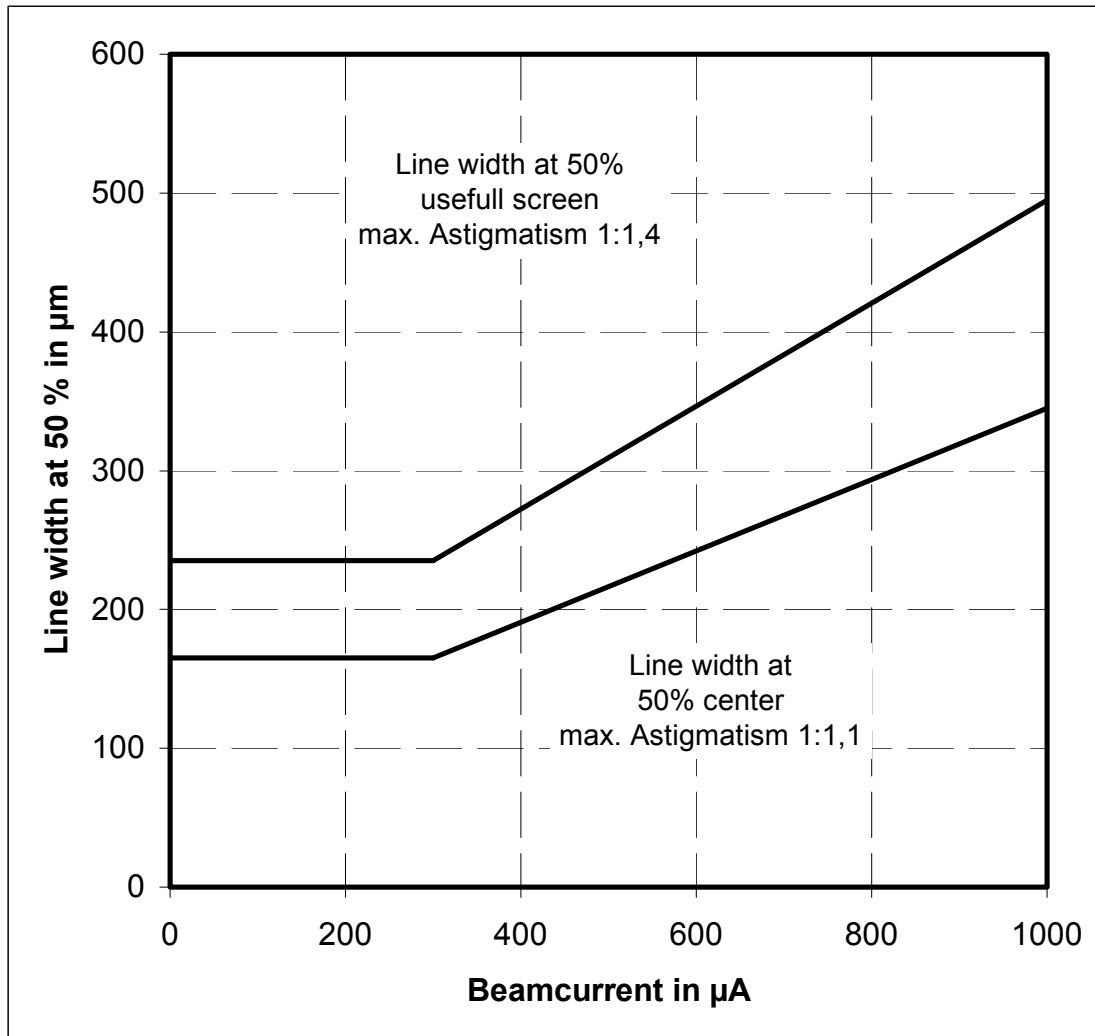
**Scratches <15  $\mu$ m are permitted**

