PHILIPS

Data handbook

PHILIPS

Electronic components and materials

Electron tubes

Book T16 1986

Black and white TV picture tubes

Monochrome data graphic display tubes

Deflection units

Elcoma – Philips Electronic Components and Materials Division – embraces a world-wide group of companies operating under the following names:

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MONOCHROME TUBES AND DEFLECTION UNITS

DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of four series of handbooks:

ELECTRON TUBES	BLUE
SEMICONDUCTORS	RED
INTEGRATED CIRCUITS	PURPLE
COMPONENTS AND MATERIALS	GREEN

The contents of each series are listed on pages iv to viii.

The data handbooks contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application information is given it is advisory and does not form part of the product specification.

Condensed data on the preferred products of Philips Electronic Components and Materials Division is given in our Preferred Type Range catalogue (issued annually).

Information on current Data Handbooks and on how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.
Product specialists are at your service and enquiries will be answered promptly.

ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks comprises:

T1	**Tubes for r.f. heating**
T2a	**Transmitting tubes for communications, glass types**
T2b	**Transmitting tubes for communications, ceramic types**
T3	**Klystrons**
T4	**Magnetrons for microwave heating**
T5	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications
T6	**Geiger-Müller tubes**
T7	**Gas-filled tubes** (will not be reprinted)
T8	**Colour display systems** Colour TV picture tubes, colour data graphic display tube assemblies, deflection units
T9	**Photo and electron multipliers**
T10	**Plumbicon camera tubes and accessories**
T11	**Microwave semiconductors and components**
T12	**Vidicon and Newvicon camera tubes**
T13	**Image intensifiers**
T14	**Infrared detectors**
T15	**Dry reed switches**
T16	**Monochrome tubes and deflection units** Black and white TV picture tubes, monochrome data graphic display tubes, deflection units

T13, T14, T15: Data collations on these subjects are available now.
Data Handbooks will be published in 1985.

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks comprises:

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks comprises:

EXISTING SERIES		Superseded by:
IC1	**Bipolar ICs for radio and audio equipment**	IC01N
IC2	**Bipolar ICs for video equipment**	IC02Na and IC02Nb
IC3	**ICs for digital systems in radio, audio and video equipment**	IC01N, IC02Na and IC02Nb
IC4	**Digital integrated circuits** CMOS HE4000B family	
IC5	**Digital integrated circuits – ECL** ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs	IC08N
IC6	**Professional analogue integrated circuits**	
IC7	**Signetics bipolar memories**	
IC8	**Signetics analogue circuits**	IC11N
IC9	**Signetics TTL logic**	IC09N and IC15N
IC10	**Signetics Integrated Fuse Logic (IFL)**	IC13N
IC11	**Microprocessors, microcomputers and peripheral circuitry**	IC14N

NEW SERIES

IC01N	**Radio, audio and associated systems** Bipolar, MOS	(published 1985)
IC02Na	**Video and associated systems** Bipolar, MOS Types MAB8031AH to TDA1524A	(published 1985)
IC02Nb	**Video and associated systems** Bipolar, MOS Types TDA2501 to TEA1002	(published 1985)
IC03N	**Integrated circuits for telephony**	(published 1985)
IC04N	**HE4000B logic family** CMOS	
IC05N	**HE4000B logic family – uncased ICs** CMOS	(published 1984)
IC06N	**High-speed CMOS; PC54/74HC/HCT/HCU** Logic family	(published 1985)
Supplement to IC06N	**High-speed CMOS; PC74HC/HCT/HCU** Logic family	(published 1985)
IC07N	**High-speed CMOS; PC54/74HC/HCT/HCU – uncased ICs** Logic family	
IC08N	**ECL 10K and 100K logic families**	(published 1984)
IC09N	**TTL logic series**	(published 1984)
IC10N	**Memories** MOS, TTL, ECL	
IC11N	**Linear LSI**	(published 1985)
IC12N	**Semi-custom gate arrays & cell libraries** ISL, ECL, CMOS	
IC13N	**Semi-custom** Integrated Fuse Logic	(published 1985)
IC14N	**Microprocessors, microcontrollers & peripherals** Bipolar, MOS	(published 1985)
IC15N	**FAST TTL logic series**	(published 1984)

Note

Books available in the new series are shown with their date of publication.

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks comprises:

C1	**Programmable controller modules** PLC modules, PC20 modules
C2	**Television tuners, coaxial aerial input assemblies, surface acoustic wave filters**
C3	**Loudspeakers**
C4	**Ferroxcube potcores, square cores and cross cores**
C5	**Ferroxcube for power, audio/video and accelerators**
C6	**Synchronous motors and gearboxes**
C7	**Variable capacitors**
C8	**Variable mains transformers**
C9	**Piezoelectric quartz devices**
C10	**Connectors**
C11	**Non-linear resistors** Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)
C12	**Potentiometers, encoders and switches**
C13	**Fixed resistors**
C14	**Electrolytic and solid capacitors**
C15	**Ceramic capacitors**
C16	**Permanent magnet materials**
C17	**Stepping motors and associated electronics**
C18	**Direct current motors**
C19	**Piezoelectric ceramics**
C20	**Wire-wound components for TVs and monitors**
C21*	**Assemblies for industrial use** HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices
C22	**Film capacitors**

* Will be issued in 1985.

SELECTION GUIDE

BLACK & WHITE TV PICTURE TUBES

face diagonal	type	deflection angle mm	neck diameter mm	max. overall length mm	V_f/I_f V/mA	V_a kV	V_{g4} V	V_{g2} V	page
24 cm (9 in)	A24-512W	90°	20	227	11/140	12	0-130	130	33
31 cm (12 in)	A31-322W	90°	20	280	11/140	12	0-130	130	45
	A31-410W	110°	20	233	11/140	12	0-350	250	55
	A31-510W	110°	20	233	11/140	12	0-130	130	67
34 cm (14 in)	A34-111W	90°	20	287	11/140	12	0-130	130	77
	A34-510W	110°	20	247	11/140	12	0-130	130	87
44 cm (17 in)	A44-510W	110°	20	288	11/140	15	0-130	130	97
	A44-520W	110°	28,6	291	6,3/240	20	0-130	130	109
50 cm (20 in)	A50-520W	110°	28,6	319	6,3/240	20	0-130	130	121
61 cm (24 in)	A61-520W	110°	28,6	370	6,3/240	20	0-130	130	133

DEFLECTION UNITS FOR BLACK & WHITE TV PICTURE TUBES

tube face diagonal	type	deflection angle	tube neck diameter	line coils		field coils		sensitivity			page
				induct-ance	resist-ance	induct-ance	resist-ance	at e.h.t.	full-scan current		
									line	field	
			mm	μH	Ω	mH	Ω	kV	A (p-p)	A(p-p)	
24 cm (9 in)	AT1077/01	90°	20	475	0,80	72	40	10	2,70	0,24	159
31/34 cm (12/14 in)	AT1077/02	90°	20	436	0,80	68	33	12	2,93	0,26	163
44/50/61 cm (17/20/24 in)	AT1040/04	110°	28,6	2090	3,55	17,0	7,37	18	2,92	1,09	147
	AT1040/15	110°	28,6	3320	6,10	17,0	7,37	18	2,35	1,09	153
	AT1040/17	110°	28,6	8360	14,2	17,0	7,37	18	1,46	1,09	147

MONOCHROME DATA GRAPHIC DISPLAY TUBES

face diagonal	type	deflection angle	useful screen diagonal mm	neck diameter mm	max. overall length mm	V_f/I_f V/mA	V_a kV	V_{g2} V	resolution (approx.) (number of lines)	page
24 cm (9 in)	M24-306 M24-308 M24-310 M24-328	90°	222,5	20	227	12/130	12	400	1300	169
	M24-322 M24-326	90°	222,5	20	227	12/75	12	400	100	183
	M24-511W M24-512W M24-514W	90°	222,5	20	227	11/140	12	130	800	195
31 cm (12 in)	M31-340 M31-342 M31-344 M31-346	90°	295	20	277	12/130	12	400	1300	257
	M31-348	90°	295	20	277	12/130	12	400	1300	271
	M31-362 M31-364	90°	295	20	277	12/75	12	400	1000	295
	M31-366	90°	295	20	277	12/75	12	400	1000	307
	M31-336 M31-338 M31-350	90°	292	20	280	12/130	12	400	1300	243
	M31-354	90°	292	20	280	12/75	12	400	1000	283
	M31-326 M31-370	110°	295	28,6	241	6,3/240	17	400	1500	219
	M31-328	110°	295	28,6	241	12/130	17	400	1500	231
34 cm (14 in)	M32EAA	90°	322	20	287	12/130	14	400	1300	319

face diagonal	type	deflection angle	useful screen diagonal mm	neck diameter mm	max. overall length mm	V_f/I_f V/mA	V_a kV	V_{g2} V	resolution (approx.) (number of lines)	page
38 cm (15 in)	M38-328 M38-330 M38-332 M38-334 M38-336 M38-338 M38-342	110°	352	28,6	279	6,3/240	17	400	1500	331
	M38-344	110°	352	28,6	279	6,3/240	17	400	1500	349
	M38-346 M38-348	110°	352	28,6	279	12/130	17	400	1500	361
44 cm (17 in)	M41EAA0	114°	413	28,6	291	6,3/240	20	400	1500	373
50 cm (20 in)	M47EAA0	114°	473	28,6	319	6,3/240	20	400	1400	385

FLAT SQUARE MONOCHROME DISPLAY TUBES

face diagonal	type	deflection angle	useful screen diagonal mm	neck diameter mm	max. overall length mm	V_f/I_f V/mA	V_a kV	V_{g2} V	resolution (approx.) (number of lines)	page
31 cm (12 in)	M29EAA M29EAB	90°	294	20	275	12/130	12	400	1300	207

NOTE

For recommended combinations for monochrome data graphic displays, see Data Handbook C20, section "Selection guide".

DEFLECTION UNITS FOR MONOCHROME DATA GRAPHIC DISPLAY TUBES

tube face diagonal	type	deflection angle	tube neck diameter	line coils		field coils		sensitivity			page
									full-scan current		
				induct-ance	resist-ance	induct-ance	resist-ance	at e.h.t.	line	field	
			mm	μH	Ω	mH	Ω	kV	A(p-p)	A(p-p)	
17 cm (7 in)	AT1071/07	90°	28,6	86,5	0,14	41,6*	16,8*	15	7,6	0,79	423
24 cm (9 in)	AT1077/01	90°	20	475	0,80	72	40	10	2,70	0,24	427
	AT1077/09	90°	20	475	0,80	18	10	12	2,91	0,50	443
	AT1077/10	90°	20	475	0,80	72	40	12	2,91	0,25	447
29 cm (12 in)	AT1078/10**	90°	20	310	0,66	23,8	13,6	12	3,33	0,44	475
31 cm (12 in)	AT1071/05	90°	28,6	91,5	0,15	13	7,0	17	9,2	0,91	419
	AT1077/05	90°	20	475	0,80	18	10	12	2,9	0,48	431
	AT1077/06	90°	20	475	0,80	72	40	12	2,9	0,24	435
	AT1077/07	90°	20	118	0,22	18	10	12	5,8	0,48	439
	AT1077/15	90°	20	240	0,42	12,5	7,25	12	4,2	0,60	451
	AT1077/16	90°	20	170	0,35	6,6	4,35	12	4,92	0,80	455
	AT1077/20	90°	20	145	0,25	18	10	12	5,3	0,50	459
	AT1077/22	90°	20	112	0,20	7,7	4,15	12	6,1	0,74	463
	AT1077/23	90°	20	240	0,42	31	16,6	12	4,2	0,37	467
	AT1078/01	90°	20	310	0,66	23,8	13,6	12	3,4	0,48	471
	AT1078/19	90°	20	245	0,53	6,85	4,10	12	3,9	0,85	479

* Coils can be connected in series or parallel. The indicated values apply to parallel-connected line coils, and series connected field coils.
** For flat square application.

tube face diagonal	type	deflection angle	tube neck diameter	line coils		field coils		sensitivity			page
				induct-ance	resist-ance	induct-ance	resist-ance	at e.h.t.	full-scan current		
									line	field	
			mm	μH	Ω	mH	Ω	kV	A(p-p)	A(p-p)	
31 cm (12 in) landscape	AT1039/03	110°	28,6	228*	0,41*	9,18*	10,2*	17	7,95	1,21	411
38 cm (15 in) portrait	AT1039/00	110°	28,6	228*	0,41*	9,18*	10,2*	17	6,4	1,35	403
38 cm (15 in) landscape	AT1039/01	110°	28,6	206*	0,39*	9,72*	10,6*	17	8,35	1,02	403
31/38 cm (12/15 in)	AT1038/40A	110°	28,6	700	1,1	14,1	7,6	17	4,56	1,12	399

NOTE

For recommended combinations for monochrome data graphic displays, see Data Handbook C20, section "Selection guide".

* Coils can be connected in series or parallel. The indicated values apply to parallel-connected line coils, and series connected field coils.

GENERAL

LIST OF SYMBOLS

Symbols denoting electrodes/elements and electrode/element connections

f	Heater
k	Cathode
g	Grid: Grids are distinguished by means of an additional numeral; the electrode nearest to the cathode having the lowest number.
a	Anode
m	External conductive coating
m^1	Rimband or tension band (T-band)
ℓ	Fluorescent screen
i.c.	Tube pin which must not be connected externally
n.c.	Tube pin which may be connected externally

Symbols denoting voltages

Unless otherwise stated, the reference point for electrode voltages is the cathode.

V	Symbol for voltage, followed by a subscript denoting the relevant electrode/element
V_f	Heater voltage
$V_{(p\text{-}p)}$	Peak-to-peak value of a voltage
V_p	Peak value of a voltage
V_{GR}	Grid 1 voltage for visual extinction of focused raster (grid drive service)
V_{KR}	Cathode voltage for visual extinction of focused raster (cathode drive service)

Symbols denoting currents

I	Symbol for current followed by a subscript denoting the relevant electrode
I_f	Heater current (r.m.s. value)

Note: The symbols quoted represent the average value of the current, unless otherwise stated.

Symbols denoting powers

P_ℓ	Dissipation of the fluorescent screen
P_g	Grid dissipation

Symbols denoting capacitances

See IEC publication 100

Symbols denoting resistances and impedances

R	Symbol for resistance followed by a subscript for the relevant electrode pair. When only one subscript is given the second electrode is the cathode.
Z	Symbol for impedance followed by a subscript for the relevant electrode pair. When only one subscript is given the second electrode is the cathode.

Symbols denoting various quantities

L	Luminance
f	Frequency
H	Magnetic field strength

GENERAL OPERATIONAL RECOMMENDATIONS

INTRODUCTION

Equipment design should be based on the characteristics as stated in the data sheets. Where deviations from these general recommendations are permissible or necessary, statements to that effect will be made.

If applications are considered which are not referred to in the data sheets of the relevant tube type extra care should be taken with circuit design to prevent the tube being overloaded due to unfavourable operating conditions.

SPREAD IN TUBE CHARACTERISTICS

The spread in tube characteristics is the difference between maximum and minimum values. Values not qualified as maximum or minimum are nominal ones. It is evident that average or nominal values, as well as spread figures, may differ according to the number of tubes of a certain type that are being checked. No guarantee is given for values of characteristics in settings substantially differing from those specified in the data sheets.

SPREAD AND VARIATION IN OPERATING CONDITIONS

The operating conditions of a tube are subject to spread and/or variation.

Spread in an operating condition is a **permanent** deviation from an average condition due to, e.g., component value deviations. The average condition is found from such a number individual cases taken at random that an increase of the number will have a negligible influence.

Variation in an operating condition is **non-permanent** (occurs as a function of time), e.g., due to supply voltage fluctuations. The average value is calculated over a period such that a prolongation of that period will have negligible influence.

LIMITING VALUES

Limiting values are in accordance with the applicable rating system as defined by IEC publication 134. Reference may be made to one of the following 3 rating systems.

Absolute maximum rating system. 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.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should 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 with respect to supply voltage variation, equipment components spread and variation, equipment control adjustment, load variations, signal variation, environmental conditions, and spread or variations in characteristics of the device under considerations and of all other electronic devices in the equipment.

Design-maximum rating system. Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device* of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and thoughout life, no design-maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

Design-centre rating system. Design-centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device* of a specified type as defined by its published data, and should not be exceeded under average conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component spread and variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations or spread in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design-centre value for the intended service is exceeded with a bogey electronic device* in equipment operating at the stated normal supply voltage.
If the tube data specify limiting values according to more than one rating system the circuit has to be designed so that none of these limiting values is exceeded under the relevant conditions.

In addition to the limiting values given in the individual data sheets the directives in the following paragraphs should be observed.

HEATER SUPPLY

→ For maximum cathode life it is recommended that the heater supply be stabilized at the nominal heater voltage, + 0%, –5%. Any deviation from this heater voltage has a detrimental effect on tube performance and life, and should therefore be kept to a minimum. Such deviations may be caused by:

- mains voltage fluctuations;
- spread in the characteristics of components such as transformers, resistors, capacitors, etc.;
- spread in circuit adjustments;
- operational variations.

Supply from mains transformer

→ The maximum deviation of the heater voltage must not exceed ± 10% (Design Maximum Value).

Supply from line output transformer

A deviation from the nominal heater voltage due to spread in component characteristics and adjustments should not exceed ± 7,5%. Considering all other possible deviations, due to mains voltage variations,
→ beam current variations, VCR-operation, etc., the total spread in heater voltage must not exceed ± 10%.

* A bogey tube is a tube whose characteristics have the published nominal values for the type. A bogey tube for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Standby (instant-on circuits)

The majority of tubes employ quick-heating cathodes and therefore an instant-on circuit is superfluous. If used, it is recommended to that the heater voltage of the tubes be reduced during standby operation to 75% of the nominal value.

Notes: If series connection of the heater circuit has to be used, and only parallel connection is quoted in the data sheet, please contact your local supplier.

Picture tubes with quick-heating cathodes should not be used in series with receiving tubes.

CATHODE TO HEATER VOLTAGE

The voltage between cathode and heater should be as low as possible and never exceed the limiting values given in the data sheets of the individual tubes. The limiting values relate to that side of the heater where the voltage between cathode and heater is greatest. The voltage between cathode and heater may be d.c., a.c., or a combination of both. Unless otherwise stated, the maximum values quoted indicate the maximum permissible d.c. voltage. If a combination of d.c. and a.c. voltages is applied, the peak value may be twice the rated V_{kf}; however, unless otherwise stated, this peak value shall never exceed 315 V. Unless otherwise stated, the V_{kf} max. holds for both polarities of the voltage; however, a positive cathode is usually the most favourable in view of insulation during life.

In order to avoid excessive hum the a.c. component of the heater to cathode voltage should be as low as possible and never exceed 20 V r.m.s. (mains frequency). A d.c. connection should always be present between heater and cathode. Unless otherwise specified the maximum resistance should not exceed 1 MΩ; the maximum impedance at mains frequency should be less than 100 kΩ.

INTERMEDIATE ELECTRODES (between cathode and final accelerator)

In no circumstances should the tube be operated without a d.c. connection between each electrode and the cathode. The total effective impedance between each electrode and the cathode should never exceed the published maximum value. However, no electrode should be connected directly to a high energy source. When such a connection is required, it should be made via a series resistor of not less then 1 kΩ.

CUT-OFF VOLTAGE

Curves showing the limits of the cut-off voltage as a function of grid 2 voltage are generally included in the data. The brightness control should be so dimensioned that it can handle any tube within the limits shown, at the appropriate grid 2 voltage.

The published limits are determined at an ambient illumination level of 10 lux. Because the brightness of a spot is in general greater than that of a raster of the same current, the cut-off voltage determined with the aid of a focused spot will be more negative by about 5 V as compared with that of a focused raster.

FOCUSING ELECTRODE VOLTAGE

Individual tubes will have satisfactory focus over the entire screen at some value within the published range of the focusing voltage.

Due to their flat focus characteristics, black and white picture tubes can generally be operated at a fixed focusing voltage within the published range. Monochrome data graphic display tubes should have adjustable focus.

LUMINESCENT SCREEN

To prevent permanent screen damage, care should be taken:

- not to operate the tube with a stationary picture at high beam currents for extended periods;
- not to operate the tube with a stationary or slowly moving spot except at extremely low beam currents;
- if no e.h.t. bleeder is used, to choose the time constants of the cathode, grid 1, grid 2, and deflection circuits, such that sufficient beam current is maintained to discharge the e.h.t. capacitance before deflection has ceased after equipment has been switched off.

EXTERNAL CONDUCTIVE COATING

The external conductive coating must be connected to the chassis. The capacitance of this coating to the final accelerating electrode may be used to provide smoothing for the e.h.t. supply.

The coating is not a perfect conductor and in order to reduce electromagnetic radiation caused by the line time base and the picture content it may be necessary to make multiple connections to the coating. See also 'Flashover'.

METAL RIMBAND

An appreciable capacitance exists between the metal rimband and the internal conductive coating of the tube; its value is quoted in the individual data sheets.To avoid electric shock, a d.c. connection should be provided between the metal band and the external conductive coating. In receivers where the chassis can be connected directly to the mains there is a risk of electric shock if access is made to the metal band. To reduce the shock to the safe limit, it is suggested that a 2 MΩ resistor capable of handling the peak voltages be inserted between the metal band and the point of contact with the external conductive coating. This safety arrangement will provide the necessary insulation from the mains but in the event of flashover high voltages will be induced on the metal band. It is therefore recommended that the 2 MΩ resistor be bypassed by a 4,7 nF capacitor capable of withstanding the peak voltage determined by the voltage divider formed by this capacitor and the capacitance of the metal rimband to the internal conductive coating, and the anode voltage. The 4,7 nF capacitor also serves to improve e.h.t. smoothing by adding the rimband capacitance to the capacitance of the outer conductive coating.

FLASHOVER

High electric field strengths are present between the gun electrodes of picture tubes. Voltages between gun electrodes may reach values of 20 kV over approx. 1 mm. Although the utmost precautions are taken in the design and manufacture of the tubes, there is always a chance that flashover will occur. The resulting transient currents and voltages may be of sufficient magnitude to cause damage to the tube itself and to various components on the chassis. Arcing terminates when the e.h.t. capacitor is discharged. Therefore it is of vital importance to provide protective circuits with spark gaps and series resistors, which should be connected according to Fig. 1. No other connections between the outer conductive coating and the chassis are permissible.

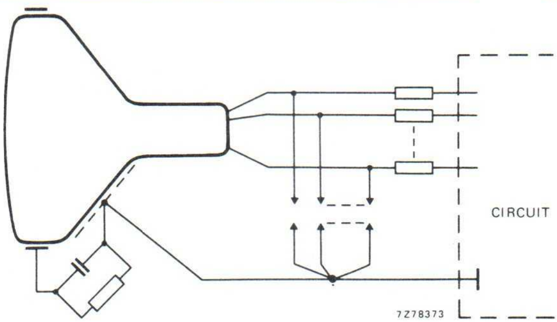


Fig. 1.

IMPLOSION PROTECTION

All picture tubes employ integral implosion protection and must be replaced with a tube of the same type number or recommended replacement to assure continued safety.

HANDLING

Although all picture tubes are provided with integral implosion protection, which meets the intrinsic protection requirements stipulated in the relevant part of IEC 65, care should be taken not to scratch or knock any part of the tube. **Stress on the tube neck must be avoided.**

When lifting a tube from the edge-down position, one hand should be placed around the parabola section of the cone and the other hand should be placed under the rim band (Fig. 2).

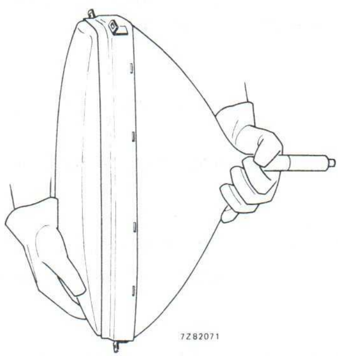
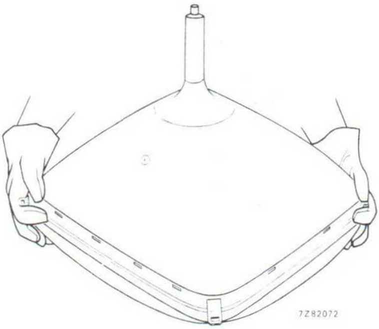


Fig. 2 Lifting picture tube from edge-down position.

When placing a tube face downwards ensure that the screen rests on a soft pad of suitable material, kept free from abrasive substances. When lifting from the face-down position the hand should be placed under the areas of the faceplate close to the mounting lugs at diagonally opposite corners of the faceplate (Fig. 3).

When lifting from the face-up position the hands should be placed under the areas of the cone close to the mounting lugs at diagonally opposite corners of the cone (Fig. 4).



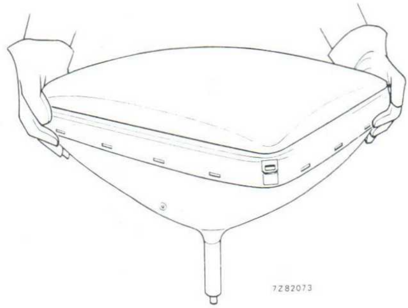


Fig. 3 Lifting picture tube from face-down position.

Fig. 4 Lifting tube from face-up position.

In all handling procedures prior to insertion in the receiver 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.**

If suspending the tube from the mounting lugs ensure that a **minimum of 2** are used; UNDER NO CIRCUMSTANCES HANG THE TUBE FROM ONE LUG.

Remember when replacing or servicing the picture tube that a residual electrical charge may be carried by the anode contact and also the external coating if not earthed. Before removing the tube from the equipment, earth the external coating and short the anode contact to the coating.

PACKING

The packing provides protection against tube damage under normal conditions of shipment or handling. Observe any instructions given on the packing and handle accordingly. The tube should under no circumstances be subjected to accelerations greater than 35g.

MOUNTING

Unless otherwise specified on the data sheets for individual tubes there are no restrictions on the position of mounting.

The tube socket should not be rigidly mounted but should have flexible leads and be allowed to move freely.

The mass of the socket and additional circuitry should not be more than 150 g. The socket of tubes with a 7-pin miniature base may not be used for mounting components.

It is very desirable that tubes should not be exposed to strong electrostatic and magnetic fields.

DIMENSIONS

In designing the equipment the tolerances given on the dimensional drawings should be considered. Under no circumstances should the equipment be designed around dimensions taken from individual tubes.

REFERENCE LINE

Where a reference line is indicated on the tube outline drawing, it is determined by means of a gauge. Drawings of the gauges are given in this section under "Reference line gauges"

GENERAL DATA ON MONOCHROME DISPLAY TUBES

Glass transmission

Two types of screen glass are available:
– normal tinted glass,
– dark tinted glass, for improved contrast.

The light transmission at the screen centre of both types is shown in the table below.

tube	normal tinted glass	dark tinted glass
24 cm (9 in), 90°	approx. 53%	approx. 42%
29 cm (12 in), 90°*	approx. 43%	approx. 30%
31 cm (12 in), 90°; 3 x 4	approx. 46%	approx. 34%
31 cm (12 in), 90°; 4 x 5	approx. 50%	approx. 34%
31 cm (12 in), 110°	approx. 46%	approx. 34%
34 cm (14 in), 90°	approx. 48%	approx. 34%
38 cm (15 in), 110°	approx. 46%	approx. 34%
41 cm (17 in), 114°	approx. 48%	–
47 cm (20 in), 114°	approx. 46%	–

Screen surface treatments

Two types of anti-glare treatments are available:
– direct grind, i.e. the screen is ground to an ultrafine finish that minimizes reflection without blurring the image or decreasing resolution,
– direct etch, i.e. the screen is etched to a finish that diffuses specular reflection.

* Flat square high resolution monochrome display tube.

Survey of screen phosphors

type	designation	fluorescent colour	phosphorescent colour	persistence*	colour co-ordinates		relative brightness (%) with respect to type WW
					x	y	
WW	P4	white	white	medium short	0,265	0,295	100
GA	P40	white	yellowish-green	medium	0,250	0,300	approx. 80
GH	P31	green	green	medium short	0,270	0,565	approx. 180
GR	P39	yellowish-green	yellowish-green	long	0,205	0,715	approx. 75
GW	P42	yellowish-green	yellowish-green	medium	0,238	0,568	approx. 115
HA	–	yellowish-green	yellowish-green	medium	0,220	0,660	approx. 85
HC	–	yellow-green	yellow-green	long	0,205	0,715	approx. 75
KC	–	yellow-green	yellow-green	medium-short	0,425	0,550	approx. 170
LA	–	orange	orange	medium	0,557	0,442	approx. 60
LM	–	orange	orange	medium short	0,547	0,446	approx. 95
LQ	–	orange	orange	medium	0,546	0,451	approx. 60
WD	–	white	white	medium	0,355	0,395	approx. 70

* medium short: 10 to 1000 μs
medium: 1 to 100 ms
long: 100 ms to 1 s.

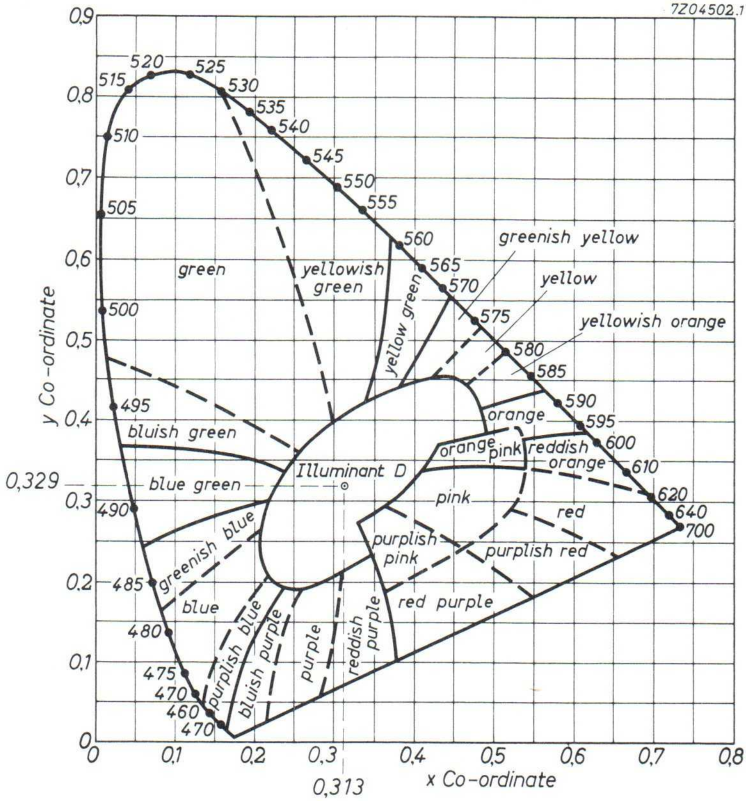


Fig. 1 Kelly chart.

Resolution characteristics

The following graphs (Figs 2 to 6) represent the line width as a function of the cathode cut-off voltage at constant anode current (shrinking raster method), at screen centre for different display tubes.

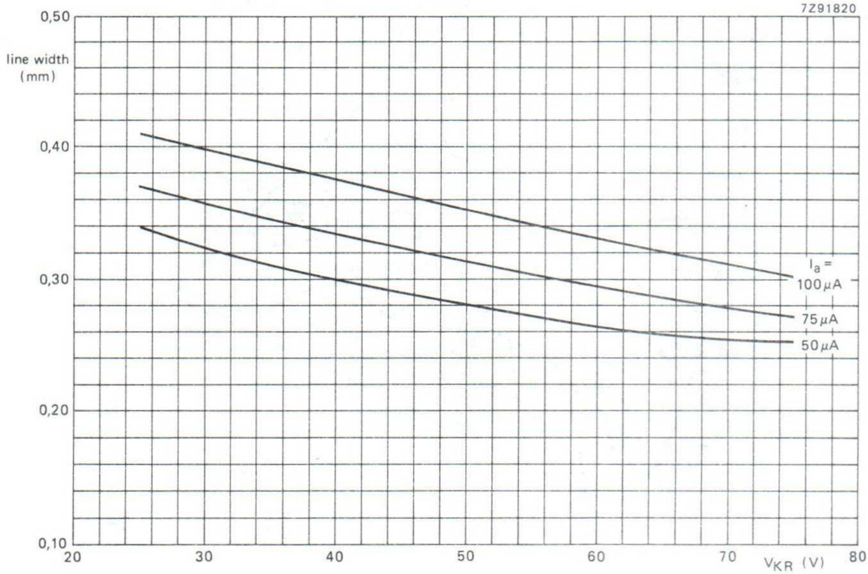


Fig. 2 Tubes M24-511W, M24-512W, M24-514W; V_a = 12 kV; raster dimensions 168 mm x 126 mm; 292 active lines at 50 Hz repetition frequency.

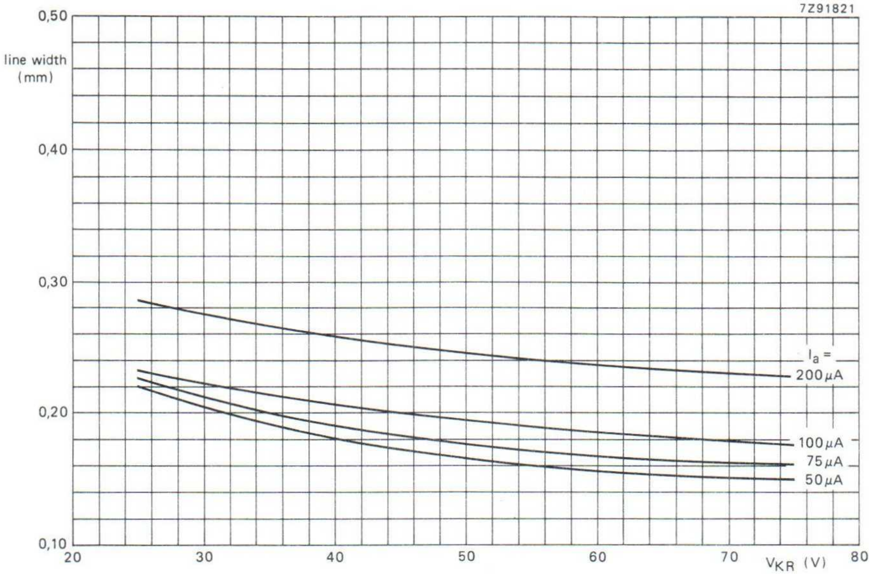


Fig. 3 Tubes M24-306, M24-308, M24-310, M24-328; V_a = 12 kV; raster dimensions 168 mm x 126 mm; 292 active lines at 50 Hz repetition frequency.

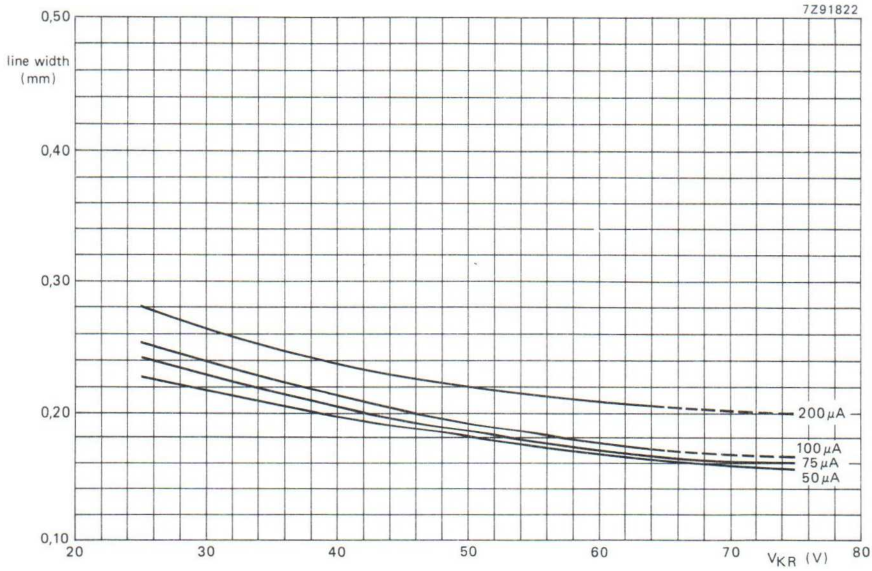


Fig. 4 Tubes M31-326, M31-328; V_a = 17 kV; raster dimensions 216 mm x 162 mm; 292 active lines at 50 Hz repetition frequency.

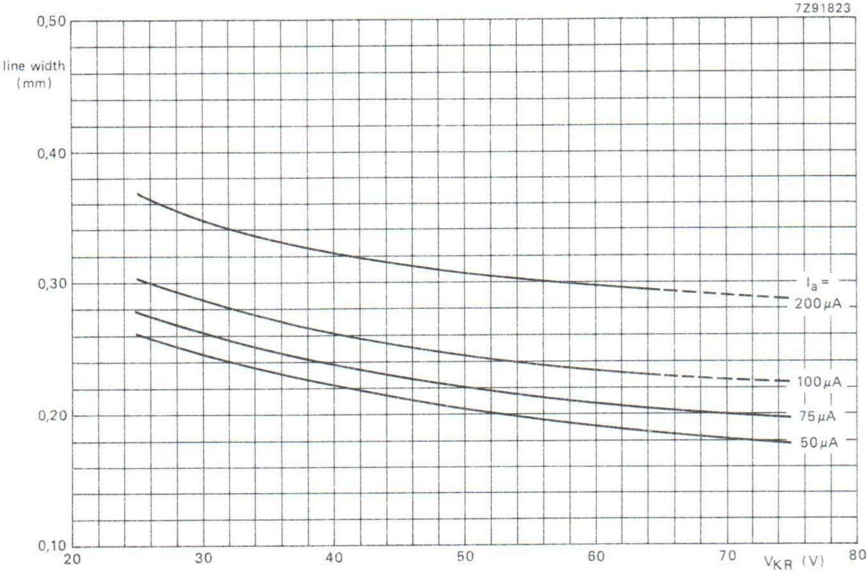


Fig. 5 Tubes M31-336/338/340/342/344/346/348/350; V_a = 12 kV; raster dimensions 216 mm x 162 mm; 292 active lines at 50 Hz repetition frequency.

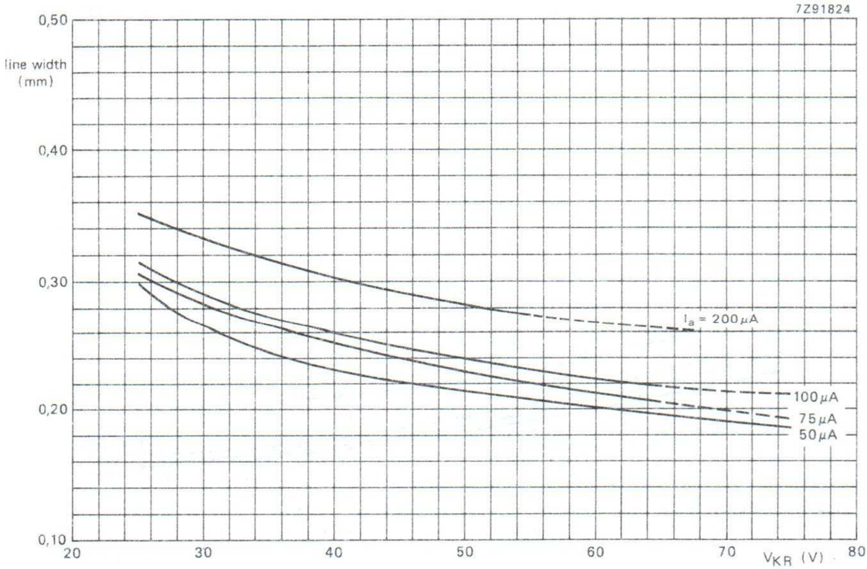


Fig. 6 Tubes M38-320/330/340 series; V_a = 17 kV; raster dimensions 259 mm x 194 mm; 292 active lines at 50 Hz repetition frequency.

TYPE DESIGNATION

Screen glass, screen surface treatment and phosphor are identified by the complete type designation. In the **old system**, used for type numbers M24-306, M31-340, etc., surface treatment and type of screen glass are identified by a type number suffix, as shown in the table below.

surface treatment	screen glass	suffix
normal glare	normal tinted	no
direct grind	normal tinted	/P
direct etch	normal tinted	/E
direct grind	dark tinted	/PD
direct etch	dark tinted	/ED

For tubes without contact strip between external coating and mounting hardware the suffix is:/. . 3.
For tubes with an internal surge limiter the suffix is:/. . 4.

Example:

M31-340GH/PD3

monitor application
face diagonal in cm
series number
screen phosphor

no contact strip
dark tinted glass
direct grind

In the **new system**, used for type numbers M29EAA, M32EAA, etc., surface treatment and type of screen glass are identified as shown in the example below.

Example:

M32EAA0WW

monitor application
minimum viewable screen diagonal in cm
family code

screen phosphor
code for a.o. glass and screen surface treatment:
0 = normal glare, normal tinted glass
1 = direct grind, normal tinted glass
2 = direct grind, dark tinted glass
3 = direct etch, dark tinted glass
5 = internal surge limiter

REFERENCE LINE GAUGES

REFERENCE LINE GAUGE C (JEDEC 126) (IEC 67-IV-3)

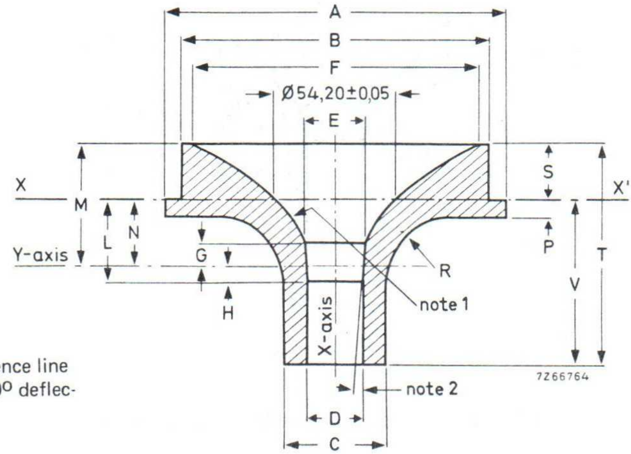


Fig. 1 Reference line gauge for 110° deflection angle.

The millimetre dimensions are derived from the original inch dimensions.

ref.	inches			millimetres			notes
	min.	nom.	max.	min.	nom.	max.	
A	–	5,000	–	–	127,00	–	–
B	–	4,500	–	–	114,30	–	–
C	–	2,000	–	–	50,80	–	–
D	1,168	1,168	1,171	29,668	29,668	29,743	–
E	1,241	1,242	1,243	31,522	31,547	31,572	–
F	4,248	4,250	4,252	107,900	107,950	108,000	–
G	–	0,279	–	–	7,09	–	2
H	–	0,250	–	–	6,35	–	–
L	1,165	1,170	1,175	29,60	29,72	29,84	2
M	–	1,634	–	–	41,50	–	–
N	–	0,920	–	–	23,37	–	1
P	–	0,250	–	–	6,35	–	–
R	–	1,000r	–	–	25,40r	–	–
S	0,712	0,714	0,716	18,085	18,136	18,186	–
T	–	3,214	–	–	81,64	–	–
V	2,490	2,500	2,510	63,25	63,50	63,75	–

Notes

1. $y = 0{,}58\,x^2 + 0{,}576$ inches ($0{,}0228\,x^2 + 14{,}630$ mm) 'y' values must be held to ±0,002'' (0,05 mm). The Y-axis is 0,920'' (23,368 mm) below the X-X' reference plane.
2. 4° ± 30' taper between planes G and L.

→ REFERENCE LINE GAUGE D (EIA G–197)

Dimensions in mm

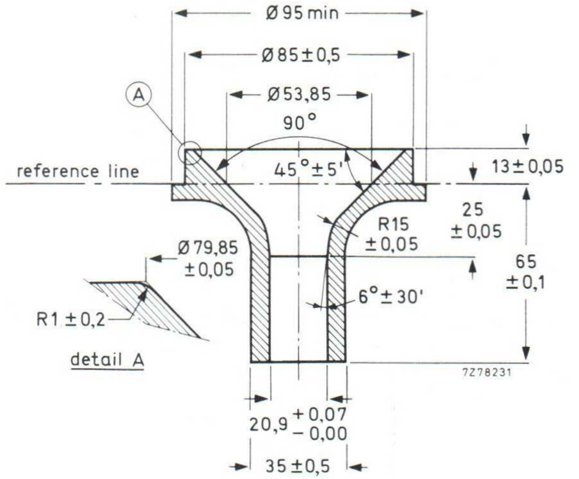


Fig. 2 Reference line gauge for 90° deflection angle.

REFERENCE LINE GAUGE G (JEDEC G148)

Dimensions in mm

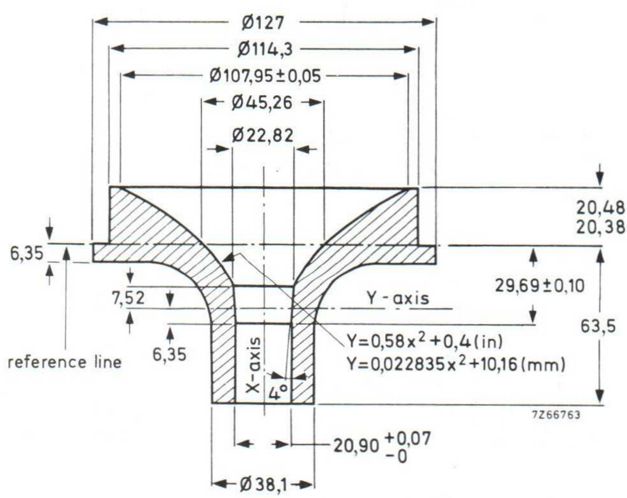


Fig. 3 Reference line gauge for 110° deflection angle.

BASES

SMALL-BUTTON NEO EIGHTAR BASE IEC 67-1-31
JEDEC B7-208

Dimensions in mm

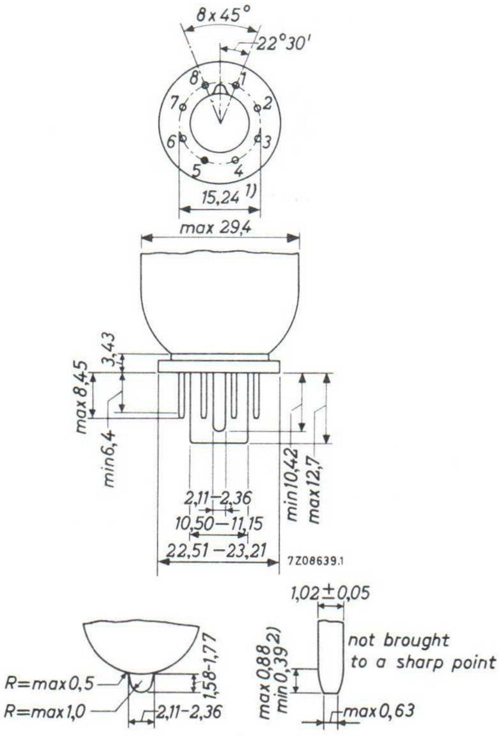


Fig. 1.

Notes

1. Base-pin positions are held to tolerances such that the base will fit a flat-plate gauge having a thickness of 9,53 and eight equally spaced holes of 1,40 ± 0,01 diameter located on a 15,24 ± 0,01 diameter circle. The gauge is also provided with a centre hole to provide 0,25 diametric clearance for the lug and key. Pin fit in the gauge shall be such that the entire length of pins will, without undue force, pass into and disengage from the gauge.
2. This dimension may vary within the limits shown around the periphery of any individual pin.

7-PIN MINIATURE BASE WITH PUMPING STEM

Dimensions in mm

Dimensions of this base are within the JEDEC E7-91 dimensions

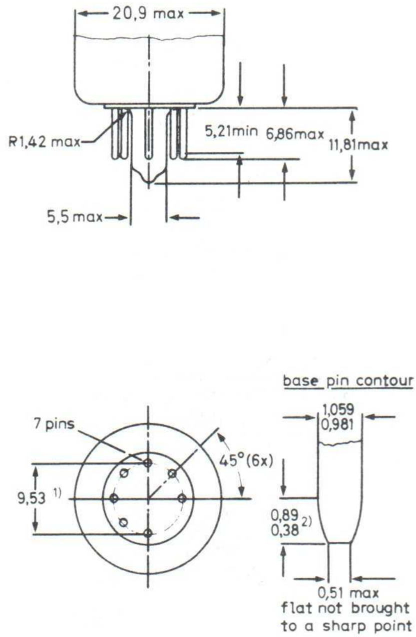


Fig. 2.

Notes

1. Base-pin and pumping stem positions are held to tolerances such that entire length of pins and stem will without undue force pass into and disengage from a flat-plate gauge having a thickness of 6,35 mm and eight holes with diameters of 1,27 ± 0,013 mm so located on a 9,525 ± 0,013 mm diameter circle that the distance along the chord between any two adjacent hole centres is 3,645 ± 0,013 mm and a centre hole of 5,97 + 0,025 mm being chamfered at the top over 1,52 mm with an angle of 45 degrees.
2. This dimension around the periphery of any individual pin may vary within the limits shown.

BLACK & WHITE TV PICTURE TUBES

TV PICTURE TUBE

24 cm (9 in), 90°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy. A special feature of this tube is its short cathode-heating time.

QUICK REFERENCE DATA

Face diagonal	24 cm (9 in)
Deflection angle	90°
Overall length	max. 227 mm
Neck diameter	20 mm
Heating	11 V, 140 mA
Grid 2 voltage	130 V
Anode voltage	12 kV
Quick-heating cathode	with a typical tube a legible picture will appear within 5 s.

SCREEN

Metal-backed phosphor	P4
Luminescence	white
Light transmission of face glass	53%
Useful diagonal	min. 222,5 mm
Useful width	min. 193 mm
Useful height	min. 145 mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	11 V
Heater current	I_f	140 mA
Limits (Absolute maximum rating system) of r.m.s. heater voltage, measured in any 20 ms	V_f	max. 12,7 V* min. 9,3 V

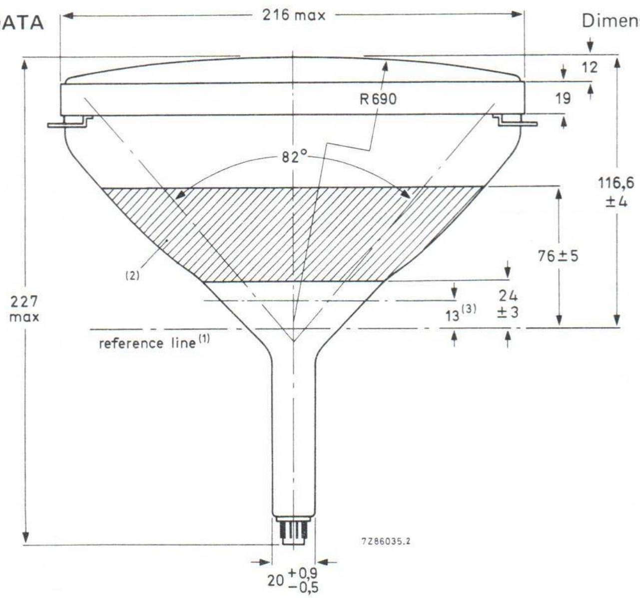
For heating time as a function of source impedance see last page of this data sheet.

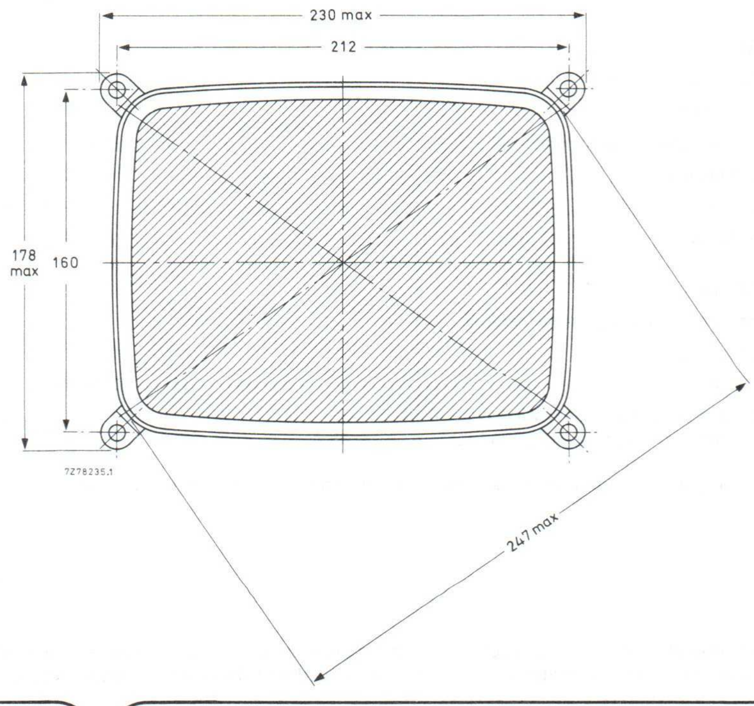
* This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed. For maximum cathode life it is recommended that the heater supply be regulated at 11 V.

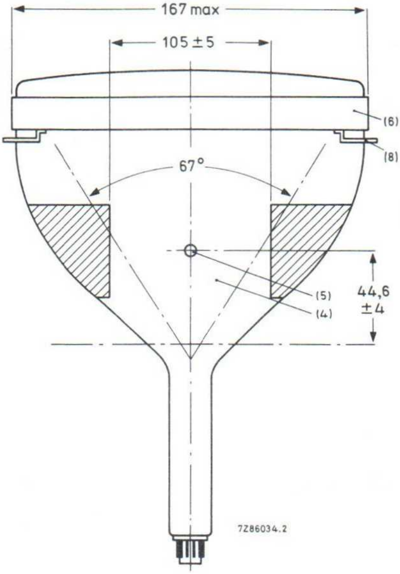
MECHANICAL DATA

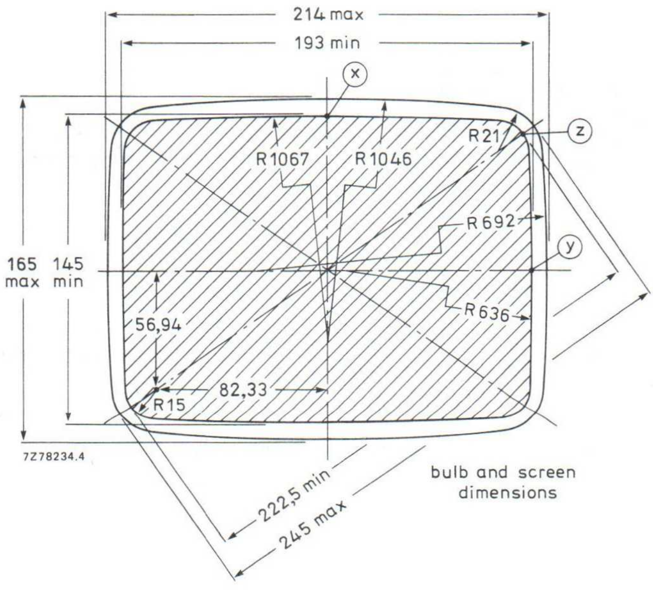
Notes are given after the drawings

Dimensions in mm

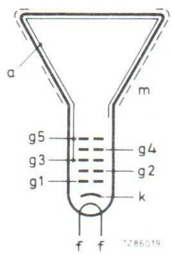


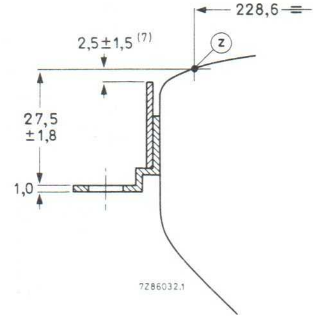


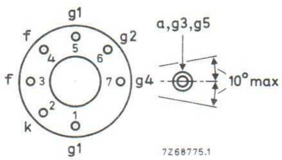


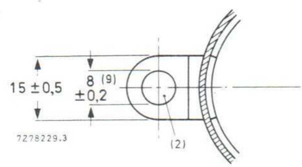


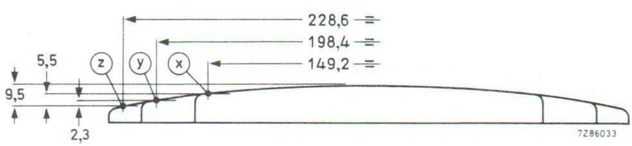
bulb and screen
dimensions











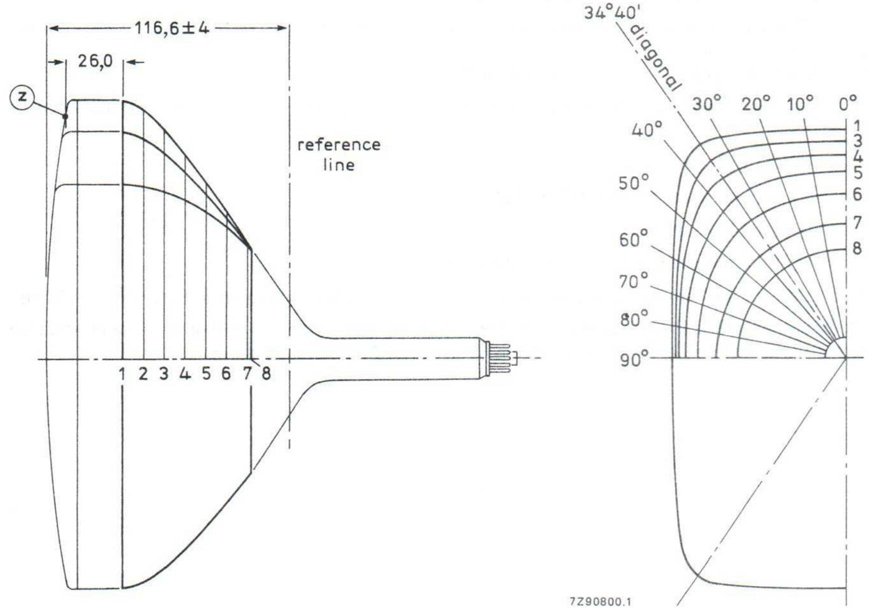
Mounting position	any
Net mass	approx. 1,8 kg
Bulb contact designation	EIA J76 1/4-B1 (EIA J240A1)
Base designation	JEDEC E7-91
Basing	7GR

The socket for this base should not be mounted rigidly; it should have flexible leads and be allowed to move freely.

Notes to outline drawings on the preceding pages

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (gauge D).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge D.
4. This area must be kept clean.
5. Recessed cavity contact IEC 67-III-2; JEDEC J1-21.
6. The rimband must be earthed.
7. Distance from reference point Z to any hardware.
8. The displacement of any lug with respect to the plane through the three other lugs is max. 1,8 mm.
9. The mounting screws in the cabinet must be situated inside a circle of 5 mm drawn around the true geometrical positions i.e. at the corners of a rectangle of 212 mm x 160 mm.

→ **Maximum cone contour**



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	108,3	109,8	114,2	121,9	123,9	121,6	106,6	95,6	88,8	85,0	83,8
2	10	105,4	106,8	111,0	117,7	119,4	117,4	104,4	93,9	87,3	83,7	82,5
3	20	98,0	99,2	102,9	107,8	109,2	108,1	99,1	90,0	83,9	80,6	79,5
4	30	88,4	89,4	92,2	95,7	96,6	96,2	91,0	84,2	79,0	76,1	75,1
5	40	78,1	78,9	81,0	83,2	83,8	83,8	81,2	76,8	72,9	70,5	69,7
6	50	66,8	67,4	68,8	70,4	70,9	71,2	70,3	68,1	65,6	63,8	63,2
7	60	54,5	54,9	55,8	56,8	57,2	57,5	57,5	56,8	55,8	54,9	54,5
8	61,2	53,0	53,3	54,2	55,1	55,4	55,7	55,7	55,2	54,3	53,4	53,1

CAPACITANCES

Anode to external conductive coating	$C_{a,g3,g5/m}$	< 750 pF > 300 pF
Anode to metal band	$C_{a,g3,g5/m'}$	100 pF
Cathode to all	C_k	3 pF
Grid 1 to all	C_{g1}	7 pF

FOCUSING

electrostatic

DEFLECTION

magnetic

Diagonal deflection angle	90^o
Horizontal deflection angle	82^o
Vertical deflection angle	67^o

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m. Maximum distance between centre of field of this magnet and reference line: 55 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid 1

Anode voltage	$V_{a,g3,g5}$	12 kV
Focusing electrode voltage	V_{g4}	0 to 130 V*
Grid 2 voltage	V_{g2}	130 V
Cathode voltage for visual extinction of focused raster	V_{KR}	45 to 65 V

* Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps: 0 V and 130 V). The optimum focusing voltage of individual tubes may be between −150 and + 150 V).

LIMITING VALUES (Design maximum rating system)

Voltages are specified with respect to grid 1 unless stated otherwise.

Anode voltage	$V_{a,g3,g5}$	max.	14 kV*
		min.	9,5 kV
Grid 4 voltage			
positive	V_{g4}	max.	500 V
negative	$-V_{g4}$	max.	200 V
Grid 2 voltage	V_{g2}	max.	200 V
Cathode voltage			
positive	V_k	max.	200 V
positive peak	V_{kp}	max.	400 V**
negative	$-V_k$	max.	0 V
negative peak	$-V_{kp}$	max.	2 V
Cathode-to-heater voltage	$V_{k/f}$	max.	200 V

CIRCUIT DESIGN VALUES

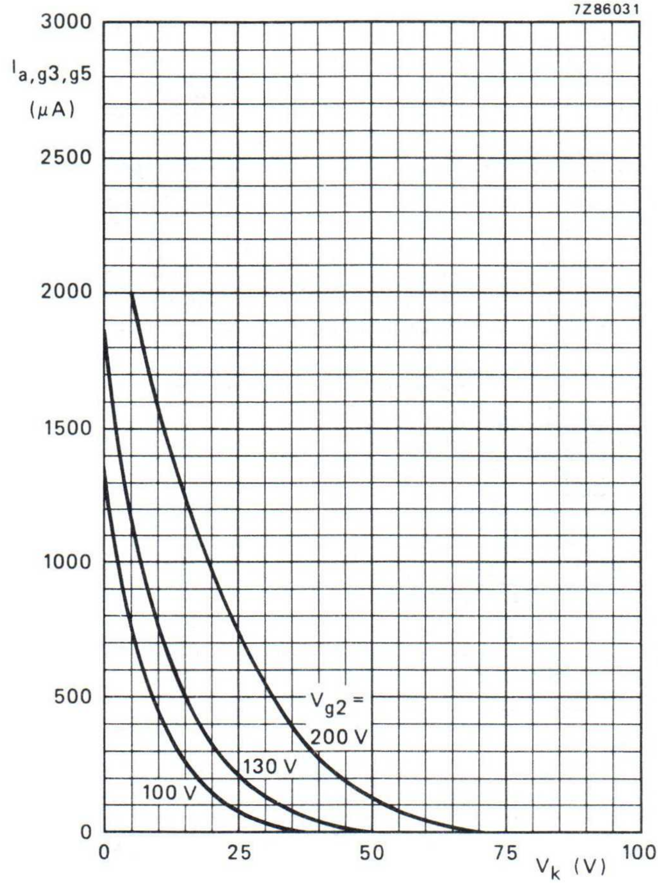
Grid 4 current			
positive	I_{g4}	max.	25 μA
negative	$-I_{g4}$	max.	25 μA
Grid 2 current			
positive	I_{g2}	max.	5 μA
negative	$-I_{g2}$	max.	5 μA

MAXIMUM CIRCUIT VALUES

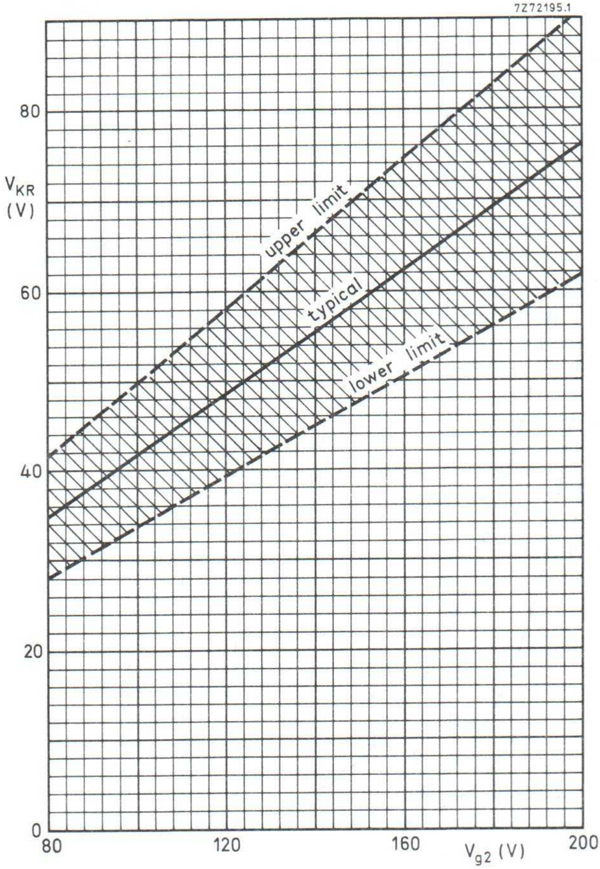
Resistance between cathode and heater	$R_{k/f}$	max.	1 MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1 MΩ
Grid 1 circuit resistance	R_{g1}	max.	1,5 MΩ
Grid 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5 MΩ

* The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

** Maximum pulse duration 22% of a cycle but max. 1,5 ms.

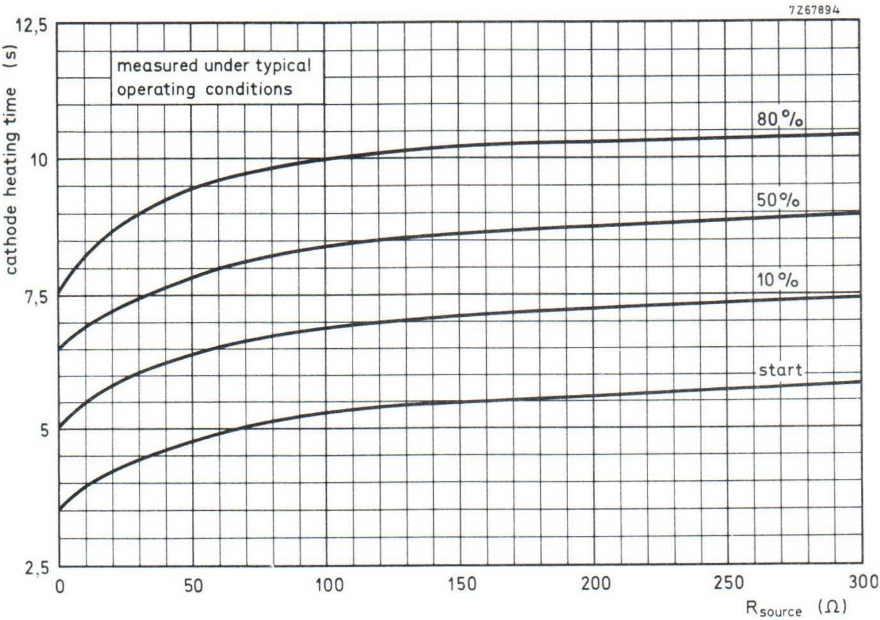


Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5} = 12$ kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

31 cm (12 in), 90°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA

Face diagonal	31 cm (12 in)
Deflection angle	90°
Overall length	max. 280 mm
Neck diameter	20 mm
Heating	11 V, 140 mA
Grid 2 voltage	130 V
Final accelerator voltage	12 kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s

SCREEN

Metal-backed phosphor	P4		
Luminescence	white		
Light transmission of face glass		50	%
Useful diagonal	min.	292,2	mm
Useful width	min.	254,1	mm
Useful height	min.	201,7	mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	11 V		
Heater current	I_f	140 mA		
Limits (Absolute max. rating system) of r.m.s. heater voltage, measured in any 20 ms	V_f	max. min.	12,7 V 9,3 V	*

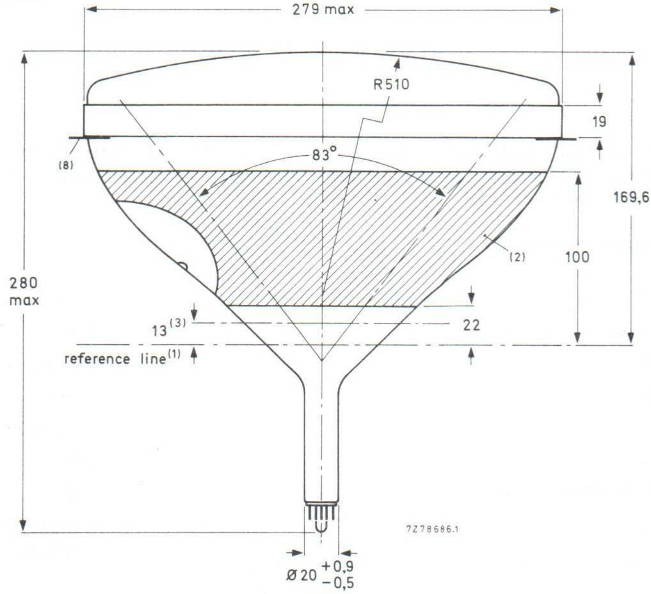
For heating time as a function of source impedance see last page of this data sheet.

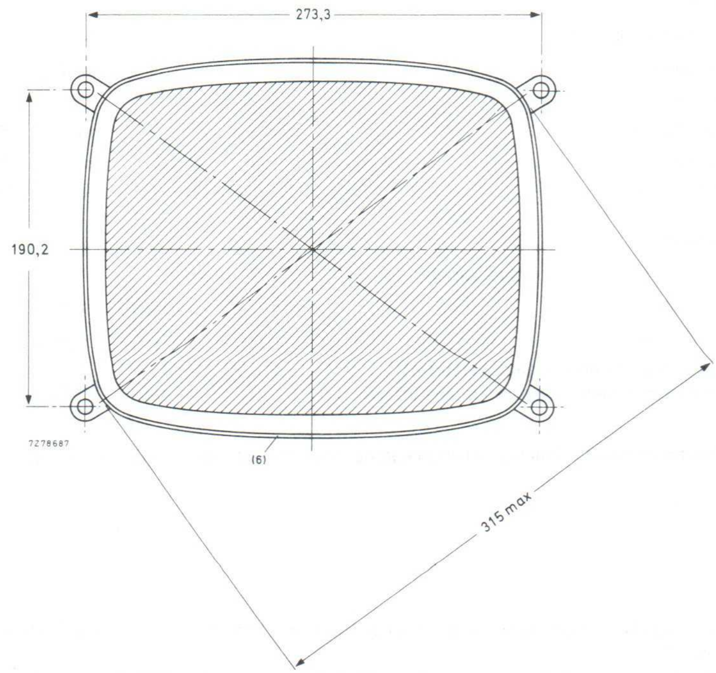
* This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

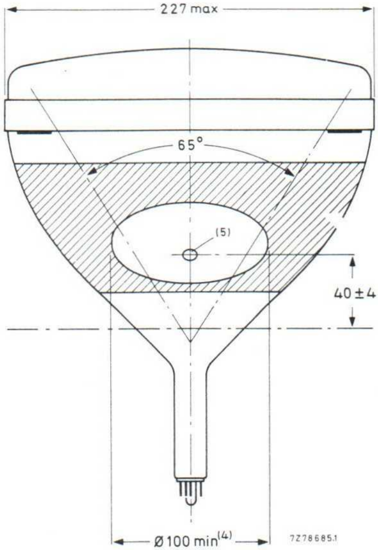
MECHANICAL DATA

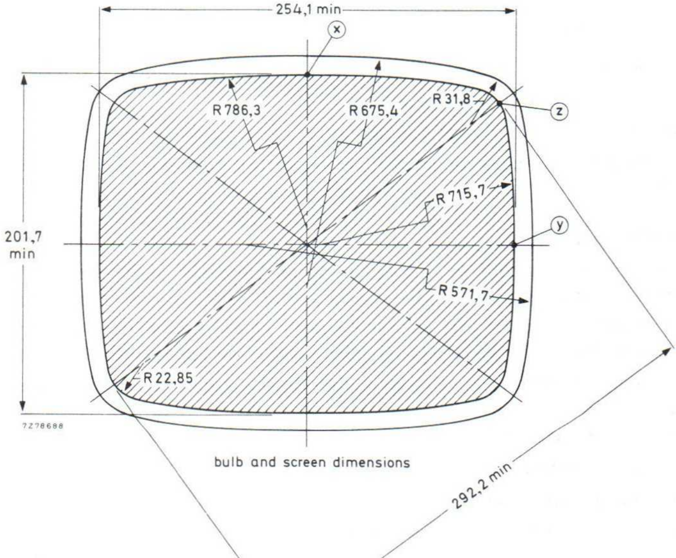
Dimensions in mm

Notes are given after the drawings.

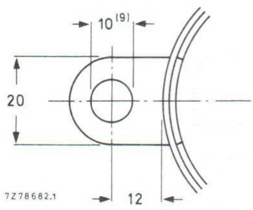


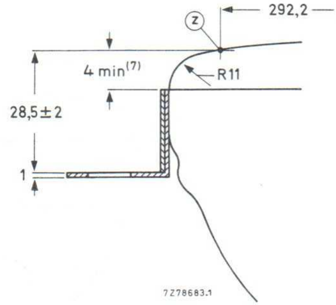


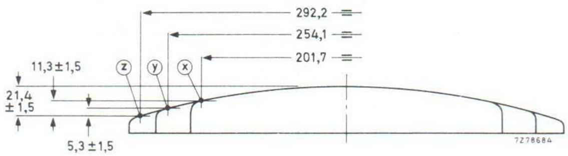


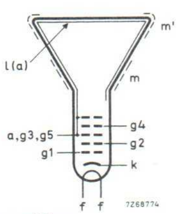


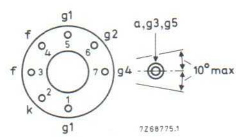
bulb and screen dimensions











Mounting position	any
Net mass	approx. 2,9 kg
Base designation	JEDEC E7-91

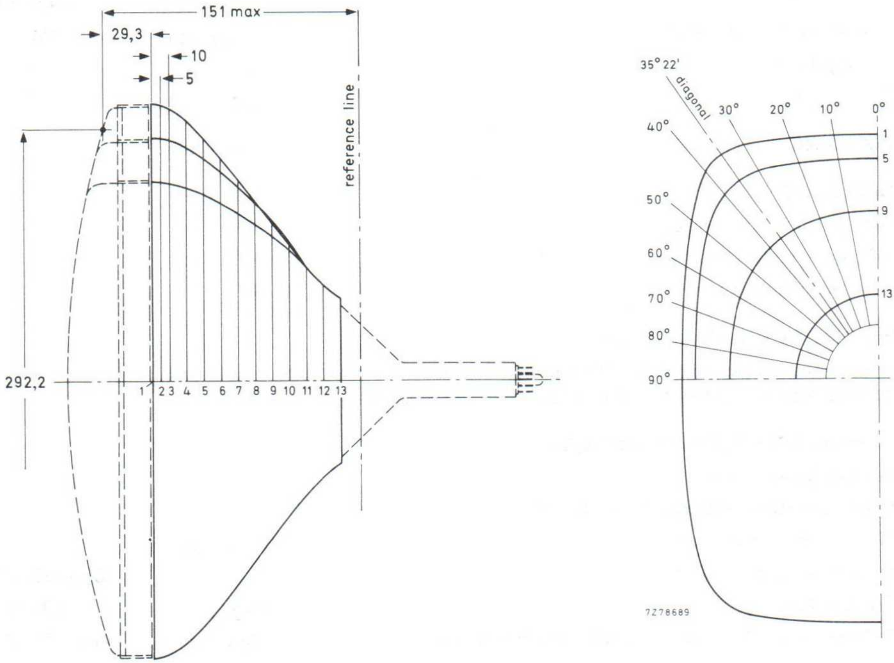
The socket for the base should not be rigidly mounted; it should have flexible leads and be allowed to move freely.

Notes to outline drawings

1. The reference line is determined by the plane of the upper edge of the reference line gauge when the gauge is resting on the cone (gauge D).
2. The configuration of the external conductive coating may be different but contains the contact area shown in the drawing. The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge D.
4. This area must be kept clean.
5. Recessed cavity contact IEC 67-III-2; JEDEC J1-21.
6. The metal band must be earthed.
7. Distance from reference point Z to any hardware.
8. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
9. The mounting screws in the cabinet must be situated inside a circle of 7 mm drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



Section	Nom. distance from section 1	Distance from centre (max. values)										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
13	105,9	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4	48,4
12	99	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3	55,3
11	90	66,1	66,0	65,8	65,6	65,4	65,4	65,3	65,3	65,3	65,4	65,4
10	80	79,7	79,5	79,0	78,4	78,1	77,8	77,3	76,9	76,6	76,5	76,4
9	70	91,8	92,0	92,1	91,8	91,4	90,9	89,6	87,9	86,2	84,9	84,3
8	60	102,3	103,0	104,2	104,8	104,5	103,9	101,4	97,8	94,4	91,8	90,9
7	50	111,8	112,8	115,1	117,1	117,2	116,5	112,3	106,5	101,3	98,0	96,9
6	40	120,4	121,6	124,9	128,6	129,3	128,5	122,1	113,7	107,3	103,5	102,3
5	30	128,2	129,6	133,7	139,1	140,6	139,6	130,3	119,9	112,6	108,4	107,1
4	20	135,0	136,5	141,3	148,3	150,8	149,4	136,9	125,0	117,1	112,6	111,1
3	10	140,0	141,7	146,8	154,9	158,1	156,3	141,5	128,7	120,3	115,6	114,1
2	5	140,9	142,6	147,9	156,0	159,2	157,3	142,4	129,6	121,1	116,4	114,9
1	0	141,3	143,0	148,3	156,5	159,6	157,6	142,7	129,9	121,5	116,8	115,3

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g3, g5/m}$	$<$ 900 pF $>$ 450 pF
Final accelerator to metal band	$C_{a, g3, g5/m'}$	150 pF
Cathode to all	C_k	3 pF
Gird 1 to all	C_{g1}	7 pF

FOCUSING

electrostatic

DEFLECTION

magnetic

Diagonal deflection angle	90°
Horizontal deflection angle	83°
Vertical deflection angle	65°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line: 55 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid 1

Final accelerator voltage	$V_{a, g3, g5}$	12 kV
Focusing electrode voltage	V_{g4}	0 to 130 V*
Grid 2 voltage	V_{g2}	130 V
Cathode voltage for visual extinction of focused raster	V_{KR}	45 to 65 V

* Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps: 0 V and 130 V). The optimum focusing voltage of individual tubes may be between −150 and + 150 V.

LIMITING VALUES (Design maximum rating system)

Voltages are specified with respect to grid 1 unless stated otherwise.

Final accelerator voltage	$V_{a, g3, g5}$	max. min.	15 kV* 10 kV
Grid 4 voltage			
positive	V_{g4}	max.	500 V
negative	$-V_{g4}$	max.	200 V
Grid 2 voltage	V_{g2}	max. min.	200 V 80 V
Cathode to grid 1 voltage			
positive	V_k	max.	200 V
positive peak	V_{kp}	max.	400 V**
negative	$-V_k$	max.	0 V
negative peak	$-V_{kp}$	max.	2 V
Cathode-to-heater voltage	$V_{k/f}$	max.	200 V

CIRCUIT DESIGN VALUES

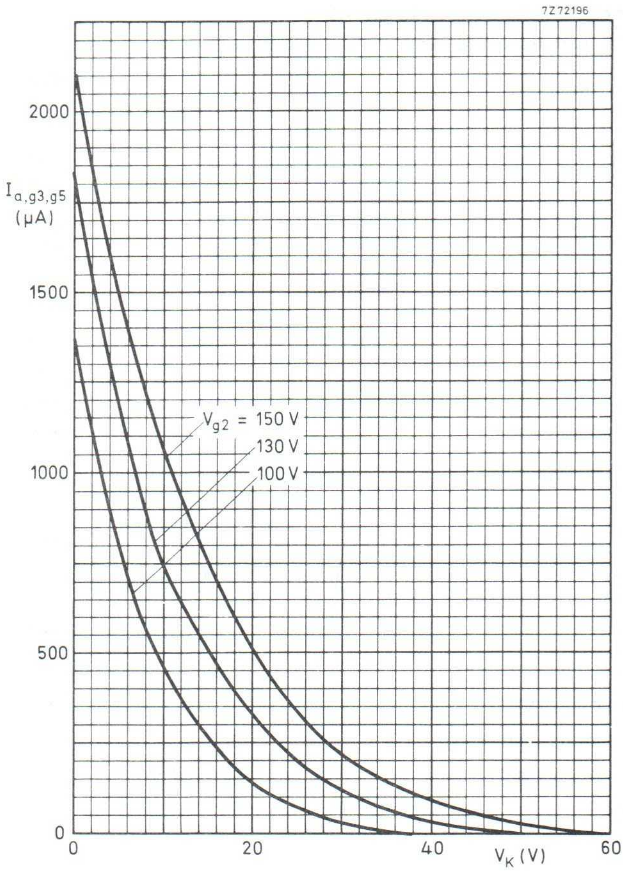
Grid 4 current			
positive	I_{g4}	max.	25 μA
negative	$-I_{g4}$	max.	25 μA
Grid 2 current			
positive	I_{g2}	max.	5 μA
negative	$-I_{g2}$	max.	5 μA

MAXIMUM CIRCUIT VALUES

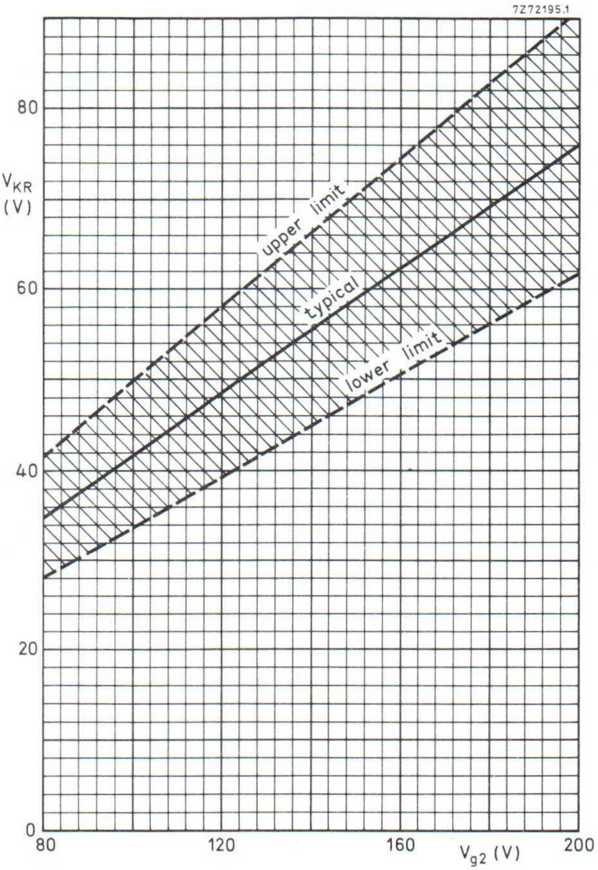
Resistance between cathode and heater	$R_{k/f}$	max.	1 MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1 MΩ
Grid 1 circuit resistance	R_{g1}	max.	1,5 MΩ
Grid 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5 MΩ

* The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

** Maximum pulse duration 22% of a cycle but max. 1,5 ms.

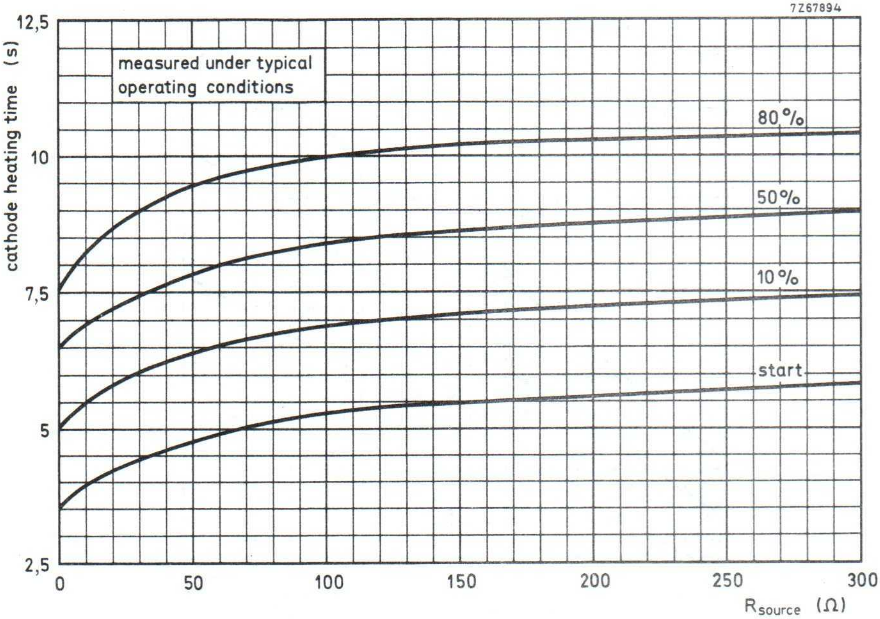


Final accelerator current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}3 \times 10^{-3}$$



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

31 cm (12in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy.
A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA			
Face diagonal		31	cm (12 in)
Deflection angle		110°	
Overall length	max.	233	mm
Neck diameter		20	mm
Heating	11 V,	140	mA
Grid no. 2 voltage		250	V
Final accelerator voltage		12	kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.		

SCREEN

Metal-backed phosphor

Luminescence	white		
Light transmission of face glass	≈	50	%
Useful diagonal	≥	295	mm
Useful width	≥	257	mm
Useful height	≥	195	mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f		11	V	
Heater current	I_f		140	mA	
Limits (Absolute max. rating system) of r.m.s. heater voltage, measured in any 20 ms	V_f	max.	12,7	V	*)
		min.	9,3	V	

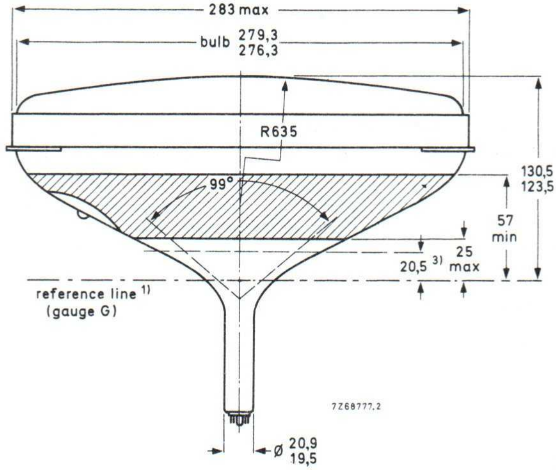
For heating time as a function of source impedance see last page of this data sheet.

