PHILIPS

Data handbook

Electronic components and materials

Electron tubes

Part 8 May 1977

TV picture tubes

ELECTRON TUBES

Part 8

May 1977

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, subassemblies and materials; it is made up of three series of handbooks each comprising several parts.

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

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

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

December 1972

ELECTRON TUBES (BLUE SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1a	Transmitting tubes for communication Tubes for r.f. heating Types PE05/25 – TBW15/25		December 1975
Part 1b	Transmitting tubes for communication Tubes for r.f. heating Amplifier circuit assemblies		January 1976
Part 2	Microwave products		May 1976
	Communication magnetrons	Diodes	
	Magnetrons for microwave heating	Triodes	
	Klystrons	T-R switches	
	Travelling-wave tubes	Microwave semiconductor devices	
	Isolators, Circulators		
Part 3	Special Quality tubes Miscellaneous devices		January 1975
Part 4	Receiving tubes		March 1975
Part 5a	Cathode-ray tubes		August 1976
Part 5b	Camera tubes Image intensifier tubes		May 1975
Part 6	Products for nuclear technology		January 1977
	Channel electron multipliers	Geiger-Müller tubes	
	Neutron tubes		
Part 7a	Gas-filled tubes		March 1977
	Thyratrons	Ignitrons	
	Industrial rectifying tubes	High-voltage rectifying tubes	
Part 7b	Gas-filled tubes		March 1977
	Segment indicator tubes	Switching diodes	
	Indicator tubes	Dry reed contact units	
Part 8	TV picture tubes		May 1977
Part 9	Photomultiplier tubes Phototubes (diodes)		June 1976

May 1977

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1a **Rectifier diodes, thyristors, triacs** — **March 1976**

Rectifier diodes
Voltage regulator diodes (> 1,5 W)
Transient suppressor diodes
Rectifier stacks
Thyristors
Triacs

Part 1b **Diodes** — **October 1975**

Small signal germanium diodes
Small signal silicon diodes
Special diodes
Voltage regulator diodes (< 1,5 W)
Voltage reference diodes
Tuner diodes

Part 2 **Low-frequency transistors** — **December 1975**

Part 3 **High-frequency and switching transistors** — **April 1976**

Part 4a **Special semiconductors** — **June 1976**

Transmitting transistors
Microwave devices
Field-effect transistors
Dual transistors
Microminiature devices for thick- and thin-film circuits

Part 4b **Devices for optoelectronics** — **July 1976**

Photosensitive diodes and transistors
Light emitting diodes
Displays
Photocouplers
Infrared sensitive devices
Photoconductive devices

Part 5a **Professional analogue integrated circuits** — **November 1976**

Part 5b **Consumer integrated circuits** — **March 1977**

Radio - Audio
Television

Part 6 **Digital integrated circuits** — **May 1976**

LOCMOS HE family
GZ family

COMPONENTS AND MATERIALS (GREEN SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1 **Functional units, Input/output devices, Peripheral devices** — November 1975

High noise immunity logic FZ/30-Series
Circuit blocks 40-Series and CSA70
Counter modules 50-Series
NORbits 60-Series, 61-Series
Circuit blocks 90-Series
Input/output devices
Hybrid integrated circuits
Peripheral devices

Part 2a **Resistors** — February 1976

Fixed resistors
Variable resistors
Voltage dependent resistors (VDR)
Light dependent resistors (LDR)
Negative temperature coefficient thermistors (NTC)
Positive temperature coefficient thermistors (PTC)
Test switches

Part 2b **Capacitors** — April 1976

Electrolytic and solid capacitors
Paper capacitors and film capacitors
Ceramic capacitors
Variable capacitors

Part 3 **Radio, Audio, Television** — January 1977

FM tuners
Loudspeakers
Television tuners and aerial input assemblies
Components for black and white television
Components for colour television

Part 4a **Soft ferrites** — October 1976

Ferrites for radio, audio and television
Beads and chokes
Ferroxcube potcores and square cores
Ferroxcube transformer cores

Part 4b **Piezoelectric ceramics, Permanent magnet materials** — December 1976

Part 5 **Ferrite core memory products** — July 1975

Ferroxcube memory cores
Matrix planes and stacks
Core memory systems

Part 6 **Electric motors and accessories** — April 1977

Small synchronous motors
Stepper motors
Miniature direct current motors

Part 7 **Circuit blocks** — September 1971

Circuit blocks 100 kHz-Series
Circuit blocks 1-Series
Circuit blocks 10-Series
Circuit blocks for ferrite core memory drive

Part 8 **Variable mains transformers** — February 1977

Part 9 **Piezoelectric quartz devices** — March 1976

Part 10 **Connectors** — November 1975

General section

LIST OF SYMBOLS

Symbols denoting electrodes/elements and electrode/element connections

Heater	f
Cathode	k
Grid Grids are distinguished by means of an additional numeral; the electrode nearest to the cathode having the lowest number.	g
External conductive coating; rim-band	m
Fluorescent screen	ℓ
Tube pin which must not be connected externally	i.c.
Tube pin which may be connected externally	n.c.

Symbols denoting voltages

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

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

Symbols denoting currents

Remark I The positive electrical current is opposite to the direction of the electron current.

Remark II The symbols quoted represent the average value of the current, unless otherwise stated.

Symbol for current followed by a subscript denoting the relevant electrode	I
Heater current	I_f

Symbols denoting powers

Dissipation of the fluorescent screen	W_ℓ
Grid dissipation	W_g

Symbols denoting capacitances

See IEC Publication 100

Symbols denoting resistances and impedances

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

Symbols denoting various quantities

Luminance	B
Frequency	f
Magnetic field strength	H

GENERAL OPERATIONAL RECOMMENDATIONS T.V. PICTURE TUBES

CONTENTS

GENERAL OPERATIONAL RECOMMENDATIONS
T.V. PICTURE TUBES

1. 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 not referred to in the data sheets of the relevant tube type extra care should be taken with circuit design to avoid that the tube is overloaded due to unfavourable operating conditions.

2. 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.

3. SPREAD AND VARIATION IN OPERATING CONDITIONS

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

3.1 Spread. 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.

3.2 Variation. 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.

4. LIMITING VALUES

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

4.1.1 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.

4.1.2 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 throughout 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.

4.1.3 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.

Note*. 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.

4.2 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.

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

5. HEATER CIRCUIT

Any deviation from the nominal heater voltage (in case of parallel connection) or from the nominal heater current (in case of series connection) has a detrimental effect on tube performance and life, and should therefore be kept at a minimum.
Such deviations may be caused by:

a) Mains voltage fluctuations.
b) Spread in the characteristics of components such as transformers, resistors capacitors etc.

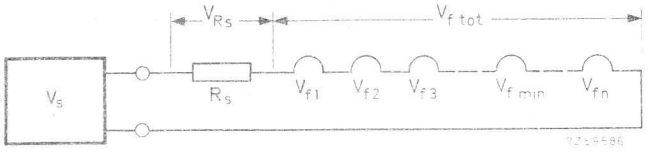
Designers of heater circuits are strongly recommended to bear this in mind when dealing with equipment to be used in areas where the actual mains voltage is likely to differ from the nominal value.

5.1 Parallel connection

The maximum deviation of the heater voltage should not exceed ± 15% (design maximum value).
This condition will be fulfilled when the mains voltage fluctuates by ± 10% and a ordinary transformer (see below) is used.

5.2 Series connection

The maximum deviation of the heater current should not exceed ± 8% (design maximum value).
When a small number of tubes with large differences in the heater voltage is used in series connection combined with a series resistor or a series capacitor, the maximum permitted deviation of the heater current may be exceeded.
To avoid this, certain restrictions must be imposed on the composition of the heater chain; the maximum part of the supply voltage that can be eliminated, and the tolerances of the voltage dropper in series with the heaters.
A number of circuits for If = 300 mA will be described in detail below.



V_s = source voltage (mains voltage or mains voltage stepped down via a transformer)

V_{Rs} = voltage drop over series resistor

$V_{ftot.} = V_{f1} + V_{f2} + V_{f3} \cdots\cdots\cdots\cdots + V_{fmin.} + \cdots\cdots\cdots\cdots V_{fn.}$

$V_{fmin.}$ = lowest individual heater voltage of all tubes in the chain

R_s = series resistor

Voltage source

The following spreads have been taken into account for the source voltage:

- Mains voltage spread ± 10% either or not combined with the voltage spread caused by a transformer with a permanent deviation from the nominal value of ± 1% and with a spread of ± 2% (ordinary, well made transformer).

The following circuits are allowed:

5.2.1 Supply directly from a voltage source ($V_s = V_{ftot.}$)

- No restrictions.

5.2.2 Supply from a voltage source via a 5% series resistor ($V_s = V_{Rs} + V_{ftot.}$)

a. One single tube: permitted if $\frac{V_{Rs}}{V_{ftot.}} \leq 2$

b. Heater chain consisting of 2 or more tubes:

the maximum permitted ratio $\frac{V_{Rs}}{V_{ftot.}}$ can be read from diagram number 1 as follows:

Determine $\frac{V_{fmin.}}{V_{ftot.}}$ of the heater chain. Draw a vertical line through the corresponding point in the diagram. Draw a horizontal line through the point of intersection of this vertical line with the line which indicates the total number of tubes in the chain. The point of intersection of this horizontal line with the vertical axis gives the maximum permitted ratio between the series resistor and the sum of the heater voltages of all tubes in the chain.

5.2.3 Supply from a voltage source via a series diode ($\frac{V_S}{\sqrt{2}} = V_{ftot.}$)

- No restrictions.

5.2.4 Supply from a voltage source via a series diode and a series resistor

($\frac{V_S}{\sqrt{2}} = V_{ftot.} + V_{RS}$)

In the above formula $V_{ftot.}$ and V_{RS} are RMS values and the maximum permitted ratio $\frac{V_{RS}}{V_{ftot.}}$ can be read from diagram number 1 (see 5.2.2).

For calculation of R_S divide the required V_{RS} (RMS) by the nominal heater current: $R_S = \frac{V_{RS}}{0.3}$

Remark to 5.2.3 and 5.2.4:

When series diodes are applied, the D.C. component of the resulting heater voltage should preferably be negative with respect to the cathodes of the tubes.

5.2.5 Supply from a voltage source via a series capacitor

a. One single 300 mA tube; permitted if

$\frac{V_{ftot.}}{V_S} \geq 0.50$ when 5% paper capacitors are applied.

b. $\frac{V_{ftot.}}{V_S} \geq 0.70$ when 10% metallized polycarbonate capacitors are applied.

c. Heater chain consisting of 2 tubes or more; permitted if $\frac{V_{ftot.}}{V_S}$

$\frac{V_{ftot.}}{V_S} \geq 0.6$ when 5% paper capacitors are applied.

$\frac{V_{ftot.}}{V_S} \geq 0.8$ when 10% metallized polycarbonate capacitors are applied.

5.3 Stand-by (instant-on circuits)

In order to maintain reliability during life, it is recommended to reduce the heater voltage of the tubes during stand-by operation to ≤ 75% of the nominal value.

Note

If other designs for the heater supply circuit are wanted than the configurations described above it is strongly recommended to contact the tube manufacturer.

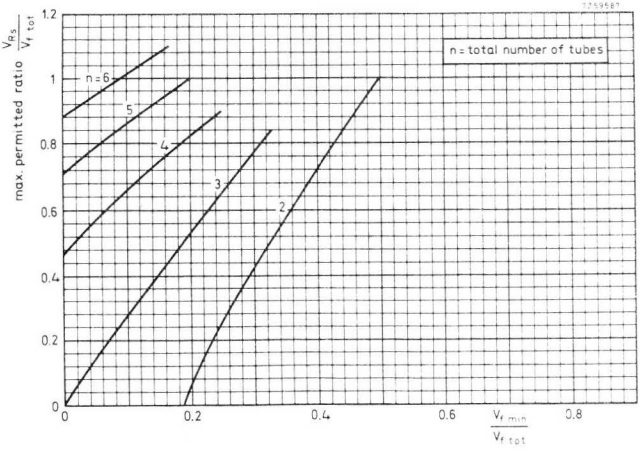


Diagram No. 1

6. CATHODE TO HEATER VOLTAGE

The voltage between cathode and heater should be as low as possible and never exceed the limiting value given on the data sheets of the individual tubes. The values given under "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 voltages. Unless otherwise stated, the maximum values quoted for the voltage between cathode and heater indicate the maximum permissible value (D.C. component). If an A.C. voltage, or an combination of D.C. and A.C. voltages, is applied the peak value may be twice the rated V_{kf}; however, unless otherwise stated, the peak value shall never exceed 315 V. The D.C. component is not allowed to exceed the published value.

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_{rms} (mains frequency).

7. 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 such as the hot line. When such a connection is required, it should be made via a series resistor of not less then 1 kΩ.

8. ELECTRODE VOLTAGES

All electrode voltages are given with respect to cathode.
For cathode drive service the reference point is grid No.1

8.1 Grid No.1 cut-off voltage

Generally curves showing the limits of grid No.1 cut-off voltage for specific values of the first accelerator voltage are included in the data. The brightness control should be so dimensioned that it can handle any tube within the limits shown, at the appropriate first accelerator voltage.
The published limits are determined at an ambient illumination level of 10 lux with the aid of a focused raster. Because the brightness of a focused spot is in general greater than that of a raster, the visual cut-off voltage determined with the aid of a spot will be more negative by about 5 V.

8.2 Grid No.2 voltage

For each individual tube the grid No.2 voltage can be adjusted so that the beam current is cut off at a fixed value within the published range of the grid No.1 voltage.
In the data, graphs are included giving the relationship between the grid No.2 voltage and the grid No.1 cut-off voltage.

8.3 Focusing electrode voltage

Individual tubes will have satisfactory focus over the entire screen at some value within the published range of the focusing voltage.
If centre-focusing is desired this range will shift in the negative direction.

9. LUMINESCENT SCREEN

To prevent permanent damage to the screen material care should be taken

a. not to operate the tube with a stationary picture at high beam currents for extended periods
b. not to operate the tube with a stationary or slowly moving spot except at extremely low beam currents
c. to choose the time constants of the grid No.1 the grid No.2 and the time bases supply line 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.

10. EXTERNAL CONDUCTIVE COATING

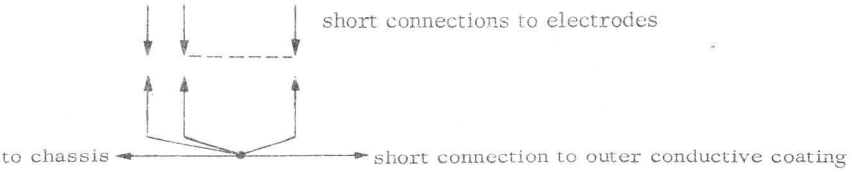
The external conductive coating must be connected to the chassis. The capacitance of this coating to the final accelerating electrode may be used to provide smoothing for the e.h.t. supply.
The coating is not a perfect conductor and in order to reduce radiation caused by the line time base it may be necessary to make multiple connections to the coating. See also 12.

11. METAL RIMBAND

An appreciable capacitance exist between the metal rimband and the internal conductive coating of the tube; its value is quoted in the individual data sheets. To avoid electric shocks, a D.C. connection should be provided between the metal band and the rest of the receiver. In receivers where the chassis can be connected directly to the mains there is a risk of electric shock if acces 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 flash-over 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.
The 4.7 nF capacitor also serves to reduce the radiation from the band.

12. FLASH-OVER

Picture tubes, in common with other high voltage devices, are prone to internal flash-over. During a breakdown arcing occurs between an electrode connected to the e.h.t. capacitor and an electrode terminated in a pin on the base of the tube. 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.
During the subsequent recharging period an additional load is imposed on the e.h.t. generator.
It is of vital importance to provide protective circuits with spark gaps, particularly when semiconductor devices are employed. The spark gaps must be connected as follows:



No other connections between the outer conductive coating and the chassis are permissible.
Additional information available on request.

13. HANDLING

The precautions taken in manufacture reduce the possibility of spontaneous implosion to a minimum but any additional stress due to mishandling considerably increases the risk of implosion: such an implosion may occur immediately or may be delayed. Care should be taken not to scratch or bump any part of the bulb, particularly the screen to cone area, as this will appreciably reduce the strength of the bulb and may lead to implosion.

When a tube is not in its equipment or original packing and is placed screen downwards, it should be placed on a soft pad of suitable material free from abrasive substances. Stresses on the neck should be avoided.

If the transportation method uses the lugs it is necessary to employ at least two lugs in the lifting of the tube. The lift should be made in such a way that the applied forces are equally distributed between the lugs.

The maximum force that may be applied to one lug, at any angle, shall not exceed twice the weight of the tube.

The tube should not be subjected to accelerations higher than 30 g.

Before removing the tube from the equipment the capacitance C_{am} should be discharged via a resistor of approx. 50 kΩ.

The manufacturers notify all concerned that they do not accept any responsibility for any damage on injury sustained in any manner in connection with the picture tube, neither is any condition or warranty given or to be implied.

14. 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 weight of the socket and possible additional circuitry should not be more than 80 g. With tubes with a 7-pin miniature base the socket may not be used for mounting components.

Tubes having all-glass bases must not be soldered direct into the wiring.
It is very desirable that tubes should not be exposed to strong electrostatic and magnetic fields.

In front of the face of a mono-panel T.V. picture tube a protecting screen of transparent material should be placed. The screen should be of adequate strength to withstand the effects of an implosion of the tube.
Tubes having integral protection do not require a protective screen.

15. DIMENSIONS

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

16. REFERENCE LINE

The reference line indicated on the tube outline drawing is determined by means of a gauge.
Drawings of these gauges are given in this book.

17. CORNER CUTTING OR NECK SHADOWING

Corner cutting is caused by a direct interception of the deflected electron beam before it is reaching the screen and results in a non-scanned corner of the raster. It may be avoided by applying an appropriate deflection unit.

18. RASTER CENTRING

To centre the raster on the screen it is recommended that either a magnetic field just behind the deflection coils (viewed from the screen) be used or a direct current be passed through the deflection coils.

The centring device should provide a shift to allow for non-centrality of the spot with respect to the geometric centre of the screen, in addition the centring device should provide the shift needed to allow for non-centrality of the visible raster (i.e. to compensate for line blanking and also time base non-linearity, if any) and the earth magnetic field.
The use of a too strong centring magnetic field should be avoided; this may result in raster distortion and even corner cutting.

TYPE DESIGNATION

PRO-ELECTRON TYPE DESIGNATION CODE

Single letter, group of figures, hyphen, group of figures, letter or letter group.

The first letter indicates the prime application of the tube:
A – Television display tube for domestic application.
M – Television display tube for professional application-direct view.

First group of figures: Diameter or diagonal of the face in cm.

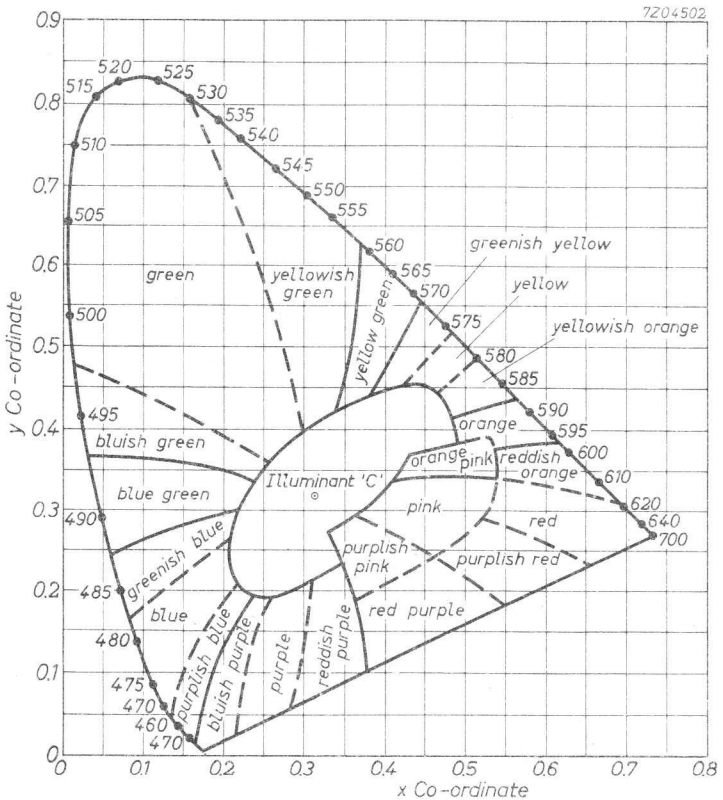
Second group of figures: Development or design number.

Final letter or letter group: Properties of the phosphor screen.
The first letter denotes the colour of the fluorescence, the second letter, if any, other specific differences in screen properties.
W – White screen for T.V. display tubes.
X – Three-colour screen for T.V. display tubes.

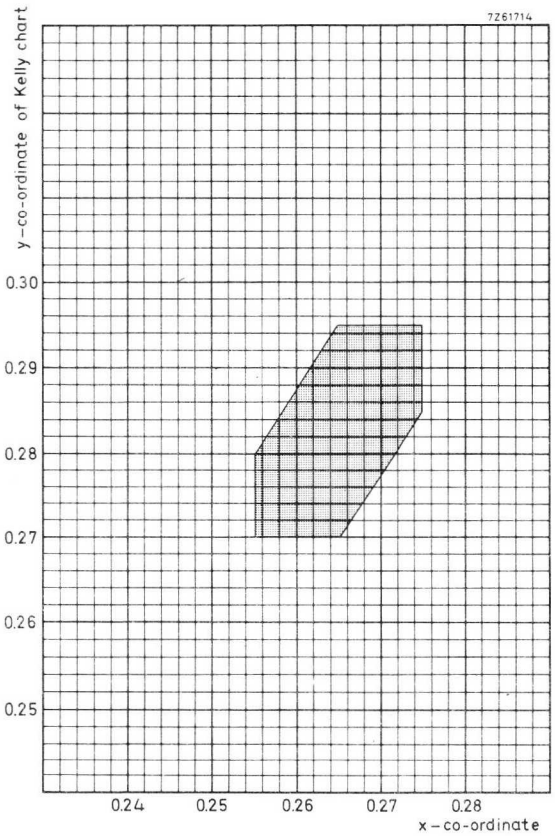
Example A66-410X

T V display tube for domestic application	Face diagonal (66 cm)	Development or design number	Three-colour screen

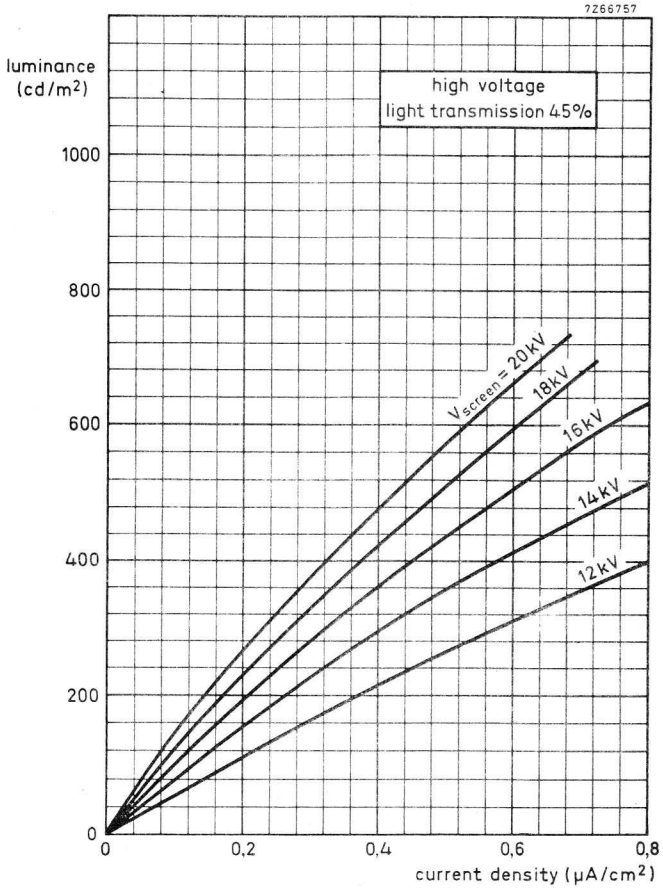
SCREEN PHOSPHORS

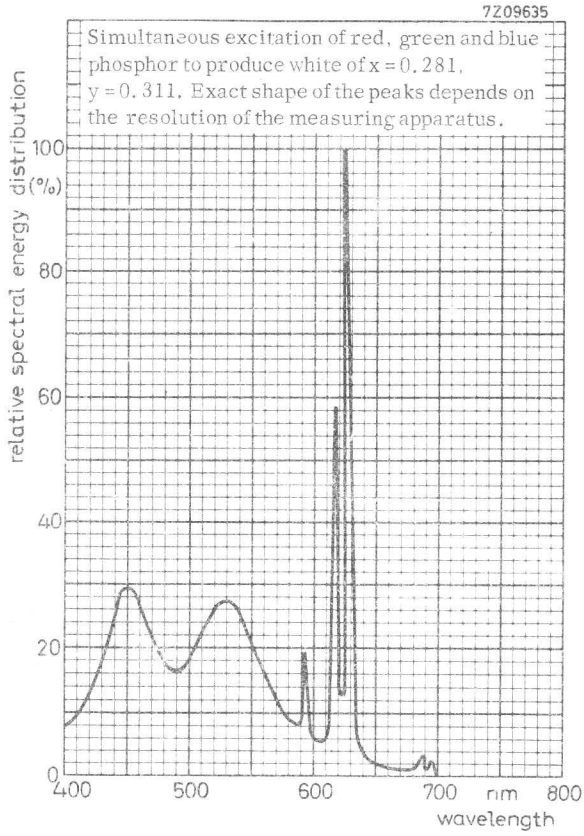


Kelly Chart



Colour point tolerance area for W phosphor


7266757
luminance
(cd/m²)
high voltage
light transmission 45%
1000
800
600
400
200
0
0
0,2
0,4
0,6
0,8
current density (μA/cm²)
V screen = 20kV
18kV
16kV
14kV
12kV

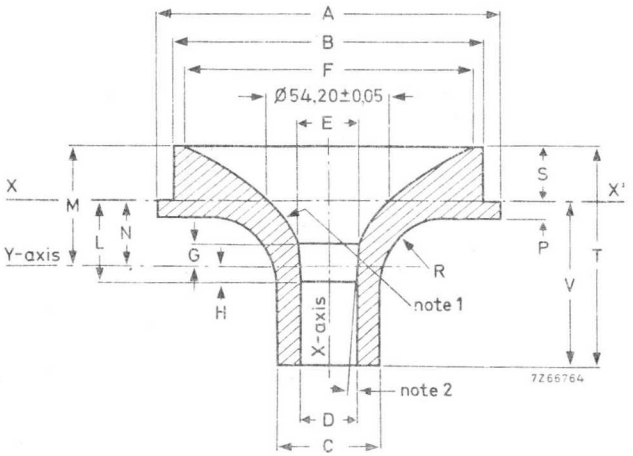


Colour coordinates

	x	y
red	0,630	0,340
green	0,315	0,600
blue	0,150	0,065

REFERENCE LINE GAUGES

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



The millimetre dimensions are derived from the original inch dimensions.

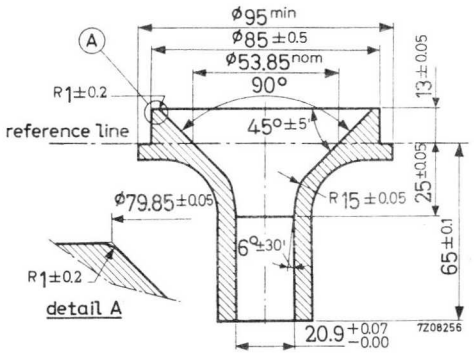
ref	inches			millimetres			notes
	min	nom	max	min	nom	max	
A	-	5,000	-	-	127,00	-	-
B	-	4,500	-	-	114,30	-	-
C	-	2,000	-	-	50,80	-	-
D	1,168	1,168	1,171	29,668	29,668	29,743	-
E	1,241	1,242	1,243	31,522	31,547	31,572	-
F	4,248	4,250	4,252	107,900	107,950	108,000	-
G	-	0,279	-	-	7,09	-	2
H	-	0,250	-	-	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	-

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^{o} ± 30' taper between planes G and L.

Reference line gauge for 110^{o} deflection angle.

REFERENCE LINE GAUGE D

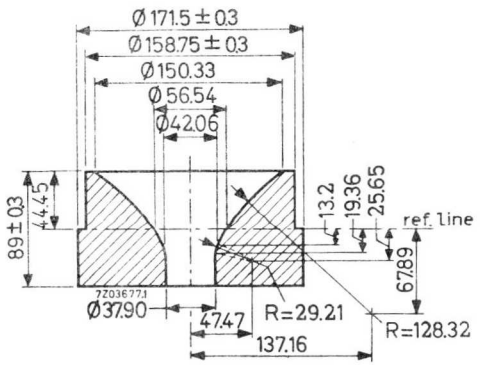
Dimensions in mm



Reference line gauge for 90° deflection angle

REFERENCE LINE GAUGE E

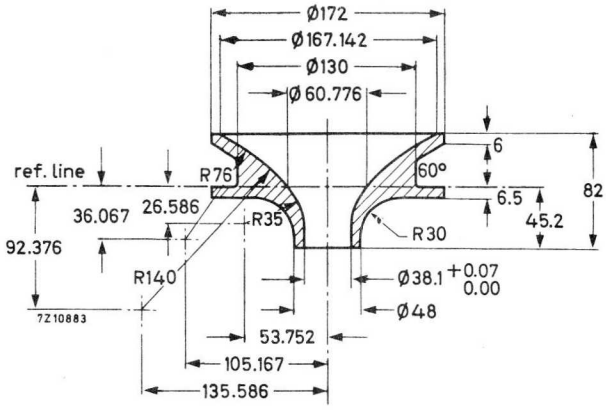
Dimensions in mm



Reference line gauge for 90° deflection angle colour tubes

REFERENCE LINE GAUGE F

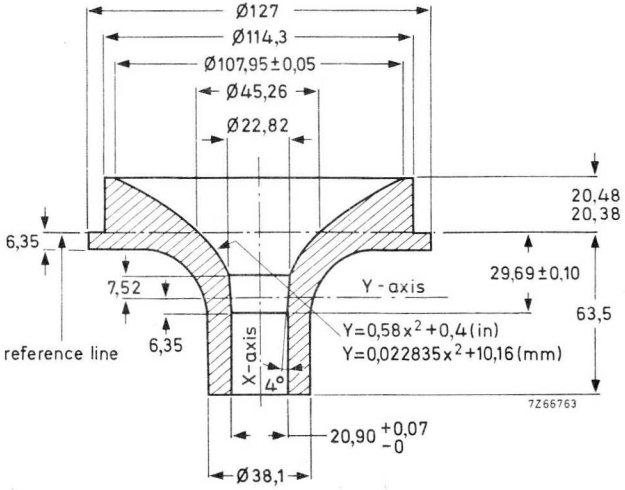
Dimensions in mm



Reference line gauge for 110° deflection angle

REFERENCE LINE GAUGE G (JEDEC G148)

Dimensions in mm

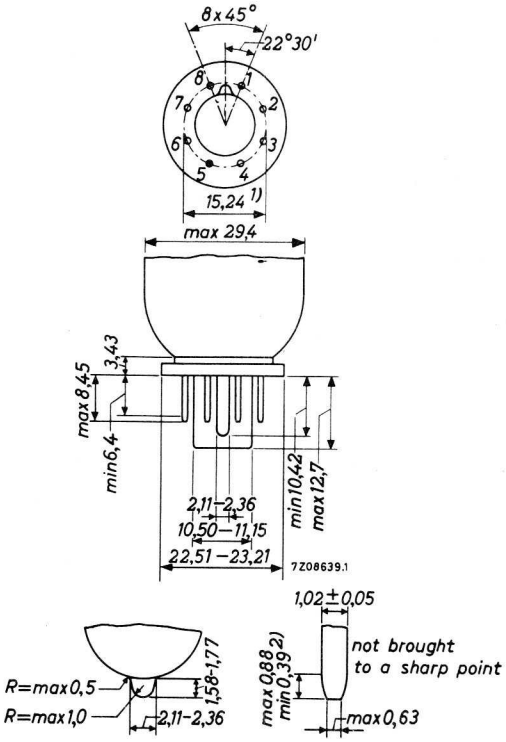


Reference line gauge for 110° deflection angle

BASES

SMALL-BUTTON NEO EIGHTAR BASE IEC67-1-31
JEDEC B7-208

Dimensions in mm

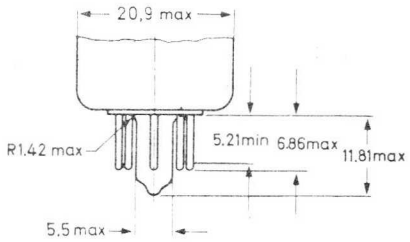


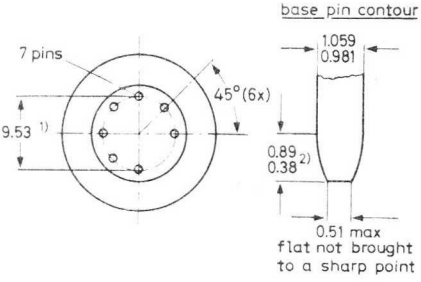
1) Base-pin positions are held to tolerances such that the base will fit a flat-plate gauge having a thickness of 9, 53 and eight equally spaced holes of 1, 40 ±0, 01 diameter located on a 15, 24 ±0, 01 diameter circle. The gauge is also provided with a centre hole to provide 0, 25 diametric clearance 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 of this base are within the JEDEC E7-91 dimensions

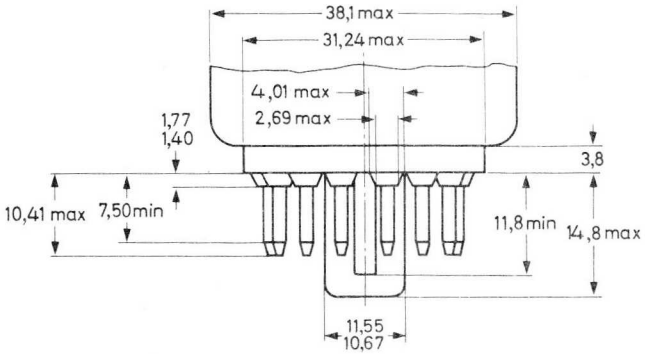


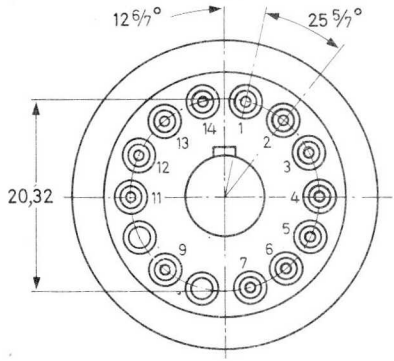


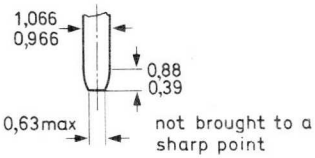
1) Base-pin and pumping stem positions are held to tolerances such that entire length of pins and stem will without undue force pass into and disengage from a flat-plate gauge having a thickness of 6, 35 mm and eight holes with diameters of 1, 27 ±0, 013 mm so located on a 9, 525 ±0, 013 mm diameter 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.

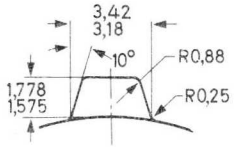
12 PIN BASE JEDEC B12-246, IEC-67-I-47a







pin contour



detail of key

Colour TV picture tubes

110° IN-LINE GUN COLOUR TELEVISION TUBE

The tube has a three-in-line gun, a slotted shadow-mask and phosphors arranged in vertical stripes. The system of tube and deflection unit AT1085 is inherently self-converging; only minor corrections are needed to compensate for tolerances and asymmetries. The shadow-mask is optimized for minimum moiré. The tube features a quick-heating cathode, an internal magnetic shield, and a very short overall length.

QUICK REFERENCE DATA		
Deflection angle	110	deg
Face diagonal	47	cm
Overall length	34	cm
Inherently self-converging system with deflection unit AT1085		
Quick-heating cathode	with a typical tube a picture will appear within 5 s	
Heating	6,3 V, 730	mA
Magnetic shield	internal	
Envelope	reinforced suitable for push-through	
Focusing	bi-potential	

SCREEN

Metal-backed vertical phosphor stripes	Red : Europium activated rare earth Green : Sulphide type Blue : Sulphide type	
Centre-to-centre distance of identical colour phosphor stripes	0,7	mm
Light transmission of face glass	56	%

HEATING : indirect by a.c. (preferably mains or line frequency) or d.c.

Heater voltage	V_f	6,3	V
Heater current	I_f	730	mA

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

For heating time as a function of source impedance see graph page 14.

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g5, g4/m}$	<	1000	pF
		>	600	pF
Final accelerator to metal rimband	$C_{a, g5, g4/m'}$		250	pF
Grid no. 1 of a gun to all other electrodes				
red gun	C_{g1R}		7	pF
green gun	C_{g1G}		7	pF
blue gun	C_{g1B}		7	pF
Cathodes of all guns (connected in parallel) to all other electrodes	C_k		12	pF
Cathode of any gun to all other electrodes	C_{kR} , C_{kG} , C_{kB}		4	pF
Grid no. 3 (focusing electrode) to all other electrodes	C_{g3}		7	pF

FOCUSING electrostatic (bi-potential)

DEFLECTION magnetic

Diagonal deflection angle	110	deg
Horizontal deflection angle	97	deg
Vertical deflection angle	77	deg

MECHANICAL DATA

Overall length	326,3 to 339,3		mm
Neck diameter	$36,5^{+1,6}_{-0,4}$		mm
Diagonal of bulb	≤	473	mm
Width of bulb	≤	407,7	mm
Height of bulb	≤	317,8	mm
Useful screen			
diagonal	≥	438,9	mm
horizontal axis	≥	368,9	mm
vertical axis	≥	274,9	mm

Mounting position: any

Net mass : approx. 10 kg

Base : 12 pin base IEC 67-I-47a, type 2

Anode contact : small cavity contact J1-21, IEC 67-III-2

Magnetic shielding, degaussing: The tube is provided with an internal magnetic shield. The internal magnetic shield and the shadow-mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering top and bottom cone parts. For proper degaussing an initial m.m.f. of 200 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate circuitry. To prevent beam landing disturbances by line-frequency currents induced in the degaussing coils, these coils should be shunted by a capacitor of sufficiently high value. In the steady state, no significant m.m.f. should remain in the coils ($\leq 0,2$ A.t.). To ease the mounting of the coils, the rimband is provided with rectangular holes.

NOTES TO OUTLINE DRAWINGS (see pages 4, 5, and 6)

1) This ridge can be used as an orientation for the deflection unit.

2) Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.

3) To clean this area, wipe only with a soft lintless cloth.

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

5) Minimum space to be reserved for mounting lug.

6) The position of the mounting screw in the cabinet must be within a circle of 8 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 401 mm x 311 mm.

7) Co-ordinates for radius R = 15,2 mm: x = 166,2 mm, y = 118,8 mm.

8) Distance from point z to any hardware.

9) Maximum dimensions in plane of lugs.

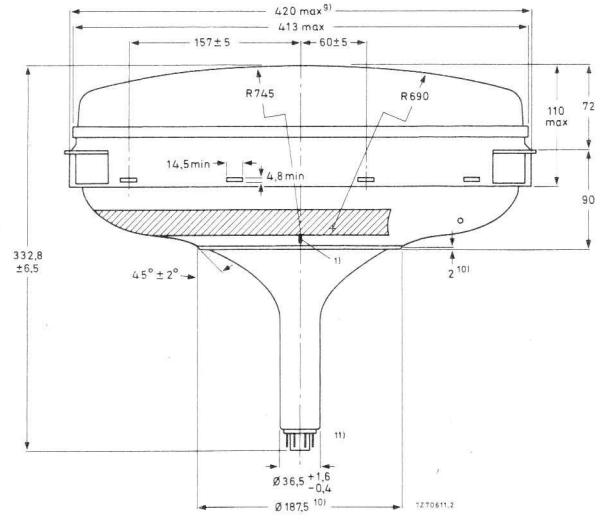
10) Centring ring for the deflection unit.

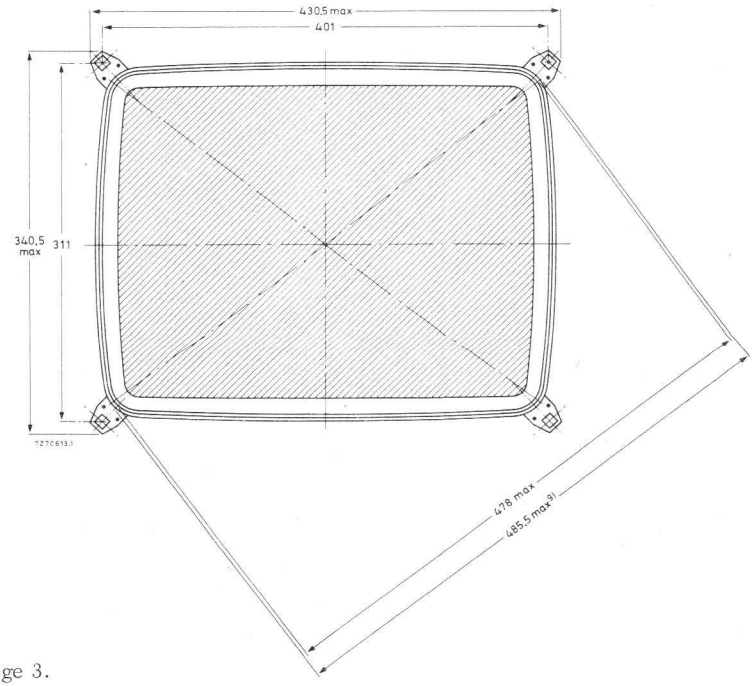
11) The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 55 mm.

12) Minimum distance between glass and rimband in plane of centre line of the apertures.

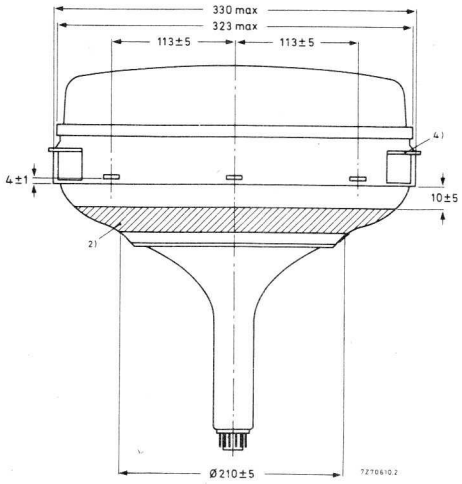
MECHANICAL DATA

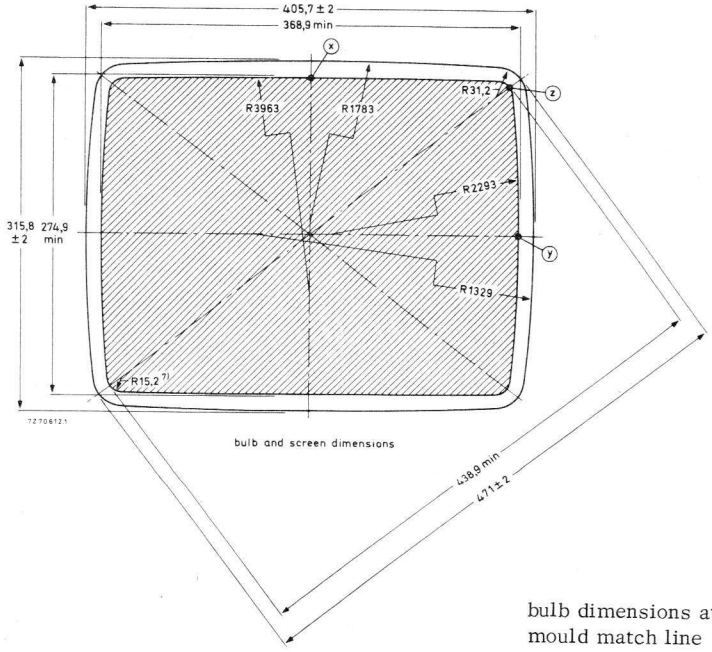
Dimensions in mm





Notes see page 3.





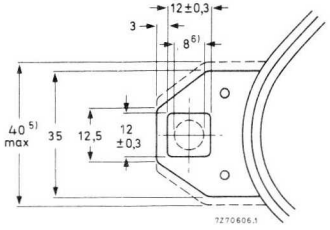
bulb and screen dimensions

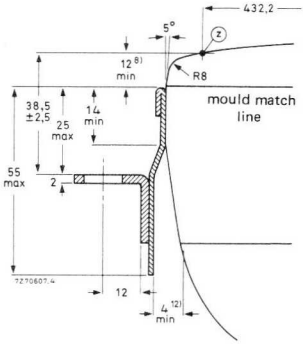
bulb dimensions at mould match line

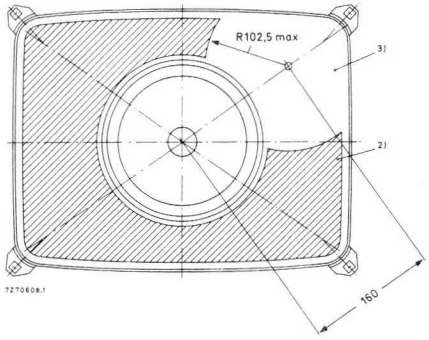
Notes see page 3.

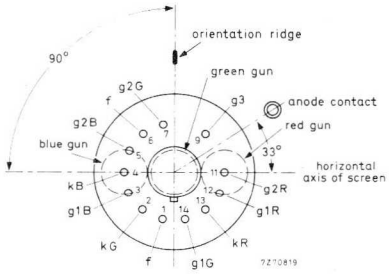
MECHANICAL DATA (continued)

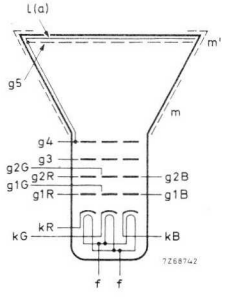
Dimensions in mm

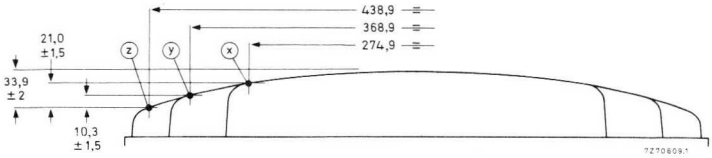












Notes see page 3.

TYPICAL OPERATING CONDITIONS cathode drive, voltages with respect to g1

Final accelerator voltage	$V_{a, g5, g4}$	25	kV
Grid no. 3 (focusing electrode) voltage	V_{g3}	4,0 to 4,8	kV
Grid no. 2 voltage for a spot cut-off voltage V_k = 140 V	V_{g2}	465 to 705	V [1]
Cathode voltage for spot cut-off at V_{g2} = 555 V	V_k	110 to 165	V [2]
Luminance at the centre of the screen [3]	L	100	cd/m^2 (nit)

EQUIPMENT DESIGN VALUES (each gun if applicable), voltages with respect to g1
Valid for final accelerator voltages between 20 kV and 27,5 kV

Grid no. 3 (focusing electrode) voltage	V_{g3}	16 to 19,2% of final accelerator voltage
Grid no. 2 voltage	V_{g2}	see cut-off design chart page 13
Cathode voltage for visual extinction of focused spot	V_k	see cut-off design chart page 13
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value is min. 75% of highest value
Grid no. 3 (focusing electrode) current	I_{g3}	−5 to +5 µA
Grid no. 2 current	I_{g2}	−5 to +5 µA
Grid no. 1 current at V_k = 150 V	I_{g1}	−5 to +5 µA

1) This range of V_{g2} has to be used when in circuit design fixed values for cut-off of the three guns are used.

2) This range of V_k has to be used when in circuit design fixed values for V_{g2} of the three guns are used.

3) Tube settings adjusted to produce white D (x = 0,313, y = 0,329), focused raster, current density 0,4 µA/cm^2.

EQUIPMENT DESIGN VALUES (continued)

			white "D"	
To produce white of the following CIE co-ordinates:	x	0,265	0,281	0,313
	y	0,290	0,311	0,329
Percentage of total anode current supplied by each gun (typical)				
red gun		26,4	30,6	41,2
green gun		34,3	35,4	32,2
blue gun		39,3	34,0	26,6
Ratio of anode current red gun to green gun	>	0,60	0,65	0,95
	av.	0,75	0,85	1,30
	<	1,00	1,15	1,70
Ratio of anode currents red gun to blue gun	>	0,50	0,65	1,15
	av.	0,65	0,90	1,55
	<	0,90	1,20	2,05

LIMITING VALUES (each gun if applicable), voltages with respect to g1
(Design maximum rating system unless otherwise specified)

Final accelerator voltage	$V_{a, g5, g4}$	max.	27,5	kV [1][2][3]
		min.	20	kV [1][4]
Long term average current for three guns	I_a	max.	1000	µA [5]
Grid no. 3 (focusing electrode) voltage	V_{g3}	max.	6	kV
Grid no. 2 voltage	V_{g2}	max.	1000	V
Cathode voltage, positive	V_k	max.	400	V
positive, operating cut-off	V_k	max.	200	V
negative	$-V_k$	max.	0	V
negative peak	$-V_{kp}$	max.	2	V
Cathode to heater voltage, positive	V_{kf}	max.	250	V [6]
positive peak	V_{kfp}	max.	300	V [1]
negative	$-V_{kf}$	max.	135	V
negative peak	$-V_{kfp}$	max.	180	V [1]

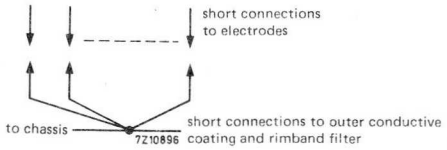
[1] Absolute maximum rating system.

[2] 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.

Continued on page 9.

REMARKS

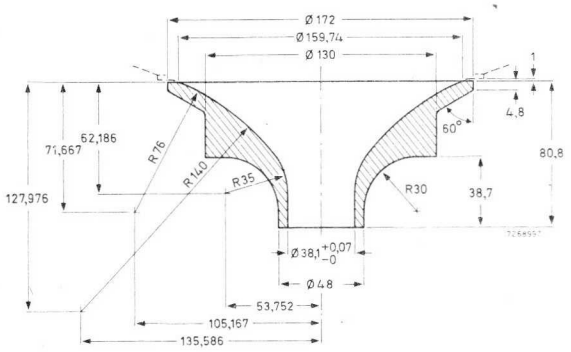
With the high voltage used with this tube (max. 27,5 kV) internal flash-overs may occur. These may destroy the cathode(s) of the tube. Therefore it is necessary to provide protective circuits, using spark gaps.
The spark gaps must be connected as follows:



No other connections between the outer conductive coating and the chassis are permissible. Additional information available on request.

During shipment and handling the tube should not be subjected to accelerations greater than 350 m/s^2 (35 g) in any direction

CONTOUR GAUGE



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3) During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.

4) Operation of the tube at lower voltages impairs the luminance and resolution.

5) 1500 µA permitted provided a current limiting circuit is used.

6) During an equipment warm-up period not exceeding 15 s V_{kf} is allowed to rise to 385 V. Between 15 s and 45 s after switching on a decrease in V_{kf} proportional with time from 385 V to 250 V is permissible.

BEAM CORRECTIONS

When the tube is used with the deflection unit AT1085 the following corrections should be applied:

Maximum required horizontal displacement of the electron beams with respect to the phosphor stripes by the purifying magnet of the multi-pole unit AT1081 [1] 45 µm

Static convergence deviations must be corrected by a static multi-pole unit AT1081 providing adjustable four-pole and six-pole fields centred around the tube axis

Maximum requred compensation for static convergence

4-pole device: red-to-blue (in any direction)	4,5 mm
6-pole device: red and blue to green (in any direction)	2,3 mm

North-South raster shape correction circuitry is not required.