**Not allowed defects:**

**Open holes, stones, folds, cracks, accumulated defects, 'cloud'.**

**9 Resolution**

**50 % of peak value**  
**Optimal focus: 300 $\mu$ A**  
**Duty cycle 100 %**

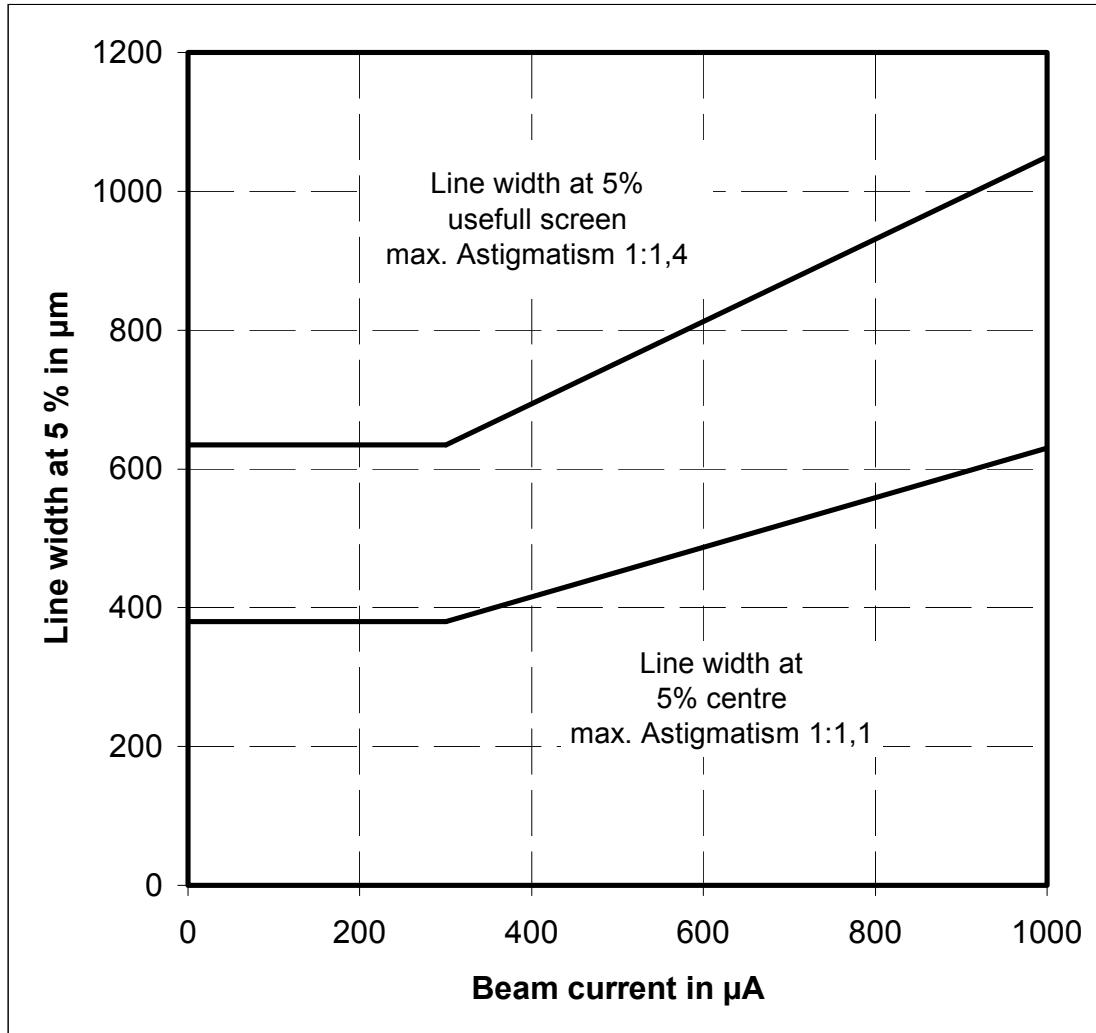


Measured with Microvision Superspot SS200 or PDS spot profile measuring system

- Astigmatism at 5% and 50%-line width has the same shape.
- Astigmatism is not allowed to turn at increased beam current
- The spot profile approximates the Gaussian distribution.

