Panasonic

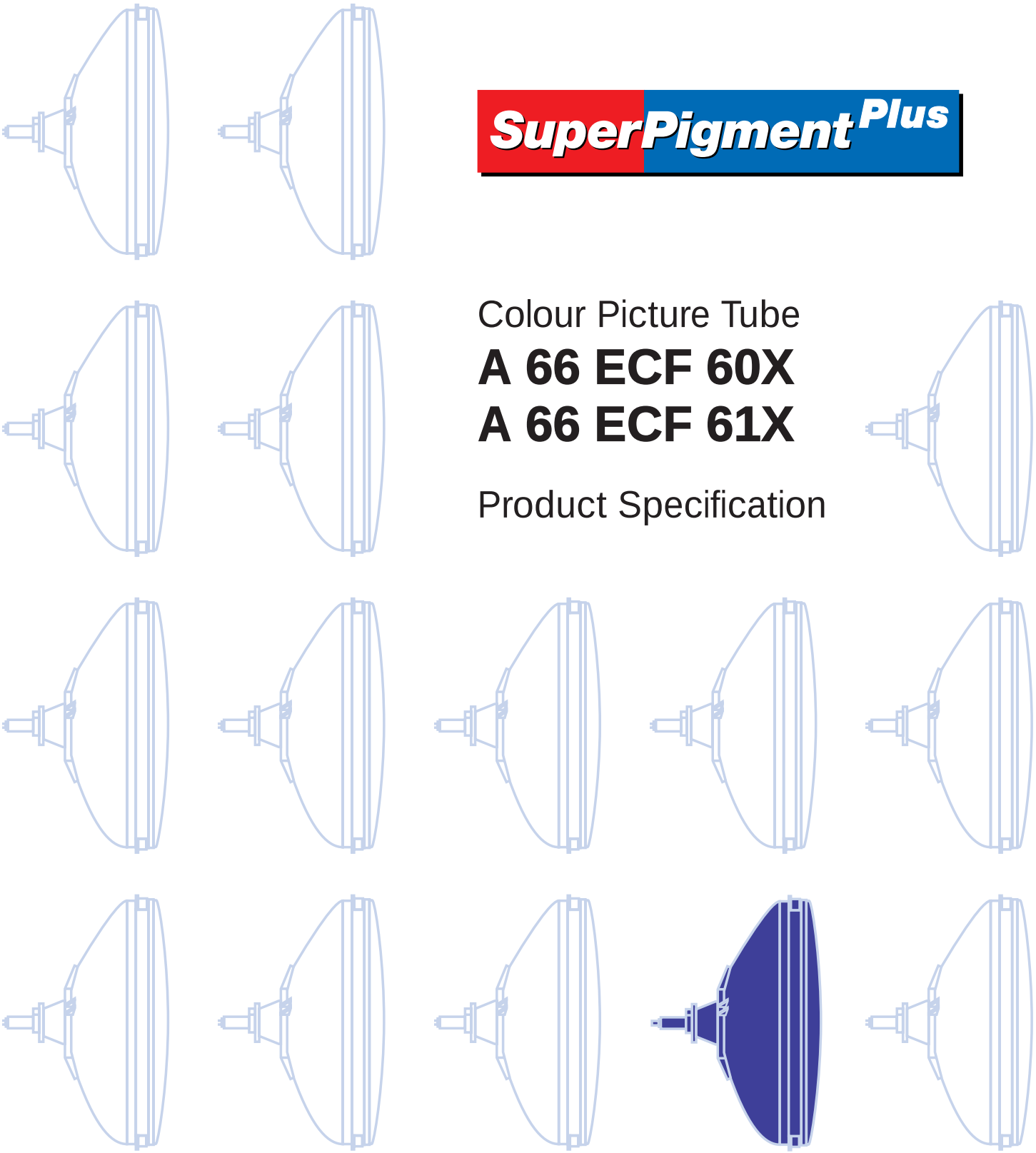


SuperPigment Plus

Colour Picture Tube

# A 66 ECF 60X
# A 66 ECF 61X

Product Specification



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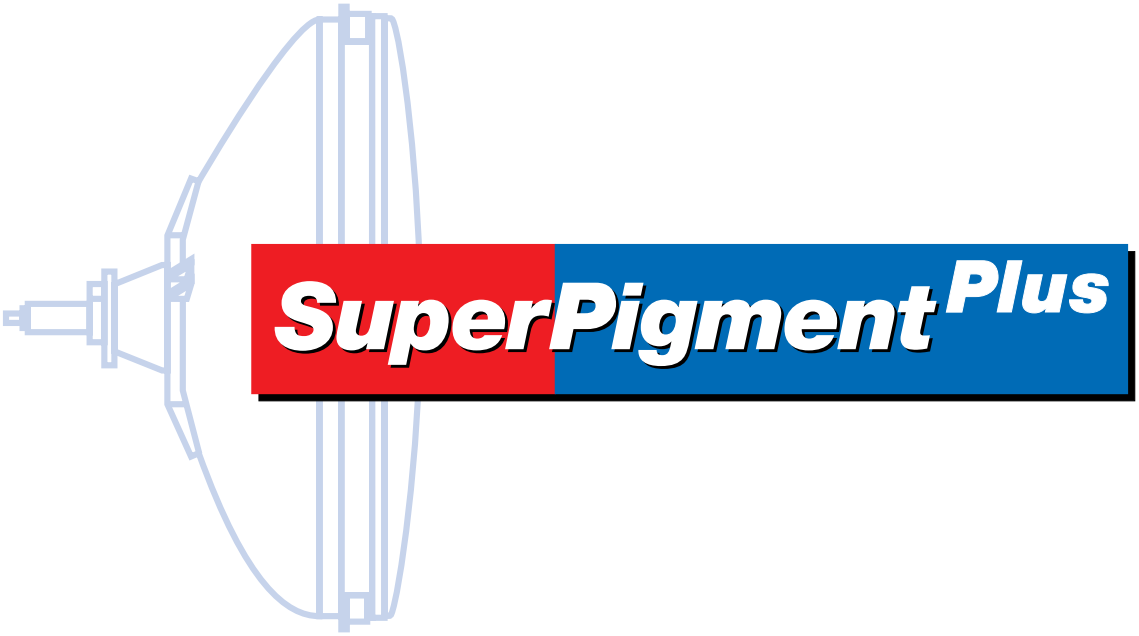
**For design purposes use only 1:1 drawings**

# Product specification

## Colour Picture Tube

... is a 28” SuperPigment Plus Colour Picture Tube with a glass diagonal of 70 cm  for TV use.
The A 66 ECF 60/61 X ... is a 4:3 Super Flat Square Colour Picture Tube with an Invar Mask.




# A 66 ECF 60X
# A 66 ECF 61X

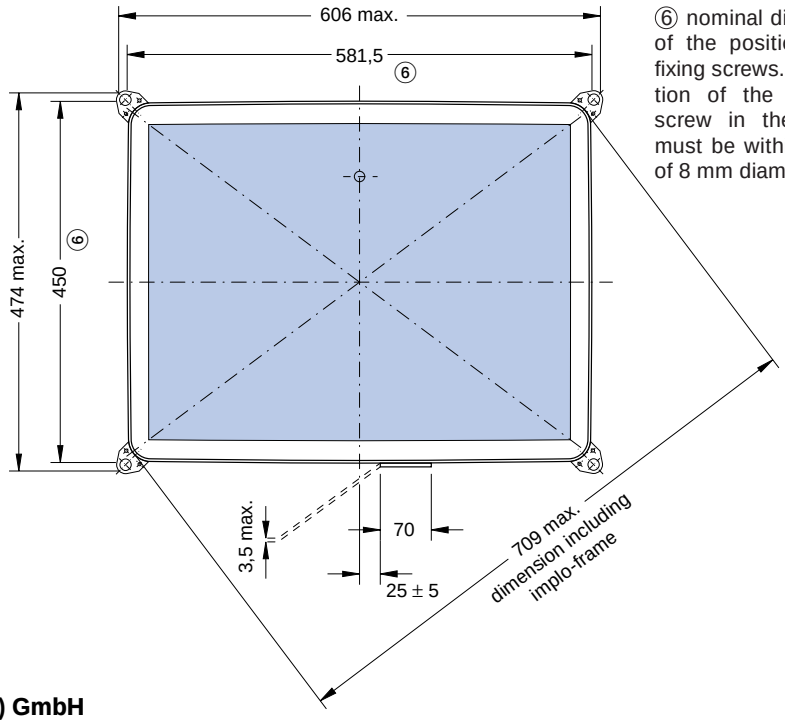
***1***
***Contents***

## *2 List of Figures and Tables*

## *3 Short Description*

| | | |
|---|---|---|
| Useful screen diagonal | 66 cm | Heater voltage (stab.) $U_F$ = 6,3 V |
| Glass diagonal | 70 cm | Heater current $I_F$ = 320 ± 20mA |
| Deflection angle | 110° | Anode voltage with full load |
| Neck diameter | 29,1 mm | $U_A$ = 25 - 29,9 kV |
| Overall length | 433 mm | Focusing voltage 26,6 - 30% $U_A$ |
| Mass | 24,2 kg | |
| Glass transmission | | |
| effective | | 48 % |
| equivalent due to superpigment | | 44% |
| Aspect ratio | | 4:3 |
| Screen | | vertical line with black matrix<br>flat and square |
| Phosphors | | cadmium free green, gold activated,<br>superpigmented high Europium red<br>superpigmented blue |
| Shadow mask assembly | | slotted type, invar<br>temperature compensated<br>anti doming treated |
| Electron gun | | in-line, Hi-Bi potential<br>Quadrupole Inline Gun (QIG)<br>internal or external multipole unit |
| Magnetic shield | | inner magnetic shield |
| Implosion protection | | shrink frame technology |
| Base cap | | B12-285 |

