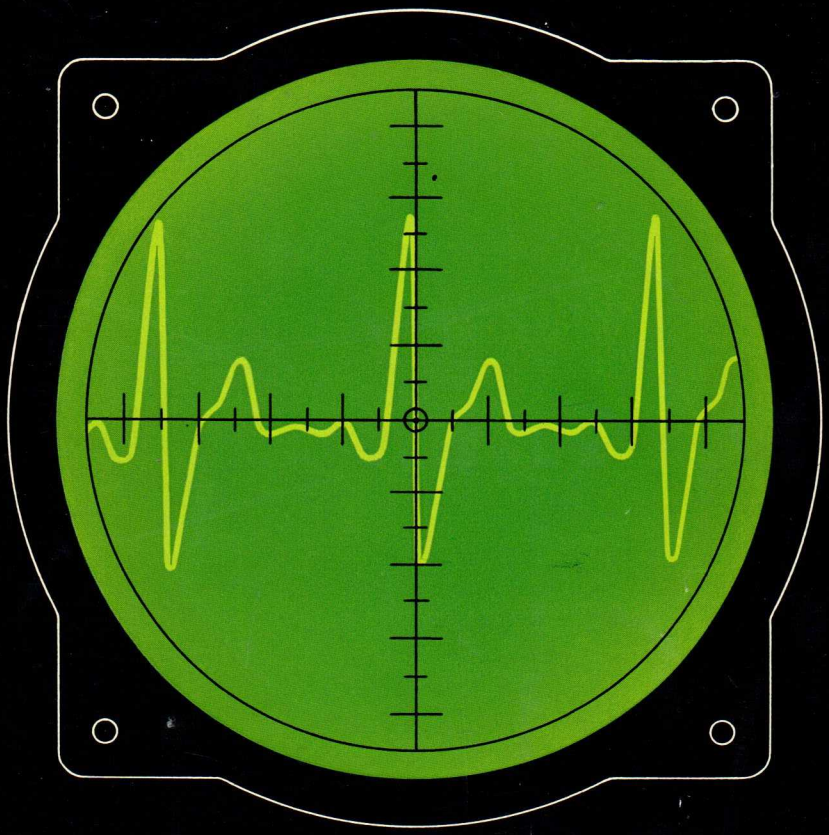
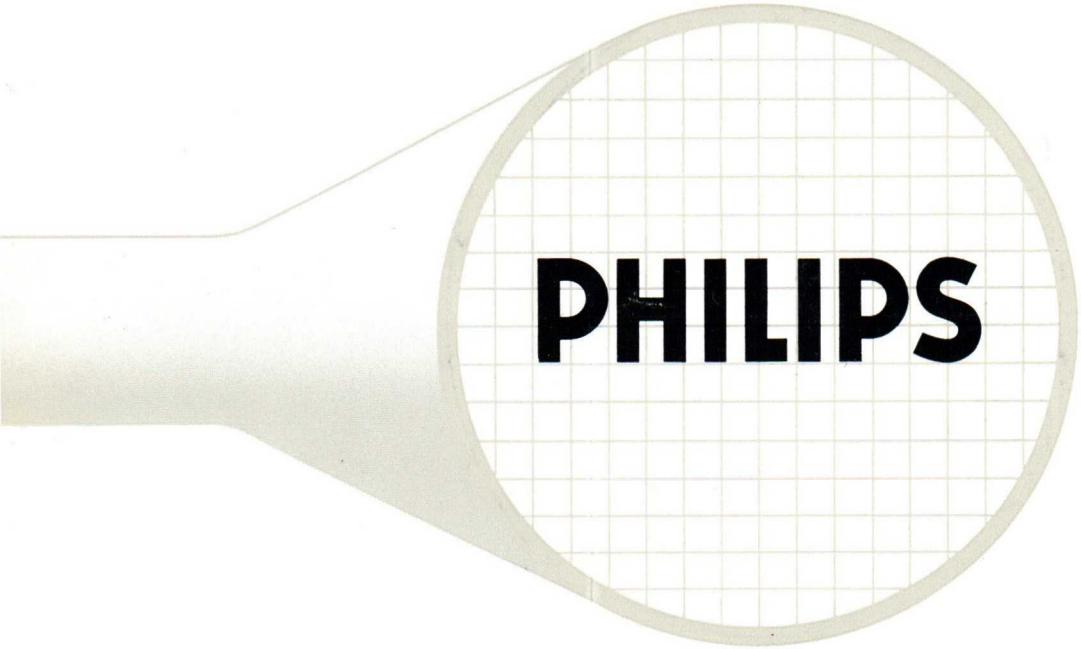
PHILIPS CATHODE-RAY TUBES

for measuring equipment



PHILIPS ELECTRONIC TUBE DIVISION



CATHODE-RAY TUBES

for measuring equipment

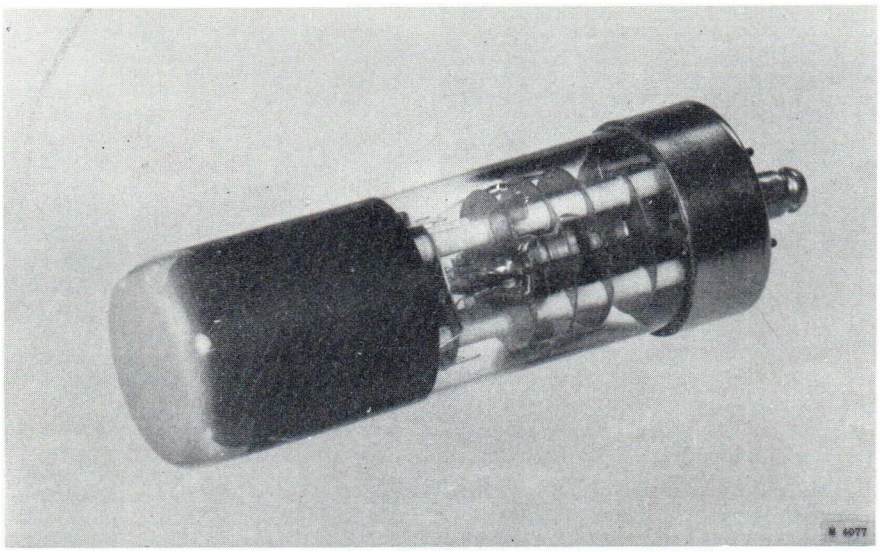
PHILIPS

DH 3-91

LOW-VOLTAGE CATHODE-RAY TUBE

with 3 cm screen

FOR INDICATING PURPOSES



Photograph of the DH 3-91 (about actual size).

The DH3-91 is a low-voltage oscilloscope tube with a 3 cm diameter screen. It features automatic focus, asymmetric vertical, and symmetric horizontal deflection. In addition, this tube, which is primarily intended for indicating purposes, monitoring etc. has the following properties:

1. An accelerator voltage of only 500 V, resulting in a very simple and small high-tension supply.

2. The tube may be operated with its cathode at earth potential, without occurrence of "electrostatic body effect". This has been reached by connecting a transparent conducting film, present between the phosphor layer and the faceplate, to the accelerator.

Besides the conventional technical data some supply arrangements have been added for the convenience of the user.

Technical data

Heating

Indirect by A.C. or D.C.; parallel supply

heater voltage	V_f	=	6.3 V
heater current	I_f	=	0.55 A

Capacitances

D_1 to all other electrodes	C_{D1}	=	3.5 pF
D_2 to all other electrodes (Except the opposite deflection plate.)	C_{D2}	=	4.5 pF
D_2' to all other electrodes (Except the opposite deflection plate.)	$C_{D2'}$	=	4.0 pF
D_2 to D_2'	$C_{D2D2'}$	=	1.0 pF
Grid No.1 to all other electrodes	C_{g1}	=	6.0 pF
Cathode to all other electrodes	C_k	=	9.0 pF

Screen

Fluorescence	green
Persistence	medium
Useful screen diameter	28 mm

Focusing

electrostatic, self focusing

Deflection

double electrostatic

D_1D_1' asymmetrical
D_2D_2' symmetrical

Line width

$V_{g2,g4,D_1'}$ = 500 V
= 0.5 µA

0.6 mm
(Measured on a circle of 25 mm diameter.)

Typical operating conditions

Accelerator voltage	$V_{g2,g4,D_1'}$	=	500 V
Negative grid no.1 voltage (For visual extinction of the focused spot.)	$-V_{g1}$	=	8-27 V
Deflection sensitivity			
Vertical D_1D_1'	N_1	=	0.22 mm/V
Horizontal D_2D_2'	N_2	=	0.19 mm/V

Limiting values (Absolute limits)

Accelerator voltage	$V_{g2,g4,D_1'}$	= max.	1000 V
		= min.	350 V
Grid No.1 voltage	$-V_{g1}$	= max.	100 V
		= min.	1 V
Peak voltage between cathode and heater	V_{kf_p}	= max.	250 V
Screen dissipation	W_ℓ	= max.	2 mW/cm²

Circuit design values and maximum circuit values

Negative grid No.1 voltage	$-V_{g1}$	=	16-54 V [1]
Deflection factor for:	D_1D_1'	=	9.1 V/mm [1]
	D_2D_2'	=	10.5 V/mm [1]
Grid No.1 circuit resistance	R_{g1}	= max.	1 MΩ
Deflection plate resistance	R_D	= max.	5 MΩ

[1]) Per kV accelerator voltage $V_{g2,g4,D_1'}$

MECHANICAL DATA

Mounting position	Any
Net weight	approx. 39 g
Base	Loctal 8-pin

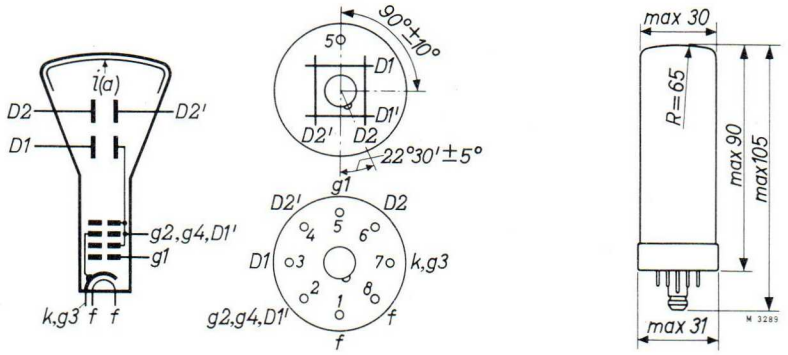


Fig.1. Electrode arrangement, electrode connections and maximum dimensions (in mm) of the DH 3-91.

OPERATING NOTES:

1. Deflection

Vertical D_1D_1' asymmetrical

Horizontal D_2D_2' symmetrical

In the vertical direction only asymmetrical operation is possible since the D_1' plate is internally connected to the accelerator electrode. In the horizontal direction the tube is designed for symmetrical operation. Although asymmetrical operation is permissible, this will result in trapezium distortion being introduced.

The arrangement of the plates is such that viewing the base with the tube axis horizontal and pin 5 vertically above pin 1, a positive voltage on the D_2 plate deflects the spot to the right and a positive voltage on the D_1 plate deflects the spot downward. When symmetrically operated the mean potential of the D_2 plates must be that of the final anode. When asymmetrical operation is used, one plate must not differ from the final anode potential by more than the deflection voltage.

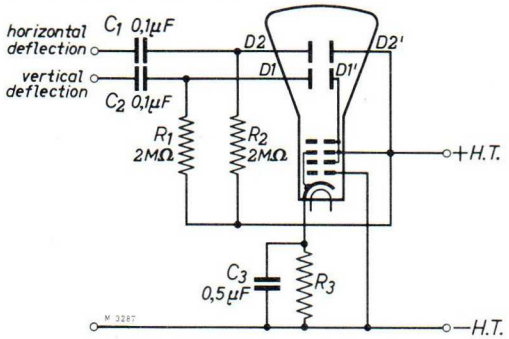


Fig.2. Supply arrangement for the DH 3-91. The value of the cathode resistor R_3 can be chosen from Fig.4.

2. Supply arrangements

In view of the simplicity of the operating requirements no additional supplies may be required when the tube is incorporated in some equipment. An arrangement suitable for use in such a case is shown in Fig 2. Fixed bias is provided by the cathode resistor R_3 which may be by-passed if necessary by a 0.5 μF capacitor. Although tubes may not be identical in respect of their "brightness-grid voltage" characteristic, this method of auto-bias produces almost constant brilliance in changing from tube to tube.

Owing to the presence of a transparent conducting film connected to the anode between the screen of the tube and the glass, the tube may be operated with its cathode at earth potential without any oscillogram distortion when an earthed body is brought near the screen.

Depending on the individual application, the simple arrangement shown may be unsuitable for a variety of reasons. Two of the commonest

drawbacks, with suggestions for overcoming them, are:

a. If various patterns are to be displayed on the same tube it is probable that different beam currents will be required to produce the same brightness on each oscillogram. A modified variable brilliance control can be provided merely by using a variable cathode bias resistor. Alternatively, if it is required to "black-out" the trace a combination of tube current and bleed can be used. In either case it is desirable to incorporate a limiting resistor in order to prevent excessive beam current being drawn.

b. Since the deflector plates are essentially at h.t. potential it is not normally possible to employ d.c. coupling to them. Should this be required it is necessary to run the tube anode at the mean potential of the deflector plates, which usually involves tapping the anode across the h.t. supply. If there is no point from which the d.c. signal can be taken, which allows the necessary minimum h.t. to be obtained, it is recommended that a negative supply be utilised. this may be incorporated in the apparatus.

Fig.3 shows the two modifications listed above. In it the D2 plates are shown d.c. connected and the D_1 plates a.c. connected. No horizontal shift network is included. V_1 is the actual working voltage of the tube.

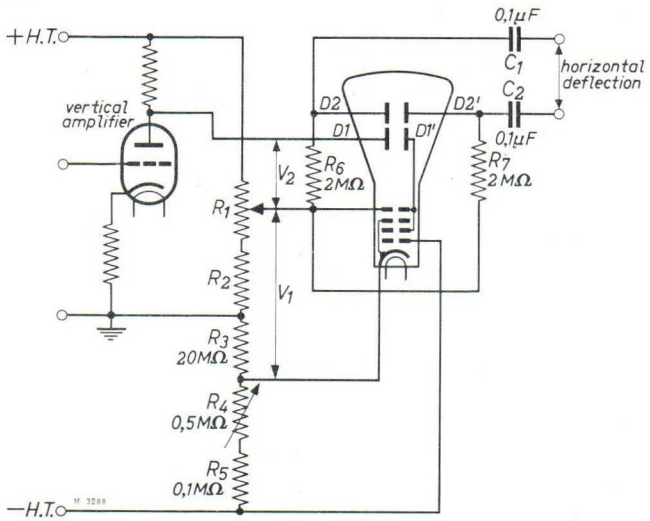


Fig.3. Supply arrangement for d.c. connected D_2 plates (horizontal deflection) and a.c. connected D_1 plates (vertical deflection). R_1 and R_2 are chosen such that the mean value of V_2 = 0 V. Brilliance control is possible by means of the variable cathode resistor.

Remark

If it is required to run the D_1 plate only from a d.c. signal the anode tap can be used as a centering device.

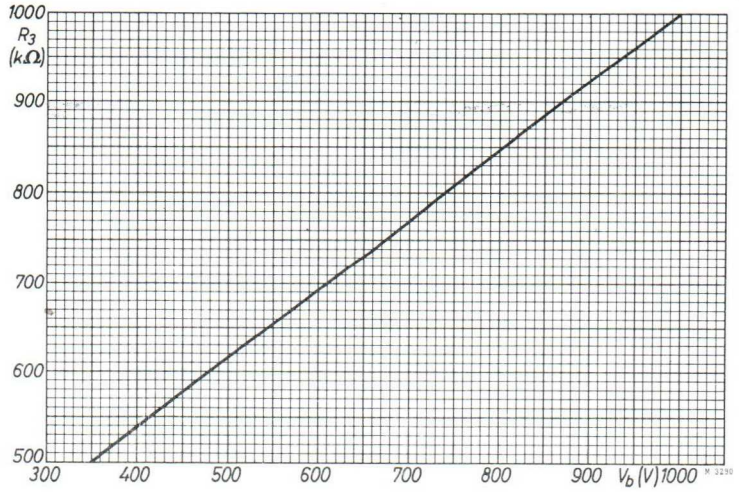
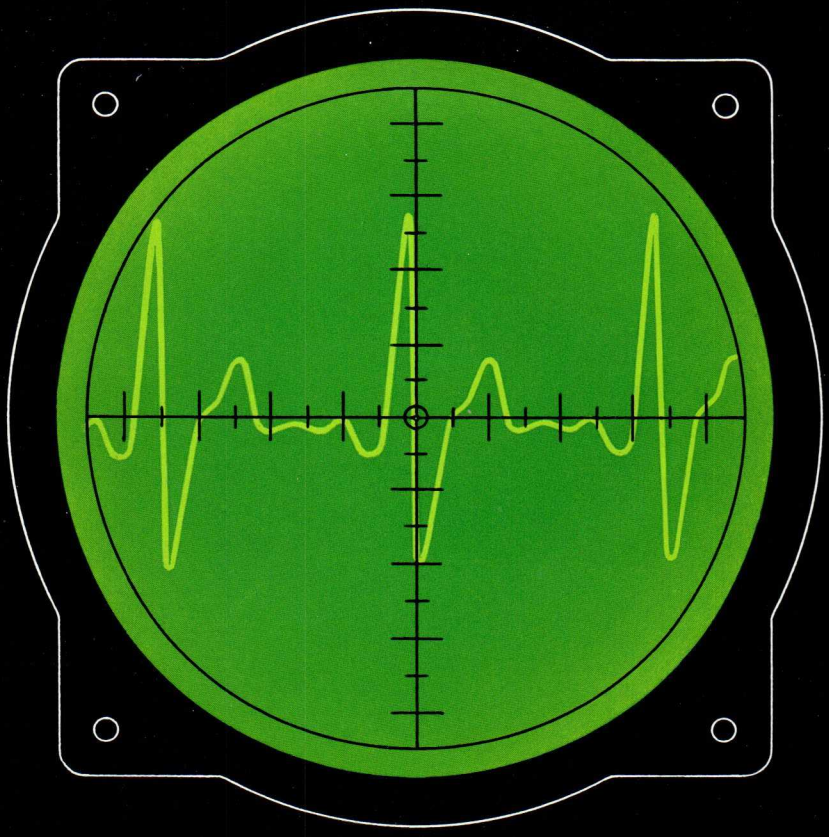


Fig.4. Cathode resistor R_3 as a function of the supply voltage for the circuit diagram of Fig.2.