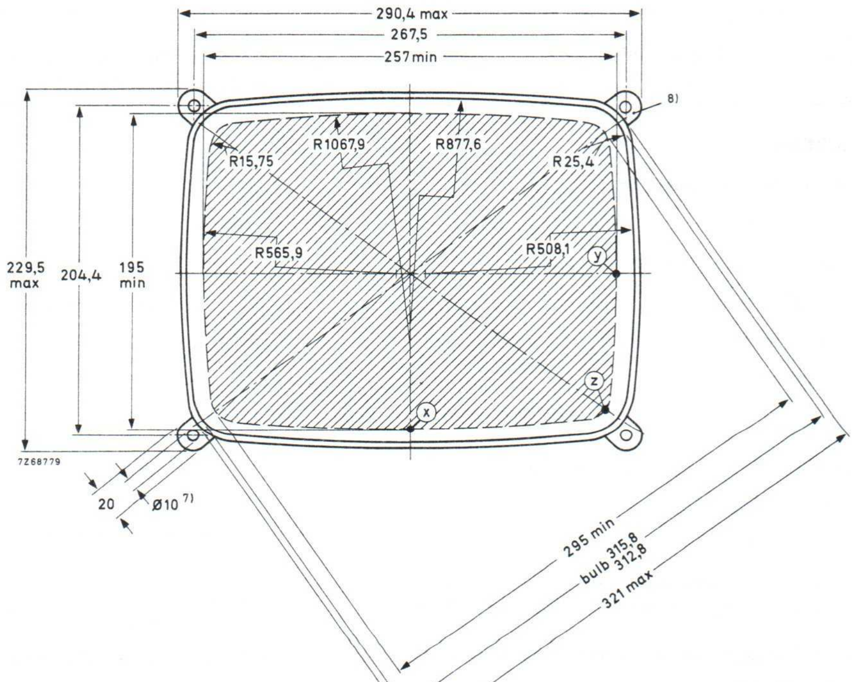
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

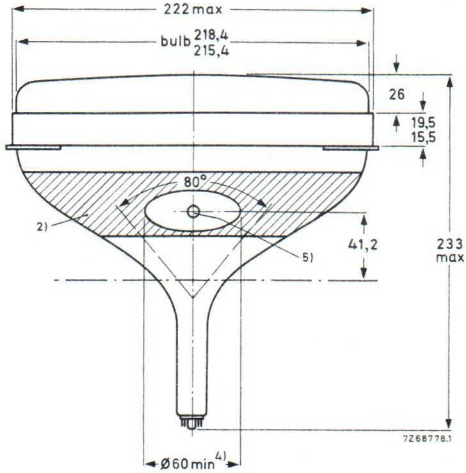
MECHANICAL DATA

Dimensions in mm

Notes are given after the drawings.



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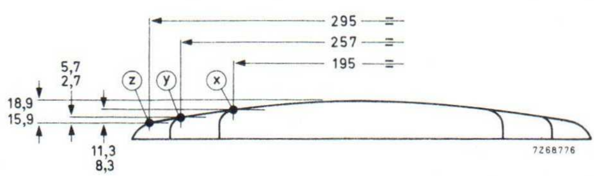
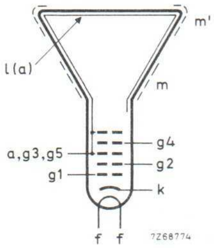
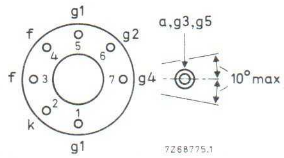
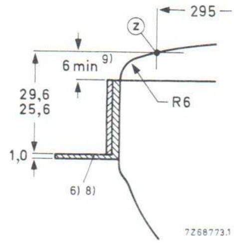
bulb 218,4 215,4
26
19,5 15,5
80°
2)
5)
41,2
233 max
7Z68778.1
Ø60 min 4)


295
257
195
5,7 2,7
18,9 15,9
11,3 8,3
z
y
x
7Z68776







Mounting position : any

Net mass : approx. 2, 8 kg.

Base : JEDEC E7-91

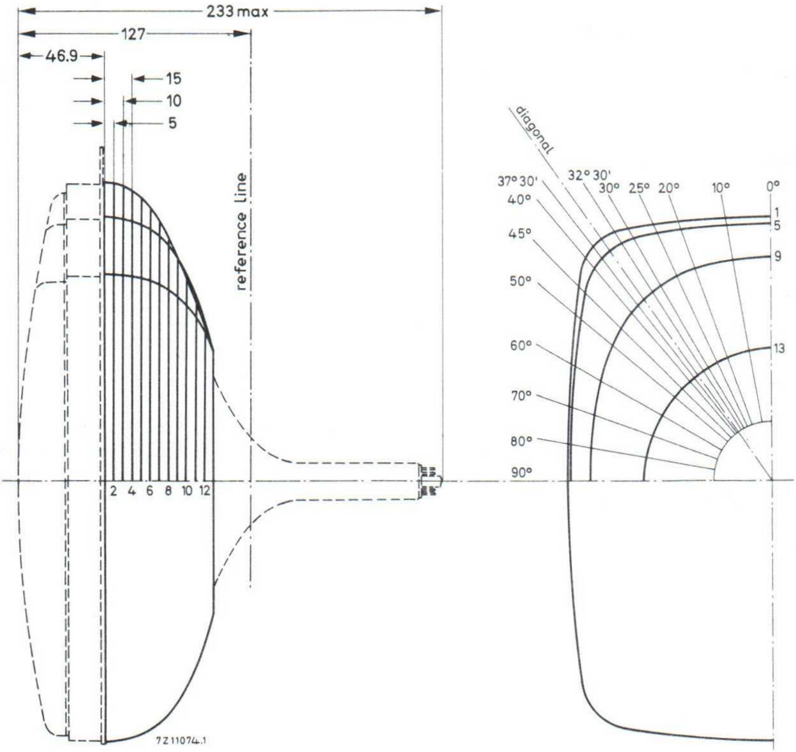
The socket for the base should not be rigidly mounted, it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone. (Gauge G).
2. The configuration of the external conductive coating may be different but contains the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge G.
4. This area must be kept clean.
5. Recessed cavity contact IEC 67-III-2.
6. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
7. The mounting screws in the cabinet must be situated inside a circle of 7 mm diameter drawn around the true geometrical positions, i.e. at the corners of a rectangle of 267, 5 mm x 204, 4 mm.
8. The metal band must be earthed.
   Electrical contact between the metal band and the mounting lugs is guaranteed.
9. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



Section	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	38'	$32^{\circ}30'$	diag.	$37^{\circ}30'$	40°	45°	50°	60°	70°	80°	90°
13	59.6	72,2	72,0	71,7	71,4	71,2	71,1	71,0	71,0	70,9	70,8	70,7	70,6	70,7	70,8	70,8
12	55	85,9	85,6	84,9	84,4	84,0	83,8	83,5	83,3	83,1	82,7	82,4	81,9	81,6	81,5	81,5
11	50	99,5	99,4	98,9	98,5	97,9	97,5	97,1	96,8	96,3	95,4	94,4	92,4	90,7	89,5	89,1
10	45	112,3	112,4	112,2	111,7	110,9	110,4	109,7	109,1	108,3	106,6	104,7	100,9	97,7	95,5	94,7
9	40	121,3	121,3	122,8	122,9	122,4	121,9	121,2	120,5	119,5	117,1	114,3	108,6	103,8	100,8	99,7
8	35	127,9	128,9	131,2	132,1	140,8	132,3	131,7	130,9	129,7	126,5	122,7	114,9	108,8	105,0	103,7
7	30	132,6	134,0	137,4	139,3	147,2	141,2	140,9	140,2	138,8	134,6	129,5	119,7	112,5	108,2	106,8
6	25	136,0	137,5	141,7	144,4	151,6	148,3	148,5	147,9	146,5	140,9	134,3	122,9	115,0	110,5	109,0
5	20	138,4	140,0	144,5	147,8	154,6	153,2	153,7	153,2	151,7	144,8	137,1	124,7	116,5	111,8	110,3
4	15	140,3	141,9	146,6	150,2	156,5	156,6	157,4	156,9	155,1	147,1	138,5	125,4	117,0	112,3	110,8
3	10	141,6	143,2	148,0	151,8	154,6	158,7	159,5	159,0	157,1	148,5	139,4	126,0	117,6	112,9	111,4
2	5	142,4	143,9	148,8	152,6	157,4	159,5	160,7	160,2	158,2	149,4	140,1	126,6	118,1	113,4	111,9
1	0	142,8	144,4	149,3	153,1	157,9	160,2	161,1	160,6	158,7	149,9	140,6	127,1	118,5	113,8	112,3

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g3, g5/m}$	< 900 pF > 450 pF
Final accelerator to metal band	$C_{a, g3, g5/m'}$	150 pF
Cathode to all	C_k	3 pF
Grid no. 1 to all	C_{g1}	7 pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110^o
Horizontal deflection angle	99^o
Vertical deflection angle	80^o

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe).
Maximum distance between centre of field of this magnet and reference line : 47 mm.

TYPICAL OPERATING CONDITIONS

Grid drive service

Final accelerator voltage	$V_{a, g3, g5}$	12	kV
Focusing electrode voltage	V_{g4}	0 to 350	V [1]
Grid no. 2 voltage	V_{g2}	250	V
Grid no. 1 voltage for visual extinction of focused raster	V_{GR}	-35 to -69	V

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a, g3, g5}$	12	kV
Focusing electrode voltage	V_{g4}	0 to 350	V [1]
Grid no. 2 voltage	V_{g2}	250	V
Cathode voltage for visual extinction of focused raster	V_{KR}	32 to 58	V

[1]) Individual tubes will have optimum focus within this range. In general an acceptable picture will be obtained with a fixed focus voltage.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage	$V_{a,g3,g5}$	max.	17	kV*)
		min.	10	kV
Grid No. 4 voltage				
positive	V_{g4}	max.	500	V
negative	$-V_{g4}$	max.	50	V
Grid No. 2 voltage	V_{g2}	max.	350	V
		min.	200	V
Grid No. 2 to grid No. 1 voltage	$V_{g2/g1}$	max.	450	V
Cathode to grid No. 1 voltage				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V**)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	$V_{k/f}$	max.	200	V

CIRCUIT DESIGN VALUES

Grid No. 4 current				
positive	I_{g4}	max.	25	µA
negative	$-I_{g4}$	max.	25	µA
Grid No. 2 current				
positive	I_{g2}	max.	5	µA
negative	$-I_{g2}$	max.	5	µA

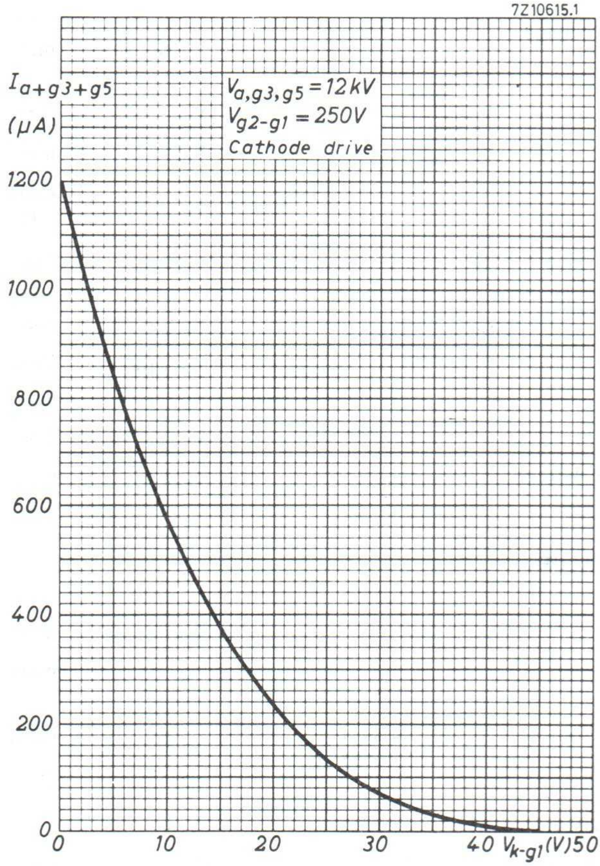
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0, 1	MΩ
Grid No. 1 circuit resistance	R_{g1}	max.	1, 5	MΩ
Grid No. 1 circuit impedance	Z_{g1} (50 Hz)	max.	0, 5	MΩ

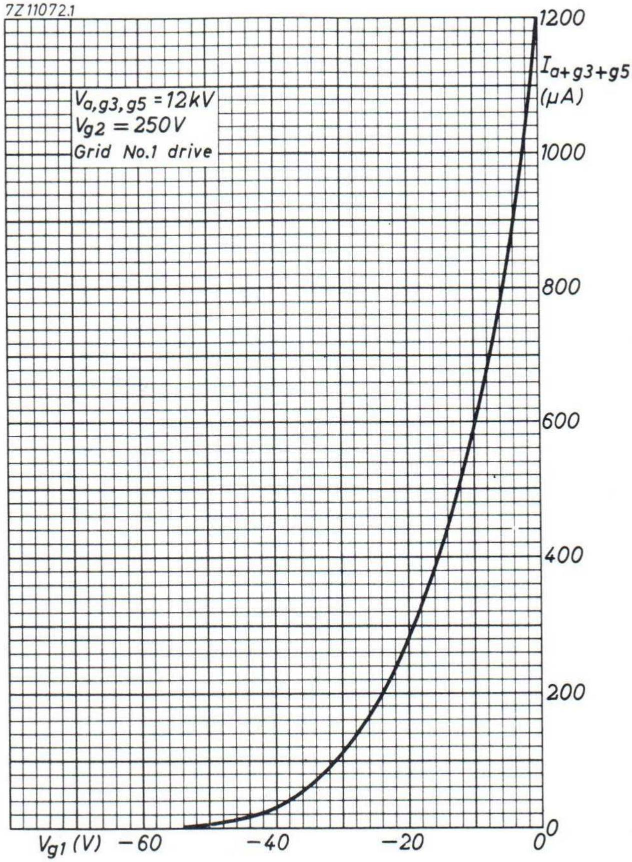
---

*) The X-ray dose rate remains below the acceptable value of 0, 5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

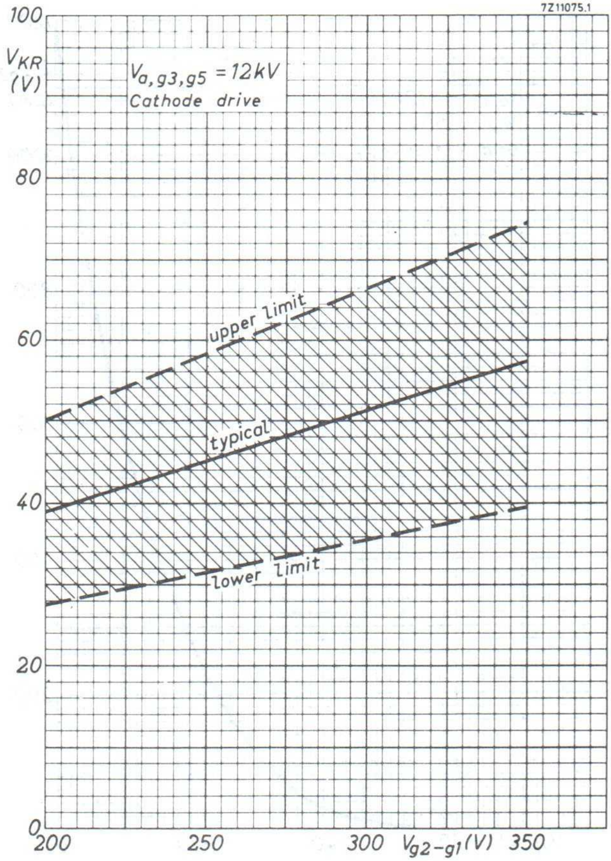
**) Maximum pulse duration 22% of a cycle but max. 1, 5 ms.



Final accelerator current as a function of cathode voltage

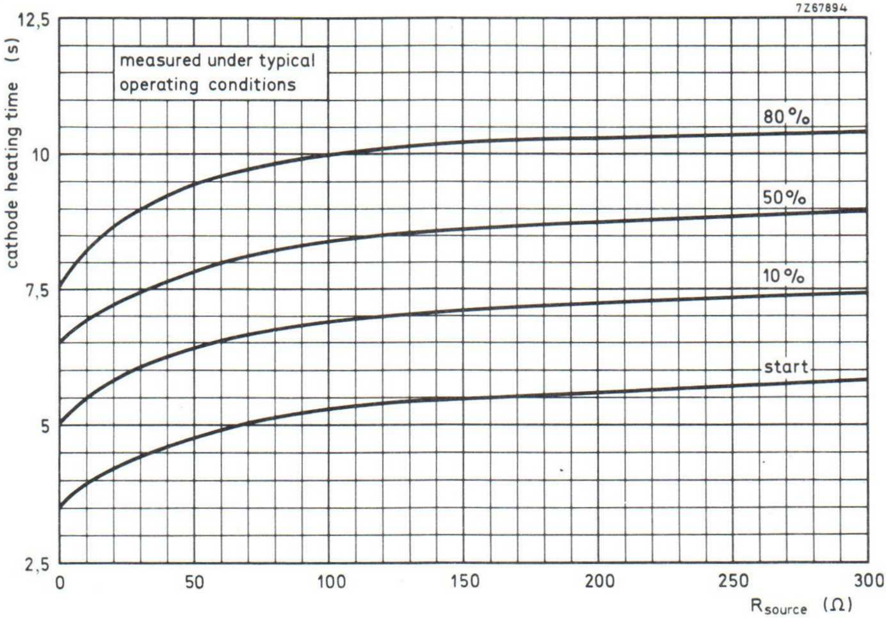


Final accelerator voltage as a function of grid no. 1 voltage



$$\frac{\Delta V_{KR}}{\Delta V_{a,\,g3,\,g5}} = 0,3 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

31 cm (12 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy.
A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA			
Face diagonal		31	cm (12 in)
Deflection angle		110 °	
Overall length	max.	233	mm
Neck diameter		20	mm
Heating	11 V ,	140	mA
Grid no. 2 voltage		130	V
Final accelerator voltage		12	kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.		

SCREEN

Metal-backed phosphor			
Luminescence	white		
Light transmission of face glass	≈	50	%
Useful diagonal	≥	295	mm
Useful width	≥	257	mm
Useful height	≥	195	mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage		V_f	11	V
Heater current		I_f	140	mA
Limits (Absolute max. rating system) of r.m.s. heater voltage	V_f	max.	12,7	V *)
		min.	9,3	V

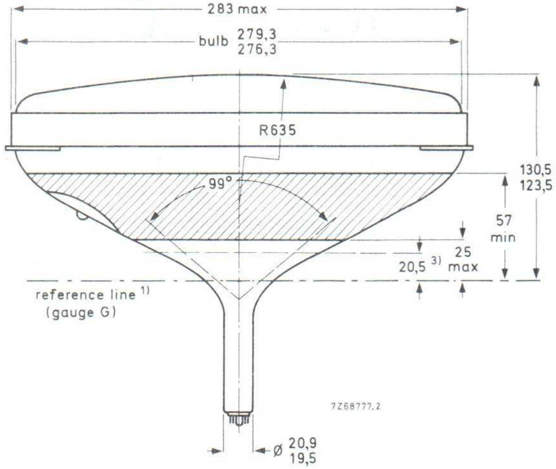
For heating time as a function of source impedance see last page of this data sheet.

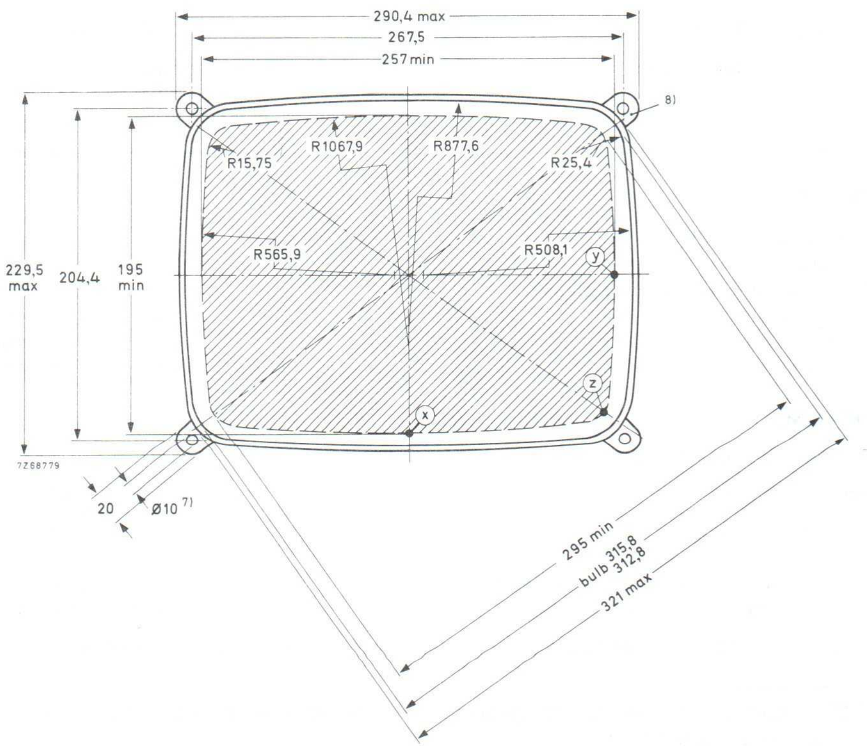
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

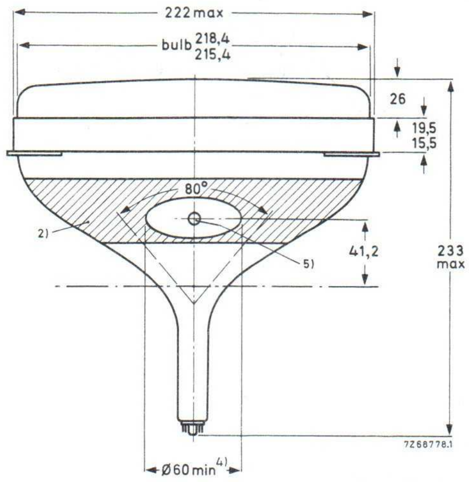
MECHANICAL DATA

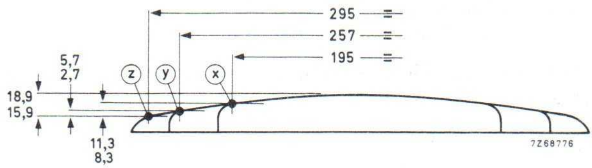
Dimensions in mm

Notes are given after the drawings.






222 max
bulb 218,4
215,4
26
19,5
15,5
80°
2)
5)
41,2
233
max
7Z68778.1
Ø60 min 4)


295
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195
5,7
2,7
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11,3
8,3
z
y
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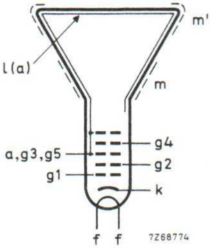
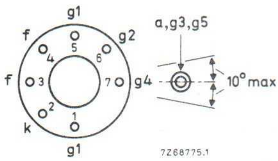
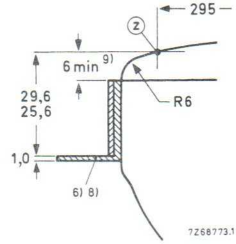






Mounting position : any

Net mass : approx. 2,8 kg

Base : JEDEC E7-91

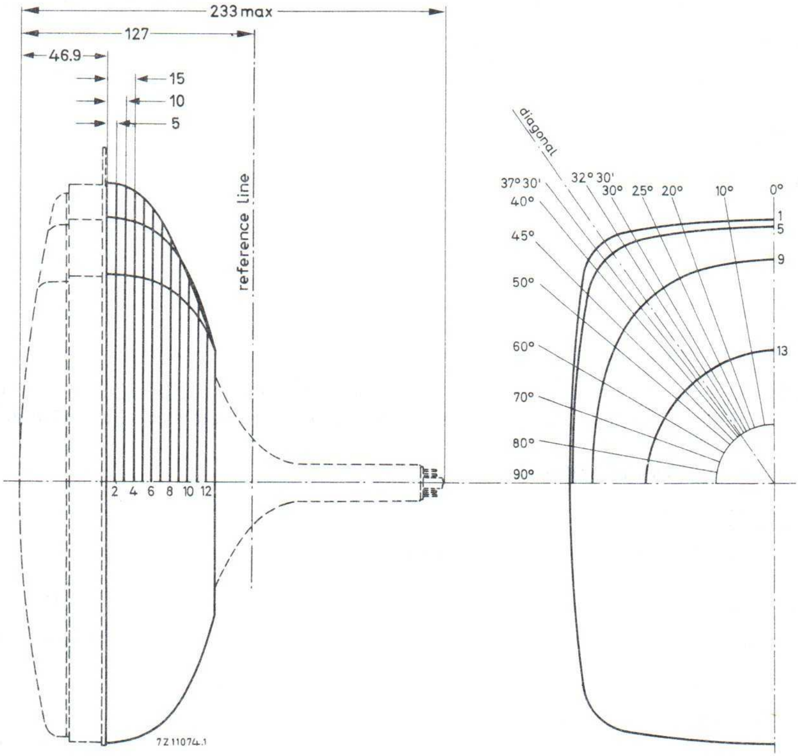
The socket for this base should not be mounted rigidly, it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (Gauge G).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge G.
4. This area must be kept clean.
5. Recessed cavity contact IEC 67-III-2.
6. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
7. The mounting screws in the cabinet must be situated inside a circle of 7 mm diameter drawn around the true geometrical positions, i.e. at the corners of a rectangle of 267,5 mm x 204,4 mm.
8. Electrical contact between the metal band and the mounting lugs is guaranteed.
9. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



Sec-tion	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	38'	$32^{\circ}30'$	diag.	$37^{\circ}30'$	40°	45°	50°	60°	70°	80°	90°
13	59.6	72,2	72,0	71,7	71,4	71,2	71,1	71,0	71,0	70,9	70,8	70,7	70,6	70,7	70,8	70,8
12	55	85,9	85,6	84,9	84,4	84,0	83,8	83,5	83,3	83,1	82,7	82,4	81,9	81,6	81,5	81,5
11	50	99,5	99,4	98,9	98,5	97,9	97,5	97,1	96,8	96,3	95,4	94,4	92,4	90,7	89,5	89,1
10	45	112,3	112,4	112,2	111,7	110,9	110,4	109,7	109,1	108,3	106,6	104,7	100,9	97,7	95,5	94,7
9	40	121,3	121,3	122,8	122,9	122,4	121,9	121,2	120,5	119,5	117,1	114,3	108,6	103,8	100,8	99,7
8	35	127,9	128,9	131,2	132,1	140,8	132,3	131,7	130,9	129,7	126,5	122,7	114,9	108,8	105,0	103,7
7	30	132,6	134,0	137,4	139,3	147,2	141,2	140,9	140,2	138,8	134,6	129,5	119,7	112,5	108,2	106,8
6	25	136,0	137,5	141,7	144,4	151,6	148,3	148,5	147,9	146,5	140,9	134,3	122,9	115,0	110,5	109,0
5	20	138,4	140,0	144,5	147,8	154,6	153,2	153,7	153,2	151,7	144,8	137,1	124,7	116,5	111,8	110,3
4	15	140,3	141,9	146,6	150,2	156,5	156,6	157,4	156,9	155,1	147,1	138,5	125,4	117,0	112,3	110,8
3	10	141,6	143,2	148,0	151,8	154,6	158,7	159,5	159,0	157,1	148,5	139,4	126,0	117,6	112,9	111,4
2	5	142,4	143,9	148,8	152,6	157,4	159,5	160,7	160,2	158,2	149,4	140,1	126,6	118,1	113,4	111,9
1	0	142,8	144,4	149,3	153,1	157,9	160,2	161,1	160,6	158,7	149,9	140,6	127,1	118,5	113,8	112,3

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g5/m}$	< 900 > 450	pF pF
Final accelerator to metal band	$C_{a,g3,g5/m'}$	150	pF
Cathode to all	C_k	3	pF
Grid no. 1 to all	C_{g1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110^o
Horizontal deflection angle	99^o
Vertical deflection angle	80^o

PICTURE CENTRİNG MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line: 47 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no.1

Final accelerator voltage	$V_{a,g3,g5}$	12	kV
Focusing electrode voltage	V_{g4}	0 to 130	V *)
Grid no.2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	30 to 50	V

*) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and +130 V (e.g. two taps; 0 V and 130 V).
The optimum focusing voltage of individual tubes may be between -100 V and +200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage	$V_{a,g3,g5}$	max.	17	kV*)
		min.	10	kV
Grid no. 4 voltage				
positive	V_{g4}	max.	500	V
negative	$-V_{g4}$	max.	200	V
Grid no. 2 voltage	V_{g2}	max.	200	V
Cathode to grid no. 1 voltage				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1_p}$	max.	400	V**)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1_p}$	max.	2	V
Cathode-to-heater voltage	$V_{k/f}$	max.	200	V

CIRCUIT DESIGN VALUES

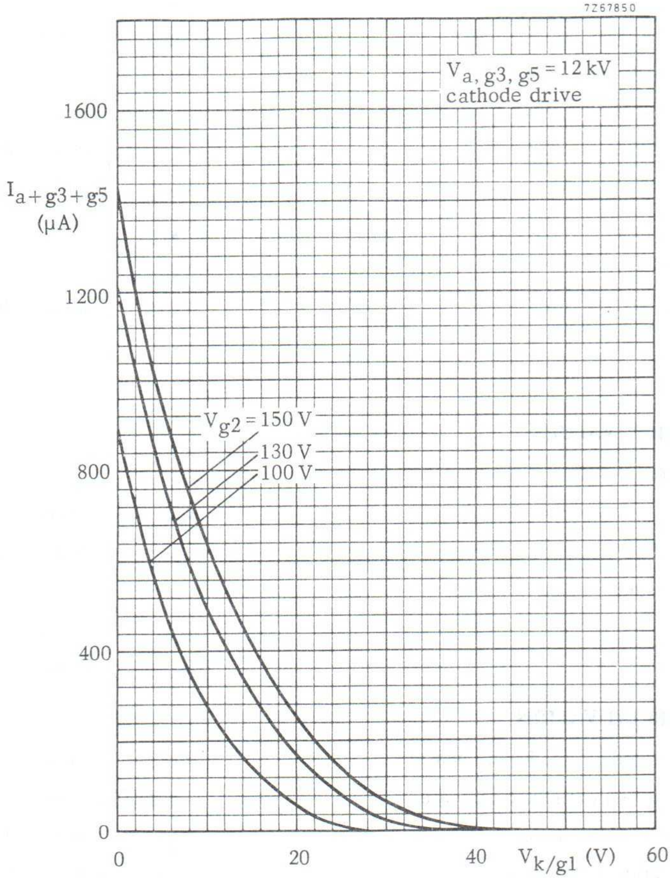
Grid no. 4 current				
positive	I_{g4}	max.	25	µA
negative	$-I_{g4}$	max.	25	µA
Grid no. 2 current				
positive	I_{g2}	max.	5	µA
negative	$-I_{g2}$	max.	5	µA

MAXIMUM CIRCUIT VALUES

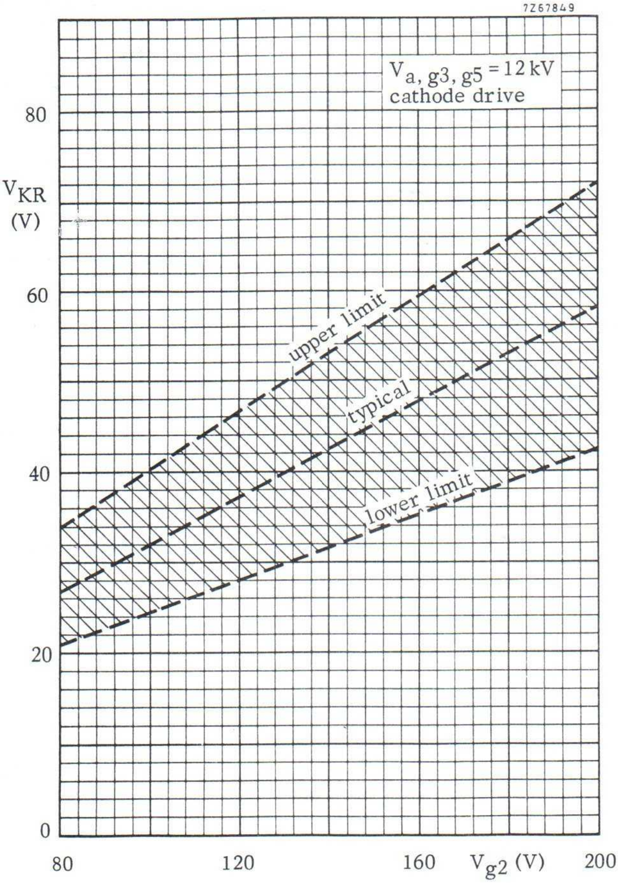
Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$(50Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1}(50Hz)	max.	0,5	MΩ

*) The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

**) Maximum pulse duration 22% of a cycle but max. 1,5 ms.

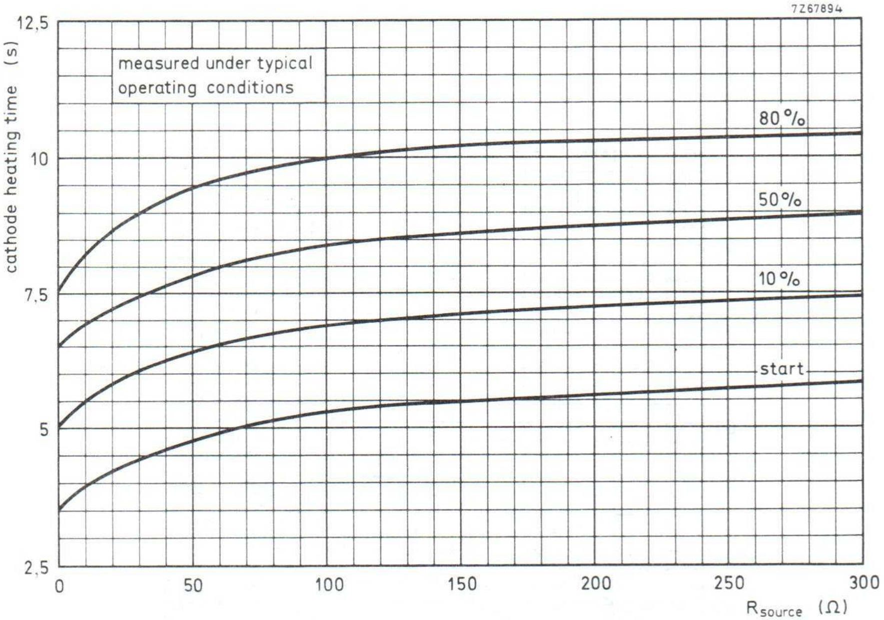


Final accelerator current as a function of cathode voltage



$$\frac{\Delta V_{KR}}{\Delta V_{a,\,g3,\,g5}} = 0,3 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no.2 voltage



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

34 cm (14 in), 90°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA

Face diagonal	34 cm (14 in)
Deflection angle	90°
Overall length	max. 287 mm
Neck diameter	20 mm
Heating	11 V, 140 mA
Grid 2 voltage	130 V
Anode voltage	12 kV
Quick heating cathode	with a typical tube a legible picture will appear within 5s

SCREEN

Metal-backed phosphor	P4
Luminescence	white
Light transmission of face glass	48%
Useful diagonal	min. 322 mm
Useful width	min. 270 mm
Useful height	min. 210 mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	11 V
Heater current	I_f	140 mA
Limits (Absolute maximum rating system) of r.m.s. heater voltage, measured in any 20 ms	V_f	max. 12,7 V* min. 9,3 V

For heating time as a function of source impedance see last page of this data sheet.

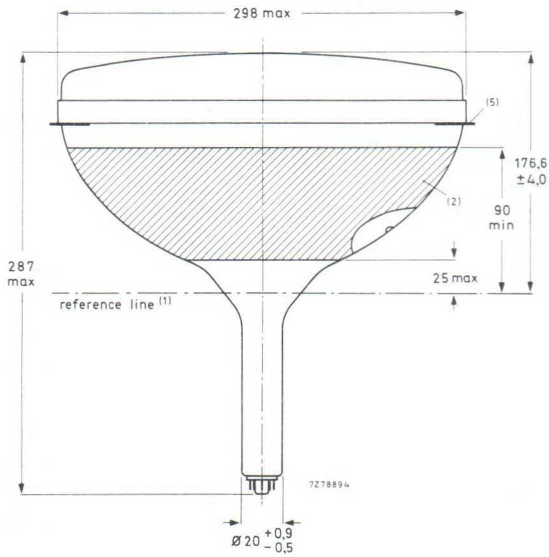
* This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

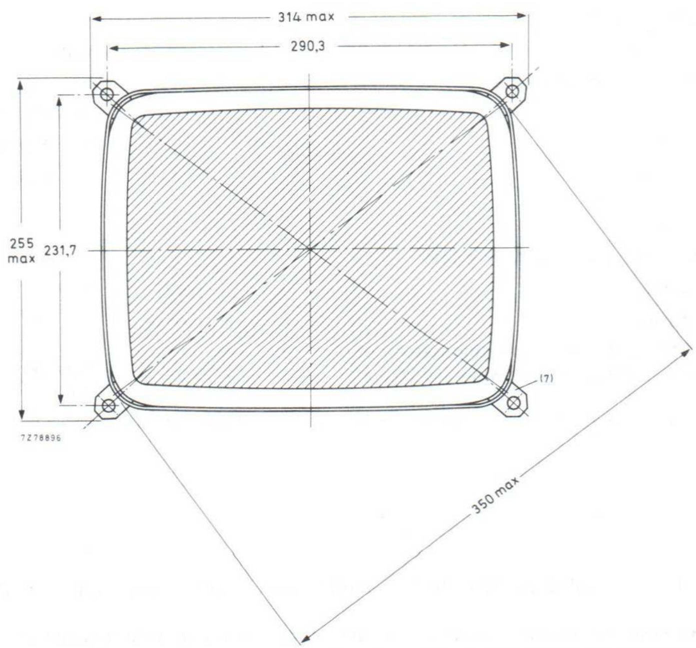
For maximum cathode life it is recommended that the heater supply be regulated at 11 V.

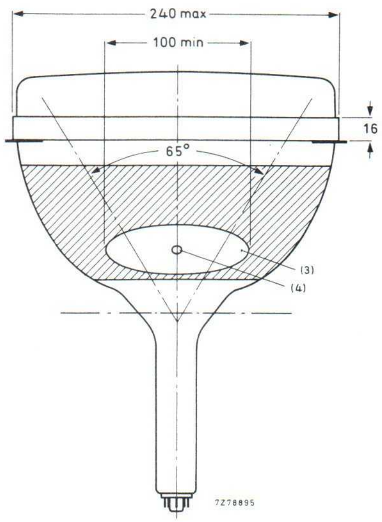
MECHANICAL DATA

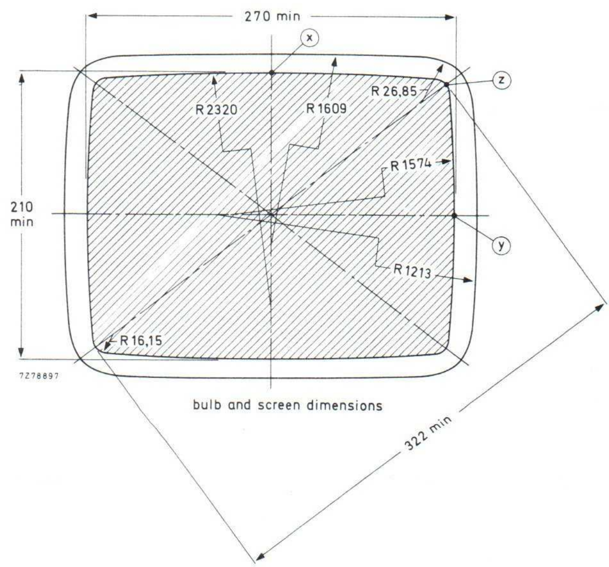
Dimensions in mm

Notes are given after the drawings

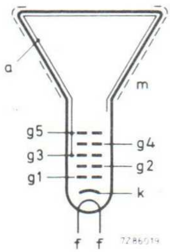


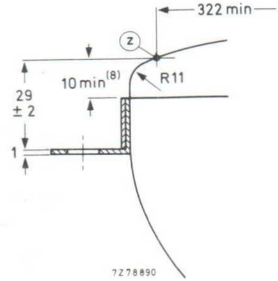


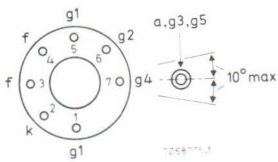


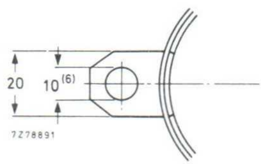


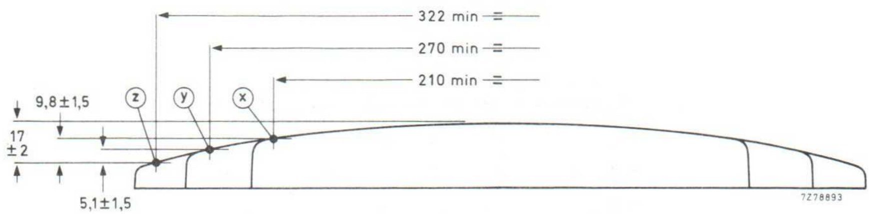
bulb and screen dimensions











Mounting position	any
Nett mass	approx. 3,6 kg
Bulb contact designation	IEC 67-III-2; JEDEC J1-21
Base designation	JEDEC E7-91
Basing	7GR

The socket for this base should not be mounted rigidly; it should have flexible leads and be allowed to move freely.

Notes to outline drawings on the preceding pages

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (gauge D).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing. The external conductive coating must be earthed.
3. This area must be kept clean.
4. Recessed cavity contact IEC67-III-2.
5. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
6. The mounting screws in the cabinet must be situated inside a circle of 7 mm drawn around the true geometrical positions i.e. at the corners of a rectangle of 290,3 mm x 231,7 mm.
7. Electrical contact between the metal band and mounting lugs is guaranteed.
8. Distance from reference point Z to any hardware.

CAPACITANCES

Anode to external conductive coating	$C_{a,g3,g5/m}$	< 1100 pF > 450 pF
Anode to metal band	$C_{a,g3,g5/m'}$	150 pF
Cathode to all	C_k	3 pF
Grid 1 to all	C_{g1}	7 pF

FOCUSING

electrostatic

DEFLECTION

magnetic

Diagonal deflection angle	90°
Horizontal deflection angle	82°
Vertical deflection angle	67°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m. Maximum distance between centre of field of this magnet and reference line: 47 mm

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid 1

Anode voltage	$V_{a,g3,g5}$	12 kV
Focusing electrode voltage	V_{g4}	0 to 130 V*
Grid 2 voltage	V_{g2}	130 V
Cathode voltage for visual extinction of focused raster	V_{KR}	45 to 65 V

* Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps: 0 V and 130 V). The optimum focusing voltage of individual tubes may be between −150 and + 150 V).

LIMTING VALUES (Design maximum rating system)

Voltages are specified with respect to grid 1 unless stated otherwise.

Anode voltage	$V_{a,g3,g5}$	max.	17 kV*
		min.	10 kV
Grid 4 voltage			
positive	V_{g4}	max.	1000 V
negative	$-V_{g4}$	max.	200 V
Grid 2 voltage	V_{g2}	max.	200 V
Cathode voltage			
positive	V_k	max.	200 V
positive peak	V_{kp}	max.	400 V**
negative	$-V_k$	max.	0 V
negative peak	$-V_{kp}$	max.	2 V
Cathode-to-heater voltage	$V_{k/f}$	max.	200 V

CIRCUIT DESIGN VALUES

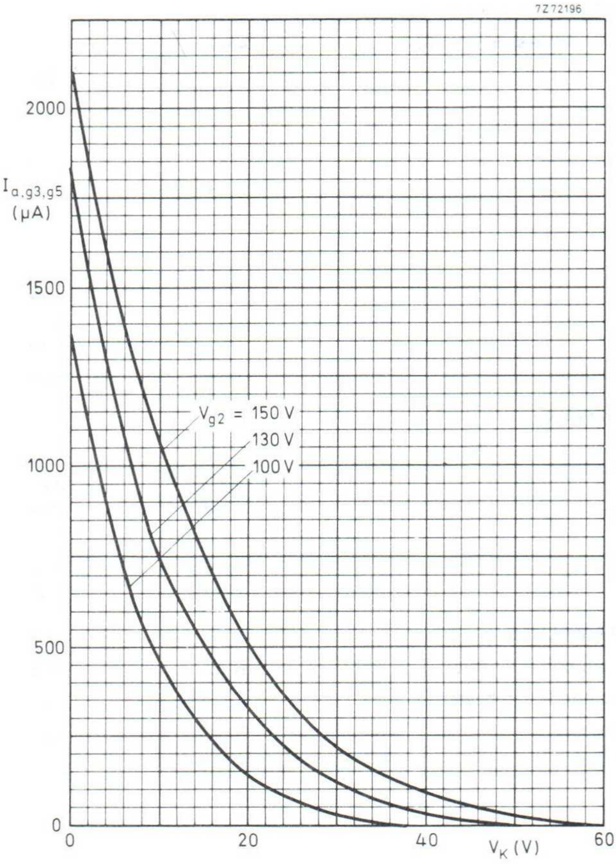
Grid 4 current			
positive	I_{g4}	max.	25 μA
negative	$-I_{g4}$	max.	25 μA
Grid 2 current			
positive	I_{g2}	max.	5 μA
negative	$-I_{g2}$	max.	5 μA

MAXIMUM CIRCUIT VALUES

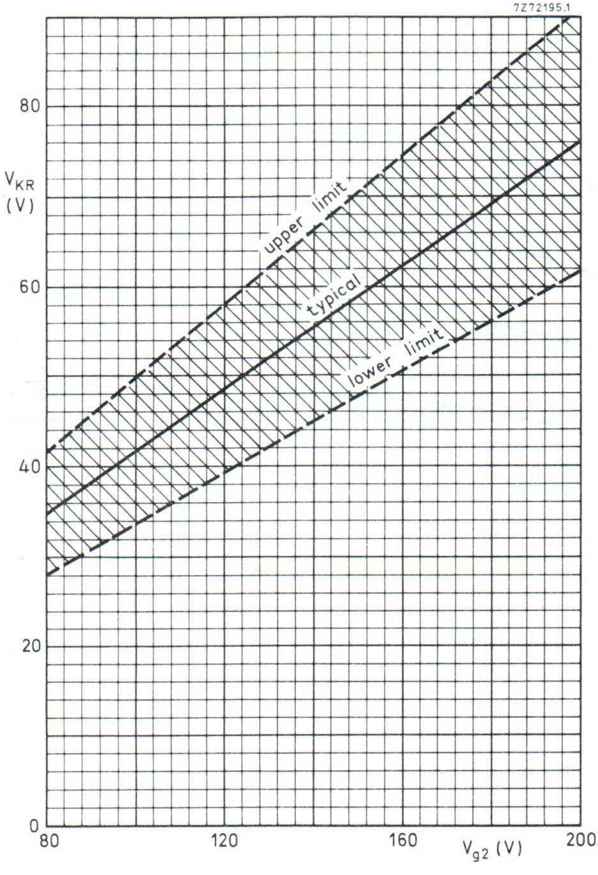
Resistance between cathode and heater	$R_{k/f}$	max.	1 MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1 MΩ
Grid 1 circuit resistance	R_{g1}	max.	1,5 MΩ
Grid 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5 MΩ

* The X-ray dose rate remains below the accpetable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

** Maximum pulse duration 22% of a cycle but max. 1,5 ms.

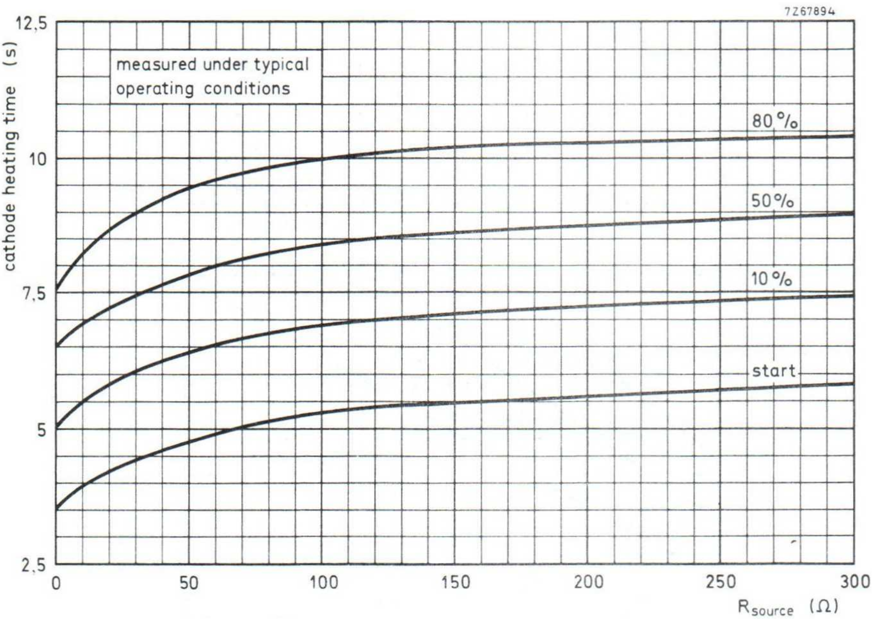


Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5} = 12$ kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}3 \times 10^{-3}$$



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

34 cm (14 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy.
A special feature of this tube is its short cathode heating time.
The tube is designed for "push through" application and is provided with four metal lugs for mounting into a cabinet.

QUICK REFERENCE DATA			
Face diagonal		34	cm (14 in)
Deflection angle		110°	
Overall length	max.	247	mm
Neck diameter		20	mm
Heating		11 V, 140	mA
Grid no. 2 voltage		130	V
Final accelerator voltage		12	kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.		

SCREEN

Metal-backed phosphor			
Luminance	white		
Light transmission of face glass	≈	48	%
Useful diagonal	≥	322,3	mm
Useful width	≥	270,2	mm
Useful height	≥	210,7	mm

HEATING

Indirect by a.c. or d.c.

Heater voltage	V_f		11	V	
Heater current	I_f		140	mA	
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max.	12,7	V	*)
		min.	9,3	V	

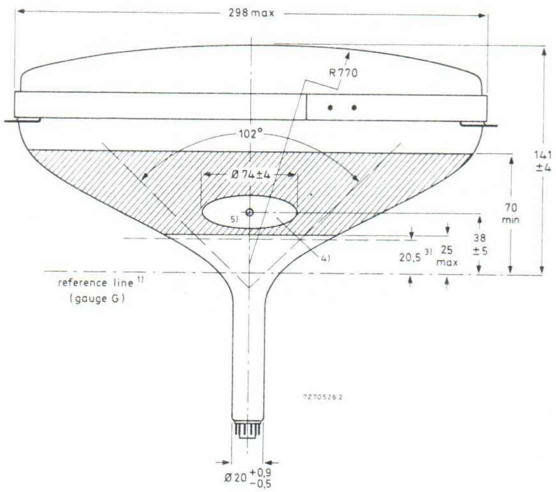
For heating time as a function of source impedance see last page of this data sheet.

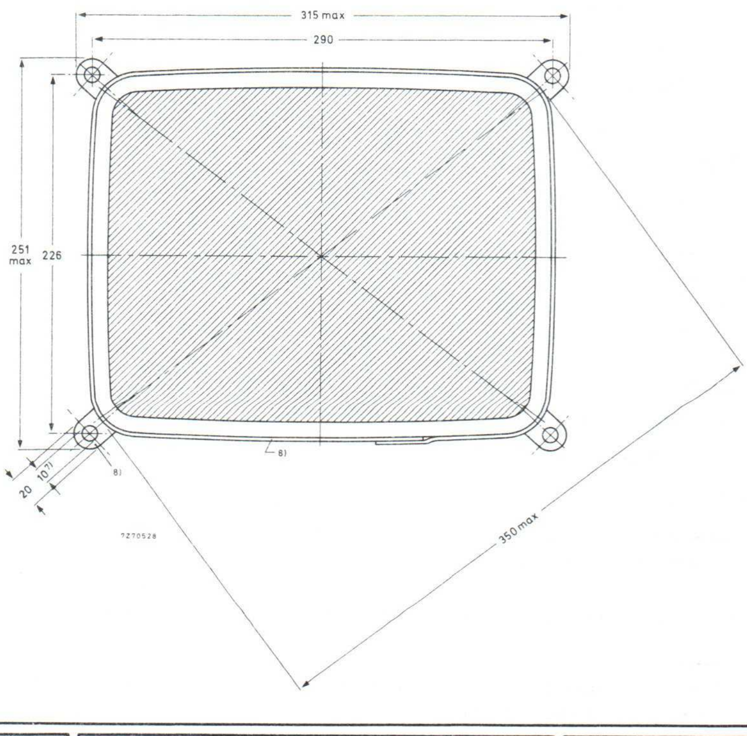
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

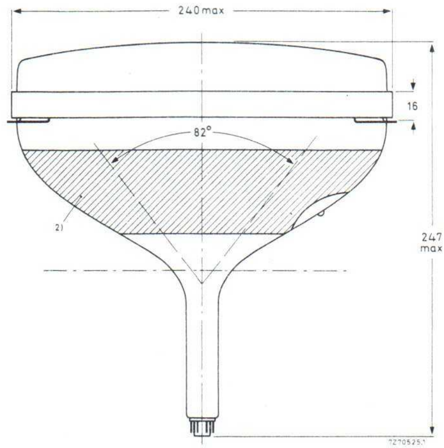
MECHANICAL DATA

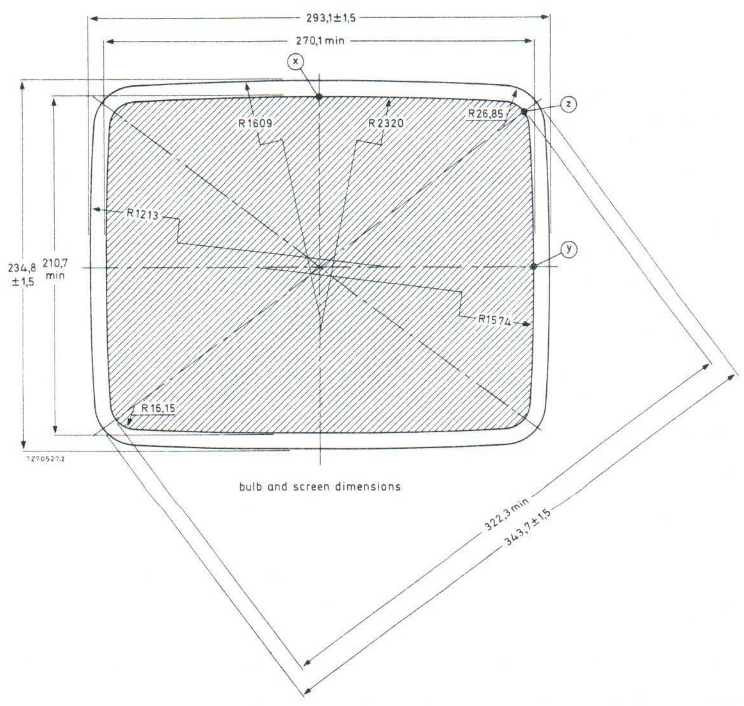
Dimensions in mm

Notes are given after the drawings.

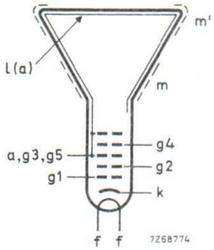


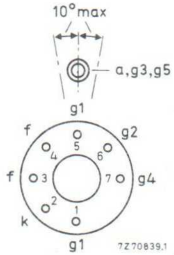


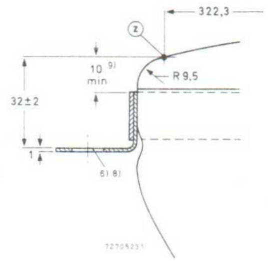


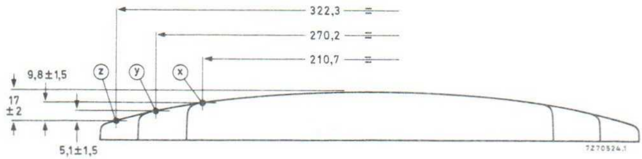


bulb and screen dimensions









Mounting position : any

Netmass : approx. 3,2 kg

Base : JEDEC E7-91

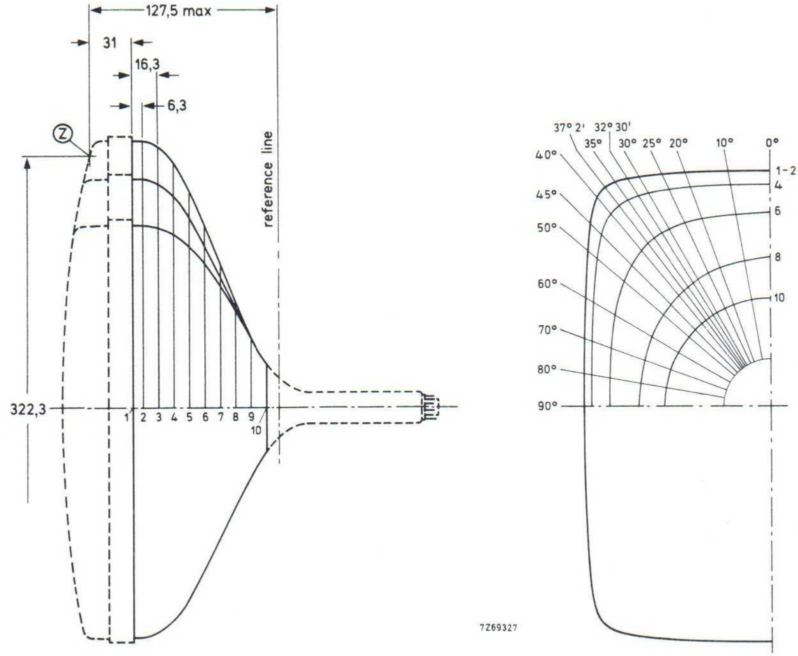
The socket for this base should not be mounted rigidly it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (gauge G).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge G.
4. This area must be kept clean.
5. Recessed cavity contact IEC67-III-2.
6. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
7. The mounting screws in the cabinet must be situated inside a circle of 7 mm drawn around the true geometrical positions i.e. at the corners of a rectangle of 290 mm x 226 mm.
8. Electrical contact between the metal band and mounting lugs is guaranteed.
9. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



Section	Nom. distance from section 1	Distance from centre (max. values)														
		0^{o}	10^{o}	20^{o}	25^{o}	30^{o}	$32^{o}30'$	35^{o}	$37^{o}2'$	40^{o}	45^{o}	50^{o}	60^{o}	70^{o}	80^{o}	90^{o}
1	0	150, 6	152, 7	159, 3	164, 4	170, 4	173, 4	175, 7	176, 5	174, 8	165, 3	154, 6	138, 6	128, 6	123, 2	121, 4
2	6, 3	150, 6	152, 7	159, 3	164, 4	170, 4	173, 4	175, 7	176, 5	174, 8	165, 3	154, 6	138, 6	128, 6	123, 2	121, 4
3	16, 3	148, 1	150, 2	156, 6	161, 6	167, 6	170, 6	173, 0	173, 9	172, 6	163, 7	153, 2	137, 3	127, 4	121, 9	120, 2
4	26, 3	141, 6	143, 5	149, 3	153, 6	158, 3	160, 3	161, 8	162, 2	161, 3	155, 5	147, 2	132, 8	123, 5	118, 3	116, 7
5	36, 3	133, 5	135, 2	139, 9	142, 9	145, 7	146, 7	147, 3	147, 3	146, 4	142, 8	137, 4	126, 1	117, 7	113, 0	111, 5
6	46, 3	124, 0	125, 3	128, 5	130, 1	131, 2	131, 4	131, 4	131, 1	130, 3	127, 9	124, 6	116, 9	110, 3	106, 2	104, 9
7	56, 3	112, 2	113, 0	114, 1	114, 3	114, 2	114, 0	113, 6	113, 2	112, 5	110, 0	109, 1	104, 7	100, 7	97, 8	96, 7
8	66, 3	95, 8	95, 6	95, 6	94, 6	93, 9	93, 6	93, 2	92, 9	92, 4	91, 5	90, 6	88, 9	87, 4	86, 3	85, 9
9	71, 3	84, 5	84, 1	83, 3	82, 8	82, 2	81, 9	81, 7	81, 4	81, 1	80, 6	80, 1	79, 3	78, 8	78, 5	78, 5
10	76, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0	69, 0.

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g3, g5/m}$	<900 >450	pF pF
Final accelerator to metal band	$C_{a, g3, g5/m}$	200	pF
Cathode to all	C_k	3	pF
Grid no. 1 to all	C_{g1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	102°
Vertical deflection angle	82°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe).
Maximum distance between centre of field of this magnet and reference line: 47 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1.

Final accelerator voltage	$V_{a, g3, g5}$	12	kV
Focusing electrode voltage	V_{g4}	0 to 130	V *)
Grid no. 2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	30 to 50	V

*) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 V and +130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may be between -100 V and +200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a, g3, g5} = 0$	$V_{a, g3, g5}$	max.	17	kV*)
		min.	10	kV
Grid no. 4 voltage,				
positive	V_{g4}	max.	500	V
negative	$-V_{g4}$	max.	200	V
Grid no. 2 voltage	V_{g2}	max.	200	V
Cathode to grid no. 1 voltage,				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V**)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	$V_{k/f}$	max.	200	V

CIRCUIT DESIGN VALUES

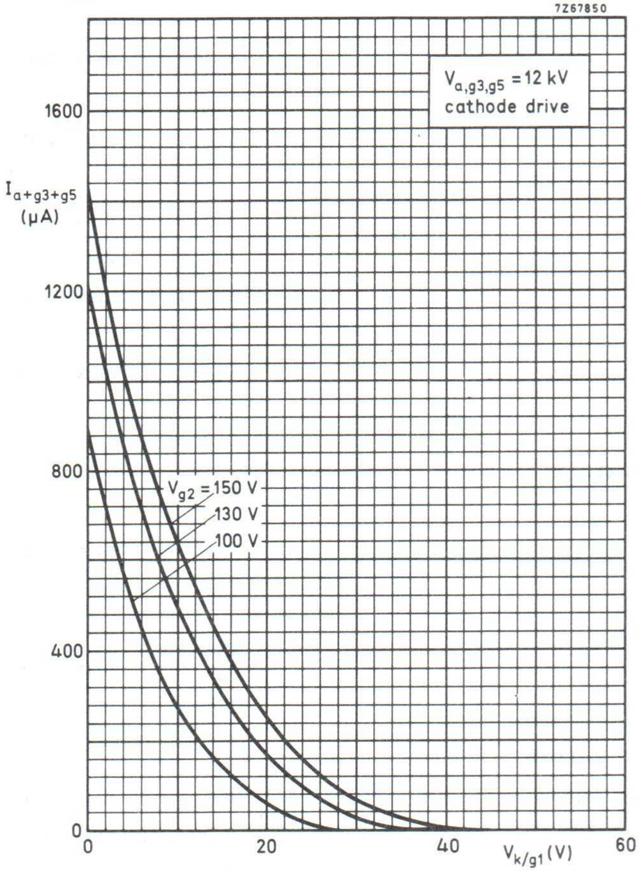
Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

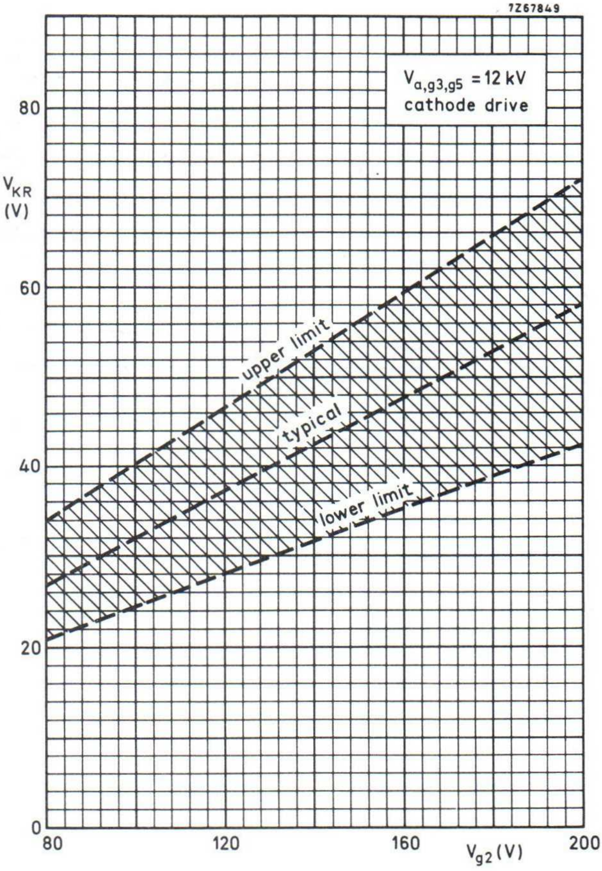
Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{f/k}$(50 Hz)	max.	0, 1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1, 5	MΩ
Grid no. 1 circuit impedance	Z_{g1}(50 Hz)	max.	0, 5	MΩ

*) The X-ray dose rate remains below the acceptable value of 0, 5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

**) Maximum pulse duration 22% of a cycle but max. 1, 5 ms.

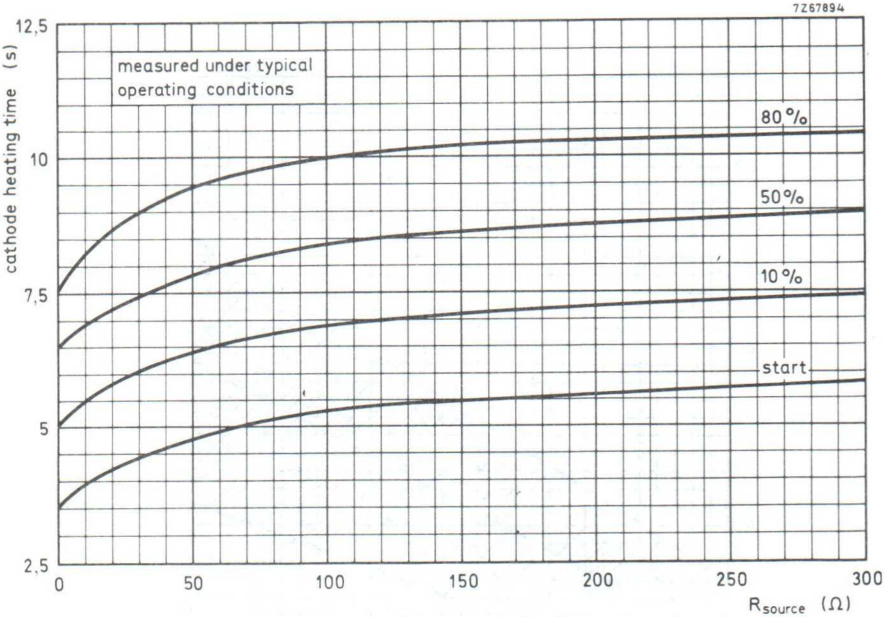


Final accelerator current as a function of cathode voltage.



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage.



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

44 cm (17 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. The 20 mm neck diameter ensures a low deflection energy.
A special feature of this tube is its short cathode heating time.
The tube is designed for "push through" application and is provided with four metal lugs for mounting into a cabinet.

QUICK REFERENCE DATA			
Face diagonal		44	cm (17 in)
Deflection angle		110°	
Overall length	max.	288	mm
Neck diameter		20	mm
Heating		11 V, 140	mA
Grid no. 2 voltage		130	V
Final accelerator voltage		15	kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.		

SCREEN

Metal-backed phosphor			
Luminescence	white		
Light transmission of face glass	≈	48	%
Useful diagonal	≥	413	mm
Useful width	≥	346	mm
Useful height	≥	270	mm

HEATING

Indirect by a.c. or d.c.

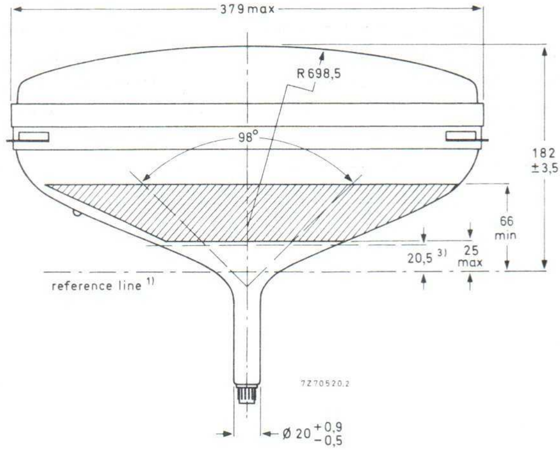
Heater voltage	V_f		11	V	
Heater current	I_f		140	mA	
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max.	12,7	V	*)
		min.	9,3	V	

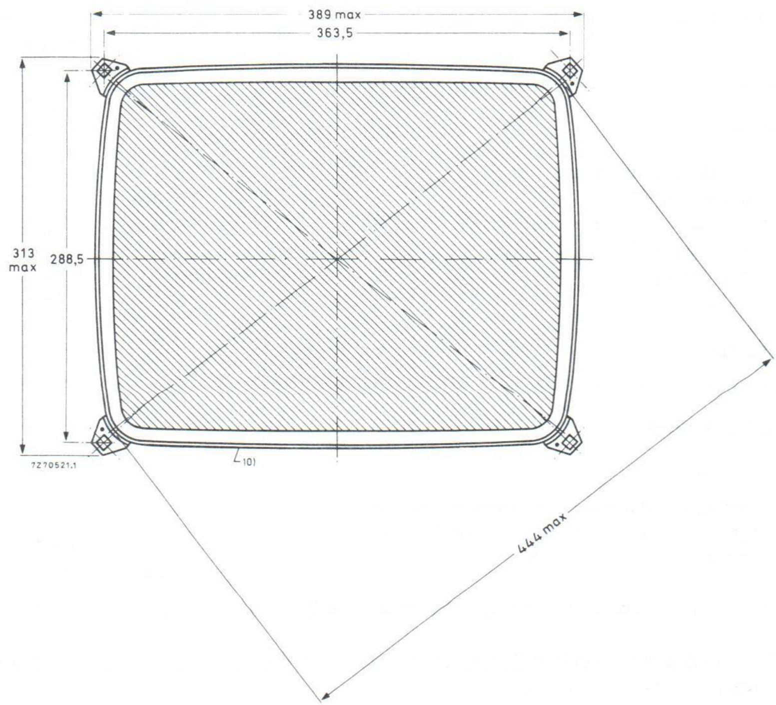
For heating time as a function of source impedance see last page of this data sheet.

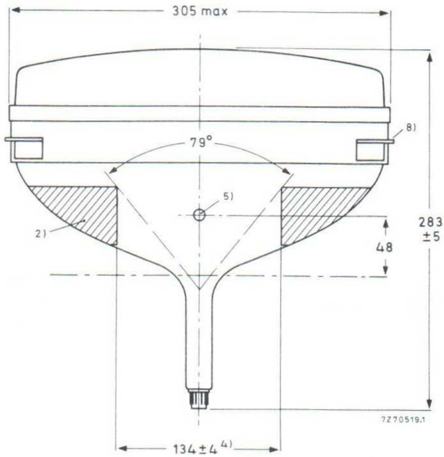
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

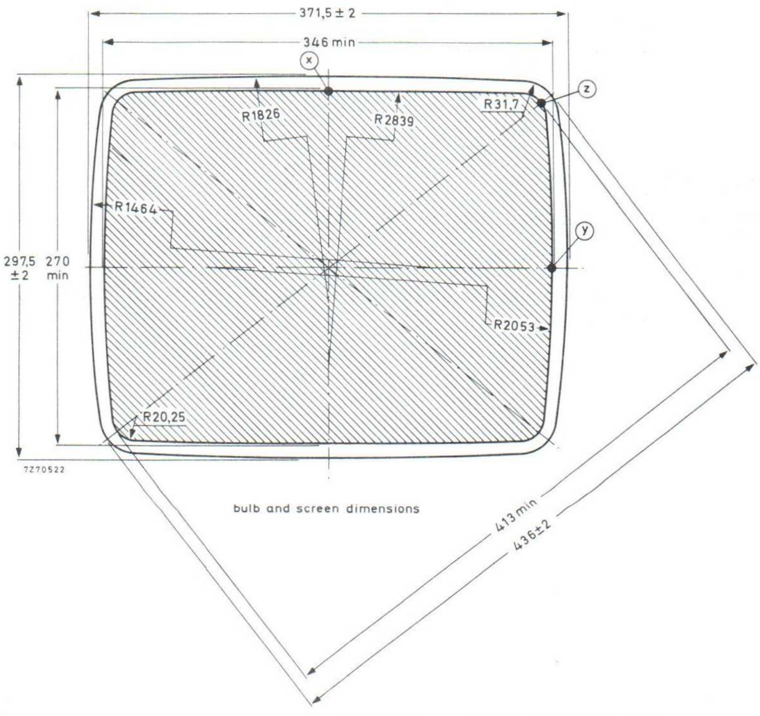
MECHANICAL DATA

Notes are given after the drawings.

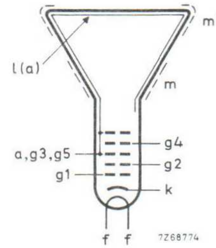


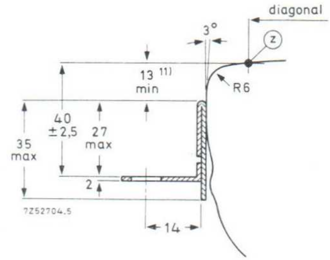


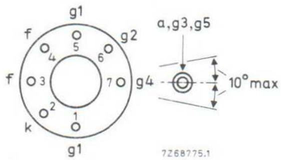


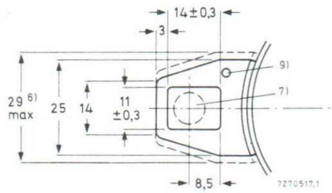


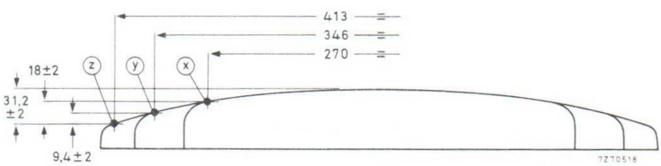
bulb and screen dimensions











Mounting position: any

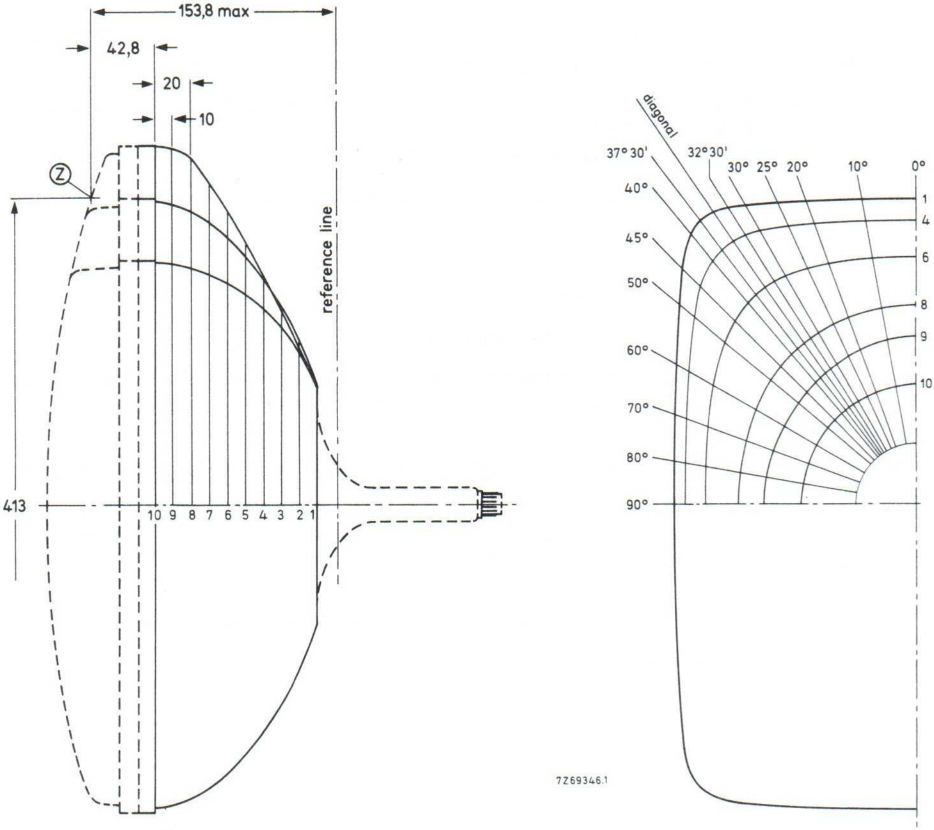
Net mass : approx. 6 kg

Base : JEDEC E7-91

The socket for the base should not be mounted rigidly, it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWING

1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (gauge G).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing.
   The external conductive coating must be earthed.
3. End of guaranteed contour. The maximum neck and cone contour is given by the reference line gauge G.
4. This area must be kept clean.
5. Recessed cavity contact IEC67-III 2.
6. Minimum space to be reserved for mounting lug.
7. The mounting screws in the cabinet must be situated inside a circle of 7,5 mm drawn around the true geometrical positions i.e. at the corners of a rectangle of 363,5 mm x 288,5 mm.
8. The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
9. The metal rim-band must be earthed. The hole of 3 mm dia in each lug is provided for this purpose. Electrical contact between the metal band and mounting lugs is guaranteed.
10. Max. curvatures of the outside rim-band are: nominal bulb radius + 4 mm.
11. Distance from reference point Z to any hardware.



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A44-510W

Section	Nom. distance from section 1	Distance from centre (max values)														
		0°	10°	20°	25°	30°	32°30'	diag.	37°30'	40°	45°	50°	60°	70°	80°	90°
10	90	73, 8	73, 6	73, 1	72, 9	72, 6	72, 5	72, 3	72, 2	72, 1	71, 9	71, 8	71, 7	71, 7	71, 8	71, 9
9	80	104, 7	103, 9	102, 1	101, 0	99, 9	99, 4	98, 6	98, 4	98, 0	97, 2	96, 5	95, 6	95, 2	95, 2	95, 3
8	70	123, 9	124, 0	123, 8	123, 5	123, 0	122, 6	122, 0	121, 8	121, 2	120, 1	118, 7	116, 0	113, 5	111, 7	111, 1
7	60	140, 4	141, 3	143, 3	144, 1	144, 5	144, 5	144, 0	143, 8	143, 2	141, 2	138, 6	132, 7	127, 3	123, 8	122, 5
6	50	154, 8	156, 3	160, 3	162, 5	164, 3	164, 9	164, 7	164, 5	163, 7	160, 5	156, 0	146, 1	138, 1	133, 2	131, 5
5	40	166, 9	168, 9	174, 5	178, 1	181, 6	183, 1	183, 4	183, 2	182, 1	177, 2	170, 2	156, 6	146, 6	140, 8	138, 9
4	30	176, 8	179, 1	185, 9	190, 9	196, 3	198, 9	200, 0	199, 8	198, 4	191, 2	181, 2	164, 4	153, 0	146, 7	144, 6
3	20	184, 1	186, 6	194, 4	200, 4	208, 0	212, 0	214, 6	214, 3	212, 6	202, 0	189, 0	169, 6	157, 4	150, 8	148, 6
2	10	188, 6	191, 2	199, 3	205, 6	213, 9	218, 4	221, 3	221, 2	219, 2	207, 2	193, 1	172, 9	160, 4	153, 6	151, 4
1	0	190, 0	192, 6	200, 7	207, 1	215, 3	219, 9	222, 7	222, 5	220, 5	208, 6	194, 4	174, 1	161, 5	154, 7	152, 5

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g5/m}$	< 1300 > 700	pF pF
Final accelerator to metal rimband	$C_{a,g3,g5/m'}$	200	pF
Cathode to all	C_k	3	pF
Grid no. 1 to all	C_{g1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	98°
Vertical deflection angle	79°

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of filed of this magnet and reference line: 47 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a,g3,g5}$	15	kV
Focusing electrode voltage	V_{g4}	0 to 130	V *)
Grid no. 2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	30 to 50	V

*) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 V and + 130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may be between − 100 V and + 200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max.	17	kV*)
		min.	10	kV
Grid no. 4 voltage				
Positive	V_{g4}	max.	500	V
Negative	$-V_{g4}$	max.	200	V
Grid no. 2 voltage	$V_{g2/k}$	max.	200	V
Cathode to grid no. 1 voltage,				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V**)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	$V_{k/f}$	max.	200	V

CIRCUIT DESIGN VALUES

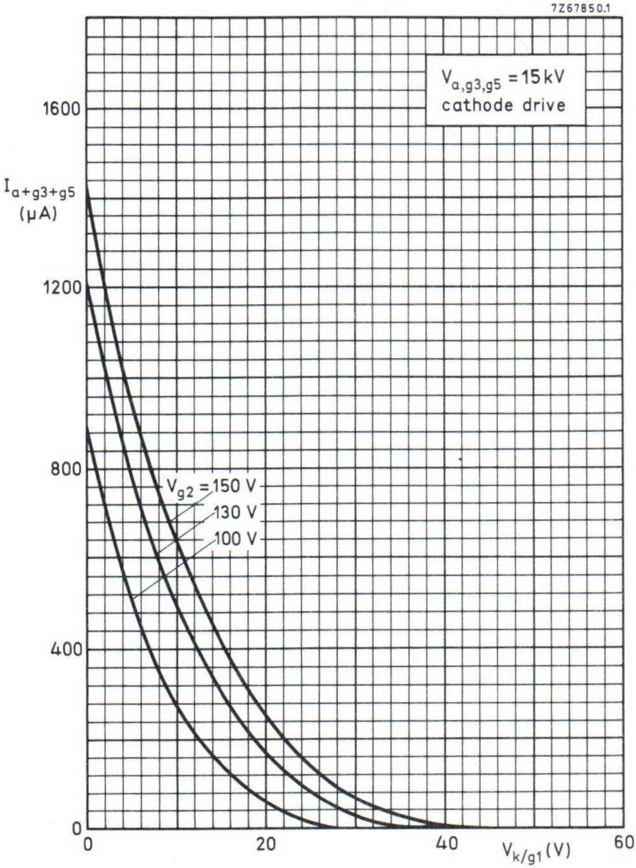
Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

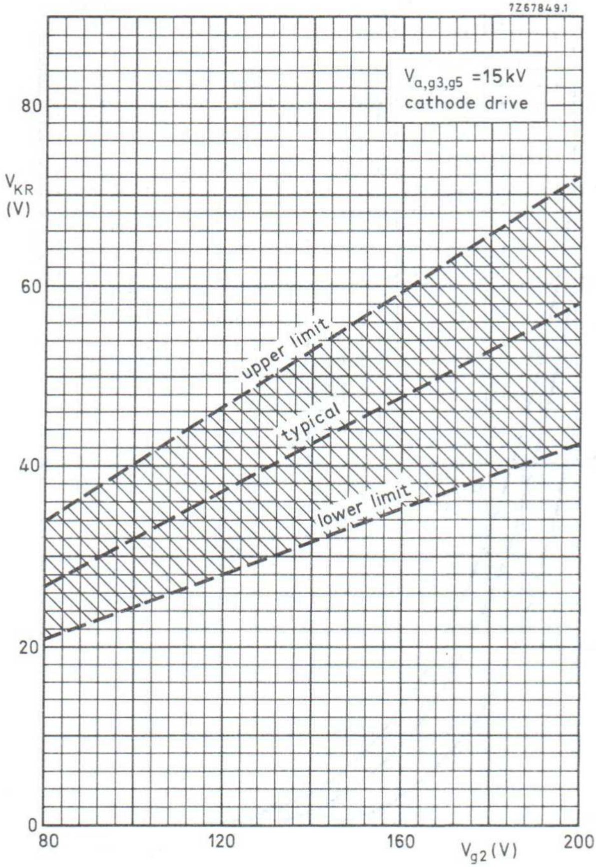
Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{f/k}$(50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 impedance	Z_{g1}(50 Hz)	max.	0,5	MΩ

*) The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

**) Maximum pulse duration 22% of a cycle but max. 1,5 ms.

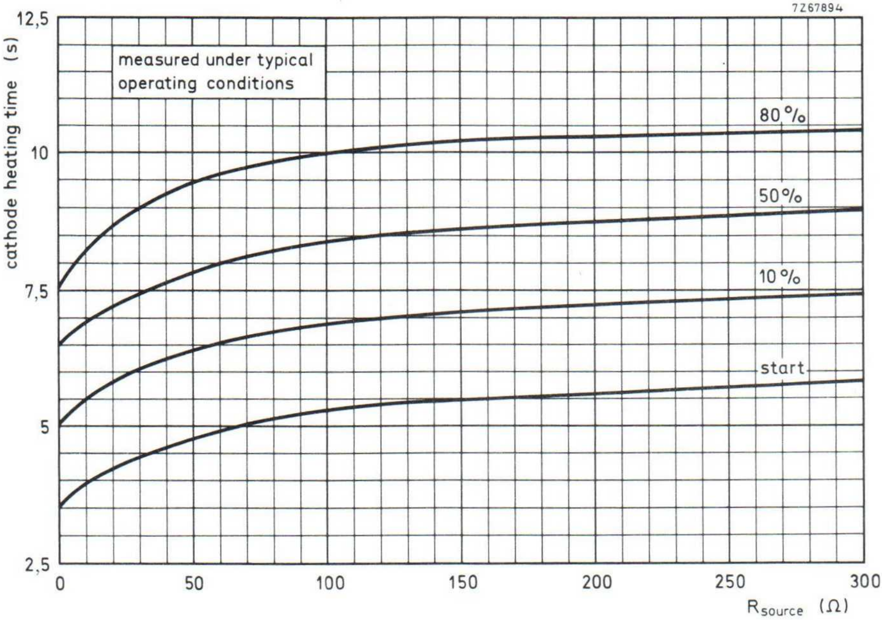


Final accelerator current as a function of cathode voltage.



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage.



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

44 cm (17 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA		
Face diagonal		44 cm
Deflection angle		110°
Overall length	max.	291 mm
Neck diameter		28, 6 mm
Heating		6, 3 V, 240 mA
Grid no. 2 voltage		130 V
Final accelerator voltage		20 kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.	

SCREEN

Metal-backed phosphor

Luminescence	white	
Light transmission of face glass	≈	48 %
Useful diagonal	≥	413 mm
Useful width	≥	346 mm
Useful height	≥	270 mm

HEATING

Indirect by a.c. or d.c.

Heater voltage	V_f		6, 3 V
Heater current	I_f		240 mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	7, 3 V *) 5, 3 V

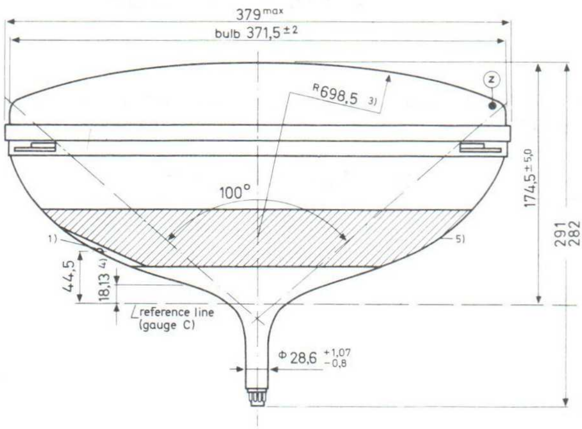
For heating time as a function of source impedance see last page of this data sheet.

