DATA SHEET

A41EFN40X
FS Hi-Bri colour picture tube

Product specification
Supersedes data of 1996 Jun 17
File under Display Components, DC01

1999 Oct 18

Philips
Components

PHILIPS

FS Hi-Bri colour picture tube A41EFN40X

FEATURES

- ‘Flatter’ and ‘squarer’ screen
- In-line, hi-bi potential ART (Aberration Reducing Triode) gun
- Hi-Bri technology
- Mask with corner suspension
- Cd-free phosphors
  - Pigmented deep red
  - Sulphide green
  - Pigmented sulphide blue
- Fine pitch over entire screen
- High gloss screen finish
- Quick-heating low-power cathodes
- Soft-flash
- Slotted shadow mask optimized for minimum moiré at 625 line systems
- Internal magnetic shield
- Internal multipole
- Reinforced envelope for mini-p mounting
- The tube is supplied with a deflection coil of the AT6050 series to form a self-converging and raster correction free assembly.

QUICK REFERENCE DATA

PARAMETER	TYP.	UNIT
Deflection angle	90	deg
Nominal useful screen diagonal	41	cm
Overall length	37	cm
Glass transmission	42	%
Neck diameter	22.9	mm
Heater voltage	6.15	V
Heater current	315	mA
Anode voltage	23	kV
Focus voltage	31% of anode voltage	
Mass	≈9	kg

ELECTRICAL DATA

SYMBOL	PARAMETER	MIN.	TYP.	UNIT
Capacitances				
$C_{a(m+m')}$	anode to external conductive coating, including rimband	1000	–	pF
C_{kR}, C_{kG}, C_{kB}	cathode of any gun to all other electrodes	–	4	pF
C_{g1}	grid 1 to all other electrodes	–	15	pF
C_{g3}	grid 3 (focus electrode) to all other electrodes	–	4	pF
Heating, indirect by AC (preferably mains or line frequency) or DC				
V_f	heater voltage	–	6.15	V
I_f	heater current	–	315	mA
Resistance				
R_{rim}	between rimband and external conductive coating	50	–	MΩ

ELECTRO-OPTICAL DATA

PARAMETER	VALUE
Electron gun system	unitized triple-aperture electrodes; Aberration Reducing Triode (ART)
Focus method	electrostatic
Focus lens	hi-bi potential
Deflection method	magnetic
Deflection angles	
diagonal	90°
horizontal	78°
vertical	60°

OPTICAL DATA

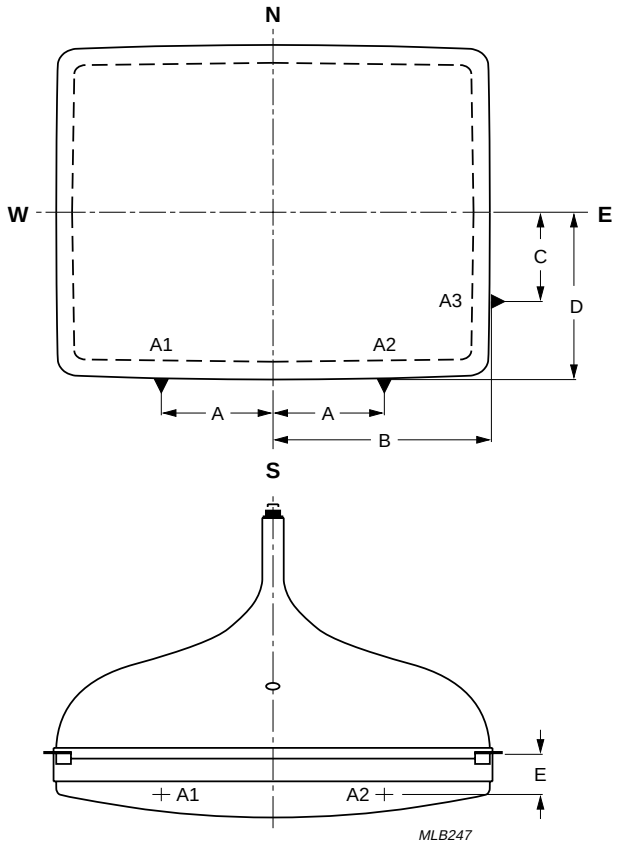
PARAMETER	VALUE
Screen	metal-backed vertical phosphor stripes; phosphor lines follow glass contour
Screen finish	high gloss
Nominal useful screen dimensions	
diagonal	410.7 mm
horizontal axis	330.0 mm
vertical axis	250.1 mm
area	≈820 cm^2
Phosphor alignment	see Fig.1
Phosphors	
red	pigmented europium activated rare earth
green	Cd-free sulphide type
blue	pigmented sulphide type
Persistence	medium short
Centre-to-centre distance of identical colour phosphor stripes at centre of screen	≈0.59 mm
Light transmission of face glass at centre of screen	42%
Luminance at screen centre; note 1	60 cd/m^2

Note

1. Tube settings adjusted to produce white D (x = 0.313, y = 0.329), focused raster, current density 0.4 $\mu A/cm^2$.

Colour coordinates

COLOUR	x	y
Red	0.630	0.330
Green	0.295	0.595
Blue	0.155	0.065



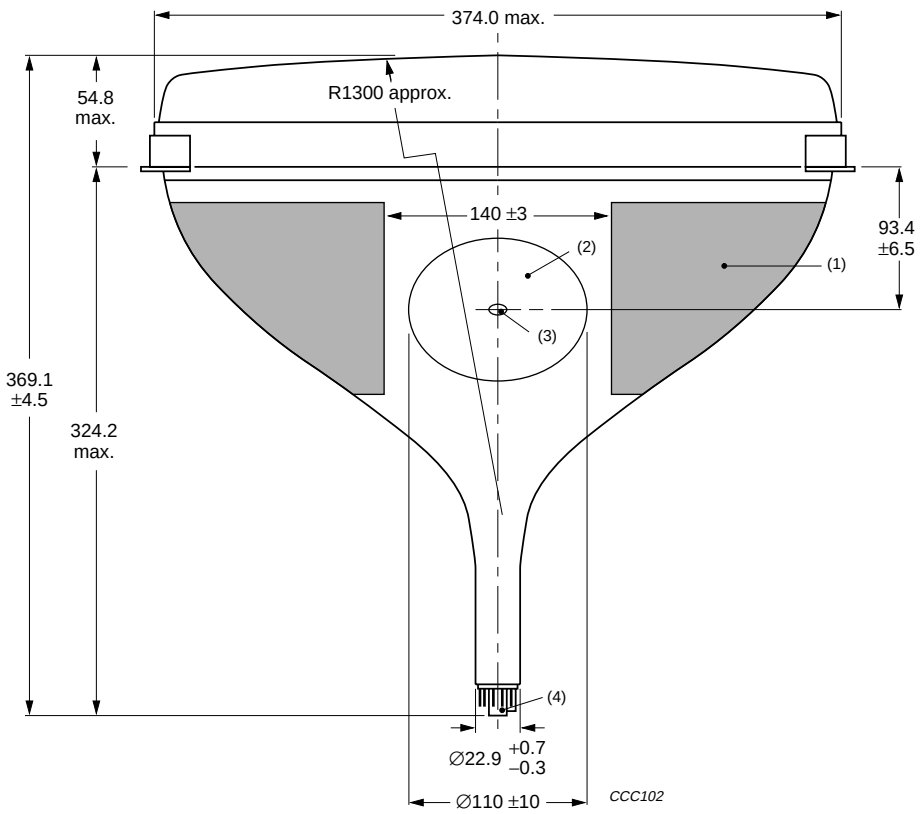
A = 139.40 mm.
B = 181.94 mm.
C = 100.0 mm.
D = 142.24 mm.
E = 29.20 mm.