To obtain a symmetrical shape for the horizontal lines at the upper part and the lower part of the screen, the unit AT1081 comprises an additional dipole correction magnet giving a displacement of the beam in the centre of the screen in vertical direction of maximum ± 3,5 mm

Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction 4 mm

With respect to dynamic convergence the display system, consisting of picture tube A47-500X and deflection unit AT1085, is inherently self-converging. However, a small fixed correction of 2,6 mm [2] is required on the horizontal axis and also small corrections should be made to compensate for tolerances and asymmetries in the tube and deflection unit combination.
For this purpose two types of dynamic four-pole fields can be used.
One is generated by additional windings on the yoke ring of the deflection unit, and energized by adjustable currents synchronized with scanning.
The other type is generated by adjustable balancing currents through the deflection coils.

Compensation to be provided by these corrections:

-horizontal red-to-blue distance at the ends of the horizontal axis in opposite directions (line symmetry)	[3]	0 ± 1,5 mm
-horizontal red-to-blue distance at the ends of the vertical axis in opposite directions (field symmetry)	[4]	0 ± 1,5 mm
-vertical red-to-blue distance at the ends of the horizontal axis in opposite directions (line balance)	[5]	0 ± 1,0 mm
-vertical red-to-blue distance at the ends of the horizontal axis in equal directions (line balance parabola)	[6]	0 ± 0,5 mm
-vertical red-to-blue distance at the top of the vertical axis (field balance top)	[7]	0 ± 1,0 mm
-vertical red-to-blue distance at the bottom of the vertical axis (field balance bottom)	[8]	0 ± 1,0 mm

Notes see page 11.

Notes

1) Purity adjustment in vertical direction is not required.

2) This correction is made by feeding a fixed parabolic current of line frequency through the additional four-pole windings on the deflection unit.

3) This correction is made by feeding a sawtooth current of line frequency through the additional four-pole windings on the deflection unit.

4) This correction is made by feeding a sawtooth current of field frequency through the additional four-pole windings on the deflection unit.

5) This correction is made by unbalancing the line deflection coil halves.

6) This correction is made by feeding a parabolic current of line frequency through the line deflection coil halves.

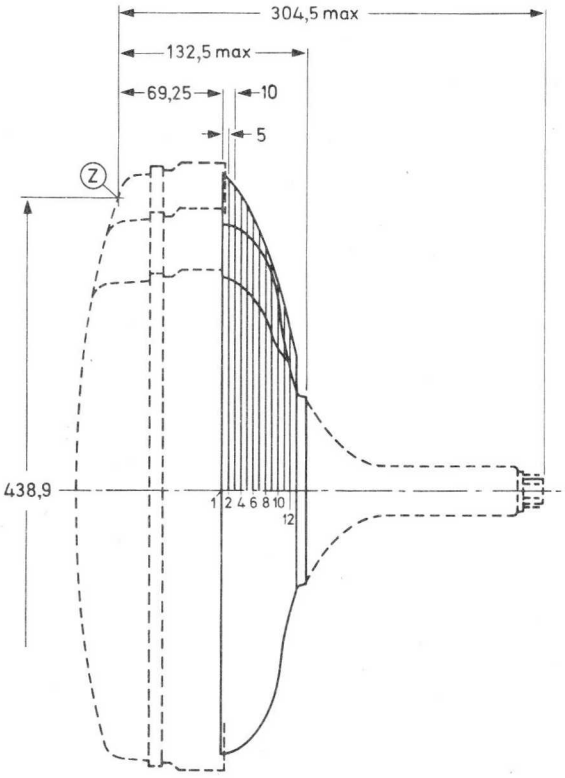
7) This correction is made by unbalancing the field deflection coil halves during the first half of the field scan.

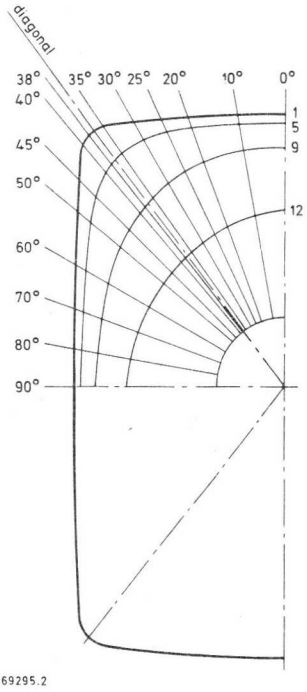
8) This correction is made by unbalancing the field deflection coil halves during the second half of the field scan.

Application information available on request.

MAXIMUM CONE CONTOUR DRAWING

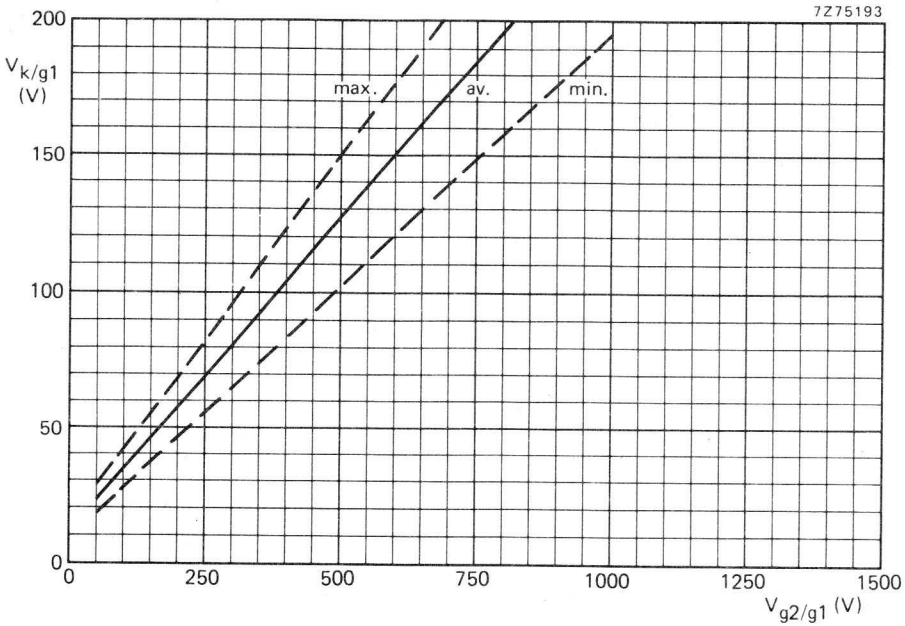
Dimensions in mm



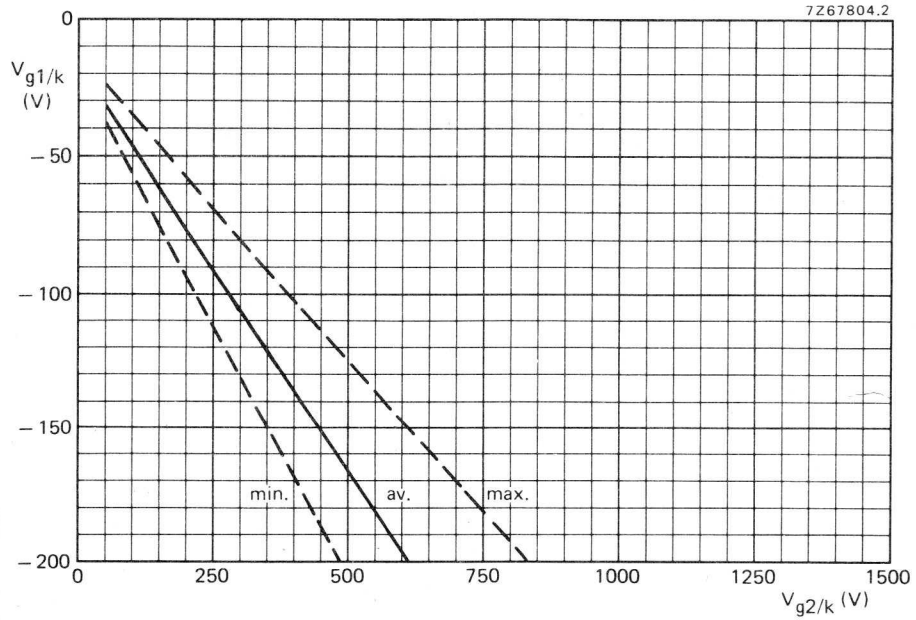


7Z69295.2

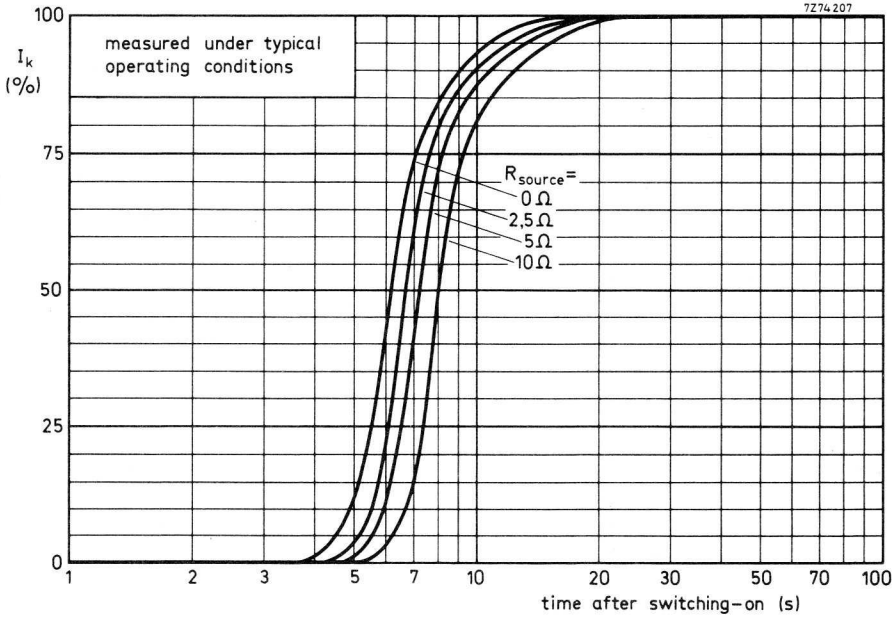
Section	Nom. distance from section 1	Distance from centre (max. values) 0°	10°	20°	25°	30°	35°	38°	40°	45°	50°	60°	70°	80°	90°
1	0	201.0	203,7	212,2	218,8	226,2	232,8	231,6	227,6	212,5	198,4	177,8	164,9	157,9	155,7
2	5	200,1	202,7	210,9	217,1	224,3	229,2	227,7	224,0	210,2	196,7	176,5	163,9	157,0	154,8
3	10	198,7	201,3	209,0	214,7	220,9	224,3	222,5	219,2	206,9	194,2	174,8	162,5	155,7	153,6
4	15	197,0	199,3	206,4	211,4	216,3	218,1	216,0	213,2	202,6	191,1	172,6	160,8	154,2	152,1
5	20	194,6	196,8	203,0	207,1	210,4	210,8	208,6	206,1	197,2	187,1	170,0	158,6	152,3	150,2
6	25	191,7	193,6	198,7	201,5	203,3	202,4	200,1	197,9	190,6	182,1	166,8	156,1	150,0	148,1
7	30	187,9	189,5	193,1	194,5	194,7	192,9	190,6	188,7	182,7	175,9	162,8	153,1	147,4	145,5
8	35	183,2	184,2	185,8	185,8	184,7	182,2	180,1	178,4	173,6	168,2	157,7	149,4	144,3	142,6
9	40	176,8	177,1	176,4	175,1	173,0	170,2	168,2	166,7	162,9	158,9	151,1	144,7	140,5	139,1
10	45	167,8	166,9	164,0	161,8	159,2	156,4	154,6	153,4	150,4	147,5	142,3	138,2	135,5	134,5
11	50	153,9	151,7	147,5	145,0	142,6	140,1	138,8	137,8	135,7	133,8	131,0	128,9	128,0	128,0
12	55	130,7	128,5	125,3	123,6	122,0	120,5	119,7	119,2	118,1	117,2	116,0	115,7	116,2	116,9
13	59,5	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0



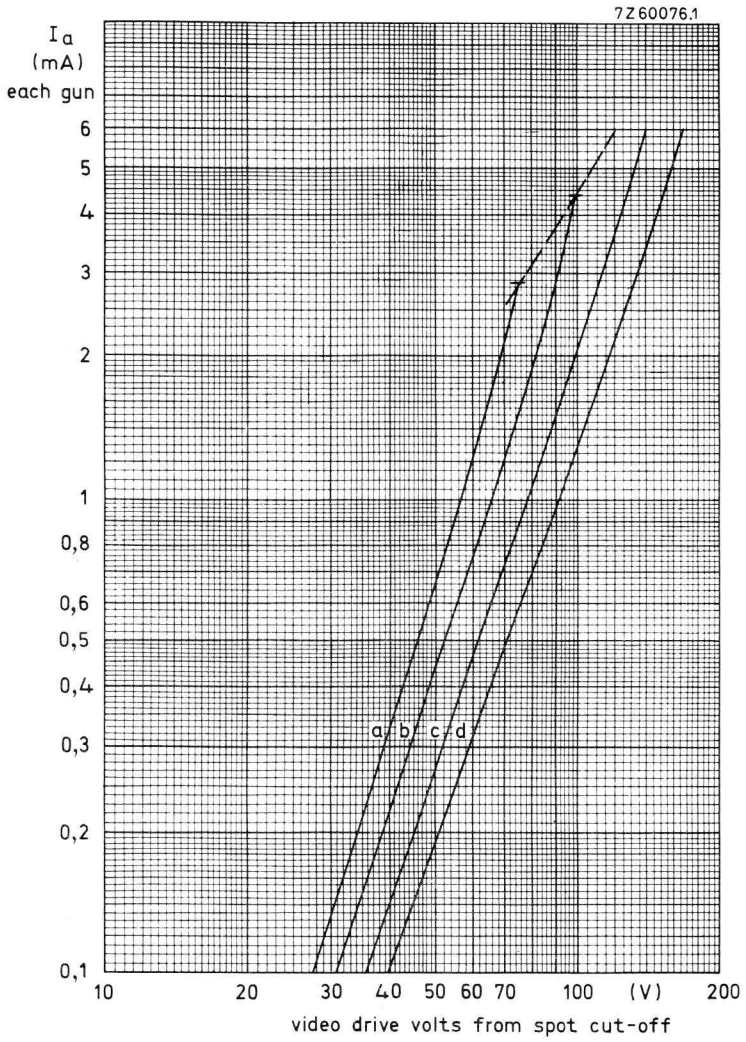
Cut-off design chart (cathode drive), V_{g3} adjusted for focus, V_a, g5, g4 = 20 to 27,5 kV



Cut-off design chart (grid drive), V_{g3} adjusted for focus, V_a, g5, g4 = 20 to 27,5 kV



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

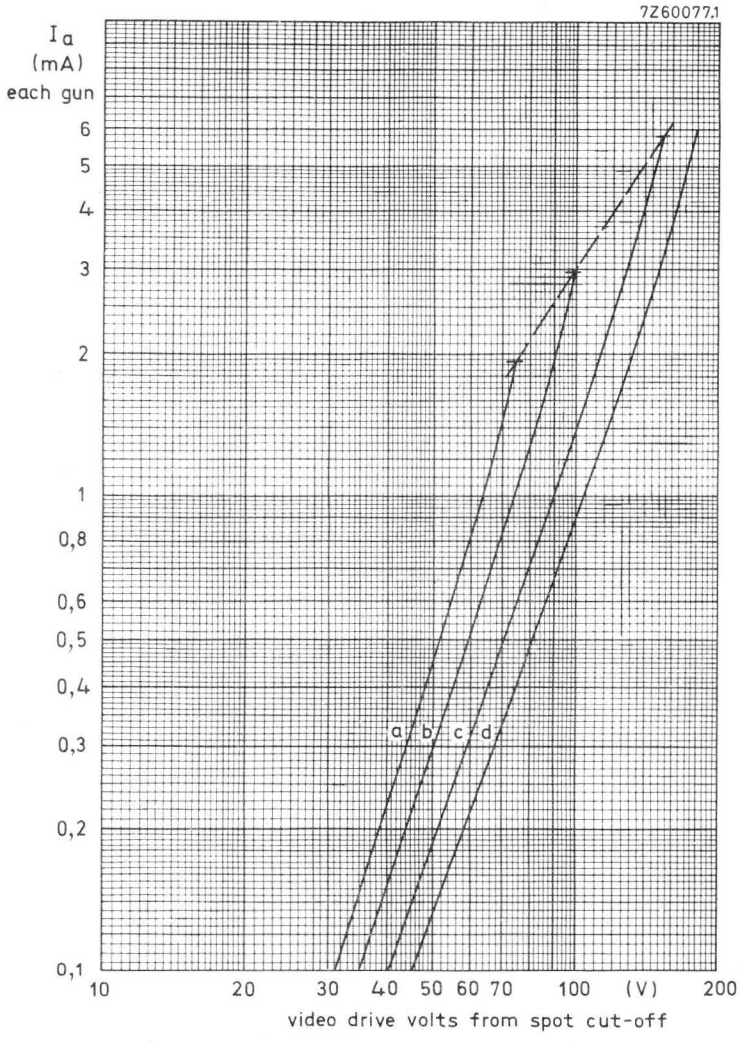


Typical cathode drive characteristics

$V_{a, g5, g4}$ = 20 kV to 27,5 kV
V_{g3} adjusted for focus
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_k

---- zero bias point

a = spot cut-off = 75 V
b = spot cut-off = 100 V
c = spot cut-off = 150 V
d = spot cut-off = 200 V



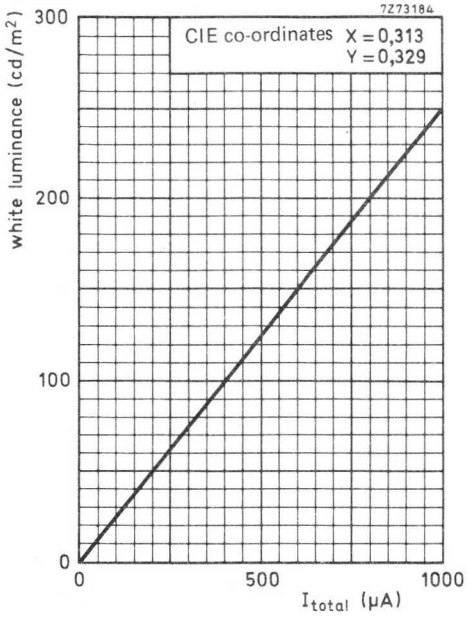
Typical grid drive characteristics

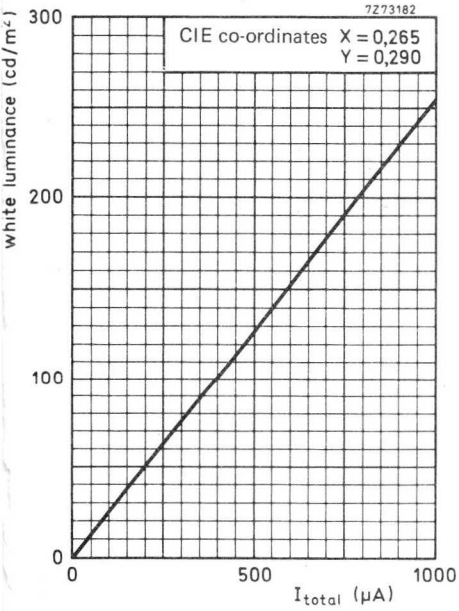
$V_{a, g5, g4}$ = 20 kV to 27,5 kV
V_{g3} adjusted for focus
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_{g1}

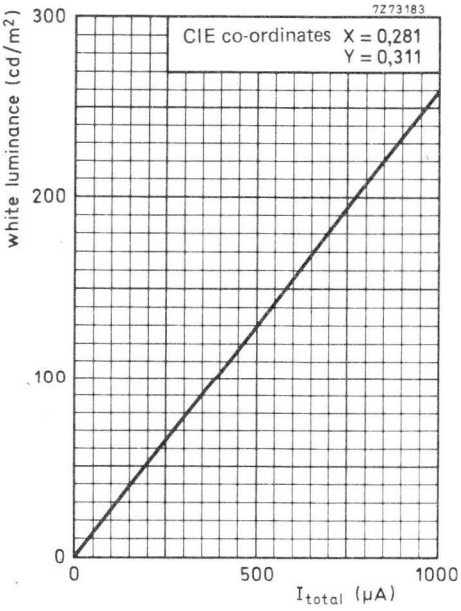
---- zero bias point

a = spot cut-off = −75 V
b = spot cut-off = −100 V
c = spot cut-off = −150 V
d = spot cut-off = −200 V

Luminance at the centre of the screen as a function of I_{total}. Scanned area 368, 9 mm x 274, 9 mm.







110° IN-LINE GUN COLOUR TELEVISION TUBE

The tube has a three-in-line gun, a slotted shadow-mask, and phosphors arranged in vertical stripes. The system of tube and deflection unit AT1085 is inherently self-converging; only minor corrections are needed to compensate for tolerances and asymmetries. The shadow-mask is optimized for minimum moiré. The tube features a quick-heating cathode, an internal magnetic shield, and a very short overall length.

QUICK REFERENCE DATA		
Deflection angle	110	deg
Face diagonal	51	cm
Overall length	35	cm
Inherently self-converging system with deflection unit AT1085		
Quick-heating cathode	with a typical tube a picture will appear within 5 s	
Heating	6,3 V, 730	mA
Magnetic shield	internal	
Envelope	reinforced, suitable for push-through	
Focusing	bi-potential	

SCREEN

Metal-backed vertical phosphor stripes Red : Europium activated rare earth
Green : Sulphide type
Blue : Sulphide type

Centre-to-centre distance of identical colour phosphor stripes	0,8	mm
Light transmission of face glass	52	%

HEATING: indirect by a.c. (preferably mains or line frequency) or d.c.

Heater voltage	V_f		6,3	V
Heater current	I_f		730	mA

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

For heating time as a function of source impedance see graph page 14.

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g5,g4/m}$	<	1400	pF
		>	900	pF
Final accelerator to metal rimband	$C_{a,g5,g4/m'}$		250	pF
Grid no. 1 of a gun to all other electrodes				
red gun	C_{g1R}		7	pF
green gun	C_{g1G}		7	pF
blue gun	C_{g1B}		7	pF
Cathodes of all guns (connected in parallel) to all other electrodes	C_k		12	pF
Cathode of any gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}		4	pF
Grid no. 3 (focusing electrode) to all other electrodes	C_{g3}		7	pF

FOCUSING electrostatic (bi-potential)

DEFLECTION magnetic

Diagonal deflection angle		110	deg
Horizontal deflection angle		97	deg
Vertical deflection angle		77	deg

MECHANICAL DATA

Overall length			351,4	mm
Neck diameter			$36,5^{+1,6}_{-0,4}$	mm
Diagonal	of bulb	≤	515,5	mm
Width	of bulb	≤	442,5	mm
Height	of bulb	≤	343,8	mm
Useful screen diagonal		≥	480	mm
horizontal axis		≥	404,4	mm
vertical axis		≥	303,3	mm

Mounting position : any

Net mass : approx. 12 kg

Base : 12 pin base IEC 67-I-47a, type 2

Anode contact : Small cavity contact J1-21, IEC 67-III-2

Magnetic shielding, degaussing : The tube is provided with an internal magnetic shield.

The internal magnetic shield and the shadow-mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering top and bottom cone parts. For proper degaussing an initial m.m.f. of 250 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate circuitry. To prevent beam landing disturbances by line-frequency currents induced in the degaussing coils, these coils should be shunted by a capacitor of sufficiently high value. In the steady state, no significant m.m.f. should remain in the coils (<0, 25 A.t.). To ease the mounting of the coils, the rimband is provided with rectangular holes.

NOTES TO OUTLINE DRAWINGS (see pages 4, 5, and 6)

1) This ridge can be used as an orientation for the deflection unit.

2) Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.

3) To clean this area, wipe only with a soft lintless cloth.

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

5) Minimum space to be reserved for mounting lug.

6) The position of the mounting screw in the cabinet must be within a circle of 8 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 434 mm x 337 mm.

7) Co-ordinates for radius R = 13, 1 mm: x = 184, 58 mm, y = 131, 93 mm.

8) Distance from point z to any hardware.

9) Maximum dimensions in plane of lugs.

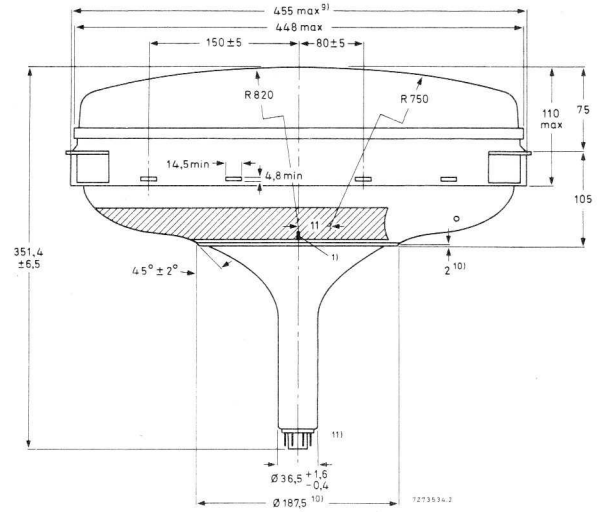
10) Centring ring for deflection unit.

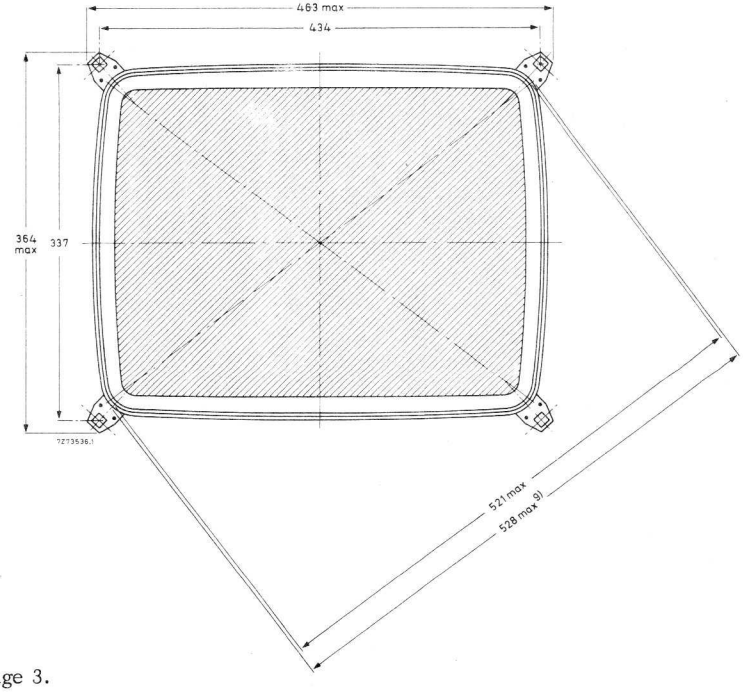
11) The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. The bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 55 mm.

12) Minimum distance between glass and rimband in plane of centre line of apertures.

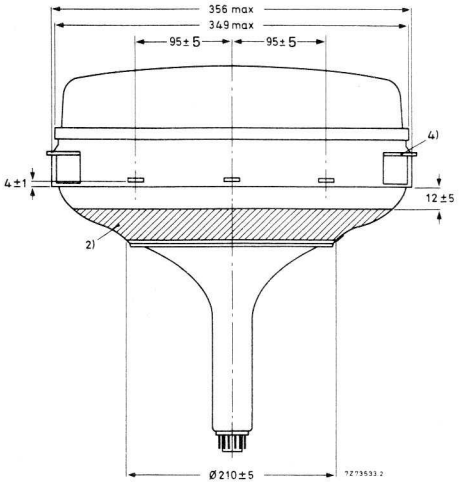
MECHANICAL DATA (continued)

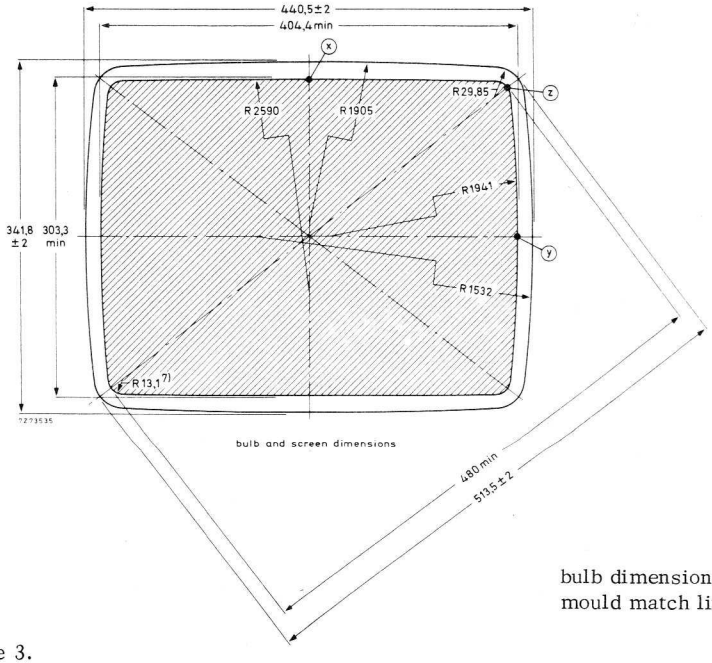
Dimensions in mm





Notes see page 3.





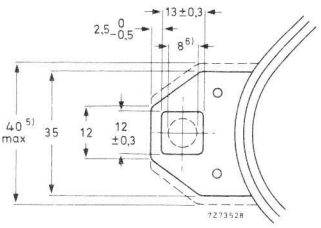
bulb and screen dimensions

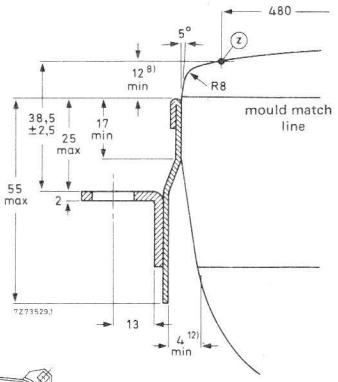
bulb dimensions at mould match line

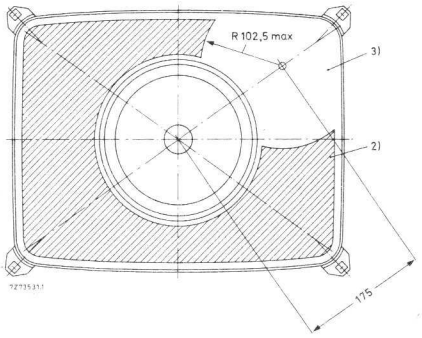
Notes see page 3.

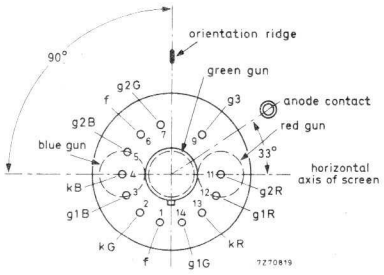
MECHANICAL DATA (continued)

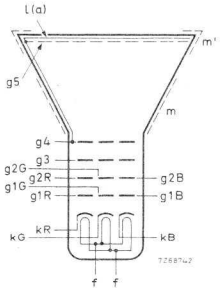
Dimensions in mm

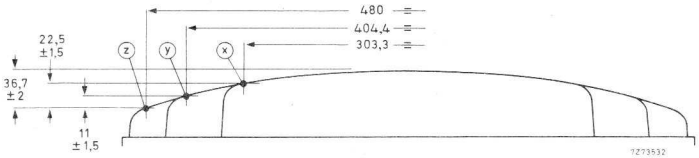












Notes see page 3.

TYPICAL OPERATING CONDITIONS cathode drive, voltages with respect to g1

Final accelerator voltage	$V_{a,g5,g4}$	25	kV	
Grid no. 3 (focusing electrode) voltage	V_{g3}	4,0 to 4,8	kV	
Grid no. 2 voltage for a spot cut-off voltage V_k = 140 V	V_{g2}	465 to 705	V	1)
Cathode voltage for spot cut-off at V_{g2} = 555 V	V_k	110 to 165	V	2)
Luminance at the centre of the screen 3)	L	100	cd/m^2 (nit)	

EQUIPMENT DESIGN VALUES (each gun if applicable), voltages with respect to g1
Valid for final accelerator voltages between 20 kV and 27,5 kV

Grid no. 3 (focusing electrode) voltage	V_{g3}	16 to 19,2% of final accelerator voltage
Grid no. 2 voltage	V_{g2}	See cut-off design chart page 13
Cathode voltage for visual extinction of focused spot	V_k	See cut-off design chart page 13
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value is min. 75% of highest value
Grid no. 3 (focusing electrode) current	I_{g3}	−5 to +5 µA
Grid no. 2 current	I_{g2}	−5 to +5 µA
Grid no. 1 current at V_k = 150 V	I_{g1}	−5 to +5 µA

1) This range of V_{g2} has to be used when in circuit design fixed values for cut-off of the three guns are used.

2) This range of V_k has to be used when in circuit design fixed values for V_{g2} of the three guns are used.

3) Tube settings adjusted to produce white D (x = 0,313, y = 0,329), focused raster, current density 0,4 µA/cm^2.

EQUIPMENT DESIGN VALUES (continued)

To produce white of the following CIE co-ordinates:				white "D"
	x	0,265	0,281	0,313
	y	0,290	0,311	0,329
Percentage of total anode current supplied by each gun (typical)				
red gun		26,4	30,6	41,2
green gun		34,3	35,4	32,2
blue gun		39,3	34,0	26,6
Ratio of anode currents red gun to green gun	>	0,60	0,65	0,95
	av.	0,75	0,85	1,30
	<	1,00	1,15	1,70
Ratio of anode currents red gun to blue gun	>	0,50	0,65	1,15
	av.	0,65	0,90	1,55
	<	0,90	1,20	2,05

LIMITING VALUES (each gun if applicable), voltages with respect to g1
(Design maximum rating system unless otherwise specified)

Final accelerator voltage	$V_{a, g5, g4}$	max.	27,5	kV 1)2)3)
		min.	20	kV 1)4)
Long term average current for three guns	I_a	max.	1000	µA 5)
Grid no. 3 (focusing electrode) voltage	V_{g3}	max.	6	kV
Grid no. 2 voltage	V_{g2}	max.	1000	V
Cathode voltage, positive	V_k	max.	400	V
positive, operating cut-off	V_k	max.	200	V
negative	$-V_k$	max.	0	V
negative peak	$-V_{kp}$	max.	2	V
Cathode to heater voltage, positive	V_{kf}	max.	250	V 6)
positive peak	V_{kfp}	max.	300	V 1)
negative	$-V_{kf}$	max.	135	V
negative peak	$-V_{kfp}$	max.	180	V 1)

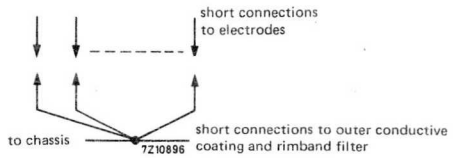
1) Absolute max. rating system.

2) 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.

Continued on page 9.

REMARKS

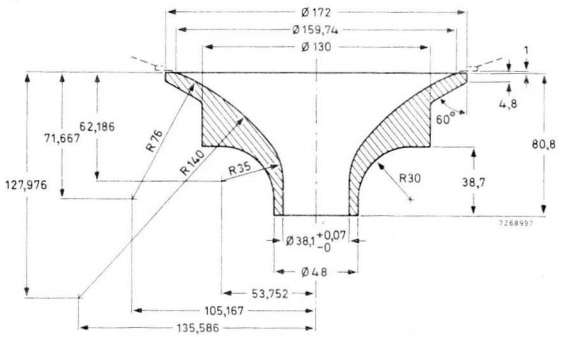
With the high voltage used with this tube (max. 27,5 kV) internal flash-overs may occur. These may destroy the cathode(s) of the tube. Therefore it is necessary to provide protective circuits, using sparks gaps.
The spark gaps must be connected as follows:



No other connections between the outer conductive coating and the chassis are permissible. Additional information available on request.

During shipment and handling the tube should not be subjected to accelerations greater than 350 m/s^2 (35 g) in any direction.

CONTOUR GAUGE



3) During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.

4) Operation of the tube at lower voltages impairs the luminance and resolution.

5) 1500 μA permitted provided a current limiting circuit is used.

6) During an equipment warm-up period not exceeding 15 s V_{kf} is allowed to rise to 385 V. Between 15 s and 45 s after switching on a decrease in V_{kf} proportional with time from 385 V to 250 V is permissible.

BEAM CORRECTIONS

When the tube is used with the deflection unit AT1085 the following corrections should be applied:

Maximum required horizontal displacement of the electron beams with respect to the phosphor stripes by the purifying magnet of the multi-pole unit AT1081 [1]	45	µm
Static convergence deviations must be corrected by a static multi-pole unit AT1081 providing adjustable four-pole and six-pole fields centred around the tube axis		
Maximum required compensation for static convergence		
4-pole device: red to blue (in any direction)	5	mm
6-pole device: red and blue to green (in any direction)	2,5	mm

North-South raster shape correction circuitry is not required.

To obtain a symmetrical shape for the horizontal lines at the upper part and the lower part of the screen, the unit AT1081 comprises an additional dipole correction magnet giving a displacement of the beam in the centre of the screen in vertical direction of maximum	±4	mm
Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction	4,5	mm

With respect to dynamic convergence the display system, consisting of picture tube A51-500X and deflection unit AT1085, is inherently self-converging. However, a small fixed correction of 1,3 mm [2] is required on the horizontal axis and also small corrections should be made to compensate for tolerances and asymmetries in the tube and deflection unit combination (using a recommended circuit).
For this purpose two types of dynamic magnetic four-pole fields can be used.
One is generated by additional windings on the yoke ring of the deflection unit, and energized by adjustable currents synchronized with scanning.
The other type is generated by adjustable balancing currents through the deflection coils.

Compensation to be provided by these corrections:		
-horizontal red-to-blue distance at the ends of the horizontal axis in opposite directions (line symmetry)	[3]	0 ± 1,5 mm
-horizontal red-to-blue distance at the ends of the vertical axis in opposite directions (field symmetry)	[4]	0 ± 1,5 mm
-vertical red-to-blue distance at the ends of the horizontal axis in opposite directions (line balance)	[5]	0 ± 1,0 mm
-vertical red-to-blue distance at the ends of the horizontal axis in equal directions (line balance parabola)	[6]	0 ± 0,5 mm
-vertical red-to-blue distance at the top of the vertical axis (field balance top)	[7]	0 ± 1,0 mm
-vertical red-to-blue distance at the bottom of the vertical axis (field balance bottom)	[8]	0 ± 1,0 mm

Notes see page 11.

Notes

1) Purity adjustment in vertical direction is not required.

2) This correction is made by feeding a fixed parabolic current of line frequency through the additional four-pole windings on the deflection unit.

3) This correction is made by feeding a sawtooth current of line frequency through the additional four-pole windings on the deflection unit.

4) This correction is made by feeding a sawtooth current of field frequency through the additional windings on the deflection unit.

5) This correction is made by unbalancing the line deflection coil halves.

6) This correction is made by feeding a parabolic current of line frequency through the line deflection coil halves.

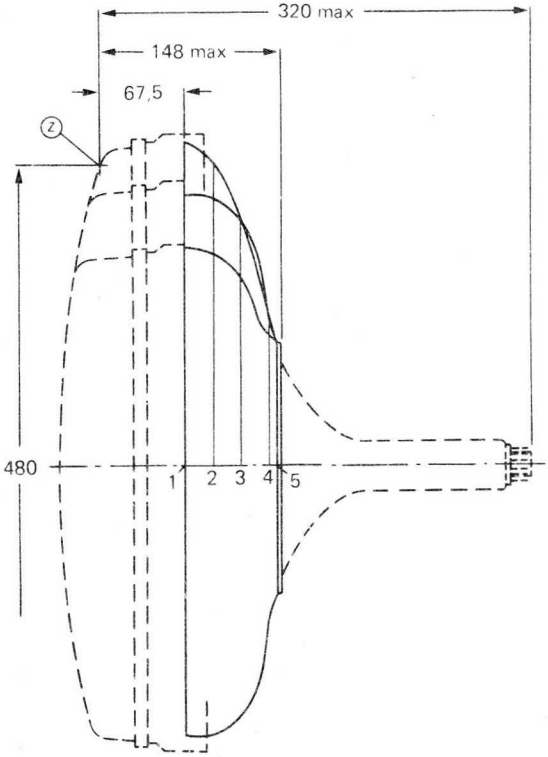
7) This correction is made by unbalancing the field deflection coil halves during the first half of the field scan.

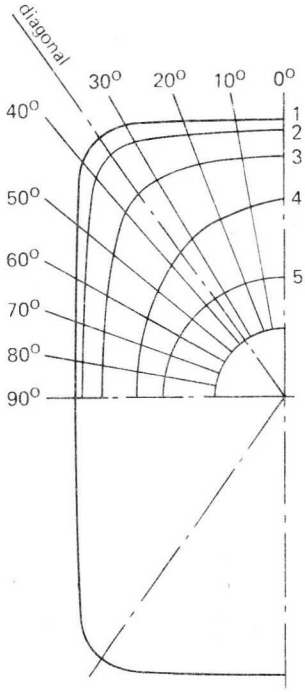
8) This correction is made by unbalancing the field deflection coil halves during the second half of the field scan.

Application information available on request.

MAXIMUM CONE CONTOUR DRAWING

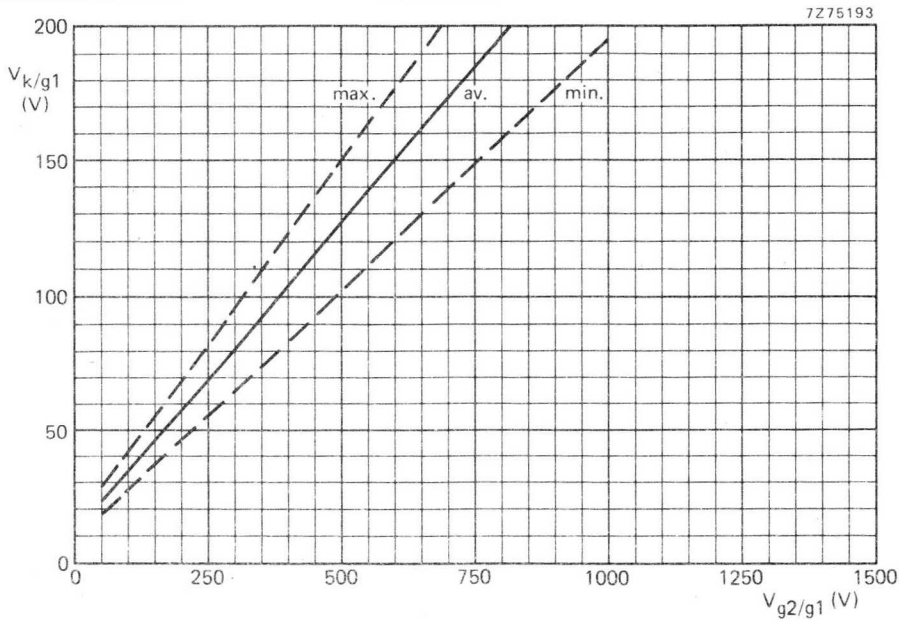
Dimensions in mm



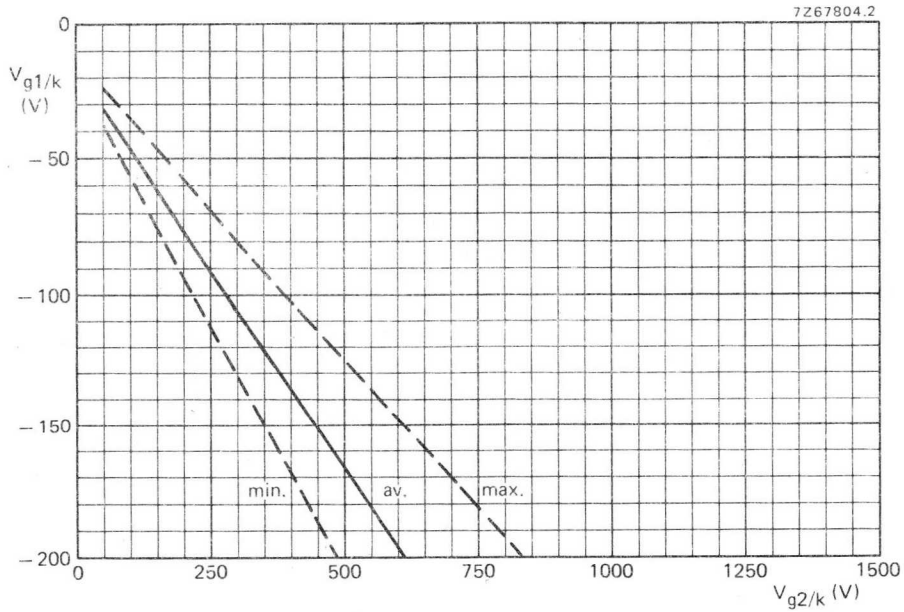


7Z75122

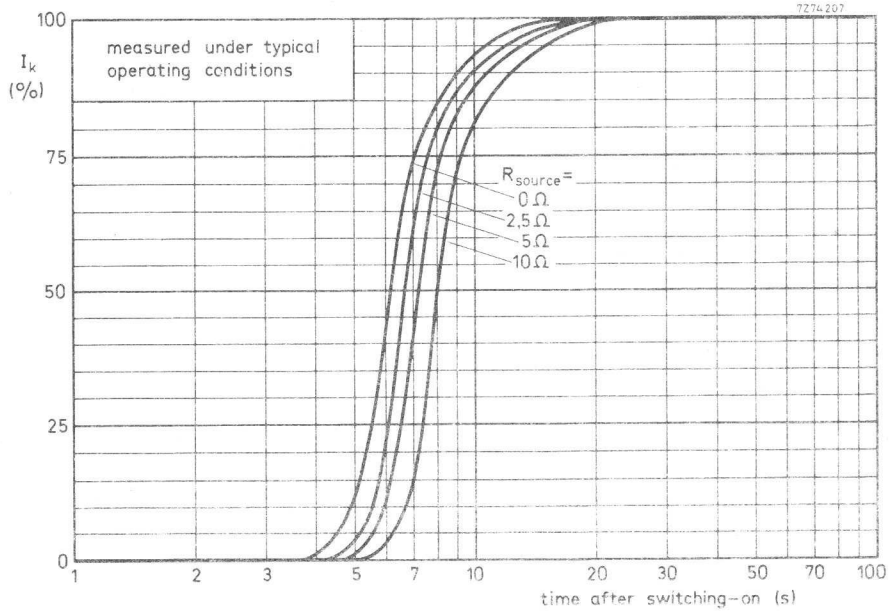
Section	Nom. distance from section 1	Distance from centre (max. values)										
		0°	10°	20°	30°	diag.	40°	50°	60°	70°	80°	90°
1	0	222	225	236	254	258	252	217	193	178	172	170
2	20	216	217	226	240	244	238	205	185	172	165	163
3	40	195	195	200	204	205	198	180	166	156	150	148
4	60	162	158	154	148	144	141	134	128	123	121	121
5	74	98	98	98	98	98	98	98	98	98	98	98



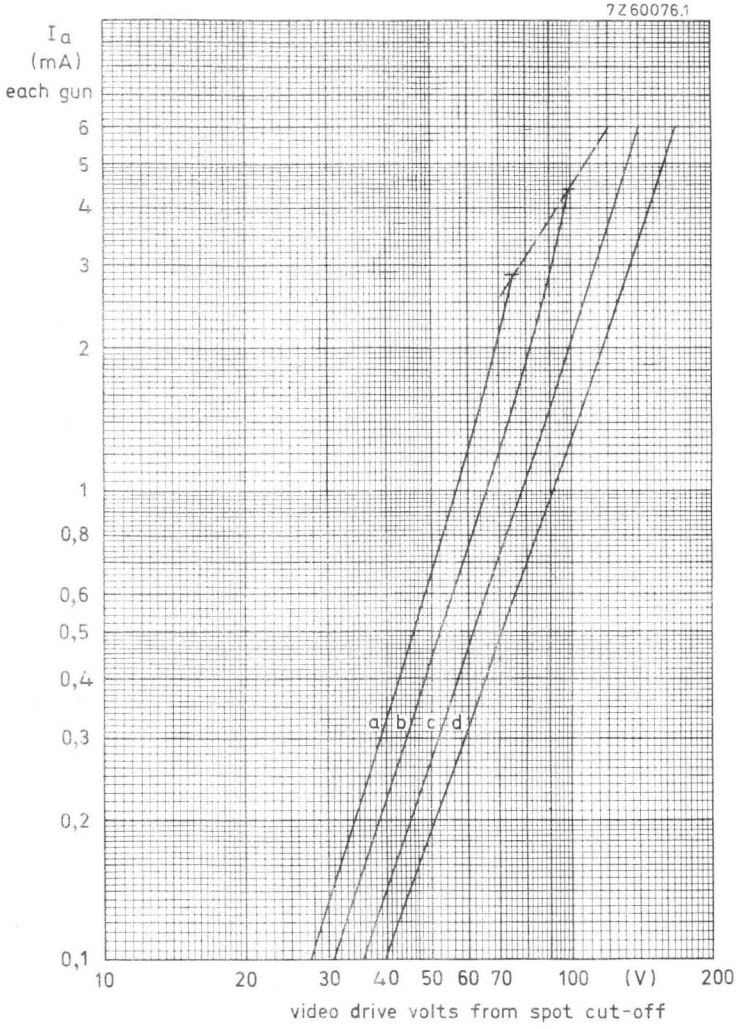
Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, V_a, g5, g4 = 20 to 27,5 kV



Spot cut-off design chart (grid drive), V_{g3} adjusted for focus, V_a, g5, g4 = 20 to 27,5 kV



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

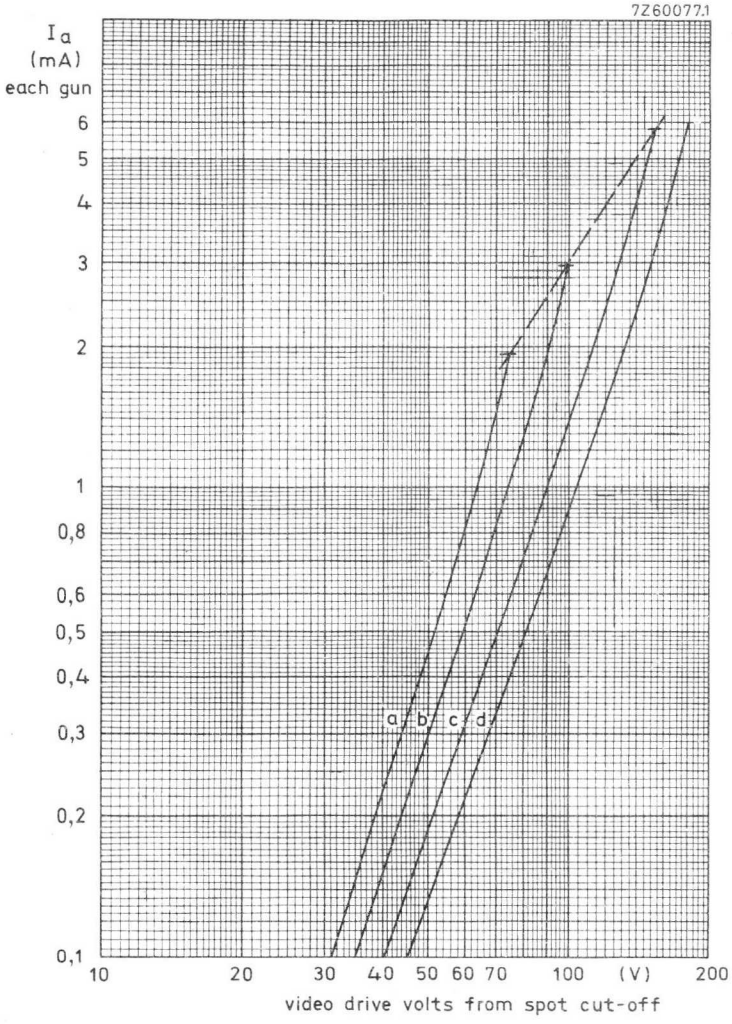


Typical cathode drive characteristics

V_a, g5, g4 = 20 kV to 27,5 kV
V_{g3} adjusted for focus
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_k

a = spot cut-off = 75 V
b = spot cut-off = 100 V
c = spot cut-off = 150 V
d = spot cut-off = 200 V

---- zero bias point



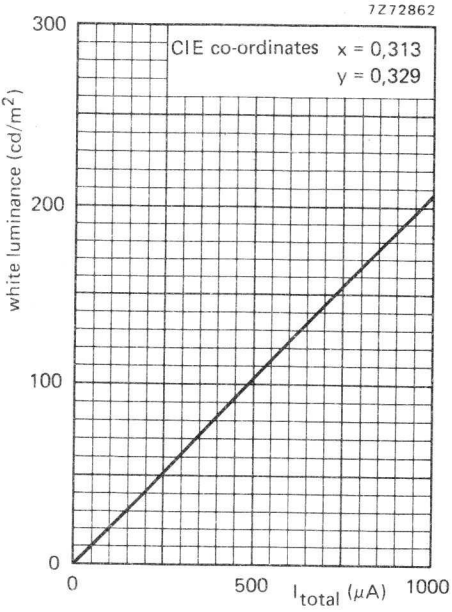
Typical grid drive characteristics

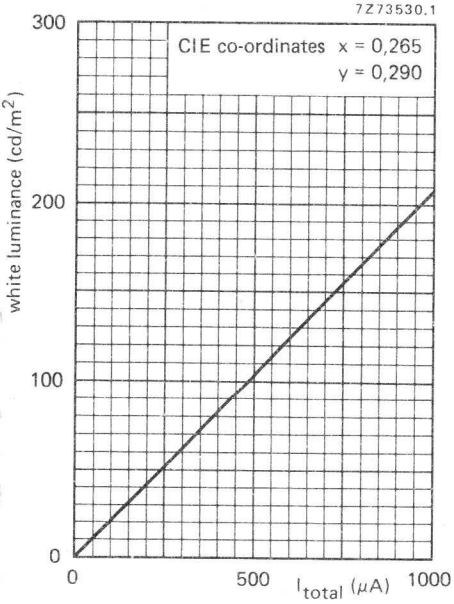
$V_{a, g5, g4}$ = 20 kV to 27,5 kV
V_{g3} adjusted for focus
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_{g1}

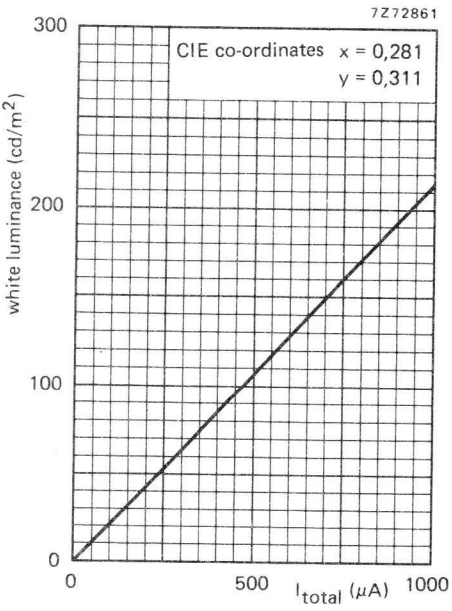
---- zero bias point

a = spot cut-off = −75 V
b = spot cut-off = −100 V
c = spot cut-off = −150 V
d = spot cut-off = −200 V

Luminance at the centre of the screen as a function of I_{total}. Scanned area 404, 4 mm x 303, 3 mm.