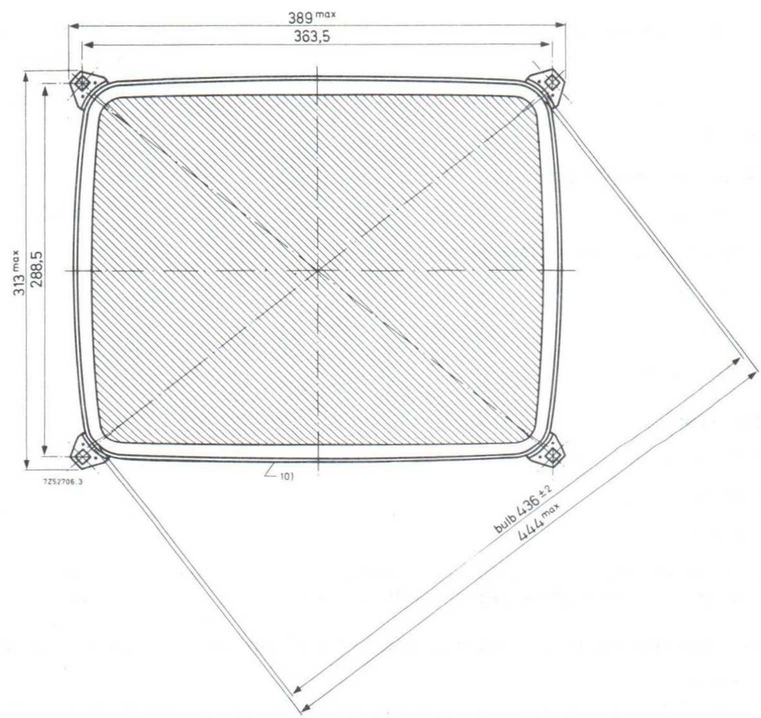
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

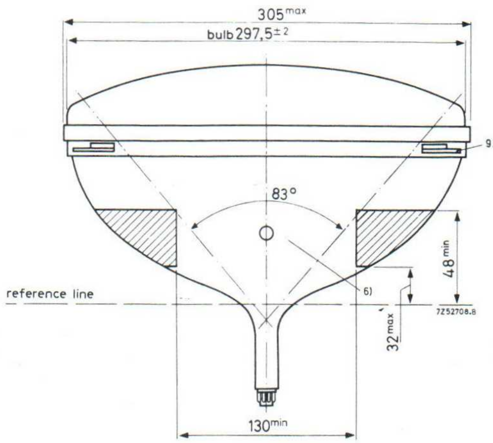
MECHANICAL DATA

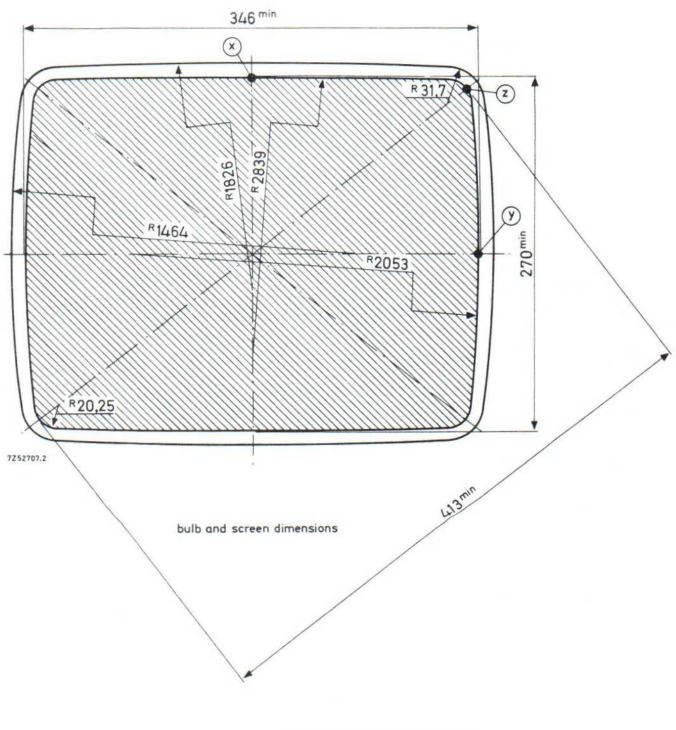
Dimensions in mm

Notes are given after the drawings.

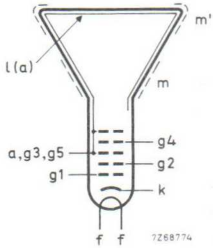


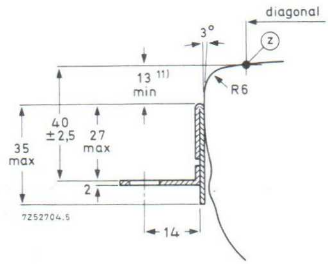


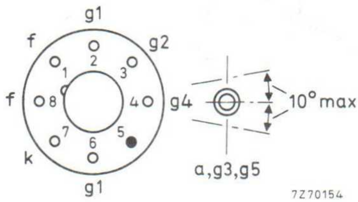


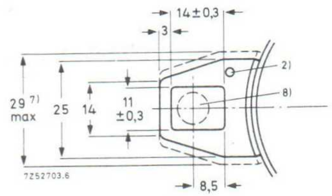


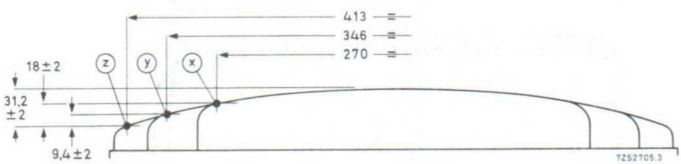
bulb and screen dimensions











Mounting position : any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC 67-I-31a

Net mass : approx. 6 kg

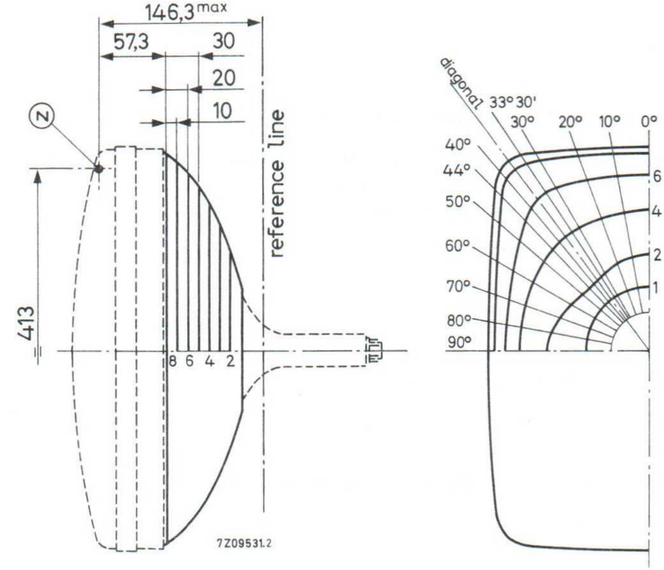
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWING

1. Small cavity contact IEC 67-III-2.
2. The metal rim-band must be earthed. The hole of 3 mm dia in each lug is provided for this purpose.
3. Spherical face-plate.
4. End of guaranteed contour. The maximum contour from reference line towards screen is given by the reference line gauge C (18, 13 mm).
5. The configuration of the external conductive coating may be different but contains the contact area as shown in the drawing.
   The external conductive coating must be earthed.
6. This area must be kept clean.
7. Minimum space to be reserved for mounting lug.
8. The mounting screws in the cabinet must be situated inside a circle of 7, 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 363, 5 mm x 288, 5 mm.
9. The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.
10. Max. curvatures of the outside rim-band are nominal bulb radius + 4 mm.
11. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



		Distance from centre (max. values)												
Section	Nom. distance from point "Z"	0° Long	10°	20°	30°	$33^{\circ}30'$	$36^{\circ}30'$ Diagonal	40°	44°	50°	60°	70°	80°	90° Short
1	128,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0
2	117,3	95,9	95,2	93,0	92,3	92,1	92,1	92,3	92,6	93,1	93,8	94,6	94,9	95,1
3	107,3	118,1	117,8	118,3	118,3	118,6	119,2	117,8	117,7	117,2	115,5	113,3	111,2	109,8
4	97,3	135,0	136,1	138,3	139,9	141,0	141,6	141,1	138,5	135,4	130,5	125,6	121,8	120,8
5	87,3	149,5	151,1	155,1	159,1	161,3	162,0	161,5	157,5	151,0	142,0	135,8	130,8	129,5
6	77,3	162,5	164,0	168,8	176,0	179,0	179,5	178,0	173,5	163,4	150,8	143,3	138,3	136,4
7	67,3	172,5	174,4	180,1	190,0	194,1	196,3	194,9	186,8	174,5	159,1	149,3	143,9	141,7
8	57,3	179,7	183,1	189,3	201,1	207,4	210,9	206,1	196,0	182,8	165,5	154,0	147,9	145,6

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g5/m}$	<	1300	pF
		>	700	pF
Final accelerator to metal band	$C_{a,g3,g5/m'}$		200	pF
Cathode to all	C_k		3	pF
Grid no. 1 to all	C_{g1}		7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110^o
Horizontal deflection angle	100^o
Vertical deflection angle	83^o

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe).
Maximum distance between centre of field of this magnet and reference line: 57 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a,g3,g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 130	V [1]
Grid no. 2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	42 to 62	V

[1]) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may be between − 100 V and + 200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max. min.	23 14	kV*) kV
Grid no. 4 voltage,				
positive	V_{g4}	max.	1000	V
negative	$-V_{g4}$	max.	500	V
Grid no. 2 voltage	V_{g2}	max. min.	200 80	V**) V
Cathode to grid no. 1 voltage,				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1_p}$	max.	400	V***)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1_p}$	max.	2	V
Cathode-to-heater voltage	V_{kf}	max.	200	V

CIRCUIT DESIGN VALUES

Grid no. 4 current,				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current,				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1,0	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5	MΩ

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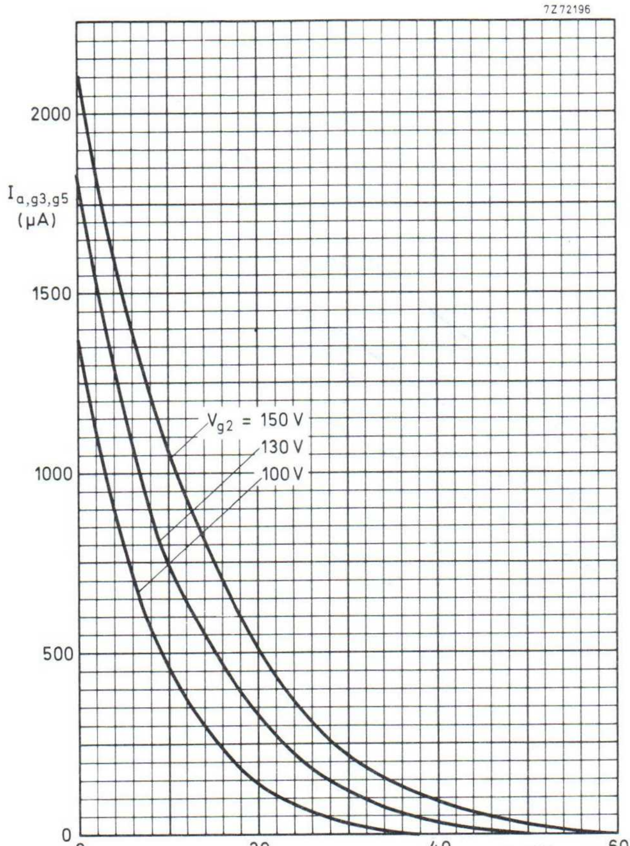
*) The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

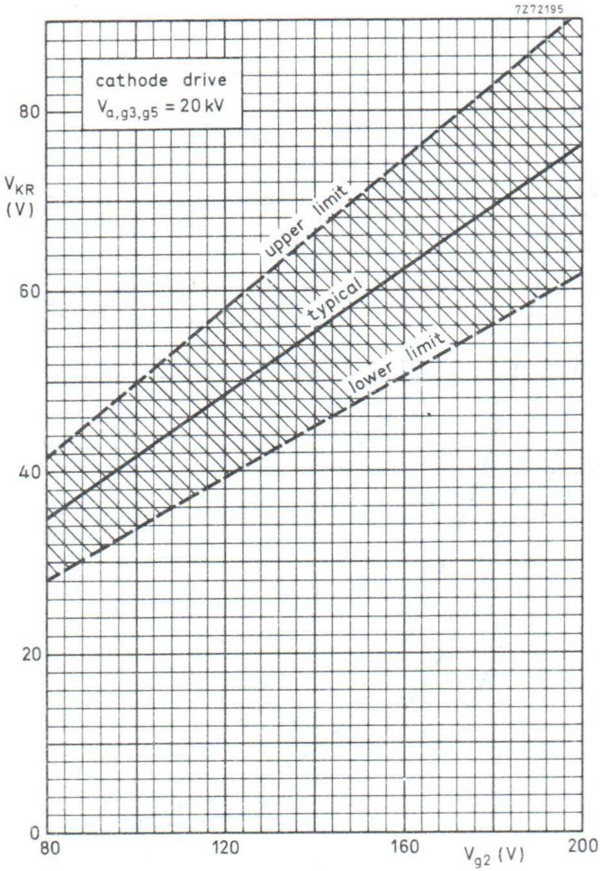
**) At $V_{k/g1} = 0$ V.

***) Maximum pulse duration 22% of a cycle but maximum 1,5 ms.



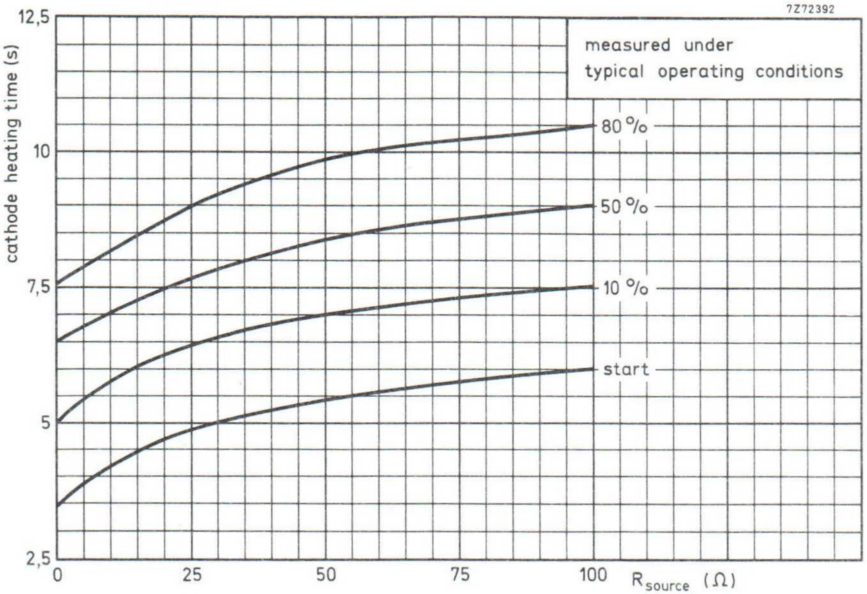
Final accelerator current as a function of cathode voltage

Cathode drive V_{a,g_3,g_5} = 20 kV



$$\frac{\Delta V_{KR}}{\Delta V_{a,\,g3,\,g5}} = 0,75 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

50 cm (20 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA		
Face diagonal		50 cm
Deflection angle		110°
Overall length	max.	319 mm
Neck diameter		28,6 mm
Heating		6,3 V, 240 mA
Grid no. 2 voltage		130 V
Final accelerator voltage		20 kV
Quick heating cathode	with a typical tube a legible picture will appear within 5 s.	

SCREEN

Metal-backed phosphor

Luminescence	white	
Light transmission of face glass	≈	45 %
Useful diagonal	≥	473 mm
Useful width	≥	394 mm
Useful height	≥	308 mm

HEATING

Indirect by a.c. or d.c.

Heater voltage	V_f		6,3 V
Heater current	I_f		240 mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	7,3 V *) 5,3 V

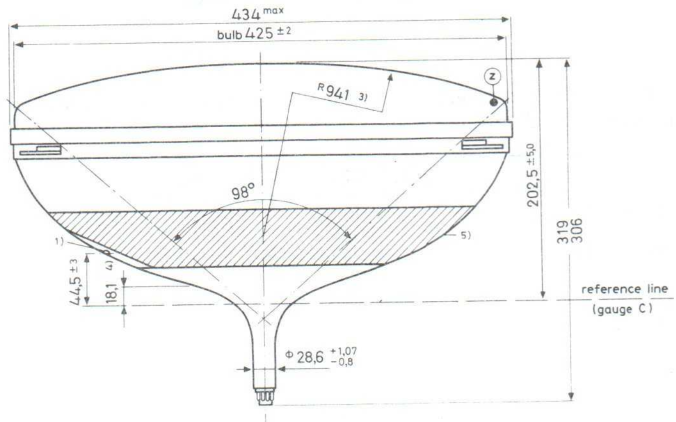
For heating time as a function of source impedance see last page of this data sheet.

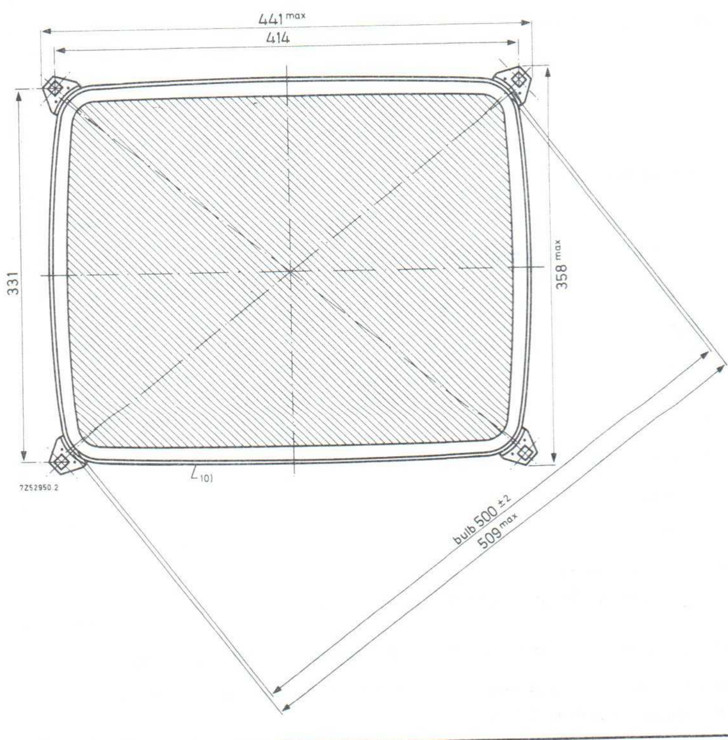
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain it not allowed.

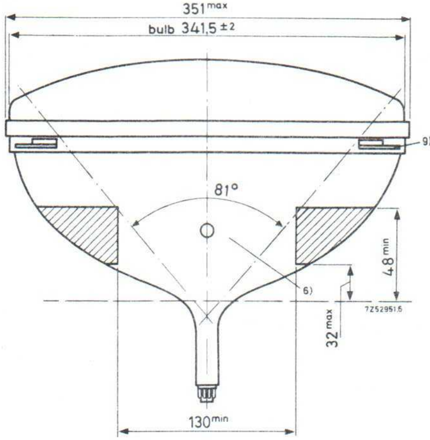
MECHANICAL DATA

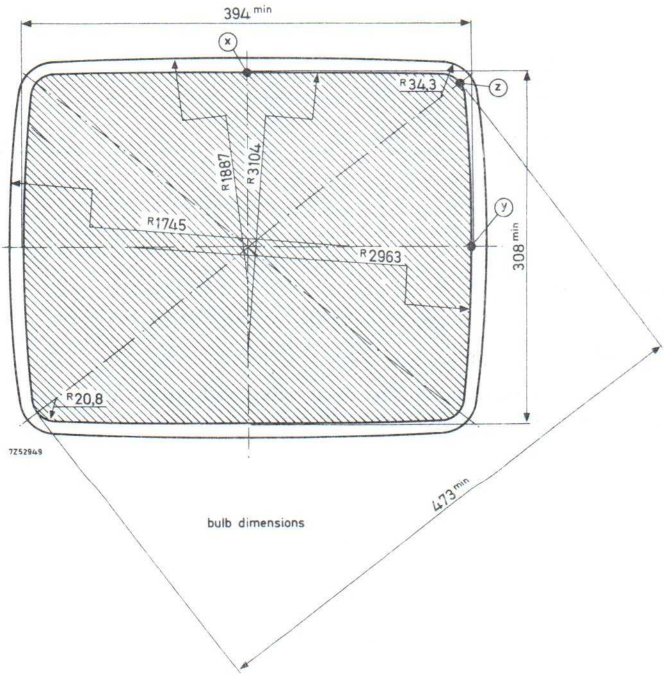
Dimensions in mm

Notes are given after the drawings.

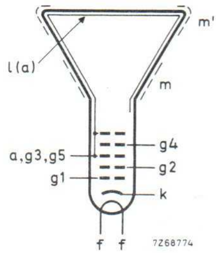


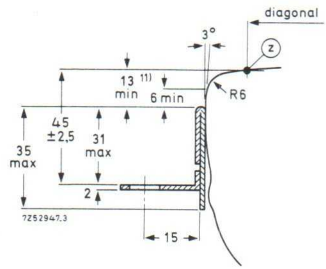


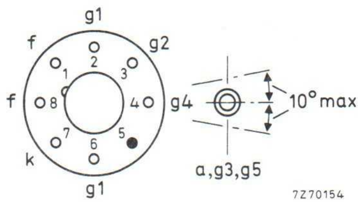


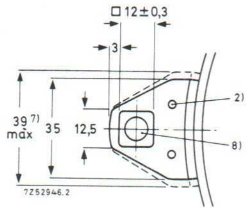


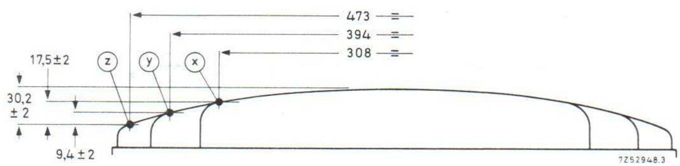
bulb dimensions











Mounting position : any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC 67-1-31a

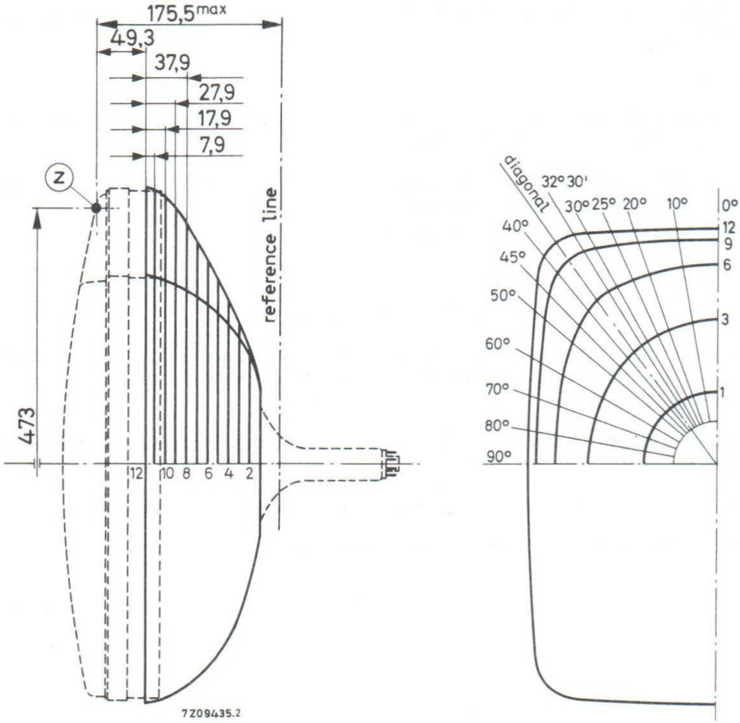
Net mass : approx. 8,5 kg

The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.

NOTES TO OUTLINE DRAWINGS

1. Small cavity contact IEC 67-III-2.
2. The metal rim-band must be earthed. The holes of 3 mm dia in each lug are provided for this purpose.
3. Spherical face plate.
4. End of guaranteed contour. The maximum neck-and-cone contour is given by the reference line gauge C (18, 13 mm).
5. The configuration of the external conductive coating may be different but contains the the contact area as shown in the drawing.
   The external conductive coating must be earthed.
6. This area must be kept clean.
7. Minimum space to be reserved for mounting lug.
8. The mounting screws in the cabinet must be situated inside a circle of 8 mm diameter drawn around the true geometrical position i.e. at the corners of a rectangle of 414 mm x 331 mm.
9. The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.
10. Max. curvatures of the outside rim-band are: nominal bulb radius + 4 mm.
11. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING



A50-120W A50-520W

		Distance from centre (max. values)													
Section	Nom distance from point "Z"	0° Long	10°	20°	25°	30°	32° 30'	36° 30' Diagonal	40°	45°	50°	60°	70°	80°	90° Short
1	157,2	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0	69,0
2	147,2	109,2	107,8	107,1	106,4	106,0	105,9	105,5	105,0	104,5	103,9	102,8	102,6	102,8	103,4
3	137,2	136,7	134,5	133,7	133,0	132,3	131,8	130,7	129,3	127,5	125,3	121,9	120,7	120,2	120,2
4	127,2	157,2	156,5	155,7	154,8	153,8	153,0	151,5	150,0	147,5	144,7	138,7	134,9	133,4	132,5
5	117,2	174,2	174,0	174,4	174,3	173,4	172,8	171,0	169,3	165,7	160,8	152,0	146,5	143,7	142,3
6	107,2	185,8	186,3	188,4	190,0	191,2	191,2	189,5	186,7	181,7	174,7	163,2	156,0	151,7	150,4
7	97,2	194,5	195,7	202,2	203,8	206,9	207,3	206,4	203,5	196,4	187,4	173,0	163,5	158,6	156,9
8	87,2	201,7	203,8	210,2	215,4	220,6	222,1	222,2	218,8	210,5	198,8	181,2	170,3	164,7	162,7
9	77,2	208,2	210,6	218,5	224,8	231,4	234,8	236,5	233,5	222,2	208,5	188,5	176,6	169,9	167,9
10	67,2	213,1	215,9	225,2	231,9	239,8	244,3	248,5	244,8	230,3	216,0	194,7	181,6	174,5	172,0
11	57,2	215,6	219,0	228,2	235,4	244,5	249,6	253,7	250,2	235,7	220,5	198,6	184,8	177,2	174,7
12	49,3	217,0	219,8	229,3	236,6	246,0	251,2	254,5	251,7	237,2	222,0	199,6	185,6	177,8	175,7

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g5/m}$	< 1500 > 1000	pF pF
Final accelerator to metal band	$C_{a,g3,g5/m'}$	250	pF
Cathode to all	C_k	3	pF
Grid no. 1 to all	C_{g1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal	110^o
Horizontal deflection angle	98^o
Vertical deflection angle	81^o

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe). Maximum distance between centre of field of this magnet and reference line: 57 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a,g3,g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 130	V*)
Grid no. 2 voltage	V_{g2}	130	V
Cathode voltage for visual extinction of focused raster	V_{KR}	42 to 62	V

*) Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 and + 130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may be between − 100 V and + 200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max.	23	kV*)
		min.	14	kV
Grid no. 4 voltage				
positive	V_{g4}	max.	1000	V
negative	$-V_{g4}$	max.	500	V
Grid no. 2 voltage	V_{g2}	max.	200	V**)
		min.	80	V
Cathode to grid no. 1 voltage				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V***)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	V_{kf}	max.	200	V

CIRCUIT DESIGN VALUES

Grid no. 4 current,				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current,				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

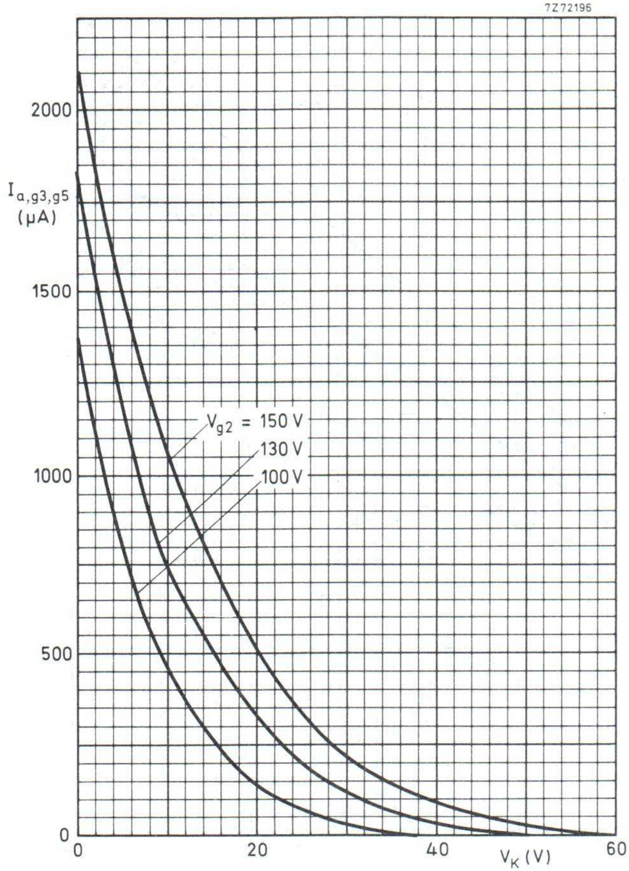
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1,0	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 impedance	Z_{g1} (50 Hz)	max.	0,5	MΩ

*) The X-ray dose rate remains below the acceptable value of 0,5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

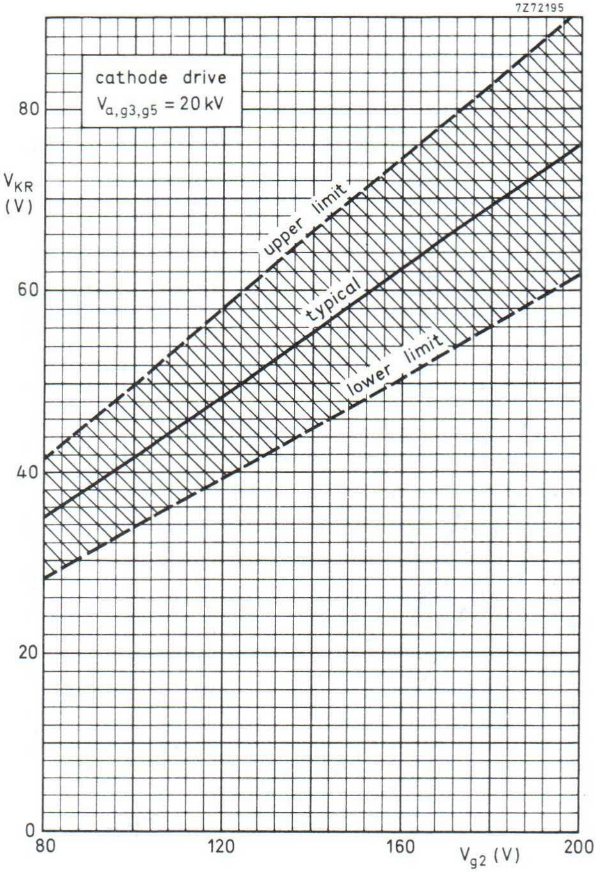
**) At $V_{g1/k} = 0$ V.

***) Maximum pulse duration 22% of a cycle but maximum 1,5 ms.



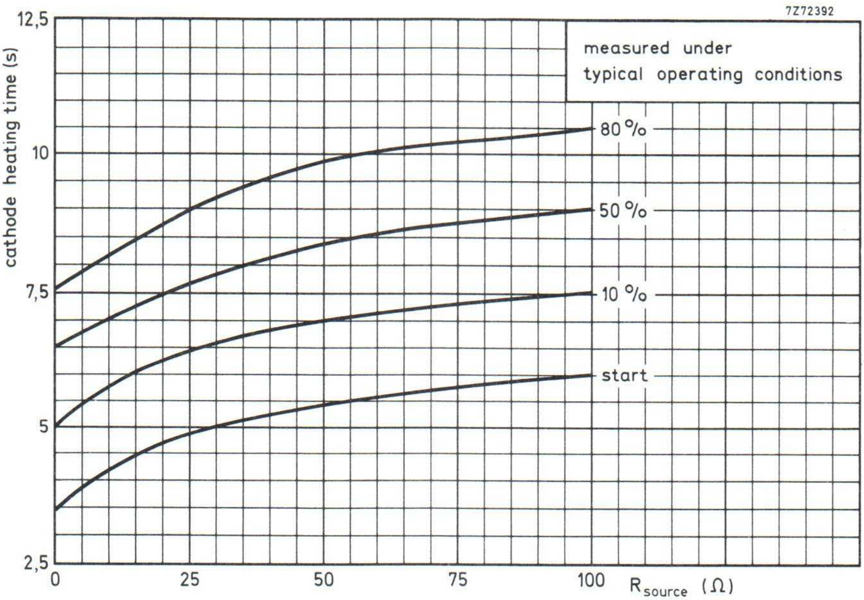
Final accelerator current as a function of cathode voltage

Cathode drive $V_{a,g3,g5} = 20$ kV



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,75 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

TV PICTURE TUBE

61 cm (24 in), 110°, rectangular direct vision picture tube with integral protection for black and white TV. A special feature of this tube is its short cathode heating time.

QUICK REFERENCE DATA		
Face diagonal		61 cm
Deflection angle		110°
Overall length	max.	370 mm
Neck diameter		28,6 mm
Heating		6,3 V, 240 mA
Grid no. 2 voltage		130 V
Final accelerator voltage		20 kV
Quick heating cathode		with a typical tube a legible picture will appear within 5 s.

SCREEN

Metal-backed phosphor

Luminescence	white	
Light transmission of face glass	≈	42 %
Useful diagonal	≥	577,5 mm
Useful width	≥	481 mm
Useful height	≥	375 mm

HEATING

Indirect by a.c. or d.c.

Heater voltage	V_f		6,3 V
Heater current	I_f		240 mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	7,3 V *) 5,3 V

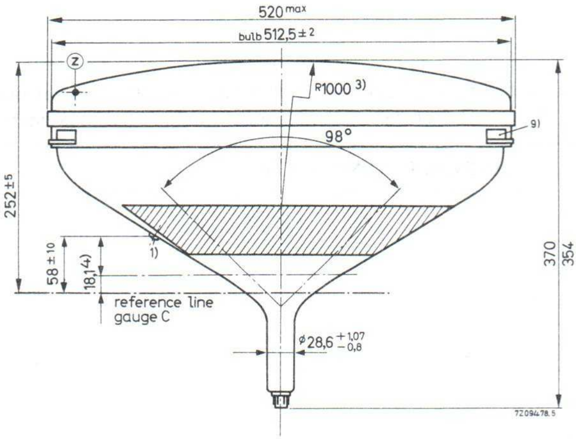
For heating time as a function of source impedance see last page of this data sheet.

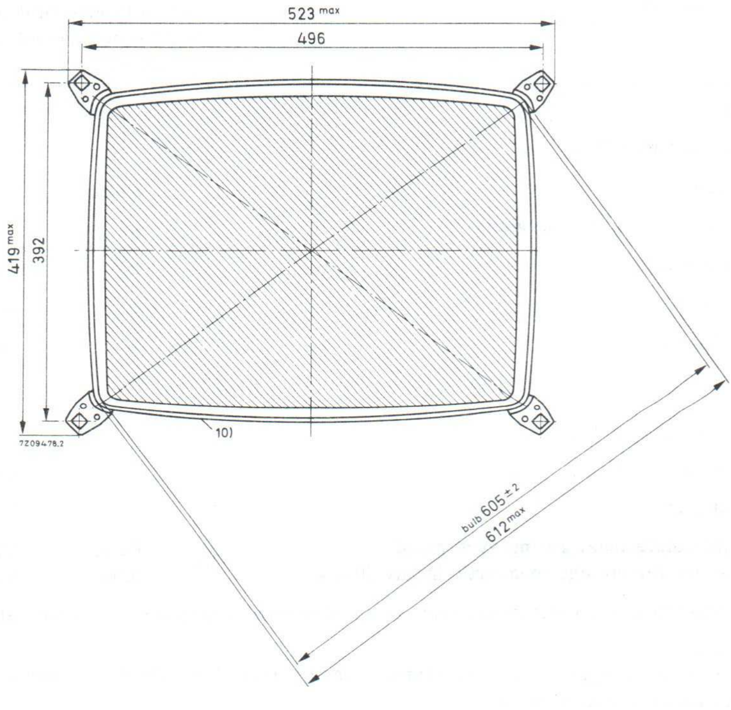
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

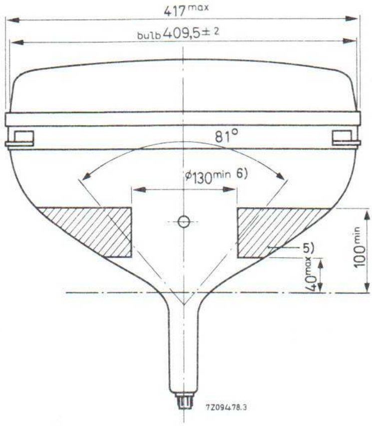
MECHANICAL DATA

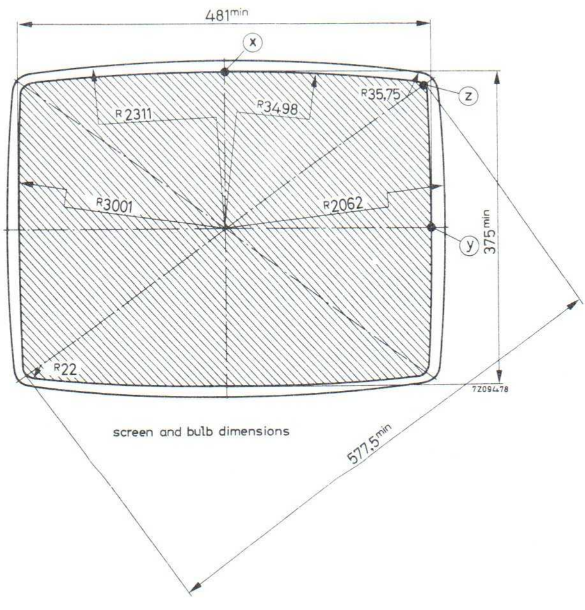
Dimensions in mm

Notes are given after the drawings.

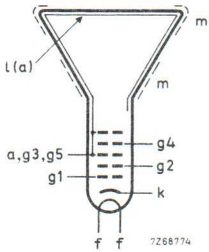


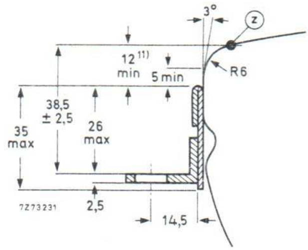


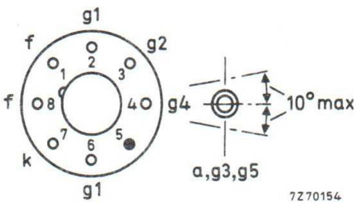


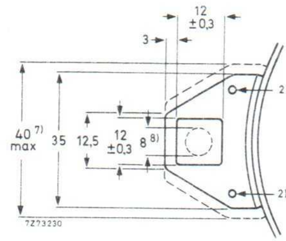


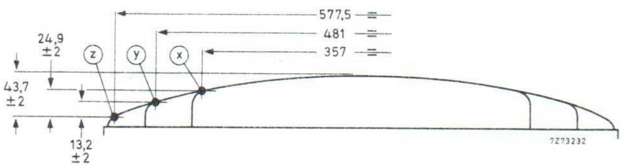
screen and bulb dimensions











Mounting position : any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC-67-I-31a

Net mass : approx. 13,5 kg

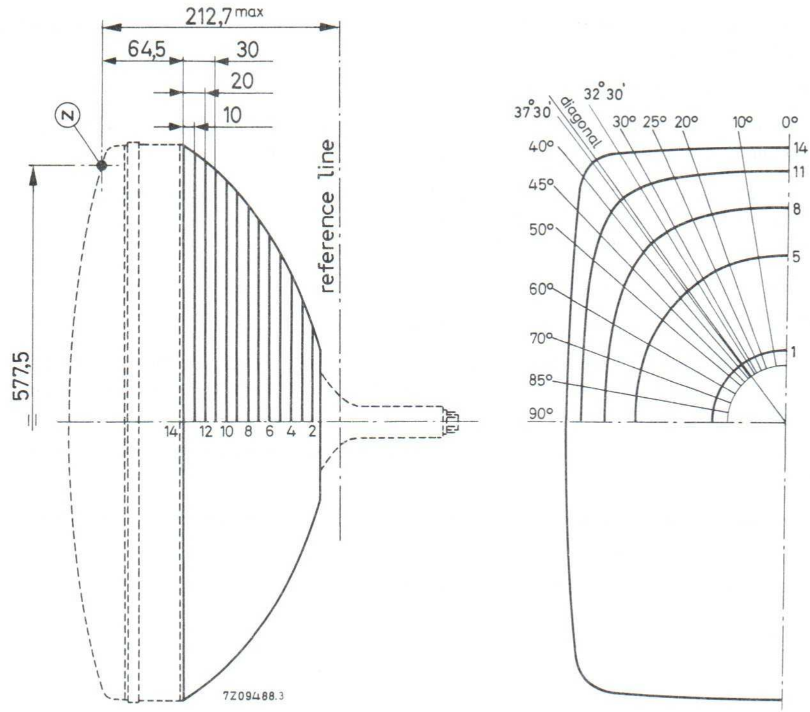
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

NOTES TO OUTLINE DRAWINGS

1. Small cavity contact IEC 67-III-2.
2. The metal rim-band must be earthed. The holes of 3 mm dia in each lug are provided for this purpose.
3. Spherical face plate.
4. End of guaranteed contour. The maximum contour from reference line towards screen is given by the reference line gauge C (18, 13 mm).
5. The configuration of the external conductive coating may be different but contains the contact area as shown in the drawing.
   The external conductive coating must be earthed.
6. This area must be kept clean.
7. Minimum space to be reserved for mounting lug.
8. The mounting screws in the cabinet must be situated inside a circle of 8 mm diameter drawn around the true geometrical position; i.e. at the corners of a rectangle of 496 x 392 mm.
9. The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.
10. The max. outer contour of the tube with the rim-band is determined by adding 5 mm to the nominal bulb dimensions.
11. Distance from reference point Z to any hardware.

MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm



Section	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	30°	32°30'	diag.	37°30'	40°	45°	50°	60°	70°	80°	90°
1	130	72,9	72,4	71,6	71,1	70,7	70,5	70,3	70,3	70,2	70,1	70,0	70,2	70,8	71,5	71,8
2	120	104,4	102,6	99,4	97,8	96,5	96,0	95,2	95,1	94,7	94,2	94,0	94,5	96,0	98,0	99,3
3	110	134,3	131,5	126,5	124,2	122,1	121,2	119,9	119,6	119,0	118,0	117,4	117,4	118,7	120,7	122,0
4	100	160,4	157,1	151,1	148,1	145,3	144,1	142,2	141,8	140,8	139,1	137,9	136,7	136,9	137,9	138,7
5	90	178,7	176,9	172,9	170,1	167,5	166,1	164,0	163,5	162,3	159,9	157,8	154,3	151,9	150,7	150,3
6	80	193,3	193,0	191,4	189,9	187,8	186,6	184,4	183,4	182,4	179,2	175,9	169,6	164,4	161,0	159,8
7	70	205,7	206,5	207,6	207,5	206,4	205,5	203,4	202,8	201,1	196,9	192,2	182,7	174,8	169,7	168,0
8	60	216,8	212,5	222,1	223,5	223,8	223,4	221,5	220,9	218,9	213,6	207,2	194,3	183,9	177,6	175,4
9	50	226,9	229,3	235,0	238,1	240,0	240,3	238,9	238,2	235,9	229,0	220,7	204,4	192,1	184,7	182,3
10	40	236,0	238,7	246,3	250,9	254,9	256,1	255,4	254,7	252,4	243,2	232,7	213,3	199,3	191,2	188,6
11	30	243,7	246,8	255,9	262,0	268,1	270,6	271,0	270,3	267,4	256,0	243,1	220,8	205,7	197,1	194,3
12	20	250,0	253,4	263,5	270,9	279,3	283,5	285,5	284,8	281,6	267,2	251,8	227,2	211,1	202,2	199,4
13	10	255,0	258,5	269,3	277,7	288,1	293,9	298,0	297,6	294,1	276,2	258,5	232,1	215,6	206,5	203,6
14	0	258,5	262,0	273,1	281,9	293,2	300,0	305,4	305,1	301,5	281,6	262,7	235,6	218,8	209,6	206,6

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g3, g5/m}$	< 2500 pF > 1500 pF
Final accelerator to metal band	$C_{a, g3, g5/m'}$	350 pF
Cathode to all	C_k	3 pF
Grid no. 1 to all	C_{g1}	7 pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110^o
Horizontal deflection angle	98^o
Vertical deflection angle	81^o

PICTURE CENTRING MAGNET

Field intensity perpendicular to the tube axis adjustable from 0 to 800 A/m (0 to 10 Oe).

Maximum distance between centre of field of this magnet and reference line: 57 mm.

TYPICAL OPERATING CONDITIONS

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	$V_{a, g3, g5}$	20 kV
Focusing electrode voltage	V_{g4}	0 to 130 V [1]
Grid no. 2 voltage	V_{g2}	130 V
Cathode voltage for visual extinction of focused raster	V_{KR}	42 to 62 V

[1]) Because of the flat focus characteristic it is suffient to choose a focusing voltage between 0 and 130 V (e.g. two taps, 0 V and 130 V).
The optimum focus voltage of individual tubes may between −100 V and +200 V.

LIMITING VALUES (Design max. rating system)

Final accelerator voltage at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max.	23	kV*)
		min.	14	kV
Grid no. 4 voltage,				
positive	V_{g4}	max.	1000	V
negative	$-V_{g4}$	max.	500	V
Grid no. 2 voltage	V_{g2}	max.	200	V**)
		min.	80	V
Cathode to grid no. 1 voltage				
positive	$V_{k/g1}$	max.	200	V
positive peak	$V_{k/g1p}$	max.	400	V***)
negative	$-V_{k/g1}$	max.	0	V
negative peak	$-V_{k/g1p}$	max.	2	V
Cathode-to-heater voltage	V_{kf}	max.	200	V

CIRCUIT DESIGN VALUES

Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

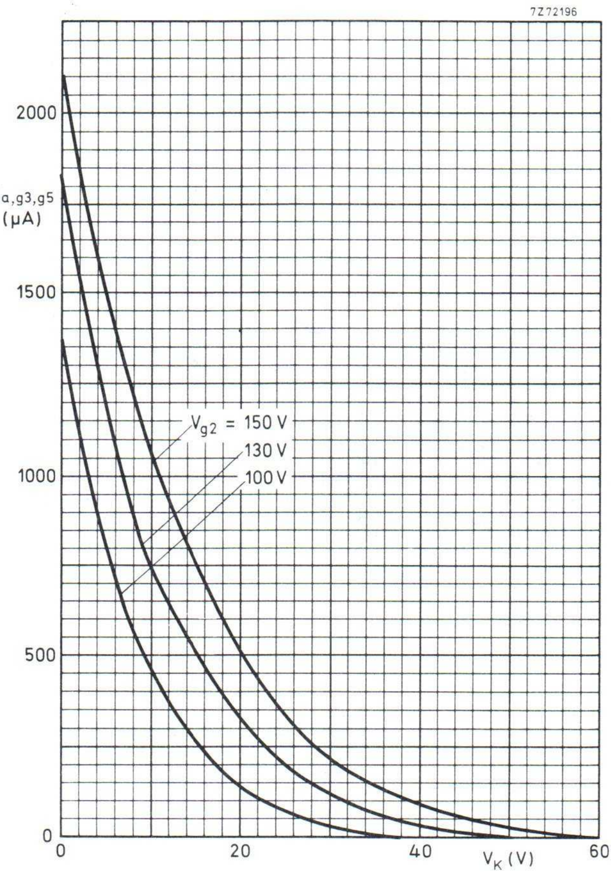
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0, 1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1, 5	MΩ
Grid no. 1 circuit impedance	Z_{g1} (50 Hz)	max.	0, 5	MΩ

*) The X-ray dose rate remains below the acceptable value of 0, 5 mR/h, measured with ionization chamber when the tube is used within its limiting values, according to IEC 65.

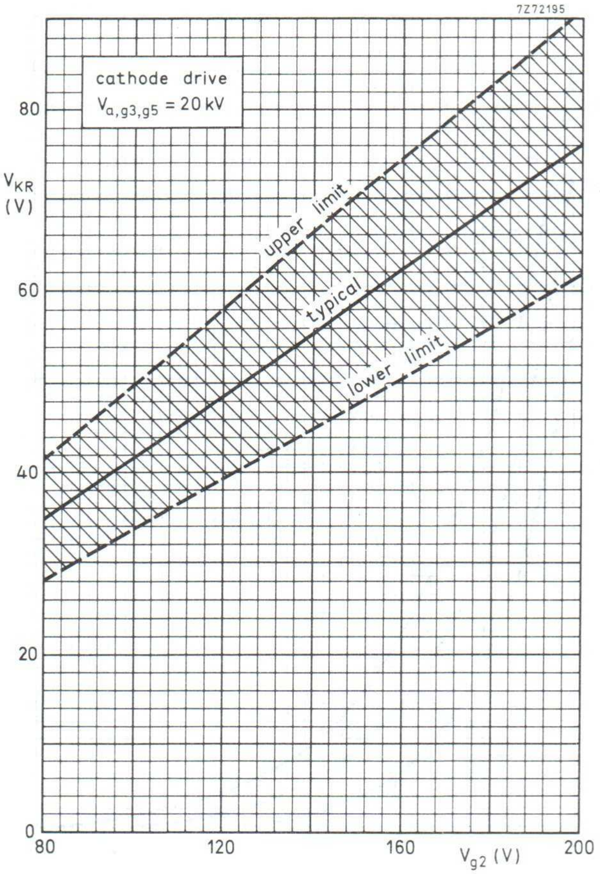
**) At $V_{k/g1} = 0$ V.

***) Maximum pulse duration 22% of a cycle but maximum 1, 5 ms.



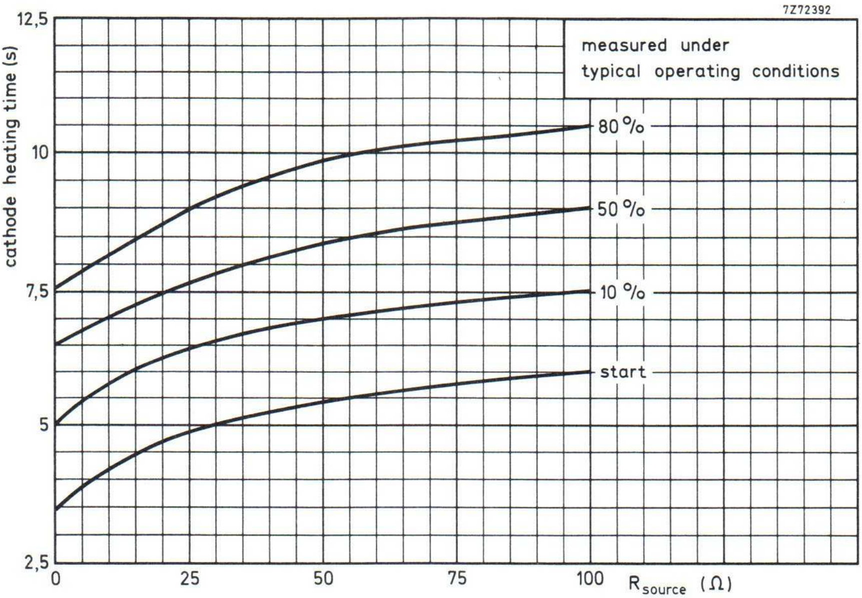
Final accelerator current as a function of cathode voltage.

Cathode drive $V_{a,g3,g5} = 20$ kV



$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,75 \times 10^{-3}$$

Limits of cathode cut-off voltage as a function of grid no. 2 voltage.



Cathode heating time to attain a certain percentage of the cathode current at equilibrium condition.

DEFLECTION UNITS FOR BLACK & WHITE TV PICTURE TUBES

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube		
diagonal	43 cm (17 in), 51 cm (20 in), 61 cm (24 in)	
neck diameter	28,6 mm	
Deflection angle	110°	
	AT1040/04	AT1040/17
Line deflection current, edge to edge at 18 kV	2,92 A (p-p)	1,46 A (p-p)
Inductance of line coils	2,09 mH	8,36 mH
Field deflection current, edge to edge at 18 kV	1,1 A (p-p)	1,1 A (p-p)
Resistance of field coils	7,4 Ω	7,4 Ω

APPLICATION

These deflection units are for use with 110° black and white picture tubes.

DESCRIPTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the picture tube.
The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide.

The units meet the self-extinguishing and non-dripping requirements of IEC 65.

For centring and pin-cushion distortion see under "Correction facilities".

MECHANICAL DATA

Dimensions in mm

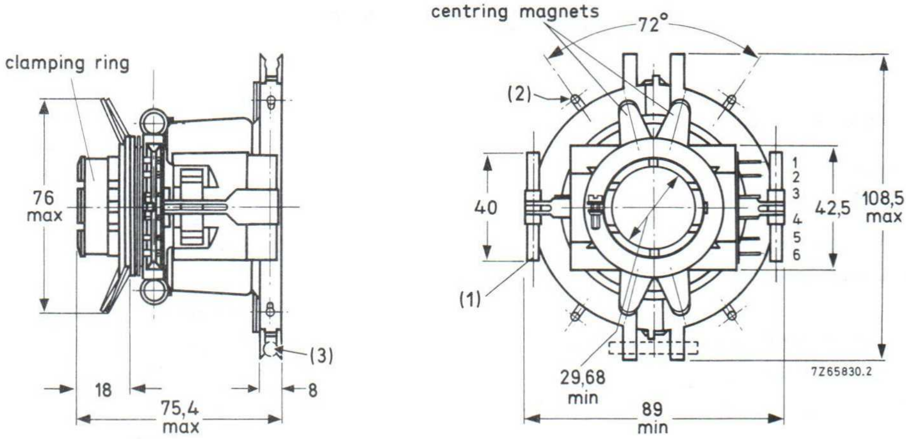


Fig. 1.

(1) Plastic bonded FXD magnet strips, mounted on brackets.
(2) For fitting plastic bonded FXD magnets, available under catalogue number 3122 104 94120.
(3) For fitting plastic bonded FXD magnet rods, available under catalogue number 3122 104 90360.

The units are provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the connection diagrams (Figs 2 and 3).

MOUNTING

The unit should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

	AT1040/04	AT1040/17
Line deflection coils		
Inductance	2,09 mH	8,36 mH
Resistance	3,55 Ω	14,2 Ω
Field deflection coils		
Inductance	17,0 mH	17,0 mH
Resistance	7,37 Ω	7,37 Ω
Maximum peak voltage between terminals of line and field coils (50 Hz)	2500 V	
Maximum operating temperature	95 °C	

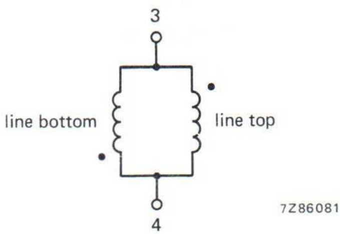


Fig. 2a Line coils, AT1040/04.

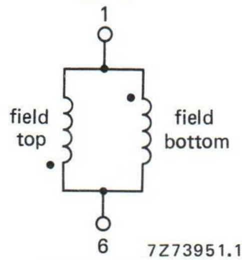


Fig. 2b Field coils, AT1040/04.

The beginning of the windings is indicated with •.

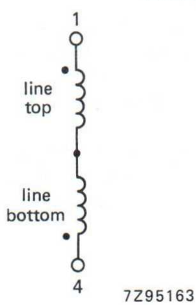


Fig. 3a Line coils, AT1040/17.

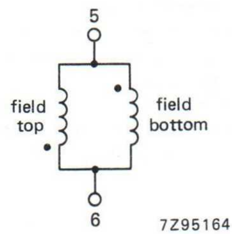


Fig. 3b Field coils, AT1040/17.

The beginning of the windings is indicated with •.

The following characteristics are measured at an e.h.t. of 18 kV on a 61 cm (24 in) reference picture tube.

Sensitivity

	AT1040/04	AT1040/17
Deflection current edge to edge		
in line direction	2,92 A (p-p)	1,46 A (p-p)
in field direction	1,1 A (p-p)	1,1 A (p-p)

Geometric distortion measured without correction and centring magnets (dimensions in mm)

The spreads in raster geometry are tabulated below as deviations from the ideal rectangle at the points indicated. Cartesian coordinates are used to show the extent of deviation resolved along x and y areas. Points A, B, C, D, E are fixed and hence have zero spreads.

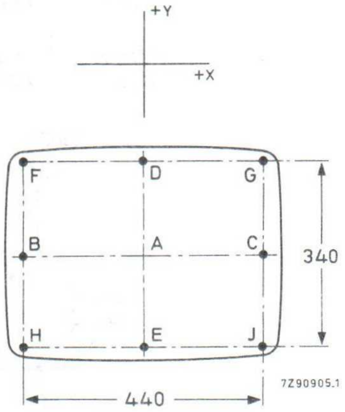


Fig. 4.

Spreads (x,y) per point:

F $(-3 \pm 4\ ,+3 \pm 4)$
G $(+3 \pm 4\ ,+3 \pm 4)$
H $(-3 \pm 4\ ,-3 \pm 4)$
J $(+3 \pm 4\ ,-3 \pm 4)$
$|Fy\text{-}Gy| \leqslant 5$
$|Gx\text{-}Jx| \leqslant 5$
$|Jy\text{-}Hy| \leqslant 5$
$|Hx\text{-}Fx| \leqslant 5$

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the picture tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetised diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.
These centring magnets can not be used for compensating the effects of non-linearity or of phase differences between the synchronisation and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

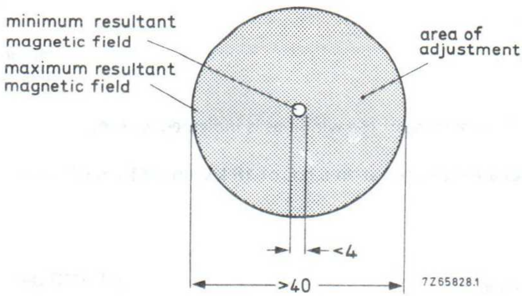


Fig. 5.

For raster geometry

Pin-cushion distortion can be corrected by plastic bonded Ferroxdure magnet strips, which have been mounted on the deflection unit brackets. Limited correction of asymmetrical pin-cushion distortion can be achieved by unequal rotation of these magnets.

Notes

To correct the corners of the raster plastic bonded Ferroxdure magnets can be fitted to the deflection unit, (2), Fig. 1.
To optimize the raster geometry plastic bonded Ferroxdure magnet rods can be fitted to the deflection unit, (3), Fig. 1.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube	
diagonal	43 cm (17 in), 51 cm (20 in), 61 cm (24 in)
neck diameter	28,6 mm
Deflection angle	110°
Line deflection current, edge to edge at 18 kV	2,35 A (p-p)
Inductance of line coils	3,32 mH
Field deflection current, edge to edge at 18 kV	1,1 A (p-p)
Resistance of field coils	7,4 Ω

APPLICATION

This deflection unit is for 110° black and white picture tubes.

DESCRIPTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the picture tube.
The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide.

The unit meets the self-extinguishing and non-dripping requirements of IEC 65.

For centring and pin-cushion distortion see under "Correction facilities".

MECHANICAL DATA

Dimensions in mm

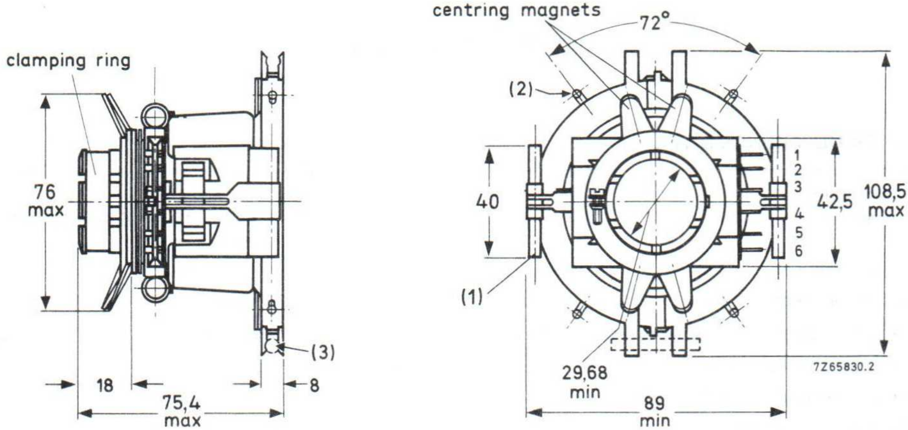


Fig. 1 Deflection unit AT1040/15.

(1) Plastic bonded FXD magnet strips, mounted on brackets.

(2) For fitting plastic bonded FXD magnets, available under catalogue number 3122 104 94120.

(3) For fitting plastic bonded FXD magnet rods, available under catalogue number 3122 104 90360.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the connection diagrams (Fig. 2).

MOUNTING

The unit should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a) terminals 3 and 4	
Inductance	3,32 mH ± 4,5%
Resistance	6,1 Ω ± 5% ←
Field deflection coils, parallel connected (Fig. 2b) terminals 1 and 6	
Inductance	17 mH ± 8% ←
Resistance	7,4 Ω ± 8%
Maximum peak voltage between terminals of line and field coils (50 Hz)	2500 V
Maximum operating temperature	95 °C

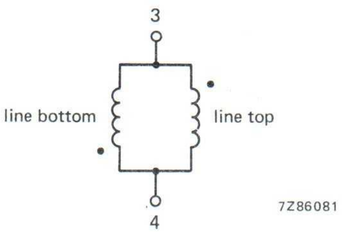


Fig. 2a Line coils.

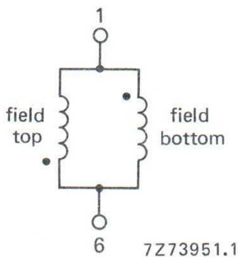


Fig. 2b Field coils.

The beginning of the windings is indicated with •.

The following characteristics are measured at an e.h.t. of 18 kV on a 61 cm (24 in) reference picture tube.

Sensitivity

Deflection current edge to edge	
in line direction	2,35 A (p-p) ←
in field direction	1,1 A (p-p)

Geometric distortion measured without correction and centring magnets (dimensions in mm)

The spreads in raster geometry are tabulated below as deviations from the ideal rectangle at the points indicated. Cartesian coordinates are used to show the extent of deviation resolved along x and y areas. Points A, B, C, D, E are fixed and hence have zero spreads.

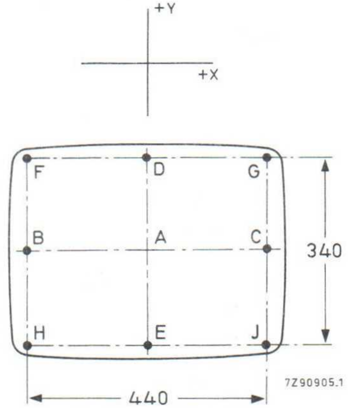


Fig. 3.

Spreads (x,y) per point:

F $(-3 \pm 4\ ,\ +3 \pm 4)$
G $(+3 \pm 4\ ,\ +3 \pm 4)$
H $(-3 \pm 4\ ,\ -3 \pm 4)$
J $(+3 \pm 4\ ,\ -3 \pm 4)$

$|Fy\text{-}Gy| \leqslant 5$
$|Gx\text{-}Jx| \leqslant 5$
$|Jy\text{-}Hy| \leqslant 5$
$|Hx\text{-}Fx| \leqslant 5$

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the picture tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetised diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.
These centring magnets can not be used for compensating the effects of non-linearity or of phase differences between the synchronisation and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

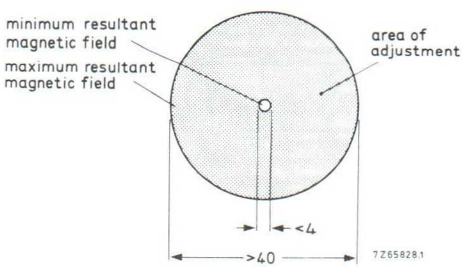


Fig. 4.

For raster geometry

Pin-cushion distortion can be corrected by plastic bonded Ferroxdure magnet strips, which have been mounted on the deflection unit brackets. Limited correction of asymmetrical pin-cushion distortion can be achieved by unequal rotation of these magnets.

Notes

To correct the corners of the raster plastic bonded Ferroxdure magnets can be fitted to the deflection unit, (2), Fig. 1.
To optimize the raster geometry plastic bonded Ferroxdure magnet rods can be fitted to the deflection unit, (3), Fig. 1.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube	
diagonal	24 cm (9 in)
neck diameter	20 mm
Deflection angle	90^o
Line deflection current for full scan, at 10 kV	2,70 A (p-p)
Inductance of line coils	475 μH
Field deflection current for full scan, at 10 kV	0,24 A (p-p)
Resistance of field coils	40 Ω

APPLICATION

This deflection unit is for 24 cm (9 in) 90^o black & white picture tubes and monitor tubes for basic displays. The unit is used in conjunction with:

– line output transformer AT2140/16 or AT2140/16B;
– linearity control unit AT4042/08A or linearity corrector AT4042/46.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound fields coils. **The line coils and the field coils are series connected**. The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

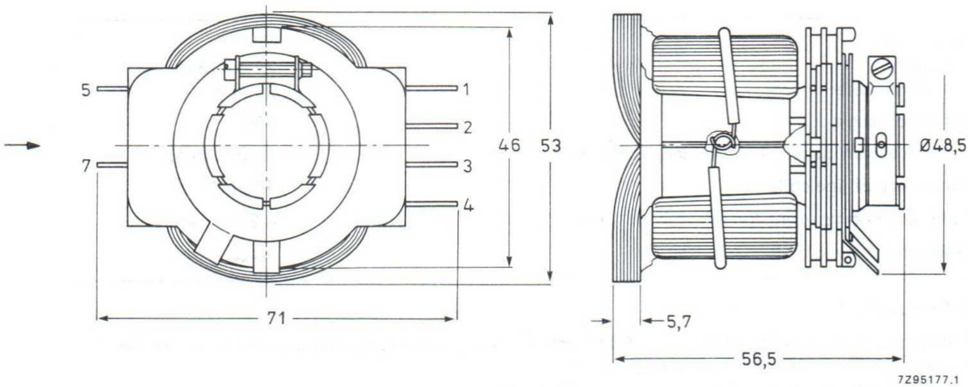


Fig. 1 Deflection unit AT1077/01.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, series connected (Fig. 2), terminals 1 and 4	
Inductance	475 μH $^{+3,5\%}_{-1,5\%}$
Resistance	0,8 Ω ± 5%
L/R	594 μH/Ω
Line deflection current, edge to edge (198 mm), at 10 kV	2,70 A (p-p) $^{+10\%}_{-4\%}$
Field deflection coils, series connected (Fig. 2), terminals 2 and 3	
Inductance	72 mH ± 8%
Resistance	40 Ω ± 5%
L/R	1,80 mH/Ω
Field deflection current, edge to edge (149 mm), at 10 kV	0,24 A (p-p) ± 10%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	≤ 1/50

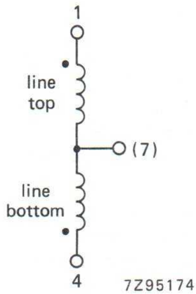


Fig. 2a Line coils.

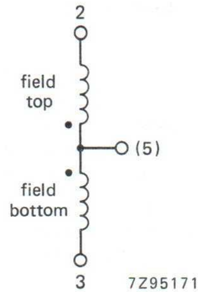


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion measured without centring magnets on a 24 cm (9 in) reference tube (dimensions in mm)

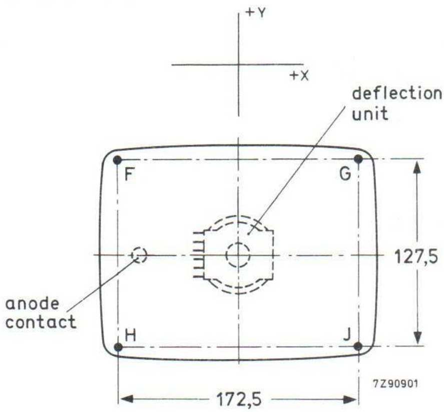


Fig. 3.

$|Fy\text{-}Gy| \leqslant 2$

$|Gx\text{-}Jx| \leqslant 2$

$|Jy\text{-}Hy| \leqslant 2$

$|Hx\text{-}Fx| \leqslant 2$

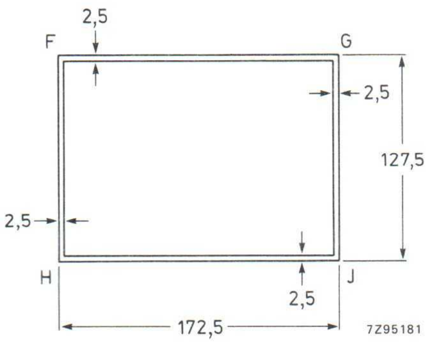


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

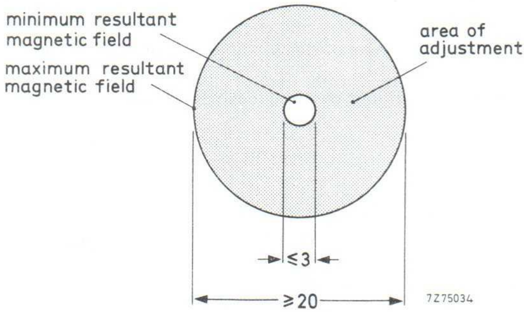


Fig. 5.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube	
diagonal	31 cm (12 in), 34 cm (14 in)
neck diameter	20 mm
Deflection angle	90^{o}
Line deflection current for full scan (12 in), at 12 kV	2,93 A (p-p)
Inductance of line coils	436 μH
Field deflection current for full scan (12 in), at 12 kV	0,26 A (p-p)
Resistance of field coils	33 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) and 34 cm (14 in) 90^{o} picture tubes. The unit is used in conjunction with:

- line output transformer AT2140/16 or AT2140/16B;
- linearity control unit AT4042/08A or linearity corrector AT4042/46.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound fields coils. **The line coils and the field coils are series connected**. The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

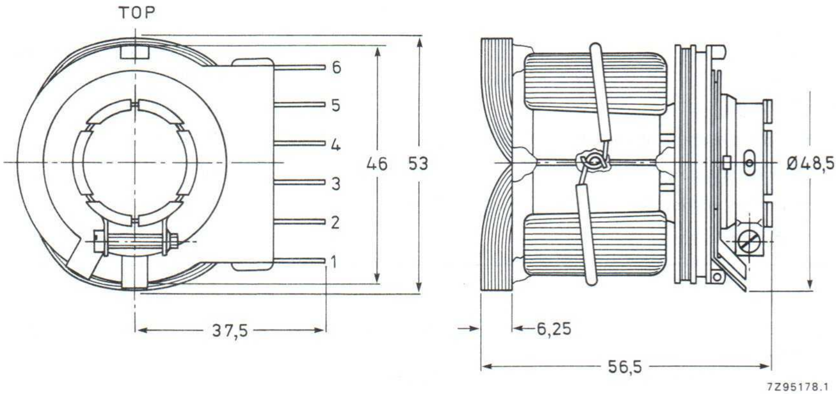


Fig. 1 Deflection unit AT1077/02.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, series connected (Fig. 2a), terminals 2 and 5	
Inductance	436 μH ± 3,5%
Resistance	0,80 Ω ± 5%
L/R	545 μH/Ω ± 5%
Line deflection current, edge to edge (254 mm, 12 in), at 12 kV	2,93 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b) terminals 3 and 4	
Inductance	68 mH ± 5%
Resistance	33,0 Ω ± 5%
L/R	2,06 mH/Ω
Field deflection current, edge to edge (201 mm, 12 in), at 12 kV	0,26 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

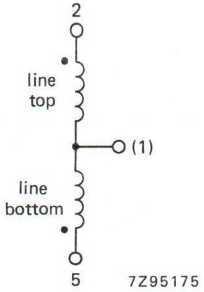


Fig. 2a Line coils.

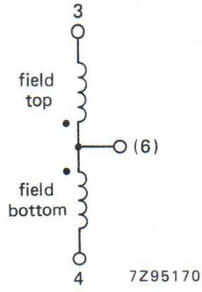


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion measured without centring magnets, on a 12 in reference tube (dimensions in mm)

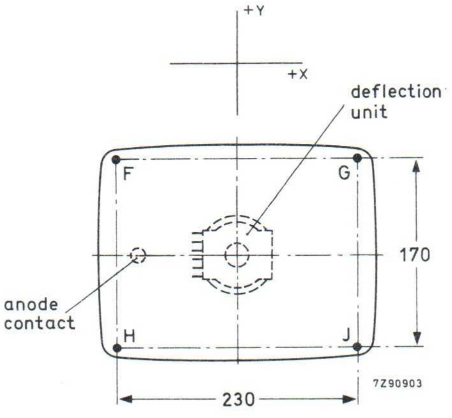


Fig. 3.

$|Fy\text{-}Gy| \leqslant 2$
$|Gx\text{-}Jx| \leqslant 2$
$|Jy\text{-}Hy| \leqslant 2$
$|Hx\text{-}Fx| \leqslant 2$

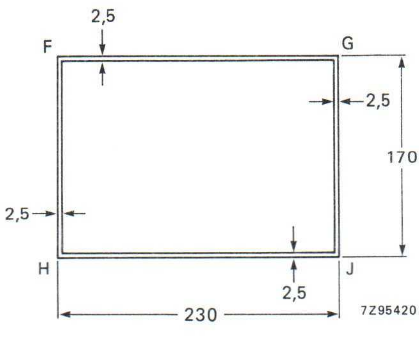


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

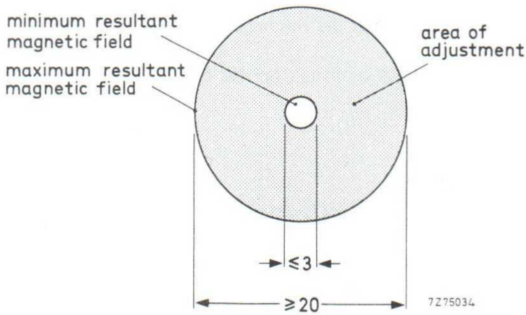


Fig. 5.

MONOCHROME DATA GRAPHIC DISPLAY TUBES

HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 90° deflection angle
- 24 cm (9 in) face diagonal; rectangular glass
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	24 cm (9 in)
Overall length	max. 227 mm
Neck diameter	20 mm
Heating	12 V/130 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	12 kV
Resolution	approx. 1300 lines

APPLICATION

These high resolution tubes are for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tubes can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

AVAILABLE VERSIONS

The following versions are available: M24-306, M24-308, M24-310 and M24-328. Differences between the tubes can be found under 'Dimensional data'.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90^{o}
horizontal	approx. 82^{o}
vertical	approx. 67^{o}
Direct interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 7 pF
Capacitance of external conductive coating to anode*	max. 850 pF min. 300 pF
Capacitance of external conductive coating to anode**	max. 750 pF min. 300 pF
Capacitance of anode to implosion protection hardware**	approx. 100 pF
Heater voltage	12 V
Heater current at 12 V	130 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 53%
tube with dark tinted face glass	approx. 42%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensions Data)

Overall length	max. 227 mm
Greatest dimensions of tube	
diagonal	248,5 mm
width	216 mm
height	167 mm
Minimum useful screen dimensions (projected)	
diagonal	222,5 mm
horizontal axis	193 mm
vertical axis	145 mm
area	268 cm^2
Implosion protection	T-band
Bulb	EIA-J240A1 or EIA-J240C1
Bulb contact designation	IEC 67-III-2, EIA-J1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 1,8 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 15 kV min. 9,5 kV
Grid 4 (focusing electrode) voltage	−200 to + 1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 130 μA
peak value	max. 600 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	12 V ± 10% *
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	30 to 60 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	34 to 64 V**

RESOLUTION

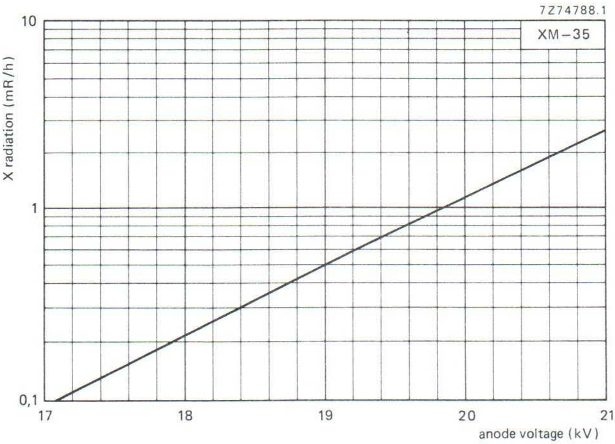
The resolution is approx. 1300 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 12 kV; phosphor type W, without anti-glare treatment, raster dimensions 168 mm x 126 mm.

X-RADIATION CHARACTERISTIC

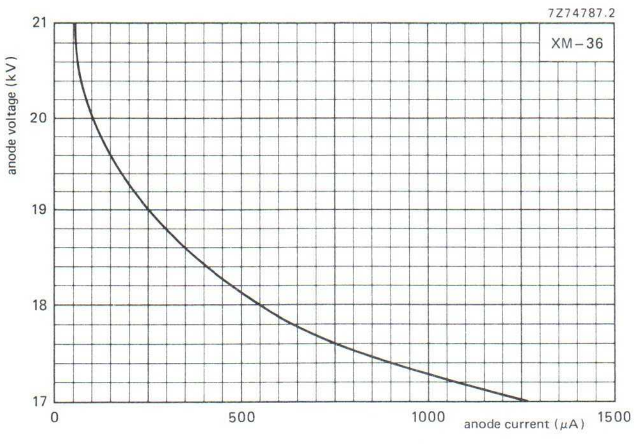
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 250 μA (peak), anode voltage = 12 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 168 mm x 126 mm:
line parabola 200 V;
field parabola 100 V.

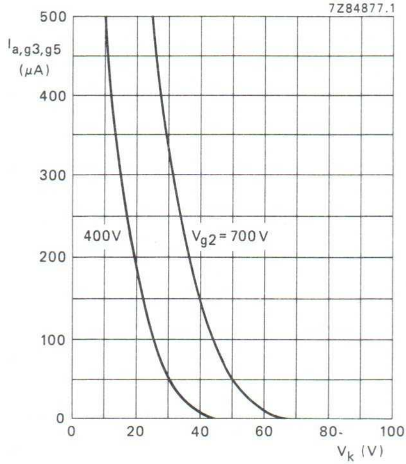
** Visual extinction of focused raster.



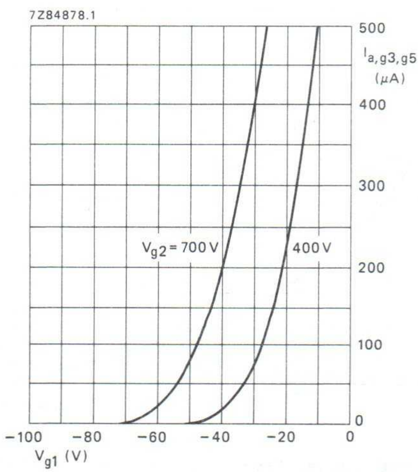
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.



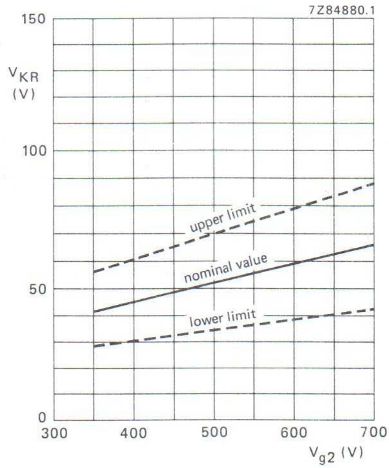
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

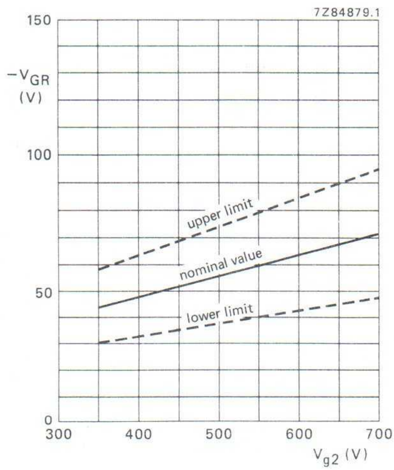


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

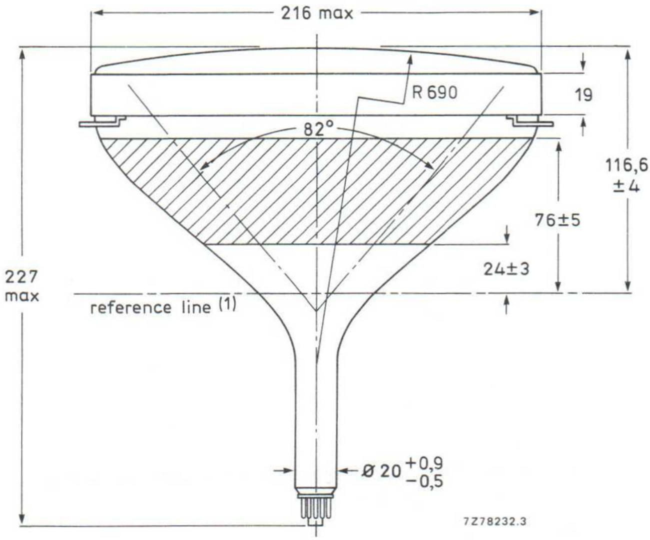


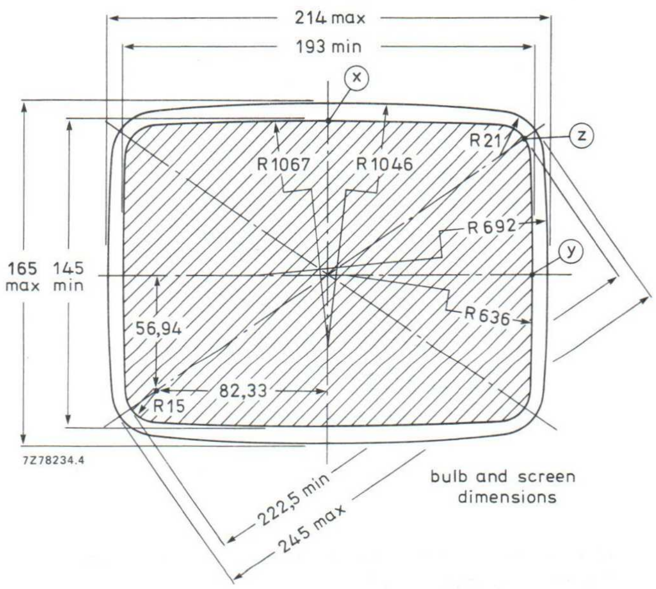
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

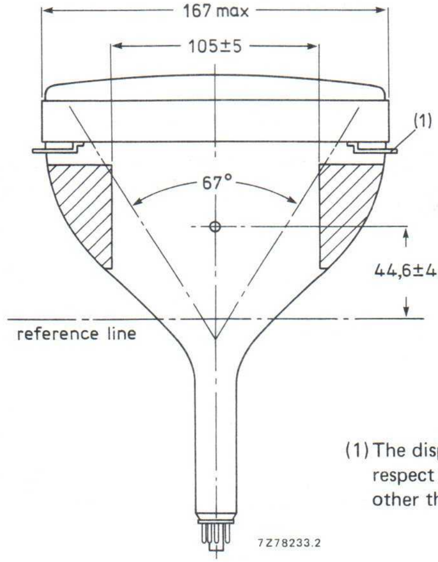
DIMENSIONAL DATA

Dimensions in mm



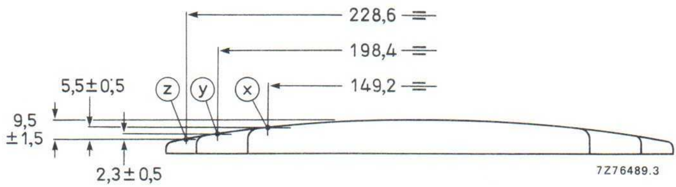


(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.

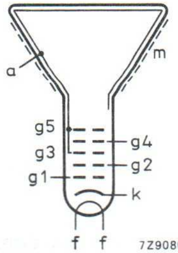


(1) The displacement of any lug with respect to the plane through the other three lugs is max. 1,8 mm.

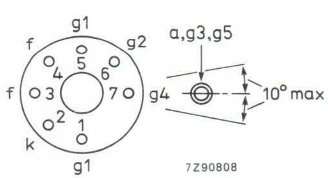
7Z78233.2



7Z76489.3

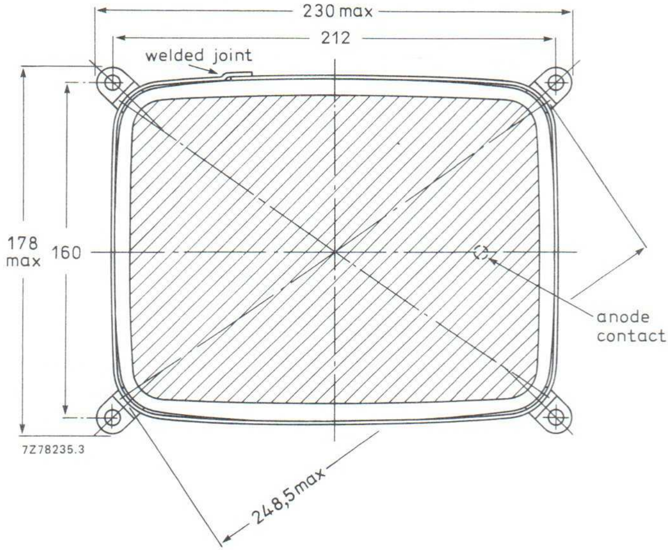


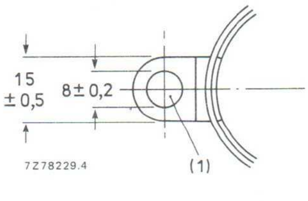
7Z90807

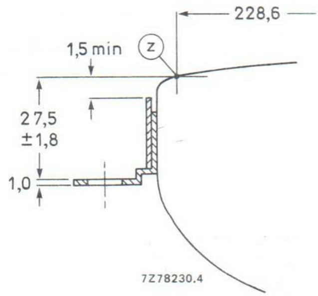


7Z90808

Front view and lug dimensions of tube M24-306

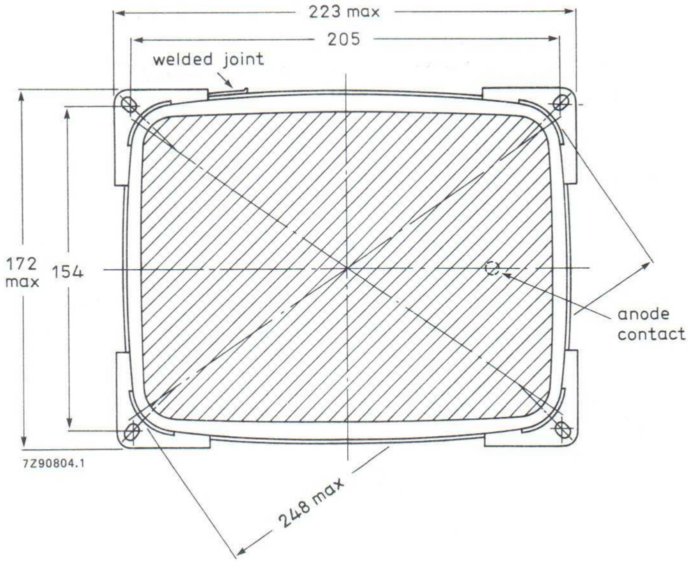






(1) The position of the mounting screws in the cabinet must be within a circle of 5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 212 mm x 160 mm.