Figure 1
Tube Dimensions, Front View




⑥ nominal dimensions of the position of the fixing screws. The position of the mounting screw in the cabinet must be within a circle of 8 mm diameter.

| | |
|---|---|
| Exposure | northern hemisphere |
| Scanning-line system | 625 scanning lines |
| Deflection yoke | * north/south pincushion free,<br>* self converging<br>* 50 or 100 Hz<br>* fully coma corrected |
| Other features | * soft flash technology<br>* optional SVM coil<br>* Cathode ray tube intrinsically safe up to 29,9 kV according to appendix III Röntgenverordnung (newly issued 8.1.1987). |

Figure 2
Tube Dimensions, Side View

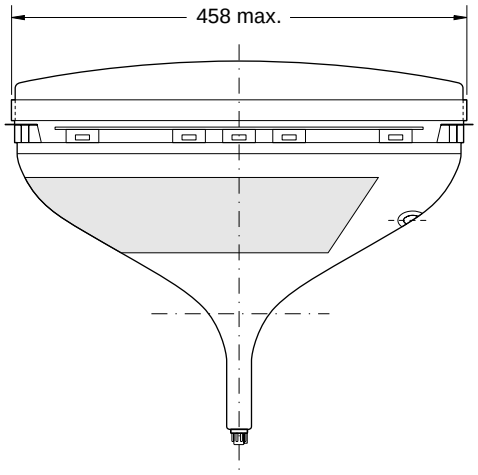
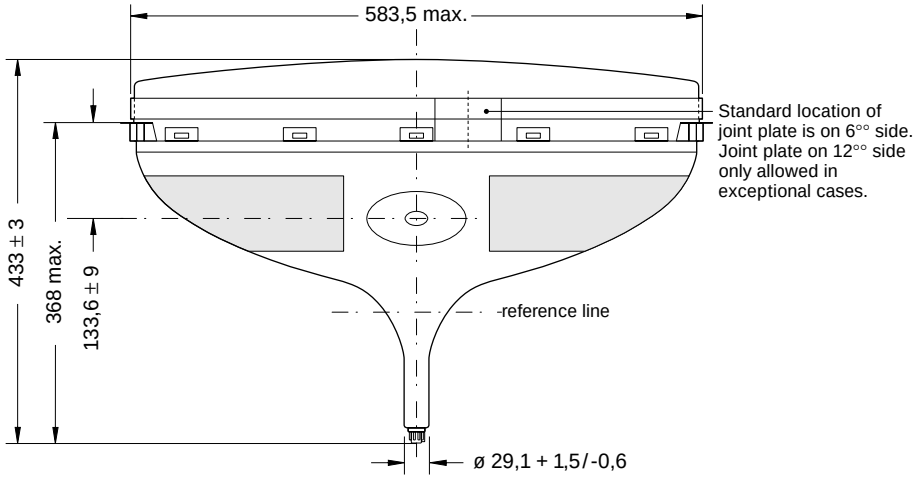



Figure 3
Tube Dimensions, Top View



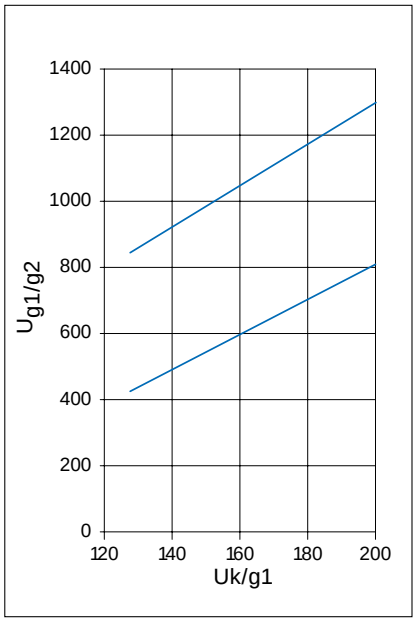
## *4*
## *Typical Operating Conditions*

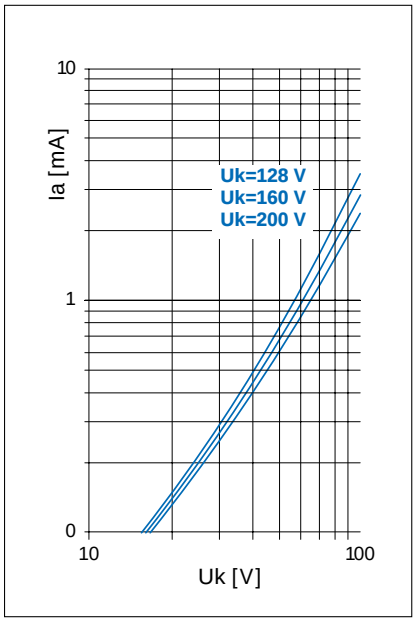
Voltages are specified with respect to grid 1

| | |
|---|---|
| Anode voltage | $U_A$ = 27 - 29 kV |
| Focusing voltage | $U_{G3}$ = 7,0 - 8,7 kV |
| Cut-off voltage grid 2 ($V_{kc}$ = 160V) | $U_{G2}$ = 600 - 1050 V |
| Heater voltage (stab.) | $U_F$ = 6,3 V |
| Heater current | $I_F$ = 320 ± 20 mA |

Figure 4 (left)
Cut-off Voltage Range

Figure 5 (right)
Video Drive Characteristics




## *5*
## *Circuit Design Values*

Voltages are specified with respect to grid 1

| | |
|---|---|
| Anode voltage | $U_A$ = 25 - 29 kV |
| Grid 3 focus voltage | $U_{G3}$ = 26,6 - 30% of $U_A$ |
| Grid 1 reference point | $U_{G1}$ = 0 V |
| Cut-off voltage range | Figure 4 |
| Grid 2 cut-off voltage | $U_{G2}$ = 600 - 1050 V |
| Recommended cathode voltage for black level adjustment. | $U_K$ = 160 V |
| Video drive characteristics | Figure 5 |
| Grid 1 to all other electrodes | $C_{G1}$ = 11,4 pF |
| Cathode to all other electrodes | $C_K$ = 4,5 pF |
| Grid 3 to all other electrodes | $C_{G3}$ = 8,0 pF |
| Anode to external conductive coating | $C_{A/M}$ ~ 2000 pF |
| Anode to metal rimband | $C_{A/Z}$ ~ 400 pF |

| | | | |
|---|---|---|---|
| Leakage current cathode-heater | $I_{KF\ max}$ | = 5 | µA |
| Test conditions | $U_A$ | = 0 | V |
| grid 1, 2 and 3 has to be connected | $U_{KF}$ | = 300 | V |
| to the cathode of the gun in test. | | | |

| | | | |
|---|---|---|---|
| Leakage currents, flashovers, stray emission | | | |
| Test conditions | $U_K$ | = 170 | V |
| for these three items. | $U_A$ | = 29,9 | kV |
| | $U_{G2}$ | = 400 | V |

| | | | |
|---|---|---|---|
| Leakage currents | | | |
| grid 3 | $I_{G3\ max.}$ | = ± 3 | µA |
| grid 2 | $I_{G2\ max.}$ | = ± 2 | µA |
| grid 1 | $I_{G1\ max.}$ | = ± 2 | µA |

| | | | |
|---|---|---|---|
| Flashovers | $U_{G3}$ | = 8,4 | kV |
| within 1 minute | max. 2 | | |
| within 15 minutes | max. 5 | | |

| | | | |
|---|---|---|---|
| Stray emission | | | |
| Vertical deflection switched off. | $U_{G3}$ | = 8,4 | kV |
| No brightening on screen visible. | | | |

| | | | |
|---|---|---|---|
| Warm-up-time | approx. 8 s | | |
| Test conditions | $U_F$ | = 6,3 | V |
| | $R_1$ | ~ 0,1 | Ω |
| Regulated power supply | I | > 6 | A |

The measuring time is from switch on of the heaters until a grid is visible.
Brightness and contrast controls should be set for normal operation.

| | | |
|---|---|---|
| Colour coordinates | x | y |
| red | 0,645 | 0,325 |
| green | 0,305 | 0,595 |
| blue | 0,15 | 0,065 |