Available for equipment maintenance. No longer recommended for equipment production.

90° COLOUR TELEVISION TUBE

QUICK REFERENCE DATA

Temperature compensated shadow-mask		
Shadow-mask optimized for 625-line system		
High white luminance at unity current ratio		
Face diagonal	56	cm
Deflection angle	90	deg
Neck diameter	36,5	mm
Envelope	reinforced; suitable for push-through	
Convergence	magnetic	
Heating, parallel or series supply	6,3 V, 900	mA
Light transmission of face glass	54,5	%

TYPICAL OPERATING CONDITIONS

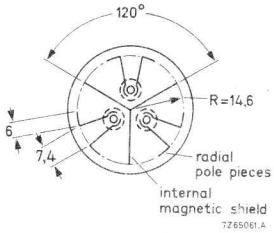
Final accelerator voltage	$V_{a,g5,g4}$			25	kV
Grid 3 (focusing electrode) voltage	V_{g3}	4,2	to	5	kV
Grid 2 voltage for a spot cut-off at $V_{g1} = -105$ V	V_{g2}	210	to	495	V
Grid 1 voltage for spot cut-off at $V_{g2} = 300$ V	V_{g1}	−70	to	−140	V

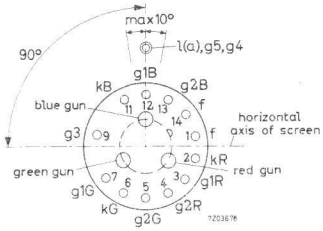
MECHANICAL DATA

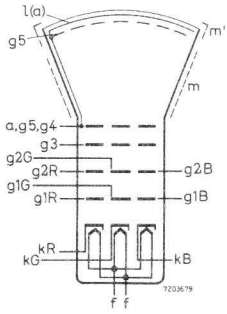
Overall length		472,2 ± 9,5	mm
Neck length		⩽ 168,7	mm
Diagonal	of bulb	⩽ 566,2	mm
Horizontal axis	of bulb	⩽ 486,3	mm
Vertical axis	of bulb	⩽ 381,8	mm
Useful screen			
diagonal		⩾ 533	mm
horizontal axis		⩾ 447	mm
vertical axis		⩾ 337	mm

Base : 12-pin base IEC 67-I-47a, JEDEC B12-246

Anode contact: IEC67-III-2, J1-21







110° COLOUR TELEVISION TUBE

Obsolete type.

Replacement type A56-140X.

A circuit modification may be necessary to compensate for the 170 mA lower heater current of the A56-410X.

110° COLOUR TELEVISION PICTURE TUBE

Three-gun temperature compensated shadow-mask rectangular colour television tube with electrostatic focus, magnetic deflection and convergence, metal-backed three-colour phosphor dot screen and internal magnetic shield. A high white luminance is obtained at near unity current ratio. Being temperature compensated, the shadow-mask makes for optimum field purity and good uniformity during warm-up. The design is such that minimum occurrence of the moiré effect is ensured. The tube has a reinforced envelope and therefore no separate safety screen is necessary. The tube features a quick heating cathode; typically, a legible picture will appear within approx. 5 s.

QUICK REFERENCE DATA		
TEMPERATURE COMPENSATED SHADOW MASK		
DESIGNED FOR MINIMUM MOIRÉ EFFECT		
HIGH WHITE LUMINANCE AT UNITY CURRENT RATIO		
Face diagonal	56	cm
Deflection angle	110	deg
Neck diameter	36,5	mm
Envelope	reinforced suitable for push through	
Magnetic shield	internal	
Focusing	bi-potential	
Deflection	magnetic	
Convergence	magnetic	
Heating	6,3 V, 730 mA	
Light transmission of face glass	54,5	%
Quick heating cathode	with a typical tube a legible picture will appear within approx. 5 s	

SCREEN

Metal-backed phosphor dots		
Phosphor type	Red : Europium activated rare earth Green: Sulphide type Blue : Sulphide type	
Dot arrangement	Triangular	
Spacing between centres of adjacent dot trios	0,81	mm
Light transmission of face glass	54,5	%

HEATING : indirect by a.c. or d.c. ; parallel supply

Heater voltage	V_f	6,3	V
Heater current	I_f	730	mA [1]

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

For heating time as a function of source impedance see graph page 12 below.

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g3,g4/m}$	max.	1800	pF
		min.	1300	pF
Final accelerator to rimband	$C_{a,g3,g4/m'}$		400	pF
Grid no.1 of any gun to all other electrodes	C_{g1}		7	pF
Cathodes of all guns (connected in parallel) to all other electrodes	C_k		15	pF
Cathode of any gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}		5	pF
Grid no.3 (focusing electrode) to all other electrodes	C_{g3}		7	pF

FOCUSING electrostatic (bi-potential)

DEFLECTION magnetic

Diagonal deflection angle	110	deg
Horizontal deflection angle	97	deg
Vertical deflection angle	77	deg

CONVERGENCE magnetic

---

[1]) If the heater is supplied from a mains transformer designed for tube type A56-140X, the source impedance should not exceed 0,6 Ω to ensure that the heater voltage of the A56-410X is not exceeded.

If the heater is supplied from a line time base designed for tube type A56-140X, the series impedance, if any, should match the lower heater current of the quick-heating tube.

MECHANICAL DATA

Overall length		387,3 to	400,3	mm
Neck diameter			36,5	mm
Diagonal	of bulb	max.	566,2	mm
Horizontal axis	of bulb	max.	486,3	mm
Vertical axis	of bulb	max.	381,8	mm
Useful screen				
diagonal		min.	533	mm
horizontal axis		min.	447	mm
vertical axis		min.	337	mm

Mounting position : any

Net weight : approx. 14,5 kg

Base : 12 pin base IEC 67-I-47a, type 2

Anode contact : Small cavity contact J1-21, IEC 67-III-2

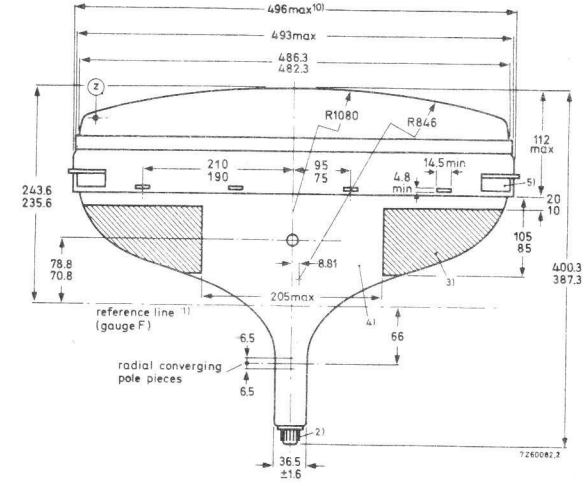
Magnetic shielding, degaussing: The tube is provided with an internal magnetic shield. The internal magnetic shield and the shadow-mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering left and right cone parts. For proper degaussing an initial m.m.f. of 450 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate circuitry. After decreasing to 10 A.t. or less, sudden switch off is permissible. In the steady state, no significant m.m.f. should remain in the coils (< 0,5 A.t.).
To ease the mounting of the coils, the rimband is provided with rectangular holes.

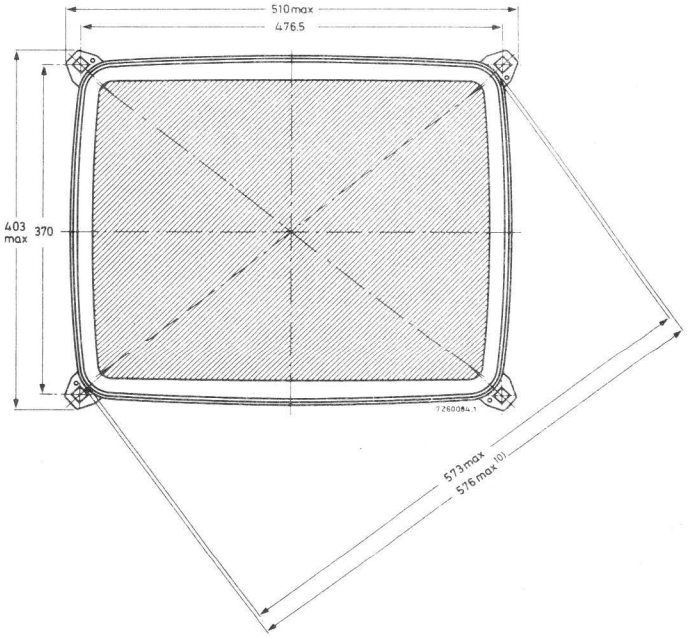
NOTES TO OUTLINE DRAWING (see pages 4, 5, and 6)

1) Reference line, determined by the plane of the upper edge of the flange of the reference line gauge, when the gauge is resting on the cone.
2) The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 55 mm.
3) Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
4) To clean this area, wipe only with a soft lintless cloth.
5) The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
6) Minimum space to be reserved for mounting lug.
7) The position of the mounting screw in the cabinet must be within a circle of 9,5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 476,5 mm x 370 mm.
8) Coördinates for radius R = 15,95 mm: x = 203,95 mm, y = 145,52 mm.
9) Distance from point z to any hardware.
10) Maximum dimensions in plane of lugs.

MECHANICAL DATA (continued)

Dimensions in mm

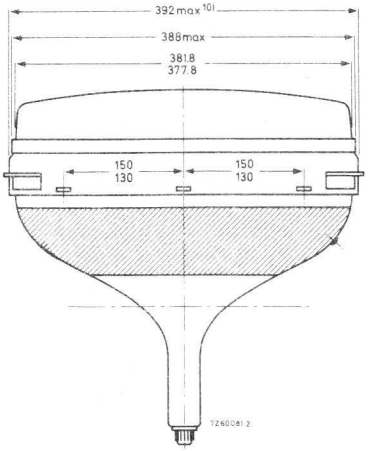


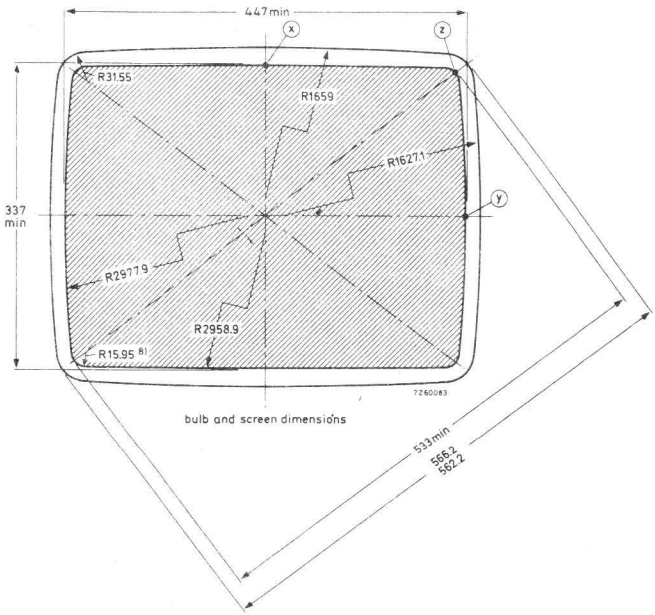


Notes see page 3

MECHANICAL DATA

Dimensions in mm



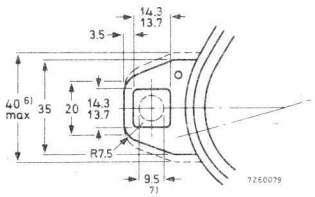


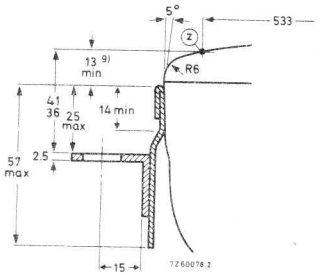
bulb and screen dimensions

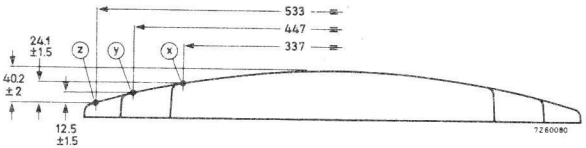
Notes see page 3

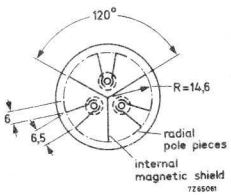
MECHANICAL DATA

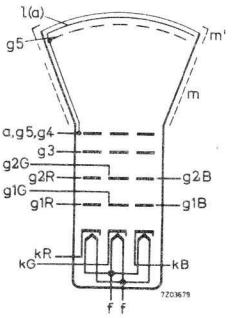
Dimensions in mm

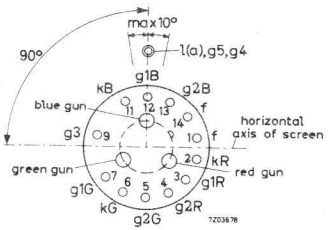












Notes see page 3

TYPICAL OPERATING CONDITIONS

Final accelerator voltage	$V_{a, g5, g4}$			25	kV
Grid no.3 (focusing electrode voltage)	V_{g3}	4,2	to	5	kV
Grid no.2 voltage for a spot cut-off voltage V_{g1} = -105 V	V_{g2}	212	to	495	V [1]
Grid no.1 voltage for spot cut-off at V_{g2} = 300 V	V_{g1}	-70	to	-140	V [2]
Luminance at the centre of the screen	L	See page 11			

EQUIPMENT DESIGN VALUES (each gun if applicable)

Valid for final accelerator voltages between 20 kV and 27,5 kV.

Grid no.3 (focusing electrode) voltage	V_{g3}	16,8 to 20 % of final accelerator voltage
Grid no.2 voltage	V_{g2}	See cut-off design chart page 12
Grid no.1 voltage for visual extinction of focused spot (cut-off voltage)	V_{g1}	See cut-off design chart page 12
Difference in cut-off voltages between guns in any tube	ΔV_{g1}	lowest value is min. 65 % of highest value
Grid no.3 (focusing electrode) current	I_{g3}	-5 to +5 µA
Grid no.2 current	I_{g2}	-5 to +5 µA
Grid no.1 current at V_{g1} = -150 V	I_{g1}	-5 to +5 µA

			[3]	[4]	[6]	
To produce white of the following CIE co-ordinates		x	0,265	0,281	0,313	
		y	0,290	0,311	0,329	
Percentage of total anode current supplied by each gun (typical)	red gun		25,8	30,2	41,0	%
	green gun		33,5	34,5	31,3	%
	blue gun		40,7	35,3	27,7	%
Ratio of anode current red gun to green gun		min.	0,55	0,65	0,95	
		av.	0,75	0,90	1,30	
		max.	1,10	1,25	1,80	
Ratio of anode currents red gun to blue gun		min.	0,50	0,65	1,15	
		av.	0,65	0,85	1,50	
		max.	0,85	1,15	2,00	

Notes see page 8

EQUIPMENT DESIGN VALUES (continued)

Required centring, measured at the centre of the screen in any direction	max.	11	mm
Correction that must be supplied by purifying magnet to compensate for mis-register in any direction	max.	100	µm
Lateral distance between blue spot and the converged red and green spots	max.	4,5	mm (in both directions)
Radial convergence displacement excluding effects of dynamic convergence (each gun) [5]	max.	7	mm (in both directions)

---

1) This range of V_{g2} has to be used when in circuit design fixed values for cut-off of the three guns are used.

2) This range of V_{g1} has to be used when in circuit design fixed values for V_{g2} of the three guns are used.

3) To produce black/white pictures a bluish white point would be preferable. This white point corresponds virtually with the white point of current black/white picture tubes.

4) This point is a compromise between white point D and the white point x = 0, 265 , y = 0, 290 given in order to enable good rendition of colour and black and white pictures with one white point.

5) Dynamic convergence to be effected by currents of approximately parabolic waveshape through the convergence coils synchronized with scanning.

6) To produce colour pictures with the best possible quality, this white point should be used when the transmission system is based on this point. (Point D).

LIMITING VALUES (Each gun if applicable)
(Design centre rating system unless otherwise specified)

Final accelerator voltage	$V_{a, g5, g4}$	max.	27,5	kV [1)2)3)]
		min.	20	kV [1)4)]
Average current for three guns	I_a	max.	1000	μA [5)]
Grid no.3 (focusing electrode) voltage	V_{g3}	max.	6000	V
Grid no.2 voltage, peak, including video signal voltage	V_{g2_p}	max.	1000	V
Grid no.1 voltage,				
negative	$-V_{g1}$	max.	400	V
negative, operating cut-off	$-V_{g1}$	max.	200	V
positive	V_{g1}	max.	0	V
positive peak	V_{g1_p}	max.	2	V
Cathode to heater voltage,				
positive	V_{kf}	max.	250	V [6)]
positive peak	V_{kf_p}	max.	300	V
negative	$-V_{kf}$	max.	135	V
negative peak	$-V_{kf_p}$	max.	180	V

---

1) Absolute max. rating system.

2) 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.

3) For optimal operating conditions the final accelerator voltage has to be stabilized. Therefore its absolute maximum value can be approached in actual operation and for this reason this value is given instead of the design centre value, During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.

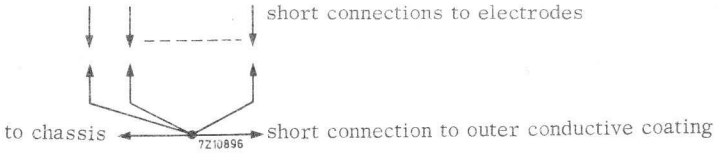
4) Operation of the tube at lower voltages impairs luminance and resolution and may have a detrimental effect on colour purity.

5) 1500 μA permitted provided a current limiting circuit is used.

6) During an equipment warm-up period not exceeding 15 s V_{kf} is allowed to rise to 385V. Between 15 s and 45 s after switching on a decrease in V_{kf} propotional with time from 385 V to 250 V is permissible.

REMARKS

With the high voltage used with this tube (max. 27,5 kV) internal flash-overs may occur. These may destroy the cathode(s) of the tube. Therefore it is necessary to provide protective circuits, using spark gaps.
The spark gaps must be connected as follows:



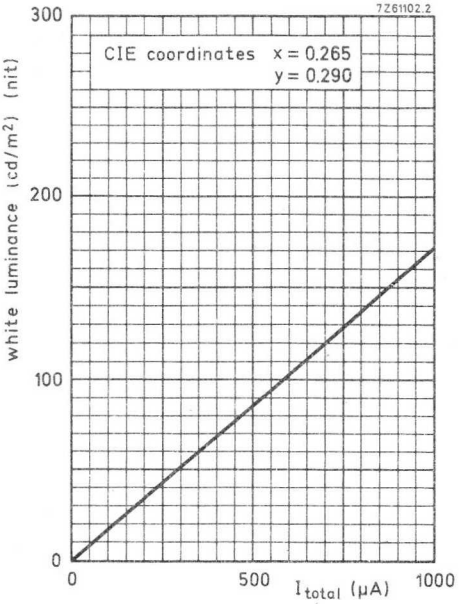
No other connections between the outer conductive coating and the chassis are permissible. Additional information is given in Application Information 258, available on request.

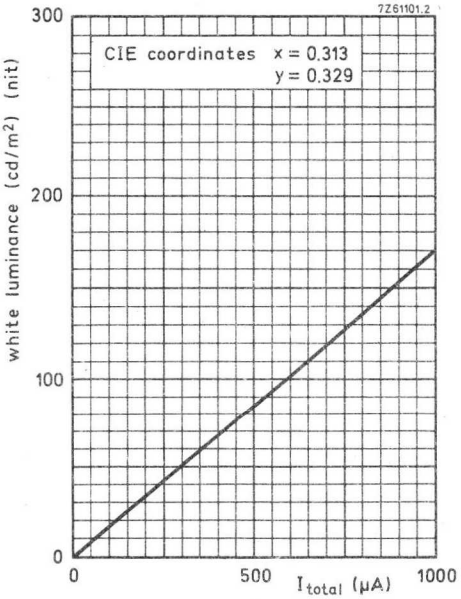
During shipment and handling the tube should not be subjected to accelerations greater than 35 g in any direction.

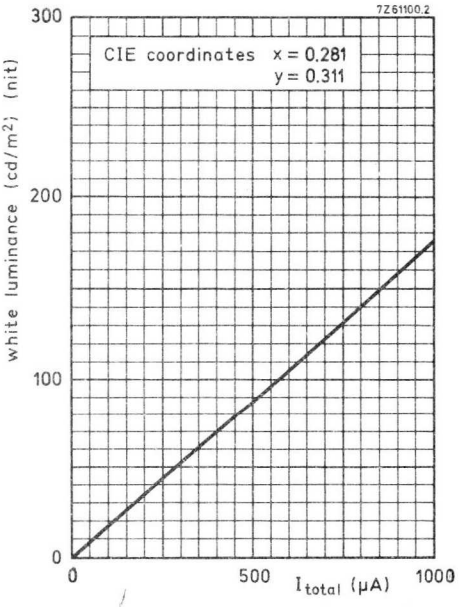
REFERENCE LINE GAUGE

Gauge F. See chapter "Reference line gauges" in front of this book.

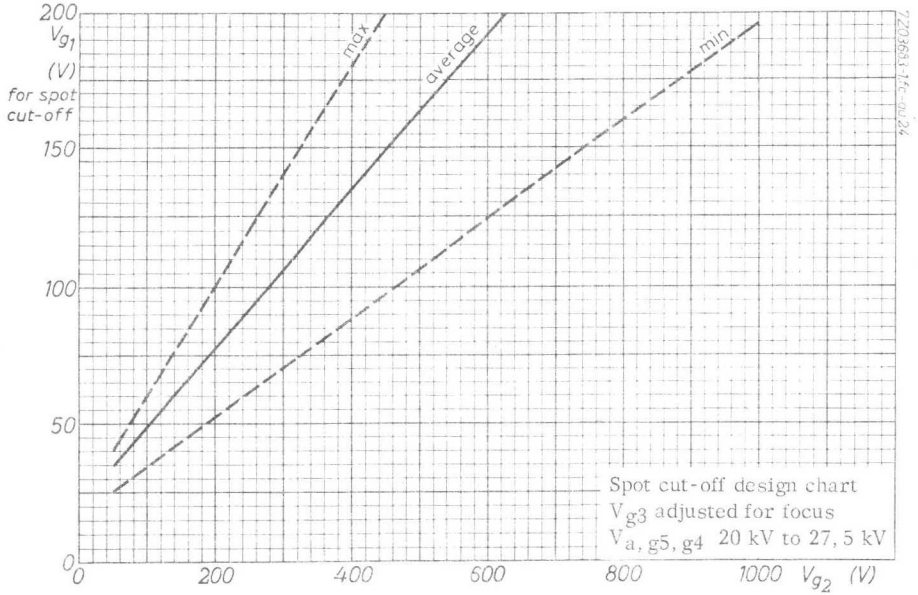
Luminance at the centre of the screen as a function of I_{total}.

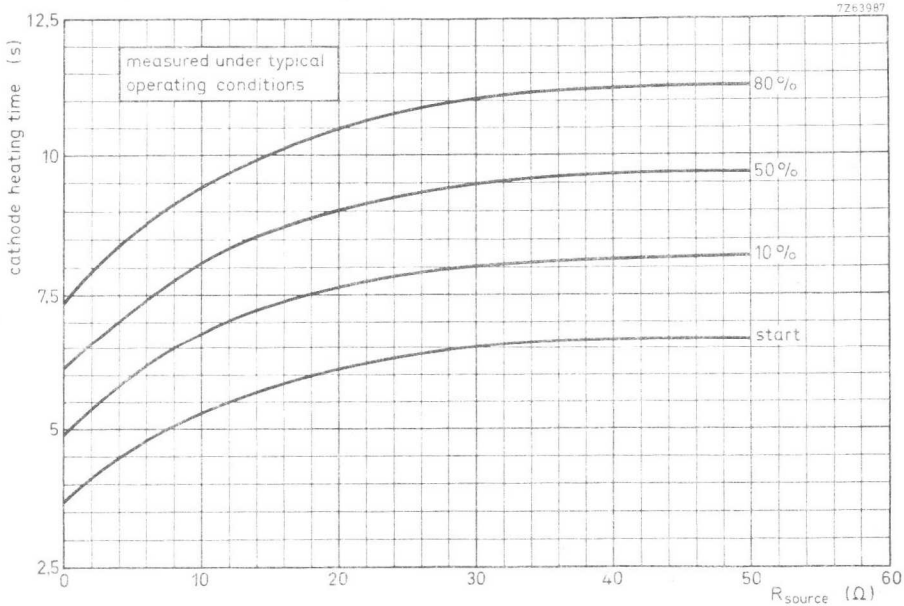




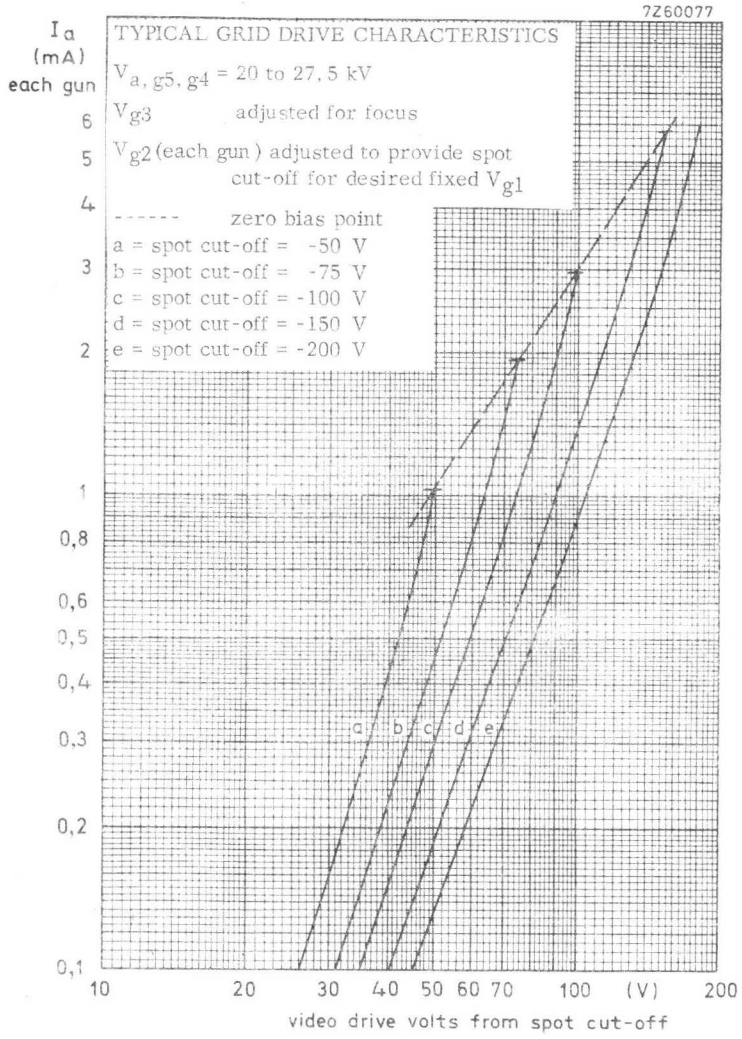


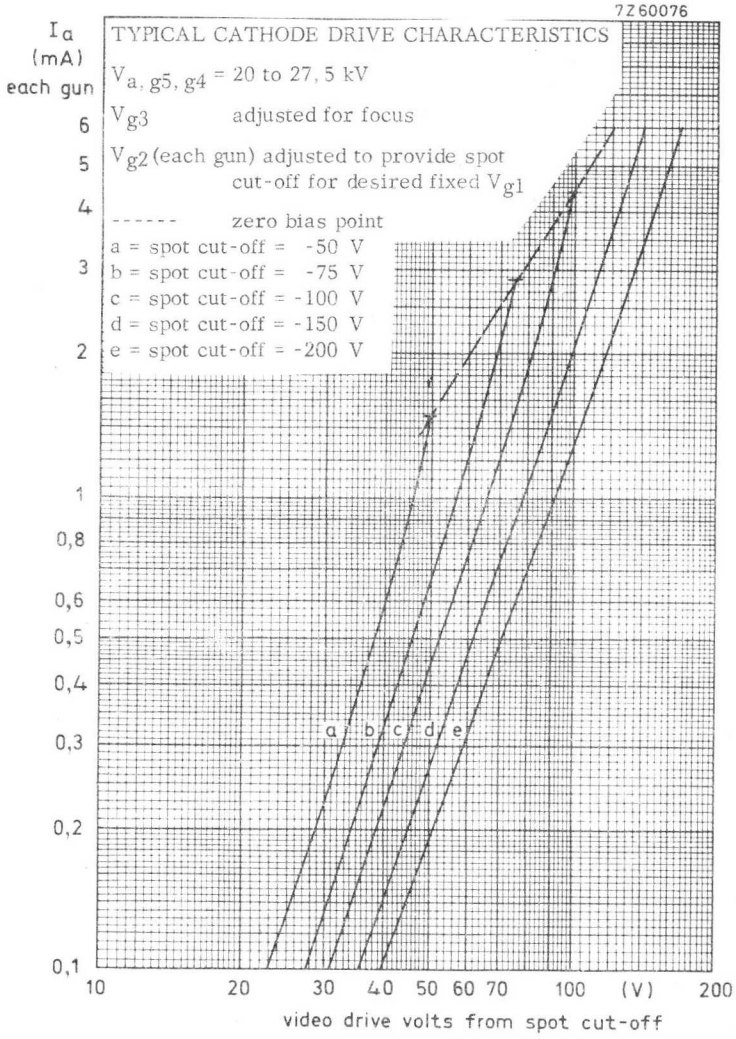
Scanned area 447 mm x 337 mm





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


7Z60077
Ia (mA) each gun
TYPICAL GRID DRIVE CHARACTERISTICS
Va, g5, g4 = 20 to 27,5 kV
Vg3 adjusted for focus
Vg2 (each gun) adjusted to provide spot cut-off for desired fixed Vg1
------ zero bias point
a = spot cut-off = -50 V
b = spot cut-off = -75 V
c = spot cut-off = -100 V
d = spot cut-off = -150 V
e = spot cut-off = -200 V
6
5
4
3
2
1
0,8
0,6
0,5
0,4
0,3
0,2
0,1
a
b
c
d
e
10
20
30
40
50
60
70
100
(V)
200
video drive volts from spot cut-off


7Z60076
TYPICAL CATHODE DRIVE CHARACTERISTICS
Va, g5, g4 = 20 to 27,5 kV
Vg3 adjusted for focus
Vg2 (each gun) adjusted to provide spot cut-off for desired fixed Vg1
------ zero bias point
a = spot cut-off = -50 V
b = spot cut-off = -75 V
c = spot cut-off = -100 V
d = spot cut-off = -150 V
e = spot cut-off = -200 V
Ia (mA) each gun
6
5
4
3
2
1
0,8
0,6
0,5
0,4
0,3
0,2
0,1
a b c d e
10 20 30 40 50 60 70 100 (V) 200
video drive volts from spot cut-off

110° IN-LINE GUN COLOUR TELEVISION TUBE

The tube has a three-in-line gun, a slotted shadow-mask, and phosphors arranged in vertical stripes. The system of tube and deflection unit AT1083/01 is inherently self-converging; only minor corrections are needed to compensate for tolerances and asymmetries. The shadow-mask is optimized for minimum moiré. The tube features a quick-heating cathode, an internal magnetic shield, and a very short overall length.

QUICK REFERENCE DATA		
Deflection angle	110	deg
Face diagonal	56	cm
Overall length	37	cm
Inherently self-converging system with deflection unit AT1083/01		
Quick-heating cathode	with a typical tube a picture will appear within 5 s	
Heating	6,3 V, 730 mA	
Magnetic shield	internal	
Envelope	reinforced, suitable for push-through	
Focusing	bi-potential	

SCREEN

Metal-backed vertical phosphor stripes	Red :	Europium activated rare earth	
	Green:	Sulphide type	
	Blue :	Sulphide type	
Centre-to-centre distance of identical colour phosphor stripes		0,8	mm
Light transmission of face glass		53,5	%

HEATING: indirect by a.c. (preferably mains or line frequency) or d.c.

Heater voltage	V_f	6,3	V
Heater current	I_f	730	mA

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

For heating time as a function of source impedance see graph page 14.

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g5, g4/m}$	<	1800	pF
		>	1300	pF
Final accelerator to metal rimband	$C_{a, g5, g4/m'}$		250	pF
Grid no. 1 of a gun to all other electrodes				
red gun	C_{g1R}		7	pF
green gun	C_{g1G}		7	pF
blue gun	C_{g1B}		7	pF
Cathodes of all guns (connected in parallel) to all other electrodes	C_k		12	pF
Cathode of any gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}		4	pF
Grid no. 3 (focusing electrode) to all other electrodes	C_{g3}		7	pF

FOCUSING electrostatic (bi-potential)

DEFLECTION magnetic

Diagonal deflection angle	110	deg
Horizontal deflection angle	97	deg
Vertical deflection angle	77	deg

MECHANICAL DATA

Overall length			367,3 to 380,3	mm
Neck diameter			36,5 $^{+1,6}_{-0,4}$	mm
Diagonal	of bulb	≤	566,2	mm
Width	of bulb	≤	486,3	mm
Height	of bulb	≤	381,8	mm
Useful screen diagonal		≥	530,6	mm
horizontal axis		≥	444,2	mm
vertical axis		≥	334,2	mm

Mounting position : any

Net mass : approx. 14,5 kg

Base : 12 pin base IEC 67-I-47a, type 2

Anode contact : Small cavity contact J1-21, IEC 67-III-2

Magnetic shielding, degaussing : The tube is provided with an internal magnetic shield.

The internal magnetic shield and the shadow-mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering top and bottom cone parts. For proper degaussing an initial m.m.f. of 250 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate circuitry. To prevent beam landing disturbances by line-frequency currents induced in the degaussing coils, these coils should be shunted by a capacitor of sufficiently high value. In the steady state, no significant m.m.f. should remain in the coils (< 0,25 A.t.). To ease the mounting of the coils, the rimband is provided with rectangular holes.

NOTES TO OUTLINE DRAWINGS (see pages 4, 5, and 6)

1) This ridge can be used as an orientation for the deflection unit.

2) Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.

3) To clean this area wipe only with a soft lintless cloth.

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

5) Minimum space to be reserved for mounting lug.

6) The position of the mounting screw in the cabinet must be within a circle of 9,5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 476,5 mm x 370 mm.

7) Co-ordinates for radius R = 14,8 mm: x = 203,9 mm, y = 145,5 mm.

8) Distance from point z to any hardware.

9) Maximum dimensions in plane of lugs.

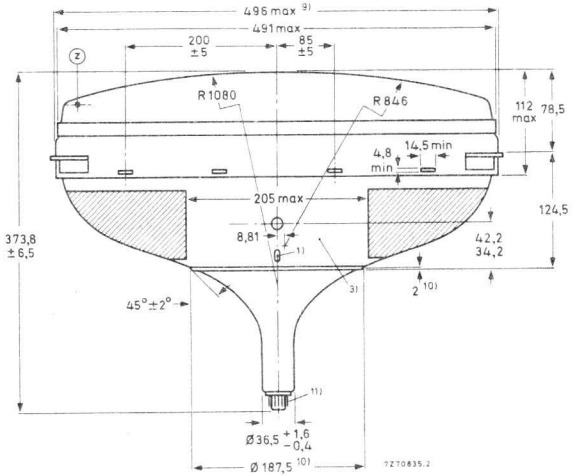
10) Centring ring for deflection unit.

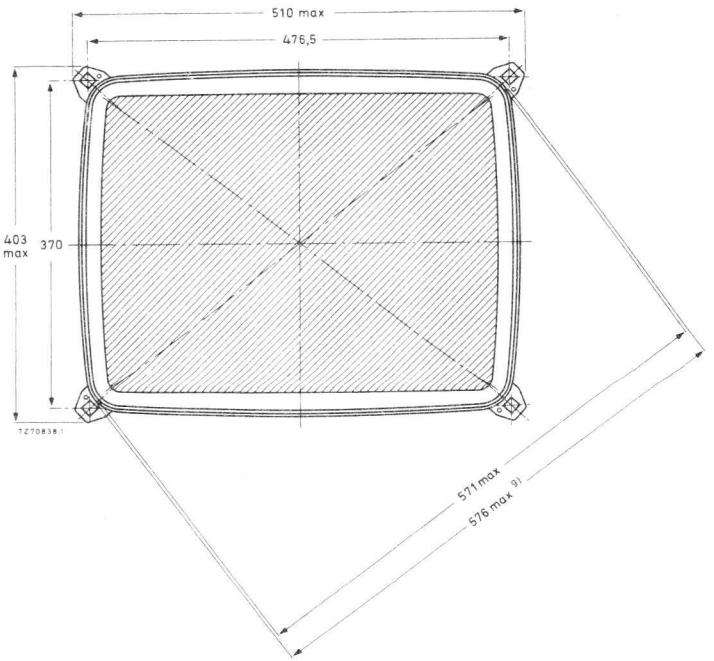
11) The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 55 mm.

12) Minimum distance between glass and rimband in plane of centre line of the apertures.

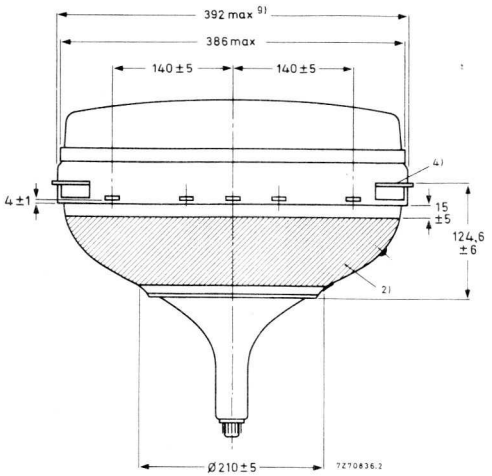
MECHANICAL DATA (continued)

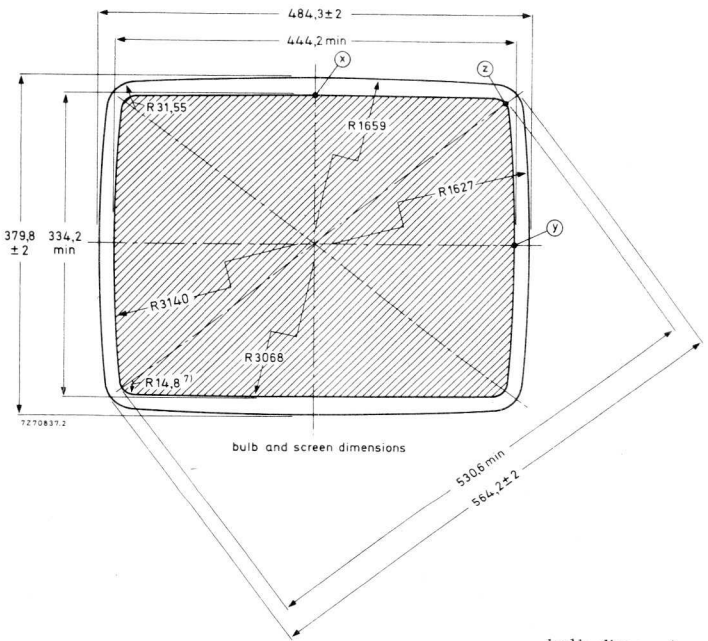
Dimensions in mm





Notes see page 3.





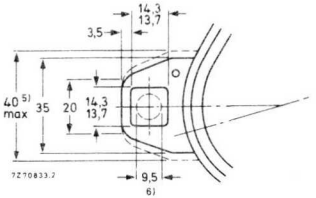
bulb and screen dimensions

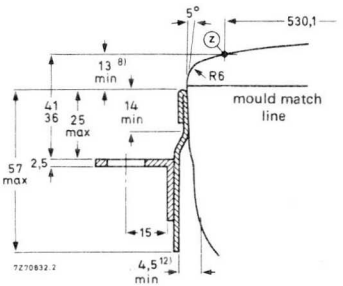
bulb dimensions at mould match line.

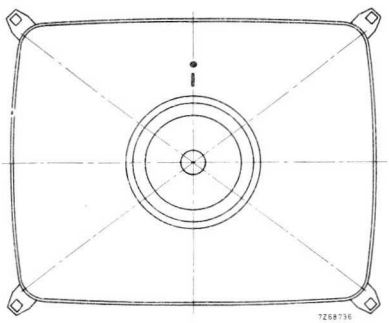
Notes see page 3.

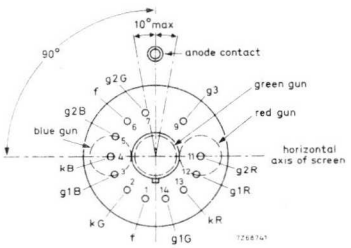
MECHANICAL DATA (continued)

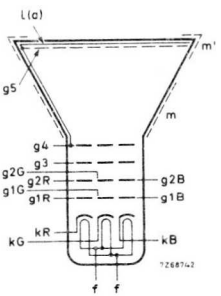
Dimensions in mm

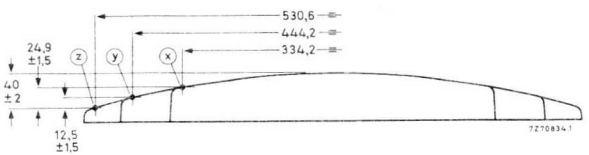












Notes see page 3.

TYPICAL OPERATING CONDITIONS cathode drive, voltages with respect to g1.

Final accelerator voltage	$V_{a, g5, g4}$	25	kV
Grid no. 3 (focusing electrode) voltage	V_{g3}	4,0 to 4,8	kV
Grid no. 2 voltage for a spot cut-off voltage V_k = 140 V	V_{g2}	465 to 705	V [1]
Cathode voltage for spot cut-off at V_{g2} = 555 V	V_k	110 to 165	V [2]
Luminance at the centre of the screen [3]	L	100	cd/m^2 (nit)

EQUIPMENT DESIGN VALUES (each gun if applicable), voltages with respect to g1
Valid for final accelerator voltages between 20 kV and 27,5 kV

Grid no. 3 (focusing electrode) voltage	V_{g3}	16 to 19,2% of final accelerator voltage
Grid no. 2 voltage	V_{g2}	see cut-off design chart page 13
Cathode voltage for visual extinction of focused spot	V_k	see cut-off design chart page 13
Difference in cut-off voltages between guns in any tube	ΔV_k	lowest value is min. 75% of highest value
Grid no. 3 (focusing electrode) current	I_{g3}	−5 to +5 µA
Grid no. 2 current	I_{g2}	−5 to +5 µA
Grid no. 1 current at V_k = 150 V	I_{g1}	−5 to +5 µA

1) This range of V_{g2} has to be used when in circuit design fixed values for cut-off of the three guns are used.

2) This range of V_k has to be used when in circuit design fixed values for V_{g2} of the three guns are used.

3) Tube settings adjusted to produce white D (x = 0,313, y = 0,329), focused raster, current density 0,4 µA/cm^2.

EQUIPMENT DESIGN VALUES (continued)

To produce white of the following CIE co-ordinates :		white "D"		
	x	0, 265	0, 281	0, 313
	y	0, 290	0, 311	0, 329
Percentage of total anode current supplied by each gun (typical)				
red gun		26, 4	30, 6	41, 2
green gun		34, 3	35, 4	32, 2
blue gun		39, 3	34, 0	26, 6
Ratio of anode currents	>	0, 60	0, 65	0, 95
red gun to green gun	av.	0, 75	0, 85	1, 30
	<	1, 00	1, 15	1, 70
Ratio of anode currents	>	0, 50	0, 65	1, 15
red gun to blue gun	av.	0, 65	0, 90	1, 55
	<	0, 90	1, 20	2, 05

LIMITING VALUES (each gun if applicable), voltages with respect to g1
(Design maximum rating system unless otherwise specified)

Final accelerator voltage	$V_{a, g5, g4}$	max.	27, 5	kV	1)2)3)
		min.	20	kV	1)4)
Long term average current for three guns	I_a	max.	1000	µA	5)
Grid no. 3 (focusing electrode) voltage	V_{g3}	max.	6	kV	
Grid no. 2 voltage	V_{g2}	max.	1000	V	
Cathode voltage, positive	V_k	max.	400	V	
positive, operating cut-off	V_k	max.	200	V	
negative	$-V_k$	max.	0	V	
negative peak	$-V_{kp}$	max.	2	V	
Cathode to heater voltage, positive	V_{kf}	max.	250	V	6)
positive peak	V_{kfp}	max.	300	V	1)
negative	$-V_{kf}$	max.	135	V	
negative peak	$-V_{kfp}$	max.	180	V	1)

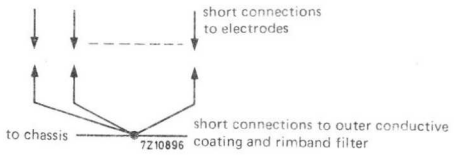
1) Absolute max. rating system.

2) 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.

Continued on page 9.

REMARKS

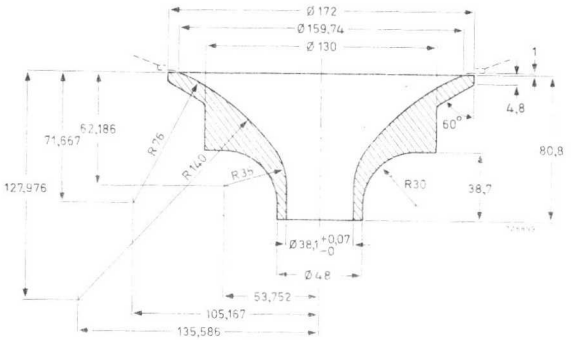
With the high voltage used with this tube (max. 27,5 kV) internal flash-overs may occur. These may destroy the cathode(s) of the tube. Therefore it is necessary to provide protective circuits, using spark gaps.
The spark gaps must be connected as follows:



No other connections between the outer conductive coating and the chassis are permissible. Additional information available on request.

During shipment and handling the tube should not be subjected to accelerations greater than 350 m/s^2 (35 g) in any direction.

CONTOUR GAUGE



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3) During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.

4) Operation of the tube at lower voltages impairs the luminance and resolution.

5) 1500 µA permitted provided a current limiting circuit is used.

6) During an equipment warm-up period not exceeding 15 s V_{kf} is allowed to rise to 385 V. Between 15 s and 45 s after switching on a decrease in V_{kf} proportional with time from 385 V to 250 V is permissible.

BEAM CORRECTIONS

When the tube is used with the deflection unit AT1083/01 the following corrections should be applied:

Maximum required horizontal displacement of the electron beams with respect to the phosphor stripes by the purifying magnet of the multi-pole unit AT1081 [1] — 45 μm

Static convergence deviations must be corrected by a static multi-pole unit AT1081 providing adjustable four-pole and six-pole fields centred around the tube axis

Maximum required compensation for static convergence

4-pole device: red-to-blue (in any direction)	5,5 mm
6-pole device: red and blue to green (in any direction)	2,8 mm

North-South raster shape correction circuitry is not required.

To obtain a symmetrical shape for the horizontal lines at the upper part and the lower part of the screen, the unit AT1081 comprises an additional dipole correction magnet giving a displacement of the beam in the centre of the screen in vertical direction of maximum ±4,5 mm

Maximum centring error in any direction after colour purity, static convergence, and horizontal centre line correction 4,5 mm

With respect to dynamic convergence the display system, consisting of picture tube A56-500X and deflection unit AT1083/01, is inherently self-converging. However, small corrections should be made to compensate for tolerances and asymmetries in the tube and deflection unit combination.
For this purpose two types of dynamic magnetic four-pole fields can be used.
One is generated by additional windings on the yoke ring of the deflection unit, and energized by adjustable currents synchronized with scanning.
The other type is generated by adjustable balancing currents through the deflection coils.

Compensation to be provided by these corrections:

- horizontal red-to-blue distance at the ends of the horizontal axis in opposite directions (line symmetry)	[2]	0 ± 1,5 mm
- horizontal red-to-blue distance at the ends of the vertical axis in opposite directions (field symmetry)	[3]	0 ± 1,5 mm
- vertical red-to-blue distance at the ends of the horizontal axis in opposite directions (line balance)	[4]	0 ± 1,0 mm
- vertical red-to-blue distance at the ends of the horizontal axis in equal directions (line balance parabola)	[5]	0 ± 0,6 mm
- vertical red-to-blue distance at the top of the vertical axis (field balance top)	[6]	0 ± 1,2 mm
- vertical red-to-blue distance at the bottom of the vertical axis (field balance bottom)	[7]	0 ± 1,2 mm

Notes see page 11.