PHILIPS CATHODE-RAY TUBES

for measuring equipment



PHILIPS ELECTRON TUBE DIVISION

DG 7-5
DB 7-5
DP 7-5
DR 7-5

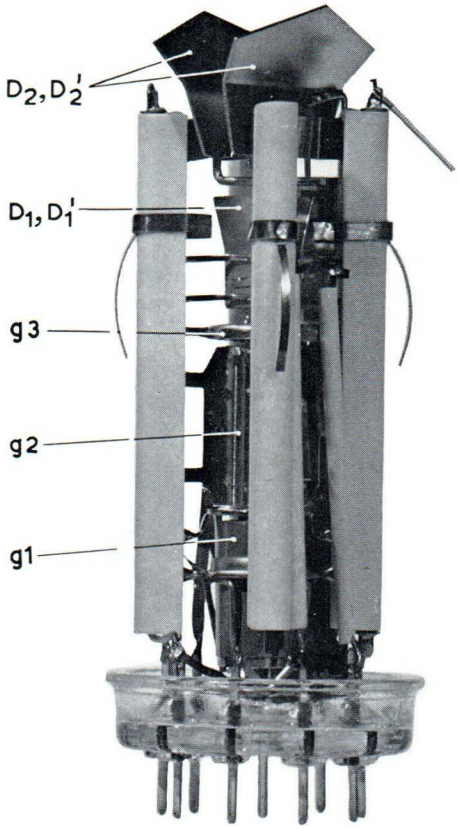
PHILIPS

INSTRUMENT CATHODE-RAY TUBE

DG 7-5
DB 7-5
DP 7-5
DR 7-5

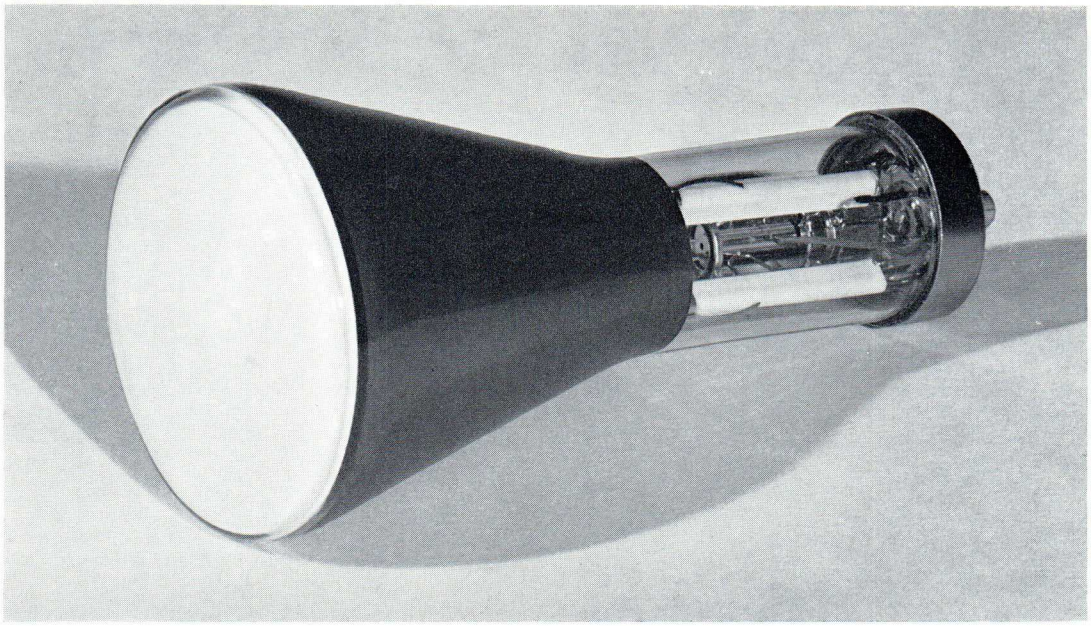
- *Overall length only 16 cm ($6\,^{5}/_{16}''$)*
- *A brilliant spot*
- *No deflection defocusing*
- *Symmetric deflection*
- *Four screen types*

The Philips Cathode Ray Tube DG 7-5 with its 7 cm (3″) screen, gives ample screen area and spot-brilliancy for small and easily transportable low-cost oscilloscopes.



Electron gun of the cathode-ray tube DG 7-5

D_2D_2' — plates for horizontal deflection
D_1D_1' — plates for vertical deflection
g_1 — control grid
g_2 — focusing electrode
g_3 — electrode for pre-deflection acceleration



The Philips Cathode-Ray Tube DG 7-5 has the following main features:

Thanks to the small dimensions and electrical characteristics, this tube will give outstanding service in all applications where low-cost, light-weight apparatus for oscilloscopy are of prime importance.

800 Volts accelerating voltage; which can easily be obtained from a relatively simple high tension supply.

A brilliant spot owing to excellent screen properties.

A remarkably good picture over the entire screen surface.

Symmetric deflection, providing for low interelectrode capacity and good linearity.

For various applications different screen types available:

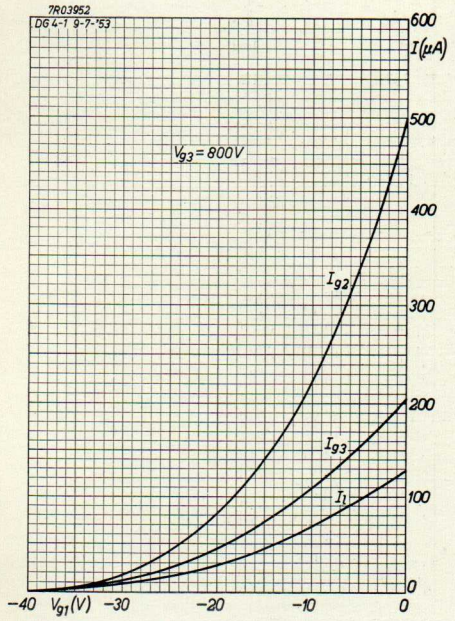
G. A green screen for oscilloscopy and recording of medium- and high-frequency phenomena.

B. A blue screen for photographic recording of non-recurrent high-speed phenomena.

P. A double-layer screen with bluish fluorescence for oscilloscopy and recording of low-frequency and low-speed non-recurrent phenomena.

R. A greenish-yellow screen for oscilloscopy and recording of low- and medium-frequency signals. *)

*) Detailed information on all phosphors is given in a folder dealing with data and characteristics of Philips phosphors.



Grid No 3, grid No 2 and screen current as a function of grid cut-off voltage

ELECTRICAL DATA

Screen

Tube type	Fluorescence (colour)	Persistence	
		Character	0.1% of max. brightness after
DG 7-5	green	medium	50 milli sec.
DB 7-5	blue	short	20 milli sec.
DP 7-5	blue (afterglow greenish-yellow)	very long	80 sec.
DR 7-5	greenish-yellow	long	20 sec.

Heating Indirect by A.C. or D.C.
Heater voltage: . . V_f = 6.3 V
Heater current: . . I_f = 0.31 A

Deflection Double electrostatic D_1D_1' symmetric, D_2D_2' symmetric

Focusing Electrostatic

Line width at V_{g3} = 800 V, I_l = 0,5 μA = 0.7 mm *)

INTERELECTRODE CAPACITANCES					
Electrodes	Symbol	Value (pF)	Electrodes	Symbol	Value (pF)
D_1 to D_1'	$C_{D_1D_1'}$	0.6	D_1' to all	$C_{D_1'}$	5.3
D_2 to D_2'	$C_{D_2D_2'}$	0.8	D_2 to all	C_{D_2}	4.5
$D_1 + D_1'$ to $D_2 + D_2'$	$C_{D_1D_1'} - D_2D_2'$	0.15	D_2' to all	$C_{D_2'}$	4.5
D_1 to all	C_{D_1}	5.3	Grid 1 to all	C_{g1}	10

Operating characteristics

Grid no. 3 voltage	V_{g3}	=	800 V
Grid no. 2 voltage	V_{g2}	=	200 - 300 V
Negative grid no. 1 voltage for visual extinction of the focused spot	$-V_{g1}$	=	0 - 50 V
Deflection sensitivity	D_1D_1'	=	0,25 mm/V
Deflection sensitivity	D_2D_2'	=	0,16 mm V

Limiting values

Grid no. 3 voltage	V_{g3}	=	max. 1000 V min. 800 V
Grid no. 2 voltage	V_{g2}	=	max. 400 V
Grid no. 1 voltage (negative value)	$-V_{g1}$	=	max. 100 V
Grid no. 1 voltage (positive value)	$+V_{g1}$	=	max. 0 V
Peak voltage on deflection plates D_1D_1'	$V_{D_1D_1'p}$	=	max. 450 V
Peak voltage on deflection plates D_2D_2'	$V_{D_2D_2'p}$	=	max. 750 V
Screen dissipation	W_l	=	max. 3 mW/cm²

Maximum circuit values

Deflection plate circuit resistance	R_D	=	max. 5 Mohm
Grid no. 1 circuit resistance	R_{g1}	=	max. 0,5 Mohm

MECHANICAL DATA

Mounting position: any

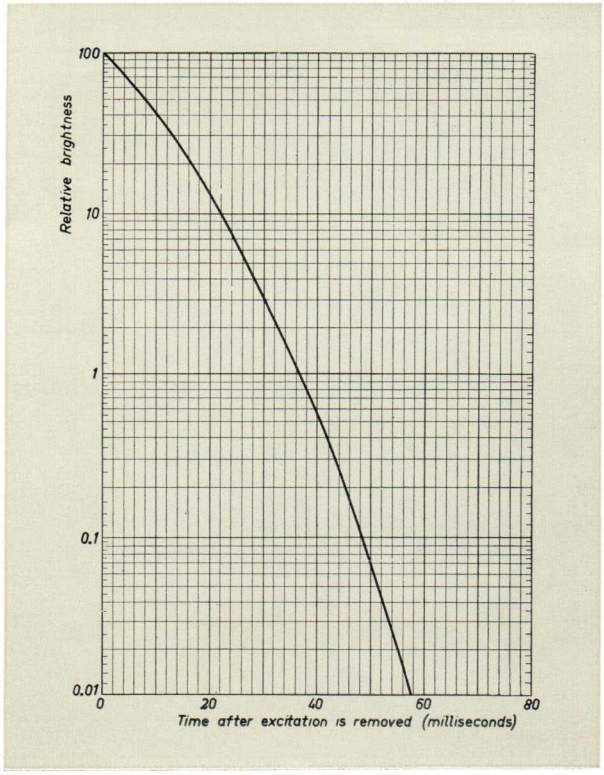
Nett weight: 140 g (5 ounces)

Dimensions: overall length 16 cm ($6\frac{5}{16}$")
screen diameter 7 cm (3")

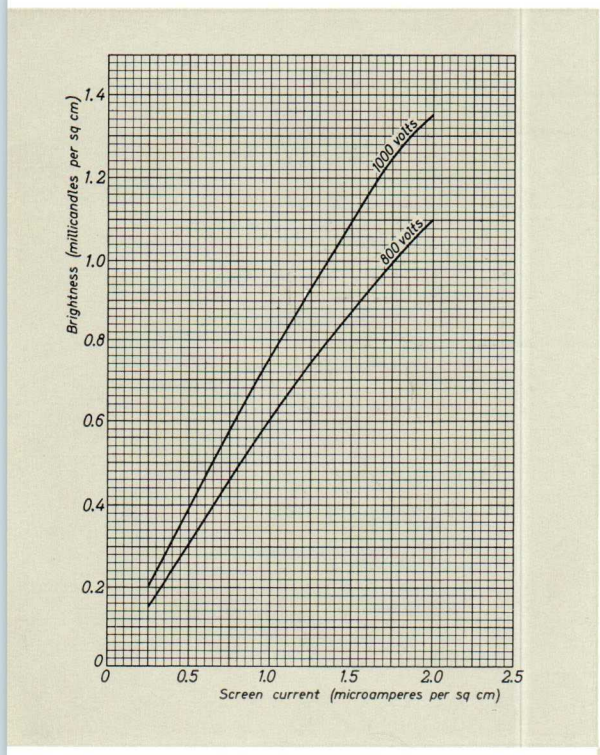
*) Measured on a circle of 50 mm diameter.

G-screen

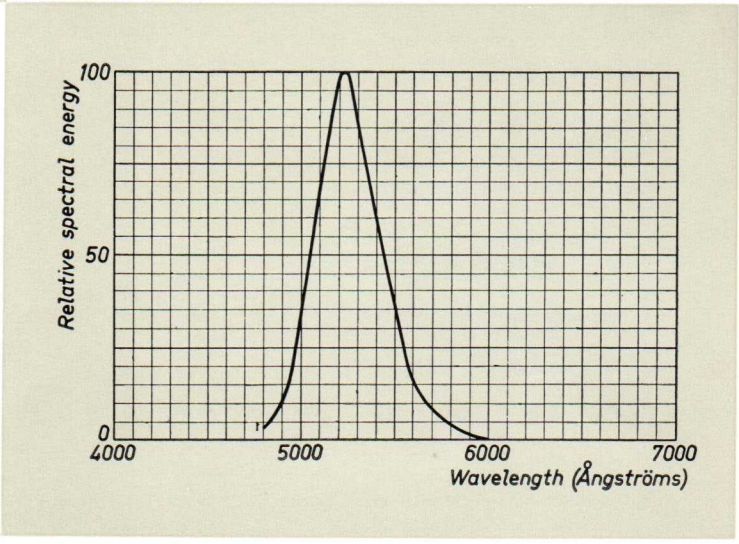
The green fluorescent G-screen provides high visual contrast under conditions of normal ambient illumination. It has medium persistence and can be used for visual observation of recurrent phenomena in the majority of applications.



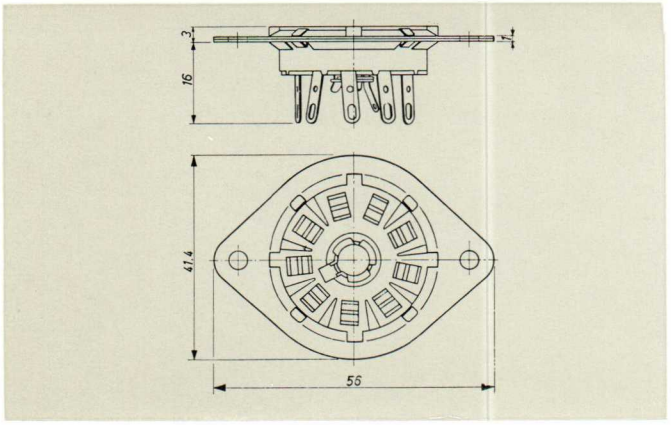
Persistence characteristic of a G-screen.



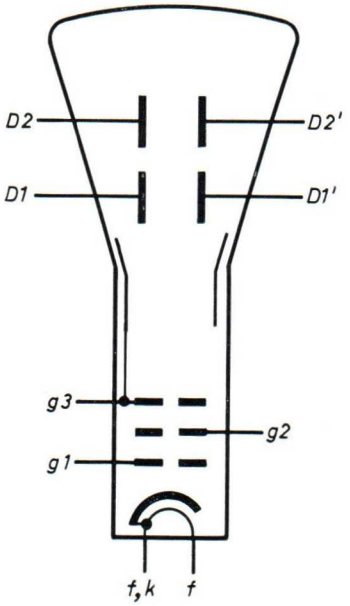
Brightness of a G-screen as a function of the screen current per square cm screen area, with the accelerating potential as a parameter.