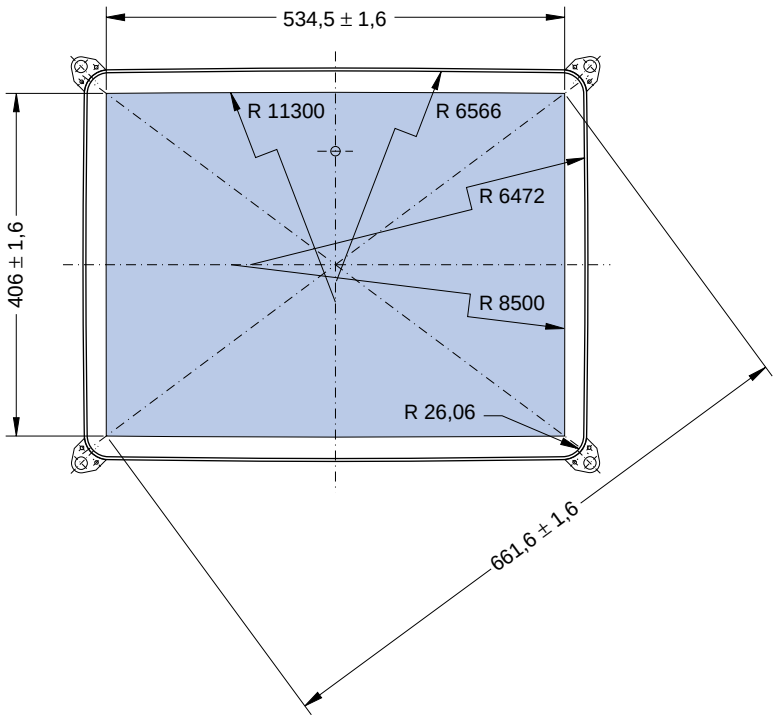
| | | |
|---|---|---|
| Cathode currents for white | D | = 6500 K +7 M.P.C.D. |
| | *D* | *= 7200 K -10 M.P.C.D.* |
| ClE-coordinates | x | = 0,313 / *0,304* |
| | y | = 0,329 / *0,307* |
| red | 42% / *38%* | |
| green | 33% / *33%* | |
| blue | 25% / *29%* | |

| | | |
|---|---|---|
| Cathode current ratio | | |
| red-blue | 1,06.....2 | *0,98....1,68* |
| red-green | 0,97.....1,53 | *1,03....1,63* |
| blue-green | 0,64.....1,1 | *0,80....1,20* |

## *6*
## *Glass- and Screen Data*
(see Figure 6)

| | |
|---|---|
| Glass transmission at screen centre | 48% |
| Brightness at the screen centre | 100 cd/m² ± 10% |
| Test conditions | $U_A$ = 27,5 kV, $I_A$ = 1 mA |
| Overscanning | 105% |
| Exact adjustment for horizontal and vertical linearity | |
| Colour temperature white | D 6500 K |
| Phosphors | |
| green - | cadmium free, gold activated |
| blue - | superpigmented blue |
| red - | superpigmented high Europium red |
| Persistence of phosphors | |
| Time to decay to 10% of initial peak value - medium short | |
| red | ca. 100 µs |
| green | 20 - 40 µs |
| blue | 11 - 17 µs |
| Pitch at the centre of tube (horizontal screen pitch - center to center distance of identical colour phosphor stripes) | 0,80 mm |
| Surface | polished |
| Visible screen area | 2152 cm² |
| Deflection angle | |
| diagonal | 110° |
| horizontal | 94° |
| vertical | 75° |

Figure 6
Phosphor and Screen Dimensions



## *7 Notes for Test and Adjustment*

Adjustment of focus voltage $U_{G3}$
Conditions: $U_A$ = 26,5 kV, $U_K$ = 160 V,
$I_{AP}$ = 3,5 mA ①

Test chart crosshatch pattern
18 squares = 19 grid lines horizontal
14 squares = 15 grid lines vertical
105% picture width and height.
Optimal adjustment of focus between horizontal- and vertical lines at the centre of the screen.

---

Test cut-off voltage area $U_{G2}$
Conditions: $U_A$ = 26,5 kV
Beam undeflected and brightness- and contrast controls to minimum.
$U_K$ at the cathode to be tested $U_K$ = 160 V
$U_K$ to other cathodes $U_K$ = 250 V
Turn $U_{G2}$-control from 300 V to cut-off.
The cut-off has to be within the range of 600 - 1050 V.
① The peak beam current of 3,5 mA corresponds roughly to 400 µA average.

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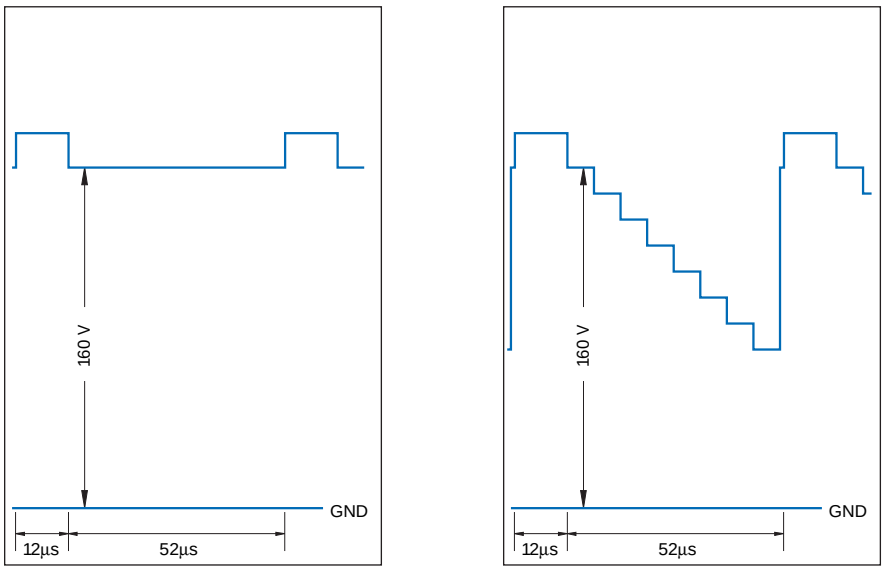
Figure 7
Recommended Cathode Voltage




Adjustment of grid 2 voltage $U_{G2}$

a) Individual cut-off adjustment
Set brightness- and contrast controls to minimum. All three cathodes at 160V. Increase $U_{G2}$ until the cut-off spot of the first gun appears. Reduce $U_K$ of the two other guns until their cut-off spot is reached.

b) Automatic cut-off with black-level clamping
Set brightness- and contrast controls to minimum. Connect one of the three cathodes to an oscilloscope. Set DC-input to display 200 V. Turn $U_{G2}$-control to the recommended cathode voltage of 160 V.

c) Automatic cut-off without black-level clamping
Test pattern grey scale.
Adjust contrast- and brightness-controls to linear grey scale.
Absolute values of voltage jumps from step to step are constant.
The last grey value is different to the black level. Set contrast control at $I_A$ ~ 500 µA. Turn $U_{G2}$-control to the recommended cathode voltage of 160 V, (see figure 7).

## *8 Mechanical Data and Dimensional Drawings*

| | |
|---|---|
| Overall length | 433 ± 3 mm |
| Neck diameter | 29,1 +1,5/-0,6 mm |
| Outside dimensions | |
| Diagonal (including rimband) | 709,0 mm max. |
| Horizontal (including lugs) | 606,0 mm max. |
| Vertical (including lugs) | 474,0 mm max. |
| Screen Dimensions | |
| Diagonal | 661,6 ± 1,6 mm |
| Horizontal | 534,5 ± 1,6 mm |
| Vertical | 406,0 ± 1,6 mm |
| Area | 2.152 $cm^2$ |
| Base | JEDEC B 12-285 |
| Anode contact | 7,92 IEC 67-III-2, JEDEC J1-21 |
| Weight | appr. 24,2 kg |

Notes to outline drawings

① Anode contact 7,92 according to IEC 67-III-2, JEDEC J1-21
② This area is free of external conductive coating and must be kept clean.
③ Implosion protection frame and external conductive coating are galvanically separated from each other. They can be connected taking into consideration the existing safety regulations.
④ The external conductive coating must be connected to the negative high voltage terminal. Conduction cross-section A=1 $mm^2$.
⑤ The tube base is in a circle of a diameter max. = 55 mm with respect to the tube axis. The socket has to be connected by flexible wires only.
⑥ Nominal dimensions of the position of the fixing screws. The nominal dimensions are designed for the use of fixing screws with a diameter up to 10 mm.
⑦ One out of the four mounting lugs may deviate by max. 1,8 mm to the plane of the other three.
⑧ Z-points are reference points for the distance to X and Y. (Figure 9)
⑨ When inserting fixing clips for degaussing coil - avoid damage of frit seal or glass, avoid deformation of rimband, soft plastic clips are recommended.
⑩ The rectangular slots in the rimband can be used for the plastic degaussing coil mounting clips.