Fig.1 Phosphor alignment.

MECHANICAL DATA

See Figs 2 to 12.

PARAMETER	VALUE
Overall length	367.3 ±4.5 mm
Neck diameter	22.9 +0.7/–0.3 mm
Bulb dimensions	
diagonal	<443.6 mm
width	<370.8 mm
height	<295.0 mm
Base	Base JEDEC B8-294
Anode contact	small cavity contact JEDEC J1-21; IEC 60067-III-2
Mounting position	anode contact on top
Implosion protection	shrunk-on rimband with integral mounting lugs
Mass	≈9 kg



Dimensions in mm.

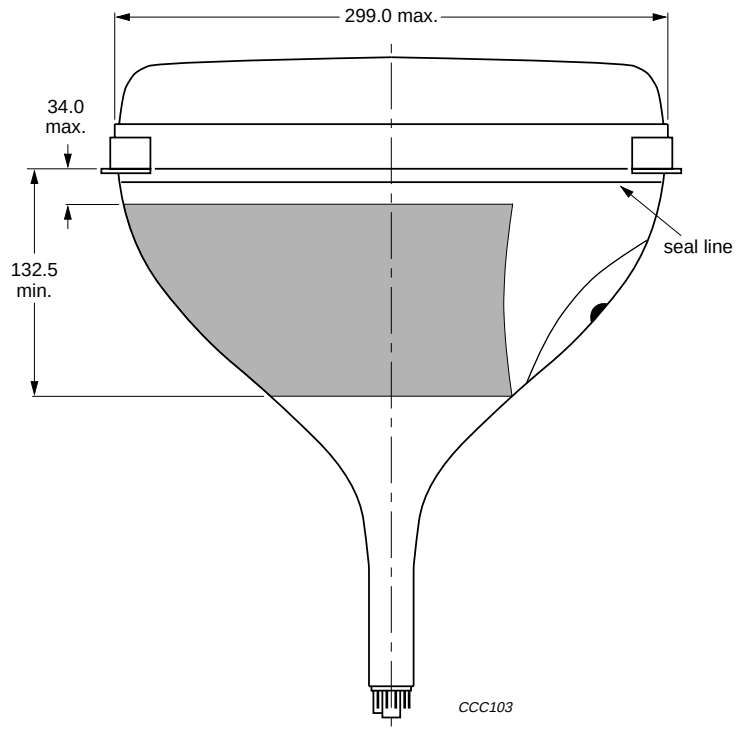
(1) The configuration of the outer conductive coating may differ, but will contain the contact area as shown.

(2) To clean this area, wipe only with a soft lint-free cloth.

(3) Small cavity contact JEDEC J1-21; IEC 60067-III-2.

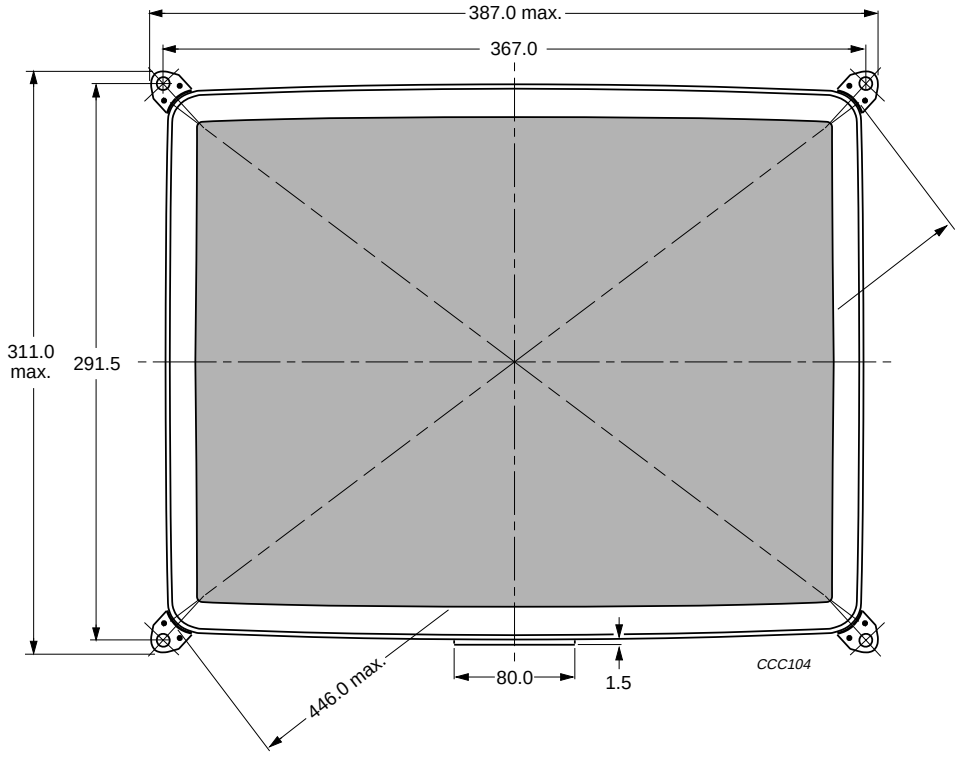
(4) The socket for this base should not be rigidly mounted, it should have flexible leads and be allowed to move freely. After mounting the tube in the cabinet, note that the position of the base can fall within a circle having a diameter of max. 30 mm concentric with an imaginary tube axis.

Fig.2 Tube dimensions; top view.



