Panasonic

SuperPigment Plus

Colour Picture Tube

A 66 ECF 50X

Product Specification

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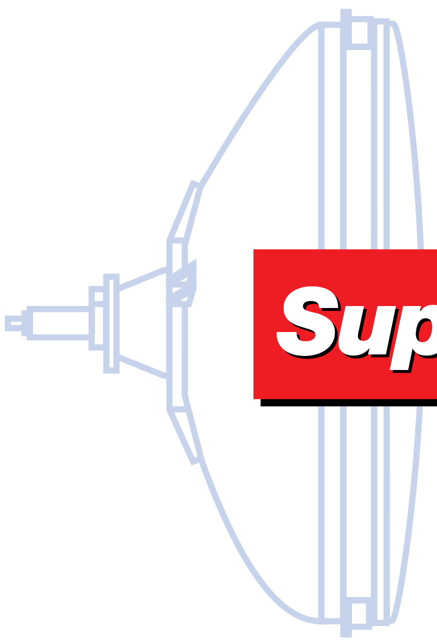
For design purposes use only 1:1 drawings

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 50 X ... is a 4:3 Super Flat Square
Colour Picture Tube with an Iron Mask.



SuperPigment Plus

A 66 ECF 50X

1 Contents

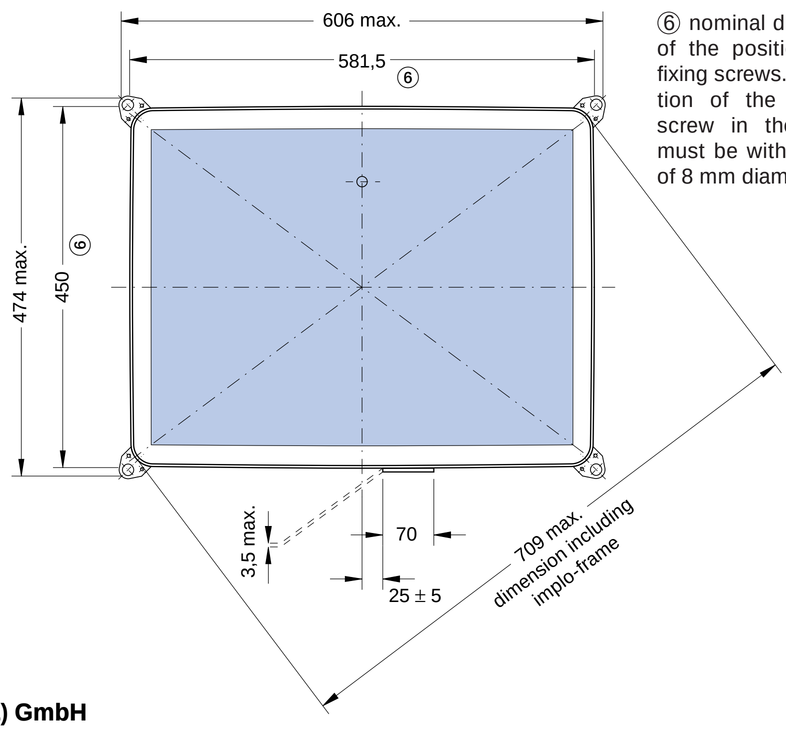
2 List of Figures and Tables

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 flat and square
Phosphors	cadmium free green, gold activated, superpigmented high Europium red superpigmented blue
Shadow mask assembly	slotted type, iron temperature compensated anti doming treated
Electron gun	in-line, Hi-Bi potential Quadrupole Inline Gun (QIG) 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, * self converging * 50 or 100 Hz * fully coma corrected
Other features	* soft flash technology * optional SVM coil * 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

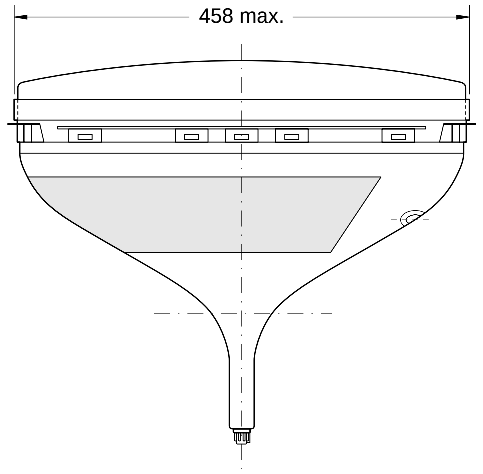
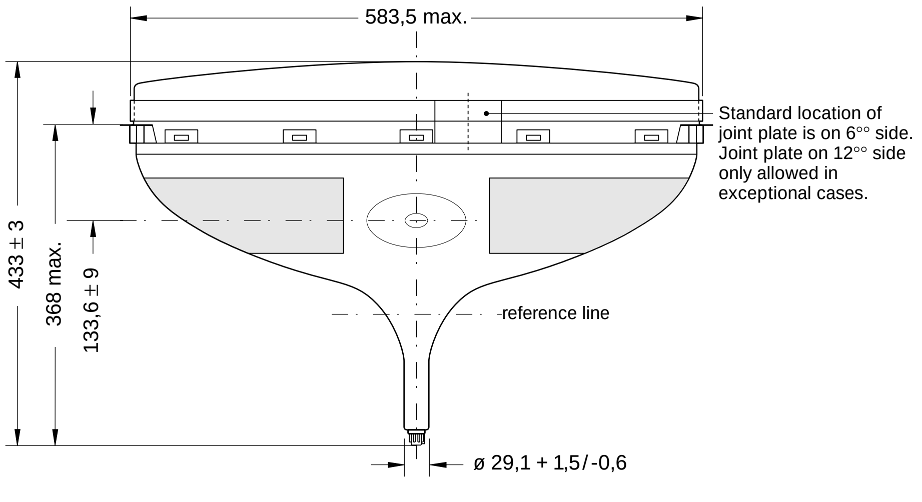