Front view and lug dimensions of tube M24-308



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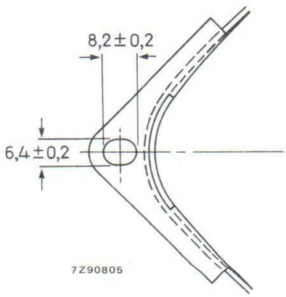
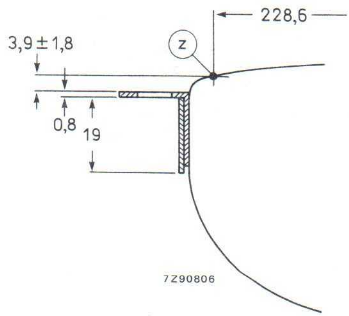


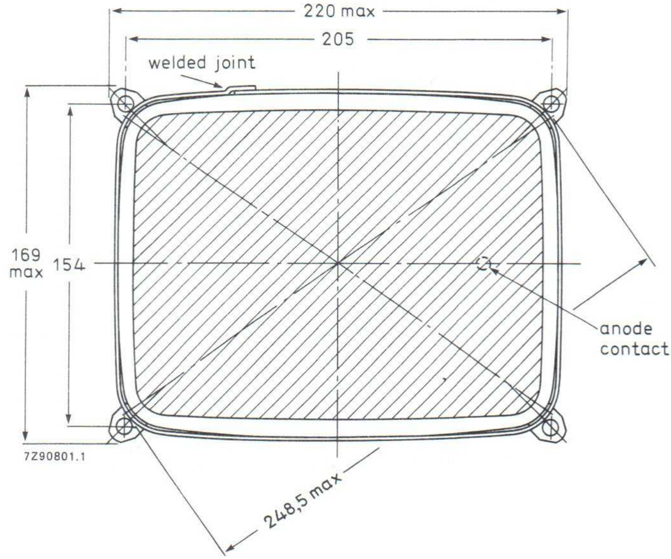
7Z90805



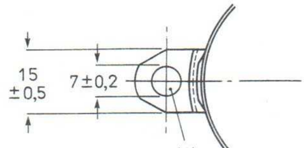
7Z90806

(1) The position of the mounting screws in the cabinet must be within a circle of 3,4 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 205 mm x 154 mm.

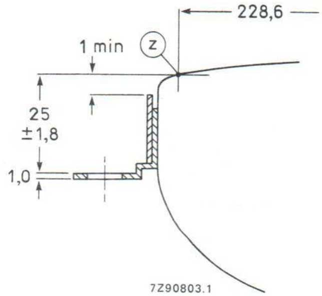
Front view and lug dimensions of tube M24-310



7Z90801.1



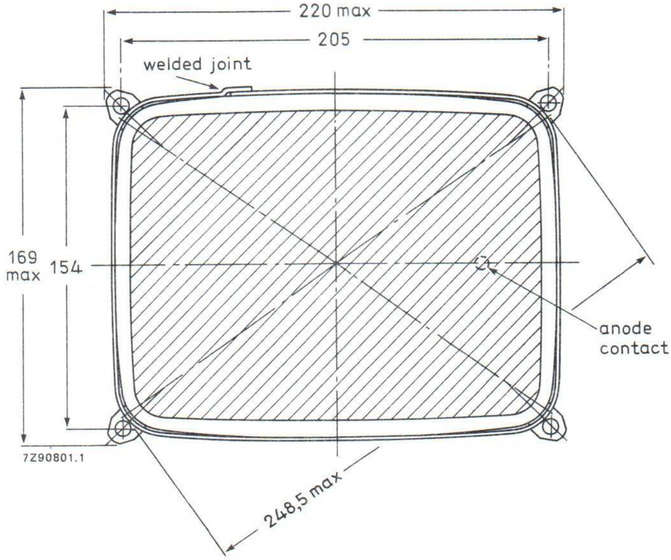
7Z90802.1

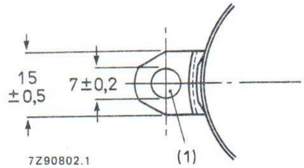


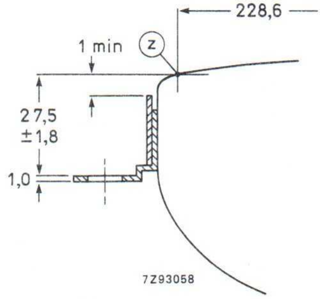
7Z90803.1

(1) The position of the mounting screws in the cabinet must be within a circle of 4 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 205 mm x 154 mm.

Front view and lug dimensions of tube M24-328 *



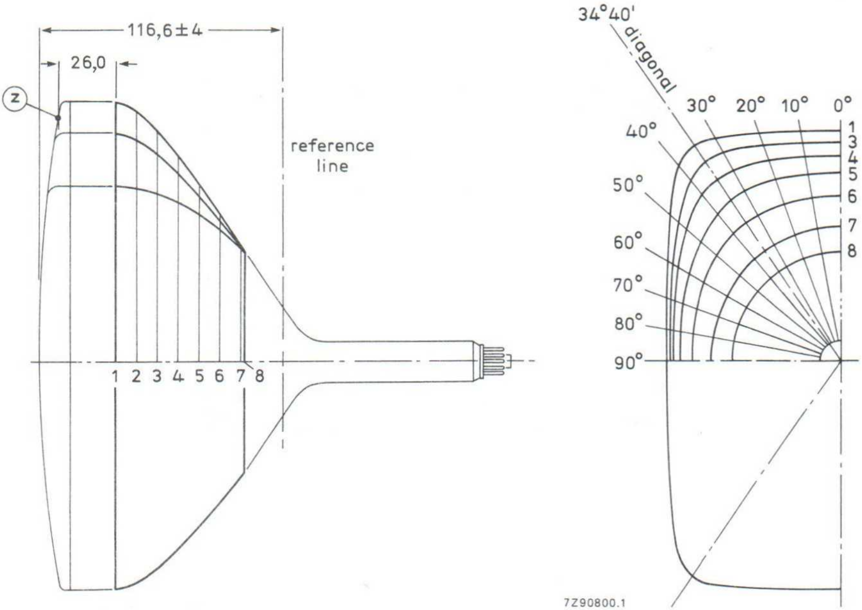




(1) The position of the mounting screws in the cabinet must be within a circle of 4 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 205 mm x 154 mm.

* This tube is still under development; data are provisional.

→ **Maximum cone contour**



section	nom. distance from section 1	max. distance from centre 0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	108,3	109,8	114,2	121,9	123,9	121,6	106,6	95,6	88,8	85,0	83,8
2	10	105,4	106,8	111,0	117,7	119,4	117,4	104,4	93,9	87,3	83,7	82,5
3	20	98,0	99,2	102,9	107,8	109,2	108,1	99,1	90,0	83,9	80,6	79,5
4	30	88,4	89,4	92,2	95,7	96,6	96,2	91,0	84,2	79,0	76,1	75,1
5	40	78,1	78,9	81,0	83,2	83,8	83,8	81,2	76,8	72,9	70,5	69,7
6	50	66,8	67,4	68,8	70,4	70,9	71,2	70,3	68,1	65,6	63,8	63,2
7	60	54,5	54,9	55,8	56,8	57,2	57,5	57,5	56,8	55,8	54,9	54,5
8	61,2	53,0	53,3	54,2	55,1	55,4	55,7	55,7	55,2	54,3	53,4	53,1

HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 90^{o} deflection angle
- 24 cm (9 in) face diagonal; rectangular glass
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90^{o}
Face diagonal	24 cm (9 in)
Overall length	max. 227 mm
Neck diameter	20 mm
Heating	12 V/75 mA
Grid 2 voltage	400 V
Anode voltage	12 kV
Resolution	approx. 1000 lines

APPLICATION

These high resolution tubes are for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tubes can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

AVAILABLE VERSIONS

The following versions are available: M24-322 and M24-326. Differences between the tubes can be found under 'Dimensional data'.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 82°
vertical	approx. 67°
Direct interelectrode capacitances	
cathode to all other electrodes	max. 5 pF
grid 1 to all other electrodes	max. 6 pF
Capacitance of external conductive coating to anode*	max. 850 pF min. 300 pF
Capacitance of external conductive coating to anode**	max. 750 pF min. 300 pF
Capacitance of anode to implosion protection hardware**	approx. 100 pF
Heater voltage	12 V
Heater current at 12 V	75 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 53%
tube with dark tinted face glass	approx. 42%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensions Data)

Overall length	max. 227 mm
Greatest dimensions of tube	
diagonal	248,5 mm
width	216 mm
height	167 mm
Minimum useful screen dimensions (projected)	
diagonal	222,5 mm
horizontal axis	193 mm
vertical axis	145 mm
area	268 cm^2
Implosion protection	T-band
Bulb	EIA-J240A1 or EIA-J240C1
Bulb contact designation	IEC 67-III-2, EIA-J1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 1,8 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 15 kV min. 9,5 kV
Grid 4 (focusing electrode) voltage	−550 to + 1100 V
Grid 2 voltage	max. 550 V
Anode current	
long-term average value	max. 100 μA
peak value	max. 150 μA
Cathode voltage, positive peak value	max. 220 V
Heater voltage	12 V ± 10% *
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	30 to 74 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	33 to 81 V**

RESOLUTION

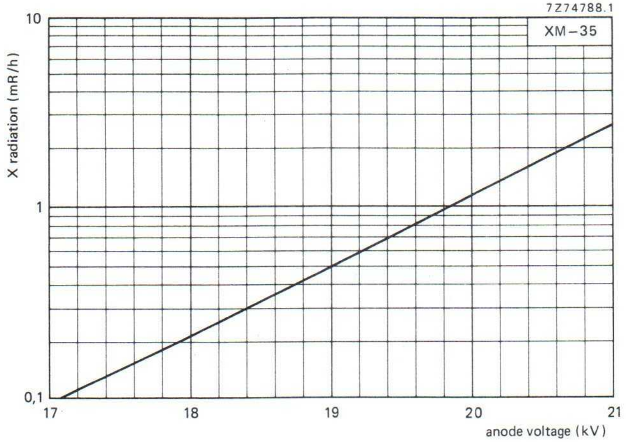
The resolution is approx. 1000 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 550 V, anode voltage = 12 kV; phosphor type W, without anti-glare treatment, raster dimensions 168 mm x 126 mm.

X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

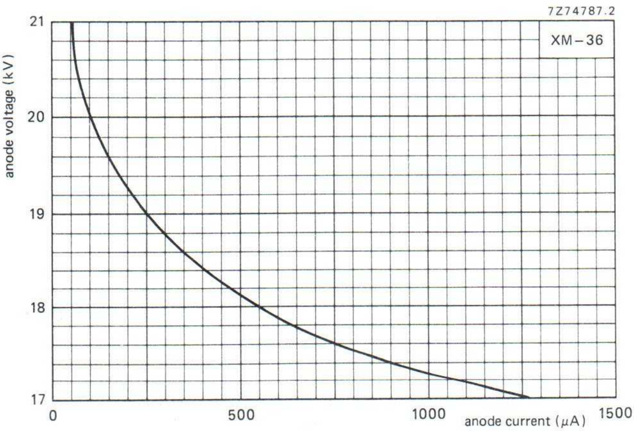
* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 12 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 168 mm x 126 mm:
line parabola 200 V;
field parabola 100 V.

** Visual extinction of focused raster.

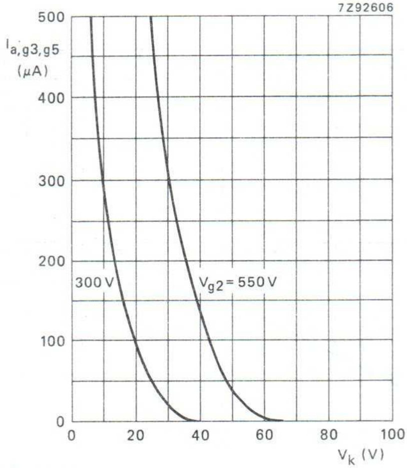


X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.

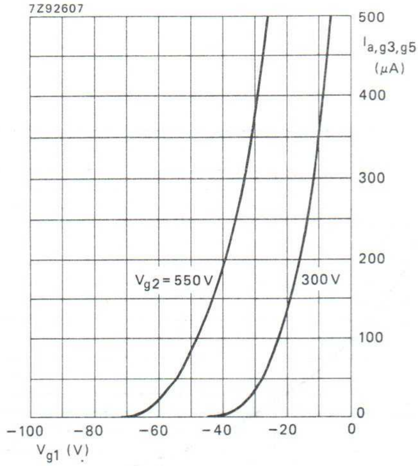
DEVELOPMENT DATA



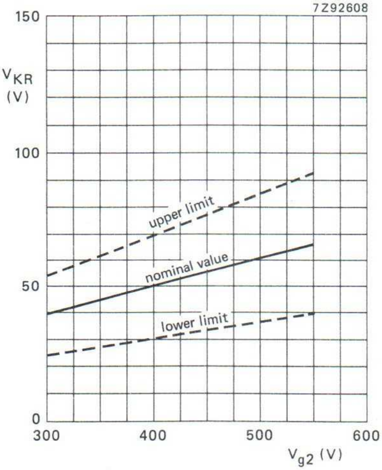
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

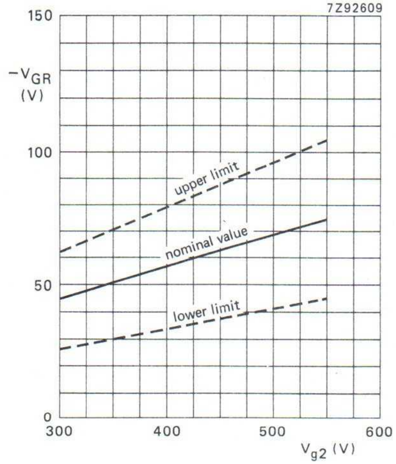


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$



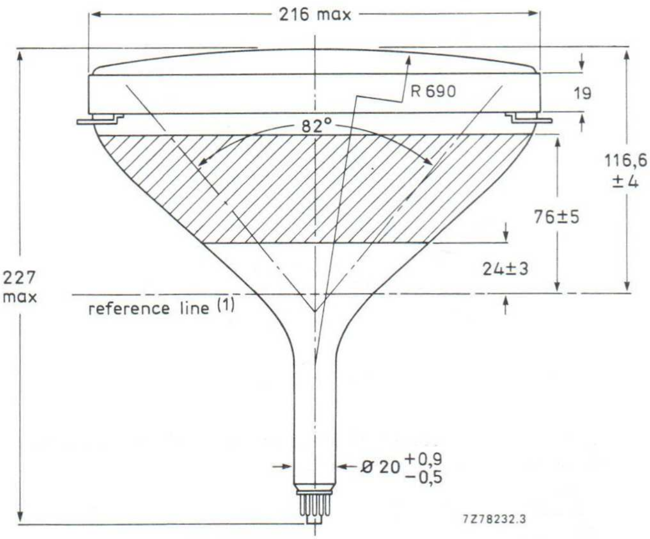
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

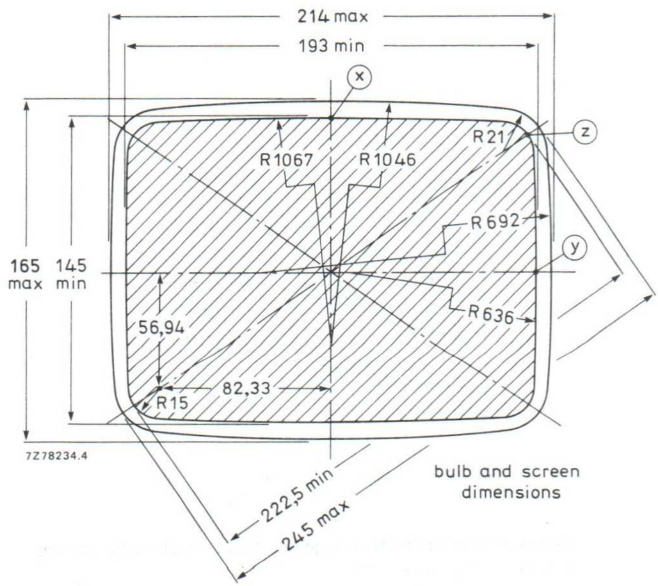
$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

DEVELOPMENT DATA

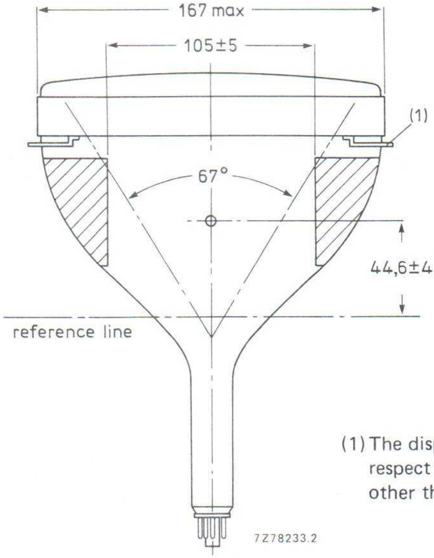
DIMENSIONAL DATA

Dimensions in mm



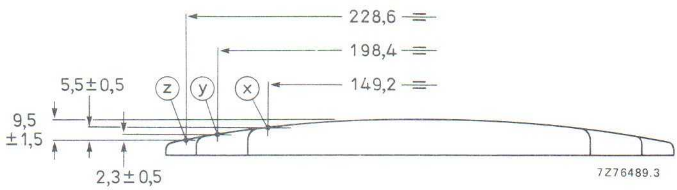


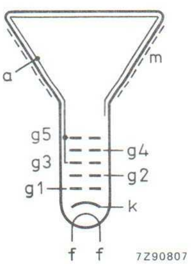
(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.

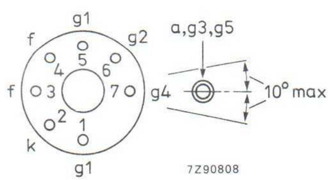


(1) The displacement of any lug with respect to the plane through the other three lugs is max. 1,8 mm.

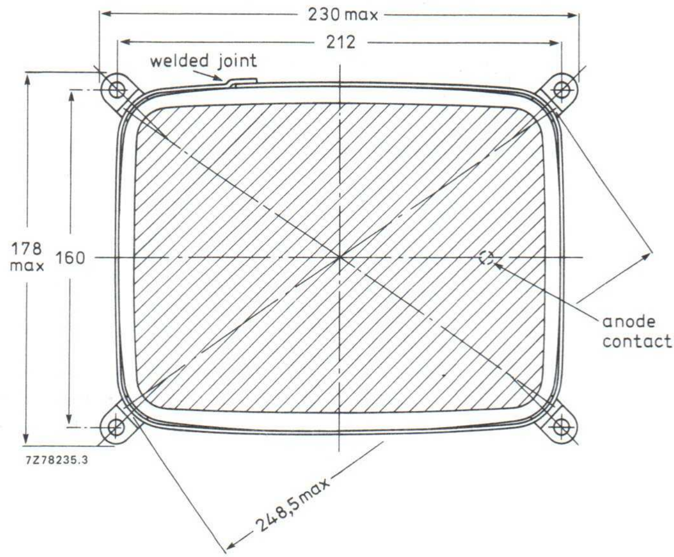
DEVELOPMENT DATA

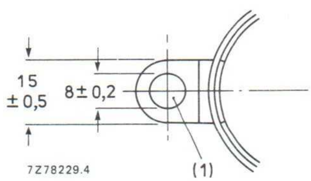


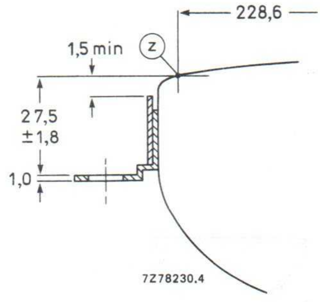




Front view and lug dimensions of tube M24-322

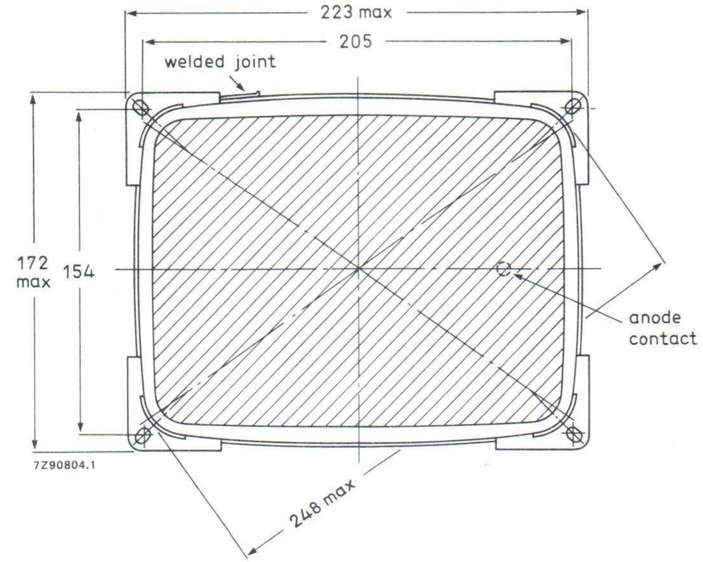


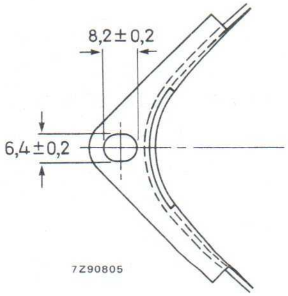


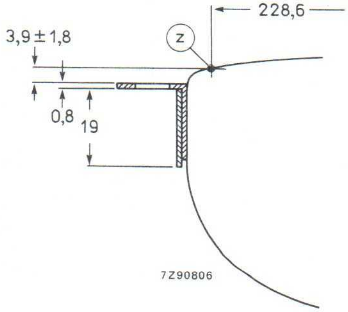


(1) The position of the mounting screws in the cabinet must be within a circle of 5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 212 mm x 160 mm.

Front view and lug dimensions of tube M24-326



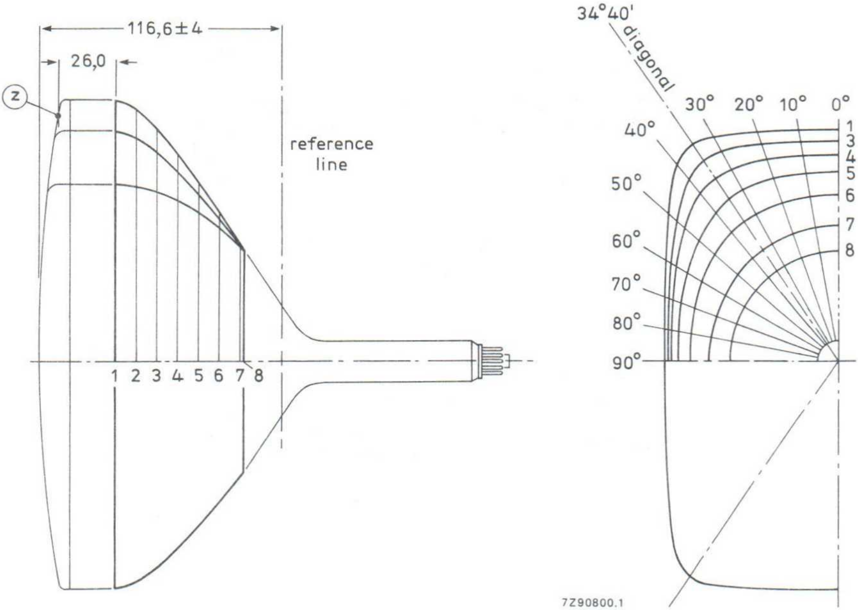




(1) The position of the mounting screws in the cabinet must be within a circle of 3,4 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 205 mm x 154 mm.

DEVELOPMENT DATA

Maximum cone contour



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	108,3	109,8	114,2	121,9	123,9	121,6	106,6	95,6	88,8	85,0	83,8
2	10	105,4	106,8	111,0	117,7	119,4	117,4	104,4	93,9	87,3	83,7	82,5
3	20	98,0	99,2	102,9	107,8	109,2	108,1	99,1	90,0	83,9	80,6	79,5
4	30	88,4	89,4	92,2	95,7	96,6	96,2	91,0	84,2	79,0	76,1	75,1
5	40	78,1	78,9	81,0	83,2	83,8	83,8	81,2	76,8	72,9	70,5	69,7
6	50	66,8	67,4	68,8	70,4	70,9	71,2	70,3	68,1	65,6	63,8	63,2
7	60	54,5	54,9	55,8	56,8	57,2	57,5	57,5	56,8	55,8	54,9	54,5
8	61,2	53,0	53,3	54,2	55,1	55,4	55,7	55,7	55,2	54,3	53,4	53,1

MONOCHROME DISPLAY TUBES

- 90° deflection angle
- 24 cm (9 in) face diagonal; rectangular glass
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	24 cm (9 in)
Overall length	max. 227 mm
Neck diameter	20 mm
Heating	11 V/140 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	130 V
Anode voltage	12 kV
Resolution	approx. 800 lines

APPLICATION

These display tubes are for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

AVAILABLE VERSIONS

The following versions are available: M24-511W, M24-512W and M24-514W. Differences between the tubes can be found under "Dimensional data".

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 82°
vertical	approx. 67°
Direct interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 8 pF
Capacitance of external conductive coating to anode*	max. 850 pF min. 300 pF
Capacitance of external conductive coating to anode**	max. 750 pF min. 300 pF
Capacitance of anode to implosion protection hardware**	approx. 100 pF
Heater voltage	11 V
Heater current at 11 V	140 mA

OPTICAL DATA

Phosphor type	W (P4)
Light transmission at screen centre	approx. 53%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensions Data)

Overall length	max. 227 mm
Greatest dimensions of tube	
diagonal	249,5 mm
width	216 mm
height	167 mm
Minimum useful screen dimensions (projected)	
diagonal	222,5 mm
horizontal axis	193 mm
vertical axis	145 mm
area	268 cm^2
Implosion protection	T-band
Bulb	EIA-J240A1
Bulb contact designation	IEC 67-III-2, EIA-J1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 1,8 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 15 kV min. 9,5 kV
Grid 4 (focusing electrode) voltage	−200 to +500 V
Grid 2 voltage	max. 200 V
Cathode voltage, positive peak value	max. 200 V
Heater voltage	11 V ± 10% *
Cathode-to-heater voltage	max. 200 V

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

* For maximum cathode life it is recommended that the heater supply be regulated at 11 V.

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

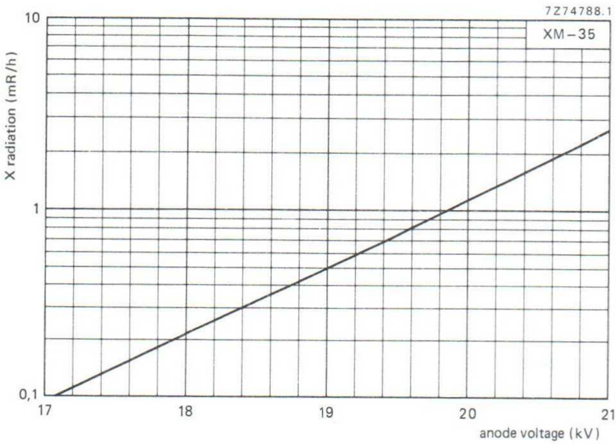
Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	130 V*
Grid 2 voltage	130 V
Cathode cut-off voltage	45 to 65 V**

RESOLUTION

The resolution is approx. 800 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 200 V, anode voltage = 12 kV; raster dimensions 168 mm x 126 mm.

X-RADIATION CHARACTERISTIC

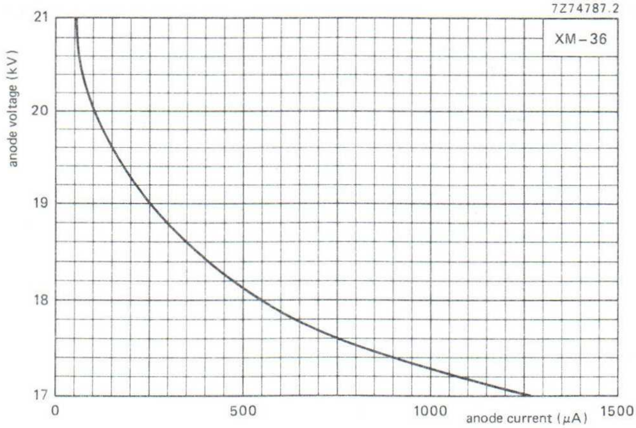
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.



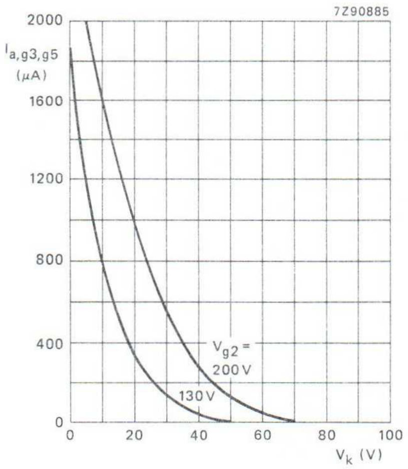
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.

* Measured at screen centre on spot at anode current = 250 μA (peak), anode voltage = 12 kV, grid 2 voltage = 130 V.
Because of the flat focus characteristic it is sufficient to choose a focusing voltage between 0 V and + 130 V. The optimum focus voltage of individual tubes may be between − 150 and + 150 V.

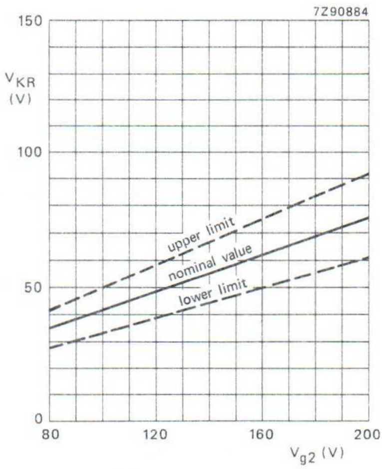
** Visual extinction of focused raster.



0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

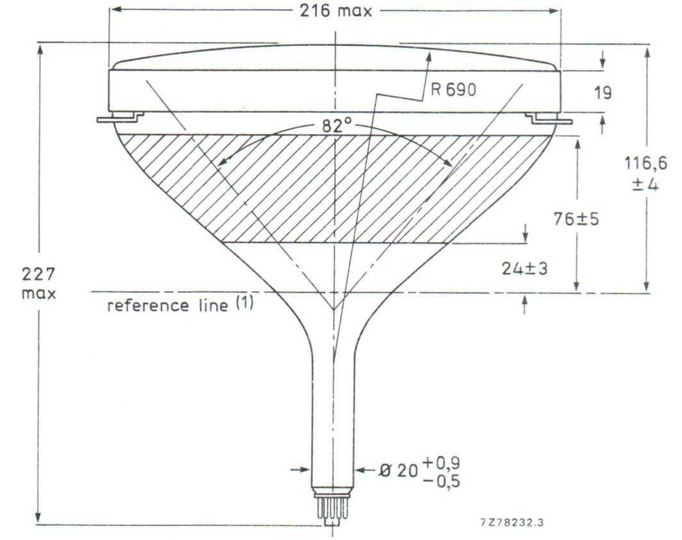


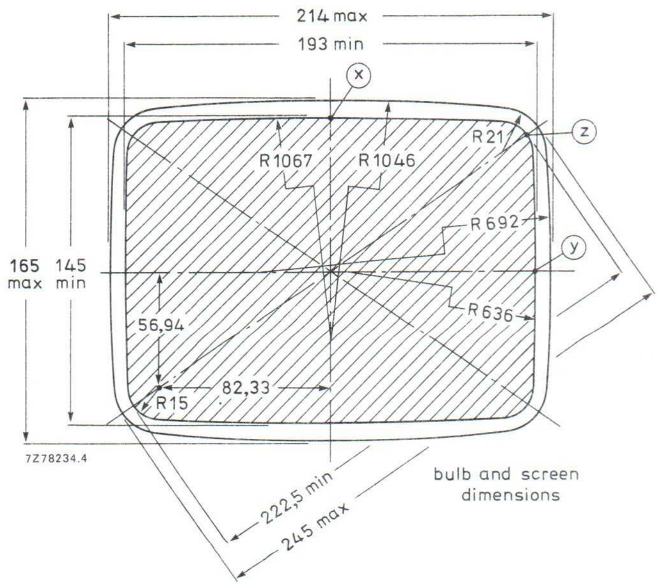
Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,3 \times 10^{-3}$$

DIMENSIONAL DATA

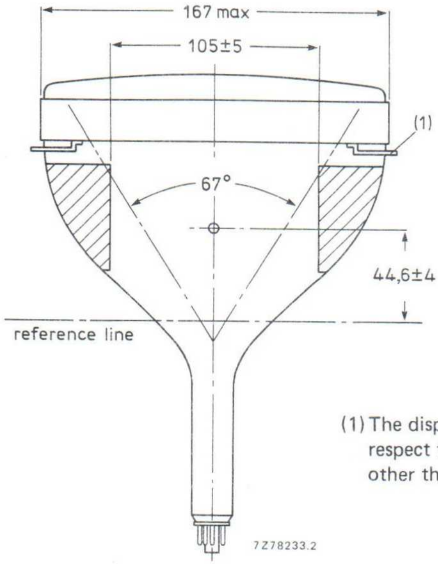
Dimensions in mm



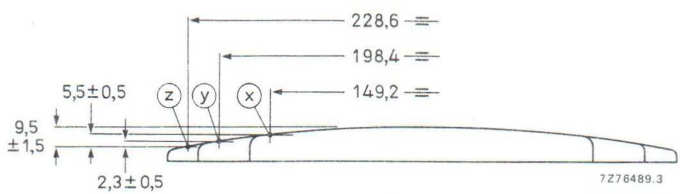


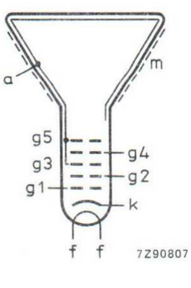
bulb and screen dimensions

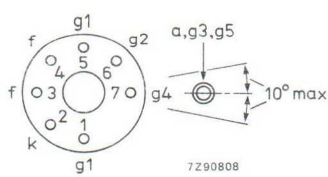
(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.



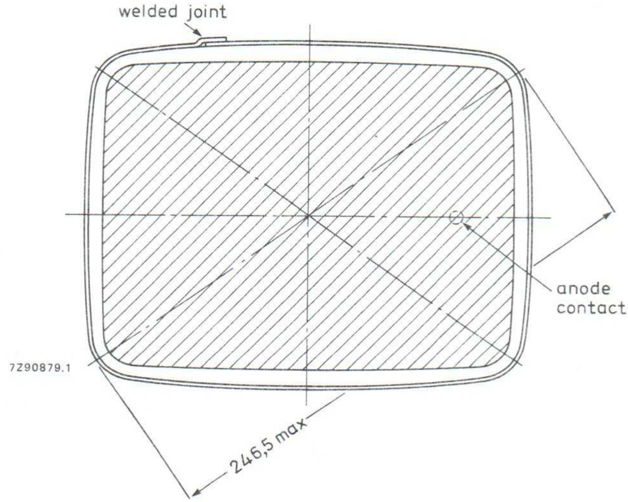
(1) The displacement of any lug with respect to the plane through the other three lugs is max. 1,8 mm.

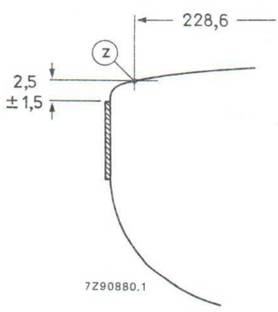




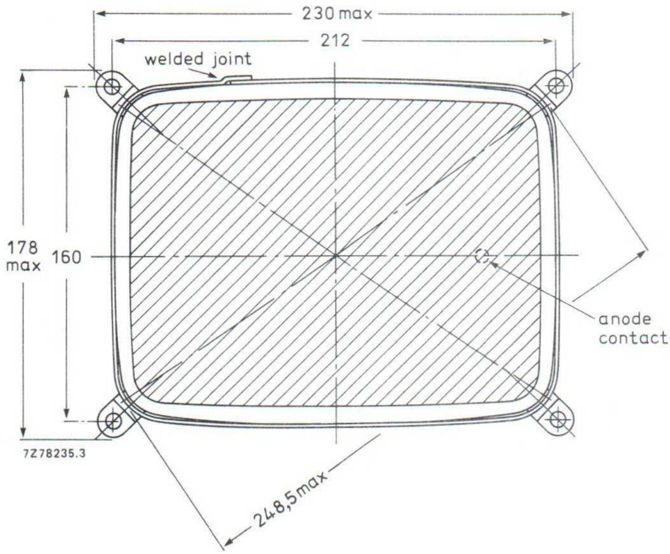


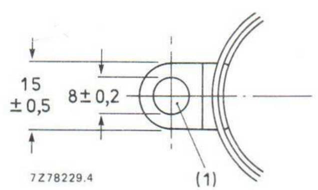
Front view of tube M24-511W

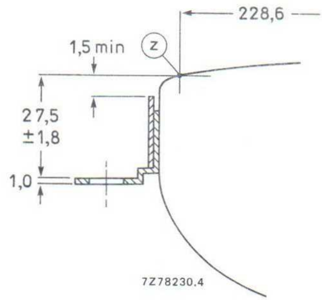




Front view and lug dimensions of tube M24-512W

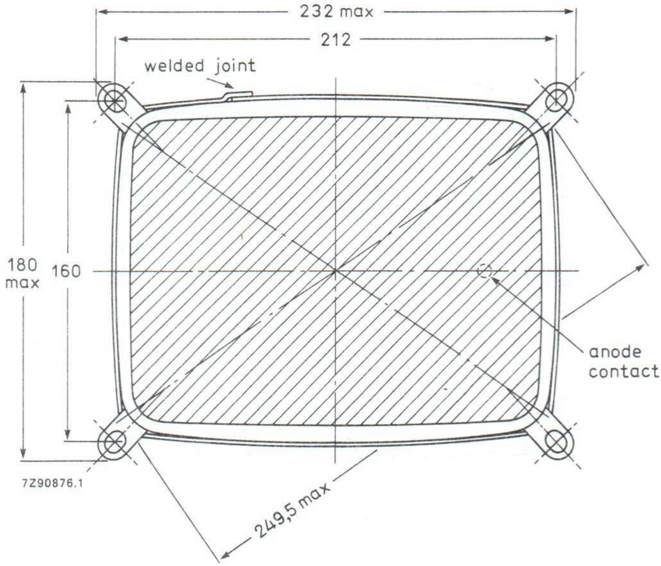


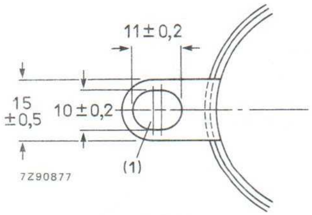


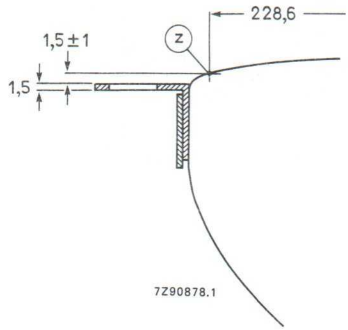


(1) The position of the mounting screws in the cabinet must be within a circle of 5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 212 mm x 160 mm.

Front view and lug dimensions of tube M24-514W

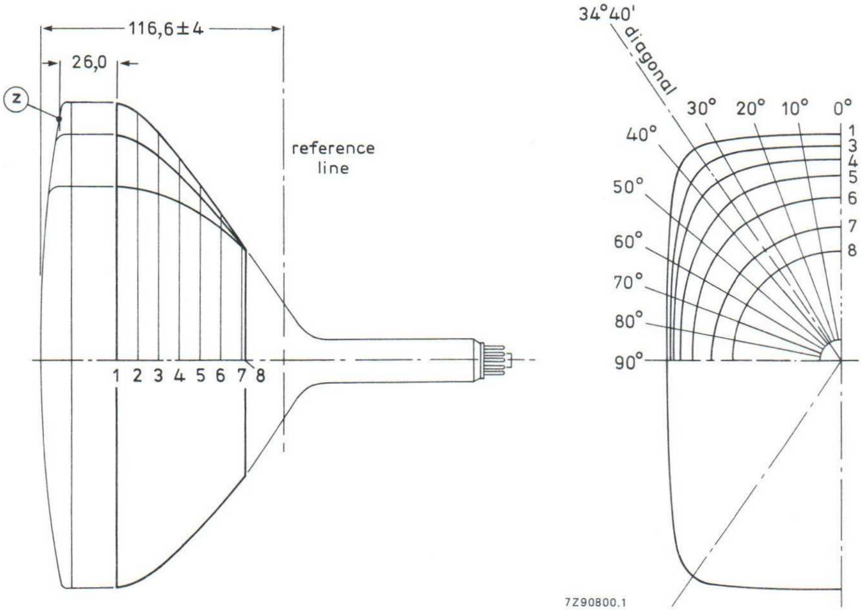






(1) The position of the mounting screws in the cabinet must be within a circle of 7 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 212 mm x 160 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre 0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	108,3	109,8	114,2	121,9	123,9	121,6	106,6	95,6	88,8	85,0	83,8
2	10	105,4	106,8	111,0	117,7	119,4	117,4	104,4	93,9	87,3	83,7	82,5
3	20	98,0	99,2	102,9	107,8	109,2	108,1	99,1	90,0	83,9	80,6	79,5
4	30	88,4	89,4	92,2	95,7	96,6	96,2	91,0	84,2	79,0	76,1	75,1
5	40	78,1	78,9	81,0	83,2	83,8	83,8	81,2	76,8	72,9	70,5	69,7
6	50	66,8	67,4	68,8	70,4	70,9	71,2	70,3	68,1	65,6	63,8	63,2
7	60	54,5	54,9	55,8	56,8	57,2	57,5	57,5	56,8	55,8	54,9	54,5
8	61,2	53,0	53,3	54,2	55,1	55,4	55,7	55,7	55,2	54,3	53,4	53,1

FLAT SQUARE
HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 90^{o} deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 1200 mm radius of screen curvature
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90^{o}
Face diagonal	31 cm (12 in)
Overall length	max. 275 mm
Neck diameter	20 mm
Heating	12 V/130 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	12 kV
Resolution	approx. 1300 lines

APPLICATION

These high resolution tubes are for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

AVAILABLE VERSIONS

The following versions are available: M29EAA and M29EAB.

The tubes can be supplied with different phosphors and anti-reflective treatments, see ''High resolution monochrome display tubes, General''.

Differences between the tubes can be found under 'Dimensional data'.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 79°
vertical	approx. 61°
Interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 7 pF
Capacitance of external conductive coating to anode*	max. 1200 pF min. 600 pF
Heater voltage	12 V
Heater current at 12 V	130 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 43%
tube with dark tinted face glass	approx. 32%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 275 mm
Greatest dimensions of tube	
diagonal	323,5 mm
width	273 mm
height	212,5 mm
Minimum useful screen dimensions (projected)	
diagonal	294 mm
horizontal axis	246 mm
vertical axis	181 mm
area	440 cm^2
Implosion protection	T-band
Bulb	EIA-J320AH1 or EIA-J320BF1
Bulb contact designation	IEC 67-III-2, EIAJ1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 3,5 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 15 kV min. 10 kV
Grid 4 (focusing electrode) voltage	−200 to + 1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 130 μA
peak value	max. 600 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	12 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V $^{+0\%}_{-5\%}$.

CIRCUIT DESIGN VALUES

Grid 4 current	
positive	max. 25 μA
negative	max. 25 μA
Grid 2 current	
positive	max. 5 μA
negative	max. 5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max. 1,0 MΩ
Impedance between cathode and heater	max. 0,1 MΩ
Grid 1 circuit resistance	max. 1,5 MΩ
Grid 1 circuit impedance	max. 0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	30 to 60 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	34 to 64 V**

RESOLUTION

The resolution is approx. 1300 lines. It is measured at the screen centre:

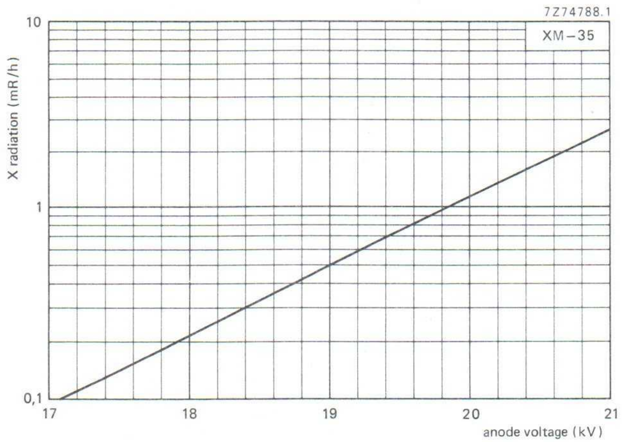
- with shrinking raster method,
- at light output 68,5 cd/m^2 (20 foot lambert) and raster dimensions 216 mm x 162 mm,
- at V_{g2} = 700 V and anode voltage = 12 kV,
- with phosphor type W (WW),
- with normal tinted face glass, without anti-glare treatment of screen surface.

X-RADIATION CHARACTERISTIC

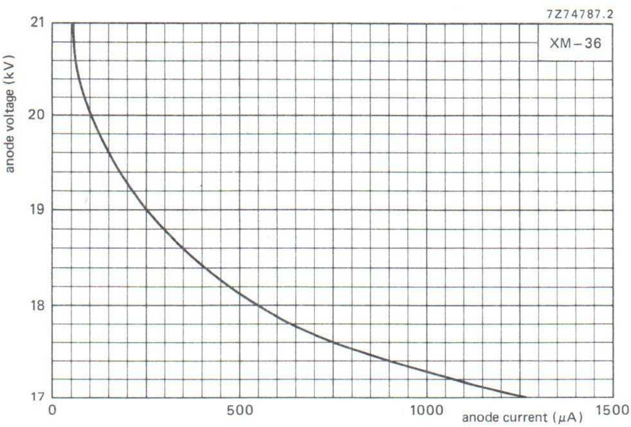
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 250 μA (peak), anode voltage = 12 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 216 mm x 162 mm:
line parabola 250 V,
field parabola 0 V.

** Visual extinction of focused raster.

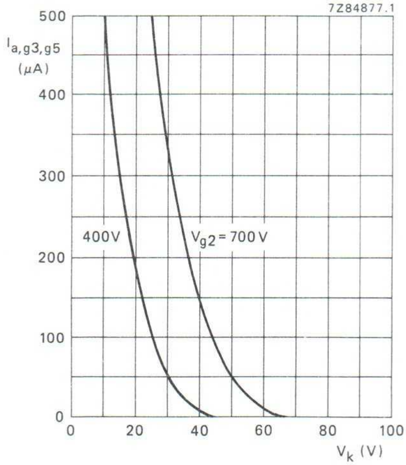


X-radiation limit curve according to JEDEC 94, at a constant anode current of 250 μA, measured according to TEPAC103A.

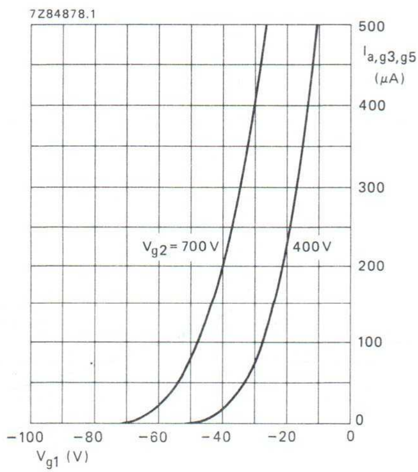


0,5 mR/h isoexposure-rate limit curve, according to JEDEC 94, measured according to TEPAC103A.

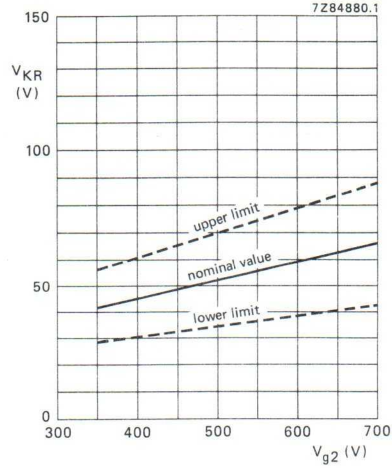
DEVELOPMENT DATA



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

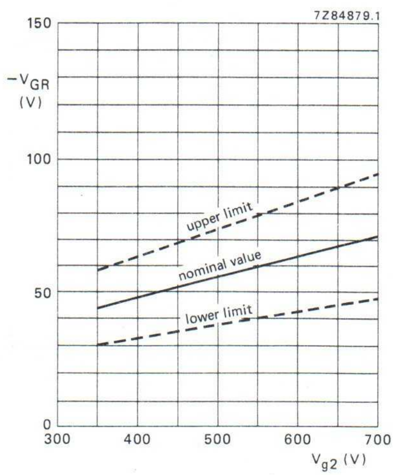


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode raster cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$



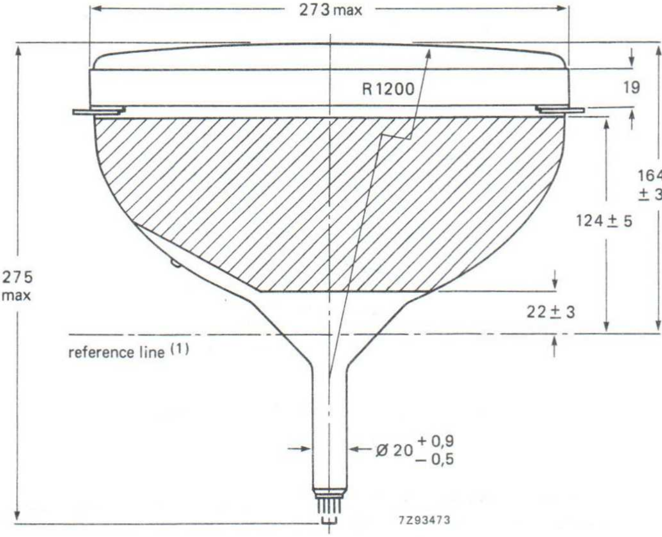
Limits of grid 1 raster cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

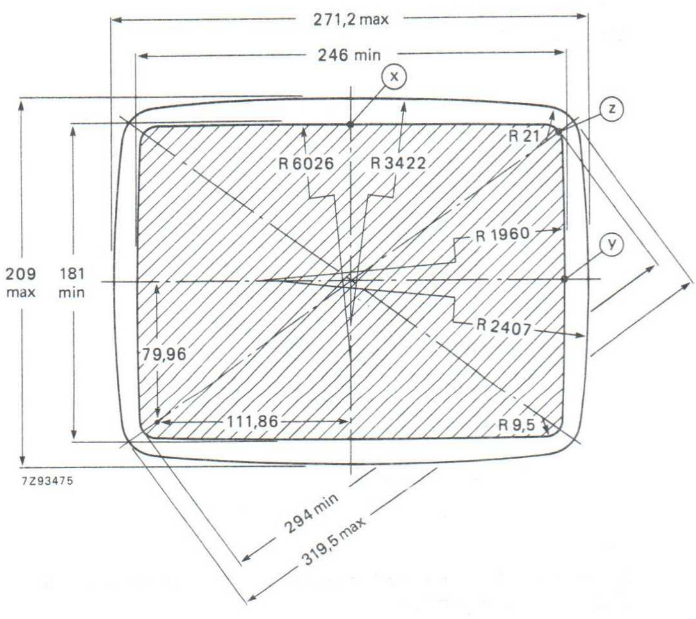
$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

DEVELOPMENT DATA

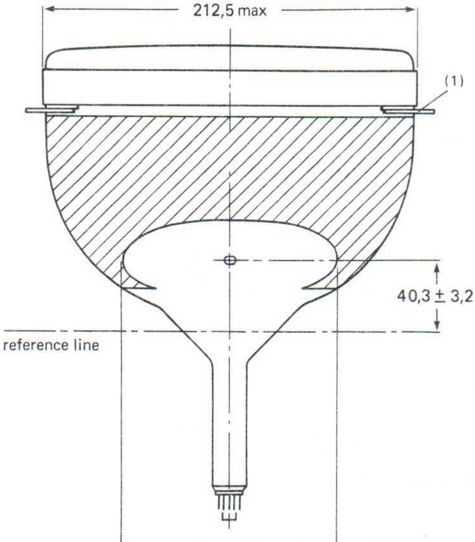
DIMENSIONAL DATA

Dimensions in mm



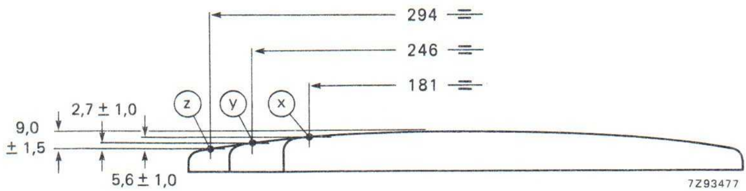


(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.

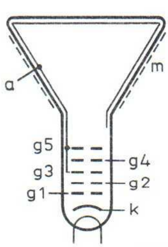


7Z93474

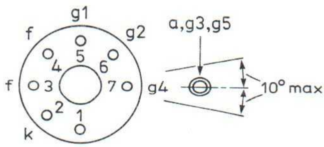
(1) The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.



7Z93477

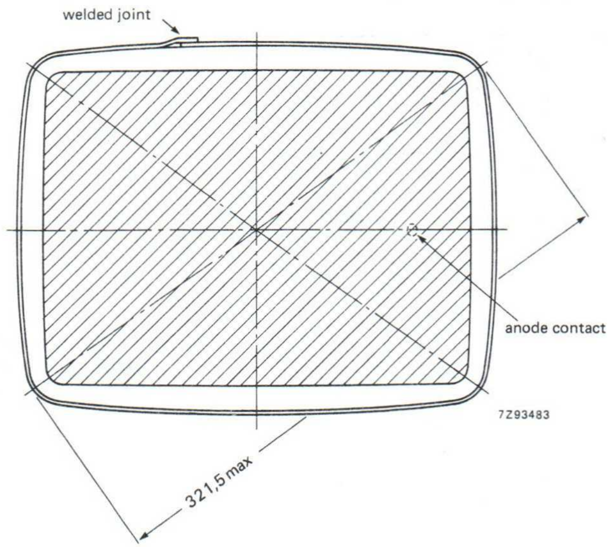


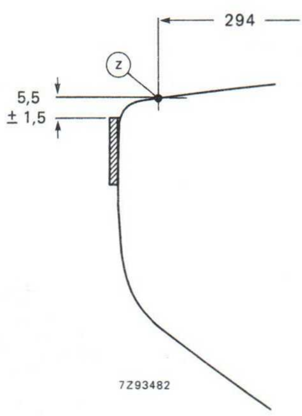
7Z90807



7Z90808

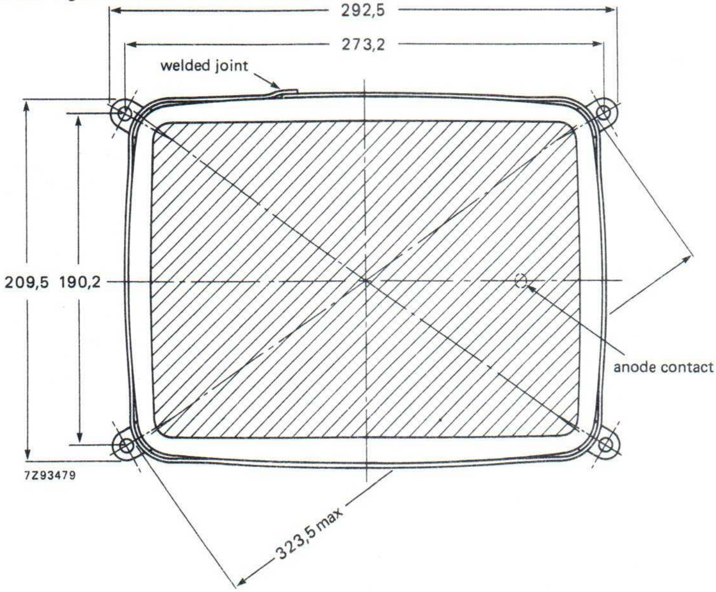
Front view of tube M29EAA

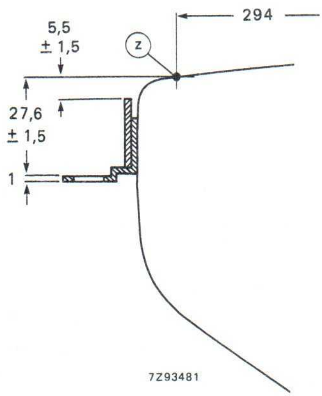


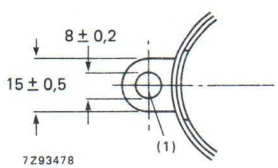


DEVELOPMENT DATA

Front view and lug dimensions of tube M29EAB

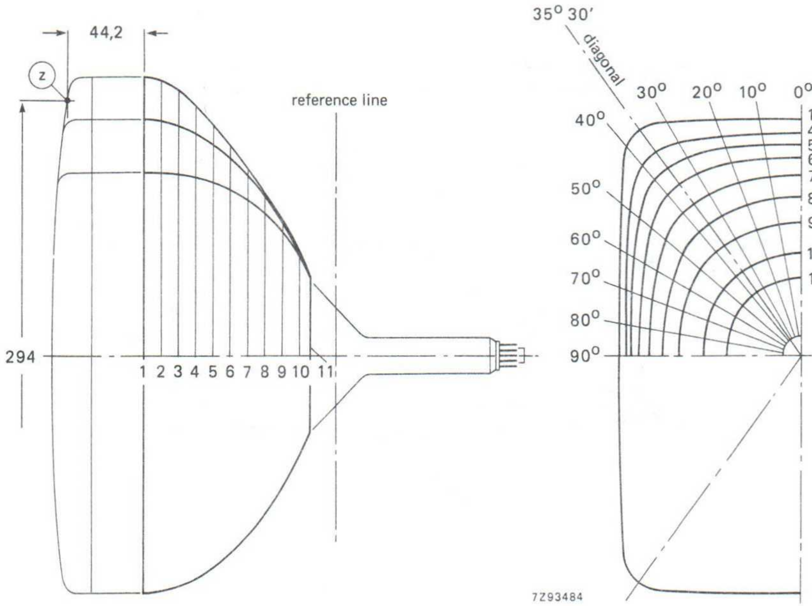






(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,2 mm x 190,2 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	136,4	138,3	144,5	155,6	160,5	157,5	135,6	120,8	111,8	106,8	105,3
2	10	135,5	137,4	143,5	154,1	158,6	155,8	135,2	120,6	111,6	106,7	105,1
3	20	132,7	134,6	140,4	149,7	153,2	151,1	133,6	119,4	110,6	105,8	104,3
4	30	128,2	129,9	135,0	142,0	144,0	142,3	129,3	116,6	108,4	103,9	102,4
5	40	121,8	123,3	127,3	132,0	132,8	131,5	122,5	112,2	104,8	100,6	99,3
6	50	113,6	114,8	117,7	120,4	120,6	119,5	113,5	105,7	99,5	95,8	94,6
7	60	103,3	104,2	105,9	107,1	106,9	106,1	102,2	96,9	92,2	89,1	88,1
8	70	90,7	91,2	92,1	92,5	92,2	91,7	89,4	86,2	83,1	80,8	80,0
9	80	75,3	75,7	76,3	76,6	76,6	76,5	75,6	74,0	72,3	71,0	70,4
10	90	57,7	57,7	57,7	57,7	57,6	57,6	57,4	57,2	57,0	56,8	56,6
11	96,5	44,7	44,7	44,7	44,7	44,7	44,7	44,7	44,7	44,7	44,7	44,7

HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 110° deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 3:4 screen aspect ratio
- 635 mm radius of screen curvature
- 28,6 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	110°
Face diagonal	31 cm (12 in)
Overall length	max. 241 mm
Neck diameter	28,6 mm
Heating	6,3 V/240 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	17 kV
Resolution	approx. 1500 lines

APPLICATION

This high resolution tube is for alpha-numeric display applications, such as computer terminals, word processors, etc.

The tube can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

AVAILABLE VERSIONS

The following versions are available: M31-326 and M31-370. Differences between the tubes can be found under 'Dimensional data'.

ELECTRICAL DATA

Focusing method	electrostatic	
Deflection method	magnetic	
Deflection angles		
diagonal	approx.	110°
horizontal	approx.	98°
vertical	approx.	81°
Direct interelectrode capacitances		
cathode to all other electrodes	max.	4 pF
grid 1 to all other electrodes	max.	9 pF
Capacitance of external conductive coating to anode*	max.	900 pF
	min.	450 pF
Capacitance of external conductive coating to anode**	max.	750 pF
	min.	450 pF
Capacitance of anode to implosion protection hardware**	approx.	150 pF
Heater voltage	6,3 V	
Heater current at 6,3 V	240 mA	

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"	
Light transmission at screen centre		
tube with normal tinted face glass	approx.	46%
tube with dark tinted face glass	approx.	34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 241 mm
Greatest dimensions of tube	
diagonal	321 mm
width	283 mm
height	222 mm
Minimum useful screen dimensions (projected)	
diagonal	295 mm
horizontal axis	257 mm
vertical axis	195 mm
area	478 cm^2
Implosion protection	T-band
Bulb	EIA-J310AF1 or EIA-J310AN1
Bulb contact designation	IEC 67-III-2, EIA-J1-21
Base designation	IEC 67-I-31a; EIA-B7-208
Basing	8HR
Mass	approx. 2,8 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max.	19 kV
	min.	13 kV
Grid 4 (focusing electrode) voltage	−500 to + 1000 V	
Grid 2 voltage	max.	700 V
Anode current		
long-term average value	max.	75 μA
peak value	max.	300 μA
Cathode voltage, positive peak value	max.	400 V
Heater voltage	6,3 V ± 10%*	
Cathode-to-heater voltage	max.	200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 6,3 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	40 to 70 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	45 to 83 V**

RESOLUTION

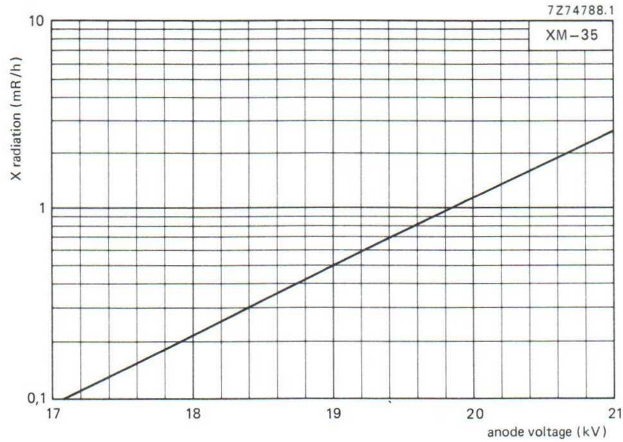
The resolution is approx. 1500 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 17 kV; phosphor type W, without anti-glare treatment, raster dimensions 216 mm x 162 mm.

X-RADIATION CHARACTERISTIC

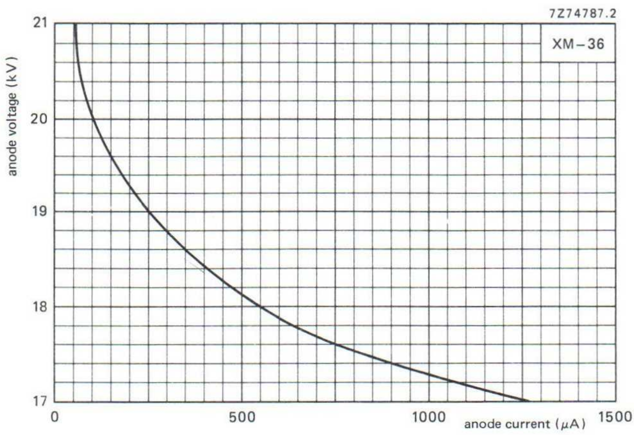
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 17 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 216 mm x 162 mm
line parabola 300 V,
field parabola 100 V.

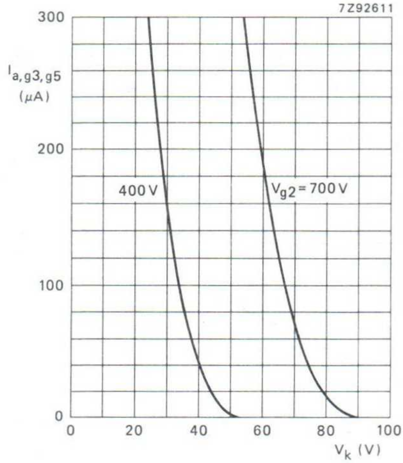
** Visual extinction of focused raster.



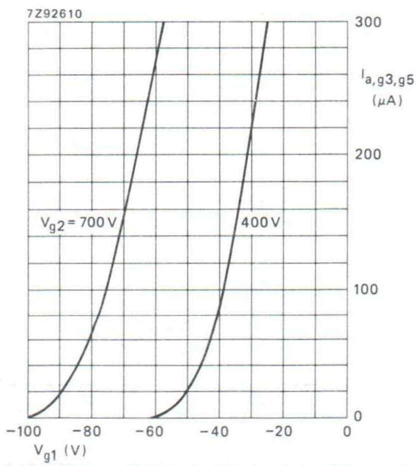
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.



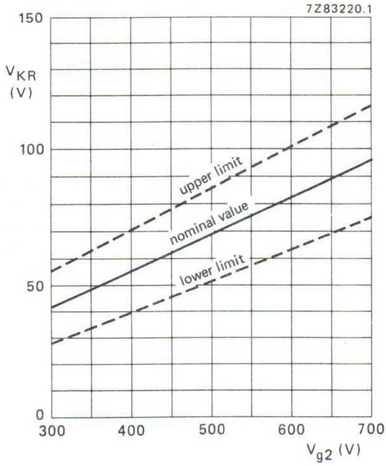
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

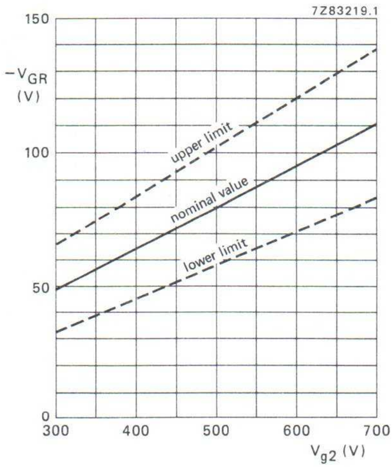


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

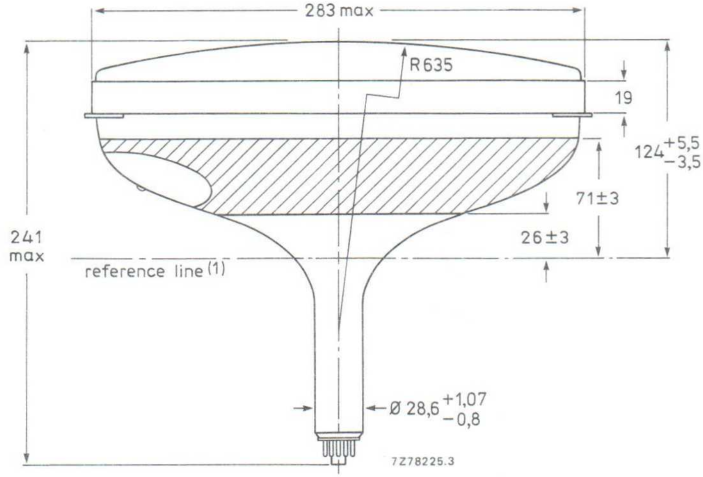


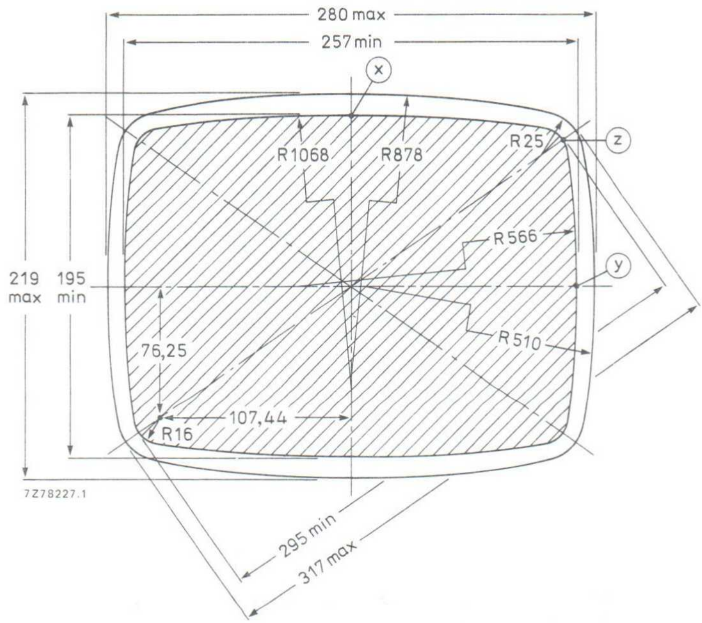
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

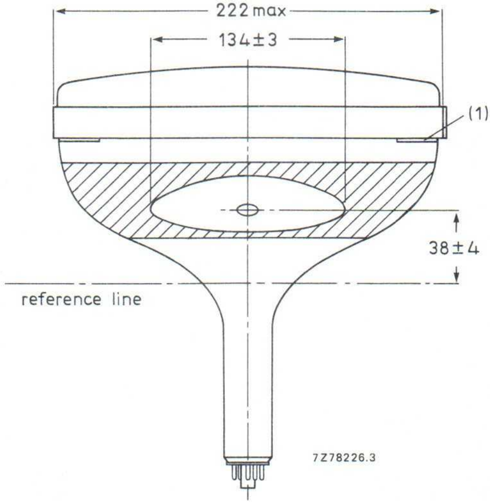
DIMENSIONAL DATA

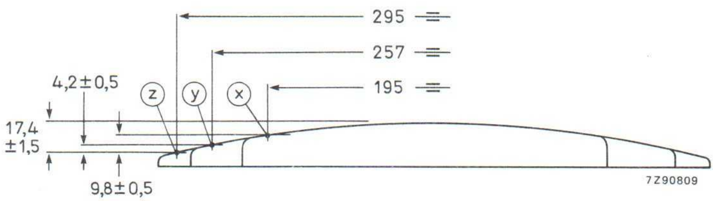
Dimensions in mm

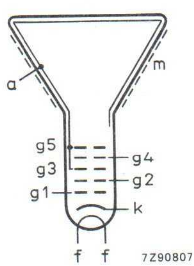


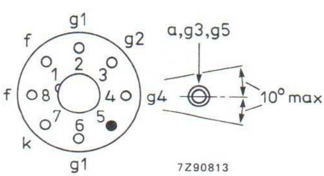


(1) The reference line is determined by the plane of the upper edge of reference line gauge C when the gauge is resting on the cone.



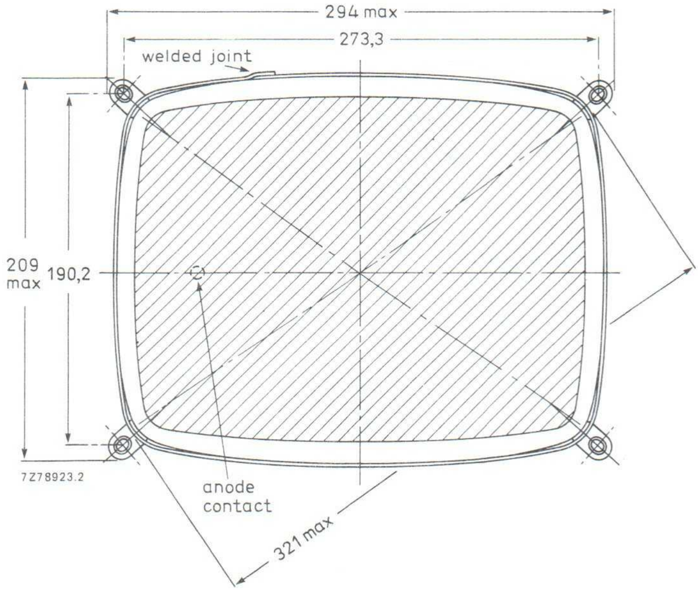


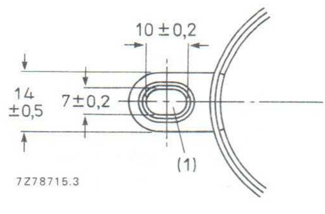


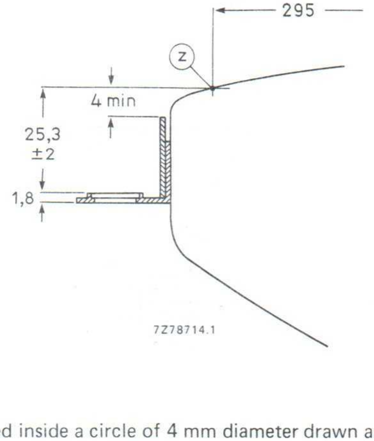


(1) The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.

Front view and lug dimensions of tube M31-326

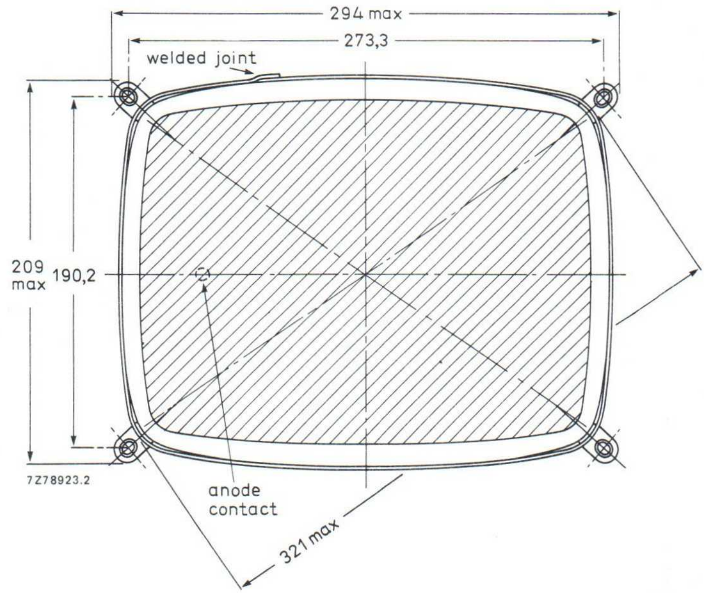


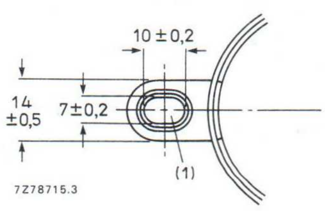


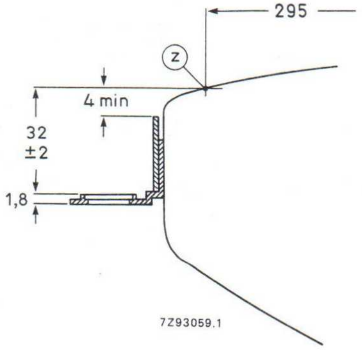


(1) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

Front view and lug dimensions of tube M31-370 (development data)

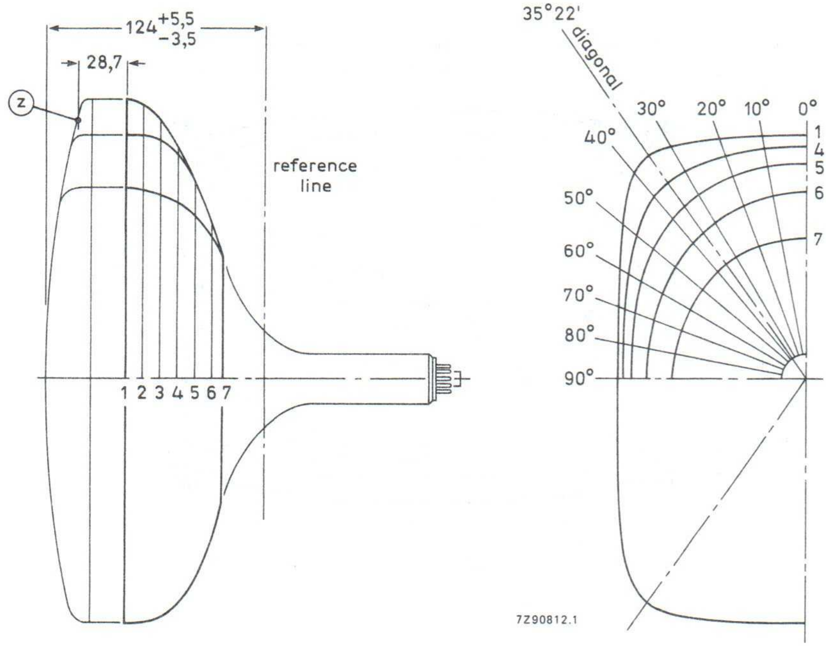






(1) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

→ **Maximum cone contour**



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	141,0	142,6	147,3	155,7	159,2	156,6	138,2	125,0	116,7	112,1	110,6
2	10	140,3	141,9	146,7	154,8	157,8	154,9	137,3	124,0	115,6	110,9	109,5
3	20	137,6	139,0	143,2	148,5	148,9	145,9	132,4	120,3	112,4	107,9	106,5
4	30	130,4	131,3	133,1	133,5	131,9	129,3	121,3	113,0	106,7	103,0	101,7
5	40	114,0	114,3	114,3	113,0	111,6	110,0	105,8	101,4	97,7	95,2	94,3
6	50	89,6	89,6	89,4	88,8	88,2	87,7	86,3	84,8	83,5	82,6	82,2
7	56,4	70,9	71,0	71,0	71,0	70,9	70,9	70,6	70,3	70,0	69,8	69,7

HIGH RESOLUTION MONOCHROME DISPLAY TUBE

- For Data Graphic Displays
- 110^{o} deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 3 : 4 screen aspect ratio
- 635 mm radius of screen curvature
- 28,6 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	110^{o}
Face diagonal	31 cm (12 in)
Overall length	max. 241 mm
Neck diameter	28,6 mm
Heating	12 V/130 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	17 kV
Resolution	approx. 1500 lines

APPLICATION

This high resolution tube is for alpha-numeric and graphic display applications, such as computer terminals, word processors, etc.

The tube can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

ELECTRICAL DATA

Focusing method	electrostatic	
Deflection method	magnetic	
Deflection angle		
diagonal	approx.	110°
horizontal	approx.	98°
vertical	approx.	81°
Direct interelectrode capacitances		
cathode to all other electrodes	max.	4 pF
grid 1 to all other electrodes	max.	9 pF
Capacitance of external conductive coating to anode*	max.	1200 pF
	min.	700 pF
Heater voltage	12 V	
Heater current at 12 V	130 mA	

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"	
Light transmission at screen centre		
tube with normal tinted face glass	approx.	46%
tube with dark tinted face glass	approx.	34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 241 mm
Greatest dimensions of tube	
diagonal	321 mm
width	283 mm
height	222 mm
Minimum useful screen dimensions (projected)	
diagonal	295 mm
horizontal axis	257 mm
vertical axis	195 mm
area	478 cm^2
Implosion protection	T-band
Bulb	EIA-J310AF1 or EIA-J310AN1
Bulb contact designation	IEC 67-III-2; EIA-J1-21
Base designation	IEC 67-I-31a; EIA B7-208
Basing	8HR
Mass	approx. 2,8 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max.	19 kV
	min.	13 kV
Grid 4 (focusing electrode) voltage		−500 to + 1000 V
Grid 2 voltage	max.	700 V
Anode current		
long-term average value	max.	75 μA
peak value	max.	300 μA
Cathode voltage, positive peak value	max.	400 V
Heater voltage		12 V ± 10%*
Cathode-to-heater voltage	max.	200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	40 to 70 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	45 to 83 V**

RESOLUTION

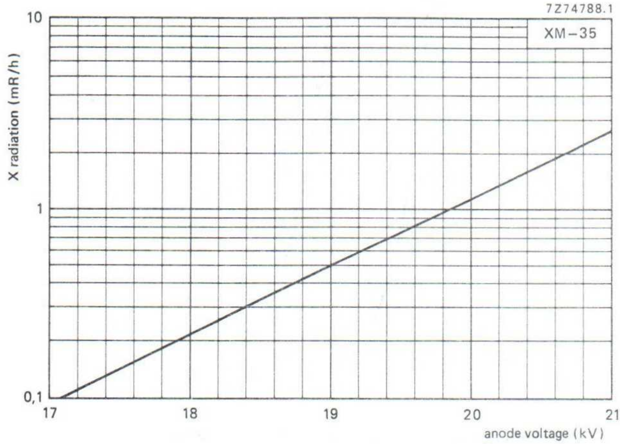
The resolution is approx. 1500 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 17 kV; phosphor type W, without anti-glare treatment, raster dimensions 216 mm x 162 mm.

X-RADIATION CHARACTERISTIC

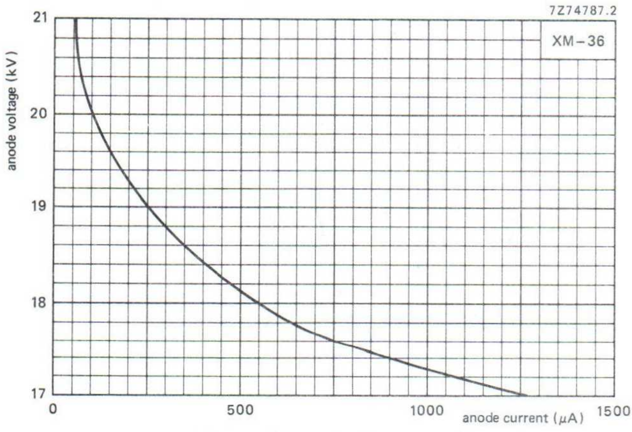
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 17 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 216 mm x 162 mm:
line parabola 300 V,
field parabola 100 V.

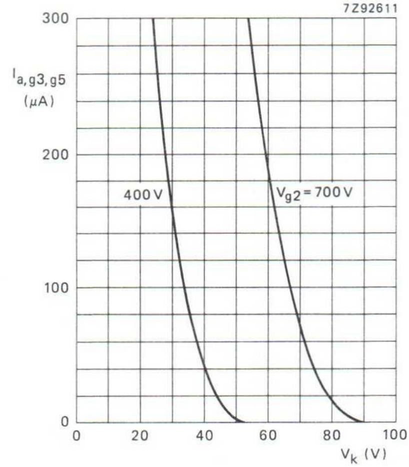
** Visual extinction of focused raster.



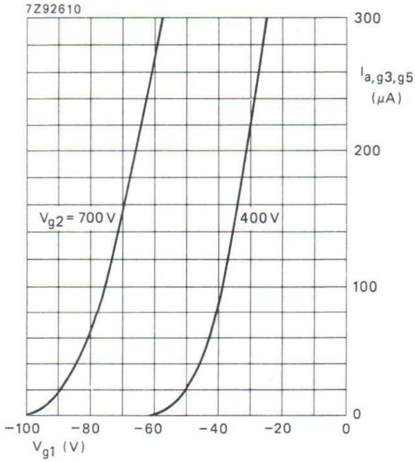
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.



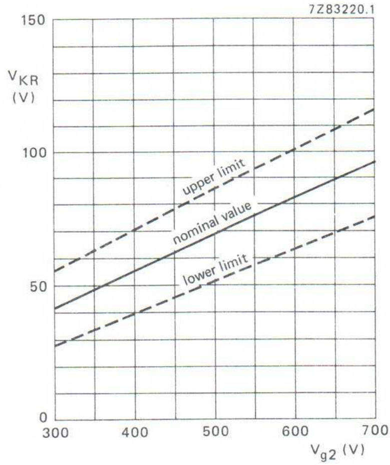
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

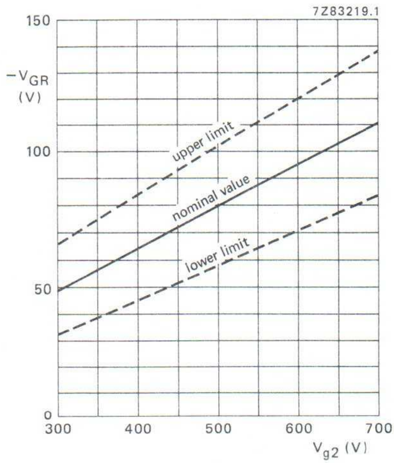


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

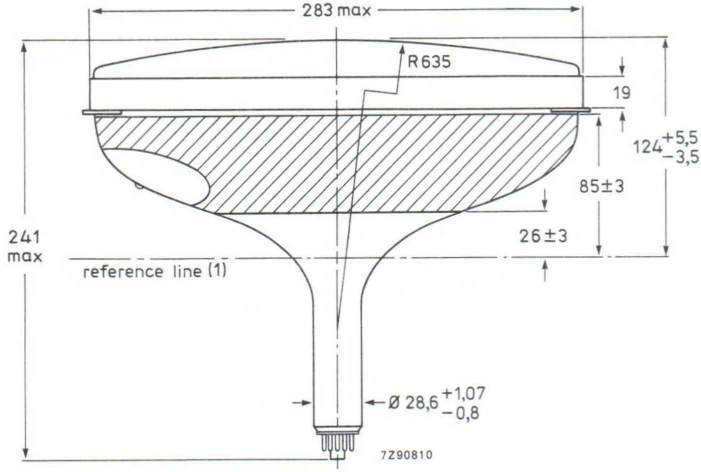


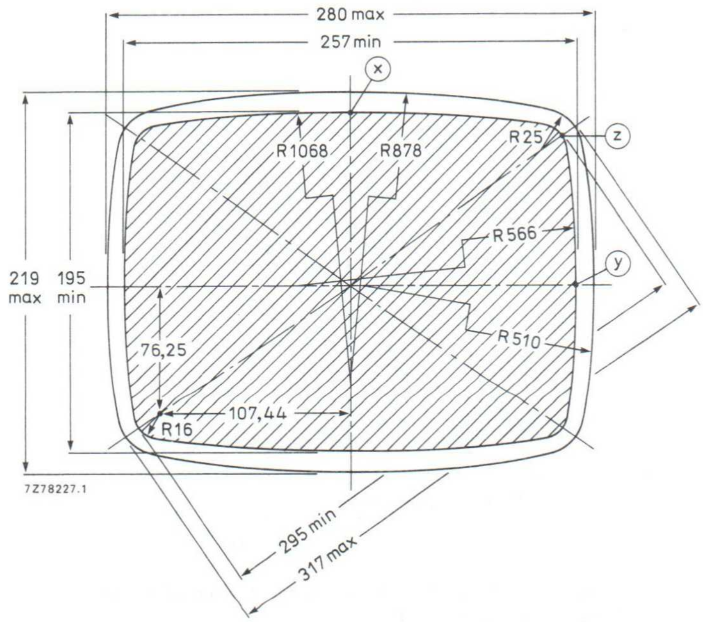
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

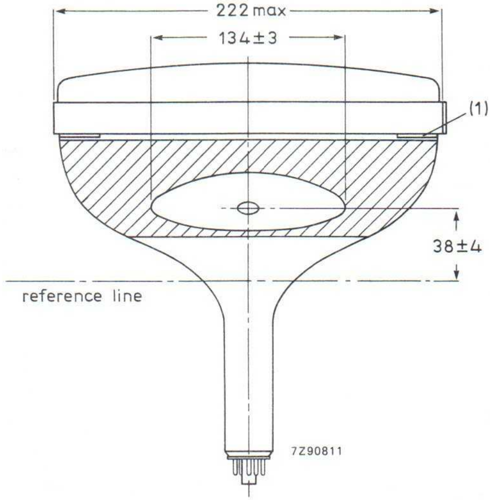
DIMENSIONAL DATA

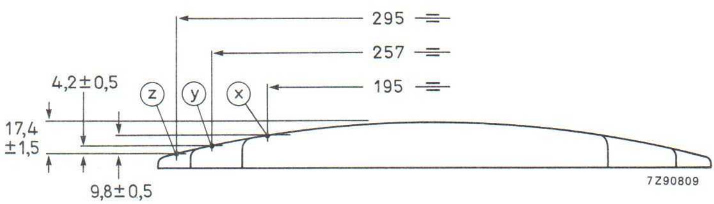
Dimensions in mm

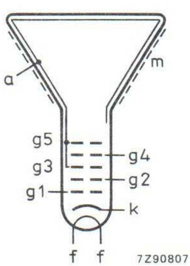


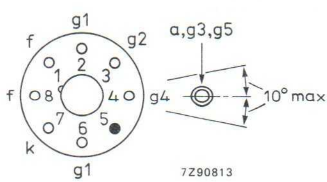


(1) The reference line is determined by the plane of the upper edge of reference line gauge C when the gauge is resting on the cone.