**Resolution**

**5 % of peak value  
Duty cycle 100 %**



**Measured with Microvision Superspot SS200 or PDS spot profile measuring system**

## 10 Electrical Data

### Deflection

magnetically, deflection angle

- horizontal ca. 60°
- vertical ca. 78°
- diagonal ca. 90°

### Focussing

electrostatic

#### Maximum currents (leakage)

$I_{G1}$	$\pm 1\mu A$	max. 5 changes allowed
$I_{G2a}$	$\pm 1\mu A$	
$I_{G2b}$	$\pm 1\mu A$	
$I_{G3}$	$\pm 2\mu A$	

#### Capacity \*)

(Grid 1 to all other electrodes)

$C_{G1-all}$  5,3 pF  $\pm$  1 pF

#### Capacity \*)

(Cathode to all other electrodes)

$C_K$  3.5 pF  $\pm$  1 pF

#### Capacity \*)

(Grid1 to cathode)

$C_{G1-K}$  2,3 pF  $\pm$  0,7 pF

#### Capacity

(Anode to outer coating)

$C_{A-M1}$  1600 ... 3000 pF

#### Electrical Data from THOMSON-Coil

Drawing nمبر. 250 898.ZZ  
THOMSON-YOKE Nr. 9290.xx

#### Horizontal deflection

Lx 27  $\mu H \pm 5 \%$   
Rx 125 m $\Omega \pm 10 \%$

#### Vertical deflection

Ly 1.80 mH  $\pm 5 \%$   
Ry 3.00  $\Omega \pm 10 \%$

#### Rotation coil

Rr 140  $\Omega \pm 10 \%$   
Ir 100 mA / 5.2 °

#### Astigmatism Axial

La 22.5  $\mu H \pm 5 \%$   
Ra 5.05  $\Omega \pm 10 \%$

#### Astigmatism Diagonal

Ld 23.2  $\mu H \pm 5 \%$   
Rd 5.05  $\Omega \pm 10 \%$

\*) measured with PHILIPS RLC Meßbrücke PM6303

## 11 Absolute limiting values

Cathode is reference point for all voltage values

First accelerating voltage	UG2 I&II	max. 1300 V min. - 400 V	
Second accelerating voltage	UA	max. 29,9 kV	
Focus voltage	UG4	max. 9 kV	
Grid 1 voltage	- UG1	max. 150 V (200 V for 5 sec. after switch off) min. 2 V	
Heating against cathode	UHC	negative	255 V
		negative peak	300 V
		positive	3 V
		positive peak	50 V
	IHC	max. 15 $\mu$ A	
Grid 1 leakage resistance	RG1	1,5 M $\Omega$	

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  $\leq 1,2 \mu$ s and a horizontal width of 300 mm at  $U_A = 29,0$  kV).

## 12 Operating values

Cathode heating - indirect  
 - Heating voltage  $U_h$  6,0 – 6,2 V  
 - Heating current,  $I_h$  approx. 100 mA;  
 $I_h$  max 0,5 A ( cold state)

An integrated series resistor of 0.39  $\Omega$  reduces the effective heater voltage to 5.6-5.8V.

Cathode is reference point vor all valtage values following

First accelerating voltage	$UG2 I$	600 - 930 V
Halo suppression voltage	$UG2 II$	0 - 200 V