Figure 3
Tube Dimensions, Top View



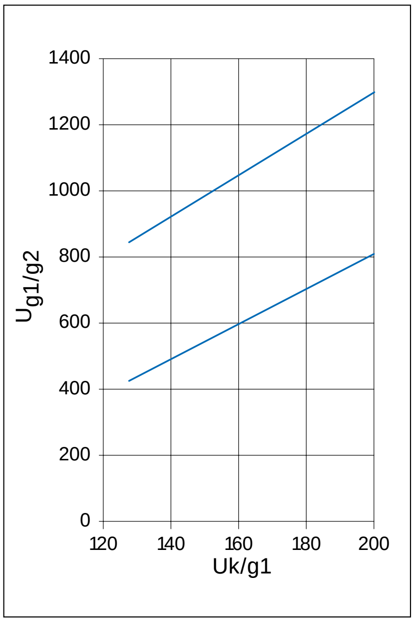
4
Typical Operating Conditions

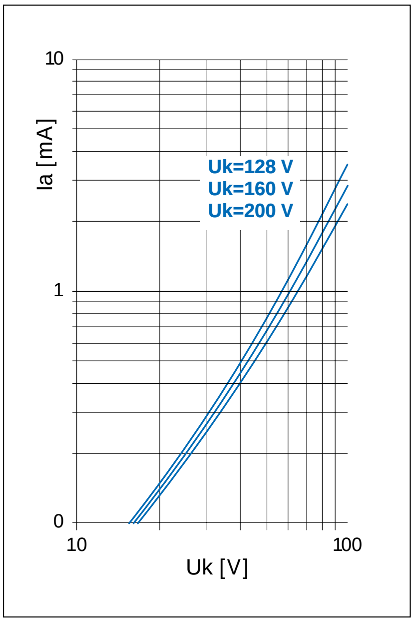
Voltages are specified with respect to grid 1

Anode voltage	U_A = 25 - 28 kV
Focusing voltage	U_{G3} = 6,65 - 8,40 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 - 28 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.*
CIE-coordinates	x	= 0,313 / *0,304*
	y	= 0,329 / *0,307*
red	42% / *38%*	
green	33% / *33%*	
blue	25% / *29%*	

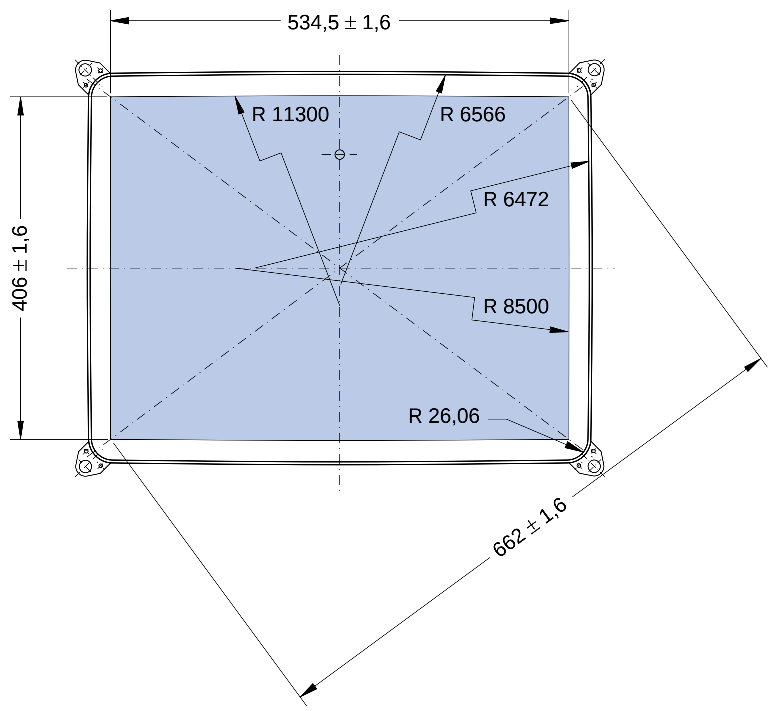
Cathode current ratio		
red-blue	1,06.....2	*0,98....1,68*
red-green	0,97.....1,53	*1,03....1,63*
blue-green	0,64.....1,1	*0,80....1,20*

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	0,80 mm
(horizontal screen pitch - center to center distance of identical colour phosphor stripes)	
Surface	polished
Visible screen area	2153 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.