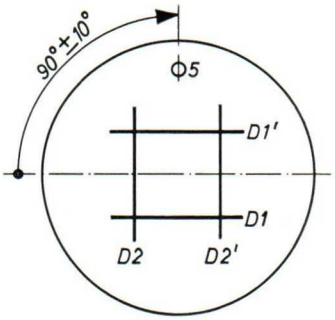
Relative spectral energy distribution of a G-screen



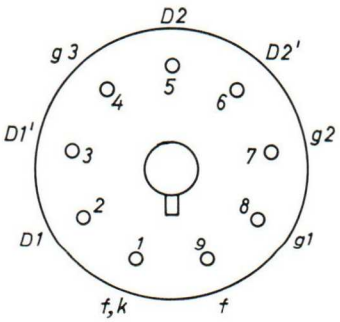
Base: English loctal 9 pins



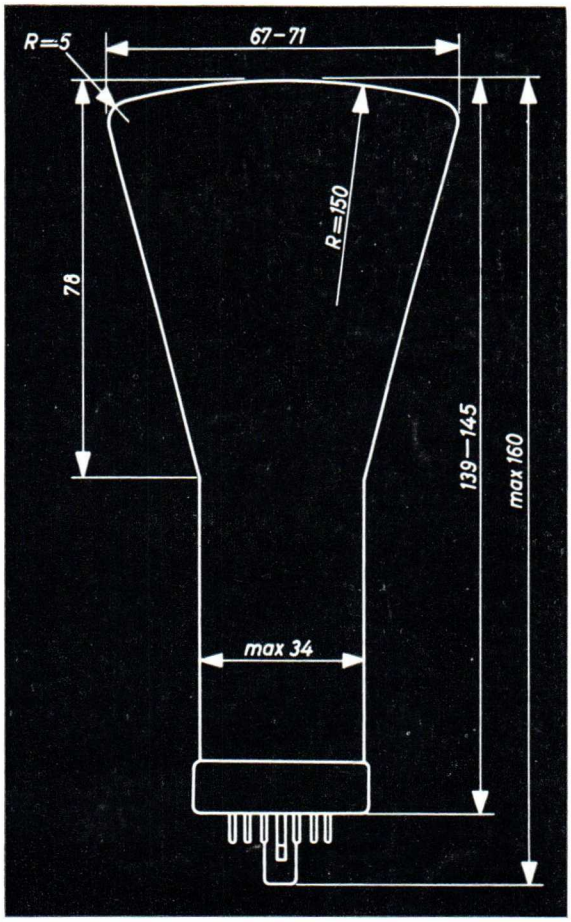
Electrode arrangement



Position of the deflection plates



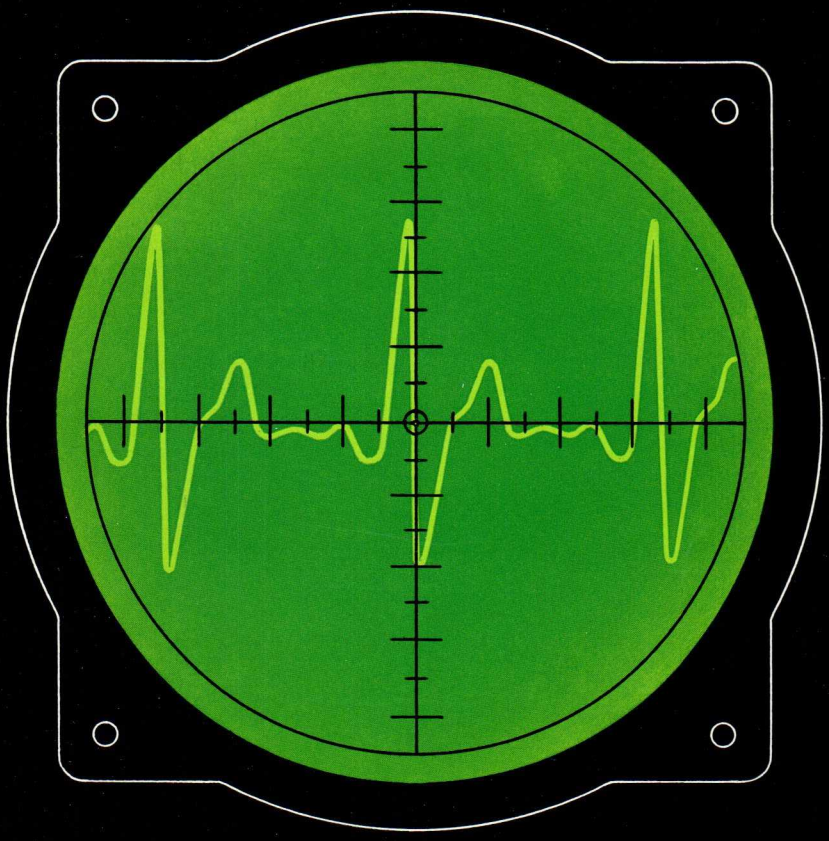
Base connections



Outline drawing of the DG 7-5 (dimensions in mm)

PHILIPS CATHODE-RAY TUBES

for measuring equipment



PHILIPS ELECTRON TUBE DIVISION

DG 7-6
DB 7-6
DP 7-6
DR 7-6

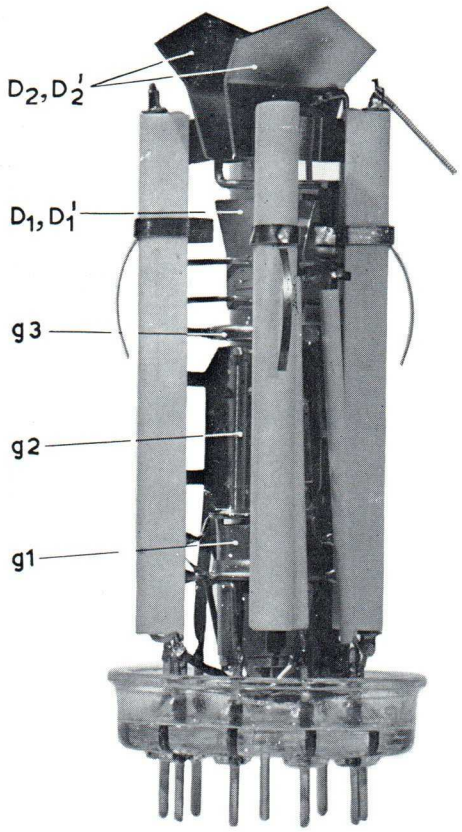
PHILIPS

INSTRUMENT CATHODE-RAY TUBE

DG 7-6
DB 7-6
DP 7-6
DR 7-6

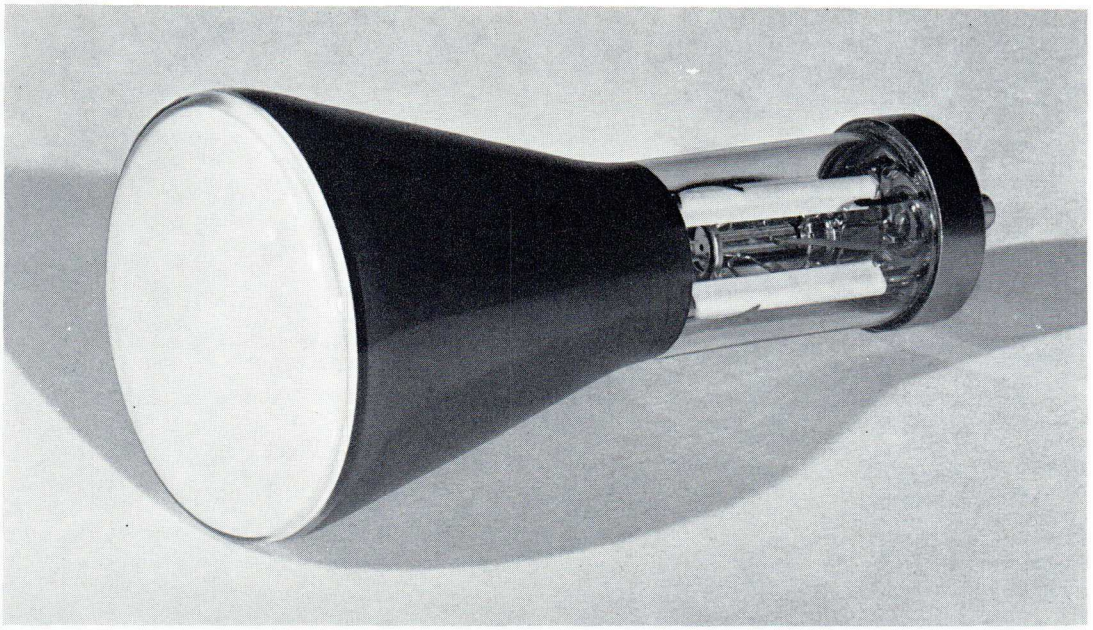
- *Overall length only of 16 cm ($6\,^{5}/_{16}''$)*
- *A brilliant spot*
- *No deflection defocusing*
- *Asymmetric deflection*
- *Different screen types*

The Philips Cathode Ray Tube DG 7-6 with its 7 cm (3″) screen, gives ample screen area and spot-brilliancy for small and easily transportable low-cost oscilloscopes.



Electron gun of the cathode-ray tube DG 7-6

D_2D_2' — plates for horizontal deflection
D_1D_1' — plates for vertical deflection
g_1 — control grid
g_2 — focusing electrode
g_3 — electrodes for pre-deflection acceleration



The Philips Cathode-Ray Tube DG 7-6 has the following main features:

Thanks to the small dimensions and electrical characteristics, this tube will give outstanding service in all applications where low-cost, light-weight apparatus for oscilloscopy are of prime importance.

800 Volts accelerating voltage; which can easily be obtained from a relatively simple high tension supply.

A brilliant spot owing to excellent screen properties.

A remarkably good picture over the entire screen surface.

Asymmetric deflection, asking only a simple design of the timebase.

For various applications different screen types available:

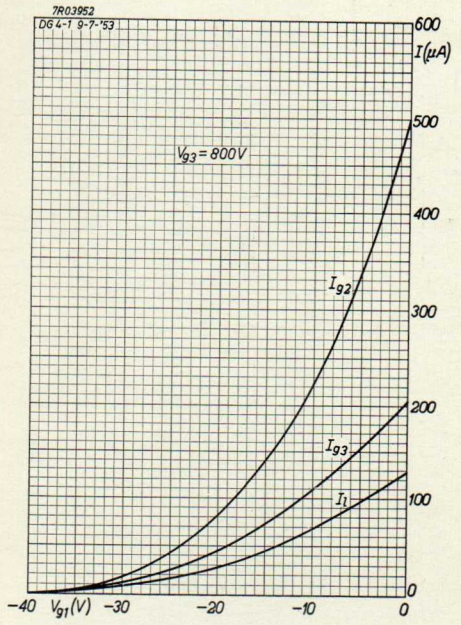
G. A green screen for oscilloscopy and recording of medium- and high-frequency phenomena.

B. A blue screen for photographic recording of non-recurrent high-speed phenomena.

P. A double-layer screen with bluish fluorescence for oscilloscopy and recording of low-frequency and low-speed non-recurrent phenomena.

R. A greenish-yellow screen for oscilloscopy and recording of low- and medium-frequency signals. *)

*) Detailed information on all phosphors is given in a folder dealing with data and characteristics of Philips phosphors.



Grid No 3, grid No 2 and screen current as a function of grid cut-off voltage

ELECTRICAL DATA

Screen

Tube type	Fluorescence (colour)	Persistence	
		Character	0.1% of max. brightness after
DG 7-6	green	medium	50 milli sec.
DB 7-6	blue	short	20 milli sec.
DP 7-6	blue (afterglow greenish-yellow)	very long	80 sec.
DR 7-6	greenish-yellow	long	20 sec.

Heating Indirect by A.C. or D.C.
Heater voltage: . . V_f = 6.3 V
Heater current: . . I_f = 0.31 A

Deflection Double electrostatic D_1D_1' symmetric, D_2D_2' asymmetric

Focusing Electrostatic

Line width at V_{g3} = 800 V, I_l = 0,5 μA = 0.7 mm *)

INTERELECTRODE CAPACITANCES					
Electrodes	Symbol	Value (pF)	Electrodes	Symbol	Value (pF)
D_1 to D_1'	$C_{D_1D_1'}$	0.6	D_1' to all	$C_{D_1'}$	5.3
D_2 to D_2'	$C_{D_2D_2'}$	0.8	D_2 to all	C_{D_2}	4.5
$D_1 + D_1'$ to $D_2 + D_2'$	$C_{D_1D_1'-D_2D_2'}$	0.5	D_2' to all	$C_{D_2'}$	4.5
D_1 to all	C_{D_1}	5.3	Grid 1 to all	C_{g_1}	10

Operating characteristics

Grid no. 3 voltage	V_{g3}	=	800 V
Grid no. 2 voltage	V_{g2}	=	200 - 300 V
Negative grid no. 1 voltage for visual extinction of the focused spot	$-V_{g1}$	=	0 - 50 V
Deflection sensitivity	D_1D_1'	=	0,25 mm/V
Deflection sensitivity	D_2D_2'	=	0,16 mm/V

Limiting values

Grid no. 3 voltage	V_{g3}	=	max. 1000 V min. 800 V
Grid no. 2 voltage	V_{g2}	=	max. 400 V
Grid no. 1 voltage (negative value)	$-V_{g1}$	=	max. 100 V
Grid no. 1 voltage (positive value)	$+V_{g1}$	=	max. 0 V
Peak voltage on deflection plates D_1D_1'	$V_{D_1D_1'p}$	=	max. 450 V
Peak voltage on deflection plates D_2D_2'	$V_{D_2D_2'p}$	=	max. 750 V
Screen dissipation	W_l	=	max. 3 mW/cm²

Maximum circuit values

Deflection plate circuit resistance	R_D	=	max. 5 Mohm
Grid no. 1 circuit resistance	R_{g_1}	=	max. 0,5 Mohm

MECHANICAL DATA

Mounting position: any

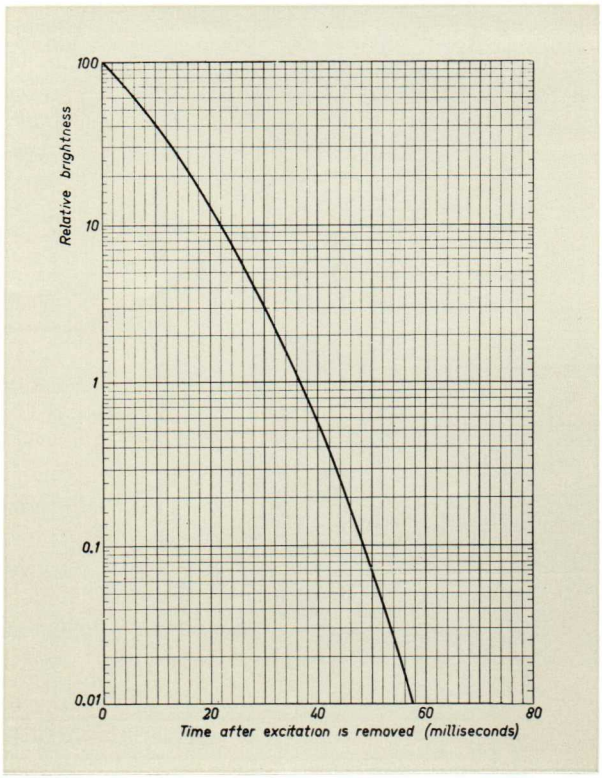
Nett weight: 140 g (5 ounces)

Dimensions: overall length 16 cm ($6\frac{5}{16}$")
screen diameter 7 cm (3")

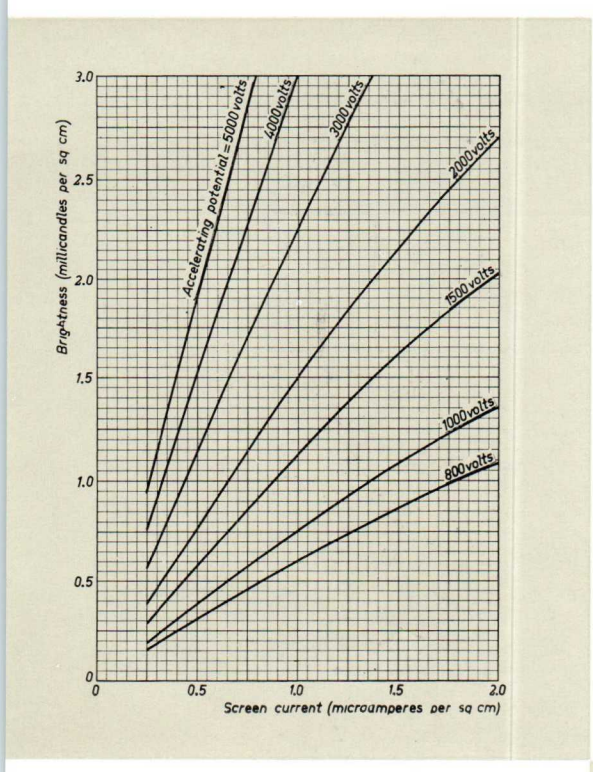
*) Measured on a circle of 50 mm diameter.

G-screen

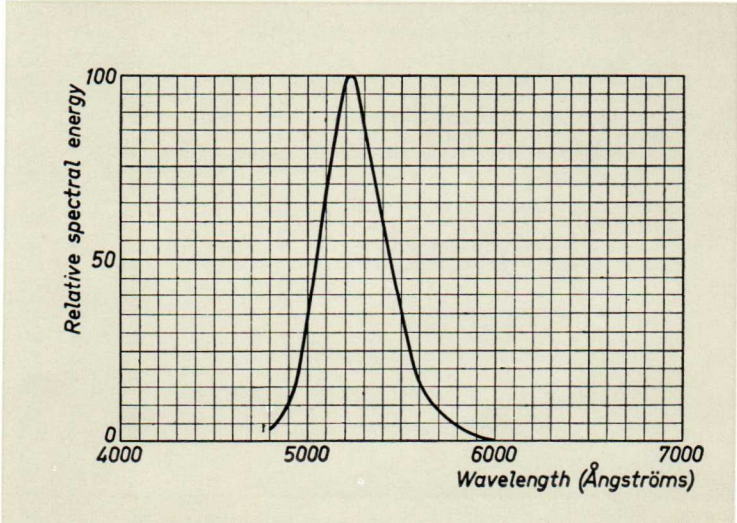
The green fluorescent G-screen provides high visual contrast under conditions of normal ambient illumination. It has medium persistence and can be used for visual observation of recurrent phenomena in the majority of applications.



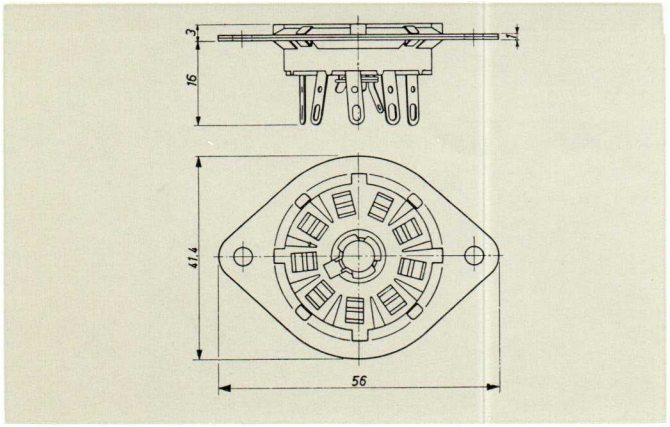
Persistence characteristic of a G-screen.



