

DATA SHEET

A59EAK071X **'Black Line FX'** **colour picture tube**

Preliminary specification
Supersedes data of 1998 Nov 24
File under Display Components, DC01

1999 Aug 27

**'Black Line FX'
colour picture tube****A59EAK071X****FEATURES**

- 'Flatter' and 'squarer' screen
- In-line, hi-bi potential ART (Aberration Reducing Triode) gun with quadrupole cathode lens
- Mask with corner suspension
- BLACK MATRIX technology
- HIGH GLOSS screen finish
- Cd-free phosphors
 - Highly pigmented deep red
 - Bright sulphide green
 - Highly pigmented sulphide blue
- Quick-heating low-power cathodes
- Slotted shadow mask optimized for minimum moiré at 525 and 625 line systems
- Internal magnetic shield
- Internal multipole.

QUICK REFERENCE DATA

PARAMETER	TYP.	UNIT
Deflection angle	110	deg
Useful screen diagonal	59	cm
Overall length	39	cm
Glass transmission	46	%
Neck diameter	29.1	mm
Heater voltage	6.15	V
Heater current	315	mA
Anode voltage	25	kV
Focus voltage	31% of anode voltage	

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ELECTRICAL DATA

SYMBOL	PARAMETER	MIN.	TYP.	UNIT
Capacitances				
$C_{a(m+m')}$	anode to external conductive coating, including rimband	1800	–	pF
$C_{am'}$	anode to metal rimband	–	300	pF
C_k	cathodes of all guns (connected in parallel) to all other electrodes	–	15	pF
C_{kR}, C_{kG}, C_{kB}	cathode of any gun to all other electrodes	–	5	pF
C_{g1}	grid 1 to all other electrodes	–	17	pF
C_{g2}	grid 2 to all other electrodes	–	4.5	pF
C_{g3}	grid 3 (focusing electrode) to all other electrodes	–	6	pF
Heating				
V_f	heater voltage at average beam current: indirect AC (preferably mains or horizontal frequency) or DC	–	6.15	V
I_f	heater current	–	315	mA
Resistance				
R_{rim}	resistance between rimband and external conductive coating	50	–	MΩ

ELECTRO-OPTICAL DATA

PARAMETER	VALUE
Electron gun system	unitized triple-aperture electrodes; aberration reducing triode
Focus method	electrostatic
Focus lens	hi-bi potential
Deflection method	magnetic
Deflection angles	
diagonal	110°
vertical	97°
horizontal	77°

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OPTICAL DATA

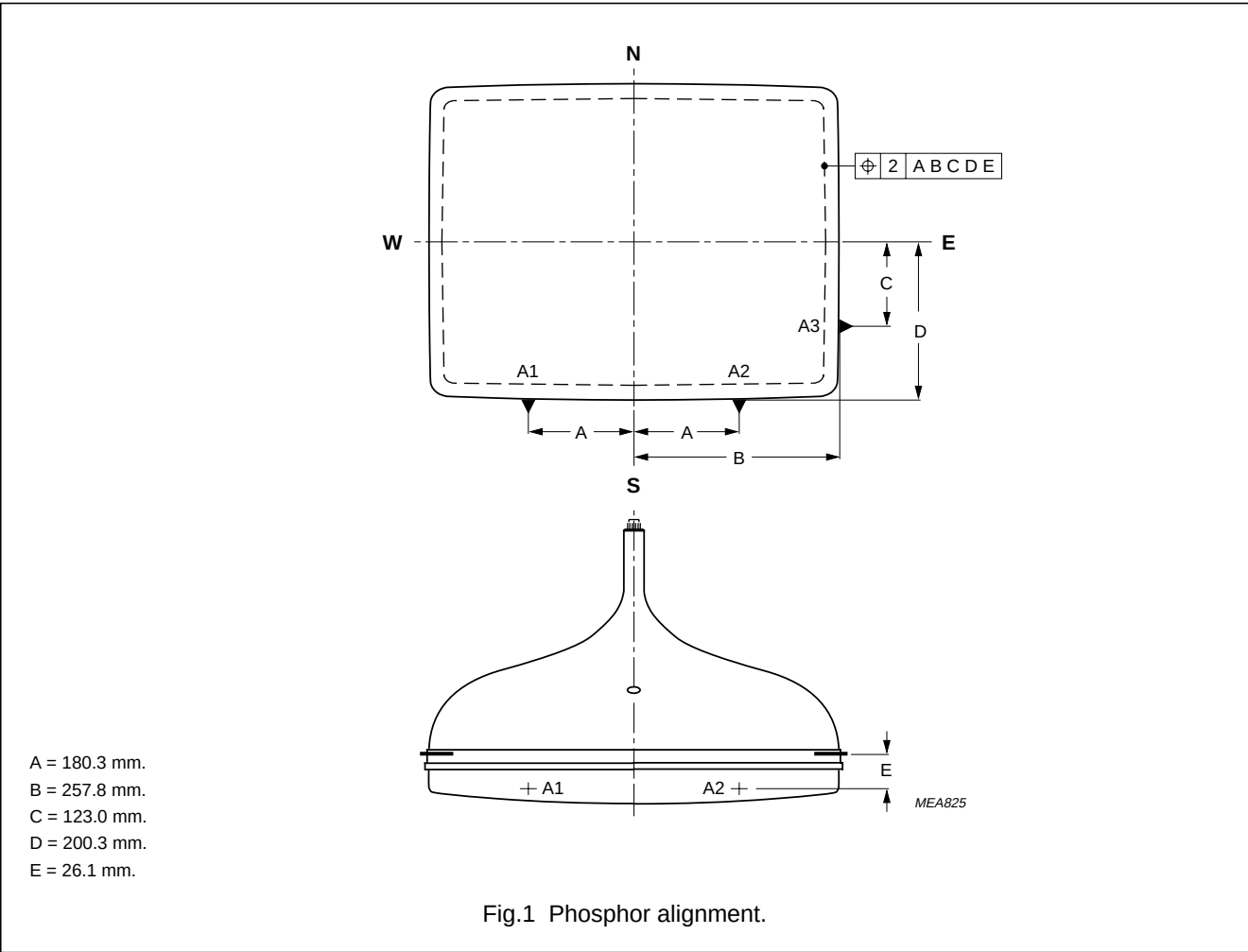
PARAMETER	VALUE
Matrix	black opaque material, PVP technology
Screen	metal-backed vertical phosphor stripes
Screen finish	high gloss
Nominal useful screen dimensions	
diagonal axis	591.0 mm
vertical axis	364.0 mm
horizontal axis	479.0 mm
area	1745 cm ²
Phosphor alignment	see Fig.1
Phosphors	
red	highly pigmented europium activated rare earth
green	bright Cd-free sulphide type
blue	highly pigmented sulphide type
Persistence	medium short
Centre-to-centre distance of identical colour phosphor stripes at centre of screen	≈0.8 mm
Light transmission of face glass at centre of screen	46%
Luminance at centre of screen; note 1	82 cd/m ²

Note

1. Tube settings adjusted to produce white D ($x = 0.313$, $y = 0.329$), focused raster, current density $0.4 \mu\text{A}/\text{cm}^2$, $V_a = 25 \text{ kV}$.