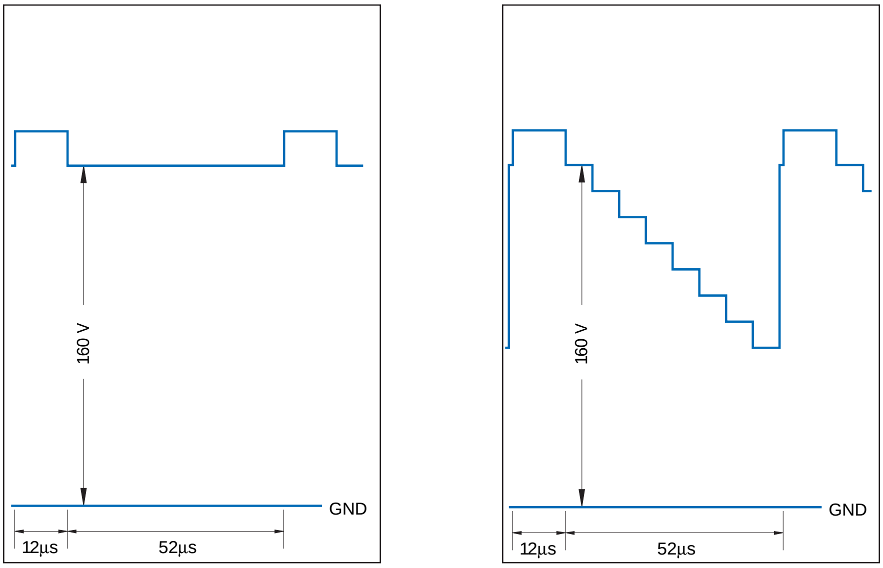
Test cut-off voltage area	U_{G2}
Conditions:	U_A = 26,5 kV

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.

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) <u>Automatic cut-off without black-level clamping</u>
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	662,0 ± 1,6 mm
Horizontal	534,5 ± 1,6 mm
Vertical	406,0 ± 1,6 mm
Area	2.153 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

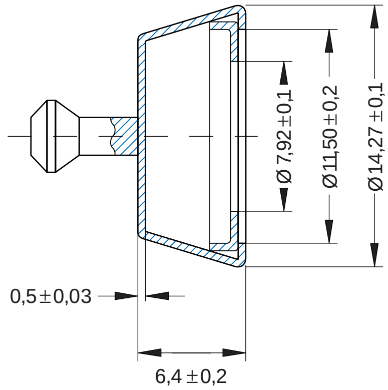


Figure 9
Panel Reference Points ⑧

Definition of outside screen curvature

$$Z = \mathrm{Sum}(A_i \cdot X^{N_i} \cdot Y^{M_i})$$

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

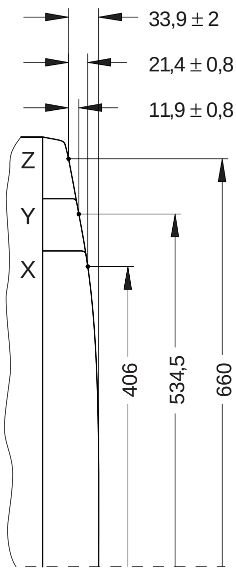
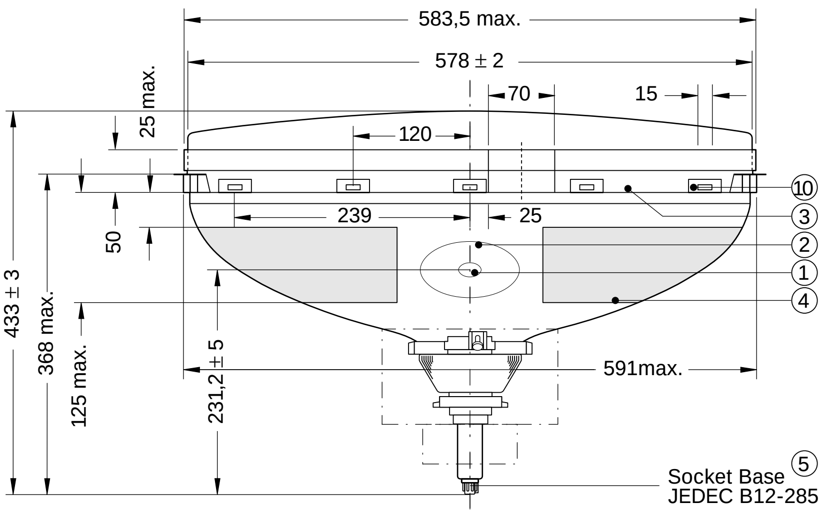