Notes

1) Purity adjustment in vertical direction is not required.

2) This correction is made by feeding a sawtooth current of line frequency through the additional four-pole windings on the deflection unit.

3) This correction is made by feeding a sawtooth current of field frequency through the additional four-pole windings on the deflection unit.

4) This correction is made by unbalancing the line deflection coil halves.

5) This correction is made by feeding a parabolic current of line frequency through the line deflection coil halves.

6) This correction is made by unbalancing the field deflection coil halves during the first half of the field scan.

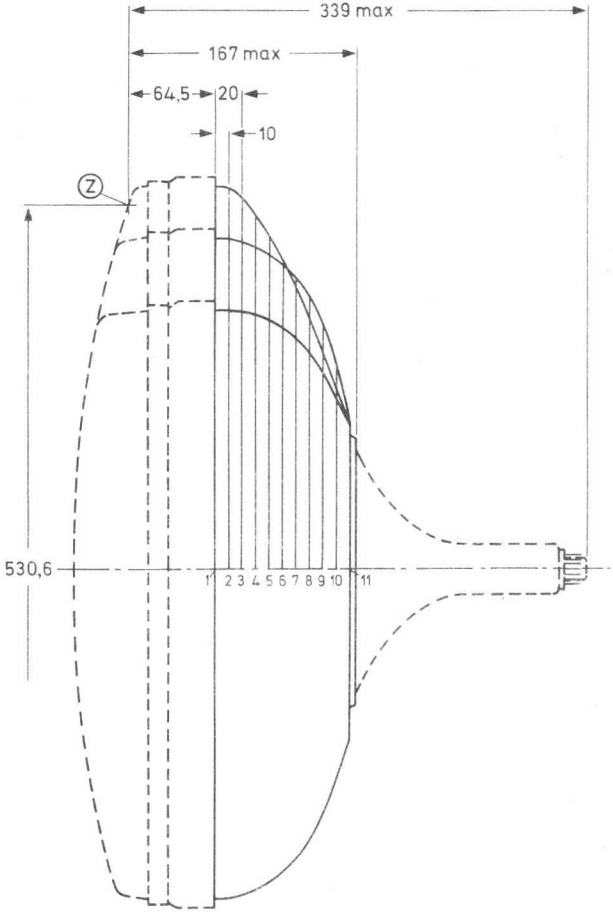
7) This correction is made by unbalancing the field deflection coil halves during the second half of the field scan.

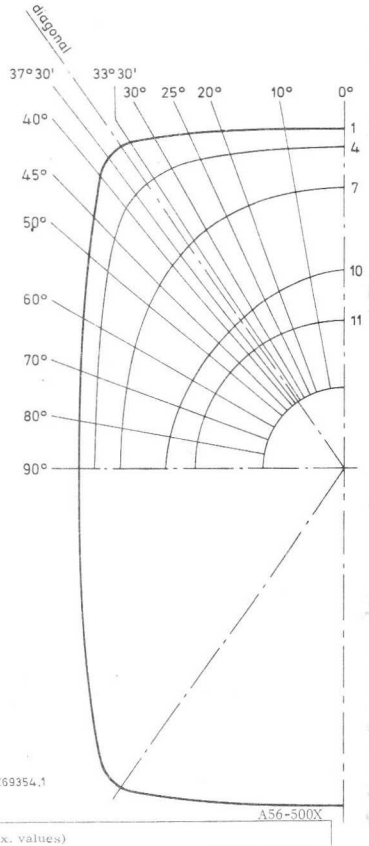
Application information available on request.

A56-500X

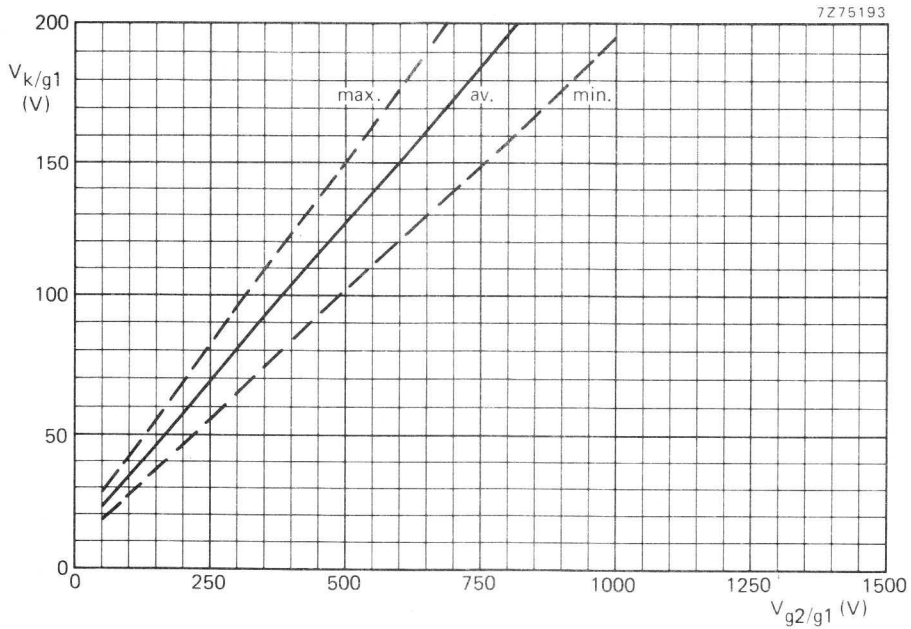
MAXIMUM CONE CONTOUR DRAWING

Dimensions in mm

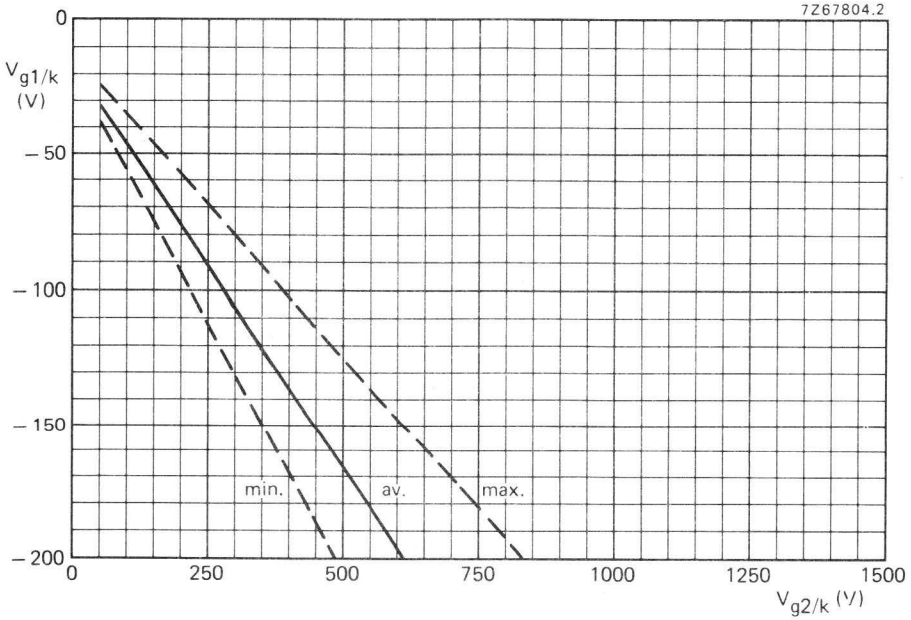




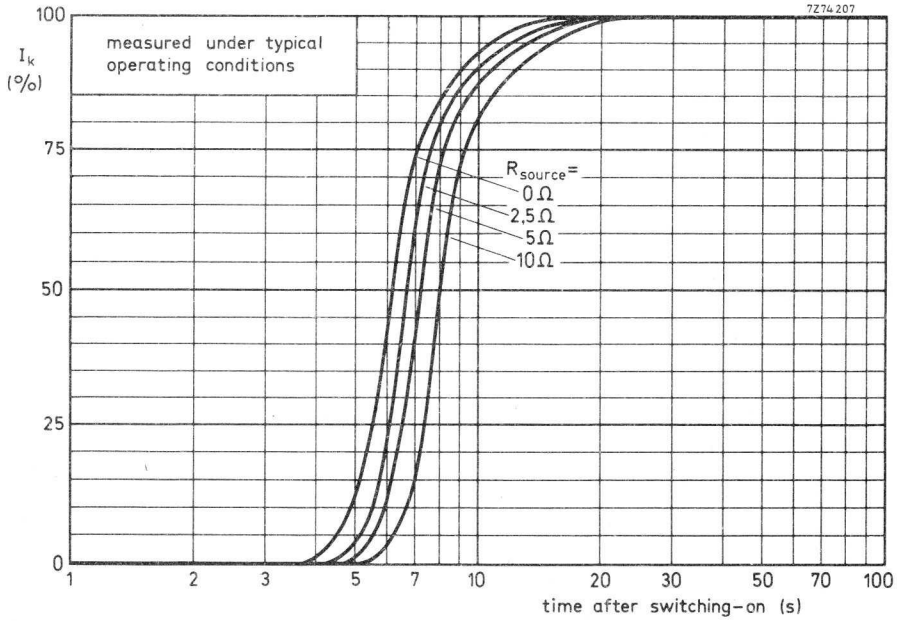
Section	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	30°	30° 30'	diag.	37° 30'	40°	45°	50°	60°	70°	80°	90°
1	0	248,0	251,2	261,3	269,3	279,5	286,8	288,0	286,8	281,7	262,3	245,9	222,0	207,0	198,7	196,0
2	10	244,4	247,6	257,6	265,4	275,3	282,3	283,3	282,0	276,8	257,8	241,6	218,0	203,2	195,0	192,4
3	20	240,5	243,6	252,9	259,6	267,0	271,2	271,3	269,7	265,3	250,6	236,6	214,2	199,6	191,4	188,8
4	30	235,0	237,8	245,5	250,2	254,4	255,7	255,0	253,3	249,9	239,5	228,3	208,6	194,8	186,9	184,3
5	40	227,7	229,9	235,2	237,8	239,1	238,7	237,6	236,0	233,3	225,8	217,3	201,0	188,8	181,6	179,2
6	50	218,2	219,6	222,2	222,9	222,3	220,8	219,6	218,1	215,8	210,1	203,6	190,9	180,9	174,7	172,6
7	60	206,4	206,8	206,8	205,9	204,0	202,2	200,9	199,5	197,5	193,2	188,4	179,2	171,6	166,8	165,2
8	70	191,6	190,9	188,5	186,6	184,1	182,2	181,0	179,8	178,2	175,0	171,7	165,7	160,8	157,7	156,6
9	80	172,5	170,9	166,8	164,4	161,9	160,1	159,1	158,2	157,0	154,8	152,9	149,7	145,6	146,5	146,2
10	90	147,0	144,8	140,5	138,3	136,3	135,0	134,3	133,6	132,9	131,7	130,8	130,0	130,3	131,3	132,0
11	99,1	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0



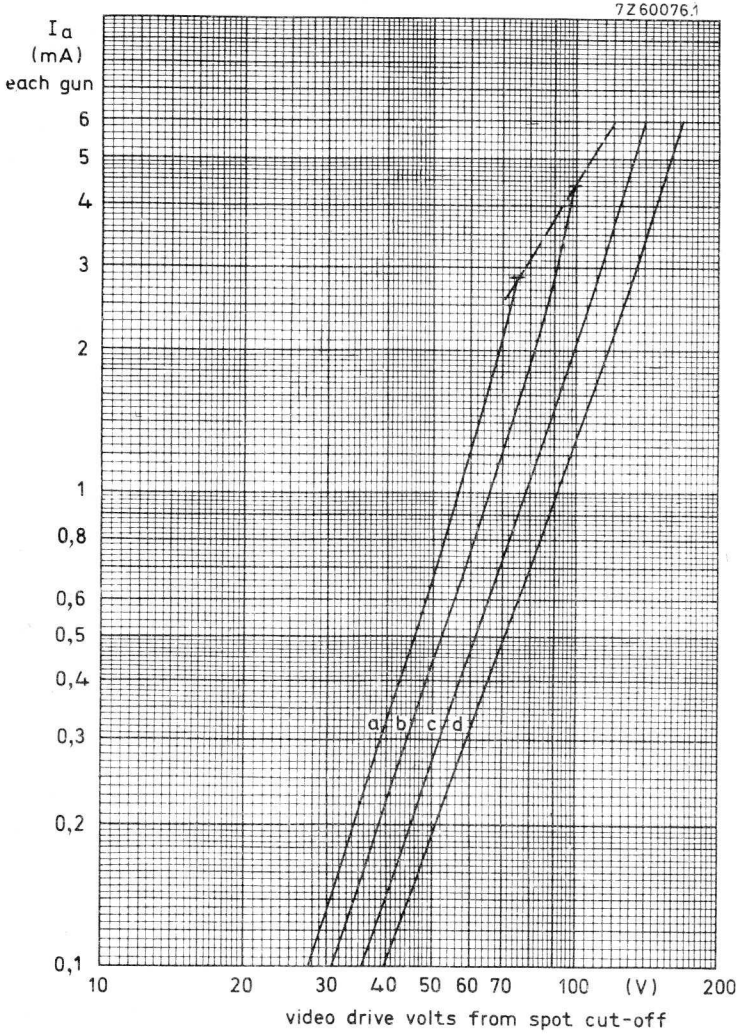
Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, V_a, g5, g4 = 20 to 27,5 kV



Spot cut-off design chart (grid drive), V_{g3} adjusted for focus, V_a, g5, g4 = 20 to 27,5 kV



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

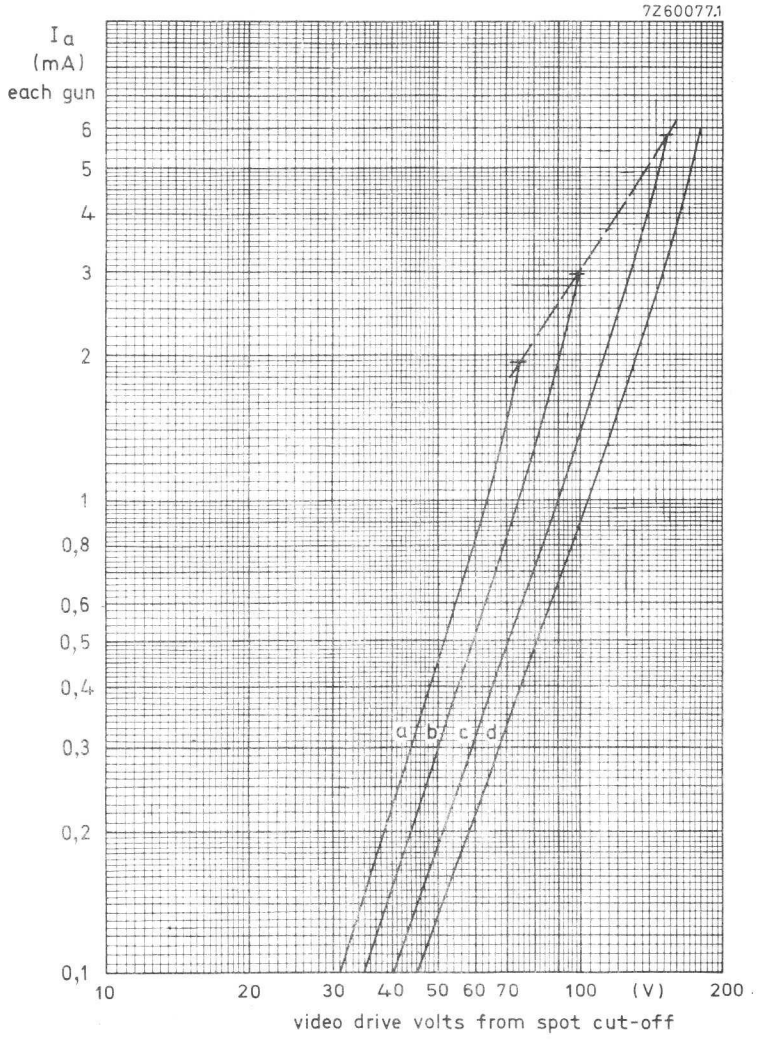


Typical cathode drive characteristics

$V_{a, g5, g4}$ = 20 kV to 27,5 kV
V_{g3} adjusted for focus
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_k

---- zero bias point

a = spot cut-off = 75 V
b = spot cut-off = 100 V
c = spot cut-off = 150 V
d = spot cut-off = 200 V



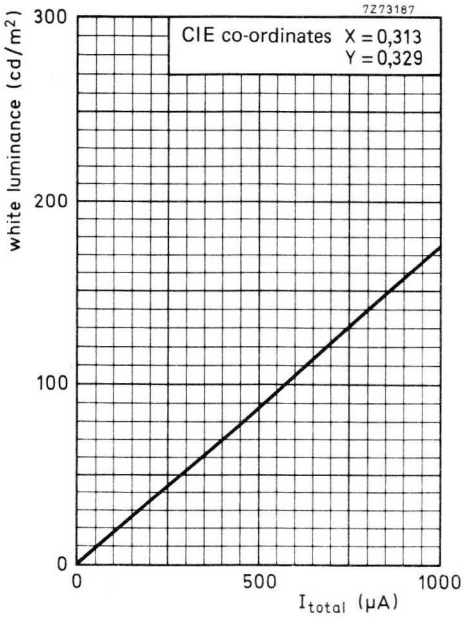
Typical grid drive characteristics

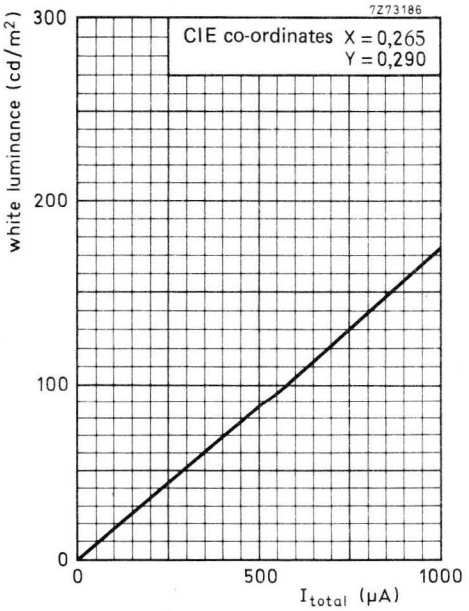
V_a, g5, g4 = 20 kV to 27,5 kV
V_{g3} adjusted for focus
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_{g1}

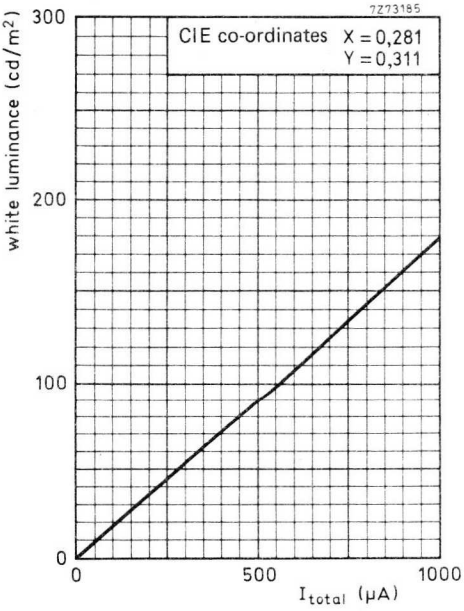
---- zero bias point

a = spot cut-off = −75 V
b = spot cut-off = −100 V
c = spot cut-off = −150 V
d = spot cut-off = −200 V

Luminance at the centre of the screen as a function of I_{total}. Scanned area 444, 2 mm x 334, 2 mm.







Available for equipment maintenance. No longer recommended for equipment production.

90° COLOUR TELEVISION TUBE

QUICK REFERENCE DATA

Temperature compensated shadow-mask		
Shadow-mask optimized for 625-line system		
High white luminance at unity current ratio		
Face diagonal	66	cm
Deflection angle	90	deg
Neck diameter	36,5	mm
Envelope	reinforced; suitable for push-through	
Convergence	magnetic	
Heating, parallel or series supply	6,3 V, 900	mA
Light transmission of face glass	52,5	%

TYPICAL OPERATING CONDITIONS

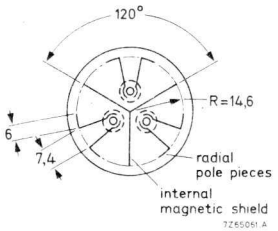
Final accelerator voltage	$V_{a,g5,g4}$			25	kV
Grid 3 (focusing electrode)voltage	V_{g3}	4,2	to	5	kV
Grid 2 voltage for a spot cut-off voltage V_{g1} = −105 V	V_{g2}	210	to	495	V
Grid 1 voltage for spot cut-off at V_{g2} = 300 V	V_{g1}	−70	to	−140	V

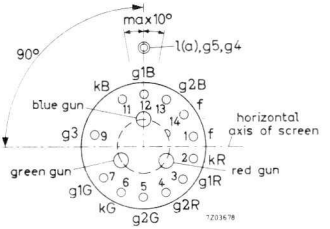
MECHANICAL DATA

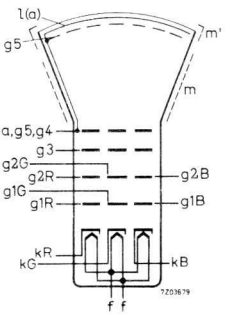
Overall length		521,8 ± 6,5	mm
Neck length		⩽ 168,7	mm
Diagonal	of bulb	⩽ 657,6	mm
Horizontal axis	of bulb	⩽ 556,4	mm
Vertical axis	of bulb	⩽ 435,3	mm
Useful screen			
diagonal		⩾ 617,8	mm
horizontal axis		⩾ 518	mm
vertical axis		⩾ 390	mm

Base : 12-pin base IEC 67-I-47a, JEDEC B12-246

Anode contact: Small cavity contact IEC 67-III-2, J1-21







110° COLOUR TELEVISION TUBE

Obsolete type.

Replacement type A66-410X.

A circuit modification may be necessary to compensate for the 170 mA lower heater current of the A66-410X.

110° COLOUR TELEVISION PICTURE TUBE

Three-gun temperature-compensated shadow-mask rectangular colour television tube with electrostatic focus, magnetic deflection and convergence, metal-backed three-colour phosphor dot screen and internal magnetic shield. A high white luminance is obtained at near unity current ratio. Being temperature compensated, the shadow-mask makes for optimum field purity and good uniformity during warm-up. The design is such that minimum occurence of the moiré effect is ensured. The tube has a reinforced envelope and therefore no separate safety screen is necessary. Typically, a legible picture will appear within 5 s.

QUICK REFERENCE DATA		
TEMPERATURE-COMPENSATED SHADOW-MASK		
DESIGNED FOR MINIMUM MOIRÉ EFFECT		
HIGH WHITE LUMINANCE AT UNITY CURRENT RATIO		
Face diagonal	66	cm
Deflection angle	110	deg
Neck diameter	36,5	mm
Envelope	reinforced	
Magnetic shield	internal	
Focusing	bi-potential	
Deflection	magnetic	
Convergence	magnetic	
Heating	6,3 V, 730 mA	
Light transmission of face glass	52,5	%
Quick heating cathode	with a typical tube a legible picture will appear after within 5 s	

SCREEN

Metal-backed phosphor dots

Phosphor type	Red: Europium activated rare earth Green: Sulphide type Blue: Sulphide type	
Dot arrangement	Triangular	
Spacing between centres of adjacent dot trios		0,81 mm
Light transmission at centre of face glass		52,5 %

HEATING : indirect by a.c. or d.c. ; parallel supply

Heater voltage	V_f	6,3	V
Heater current	I_f	730	mA [1])

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

For heating time as a function of source impedance see graph page 13 below.

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g_3,g_4/m}$	max. 2100 min. 1600	pF pF
Final accelerator to metal rimband	$C_{a,g3,g4/m'}$	500	pF
Grid no.1 of any gun to all other electrodes	C_{g1}	7	pF
Cathodes of all guns (connected in parallel) to all other electrodes	C_k	15	pF
Cathode of any gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}	5	pF
Grid no.3 (focusing electrode) to all other electrodes	C_{g3}	7	pF

FOCUSING electrostatic (bi-potential)

DEFLECTION magnetic

Diagonal deflection angle	110 °
Horizontal deflection angle	97 °
Vertical deflection angle	77 °

CONVERGENCE magnetic

[1]) If the heater is fed from a mains transformer designed for tube type A66-140X, the source impedance should not exceed 0,6 Ω to ensure that the heater voltage of the A66-410X is not exceeded.

If the heater is fed from a line time base designed for tube type A66-140X, the series impedance, if any, should match the lower heater current of the quick-heating tube.

MECHANICAL DATA

Overall length		425.1 to 438.1	mm
Neck diameter		36.5	mm
Diagonal		max. 657.6	mm
Horizontal axis	of bulb	max. 556.4	mm
Vertical axis	of bulb	max. 435.3	mm
Useful screen			
diagonal		min. 617.8	mm
horizontal axis		min. 518	mm
vertical axis		min. 390	mm

Mounting position: any

Net weight : approx. 20 kg

Base : 12 pin base JEDEC B12-246

Anode contact : Small cavity contact J1-21, IEC 67-III-2

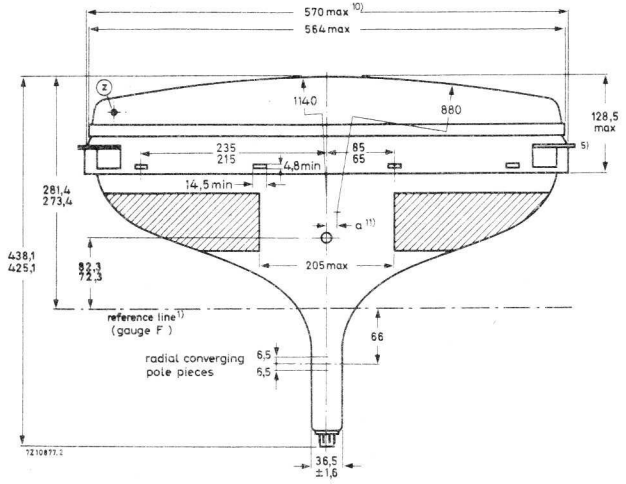
Magnetic shielding, degaussing: The tube is provided with an internal magnetic shield. The internal magnetic shield and the shadow-mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering left and right cone parts. For proper degaussing an initial m.m.f. of 500 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate circuitry. After decreasing to 10 A.t. or less, sudden switch off is permissible. In the steady state, no significant m.m.f. should remain in the coils ($\leq$ 0.5 A.t.).
To ease the mounting of the coils, the rimband is provided with rectangular holes.

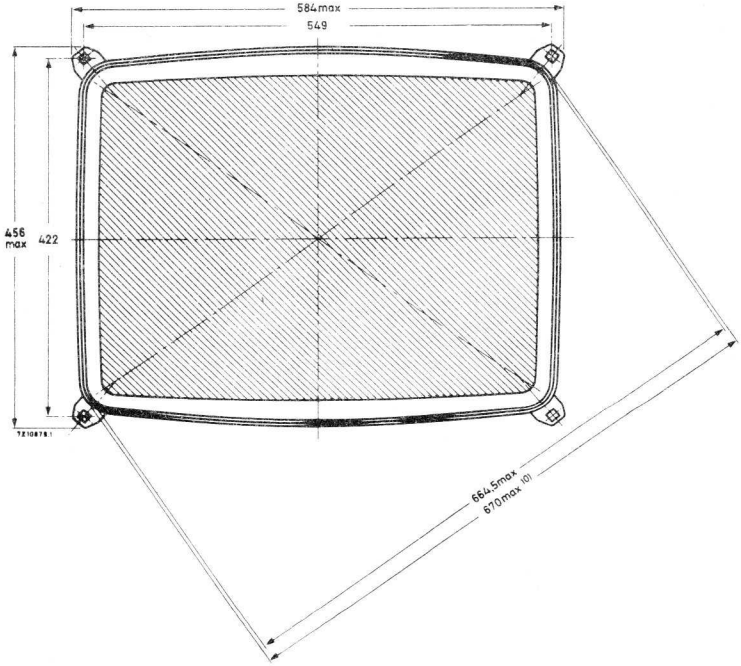
NOTES TO OUTLINE DRAWING (see pages 4, 5, and 6)

1) Reference line, determined by the plane of the upper edge of the flange of the reference line gauge, when the gauge is resting on the cone.
2) The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 55 mm.
3) Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.
4) To clean this area, wipe only with a soft lintless clotch.
5) The displacement of any lug with respect to the plane through the three other lugs is max. 2 mm.
6) Minimum space to be reserved for mounting lug.
7) The position of the mounting screw in the cabinet must be within a circle of 9.5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 549 mm x 422 mm.
8) Coördinates for radius R = 18,2 mm: x = 236,6 mm, y = 168,9 mm.
9) Distance from point z to any hardware.
10) Maximum dimensions in plane of lugs.
11) Dimension a = 30,0 mm on diagonal, 28,4 mm on major axis, 18,8 mm on minor axis.

MECHANICAL DATA (continued)

Dimensions in mm

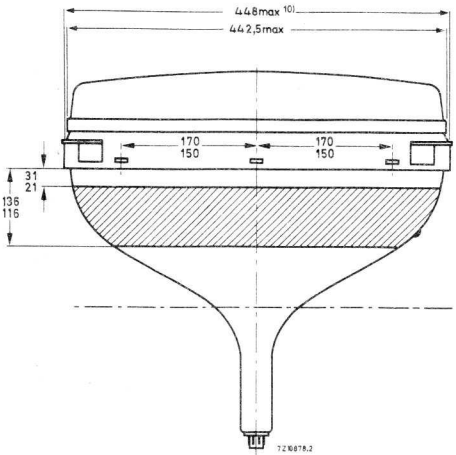


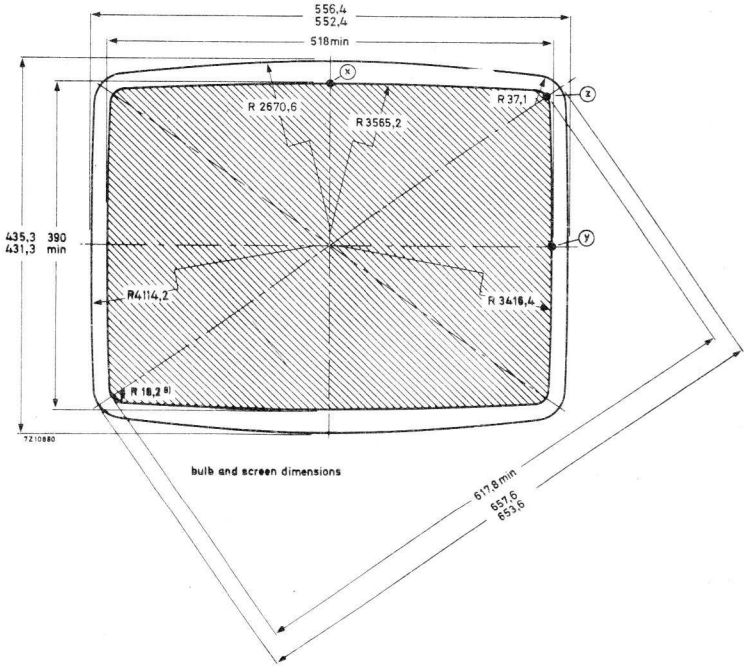


Notes see page 3

MECHANICAL DATA

Dimensions in mm



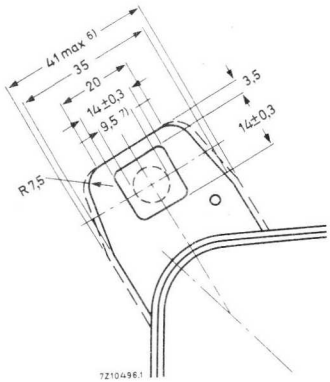


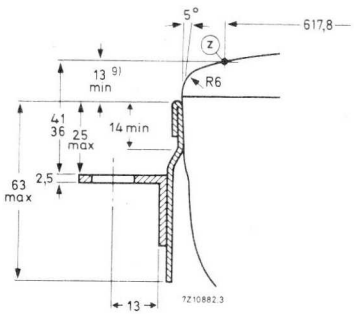
bulb and screen dimensions

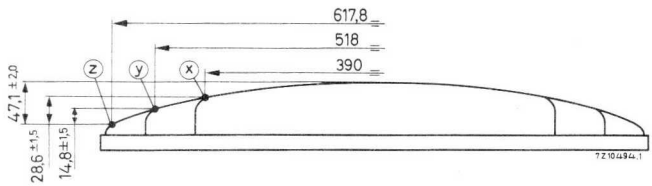
Notes see page 3

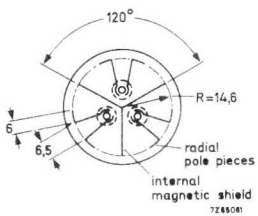
MECHANICAL DATA (continued)

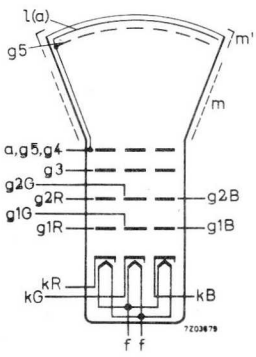
Dimensions in mm

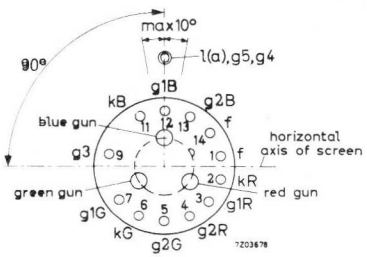








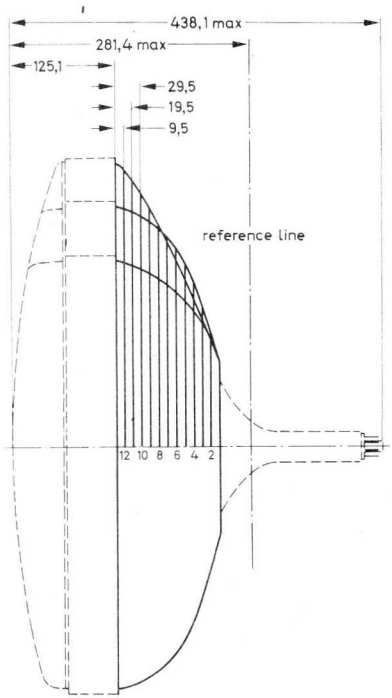


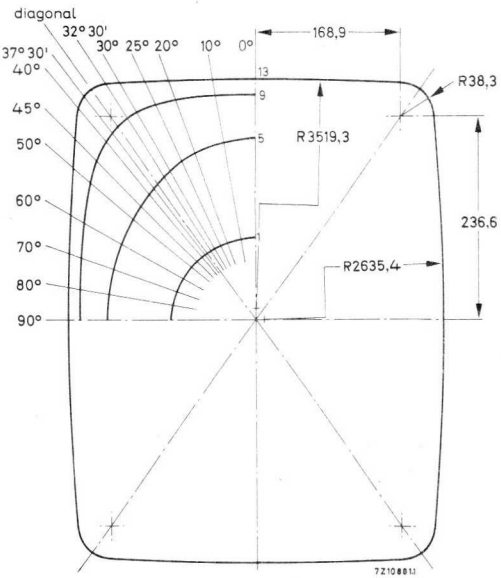


Notes see page 3

MAXIMUM CONE CONTOUR DRAWING

dimensions in mm





Section	Distance from section 13	Distance from centre 0° Long	10°	20°	25°	30°	32° 30'	35° 31' Diagon.	37° 30'	40°	45°	50°	60°	70°	80°	90° Short
1	119,5 nom.	99,41	99,18	98,70	98,46	98,26	98,18	98,11	98,07	98,05	98,05	98,13	98,51	99,08	99,65	99,93
2	109,5 "	142,11	139,07	133,90	131,47	129,35	128,43	127,45	126,89	126,26	125,38	124,90	125,19	126,92	129,46	131,09
3	99,5 "	171,81	168,10	161,35	157,99	154,92	153,52	151,98	151,06	149,99	148,22	146,91	145,65	145,96	147,25	148,22
4	89,5 "	193,96	191,36	185,57	182,25	178,92	177,30	175,41	174,22	172,78	170,12	167,81	164,25	162,10	161,14	160,96
5	79,5 "	213,30	211,91	207,82	204,94	201,66	199,92	197,75	196,31	194,48	190,86	187,37	181,15	176,39	173,40	172,38
6	69,5 "	230,11	229,83	227,80	225,69	222,75	220,99	218,64	216,97	214,76	210,09	205,28	196,20	188,93	184,26	182,64
7	59,5 "	243,54	244,45	245,30	244,63	242,68	241,15	238,79	236,97	234,39	228,50	222,08	209,60	199,67	193,44	191,31
8	49,5 "	253,95	255,93	260,00	261,38	261,16	260,19	258,10	256,19	253,23	245,82	237,40	221,05	208,54	200,97	198,44
9	39,5 "	262,25	265,05	272,04	275,72	277,94	277,99	276,37	274,36	270,89	261,35	250,54	230,35	215,70	207,15	204,34
10	29,5 "	268,76	272,13	281,47	287,43	292,66	294,27	293,44	291,30	287,13	274,58	261,11	237,50	221,30	212,11	209,13
11	19,5 "	273,39	277,11	288,19	296,17	304,82	308,65	309,17	307,00	301,85	285,09	268,75	242,46	225,33	215,81	212,75
12	9,5 "	276,43	280,34	292,47	301,96	313,84	320,37	323,09	321,27	314,80	292,49	273,50	245,58	228,11	218,52	215,46
13	0	279,00	282,96	295,36	305,23	318,01	325,40	329,00	327,49	320,66	296,49	276,73	248,34	230,73	221,08	218,00

TYPICAL OPERATING CONDITIONS

Final accelerator voltage	Va, g5, g4	25 kV
Grid No. 3 (Focusing electrode) voltage	V_{g3}	4,2 to 5 kV
Grid No. 2 voltage for a spot cut-off voltage V_{g1} = -105 V	V_{g2}	212 to 495 V [1]
Grid No. 1 voltage for spot cut-off at V_{g2} = 300 V	V_{g1}	-70 to -140 V [2]
Luminance at the centre of the screen		See page 12

EQUIPMENT DESIGN VALUES (each gun if applicable)

Valid for final accelerator voltages between 20 kV and 27,5 kV.

Grid No. 3 (focusing electrode) voltage	V_{g3}	16,8 to 20% of final accelerator voltage
Grid No. 2 voltage	V_{g2}	See cut-off design chart page 13
Grid No. 1 voltage for visual extinction of focused spot (cut-off voltage) [2]	V_{g1}	See cut-off design chart page 13
Difference in cut-off voltages between guns in any tube	ΔV_{g1}	lowest value is min. 65% of highest value
Grid No. 3 (focusing electrode) current	I_{g3}	-5 to +5 µA
Grid No. 2 current	I_{g2}	-5 to +5 µA
Grid No. 1 current at V_{g1} = -150 V	I_{g1}	-5 to +5 µA

To produce white of the following CIE coordinates		[3]	[4]	[6]
	x	0,265	0,281	0,313
	y	0,290	0,311	0,329
Percentage of total anode current supplied by each gun (typical)				
red gun		25,8	30,2	41,0
green gun		33,5	34,5	31,3
blue gun		40,7	35,3	27,7
Ratio of anode currents red gun to green gun	min.	0,55	0,65	0,95
	av.	0,75	0,90	1,30
	max.	1,10	1,25	1,80
Ratio of anode currents red gun to blue gun	min.	0,50	0,65	1,15
	av.	0,65	0,85	1,50
	max.	0,85	1,15	2,00

Notes see page 9.

EQUIPMENT DESIGN VALUES (continued)

Required centring, measured at the centre of the screen in any direction	max.	12	mm
Correction that must be supplied by purifying magnet to compensate for mis-register in any direction	max.	100	µm
Lateral distance between blue spot and the converged red and green spots	max.	5	mm (in both directions)
Radial convergence diaplacement excluding effects of dynamic convergence (each gun) [5]	max.	8	mm (in both directions)

[1]) This range of V_{g2} has to be used when in circuit design fixed values for cut-off of the three guns are used.

[2]) This range of V_{g1} has to be used when in circuit design fixed values for V_{g2} of the three guns are used.

[3]) To produce black/white pictures a bluish white point would be preferable. This white point corresponds virtually with the white point of current black/white picture tubes.

[4]) This point is a compromise between white point D and the white point x = 0.265 y = 0.290, given in order to enable good rendition of colour and black and white pictures with one white point.

[5]) Dynamic convergence to be effected by currents of approximately parabolic waveshape through the convergence coils synchronized with scanning.

[6]) To produce colour pictures with the best possible quality, this white point should be used when the transmission system is based on this point. (Point D).

LIMITING VALUES (Each gun if applicable)
(Design centre rating system unless otherwise specified)

Final accelerator values	V_a, g5, g4	max.	27,5	kV [1) 2) 3)]
		min.	20	kV [1) 4)]
Average current for three guns	I_a	max.	1000	μA [5)]
Grid No. 3 (focusing electrode) voltage	V_{g3}	max.	6000	V
Grid No. 2 voltage, peak, including video signal voltage	V_{g2p}	max.	1000	V
Grid No. 1 voltage,				
negative,	$-V_{g1}$	max.	400	V
negative, operating cut-off	$-V_{g1}$	max.	200	V
positive	V_{g1}	max.	0	V
positive peak	V_{g1p}	max.	2	V
Cathode to heater voltage,				
positive	V_{kf}	max.	250	V [6)]
positive peak	V_{kfp}	max.	300	V
negative	$-V_{kf}$	max.	135	V
negative peak	$-V_{kfp}$	max.	180	V

1) Absolute max. rating system.

2) The X-ray dose rate remains below the acceptable value of 0,5mr/h, measured with ionization chamber when the tube is used within its limiting values.

3) For optimal operating conditions the final accelerator voltage has to be stabilized. Therefore its absolute maximum value can be approached in actual operation and for this reason this value is given instead of the design centre value. During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.

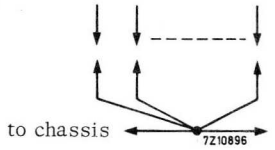
4) Operation of the tube at lower voltages impairs brightness and resolution and may have a detrimental effect on colour purity.

5) 1500 μA permitted provided a current limiting circuit is used.

6) During an equipment warm-up period not exceeding 15 s V_{kf} is allowed to rise to 385 V. Between 15 s and 45 s after switching on a decrease in V_{kf} proportional with time from 385 V to 250 V is permissible.

REMARKS

With the high voltage used with this tube (max. 27,5 kV) internal flash-overs may occur. These may destroy the cathode(s) of the tube. Therefore it is necessary to provide protective circuits, using spark gaps.
The spark gaps must be connected as follows:



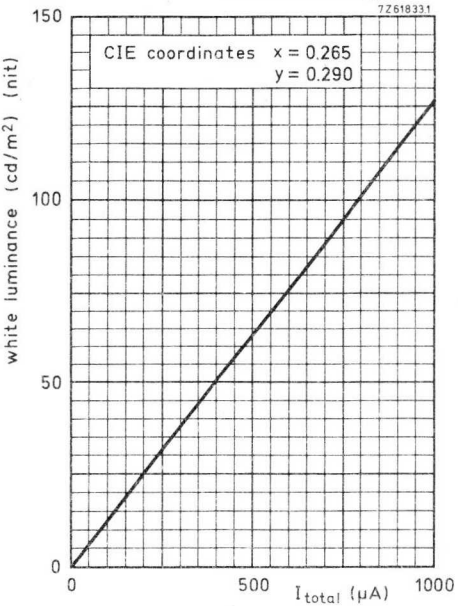
No other connections between the outer conductive coating and the chassis are permissible.
Additional information is given in Application Information 258, available on request.

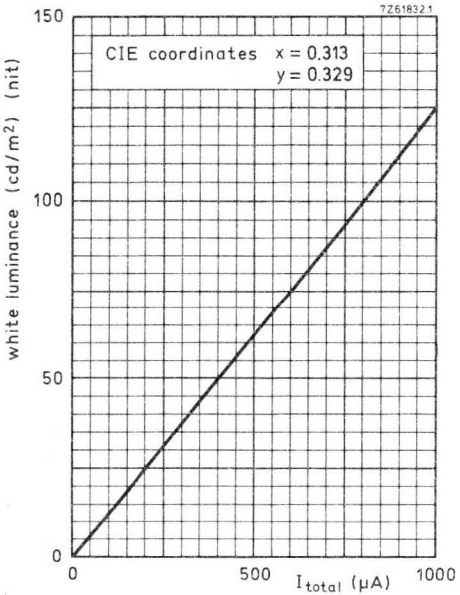
During shipment and handling the tube should not be subjected to accelerations greater than 35 g in any direction.

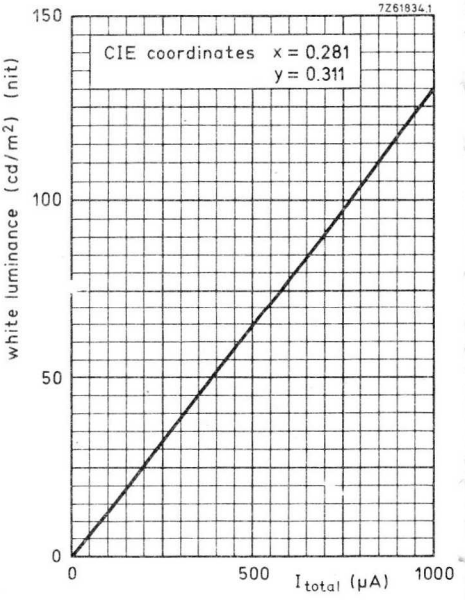
REFERENCE LINE GAUGE (gauge F)

Gauge F. See chapter "Reference line gauges" in front of this book.

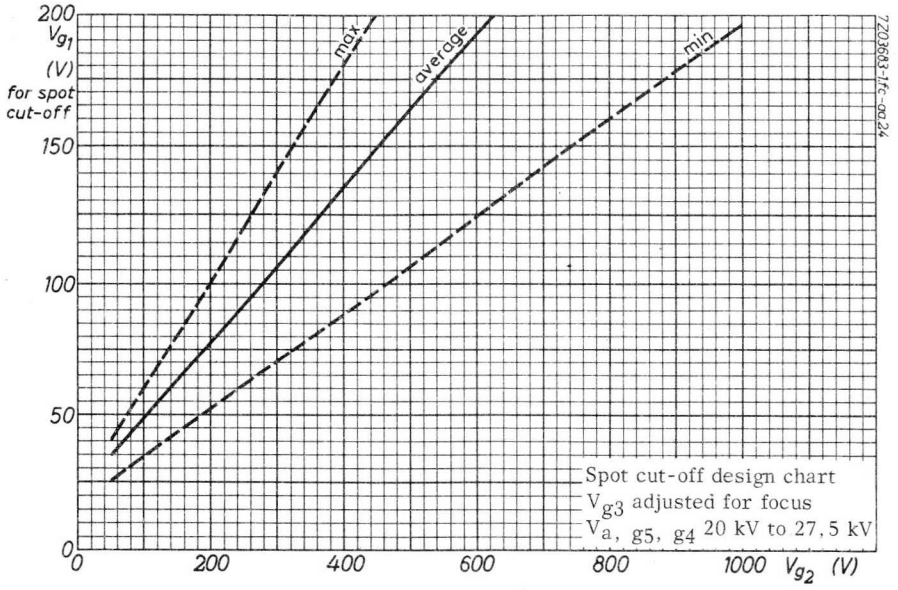
Luminance at the centre of the screen as a function of I_{total}.