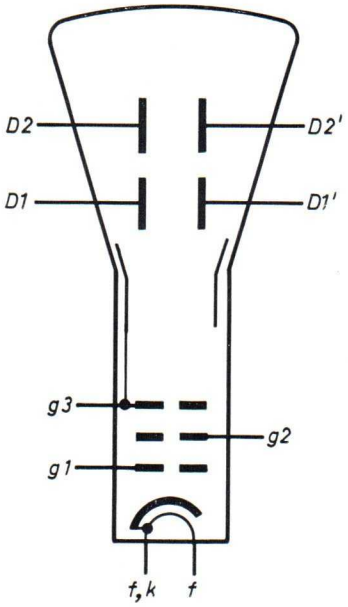
Brightness of a G-screen as a function of the screen current per square cm screen area, with the accelerating potential as a parameter.



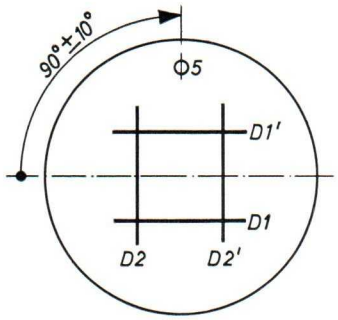
Relative spectral energy distribution of a G-screen



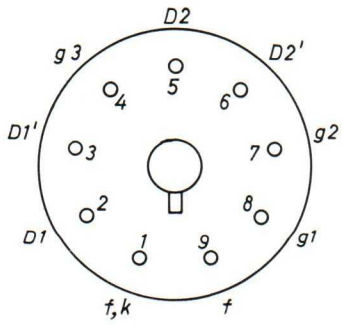
Base: English loctal 9 pins



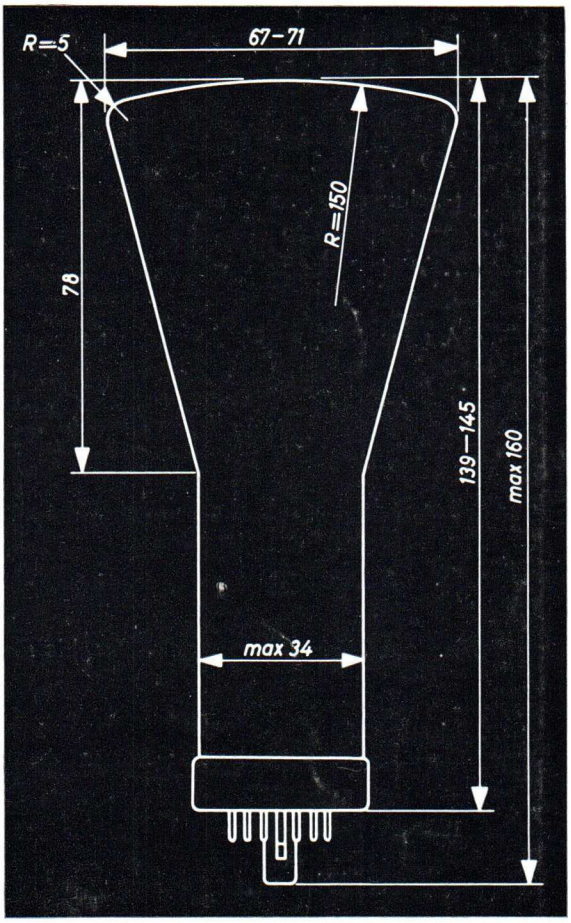
Electrode arrangement



Position of the deflection plates



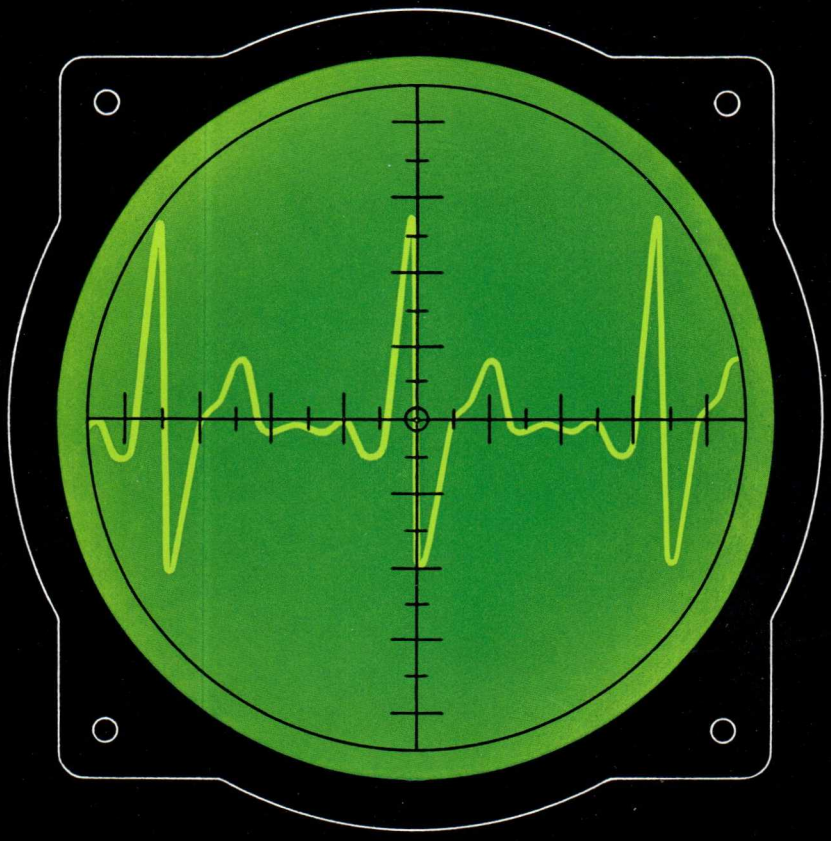
Base connections



Outline drawing of the DG 7-6 (dimensions in mm)

PHILIPS CATHODE-RAY TUBES

for measuring equipment



PHILIPS ELECTRON TUBE DIVISION

LOW-VOLTAGE
Cathode-Ray Tube

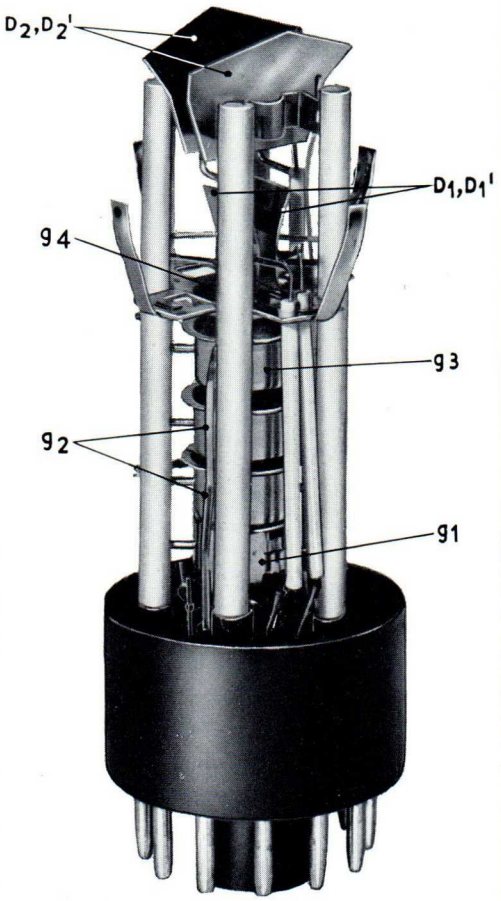
DG 7-31

PHILIPS

LOW-VOLTAGE INSTRUMENT CATHODE-RAY TUBE

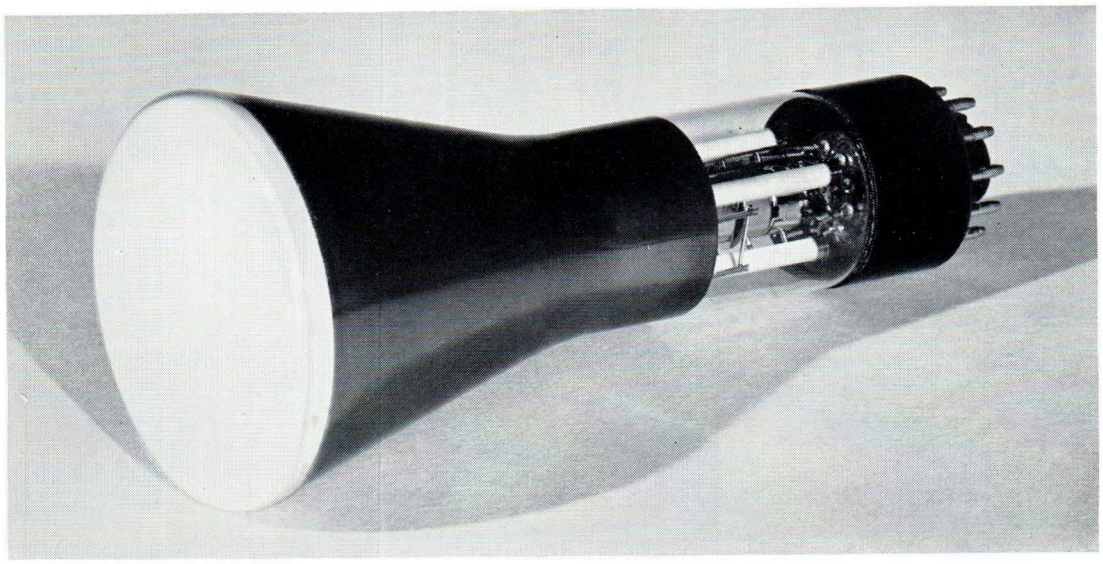
DG 7-31

- *400 V final anode voltage*
- *Deflection sensitivity 0.4 mm/V*
- *Small spot size, high brilliancy, excellent contrast*
- *Asymmetric deflection*
- *Overall length only 17 cm ($6^3/_4$")*



Electron gun of the cathode-ray tube DG 7-31

D_2D_2' — plates for horizontal deflection.
D_1D_1' — plates for vertical deflection
g_1 — control grid
g_2,g_4 — electrodes for pre-deflection acceleration
g_3 — focusing electrode



The DG 7-31 is a new type in our range of 7 cm (3″) cathode-ray tubes with characteristics making the tube particularly suitable for applications in low-cost, low-voltage, indicating instruments such as small, light-weight service oscilloscopes etc.

The type DG 7-31 has the following main features:

- Low anode voltage(400V) without screenburn or screencharge, thanks to the gun construction and a conductive layer placed in between the inner glass surface and the phosphor screen;
- High deflection sensitivity (0,4 mm/V) owing to the special design of the deflection plates;
- Asymmetric deflection; simplified design of the time base circuit;
- Fine and brilliant spot with a high contrast ratio;
- Overall length of only 17 cm ($6^3/_4$″).

The transparent, contrast improving and conductive layer between the face and the phosphor, being connected to the final anode, gives full protection against "electrostatic body-effect" even at high operation potential.

The fine characteristics of the tube render it very suitable for a wide range of applications in the indicating instruments field.

ELECTRICAL DATA

Screen
Fluorescence: green
Persistence : medium

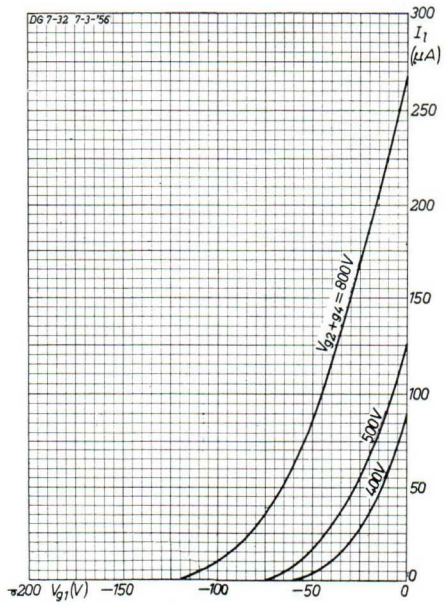
Heating indirect by a.c. or d.c.; series or parallel supply

Heater voltage	V_f =	6.3	V
Heater current	I_f =	0.3	A

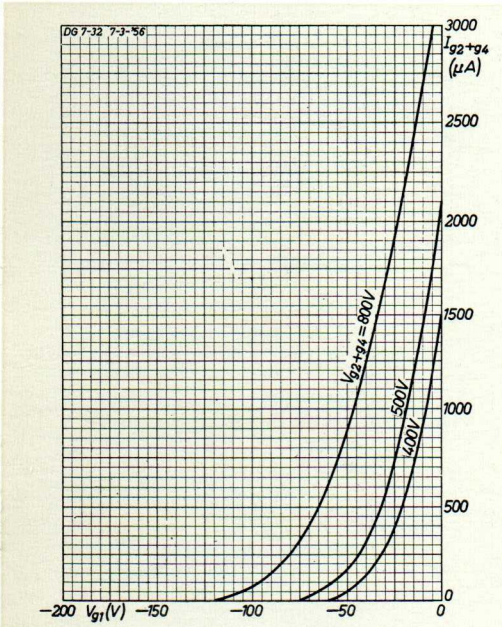
Focusing electrostatic

Deflection double electrostatic		D_1D_1' symmetric D_2D_2' asymmetric [1]
Line width at $V_{(g_2+g_4)}$	= 500 V	
I_l	= 0.5 μA	0.5 mm [2]

1) D_2 has to be connected to g_2+g_4
2) Measured on a circle of 50 mm diameter.



Screen current plotted against negative grid No 1 voltage



Final anode current plotted against grid cut-off voltage

INTERELECTRODE CAPACITANCES

Electrodes	Symbol	Cap. (pF)
D_1 to D_1'	$C_{D_1D_1'}$	1.1
D_2 to D_2'	$C_{D_2D_2'}$	1.8
D_1 to all	C_{D_1}	2.5[1])
D_1' to all	$C_{D_1'}$	2.5[1])
D_2 to all	C_{D_2}	3.4[1])
D_2' to all	$C_{D_2'}$	3.0[1])
Grid 1 to all	C_{g1}	7.6
Cathode to all	C_k	3.2

Operating characteristics

Grid No. 2 and grid No. 4 voltage	$V_{(g_2+g_4)}$	=	500	V
Grid No. 3 voltage	V_{g_3}	=	0-120	V [2])
Negative grid No. 1 voltage for visual extinction of the focused spot	$-V_{g_1}$	=	50-100	V
Deflection sensitivity	D_2D_2'	=	0.35-0.43	mm/V
Deflection sensitivity	D_1D_1'	=	0.22-0.28	mm/V

Limiting values (design centre values)

Grid No. 2 and grid No. 4 voltage	$V_{(g_2+g_4)}$	= max.	800	V
		= min.	400	V
Grid No. 3 voltage	V_{g_3}	= max.	200	V [2])
Grid No. 1 voltage (negative value)	$-V_{g_1}$	= max.	160	V
Grid No. 1 voltage (positive value)	$+V_{g_1}$	= max.	0	V
Peak voltage on D_1D_1'	$V_{D_1D_1'p}$	= max.	450	V
Peak voltage on D_2D_2'	$V_{D_2D_2'p}$	= max.	750	V
Voltage between cathode and heater	V_{kf}	= max.	125	V
Screen dissipation	W_l	= max.	3	mW/cm^2
Grid No. 2 and grid No. 4 dissipation	$W_{(g_2+g_4)}$	= max.	0.5	W

Maximum circuit values

Deflection plate circuit resistance	R_D	=	5	MΩ
Grid No. 1 circuit resistance	R_{g_1}	=	0.5	MΩ

MECHANICAL DATA

Mounting position: any

Dimensions: overall length 172 mm ($6^3/_4$″)
screen diameter 70 mm (3″)

Net weight: 120 g (4.2 ounce)

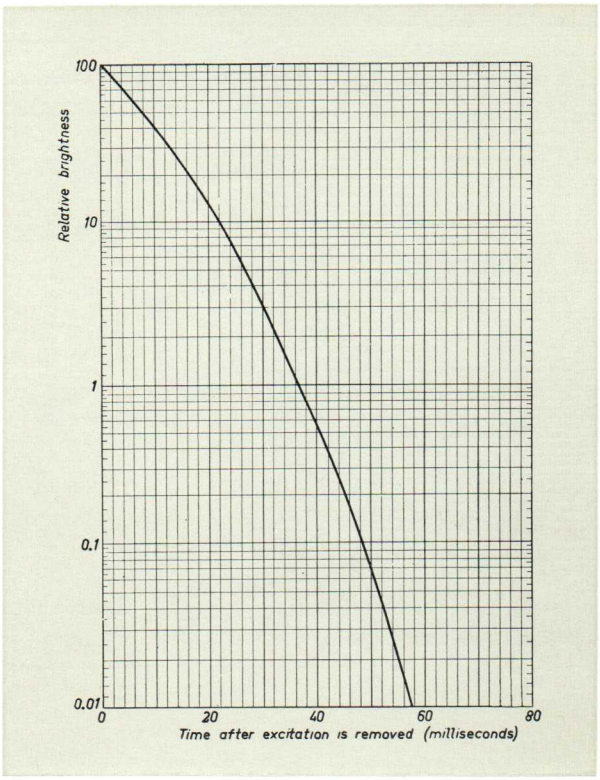
---

1) Except the opposite deflection plate.