Figure 10
Overall Dimensions of Tube, Top View

<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

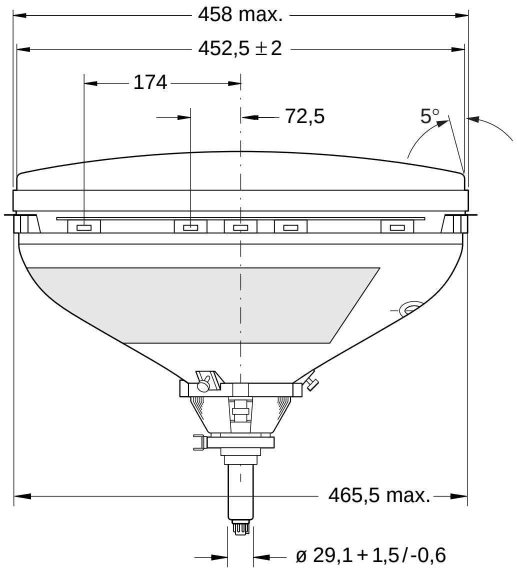
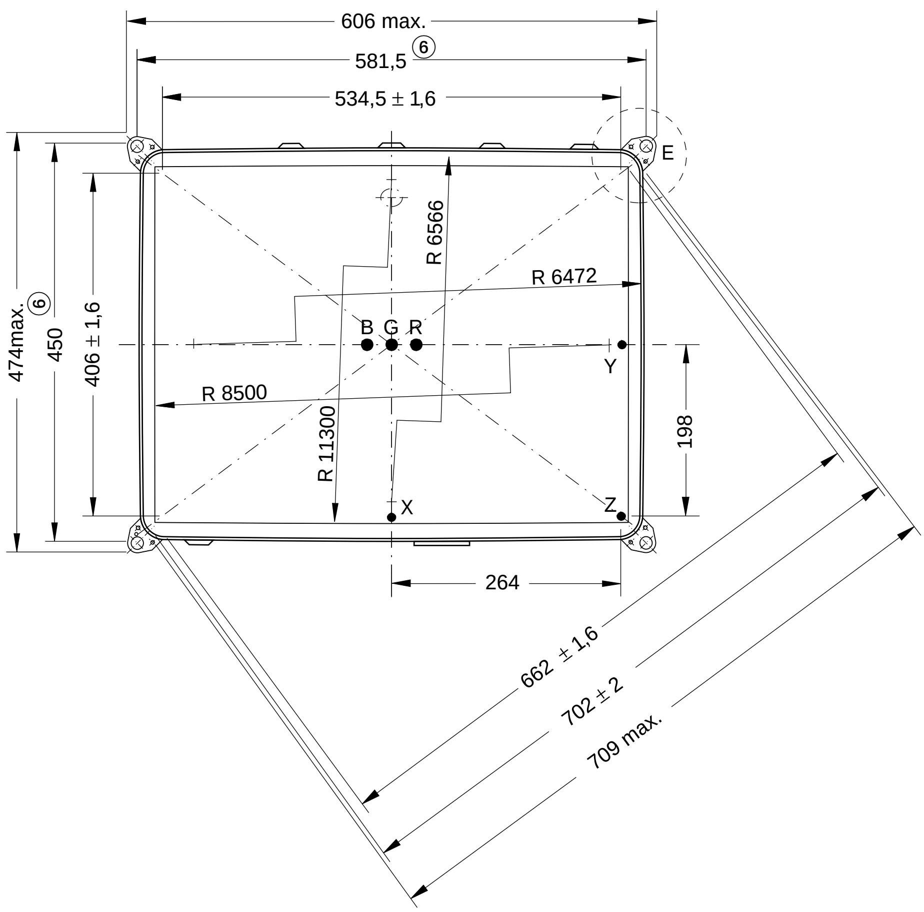


Figure 12
Overall Dimensions of Tube,
Front View



For design purposes use only 1:1 drawings.

Figure 13
Detail E, Dimensions of Lug

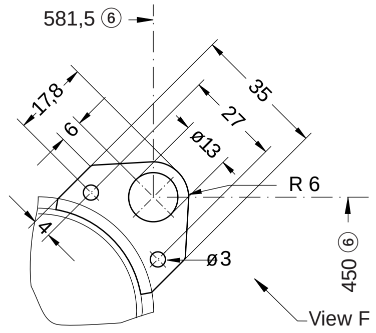


Figure 14
Dimensions of Lug, View F

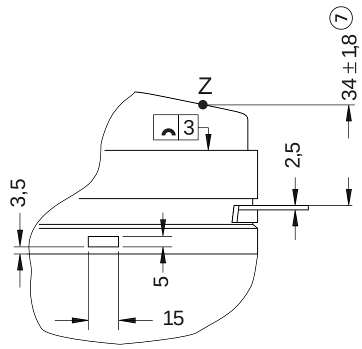
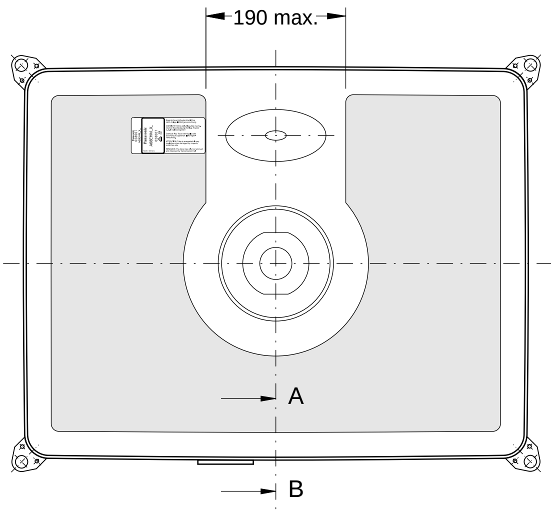


Figure 15
External Coating



For design purposes use only 1:1 drawings.

