Specification

M 51EDF300WB70L

51 cm / 21 inch rectangular monochrome CRT

Landscape format

Status: Preliminary
Modifications may be agreed upon after evaluation of about 200 products.
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17 X-RADIATION
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:

<table>
<thead>
<tr>
<th>Company/Department</th>
<th>Name</th>
<th>Tel.</th>
<th>Date</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDS</td>
<td>P. Aerssens</td>
<td>+31 45 5439331</td>
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Siemens
A&D SE BT E

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<th>Date</th>
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<td>01</td>
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<td>08</td>
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Changed pages:

- 02: Type designation changed
- 01: Blemish specification changed
- 11: Blemish specification changed
- 16: Heater Cathode voltage
- 25: Drawing: brackets added
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 coated against charching
- intrinsically safe
- high contrast
- high luminance
- long life time

4 Important notes

<table>
<thead>
<tr>
<th>Implosion hazard</th>
<th>CRT is evacuated. In case of mechanical damage (e.g. by shock or scratches) implosion can occur.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT is labeled</td>
<td>UL 1418</td>
</tr>
<tr>
<td>according:</td>
<td>MPR II</td>
</tr>
<tr>
<td>High voltage</td>
<td>For reasons of the CRT’s capacities the anode connection can conduct high voltage for a long time after high voltage is switches off.</td>
</tr>
<tr>
<td>X-ray emission</td>
<td>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)</td>
</tr>
<tr>
<td></td>
<td>The tube is an intrinsic CRT type according the RöV (German Röntgenverordnung) dated Jan, 8th 1987, Part I; Attechment III, paragraph 6.</td>
</tr>
</tbody>
</table>
## 5 Mechanical Data

### Screen
- Rectangular, \( R = 1370 \) mm

### Useable screen
- Screen diagonal: min. 508.0 mm
- Screen width: min. 304.8 mm
- Screen height: min. 406.4 mm

### Position of operation
- Anode connector on top of tube

### 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 number: 250 898.ZZ
- THOMSON-Yoke No.: 9294.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 to an apparatus (see schematic in enclosure 1) 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 ± 1 mm.

- Phosphor material must be everywhere within a window of 300 × 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 symmetrical and equal 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 top of the tube,
  - 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: 49 % ± 3 % at 546 nm

Phosphor P45

7.1 Noise Power (see fig.)

Color coordinates: P45-Phosphor
at a luminance of 250 Cd/m² (Nit) with CL60-Filter,
(measured with LMT Color meter or Minolta CA100)
X = (0,250 ± 0,01) Y = (0,305 ± 0,01)

Front panel Transmission at 546 nm ca. 95% Coating Flabeg OEL-95
Direct coating alternative after agreement with customer. The connection with the mounting device aluminium strips are mounted on front panel.

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/m² (Nit) at any point of the screen.

Glass bulb Drawingnmbr. 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

\( d = 300 \text{ mm} \)
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 \( L/B > 3 \) \( G = \frac{L}{20} + 2B \)

Permissible defect (Panel included)

<table>
<thead>
<tr>
<th>Defect size G in mm</th>
<th>Number of defects Zone I</th>
<th>Number of defects Zone II</th>
<th>Number of defects Sum 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0,2</td>
<td>Within any area of 30 *30 mm only 3 phosphor defects with size 0.1 – 0.2 mm are allowed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,2 &lt; G &lt; 0,4</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>0,4 &lt; G &lt; 0,6</td>
<td>-</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Distance between defects</td>
<td>&gt; 50 mm</td>
<td>&gt; 50 mm</td>
<td></td>
</tr>
</tbody>
</table>

1) Maximum number of defects in zone I and II : 4

Scratches

Sum \( \leq 2 \)
distance \( > 50 \) mm
max. length \( < 10 \) mm
max. width \( < 50 \) µm

Scratches \( <15 \) µm are permitted

Not allowed defects:
Open holes, stones, folts, cracks, accumulated defects, ‘cloud’.
9 Resolution

50 % of peak value
Optimal focus: 300µA
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. 78°
- vertical ca. 60°
- diagonal ca. 90°

**Focussing electrostatic**

<table>
<thead>
<tr>
<th>Maximum currents (leakage)</th>
<th>$I_{G1}$</th>
<th>$\pm 1 \mu A$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{G2a}$</td>
<td>$\pm 1 \mu A$</td>
<td>max. 5 changes allowed</td>
</tr>
<tr>
<td>$I_{Gs}$</td>
<td>$\pm 1 \mu A$</td>
<td></td>
</tr>
<tr>
<td>$I_{G3}$</td>
<td>$\pm 2 \mu A$</td>
<td></td>
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</tbody>
</table>