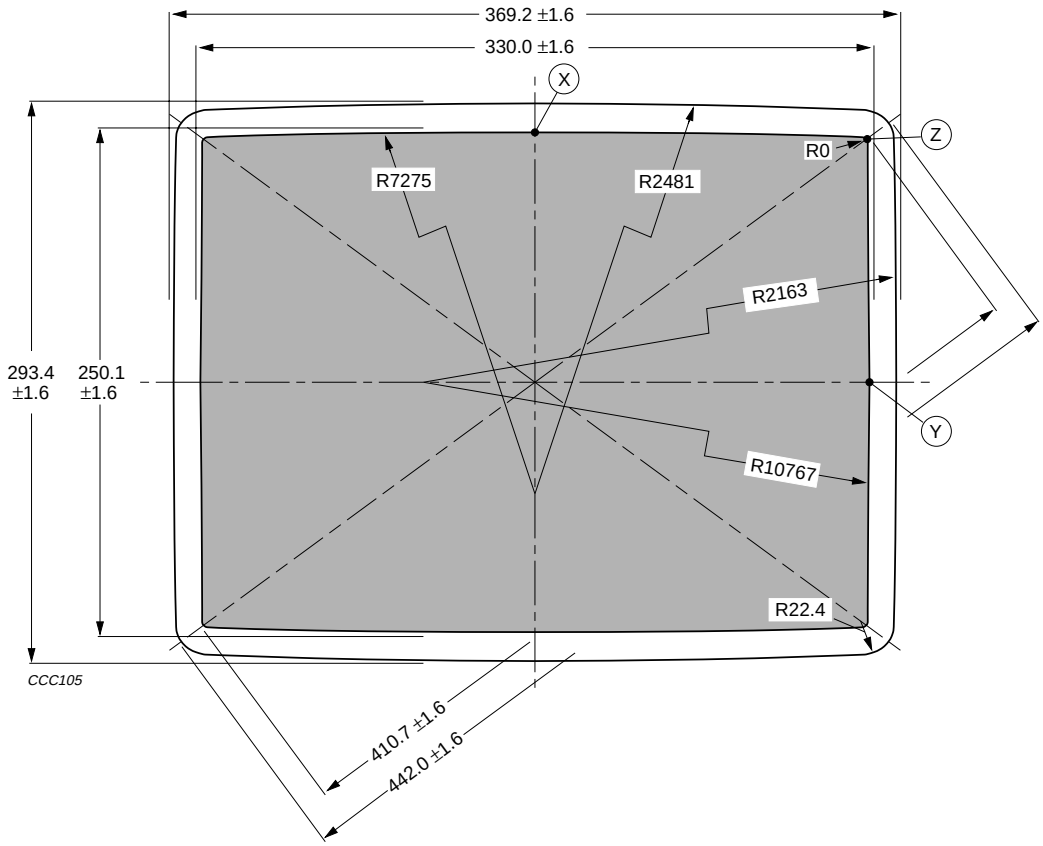
Dimensions in mm.

Fig.3 Tube dimensions; side view.



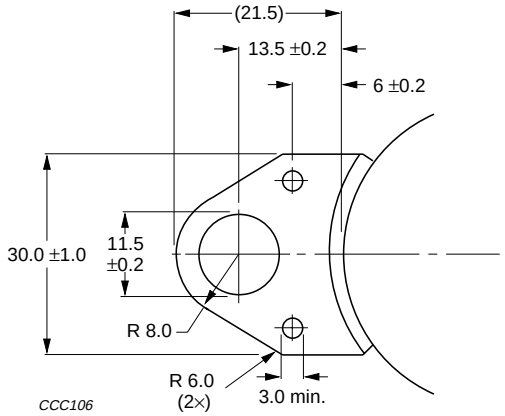
Dimensions in mm.

Fig.4 Tube dimensions; front view.



Dimensions in mm.

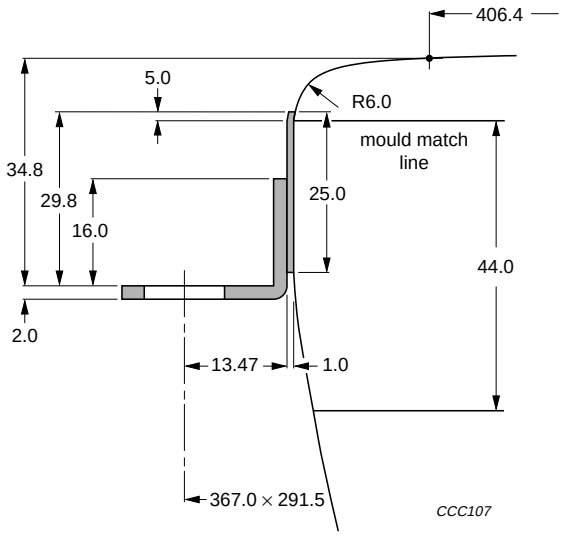
Fig.5 Phosphor and screen dimensions.



Dimensions in mm.

The position of the mounting screw in the cabinet must be within a circle of 8 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 367.0 mm × 291.5 mm.

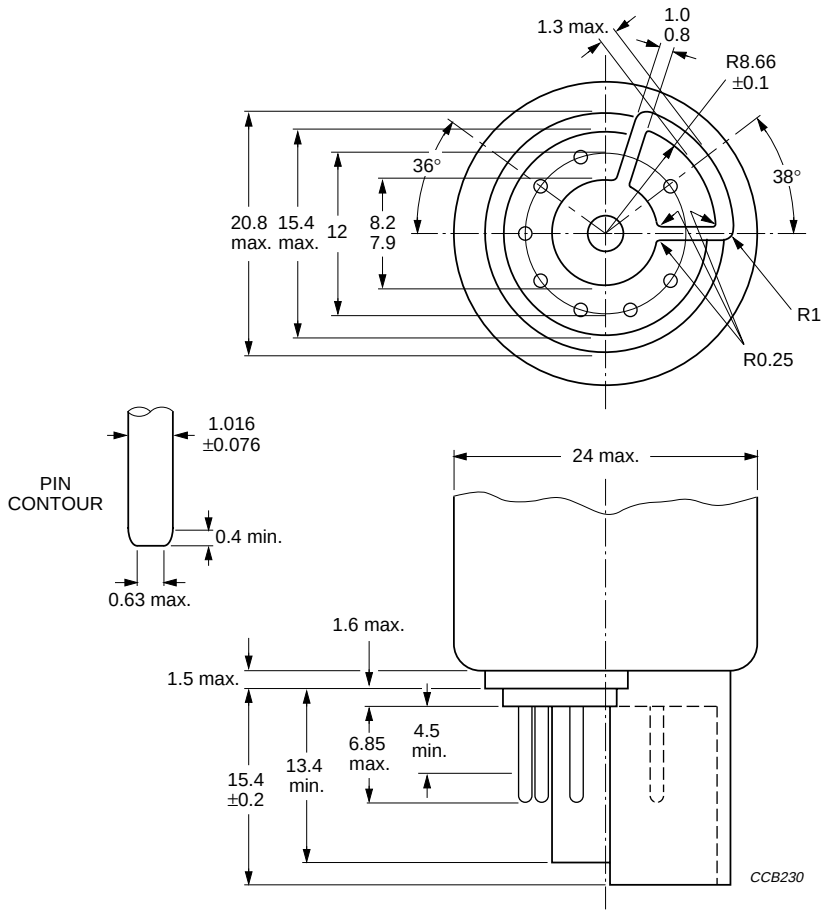
Fig.6 Lug dimensions.



Dimensions in mm.

The maximum displacement of any lug with respect to the plane through the other 3 lugs is maximum 1.5 mm. The 1.5 mm tolerance is incorporated in this deviation.

Fig.7 Lug position.



Dimensions in mm.

Fig.8 Base JEDEC B8-294.