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

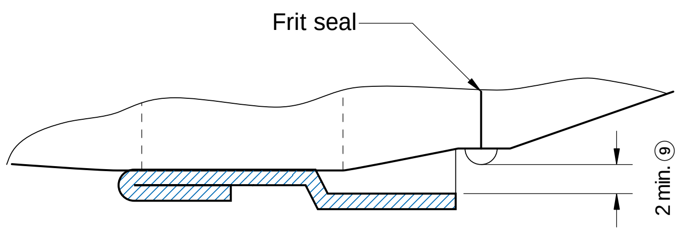
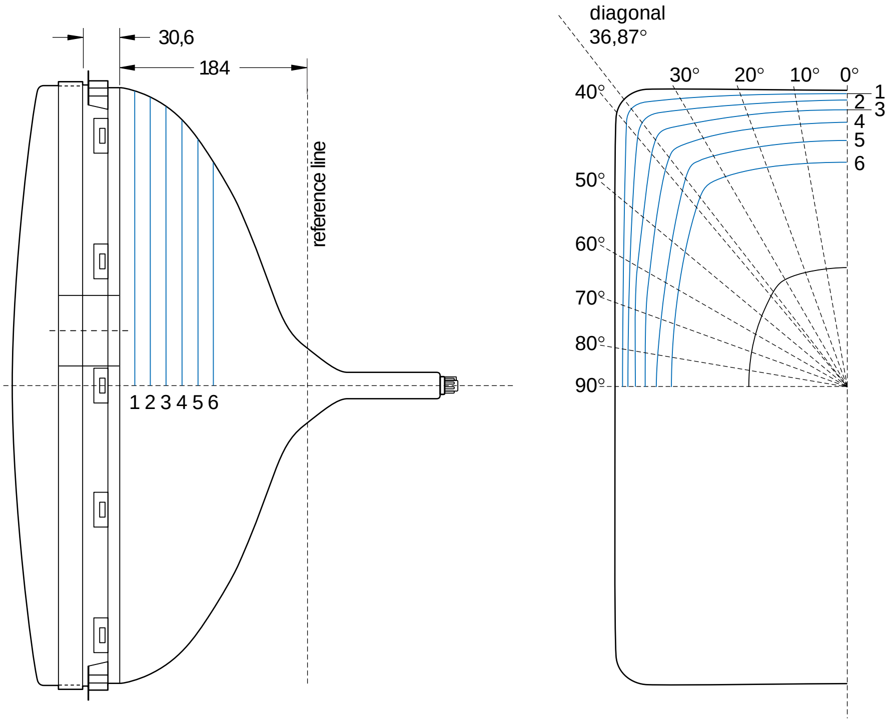


Figure 17
Funnel Radial Coordionates

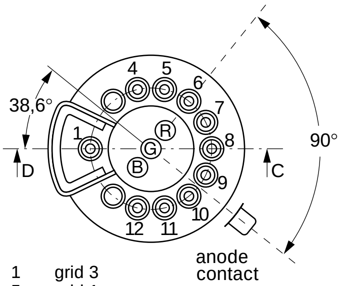
For design purposes use only
1:1 drawings.

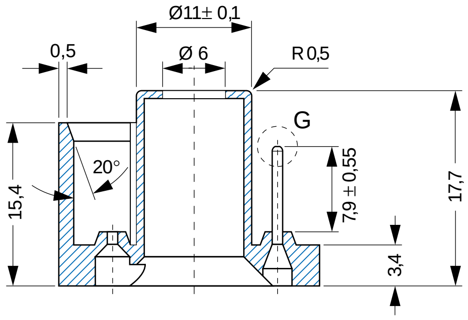


Nominal Outside Contour Radial Coordinates												
	Height from	**Major Axis**				**Diag. Axis**						**Minor Axis**
No.	**ref. line**	**0°**	**10°**	**20°**	**30°**	**36,87°**	**40°**	**50°**	**60°**	**70°**	**80°**	**90°**
1	164,8	283,4	287,4	300,2	323,5	342,5	333,8	283,4	252,2	233,2	222,9	219,6
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





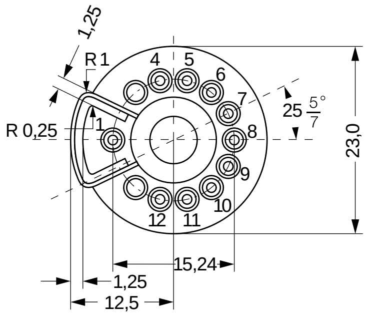
1 grid 3
5 grid 1
6 cathode green
7 grid 2
8 cathode red
9 heater
10 heater
11 cathode blue

anode: grid 4, screen mask

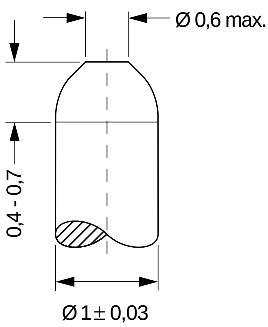
unused pins 4 and 12 must not be connected

tube base JEDEC-Nr. B 12-285

For design purposes use only
1:1 drawings



Detail G



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.