Figure 8
Anode Contact ①

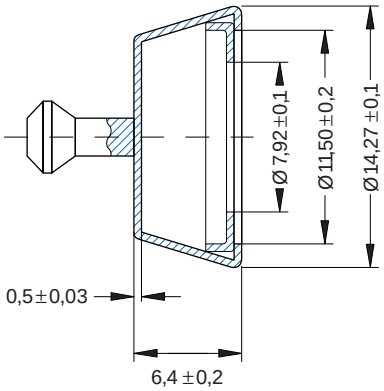



Figure 9
Panel Reference Points ⑧

Definition of outside screen curvature

**$Z=Sum(Ai \bullet X^{Ni} \bullet Y^{Mi})$**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A1 | = | 0,294146511 | E-03 | N (1) | = 2 | M (1) | = 0 |
| A2 | = | 0,285406567 | E-09 | N (2) | = 4 | M (2) | = 0 |
| A3 | = | -0,128200388 | E-14 | N (3) | = 6 | M (3) | = 0 |
| A4 | = | 0,292828301 | E-03 | N (4) | = 0 | M (4) | = 2 |
| A5 | = | 0,785337389 | E-09 | N (5) | = 2 | M (5) | = 2 |
| A6 | = | -0,103338210 | E-13 | N (6) | = 4 | M (6) | = 2 |
| A7 | = | 0,520068152 | E-19 | N (7) | = 6 | M (7) | = 2 |
| A8 | = | 0,364020149 | E-09 | N (8) | = 0 | M (8) | = 4 |
| A9 | = | -0,115858396 | E-13 | N (9) | = 2 | M (9) | = 4 |
| A10 | = | 0,134566027 | E-18 | N(10) | = 4 | M(10) | = 4 |
| A11 | = | -0,474903919 | E-24 | N(11) | = 6 | M(11) | = 4 |
| A12 | = | -0,230485665 | E-14 | N(12) | = 0 | M(12) | = 6 |
| A13 | = | 0,627741552 | E-19 | N(13) | = 2 | M(13) | = 6 |
| A14 | = | -0,240675762 | E-24 | N(14) | = 4 | M(14) | = 6 |
| A15 | = | -0,237245485 | E-29 | N(15) | = 6 | M(15) | = 6 |

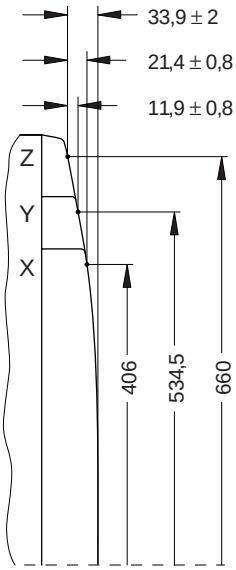
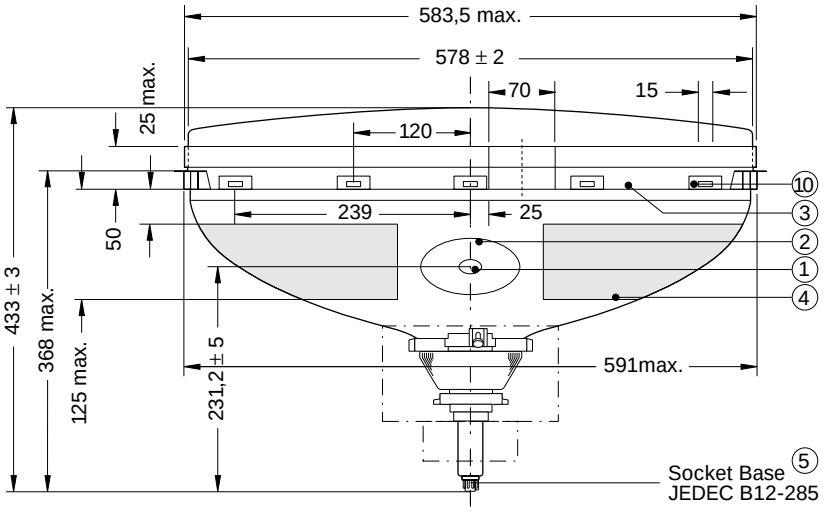



Figure 10
Overall Dimensions of Tube, Top View

**<u>For design purposes use only 1:1 drawings</u>**




Standard location of joint plate is on 6°° side.
Joint plate on 12°° side only allowed in exceptional cases.

Figure 11
Overall Dimensions of Tube,
Side View

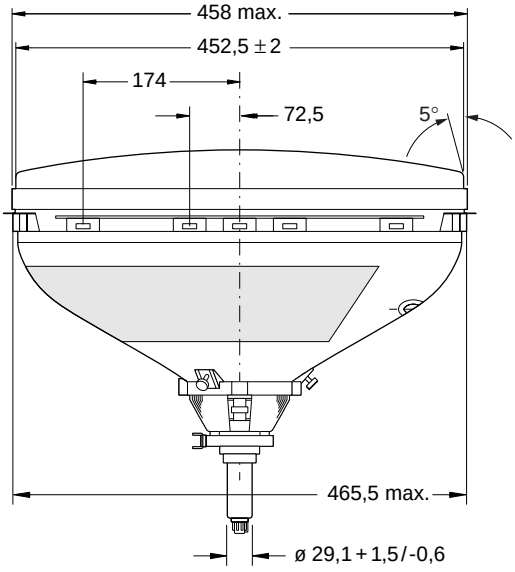
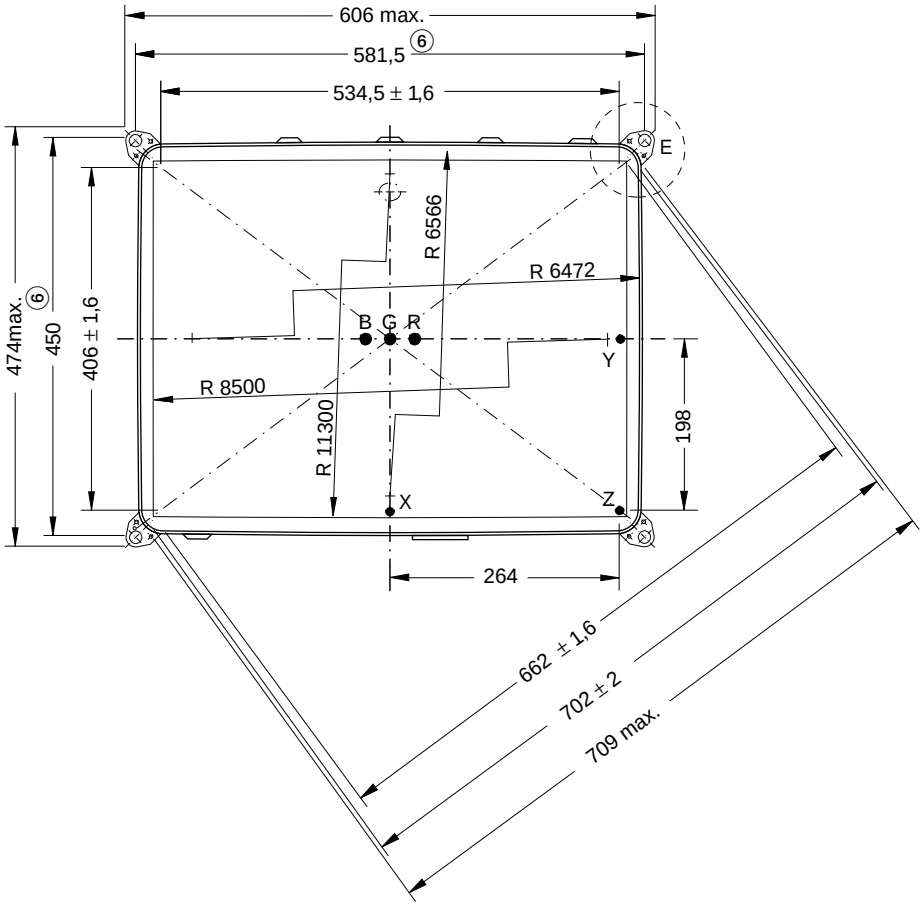



Figure 12
Overall Dimensions of Tube,
Front View




**For design purposes use only 1:1 drawings.**

Figure 13
Detail E, Dimensions of Lug

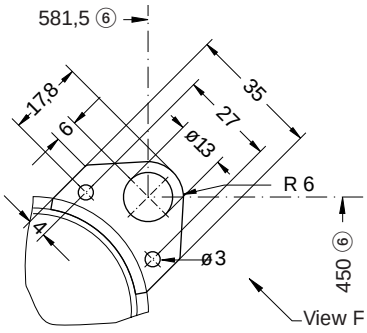



Figure 14
Dimensions of Lug, View F

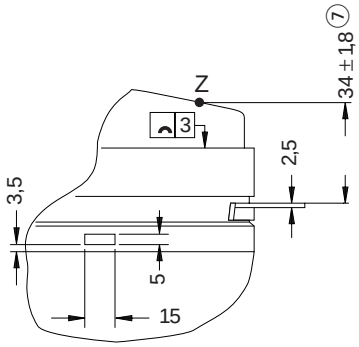
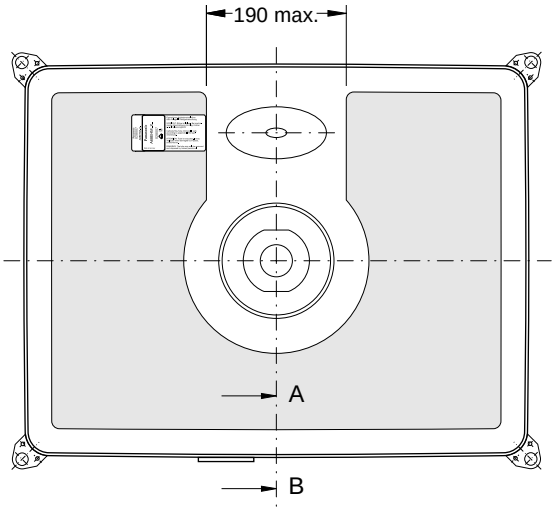