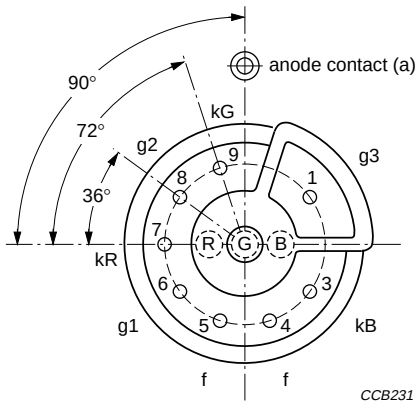


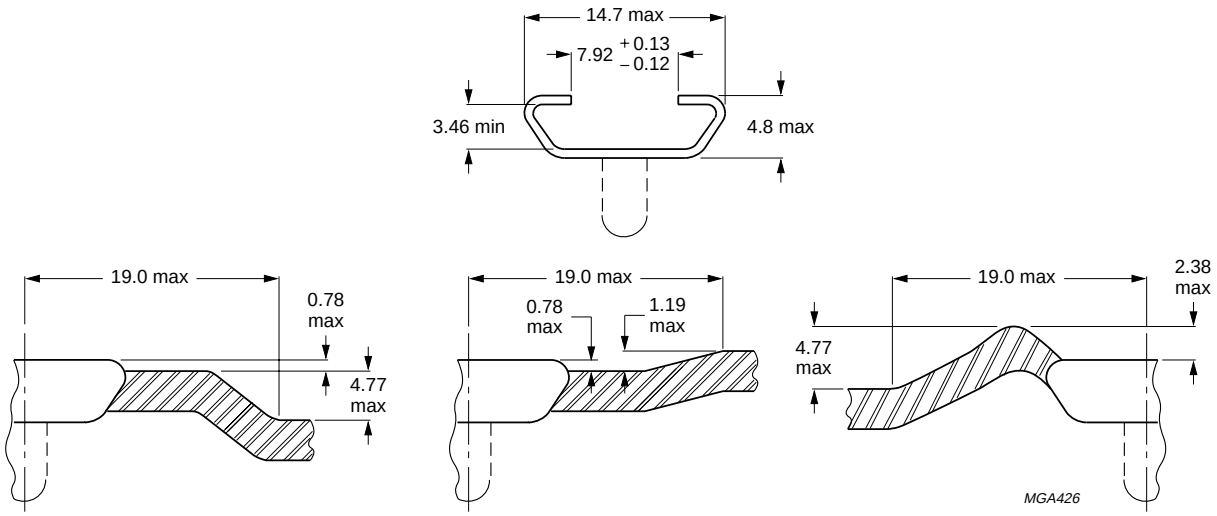
Fig.9 Pin arrangement.

Remarks: to Figs 8 and 9.

The socket for this base should not be rigidly mounted, it should have flexible leads and be allowed to move freely. After mounting the tube in the cabinet, note that the position of the base can fall within a circle having a diameter of max. 30 mm concentric with an imaginary tube axis.

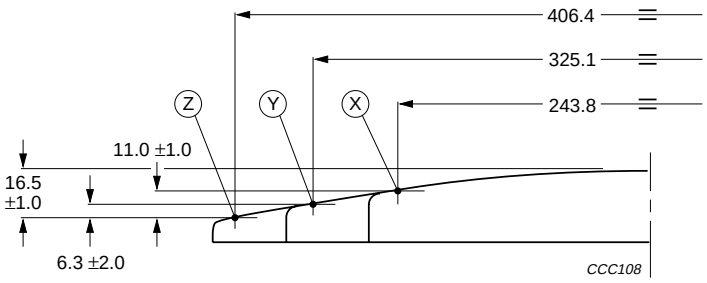
The mass of the mounting socket assembly should not exceed 150 g.

Maximum permissible torque on the tube neck is 0.04 Nm.



Dimensions in mm.

Fig.10 Cavity cap JEDEC J-21, IEC 60067-III-2.



Dimensions in mm.

The X, Y and Z reference points are located on the outside surface of the face plate at the intersection of the minor, major and diagonal screen axis respectively.

The distance Z from any point on the screen to the centre can be calculated using the following formula:

$R_1 = 1370$

$R_2 = 1100$

$X_A = 90.01$

$X_B = 17.74$

$$X_X = \sqrt{X^2 + Y^2}$$

$$X_B = X_A - \frac{R_2}{R_1} \times X_A$$

$$Z_A = R_1 - \sqrt{R_1^{\,2} - X_A^{\,2}}$$

$$Z_B = R_1 - R_2 - Z_C$$

$$Z_C = (R_1 - Z_A) \times \frac{X_B}{X_A}$$

if $X_X < X_A$ then $Z = R_1 - \sqrt{R_1^{\,2} - X_X^{\,2}}$ else $Z = Z_B + R_2 - \sqrt{R_2^{\,2} - (X_X - X_B)^2}$

Fig.11 Screen reference points.

Sagittal heights

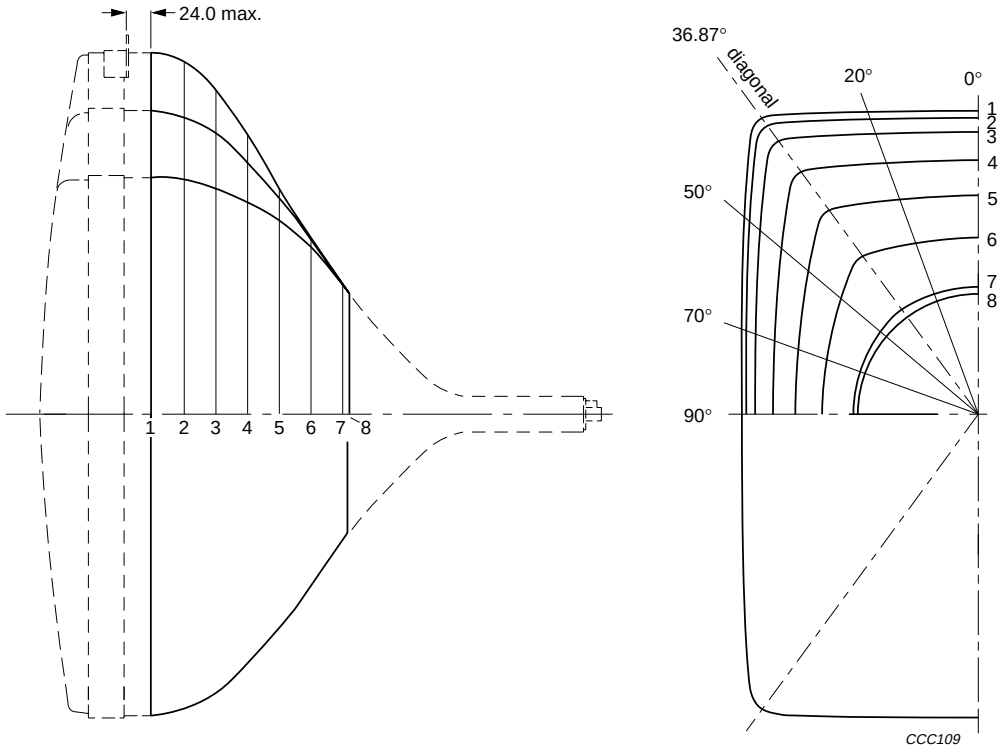
Sagittal heights of the useful screen measured with respect to the end of the diagonal axis.