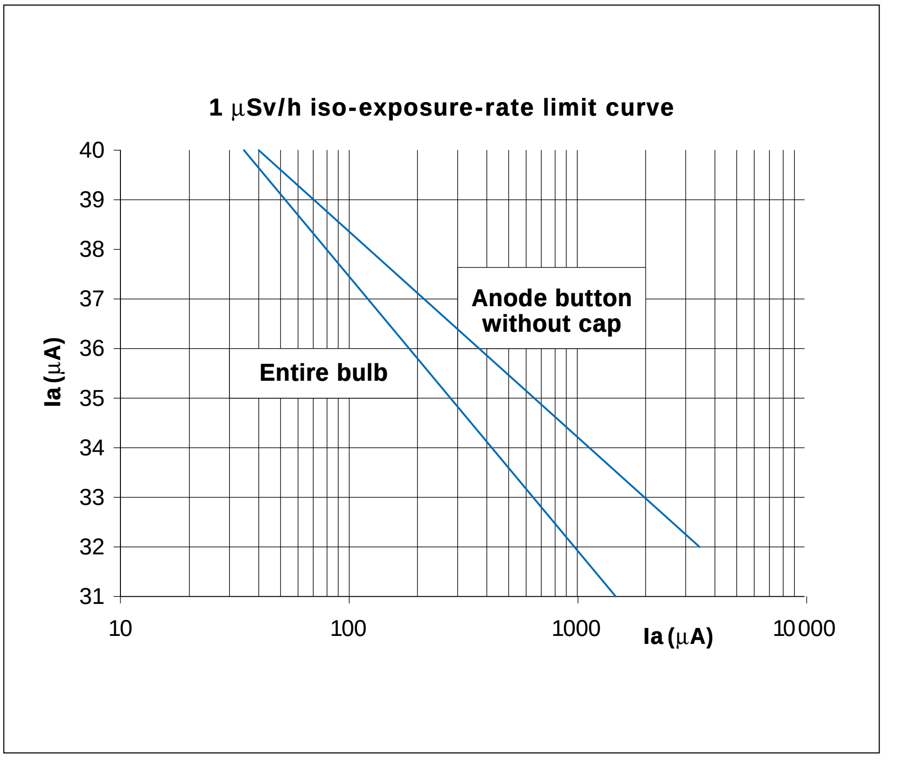
(II) During warm up period of max. 15 sec the maximum voltage between heater and cathode must not exceed 450 V. This voltage must be reduced to 250 V at least time proportionally within 45 sec.

(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 Dose rate measuring in the distance of 100 mm to the glass surface.		
ISO-dose rate Maximum Parameters: Anode voltage - anode current	Figure 20 1 µSv/h	

Figure 20
ISO Dose Rate



10
Screen- and Glass-Blemishes Limits

Contrast blemishes 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 The defect remains visible if template is moved from 0,7 to 1,3 filter.	
Defects with medium contrast Defect disappears if template is moved from 0,7 to 1,3 filter.	
Screen zones Zone A, centre area Zone B, outside area Zone C is defined as the unscreened area of the faceplate.	see Figure 23 260 x 200 mm

Figure 21
Blemishes, High Contrast

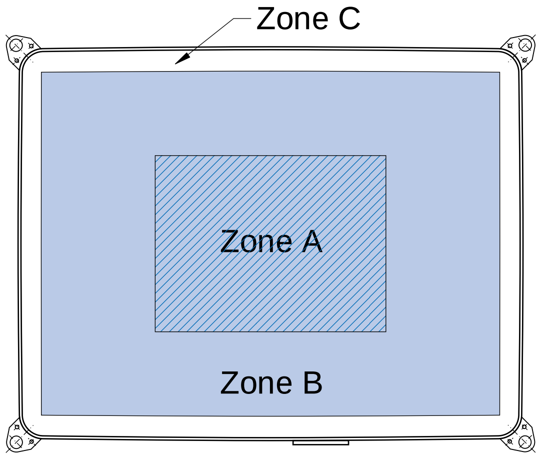
Blemish size (mm)	Limited blemishes A	A+B	Distance (mm)
>1,0	0	0	-
0,8...<1,0	0	1	-
0,5...<0,8	1	3	80
0,25..<0,5	2	4	50 (1)
< 0,25 (2)	unlimited	unlimited	-

(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	Limited stains 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	U_{G2}	=	600-1050 V
recommended cathode voltage	U_K	=	160 V
5. Focusing voltage adjustment for optimum of focus for vertical and horizontal lines at the centre	U_{G3}, I_{AP}	=	2 mA
6. Screen has to face east			
7. Test pattern	Cross hatch pattern 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