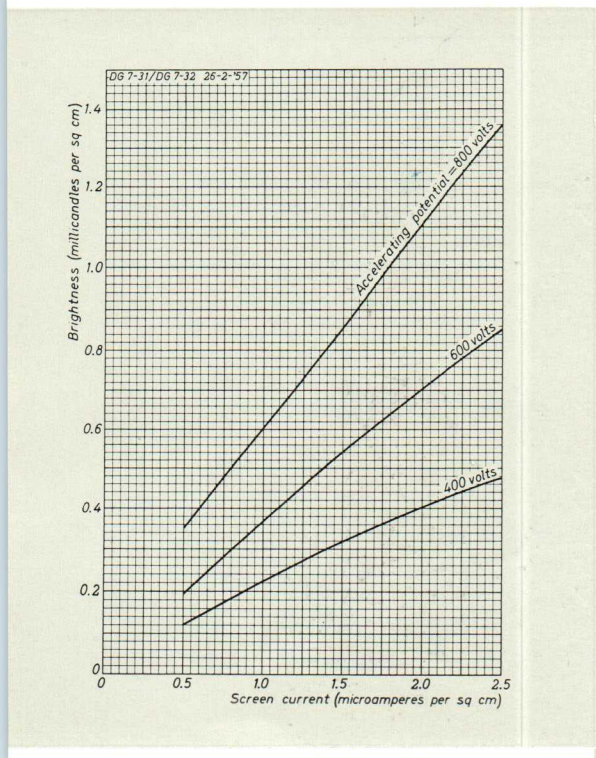
2) For calculation of the grid 3 potentiometer a grid 3 current of min. −15 μA and max. +10 μA must be taken into account.

G-screen

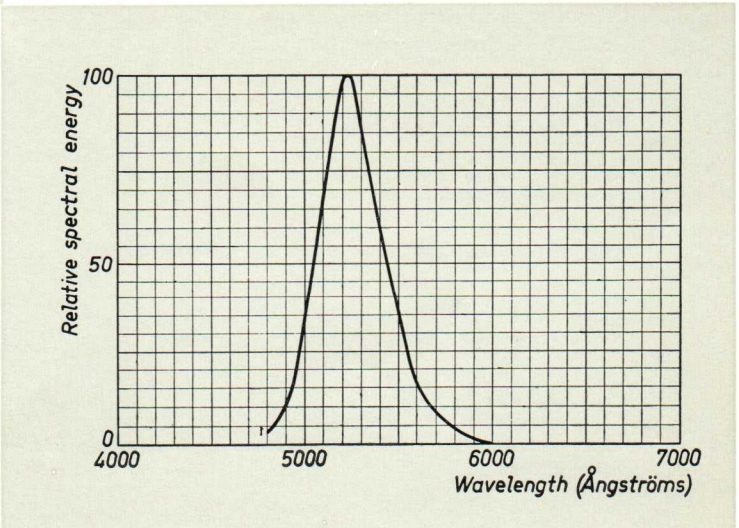
The green fluorescent G-screen provides high visual contrast under conditions of normal ambient illumination. It has medium persistence and can be used for visual observation of recurrent phenomena in the majority of applications.



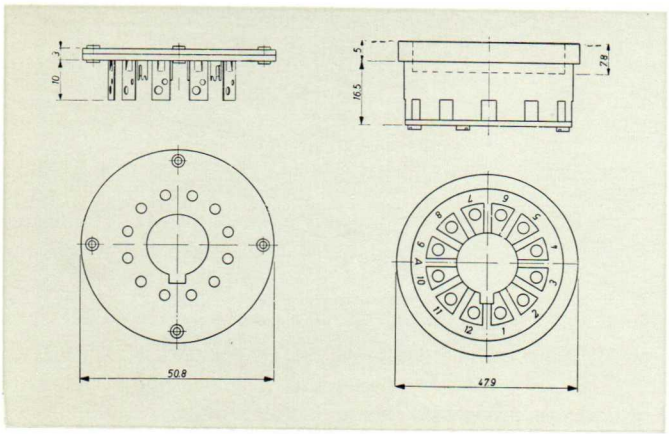
Persistence characteristic of a G-screen.



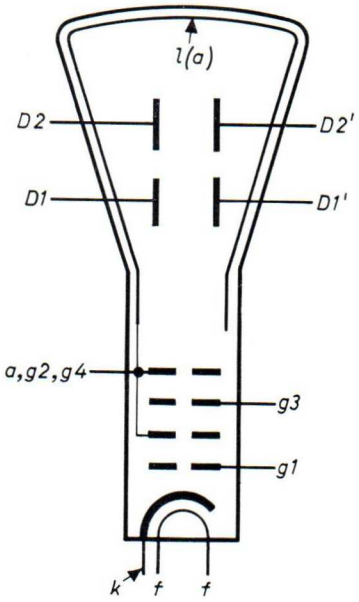
Brightness of a G-screen as a function of the screen current per square cm screen area, with the accelerating potential as a parameter.



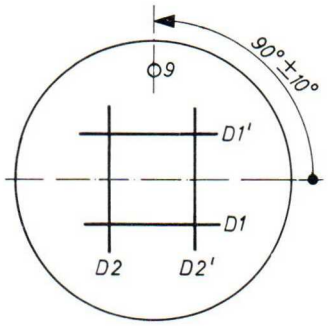
Relative spectral energy distribution of a G-screen.



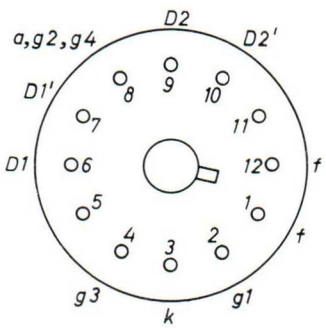
Base: duodecal 12-pins



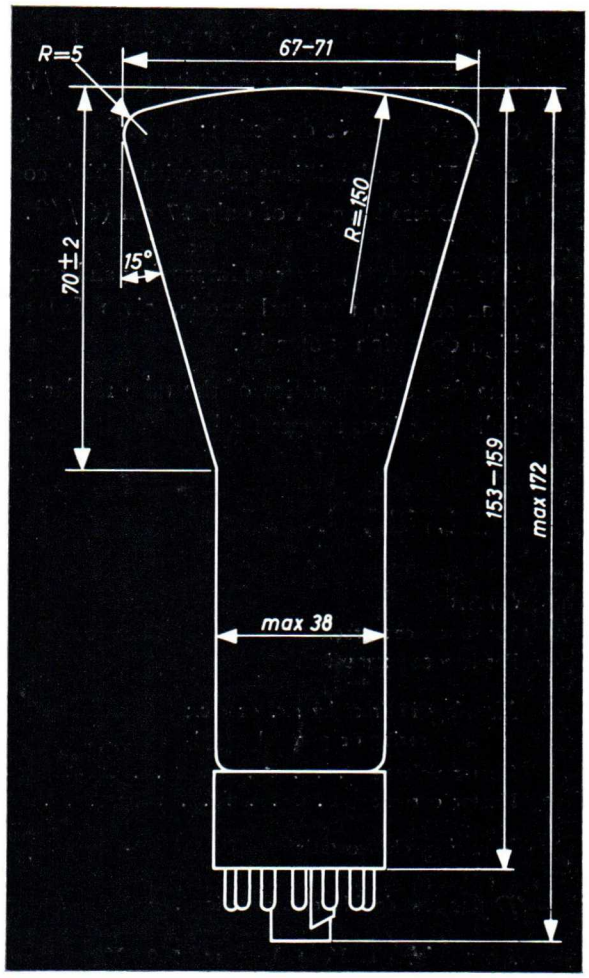
Electrode arrangement



Position of the deflection plates



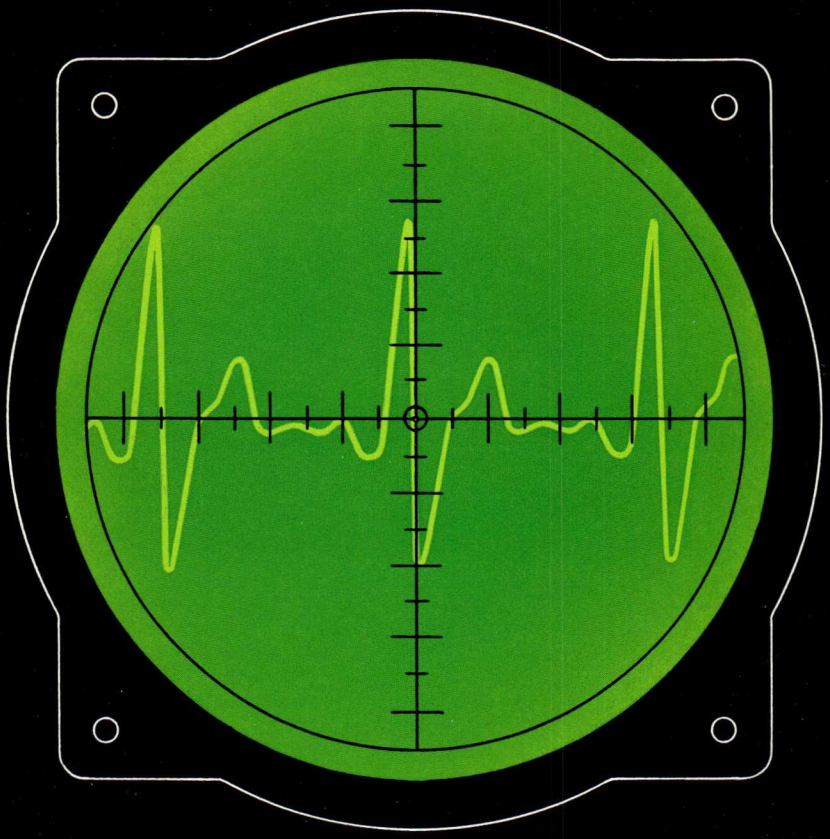
Base connections



Outline drawing of the DG 7-31 (dimensions in mm)

PHILIPS CATHODE-RAY TUBES

for measuring equipment



PHILIPS ELECTRON TUBE DIVISION

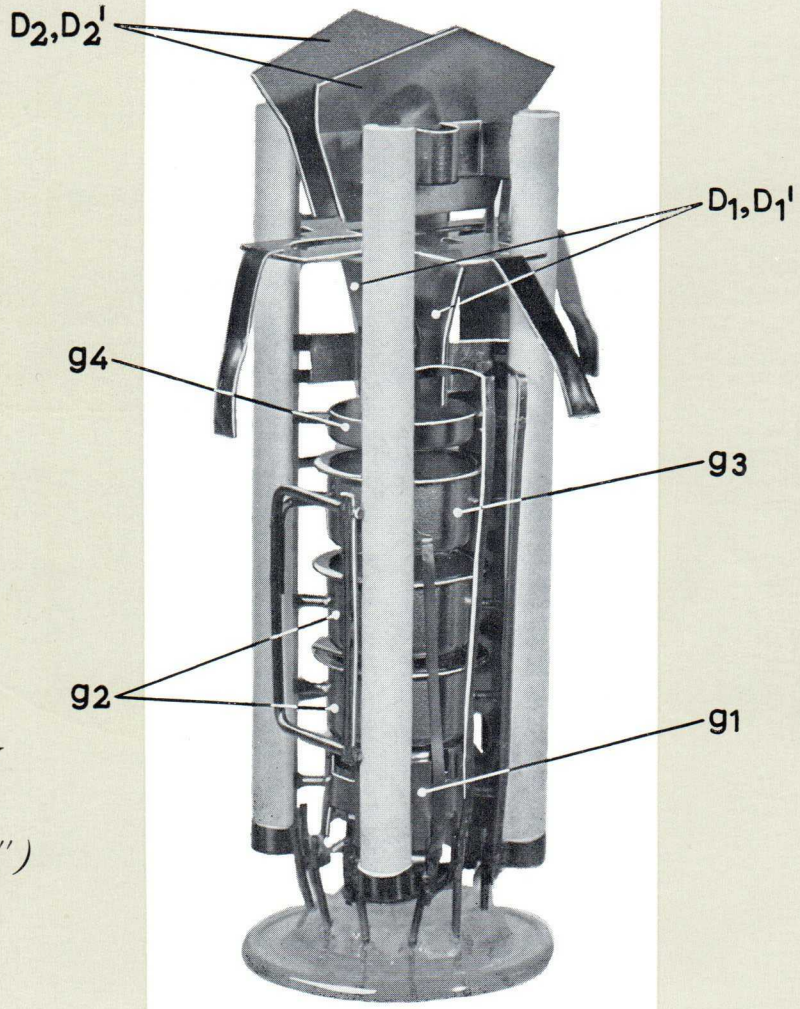
LOW-VOLTAGE
Cathode-Ray Tube

DG 7-32

PHILIPS

LOW-VOLTAGE INSTRUMENT CATHODE-RAY TUBE

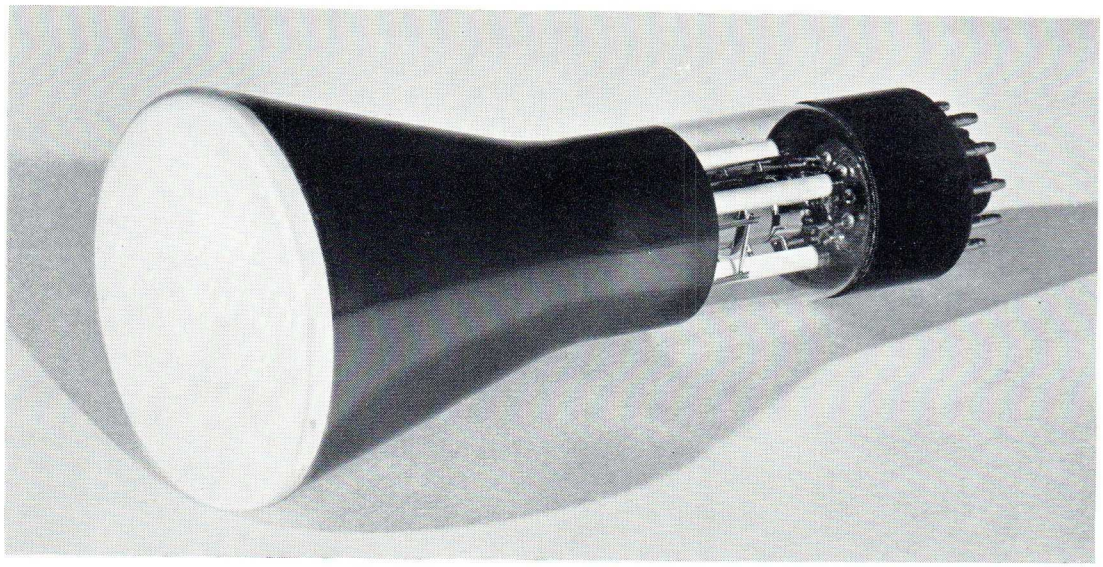
DG 7-32



- *400 V final anode voltage*
- *Deflection sensitivity 0.4 mm/V*
- *Overall length only 17 cm ($6^3/_4''$)*
- *High brilliancy*
- *Small spot size*
- *Excellent contrast*

Electron gun of the cathode-ray tube DG 7-32

D_2D_2' — plates for horizontal deflection
D_1D_1' — plates for vertical deflection
g_1 — control grid
g_2, g_4 — electrodes for pre-deflection acceleration
g_3 — focusing electrode



The DG 7-32 is a new type in our range of 7 cm (3″) cathode-ray tubes with characteristics making the tube particularly suitable for applications in low-cost, low-voltage, indicating instruments such as small, light-weight service oscilloscopes etc.

The type DG 7-32 has the following main features:

- Low anode voltage (400V) without screenburn or screencharge, thanks to the gun construction and a conductive layer placed in between the inner glass surface and the phosphor screen;
- High deflection sensitivity (0,4 mm/V) owing to the special design of the deflection plates;
- Fine and brilliant spot with a high contrast ratio;
- Symmetrical deflection to ensure minimum distortion and to minimize deflection voltages;
- Overall length of only 17 cm ($6^3/_4$″).

The transparent, contrast improving and conductive layer between the face and the phosphor, being connected to the final anode, gives full protection against "electrostatic body-effect" even at high operation potential.

The fine characteristics of the tube render it very suitable for a wide range of applications in the indicating instruments field.

ELECTRICAL DATA

Screen
Fluorescence: green
Persistence: medium

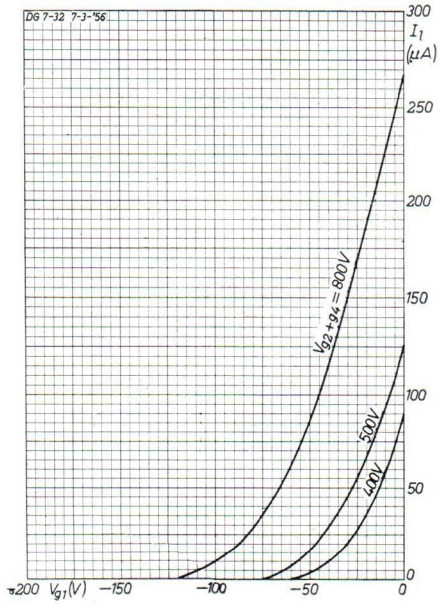
Heating indirect by a.c. or d.c.;
series or parallel supply

Heater voltage	V_f =	6.3	V
Heater current	I_f =	0.3	A

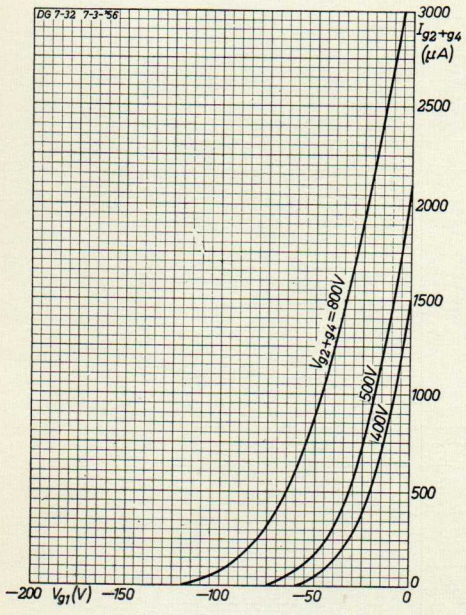
Focusing electrostatic

Deflection double electrostatic . . . . . D_1D_1' symmetric
D_2D_2' symmetric

Line width at $V_{(g_2 + g_4)}$ = 500 V
I_l = 0.5 μA = 0.5 mm [1])



[1]) Measured on a circle of 50 mm diameter.