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Colour coordinates

COLOUR	x	y
Red	0.640	0.335
Green	0.300	0.610
Blue	0.155	0.065

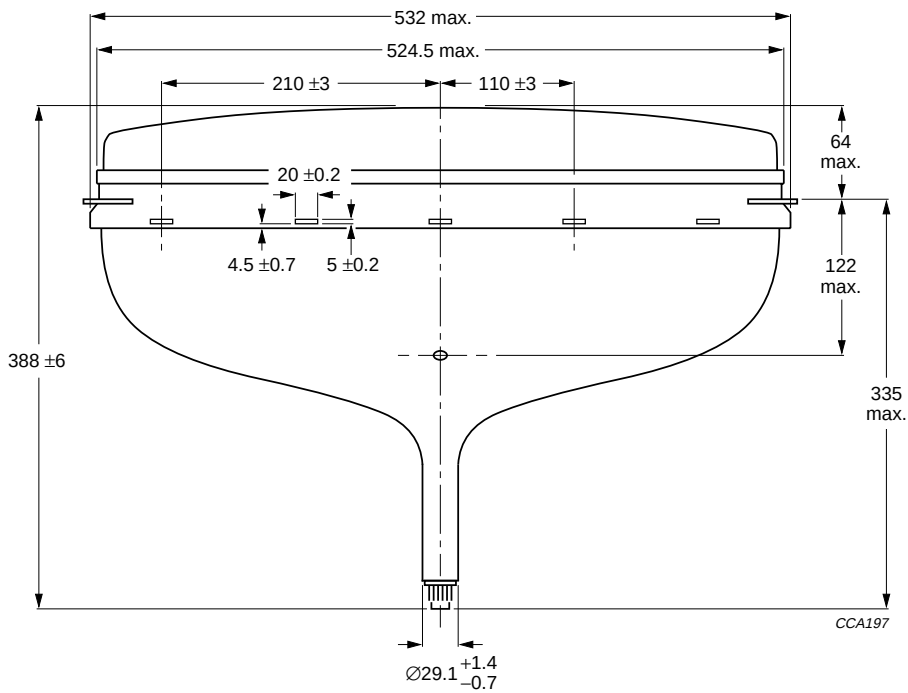
MECHANICAL DATA

See Figs 2 to 12.

PARAMETER	VALUE
Base	Base JEDEC B10-277
Anode contact	small cavity contact JEDEC J1-21; IEC 60067-III-2
Mounting position	anode contact on top
Implosion protection	shrunk-on rimband
Mass including deflection unit	≈19 kg

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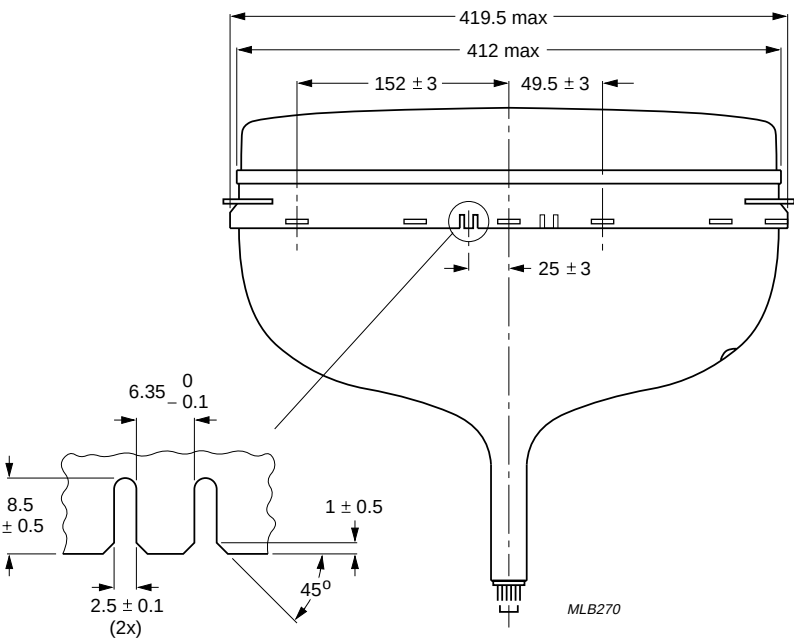


Dimensions in mm.

Fig.2 Tube dimensions; top view.

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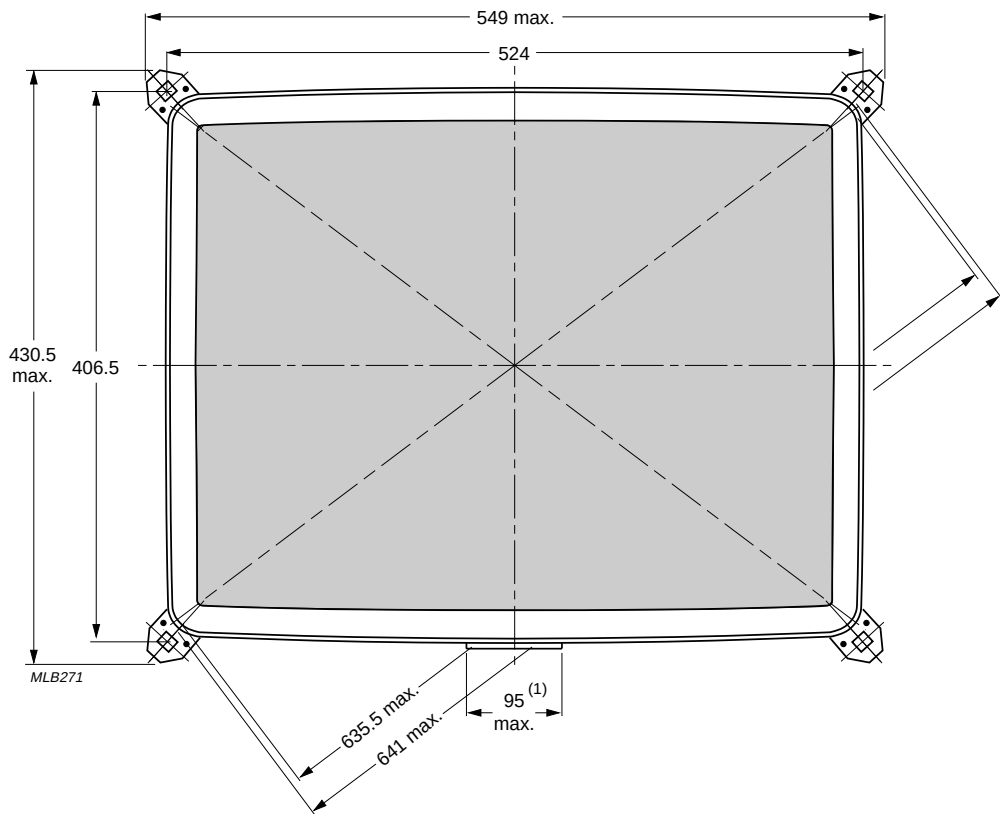


Dimensions in mm.