NOMINAL USEFUL SCREEN (NUS)			3 mm INSIDE NUS			5 mm OUTSIDE NUS		
COORDINATES		SAGITTAL HEIGHT	COORDINATES		SAGITTAL HEIGHT	COORDINATES		SAGITTAL HEIGHT
X (mm)	Y (mm)	(mm)	X (mm)	Y (mm)	(mm)	X (mm)	Y (mm)	(mm)
0.0(1)	125.1	10.9	0.0	122.1	10.5	0.0	130.1	11.6
10.0	125.1	10.8	10.0	122.1	10.4	10.0	130.1	11.5
20.0	125.0	10.7	20.0	122.0	10.3	20.0	130.0	11.4
30.0	125.0	10.5	30.0	122.0	10.1	30.0	130.0	11.2
40.0	125.0	10.3	40.0	122.0	9.8	40.0	130.0	11.0
50.0	124.9	9.9	50.0	121.9	9.5	50.0	129.9	10.6
60.0	124.8	9.5	60.0	121.9	9.1	60.0	128.8	10.2
70.0	124.7	9.0	70.0	121.7	8.5	70.0	129.7	9.7
80.0	124.6	8.4	80.0	121.6	8.0	80.0	129.6	9.1
90.0	124.5	7.7	90.0	121.5	7.3	90.0	129.5	8.4
100.0	124.4	6.9	100.0	121.4	6.5	100.0	129.4	7.6
110.0	124.2	6.1	110.0	121.2	5.7	110.0	129.2	6.8
120.0	124.1	5.2	120.0	121.1	4.8	120.0	129.1	5.9
130.0	123.9	4.1	130.0	120.9	3.7	130.0	128.9	4.8
140.0	123.7	3.0	140.0	120.7	2.6	140.0	128.7	3.7
150.0	123.5	1.9	150.0	120.5	1.5	150.0	128.5	2.5
160.0	123.3	0.6	160.0	120.3	0.2	160.0	128.3	1.3
164.3(2)	123.2	0.0	161.3	120.3	0.0	169.2	128.1	0.0
164.3	120.0	0.3	–	–	–	169.3	120.0	0.8
164.4	110.0	1.2	161.4	110.0	1.0	169.4	110.0	1.8
164.5	100.0	2.1	161.5	100.0	1.8	169.5	100.0	2.7
164.6	90.0	2.9	161.6	90.0	2.6	169.6	90.0	3.4
164.7	80.0	3.6	161.7	80.0	3.3	169.7	80.0	4.1
164.8	70.0	4.2	161.8	70.0	3.9	169.8	70.0	4.8
164.8	60.0	4.8	161.8	60.0	4.5	169.8	60.0	5.3
164.9	50.0	5.2	161.9	50.0	4.9	169.9	50.0	5.7
164.9	40.0	5.6	161.9	40.0	5.3	169.9	40.0	6.1
164.9	30.0	5.9	161.9	30.0	5.5	169.9	30.0	6.4
165.0	20.0	6.1	162.0	20.0	5.8	170.0	20.0	6.6
165.0	10.0	6.2	162.0	10.0	5.9	170.0	10.0	6.7
165.0(3)	0.0	6.2	162.0	0.0	5.9	170.0	0.0	6.7

Notes

1. End of short axis.
2. End of diagonal axis.
3. End of long axis.

Cone contour



Dimensions in mm.

Fig.12 Maximum cone contour.

Cone contour data

SECTION	NOMINAL DISTANCE FROM SECTION 1 (mm)	MAXIMUM DISTANCE FROM TUBE AXIS (mm)										
		0°	10°	20°	30°	36.87°	40°	50°	60°	70°	80°	90°
1	0.0	184.3	186.9	195.1	210.0	221.0	217.9	187.3	167.2	154.9	148.2	146.1
2	20.0	179.8	182.1	189.2	201.1	209.6	207.2	181.5	162.5	150.6	144.1	142.1
3	40.0	169.9	171.6	176.4	183.5	186.6	185.2	169.0	153.5	143.2	137.4	135.5
4	60.0	154.8	155.8	158.5	161.7	162.0	160.9	152.4	142.1	134.3	129.6	128.1
5	80.0	134.1	134.7	136.1	137.1	136.6	135.9	132.2	127.2	122.6	119.5	118.4
6	100.0	109.9	110.2	110.6	110.6	110.3	110.0	108.6	106.9	105.1	103.7	103.2
7	120.0	82.4	82.5	82.7	82.7	82.6	82.6	82.3	81.9	81.5	81.1	80.9
8	124.8	75.4	75.4	75.4	75.5	75.5	75.4	75.4	75.3	75.3	75.2	75.2

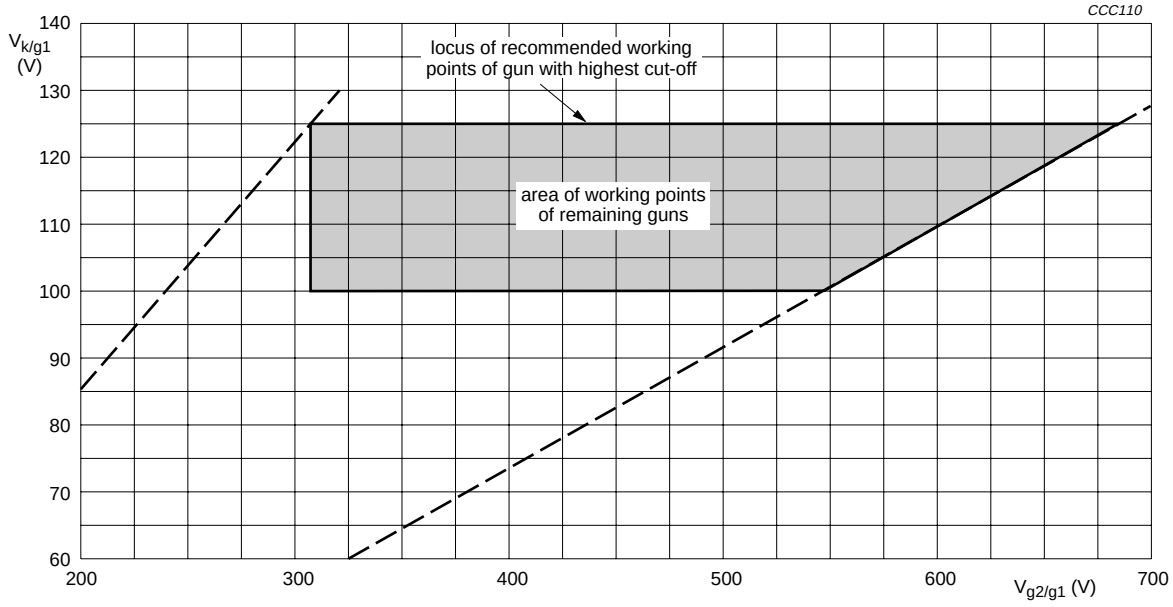
HANDLING

During shipment and handling the tube should not be subjected to accelerations greater than 350 m/s^2 in any direction (at pulse ≤10 ms).

OPERATING DATA

The voltages are specified with respect to grid 1.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_a	anode voltage		–	23	–	kV
V_{g3}	grid 3 (focus electrode) voltage		6.7	–	7.6	kV
V_{g2}	grid 2 voltage	for spot cut-off voltage V_k = 125 V	310	–	685	V
V_f	heater voltage	operating	–	6.15	–	V



Grid 2 voltage (V_{g2}) adjusted for highest gun spot cut-off voltage V_k = 125 V.

Remaining guns adjusted for spot cut-off by means of cathode voltage.

V_{g2} range: 310 to 685 V.

V_k range: 100 to 125 V.

Adjustment procedure:

Set cathode voltage (V_k) for each gun at 125 V; increase the grid 2 voltage (V_{g2}) from approximately 300 V to the value at which one of the colours becomes just visible. Now decrease the cathode voltage of the remaining guns so that the other colours become visible.

Fig.13 Spot cut-off design chart.