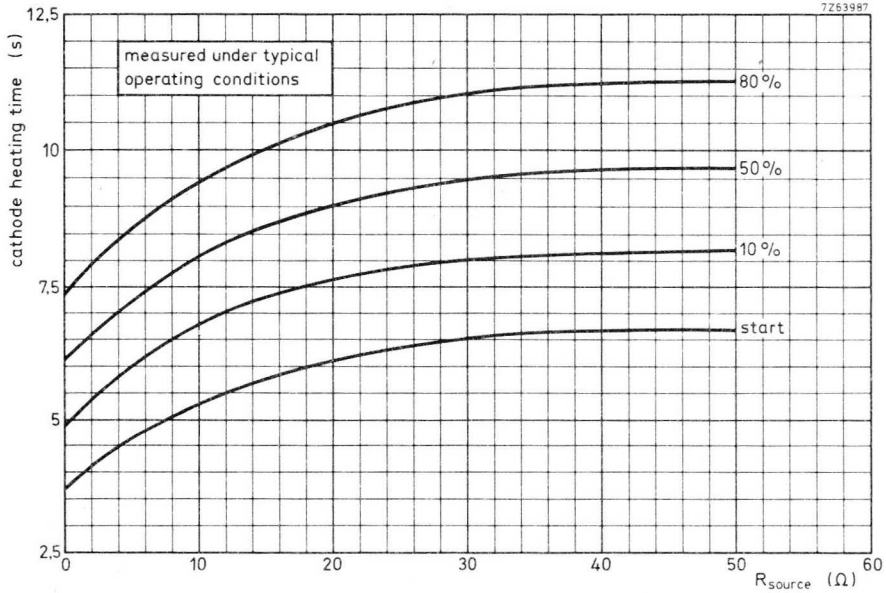




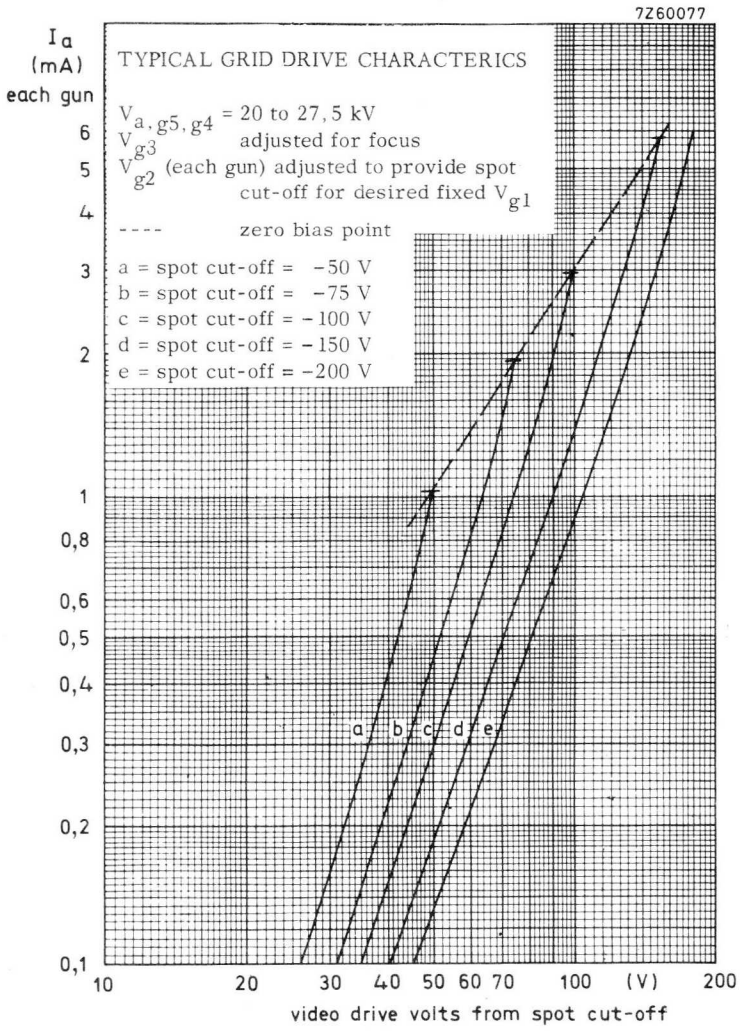


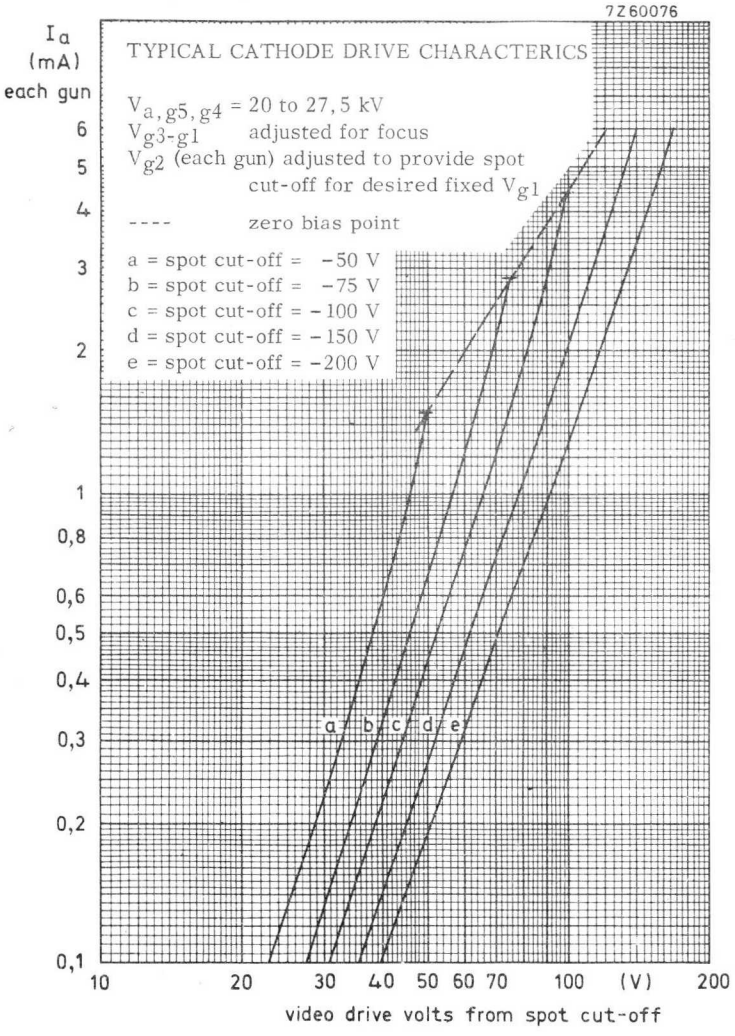
Scanned area 518 mm x 390 mm





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


7Z60077
I_a (mA) each gun
TYPICAL GRID DRIVE CHARACTERICS
$V_{a,g5,g4}$ = 20 to 27,5 kV adjusted for focus
V_{g3}
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_{g1}
---- zero bias point
a = spot cut-off = −50 V
b = spot cut-off = −75 V
c = spot cut-off = −100 V
d = spot cut-off = −150 V
e = spot cut-off = −200 V
6
5
4
3
2
1
0,8
0,6
0,5
0,4
0,3
0,2
0,1
a b c d e
10 20 30 40 50 60 70 100 (V) 200
video drive volts from spot cut-off


7Z60076
I_a (mA) each gun
TYPICAL CATHODE DRIVE CHARACTERICS
$V_{a,g5,g4}$ = 20 to 27,5 kV
$V_{g3\text{-}g1}$ adjusted for focus
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_{g1}
---- zero bias point
a = spot cut-off = −50 V
b = spot cut-off = −75 V
c = spot cut-off = −100 V
d = spot cut-off = −150 V
e = spot cut-off = −200 V
6
5
4
3
2
1
0,8
0,6
0,5
0,4
0,3
0,2
0,1
a b c d e
10 20 30 40 50 60 70 100 (V) 200
video drive volts from spot cut-off

110° IN-LINE GUN COLOUR TELEVISION TUBE

The tube has a three-in-line gun, a slotted shadow mask, and phosphors arranged in vertical stripes. The system of tube and deflection unit AT1080 is inherently self-converging; only minor corrections are needed to compensate for tolerances and asymmetries. The shadow-mask is optimized for minimum moiré. The tube features a quick-heating cathode, an internal magnetic shield, and a very short overall length.

QUICK REFERENCE DATA		
Deflection angle	110	deg
Face diagonal	66	cm
Overall length	41	cm
Inherently self-converging system with deflection unit AT1080		
Quick-heating cathode	with a typical tube a picture will appear within 5 s	
Heating	6,3 V, 730	mA
Magnetic shield	internal	
Envelope	reinforced suitable for push-through	
Focusing	bi-potential	

SCREEN

Metal-backed vertical phosphor stripes	Red : Europium activated rare earth Green: Sulphide type Blue : Sulphide type	
Centre-to-centre distance of identical colour phosphor stripes		0,8 mm
Light transmission of face glass		52,5 %

HEATING: indirect by a.c. (preferably mains or line frequency) or d.c.

Heater voltage		V_f	6,3	V
Heater current		I_f	730	mA

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

For heating time as a function of source impedance see graph page 14.

CAPACITANCES

Final accelerator to external conductive coating	$C_{a,g5,g4/m}$	<	2000	pF
		>	1500	pF
Final accelerator to metal rimband	$C_{a,g5,g4/m'}$		300	pF
Grid no. 1 of a gun to all other electrodes				
red gun	C_{g1R}		7	pF
green gun	C_{g1G}		7	pF
blue gun	C_{g1B}		7	pF
Cathodes of all guns (connected in parallel) to all other electrodes	C_k		12	pF
Cathode of any gun to all other electrodes	C_{kR}, C_{kG}, C_{kB}		4	pF
Grid no. 3 (focusing electrode) to all other electrodes	C_{g3}		7	pF

FOCUSING electrostatic (bi-potential)

DEFLECTION magnetic

Diagonal deflection angle		110	deg
Horizontal deflection angle		97	deg
Vertical deflection angle		77	deg

MECHANICAL DATA

Overall length			405,1 to 418,1	mm
Neck diameter			$36,5^{+1,6}_{-0,4}$	mm
Diagonal	of bulb	≤	664,5	mm
→ Width	of bulb	≤	564	mm
Height	of bulb	≤	442,5	mm
Useful screen diagonal		≥	617,8	mm
horizontal axis		≥	518	mm
vertical axis		≥	390	mm

Mounting position: any

Net mass : approx. 20 kg

Base : 12 pin base IEC67-I-47a, type 2

Anode contact : Small cavity contact J1-21, IEC 67-III-2

Magnetic shielding, degaussing: The tube is provided with an internal magnetic shield. The internal magnetic shield and the shadow-mask with its suspension system may be provided with an automatic degaussing system, consisting of two coils covering top and bottom cone parts. For proper degaussing an initial m.m.f. of 300 ampere-turns is required in each of the coils. This m.m.f. has to be gradually decreased by appropriate circuitry. To prevent beam landing disturbances by line-frequency currents induced in the degaussing coils, these coils should be shunted by a capacitor of sufficiently high value. In the steady state, no significant m.m.f. should remain in the coils (≤0,3 A.t.). To ease the mounting of the coils, the rimband is provided with rectangular holes.

NOTES TO OUTLINE DRAWINGS (see pages 4, 5, and 6)

1) This ridge can be used as an orientation for the deflection unit.

2) Configuration of outer conductive coating may be different, but will contain the contact area as shown in the drawing.

3) To clean this area, wipe only with a soft lintless cloth.

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

5) Minimum space to be reserved for mounting lug.

6) The position of the mounting screw in the cabinet must be within a circle of 9,5 mm diameter drawn around the true geometrical positions, i.e. the corners of a rectangle of 549 mm x 422 mm.

7) Co-ordinates for radius R = 18,2 mm: x = 236,6 mm, y = 168,9 mm.

8) Distance from point z to any hardware.

9) Maximum dimensions in plane of lugs.

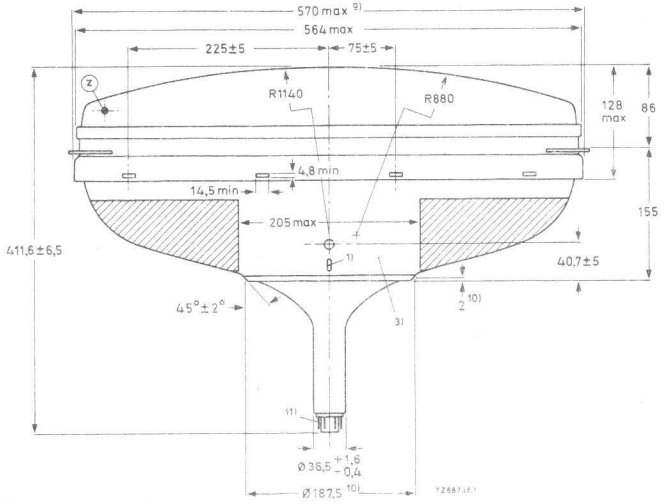
10) Centring ring for the deflection unit.

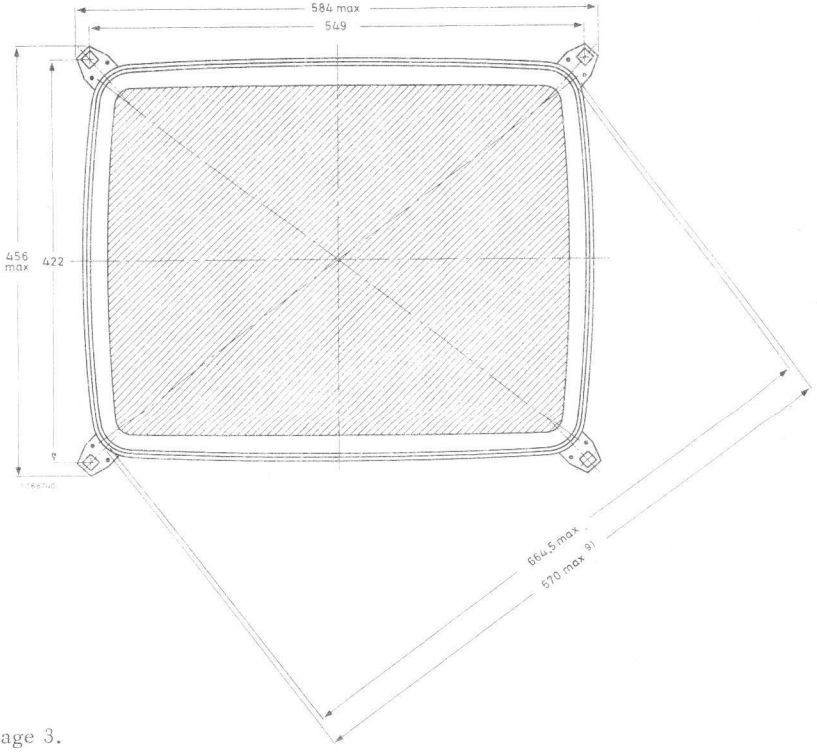
11) The socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a circle concentric with the tube axis and having a diameter of 55 mm.

12) Minimum distance between glass and rimband in plane of the apertures.

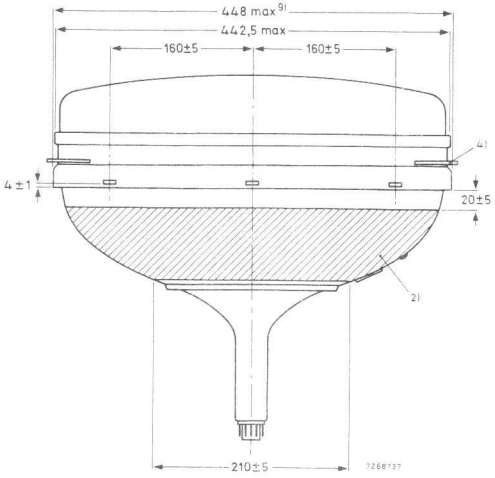
MECHANICAL DATA (continued)

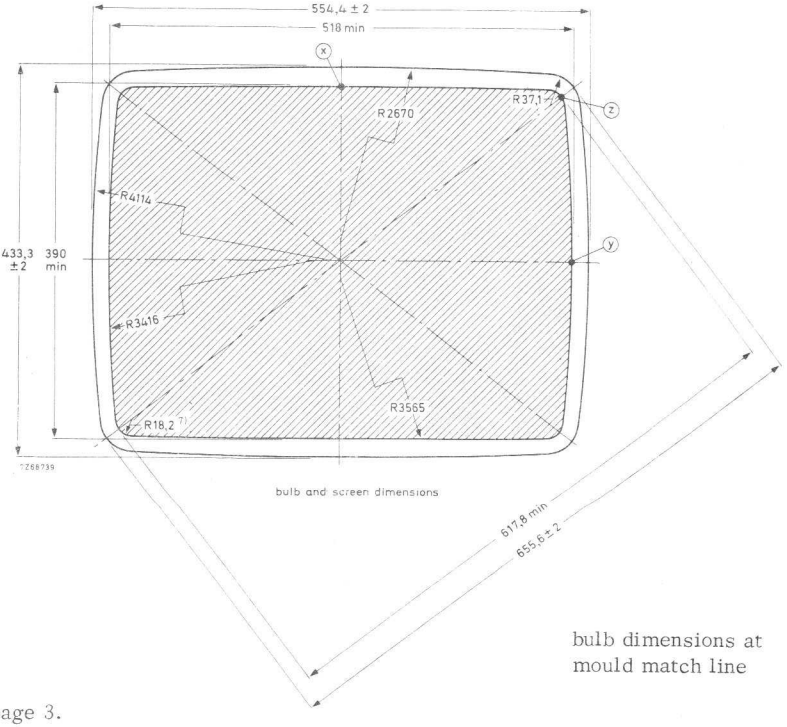
Dimensions in mm





Notes see page 3.



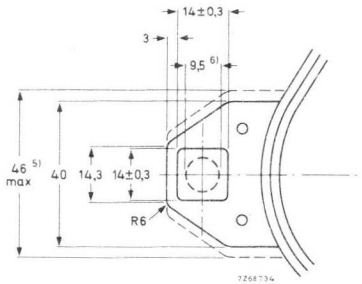


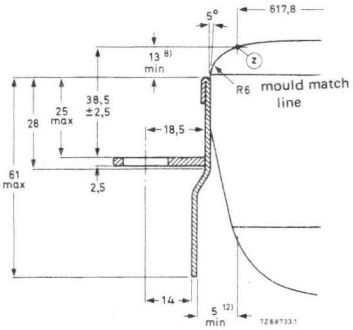
bulb dimensions at mould match line

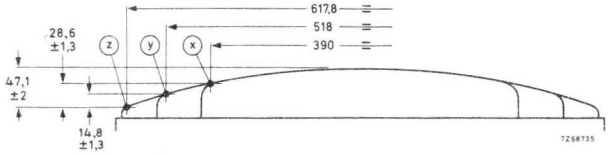
Notes see page 3.

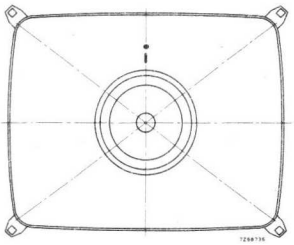
MECHANICAL DATA (continued)

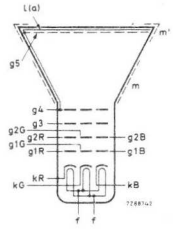
Dimensions in mm

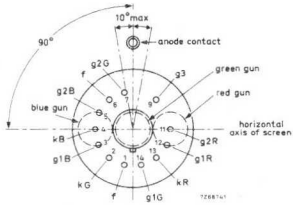












Notes see page 3.

TYPICAL OPERATING CONDITIONS cathode drive, voltages with respect to g1.

Final accelerator voltage	$V_{a, g5, g4}$	25	kV
Grid no. 3 (focusing electrode) voltage	V_{g3}	4,0 to 4,8	kV
Grid no. 2 voltage for a spot cut-off voltage V_k = 140 V	V_{g2}	465 to 705	V [1]
Cathode voltage for spot cut-off at V_{g2} = 555 V	V_k	110 to 165	V [2]
Luminance at the centre of the screen [3]	L	100	cd/m^2 (nit)

EQUIPMENT DESIGN VALUES (each gun if applicable), voltages with respect to g1
Valid for final accelerator voltages between 20 kV and 27,5 kV

Grid no. 3 (focusing electrode) voltage	V_{g3}	16 to 19,2% of final accelerator voltage
Grid no. 2 voltage	V_{g2}	see cut-off design chart page 13
Cathode voltage for visual extinction of focused spot	V_k	see cut-off design chart page 13
Difference in cut-off voltage between guns in any tube	ΔV_k	lowest value is min. 75% of highest value
Grid no. 3 (focusing electrode) current	I_{g3}	−5 to +5 μA
Grid no. 2 current	I_{g2}	−5 to +5 μA
Grid no. 1 current at V_k = 150 V	I_{g1}	−5 to +5 μA

1) This range of V_{g2} has to be used when in circuit design fixed values for cut-off of the three guns are used.

2) This range of V_k has to be used when in circuit design fixed values for V_{g2} of the three guns are used.

3) Tube settings adjusted to produce white D (x = 0,313, y = 0,329), focused raster, current density 0,4 μA/cm^2.

EQUIPMENT DESIGN VALUES (continued)

		white "D"		
To produce white of the following CIE co-ordinates:	x	0,265	0,281	0,313
	y	0,290	0,311	0,329
Percentage of total anode current supplied by each gun (typical)				
red gun		26,4	30,6	41,2
green gun		34,3	35,4	32,2
blue gun		39,3	34,0	26,6
Ratio of anode currents red gun to green gun	min.	0,60	0,65	0,95
	av.	0,75	0,85	1,30
	max.	1,00	1,15	1,70
Ratio of anode currents red gun to blue gun	min.	0,50	0,65	1,15
	av.	0,65	0,90	1,55
	max.	0,90	1,20	2,05

LIMITING VALUES (each gun if applicable), voltages with respect to g1
(design maximum rating system unless otherwise specified)

Final accelerator voltage	$V_{a, g5, g4}$	max.	27,5	kV [1)2)3)]
		min.	20	kV [1)4)]
Long term average current for three guns	I_a	max.	1000	µA [5)]
Grid no. 3 (focusing electrode) voltage	V_{g3}	max.	6	kV
Grid no. 2 voltage	V_{g2}	max.	1000	V
Cathode voltage, positive	V_k	max.	400	V
positive, operating cut-off	V_k	max.	200	V
negative	$-V_k$	max.	0	V
negative peak	$-V_{kp}$	max.	2	V
Cathode to heater voltage, positive	V_{kf}	max.	250	V [6)]
positive peak	V_{kfp}	max.	300	V [1)]
negative	$-V_{kf}$	max.	135	V
negative peak	$-V_{kfp}$	max.	180	V [1)]

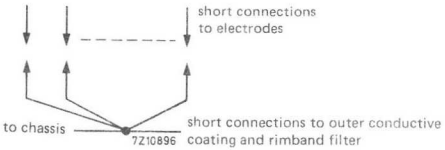
1) Absolute max. rating system.

2) 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.

Continued on page 9.

REMARKS

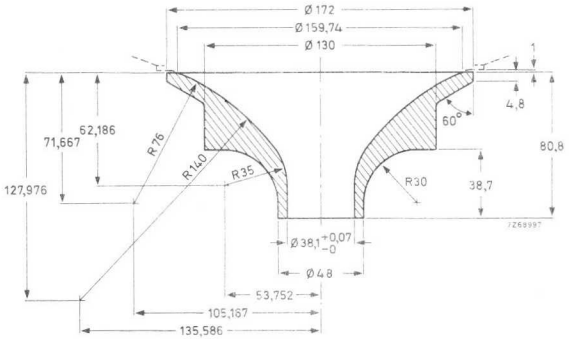
With the high voltage used with this tube (max. 27,5 kV) internal flash-overs may occur. These may destroy the cathode(s) of the tube. Therefore it is necessary to provide protective circuits, using spark gaps.
The spark gaps must be connected as follows:



No other connections between the outer conductive coating and the chassis are permissible. Additional information available on request.

During shipment and handling the tube should not be subjected to accelerations greater than 350 m/s^2 (35 g) in any direction.

CONTOUR GAUGE



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3) During adjustment on the production line this value is likely to be surpassed considerably. It is therefore strongly recommended to first make the necessary adjustments for normal operation without picture tube.

4) Operation of the tube at lower voltages impairs the luminance and resolution.

5) 1500 μA permitted provided a current limiting circuit is used.

6) During an equipment warm-up period not exceeding 15 s V_{kf} is allowed to rise to 385 V. Between 15 s and 45 s after switching on a decrease in V_{kf} proportional with time from 385 V to 250 V is permissible.

BEAM CORRECTIONS

When the tube is used with the deflection unit AT1080 the following corrections should be applied:

Maximum required horizontal displacement of the electron beams with respect to the phosphor stripes by the purifying magnet of the multi-pole unit AT1081 [1] — 45 μm

Static convergence deviations must be corrected by a static multi-pole unit AT1081 providing adjustable four-pole and six-pole fields centred around the tube axis

Maximum required compensation for static convergence

- 4-pole device: red to blue (in any direction) — 6 mm
- 6-pole device: red and blue to green (in any direction) — 3 mm

North-South raster shape correction circuitry is not required.

To obtain symmetrical shape for the horizontal lines at the upper part and the lower part of the screen, the unit AT1081 comprises an additional dipole correction magnet giving a displacement of the beam in the centre of the screen in vertical direction of maximum ± 5,5 mm

Maximum centring error in any direction after colour-purity, static convergence, and horizontal centre line correction 5 mm

With respect to dynamic convergence the display system, consisting of picture tube A66-500X and deflection unit AT1080, is inherently self-converging. However, a small systematic correction is required on the vertical axis and also small corrections should be made to compensate for tolerances and asymmetries in the tube and deflection unit combination (using a recommended circuit).

For this purpose two types of dynamic magnetic four-pole fields can be used. One is generated by additional windings on the yoke ring of the deflection unit, and energized by adjustable currents synchronized with scanning. The other type is generated by adjustable balancing currents through the deflection coils.

Compensation to be provided by these corrections:

- horizontal red-to-blue distance at the ends of the horizontal axis in opposite directions (line symmetry) [2] — 0 ± 2 mm
- horizontal red-to-blue distance at the top of the vertical axis (field symmetry top) [3] — 3,5 ± 1,5 mm
- horizontal red-to-blue distance at the bottom of the vertical axis (field symmetry bottom) [3] — 3,5 ± 1,5 mm
- vertical red-to-blue distance at the ends of the horizontal axis in opposite directions (line balance) [4] — 0 ± 1,5 mm
- vertical red to blue distance at the ends of the horizontal axis in equal directions (line balance parabola) [5] — 0 ± 0,7 mm
- vertical red-to-blue distance at the top of the vertical axis (field balance top) [6] — 0 ± 1,5 mm
- vertical red-to-blue distance at the bottom of the vertical axis (field balance bottom) [7] — 0 ± 1,5 mm

Notes see page 11.

Notes

1) Purity adjustment in vertical direction is not required.

2) This correction is made by feeding a sawtooth current of line frequency through the additional four-pole windings on the deflection unit.

3) This correction is made by feeding a rectified sawtooth current of field frequency through the additional four-pole windings on the deflection unit.

4) This correction is made by unbalancing the line deflection coil halves.

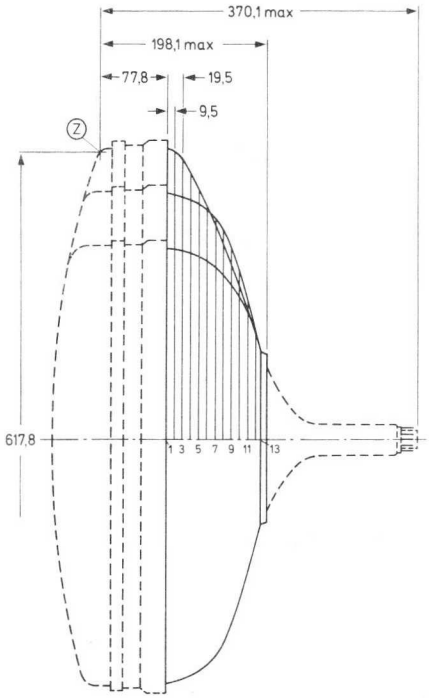
5) This correction is made by feeding a parabolic current of line frequency through the line deflection coil halves.

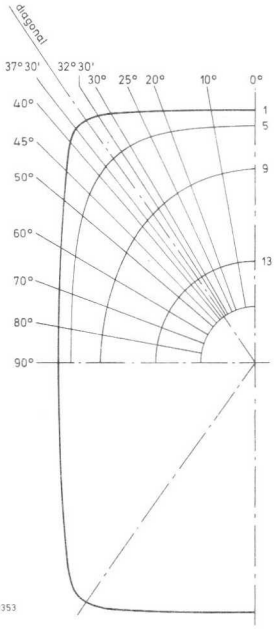
6) This correction is made by unbalancing the field deflection coil halves during the first half of the field scan.

7) This correction is made by unbalancing the field deflection coil halves during the second half of the field scan.

Application information available on request.

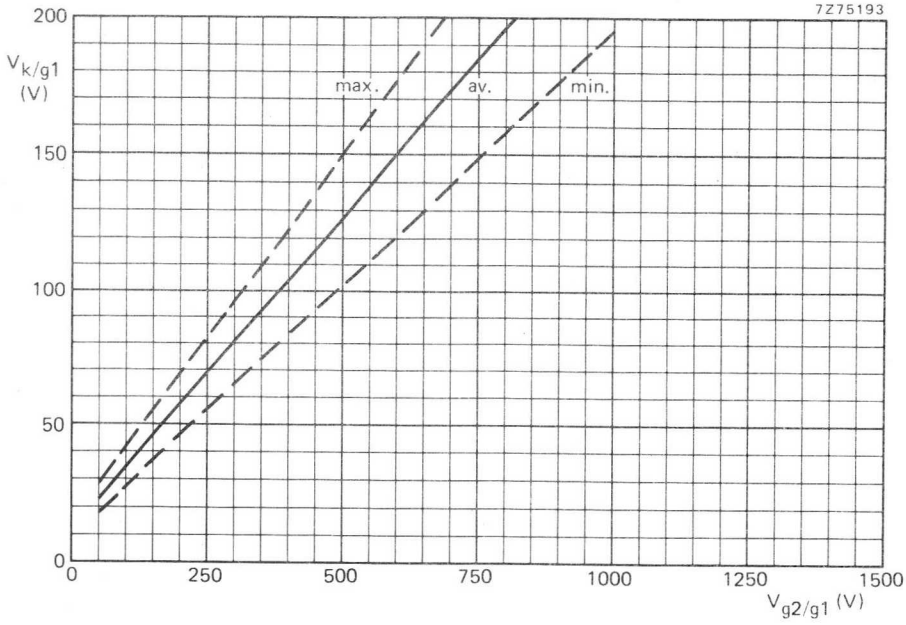
MAXIMUM CONE CONTOUR DRAWING



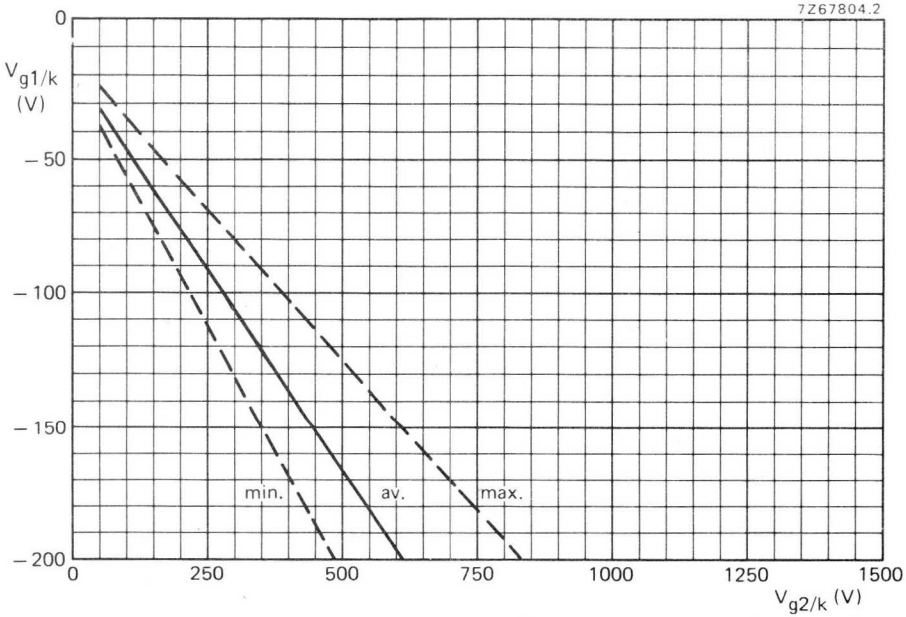


A66-500X

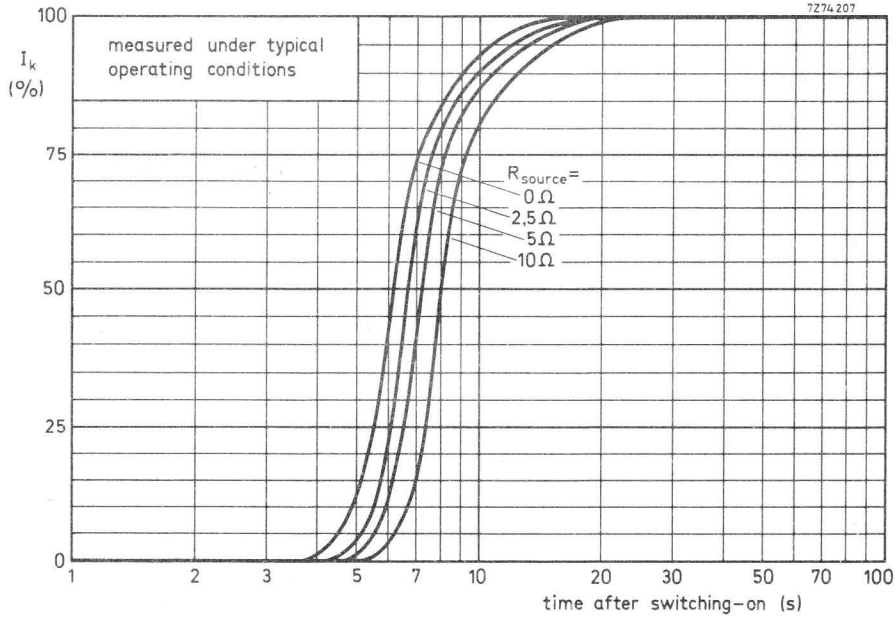
Section	Nominal distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	30°	32° 30'	diag.	37° 30'	40°	45°	50°	60°	70°	80°	90°
1	0	279,0	283,0	295,4	305,2	318,0	325,4	329,0	327,5	320,7	296,5	276,7	248,3	230,7	221,1	218,0
2	9,5	276,4	280,3	292,5	302,0	313,8	320,4	323,1	321,3	314,8	292,5	273,5	245,6	228,1	218,5	215,5
3	19,5	273,4	277,1	288,2	296,2	304,8	308,7	309,2	307,0	301,9	285,1	268,8	242,5	225,3	215,8	212,8
4	29,5	268,8	272,1	281,5	287,4	292,7	294,3	293,4	291,3	287,1	274,6	261,1	237,5	221,3	212,1	209,1
5	39,5	262,3	265,1	272,0	275,7	277,9	278,0	276,4	274,4	270,9	261,4	250,5	230,4	215,7	207,2	204,3
6	49,5	254,0	255,9	260,0	261,4	261,2	260,2	258,1	256,2	253,2	245,8	237,4	221,1	208,5	201,0	198,4
7	59,5	243,5	244,5	245,3	244,6	242,7	241,2	238,8	237,0	234,4	228,5	222,1	209,6	199,7	193,4	191,3
8	69,5	230,1	229,8	227,8	225,7	222,8	221,0	218,6	217,0	214,8	210,1	205,3	196,2	188,9	184,3	184,6
9	79,5	213,3	211,9	207,8	204,9	201,7	199,9	197,7	196,3	194,5	190,9	187,4	181,2	176,4	173,4	172,4
10	89,5	194,0	191,4	185,6	182,3	178,9	177,3	175,4	174,2	172,8	170,1	167,8	164,3	162,1	161,1	161,0
11	99,5	172,8	168,1	161,4	158,0	154,9	153,5	152,0	151,1	150,0	148,2	146,9	145,7	146,0	147,3	148,2
12	109,5	142,1	139,1	133,9	131,5	129,4	128,4	127,5	126,9	126,3	125,4	124,9	125,2	126,9	129,5	131,1
13	119,5	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0



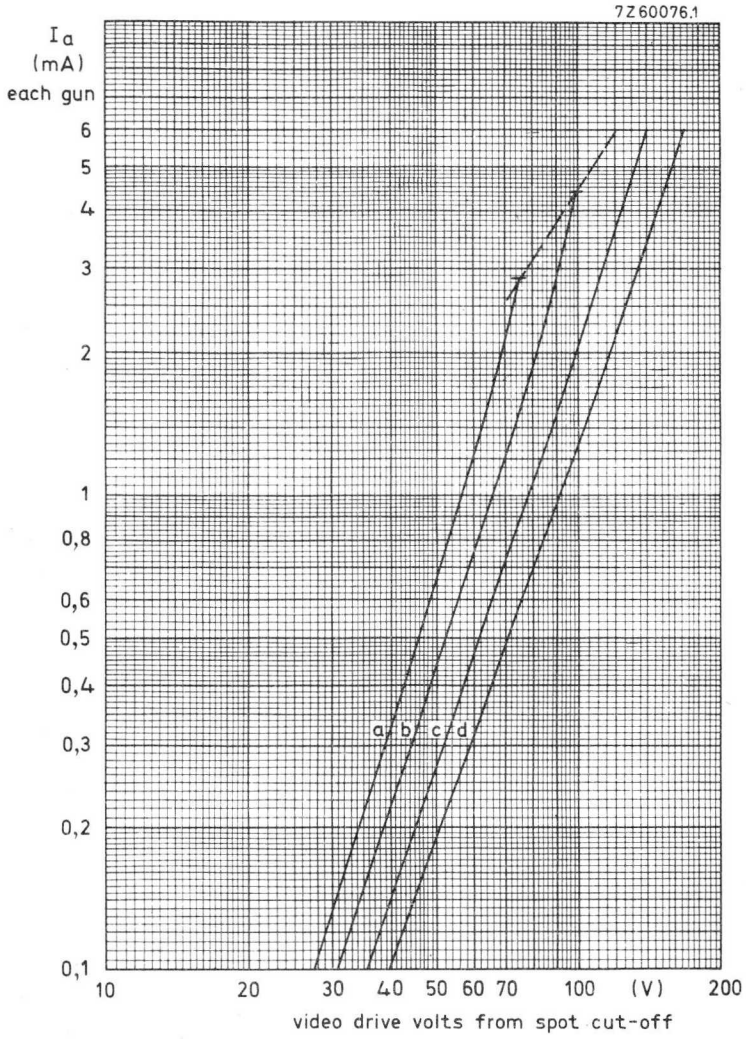
Spot cut-off design chart (cathode drive), V_{g3} adjusted for focus, V_a, g5, g4 = 20 to 27,5 kV



Spot cut-off design chart (grid drive), V_{g3} adjusted for focus, V_a, g5, g4 = 20 to 27,5 kV



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

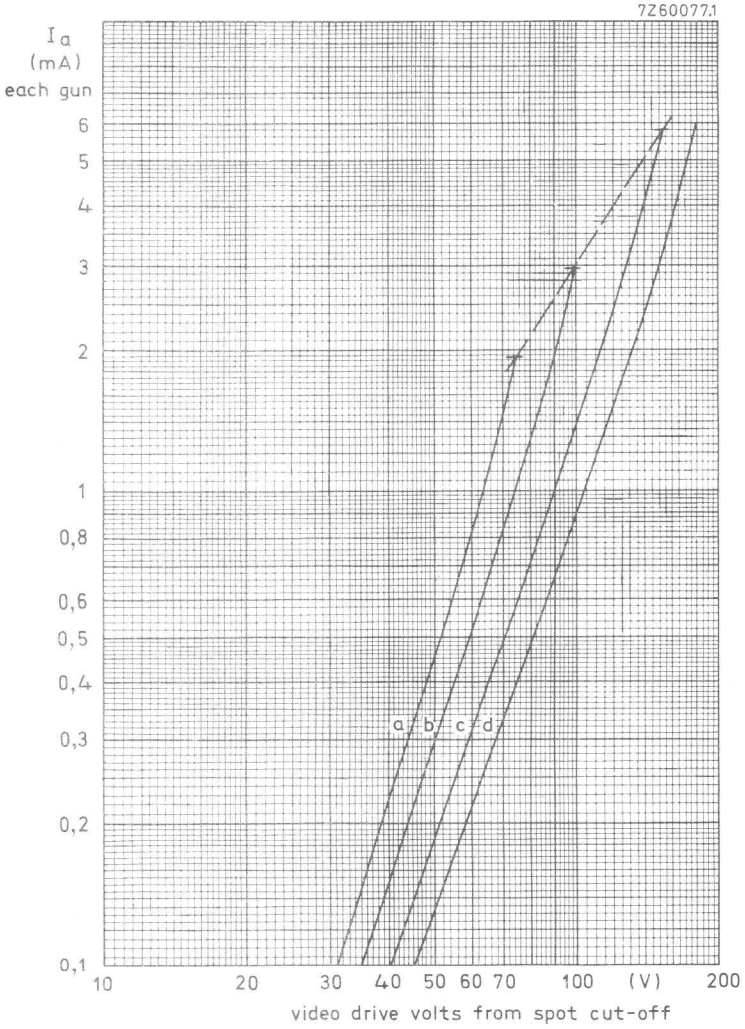


Typical cathode drive characteristics

V_a, g5, g4 = 20 kV to 27,5 kV
V_{g3} adjusted for focus
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_k

---- zero bias point

a = spot cut-off = 75 V
b = spot cut-off = 100 V
c = spot cut-off = 150 V
d = spot cut-off = 200 V



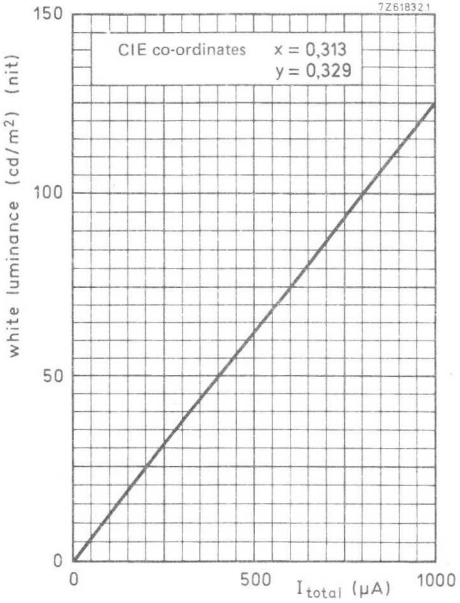
Typical grid drive characteristics

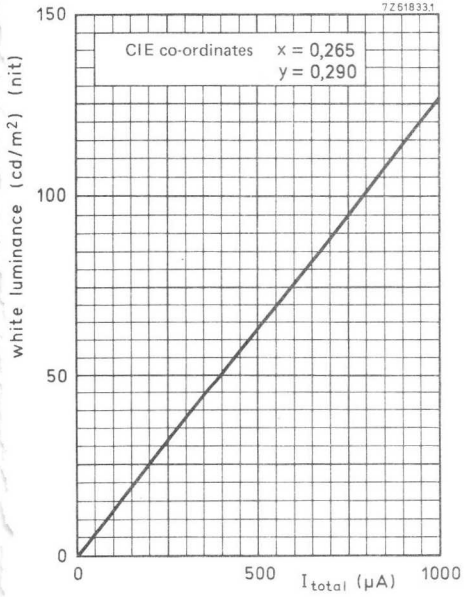
V_a, g5, g4 = 20 kV to 27,5 kV
V_{g3} adjusted for focus
V_{g2} (each gun) adjusted to provide spot cut-off for desired fixed V_{g1}

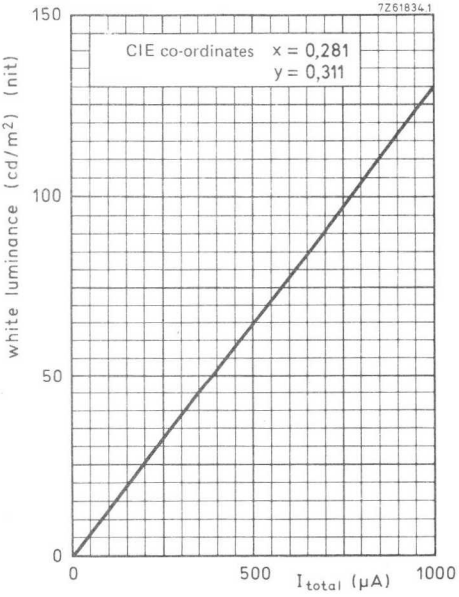
---- zero bias point

a = spot cut-off = −75 V
b = spot cut-off = −100 V
c = spot cut-off = −150 V
d = spot cut-off = −200 V

Luminance in the centre of the screen as a function of I_{total}. Scanned area 518 mm x 390 mm.







Black and 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	deg
Overall length	max.	227	mm
Neck diameter		20	mm
Heating		11 V, 140	mA
Grid no. 2 voltage		130	V
Final accelerator voltage		10	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		53	%
Useful diagonal	min.	228,6	mm
Useful width	min.	198,4	mm
Useful height	min.	149,2	mm

HEATING

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

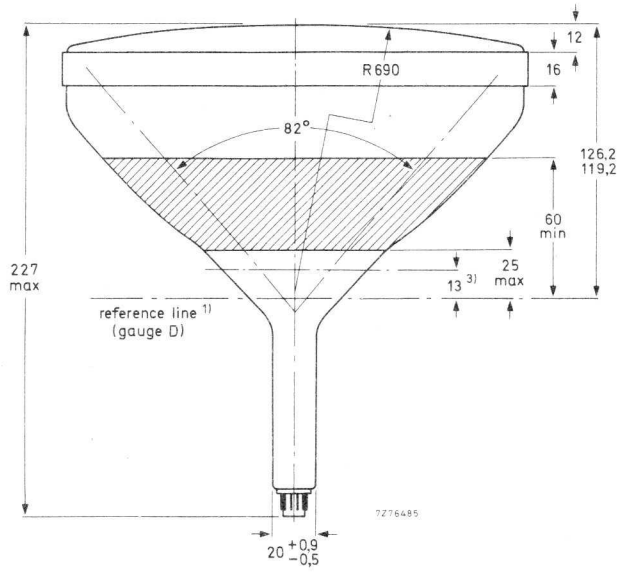
Heater voltage	V_f	11	V
Heater current	I_f	140	mA
Limits (Absolute max. rating system) of r.m.s. heater voltage	V_f max.	12,7	V [1]
	V_f min.	9,3	V

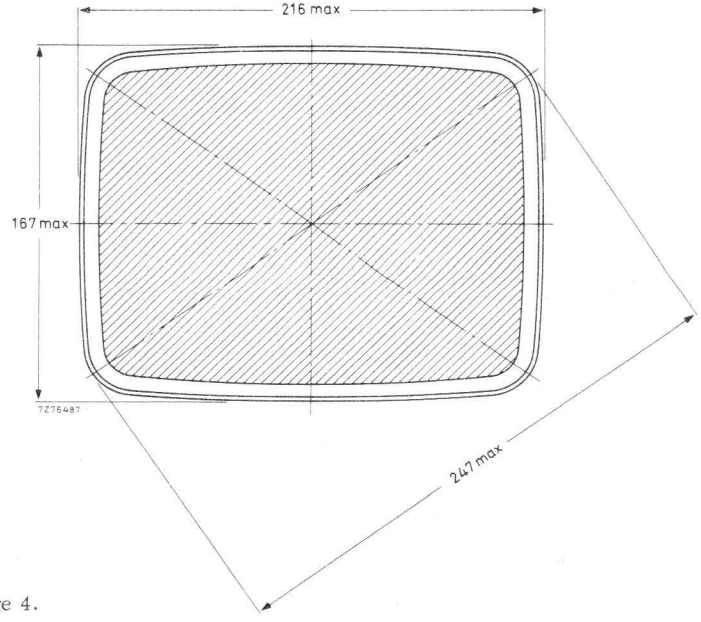
For heating time as a function of source impedance see page 10.

[1] Measured during any 20 ms.

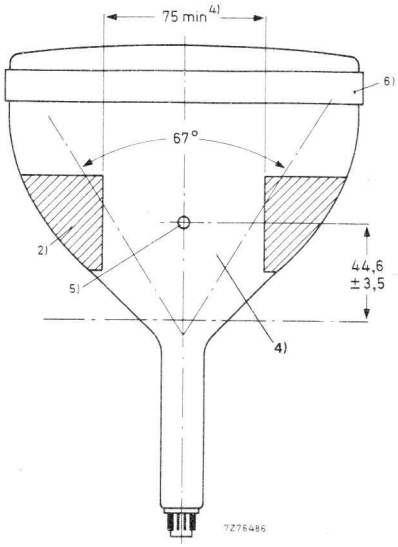
MECHANICAL DATA

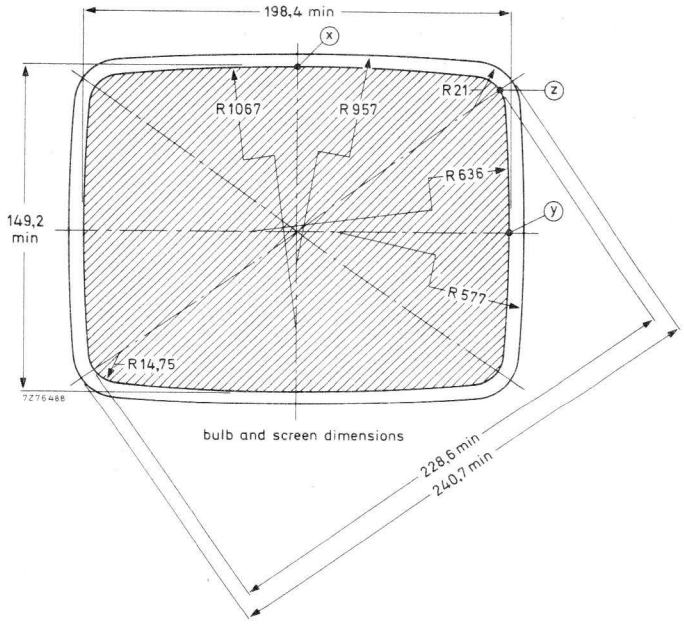
Dimensions in mm

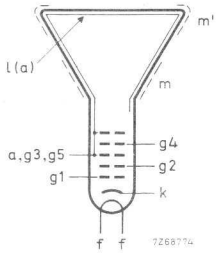


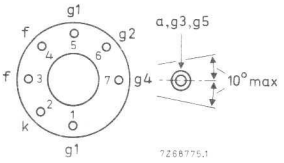


Notes see page 4.


75 min 4)
6)
67°
2)
5)
44,6
±3,5
4)
7Z76486


198,4 min
X
R1067
R957
R21
Z
R636
149,2
min
Y
R577
R14,75
7Z76488
bulb and screen dimensions
228,6 min
240,7 min





Mounting position : any

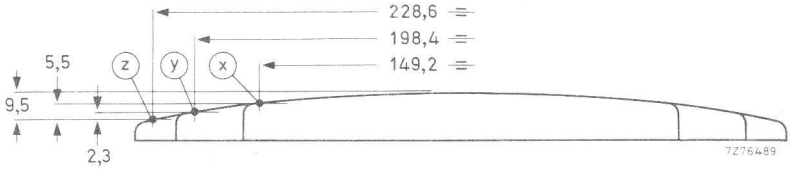
Net mass : approx. 1,8 kg

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.

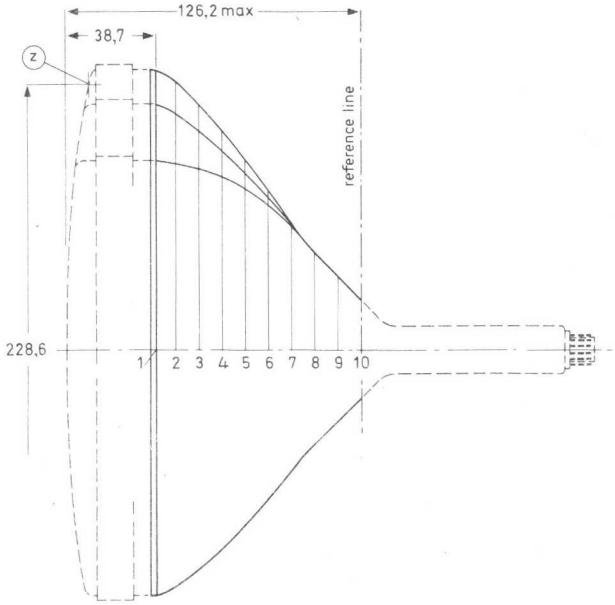
NOTES TO OUTLINE DRAWINGS

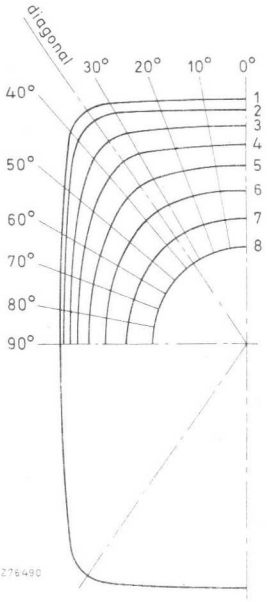
1. The reference line is determined by the plane of the upper edge of the flange of the reference line gauge when the gauge is resting on the cone (Gauge D).
2. The configuration of the external conductive coating may be different, but covers the contact area shown in the drawing.
   The external conductive 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.
6. The rimband must be earthed.