INTERELECTRODE CAPACITANCES

electrodes	symbol	value (pF)
D_1 to D_1'	$C_{D_1D_1'}$	1.0
D_2 to D_2'	$C_{D_2D_2'}$	1.4
$D_1 + D_1'$ to $D_2 + D_2'$	$C_{D_1D_1'\text{-}D_2D_2'}$	0.27
D_1 to all	C_{D_1}	2.9
D_1' to all	$C_{D_1'}$	3.1
D_2 to all	C_{D_2}	3.7
D_2' to all	$C_{D_2'}$	3.7
Grid 1 to all	C_{g_1}	7.8
Cathode to all	C_k	4.0
Grid 1 to $D_1D_1'D_2D_2'$	$C_{g_1\text{-}D_1D_1'D_2D_2'}$	0.45
Cathode to $D_1D_1'D_2D_2'$	$C_{k\text{-}D_1D_1'D_2D_2'}$	0.14

Operating characteristics

Grid No. 2 and grid No. 4 voltage	$V_{(g_2+g_4)}$	=	500	V
Grid No. 3 voltage	V_{g_3}	=	0 - 120	V [1]
Negative grid No. 1 voltage for visual extinction of the focused spot	$-V_{g_1}$	=	50 - 100	V
Deflection sensitivity	D_1D_1'	=	0.35 - 0.43	mm/V
Deflection sensitivity	D_2D_2'	=	0.22 - 0.28	mm/V

Limiting values (design centre values)

			max. 800	V
Grid No. 2 and grid No. 4 voltage	$V_{(g_2+g_4)}$	=	min. 400	V
Grid No. 3 voltage	V_{g_3}	=	max. 200	V [1]
Grid No. 1 voltage (negative value)	$-V_{g_1}$	=	max. 160	V
Grid No. 1 voltage (positive value)	$+V_{g_1}$	=	max. 0	V
Peak voltage on D_1D_1'	$V_{D_1D_1'p}$	=	max. 450	V
Peak voltage on D_2D_2'	$V_{D_2D_2'p}$	=	max. 750	V
Voltage between cathode and heater	V_{kf}	=	max. 125	V
Screen dissipation	W_l	=	max. 3	mW/cm²
Grid No. 2 and grid No. 4 dissipation	$W_{(g_2+g_4)}$	=	max. 0.5	W

Maximum circuit values

Deflection plate circuit resistance	R_D	=	5	MΩ
Grid No. 1 circuit resistance	R_{g_1}	=	0.5	MΩ

MECHANICAL DATA

Mounting position: any

Dimensions: overall length 172 mm ($6\frac{3}{4}$″)
screen diameter 70 mm (3″)

Net weight: 120 g (4.2 ounce)

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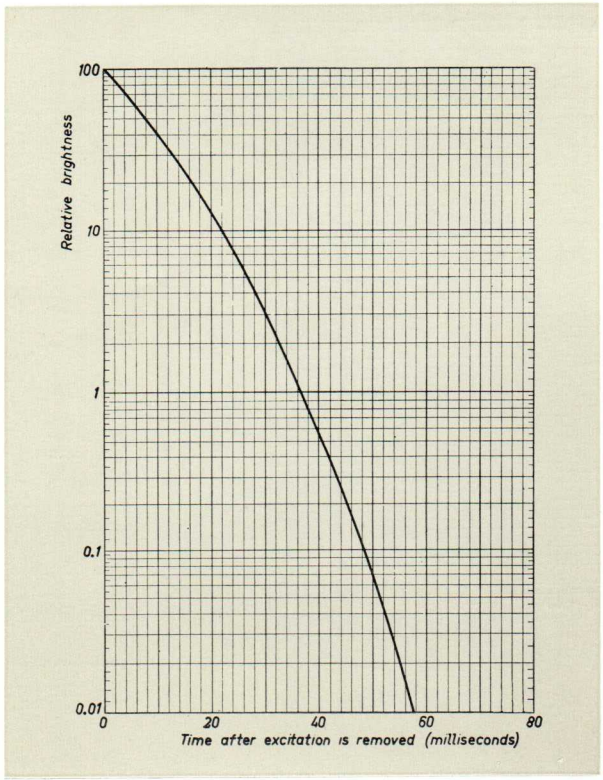
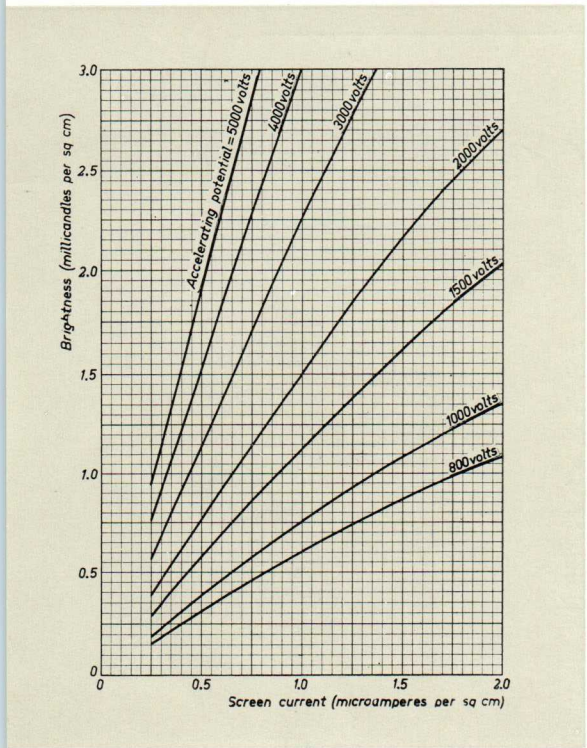
1) For calculation of the grid 3 potentiometer a grid 3 current of min. -15 μA and max. +10 μA must be taken into account.

G-screen

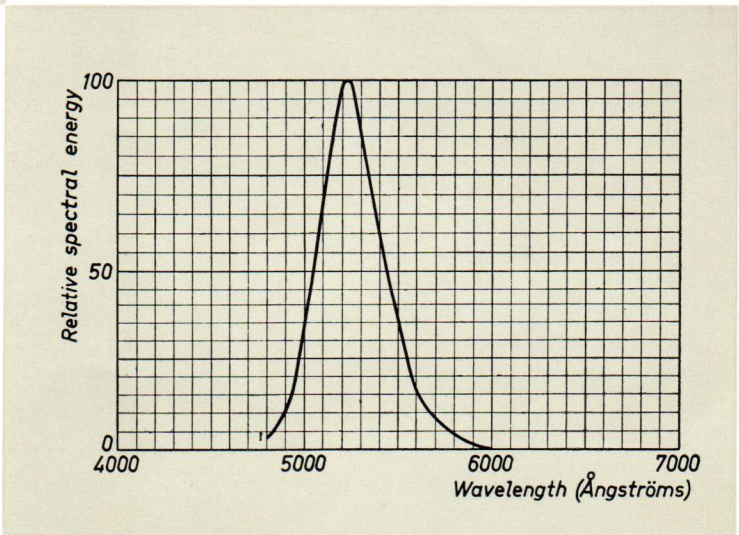
The green fluorescent G-screen provides high visual contrast under conditions of normal ambient illumination. It has medium persistence and can be used for visual observation of recurrent phenomena in the majority of applications.



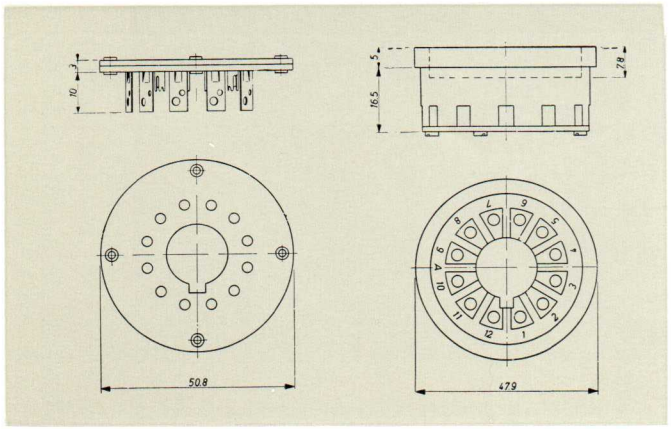
Persistence characteristic of a G-screen.



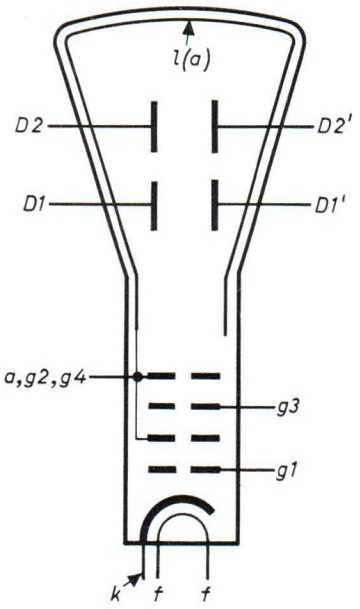
Brightness of a G-screen as a function of the screen current per square cm screen area, with the accelerating potential as a parameter.



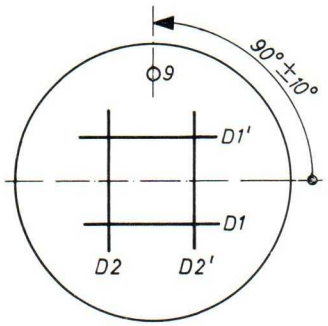
Relative spectral energy distribution of a G-screen



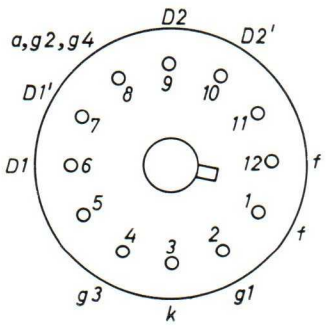
Base: duodecal 12-pins



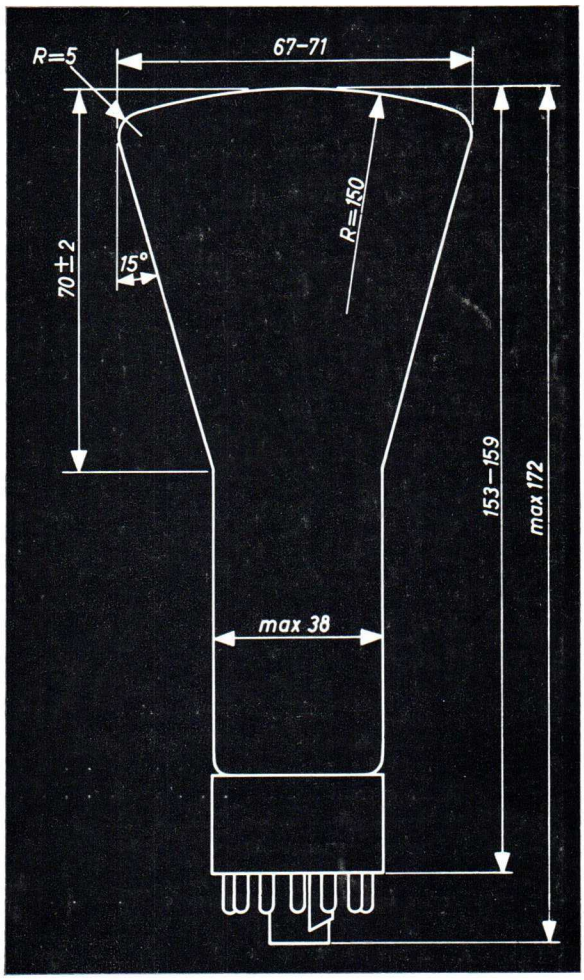
Electrode arrangement



Position of the deflection plates



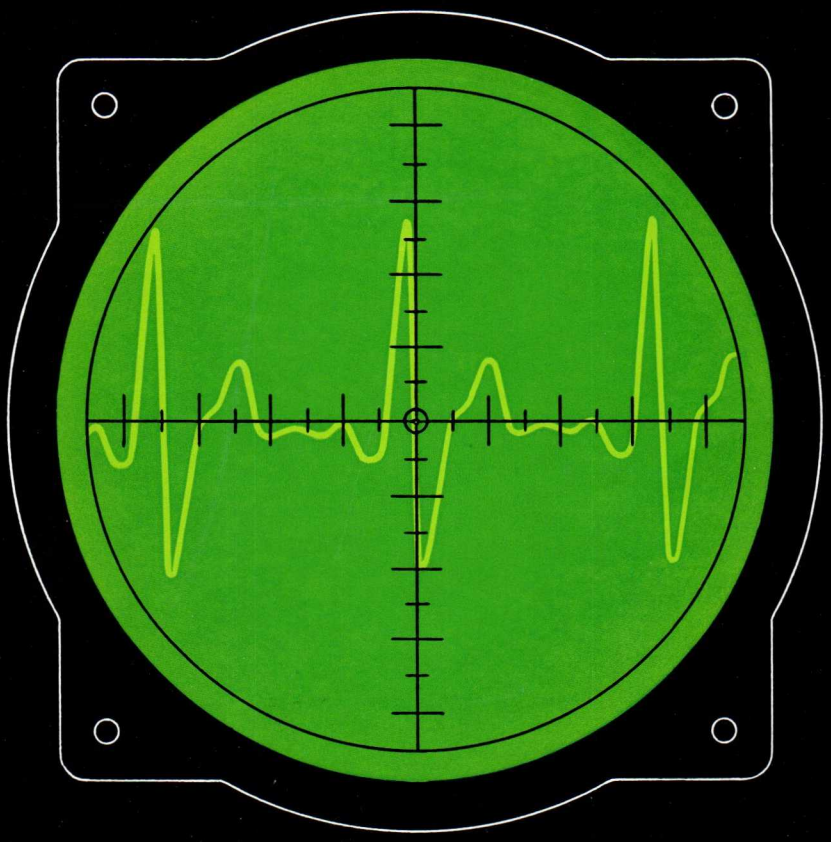
Base connections



Outline drawing of the DG 7-32 (dimensions in mm)

PHILIPS CATHODE-RAY TUBES

for measuring equipment



PHILIPS ELECTRON TUBE DIVISION

7 cm Cathode-Ray Tube
for
MEASURING PURPOSES

DG 7-36

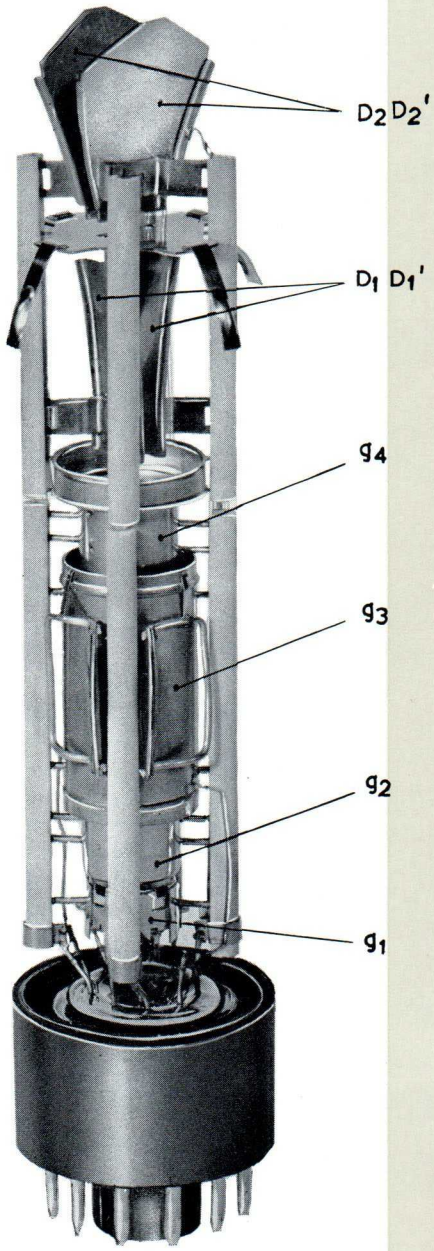
PHILIPS

7 cm CATHODE-RAY TUBE FOR MEASURING PURPOSES

DG 7-36

- *High sensitivity*
- *Flat faceplate*
- *Independent focusing control*
- *Brilliant and fine spot*
- *High-grade phosphor screen*

The DG 7-36 is a Cathode-Ray Tube for measuring purposes, with a flat faceplate of 7 cm (3″) diameter, featuring electrostatic focusing and highly sensitive, electrostatic double symmetric deflection. The tube has especially been designed for use in applications where close tolerances in the electrical and mechanical characteristics are of prime importance.



Electron gun of the cathode-ray tube DG 7-36

D_2D_2' — plates for horizontal deflection
D_1D_1' — plates for vertical deflection
g_1 — control grid
g_2,g_4 — electrodes for pre-deflection acceleration
g_3 — focusing electrode

The Philips Cathode-Ray Tube DG 7-36 has the following main features:

Very high deflection sensitivity, permitting the use of smaller amplifiers, both for the time-base and the signal under examination.

The plane parallel faceplate of high-quality glass ensures correct reading, drawing or photographic recording of the oscillograms without parallax.