Grid 1 voltage (for spot suppression)	- $UG1$	105 V
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second accelerating voltage	$U_A$	29,0 kV
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Drive voltage (grid drive) (from $I_c = 0 \mu A$ to $I_c = 1200 \mu A^1$ )	$\Delta U_{WE}$	max. 85 V
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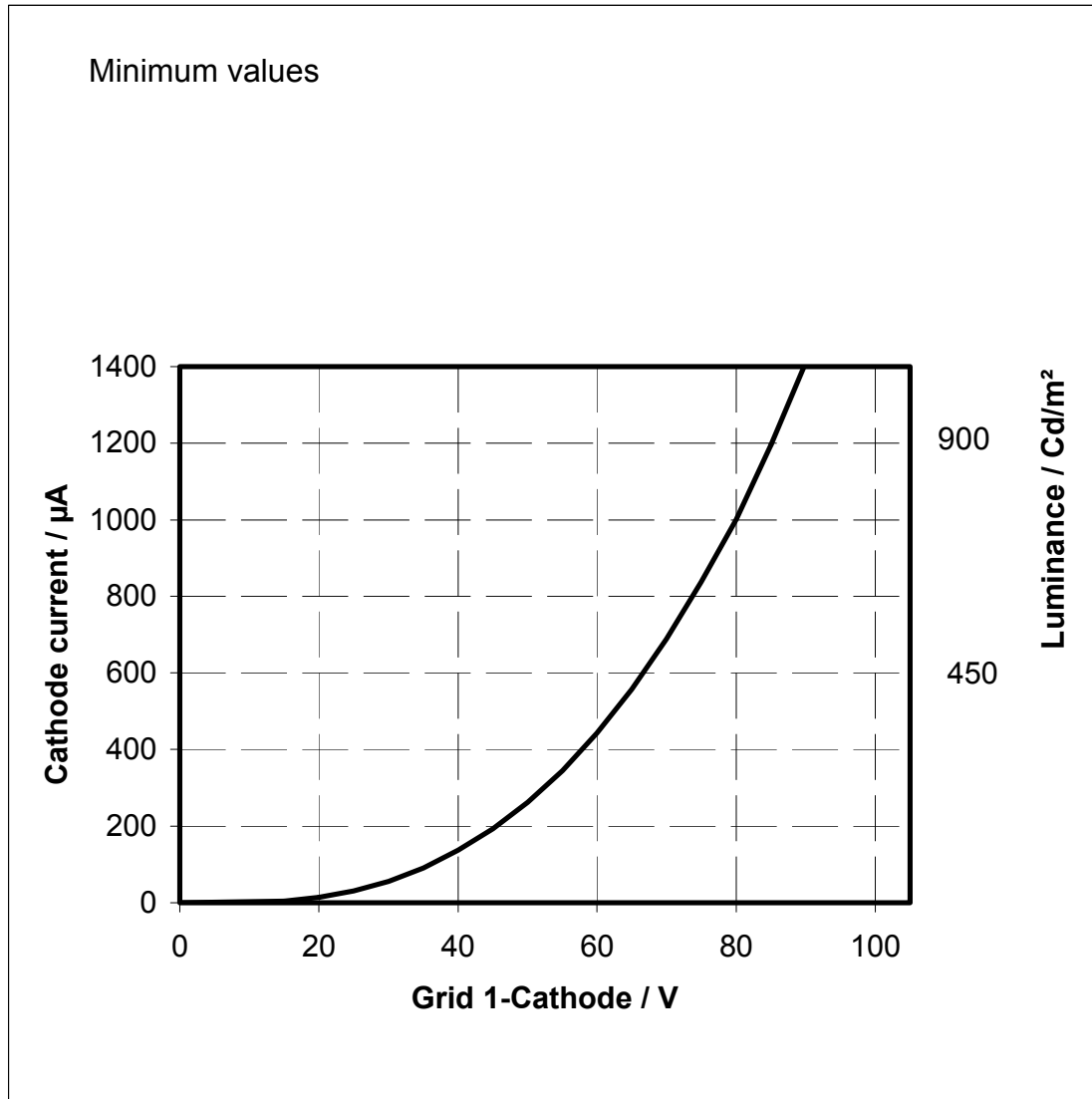
Luminance drift over time	max. 18 minutes after switch on (an overshoot of max 10% of cut-off voltage is allowed during this time)	