Fig.3 Tube dimensions; side view.

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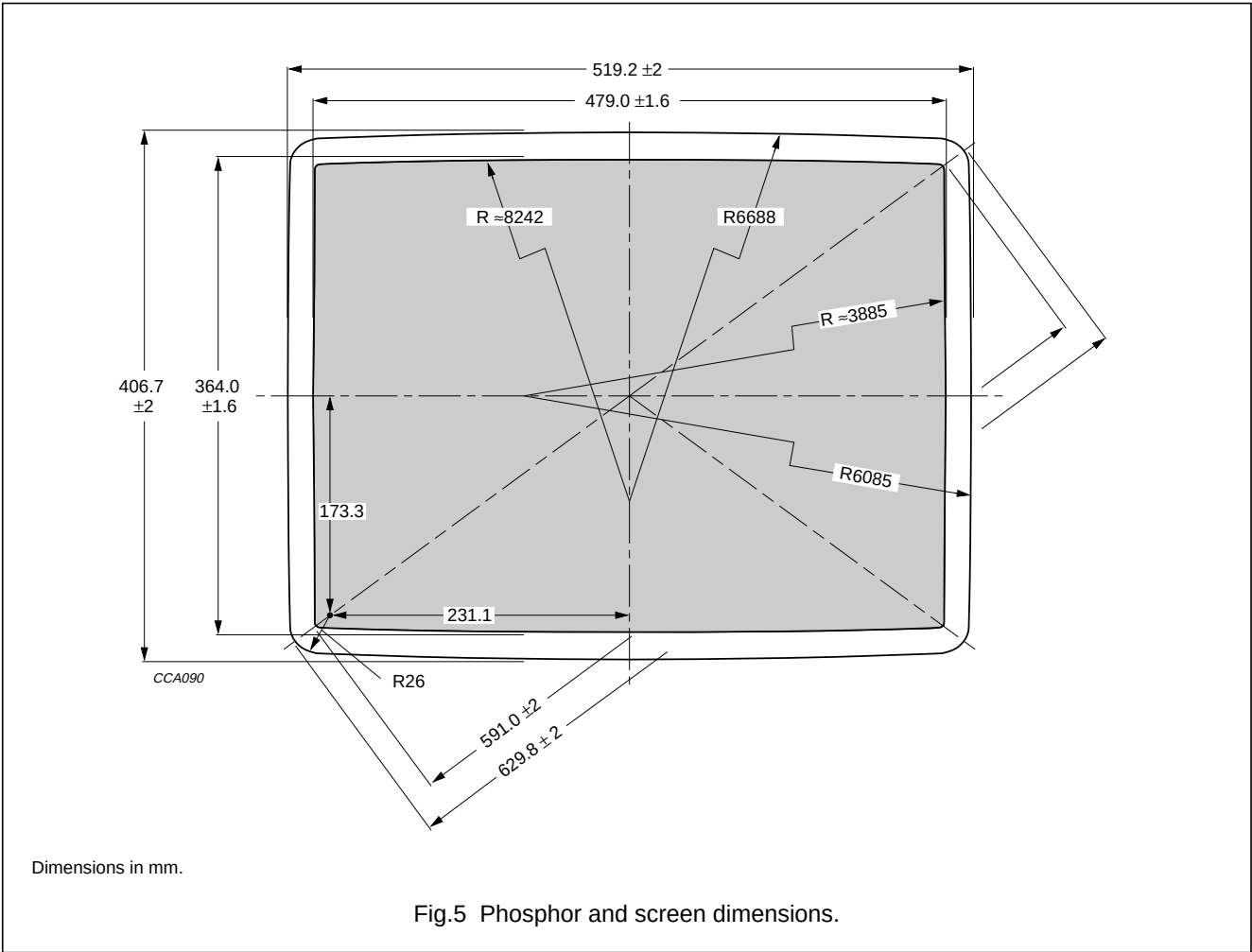


Dimensions in mm.
(1) Location of fish-plate.

Fig.4 Tube dimensions; front view.

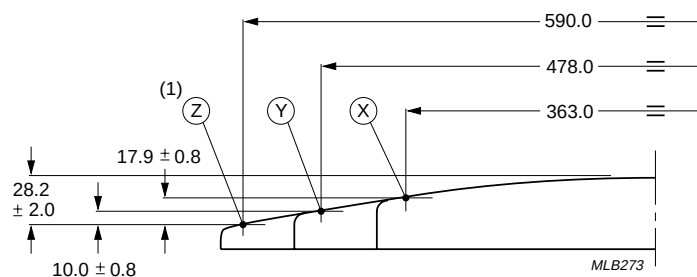
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Dimensions in mm.

(1) Coordinates of Z-point: X = 236, Y = 177.

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:

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

$$R1 = 1607.25$$

$$XB = XA - \frac{R2 \times XA}{R1}$$

$$R2 = 1416.39$$

$$XA = 150.4 \text{ (transition)}$$

$$ZA = R1 - \sqrt{R1^2 - XA^2}$$

$$ZB = R1 - R2 - ZC$$

$$ZC = \frac{(R1 - ZA) \times XB}{XA}$$

$$\text{If } R < XA \text{ then } Z = R1 - \sqrt{R1^2 - R^2}$$

$$\text{else } Z = ZB + R2 - \sqrt{R2^2 - (R - XB)^2}$$

Fig.6 Screen reference points.