The focusing control is independent of the brightness control, so that the spot remains sharp when the beam-current is varied over a wide range. Owing to the very small current drawn by the focusing electrode, a low-current voltage-divider system can be used.

Thanks to the high-grade phosphor screen, high brilliancy at small spot dimensions is achieved. As a result of these very interesting electrical and mechanical characteristics, the DG 7-36 is an outstanding type for measuring equipment with a high standard of accuracy.

ELECTRICAL DATA

Heating:

Indirect by A.C. or D.C.; parallel supply
Heater voltage . . . . . 6.3 V
Heater current . . . . . 0.3 A

Screen:

Fluorescence: green
Persistence : medium

Focusing: Electrostatic

Deflection: Double electrostatic

D_1D_1' symmetric
D_2D_2' symmetric
Angle between D_1D_1' and D_2D_2' traces 90° ± 1°

Line width at:

$V_{(g_2+g_4)}$ = 1500 V
I_l = 0.5 μA
0.4 mm [1]

INTERELECTRODE CAPACITANCES		
Electrodes	Symbol	Cap. (pF)
D_1 to D_1'	$C_{D_1D_1'}$	1.7
D_2 to D_2'	$C_{D_2D_2'}$	1.9
D_1 to all	C_{D_1}	4.7
D_1' to all	$C_{D_1'}$	4.7
D_2 to all	C_{D_2}	6.0
D_2' to all	$C_{D_2'}$	6.0
Grid 1 to all	C_{g_1}	5.7
Cathode to all	C_k	3.3

1) Measured on a circle of 50 mm diameter
2) To all electrodes, except the opposite deflection plate.

Operating characteristics

Grid No. 2 and grid No. 4 voltage	$V_{(g_2+g_4)}$	= 1500	V
Grid No. 3 voltage	V_{g_3}	= 247-397	V [3]
Negative grid No. 1 voltage for visual extinction of the focused spot	V_{g_1}	= 40- 80	V
Deflection sensitivity	D_1D_1'	= 0.49-0.59	mm/V
Deflection sensitivity	D_2D_2'	= 0.33-0.41	mm/V
Minimum useful screen diameter	D_1D_1'	= 57	mm [4]
	D_2D_2'	= 68	mm [5]
Variation of the linearity of deflection		= max. 2	% [6]

Pattern distortion

The length of the edges of a raster pattern, whose mean dimensions are smaller than 75 % of the useful scan will not deviate from this mean dimensions by more than 2.5 %.

Spot position

With the tube shielded the undeflected spot will be within a circle of 4 mm radius, the circle being centered with respect to the tube face.

Limiting values (design centre values)

Grid No. 2 and grid No. 4 voltage	$V_{(g_2+g_4)}$	= max. 2500 / min. 1000	V
Grid No. 3 voltage	V_{g_3}	= max. 1000	V [3]
Grid No. 1 voltage (negative value)	$-V_{g_1}$	= max. 200	V
Grid No. 1 voltage (positive value)	$+V_{g_1}$	= max. 0	V
Positive peak voltage at grid No. 1	$+V_{g_{1p}}$	= max. 2	V
Peak voltage between grid No. 2 and grid No. 4 and any of the deflection plates	$V_{D\text{-}(g_2+g_4)p}$	= max. 500	V [7]
Voltage between cathode and heater	V_{kf}	= max. 180	V
Screen dissipation	W_l	= max. 3	mW/cm²
Grid No. 2 and grid No. 4 dissipation	$W_{(g_2+g_4)}$	= max. 6	W

Circuit design values

Grid No. 3 voltage	V_{g_3}	= 165- 265 V	Per 1000 volts of grid No. 2 and grid No. 4 voltage
Negative grid No. 1 voltage	V_{g_1}	= 27- 53 V	
Deflection factor	D_1D_1'	= 11.2-13.7 V/cm	
	D_2D_2'	= 16.2-20.0 V/cm	
Deflection plate circuit resistance	R_D	= 5 MΩ [8]	
Grid No. 1 circuit resistance	R_{g_1}	= 1.5 MΩ	

MECHANICAL DATA

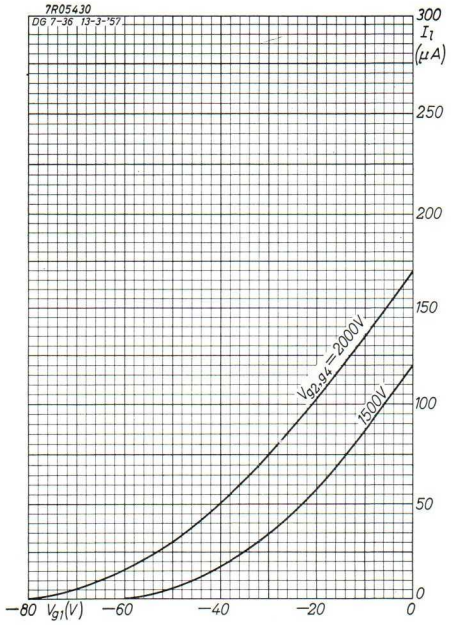
Mounting position: any

Dimensions: overall length 296 mm ($11^{21}/_{32}$'')
screen diameter 7 cm (3'')

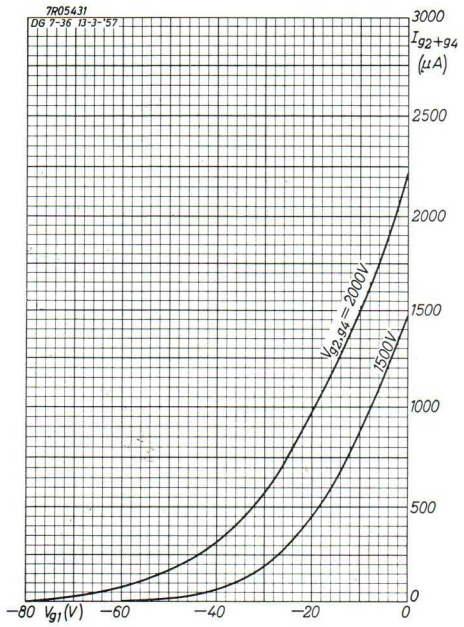
Net weight: approx. 370 g (13 ounces)

Base: Duodecal 12-p

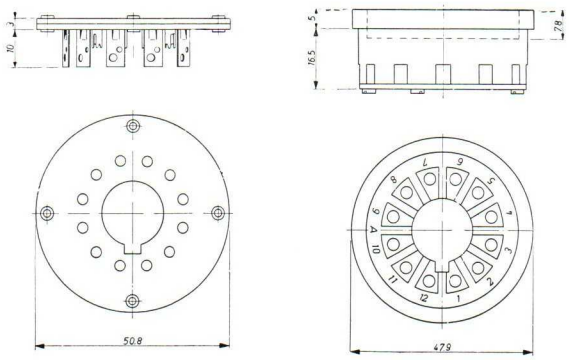
3) For calculation of the grid No. 3 potentiometer a grid No. 3 current of min. —15 μA and max. +10 μA must be taken into account.
4) Min. 28.5 mm at both sides from the tube face centre.
5) Min. 34 mm at both sides from the tube face centre.
6) The sensitivity of the deflection plates for a deflection smaller than 75 % of the useful scan will not differ from the sensitivity for a deflection of 25 % of the useful scan by more than the indicated value.
7) For optimum focus the average potentials of the deflection plates and grid No. 2 and 4 should be equal.
8) The deflection plate resistances should be approximately equal.



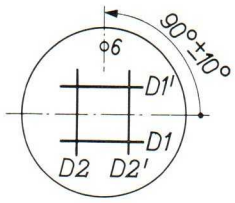
Screen current as a function of negative grid cut-off voltage



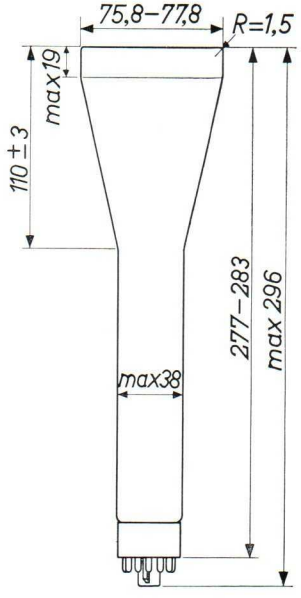
Final anode current as a function of negative grid cut-off voltage



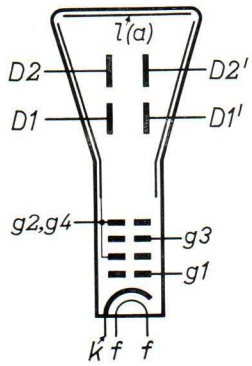
Base: duodecal 12-pins; type number 5912/20



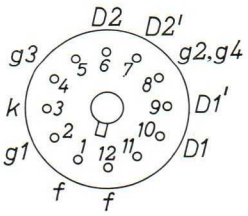
Position of the deflection plates



Outline drawing of the DG 7-36 (dimensions in mm)



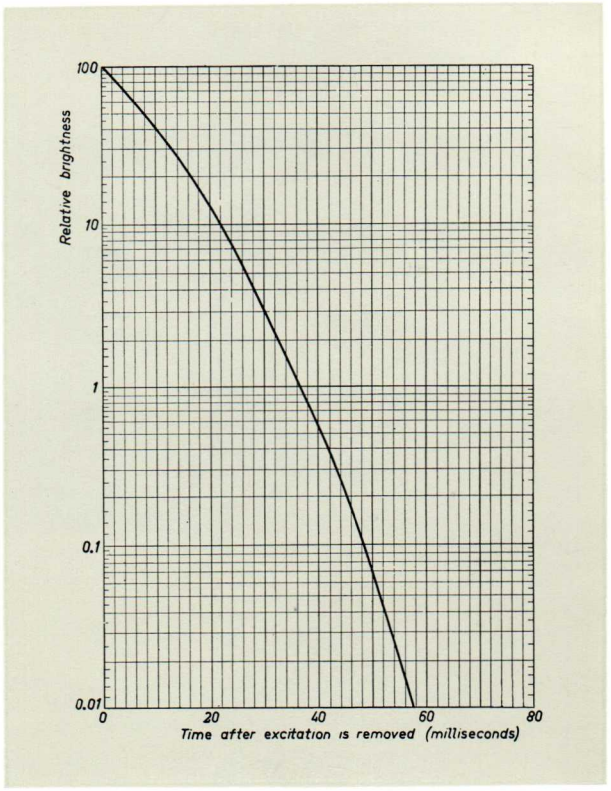
Electrode arrangement



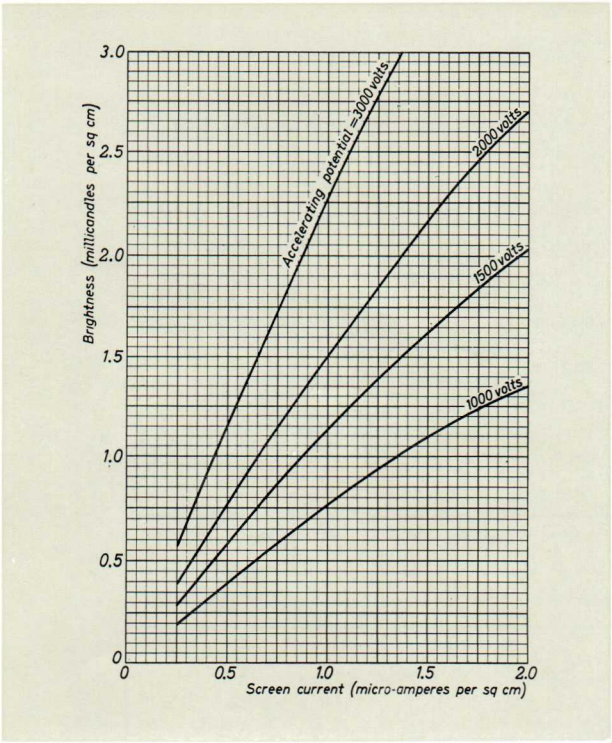
Base connections

G-screen

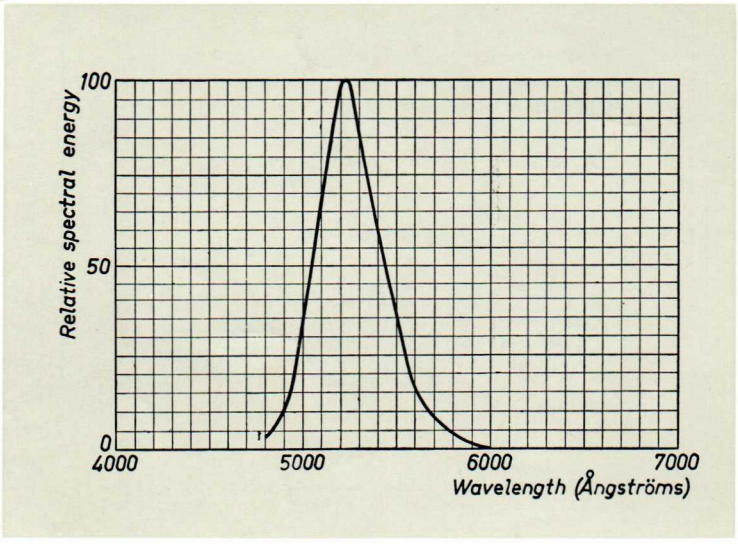
The green fluorescent G-screen provides high visual contrast under conditions of normal ambient illumination. It has medium persistence and can be used for visual observation of recurrent phenomena in the majority of applications.



Persistence characteristic of a G-screen.



Brightness of a G-screen as a function of the screen current per square cm screen area, with the accelerating potential as a parameter.



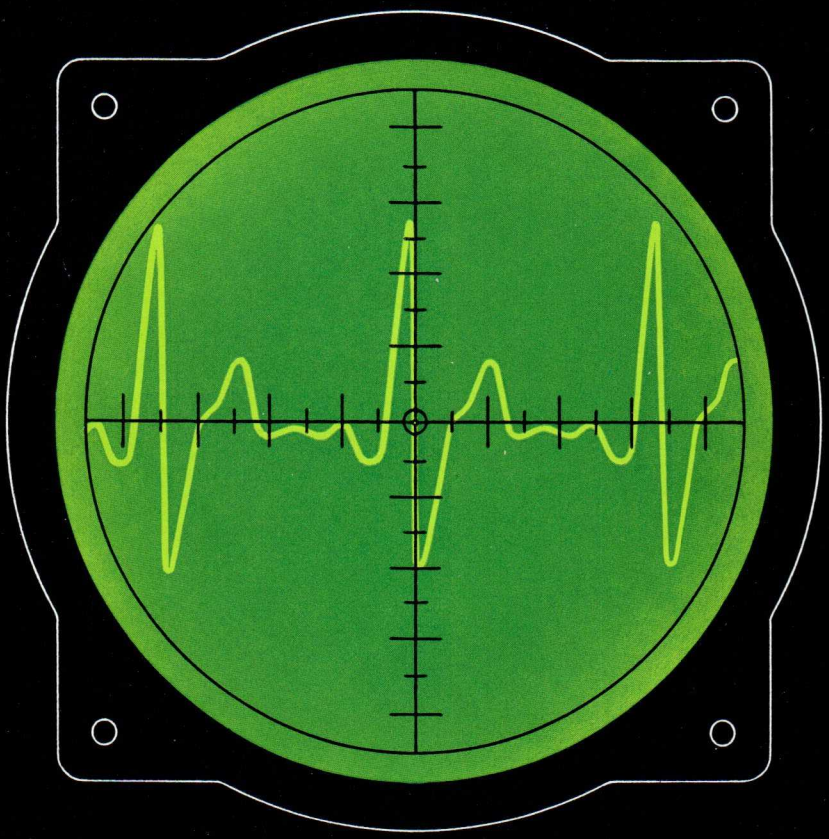
Relative spectral energy distribution of a G-screen