**Capacity *)**
- (Grid 1 to all other electrodes) $C_{G1-all}$ 5,3 pF ± 1 pF
- (Cathode to all other electrodes) $C_{K}$ 3.5 pF ± 1 pF
- (Grid 1 to cathode) $C_{G1-K}$ 2,3 pF ± 0,7 pF
- (Anode to outer coating) $C_{A-M1}$ 1600 ... 3000 pF

**Electrical Data from Drawing nmbr. 250 898.ZZ**

- Horizontal deflection: $L_x$ 49,5 µH ± 5 %
- Rx 150 mΩ ± 10 %
- Vertical deflection: $L_y$ 1.83 mH ± 5 %
- Ry 3.28 Ω ± 10 %
- Rotationcoil: $R_r$ 133 Ω ± 10 %
- $I_r$ 47 mA / 1 °
- Astigmatism Axial: $L_a$ 23 µH ± 5 %
- $R_a$ < 6 Ω
- Astigmatism Diagonal: $L_d$ 23 µH ± 5 %
Rd $< 6 \, \Omega$

*) measured with PHILIPS RLC Meßbrücke PM6303
### 11 Absolute limiting values

Cathode is reference point for all voltage values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Voltage Value</th>
</tr>
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<tbody>
<tr>
<td>First accelerating voltage</td>
<td>$U_{G2,I&amp;II}$: max. 1300 V, min. - 400 V</td>
</tr>
<tr>
<td>Second accelerating voltage</td>
<td>$U_A$: max. 29.9 kV</td>
</tr>
<tr>
<td>Focus voltage</td>
<td>$U_{G4}$: max. 9 kV</td>
</tr>
<tr>
<td>Grid 1 voltage</td>
<td>$-U_{G1}$: max. 150 V (200 V for 5 sec. after switch off), min. 2 V</td>
</tr>
<tr>
<td>Heating against cathode</td>
<td>$U_{HC}$: negative 255 V, negative peak 300 V, positive 3 V, positive peak 50 V</td>
</tr>
<tr>
<td></td>
<td>$I_{HC}$: max. 15 µA</td>
</tr>
</tbody>
</table>

Grid 1 leakage resistance: $R_{G1} = 1.5 \, \text{M}\Omega$

Damping of deflection field: The power consumption of the horizontal deflection is allowed to increase by max. 1.4 W when yoke is mounted to the CRT. (at 80 kHz horizontal frequency, a retrace time of ≤ 2.5 µs and a horizontal width of 400 mm at $U_A = 27.5$ kV).
### 12 Operating values

**Cathode heating** - indirect
- Heating voltage: $U_h = 6.1 \, \text{V} \pm 2\%$
- Heating current: $I_h \approx 100 \, \text{mA}$; $I_{h\text{max}} = 0.5 \, \text{A (cold state)}$

Cathode is reference point for all voltage values following:

<table>
<thead>
<tr>
<th>Voltage Type</th>
<th>Symbol</th>
<th>Range</th>
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</thead>
<tbody>
<tr>
<td>First accelerating voltage</td>
<td>$U_G^1$</td>
<td>600 - 930 V</td>
</tr>
<tr>
<td>Halo suppression voltage</td>
<td>$U_G^{II}$</td>
<td>0 - 200 V</td>
</tr>
<tr>
<td>Grid 1 voltage (spot suppression)</td>
<td>$U_G^1$</td>
<td>105 V</td>
</tr>
<tr>
<td>Second accelerating voltage</td>
<td>$U_A$</td>
<td>29.0 kV</td>
</tr>
<tr>
<td>Drive voltage (grid drive)</td>
<td>$\Delta U_{WE}$</td>
<td>max. 85 V</td>
</tr>
<tr>
<td>(from $I_C = 0 , \mu\text{A}$ to $I_C = 1200 , \mu\text{A}$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminance drift over time</td>
<td></td>
<td>max. 18 minutes after switch on</td>
</tr>
<tr>
<td>(an overshoot of max 10% of cutoff voltage is allowed during this time)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focus voltage (at centre of screen at $I_C = 300 , \mu\text{A}$)</td>
<td>$U_G^3$</td>
<td>min. 6.80 kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>nom. 7.15 kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>max. 7.50 kV</td>
</tr>
<tr>
<td>Dynamic focus voltage (with reference to Thomson-yoke Nr. 9294.xx)</td>
<td>$U_{G^3\text{dyn.}}$</td>
<td>max. = 850 V</td>
</tr>
</tbody>
</table>
13 Grid drive characteristics

Luminance at 100% Transmission
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 Microvision system 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.

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

X-Radiation Limit Curve

Conditions:
Cathode current $I_C = 250 \, \mu A$

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 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.