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Sagittal heights with reference to screen centre at edge of the nominal useful screen

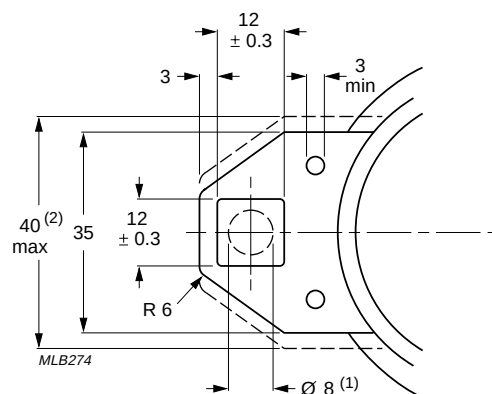
NOMINAL USEFUL SCREEN (NUS)			3 mm INSIDE NUS			10 mm OUTSIDE NUS		
COORDINATES		SAGITTAL HEIGHT	COORDINATES		SAGITTAL HEIGHT	COORDINATES		SAGITTAL HEIGHT
X (mm)	Y (mm)		X (mm)	Y (mm)		X (mm)	Y (mm)	
0.0 ⁽¹⁾	182.0	10.4	0.0	179.0	10.0	0.0	192.0	11.6
20.0	182.0	10.5	20.0	179.0	10.2	20.0	192.0	11.7
40.0	181.9	10.9	40.0	178.9	10.5	40.0	191.9	12.1
60.0	181.8	11.5	60.0	178.8	11.2	60.0	191.8	12.7
80.0	181.6	12.4	80.0	178.6	12.1	80.0	191.6	13.6
100.0	181.4	13.5	100.0	178.4	13.2	100.0	191.4	14.8
120.0	181.1	15.0	120.0	178.1	14.6	120.0	191.1	16.2
140.0	180.8	16.6	140.0	177.8	16.3	140.0	190.8	17.8
160.0	180.5	18.6	160.0	177.5	18.2	160.0	190.5	19.8
180.0	180.0	20.8	180.0	177.0	20.4	180.0	190.0	22.0
200.0	179.6	23.2	200.0	176.6	22.9	200.0	189.6	24.5
220.0	179.1	26.0	220.0	176.1	25.6	220.0	189.1	27.2
—	—	—	—	—	—	240.0	188.5	30.3
235.4 ⁽²⁾	178.6	28.3	232.5	175.7	27.5	244.9	188.4	31.1
—	—	—	—	—	—	245.3	180.0	30.1
236.2	160.0	26.3	233.2	160.0	25.8	246.2	160.0	27.9
237.0	140.0	24.4	234.0	140.0	23.9	247.0	140.0	26.1
237.7	120.0	22.8	234.6	120.0	22.3	247.7	120.0	24.4
238.2	100.0	21.4	235.2	100.0	20.9	248.2	100.0	23.0
238.7	80.0	20.3	235.7	80.0	19.8	248.7	80.0	21.9
239.0	60.0	19.4	236.0	60.0	18.9	249.0	60.0	21.0
239.3	40.0	18.8	236.3	40.0	18.3	249.3	40.0	20.4
239.5	20.0	18.4	236.5	20.0	17.9	249.5	20.0	20.0
239.5 ⁽³⁾	0.0	18.3	236.5	0.0	17.8	249.5	0.0	19.9

Notes

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

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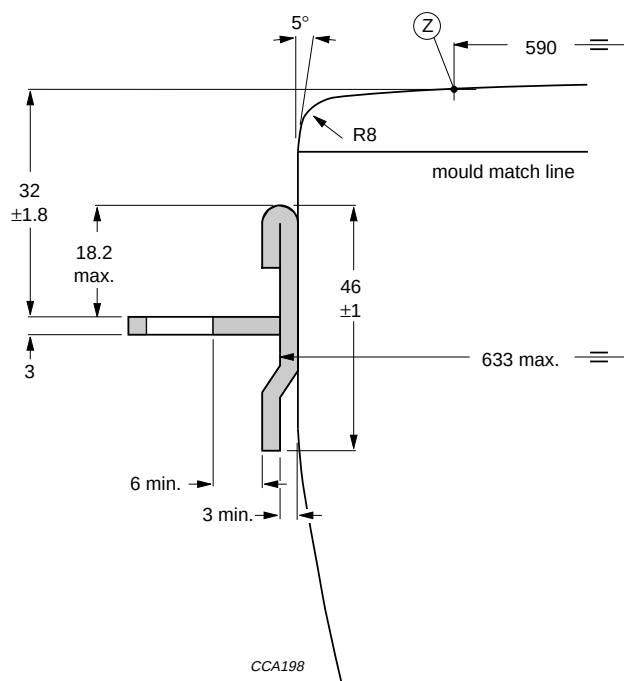
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Dimensions in mm.

- (1) 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 524.0 mm × 406.5 mm.
(2) Minimum space to be reserved for mounting lug in cabinet.

Fig.7 Lug dimensions.



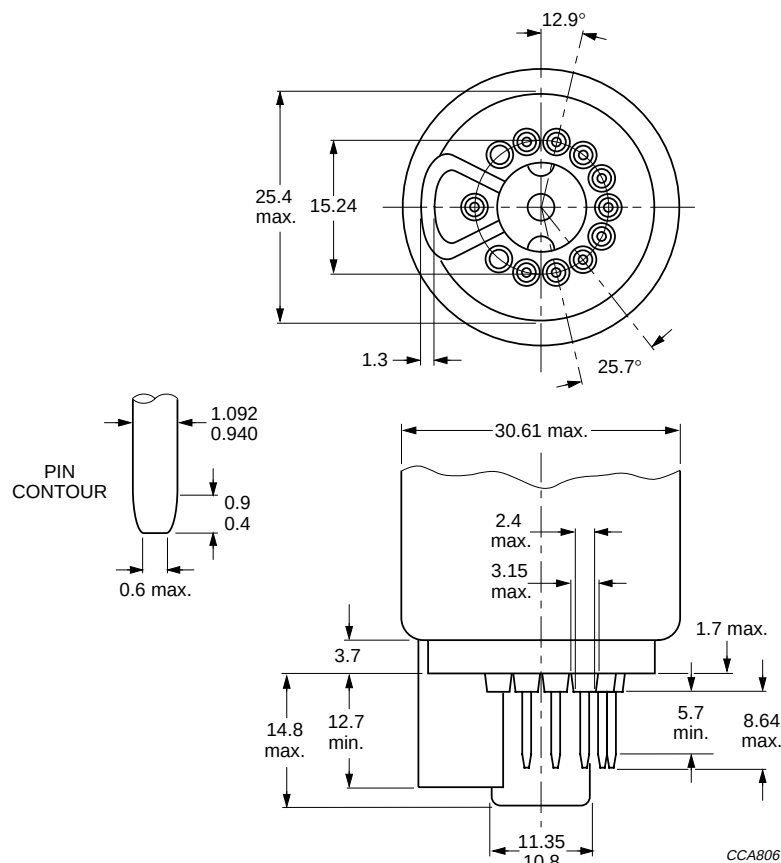
Dimensions in mm.

The displacement of any lug with respect to the plane through the three other lugs is max. 1.5 mm. This deviation is incorporated in the tolerance of ± 1.8 mm.

Fig.8 Lug position.

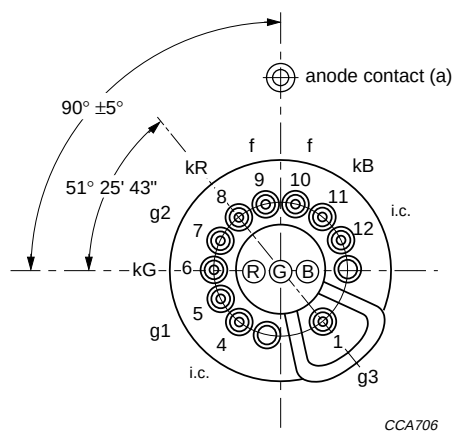
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Dimensions in mm.