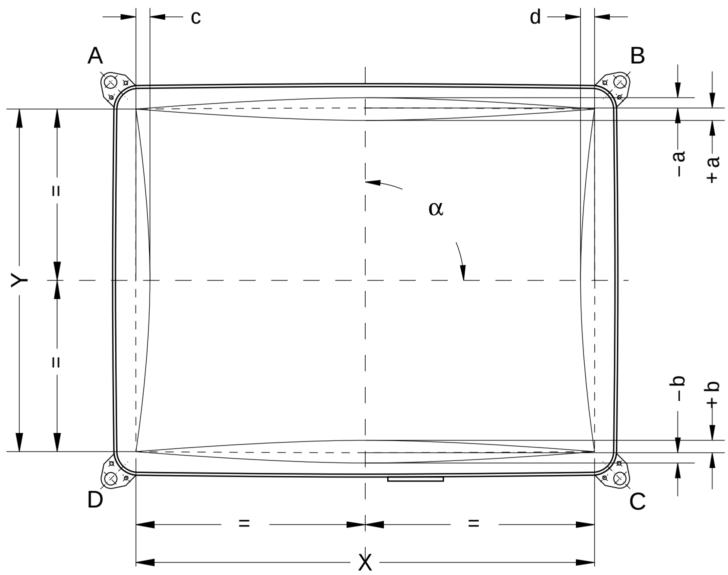
Linearity, picture width and height should be correctly adjusted.

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		$\alpha = 90 \pm 0{,}3°$	

Figure 26
Raster Distortion, Separate



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

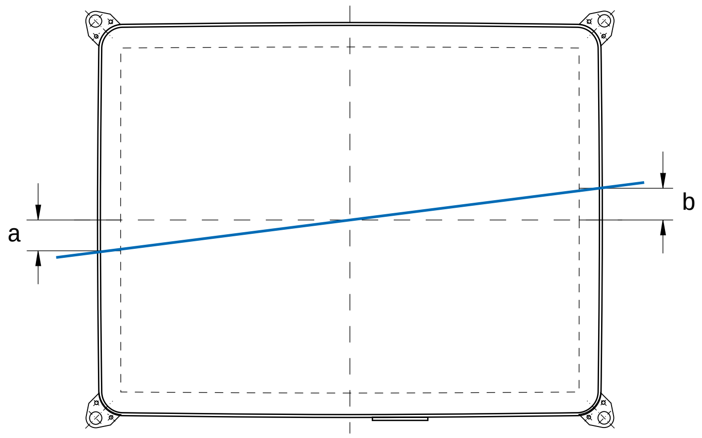


Figure 27
Raster Rotation

a + b max.	3,0 mm

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

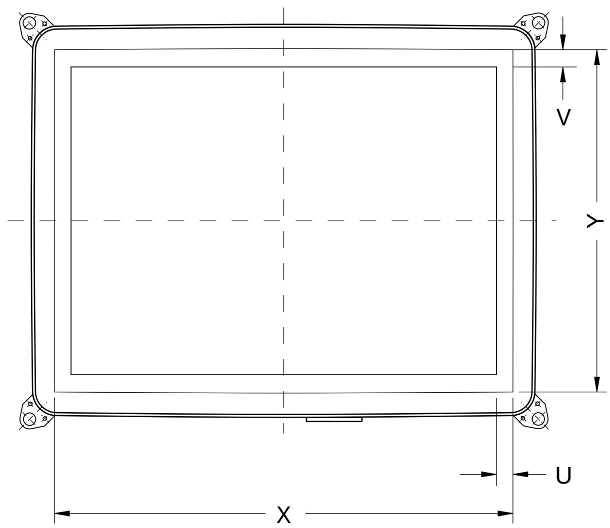


Figure 28
Raster Distortion, Sum

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

Rastershift

Horizontal	max. 5 mm
Vertical	max. 5 mm

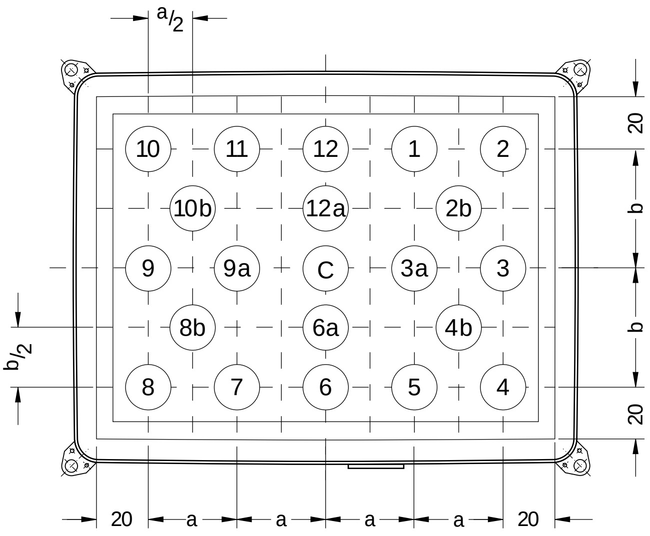
Scanning switched off. Beam current adjusted to a visible spot. The value is the distance of the spot to the mechanical centre.