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Focus voltage (at centre of screen at $I_c = 300 \mu A$ $UG3$ )	min. 6,80 kV nom. 7,15kV max. 7,50 kV
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Dynamic focus voltage (with reference to Thomson-yoke Nr. 9290.xx)	$UG3$ dyn. max. = 850 V
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Brightness variation when changing from 100% white pattern to 10% square white pattern ( same drive voltage)	No brightness variation allowed
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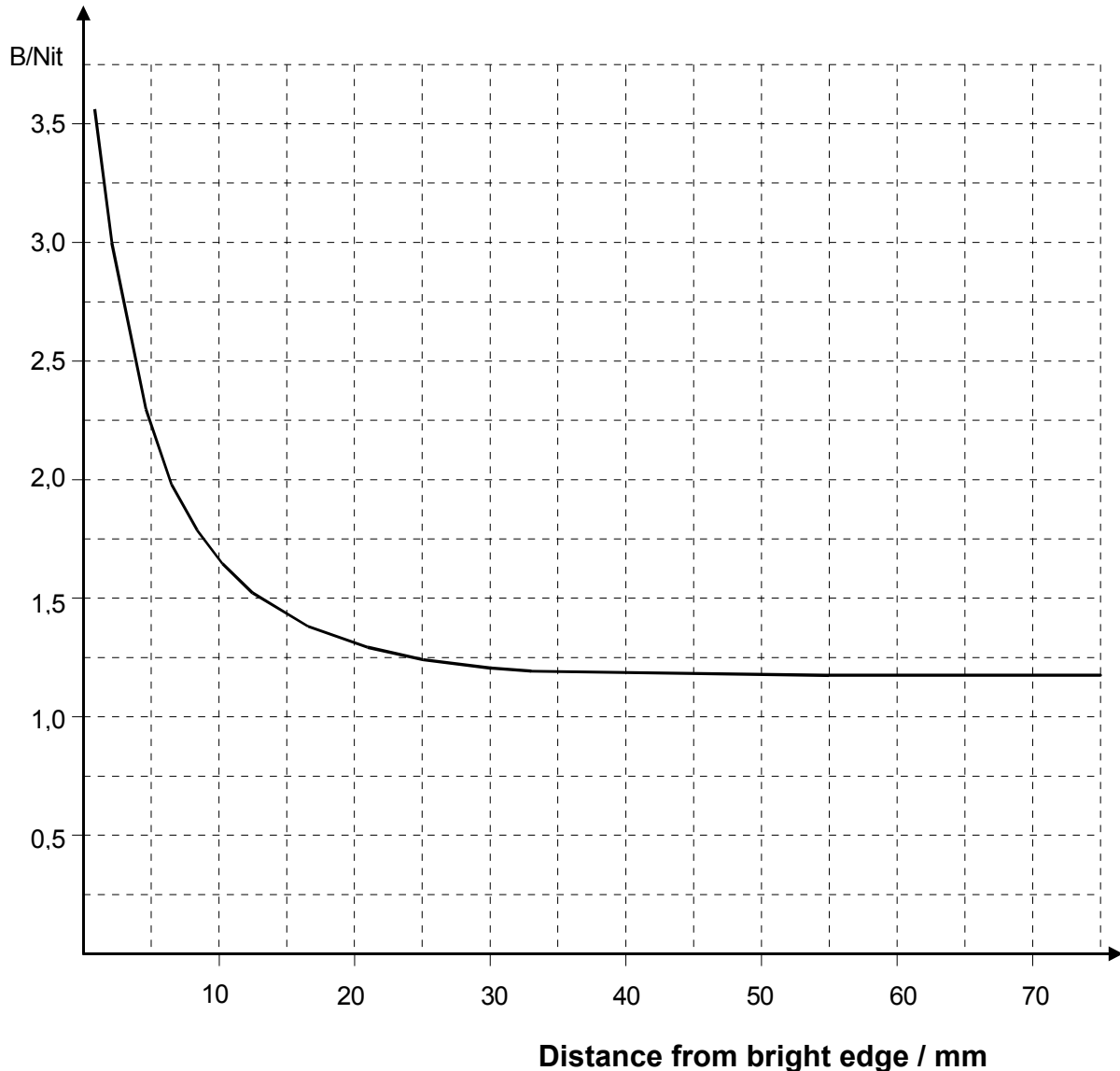
**Grid drive characteristics**