Fig.9 Base JEDEC B10-277.



i.c. = internally connected and not to be used.

Fig.10 Pin arrangement.

Remarks: to Figs 9 and 10.

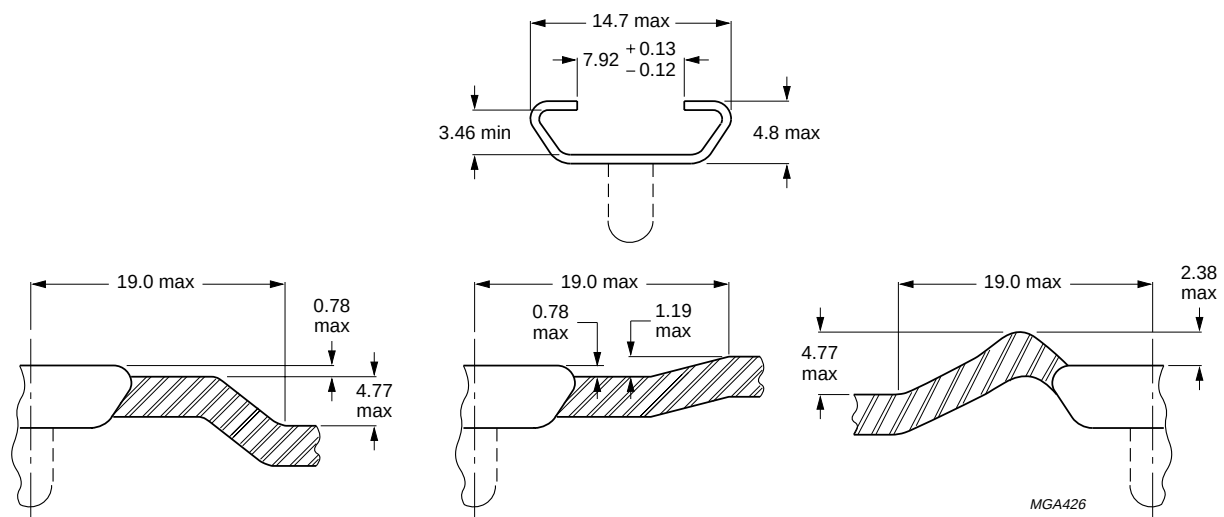
The socket for this base should not be rigidly mounted, it should have flexible leads and be allowed to move freely. After mounting the tube in the cabinet, note that the position of the base can fall within a circle, having a diameter of max. 55 mm concentric with an imaginary tube axis.

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

Maximum permissible torque on the tube neck is 0.04 Nm.

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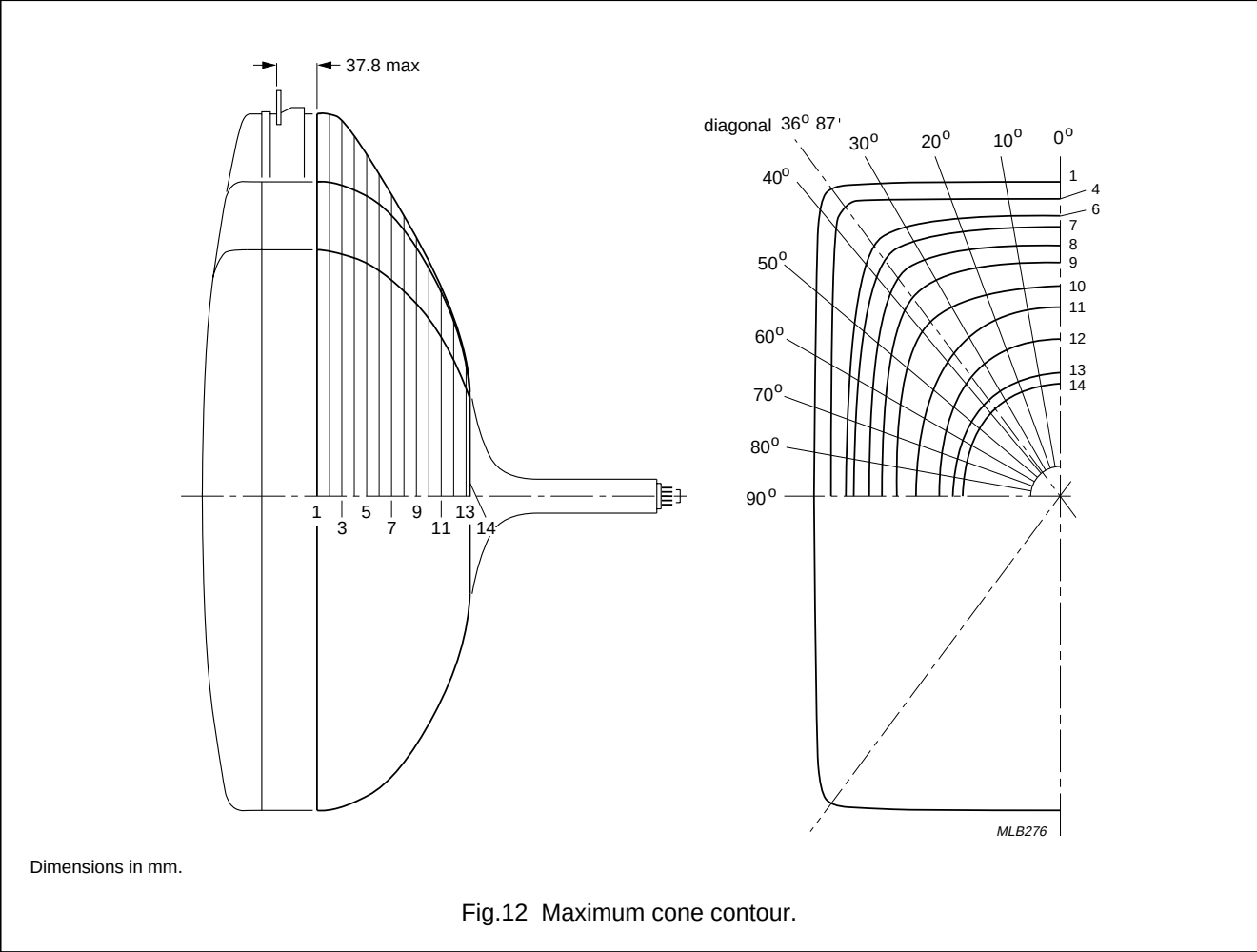
Dimensions in mm.

Fig.11 Cavity cap JEDEC J1-21, IEC 60067-III-2.