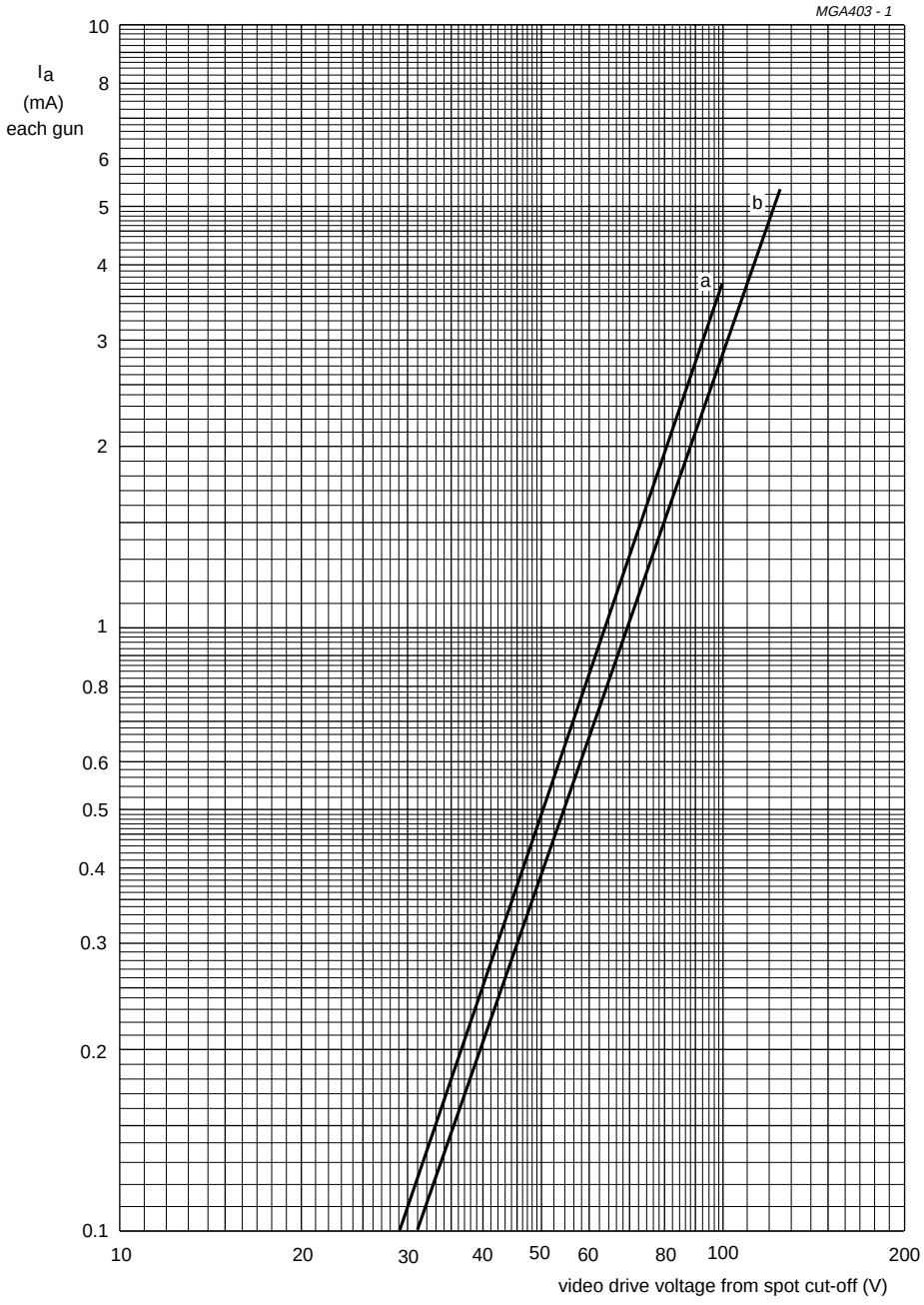
CHASSIS DESIGN VALUES

The values are valid for anode voltages between 20 and 27.5 kV. The voltages are specified with respect to grid 1.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{g3}	grid 3 (focus electrode) voltage as a percentage of anode voltage		29	–	33	%
V_{g2} and V_k	grid 2 voltage and cathode voltage	for visual extinction of focused spot	see Fig.13			
ΔV_k	difference in cut-off voltage between guns in any tube		lowest value >80% of highest value			
V_f	heater voltage	operating	–	6.15	–	V
	video drive characteristics		note 1 and Fig.14			
I_{g3}	grid 3 (focus electrode) current		–2	–	+2	μA
I_{g2}	grid 2 current		–2	–	+2	μA
I_{g1}	grid 1 current	under cut-off conditions	–2	–	+2	μA
R_{ins}	insulation resistance	each cathode to grid 1 and heater	50	–	–	MΩ
Anode currents to produce white of 6500 K + 7 MPCD (CIE coordinates: x = 0.313; y = 0.329)						
PERCENTAGE OF THE TOTAL ANODE CURRENT SUPPLIED BY EACH GUN (TYPICAL)						
	red gun		–	41.3	–	%
	green gun		–	34.4	–	%
	blue gun		–	24.3	–	%
RATIO OF ANODE CURRENTS						
	red gun to green gun		0.85	1.20	1.55	
	red gun to blue gun		1.20	1.70	2.20	
	blue gun to green gun		0.40	0.70	1.00	

Note

1. For optimum picture performance it is recommended that the cathodes are not driven below +1 V with respect to grid 1.



V_f = 6.15 V.
V_a = 23 kV.
V_{g3} adjusted for focus.
V_{g2} (each gun) adjusted to provide spot cut-off for V_k = 100 V (curve a) and V_k = 125 V (curve b).

Fig.14 Typical cathode drive characteristics.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are specified with respect to grid 1.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_a	anode voltage	notes 1 and 2	20[3]	27.5[4]	kV
I_a	long-term average current for three guns	note 5	–	750	μA
V_{g3}	grid 3 (focus electrode) voltage		–	11	kV
V_{g2}	grid 2 voltage		–	1000	V
V_f	heater voltage	note 6	5.7	6.6[4]	V
Cathode voltage					
V_k	positive	operating	–	250	V
		during blanking	–	400	V
V_k	positive operating cut-off		–	200	V
V_k	negative		–	0	V
V_{kp}	negative peak		–	–2	V
Cathode to heater voltage					
V_{kf}	positive		–	250	V
V_{kfp}	positive peak		–	300	V
V_{kf}	negative		–	0	V
V_{kfp}	negative peak		–	–50	V
Circuit values					
R_{g3}	grid 3 circuit resistance		–	70	MΩ
R_{g2}	grid 2 circuit resistance		–	7	MΩ
R_{g1k}	grid 1 to cathode circuit resistance (each gun)		–	750	kΩ

Notes

1. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without the picture tube.
2. The picture tube does not emit X-radiation above 1 μSv/h when operated with anode voltage of 27.5 kV and an anode current of 1 mA.
3. Operation of the tube at lower voltages impairs the luminance and resolution and may impair the convergence.
4. This value is an absolute maximum.
5. The short-term average anode current should be limited by circuitry to 1000 μA.
6. For maximum cathode life and optimum performance it is recommended that the heater supply is designed for 6.15 V at average beam current, for most applications this equals 6.3 V at zero beam current.