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°
10	87,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5	20,5
9	77,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5	30,5
8	67,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5
7	57,5	52,8	52,9	53,1	53,5	53,6	53,4	53,0	52,5	52,1	51,9	52,0
6	47,5	64,8	65,2	66,4	67,8	67,9	67,7	66,2	64,0	62,4	61,5	61,2
5	37,5	75,5	76,2	78,1	80,8	81,2	80,7	77,4	73,2	70,3	68,6	68,1
4	27,5	85,0	86,0	88,8	93,6	93,6	92,7	86,6	80,4	76,3	73,9	73,2
3	17,5	93,6	94,7	98,1	104,1	105,3	103,7	93,7	85,8	80,6	77,7	76,9
2	7,5	101,3	102,7	106,9	114,4	116,3	113,8	99,7	89,9	83,6	80,3	79,3
1	0	104,7	106,2	110,3	117,9	120,0	117,2	102,0	91,4	84,8	81,2	80,3

CAPACITANCES

Final accelerator to external conductive coating	$C_{a, g3, g5/m}$	<	750	pF
		>	300	pF
Final accelerator to metal band	$C_{a, g3, g5/m'}$		100	pF
Cathode to all	C_k		3	pF
Grid no. 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 (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 no. 1

Final accelerator voltage	$V_{a, g3, g5}$		10	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}	30 to	50	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 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. min.	14 8	kV [1] 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	[2]
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

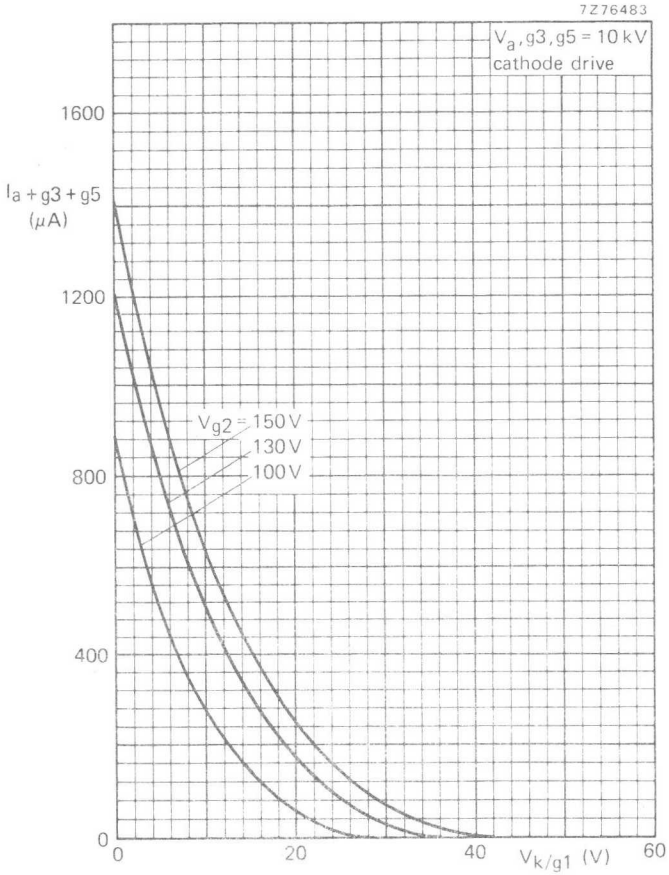
Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

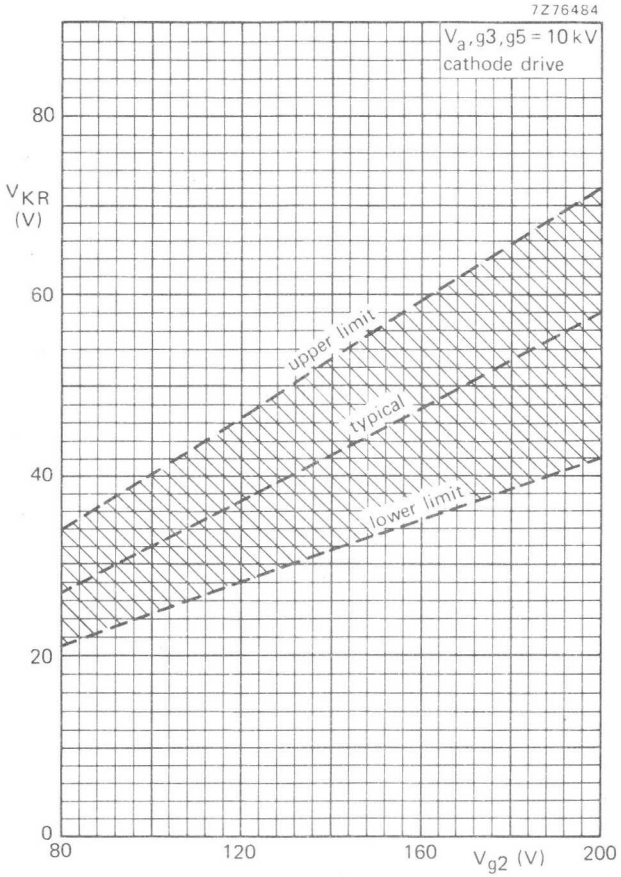
Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$(50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1}(50 Hz)	max.	0,5	MΩ

1) 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.

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

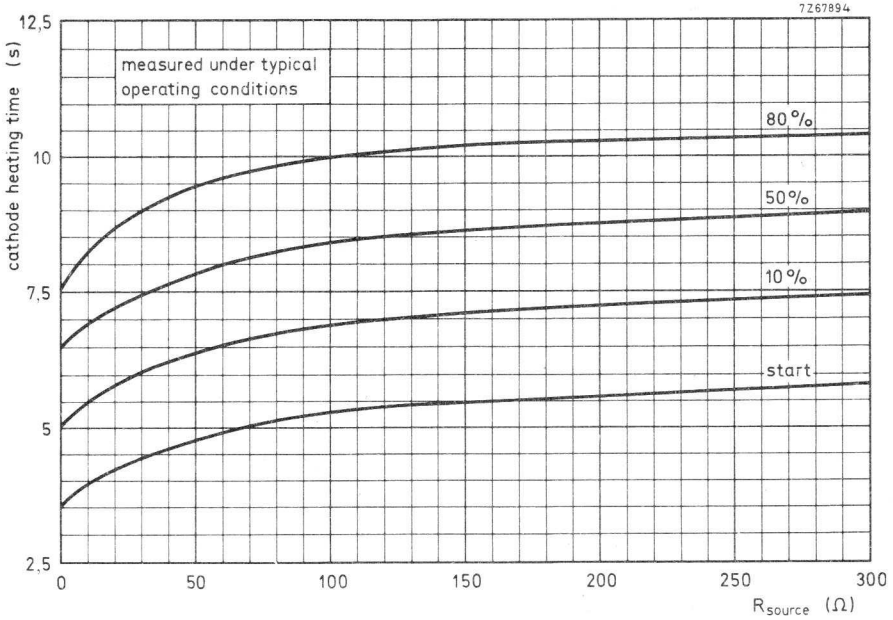


Final accelerator current as a function of cathode voltage.



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

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

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 to 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	≈	50	%
Useful diagonal	≥	295	mm
Useful width	≥	257	mm
Useful height	≥	195	mm

HEATING

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

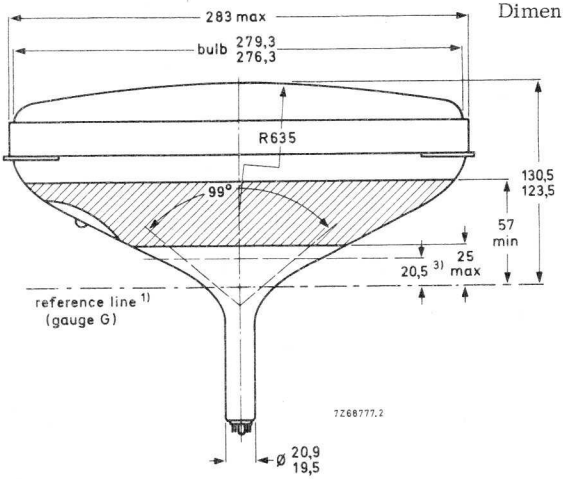
Heater voltage	V_f		11	V
Heater current	I_f		140	mA
Limits (Absolute max. rating system) of r.m.s. heater voltage, measured in any 20 ms	V_f	max.	12,7	V *)
		min.	9,3	V

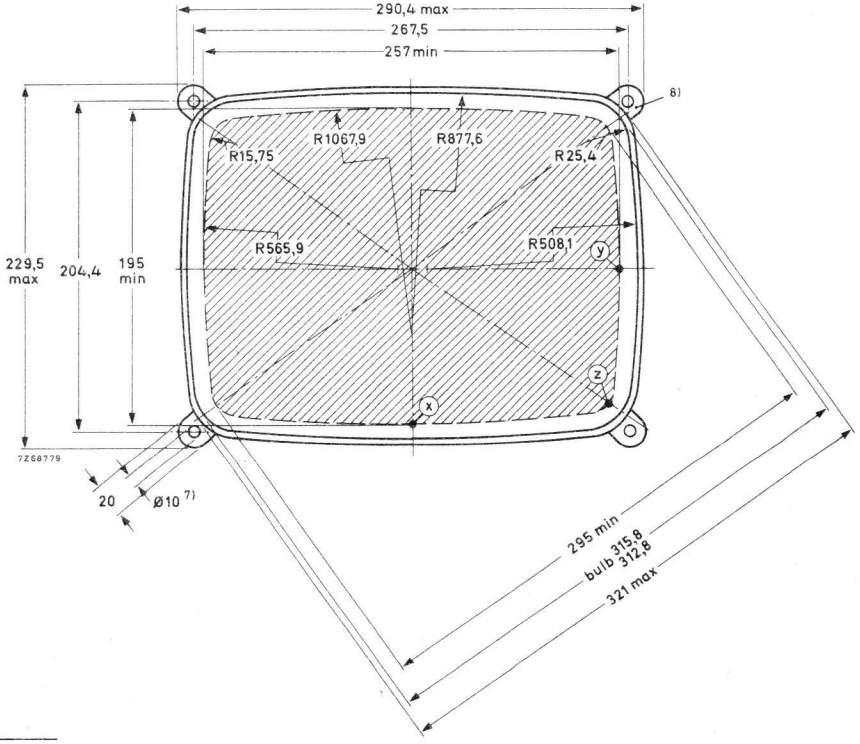
For heating time as a function of source impedance see page 11.

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

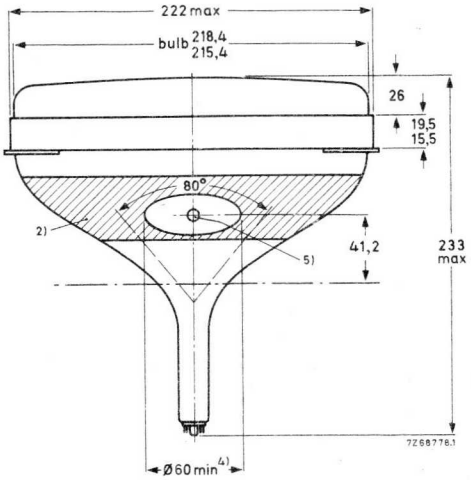
MECHANICAL DATA

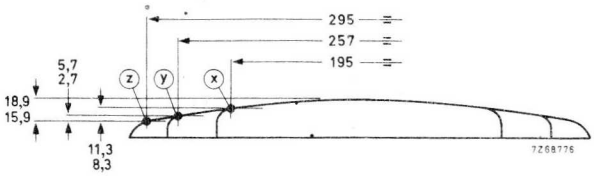
Dimensions in mm





Notes see page 4.


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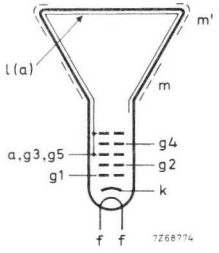
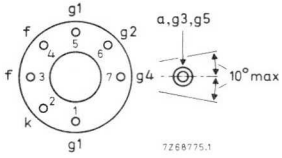
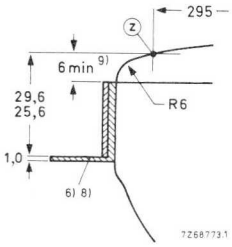






Mounting position : any

Net mass : approx. 2, 8 kg.

Base : JEDEC E7-91

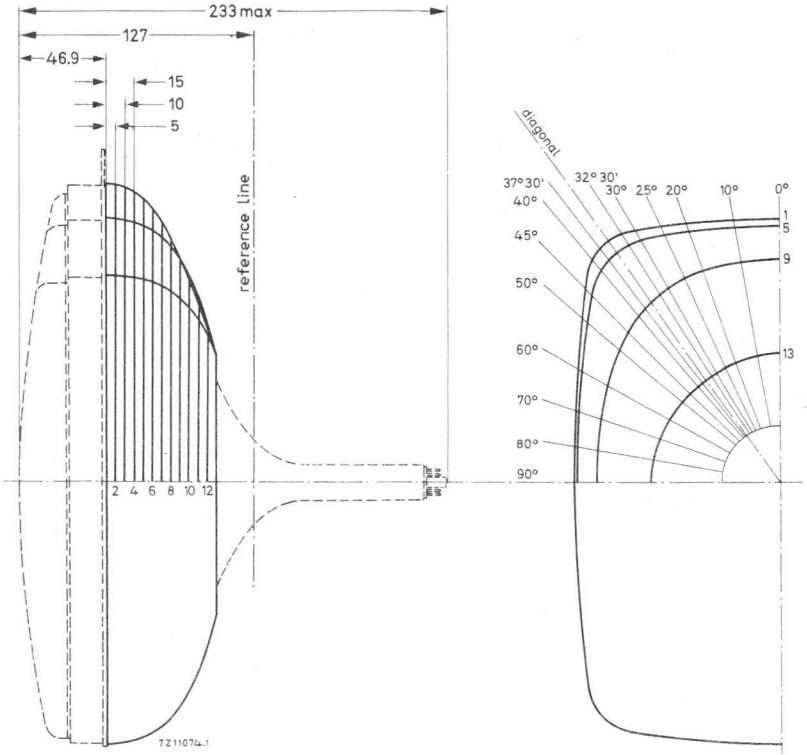
The socket for the base should not be rigidly mounted, it should have flexible leads and be allowed to move freely.

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°30'	diag.	37°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	95,3	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°
Horizontal deflection angle	99°
Vertical deflection angle	80°

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 to 15	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 to 15	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.	9	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

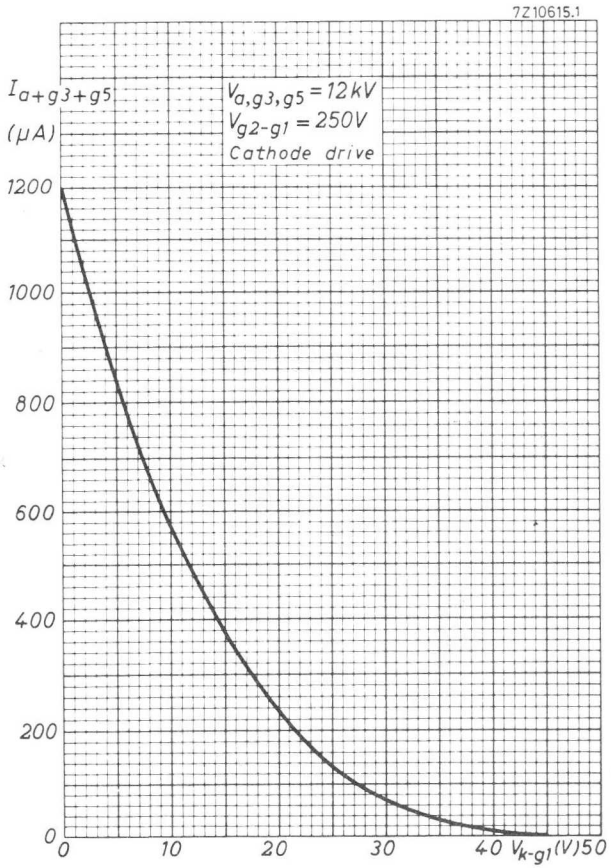
Grid No. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid No. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

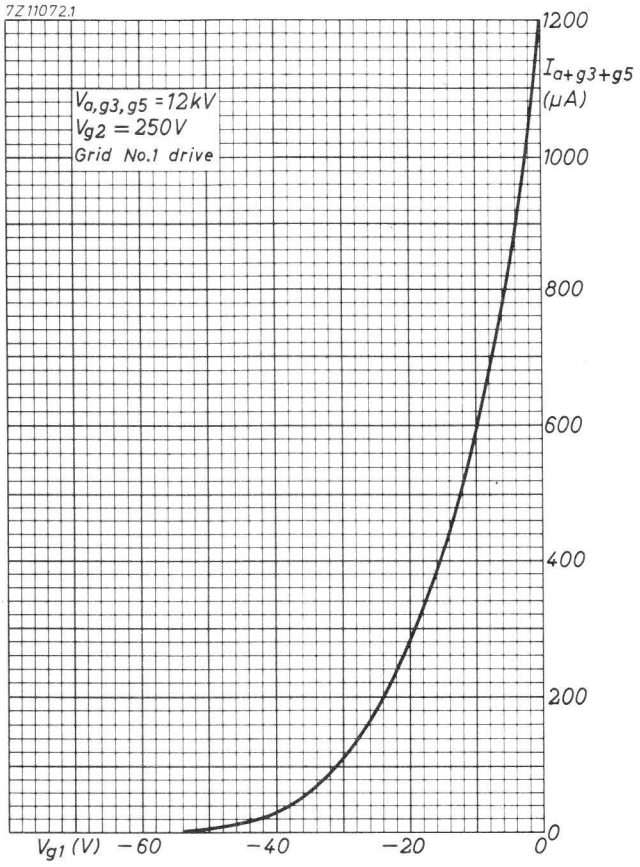
Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1	MΩ
Grid No. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid No. 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5	MΩ

*) 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.

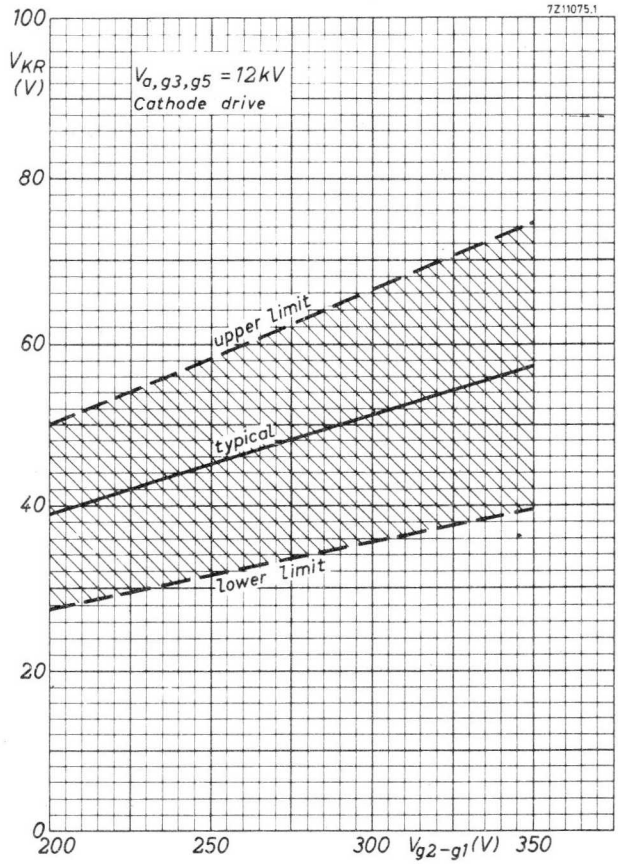
**) Maximum pulse duration 22% of a cycle but max. 1,5 ms.



Final accelerator voltage as a function of cathode voltage

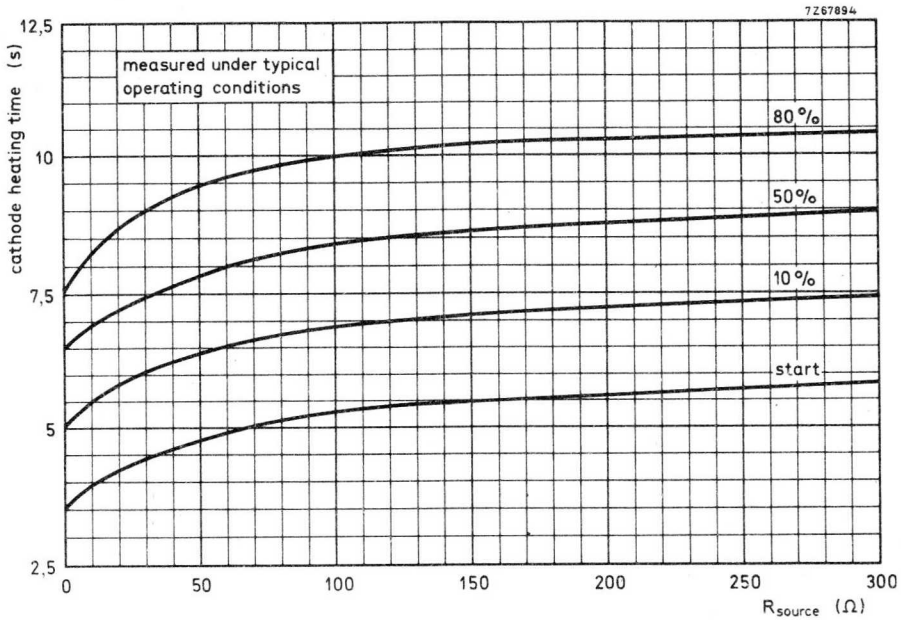


Final accelerator voltage as a function of grid no. 1 voltage



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

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 to 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		≈ 50	%
Useful diagonal		≥ 295	mm
Useful width		≥ 257	mm
Useful height		≥ 195	mm

HEATING

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

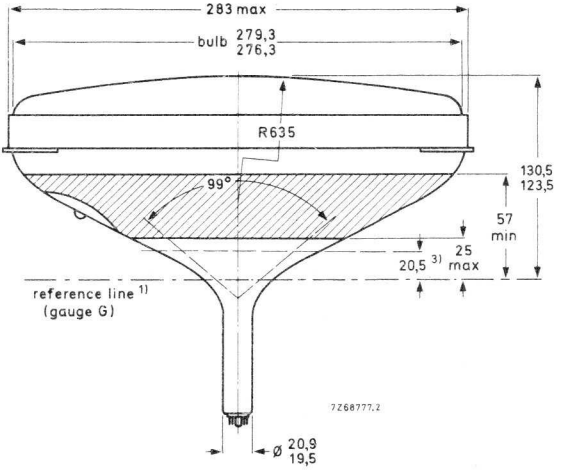
Heater voltage		V_f 11	V
Heater current		I_f 140	mA
Limits (Absolute max. rating system) of r.m.s. heater voltage	V_f	max. 12,7	V *)
		min. 9,3	V

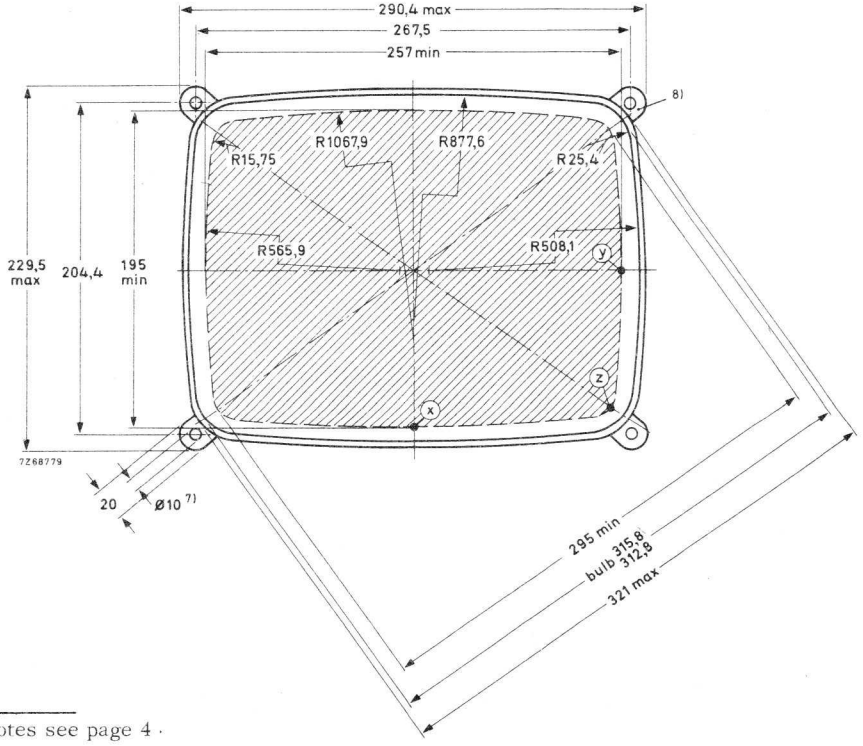
For heating time as a function of source impedance see page 10.

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

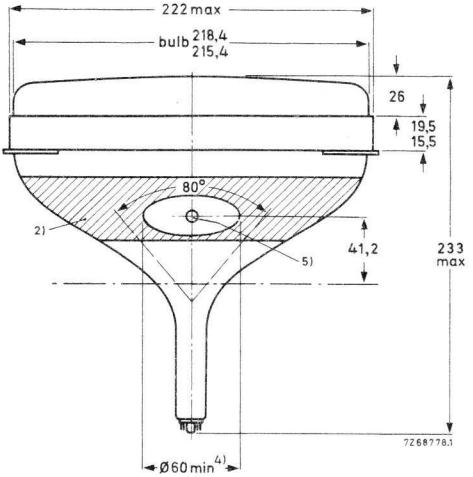
MECHANICAL DATA

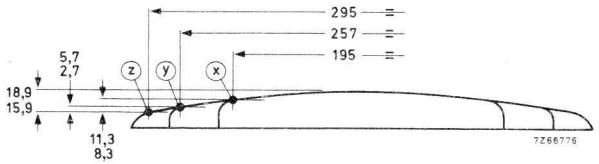
Dimensions in mm





Notes see page 4.


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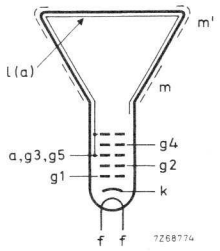
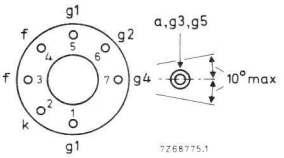
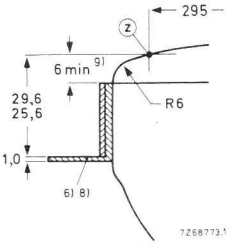






Mounting position : any

Net mass : approx. 2,8 kg

Base : JEDEC E7-91

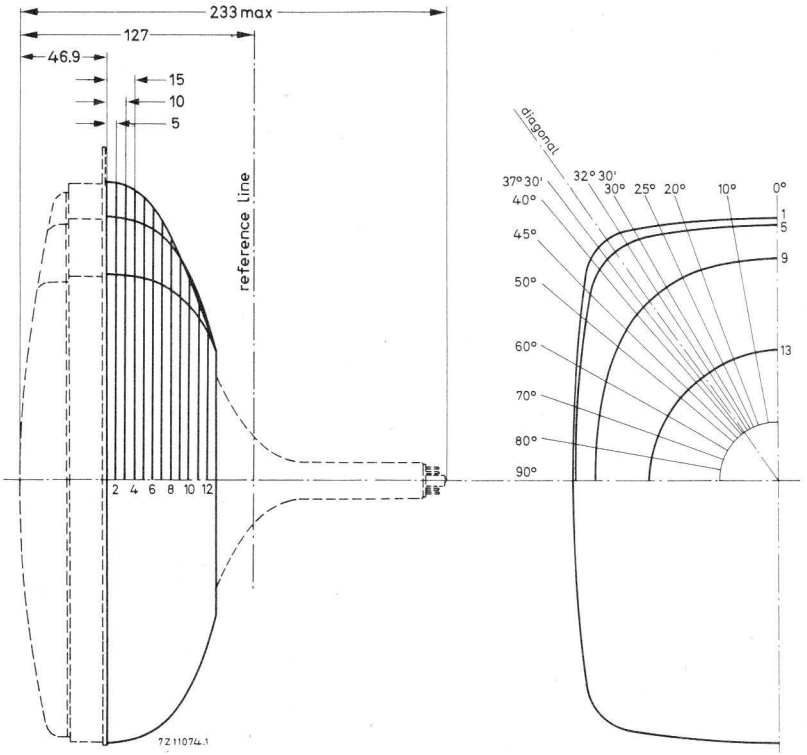
The socket for this base should not be mounted rigidly, it should have flexible leads and be allowed to move freely.

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



Section	Nom. distance from section 1	Distance from centre (max. values)														
		0°	10°	20°	25°	38°	32°30'	diag.	37°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°
Horizontal deflection angle	99°
Vertical deflection angle	80°

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 to 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 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.	9	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

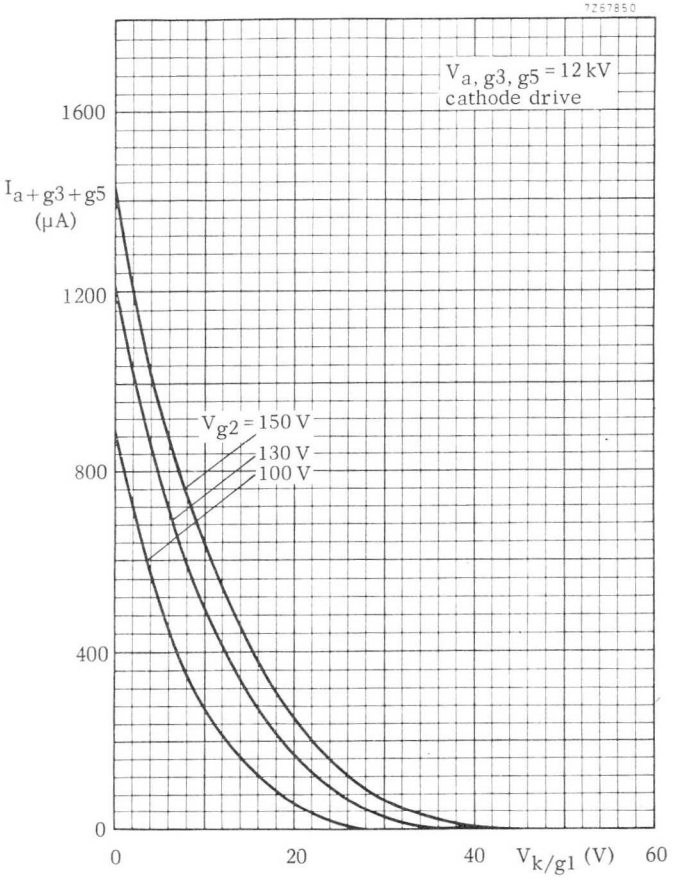
Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

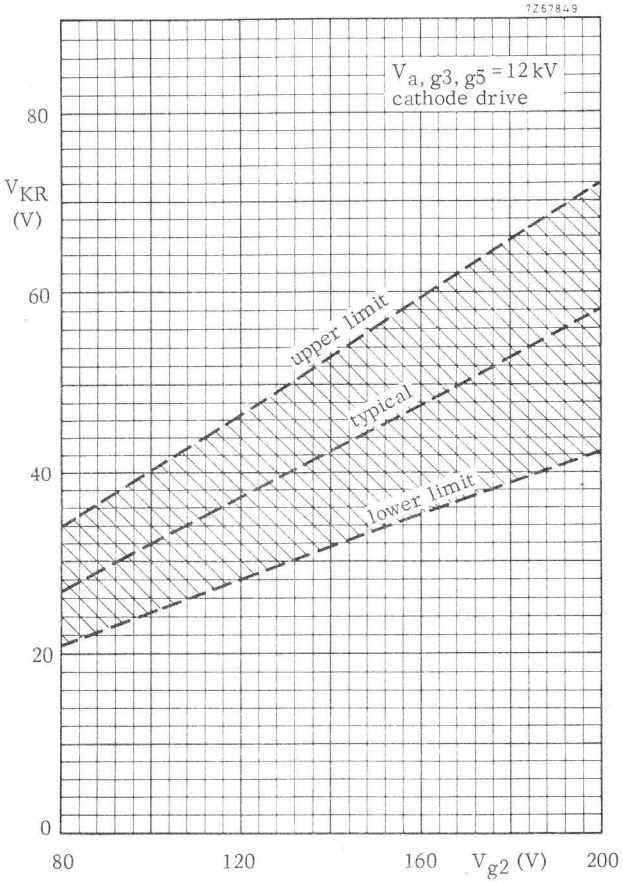
Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{k/f}$(50Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1}(50Hz)	max.	0,5	MΩ

*) 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.

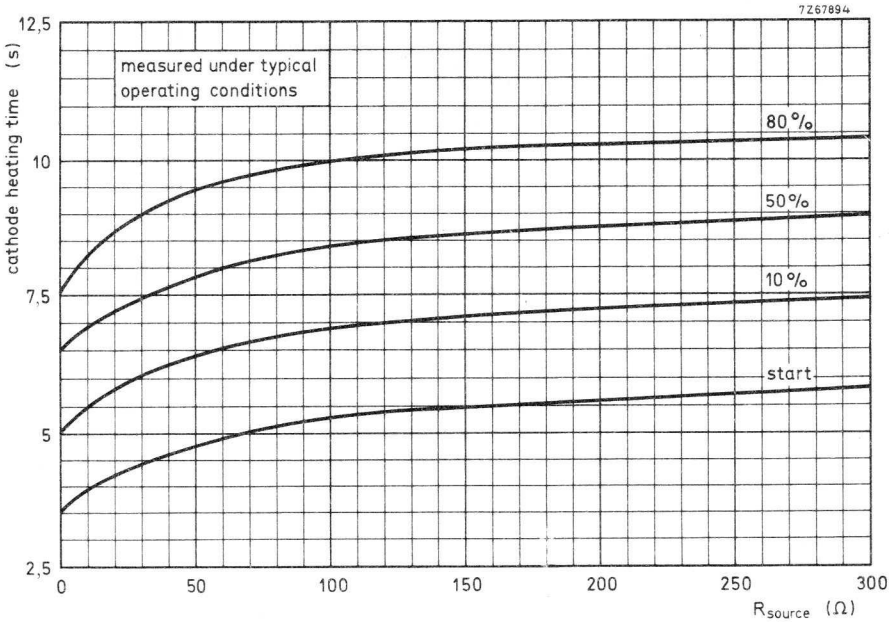


Final accelerator current as a function of cathode voltage



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

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), 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 to 15	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.

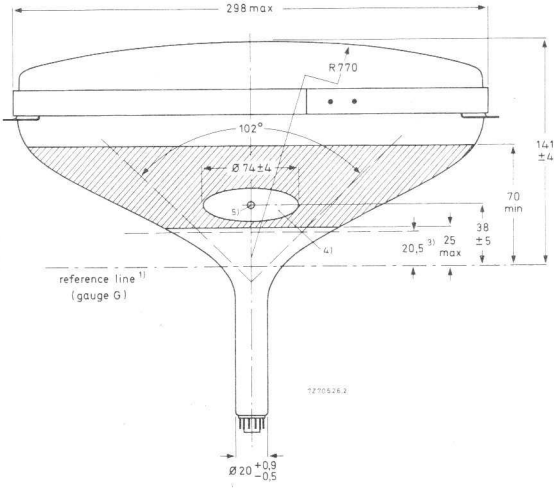
Heater voltage	V_f		11	V	
Heater current	I_f		140	mA	
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max.	12,7	V	*)
		min.	9,3	V	

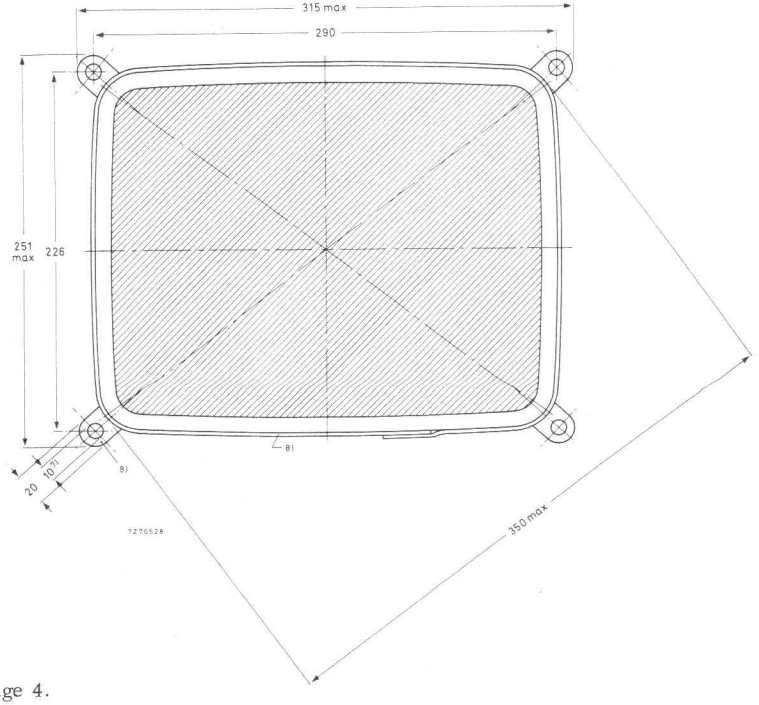
For heating time as a function of source impedance see page 10.

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

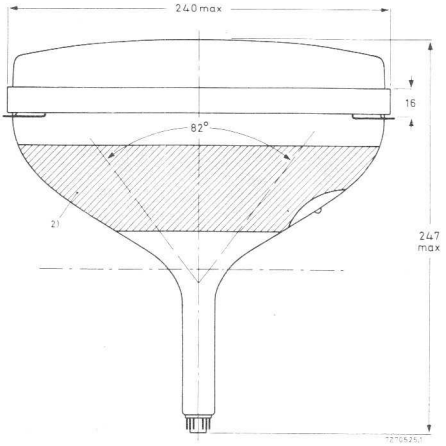
MECHANICAL DATA

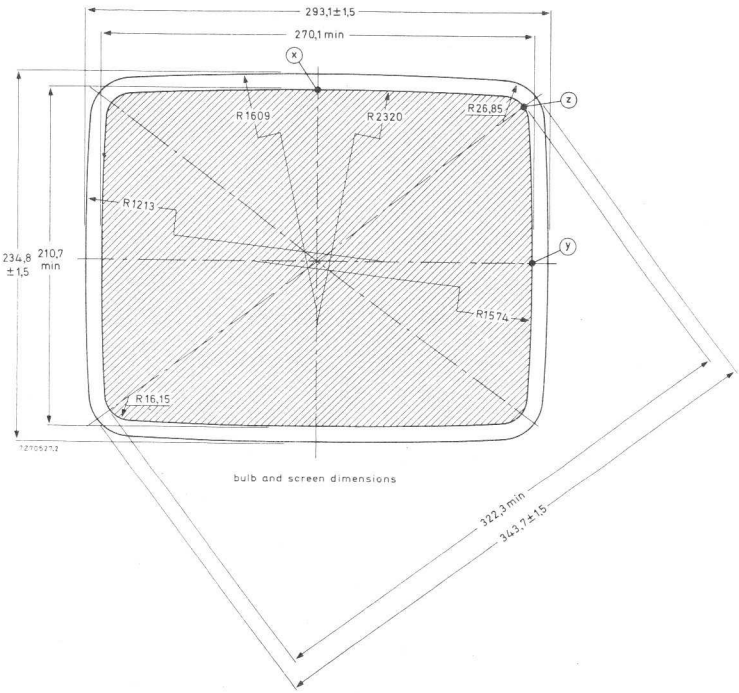
Dimensions in mm



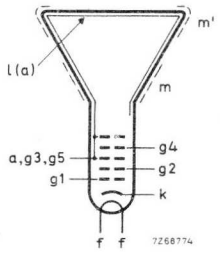


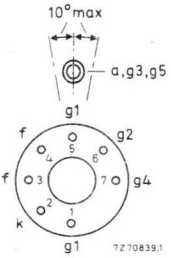
Notes see page 4.

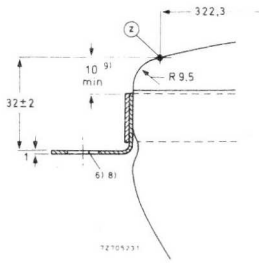


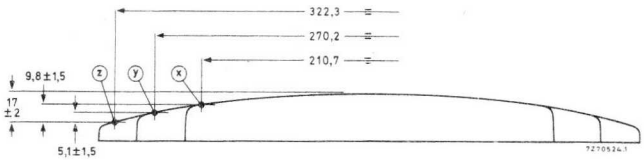


bulb and screen dimensions









Mounting position : any

Netmass : approx. 3,2 kg

Base : JEDEC E7-91

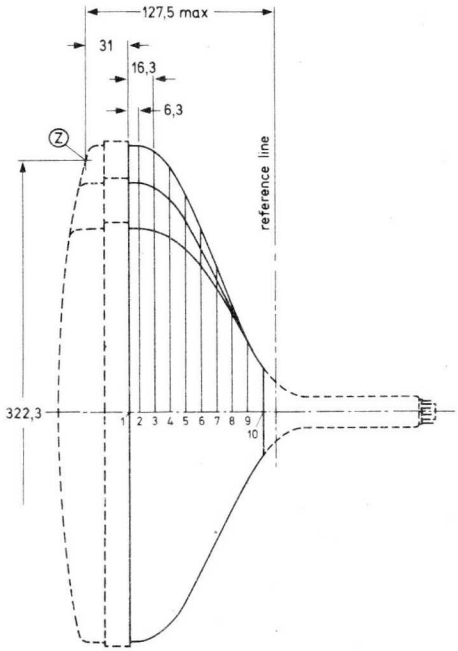
The socket for this base should not be mounted rigidly it should have flexible leads and be allowed to move freely.

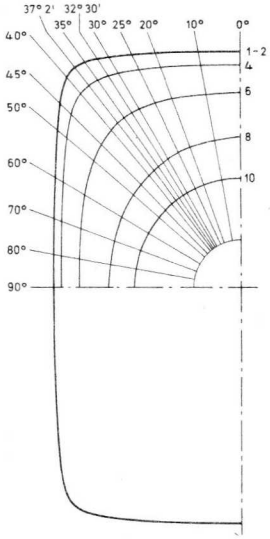
NOTES TO OUTLINE DRAWINGS

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°	10°	20°	25°	30°	32°30'	35°	37°2'	40°	45°	50°	60°	70°	80°	90°
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 to 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. min.	17 9	kV*) 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

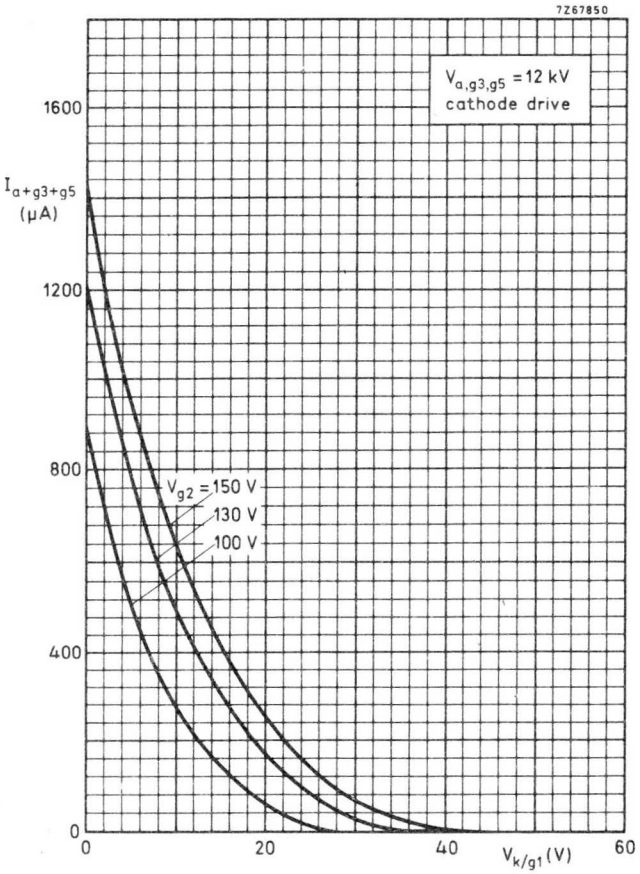
Grid no. 4 current				
positive	I_{g4}	max.	25	µA
negative	$-I_{g4}$	max.	25	µA
Grid no. 2 current				
positive	I_{g2}	max.	5	µA
negative	$-I_{g2}$	max.	5	µA

MAXIMUM CIRCUIT VALUES

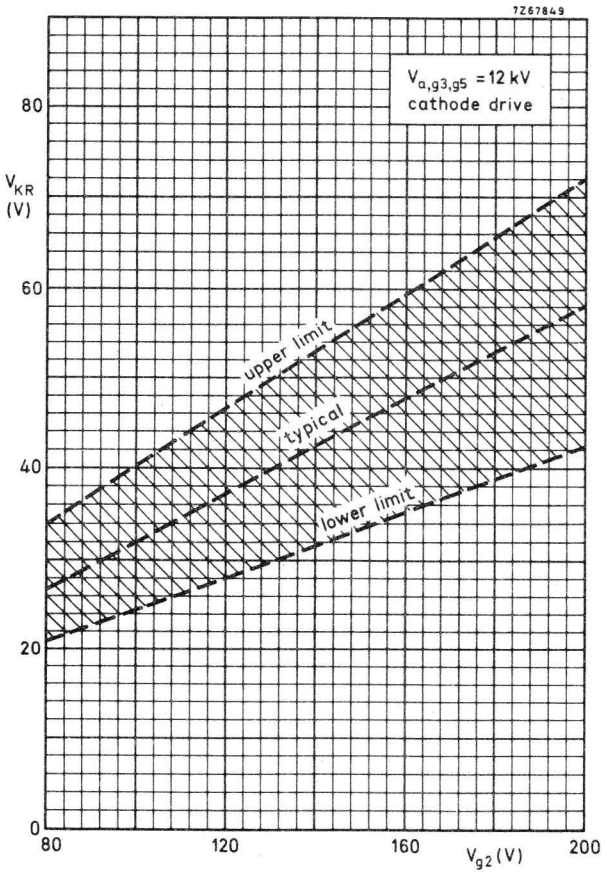
Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{f/k}$(50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1}(50 Hz)	max.	0,5	MΩ

*) 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.

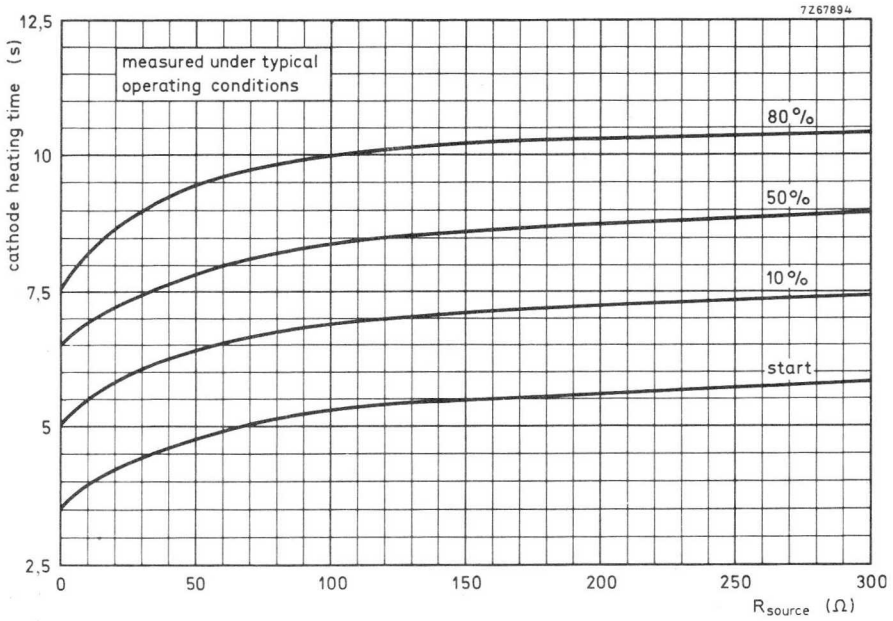


Final accelerator current as a function of cathode voltage.



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

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.

QUICK REFERENCE DATA	
Face diagonal	44 cm
Deflection angle	110°
Overall length	284,5 mm
Neck diameter	28,6 mm
Heating	6,3 V, 300 mA
Grid no. 2 voltage	400 V
Final accelerator voltage	20 kV

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

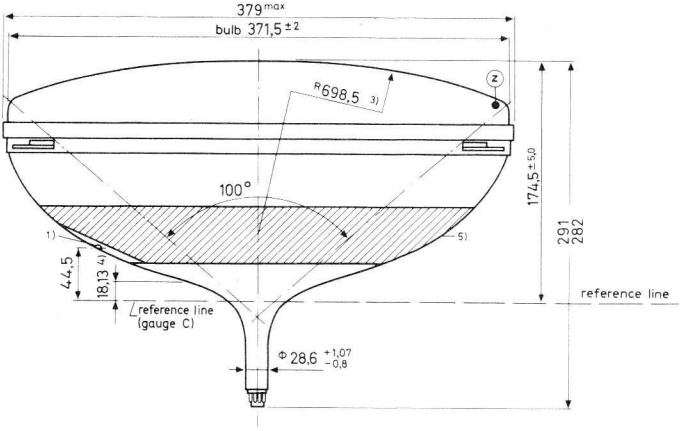
Indirect by a.c. or d.c.; series or parallel supply

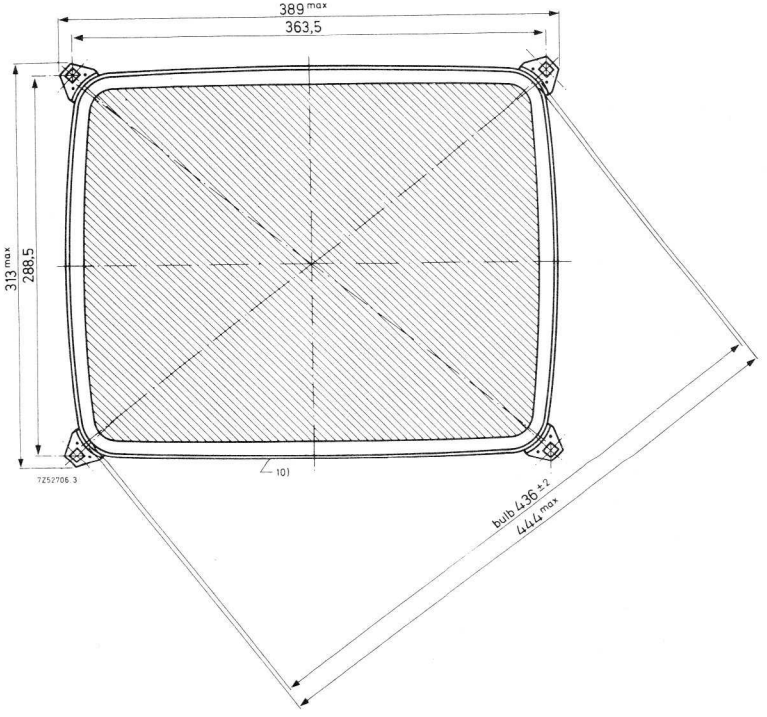
Heater current	I_f	300 mA
Heater voltage	V_f	6,3 V

If the tube is connected in a series heater chain the surge heater voltage must not exceed an r.m.s. value of 9,5 V when the supply is switched on.

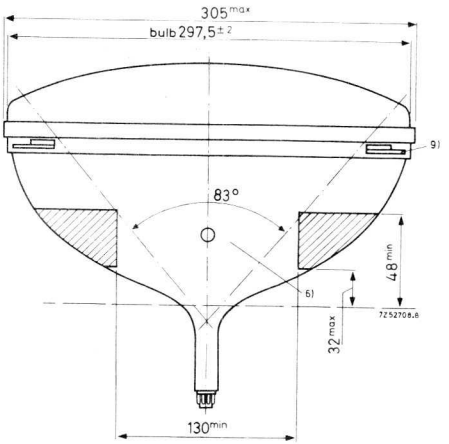
MECHANICAL DATA

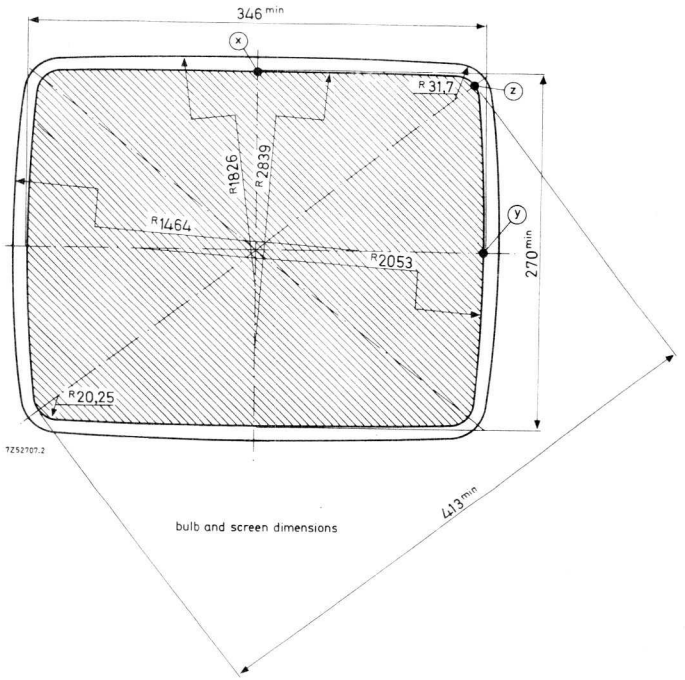
Dimensions in mm





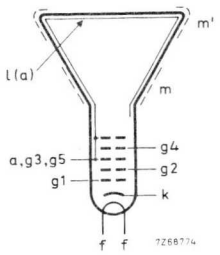
Notes see page 5.