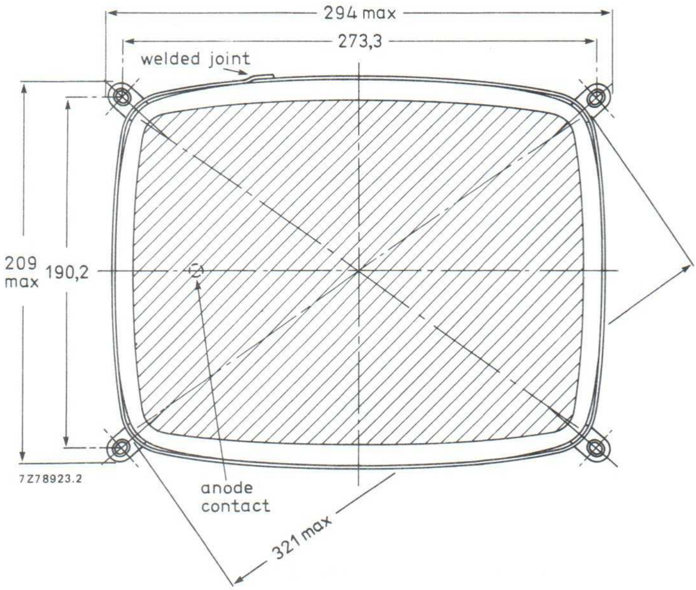


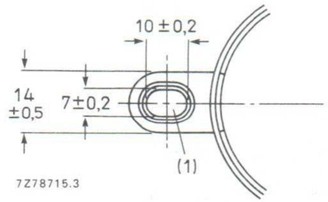


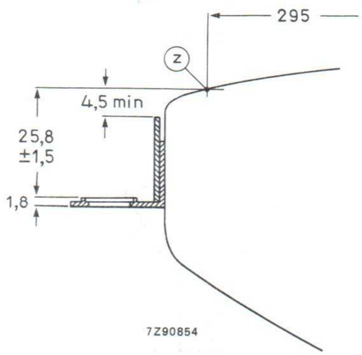


(1) The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.

Front view and lug dimensions of tube M31-328

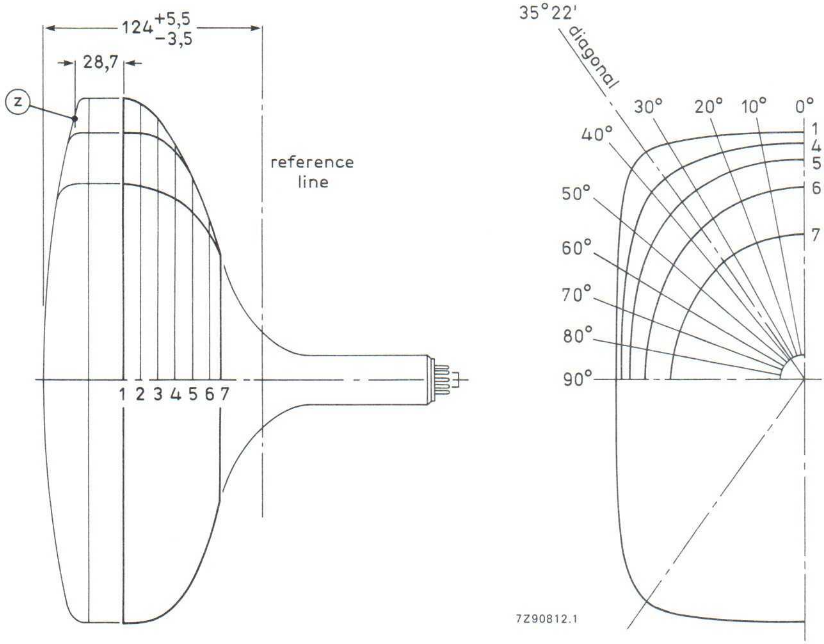






(1) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	141,0	142,6	147,3	155,7	159,2	156,6	138,2	125,0	116,7	112,1	110,6
2	10	140,3	141,9	146,7	154,8	157,8	154,9	137,3	124,0	115,6	110,9	109,5
3	20	137,6	139,0	143,2	148,5	148,9	145,9	132,4	120,3	112,4	107,9	106,5
4	30	130,4	131,3	133,1	133,5	131,9	129,3	121,3	113,0	106,7	103,0	101,7
5	40	114,0	114,3	114,3	113,0	111,6	110,0	105,8	101,4	97,7	95,2	94,3
6	50	89,6	89,6	89,4	88,8	88,2	87,7	86,3	84,8	83,5	82,6	82,2
7	56,4	70,9	71,0	71,0	71,0	70,9	70,9	70,6	70,3	70,0	69,8	69,7

HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 90° deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 4:5 screen aspect ratio
- 510 mm radius of screen curvature
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	31 cm (12 in)
Overall length	max. 280 mm
Neck diameter	20 mm
Heating	12 V/130 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	12 kV
Resolution	approx. 1300 lines

APPLICATION

These high resolution tubes are for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tubes can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

AVAILABLE VERSIONS

The following versions are available: M31-336, M31-338 and M31-350. Differences between the tubes can be found under 'Dimensional data'.

ELECTRICAL DATA

Focusing method	electrostatic	
Deflection method	magnetic	
Deflection angles		
diagonal	approx.	90^{o}
horizontal	approx.	83^{o}
vertical	approx.	65^{o}
Direct interelectrode capacitances		
cathode to all other electrodes	max.	4 pF
grid 1 to all other electrodes	max.	7 pF
Capacitance of external conductive coating to anode*	max.	1050 pF
	min.	450 pF
Capacitance of external conductive coating to anode**	max.	900 pF
	min.	450 pF
Capacitance of anode to implosion protection hardware**	approx.	150 pF
Heater voltage	12 V	
Heater current at 12 V	130 mA	

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"	
Light transmission at screen centre		
tube with normal tinted face glass	approx.	50%
tube with dark tinted face glass	approx.	34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 280 mm
Greatest dimensions of tube	
diagonal	315 mm
width	279 mm
height	227 mm
Minimum useful screen dimensions (projected)	
diagonal	292 mm
horizontal axis	254 mm
vertical axis	201 mm
area	484 cm^2
Implosion protection	T-band
Bulb	EIA-J310N1 or EIA-J310AP1
Bulb contact designation	IEC 67-III-2, EIA-J1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 2,9 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 15 kV min. 10 kV
Grid 4 (focusing electrode) voltage	−200 to + 1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 130 μA
peak value	max. 600 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	12 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	30 to 60 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	34 to 64 V**

RESOLUTION

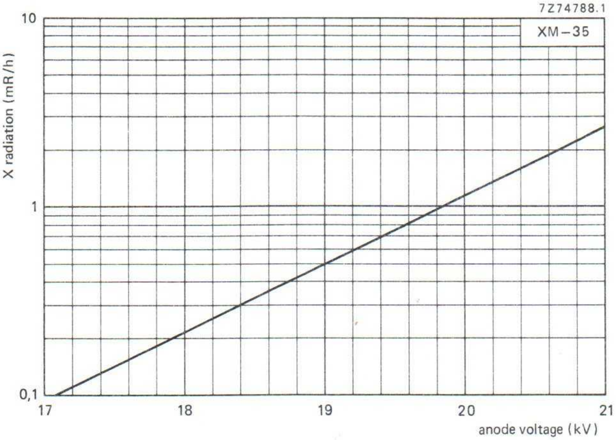
The resolution is approx. 1300 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 12 kV; phosphor type W, without anti-glare treatment, raster dimensions 216 mm x 162 mm.

X-RADIATION CHARACTERISTIC

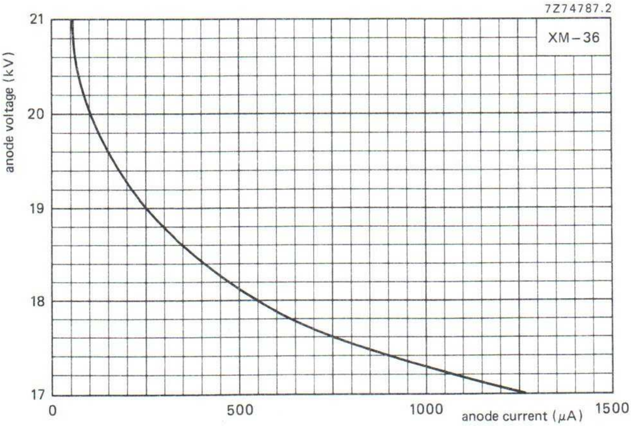
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 250 μA (peak), anode voltage = 12 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 216 mm x 162 mm:
line parabola 200 V,
field parabola 100 V.

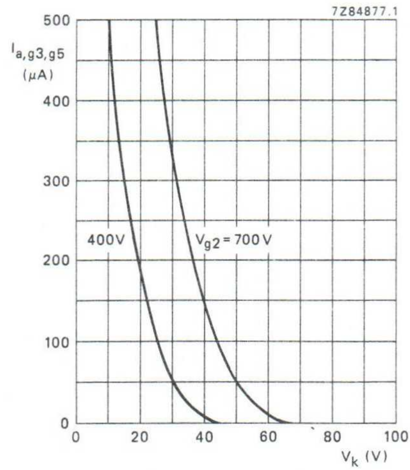
** Visual extinction of focused raster.



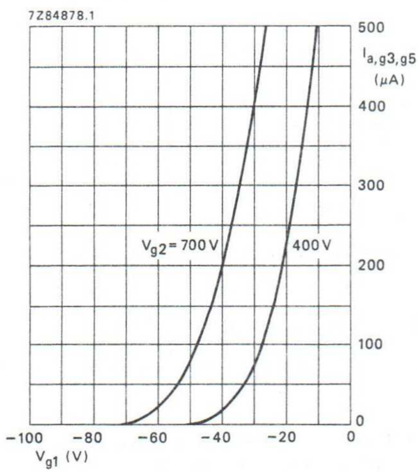
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.



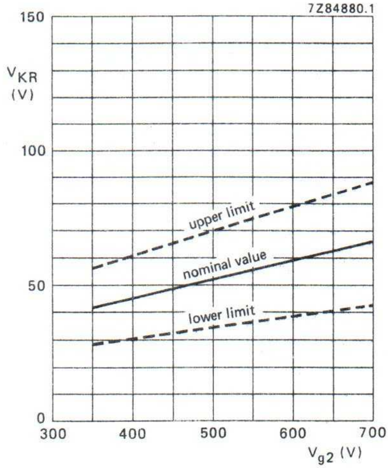
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

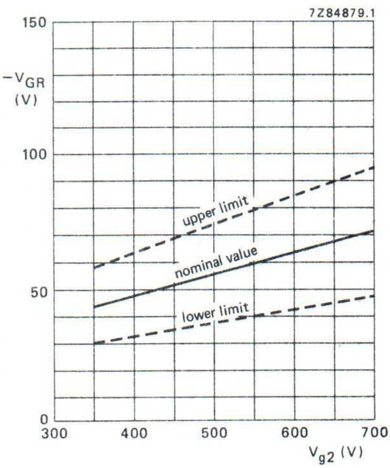


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

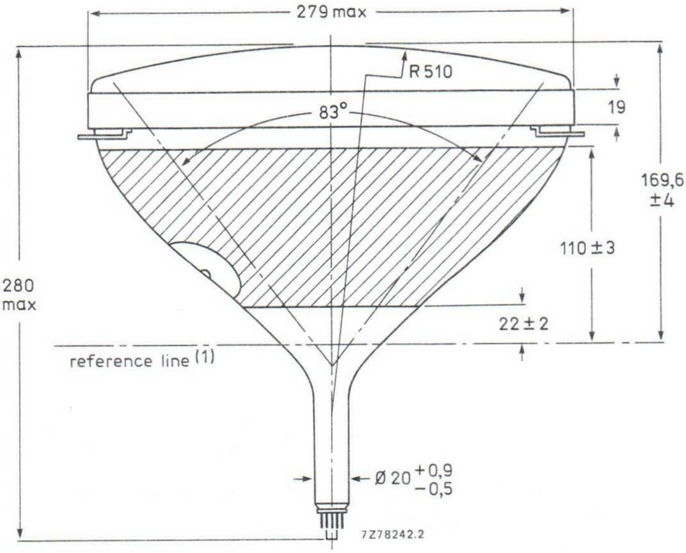


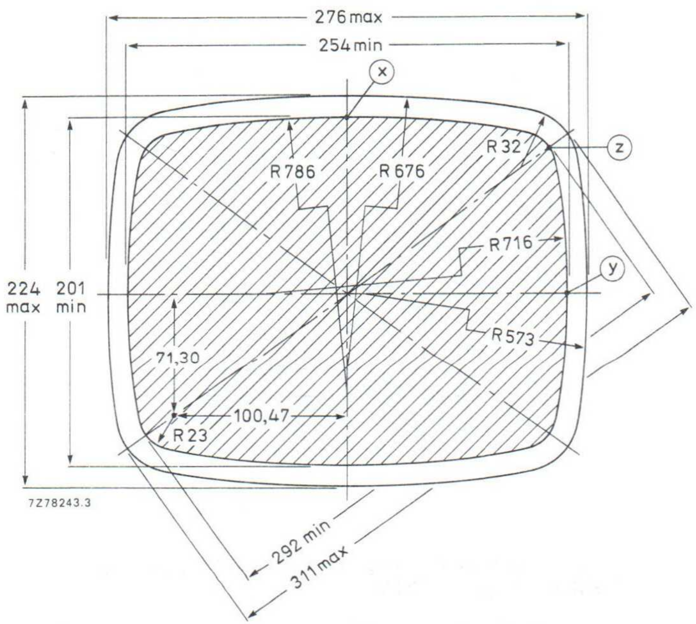
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

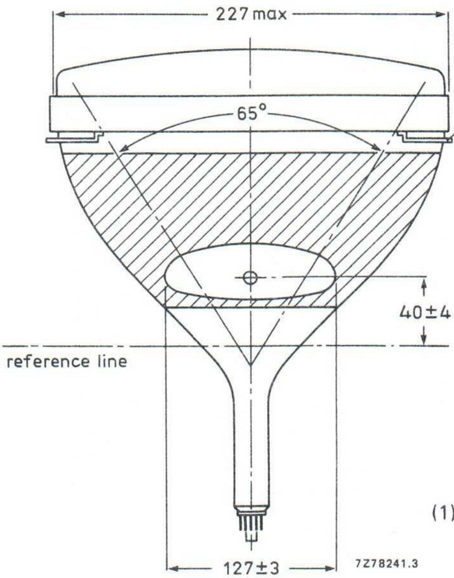
DIMENSIONAL DATA

Dimensions in mm

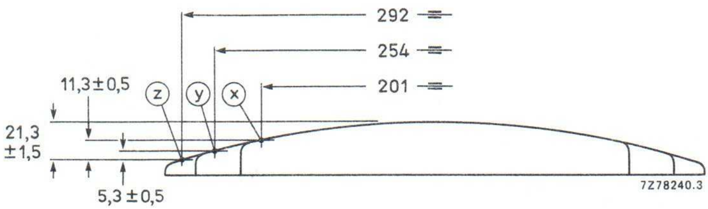


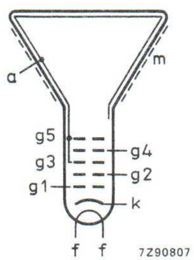


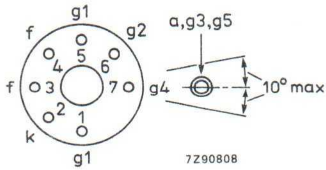
(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.



(1) The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.

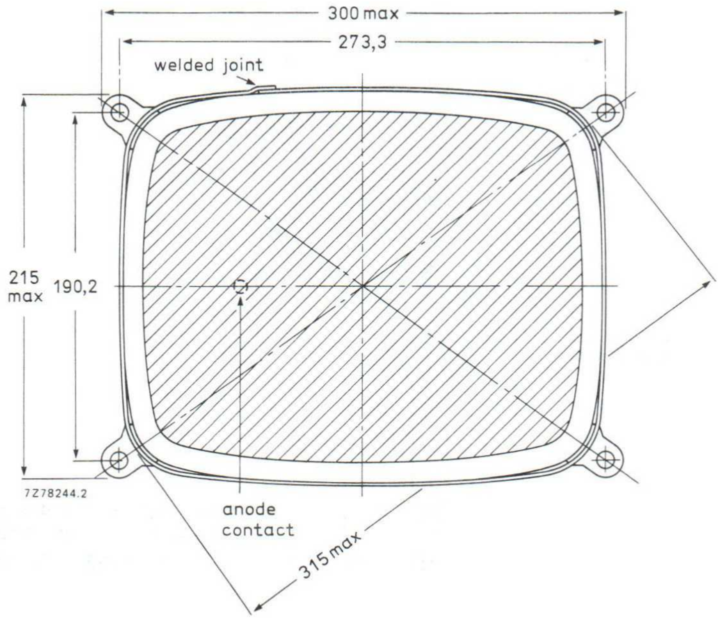


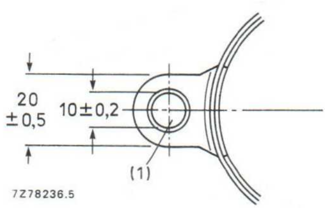


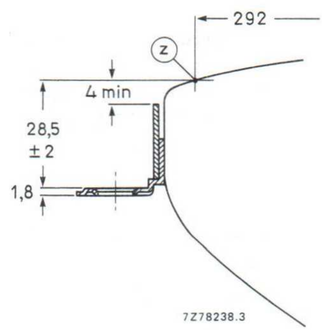


Front view and lug dimensions of tube M31-336

Dimensions in mm

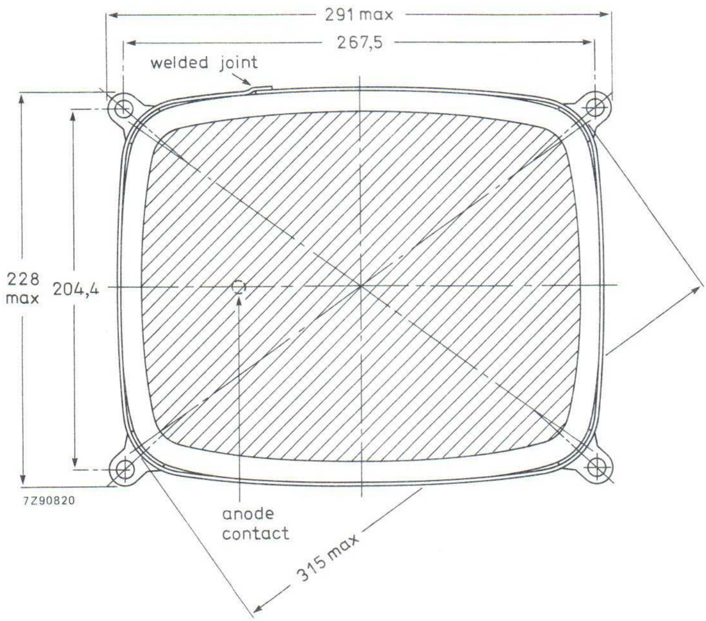


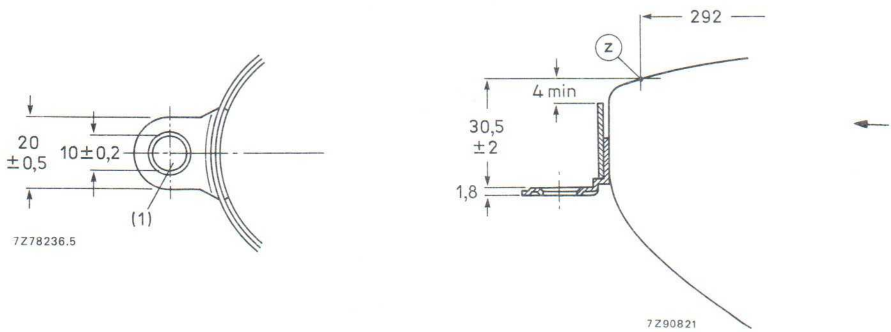




(1) The position of the mounting screws in the cabinet must be within a circle of 7 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 273,3 mm x 190,2 mm.

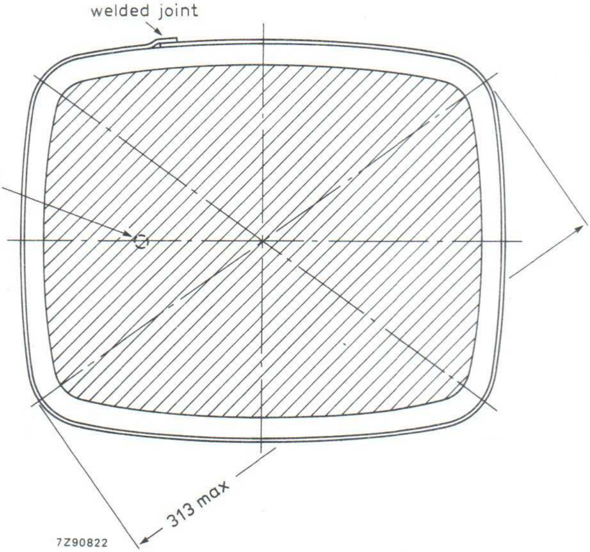
Front view and lug dimensions of tube M31-338

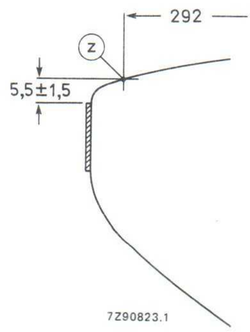




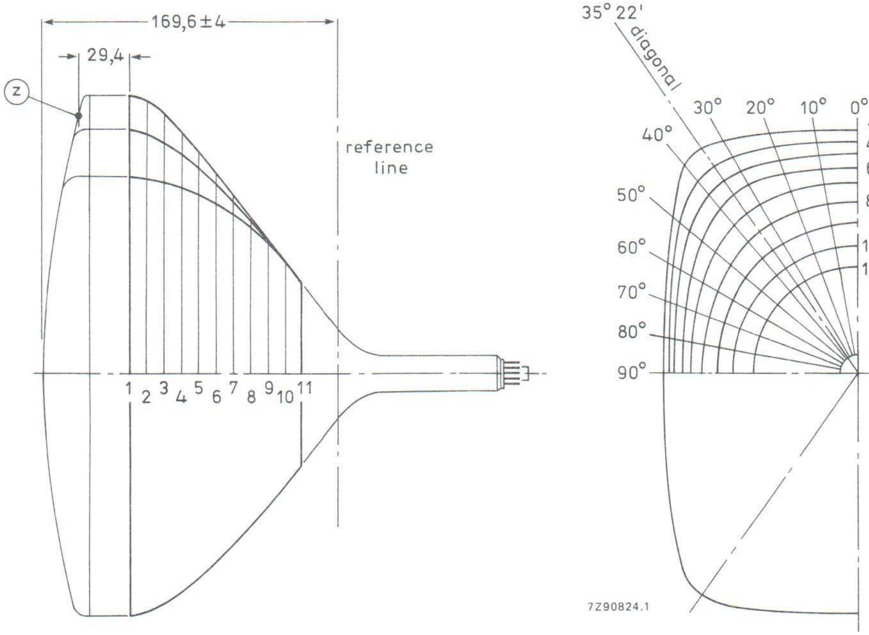
(1) The position of the mounting screws in the cabinet must be within a circle of 7 mm diameter drawn around the true geometrical positions, i.e. corners of a rectangle of 267,5 mm x 204,4 mm.

Front view of tube M31-350





Maximum cone contour



section	nom. distance from section 1	max. distance from centre 0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	138,3	139,9	145,0	153,9	156,6	154,7	138,9	126,3	118,2	113,7	112,3
2	10	136,5	138,1	143,2	151,5	154,4	152,6	137,5	125,0	116,9	112,4	110,9
3	20	131,8	133,4	138,1	145,1	147,5	146,2	133,8	122,1	114,3	110,0	108,6
4	30	125,2	126,6	130,6	136,0	137,5	136,6	127,9	117,8	110,7	106,6	105,3
5	40	117,0	118,2	121,3	124,8	125,6	125,0	119,6	112,1	106,1	102,5	101,3
6	50	107,9	108,8	111,0	113,1	113,5	113,2	110,2	105,2	100,6	97,6	96,6
7	60	98,1	98,7	100,0	101,1	101,3	101,2	99,8	97,2	94,3	92,0	91,2
8	70	87,7	88,0	88,5	89,0	89,1	89,1	88,8	87,9	86,6	85,5	84,9
9	80	76,6	76,5	76,5	76,6	76,8	76,9	77,1	77,3	77,4	77,3	77,2
10	90	64,6	64,4	64,1	64,1	64,2	64,3	64,8	65,5	66,3	66,9	67,3
11	99	51,1	51,1	51,1	51,1	51,1	51,1	51,1	51,1	51,1	51,1	51,1

HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 90° deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 3: 4 screen aspect ratio
- 635 mm radius of screen curvature
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	31 cm (12 in)
Overall length	max. 277 mm
Neck diameter	20 mm
Heating	12 V/130 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	12 kV
Resolution	approx. 1300 lines

APPLICATION

These high resolution tubes are for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.
The tubes can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

AVAILABLE VERSIONS

The following versions are available: M31-340, M31-342, M31-344 and M31-346.
Differences between the tubes can be found under 'Dimensional data'.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 61°
Interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 7 pF
Capacitance of external conductive coating to anode*	max. 1200 pF min. 450 pF
Capacitance of external conductive coating to anode**	max. 1050 pF min. 450 pF
Capacitance of anode to implosion protection hardware**	approx. 150 pF
Heater voltage	12 V
Heater current at 12 V	130 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 46%
tube with dark tinted face glass	approx. 34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.

** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 277 mm
Greatest dimensions of tube	
diagonal	321 mm
width	283 mm
height	222 mm
Minimum useful screen diremsions (projected)	
diagonal	295 mm
horizontal axis	257 mm
vertical axis	195 mm
area	478 cm^2
Implosion protection	T-band
Bulb	EIA-J310Z1, EIA-J310AJ1 or EIA-J99AG1
Bulb contact designation	IEC 67-III-2, EIAJ1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 2,9 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 15 kV min. 10 kV
Grid 4 (focusing electrode) voltage	−200 to + 1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 130 μA
peak value	max. 600 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	12 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current	
positive	max. 25 μA
negative	max. 25 μA
Grid 2 current	
positive	max. 5 μA
negative	max. 5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max. 1,0 MΩ
Impedance between cathode and heater	max. 0,1 MΩ
Grid 1 circuit resistance	max. 1,5 MΩ
Grid 1 circuit impedance	max. 0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	30 to 60 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	34 to 64 V**

RESOLUTION

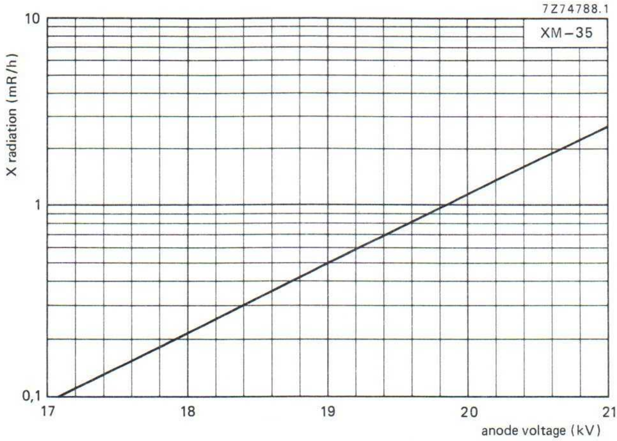
The resolution is approx. 1300 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 12 kV; phosphor type W, without anti-glare treatment, raster dimensions 216 mm x 162 mm.

X-RADIATION CHARACTERISTIC

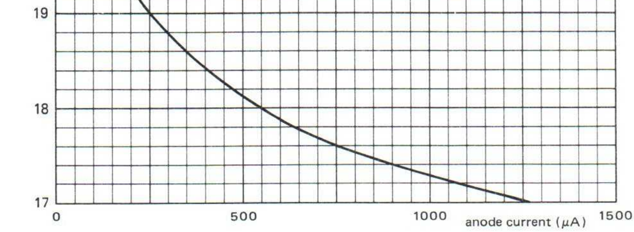
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 250 μA (peak), anode voltage = 12 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 216 mm x 162 mm:
line parabola 200 V,
field parabola 100 V.

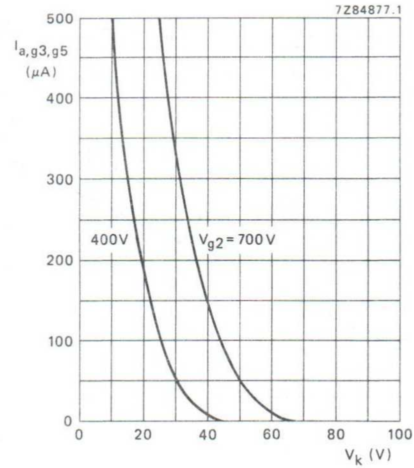
** Visual extinction of focused raster.



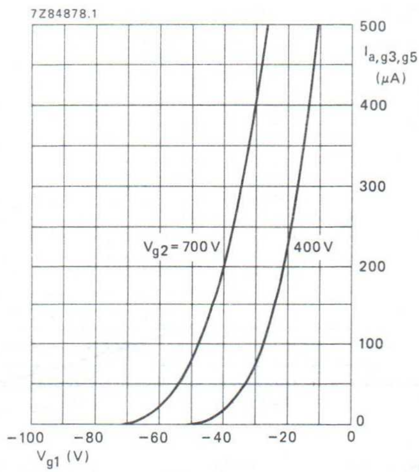
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.



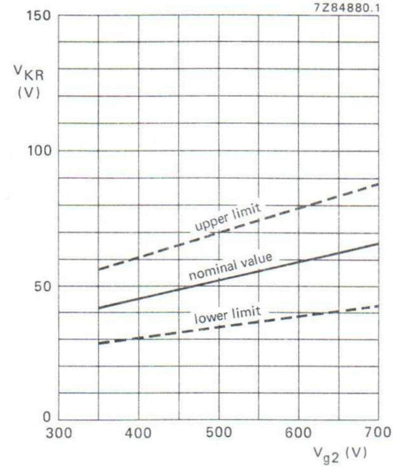
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

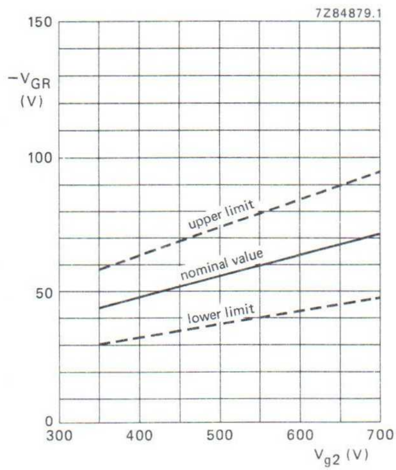


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5} = 12$ kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

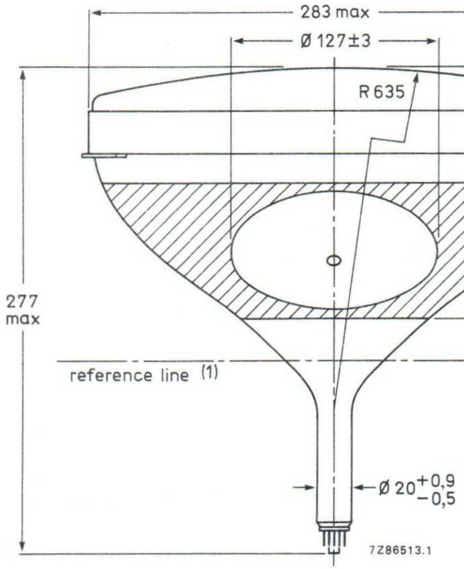


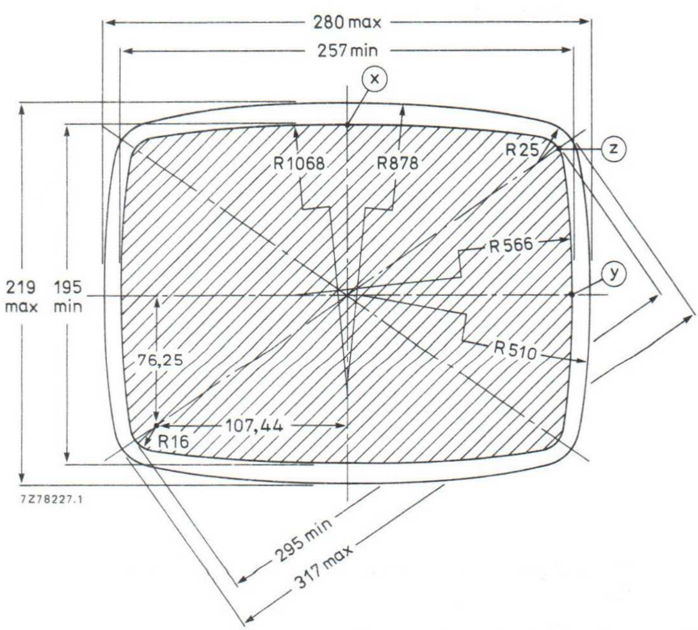
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5} = 12$ kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

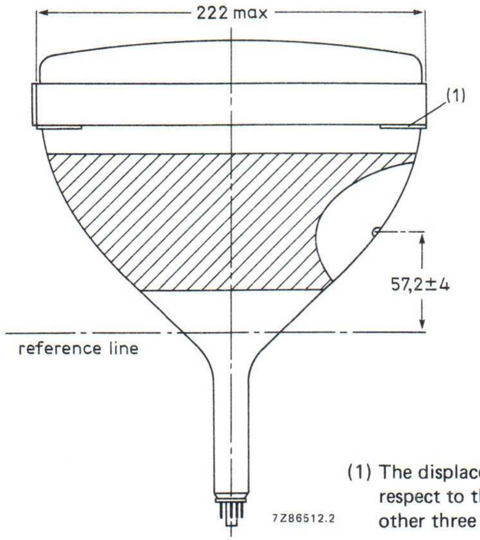
DIMENSIONAL DATA

Dimensions in mm

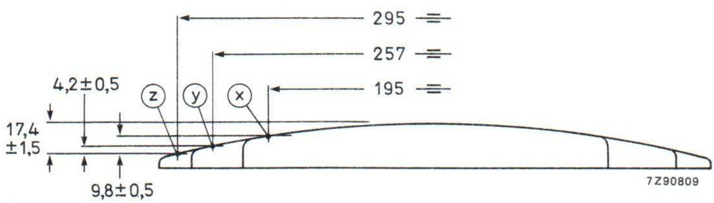


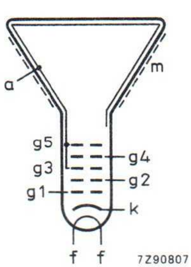


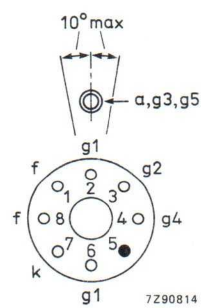
(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.



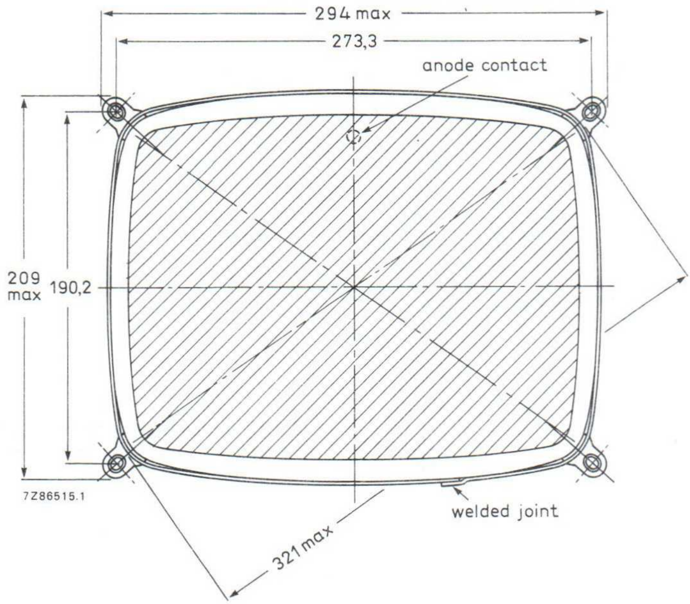
(1) The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.

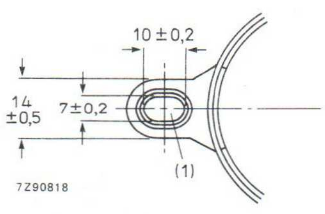


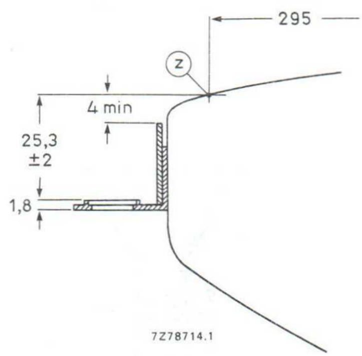




Front view and lug dimensions of tube M31-340

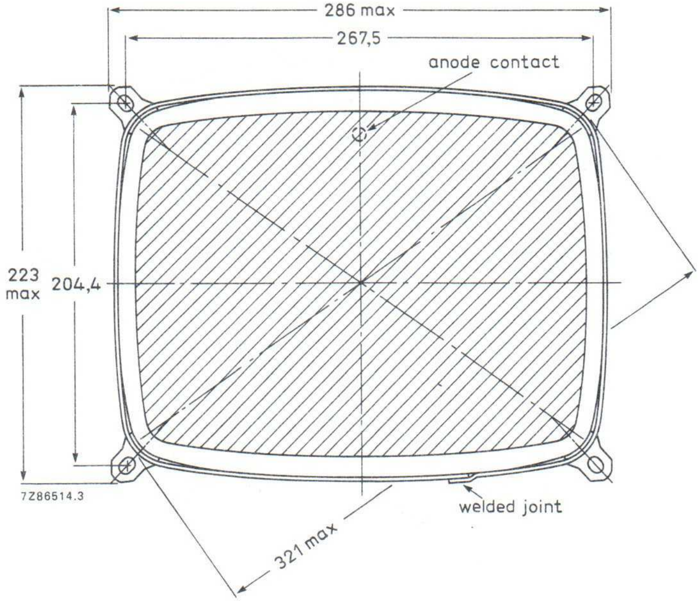


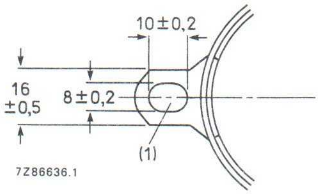


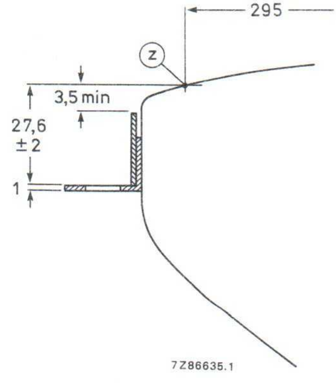


(1) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

Front view and lug dimensions of tube M31-342

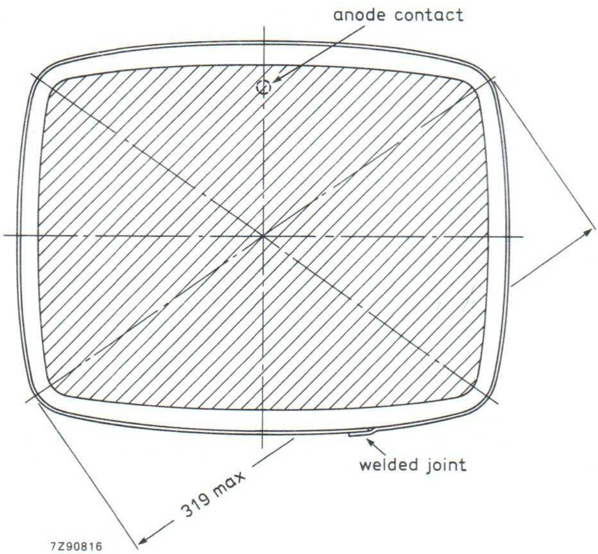




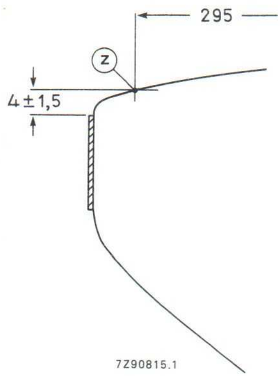


(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 267,5 mm x 204,4 mm.

Front view of tube M31-344

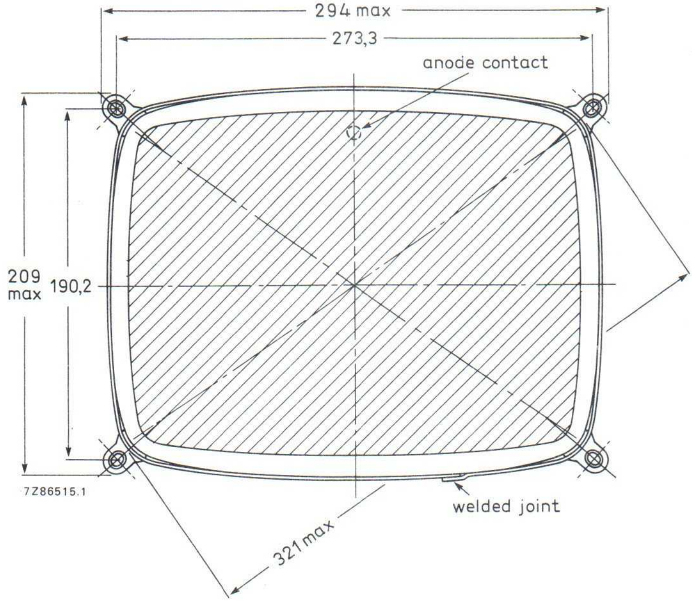


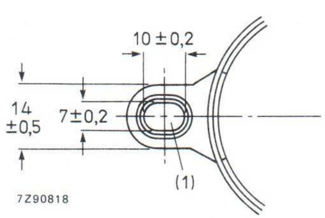
7Z90816

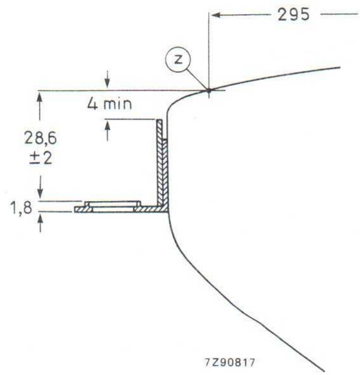


7Z90815.1

Front view and lug dimensions of tube M31-346

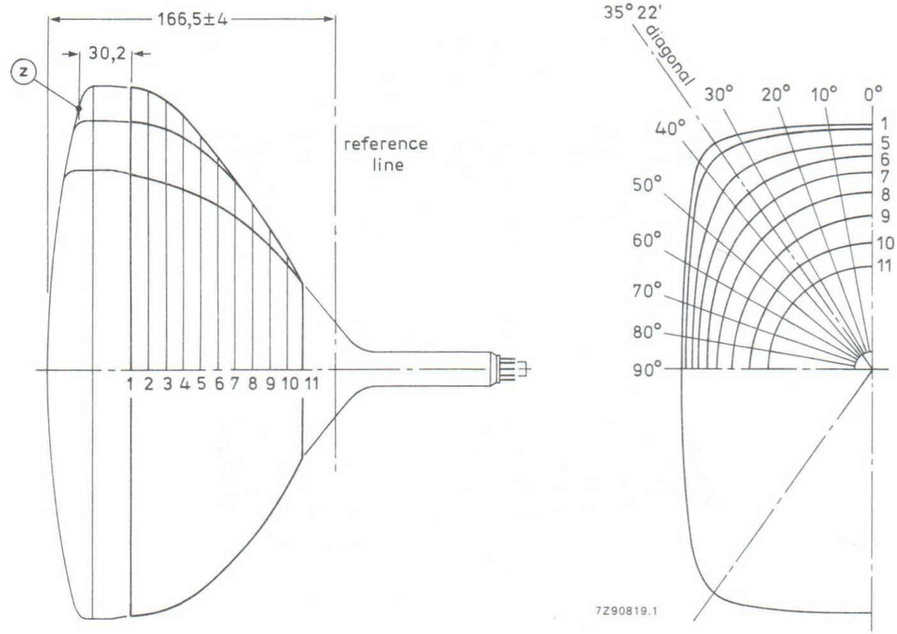






(1) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	140,6	142,4	147,9	156,8	160,4	156,9	139,3	126,1	117,5	112,7	111,2
2	10	139,8	141,6	147,0	155,5	158,5	154,4	136,8	123,7	115,2	110,5	109,0
3	20	137,8	139,4	144,4	151,9	153,6	149,5	133,0	120,4	112,3	107,8	106,4
4	30	133,5	135,0	139,3	144,8	145,1	141,6	127,7	116,3	108,7	104,5	103,1
5	40	126,9	128,1	131,3	134,2	133,6	130,9	120,7	110,9	104,2	100,4	99,1
6	50	117,9	118,8	120,9	122,1	121,1	119,2	112,1	104,5	98,7	95,3	94,2
7	60	107,2	107,9	109,1	109,3	108,5	107,1	102,3	96,8	92,1	89,1	88,1
8	70	95,5	95,9	96,4	96,0	95,2	94,2	91,2	87,5	84,1	81,8	80,9
9	80	82,4	82,5	82,4	81,8	81,2	80,5	78,7	76,6	74,5	73,0	72,4
10	90	67,5	67,5	67,2	66,6	66,3	65,9	65,0	64,1	63,2	62,5	62,2
11	99	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3

HIGH RESOLUTION MONOCHROME DISPLAY TUBE

- For Data Graphic Displays
- 90° deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 3:4 screen aspect ratio
- 635 mm radius of screen curvature
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	31 cm (12 in)
Overall length	max. 277 mm
Neck diameter	20 mm
Heating	12 V/130 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	12 kV
Resolution	approx. 1300 lines

APPLICATION

This high resolution tube is for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.
The tube can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 61°
Interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 7 pF
Capacitance of external conductive coating to anode*	max. 1200 pF min. 450 pF
Capacitance of external conductive coating to anode**	max. 1050 pF min. 450 pF
Capacitance of anode to implosion protection hardware**	approx. 150 pF
Heater voltage	12 V
Heater current at 12 V	130 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 46%
tube with dark tinted face glass	approx. 34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.

** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (See also the figures under Dimensional Data)

Overall length	max. 277 mm
Greatest dimensions of tube	
diagonal	321 mm
width	283 mm
height	222 mm
Minimum useful screen dimensions (projected)	
diagonal	295 mm
horizontal axis	257 mm
vertical axis	195 mm
area	478 cm^2
Implosion protection	T-band
Bulb	EIA-J310Z1, EIA-J310AJ1 or EIA-J99AG1 ←
Bulb contact designation	IEC 67-III-2, EIAJ1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 2,9 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 15 kV min. 10 kV
Grid 4 (focusing electrode) voltage	−200 to + 1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 130 μA
peak value	max. 600 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	12 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current	
positive	max. 25 μA
negative	max. 25 μA
Grid 2 current	
positive	max. 5 μA
negative	max. 5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max. 1,0 MΩ
Impedance between cathode and heater	max. 0,1 MΩ
Grid 1 circuit resistance	max. 1,5 MΩ
Grid 1 circuit impedance	max. 0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	30 to 60 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	34 to 64 V**

RESOLUTION

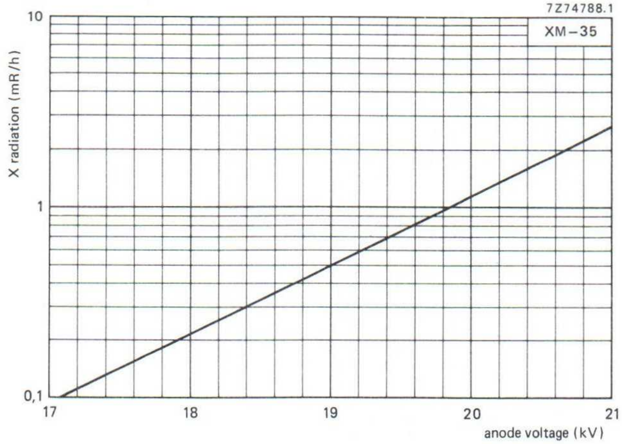
The resolution is approx. 1300 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 12 kV; phosphor type W, without anti-glare treatment, raster dimensions 216 mm x 162 mm.

X-RADIATION CHARACTERISTIC

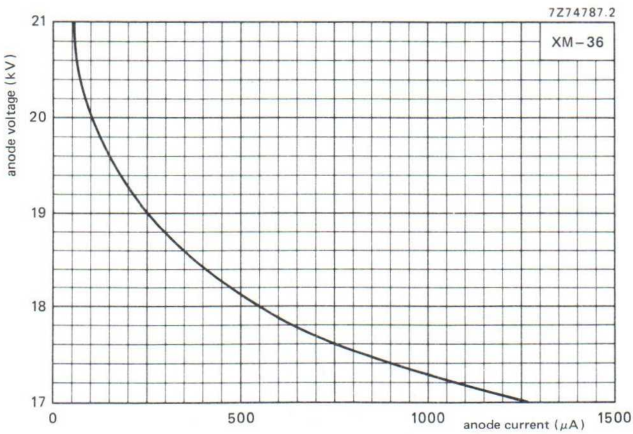
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 250 μA (peak), anode voltage = 12 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 216 mm x 162 mm:
line parabola 200 V,
field parabola 100 V.

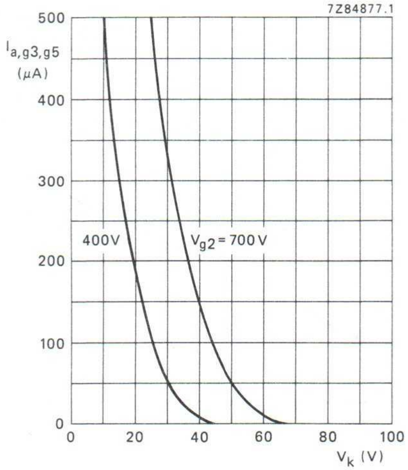
** Visual extinction of focused raster.



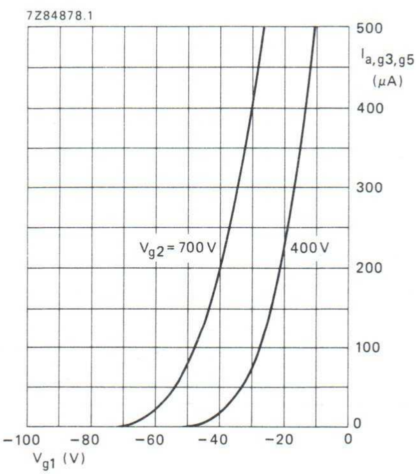
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.



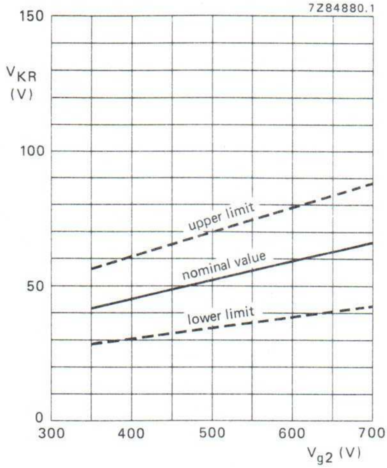
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

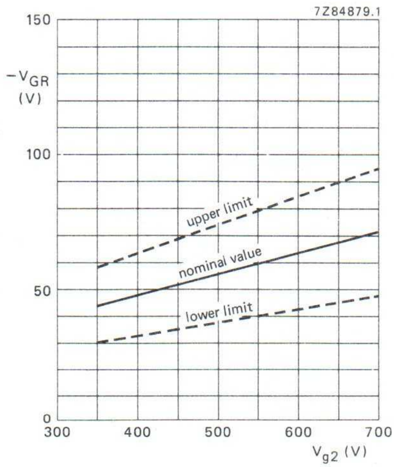


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage. Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}$$

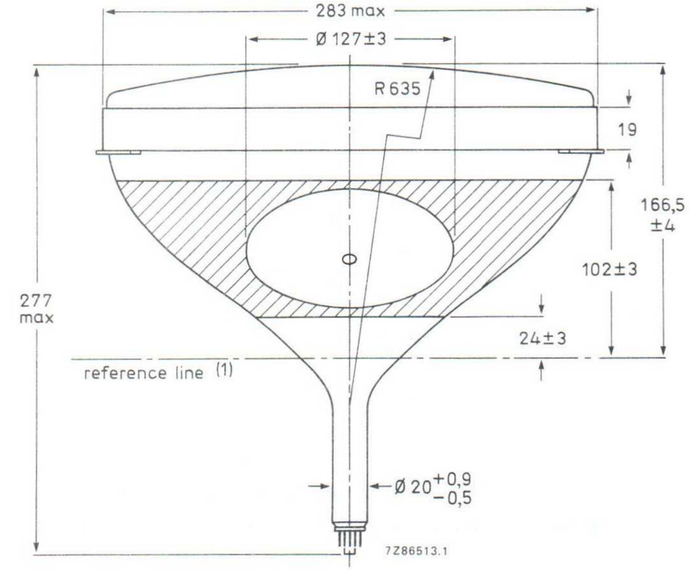


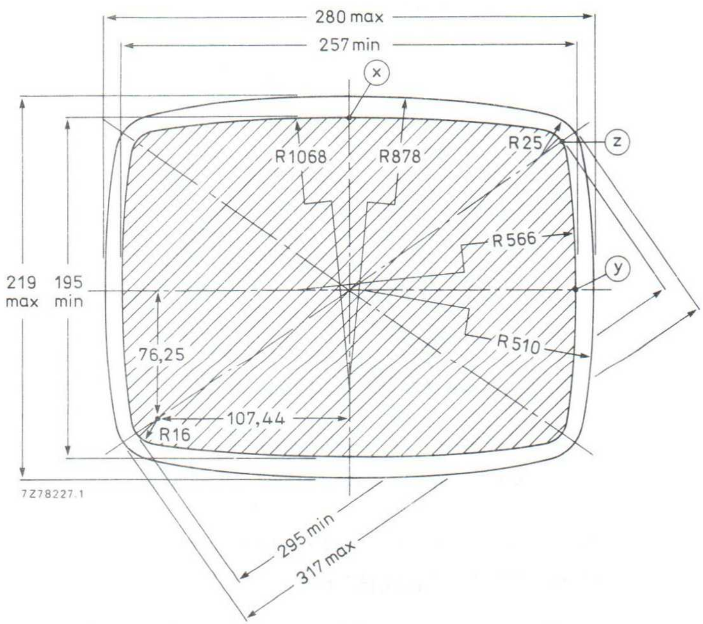
Limits of grid 1 cut-off voltage as a function of grid 2 voltage. Grid drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}$$

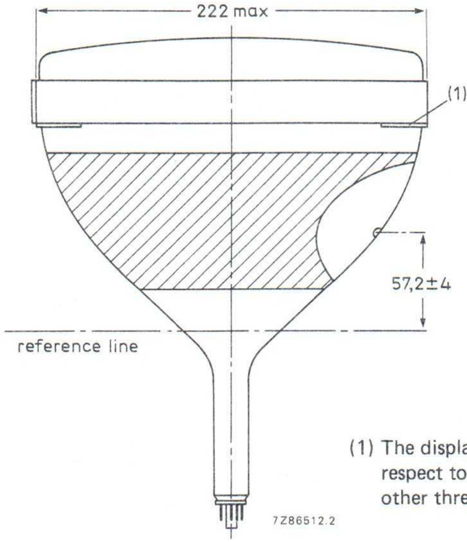
DIMENSIONAL DATA

Dimensions in mm

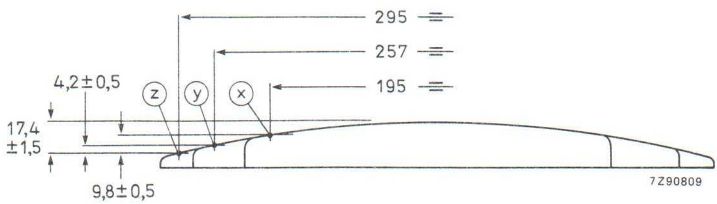


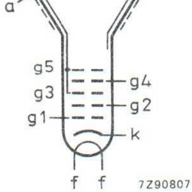


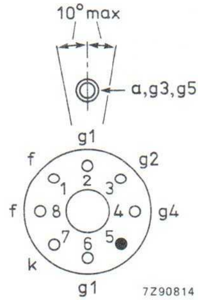
(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.



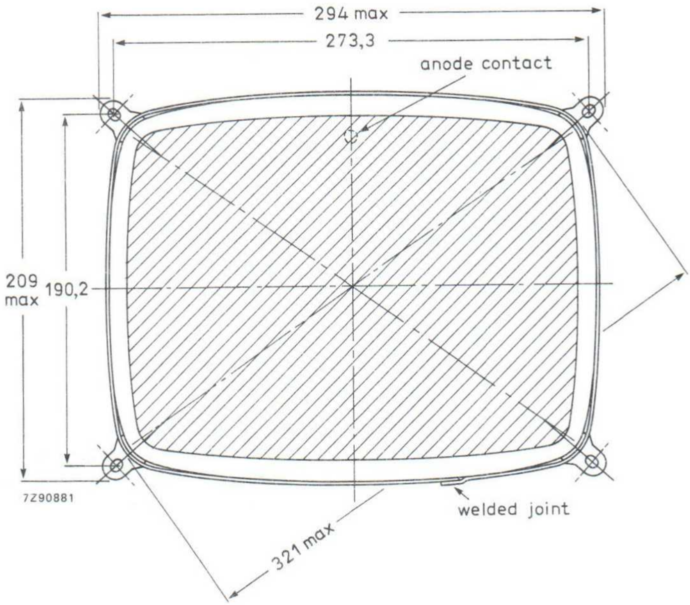
(1) The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.



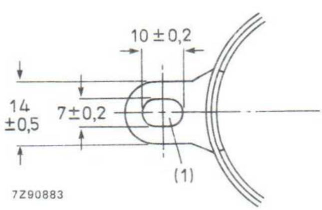




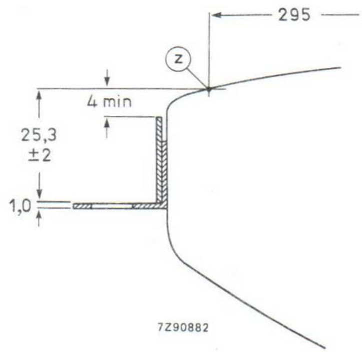
Front view and lug dimensions



7Z90881



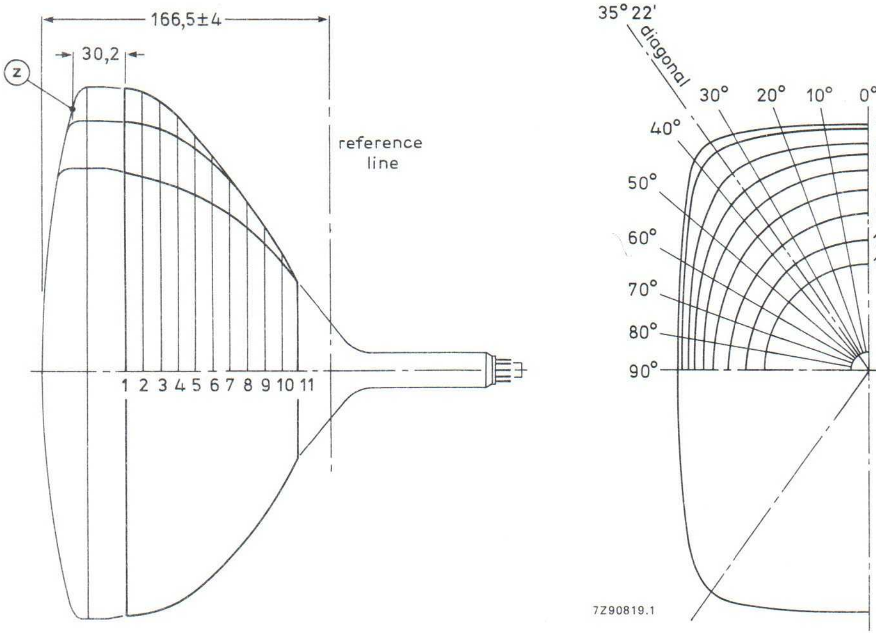
7Z90883



7Z90882

(1) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	140,6	142,4	147,9	156,8	160,4	156,9	139,3	126,1	117,5	112,7	111,2
2	10	139,8	141,6	147,0	155,5	158,5	154,4	136,8	123,7	115,2	110,5	109,0
3	20	137,8	139,4	144,4	151,9	153,6	149,5	133,0	120,4	112,3	107,8	106,4
4	30	133,5	135,0	139,3	144,8	145,1	141,6	127,7	116,3	108,7	104,5	103,1
5	40	126,9	128,1	131,3	134,2	133,6	130,9	120,7	110,9	104,2	100,4	99,1
6	50	117,9	118,8	120,9	122,1	121,1	119,2	112,1	104,5	98,7	95,3	94,2
7	60	107,2	107,9	109,1	109,3	108,5	107,1	102,3	96,8	92,1	89,1	88,1
8	70	95,5	95,9	96,4	96,0	95,2	94,2	91,2	87,5	84,1	81,8	80,9
9	80	82,4	82,5	82,4	81,8	81,2	80,5	78,7	76,6	74,5	73,0	72,4
10	90	67,5	67,5	67,2	66,6	66,3	65,9	65,0	64,1	63,2	62,5	62,2
11	99	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3

HIGH RESOLUTION MONOCHROME DISPLAY TUBE

- For Data Graphic Displays
- 90^{o} deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 4:5 screen aspect ratio
- 510 mm radius of screen curvature
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90^{o}
Face diagonal	31 cm (12 in)
Overall length	max. 280 mm
Neck diameter	20 mm
Heating	12 V/75 mA
Grid 2 voltage	400 V
Anode voltage	12 kV
Resolution	approx. 1000 lines

APPLICATION

This high resolution tube is for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tube can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 83°
vertical	approx. 65°
Direct interelectrode capacitances	
cathode to all other electrodes	max. 5 pF
grid 1 to all other electrodes	max. 6 pF
Capacitance of external conductive coating to anode*	max. 1050 pF
	min. 450 pF
Capacitance of external conductive coating to anode**	max. 900 pF
	min. 450 pF
Capacitance of anode to implosion protection hardware**	approx. 150 pF
Heater voltage	12 V
Heater current at 12 V	75 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 50%
tube with dark tinted face glass	approx. 34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 280 mm
Greatest dimensions of tube	
diagonal	315 mm
width	279 mm
height	227 mm
Minimum useful screen dimensions (projected)	
diagonal	292 mm
horizontal axis	254 mm
vertical axis	201 mm
area	484 cm^2
Implosion protection	T-band
Bulb	EIA-J310N1 or EIA-J310AP1
Bulb contact designation	IEC67-III-2, EIAJ1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 2,9 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 15 kV min. 10 kV
Grid 4 (focusing electrode) voltage	−550 to + 1100 V
Grid 2 voltage	max. 550 V
Anode current	
long-term average value	max. 100 μA
peak value	max. 150 μA
Cathode voltage, positive peak value	max. 220 V
Heater voltage	12 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	30 to 74 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	33 to 81 V**

RESOLUTION

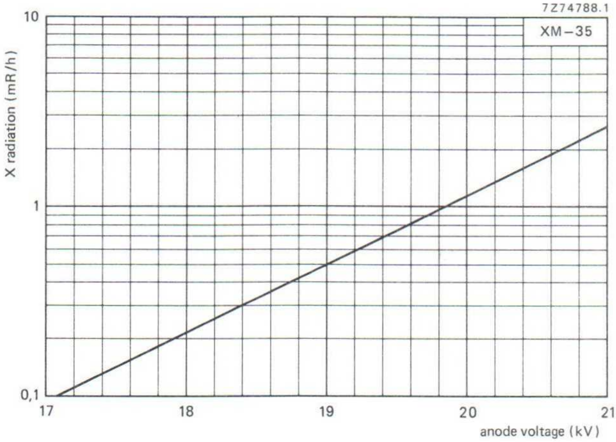
The resolution is approx. 1000 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 550 V, anode voltage = 12 kV; phosphor type W, without anti-glare treatment, raster dimensions 216 mm x 162 mm.

X-RADIATION CHARACTERISTIC

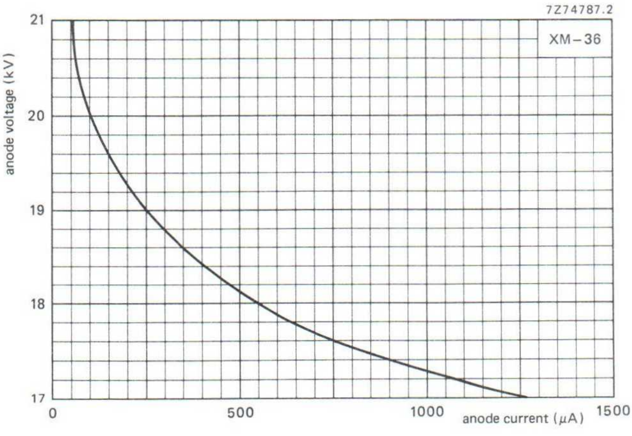
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 12 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 216 mm x 162 mm:
line parabola 200 V,
field parabola 100 V.

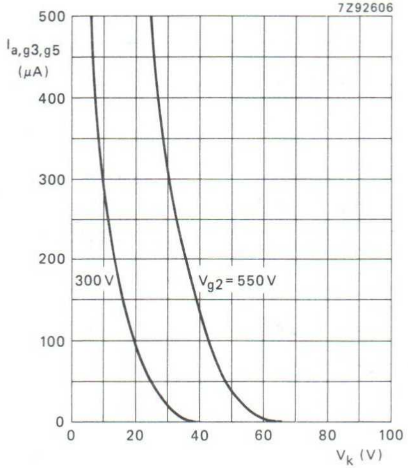
** Visual extinction of focused raster.



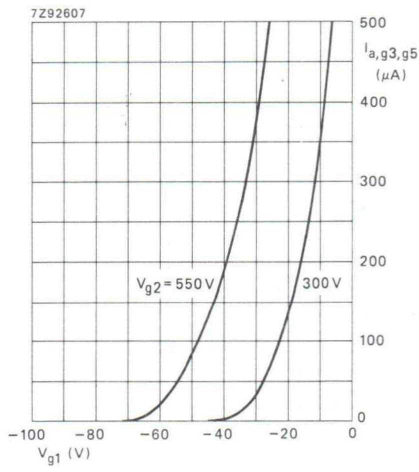
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.



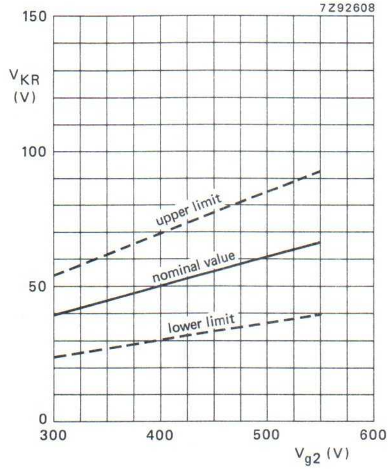
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

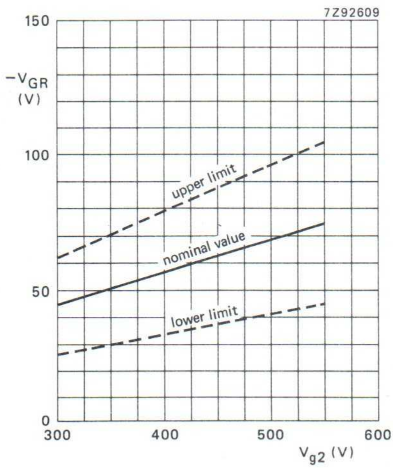


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

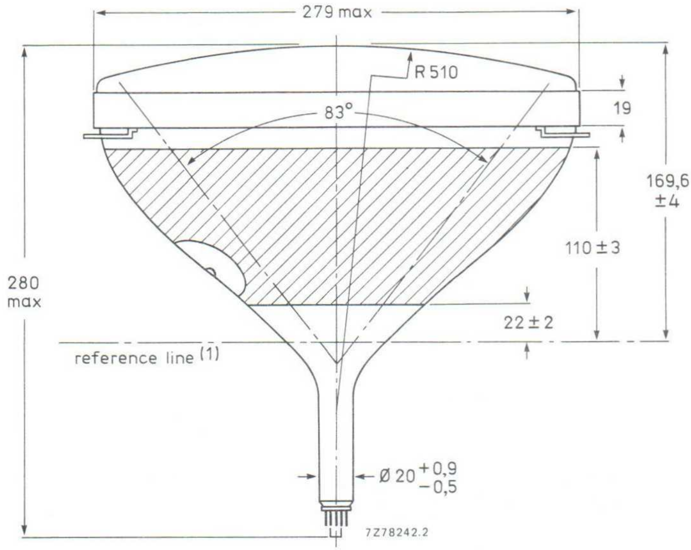


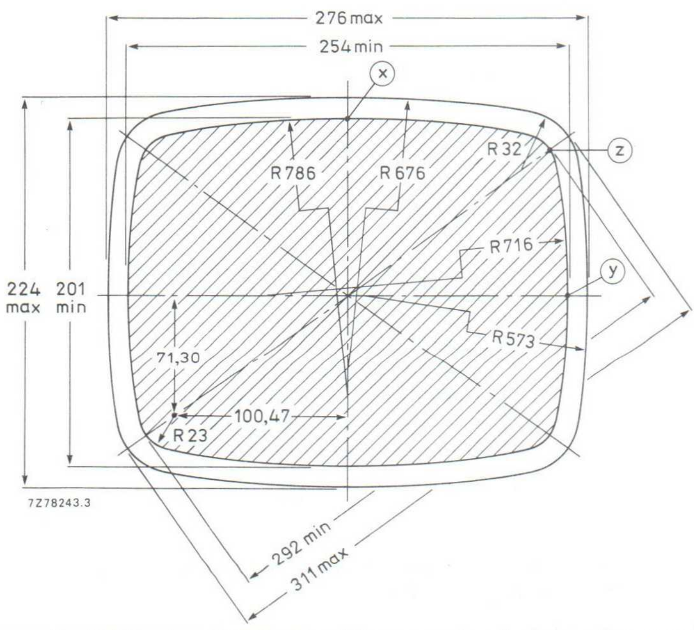
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

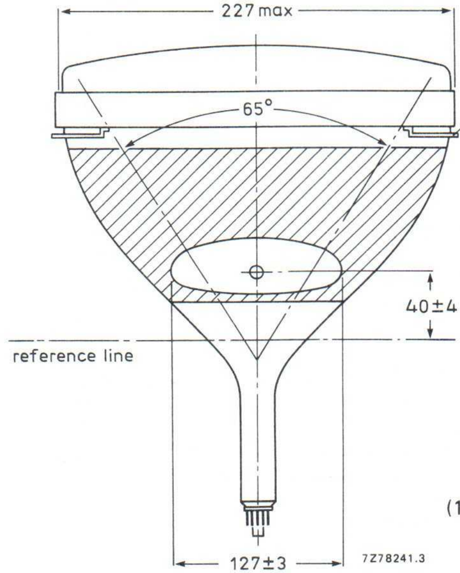
DIMENSIONAL DATA

Dimensions in mm



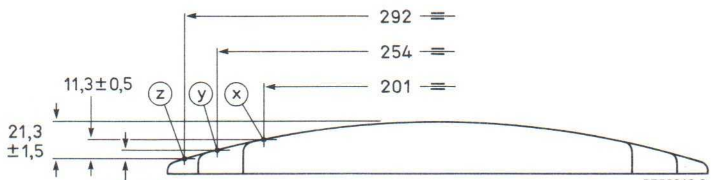


(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.

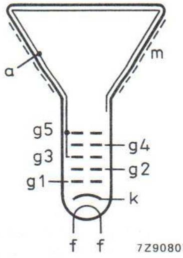


7Z78241.3

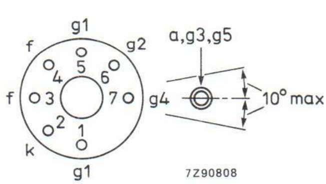
(1) The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.



7Z78240.3

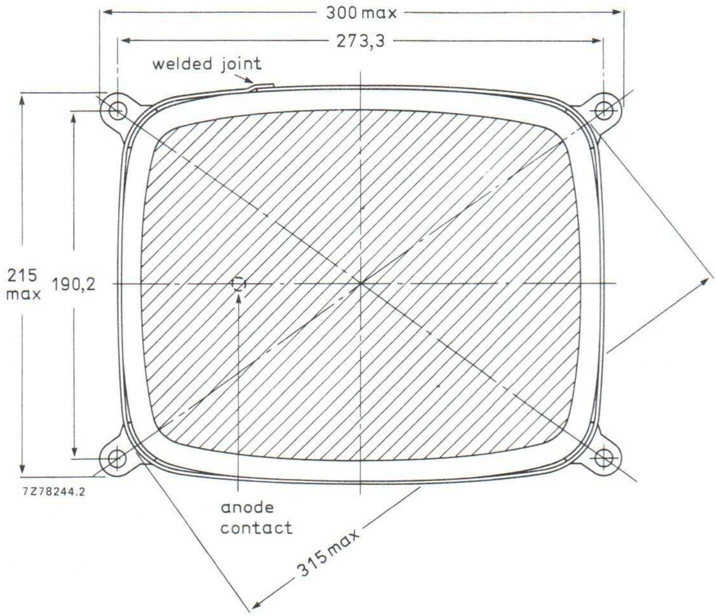


7Z90807

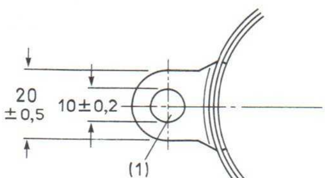


7Z90808

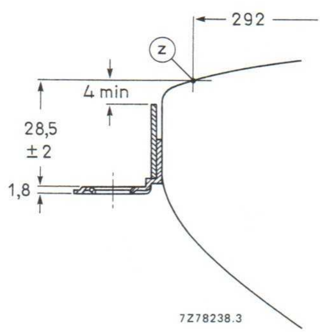
Front-view and lug dimensions of tube



7Z78244.2



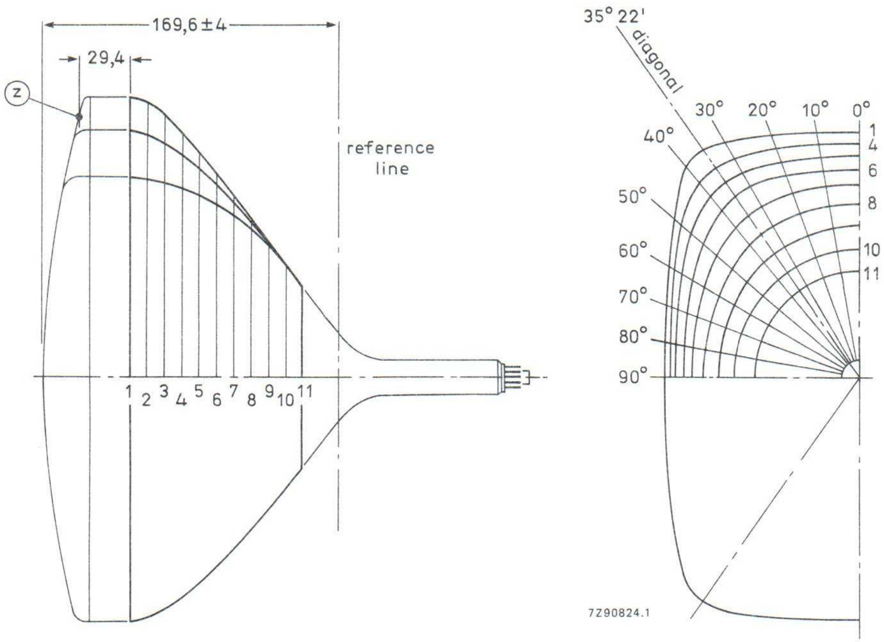
7Z78236.4



7Z78238.3

(1) The position of the mounting screws in the cabinet must be within a circle of 7 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 273,3 mm x 190,2 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	138,3	139,9	145,0	153,9	156,6	154,7	138,9	126,3	118,2	113,7	112,3
2	10	136,5	138,1	143,2	151,5	154,4	152,6	137,5	125,0	116,9	112,4	110,9
3	20	131,8	133,4	138,1	145,1	147,5	146,2	133,8	122,1	114,3	110,0	108,6
4	30	125,2	126,6	130,6	136,0	137,5	136,6	127,9	117,8	110,7	106,6	105,3
5	40	117,0	118,2	121,3	124,8	125,6	125,0	119,6	112,1	106,1	102,5	101,3
6	50	107,9	108,8	111,0	113,1	113,5	113,2	110,2	105,2	100,6	97,6	96,6
7	60	98,1	98,7	100,0	101,1	101,3	101,2	99,8	97,2	94,3	92,0	91,2
8	70	87,7	88,0	88,5	89,0	89,1	89,1	88,8	87,9	86,6	85,5	84,9
9	80	76,6	76,5	76,5	76,6	76,8	76,9	77,1	77,3	77,4	77,3	77,2
10	90	64,6	64,4	64,1	64,1	64,2	64,3	64,8	65,5	66,3	66,9	67,3
11	99	51,1	51,1	51,1	51,1	51,1	51,1	51,1	51,1	51,1	51,1	51,1

HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 90° deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 3:4 screen aspect ratio
- 635 mm radius of screen curvature
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	31 cm (12 in)
Overall length	max. 277 mm
Neck diameter	20 mm
Heating	12 V/75 mA
Grid 2 voltage	400 V
Anode voltage	12 kV
Resolution	approx. 1000 lines

APPLICATION

These high resolution tubes are for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tubes can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

AVAILABLE VERSIONS

The following versions are available: M31-362 and M31-364. Differences between the tubes can be found under 'Dimensional Data'.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 61°
Interelectrode capacitances	
cathode to all other electrodes	max. 5 pF
grid 1 to all other electrodes	max. 6 pF
Capacitance of external conductive coating to anode*	max. 1200 pF
	min. 450 pF
Capacitance of external conductive coating to anode**	max. 1050 pF
	min. 450 pF
Capacitance of anode to implosion protective hardware**	approx. 150 pF
Heater voltage	12 V
Heater current at 12 V	75 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 46%
tube with dark tinted face glass	approx. 34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (See also the figures under Dimensional Data)

Overall length	max. 277 mm
Greatest dimensions of tube	
diagonal	321 mm
width	283 mm
height	222 mm
Minimum useful screen dimensions (projected)	
diagonal	295 mm
horizontal axis	257 mm
vertical axis	195 mm
area	478 cm^2
Implosion protection	T-band
Bulb	EIA-J310Z1, EIA-J310AJ1 or EIA-J99AG1
Bulb contact designation	IEC 67-III-2, EIA-J1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 2,9 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 15 kV min. 10 kV
Grid 4 (focusing electrode) voltage	−550 to + 1100 V
Grid 2 voltage	max. 550 V
Anode current	
long-term average value	max. 100 μA
peak value	max. 150 μA
Cathode voltage, positive peak value	max. 220 V
Heater voltage	12 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXUMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	30 to 74 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	33 to 81 V**

RESOLUTION

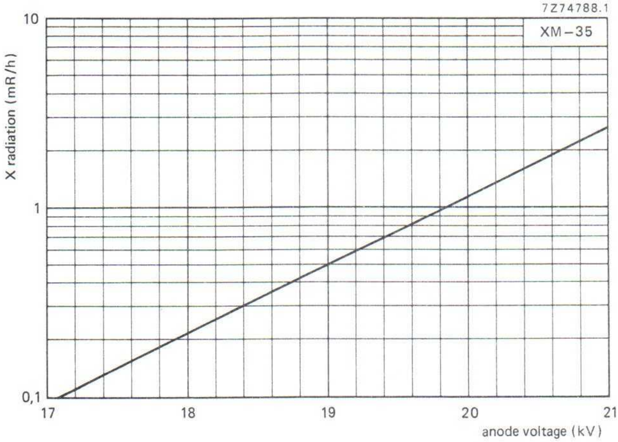
The resolution is approx. 1000 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 550 V, anode voltage = 12 kV; phosphor type W, without anti-glare treatment, raster dimensions 216 mm x 162 mm.

X-RADIATION CHARACTERISTIC

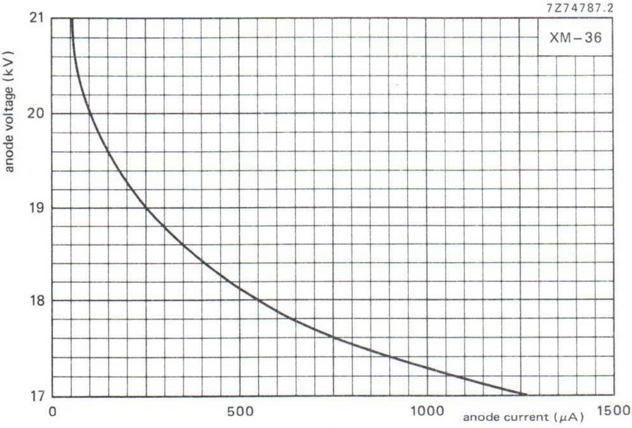
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 12 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 216 mm x 162 mm:
line parabola 200 V,
field parabola 100 V.

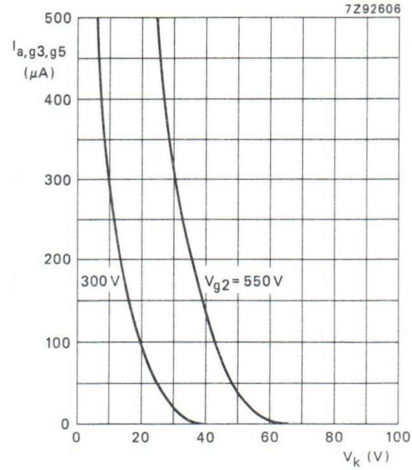
** Visual extinction of focused raster.



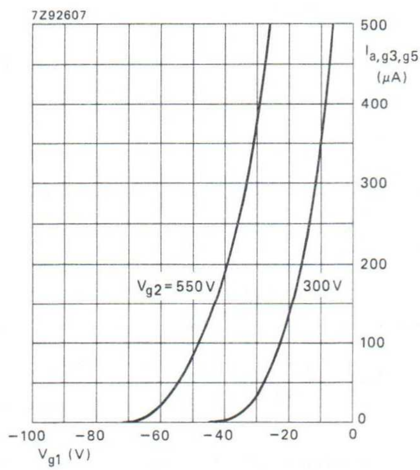
X-radiation limit curve according to JEDEC 94, at a constant anode current of 250 μA, measured according to TEPAC103A.



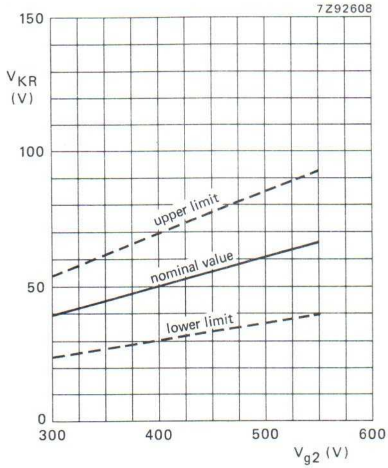
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

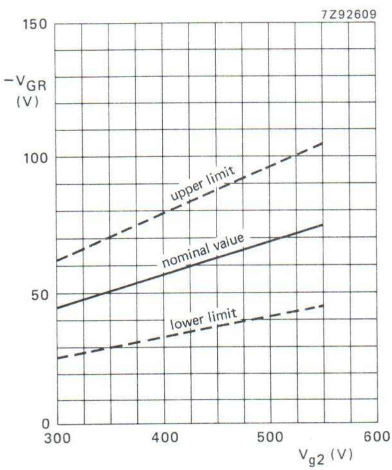


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

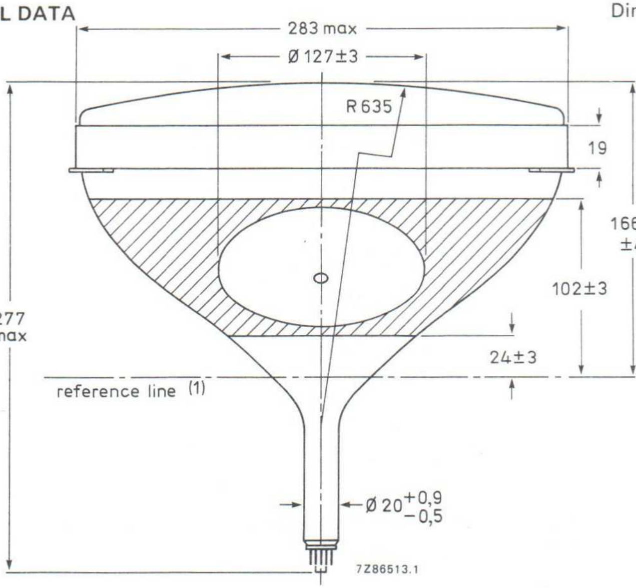


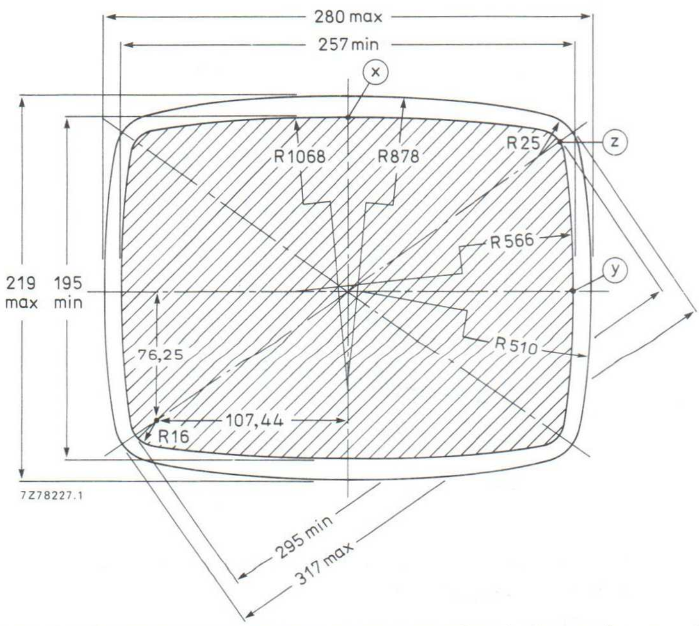
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

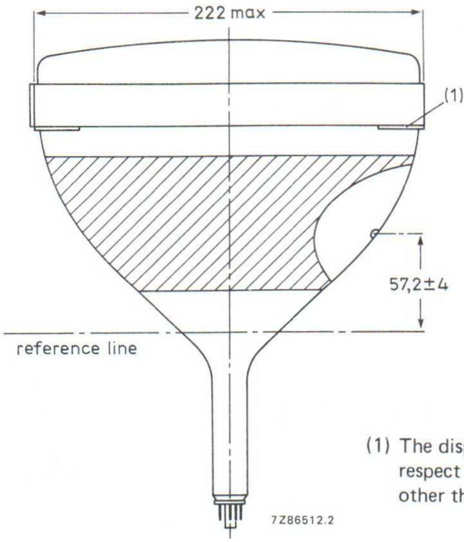
DIMENSIONAL DATA

Dimensions in mm

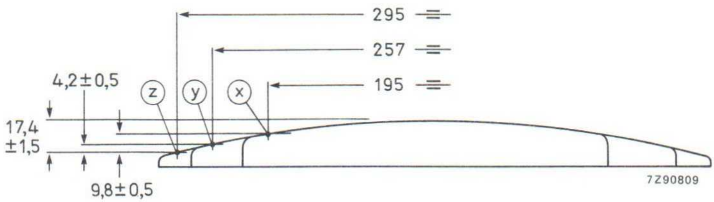


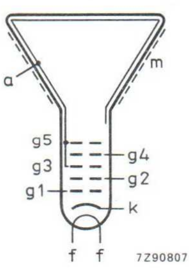


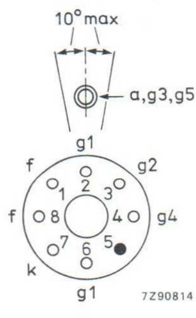
(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.