Figure 15
External Coating




**<u>For design purposes use only 1:1 drawings.</u>**

Figure 16
Implosion Frame
(External Coating, Section A - B)

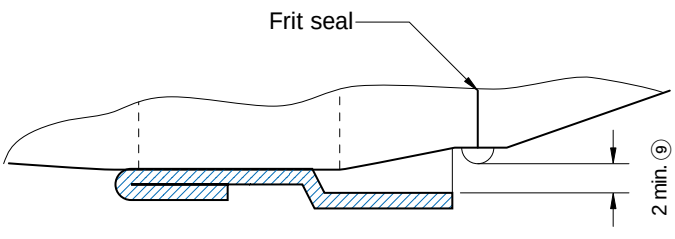
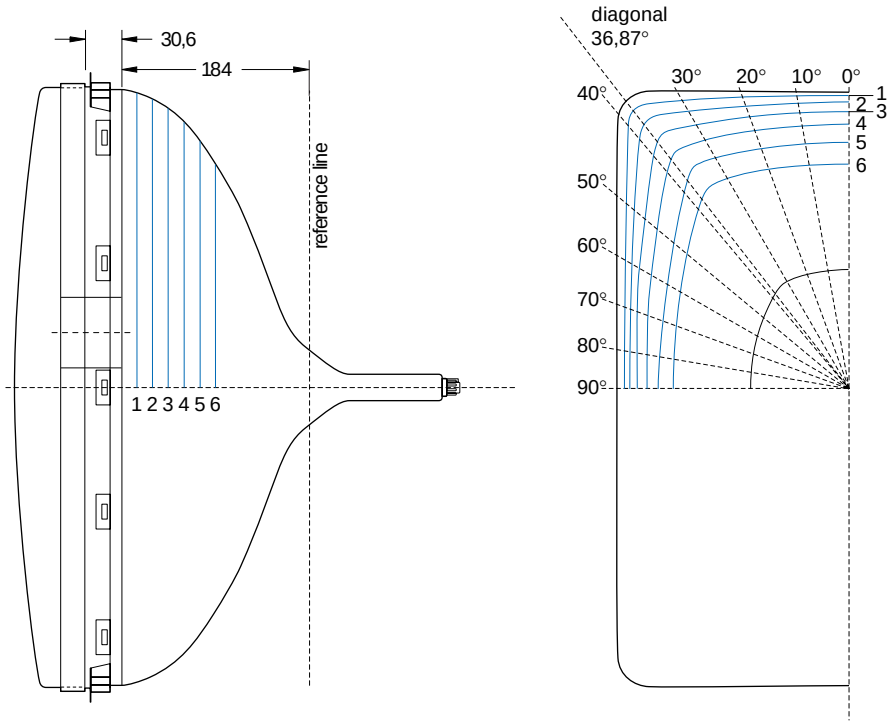


Figure 17
Funnel Radial Coordinates



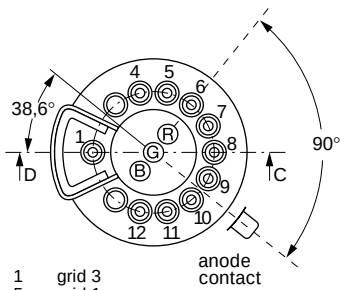

**For design purposes use only 1:1 drawings.**

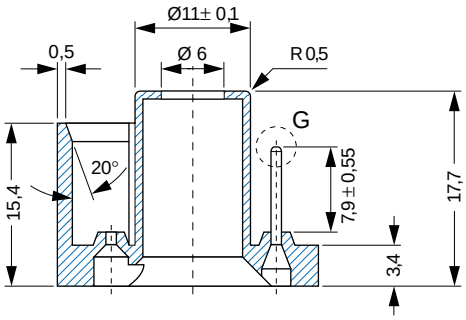
***Nominal Outside Contour Radial Coordinates***

| No. | Height from ref. line | Major Axis 0° | 10° | 20° | 30° | Diag. Axis 36,87° | 40° | 50° | 60° | 70° | 80° | Minor Axis 90° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 164,8 | 283,4 | 287,4 | 300,2 | 323,5 | 342,5 | 333,8 | 283,4 | 252,2 | 233,2 | 222,9 | 219,6 |
| 2 | 149,8 | 275,9 | 279,5 | 290,7 | 311,0 | 325,7 | 315,3 | 271,2 | 243,2 | 225,9 | 216,4 | 213,4 |
| 3 | 134,8 | 267,4 | 270,3 | 279,6 | 295,8 | 305,3 | 294,3 | 257,1 | 232,7 | 217,2 | 208,7 | 206,0 |
| 4 | 119,8 | 255,5 | 257,9 | 265,4 | 278,3 | 283,3 | 272,7 | 241,3 | 220,2 | 206,6 | 199,0 | 196,6 |
| 5 | 104,8 | 237,9 | 240,0 | 246,6 | 257,8 | 260,2 | 250,6 | 223,9 | 205,6 | 193,7 | 186,9 | 184,8 |
| 6 | 89,8 | 216,0 | 218,0 | 224,2 | 234,9 | 235,4 | 227,0 | 204,2 | 188,3 | 177,9 | 171,9 | 170,0 |

Figure 18 (left)
Tube Base

Figure 19 (right)
Tube Base, Section C - D



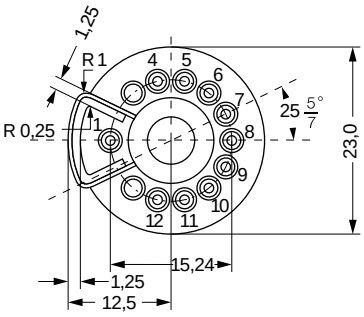

| | |
|---|---|
| 1 | grid 3 |
| 5 | grid 1 |
| 6 | cathode green |
| 7 | grid 2 |
| 8 | cathode red |
| 9 | heater |
| 10 | heater |
| 11 | cathode blue |

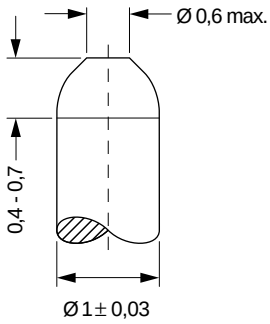
anode: grid 4, screen mask

unused pins 4 and 12 must not be connected

tube base JEDEC-Nr. B 12-285

Detail G




**For design purposes use only 1:1 drawings**

***9***
***Limiting Values***

| | | | | | |
|---|---|---|---|---|---|
| Heater voltage | $U_F$ | | = | 6,1 - 6,5 | V (I) |
| Anode voltage | $U_A$ | max | = | 29,9 | kV |
| Anode voltage | $U_A$ | min. | = | 25 | kV |
| Anode current | $I_A$ | max. | = | 1,5 | mA (IV) |
| Focusing voltage grid 3 | $U_{G3}$ | max. | = | 12 | kV |
| Voltage between grid 3 and grid 4 | $U_{G3/G4}$ | max. | = | 20 | kV |
| Screen grid voltage peak | $U_{G2p}$ | max. | = | 1,5 | kV |
| Cathode voltages | | | | | |
| positive | $U_K$ | max. | = | 200 | V |
| negative | $-U_K$ | max. | = | 0 | V |
| positive peak voltage | $U_{KP}$ | max. | = | 400 | V |
| negative peak voltage | $-U_{KP}$ | max. | = | 2 | V |
| Voltages between heater and cathode | | | | | |
| Heater negative to cathode | $U_{-FK}$ | max. | = | 450 | V (II) |
| Heater positive to cathode | $U_{+FK}$ | | = | 0 | V |
| Heater to cathode peak voltage Heater negative to cathode | $U_{-FKP}$ | max. | = | 300 | V |
| Heater to cathode peak voltage Heater positive to cathode | $U_{+FKP}$ | max. | = | 180 | V |

**Shock acceleration during transport and handling (</= 350 m/s²)** (III)

(I) To secure good emission characteristics through the life, it is recommended to regulate the heater voltage at 6,3 V.

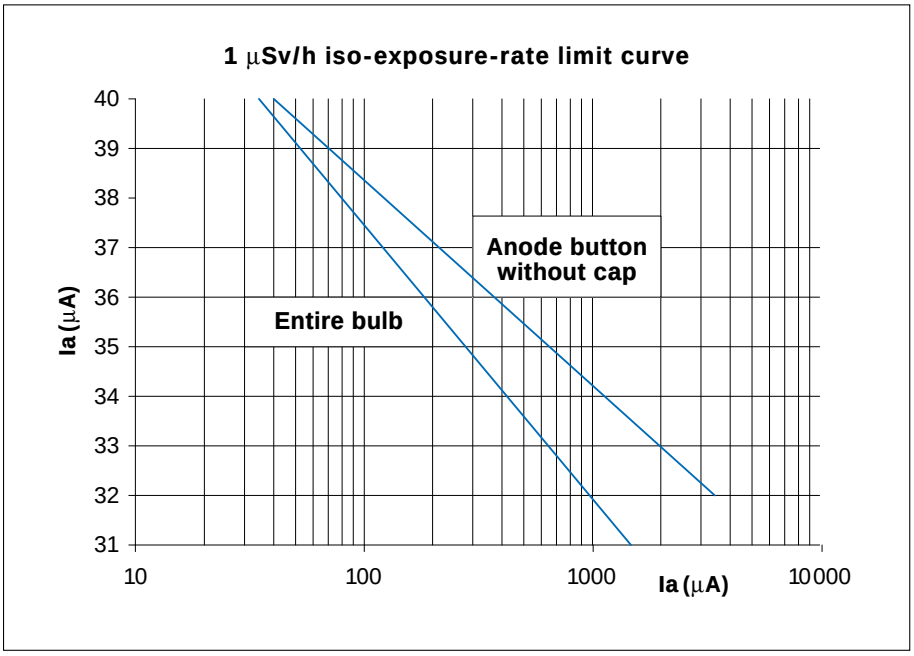
(II) During warm up period of max. 15 sec the maximum voltage between heater and cathode must not exceed 450 V. This voltage must be reduced to 250 V at least time proportionally within 45 sec.