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Cone contour



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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	258.5	262.4	274.5	296.9	314.4	308.5	261.6	232.4	214.7	205.2	202.1
2	10.0	257.1	260.9	272.9	295.0	311.7	305.4	258.8	230.0	212.5	203.0	200.0
3	20.0	254.8	258.5	270.2	291.8	304.7	298.9	254.6	226.4	209.2	199.9	196.9
4	30.0	250.9	254.5	265.6	285.9	293.0	287.8	248.1	221.0	204.5	195.5	192.6
5	40.0	245.1	248.4	258.6	276.0	277.4	272.8	239.2	213.8	198.2	189.7	187.0
6	50.0	237.0	239.9	248.9	261.4	260.1	255.9	228.3	205.0	190.6	182.7	180.1
7	60.0	225.8	228.2	235.7	243.8	241.1	237.5	215.0	194.2	181.2	174.0	171.7
8	70.0	210.7	212.7	218.7	223.5	220.4	217.1	199.1	181.1	169.6	163.1	161.1
9	80.0	191.7	193.1	197.6	200.3	197.3	194.6	180.2	165.0	155.2	149.7	147.9
10	90.0	170.1	170.8	173.0	173.9	171.1	168.8	157.5	145.7	137.8	133.4	131.9
11	100.0	145.8	145.6	145.3	144.3	141.6	139.8	131.6	123.4	117.9	114.8	113.7
12	110.0	115.3	114.7	113.2	110.7	108.5	107.3	102.8	99.1	96.5	95.0	94.4
13	120.0	75.4	75.4	75.3	75.2	75.2	75.2	75.1	75.0	75.0	74.9	74.9

HANDLING

During shipment and handling the tube should not be subjected to accelerations greater than 350 m/s² in any direction (at pulse ≤10 ms).

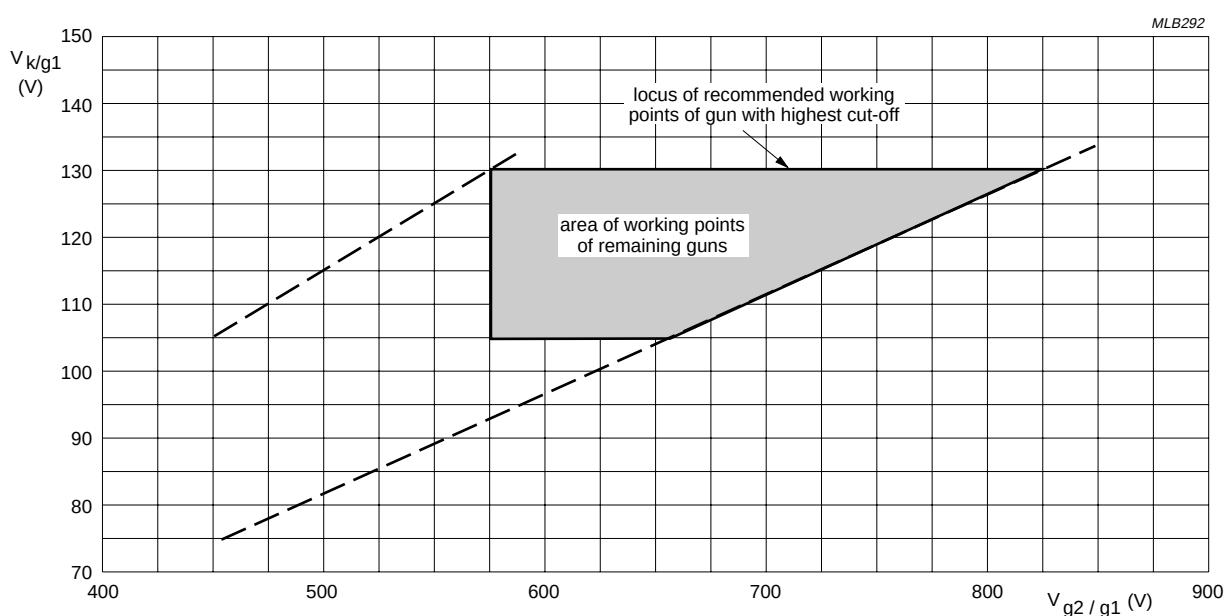
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OPERATING DATA

The voltages are specified with respect to grid 1.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V _{a,g4}	anode voltage	tube operating at no load	–	25	–	kV
V _{g3}	grid 3 (focus electrode) voltage		7.25	–	8.25	kV
V _{g2}	grid 2 voltage	for spot cut-off voltage V _k = 130 V	575	–	825	V
V _f	heater voltage	tube operating	–	6.15	–	V



Grid 2 voltage (V_{g2}) adjusted for highest gun spot cut-off voltage $V_k = 130$ V.

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

V_{g2} range: 575 to 825 V.

V_k range: 105 to 130 V.

Adjustment procedure:

Set cathode voltage (V_k) for each gun at 130 V; increase the grid 2 voltage (V_{g2}) from approximately 550 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.

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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.