BEAM CENTRING

Maximum centring error is 3 mm in any direction after colour purity, static convergence and horizontal centre line correction (measured with deflection coils at nominal position).

FLASHOVER PROTECTION

With the high voltage used with this tube (max. 27.5 kV) internal flashovers may occur. As a result of Soft-Flash technology these flashover currents are limited to approximately 60 A offering higher reliability, optimum circuit protection and component savings.

Primary protective circuitry using properly grounded spark gaps and series isolation resistors (preferably carbon composition) is still necessary to prevent tube damage. The spark gaps should be connected to all picture tube electrodes at the socket in accordance with Fig.15; they are not required on the heater pins. No other connections between the outer conductive coating and the chassis are permissible. The spark gaps should be designed for a breakdown voltage at the focus electrode (g3) of 12 kV ($1.5 \times V_{g3}$ max. at V_a = 25 kV), and 2 kV at the other electrodes, at an atmospheric pressure of 100 kPa.

The values of the series isolation resistors should be as high as possible (min. 1.5 kΩ) without causing deterioration of the circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focusing circuit and 12 kV for the remaining circuits without arcing.

Additional information is available on request.

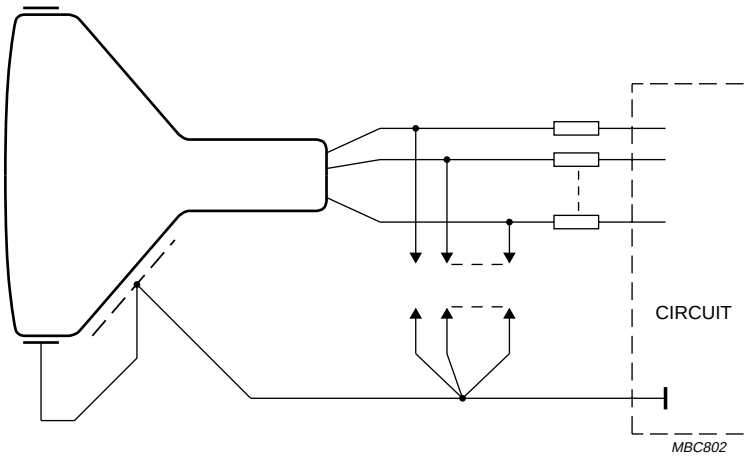
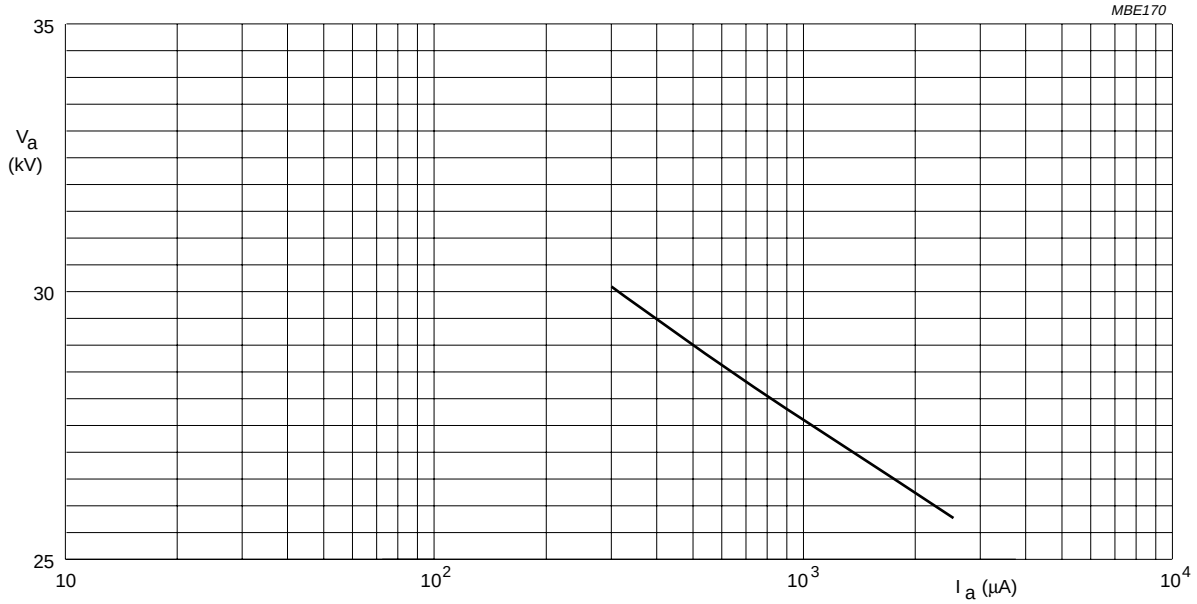


Fig.15 Flashover protection circuit.

X-RADIATION

The tube does not emit X-radiation above 1 μSv/h when operated at 27.5 kV and 1 mA.



The X-radiation emitted will also not exceed 1 μSv/h for anode voltage and current combinations shown in the iso-exposure-rate limit curve.

Fig.16 1 μSv/h iso-exposure-rate limit curve.

DEGAUSSING

The picture tube is provided with an internal magnetic shield. This shield and the shadow mask with its suspension system may be provided with an automatic degaussing system, consisting of one magnetic coil winding mounted on the cone of the picture tube.

For proper degaussing an initial magnetomotive force (MMF) of 600 ampere-turns is required in the coil. This MMF must be gradually decreased (maximum 30% per half period) by appropriate circuitry. To prevent beam landing disturbance by line frequency currents induced in the degaussing coils, this coil should be shunted by a capacitor of sufficiently high value. In steady state, no significant MMF should remain in the coil (≤0.6 ampere-turns).

If single-phase power rectification is employed in the TV circuitry, provision should be included to prevent asymmetric distortion of the AC voltage applied to the degaussing circuit due to high DC inrush currents.

An example of a degaussing circuit and coil data is given in Fig.17 and Table “Degaussing coil data”.

Degaussing coil data

PARAMETER	110/120 V (AC) MAINS	220/240 V (AC) MAINS	UNIT
Circumference	113	113	cm
Number of turns	70	120	
Copper wire diameter	0.50	0.36	mm
Resistance	6.8	23.5	Ω
Catalogue number of an appropriate dual PTC thermistor	2322 662 96013	2322 662 96009	