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

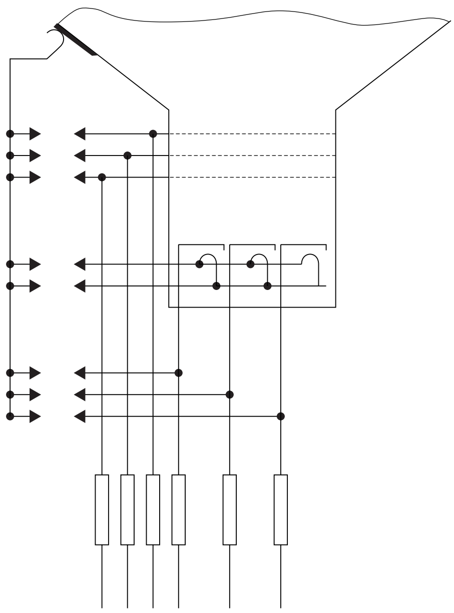
To avoid screen damages please pay attention to the following:

* 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



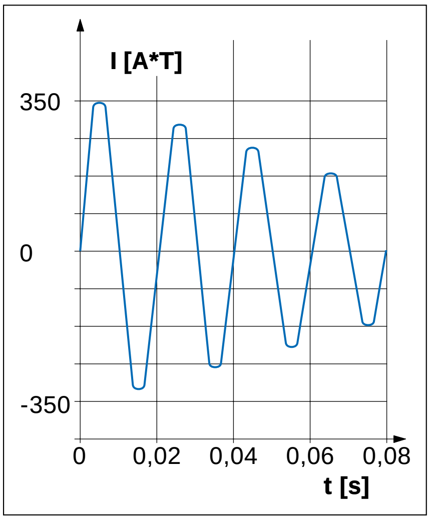
R_{KG} = 1,5 kΩ
R_{KR} = 1,5 kΩ
R_{KB} = 1,5 kΩ
R_{G1} = 100 kΩ
R_{G2} = 100 kΩ
R_{G3} = 1 MΩ

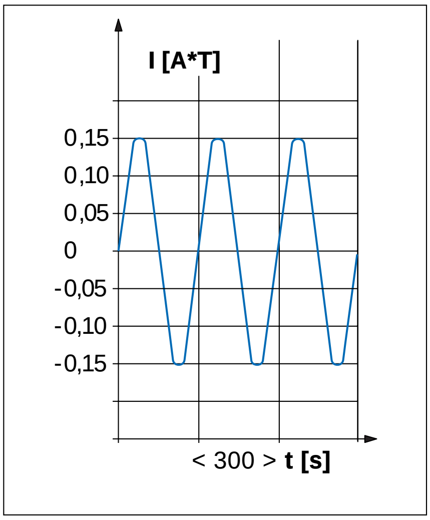
12.6
Degaussing

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

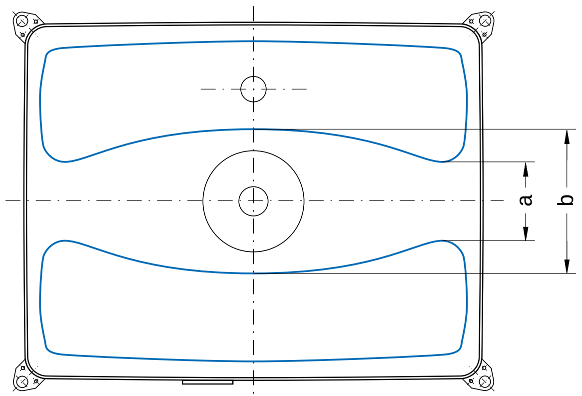


Figure 33
Placement of Degaussing Coil,
Version 1

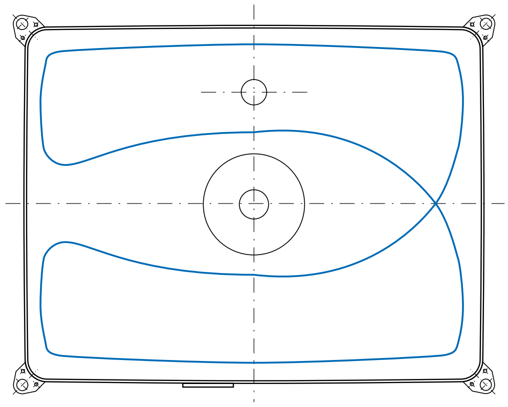


Figure 34
Placement of Degaussing Coil,
Version 2

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

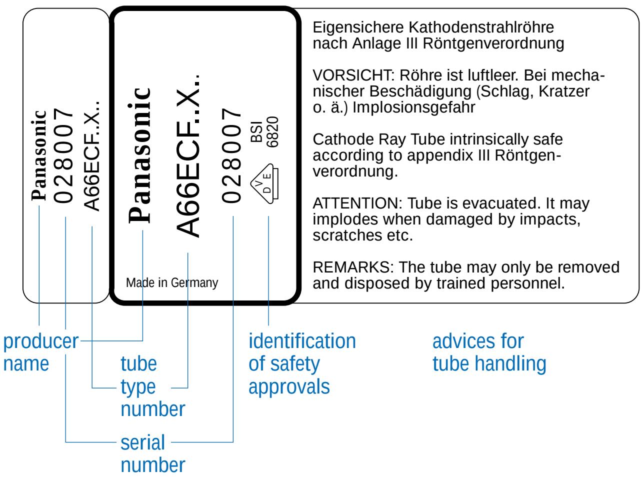
12.12
Storage

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	U_{+FK}
Heater positive to cathode	
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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