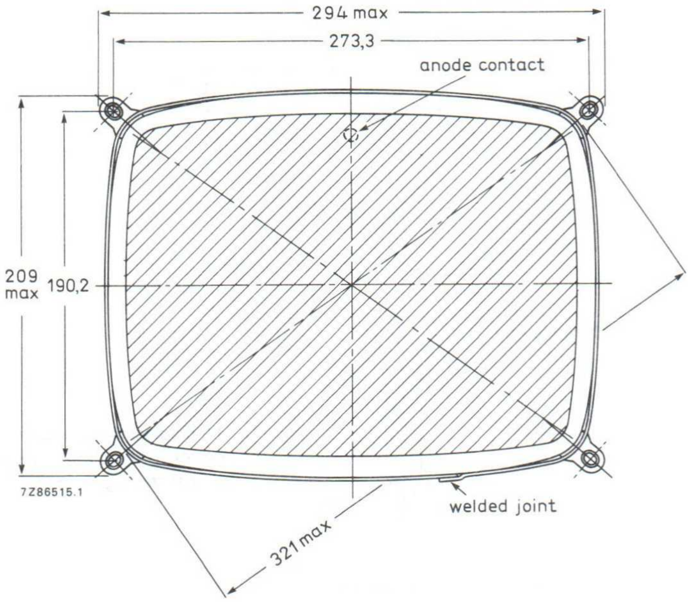
(1) The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.



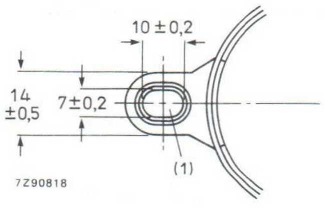




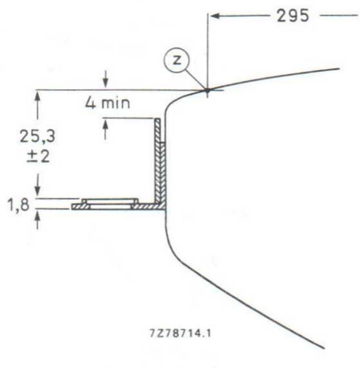
Front view and lug dimensions of tube M31-362



7Z86515.1



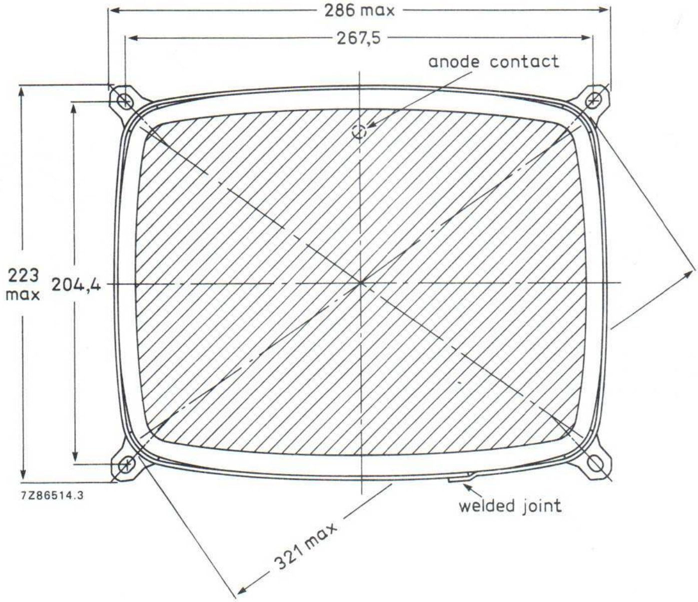
7Z90818

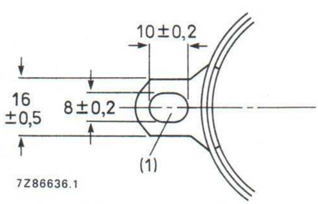


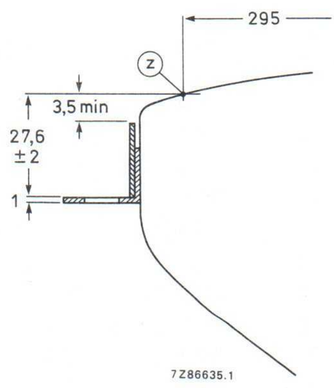
7Z78714.1

(1) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

Front view and lug dimensions of tube M31-364

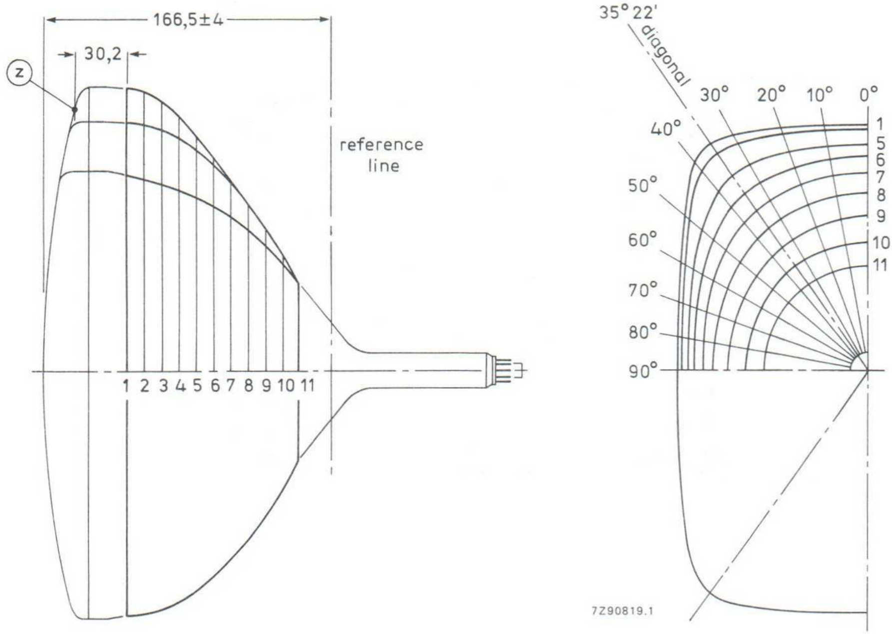






(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 267,5 mm x 204,4 mm.

→ **Maximum cone contour**



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	140,6	142,4	147,9	156,8	160,4	156,9	139,3	126,1	117,5	112,7	111,2
2	10	139,8	141,6	147,0	155,5	158,5	154,4	136,8	123,7	115,2	110,5	109,0
3	20	137,8	139,4	144,4	151,9	153,6	149,5	133,0	120,4	112,3	107,8	106,4
4	30	133,5	135,0	139,3	144,8	145,1	141,6	127,7	116,3	108,7	104,5	103,1
5	40	126,9	128,1	131,3	134,2	133,6	130,9	120,7	110,9	104,2	100,4	99,1
6	50	117,9	118,8	120,9	122,1	121,1	119,2	112,1	104,5	98,7	95,3	94,2
7	60	107,2	107,9	109,1	109,3	108,5	107,1	102,3	96,8	92,1	89,1	88,1
8	70	95,5	95,9	96,4	96,0	95,2	94,2	91,2	87,5	84,1	81,8	80,9
9	80	82,4	82,5	82,4	81,8	81,2	80,5	78,7	76,6	74,5	73,0	72,4
10	90	67,5	67,5	67,2	66,6	66,3	65,9	65,0	64,1	63,2	62,5	62,2
11	99	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3

HIGH RESOLUTION MONOCHROME DISPLAY TUBE

- For Data Graphic Displays
- 90° deflection angle
- 31 cm (12 in) face diagonal; rectangular glass
- 3 : 4 screen aspect ratio
- 635 mm radius of screen curvature
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	31 cm (12 in)
Overall length	max. 277 mm
Neck diameter	20 mm
Heating	12 V/75 mA
Grid 2 voltage	400 V
Anode voltage	12 kV
Resolution	approx. 1000 lines

APPLICATION

This high resolution tube is for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tube can be supplied with different phosphors and anti-reflective treatments, see ''High resolution monochrome display tubes, General''.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 78°
vertical	approx. 61°
Interelectrode capacitances	
cathode to all other electrodes	max. 5 pF
grid 1 to all other electrodes	max. 6 pF
Capacitance of external conductive coating to anode*	max. 1200 pF
	min. 450 pF
Capacitance of external conductive coating to anode**	max. 1050 pF
	min. 450 pF
Capacitance of anode to implosion protective hardware**	approx. 150 pF
Heater voltage	12 V
Heater current at 12 V	75 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 46%
tube with dark tinted face glass	approx. 34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (See also the figures under Dimensional Data)

Overall length	max. 277 mm
Greatest dimensions of tube	
diagonal	321 mm
width	283 mm
height	222 mm
Minimum useful screen dimensions (projected)	
diagonal	295 mm
horizontal axis	257 mm
vertical axis	195 mm
area	478 cm^2
Implosion protection	T-band
Bulb	EIA-J310Z1, EIA-J310AJ1 or EIA-J99AG1
Bulb contact designation	IEC 67-III-2, EIA-J1-21
Base designation	EIA E7-91
Basing	7GR
Mass	approx. 2,9 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max.	15 kV
	min.	10 kV
Grid 4 (focusing electrode) voltage		−550 to + 1100 V
Grid 2 voltage	max.	550 V
Anode current		
long-term average value	max.	100 μA
peak value	max.	150 μA
Cathode voltage, positive peak value	max.	220 V
Heater voltage		12 V ± 10%*
Cathode-to-heater voltage	max.	200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXUMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	30 to 74 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	12 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	33 to 81 V**

RESOLUTION

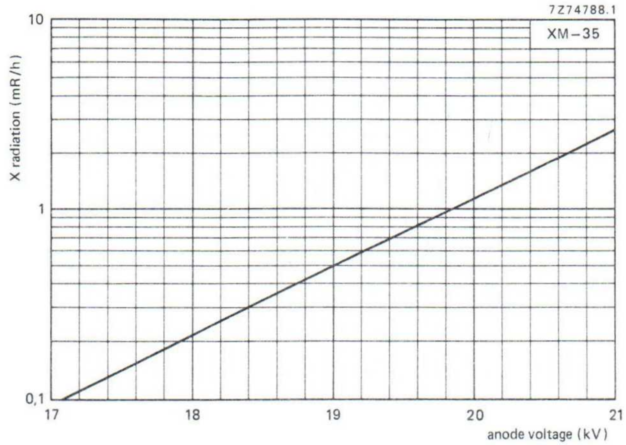
The resolution is approx. 1000 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 550 V, anode voltage = 12 kV; phosphor type W, without anti-glare treatment, raster dimensions 216 mm x 162 mm.

X-RADIATION CHARACTERISTIC

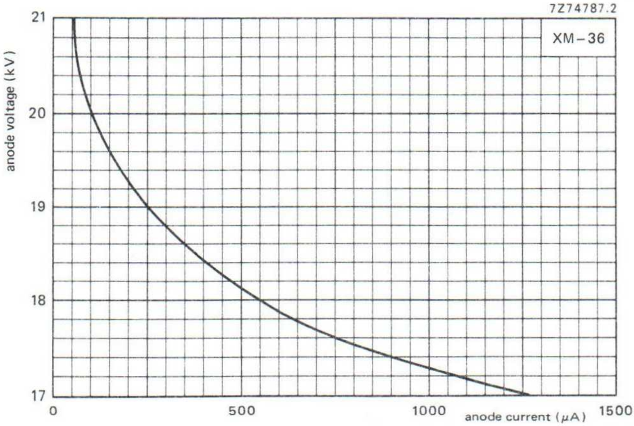
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 12 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 216 mm x 162 mm:
line parabola 200 V,
field parabola 100 V.

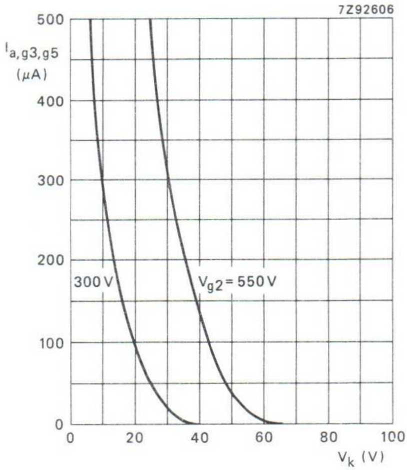
** Visual extinction of focused raster.



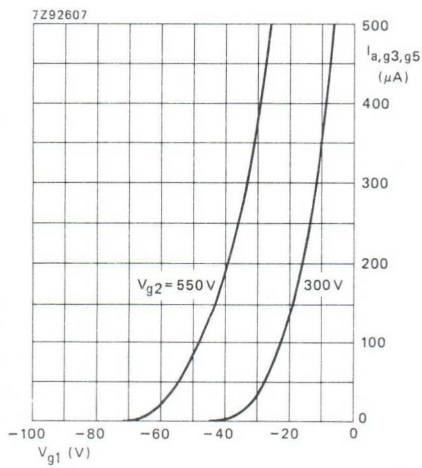
X-radiation limit curve according to JEDEC 94, at a constant anode current of 250 μA, measured according to TEPAC103A.



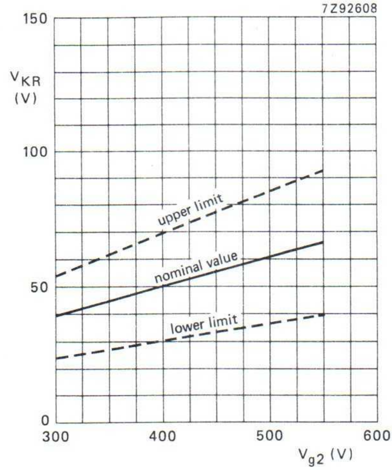
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

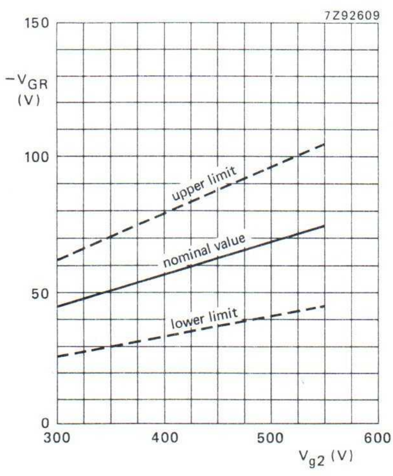


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}$$

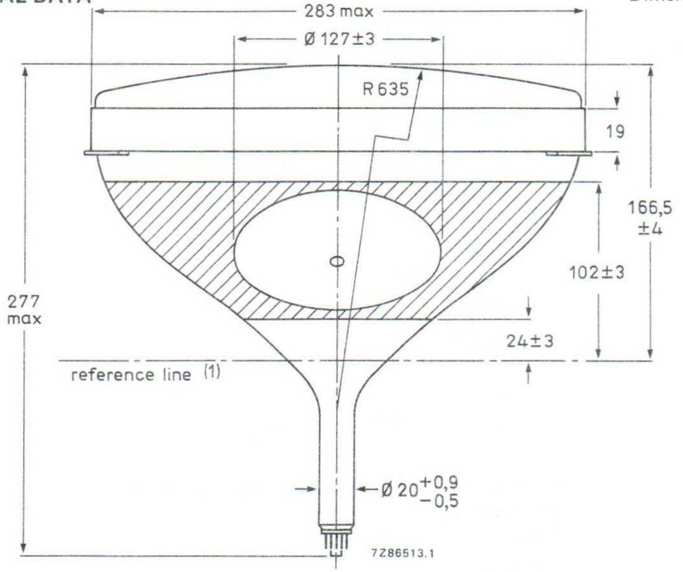


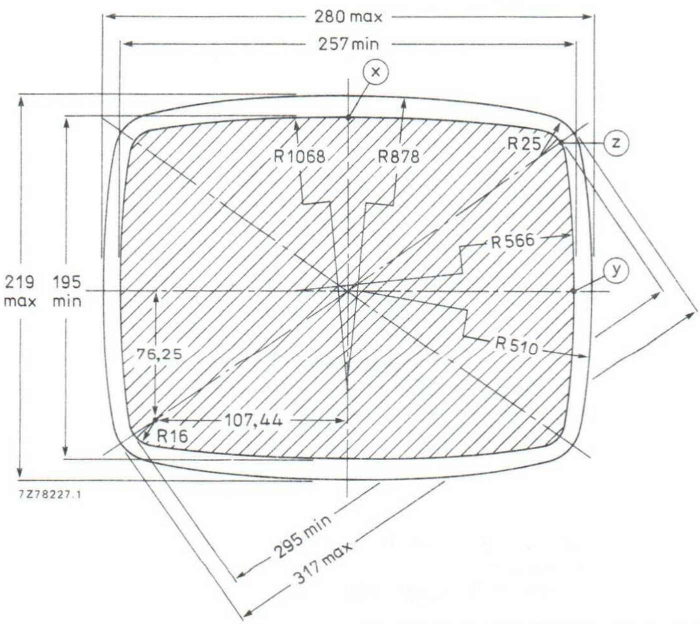
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 12 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0,15 \times 10^{-3}.$$

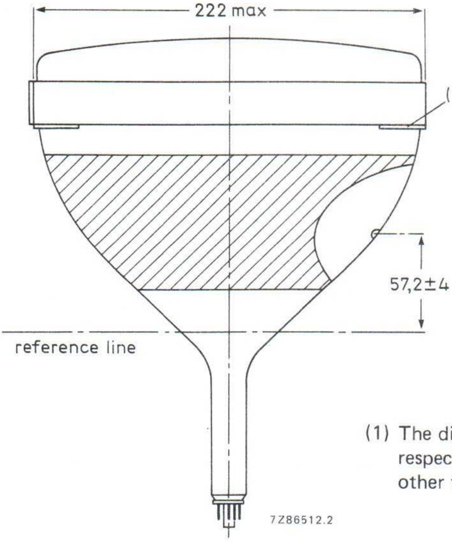
DIMENSIONAL DATA

Dimensions in mm

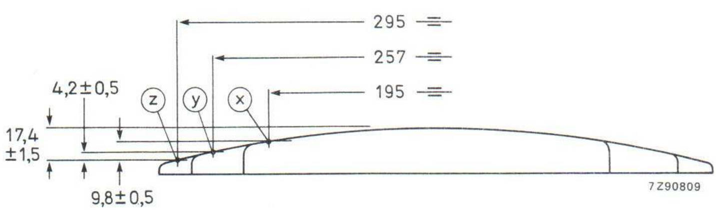


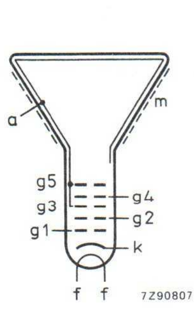


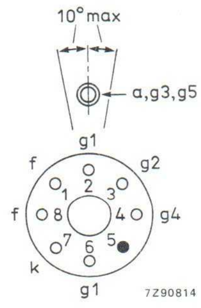
(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.



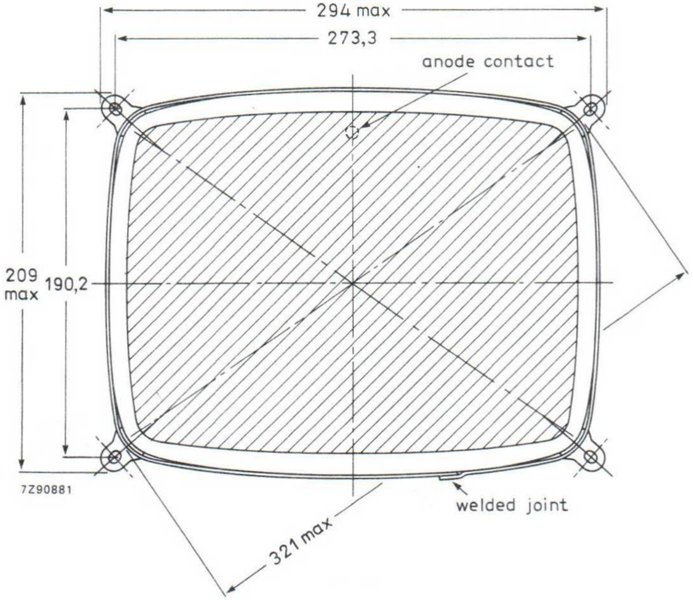
(1) The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.

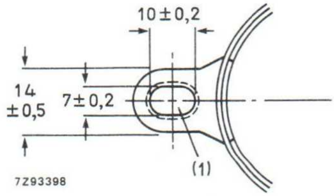


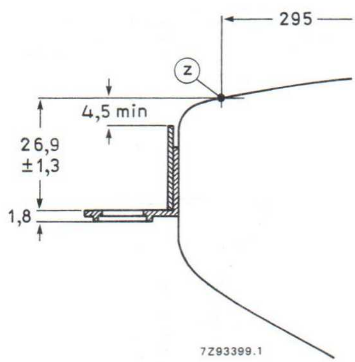




Front view and lug dimensions

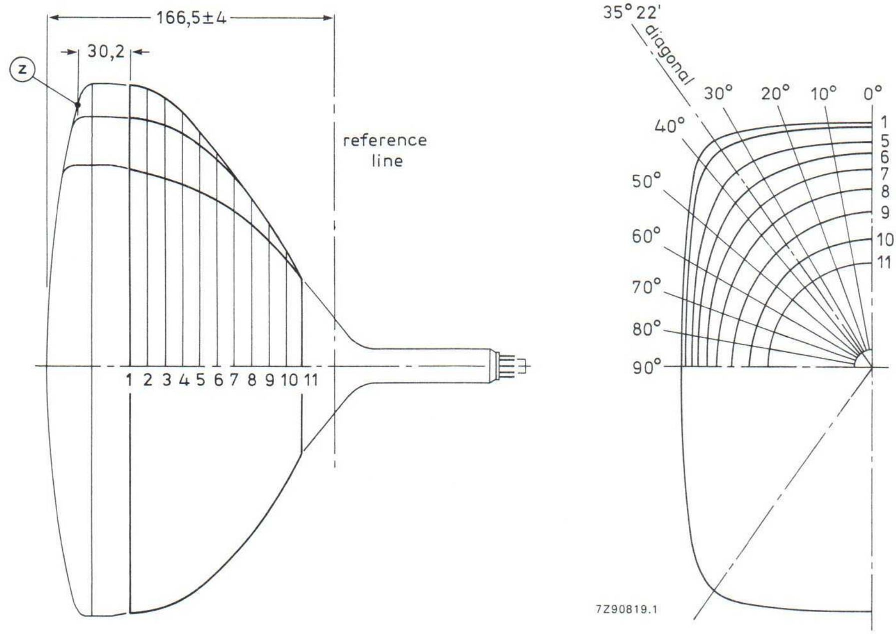






(1) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 273,3 mm x 190,2 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre 0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	140,6	142,4	147,9	156,8	160,4	156,9	139,3	126,1	117,5	112,7	111,2
2	10	139,8	141,6	147,0	155,5	158,5	154,4	136,8	123,7	115,2	110,5	109,0
3	20	137,8	139,4	144,4	151,9	153,6	149,5	133,0	120,4	112,3	107,8	106,4
4	30	133,5	135,0	139,3	144,8	145,1	141,6	127,7	116,3	108,7	104,5	103,1
5	40	126,9	128,1	131,3	134,2	133,6	130,9	120,7	110,9	104,2	100,4	99,1
6	50	117,9	118,8	120,9	122,1	121,1	119,2	112,1	104,5	98,7	95,3	94,2
7	60	107,2	107,9	109,1	109,3	108,5	107,1	102,3	96,8	92,1	89,1	88,1
8	70	95,5	95,9	96,4	96,0	95,2	94,2	91,2	87,5	84,1	81,8	80,9
9	80	82,4	82,5	82,4	81,8	81,2	80,5	78,7	76,6	74,5	73,0	72,4
10	90	67,5	67,5	67,2	66,6	66,3	65,9	65,0	64,1	63,2	62,5	62,2
11	99	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3	50,3

HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 90° deflection angle
- 34 cm (14 in) face diagonal; rectangular glass
- 20 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	90°
Face diagonal	34 cm (14 in)
Overall length	max. 287 mm
Neck diameter	20 mm
Heating	12 V/130 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	14 kV
Resolution	approx. 1300 lines

APPLICATION

These high resolution tubes are for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tubes can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

AVAILABLE VERSIONS

The following versions are available:
M32EAA0 – normal glare and normal tinted face glass;
M32EAA1 – direct grind and normal tinted face glass;
M32EAA2 – direct grind and dark tinted face glass;
M32EAA3 – direct etch and dark tinted face glass;
M32EAA4 – high glare and dark tinted face glass.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 90°
horizontal	approx. 82°
vertical	approx. 67°
Interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 7 pF
Capacitance of external conductive coating to anode*	max. 1200 pF min. 600 pF
Capacitance of external conductive coating to anode**	max. 1050 pF min. 450 pF
Capacitance of anode to implosion protection hardware**	approx. 150 pF
Heater voltage	12 V
Heater current at 12 V	130 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 48%
tube with dark tinted face glass	approx. 34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 287 mm
Greatest dimensions of tube	
diagonal	350 mm
width	298 mm
height	240 mm
Minimum useful screen dimensions (projected)	
diagonal	322 mm
horizontal axis	270 mm
vertical axis	210 mm
area	554 cm^2
Implosion protection	T-band
Bulb	EIA-J340B1 or EIA-J340D1
Bulb contact designation	IEC 67-III-2, EIAJ1-21
Base designation	EIA-E7-91
Basing	7GR
Mass	approx. 3,6 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 16 kV min. 10 kV
Grid 4 (focusing electrode) voltage	−200 to + 1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 130 μA
peak value	max. 600 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	12 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	14 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	32 to 64 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	14 kV
Grid 4 (focusing electrode) voltage	0 to 300 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	35 to 70 V**

RESOLUTION

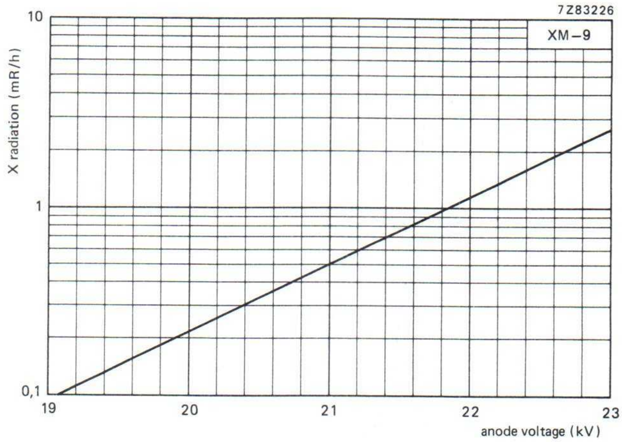
The resolution is approx. 1300 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 14 kV; phosphor type WW, without anti-glare treatment, raster dimensions 237 mm x 178 mm.

X-RADIATION CHARACTERISTIC

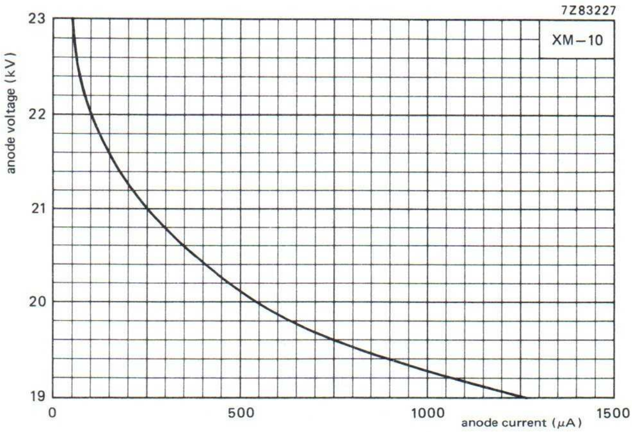
X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

* Measured at screen centre on spot at anode current = 250 μA (peak), anode voltage = 14 kV, grid 2 voltage = 400 V.
Dynamic focus (only for optimization): Typical correction for a video field of H x V = 237 mm x 178 mm:
line parabola 200 V,
field parabola 100 V.

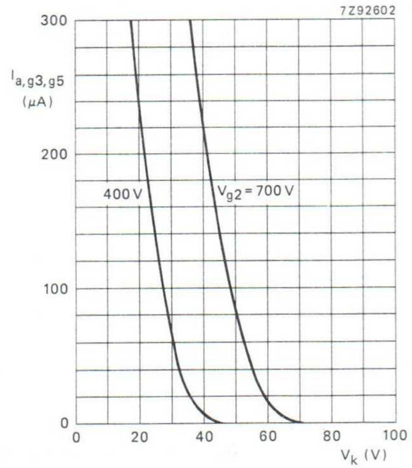
** Visual extinction of focused raster.



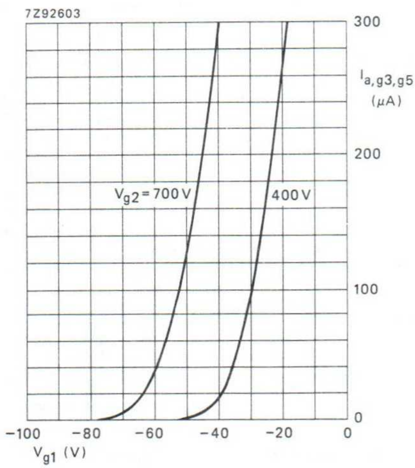
X-radiation limit curve according to JEDEC94, at a constant anode current of 250 μA, measured according to TEPAC103A.



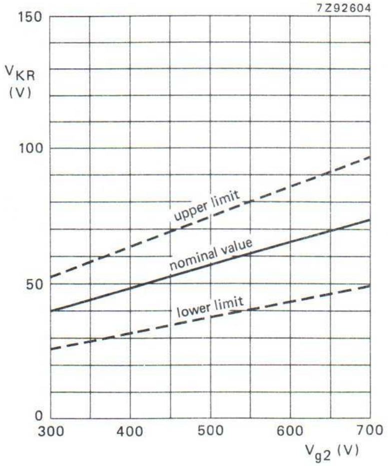
0,5 mR/h isoexposure-rate limit curve, according to JEDEC94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 14 kV.

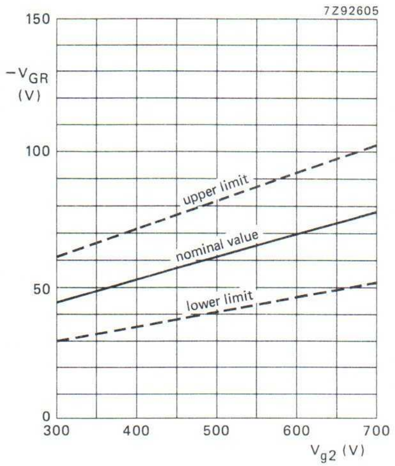


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 14 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 14 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

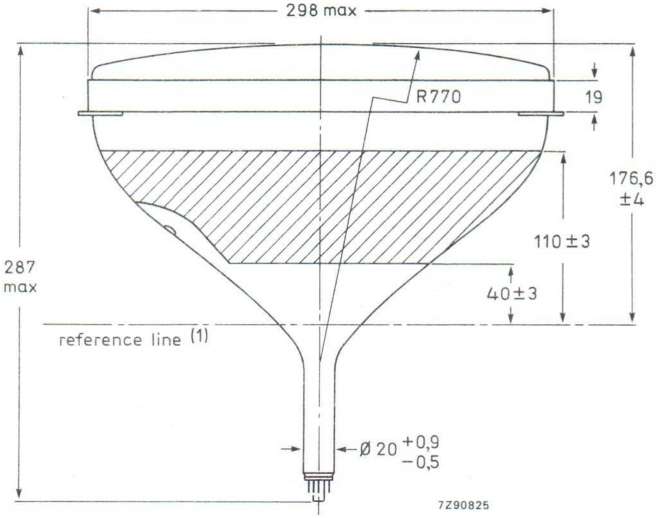


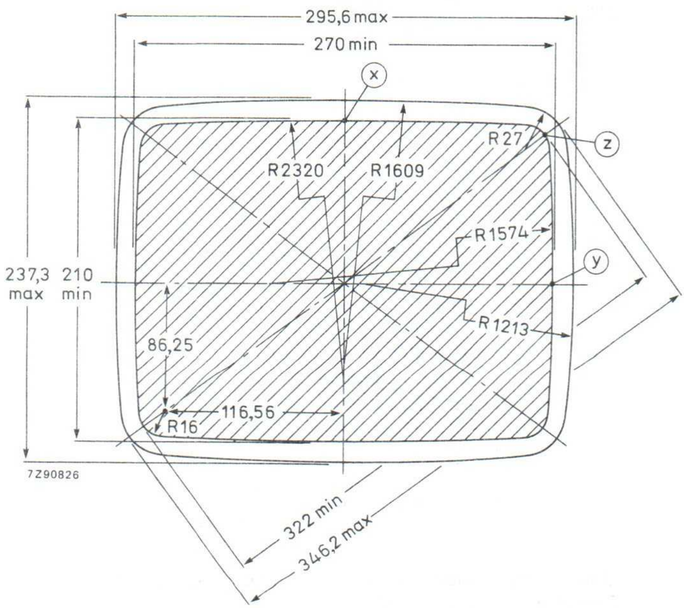
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 14 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

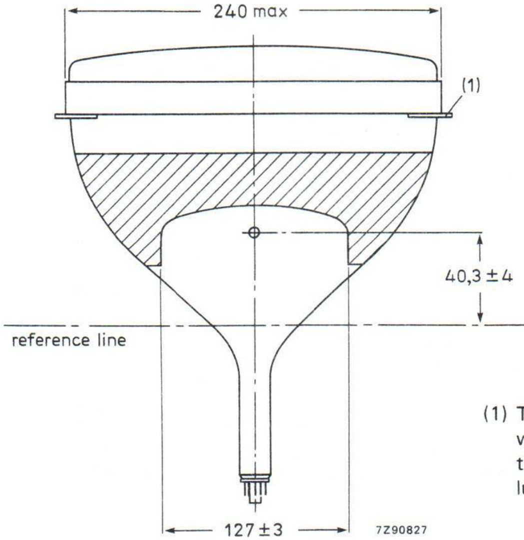
DIMENSIONAL DATA

Dimensions in mm

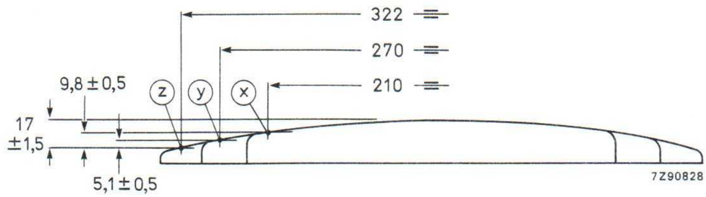


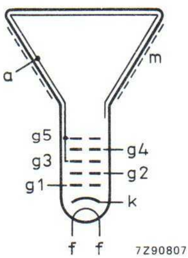


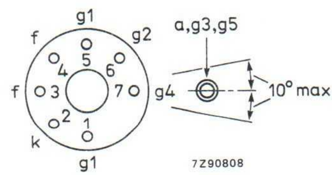
(1) The reference line is determined by the plane of the upper edge of reference line gauge D when the gauge is resting on the cone.



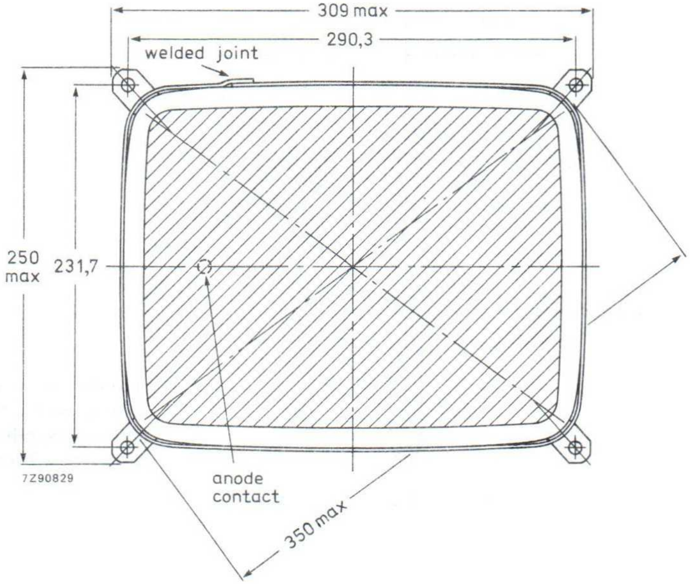
(1) The displacement of any lug with respect to the plane through the other three lugs is max. 2 mm.

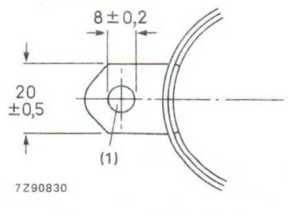


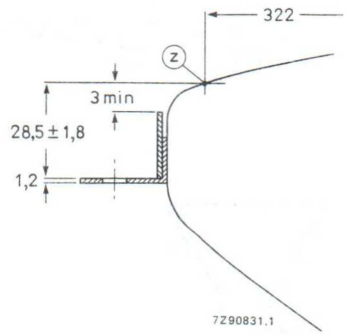




Front view and lug dimensions

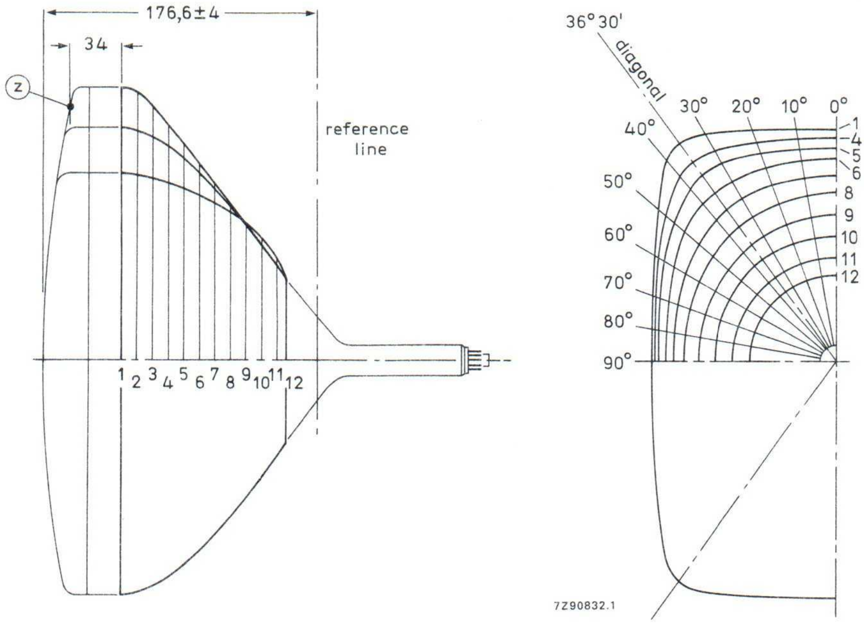






(1) The mounting screws in the cabinet must be situated inside a circle of 4 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 290,3 mm x 231,7 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	148,0	150,1	156,5	167,9	173,6	172,0	152,3	136,3	126,5	121,1	119,4
2	10	146,1	148,2	154,6	165,4	171,0	169,6	150,9	135,2	125,4	120,1	118,4
3	20	142,4	144,3	150,1	158,4	161,6	160,4	146,3	132,0	122,8	117,7	116,1
4	30	136,7	138,4	143,1	148,8	150,2	149,2	139,4	127,6	119,2	114,5	113,0
5	40	128,9	130,3	133,9	137,6	138,3	137,6	131,2	122,2	115,0	110,7	109,3
6	50	119,5	120,6	123,2	125,7	126,2	125,8	122,0	115,8	110,0	106,3	105,1
7	60	109,2	110,1	111,8	113,5	113,9	113,8	111,9	108,1	104,1	101,1	100,1
8	70	98,7	99,2	100,2	101,2	101,5	101,6	100,9	99,1	96,8	94,9	94,1
9	80	87,6	87,7	88,1	88,6	88,9	89,0	89,0	88,6	87,8	86,9	86,4
10	90	75,5	75,4	75,4	75,6	75,7	75,8	76,1	76,3	76,3	76,2	76,1
11	100	62,0	62,0	61,8	61,8	61,8	61,9	62,0	62,2	62,4	62,5	62,5
12	105,7	51,5	51,5	51,5	51,5	51,5	51,5	51,5	51,5	51,5	51,5	51,5

HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 110^{o} deflection angle
- 38 cm (15 in) face diagonal; rectangular glass
- 28,6 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	110^{o}
Face diagonal	38 cm (15 in)
Overall length	max. 279 mm
Neck diameter	28,6 mm
Heating	6,3 V/240 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	17 kV
Resolution	approx. 1500 lines

APPLICATION

These high resolution tubes are for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tubes can be supplied with different phosphors and anti-reflective treatments, see 'High resolution monochrome display tubes, General''.

AVAILABLE VERSIONS

The following versions are available: M38-328, M38-330, M38-332, M38-334, M38-336, M38-338 and M38-342.

Differences between the tubes can be found under 'Dimensional data'.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 110°
horizontal	approx. 98°
vertical	approx. 81°
Direct interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 9 pF
Capacitance of external conductive coating to anode*	max. 1200 pF
	min. 600 pF
Capacitance of external conductive coating to anode**	max. 1000 pF
	min. 500 pF
Capacitance of anode to implosion protection hardware**	approx. 200 pF
Heater voltage	6,3 V
Heater current at 6,3 V	240 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 46%
tube with dark tinted face glass	approx. 34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 279 mm
Greatest dimensions of tube	
diagonal	383 mm
width	324 mm
height	262 mm
Minimum useful screen dimensions (projected)	
diagonal	352 mm
horizontal axis	292 mm
vertical axis	227 mm
area	652 cm^2
Implosion protection	rimband
Bulb	EIA-J370BN1 or EIA-J370BR1
Bulb contact designation	IEC 67-III-2; EIA-J1-21
Base designation	IEC 67-1-31a; EIA-B7-208
Basing	8 HR
Mass	approx. 4 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 19 kV min. 13 kV
Grid 4 (focusing electrode) voltage	−500 to +1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 75 μA
peak value	max. 300 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	6,3 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 6,3 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	40 to 70 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	45 to 83 V**

RESOLUTION

The resolution is approx. 1500 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 17 kV; phosphor type W, without anti-glare treatment, raster dimensions 259 mm x 194 mm.

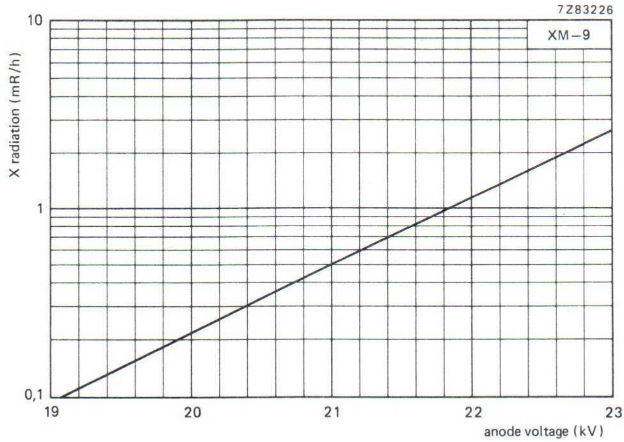
X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

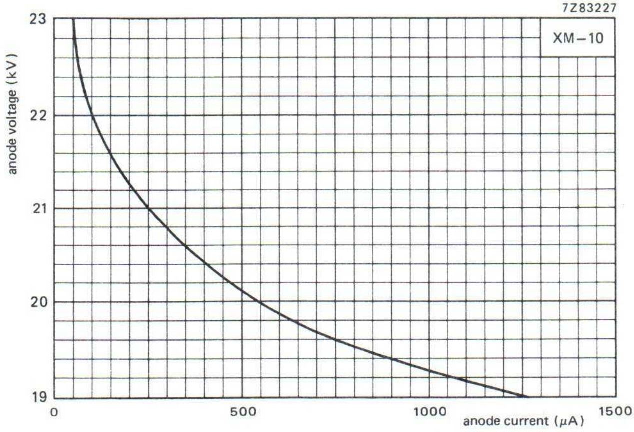
* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 17 kV, grid 2 voltage = 400 V.

Dynamic focus (only for optimization): Typical correction for a video field of
→ H x V = 259 mm x 194 mm (landscape format): line parabola 300 V, field parabola 100 V;
→ H x V = 194 mm x 259 mm (portrait format): line parabola 200 V, field parabola 250 V.

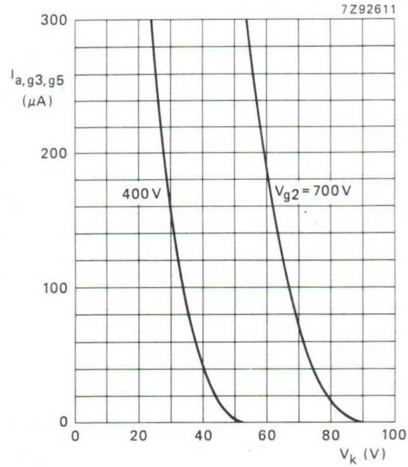
** Visual extinction of focused raster.



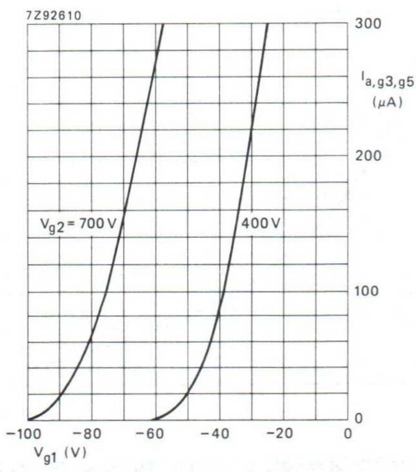
X-radiation limit curve according to JEDEC 94, at a constant anode current of 250 μA, measured according to TEPAC103A.



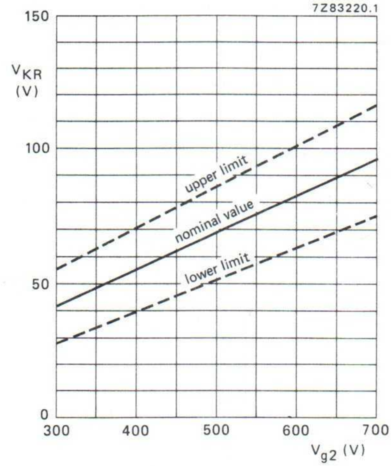
0,5 mR/h isoexposure rate limit curve, according to JEDEC 94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

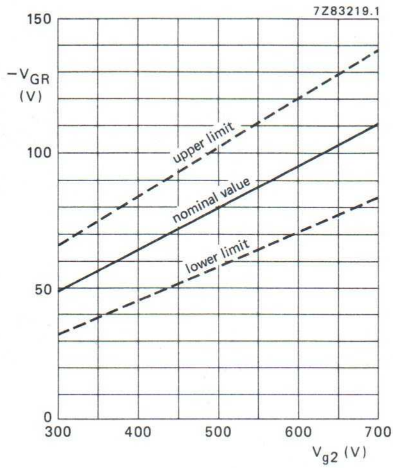


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

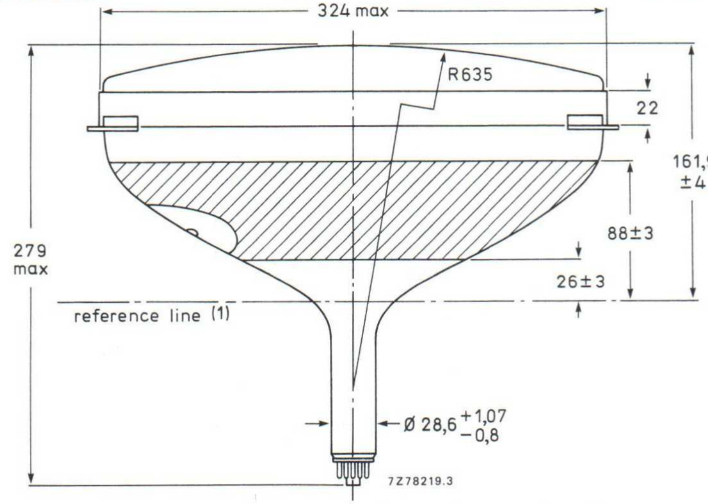


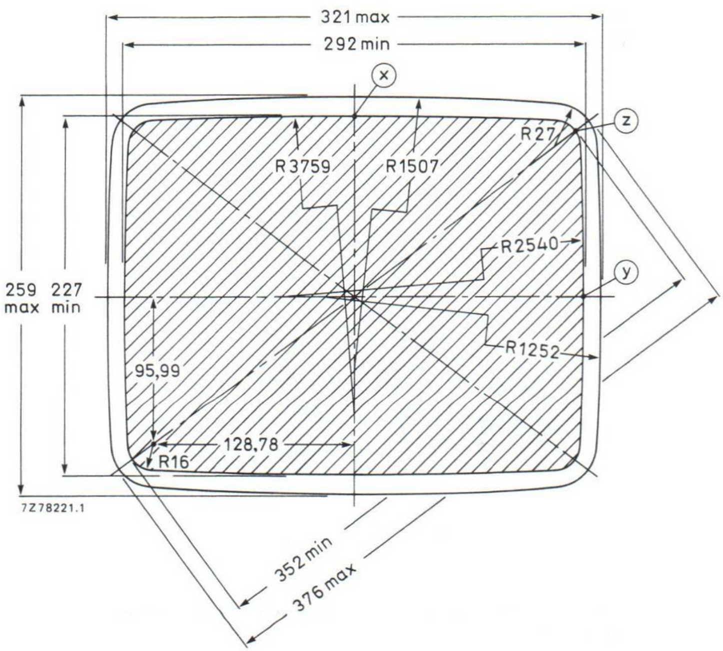
Limits of grid 1 cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

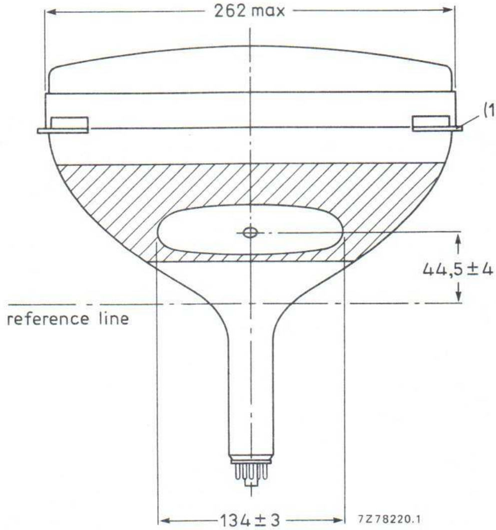
DIMENSIONAL DATA

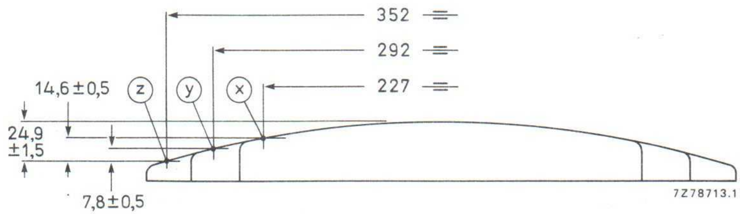
Dimensions in mm

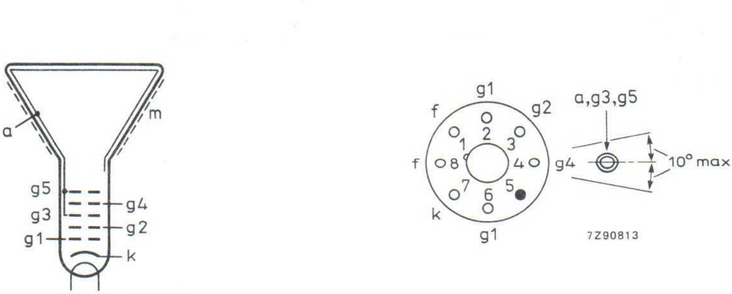




(1) The reference line is determined by the plane of the upper edge of reference line gauge C when the gauge is resting on the cone.

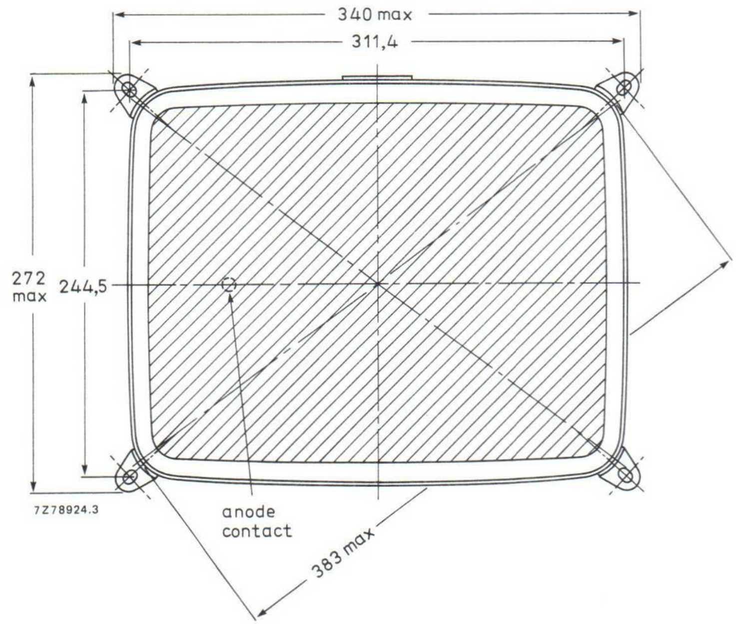


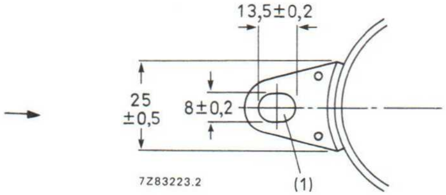


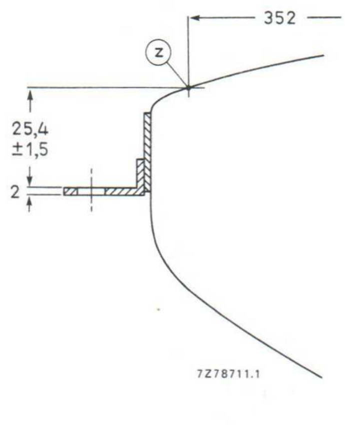


(1) The displacement of any lug with respect to the plane through the three other lugs is max. 1,5 mm.

Front view and lug dimensions of tube M38-328

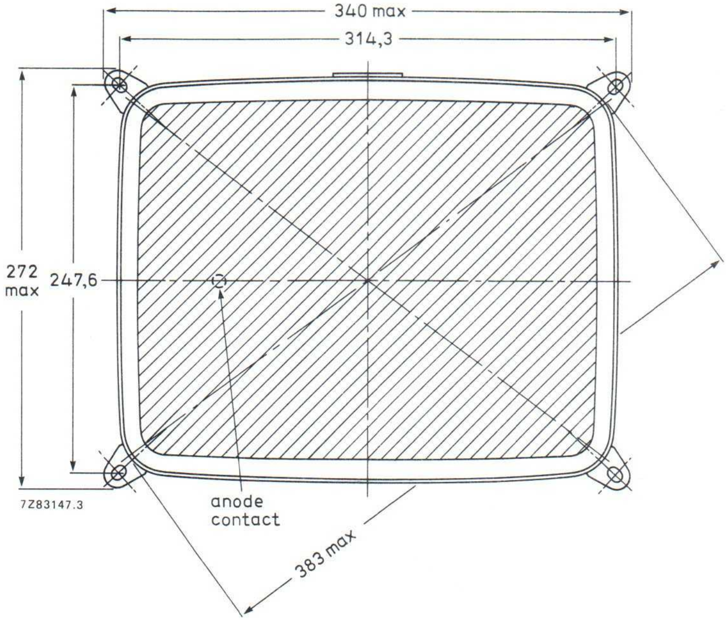


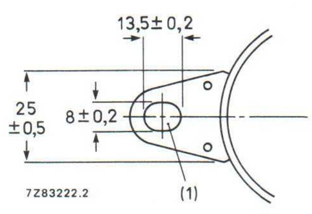


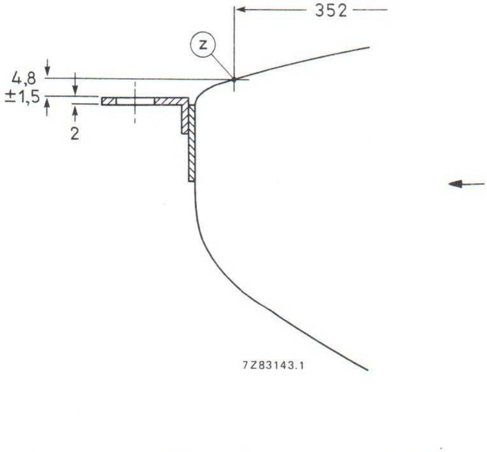


(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 311,4 mm x 244,5 mm.

Front view and lug dimensions of tube M38-330

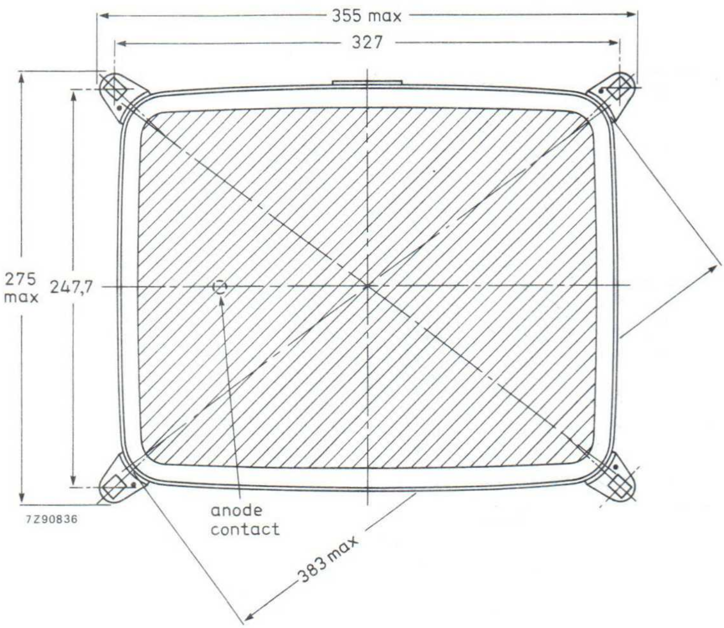


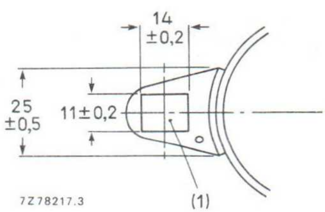


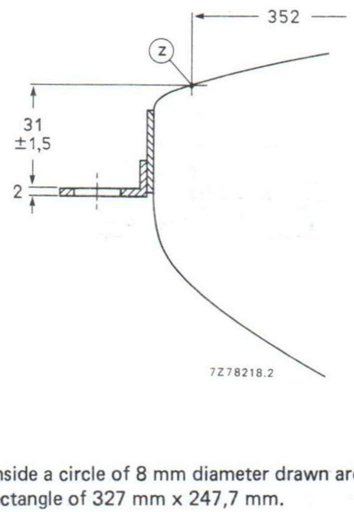


(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 314,3 mm x 247,6 mm.

Front view and lug dimensions of tube M38-332

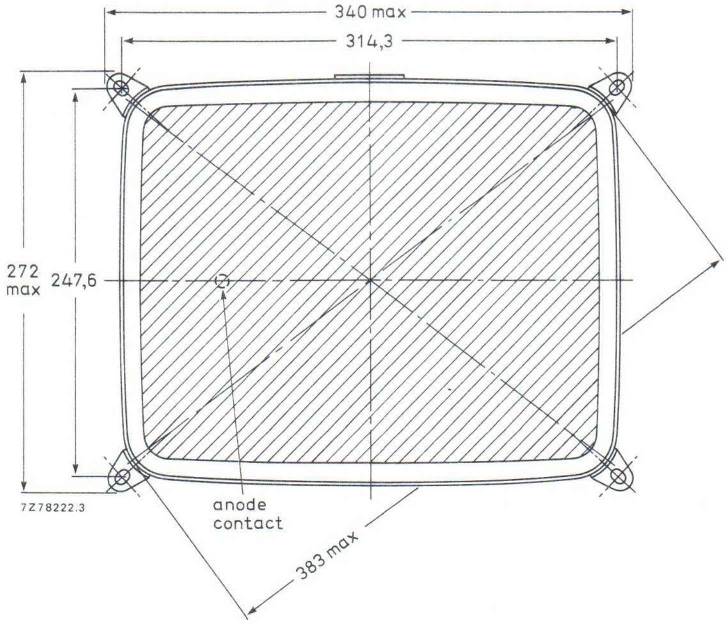


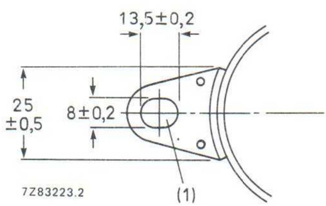


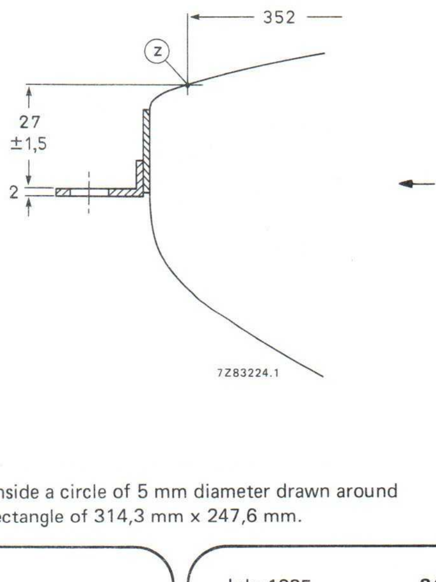


(1) The mounting screws in the cabinet must be situated inside a circle of 8 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 327 mm x 247,7 mm.

Front view and lug dimensions of tube M38-334

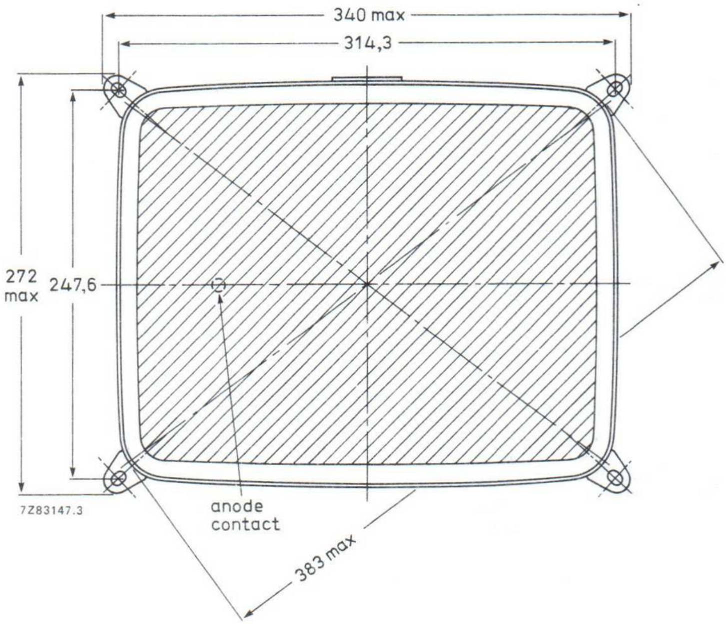


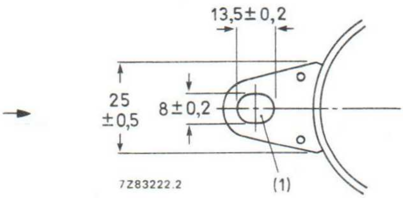


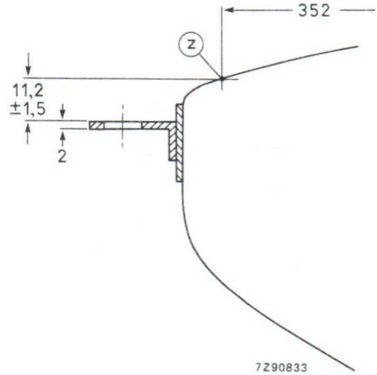


(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 314,3 mm x 247,6 mm.

Front view and lug dimensions of tube M38-336

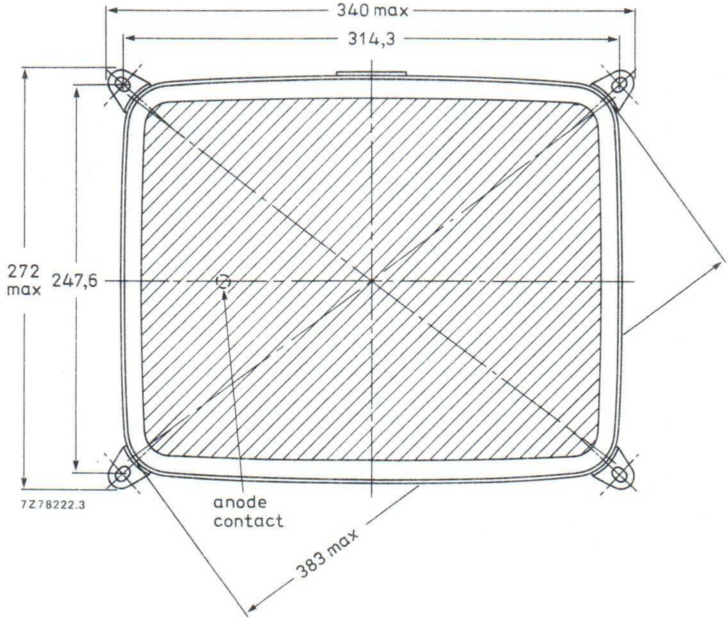


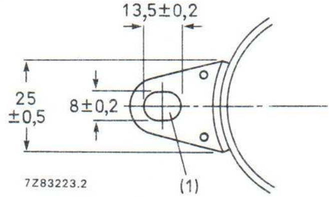


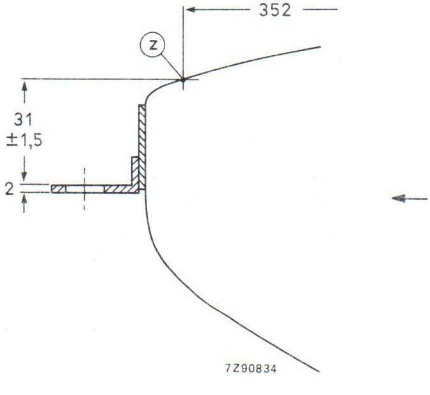


(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 314,3 mm x 247,6 mm.

Front view and lug dimensions of tube M38-338

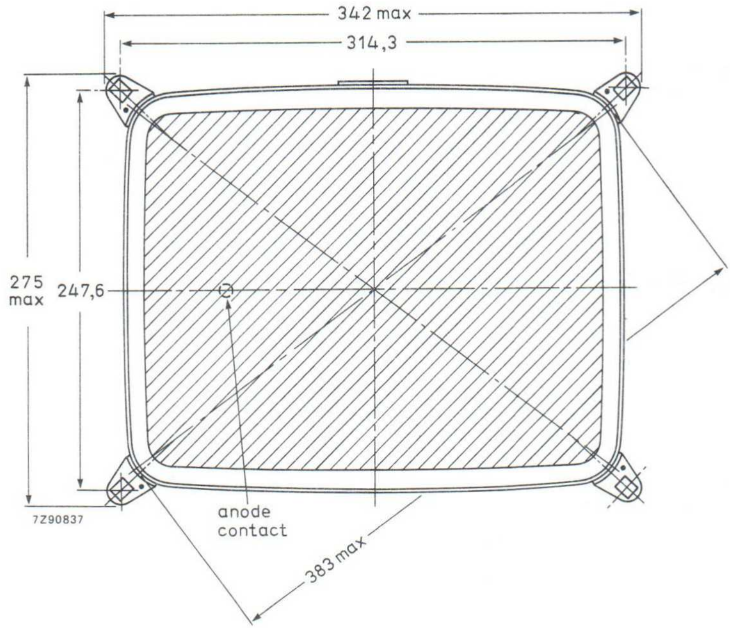


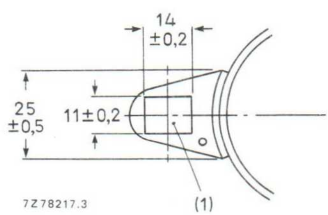


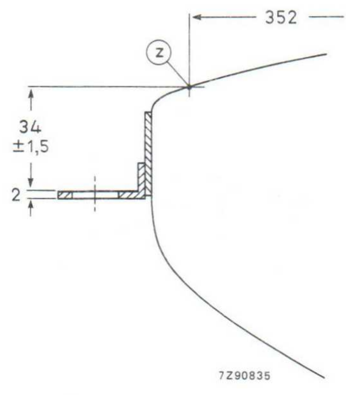


(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 314,3 mm x 247,6 mm.

Front view and lug dimensions of tube M38-342

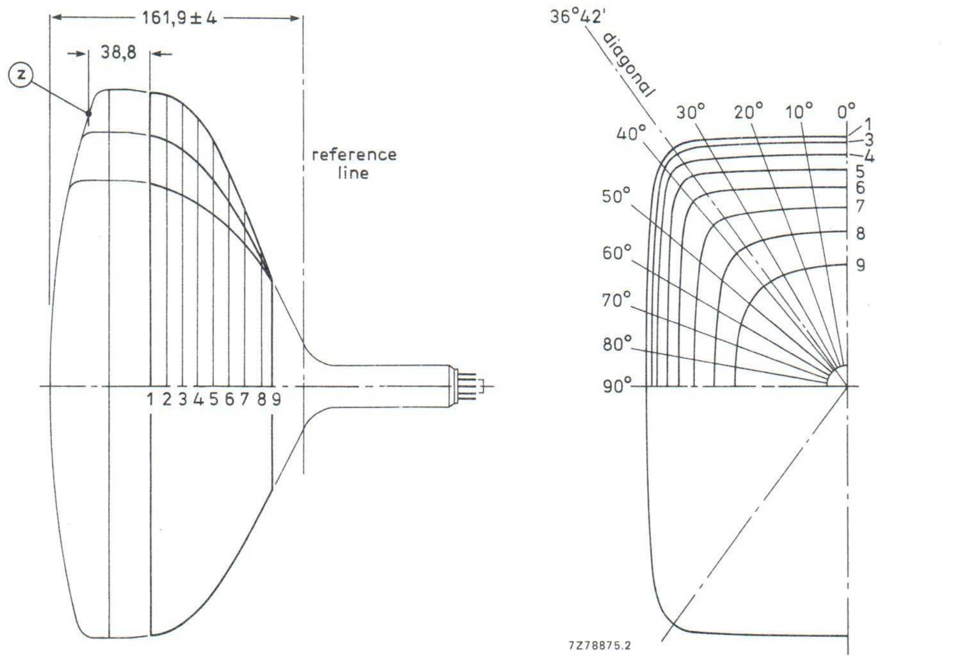






(1) The mounting screws in the cabinet must be situated inside a circle of 8 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 314,3 mm x 247,6 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre 0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	160,0	162,2	168,9	180,8	187,8	185,9	163,3	146,7	136,3	130,6	128,8
2	10	158,2	160,4	167,2	179,3	186,4	184,5	161,6	144,8	134,5	128,8	127,0
3	20	152,8	154,9	161,5	173,6	181,3	179,1	155,7	139,5	129,4	123,9	122,2
4	30	143,4	145,4	151,7	163,1	170,9	169,1	147,1	131,6	122,1	116,8	115,2
5	40	131,3	133,1	138,8	149,0	156,3	155,4	136,6	122,3	113,4	108,6	107,0
6	50	116,9	118,5	123,4	132,0	138,1	138,2	124,1	111,7	103,8	99,5	98,1
7	60	101,1	102,3	106,2	112,4	116,2	116,6	109,5	100,0	93,6	89,9	88,7
8	70	84,5	85,3	87,4	89,9	90,9	91,0	89,4	85,8	82,1	79,7	78,8
9	76,7	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3

HIGH RESOLUTION MONOCHROME DISPLAY TUBE

- For Data Graphic Displays
- 110° deflection angle
- 38 cm (15 in) face diagonal; rectangular glass
- 28,6 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	110°
Face diagonal	38 cm (15 in)
Overall length	max. 279 mm
Neck diameter	28,6 mm
Heating	6,3 V/240 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	17 kV
Resolution	approx. 1500 lines

APPLICATION

This high resolution tube is for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tube can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 110°
horizontal	approx. 98°
vertical	approx. 81°
Direct interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 9 pF
Capacitance of external conductive coating to anode*	max. 1200 pF min. 600 pF
Capacitance of external conductive coating to anode**	max. 1000 pF min. 500 pF
Capacitance of anode to implosion protection hardware**	approx. 200 pF
Heater voltage	6,3 V
Heater current at 6,3 V	240 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 46%
tube with dark tinted face glass	approx. 34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.

** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 279 mm
Greatest dimensions of tube	
diagonal	383 mm
width	324 mm
height	262 mm
Minimum useful screen dimensions (projected)	
diagonal	352 mm
horizontal axis	292 mm
vertical axis	227 mm
area	652 cm^2
Implosion protection	rimband
Bulb	EIA-J370BN1 or EIA-J370BR1
Bulb contact designation	IEC 67-III-2; EIA-J1-21
Base designation	IEC 67-1-31a; EIA-B7-208
Basing	8 HR
Mass	approx. 4 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 19 kV min. 13 kV
Grid 4 (focusing electrode) voltage	−500 to +1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 75 μA
peak value	max. 300 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	6,3 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 6,3 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	40 to 70 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	45 to 83 V**

RESOLUTION

The resolution is approx. 1500 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 17 kV; phosphor type W, without anti-glare treatment, raster dimensions 259 mm x 194 mm.

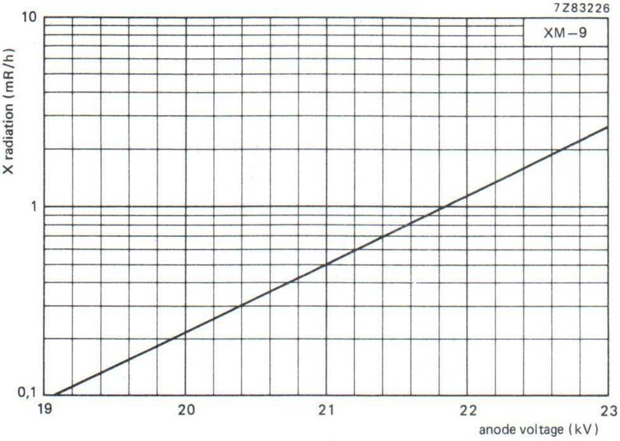
X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

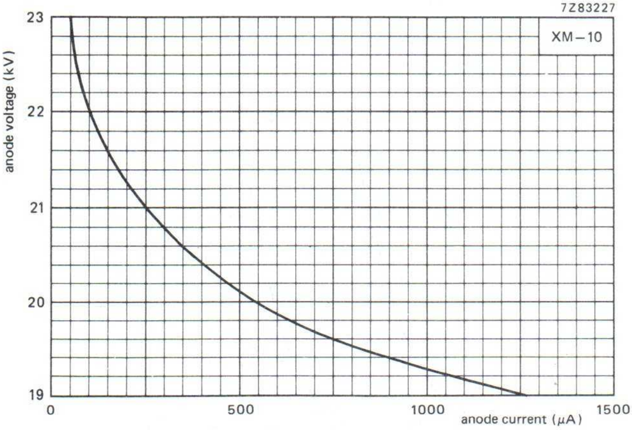
* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 17 kV, grid 2 voltage = 400 V.

Dynamic focus (only for optimization): Typical correction for a video field of
→ H x V = 259 mm x 194 mm (landscape format): line parabola 300 V, field parabola 100 V;
→ H x V = 194 mm x 259 mm (portrait format): line parabola 200 V, field parabola 250 V.

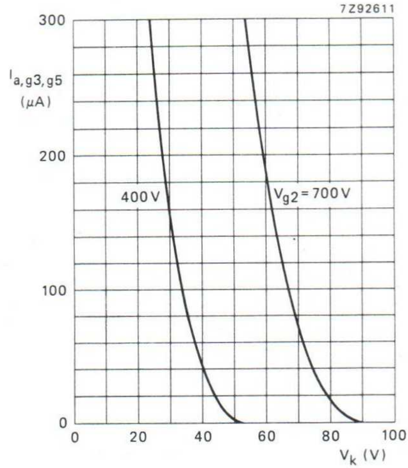
** Visual extinction of focused raster.



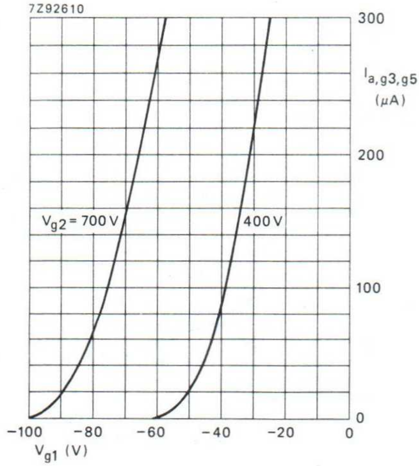
X-radiation limit curve according to JEDEC 94, at a constant anode current of 250 μA, measured according to TEPAC103A.



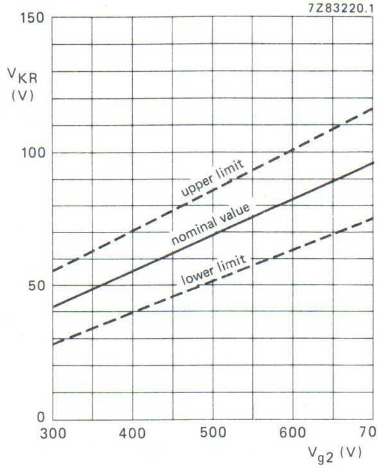
0,5 mR/h isoexposure rate limit curve, according to JEDEC 94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

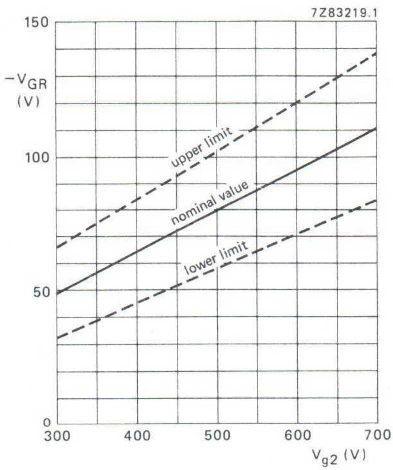


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage. Cathode drive; $V_{a,g3,g5} = 17$ kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}$$

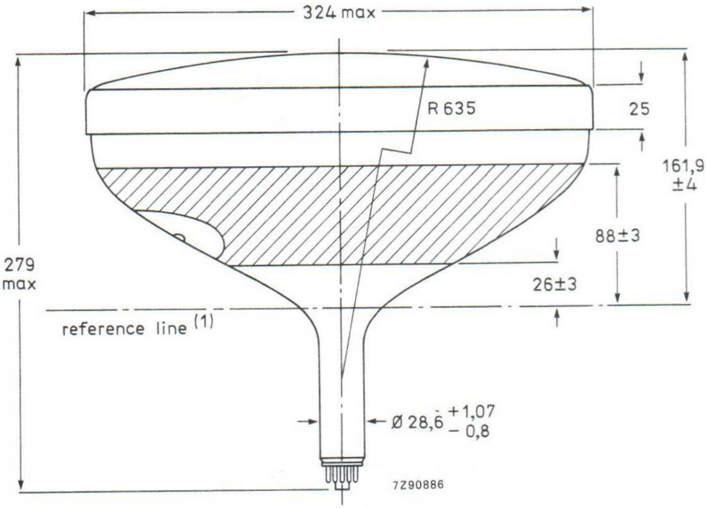


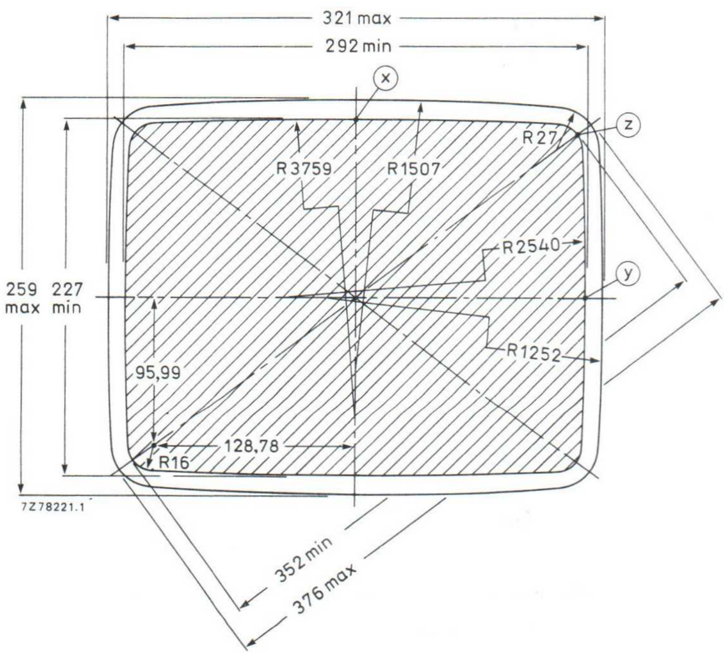
Limits of grid 1 cut-off voltage as a function of grid 2 voltage. Grid drive; $V_{a,g3,g5} = 17$ kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}$$

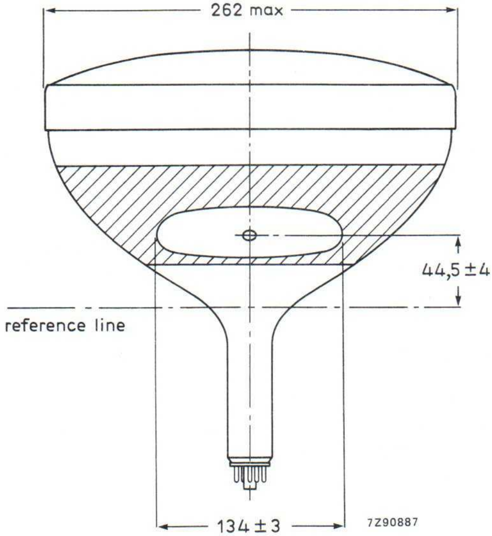
DIMENSIONAL DATA

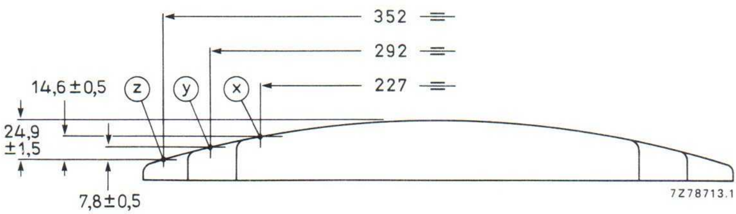
Dimensions in mm

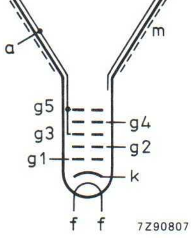


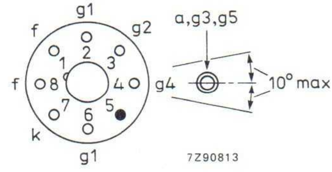


(1) The reference line is determined by the plane of the upper edge of reference line gauge C when the gauge is resting on the cone.

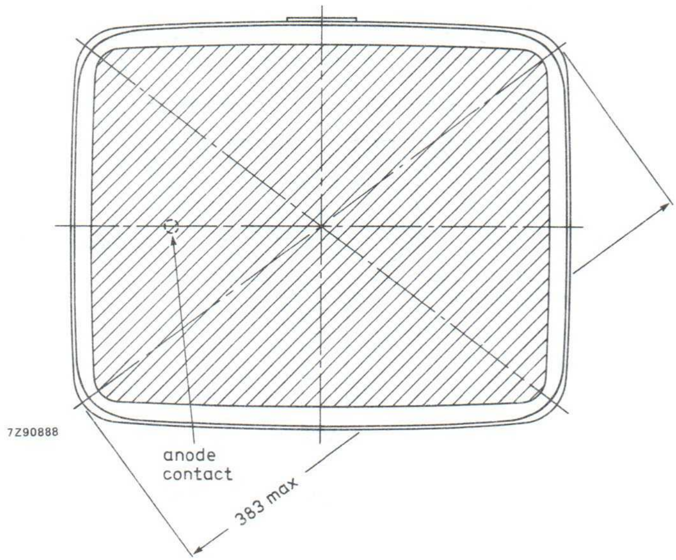

262 max
44,5 ± 4
reference line
134 ± 3
7Z90887

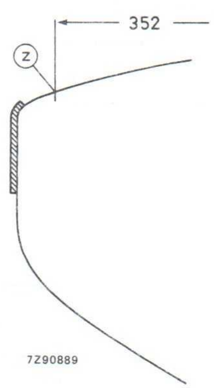

352
292
227
14,6 ± 0,5
z
y
x
24,9
± 1,5
7,8 ± 0,5
7Z78713.1


a
m
g5
g4
g3
g2
g1
k
f f
7Z90807

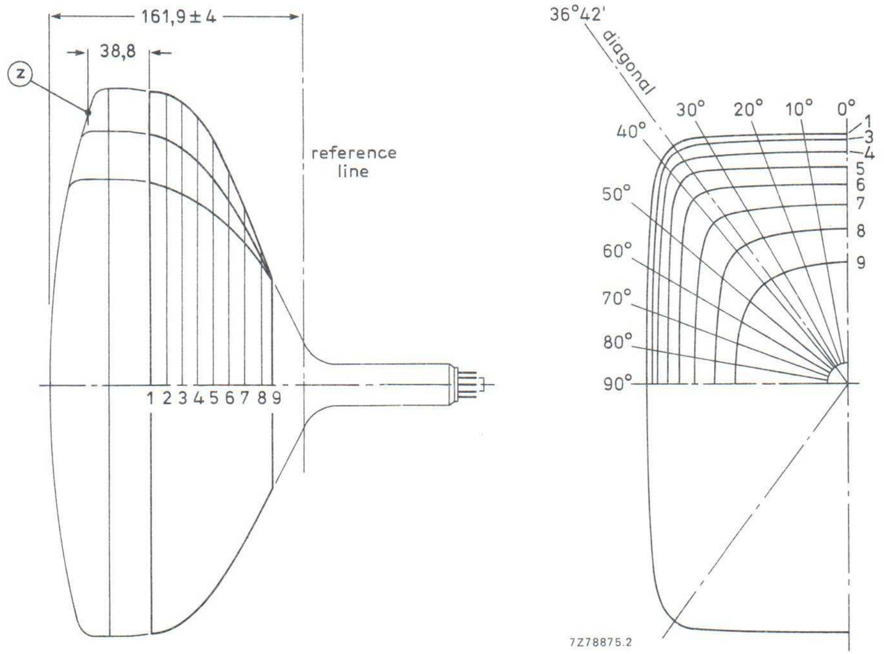

g1
f
g2
1 2 3
f 8 4 g4
7 6 5
k
g1
a,g3,g5
10° max
7Z90813

Front view





Maximum cone contour



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	160,0	162,2	168,9	180,8	187,8	185,9	163,3	146,7	136,3	130,6	128,8
2	10	158,2	160,4	167,2	179,3	186,4	184,5	161,6	144,8	134,5	128,8	127,0
3	20	152,8	154,9	161,5	173,6	181,3	179,1	155,7	139,5	129,4	123,9	122,2
4	30	143,4	145,4	151,7	163,1	170,9	169,1	147,1	131,6	122,1	116,8	115,2
5	40	131,3	133,1	138,8	149,0	156,3	155,4	136,6	122,3	113,4	108,6	107,0
6	50	116,9	118,5	123,4	132,0	138,1	138,2	124,1	111,7	103,8	99,5	98,1
7	60	101,1	102,3	106,2	112,4	116,2	116,6	109,5	100,0	93,6	89,9	88,7
8	70	84,5	85,3	87,4	89,9	90,9	91,0	89,4	85,8	82,1	79,7	78,8
9	76,7	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3

HIGH RESOLUTION MONOCHROME DISPLAY TUBES

- For Data Graphic Displays
- 110° deflection angle
- 38 cm (15 in) face diagonal; rectangular glass
- 28,6 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	110°
Face diagonal	38 cm (15 in)
Overall length	max. 279 mm
Neck diameter	28,6 mm
Heating	12 V/130 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	17 kV
Resolution	approx. 1500 lines

APPLICATION

This high resolution tube is for alpha-numeric and graphic display applications, such as computer terminals, small business computers, etc.