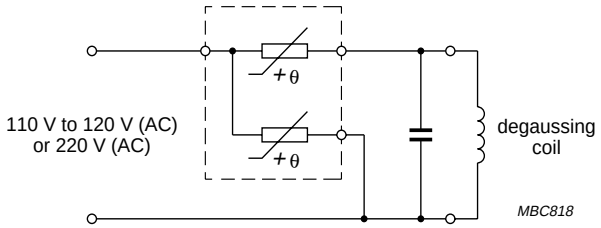
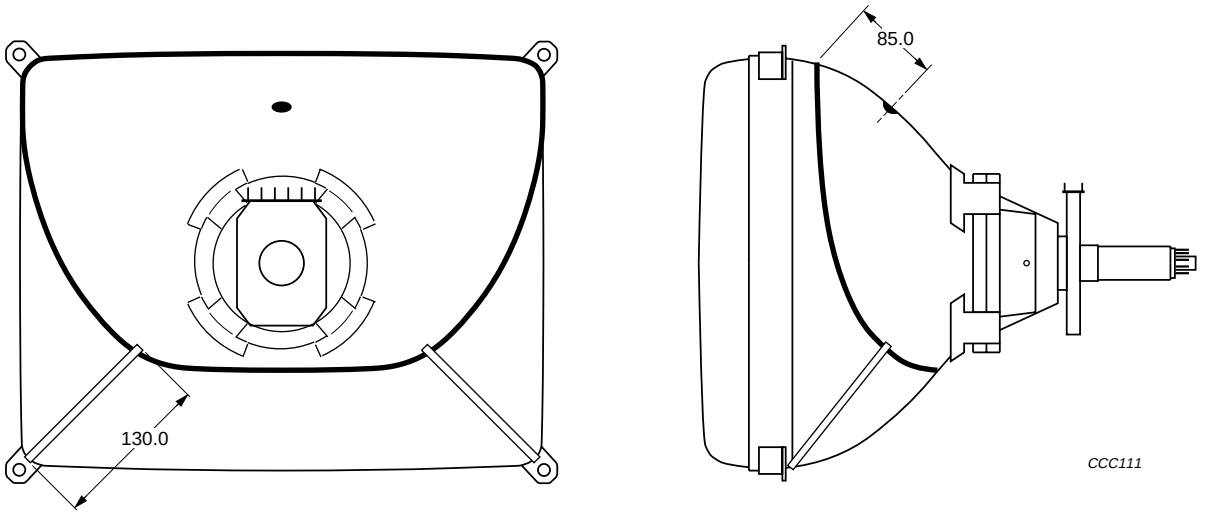


Fig.17 Typical degaussing circuit using a dual PTC thermistor.



Dimensions in mm.

Fig.18 Position of the degaussing coil on the picture tube.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

Philips Components – a worldwide company

Australia: Philips Components Pty Ltd., HOMEBUSH,
Tel. +61 2 9704 8141, Fax. +61 2 9704 8139

Austria: Österreichische Philips Industrie GmbH, WIEN,
Tel. +43 1 60 101 12 41, Fax. +43 1 60 101 12 11

Belarus: Philips Office Belarus, MINSK,
Tel. +375 172 200 924/733, Fax. +375 172 200 773

Benelux: Philips Nederland B.V., EINDHOVEN, NL,
Tel. +31 40 25 90 772, Fax. +31 40 25 90 777

Brazil: Philips Components, SÃO PAULO,
Tel. +55 11 821 2333, Fax. +55 11 829 1849

Canada: Philips Electronics Ltd., SCARBOROUGH,
Tel. +1 416 292 5161, Fax. +1 416 754 6248

China: Philips Company, SHANGHAI,
Tel. +86 21 6354 1088, Fax. +86 21 6354 1060

Denmark: Philips Components A/S, COPENHAGEN V,
Tel. +45 3329 3333, Fax. +45 3329 3905

Finland: Philips Components, ESPOO,
Tel. +358 9 615 800, Fax. +358 9 615 80510

France: Philips Composants, SURESNES,
Tel. +33 1 4099 6161, Fax. +33 1 4099 6493

Germany: Philips Components GmbH, HAMBURG,
Tel. +49 40 2489-0, Fax. +49 40 2489 1400

Hong Kong: Philips Hong Kong, KOWLOON,
Tel. +852 2784 3000, Fax. +852 2784 3003

India: Philips India Ltd., MUMBAI,
Tel. +91 22 4930 311, Fax. +91 22 4930 966/4950 304

Indonesia: P.T. Philips Development Corp., JAKARTA,
Tel. +62 21 794 0040, Fax. +62 21 794 0080

Ireland: Philips Electronics (Ireland) Ltd., DUBLIN,
Tel. +353 1 7640 203, Fax. +353 1 7640 210

Israel: Rapac Electronics Ltd., TEL AVIV,
Tel. +972 3 6450 444, Fax. +972 3 6491 007

Italy: Philips Components S.r.l., MILANO,
Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

Japan: Philips Japan Ltd., TOKYO,
Tel. +81 3 3740 5135, Fax. +81 3 3740 5035

Korea (Republic of): Philips Electronics (Korea) Ltd., SEOUL,
Tel. +82 2 709 1472, Fax. +82 2 709 1480

Malaysia: Philips Malaysia SDN Berhad,
Components Division, PULAU PINANG,
Tel. +60 3 750 5213, Fax. +60 3 757 4880

Mexico: Philips Components, EL PASO, U.S.A.,
Tel. +52 915 772 4020, Fax. +52 915 772 4332

New Zealand: Philips New Zealand Ltd., AUCKLAND,
Tel. +64 9 815 4000, Fax. +64 9 849 7811

Norway: Philips Components, STOCKHOLM,
Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

Pakistan: Philips Electrical Industries of Pakistan Ltd., KARACHI,
Tel. +92 21 587 4641-49, Fax. +92 21 577 035/+92 21 587 4546

Philippines: Philips Semiconductors Philippines Inc.,
METRO MANILA, Tel. +63 2 816 6345, Fax. +63 2 817 3474

Poland: Philips Poland Sp. z.o.o., WARSZAWA,
Tel. +48 22 5710 000, Fax. +48 22 5710 001

Portugal: Philips Portuguesa S.A.,
Philips Components: LINDA-A-VELHA,
Tel. +351 1 416 3160/416 3333, Fax. +351 1 416 3174/416 3366

Russia: Philips Russia, MOSCOW,
Tel. +7 95 755 6918, Fax. +7 95 755 6919

Singapore: Philips Singapore Pte Ltd., SINGAPORE,
Tel. +65 350 2000, Fax. +65 355 1758

South Africa: S.A. Philips Pty Ltd., JOHANNESBURG,
Tel. +27 11 470 5911, Fax. +27 11 470 5494

Spain: Philips Components, BARCELONA,
Tel. +34 93 301 63 12, Fax. +34 93 301 42 43

Sweden: Philips Components, STOCKHOLM,
Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

Switzerland: Philips Components AG, ZÜRICH,
Tel. +41 1 488 22 11, Fax. +41 1 481 7730

Taiwan: Philips Taiwan Ltd., TAIPEI,
Tel. +886 2 2134 2900, Fax. +886 2 2134 2929

Turkey: Türk Philips Ticaret A.S., UMRABIYE/ISTANBUL,
Tel. +90 216 522 18 00, Fax. +90 216 522 18 14

United Kingdom: Philips Components Ltd., DORKING,
Tel. +44 1306 512 000, Fax. +44 1306 512 345

United States:

- Philips Components, SAN JOSE, CA,
  Tel. +1 408 570 5600, Fax. +1 408 570 5700
- Philips Display Components, ANN ARBOR, MI,
  Tel. +1 734 996 9400, Fax. +1 734 761 2776

Yugoslavia (Federal Republic of): Philips Components, BELGRADE,
Tel. +381 11 625 344 / +381 11 3341 299, Fax. +381 11 635 777

Internet:

- Advanced Ceramics & Modules: www.acm.components.philips.com
- Display Components: www.philipsdisplay.com

For all other countries apply to:
Philips Components, Building BAE-1, P.O. Box 218, 5600 MD EINDHOVEN,
The Netherlands, Fax. +31 40 27 22 599

COD31

Printed in The Netherlands

050610/200/02/pp24 Date of release: 1999 Oct 18
Document order number: 9397 378 45011

Let's make things better.

Philips
Components

PHILIPS