(III) The tube has an integrated implosion protection according to VDE and BSI requirements. Rough tube mechanical treatment might lead to implosions.

(IV) short term average (with ABL circuit) $I_{A\ max.}$ = 1,5 mA
long term average (with ABL circuit) $I_{A\ max.}$ = 1,2 mA

| | | |
|---|---|---|
| Cut-off voltage ratio | $U_K$-Quotient | = 1,25 |
| X-radiation | max. 1 µSv/h | |
| Test conditions<br>Dose rate measuring in the distance of 100 mm to the glass surface. | | |
| ISO-dose rate<br>Maximum<br>Parameters:<br>Anode voltage - anode current | Figure 20<br>1 µSv/h | |

Figure 20
ISO Dose Rate



***10***
***Screen- and Glass-Blemishes***
***Limits***

| | |
|---|---|
| Contrast blemishes<br>Bubbles in glass, missing phosphor, black spots. | Figure 21 + 22 |
| The size of the blemish is defined by length plus width divided by two. Judgement of defects should not be done before 10 minutes after switch on. | (L + W) / 2 |
| Viewing distance to classify the contrast degree is | 60 cm |
| For definition of defect size and contrast degree template can be used. | |
| **Defects with high contrast**<br>The defect remains visible if template is moved from 0,7 to 1,3 filter. | |
| **Defects with medium contrast**<br>Defect disappears if template is moved from 0,7 to 1,3 filter. | |
| Screen zones<br>Zone A, centre area<br>Zone B, outside area<br>Zone C is defined as the unscreened area of the faceplate. | see Figure 23<br>260 x 200 mm |

Figure 21
Blemishes, High Contrast

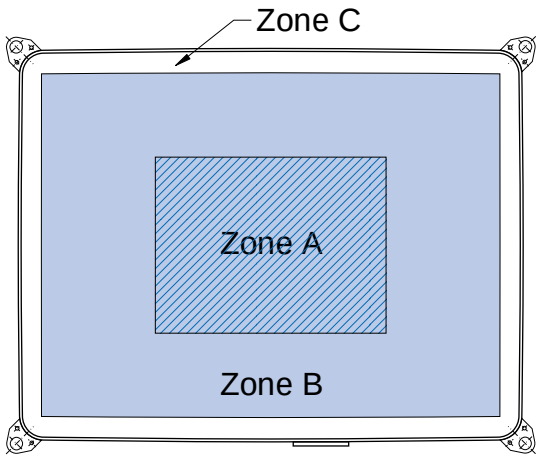
| Blemish size (mm) | Limited blemishes A | A+B | Distance (mm) |
|---|---|---|---|
| >1,0 | 0 | 0 | - |
| 0,8...<1,0 | 0 | 1 | - |
| 0,5...<0,8 | 1 | 3 | 80 |
| 0,25..<0,5 | 2 | 4 | 50 ① |
| < 0,25 ② | unlimited | unlimited | - |

① Accepted are three defects, minimum distance of 2 failures is 50 mm.
② Blemish size unlimited. Limited only by cloud in a viewing distance of 1 m.

Figure 22
Blemishes, Medium Contrast

| Blemish size (mm) | Limited blemishes A | A+B | Distance (mm) |
|---|---|---|---|
| >1,0 | 0 | 0 | - |
| 0,8...<1,0 | 1 | 2 | 80 |
| 0,5...<0,8 | 4 | 8 | 50 ① |
| < 0,5 ② | unlimited | unlimited | - |

Figure 23
Screen Zones




| | |
|---|---|
| Scratches on the faceplate | (see Figure 24) |
| The sum of all scratches with a width of 0.05-0.15 mm should not exceed 180 mm. | |
| Viewing distance | ~1,5 m |
| Ambient light (activated screen) | ~1 Lux |
| Ambient light (non-activated screen) | ~1.000 Lux |

Figure 24
Scratches on the Faceplate

| Width (mm) | Length (mm) | Distance (mm) |
|---|---|---|
| </= 0,05 | unlimited | - |
| 0,05...<0,10 | 50 | 19 |
| 0,10...</= 0,15 | 13 | 45 |
| > 0,15 | - | - |

Figure 25
Stains on the Faceplate

| Stain size (mm) | Limited stains A | A+B | Distance (mm) |
|---|---|---|---|
| >1,3 ... </= 1,8 | 1 | 2 | 80 |
| >0,8 ... </= 1,3 | 2 | 3 | 80 |

## *11 Geometry and Convergence Specification*

For the judgement of geometry and convergence the following conditions are valid:

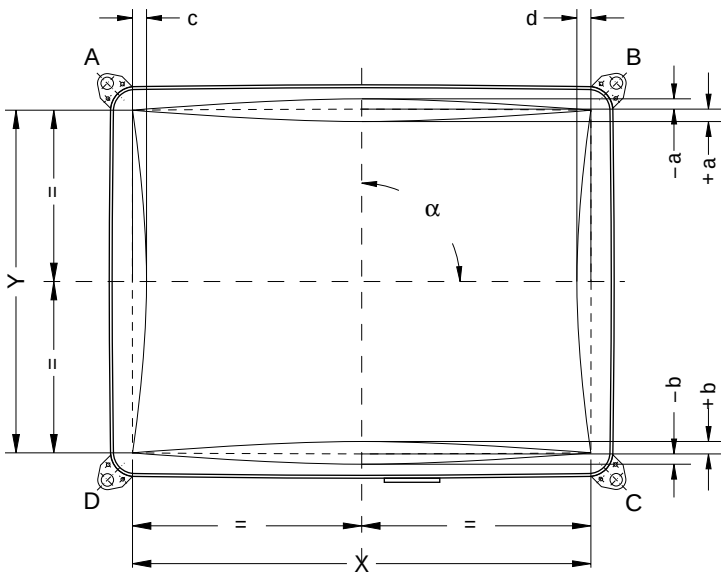
| | | | |
|---|---|---|---|
| 1. Warm up time | 15 min | | |
| 2. Anode voltage | $U_A$ | = | 27,5 kV |
| 3. Heater voltage | $U_F$ | = | 6,3 V |
| 4. $U_{G2}$ adjustment related to recommended cathode voltage | $U_{G2}$<br>$U_K$ | =<br>= | 600-1050 V<br>160 V |
| 5. Focusing voltage adjustment for optimum of focus for vertical and horizontal lines at the centre | $U_{G3}$, $I_{AP}$ | = | 3,5 mA |
| 6. Screen has to face east | | | |
| 7. Test pattern | Cross hatch pattern<br>White pattern | | |
| 8. Colour temperature adjustment to white | D | = | 6500 K |

| | | |
|---|---|---|
| **Raster distortion** | Figure 26 | |
| Test pattern | Cross hatch pattern, green only. | |
| The peak beam current of 200 µA corresponds roughly to 25 µA average. | $I_{AP}$ | = 200 µA |
| Linearity, picture width and height should be correctly adjusted. | | |

| | |
|---|---|
| Overscanning | 5% |

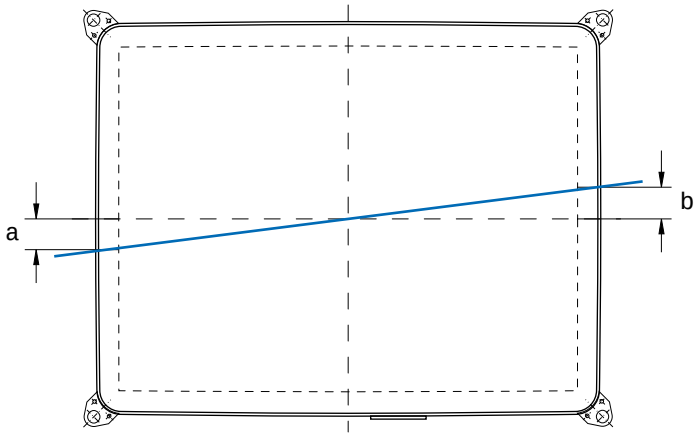
| | | | max. (%) |
|---|---|---|---|
| north-south distortion | [2(a+b)/(AD+BC)] | •100% | 1 |
| north-south symmetry | [2(a-b)/(AD+BC)] | •100% | 1 |
| east-west distortion | [2(c+d)/(AB+CD)] | •100% | -11 |
| east-west symmetry | [2(c-d)/(AB+CD)] | •100% | 1 |
| horizontal trapezium | [(AD-BC)/(AD+BC)] | •100% | 1 |
| vertical trapezium | [(AB-DC)/(AB+DC)] | •100% | 1 |
| orthogonality | | α = 90 ± 0,3° | |

Figure 26
Raster Distortion, Separate



**Rasterrotation** Figure 27
Cross hatch pattern green only.
Difference between the mechanical and the electrical centre line.