The tube can be supplied with different phosphors and anti-reflective treatments, see "High resolution monochrome display tubes, General".

AVAILABLE VERSIONS

The following versions are available: M38-346 and M38-348. Differences between the tubes can be found under 'Dimensional data'.

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 110°
horizontal	approx. 98°
vertical	approx. 81°
Direct interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 9 pF
Capacitance of external conductive coating to anode*	max. 1200 pF
	min. 600 pF
Capacitance of external conductive coating to anode**	max. 1000 pF
	min. 500 pF
Capacitance of anode to implosion protection hardware**	approx. 200 pF
Heater voltage	12 V
Heater current at 12 V	130 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre	
tube with normal tinted face glass	approx. 46%
tube with dark tinted face glass	approx. 34%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 279 mm
Greatest dimensions of tube	
diagonal	383 mm
width	324 mm
height	262 mm
Minimum useful screen dimensions (projected)	
diagonal	352 mm
horizontal axis	292 mm
vertical axis	227 mm
area	652 cm^2
Implosion protection	rimband
Bulb	EIA-J370BN1 or EIA-J370BR1
Bulb contact designation	IEC 67-III-2; EIA-J1-21
Base designation	IEC 67-1-31a; EIA-B7-208
Basing	8 HR
Mass	approx. 4 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 19 kV min. 13 kV
Grid 4 (focusing electrode) voltage	−500 to +1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 75 μA
peak value	max. 300 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	12 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 12 V.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	40 to 70 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	17 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	45 to 83 V**

RESOLUTION

The resolution is approx. 1500 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 17 kV; phosphor type W, without anti-glare treatment, raster dimensions 259 mm x 194 mm.

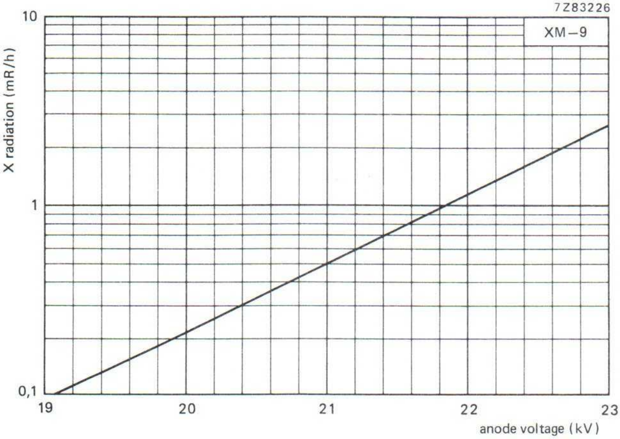
X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

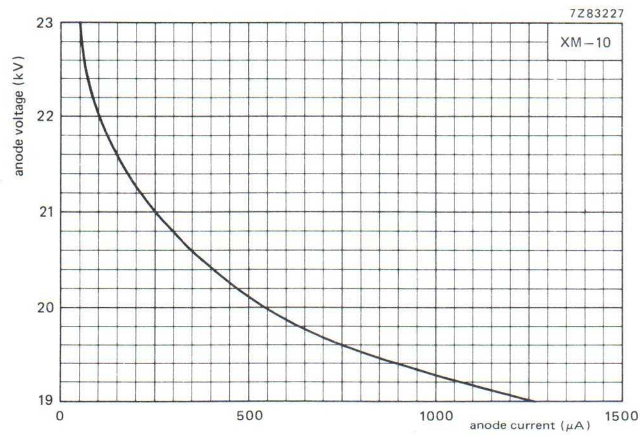
* Measured at screen centre on spot at anode current = 50 μA (peak), anode voltage = 17 kV, grid 2 voltage = 400 V.

Dynamic focus (only for optimization): Typical correction for a video field of
→ H x V = 259 mm x 194 mm (landscape format): line parabola 300 V, field parabola 100 V;
→ H x V = 194 mm x 259 mm (portrait format): line parabola 200 V, field parabola 250 V.

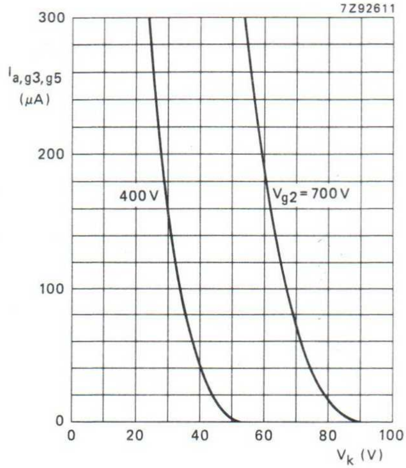
** Visual extinction of focused raster.



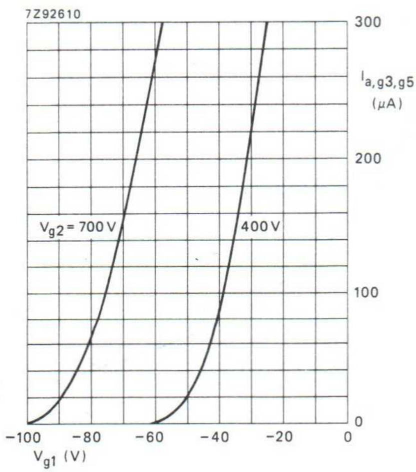
X-radiation limit curve according to JEDEC 94, at a constant anode current of 250 μA, measured according to TEPAC103A.



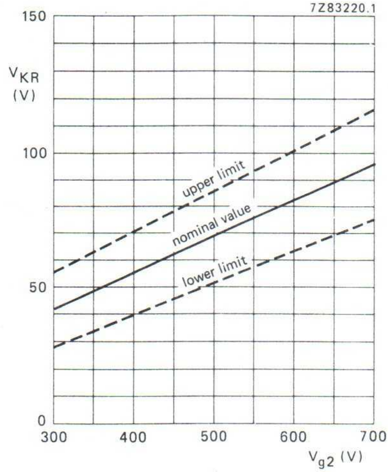
0,5 mR/h isoexposure rate limit curve, according to JEDEC 94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 17 kV.

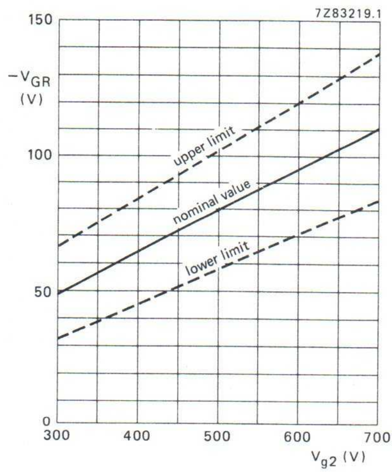


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 17 kV.



Limits of cathode cut-off voltage as a function of grid 2 voltage. Cathode drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}$$

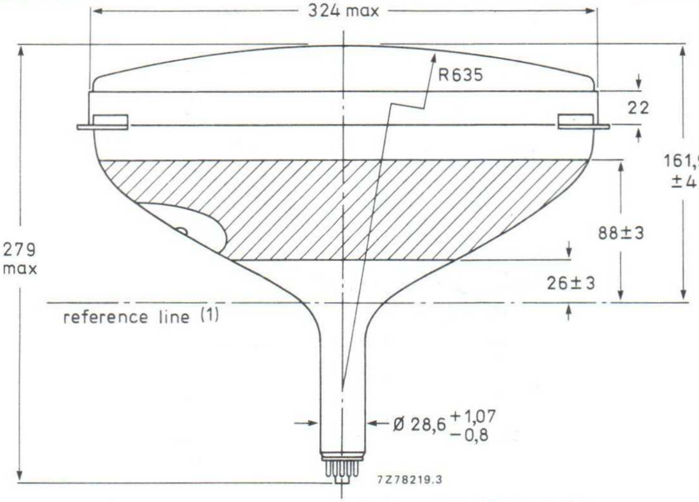


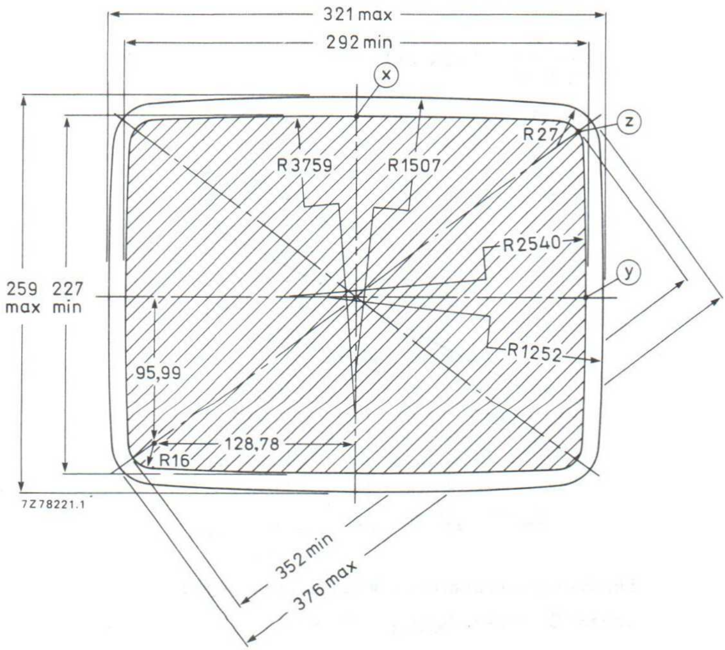
Limits of grid 1 cut-off voltage as a function of grid 2 voltage. Grid drive; $V_{a,g3,g5}$ = 17 kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}$$

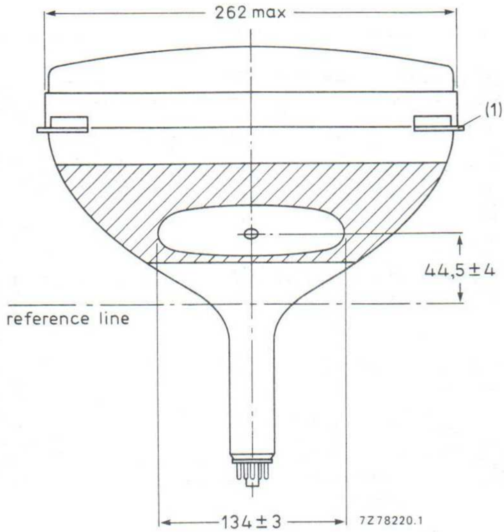
DIMENSIONAL DATA

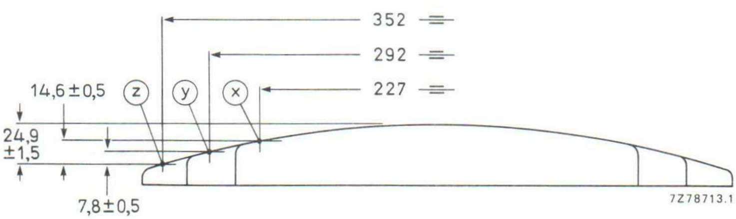
Dimensions in mm

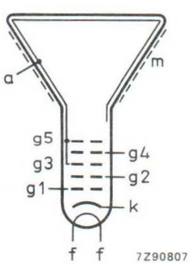


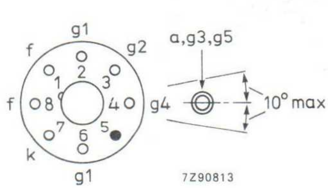


(1) The reference line is determined by the plane of the upper edge of reference line gauge C when the gauge is resting on the cone.



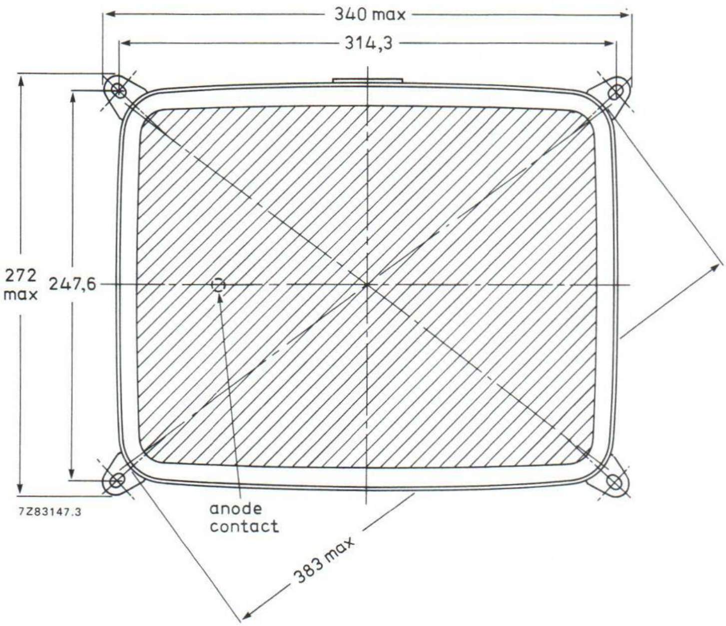


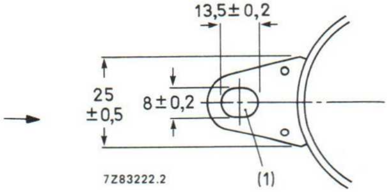


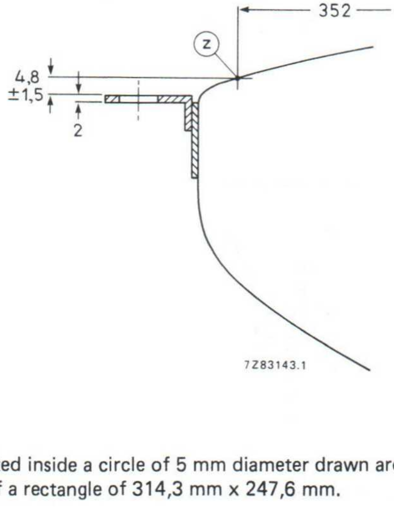


(1) The displacement of any lug with respect to the plane through the three other lugs is max. 1,5 mm.

Front view and lug dimensions of tube M38-346

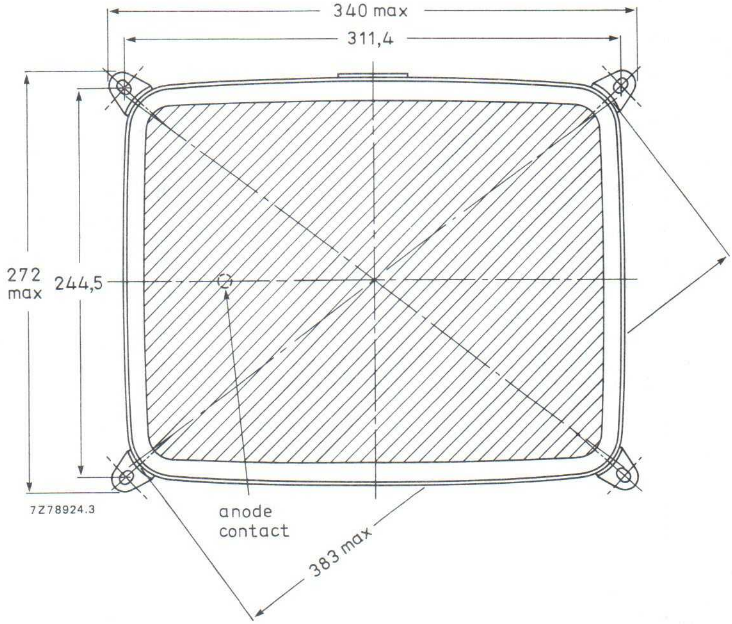


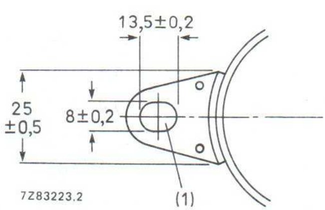


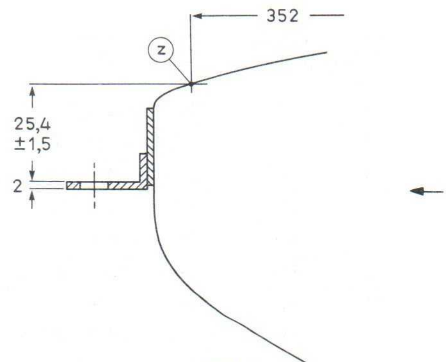


(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 314,3 mm x 247,6 mm.

Front view and lug dimensions of tube M38-348

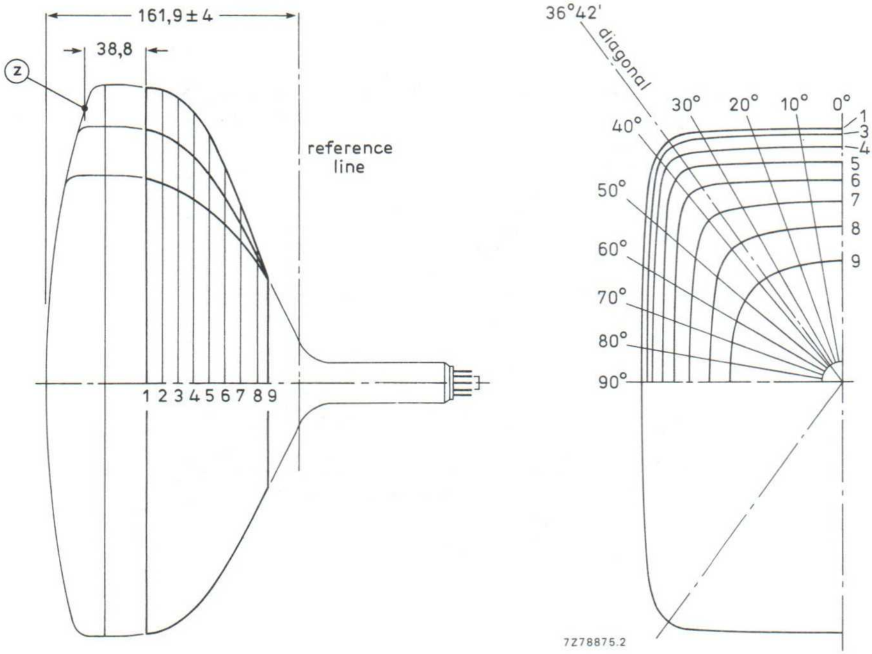






(1) The mounting screws in the cabinet must be situated inside a circle of 5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 311,4 mm x 244,5 mm.

→ **Maximum cone contour**



sec-tion	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	160,0	162,2	168,9	180,8	187,8	185,9	163,3	146,7	136,3	130,6	128 8
2	10	158,2	160,4	167,2	179,3	186,4	184,5	161,6	144,8	134,5	128,8	127,0
3	20	152,8	154,9	161,5	173,6	181,3	179,1	155,7	139,5	129,4	123,9	122,2
4	30	143,4	145,4	151,7	163,1	170,9	169,1	147,1	131,6	122,1	116,8	115,2
5	40	131,3	133,1	138,8	149,0	156,3	155,4	136,6	122,3	113,4	108,6	107,0
6	50	116,9	118,5	123,4	132,0	138,1	138,2	124,1	111,7	103,8	99,5	98,1
7	60	101,1	102,3	106,2	112,4	116,2	116,6	109,5	100,0	93,6	89,9	88,7
8	70	84,5	85,3	87,4	89,9	90,9	91,0	89,4	85,8	82,1	79,7	78,8
9	76,7	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3	67,3

HIGH RESOLUTION MONOCHROME DISPLAY TUBE

- For Data Graphic Displays
- 114° deflection angle
- 44 cm (17 in) face diagonal; rectangular glass
- 28,6 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	114°
Face diagonal	44 cm (17 in)
Overall length	max. 291 mm
Neck diameter	28,6 mm
Heating	6,3 V/240 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	20 kV
Resolution	approx. 1500 lines

APPLICATION

This high resolution tube is for alpha-numeric and graphic display applications, such as computer terminals, etc.

The tube can be supplied with different phosphors, see "High resolution monochrome display tubes, General".

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Defelction angles	
diagonal	approx. 114°
horizontal	approx. 104°
vertical	approx. 90°
Direct interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 9 pF
Capacitance of external conductive coating to anode*	max. 1500 pF min. 800 pF
Capacitance of external conductive coating to anode**	max. 1300 pF min. 700 pF
Capacitance of anode to implosion protection hardware**	approx. 200 pF
Heater voltage	6,3 V
Heater current at 6,3 V	240 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre (normal tinted glass)	approx. 48%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 291 mm
Greatest dimensions of tube	
diagonal	441 mm
width	377 mm
height	302 mm
Minimum useful screen dimensions (projected)	
diagonal	413 mm
horizontal axis	346 mm
vertical axis	270 mm
area	912 cm^2
Implosion protection	rimband
Bulb	EIA J436A
Bulb contact designation	IEC 67-III-2; EIA J1-21
Base designation	IEC 67-1-31a; EIA B7-208
Basing	8 HR
Mass	approx. 6 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 23 kV min. 15 kV
Grid 4 (focusing electrode) voltage	−500 to +1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 75 μA
peak value	max. 300 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	6,3 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at 6,3 V $^{+0\%}_{-5\%}$.

CIRCUIT DESIGN VALUES

Grid 4 current		
positive	max.	25 μA
negative	max.	25 μA
Grid 2 current		
positive	max.	5 μA
negative	max.	5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max.	1,0 MΩ
Impedance between cathode and heater	max.	0,1 MΩ
Grid 1 circuit resistance	max.	1,5 MΩ
Grid 1 circuit impedance	max.	0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1

Anode voltage	20 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	40 to 70 V**

Grid drive; voltages specified with respect to cathode

Anode voltage	20 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	45 to 83 V**

RESOLUTION

The resolution is approx. 1500 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 20 kV; phosphor type W, without anti-glare treatment, raster dimensions 304 mm x 228 mm.

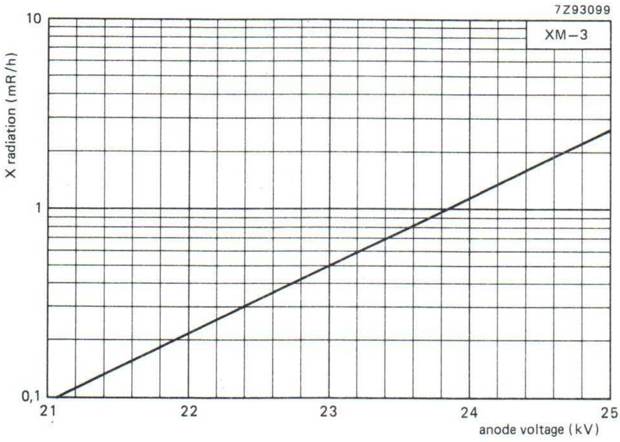
X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

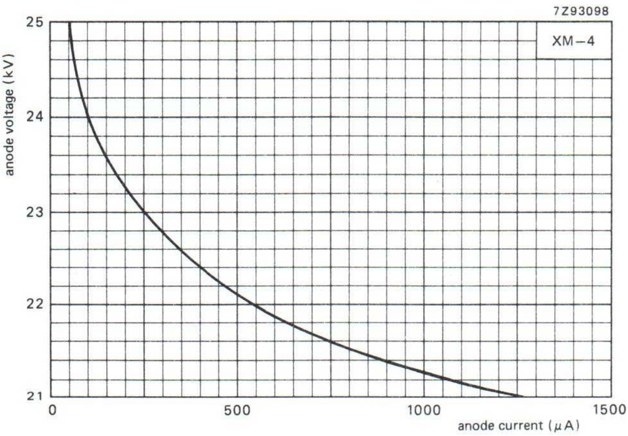
* Measured at screen centre on spot at anode current = 200 μA (peak), anode voltage = 20 kV, grid 2 voltage = 400 V.

Dynamic focus (only for optimization): Typical correction for a video field of H x V = 304 mm x 228 mm (landscape format): line parabola 300 V, field parabola 100 V.

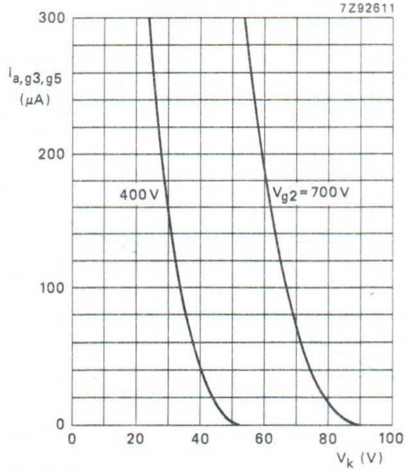
** Visual extinction of focused raster.



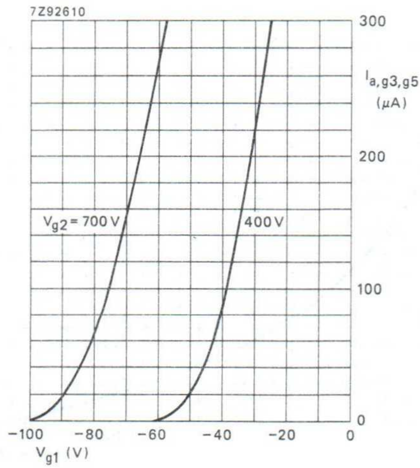
X-radiation limit curve according to JEDEC 94, at a constant anode current of 250 μA, measured according to TEPAC103A.



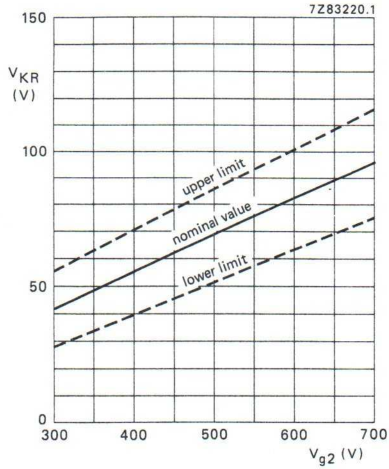
0,5 mR/h isoexposure rate limit curve, according to JEDEC 94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 20 kV.

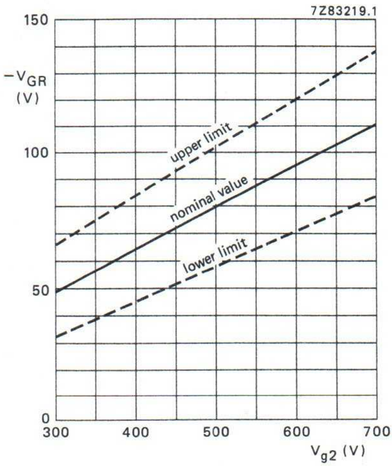


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 20 kV.



Limits of cathode raster cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5} = 20$ kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

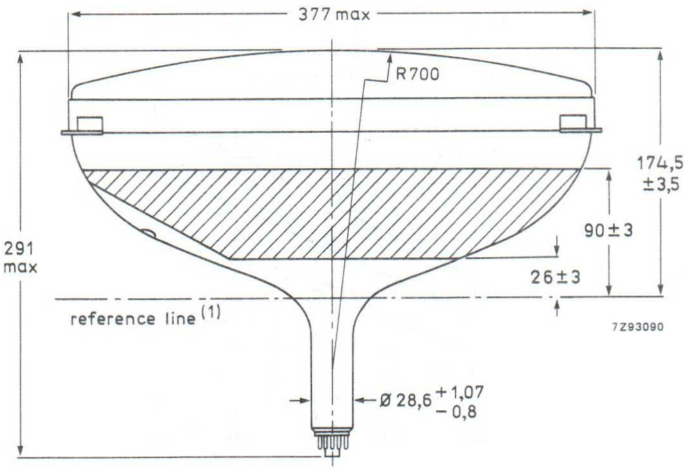


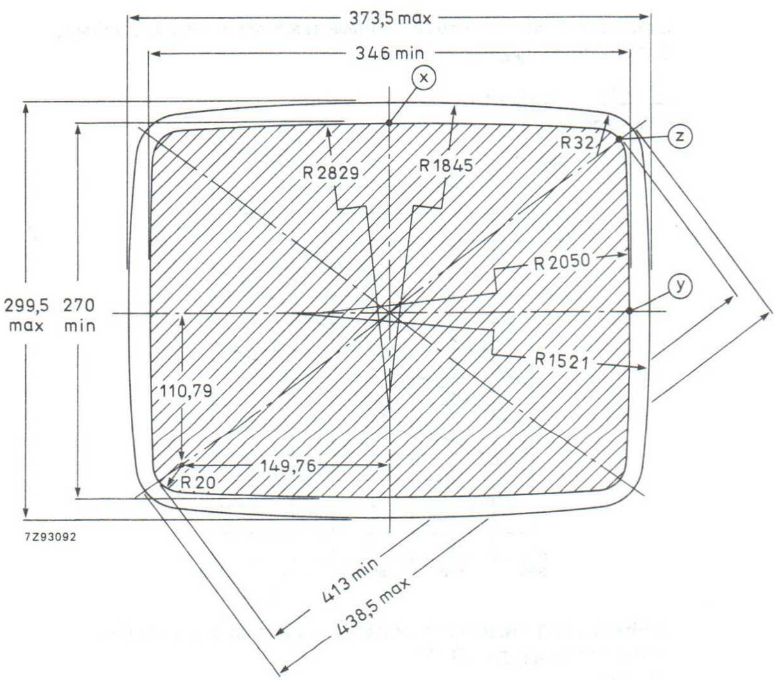
Limits of grid 1 raster cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5} = 20$ kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

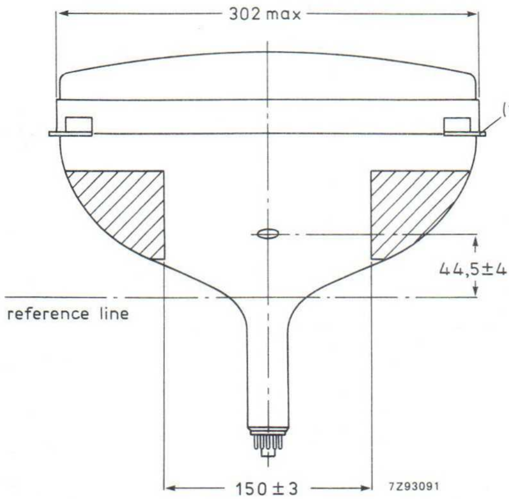
DIMENSIONAL DATA

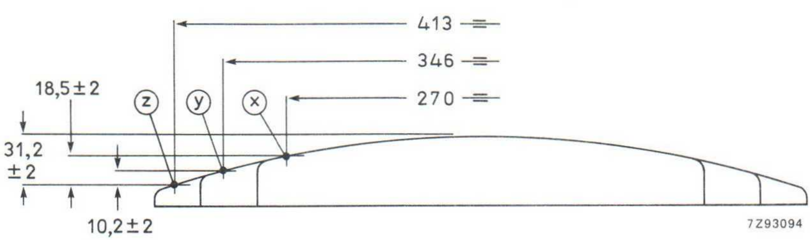
Dimensions in mm

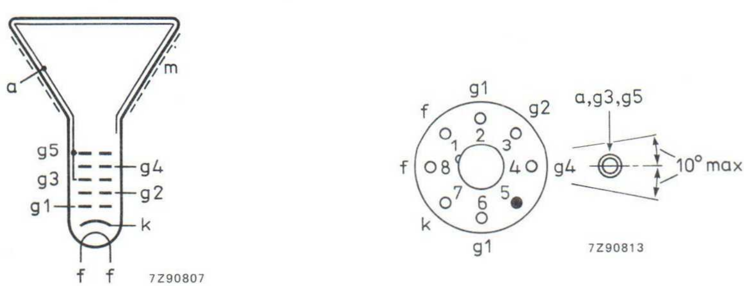




(1) The reference line is determined by the plane of the upper edge of reference line gauge C when the gauge is resting on the cone.

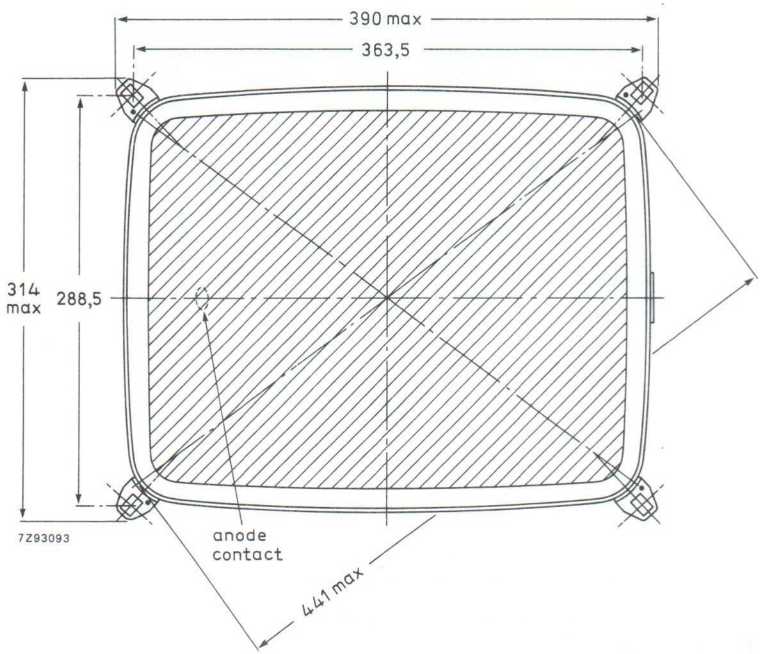


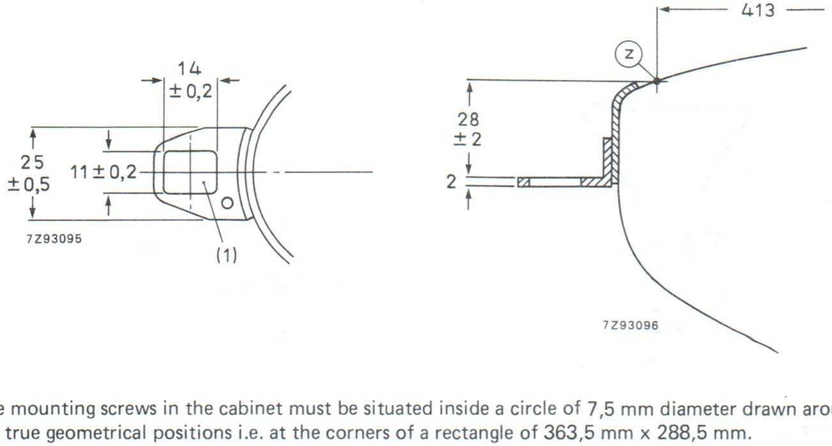




(1) The displacement of any lug with respect to the plane through the three other lugs is max. 1,5 mm.

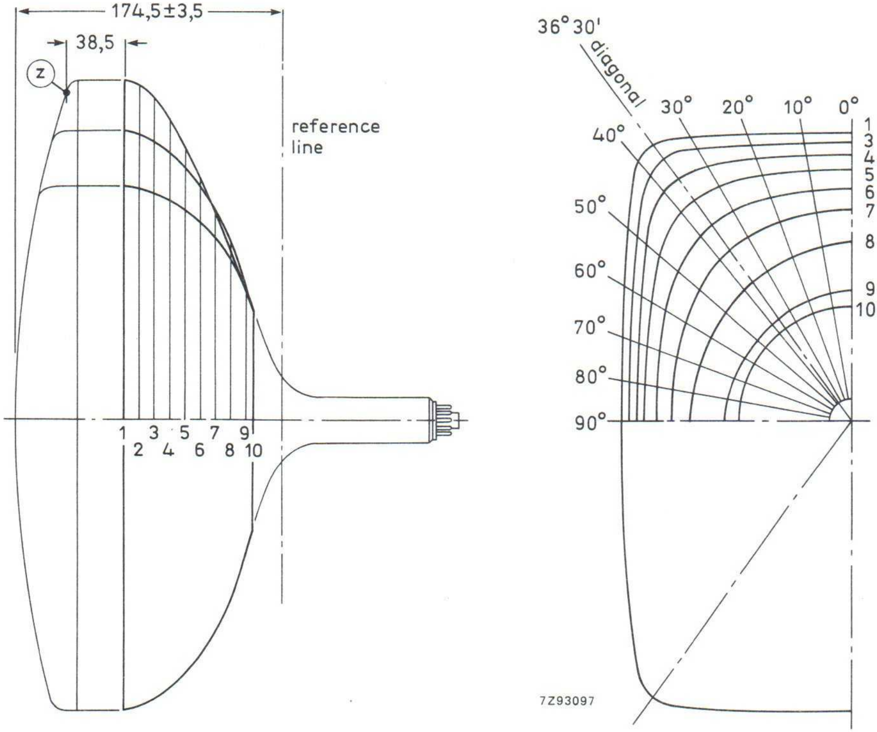
Front view and lug dimensions





(1) The mounting screws in the cabinet must be situated inside a circle of 7,5 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 363,5 mm x 288,5 mm.

Maximum cone contour



section	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	186,3	188,9	196,8	211,1	219,2	216,8	190,0	170,4	158,2	151,5	149,4
2	10	184,6	187,1	194,9	209,0	216,8	214,4	188,3	168,9	156,9	150,3	148,2
3	20	179,9	182,3	189,6	202,4	208,9	206,9	183,9	165,3	153,7	147,2	145,2
4	30	171,8	173,9	180,2	189,6	192,8	191,2	175,2	159,1	148,4	142,4	140,5
5	40	161,7	163,4	168,3	173,7	174,5	173,2	163,3	151,1	141,9	136,6	134,8
6	50	148,7	150,0	152,9	155,1	154,8	153,7	147,9	140,1	133,2	128,8	127,3
7	60	134,2	134,7	135,3	135,0	134,0	133,2	129,9	125,9	122,1	119,2	118,2
8	70	114,0	113,4	112,1	110,5	109,5	108,9	107,5	106,3	105,5	105,1	105,0
9	80	82,9	82,3	81,5	80,8	80,5	80,3	80,2	80,5	81,0	81,8	82,3
10	83,5	71,3	71,1	70,7	70,3	70,2	70,2	70,2	70,4	70,8	71,2	71,5

HIGH RESOLUTION MONOCHROME DISPLAY TUBE

- For Data Graphic Displays
- 114° deflection angle
- 50 cm (20 in) face diagonal; rectangular glass
- 28,6 mm neck diameter
- Integral implosion protection

QUICK REFERENCE DATA

Deflection angle	114°
Face diagonal	50 cm (20 in)
Overall length	max. 319 mm
Neck diameter	28,6 mm
Heating	6,3 V/240 mA
Quick heating cathode	with a typical tube a legible picture will appear within 5 s
Grid 2 voltage	400 V
Anode voltage	20 kV
Resolution	approx. 1400 lines

APPLICATION

This high resolution tube is for alpha-numeric and graphic display applications, such as computer terminals, etc.

The tube can be supplied with different phosphors, see "High resolution monochrome display tubes, General".

ELECTRICAL DATA

Focusing method	electrostatic
Deflection method	magnetic
Deflection angles	
diagonal	approx. 114^{o}
horizontal	approx. 104^{o}
vertical	approx. 90^{o}
Direct interelectrode capacitances	
cathode to all other electrodes	max. 4 pF
grid 1 to all other electrodes	max. 9 pF
Capacitance of external conductive coating to anode*	max. 1750 pF min. 1100 pF
Capacitance of external conductive coating to anode**	max. 1500 pF min. 1000 pF
Capacitance of anode to implosion protection hardware**	approx. 250 pF
Heater voltage	6,3 V
Heater current at 6,3 V	240 mA

OPTICAL DATA

Phosphor type	see "High resolution monochrome display tubes, General"
Light transmission at screen centre (normal tinted glass)	approx. 46%

RASTER CENTRING

The field intensity perpendicular to the tube axis should be adjustable from 0 to 800 A/m. For optimum overall sharpness it is recommended to centre the raster electrically via the deflection coils.

* Implosion protection hardware connected to external conductive coating.
** Implosion protection hardware not connected to external conductive coating.

MECHANICAL DATA (see also the figures under Dimensional Data)

Overall length	max. 319 mm
Greatest dimensions of tube	
diagonal	504,5 mm
width	430,5 mm
height	346,5 mm
Minimum useful screen dimensions (projected)	
diagonal	473 mm
horizontal axis	394 mm
vertical axis	308 mm
area	1187 cm^2
Implosion protection	rimband
Bulb	EIA J500A
Bulb contact designation	IEC 67-III-2; EIA J1-21
Base designation	IEC 67-1-31a; EIA B7-208
Basing	8 HR
Mass	approx. 8,5 kg

RATINGS (Absolute Maximum System)

Unless otherwise specified voltage values are positive and measured with respect to grid 1.

Anode voltage	max. 23 kV min. 15 kV
Grid 4 (focusing electrode) voltage	−500 to +1000 V
Grid 2 voltage	max. 700 V
Anode current	
long-term average value	max. 75 μA
peak value	max. 300 μA
Cathode voltage, positive peak value	max. 400 V
Heater voltage	6,3 V ± 10%*
Cathode-to-heater voltage	max. 200 V

* For maximum cathode life it is recommended that the heater supply be regulated at $6{,}3\ V^{+0\%}_{-5\%}$.

CIRCUIT DESIGN VALUES

Grid 4 current	
positive	max. 25 μA
negative	max. 25 μA
Grid 2 current	
positive	max. 5 μA
negative	max. 5 μA

MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	max. 1,0 MΩ
Impedance between cathode and heater	max. 0,1 MΩ
Grid 1 circuit resistance	max. 1,5 MΩ
Grid 1 circuit impedance	max. 0,5 MΩ

TYPICAL OPERATING CONDITIONS

Cathode drive; voltages specified with respect to grid 1	
Anode voltage	20 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Cathode cut-off voltage	40 to 70 V**
Grid drive; voltages specified with respect to cathode	
Anode voltage	20 kV
Grid 4 (focusing electrode) voltage	0 to 400 V*
Grid 2 voltage	400 V
Grid 1 cut-off voltage	45 to 83 V**

RESOLUTION

The resolution is approx. 1400 lines. It is measured at the screen centre, with shrinking raster method, at light output = 68,5 cd/m^2 (20 foot lambert), grid 2 voltage = 700 V, anode voltage = 20 kV; phosphor type W, without anti-glare treatment, raster dimensions 348 mm x 261 mm.

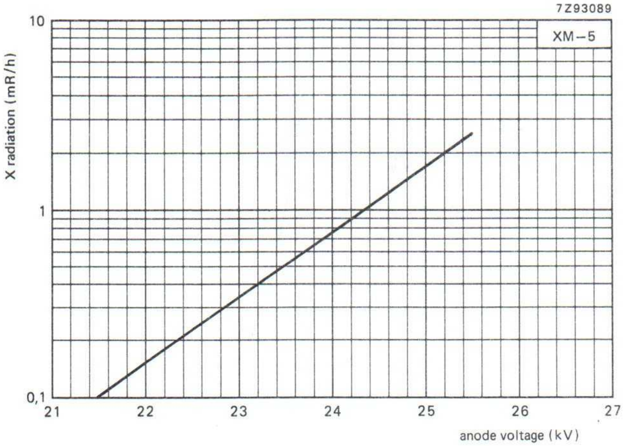
X-RADIATION CHARACTERISTIC

X-radiation emitted will not exceed 0,5 mR/h throughout the useful life of the tube, when operated within the given ratings.

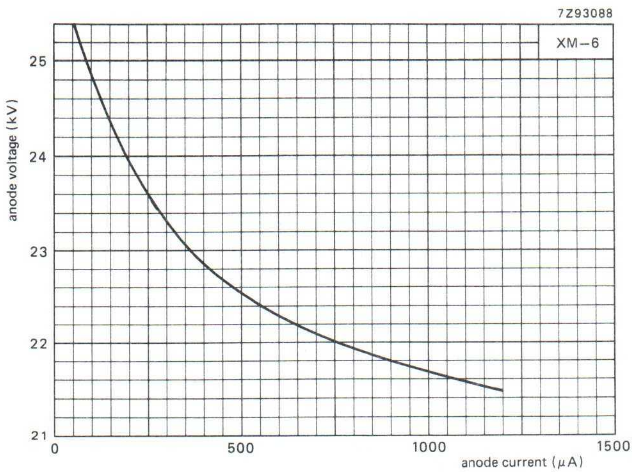
* Measured at screen centre on spot at anode current = 200 μA (peak), anode voltage = 20 kV, grid 2 voltage = 400 V.

Dynamic focus (only for optimization): Typical correction for a video field of H x V = 348 mm x 261 mm (landscape format): line parabola 300 V, field parabola 100 V.

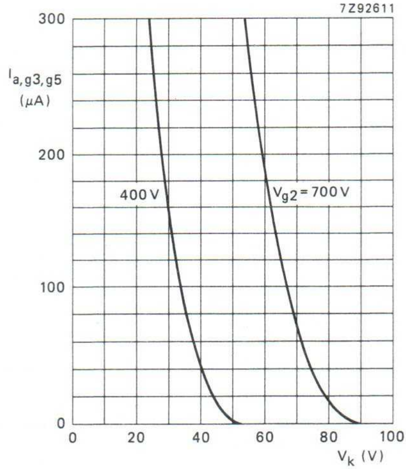
** Visual extinction of focused raster.



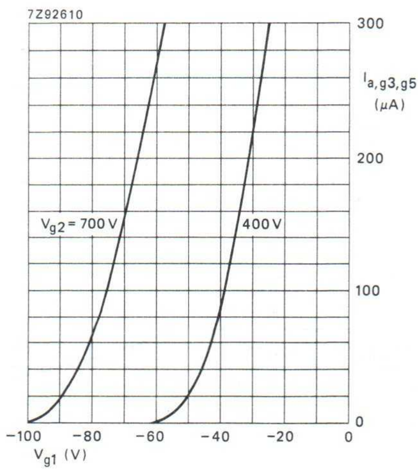
X-radiation limit curve according to JEDEC 94, at a constant anode current of 250 μA, measured according to TEPAC103A.



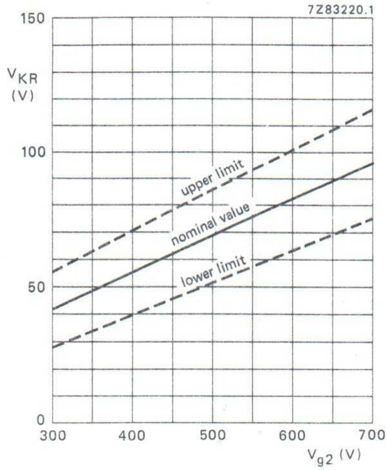
0,5 mR/h isoexposure rate limit curve, according to JEDEC 94, measured according to TEPAC103A.



Anode current as a function of cathode voltage.
Cathode drive; $V_{a,g3,g5}$ = 20 kV.

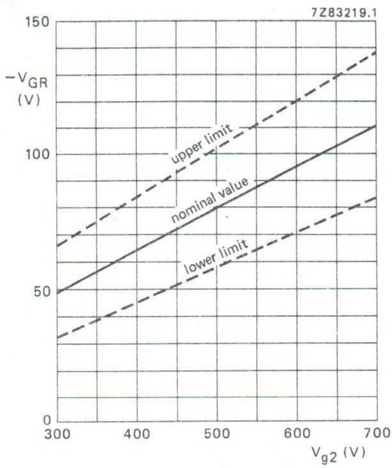


Anode current as a function of grid 1 voltage.
Grid drive; $V_{a,g3,g5}$ = 20 kV.



Limits of cathode raster cut-off voltage as a function of grid 2 voltage.
Cathode drive; $V_{a,g3,g5} = 20$ kV.

$$\frac{\Delta V_{KR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

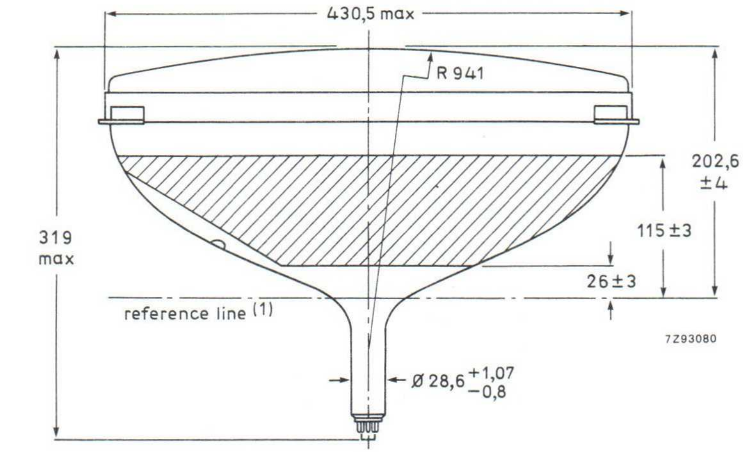


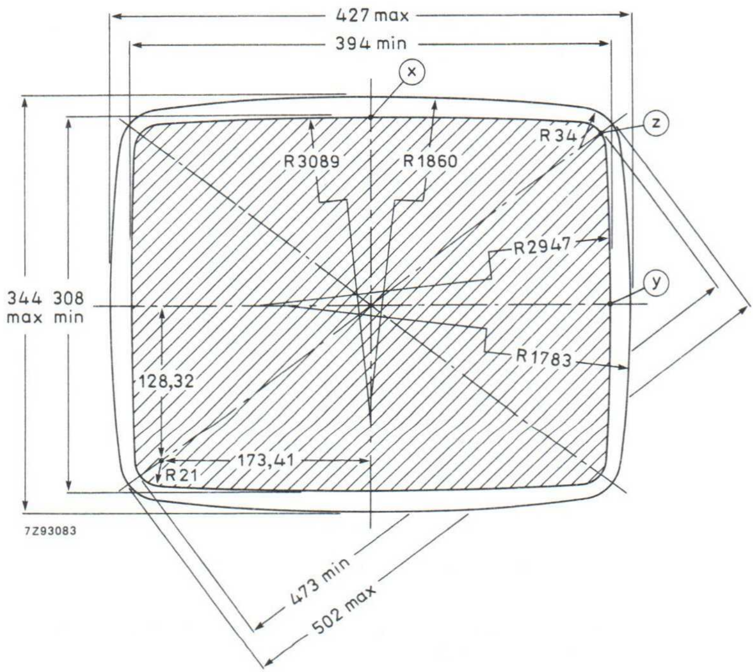
Limits of grid 1 raster cut-off voltage as a function of grid 2 voltage.
Grid drive; $V_{a,g3,g5} = 20$ kV.

$$\frac{\Delta V_{GR}}{\Delta V_{a,g3,g5}} = 0{,}15 \times 10^{-3}.$$

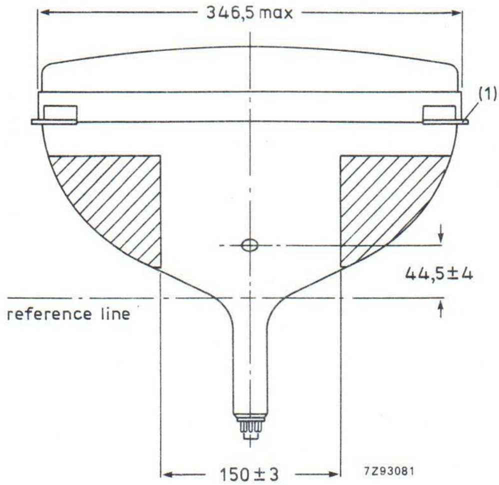
DIMENSIONAL DATA

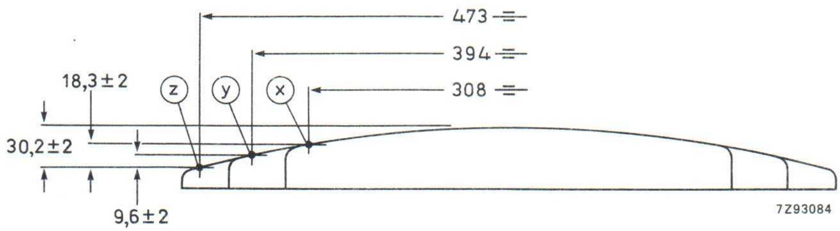
Dimensions in mm

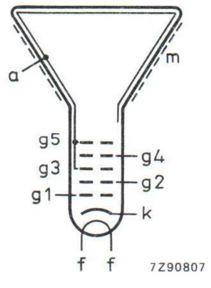


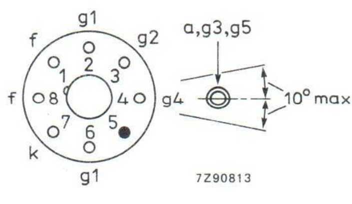


(1) The reference line is determined by the plane of the upper edge of reference line gauge C when the gauge is resting on the cone.



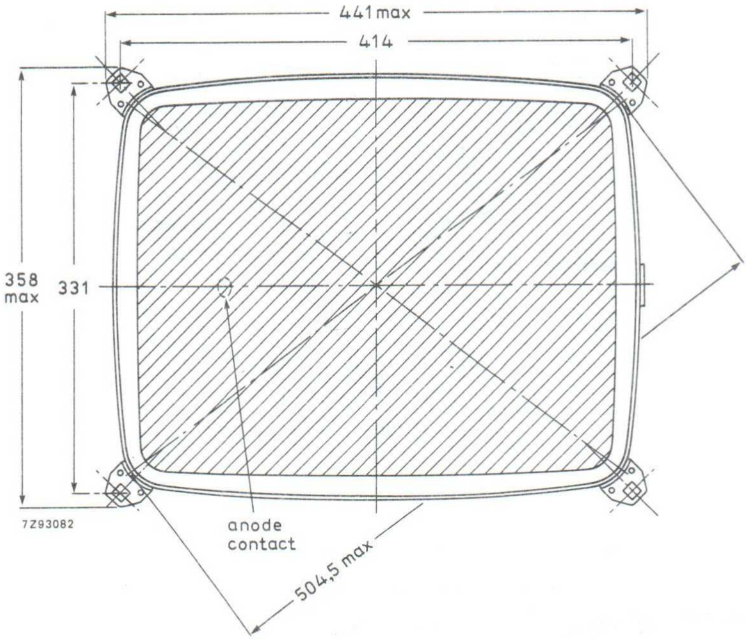


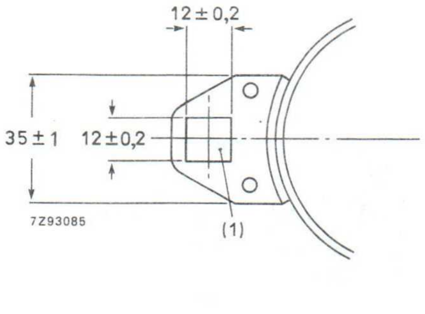


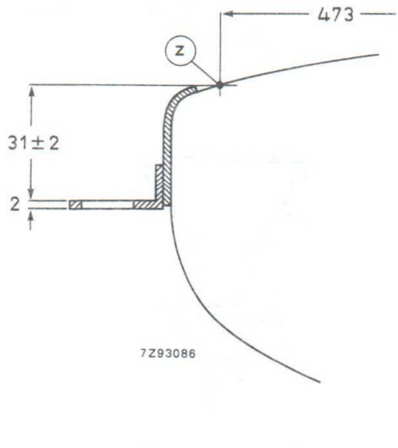


(1) The displacement of any lug with respect to the plane through the three other lugs is max. 1,5 mm.

Front view and lug dimensions

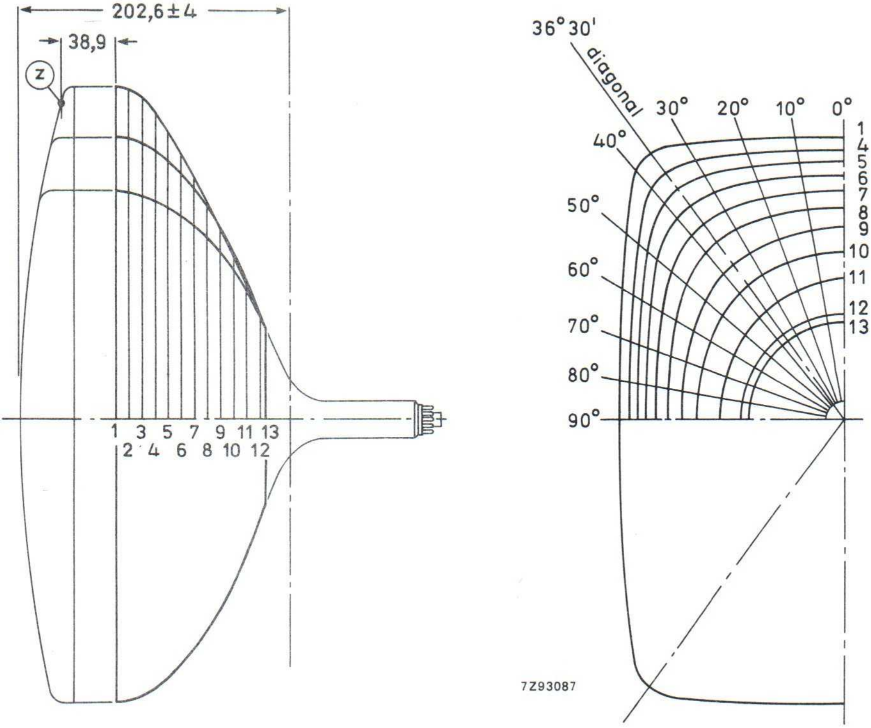






(1) The mounting screws in the cabinet must be situated inside a circle of 8 mm diameter drawn around the true geometrical positions i.e. at the corners of a rectangle of 414 mm x 331 mm.

Maximum cone contour



sec-tion	nom. distance from section 1	max. distance from centre										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	213,1	216,0	225,2	241,7	251,3	248,3	217,4	195,3	181,6	174,0	171,6
2	10	212,0	214,9	224,0	240,3	249,9	246,7	216,1	194,1	180,4	172,9	170,5
3	20	209,2	212,0	220,8	236,1	244,4	241,3	212,9	191,5	178,0	170,6	168,3
4	30	203,6	206,2	214,2	226,5	231,1	228,5	206,6	186,6	173,8	166,7	164,4
5	40	194,7	197,0	203,9	213,1	215,4	213,4	197,5	180,0	167,9	161,1	158,9
6	50	183,8	185,8	191,4	198,2	199,0	197,2	185,3	171,2	160,5	154,1	152,1
7	60	171,8	173,5	177,8	181,7	181,7	180,3	171,6	160,5	151,5	146,0	144,2
8	70	158,5	159,5	161,9	163,9	163,3	162,1	155,7	147,6	140,8	136,5	135,1
9	80	143,3	143,7	144,6	144,7	143,7	142,7	138,4	133,1	128,5	125,4	124,4
10	90	125,7	125,7	125,2	123,9	122,7	121,9	119,2	116,4	114,0	112,3	111,6
11	100	104,9	104,2	102,8	101,1	100,0	99,4	97,9	96,8	96,1	95,8	95,8
12	110	78,0	77,3	76,4	75,5	74,9	74,7	74,1	73,8	73,8	74,1	74,4
13	112,2	71,1	70,8	70,2	69,6	69,3	69,1	68,8	68,6	68,7	68,9	69,1

DEFLECTION UNITS FOR MONOCHROME
DATA GRAPHIC DISPLAY TUBES

replaces AT1038/40

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in), 38 cm (15 in)
neck diameter	28,6 mm
Deflection angle	110^o
Line deflection current, edge to edge at 17 kV	4,56 A (p-p)
Inductance of line coils	700 μH
Field deflection current, edge to edge at 17 kV	1,13 A (p-p)
Resistance of field coils (parallel connected)	7,6 Ω

APPLICATION

This deflection unit has been designed for use with 31 cm (12 in) and 38 cm (15 in) 110^o monochrome monitor tubes in conjunction with:

line output transformer AT2102/04C, AT2102/06C or AT2076/84;
linearity control unit AT4042/08A;
line driver transformer AT4043/59.

DESCRIPTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the monitor tube. The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the field and line deflection centres coincide. Provisions are made for centring, and correction of pin-cushion distortion. The unit meets the self-extinguishing and non-dripping requirements of IEC 65-14, UL1413 and UL94-V1.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the monitor tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the monitor tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

MECHANICAL DATA

Dimensions in mm

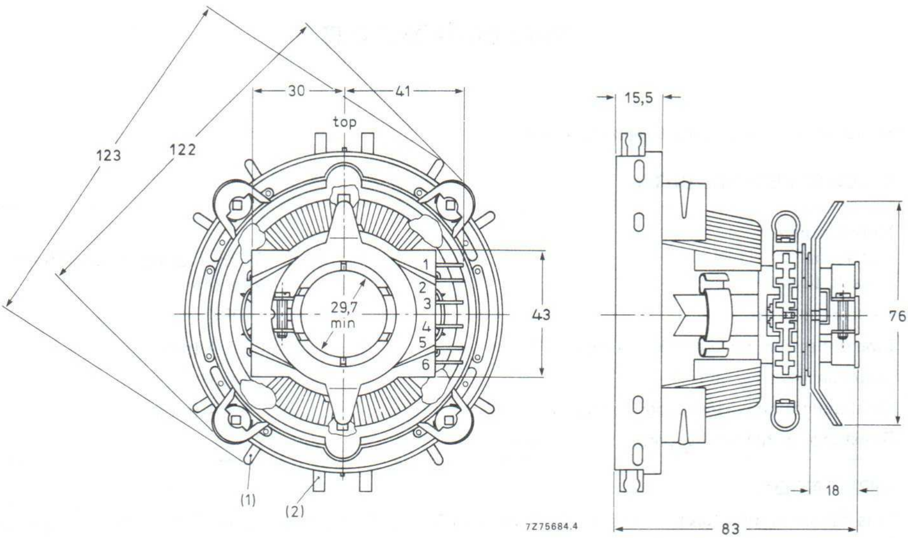
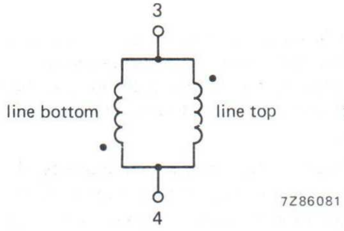


Fig. 1 Deflection unit AT1038/40A.
(1) for plastic-bonded FXD magnets 3122 104 94120.
(2) for plastic-bonded FXD magnet rods 3122 104 90360.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a); terminals 3 and 4	
Inductance	700 μH ± 4,5%
Resistance	1,1 Ω
Field deflection coils, parallel or series connected (Fig. 2b); terminals 1 and 2 for parallel connected coils (terminals 1 and 6, and 2 and 5 to be interconnected); terminals 2 and 6 for series connected coils (terminals 1 and 5 to be interconnected)	
Inductance (parallel connected coils)	14,1 mH
Inductance (series connected coils)	56,4 mH
Resistance (parallel connected coils)	7,6 Ω ± 8%
Resistance (series connected coils)	30,4 Ω ± 8%
Maximum d.c. voltage between line and field coils	2500 V
Maximum operating temperature	95 °C



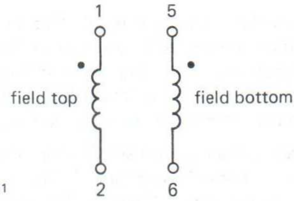


Fig. 2a Line coils. Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

The following characteristics are measured at an e.h.t. of 17 kV on a 38 cm (15 in) reference tube.

Sensitivity

Deflection current edge to edge	
in line direction	4,56 A (p-p)
in field direction (parallel connected coils)	1,13 A (p-p)

Geometric distortion measured without correction and centring magnets on a 38 cm (15 in) reference tube.

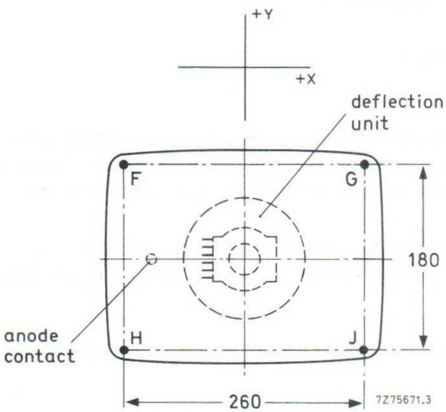


Fig. 3.

Fy : $+4^{+2\frac{1}{4}}_{-2\frac{1}{4}}$	Fx : $-4^{-2\frac{1}{4}}_{+2\frac{1}{4}}$
Gy : $+4^{+2\frac{1}{4}}_{-2\frac{1}{4}}$	Gx : $+4^{+2\frac{1}{4}}_{-2\frac{1}{4}}$
Jy : $-4^{-2\frac{1}{4}}_{+2\frac{1}{4}}$	Jx : $+4^{+2\frac{1}{4}}_{-2\frac{1}{4}}$
Hy : $-4^{-2\frac{1}{4}}_{+2\frac{1}{4}}$	Hx : $-4^{-2\frac{1}{4}}_{+2\frac{1}{4}}$

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

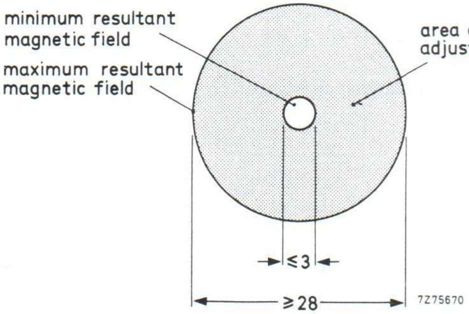


Fig. 4.

For pin-cushion distortion

Pin-cushion distortion can be corrected by four Ferroxdure magnets with pole-shoe brackets, which have been mounted on the deflection unit. Limited correction of asymmetrical pin-cushion distortion can be achieved by unequal movement of these magnets. The field strength can be adjusted by rotation of these magnets.

To correct the top and bottom of the raster, two plastic-bonded Ferroxdure magnet rods* can be fitted (Fig. 1). To correct the corners of the raster, four plastic-bonded Ferroxdure magnets** can be fitted (Fig. 1).

Note: After adjustment centring magnets and pole-shoe brackets have to be locked with locking paint.

* Available under catalogue number 3122 104 90360.
** Available under catalogue number 3122 104 94120.

DEFLECTION UNITS

- For Data Graphic Displays
- For use with high resolution 38 cm (15 in)/110^{o} monochrome CRTs*
- Optimized for minimum deflection defocusing
- Preset raster geometry for high resolution display tube M38-328
- Separate types for landscape and portrait formats

QUICK REFERENCE DATA

	AT1039/00	AT1039/01
Deflection angle	110^{o}	110^{o}
Neck diameter of CRT	28,6 mm	28,6 mm
Screen diagonal of CRT	38 cm	38 cm
Display format	portrait	landscape
Line deflection current for full scan, at 17 kV	6,40 $A_{(p-p)}$	8,35 $A_{(p-p)}$
Inductance of line coils, parallel connected	228 μH	206 μH
Field deflection current for full scan, at 17 kV	1,35 $A_{(p-p)}$	1,02 $A_{(p-p)}$
Resistance of field coils, series connected	10,2 Ω	10,6 Ω

APPLICATION

These deflection units are for Data Graphic Displays, especially when high resolution and/or high frequency operation is required. They are developed in conjunction with the high resolution display tube M38-328 to provide minimum deflection defocusing and good raster geometry without additional adjustments. Deflection unit AT1039/00 is for displays in vertical (portrait) format, AT1039/01 for displays in horizontal (landscape, TV) format.

To utilize the full potential of these deflection units in respect of deflection defocusing, dynamic focusing has to be applied in horizontal and vertical directions.

The line scan frequency is limited by the temperature of the deflection coils. The practical value depends on environmental conditions, but in general terms the highest operating frequency is approx. 50 kHz in landscape format and approx. 70 kHz in portrait format.

To provide some choice of impedances, the termination of the coils are brought out permitting either series or parallel connections.
When the coils are connected in parallel it is possible to provide scan at the highest frequency using existing devices. The impedance of the field coils (series connected) is adjusted for operation with integrated circuits (e.g. TDA2653A).

* Versions for other tube sizes are under development.

The following associated wound components are available for use in line time base circuits:

AT2076/84 – universal line output transformer;
→ AT4042/33A – linearity control unit (parallel connection);
→ AT4042/08A – linearity control unit (series connection);
AT4043/64 – line driver transformer;
AT4043/29 – d.c. shift transformer;
AT4044/35 – amplitude control unit.

A universal monitor design (C64) has been developed, which is based on AT1039 deflection coils; it permits adjustment of the operating frequencies to the desired value by replacement of a few components only.
Further details are available on request.

DESCRIPTION

The line and field deflection coils are basically saddle-shaped and are surrounded by a Ferroxcube yoke ring. A special winding technique guarantees a precise magnetic field and a high reproducibility.
Ferroxdure magnets are provided for beam centring. Provisions are made for mounting raster correction magnets.
The units meet the self-extinguishing requirements of CSA, IEC and UL.
The top of the units is marked.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube so that it touches the cone; the maximum push-on force on the tube is 50 N.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,75 to 0,90 Nm.

MECHANICAL DATA

Dimensions in mm

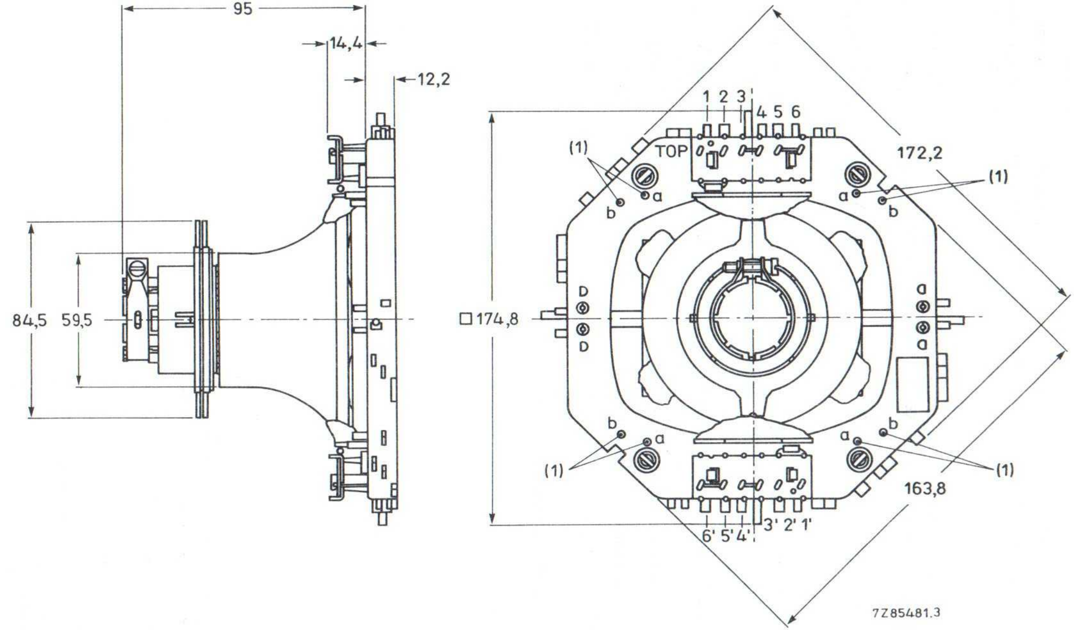


Fig. 1 Deflection units AT1039/00 and AT1039/01.

If a further improvement of raster geometry is required use can be made of correction magnets*, which must be fitted to mounting posts (1); posts **a** to be used for AT1039/00, posts **b** for AT1039/01.

The unit has solder pins for connection. The pin numbering in Fig. 1 corresponds to that in Fig. 2.

* Catalogue number 3122 134 92300. Six magnets are included in the packing of the deflection unit.

ELECTRICAL DATA

	AT1039/00		AT1039/01	
	parallel connected	series connected	parallel connected	series connected
Line deflection coils				
inductance	228 μH ± 4%	912 μH ± 4%	206 μH ± 4%	824 μH ± 4%
resistance	0,41 Ω ± 10%	1,64 Ω ± 10%	0,39 Ω ± 10%	1,56 Ω ± 10%
line deflection current edge to edge, at 17 kV	6,40 $A_{(p-p)}$	3,20 $A_{(p-p)}$	8,35 $A_{(p-p)}$	4,18 $A_{(p-p)}$
Field deflection coils				
inductance	2,30 mH ± 10%	9,18 mH ± 10%	2,43 mH ± 10%	9,72 mH ± 10%
resistance	2,55 Ω ± 7%	10,2 Ω ± 7%	2,65 Ω ± 7%	10,6 Ω ± 7%
field deflection current, edge to edge, at 17 kV	2,70 $A_{(p-p)}$ ± 5%	1,35 $A_{(p-p)}$ ± 5%	2,04 $A_{(p-p)}$ ± 5%	1,02 $A_{(p-p)}$ ± 5%

Maximum permissible d.c. voltage between line and field coils	3000 V
Maximum permissible d.c. voltage between field coil and yoke ring	300 V
Coupling between line and field coils, at 1 V, 500 Hz	$\leqslant$ 1/100

Note: The values apply at an ambient temperature of 23 ^{o}C

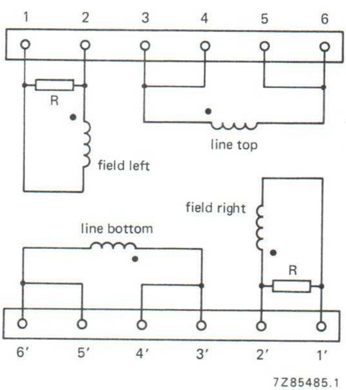


Fig. 2 Diagram of line and field coils; R = 270 Ω. The beginning of the windings is indicated with ●.

Interconnections

	terminals to be interconnected	output terminals* live	output terminals* neutral
Line deflection coils			
parallel connection	3, 4 to 5', 6' and 3', 4' to 5, 6	3, **4'** 5', 6'	3', **4'**, 5, 6
series connection	3, 4 to 3', 4'	5', **6'**	**5**, 6
Field deflection coils			
parallel connection	1 to 2' and 1' to 2	**1'**, 2	1, **2'**
series connection	2 to 2'	**1'**	**1**

Tolerances of raster geometry due to deflection coils

The spreads in raster geometry are tabulated below as deviations from the ideal rectangle at the points indicated. Cartesian coordinates are used to show the extent of deviation resolved along x and y areas. Points A, B, C, D, E are fixed and hence have zero spreads.
The spreads were obtained from measurements on a nominal tube M38-328 (without raster correction and centring magnets), at V_a = 17 kV, V_{g2} = 700 V, I_a = 50 μA; horizontal and vertical dynamic focus applied and with terrestrial magnetic field compensated.

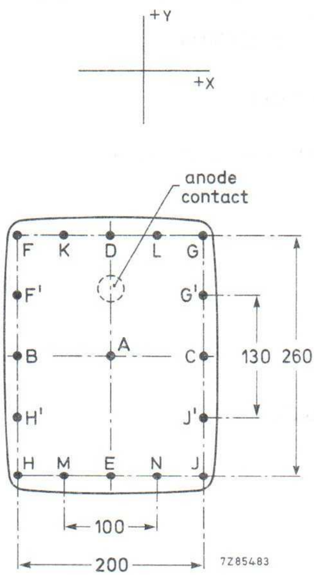


Fig. 3 AT1039/00.

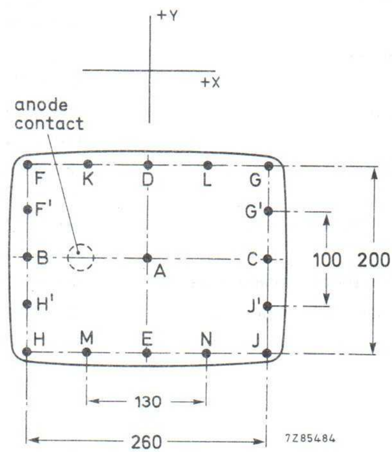


Fig. 4 AT1039/01.

* Terminals which are most convenient to be used as output terminals are underlined.

Spreads (x, y) per point, for both AT1039/00 and AT1039/01 (Dimensions in mm)

F (−0,7 ± 1,5 , +0,5 ± 1,5)	F′ (−0,35 ± 0,75 , +0,25 ± 0,75)
G (+0,3 ± 1,5 , +0,5 ± 1,5)	G′ (+0,15 ± 0,75 , +0,25 ± 0,75)
J (+0,7 ± 1,5 , −0,5 ± 1,5)	J′ (+0,35 ± 0,75 , −0,25 ± 0,75)
H (−0,3 ± 1,5 , −0,5 ± 1,5)	H′ (−0,15 ± 0,75 , −0,25 ± 0,75)
K (−0,5 ± 1,0 , +0,25 ± 0,75)	
L (0,0 ± 1,0 , +0,25 ± 0,75)	
N (+0,5 ± 1,0 , −0,25 ± 0,75)	
M (0,0 ± 1,0 , −0,25 ± 0,75)	

ENVIRONMENTAL DATA

Maximum operating temperature (average copper temperature)	95 °C
Maximum possible temperature rise (ΔT) as a result of coil losses	35 °C
Storage temperature range	−25 to + 95 °C
Flame retarding	according to UL1413
Flammability	according to UL94, category V1

ENVIRONMENTAL TESTS

The deflection units withstand the following tests:

Vibration	IEC 68-2-6; test Fc, procedure B4; 10-55-10 Hz, amplitude 0,35 mm, 3 x 30 min.
Bump	IEC 68-2-29, test Eb; 250 m/s^2, 1000 bumps, 6 directions.
Shock	IEC 68-2-27. test Ea; 11 ms, half-sine pulse shape, 350 m/s^2, 3 x 6 directions.
Cold	IEC 68-2-1, test Ab; 96 h, −25 °C.
Dry heat	IEC 68-2-2, test Bb; 96 h, + 95 °C.
Cyclic damp heat	IEC 68-2-30, test Db; 21 cycles, + 40 °C.
Damp heat, steady state	IEC 68-2-3, test Ca, 21 days.
Change of temperature	IEC 68-2-14, test Nb; 5 cycles of 2 h at −25 °C and 2 h at + 95 °C, duration of one cycle 5 h.

BEAM CENTRING

The deflection units have two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are for placing the electron beam coaxially with the deflection coils. They are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The required torque on the magnets is 35 to 250 mNm. See also Fig. 5.
The correct position of the magnets ensures freedom from curved lines in the centre of the raster and is beneficial with regard to raster geometry, deflection defocusing, corner cutting etc. For quality performance, picture shift should be obtained by applying d.c. current through the deflection coils.
This should be done after adjustment of raster linearity and after correct phasing of displayed information in respect of the raster.

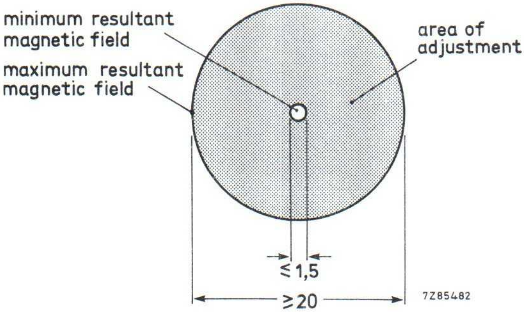


Fig. 5.

PACKING

The deflection units are packed in boxes of 16.

DEFLECTION UNIT

- For Data Graphic Displays
- For use with high resolution 31 cm (12 in)/110° monochrome CRTs
- Optimized for minimum deflection defocusing
- Preset raster geometry for high resolution display tube M31-326

QUICK REFERENCE DATA

Deflection angle	110°
Neck diameter of CRT	28,6 mm
Screen diagonal of CRT	31 cm
Display format	landscape
Line deflection current for full scan, at 17 kV	7,95 A (p-p)
Inductance of line coils, parallel connected	228 μH
Field deflection current for full scan, at 17 kV	1,21 A (p-p)
Resistance of field coils, series connected	10,2 Ω

APPLICATION

This deflection unit is for Data Graphic Displays, especially when high resolution and/or high frequency operation is required. It is developed in conjunction with the high resolution display tube M31-326 to provide minimum deflection defocusing and good raster geometry without additional adjustments.

To utilize the full potential of this deflection unit in respect of deflection defocusing, dynamic focusing has to be applied in horizontal and vertical directions.

The line scan frequency is limited by the temperature of the deflection coils. The practical value depends on environmental conditions, but in general terms the highest operating frequency is approx. 50 kHz.

To provide some choice of impedances, the terminations of the coils are brought out permitting either series or parallel connections.
When the coils are connected in parallel it is possible to provide scan at the highest frequency using existing devices. The impedance of the field coils (series connected) is adjusted for operation with integrated circuits (e.g. TDA2653A).

The following associated wound components are available for use in line time base circuits:

AT2076/84 – universal line output transformer;
AT4042/33A – linearity control unit (parallel connection);
AT4042/08A – linearity control unit (series connection);
AT4043/64 – line driver transformer;
AT4043/29 – d.c. shift transformer;
AT4044/35 – amplitude control unit.

A universal monitor design (C64) has been developed, which is based on AT1039 deflection coils; it permits adjustment of the operating frequencies to the desired value by replacement of a few components only.
Further details are available on request.

DESCRIPTION

The line and field deflection coils are basically saddle-shaped and are surrounded by a ferroxcube yoke ring. A special winding technique guarantees a precise magnetic field and a high reproducibility.
Ferroxdure magnets are provided for beam centring. Provisions are made for mounting raster correction magnets.
The unit meets the self-extinguishing requirements of CSA, IEC and UL.
The top of the unit is marked.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube so that it touches the cone; the maximum push-on force on the tube is 50 N.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,75 to 0,90 Nm.

MECHANICAL DATA

Dimensions in mm

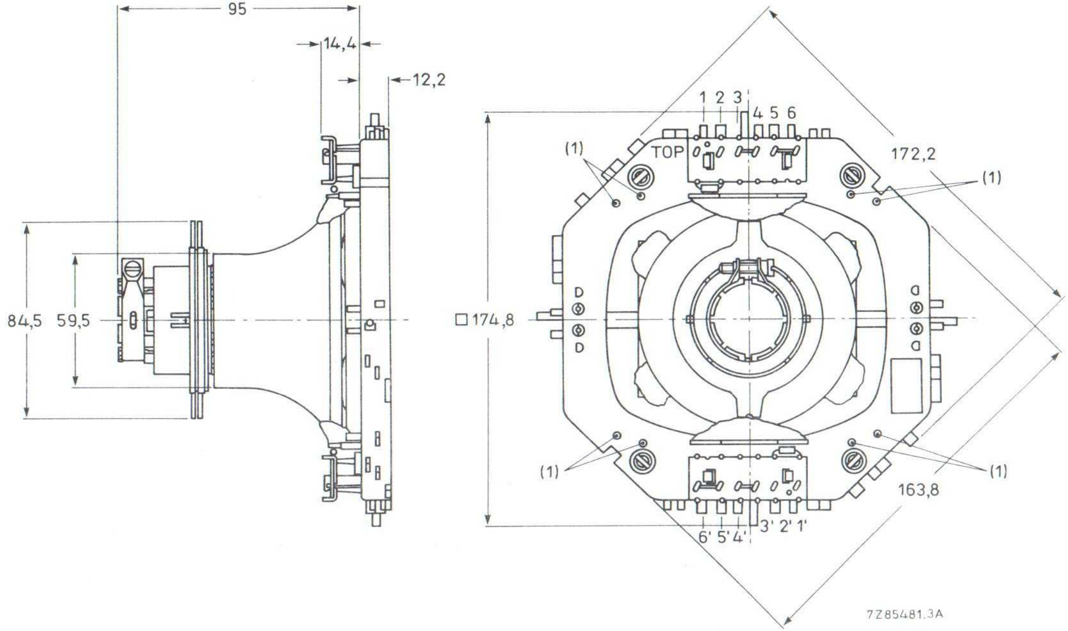


Fig. 1 Deflection unit AT1039/03.

If a further improvement of raster geometry is required use can be made of correction magnets*, which must be fitted to mounting posts (1).

The unit has solder pins for connection. The pin numbering in Fig. 1 corresponds to that in Fig. 2.

* Catalogue number 3122 134 92300. Six magnets are included in the packing of the deflection unit.

ELECTRICAL DATA

	parallel connected	series connected
Line deflection coils		
inductance	228 μH ± 4%	912 μH ± 4%
resistance	0,41 Ω ± 10%	1,64 Ω ± 10%
line deflection current, edge to edge, at 17 kV	7,95 A (p-p) ± 5%	3,98 A (p-p) ± 5%
Field deflection coils		
inductance	2,30 mH ± 10%	9,18 mH ± 10%
resistance	2,55 Ω ± 7%	10,2 Ω ± 7%
field deflection current, edge to edge, at 17 kV	2,42 A (p-p) ± 5%	1,21 A (p-p) ± 5%

Maximum permissible d.c. voltage between line and field coils	3000 V
Maximum permissible d.c. voltage between field coil and yoke ring	300 V
Coupling between line and field coils, at 1 V, 500 Hz	$\leqslant$ 1/100

Note: The values apply at an ambient temperature of 23 ^{o}C.

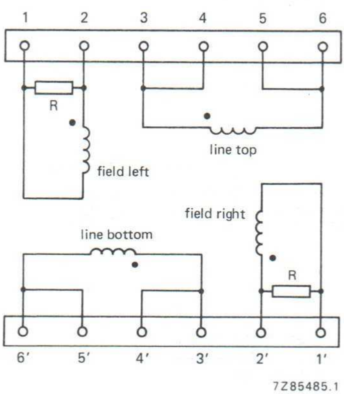


Fig. 2 Diagram of line and field coils; R = 270 Ω.
The beginning of the windings is indicated with●.

Interconnections

	terminals to be interconnected	output terminals*	
		live	neutral
Line deflection coils			
parallel connected	3, 4 to 5′, 6′ and 3′, 4′ to 5, 6	3, **4′**, 5′, 6′	3′, **4′**, 5, 6
series connection	3, 4 to 3′, 4′	5′, **6′**	**5**, 6
Field deflection coils			
parallel connected	1 to 2′ and 1′ to 2	**1′**, 2	1, **2′**
series connection	2 to 2′	**1′**	**1**

Tolerances of raster geometry due to deflection coils

The nominal shape of the raster geometry is tabulated below as deviations from the ideal rectangle at the points indicated. Cartesian coordinates are used to show the extent of deviation resolved along x and y areas. Points A, B, C, D, E are fixed.
The values were obtained from measurements on a nominal tube M31-326, (without raster correction and centring magnets) at V_a = 17 kV, with terrestrial magnetic field compensated.