**Luminance at 100% duty cycle . Horizontal freq: 64 kHz; Vertical freq: 50 Hz.**

**Scan area 300\*400 mm**



**14 Large area contrast****Max. value**

To measure the large area contrast a bright rectangle is displayed on one half of the screen. This area must be 50% of the total screen area with an aspect ratio of  $x : y = 2:3$ , and a luminance of 400 Nit.

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) the brightness is measured in relation to the distance from the black/white 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 adjusted)

after                              20.000 hrs. < 10 %

Burning conditions:

The cathode current during testing is max. 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.

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At a maximum luminance level of 350 Nit, after 20.000 hours of operation ,the maximum decrease in phosphor luminance is 15 %.

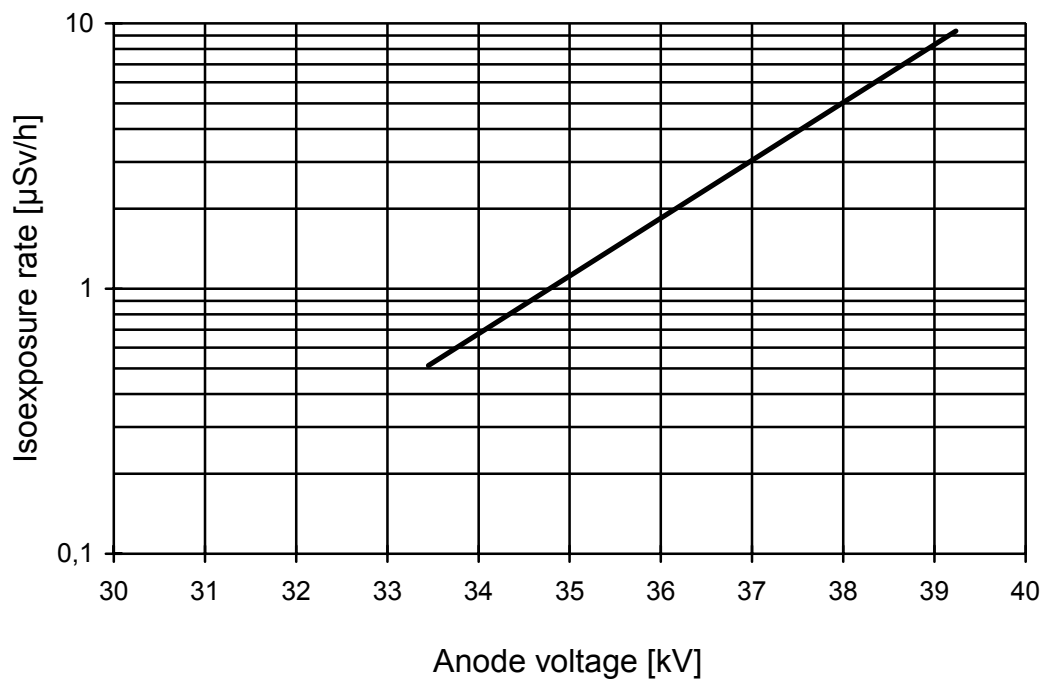
Stray emission : Maximum anode current in cut-off condition  $U_c - U_{g1} > U_{co}$  after 10.000 hrs. : < 1 µA

17 X-radiation

**X-Radiation Limit Curve**

**Conditions:**

**Cathode current  $I_c = 250 \mu A$**



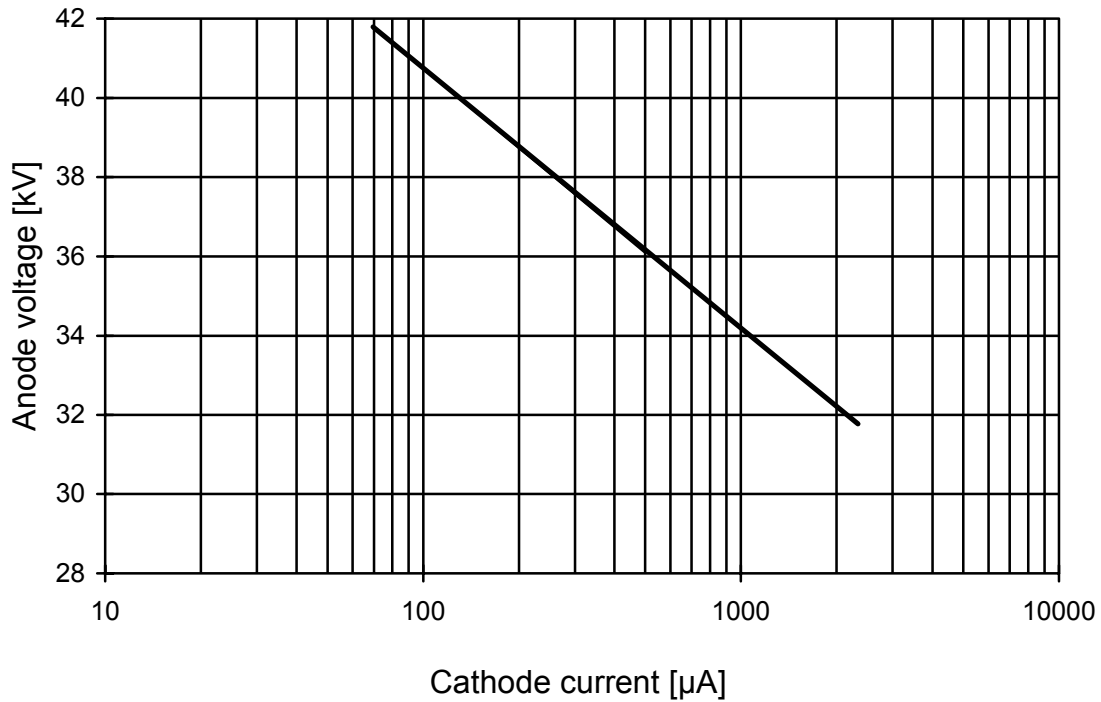
**X-Radiation exposure rate vs. anode voltage at a constant value of cathode current measured at 5 cm from the CRT.**