Figure 27
Raster Rotation

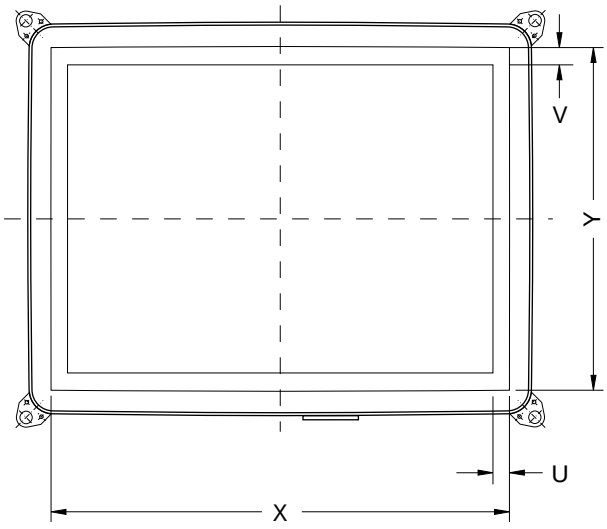



a + b max. 3,0 mm

---

**Sum of raster distortion** Figure 28
All raster failures have to be inside the shown frame

Figure 28
Raster Distortion, Sum




X = 514 mm
Y = 386 mm
U = 6 mm
V = 5 mm

**Rastershift**

| | |
|---|---|
| Horizontal | max. 5 mm |
| Vertical | max. 5 mm |

Scanning switched off. Beam current adjusted to a visible spot. The value is the distance of the spot to the mechanical centre.

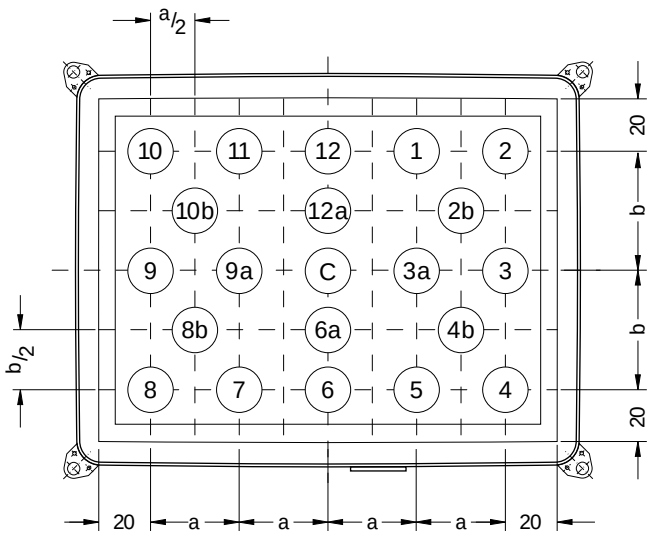
---

**Convergence** Figure 29

Test pattern cross hatch white. $I_{AP}$ = 3500 µA

The peak beam current of 3500 µA corresponds roughly to 400 µA average.

Figure 29
Convergence




| | |
|---|---|
| C | 0,3 mm |
| 2, 4, 8, 10 | 1,8 mm |
| 3, 6, 9, 12 | 1,3 mm |
| 1, 5, 7, 11 | 1,4 mm |
| 3a, 9a | 1,0 mm |
| 2b, 4b, 8b, 10b | 1,4 mm |

Maximum values shown are related to the distance between the centre of red-, green- and blue lines, in vertical and horizontal direction.

---

**White uniformity**

Test pattern white

| | |
|---|---|
| Beam current | $I_A$ = 1000 µA |
| Viewing distance | 2 m |
| Ambient light | ~1 Lux |

**Tube has to be degaussed**

**Tube is acceptable if there are no distinct colour differences visible.**

---

**Purity**

Test pattern white

| | |
|---|---|
| Beam current | $I_A$ = 1000 µA |
| Viewing distance | 2 m |

**Tube has to be degaussed. Check each colour red, green and blue.**

**The tube is acceptable if there is no discolouration visible.**

## *12 General Notes*

Absolute 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, and should not be exceeded under the worst probable conditions.

## *12.1 Limit Values by IEC Publication*

The equipment manufacturer must design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions:

* supply voltage variation
* equipment and control adjustment
* components spread and variation
* load variations
* signal variations
* environmental conditions and also picture tube spread and variations.

## *12.2 Voltage between Heater and Cathode*

The voltage between heater and cathode should be as small as possible.

## *12.3 Voltages between Cathode and Grids 1, 2, 3*

Do not operate the tube unless all electrodes are connected to a DC potential.
Do not exceed the limit value of any electrode.
No electrode should be connected to a high voltage potential.
Test- or check circuits should be agreed with Matsushita Electronics (Europe) GmbH.

## *12.4 Screen*

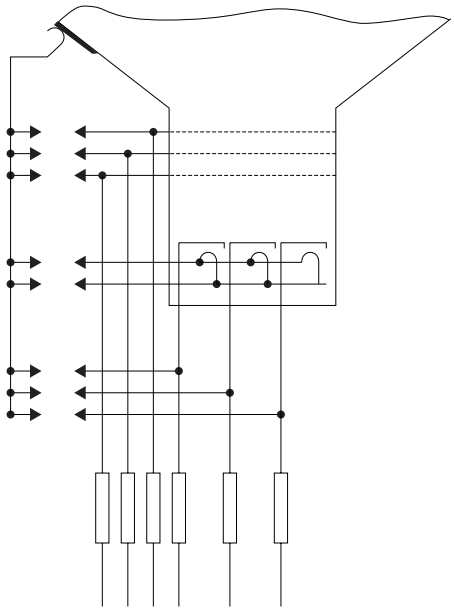
To avoid screen damages please pay attention to the following:

* Do not operate the tube with a stationary cross hatch pattern similar or a test pattern.
* Do not operate picture tube with a stationary luminary spot except with an extremely low beam current.
* Afterglow should not exceed 1,5 sec.
* The anode voltage $U_A$ has to be reduced to less than 15 kV within 1 sec after switch off or switching into standby.
* If no bleeder resistor is used it has to be ensured by circuit design, that the tube will be discharged in a time <1 sec.

## *12.5 Spark Gaps*

To avoid possible damages to tube or circuitry by internal flash over, spark gaps should be used (Figure 30).
For the connection of the spark gaps to the external conductive coating, the shortest possible wires should be used.
The connection to the external conductive coating should cover a large area.
Isolation resistors should be used in series with each grid and cathode wire.
The spark gaps should be designed for a breakdown voltage at the focusing electrode of 12 kV at the other electrodes of 1,5 - 2kV.

Figure 30
Spark Gaps -
Recommended Values



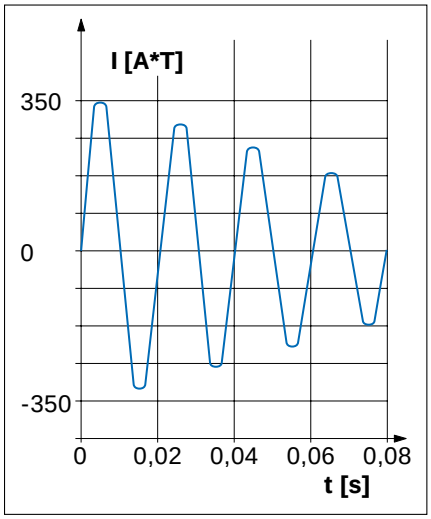
$R_{KG}$ = 1,5 kΩ
$R_{KR}$ = 1,5 kΩ
$R_{KB}$ = 1,5 kΩ
$R_{G1}$ = 100 kΩ
$R_{G2}$ = 100 kΩ
$R_{G3}$ = 1 MΩ

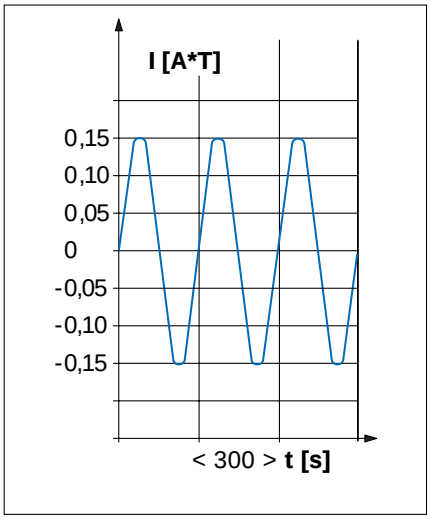
### *12.6 Degaussing*

The tube has an internal shielding against external magnetic fields. The shield and the mask should be degaussed automatically whenever the TV-set is switched on.
To get sufficient degaussing a magnetomotive force with an initial value of minimum 350 ampere turns peak per coil is needed (see figure 31). The total number of turns is the sum of turns of each coil.
The time of current decay has to be continuously. The value of the degaussing current after 4 cycles should be 50% of the initial value (4 cycles 50Hz = 80 ms, 60Hz = 67 ms, see figure 31). Figures 33 and 34 show a possible layout of the degaussing coil, figure 35 shows a recommended degaussing circuit.
The reduction of current per half wave must be less than 10 percent. The residual value of magnetic flux must be less than 0,15 ampere turns peak per coil (see figure 32).