Nominal deviation (x, y) per point (mm)

F (0,0 , 0,0)
G (+0,2 , −0,5)
J (+0,1 , +0,1)
H (−0,6 , +0,5)

K (−0,8 , 0,0)
L (+0,7 , −0,7)
N (+0,7 , −0,1)
M (−0,8 , +0,4)

F′ (+0,1 , +0,1)
G′ (+0,1 , −0,1)
J′ (0,0 , −0,1)
H′ (−0,7 , −0,1)

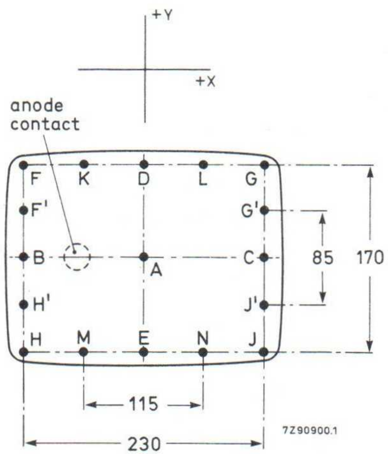


Fig. 3.

* Terminals which are most convenient to be used as output terminals are underlined.

Spreads (mm)

The spreads in raster geometry are indicated in Fig. 4. The edges of the displayed raster fall between the two rectangles. The obliquity of the raster is as follows:

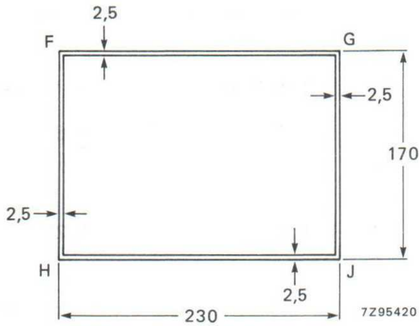


Fig. 4.

$|F_x - G_x| \leq 2$ $\quad |F_x - H_x| \leq 2$

$|F_y - H_y| \leq 2$ $\quad |F_y - G_y| \leq 2$

$|G_y - J_y| \leq 2$ $\quad |G_x - J_x| \leq 2$

$|H_x - J_x| \leq 2$ $\quad |H_y - J_y| \leq 2$

ENVIRONMENTAL DATA

Maximum operating temperature (average copper temperature)	95 °C
Maximum possible temperature rise (ΔT) as a result of coil losses	35 °C
Storage temperature range	−25 to + 95 °C
Flame retarding	according to UL1413
Flammability	according to UL94, category V1

ENVIRONMENTAL TESTS

The deflection units withstand the following tests:

Vibration	IEC 68-2-6; test Fc, procedure B4; 10-55-10 Hz, amplitude 0,35 mm, 3 x 30 min.
Bump	IEC 68-2-29, test Eb; 250 m/s^2, 1000 bumps, 6 directions.
Shock	IEC 68-2-27, test Ea; 11 ms, half-sine pulse shape, 350 m/s^2, 3 x 6 directions.
Cold	IEC 68-2-1, test Ab; 96 h, −25 °C.
Dry heat	IEC 68-2-2, test Bb; 96 h, + 95 °C.
Cyclic damp heat	IEC 68-2-30, test Db; 21 cycles, + 40 °C.
Damp heat, steady state	IEC 68-2-3, test Ca, 21 days.
Change of temperature	IEC 68-2-14, test Nb; 5 cycles of 2 h at −25 °C and 2 h at + 95 °C, duration of one cycle 5 h.

BEAM CENTRING

The deflection unit has two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are for placing the electron beam coaxially with the deflection coils. They are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The required torque on the magnets is 35 to 250 mNm. See also Fig. 5.
The correct position of the magnets ensures freedom from curved lines in the centre of the raster and is beneficial with regard to raster geometry, deflection defocusing, corner cutting etc. For quality performance, picture shift should be obtained by applying d.c. current through the deflection coils.
This should be done after adjustment of raster linearity and after correct phasing of displayed information in respect of the raster.

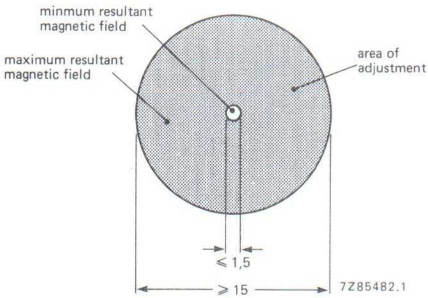


Fig. 5.

PACKING

The deflection unit is packed in boxes of 16.

DEFLECTION UNIT

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	28,6 mm
Deflection angle	90°
Line deflection current, edge to edge at 17 kV	9,2 A (p-p)
Inductance of line coils (parallel connected)	91,5 μH
Field deflection current, edge to edge at 17 kV	0,91 A (p-p)
Resistance of field coils	7,0 Ω

APPLICATION

This deflection unit is for use with 31 cm (12 in) 90° high resolution monochrome monitor tube M31-250, in conjunction with:
line output transformer AT2102/02;
linearity control unit AT4036/00A;
line driver transformer AT4043/56.

DESCRIPTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the monitor tube. The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide. Provisions are made for centring, and correction of raster-geometry distortion. The unit meets the self-extinguishing and non-dripping requirements of IEC 65.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the monitor tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the monitor tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

MECHANICAL DATA

Dimensions in mm

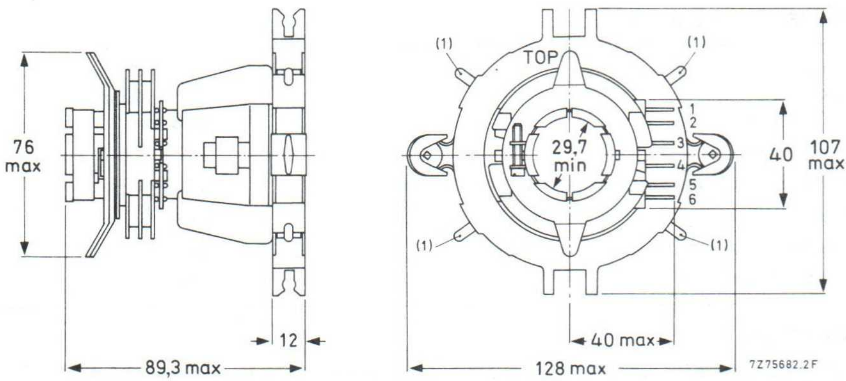


Fig. 1 Deflection unit AT1071/05.
(1) Facilities for fitting plastic-bonded FXD correction magnets, catalogue number 3122 104 94120.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the connection diagram (Figs 2a and 2b).

ELECTRICAL DATA

Line deflection coils (Fig. 2a);	
Inductance (parallel connected coils)	91,5 μH
Resistance (parallel connected coils)	0,15 Ω
Field deflection coils, (Fig. 2b);	
Inductance	13,0 mH
Resistance	7,0 Ω
Maximum d.c. voltage between terminals of line and field coils	2000 V
Maximum operating temperature	95 °C

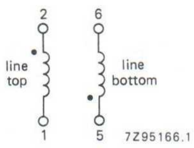


Fig. 2a Line coils.

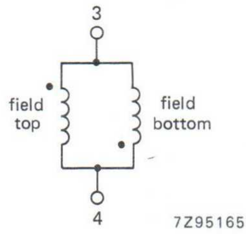


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

The following characteristics are measured at an e.h.t. of 17 kV on a M31-250 reference tube.

Sensitivity

Deflection current edge to edge (without correction and centring magnets)	
in line direction (parallel connected coils)	9,2 A (p-p)
in field direction	0,91 A (p-p)
Deflection current edge to edge (with correction and centring magnets)	
in line direction (parallel connected coils)	approx. 8,7 A (p-p)
in field direction	approx. 0,93 A (p-p)

Geometric distortion measured without correction and centring magnets on a M31-250 reference tube (dimensions in mm)

The spreads in raster geometry are tabulated below as deviations from the ideal rectangle at the points indicated. Cartesian coordinates are used to show the extent of deviation resolved along x and y areas. Points A, B, C, D, E are fixed and hence have zero spreads.

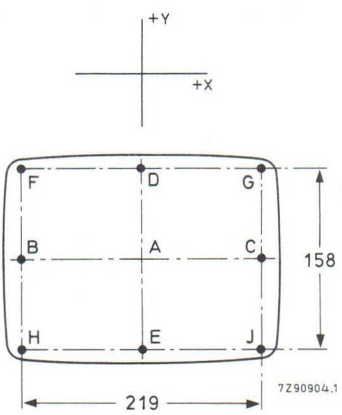


Fig. 3.

Spreads (x,y) per point

F (−3,5 ± 2,0 , +4,0 ± 2,0)
G (+3,5 ± 2,0 , +4,0 ± 2,0)
H (−3,5 ± 2,0 , −4,0 ± 2,0)
J (+3,5 ± 2,0 , −4,0 ± 2,0)

$|Fx\text{-}Hx| \leqslant 2{,}0$
$|Gx\text{-}Jx| \leqslant 2{,}0$
$|Fy\text{-}Gy| \leqslant 2{,}0$
$|Hy\text{-}Jy| \leqslant 2{,}0$

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

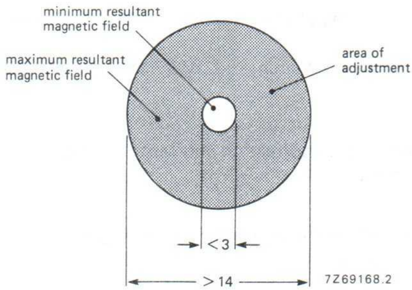


Fig. 4.

For raster-geometry distortion

Pin-cushion distortion can be corrected by two Ferroxdure magnets with pole-shoe brackets, which have been mounted on the deflection unit. Limited correction of asymmetrical pin-cushion distortion can be achieved by unequal movement of these magnets. The field strength can be adjusted by rotation of these magnets. To correct the corners of the raster, four plastic-bonded Ferroxdure magnets* (Fig. 1) can be fitted.

Recommended adjustment procedure

- Place the centring magnets in zero position (marking holes in opposite directions).
- Adjust the two magnets with pole-shoe brackets to obtain a straight east-west raster.
- Adjust the optimum horizontal and vertical linearity of deflection current.
- Centre the raster with the two centring magnets.
- Small readjustment of the magnets with pole-shoes may be necessary to obtain an optimum overall raster. If required correction of the corners can be done with the magnets mentioned in the foot note.
- Lock the centring magnets and pole-shoes with locking paint.

* Available under catalogue number 3122 104 94120.

DEFLECTION UNIT

QUICK REFERENCE DATA

Monitor tube	
diagonal	17 cm (7 in)
neck diameter	28,6 mm
Deflection angle	90^{o}
Line deflection current, edge to edge at 15 kV	7,6 A (p-p) ←
Inductance of line coils	86,5 μH
Field deflection current, edge to edge at 15 kV	0,79 A (p-p) ←
Resistance of field coils (parallel connected)	4,2 Ω

APPLICATION

This deflection unit is for use with 17 cm (7 in) 70^{o} monitor tube M17-142 in conjunction with:
- line output transformer AT2102/02;
- linearity control unit AT4036/00A;
- line driver transformer AT4043/56.

DESCRIPTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the monitor tube. The field deflection coils are wound on a Ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide. Provisions are made for centring, and correction of pin-cushion distortion. The unit meets the self-extinguishing and non-dripping requirements of IEC 65.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the monitor tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the monitor tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

MECHANICAL DATA

Dimensions in mm

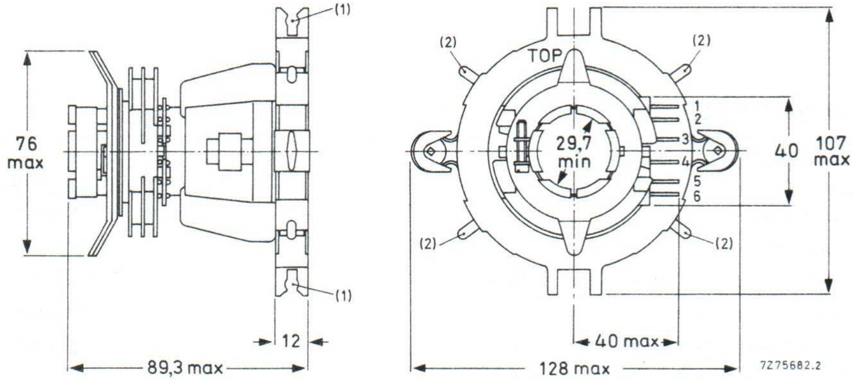


Fig. 1 Deflection unit AT1071/07. Facilities for fitting correction magnets:
(1) for plastic-bonded FXD magnet rods catalogue number 3122 104 90360;
(2) for plastic-bonded FXD magnets, catalogue number 3122 104 94120.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the connection diagram (Figs 2a and 2b).

ELECTRICAL DATA

Line deflection coils, parallel connected (Fig. 2a); terminals 3 and 4

Inductance	86,5 μH
Resistance	0,14 Ω

Field deflection coils, parallel or series connected (Fig. 2b); terminals 1 and 2 for parallel connected coils (terminals 1 and 6, and 2 and 5 to be interconnected); terminals 2 and 6 for series connected coils (terminals 1 and 5 to be interconnected)

Inductance (parallel connected coils)	10,4 mH
Inductance (series connected coils)	41,6 mH
Resistance (parallel connected coils)	4,2 Ω
Resistance (series connected coils)	16,8 Ω

Maximum d.c. voltage between terminals of line and field coils	2000 V
Maximum operating temperature	95 °C

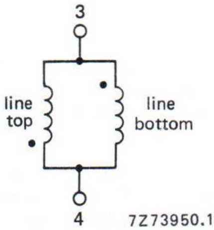


Fig. 2a Line coils.

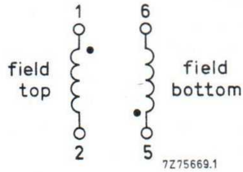


Fig. 2b Field coils.

The beginning of the windings is indicated with •.

Sensitivity measured at an e.h.t. of 15 kV on a 17 cm (7 in) 70° reference tube.

Deflection current edge to edge

in line direction	7,6 A (p-p)
in field direction (parallel connected coils)	0,79 A (p-p)

Geometric distortion measured without correction and centring magnets on a 17 cm (7 in) 70° reference tube (dimensions in mm)

The spreads in raster geometry are tabulated below as deviations from the ideal rectangle at the points indicated. Cartesian coordinates are used to show the extent of deviation resolved along x and y areas. Points A, B, C, D, E are fixed and hence zero spreads.

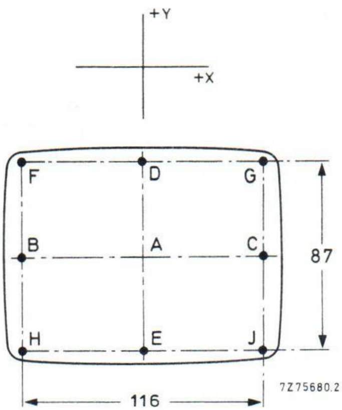


Fig. 3.

Spreads (x,y) per point

F (−0,5 ± 2,0 , +1,0 ± 1,5)
G (+0,5 ± 2,0 , +1,0 ± 1,5)
H (−0,5 ± 2,0 , −1,0 ± 1,5)
J (+0,5 ± 2,0 , −1,0 ± 1,5)

DEVELOPMENT DATA

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded Ferroxdure. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

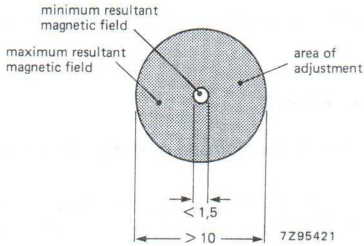


Fig. 4.

For pin-cushion distortion

Pin-cushion distortion can be corrected by two Ferroxdure magnets with pole-shoe brackets, which have been mounted on the deflection unit. Limited correction of asymmetrical pin-cushion distortion can be achieved by unequal movement of these magnets. The field strength can be adjusted by rotation of these magnets. To correct the top and bottom of the raster, two plastic-bonded Ferroxdure magnet rods* can be fitted (Fig. 1). To correct the corners of the raster, four plastic-bonded Ferroxdure magnets** (Fig. 1) can be fitted.

* Available under catalogue number 3122 104 90360.

** Available under catalogue number 3122 104 94120.

DEFLECTION UNIT

QUICK REFERENCE DATA

Picture tube	
diagonal	24 cm (9 in)
neck diameter	20 mm
Deflection angle	90^{o}
Line deflection current for full scan, at 10 kV	2,70 A (p-p)
Inductance of line coils	475 μH
Field deflection current for full scan, at 10 kV	0,24 A (p-p)
Resistance of field coils	40 Ω

APPLICATION

This deflection unit is for 24 cm (9 in) 90^{o} black & white picture tubes and monitor tubes for basic displays. The unit is used in conjunction with:
- line output transformer AT2140/16 or AT2140/16B;
- linearity control unit AT4042/08A or linearity corrector AT4042/46.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound fields coils. **The line coils and the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

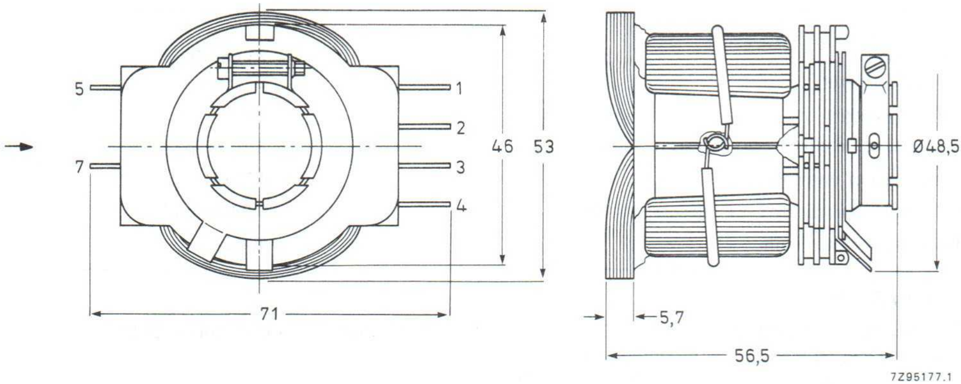


Fig. 1 Deflection unit AT1077/01.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, series connected (Fig. 2), terminals 1 and 4	
Inductance	475 μH $^{+3,5\%}_{-1,5\%}$
Resistance	0,8 Ω ± 5%
L/R	594 μH/Ω
Line deflection current, edge to edge (198 mm), at 10 kV	2,70 A (p-p) $^{+10\%}_{-4\%}$
Field deflection coils, series connected (Fig. 2), terminals 2 and 3	
Inductance	72 mH ± 8%
Resistance	40 Ω ± 5%
L/R	1,80 mH/Ω
Field deflection current, edge to edge (149 mm), at 10 kV	0,24 A (p-p) ± 10%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

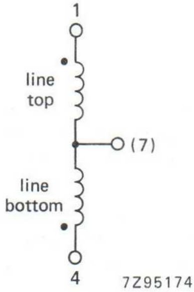


Fig. 2a Line coils.

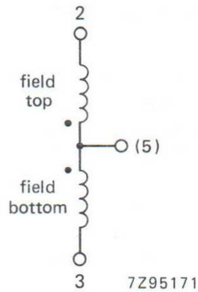
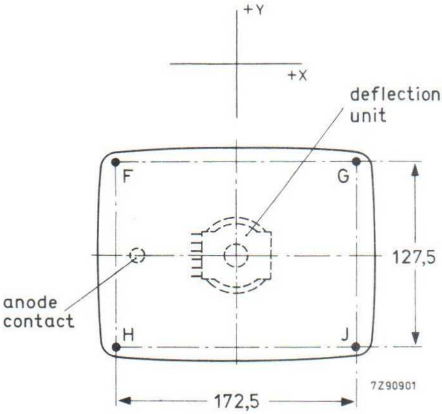


Fig. 2b Field coils.

The beginning of the windings is indicated with •.

Geometric distortion measured without centring magnets on a 24 cm (9 in) reference tube (dimensions in mm)



$|Fy\text{-}Gy| \leq 2$
$|Gx\text{-}Jx| \leq 2$
$|Jy\text{-}Hy| \leq 2$
$|Hx\text{-}Fx| \leq 2$

Fig. 3.

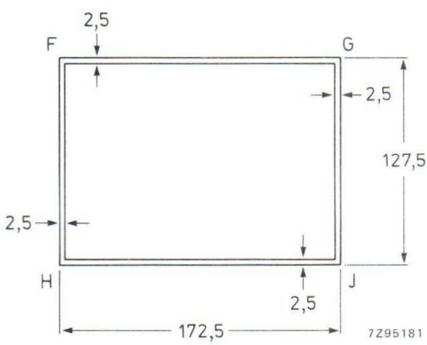


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

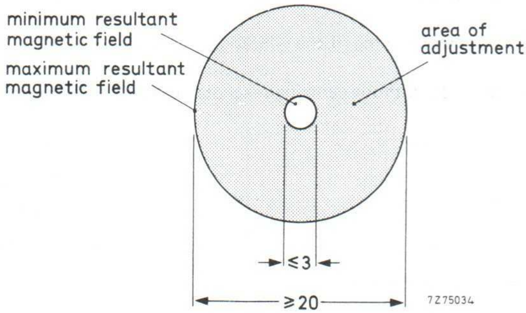


Fig. 5.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	2,9 A (p-p)
Inductance of line coils	475 μH
Field deflection current for full scan, at 12 kV	0,485 A (p-p)
Resistance of field coils	10 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90° monochrome monitor tubes. The unit is used in conjunction with*:

- line output transformer AT2140/16 or AT2140/16B;
- linearity control unit AT4042/08A or linearity corrector AT4042/46.

Comprehensive application information is available on request.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **Both the line coils and the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

* In the C6T concept.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

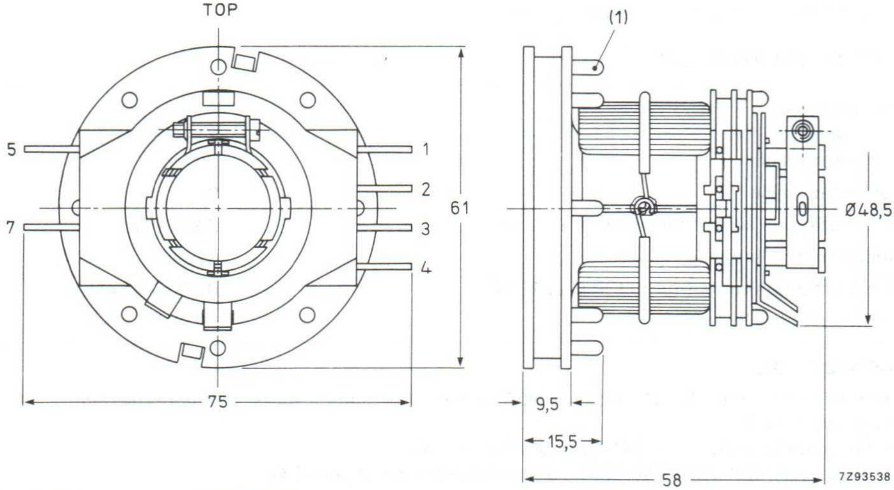


Fig. 1 Deflection unit AT1077/05.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, series connected (Fig. 2a), terminals 1 and 4	
Inductance	475 μH ± 3,5%
Resistance	0,8 Ω ± 5%
L/R	594 μH/Ω
Line deflection current, edge to edge (257 mm), at 12 kV	2,9 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b) terminals 2 and 3	
Inductance	18 mH ± 5%
Resistance	10 Ω ± 5%
L/R	1,80 mH/Ω
Field deflection current, edge to edge (195 mm), at 12 kV	0,485 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

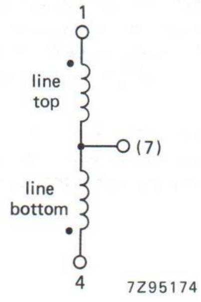


Fig. 2a Line coils.

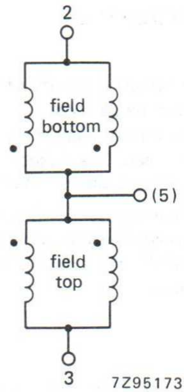


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion measured without raster correction and centring magnets on a 31 cm (12 in) reference tube M31-340 (dimensions in mm)

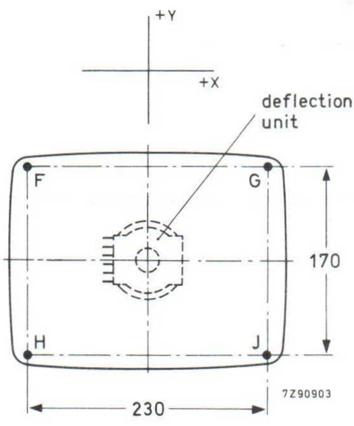


Fig. 3.

$|Fy\text{-}Gy| \leqslant 3$

$|Gx\text{-}Jx| \leqslant 3$

$|Jy\text{-}Hy| \leqslant 3$

$|Hx\text{-}Fx| \leqslant 3$

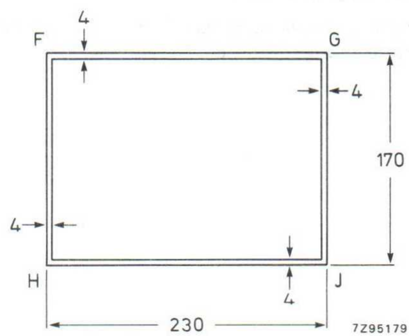


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

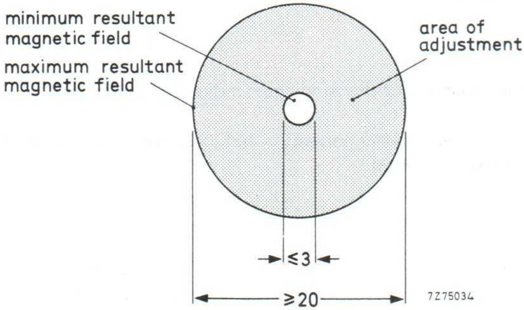


Fig. 5.

For raster correction

Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

* Four magnets, packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	2,9 A (p-p)
Inductance of line coils	475 μH
Field deflection current for full scan, at 12 kV	0,24 A (p-p)
Resistance of field coils	40 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90° monochrome monitor tubes. The unit is used in conjunction with:
- line output transformer AT2140/16 or AT2140/16B;
- linearity control unit AT4042/08A or linearity corrector AT4042/46.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound fields coils. **The line coils and the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

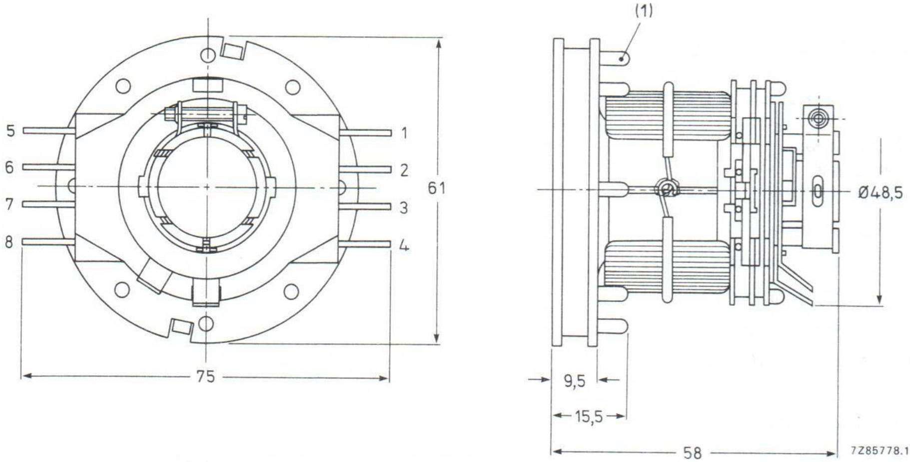


Fig. 1 Deflection unit AT1077/06.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

→ **Line deflection coils**, series connected (Fig. 2a), terminals 1 and 4	
Inductance	475 μH ± 3,5%
Resistance	0,8 Ω ± 5%
L/R	594 μH/Ω
Line deflection current, edge to edge (257 mm), at 12 kV	2,9 A (p-p) ± 5%
→ **Field deflection coils**, series connected (Fig. 2b), terminals 2 and 3	
Inductance	72 mH ± 5%
Resistance	40 Ω ± 5%
L/R	1,80 mH/Ω
Field deflection current, edge to edge (195 mm), at 12 kV	0,24 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

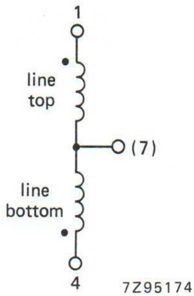


Fig. 2a Line coils.

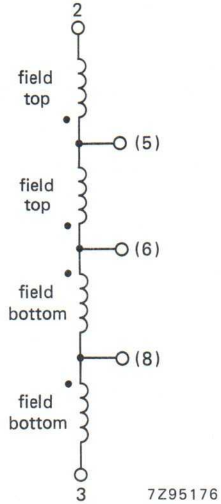


Fig. 2b Field coils.

The beginning of the windings is indicated with •.

Geometric distortion measured without raster correction and centring magnets, on a 31 cm (12 in) reference tube M31-340 (dimensions in mm).

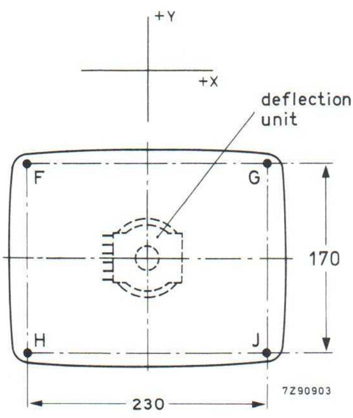


Fig. 3.

$|Fy\text{-}Gy| \leqslant 3$

$|Gx\text{-}Jx| \leqslant 3$

$|Jy\text{-}Hy| \leqslant 3$

$|Hx\text{-}Fx| \leqslant 3$

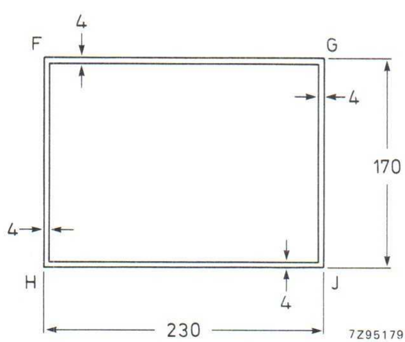


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

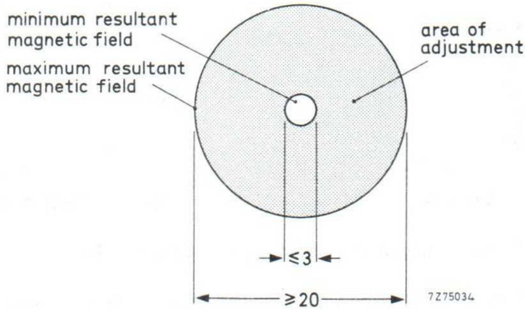


Fig. 5.

For raster correction

Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

* Four magnets, packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	5,8 A (p-p)
Inductance of line coils	118 μH
Field deflection current for full scan, at 12 kV	0,485 A (p-p)
Resistance of field coils	10 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90° monochrome monitor tubes. Application information is available on request.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **The line coils are parallel connected, the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

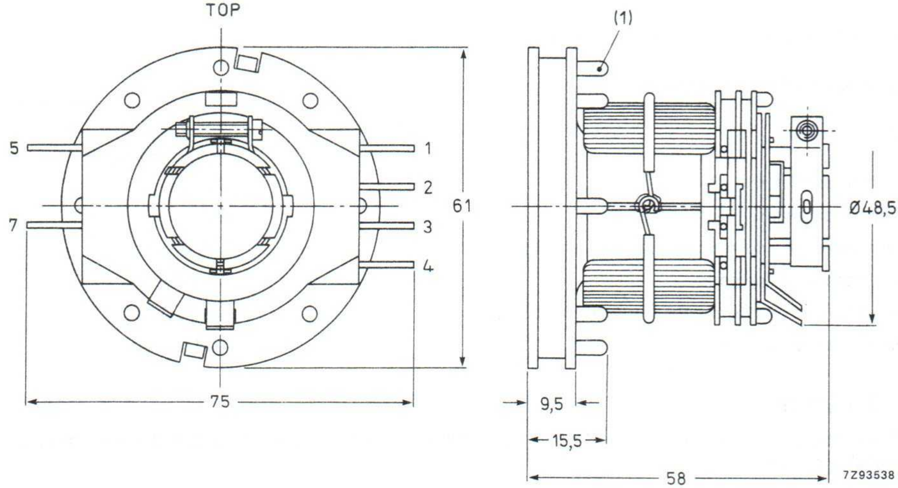


Fig. 1 Deflection unit AT1077/07.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a), terminals 1 and 4	
Inductance	118 μH ± 3,5%
Resistance	0,22 Ω ± 5%
L/R	536 μH/Ω ± 5%
Line deflection current, edge to edge (257 mm), at 12 kV	5,8 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b) terminals 2 and 3	
Inductance	18 mH ± 5%
Resistance	10 Ω ± 5%
L/R	1,80 mH/Ω ± 5%
Field deflection current, edge to edge (195 mm), at 12 kV	0,485 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

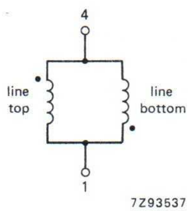


Fig. 2a Line coils.

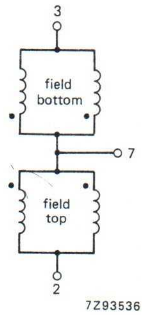


Fig. 2b Field coils.

The beginning of the windings is indicated with •.

Geometric distortion measured without raster correction and centring magnets on a 31 cm (12 in) reference tube M31-340 (dimensions in mm).

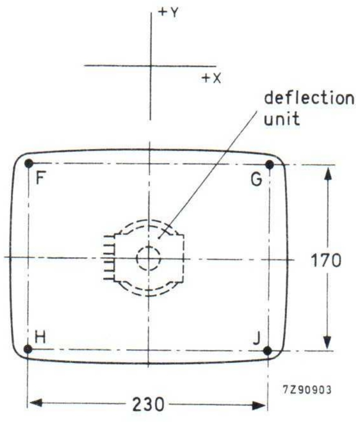


Fig. 3.

$|Fy\text{-}Gy| \leqslant 3{,}0$

$|Gx\text{-}Jx| \leqslant 3{,}0$

$|Jy\text{-}Hy| \leqslant 3{,}0$

$|Hx\text{-}Fx| \leqslant 3{,}0$

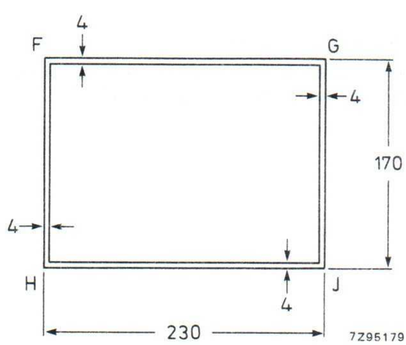


Fig. 4 The edges of the displayed raster fall within the two rectangles.

DEVELOPMENT DATA

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

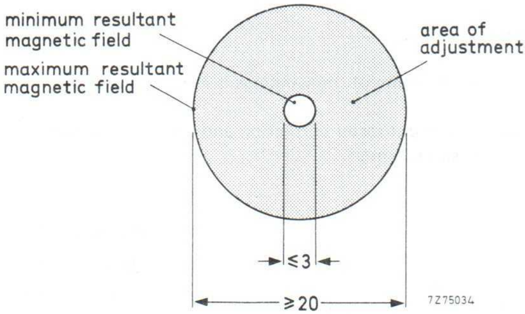


Fig. 5.

For raster correction

Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

* Four magnets packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	24 cm (9 in)
neck diagram	20 mm
Deflection angle	90^{o}
Line deflection current for full scan, at 12 kV	2,91 A (p-p)
Inductance of line coils	475 μH
Field deflection current for full scan, at 12 kV	0,508 A (p-p)
Resistance of field coils	10 Ω

APPLICATION

This deflection unit is for 24 cm (9 in) 90^{o} monochrome monitor tubes. The unit is used in conjunction with*:

- line output transformer AT2140/16 or AT2140/16B;
- linearity control unit AT4042/08A or linearity corrector AT4042/46.

Comprehensive application information is available on request.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **Both the line coils and the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

* In the C6T concept.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

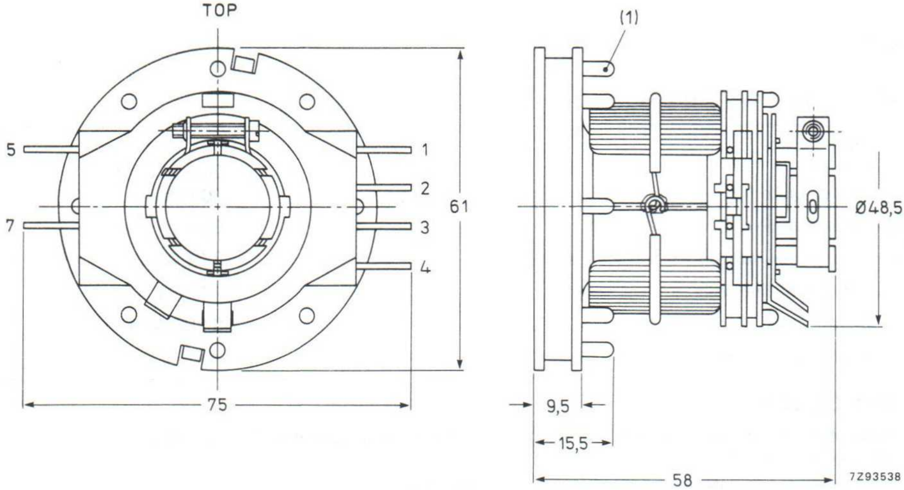


Fig. 1 Deflection unit AT1077/09.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, series connected (Fig. 2a), terminals 1 and 4	
Inductance	475 μH ± 3,5%
Resistance	0,8 Ω ± 5%
L/R	594 μH/Ω
Line deflection current, edge to edge (198 mm), at 12 kV	2,91 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b) terminals 2 and 3	
Inductance	18 mH ± 5%
Resistance	10 Ω ± 5%
L/R	1,80 mH/Ω
Field deflection current, edge to edge (149 mm) at 12 kV	0,508 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	≤ 1/50

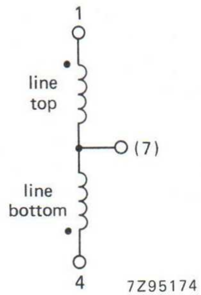


Fig. 2a Line coils.

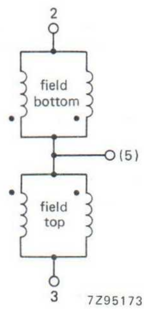


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion measured without raster correction and centring magnets, on a 24 cm (9 in) reference tube M24-306 (dimensions in mm).

$|Fy\text{-}Gy| \leqslant 2$

$|Gx\text{-}Jx| \leqslant 2$

$|Jy\text{-}Hy| \leqslant 2$

$|Hx\text{-}Fx| \leqslant 2$

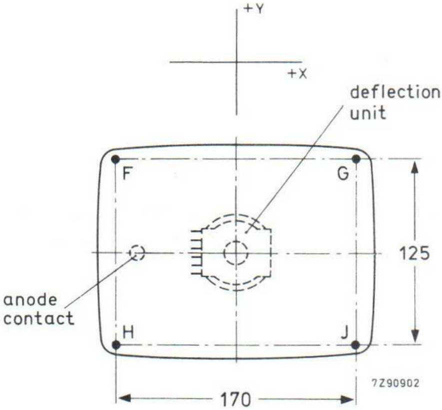


Fig. 3.

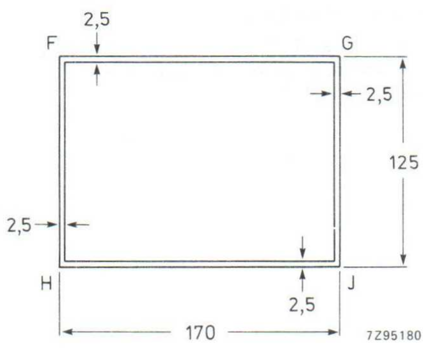


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

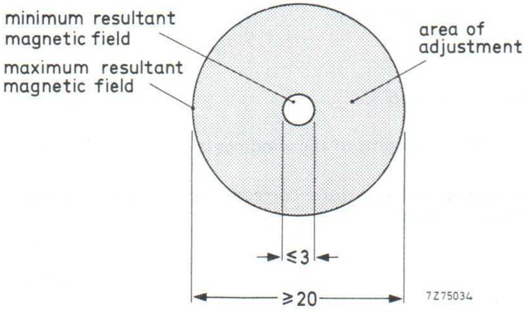


Fig. 5.

For raster correction

The unit has plastic bonded Ferroxdure magnet strips for raster correction. Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to optimize the raster geometry. See also Fig. 1.

* Four magnets, packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	24 cm (9 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	2,91 A (p-p)
Inductance of line coils	475 μH
Field deflection current for full scan, at 12 kV	0,255 A (p-p)
Resistance of field coils	40 Ω

APPLICATION

This deflection unit is for 24 cm (9 in) 90° monochrome monitor tubes. The unit is used in conjunction with:
- line output transformer AT2140/16 or AT2140/16B;
- linearity control unit AT4042/08A or linearity corrector AT4042/46.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound fields coils. **The line coils and the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

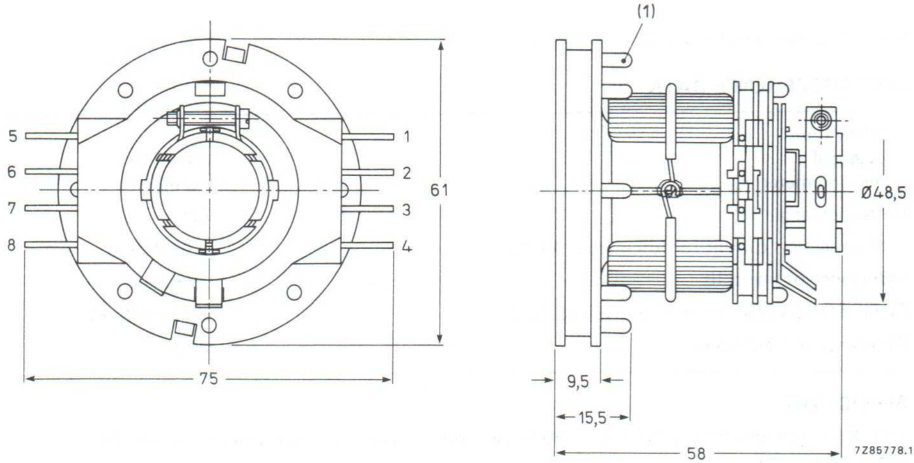


Fig. 1 Deflection unit AT1077/10.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 ^{o}C.

Line deflection coils, series connected (Fig. 2a), terminals 1 and 4	
Inductance	475 μH ± 3,5%
Resistance	0,8 Ω ± 5%
L/R	594 μH/Ω
Line deflection current, edge to edge (198 mm), at 12 kV	2,91 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b), terminals 2 and 3	
Inductance	72 mH ± 5%
Resistance	40 Ω ± 5%
L/R	1,80 mH/Ω
Field deflection current, edge to edge (149 mm), at 12 kV	0,255 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 ^{o}C
Storage temperature range	–40 to + 75 ^{o}C
Coupling between line and field coils, at 500 Hz	$\leqslant$ 1/50

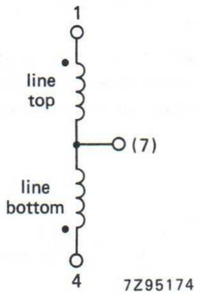


Fig. 2a Line coils.

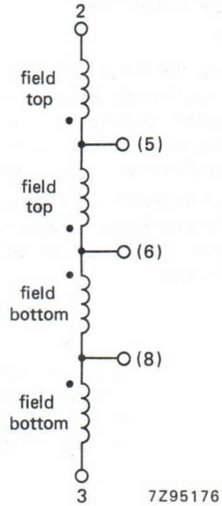


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion measured without raster correction and centring magnets, on a 24 cm (9 in) reference tube M24-306 (dimensions in mm).

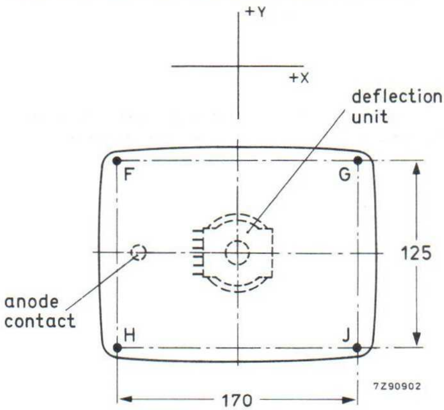


Fig. 3.

$|Fy\text{-}Gy| \leqslant 2$

$|Gx\text{-}Jx| \leqslant 2$

$|Jy\text{-}Hy| \leqslant 2$

$|Hx\text{-}Fx| \leqslant 2$

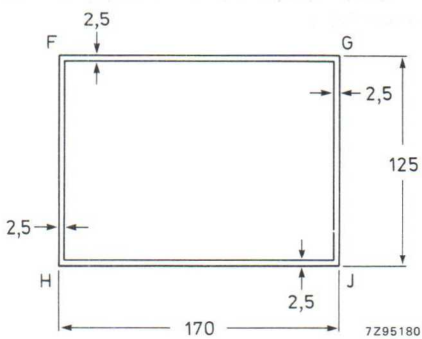


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

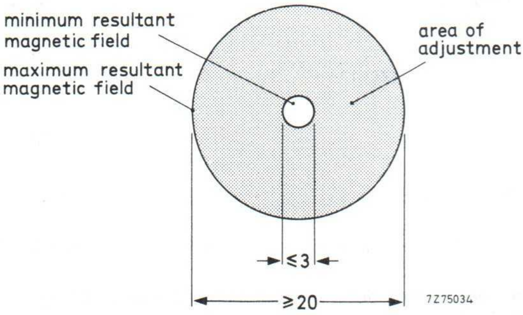


Fig. 5.

For raster correction

The unit has plastic bonded Ferroxdure magnet strips for raster correction. Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to optimize the raster geometry. See also Fig. 1.

* Four magnets, packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90^o
Line deflection current for full scan, at 12 kV	4,2 A (p-p)
Inductance of line coils	240 μH
Field deflection current for full scan, at 12 kV	0,60 A (p-p)
Resistance of field coils	7,25 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90^o monochrome monitor tubes. Application information is available on request.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **The line coils are parallel connected, the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

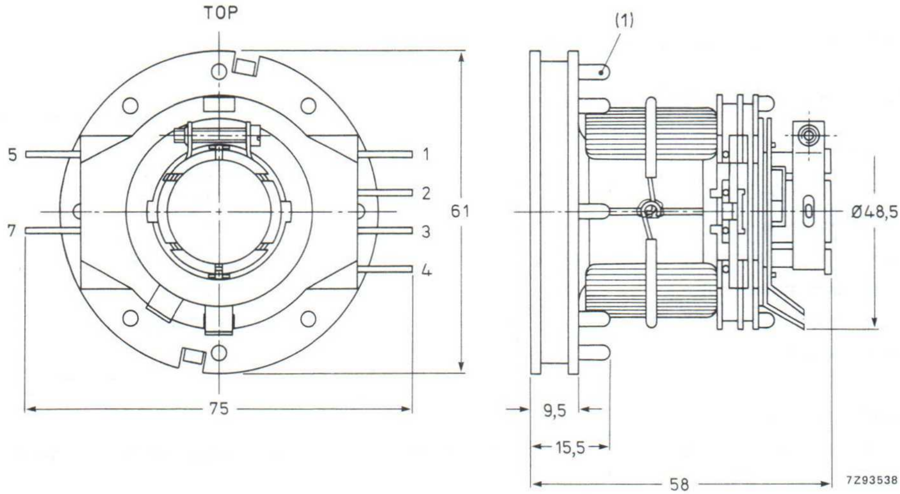


Fig. 1 Deflection unit AT1077/15.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a), terminals 1 and 4	
Inductance	240 μH ± 3,5%
Resistance	0,42 Ω ± 5%
L/R	565 μH/Ω ± 5%
Line deflection current, edge to edge (257 mm), at 12 kV	4,2 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b) terminals 2 and 3	
Inductance	12,5 mH ± 5%
Resistance	7,25 Ω ± 5%
L/R	1,7 mH/Ω ± 5%
Field deflection current, edge to edge (195 mm), at 12 kV	0,60 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	≤ 1/50

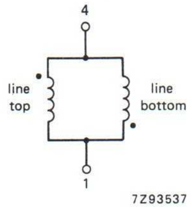


Fig. 2a Line coils.

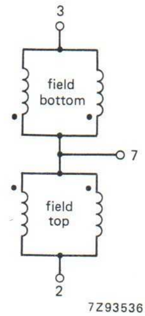


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion measured without raster correction and centring magnets on a 31 cm (12 in) reference tube M31-340 (dimensions in mm).

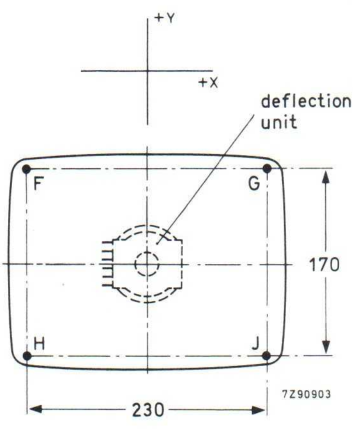


Fig. 3.

$|Fy-Gy| \leqslant 2{,}5$

$|Gx-Jx| \leqslant 2{,}5$

$|Jy-Hy| \leqslant 2{,}5$

$|Hx-Fx| \leqslant 2{,}5$

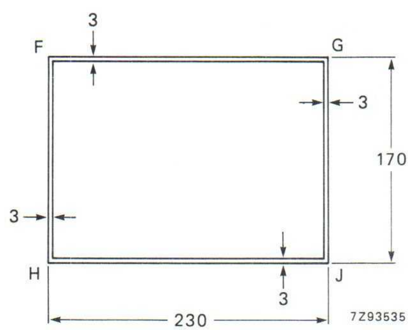


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

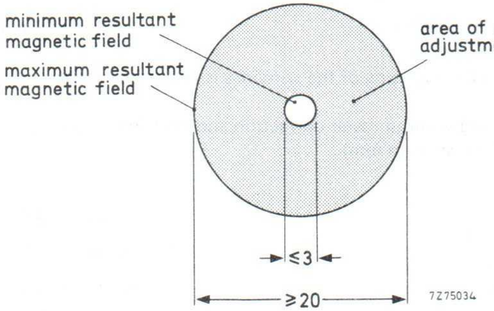


Fig. 5.

For raster correction

Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

* Four magnets packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90^{o}
Line deflection current for full scan, at 12 kV	4,92 A (p-p)
Inductance of line coils	170 μH
Field deflection current for full scan, at 12 kV	0,80 A (p-p)
Resistance of field coils	4,35 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90^{o} monochrome monitor tubes. Application information is available on request.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **The line coils are parallel connected, the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

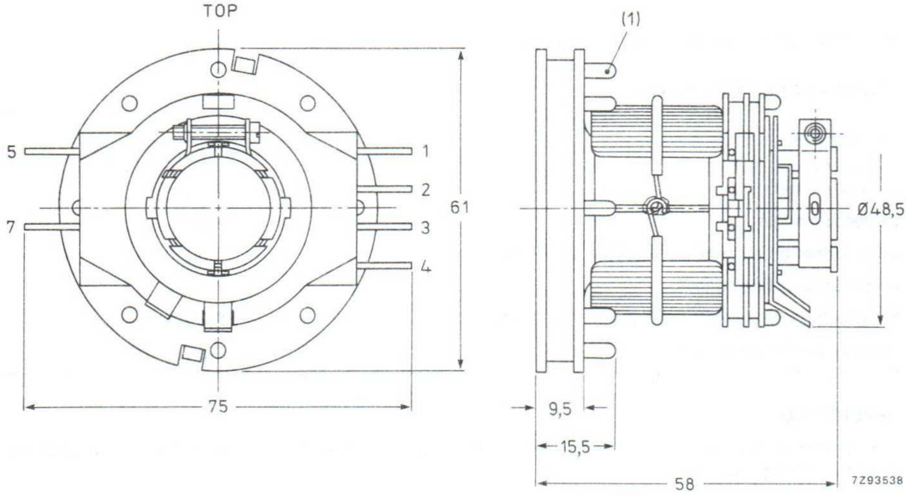


Fig. 1 Deflection unit AT1077/16.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a), terminals 1 and 4	
Inductance	170 μH ± 3,5%
Resistance	0,35 Ω ± 5%
L/R	485 μH/Ω ± 5%
Line deflection current, edge to edge (257 mm), at 12 kV	4,92 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b) terminals 2 and 3	
Inductance	6,6 mH ± 5%
Resistance	4,35 Ω ± 5%
L/R	1,5 mH/Ω ± 5%
Field deflection current, edge to edge (195 mm), at 12 kV	0,80 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	≤ 1/50

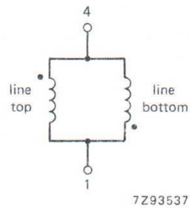


Fig. 2a Line coils.

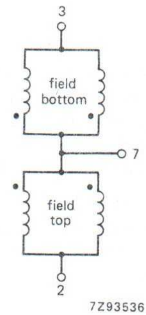


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion measured without raster correction and centring magnets on a 31 cm (12 in) reference tube M31-340 (dimensions in mm).

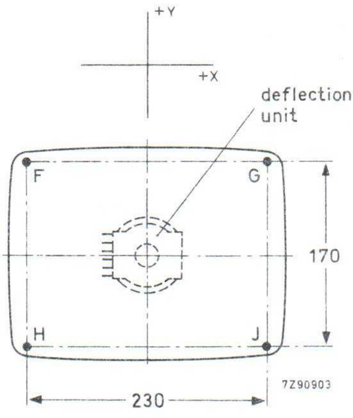


Fig. 3.

$|Fy\text{-}Gy| \leqslant 2{,}5$

$|Gx\text{-}Jx| \leqslant 2{,}5$

$|Jy\text{-}Hy| \leqslant 2{,}5$

$|Hx\text{-}Fx| \leqslant 2{,}5$

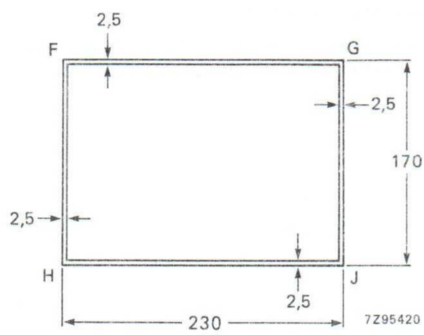


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

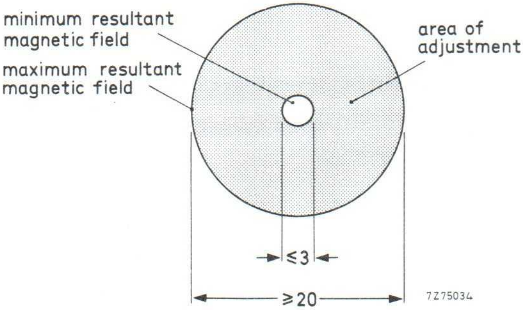


Fig. 5.

For raster correction

Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

* Four magnets, packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	5,30 A (p-p)
Inductance of line coils	145 μH
Field deflection current for full scan, at 12 kV	0,50 A (p-p)
Resistance of field coils	10 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90° monochrome monitor tubes. Application information is available on request.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **The line coils are parallel connected,the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A srew-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

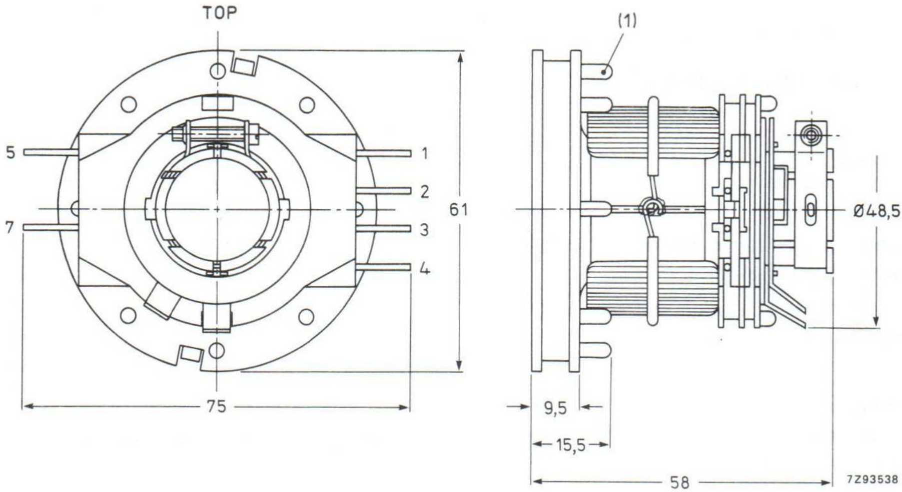


Fig. 1 Deflection unit AT1077/20.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a), terminals 1 and 4	
Inductance	145 μH ± 3,5%
Resistance	0,25 Ω ± 5%
L/R	575 μH/Ω ± 5%
Line deflection current, edge to edge (257 mm), at 12 kV	5,30 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b), terminals 2 and 3	
Inductance	18 mH ± 5%
Resistance	10 Ω ± 5%
L/R	1,80 mH/Ω ± 5%
Field deflection current, edge to edge (195 mm), at 12 kV	0,50 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

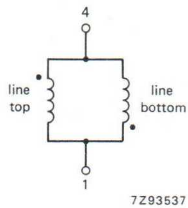


Fig. 2a Line coils.

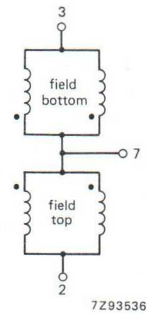


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

DEVELOPMENT DATA

Geometric distortion measured without raster correction and centring magnets on a 31 cm (12 in) reference tube M31-340 (dimensions in mm).

$|Fy\text{-}Gy| \leqslant 2{,}5$

$|Gx\text{-}Jx| \leqslant 2{,}5$

$|Jy\text{-}Hy| \leqslant 2{,}5$

$|Hx\text{-}Fx| \leqslant 2{,}5$

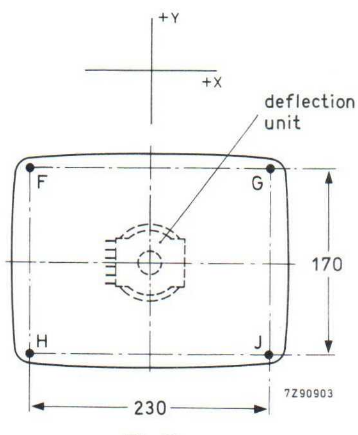


Fig. 3.

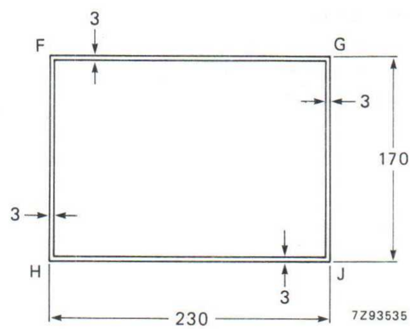


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

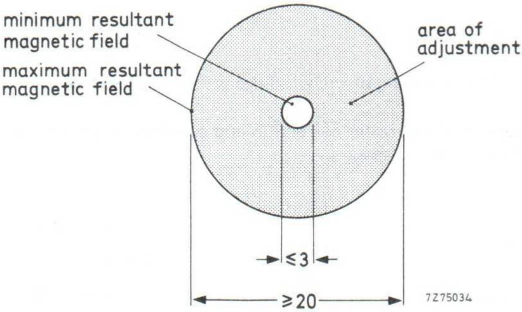


Fig. 5.

For raster correction

Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

* Four magnets, packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	6,10 A (p-p)
Inductance of line coils	112 μH
Field deflection current for full scan, at 12 kV	0,74 A (p-p)
Resistance of field coils	4,15 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90° monochrome monitor tubes. Application information is available on request.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **The line coils are parallel connected, the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

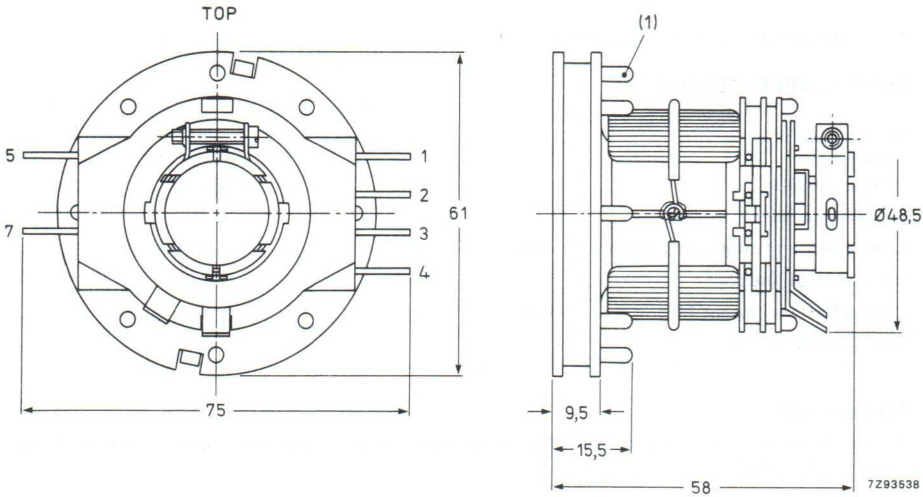


Fig. 1 Deflection unit AT1077/22.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a), terminals 1 and 4

Inductance	112 μH ± 3,5%
Resistance	0,20 Ω ± 5%
L/R	535 μH/Ω ± 5%
Line deflection current, edge to edge (257 mm), at 12 kV	6,10 A (p-p) ± 5%

Field deflection coils, series connected (Fig. 2b) terminals 2 and 3

Inductance	7,7 mH ± 5%
Resistance	4,15 Ω ± 5%
L/R	1,85 mH/Ω ± 5%
Field deflection current, edge to edge (195 mm), at 12 kV	0,74 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

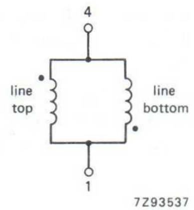


Fig. 2a Line coils.

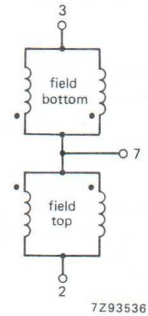


Fig. 2b Field coils.

The beginning of the windings is indicated with •.

Geometric distortion measured without raster correction and centring magnets on a 31 cm (12 in) reference tube M31-340 (dimensions in mm).

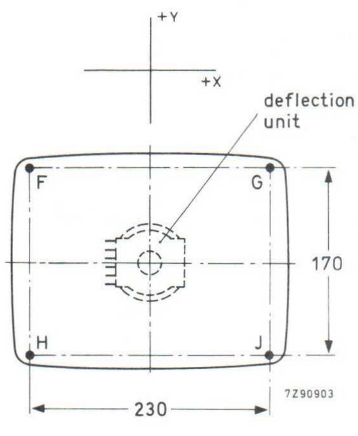


Fig. 3.

$|Fy\text{-}Gy| \leq 2{,}5$

$|Gx\text{-}Jx| \leq 2{,}5$

$|Jy\text{-}Hy| \leq 2{,}5$

$|Hx\text{-}Fx| \leq 2{,}5$

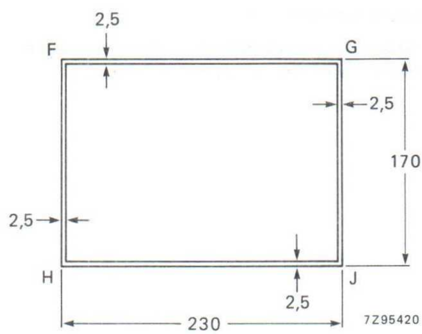


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

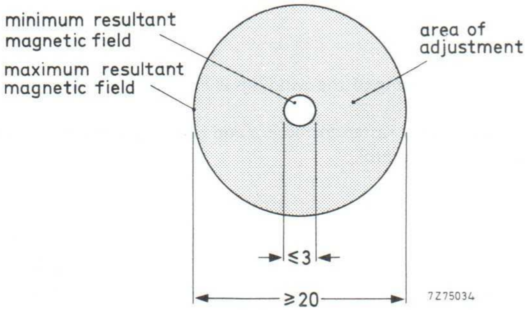


Fig. 5.

For raster correction

Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

* Four magnets, packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	4,20 A (p-p)
Inductance of line coils	240 μH
Field deflection current for full scan, at 12 kV	0,37 A (p-p)
Resistance of field coils	16,6 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90° monochrome monitor tubes. Application information is available on request.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **The line coils are parallel connected, the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

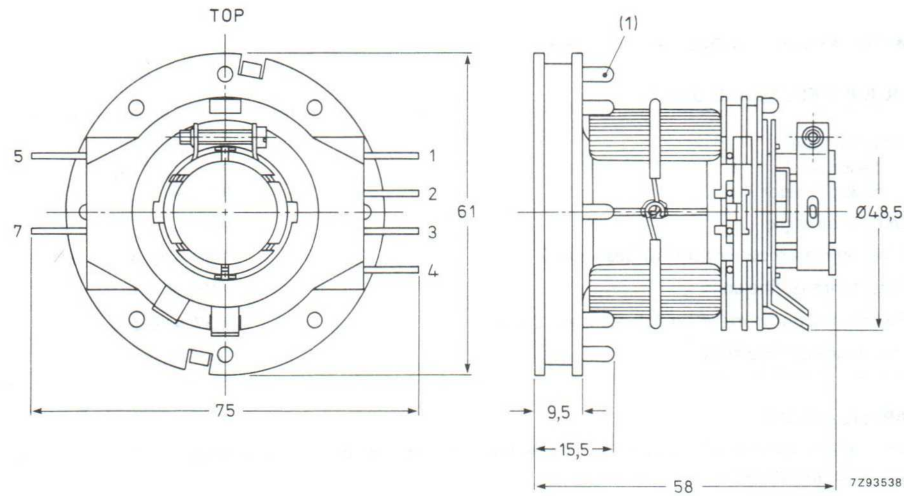


Fig. 1 Deflection unit AT1077/23.

(1) For fitting plastic-bonded FXD magnet, catalogue number 3122 104 94120, see "Correction facilities".

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a), terminals 1 and 4	
Inductance	240 μH ± 3,5%
Resistance	0,42 Ω ± 5%
L/R	572 μH/Ω ± 5%
Line deflection current, edge to edge (257 mm), at 12 kV	4,20 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b), terminals 2 and 3	
Inductance	31,0 mH ± 5%
Resistance	16,6 Ω ± 5%
L/R	1,8 mH/Ω ± 5%
Field deflection current, edge to edge (195 mm), at 12 kV	0,37 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

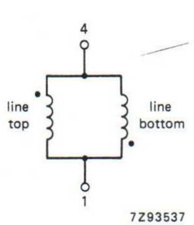


Fig. 2a Line coils.

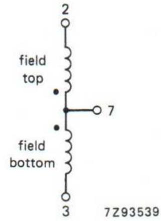


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion measured without raster correction and centring magnets on a 31 cm (12 in) reference tube M31-340 (dimensions in mm).

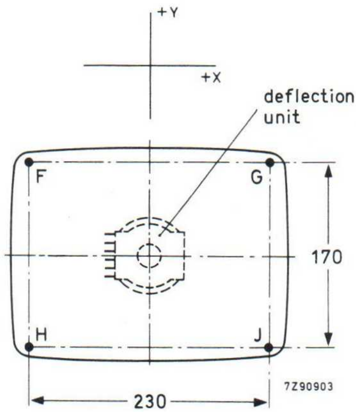


Fig. 3.

$|F_y - G_y| \leq 2{,}5$

$|G_x - J_x| \leq 2{,}5$

$|J_y - H_y| \leq 2{,}5$

$|H_x - F_x| \leq 2{,}5$

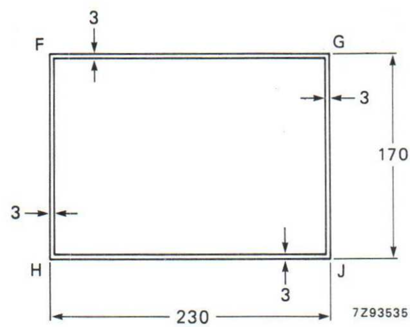


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

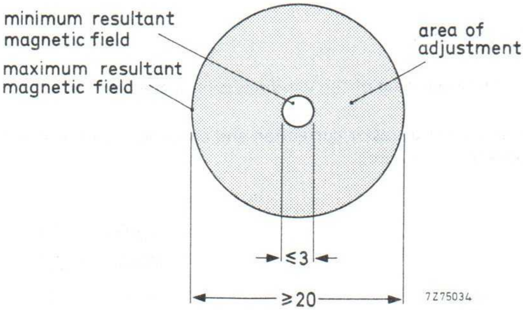


Fig. 5.

For raster correction

Up to eight plastic bonded Ferroxdure magnets* can be mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

* Four magnets, packed in a plastic bag, are supplied with the deflection unit; catalogue number of the magnets: 3122 104 94120.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	3,40 A (p-p)
Inductance of line coils	310 μH
Field deflection current for full scan, at 12 kV	0,455 A (p-p)
Resistance of field coils	13,6 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90° monochrome monitor tubes, especially when high resolution is required. It is developed in conjunction with the high resolution display tube M31-340 to provide minimum deflection defocusing and pre-adjusted raster geometry, requiring only small additional adjustments. To utilize the full potential of this deflection unit in respect of deflection defocusing, dynamic focusing has to be applied.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **Both the line coils and the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction*. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

* At delivery of the deflection unit the beam centring and raster correction magnets are pre-adjusted on a reference tube.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

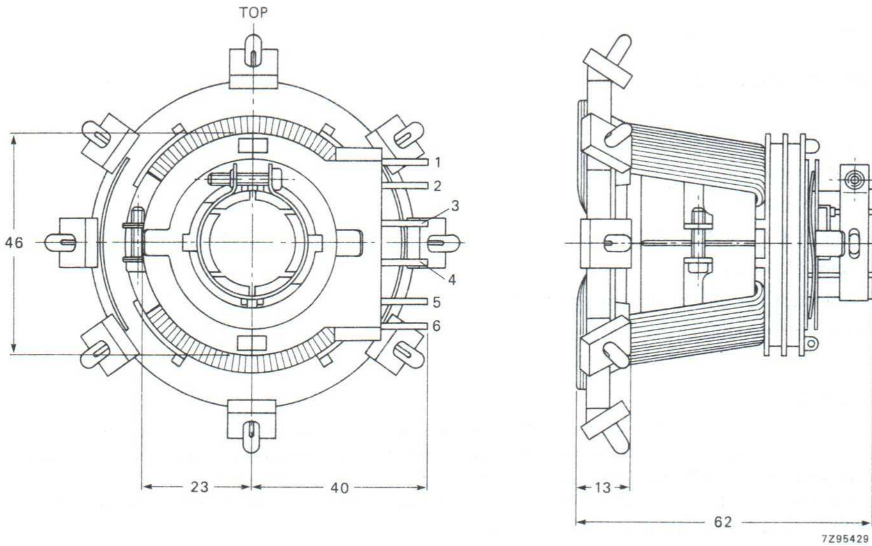


Fig. 1 Deflection unit AT1078/01.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, series connected (Fig. 2a), terminals 2 and 5	
Inductance	310 μH ± 3,5%
Resistance	0,66 Ω ± 5%
L/R	470 μH/Ω
Line deflection current, edge to edge (257 mm), at 12 kV	3,40 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b) terminals 3 and 4	
Inductance	23,8 mH ± 5%
Resistance	13,6 Ω ± 5%
L/R	1,75 mH/Ω
Field deflection current, edge to edge (195 mm), at 12 kV	0,455 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

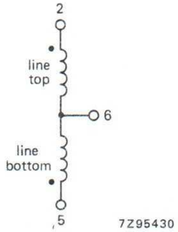


Fig. 2a Line coils.

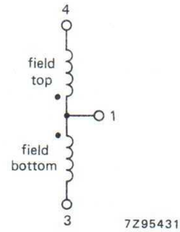
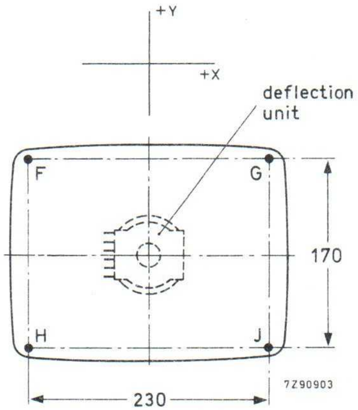


Fig. 2b Field coils.

The beginning of the windings is indicated with •.

Geometric distortion, measured with beam centring and raster correction magnets pre-adjusted on a 31 cm (12 in) reference tube M31-340 (dimensions in mm)



$|Fy\text{-}Gy| \leqslant 2{,}0$
$|Gx\text{-}Jx| \leqslant 2{,}0$
$|Jy\text{-}Hy| \leqslant 2{,}0$
$|Hx\text{-}Fx| \leqslant 2{,}0$

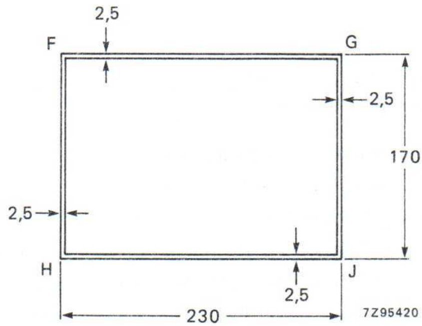


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

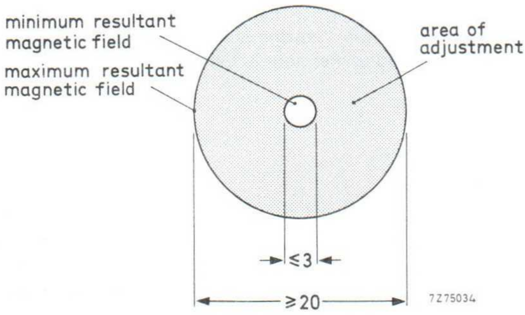


Fig. 5.

For raster correction

Eight plastic bonded Ferroxdure magnets are mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

Recommended adjustment procedure

- Centre the raster with the two centring magnets.
- Adjust the east-west raster correction magnets.
- Adjust the north-south raster correction magnets.
- Adjust the corner raster correction magnets.
- If required, repeat these adjustments in the same sequence.
- Lock the centring and raster correction magnets with locking paint.

DEFLECTION UNIT

- For FLAT SQUARE Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Flat Square monitor tube	
diagonal	29 cm (12 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	3,33 A (p-p)
Inductance of line coils	310 μH
Field deflection current for full scan, at 12 kV	0,44 A (p-p)
Resistance of field coils	13,6 Ω

APPLICATION

This deflection unit is for 29 cm (12 in) 90° Flat Square monochrome monitor tubes, especially when high resolution is required. It is developed in conjunction with the high resolution display tube M29EAA to provide minimum deflection defocusing and pre-adjusted raster geometry, requiring only small additional adjustments. To utilize the full potential of this deflection unit in respect of deflection defocusing, dynamic focusing has to be applied.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **Both the line coils and the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction*. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

* At delivery of the deflection unit the beam centring and raster correction magnets are pre-adjusted on a reference tube.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

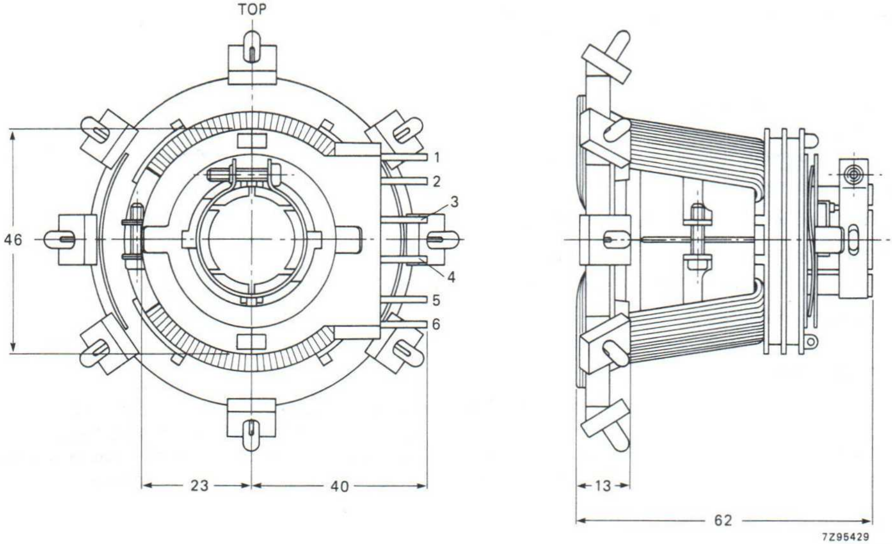


Fig. 1 Deflection unit AT1078/10.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, series connected (Fig. 2a), terminals 2 and 5	
Inductance	310 μH ± 3,5%
Resistance	0,66 Ω ± 5%
L/R	470 μH/Ω
Line deflection current, edge to edge (246 mm), at 12 kV	3,33 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b) terminals 3 and 4	
Inductance	23,8 mH ± 5%
Resistance	13,6 Ω ± 5%
L/R	1,75 mH/Ω
Field deflection current, edge to edge (181 mm), at 12 kV	0,44 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

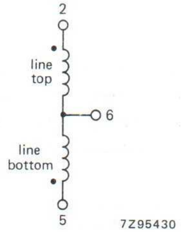


Fig. 2a Line coils.

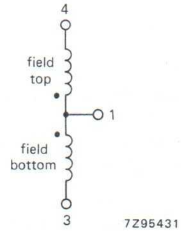
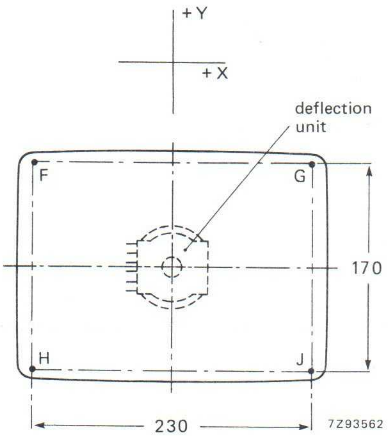


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion, measured with beam centring and raster correction magnets pre-adjusted on a 29 cm (12 in) Flat Square reference tube M29EAA (dimensions in mm).



|Fy-Gy| ≤ 2,0
|Gx-Jx| ≤ 2,0
|Jy-Hy| ≤ 2,0
|Hx-Fx| ≤ 2,0

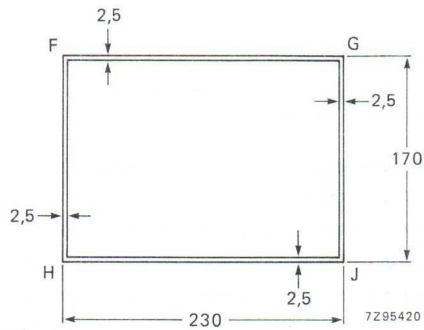


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

These centring magnets cannot be used for compensating the effects of non-linearity or of phase differences between the synchronization and time base, as otherwise the correction needed becomes excessive. Even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

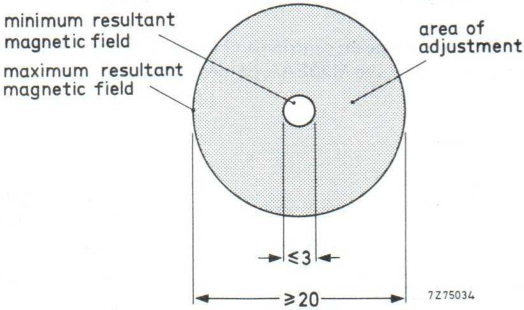


Fig. 5.

For raster correction

Eight plastic bonded Ferroxdure magnets are mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

Recommended adjustment procedure

- Centre the raster with the two centring magnets.
- Adjust the east-west raster correction magnets.
- Adjust the north-south raster correction magnets.
- Adjust the corner raster correction magnets.
- If required, repeat these adjustments in the same sequence.
- Lock the centring and raster correction magnets with locking paint.

DEFLECTION UNIT

- For Monochrome Data Graphic Displays

QUICK REFERENCE DATA

Monitor tube	
diagonal	31 cm (12 in)
neck diameter	20 mm
Deflection angle	90°
Line deflection current for full scan, at 12 kV	3,90 A (p-p)
Inductance of line coils	245 μH
Field deflection current for full scan, at 12 kV	0,85 A(p-p)
Resistance of field coils	4,10 Ω

APPLICATION

This deflection unit is for 31 cm (12 in) 90° monochrome monitor tubes, especially when high resolution is required. It is developed in conjunction with the high resolution display tube M31-340 to provide minimum deflection defocusing and pre-adjusted raster geometry, requiring only small additional adjustments. To utilize the full potential of this deflection unit in respect of deflection defocusing, dynamic focusing has to be applied.

DESCRIPTION

The deflection unit is of the hybrid type, with saddle wound line coils and toroidal wound field coils. **The line coils are parallel connected, the field coils are series connected.** The unit has a non-magnetic metal clamping ring for fixing to the tube neck. Provisions are made for beam centring and raster correction*. The unit meets the self-extinguishing and non-dripping requirements of IEC 65 and UL1413.

MOUNTING

The unit should be mounted as far forward as possible on the neck of the tube, so that it touches the cone.

To orient the raster correctly, the unit may be rotated by hand on the neck of the tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position; the tightening torque is 0,6 ± 0,2 Nm.

* At delivery of the deflection unit the beam centring and raster correction magnets are pre-adjusted on a reference tube.

MECHANICAL DATA

Dimensions in mm

The deflection unit fits a tube with a neck diameter of max. 20,9 mm.

The unit is provided with solder pins for connection. The pin numbering in Fig. 1 corresponds to that in the diagram (Fig. 2).

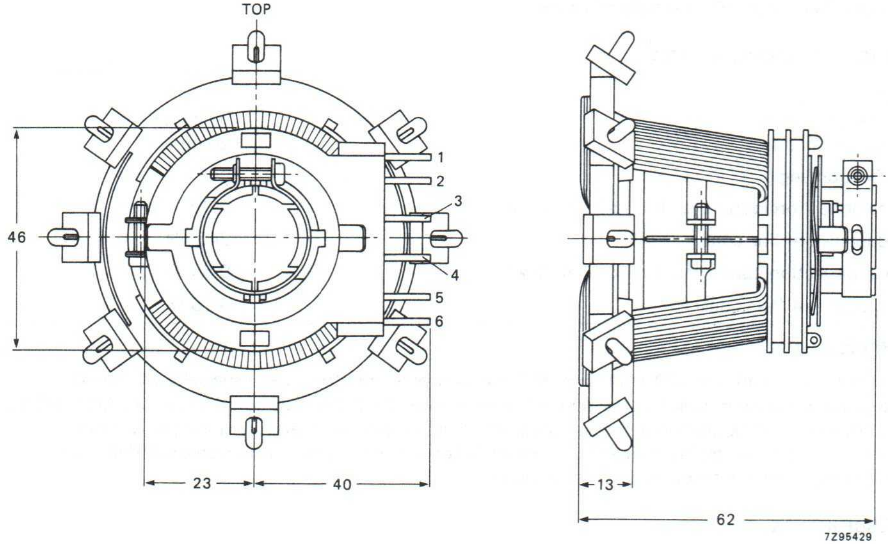


Fig. 1 Deflection unit AT1078/19.

ELECTRICAL DATA

The electrical values apply at an ambient temperature of 25 °C.

Line deflection coils, parallel connected (Fig. 2a), terminals 2 and 5	
Inductance	245 μH ± 3,5%
Resistance	0,53 Ω ± 5%
L/R	462 μH/Ω
Line deflection current, edge to edge (257 mm), at 12 kV	3,90 A (p-p) ± 5%
Field deflection coils, series connected (Fig. 2b) terminals 3 and 4	
Inductance	6,85 mH ± 5%
Resistance	4,10 Ω ± 5%
L/R	1,66 mH/Ω
Field deflection current, edge to edge (195 mm), at 12 kV	0,85 A (p-p) ± 5%
Maximum d.c. voltage between terminals of line and field coils	500 V
Maximum operating temperature (average copper temperature)	80 °C
Storage temperature range	−40 to + 75 °C
Coupling between line and field coils, at 500 Hz	⩽ 1/50

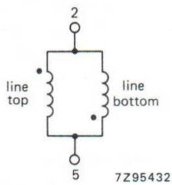


Fig. 2a Line coils.

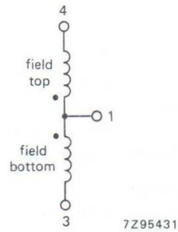
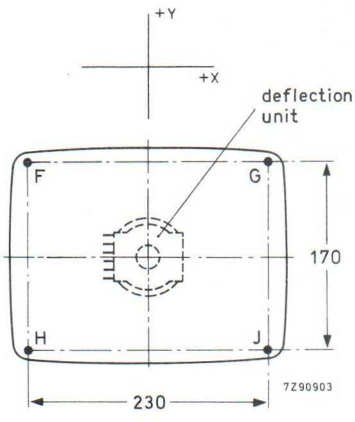


Fig. 2b Field coils.

The beginning of the windings is indicated with ●.

Geometric distortion, measured with beam centring and raster correction magnets pre-adjusted on a 31 cm (12 in) reference tube M31-340 (dimensions in mm)



$|Fy\text{-}Gy| \leqslant 2{,}0$
$|Gx\text{-}Jx| \leqslant 2{,}0$
$|Jy\text{-}Hy| \leqslant 2{,}0$
$|Hx\text{-}Fx| \leqslant 2{,}0$

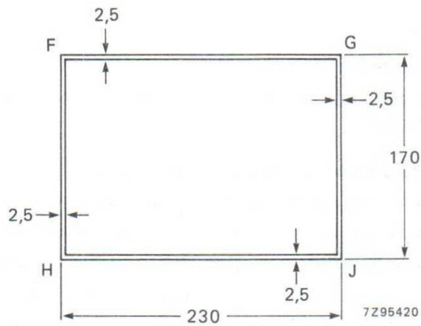


Fig. 4 The edges of the displayed raster fall within the two rectangles.

CORRECTION FACILITIES

For centring

After adjustment of the linearity of the deflection current, the eccentricity of the monitor tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are magnetized diametrically. By turning the magnets with respect to each other the resulting field strength is varied. The direction of the resulting magnetic field is adjusted by turning the magnets simultaneously. The torque on the magnets is 50 to 200 mNm.

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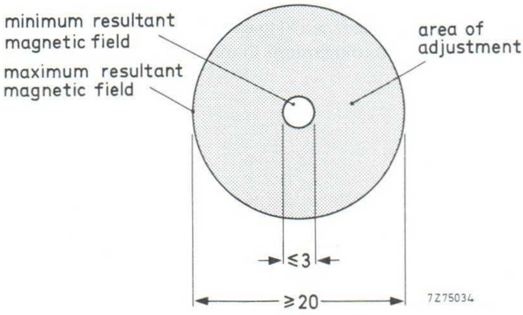

Fig. 5.

For raster correction

Eight plastic bonded Ferroxdure magnets are mounted to the back of the front rim to correct raster distortion. See also Fig. 1.

Recommended adjustment procedure

- Centre the raster with the two centring magnets.
- Adjust the east-west raster correction magnets.
- Adjust the north-south raster correction magnets.
- Adjust the corner raster correction magnets.
- If required, repeat these adjustments in the same sequence.
- Lock the centring and raster correction magnets with locking paint.

CONVERSION LIST

CONVERSION LIST

Conversion of catalogue number to type number (deflection units only)

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3122 137 12160	AT1040/15	153
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NOTES

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