**The measurement is according:**

**“Röntgenverordnung der Bundesrepublik Deutschland vom 8. Januar 1987”**

**Isoexposure - Rate Limit Curve**

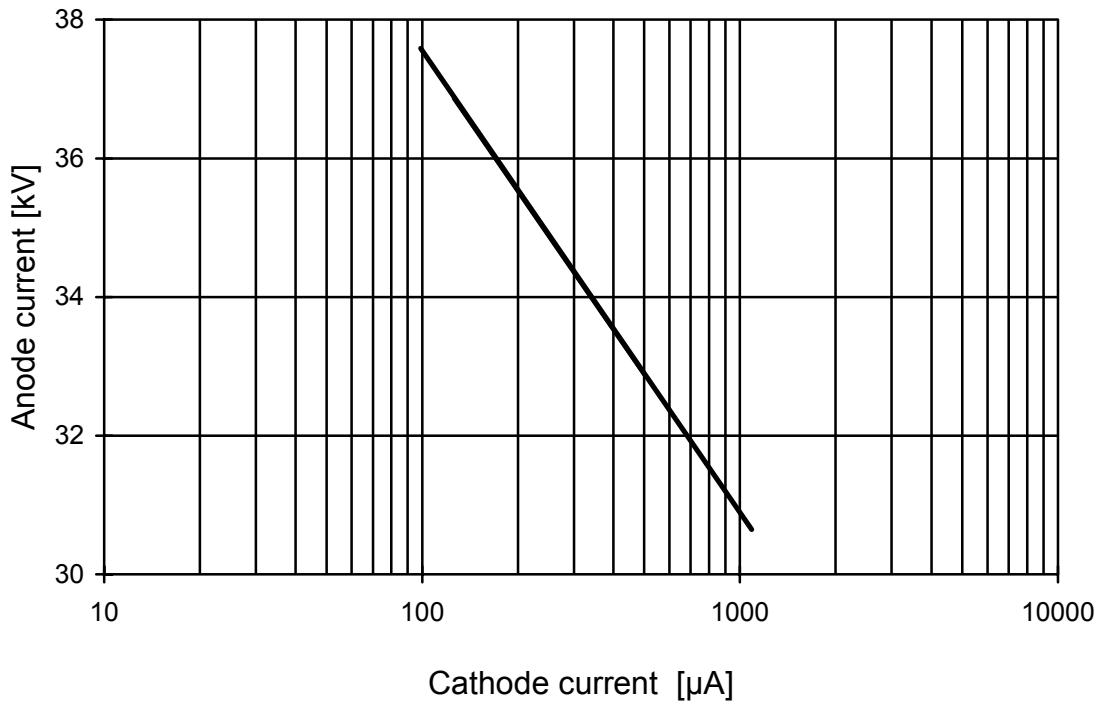
Calculated for 5  $\mu\text{Sv/h}$



This limit curve is plotted at an isoexposure rate of 5  $\mu\text{Sv/h}$  (0,5 mR/h) measured at 5 cm from the CRT.

**Isoexposure - Rate Limit Curve**

Calculated for 1  $\mu\text{Sv/h}$



**This limit curve is plotted at an isoexposure rate of 1  $\mu\text{Sv/h}$  (0,1 mR/h) measured at 5 cm from the CRT.**