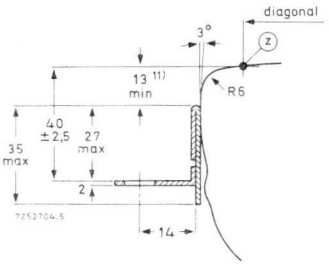


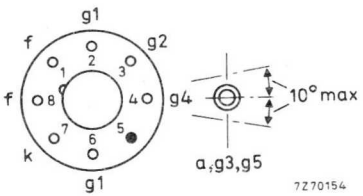


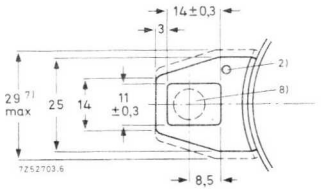
bulb and screen dimensions

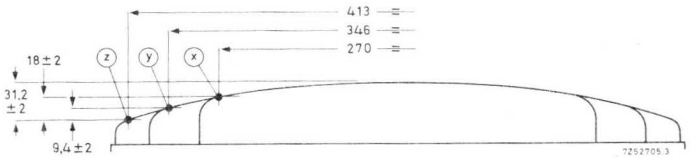
Dimensions in mm











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.

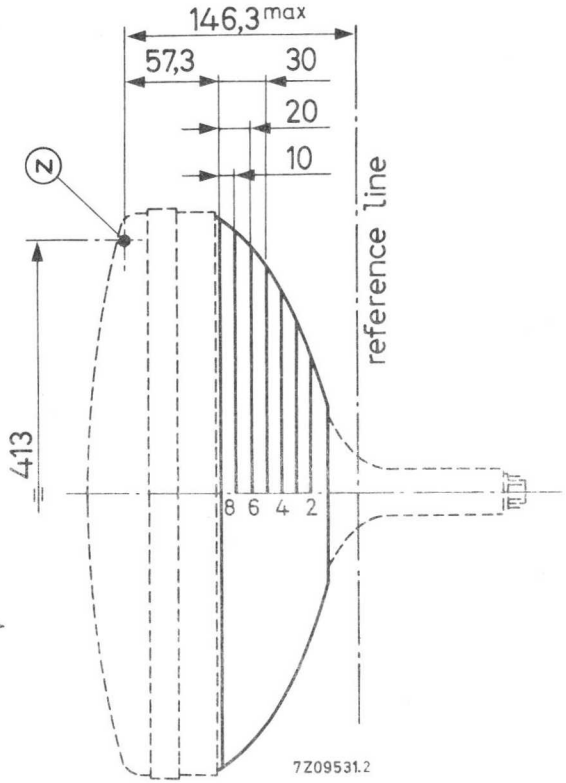
Notes see page 5

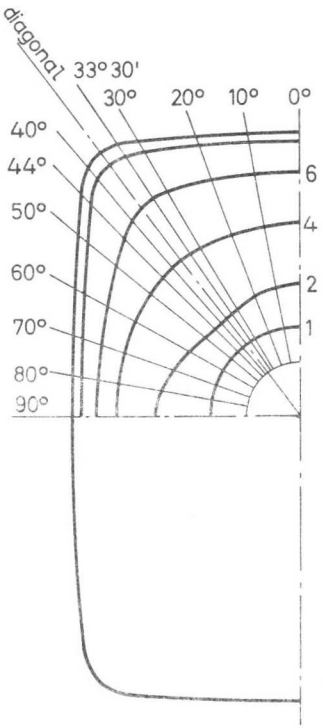
NOTES TO OUTLINE DRAWINGS

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





Section	Nom. distance from point "Z"	Distance from centre (max. values)												
		0° Long	10°	20°	30°	33°30'	36°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		5	pF
Grid no. 1 to all	C_{g1}		7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal deflection angle	110°
Horizontal deflection angle	100°
Vertical deflection angle	83°

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

Grid drive service

Final accelerator voltage	$V_{a,g3,g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 400	V [1]
Grid no. 2 voltage	V_{g2}	400	V
Grid no. 1 voltage for visual extinction of focused raster	V_{GR}	−40 to −77	V

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 400	V [1]
Grid no. 2 voltage	V_{g2}	400	V
Cathode voltage for visual extinction of focused raster	V_{KR}	36 to 66	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 at $I_{a,g3,g5} = 0$	$V_{a,g3,g5}$	max. min.	23 12	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.	700 350	V***) V
Grid no. 2 to grid no. 1 voltage	$V_{g2/g1}$	max.	850	V
Grid no. 1 voltage				
positive	V_{g1}	max.	0	V
positive peak	V_{g1p}	max.	2	V
negative	$-V_{g1}$	max.	200	V
negative peak	$-V_{g1p}$	max.	400	V**)
Cathode to heater voltage,				
positive	$V_{k/f}$	max.	250	V
positive peak	$V_{k/fp}$	max.	300	V
negative	$-V_{k/f}$	max.	200	V
positive during equipment warm-up period not exceeding 15 s	$V_{k/f}$	max.	450	V****)

*) 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 maximum 1,5 ms.

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

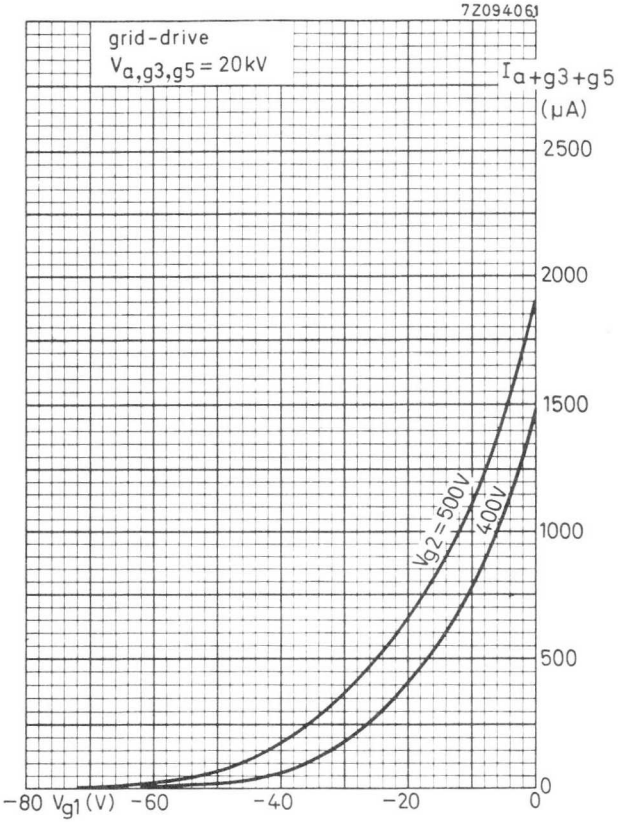
****) Between 15 s and 45 s after switching on a decrease in k/f voltage from 450 V to 250 V, linearly proportional with time, is permissible.

CIRCUIT DESIGN VALUES

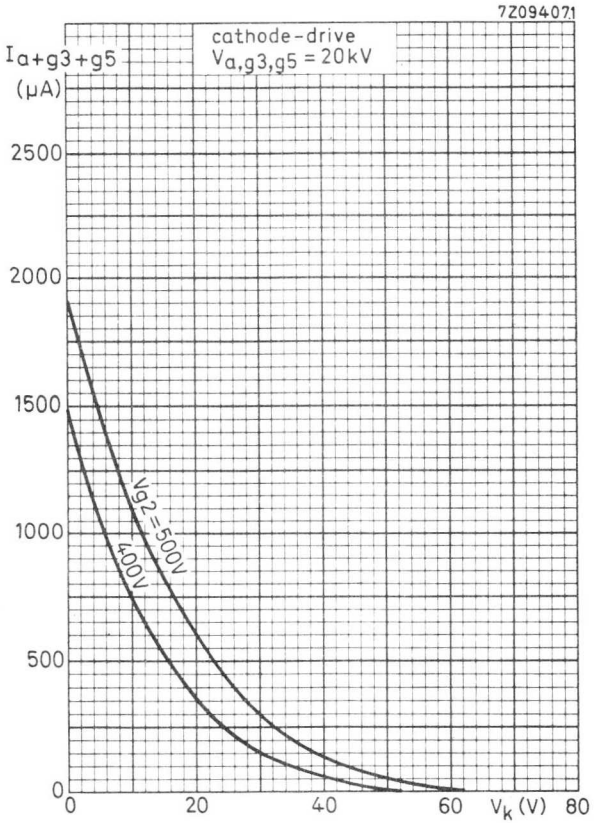
Grid no. 4 current,				
positive	I_{g4}	<	25	μA
negative	$-I_{g4}$	<	25	μA
Grid no. 2 current,				
positive	I_{g2}	<	5	μA
negative	$-I_{g2}$	<	5	μA

MAXIMUM CIRCUIT VALUES

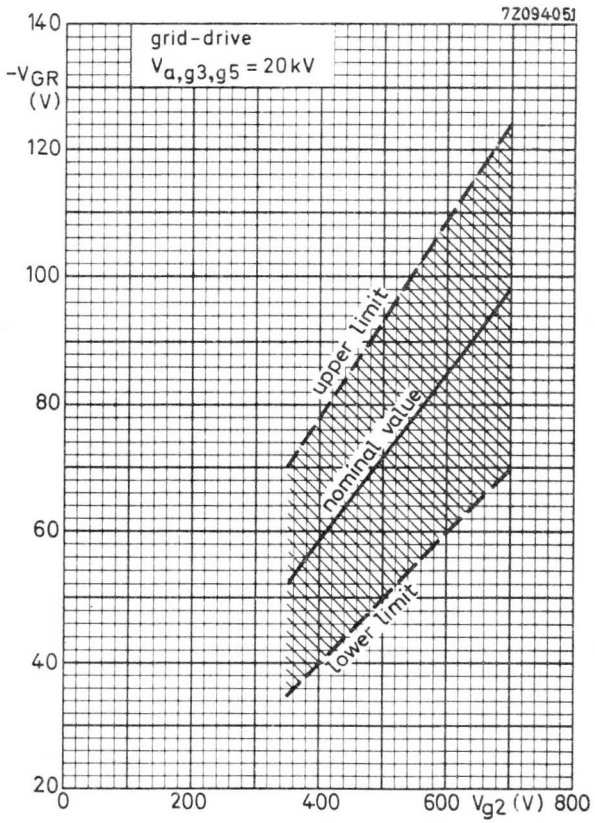
Resistance between cathode and heater	$R_{k/f}$	max.	1,0	MΩ
Impedance between cathode and heater	$Z_{k/f}$(50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1}(50 Hz)	max.	0,5	MΩ



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

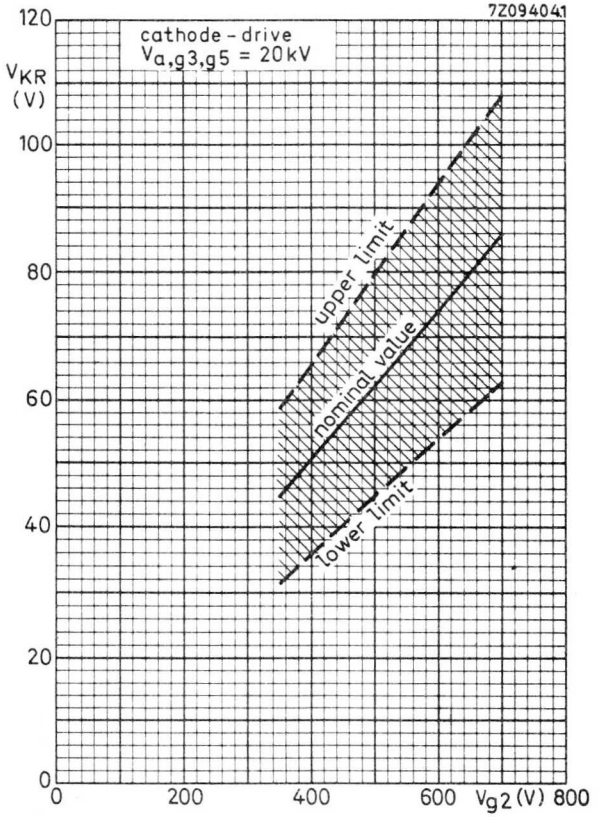


Final accelerator current as a function of cathode voltage



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

Limits of grid No. 1 cut-off voltage as a function of grid no. 2 voltage



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

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

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		12 to 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

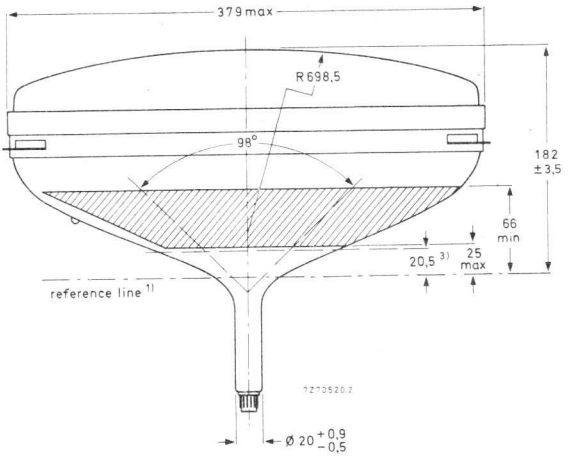
HEATING

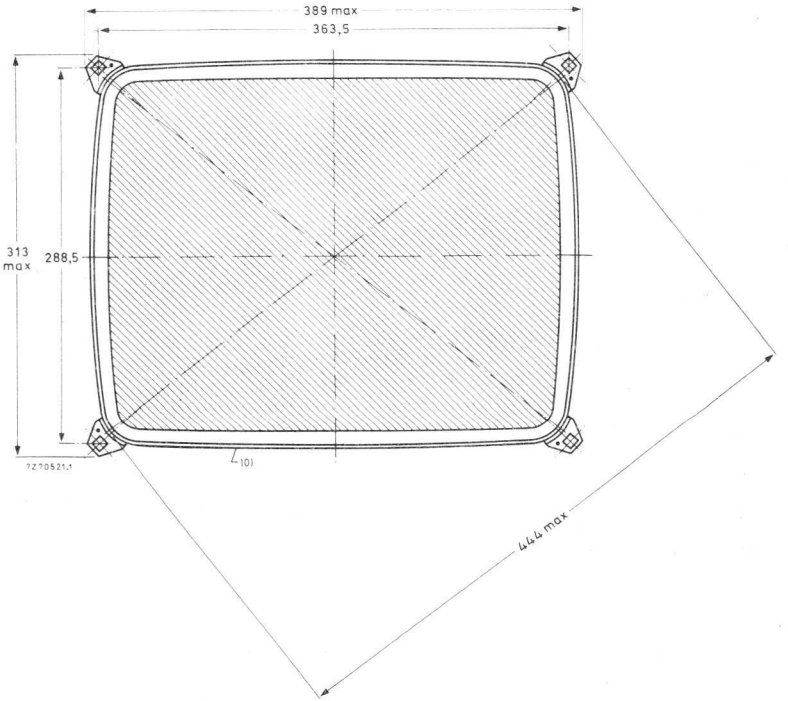
Indirect by a.c. or d.c.

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. min.	12,7 9,3	V *) V

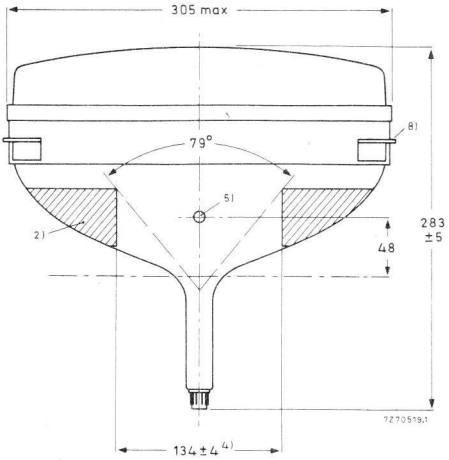
For heating time as a function of source impedance see page 10.

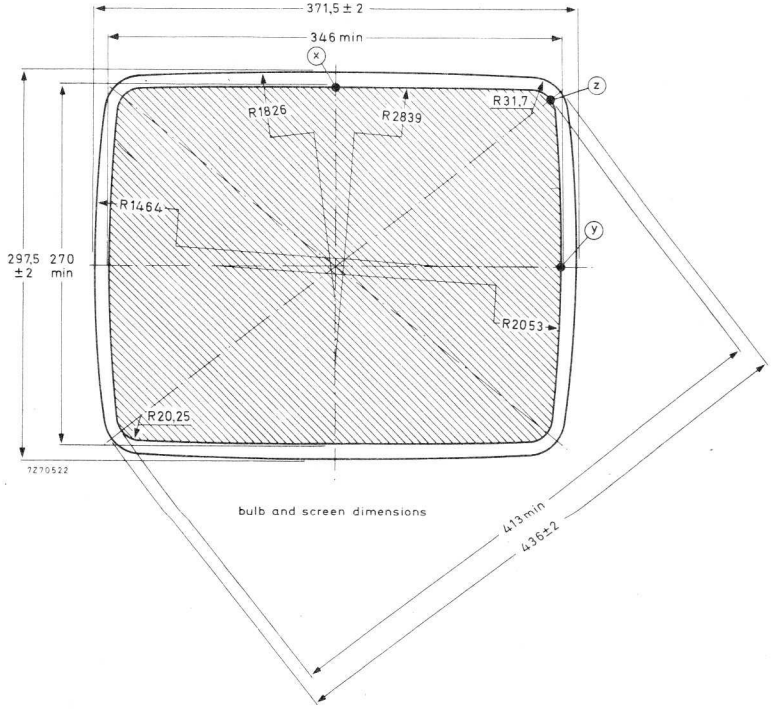
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain is not allowed.

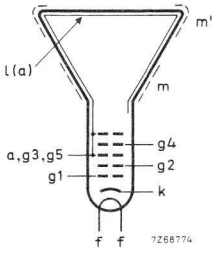


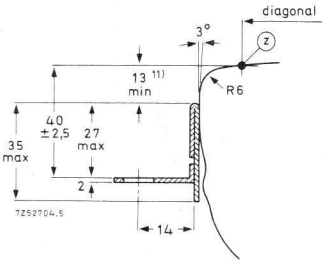


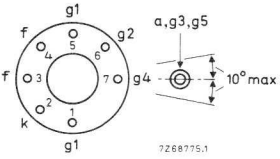
Notes see page 5.

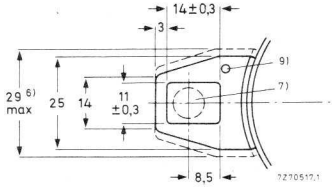

305 max
79°
8)
5)
2)
283
±5
48
7Z70519.1
134±4 4)

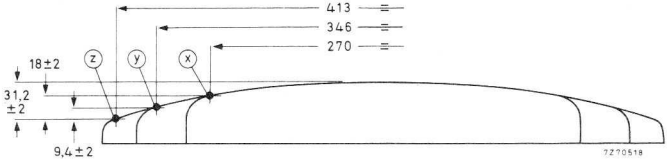

371,5±2
346 min
x
z
y
R1826
R2839
R31.7
R1464
R2053
R20.25
297,5
±2
270
min
7Z70522
bulb and screen dimensions
413 min
436±2











Mounting position : any

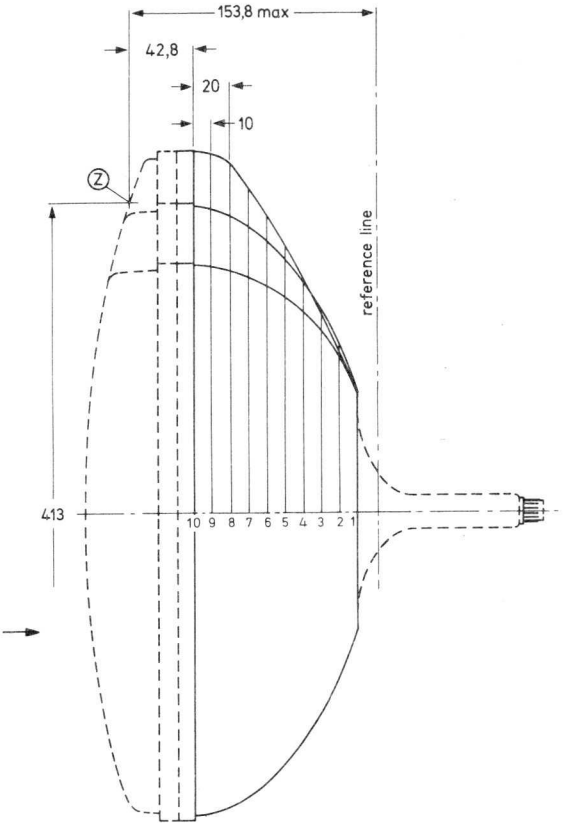
Net mass : approx. 6 kg

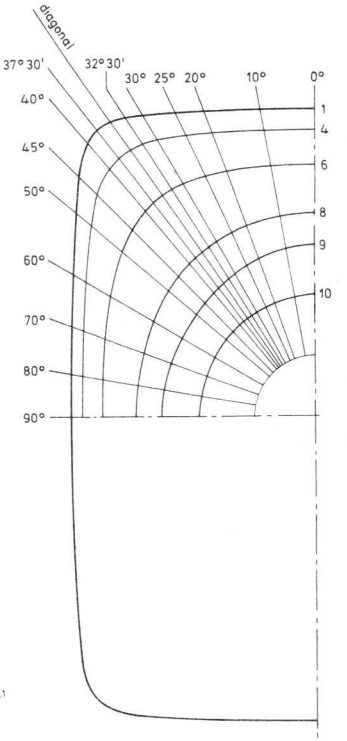
Base : JEDEC E7-91

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 IEC-67-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.





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	$V_{a,g3,g5}$	12 to 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. min.	17 9	kV*) 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

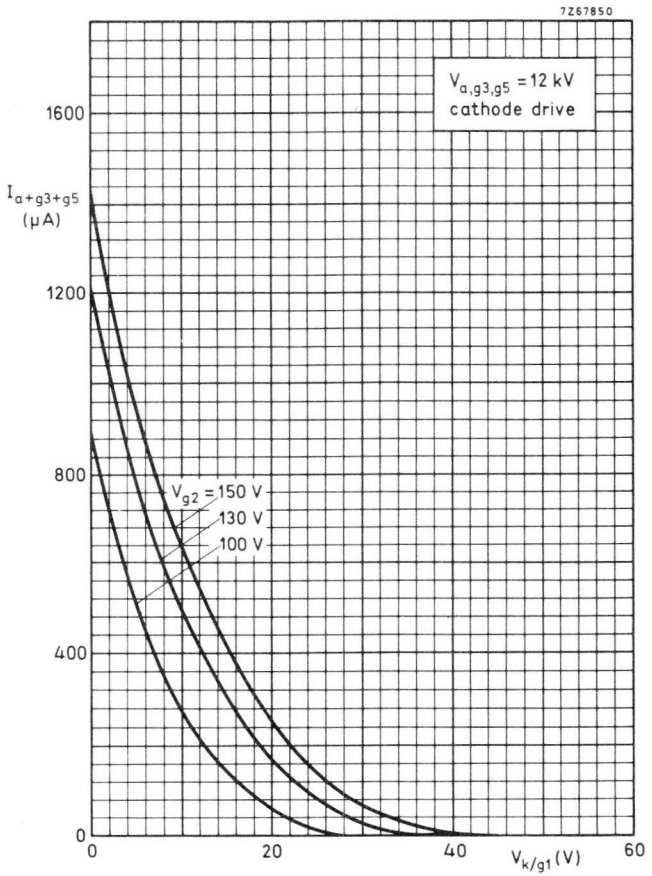
Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

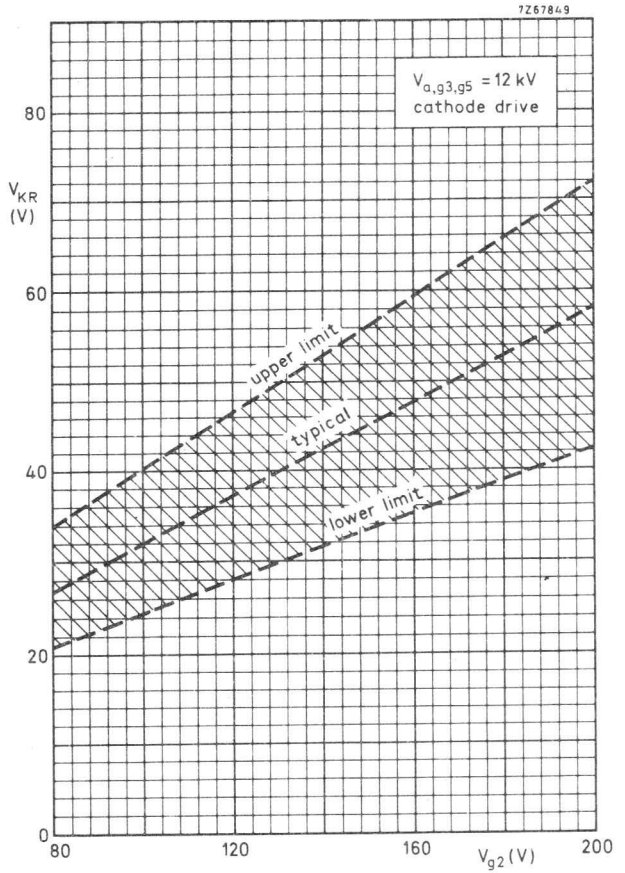
Resistance between cathode and heater	$R_{k/f}$	max.	1	MΩ
Impedance between cathode and heater	$Z_{f/k}$(50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 impedance	Z_{g1}(50 Hz)	max.	0,5	MΩ

*) 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.

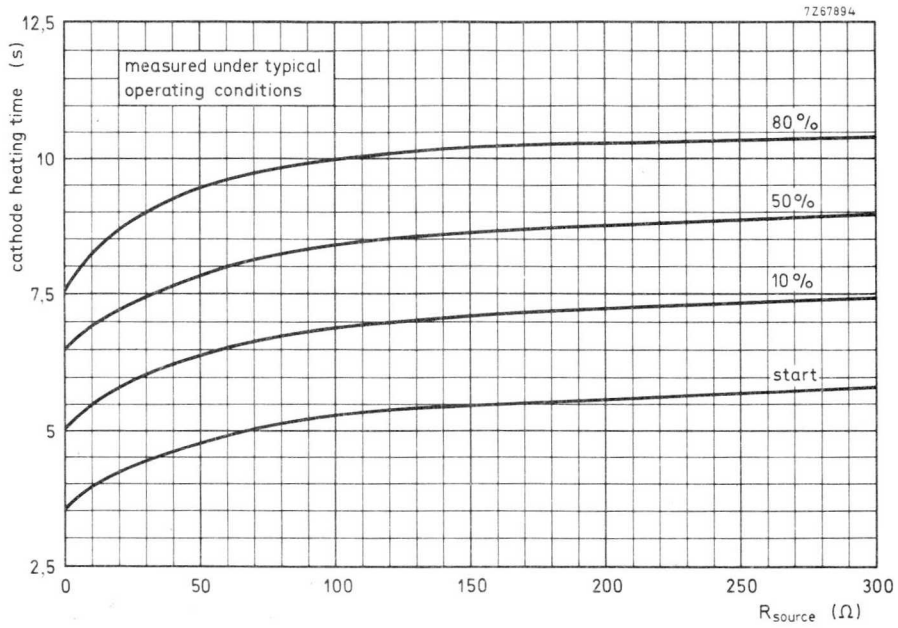


Final accelerator current as a function of cathode voltage.



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

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.

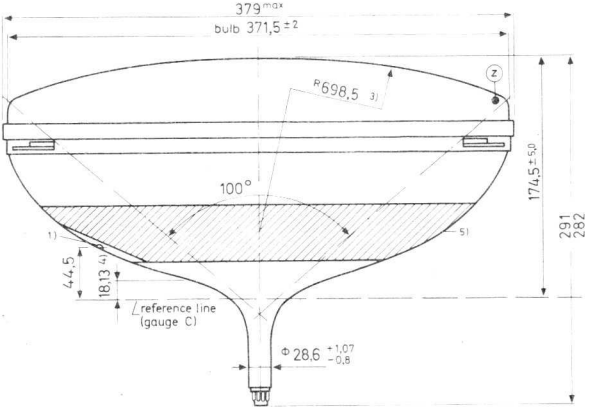
Heater voltage	V_f		6,3 V
Heater current	I_f		240 mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	7,3 V*) 5,3 V

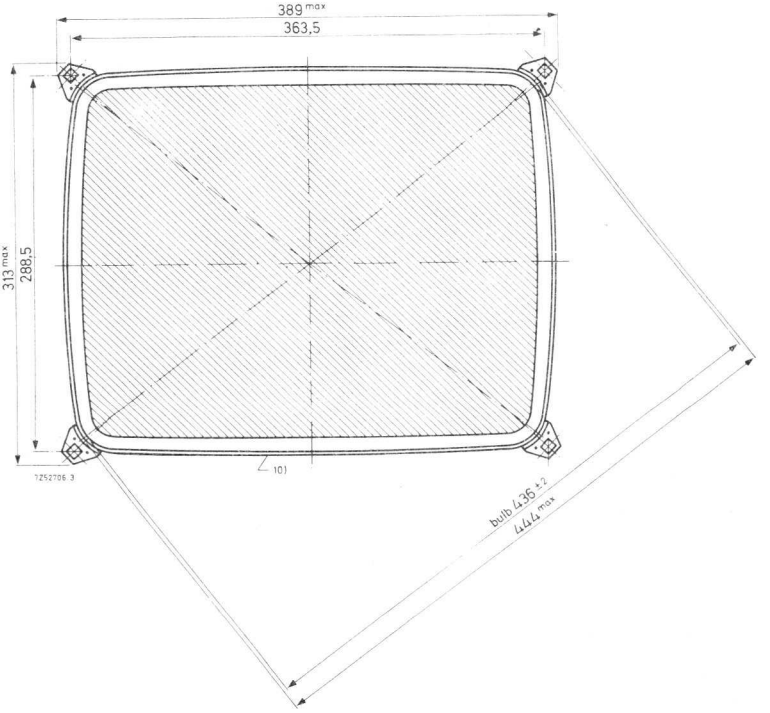
For heating time as a function of source impedance see page 11.

*) 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

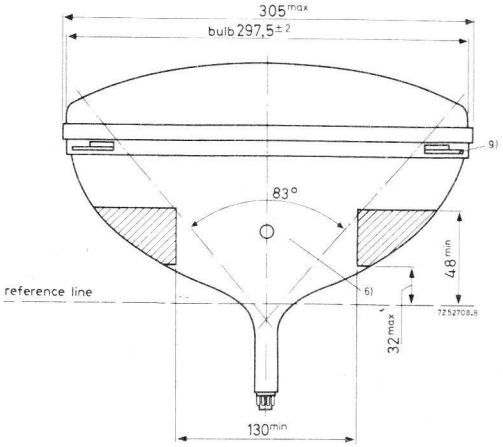


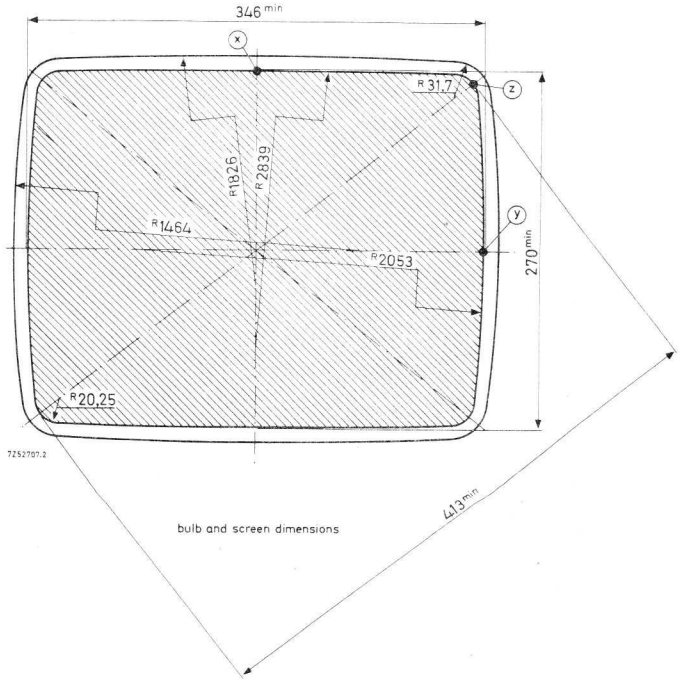


Notes see page 5

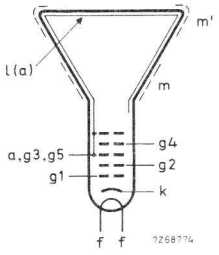
MECHANICAL DATA (continued)

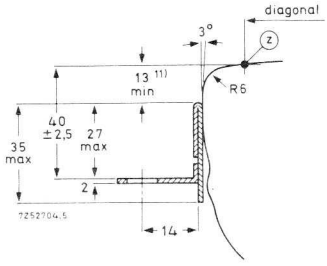
Dimensions in mm

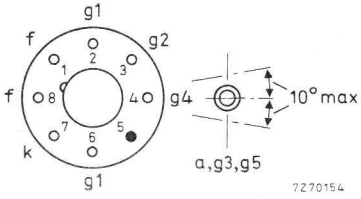


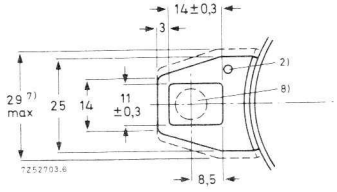


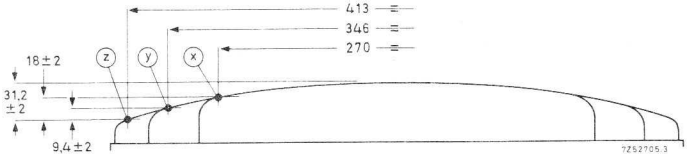
Notes see page 5











Mounting position: any

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

Net mass : approx. 6 kg

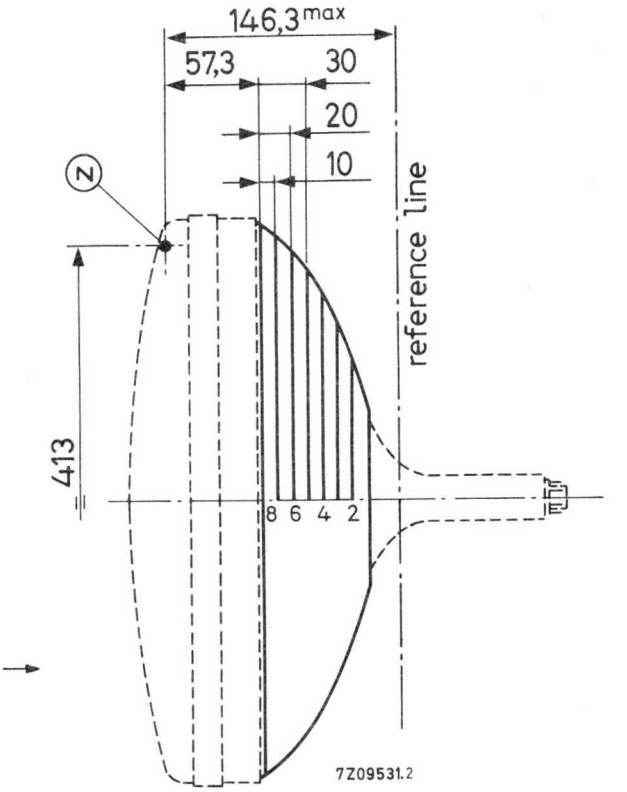
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

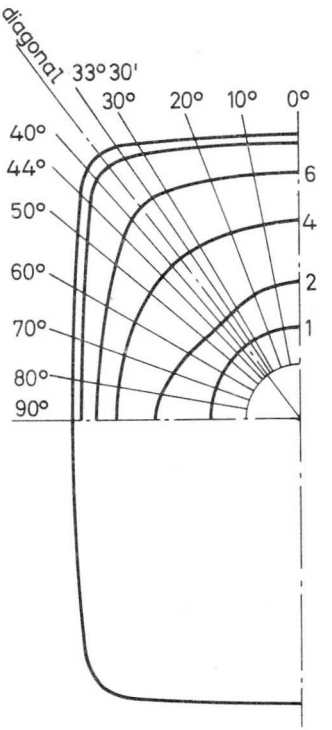
NOTES TO OUTLINE DRAWING

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





Section	Nom. distance from point "Z"	Distance from centre (max. values)												
		0° Long	10°	20°	30°	33°30'	36°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°
Horizontal deflection angle	100°
Vertical deflection angle	83°

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 12	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

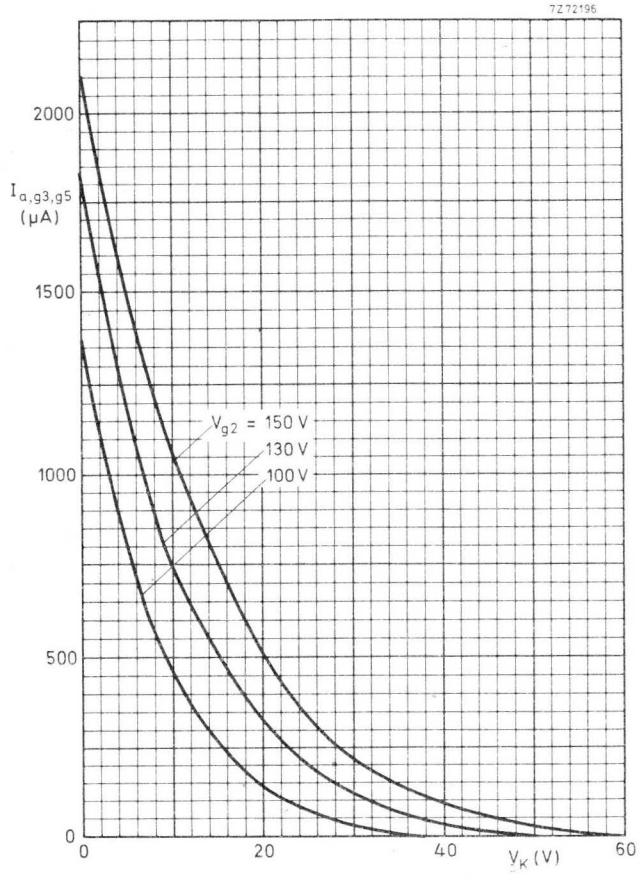
MAXIMUM CIRCUIT VALUES

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

*) 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.

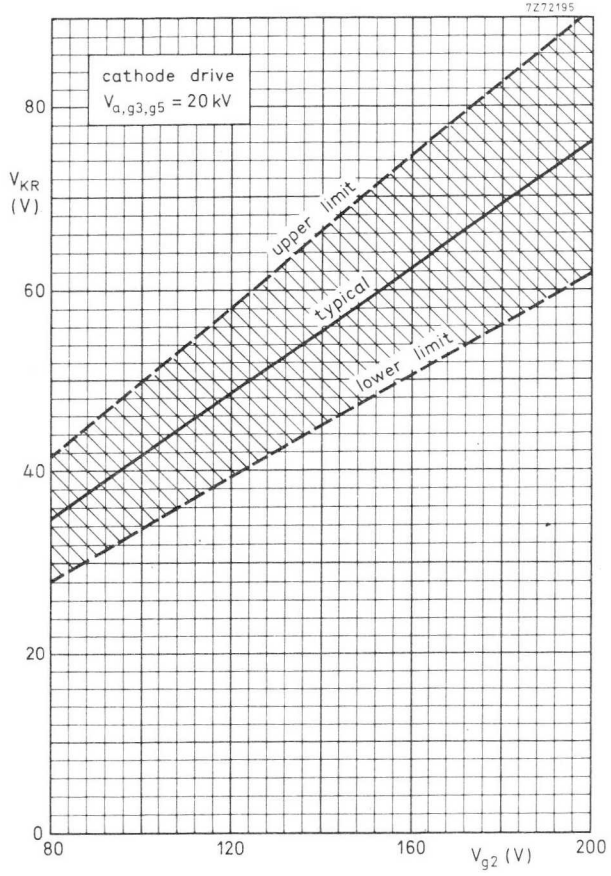
**) At $V_{k/g1} = 0$ V.

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



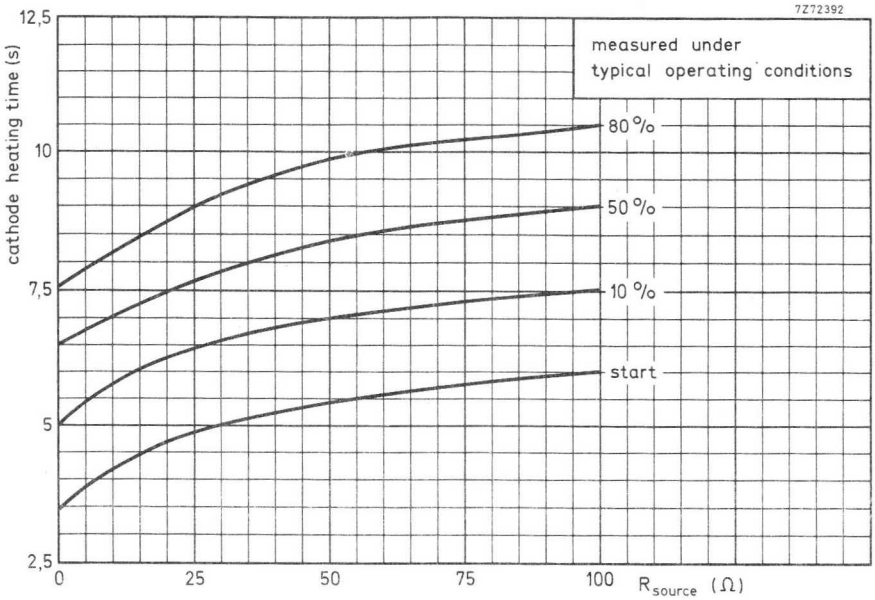
Final accelerator current as a function of cathode voltage

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.

QUICK REFERENCE DATA	
Face diagonal	50 cm (20 in)
Deflection angle	110°
Overall length	312,5 mm
Neck diameter	28,6 mm
Heating	6,3 V, 300 mA
Grid no. 2 voltage	400 V
Final accelerator voltage	20 kV

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

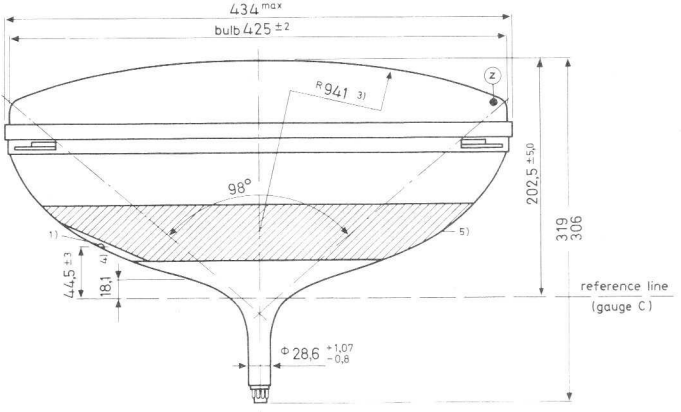
Indirect by a.c. or d.c.; series or parallel supply

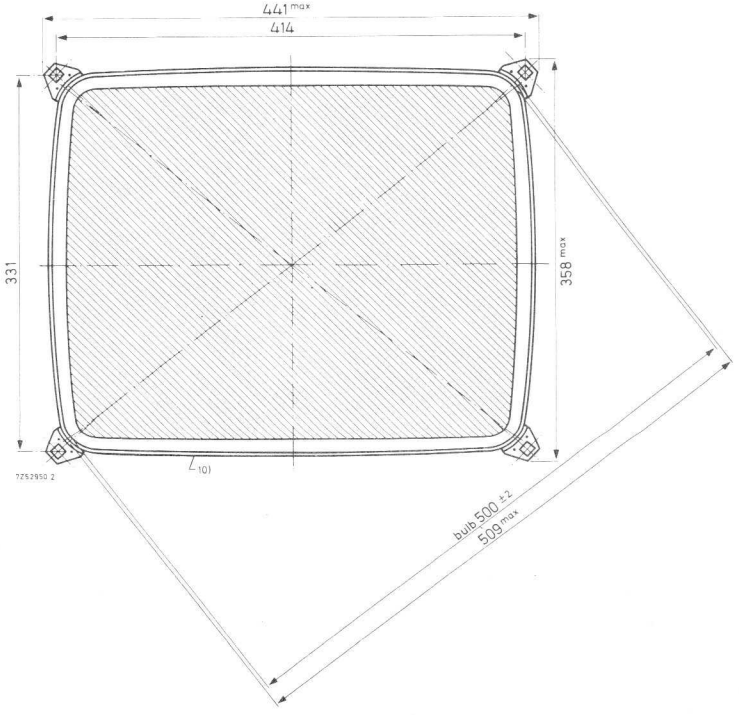
Heater current	I_f	300	mA
Heater voltage	V_f	6,3	V

If the tube is connected in a series heater chain the surge heater voltage must not exceed an r.m.s. value of 9,5 V when the supply is switched on.

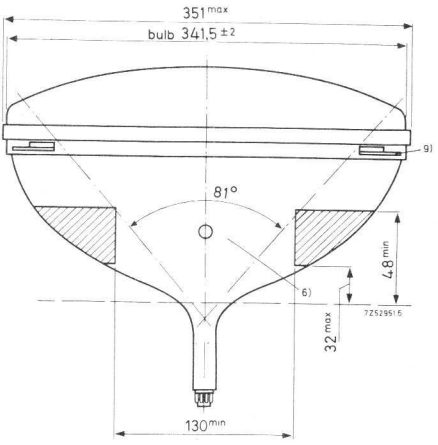
MECHANICAL DATA

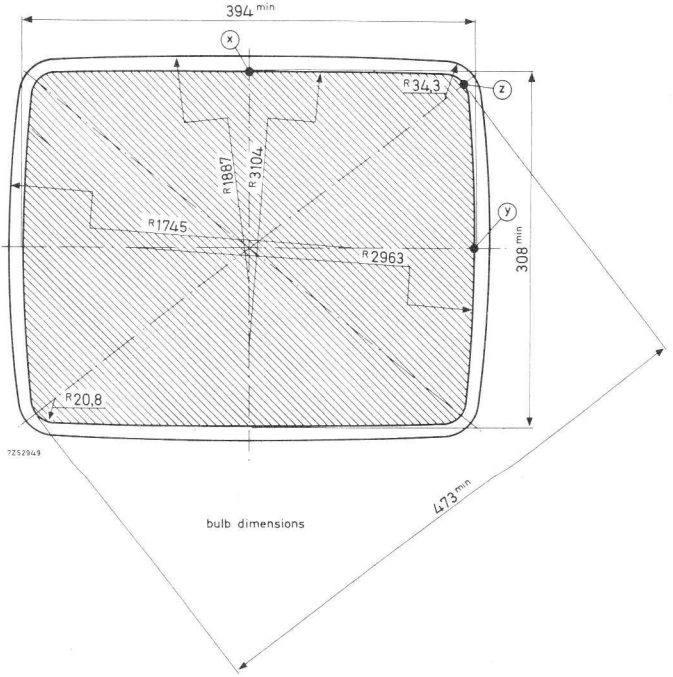
Dimensions in mm



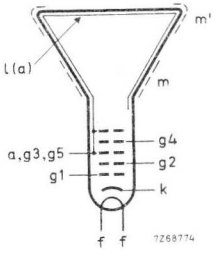


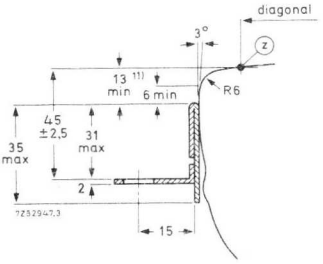
Notes see page 5

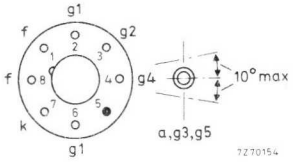


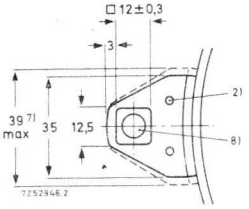


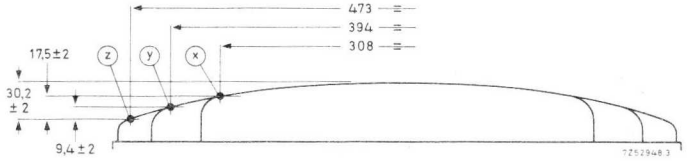
bulb dimensions











Mounting position: any

Base : neo eightar 7 pin JEDEC B7-208, B8H, IEC67-1-31a

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.

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

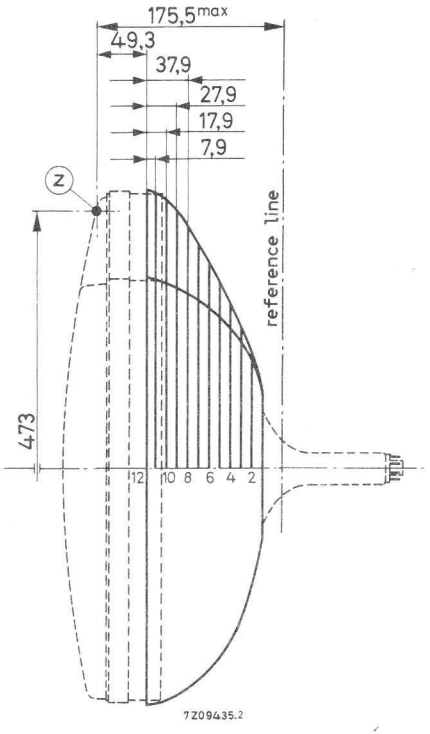
Notes see page 5

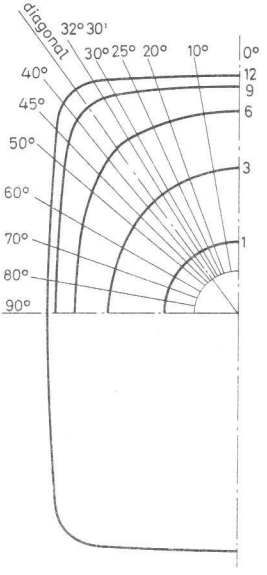
NOTES TO OUTLINE DRAWINGS

1. Small cavity contact IEC67-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 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

Dimensions in mm





A50-120W A50-520W

Section	Nom distance from point "Z"	Distance from centre (max. values)													
		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	$C_{a, g_3, g_5/m}$	< 1500 > 1000	pF ← pF ←
Final accelerator to metal band	$C_{a, g_3, g_5/m'}$	250	pF ←
Cathode to all	C_k	5	pF
Grid no. 1 to all	C_{g_1}	7	pF

FOCUSING electrostatic

DEFLECTION magnetic

Diagonal	110°
Horizontal deflection angle	98°
Vertical deflection angle	81°

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

Grid drive service

Final accelerator voltage	V_{a, g_3, g_5}	20	kV
Focusing electrode voltage	V_{g_4}	0 to 400	V *)
Grid no. 2 voltage	V_{g_2}	400	V
Grid no. 1 voltage for visual extinction of focused raster	V_{GR}	−40 to −77	V

Cathode drive service

Voltages are specified with respect to grid no. 1

Final accelerator voltage	V_{a, g_3, g_5}	20	kV
Focusing electrode voltage	V_{g_4}	0 to 400	V *)
Grid no. 2 voltage	V_{g_2}	400	V
Cathode voltage for visual extinction of focused raster	V_{KR}	36 to 66	V

*) 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 at I_a, g_3, g_5 = 0	$V_{a, g3, g5}$	max. min.	23 12	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.	700 350	V***) V
Grid no. 2 to grid no. 1 voltage	$V_{g2/g1}$	max.	850	V
Grid no. 1 voltage,				
positive	V_{g1}	max.	0	V
positive peak	V_{g1p}	max.	2	V
negative	$-V_{g1}$	max.	200	V
negative peak	$-V_{g1p}$	max.	400	V**)
Cathode-to-heater voltage				
positive	$V_{k/f}$	max.	250	V
positive peak	$V_{k/fp}$	max.	300	V
negative	$-V_{k/f}$	max.	200	V
positive during equipment warm-up period not exceeding 15 s	$V_{k/f}$	max.	450	V****)

*) 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 maximum 1,5 ms.