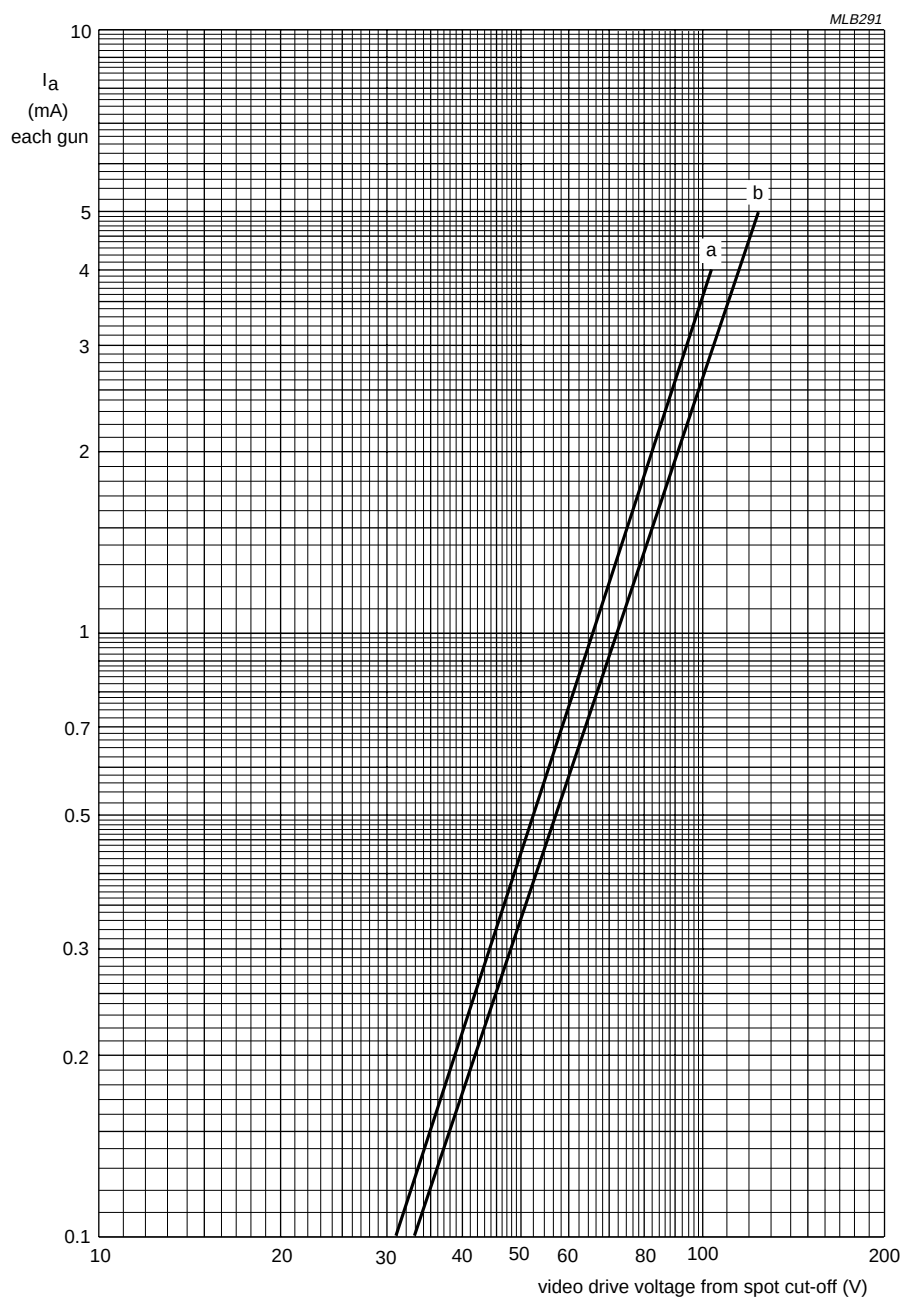
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{g3}	grid 3 (focus electrode) voltage as a percentage of anode voltage		29	—	33	%
V_{g2} and V_k	grid 2 voltage and cathode voltage	for visual extinction of focused spot	see Fig.13			
ΔV_k	difference in cut-off voltage between guns in any tube		lowest 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	—	—	M Ω
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		—	39	—	%
	green gun		—	31	—	%
	blue gun		—	30	—	%
RATIO OF ANODE CURRENTS						
	red gun to green gun		1.05	1.25	1.45	
	red gun to blue gun		1.10	1.40	1.70	
	blue gun to green gun		0.80	0.90	1.00	

Note

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

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$V_f = 6.15$ V.

$V_{a,g4} = 25$ kV.

V_{g3} adjusted for focus.

V_{g2} (each gun) adjusted to provide spot cut-off for $V_k = 105$ V (curve a) and $V_k = 130$ V (curve b).

Fig.14 Typical cathode drive characteristics.

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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	note 1	20 ⁽²⁾	29.5 ⁽³⁾	kV
I_a	long-term average current for three guns	note 4	–	1000	μ A
V_{g3}	grid 3 (focus electrode) voltage	note 5	–	12	kV
V_{g2}	grid 2 voltage	note 6	–	1200	V
V_f	heater voltage	note 7	5.7	6.6 ⁽³⁾	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	M Ω
R_{g2}	grid 2 circuit resistance		–	7	M Ω
R_{g1k}	grid 1 to cathode circuit resistance (each gun)		–	750	k Ω

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. Operation of the tube at lower voltages impairs the luminance and resolution and may impair the convergence.
3. This value is an absolute maximum.
4. The short-term average anode current should be limited by circuitry to 1500 μ A.
5. During flashover conditions maximum 20 kV is permitted (see Chapter "Flashover protection").
6. During adjustment on the production line maximum 1500 V is permitted.
7. 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 in any direction is 4 mm.

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FLASHOVER PROTECTION

The high voltages used with this tube (absolute max. 29.5 kV) may produce internal flashovers. Soft-flash technology limits these flashover currents 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 (except the tube heaters) at the tube socket in accordance with Fig.15. No other connections between the outer conductive coating and the chassis are permissible. The spark gaps should be designed for a maximum breakdown voltage at the focus electrode (g_3) of approximately 19 to 20 kV and at the other electrodes of 2 kV at the lowest operating atmospheric pressure.

The values of the series isolation resistors should be as high as possible (min. 0.5 k Ω) without causing deterioration of circuit performance. The resistors should be able to withstand an instantaneous surge of 20 kV for the focus circuit and 12 kV for the remaining circuits without arcing.

To guarantee the soft flash behaviour, the internal dynamic resistance of the tube during flashover is minimum 400 Ω and maximum 800 Ω .