Figure 31 (left)
Degaussing - Reduction of Current per Halfwave

Figure 32 (right)
Degaussing - Residual Value of Magnetomotive Force



To avoid coupling of line frequency current, a sufficient capacitor should be connected in parallel to the degaussing coil.
When using external degaussing coils, vertical deflection of tube must be switched off. In this case the initial value of magnetic field strength at front panel should be min. 160 A/m .

a = 150 mm, b = 200 mm

Figure 33
Placement of Degaussing Coil, Version 1

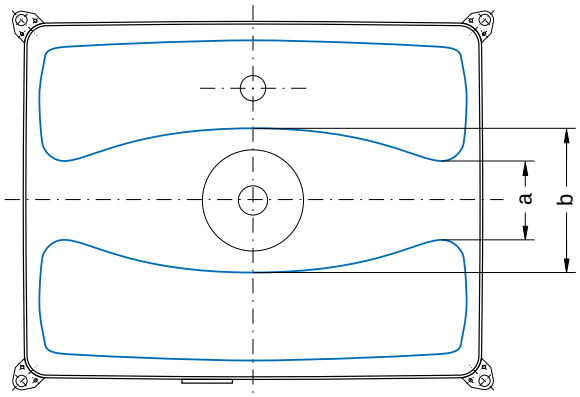
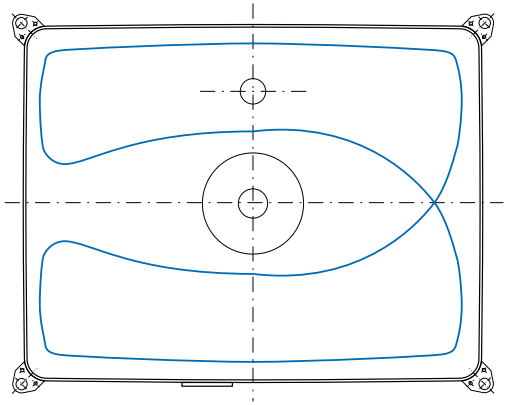



Figure 34
Placement of Degaussing Coil, Version 2



***12.7***
***Implosion Protection***

All picture tubes from Matsushita Electronics (Europe) GmbH are implosion protected according to VDE DIN 57860, IEC 65, BSI and CCIB.
Care should be taken not to scratch or knock any part of the tube.
Please handle tube careful to avoid any risk of implosion.
In all handling procedures prior to insertion into the cabinet, there is a risk of personal injury as a result of severe accidental damage to the tube. It is therefore recommended that protective clothing should be worn, particularly eye shielding.
Remember when replacing or servicing the tube assembly, that a residual electrical charge may be carried by the anode contact and also the external coating if not earthed. Before removing the tube assembly from the equipment, earth the external coating and short the anode contact to the coating.
**The final customer has to be informed about statements of implosion protection**

***12.8***
***Handling***

Avoid any mechanical stress to the neck components during transport and handling, it could cause loss of performance.

***12.9***
***Cabinet Design***

Design of the cabinet has to be done according to the 1:1 drawing and not to a tube sample or this specification.

***12.10***
***Microphony***

Intense vibration of the loudspeakers inside the TV set can result in a visible modulation of brightness. This can be minimized by a suitable design of the TV cabinet.

***12.11***
***Transport***

To avoid tube damage during transport, the following has to be taken into consideration:

a. Single tubes
Single tubes must be delivered in Matsushita Electronics (Europe) GmbH designed packaging only and transported in the position printed on the carton.

b. TV set
This must be transported in the packing designed by the set manufacturer in the position printed on the carton. If the tube is transported with it's faceplate in a horizontal position it could cause irreparable damage to the shadow mask

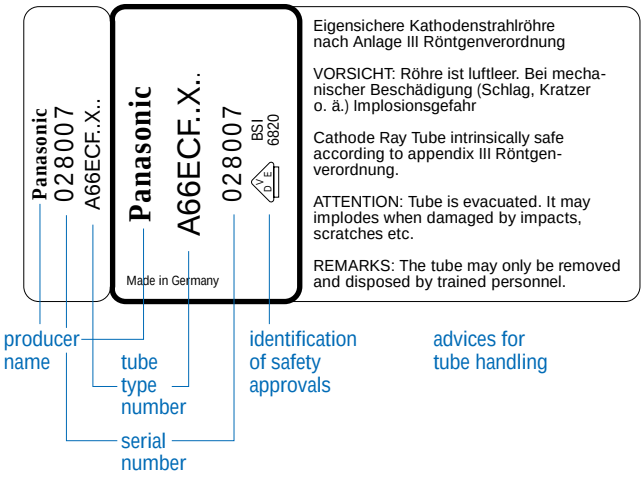
***12.12***
***Storage***

a. Tubes must only be stored in dry and clean storage facilities. Tubes and polystyrene have to be protected against rain and humidity.
b. Temperature of tube should be same as room temperature.

***12.13***
***Type Designation by Pro Electron and Tube Label***

Type .....A 66 ECF 50X
TV picture tube .....A
Screen diagonal (cm) .....66
Family code (tube) .....ECF
Member of family code.....50
Tri-colour screen.....X
Code of deflection yoke .....see separate yoke specification
.....(50Hz and 100Hz available)

Figure 35
Tube Label (Example)



## *13 Used Formula Signs*

| | |
|---|---|
| **Voltages** | |
| Anode voltage | $U_A$ |
| Cathode voltage | $U_K$ |
| Voltage cathode to heater | $U_{KF}$ |
| Peak cathode voltage | $U_{KP}$ |
| DC voltage grid 1, 2, 3 | $U_{G1}$ $U_{G2}$ $U_{G3}$ |
| DC voltage between grid 2 and cathode | $U_{G2/K}$ |
| Voltage between grid 3 and grid 4 | $U_{G3, G4}$ |
| Screen grid voltage peak | $U_{G2p}$ |
| Heater negative to cathode | $U_{-FK}$ |
| Heater positive to cathode | $U_{+FK}$ |
| Heater to cathode peak voltage | $U_{-FKP}$ |
| Voltage between heater and cathode Heater positive to cathode | $U_{+FK}$ |
| Heater voltage | $U_F$ |
| Voltage peak to peak | $U_{PP}$ |
| **Currents** | |
| Anode current | $I_A$ |
| Cathode Current | $I_K$ |
| Leakage current cathode-heater | $I_{KF}$ |
| Current Grid 1, 2, 3 | $I_{G1}$ $I_{G2}$ $I_{G3}$ |
| Heater current | $I_F$ |
| Beam current | $I_A$ |
| Deflection current horizontal peak to peak | $I_{HP\ P}$ |
| Deflection current vertical peak to peak | $I_{VPP}$ |
| **Capacities** | |
| Outside capacity | C |
| Grid 1 to all other electrodes | $C_{G1}$ |
| Cathode to all other electrodes | $C_K$ |
| Grid 3 to all other electrodes | $C_{G3}$ |
| Anode to external conductive coating | $C_{A/M}$ |
| Anode to metal rimband | $C_{A/Z}$ |
| Grid 1 to cathode | $C_{G1/K}$ |
| **Resistance** | |
| Active resistance of horizontal deflection coils | $R_H$ |
| Active resistance of vertical deflection coils | $R_v$ |
| Resistance of wires to cathodes green, red, blue | $R_{KG}$ $R_{KR}$ $R_{KB}$ |
| Resistance of wires to grids 1, 2, 3 | $R_{G1}$ $R_{G2}$ $R_{G3}$ |

**Indices**

| | |
|---|---|
| Anode | A |
| Heater | F |
| Grid | G |
| Cathode | K |
| Outside conductive coating | M |
| Peak to peak | p-p |
| Edge to edge | e-e |
| Limit value | max. |
| Peak value | P |
| Point on Panel Diagonal | Z |

**Different Dimensions and Abbreviations**

| | |
|---|---|
| Ambient temperature | T amb |
| Absolut beam limiter | ABL |
| Brightness or inductance | L |
| British Standard Institution | BSI |
| DC | direct current |
| eff. | effective |
| Inductance horizontal deflection coils | $L_H$ |
| Inductance vertical deflection coils | $L_V$ |
| International Electrotechnical Commission | IEC |
| International Standards Organisation | ISO |
| Joint Electron Device Engineering Council | JEDEC |
| Minimum Perception Colour Difference | M.P.C.D. |
| Multi Functional Triode | MFT |
| Multi Pre Focus | MPF |
| N, S, E, W | north, south, east, west |
| Overlapped Field Lens | OLF |
| Pulse duration | $t_P$ |
| Sensitivity | $LI^2e$-e |
| Sensitivity | $RI^2e$-e |
| Verband Deutscher Elektrotechniker e.V. | VDE |

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