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

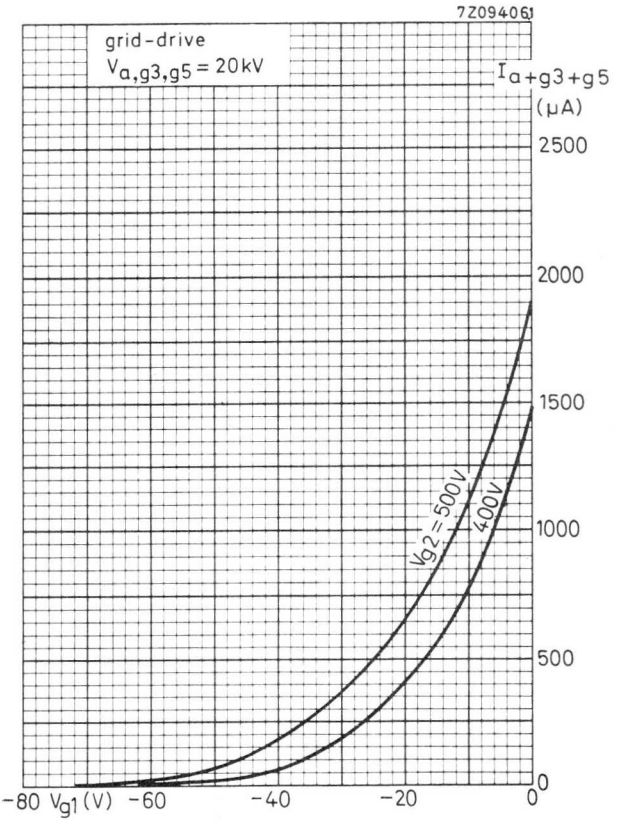
****) Between 15 s and 45 s after switching on a decrease in k/f voltage from 450 V to 250 V, linearly proportional with time, is permissible.

CIRCUIT DESIGN VALUES

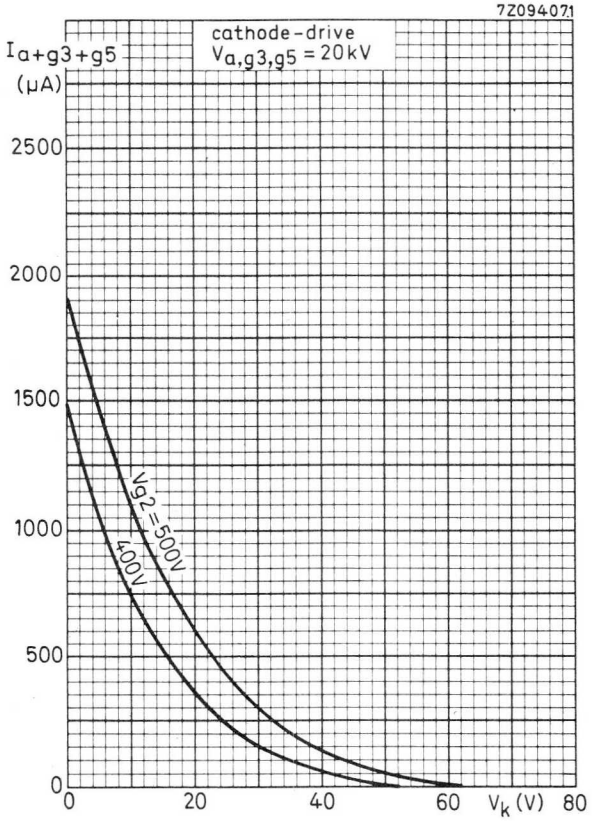
Grid no. 4 current				
positive	I_{g4}	max.	25	μA
negative	$-I_{g4}$	max.	25	μA
Grid no. 2 current				
positive	I_{g2}	max.	5	μA
negative	$-I_{g2}$	max.	5	μA

MAXIMUM CIRCUIT VALUES

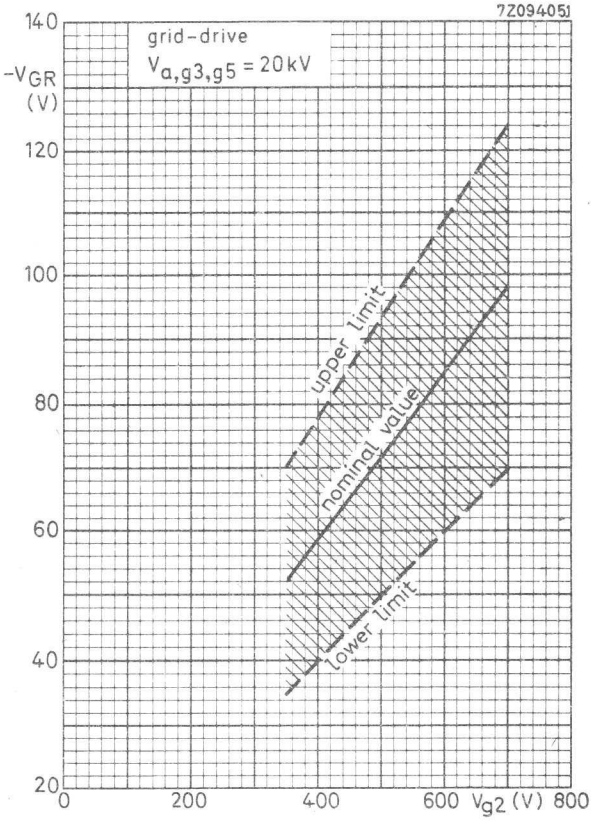
Resistance between cathode and heater	$R_{k/f}$	max.	1,0	MΩ
Impedance between cathode and heater	$Z_{k/f}$ (50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	R_{g1}	max.	1,5	MΩ
Grid no. 1 circuit impedance	Z_{g1} (50 Hz)	max.	0,5	MΩ



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

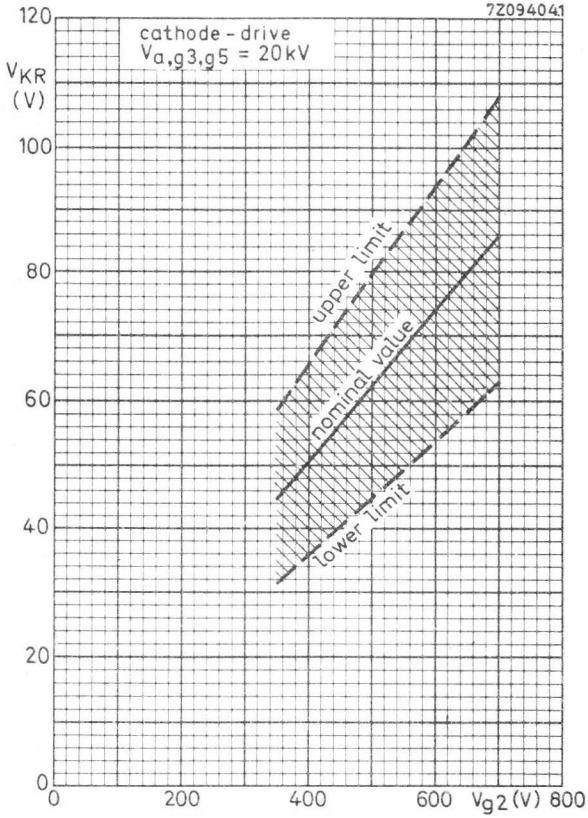


Final accelerator current as a function of cathode voltage



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

Limits of grid no. 1 cut-off voltage as a function of grid no. 2 voltage



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

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

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.

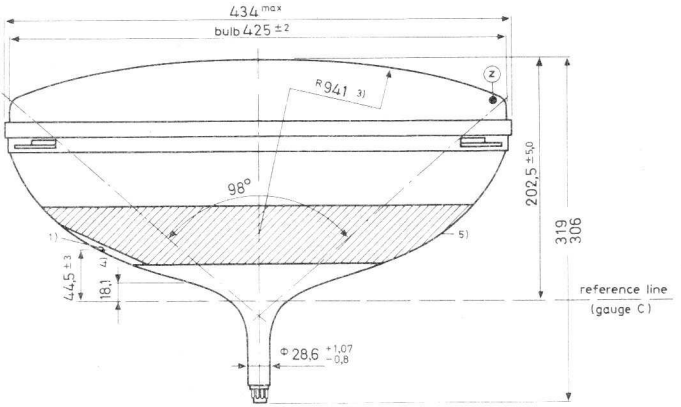
Heater voltage	V_f		6,3 V
Heater current	I_f		240 mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	7,3 V *) 5,3 V

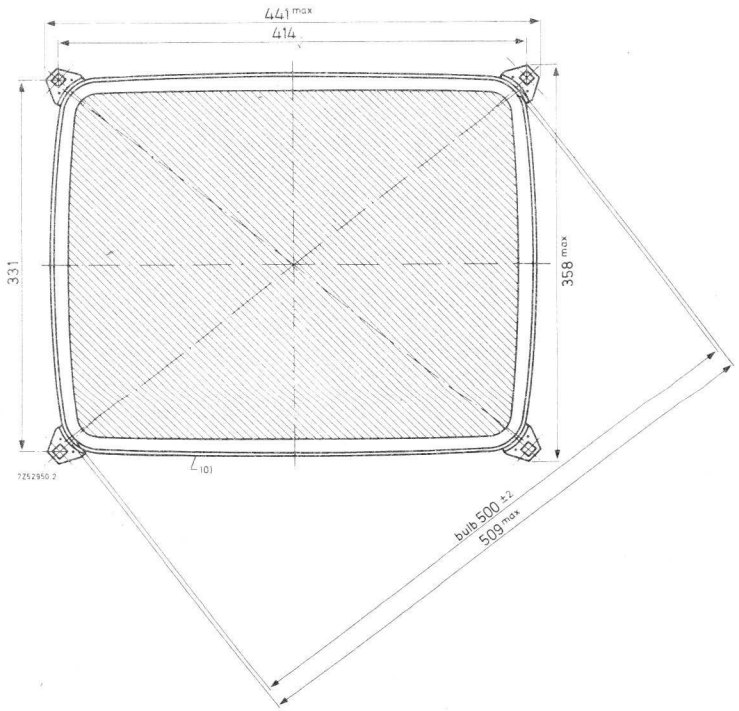
For heating time as a function of source impedance see page 11.

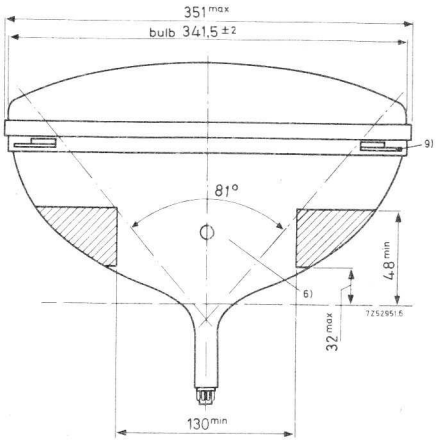
*) This limit also applies during equipment warming-up. Use of the tube in a series heater chain it not allowed.

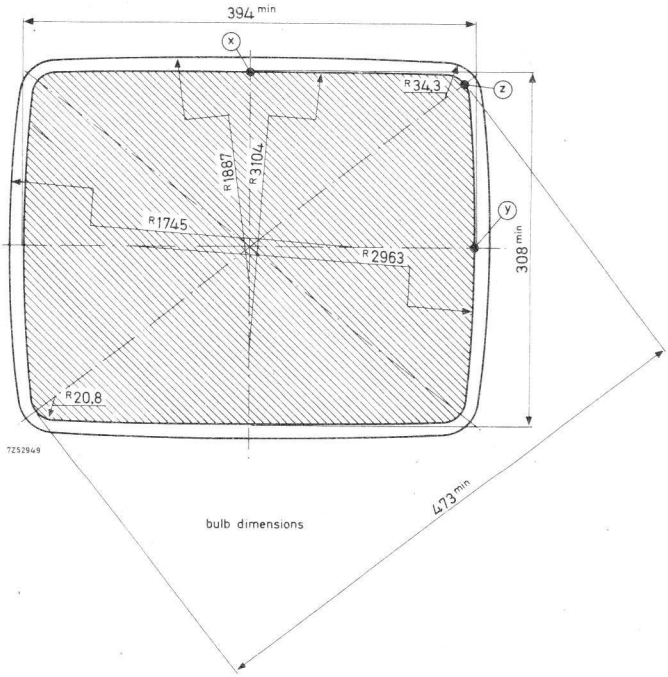
MECHANICAL DATA

Dimensions in mm

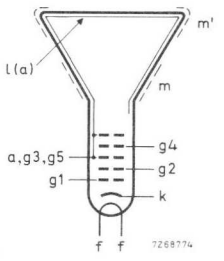


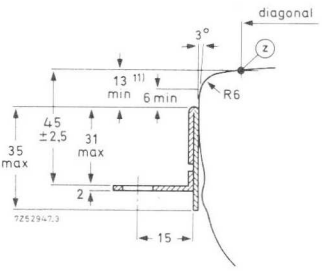


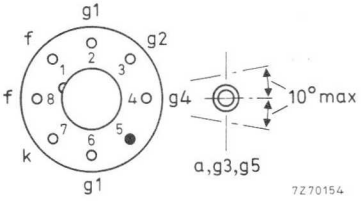


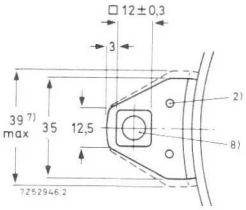


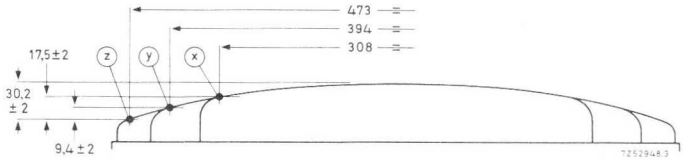
bulb dimensions











Mounting position : any

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

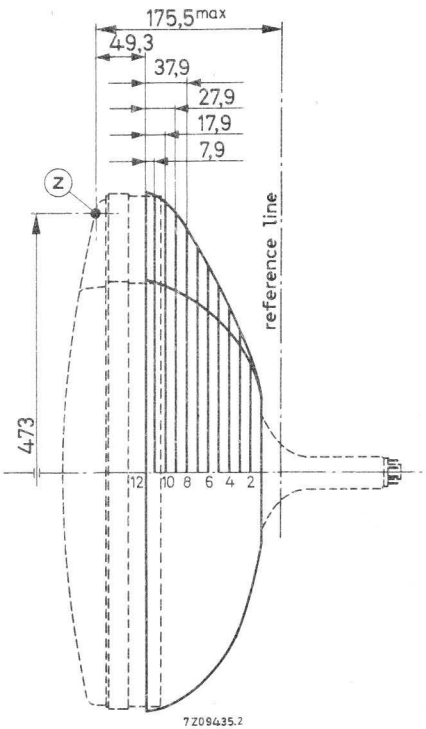
Net mass : approx. 8,5 kg

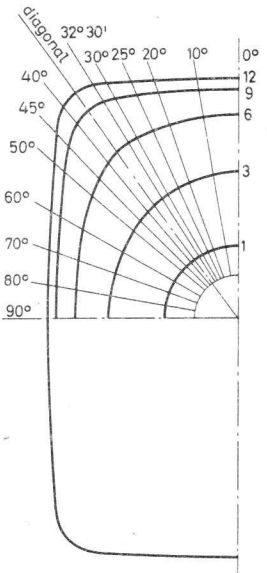
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.

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

Section	Nom distance from point "Z"	Distance from centre (max. values)													
		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	pF ←
		>	1000	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°
Horizontal deflection angle	98°
Vertical deflection angle	81°

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. min.	23 12	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	$V_{k/g1p}$	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

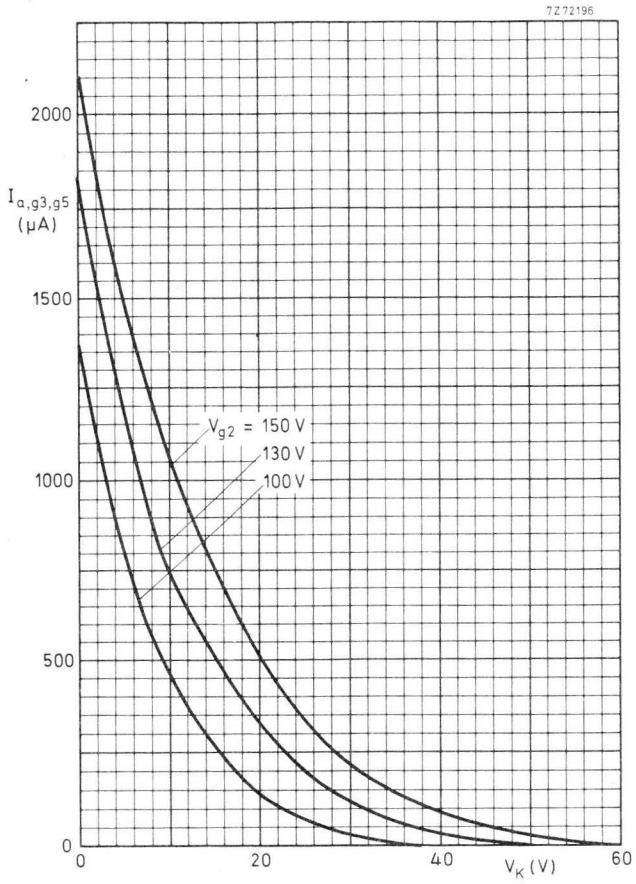
MAXIMUM CIRCUIT VALUES

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.

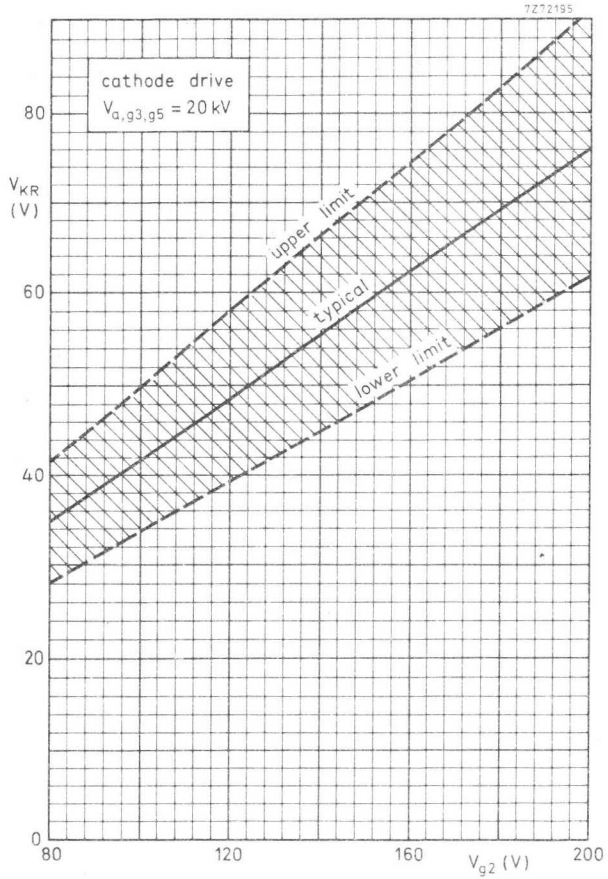
**) At $V_{g1/k} = 0$ V.

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



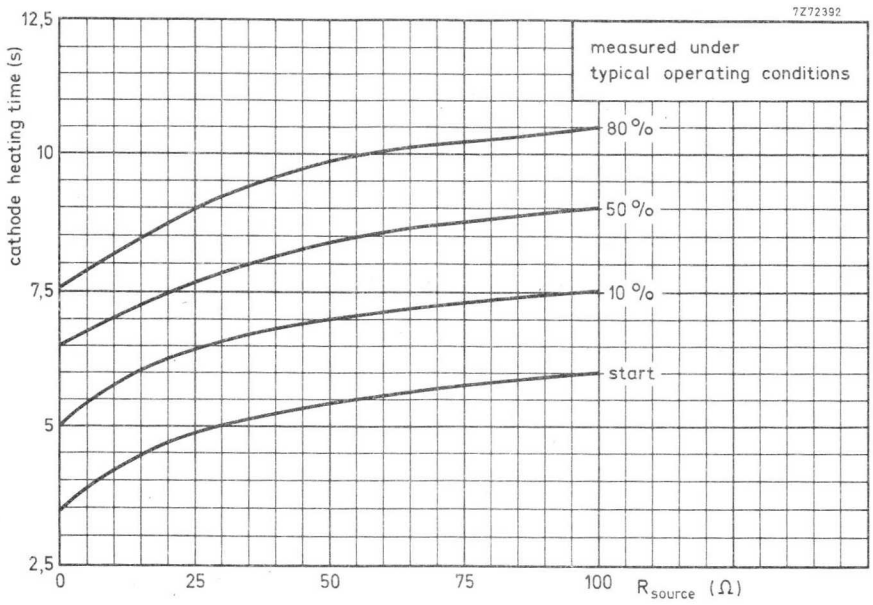
Final accelerator current as a function of cathode voltage

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.

QUICK REFERENCE DATA		
Face diagonal	61	cm (24 in)
Deflection angle	110°	
Overall length	max. 370	mm
Neck diameter	28,6	mm
Heating	6,3 V, 300	mA
Grid no. 2 voltage	400	V
Final accelerator voltage	20	kV

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

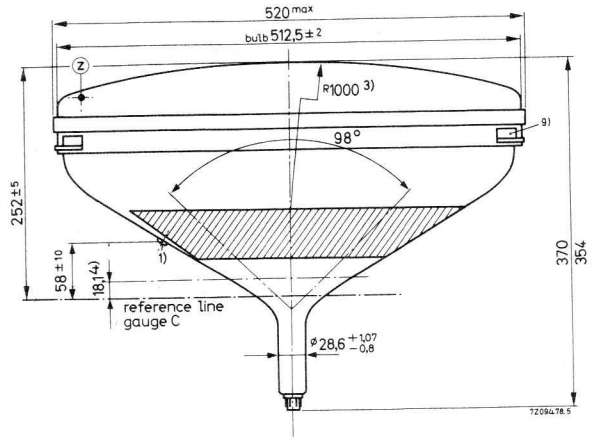
Indirect by a.c. or d.c.; series or parallel supply

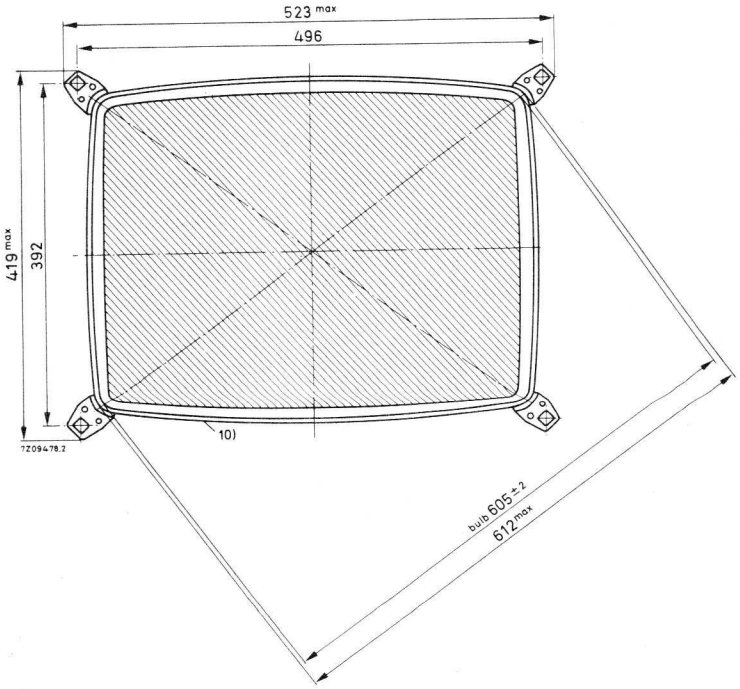
Heater current	I_f	300	mA
Heater voltage	V_f	6,3	V

If the tube is connected in a series heater chain the surge heater voltage must not exceed an r.m.s. value of 9,5 V when the supply is switched on.

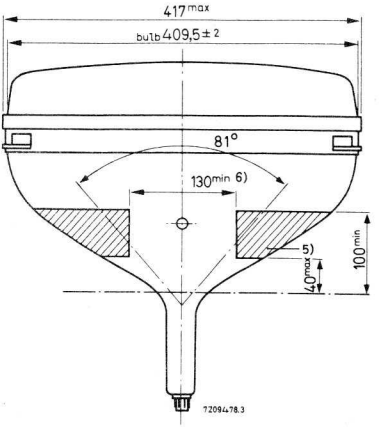
MECHANICAL DATA

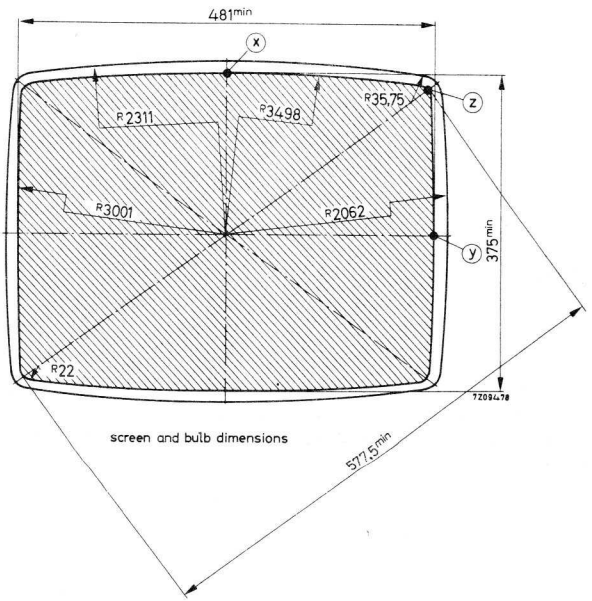
Dimensions in mm



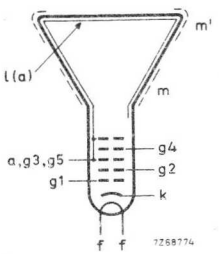


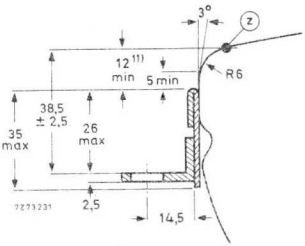
Notes see page 5.

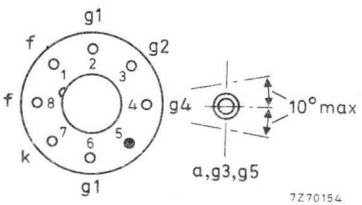


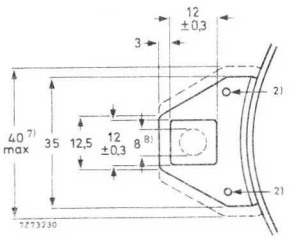


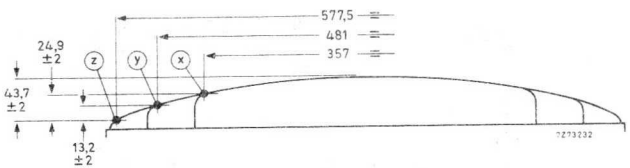
screen and bulb dimensions











Mounting position: any

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

Net mass : approx. 13, 5 kg

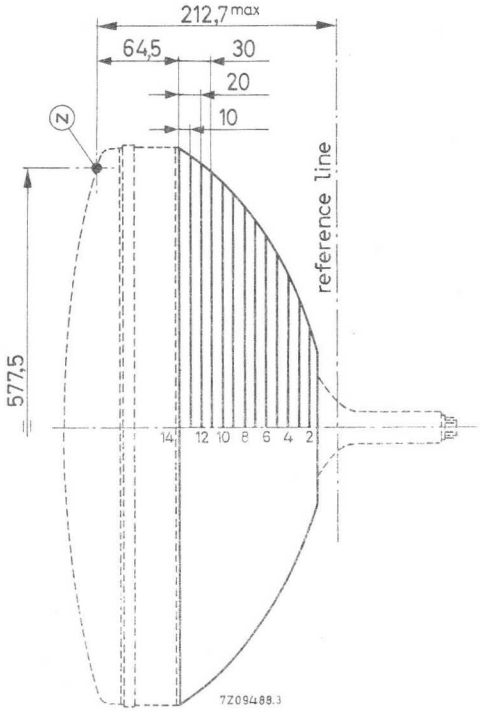
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

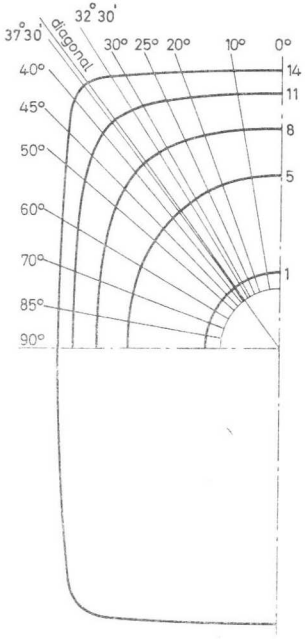
NOTES TO OUTLINE DRAWINGS

1. Small cavity contact I E C -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 > 1500	pF pF
Final accelerator to metal band	Ca, g3, g5/m'	350	pF ←
Cathode to all	C_k	5	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	81°

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

Grid drive service

Final accelerator voltage	$V_{a, g3, g5}$	20	kV
Focusing electrode voltage	V_{g4}	0 to 400	V*)
Grid no. 2 voltage	V_{g2}	400	V
Grid no. 1 voltage for visual exinction of focused raster	V_{GR}	-40 to -77	V

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 400	V*)
Grid no. 2 voltage	V_{g2}	400	V
Cathode voltage for visual extinction of focused raster	V_{KR}	36 to 66	V

*) 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 at Ia, g3, g5 = 0	Va, g3, g5	max. min.	23 12	kV*) kV
Grid no. 4 voltage,				
positive	Vg4	max.	1000	V
negative	-Vg4	max.	500	V
Grid no. 2 voltage	Vg2	max. min.	700 350	V***) V
Grid no. 2 to grid no. 1 voltage	Vg2/g1	max.	850	V
Grid no. 1 voltage				
positive	Vg1	max.	0	V
positive peak	Vg1p	max.	2	V
negative	-Vg1	max.	200	V
negative peak	-Vg1p	max.	400	V**)
Cathode-to-heater voltage,				
positive	Vk/f	max.	250	V
positive peak	Vk/fp	max.	300	V
negative	-Vk/f	max.	200	V
positive during equipment warm-up period not exceeding 15 s	Vk/f	max.	450	V****)

*) 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 maximum 1,5 ms.

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

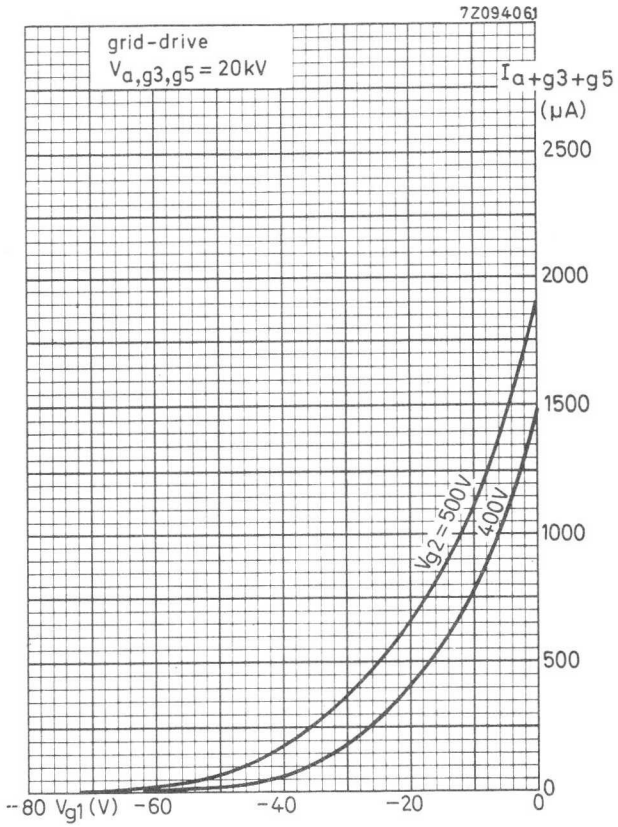
****) Between 15 s and 45 s after switching on a decrease in k/f voltage from 450 V to 250 V, linearly proportional with time, is permissible.

CIRCUIT DESIGN VALUES

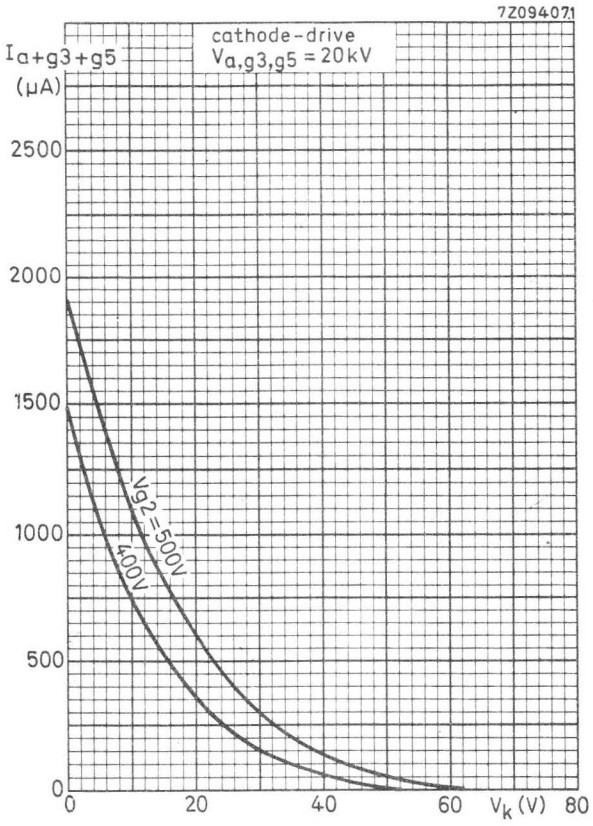
Grid no. 4 current,				
positive	Ig4	max.	25	µA
negative	-Ig4	max.	25	µA
Grid no. 2 current				
positive	Ig2	max.	5	µA
negative	-Ig2	max.	5	µA

MAXIMUM CIRCUIT VALUES

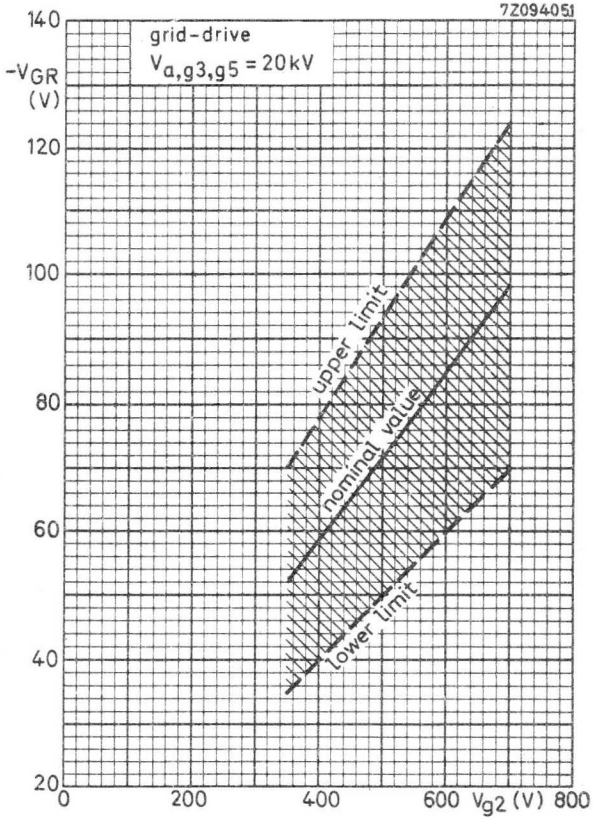
Resistance between cathode and heater	Rk/f	max.	1	MΩ
Impedance between cathode and heater	Zk/f(50 Hz)	max.	0,1	MΩ
Grid no. 1 circuit resistance	Rg1	max.	1,5	MΩ
Grid no. 1 circuit impedance	Zg1(50 Hz)	max.	0,5	MΩ



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

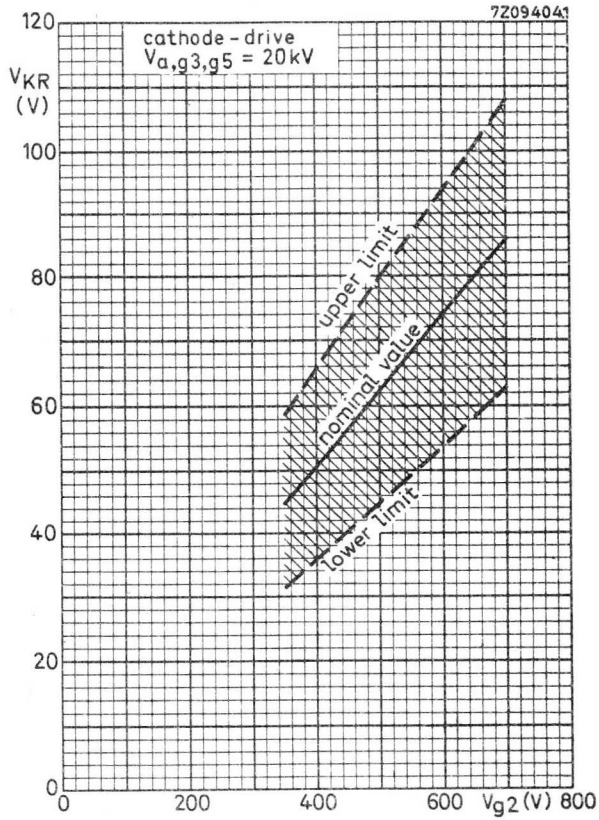


Final accelerator current as a function of cathode voltage.



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

Limits of grid no. 1 cut-off voltage as a function of grid no. 2 voltage.



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

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

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..

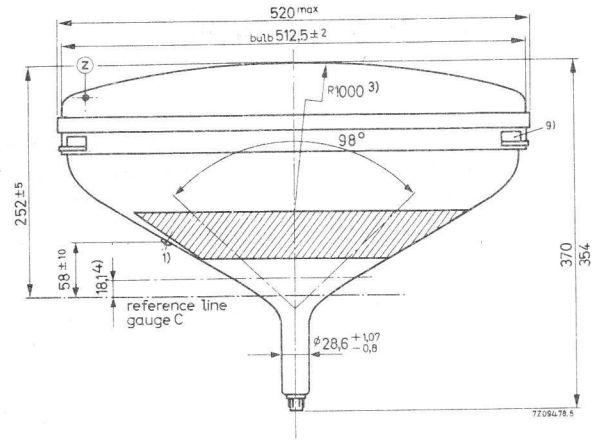
Heater voltage	V_f		6,3 V
Heater current	I_f		240 mA
Limits (Absolute max. rating system) of r.m.s. heater voltage measured in any 20 ms	V_f	max. min.	7,3 V *) 5,3 V

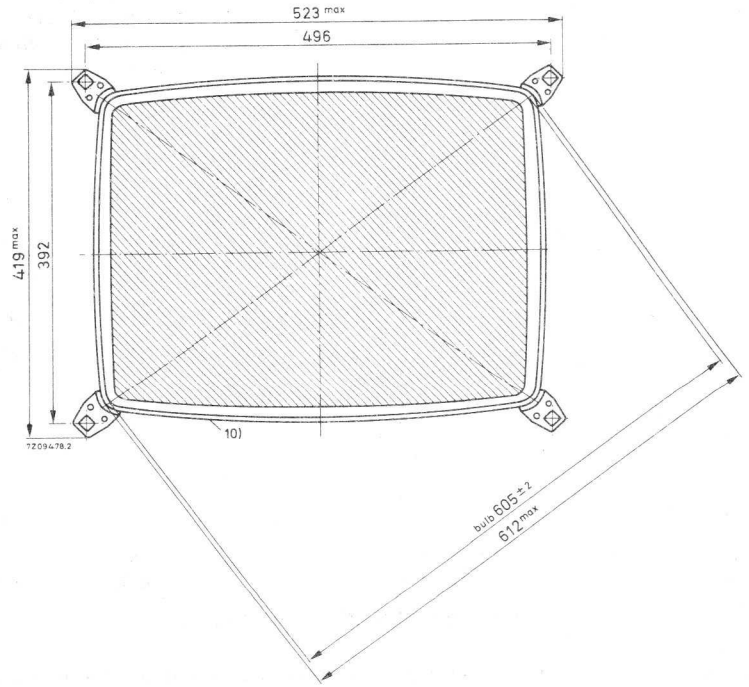
For heating time as a function of source impedance see page 11.

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

MECHANICAL DATA

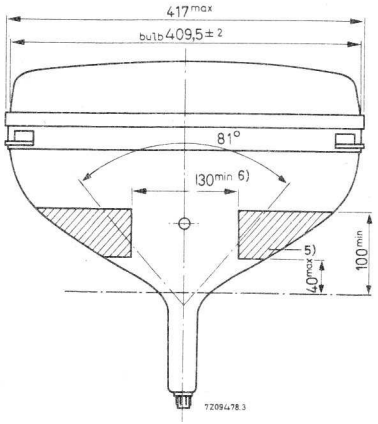
Dimensions in mm

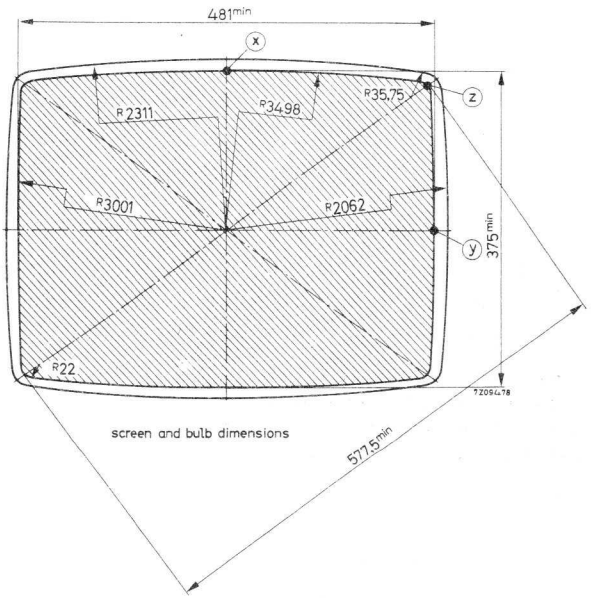




MECHANICAL DATA (continued)

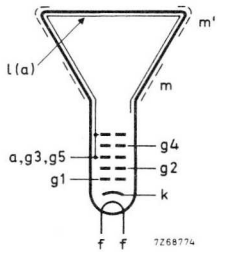
Dimensions in mm

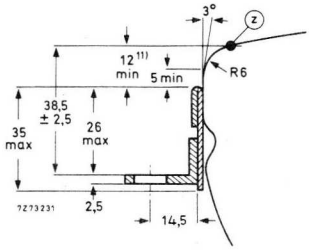


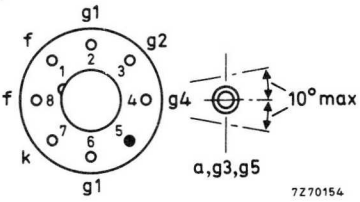


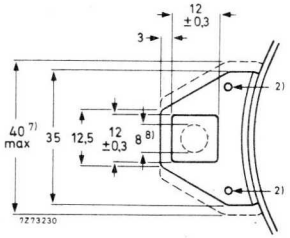
screen and bulb dimensions

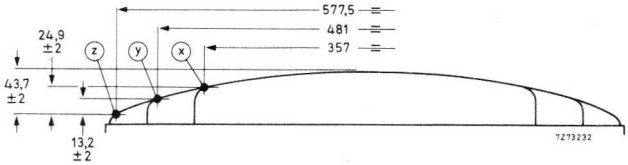
For notes see page 5











Mounting position : any

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

Net mass : approx. 13,5 kg

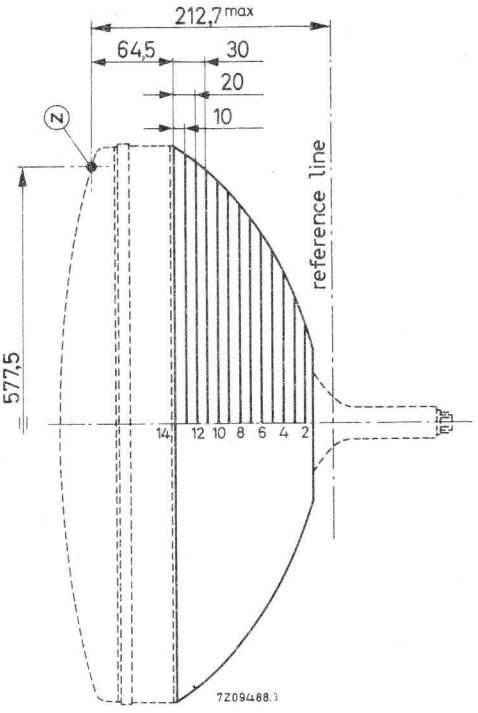
The bottom circumference of the base wafer will fall within a circle concentric with the tube axis and having a diameter of 40 mm.
The socket for the base should not be rigidly mounted: it should have flexible leads and be allowed to move freely.

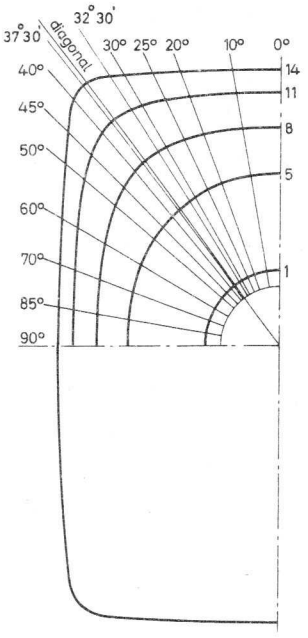
NOTES TO OUTLINE DRAWINGS

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	$C_a, g_3, g_5/m$	< 2500	pF
		> 1500	pF
Final accelerator to metal band	$C_a, g_3, g_5/m'$	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°
Horizontal deflection angle	98°
Vertical deflection angle	81°

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, g_3, g_5	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. min.	23 12	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

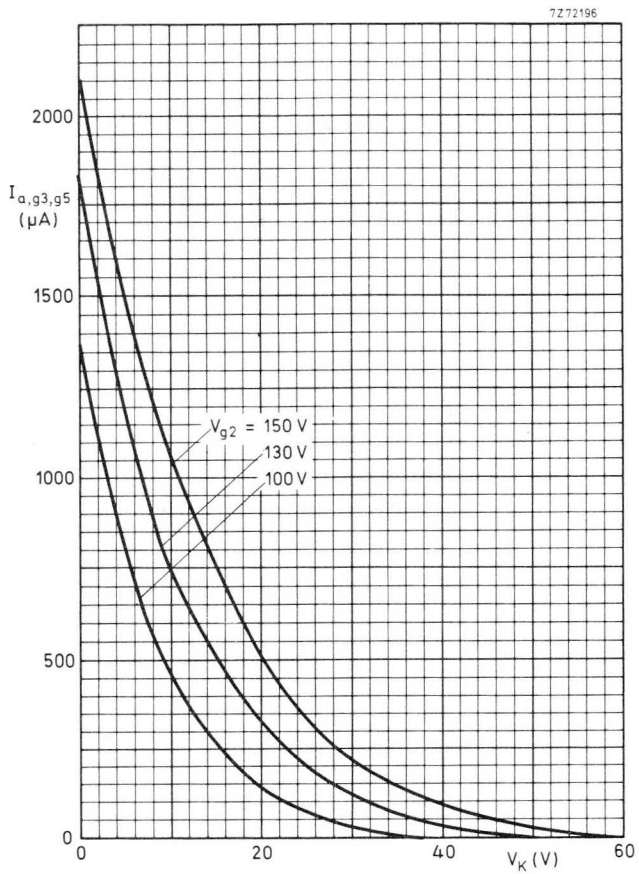
MAXIMUM CIRCUIT VALUES

Resistance between cathode and heater	$R_{k/f}$	max.	1	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.

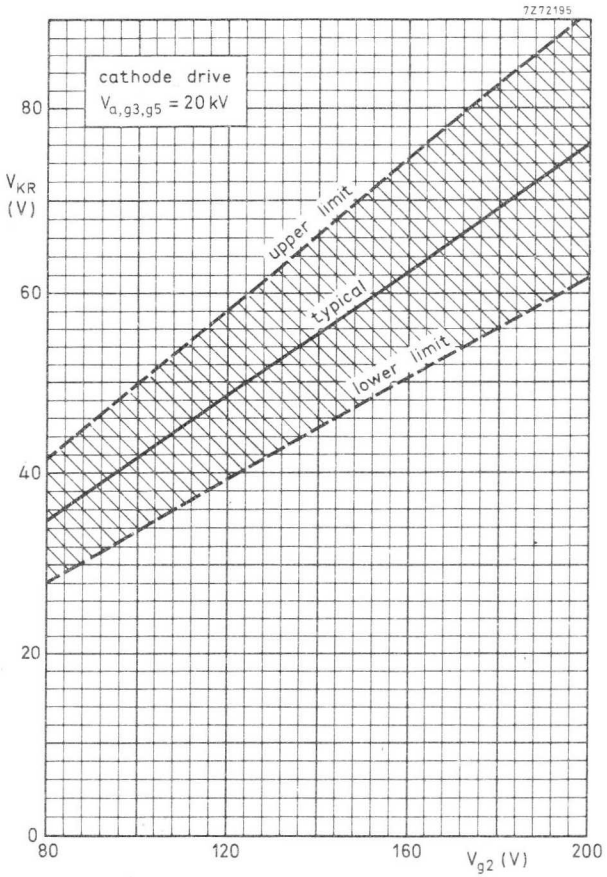
**) At $V_{k/g1} = 0$ V.

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



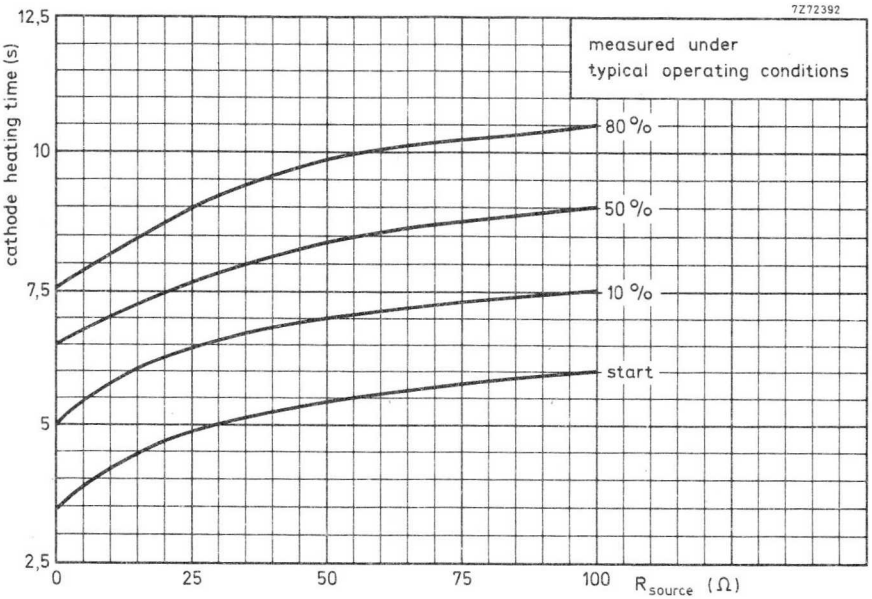
Final accelerator current as a function of cathode voltage.

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.

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BW = Black and white TV picture tubes
C = Colour TV picture tubes

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