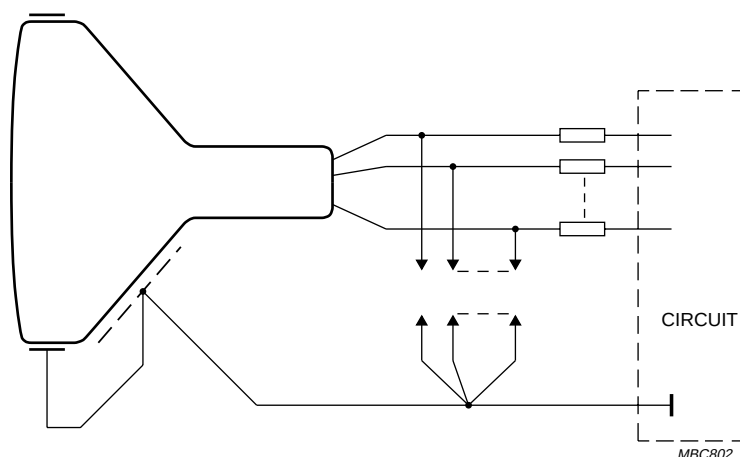


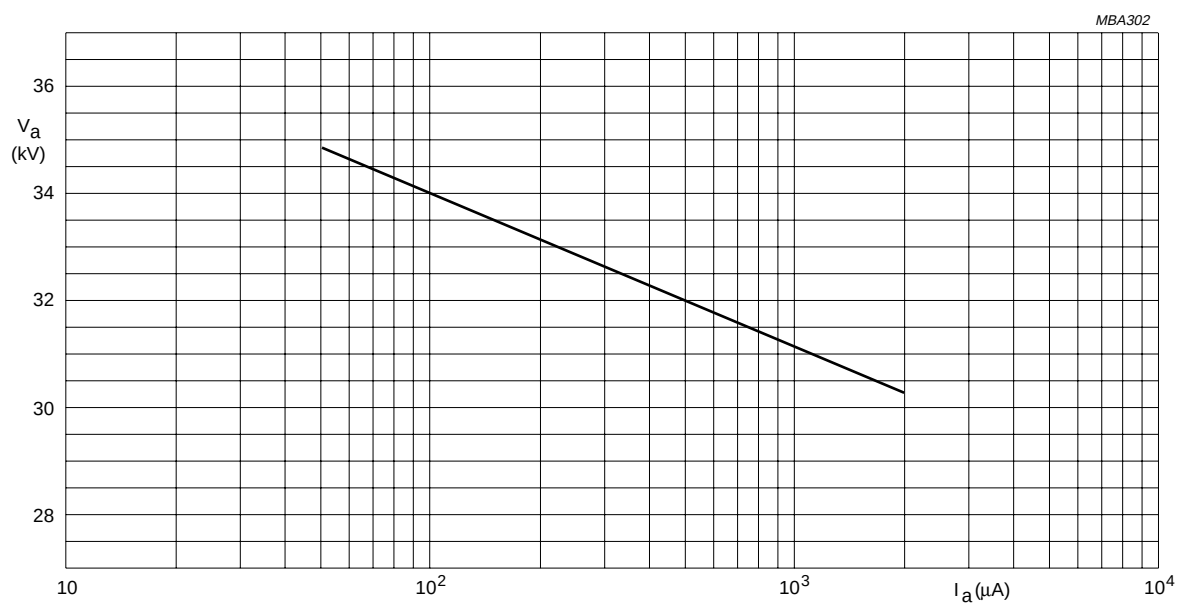
Fig.15 Flashover protection circuit.

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X-RADIATION

The tube does not emit X-radiation above 1 $\mu\text{Sv/h}$ when operated at 30 kV and 1.5 mA.



The X-radiation emitted will also not exceed 1 $\mu\text{Sv/h}$ for anode voltage and current combinations shown in the iso-exposure-rate limit curve.

Fig.16 1 $\mu\text{Sv/h}$ iso-exposure-rate limit curve.

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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 an eight-shaped coil mounted on the cone of the picture tube.

For proper degaussing an initial peak magnetomotive force (MMF) of 400 ampere-turns is required. This MMF has to be gradually decreased with a maximum of 25% per half period, using appropriate degaussing circuitry. At an initial peak MMF of >500 ampere-turns, the MMF has to be gradually decreased with a maximum of 30% per half period. In the steady state, no significant MMF should remain in the degaussing coil (≤ 0.33 ampere-turns). Switch-off is permitted at a peak MMF of ≤ 5 ampere-turns.

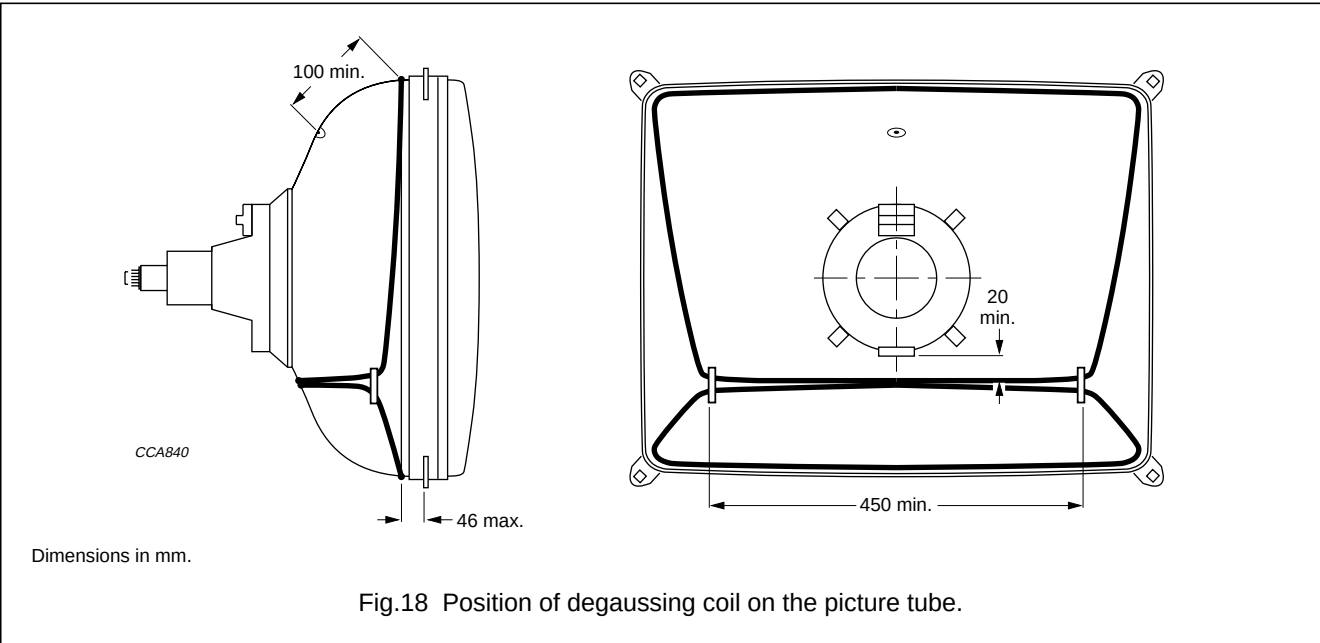
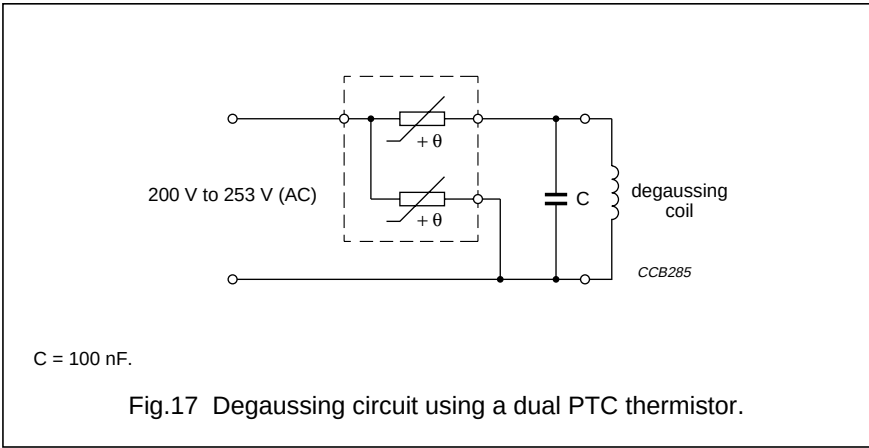
To prevent beam landing disturbances by horizontal frequency currents induced in the degaussing coils, these coils should be shunted by a capacitor of sufficiently high value.

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	TYP.	UNIT
Circumference	276	cm
Number of turns	60	
Copper wire diameter	0.355	mm
Resistance	28.4	Ω
PTC thermistor	2322 662 96706	



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A59EAK071X**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.

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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: Norsk A/S Philips, OSLO,
Tel. +47 22 74 8000, Fax. +47 22 74 8341

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,
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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 AB, 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,
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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,
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