Printed in Holland

20/288/B/E- 7-'57

PHILIPS CATHODE-RAY TUBES

for measuring equipment



PHILIPS ELECTRON TUBE DIVISION

DG 10-6
DB 10-6
DP 10-6
DR 10-6

PHILIPS

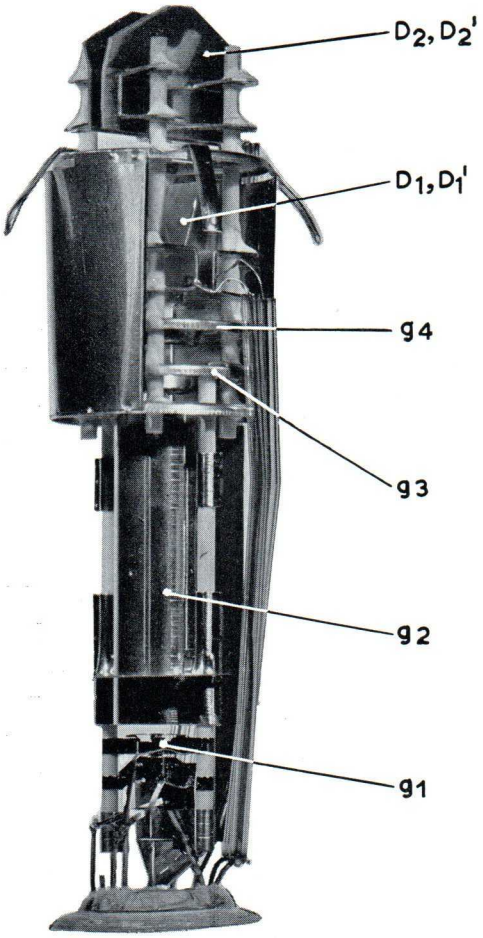
2

GENERAL PURPOSE CATHODE RAY TUBE

DG 10-6
DB 10-6
DP 10-6
DR 10-6

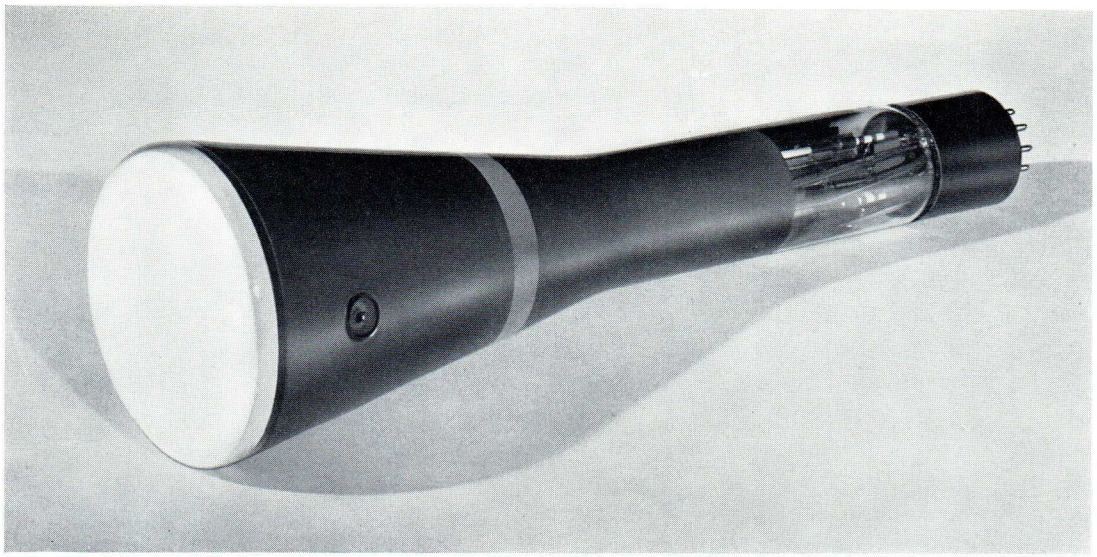
- *High-tension post-acceleration*
- *A brilliant spot*
- *Symmetrical deflection*
- *Good linearity*
- *Four screen types*

The DG 10-6 is a general-purpose Cathode-Ray Oscilloscope Tube, with a faceplate of 10 cm (4″) diameter, featuring electrostatic double symmetrical deflection and extra high tension post-acceleration



Electron gun of the Cathode-Ray Tube DG 10-6

D_2D_2' — plates for horizontal deflection
D_1D_1' — plates for vertical deflection
g_1 — control grid
g_2g_4 — electrodes for pre-deflection acceleration
g_3 — focusing electrode



The Philips Cathode-Ray Tube DG 10-6, has the following main features:

Thanks to the high-grade phosphor screen and extra high-tension post acceleration, high brilliancy at small spot dimensions is achieved.

Symmetrical deflection, providing for low interelectrode capacity and good linearity.

For various applications different screen types available:

G - A green screen for oscilloscopy and recording of medium and high-frequency phenomena.

B - A blue screen for photographic recording of non-recurrent high-speed phenomena.

P - A double-layer screen with bluish fluorescence for oscilloscopy and recording of low-frequency and low-speed non-recurrent phenomena.

R - A greenish-yellow screen for oscilloscopy and recording of low- and medium-frequency signals*)

As a result of these electrical and mechanical characteristics, this tube is particularly suitable for measuring equipment.

ELECTRICAL DATA

Screen

Tube type	Fluorescence (colour)	Persistence	
		Character	0.1 % of max. brightness after
DG 10-6	green	medium	50 millisec.
DB 10-6	blue	short	20 millisec.
DP 10-6	blue (afterglow greenish-yellow)	very long	80 sec.
DR 10-6	greenish-yellow	long	20 sec.

Heating indirect by A.C. or D.C.

Heater voltage: . . . . . $V_f = 6.3$ V

Heater current: . . . . . $I_f = 0.3$ A

Deflection double electrostatic D_1D_1' symmetric, D_2D_2' symmetric

Focusing electrostatic

Line width at $V_{g_5} = 2000$ V

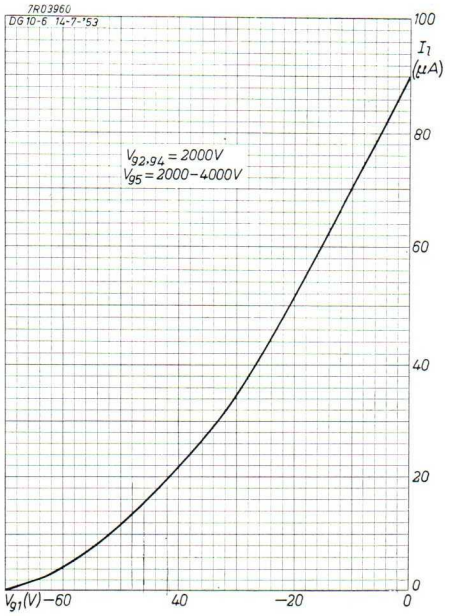
$V_{(g_2 + g_4)} = 2000$ V 0.4 mm **)

$I_l = 0.5$ µA

$V_{g_5} = 4000$ V

$V_{(g_2 + g_4)} = 2000$ V 0.3 mm **)

$I_l = 0.5$ µA



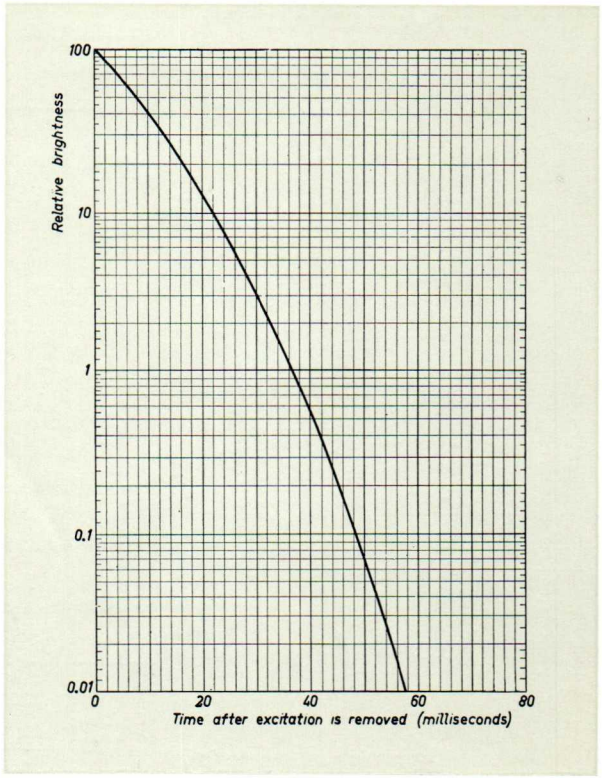
Screen current as a function of negative grid cut-off voltage

*) Detailed information on all phosphors is given in a folder dealing with data and characteristics of Philips phosphors.

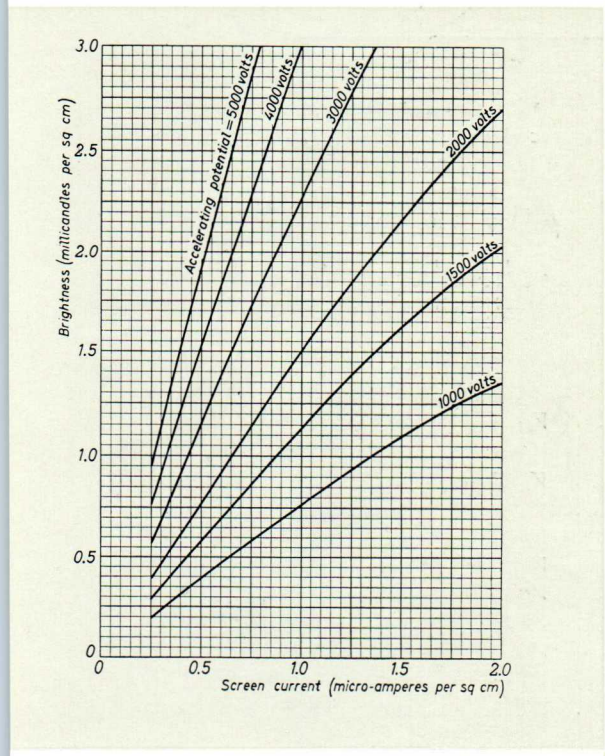
**) Measured on a circle of 50 mm diameter.

G-screen

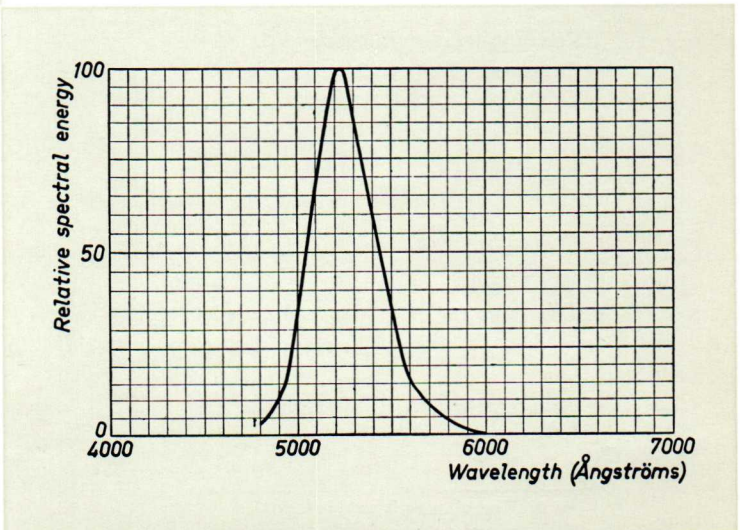
The green fluorescent G-screen provides high visual contrast under conditions of normal ambient illumination. It has medium persistence and can be used for visual observation of recurrent phenomena in the majority of applications.



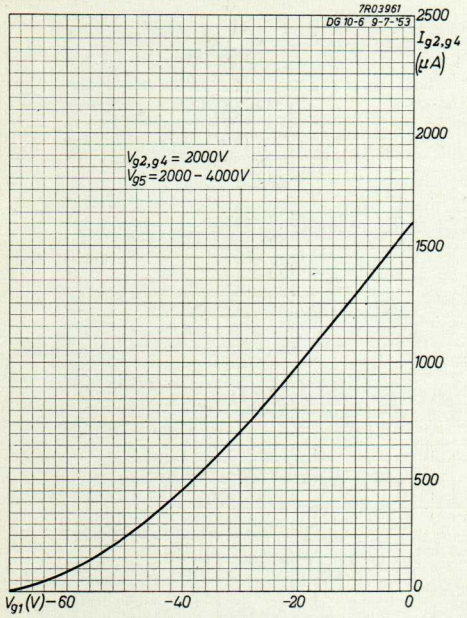
Persistence characteristic of a G-screen.



Brightness of a G-screen as a function of the screen current per square cm screen area, with the accelerating potential as a parameter.



Relative spectral energy distribution of a G-screen



Final anode current as a function of negative grid cut-off voltage

INTERELECTRODE CAPACITANCES		
Electrodes	Symbol	Value (pF)
D_1 to D_1'	$C_{D_1D_1'}$	1.9
D_2 to D_2'	$C_{D_2D_2'}$	2.5
D_1 to all	C_{D_1}	4.7
D_1' to all	$C_{D_1'}$	4.7
D_2 to all	C_{D_2}	5.5
D_2' to all	$C_{D_2'}$	5.5
Grid 1 to all	C_{g_1}	4.6
Cathode to all	C_k	6.0

Operating characteristics			with post acceleration	without post acceleration
Grid No. 5 voltage	V_{g_5}	=	4000	2000 V
Grid No. 2 + No. 4 voltage*)	$V_{(g_2+g_4)}$	=	2000	2000 V
Grid No. 3 voltage	V_{g_3}	=	400 - 720	400 - 720 V
Negative grid No. 1 voltage **)	$-V_{g_1}$	=	45 - 100	45 - 100 V
Deflection sensitivity	D_1D_1'	=	0.25 - 0.31	0.32 - 0.38 mm/V
Deflection sensitivity	D_2D_2'	=	0.19 - 0.25	0.24 - 0.30 mm/V

Limiting values (design center values)				
Grid No. 5 voltage	V_{g_5}	= max.	5000	V
Grid No. 2 and grid No. 4 voltage	$V_{(g_2+g_4)}$	= max.	2500	V
Ratio $V_{g_5}/V_{(g_2+g_4)}$	$V_{g_5}/V_{(g_2+g_4)}$	= max.	2	
Grid No. 3 voltage	V_{g_3}	= max.	1000	V
Grid No. 1 voltage (negative value)	$-V_{g_1}$	= max.	150	V
Grid No. 1 voltage (positive value)	$+V_{g_1}$	= max.	0	V
Peak voltage on D_1D_1'	$V_{D_1D_1'p}$	= max.	450	V
Peak voltage on D_2D_2'	$V_{D_2D_2'p}$	= max.	450	V
Voltage between cathode and heater	V_{kf}	= max.	125	V
Screen dissipation	W_l	= max.	3	mW/cm²
Grid No. 2 and Grid No. 4 dissipation	$W_{(g_2+g_4)}$	= max.	4	W

Maximum circuit values				
Deflection plate circuit resistance	R_D	= max.	5	MΩ
Grid No. 1 circuit resistance	R_{g_1}	= max.	1.5	MΩ

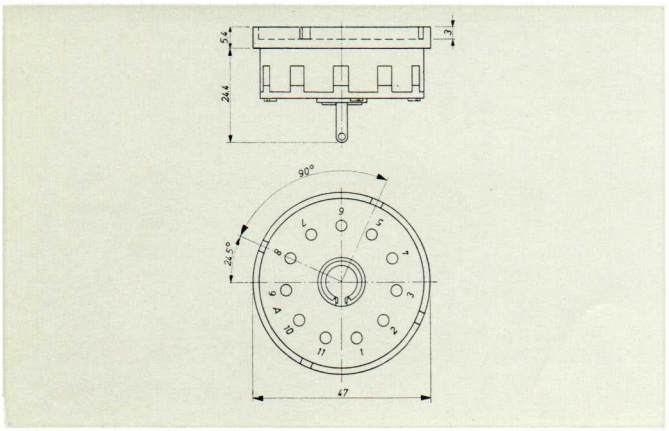
MECHANICAL DATA

Mounting position any

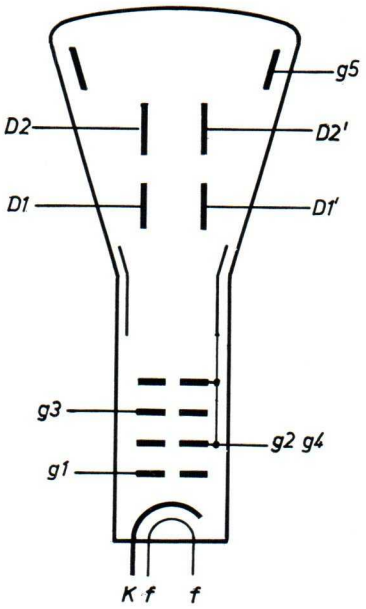
Dimensions overall-length max. 341 mm ($13^{27}/_{64}$")
screen diameter 10 cm (4")

Anode contact B1.885.06.

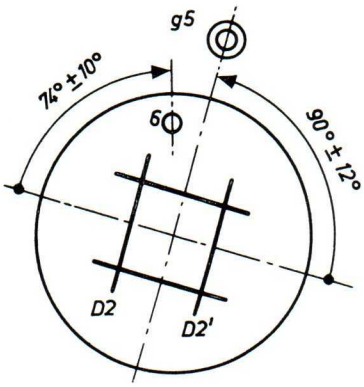
*) Earthing of g_2, g_4 is recommended.
**) For visual extinction of the focused spot.



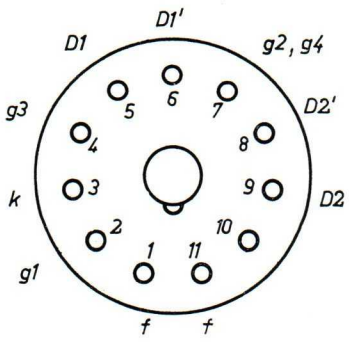
Base: Magnal



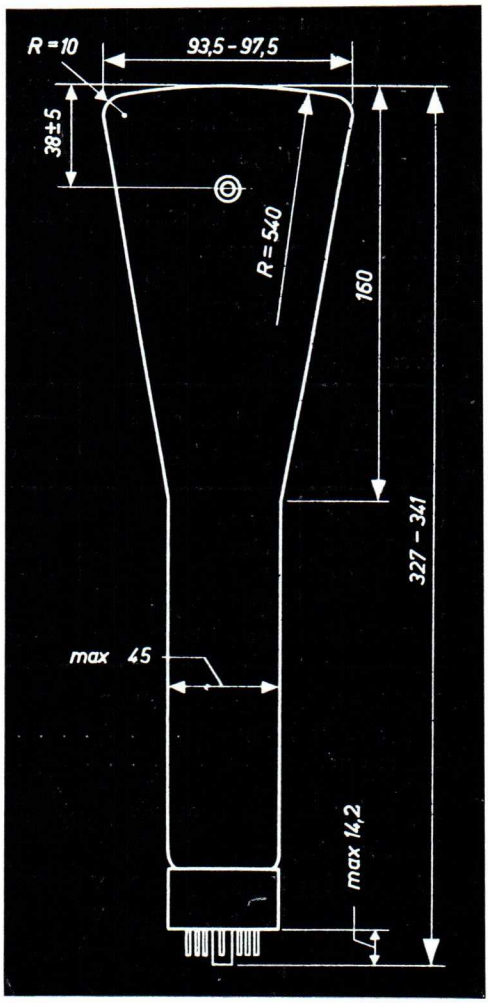
Electrode arrangement



Position of the deflection plates



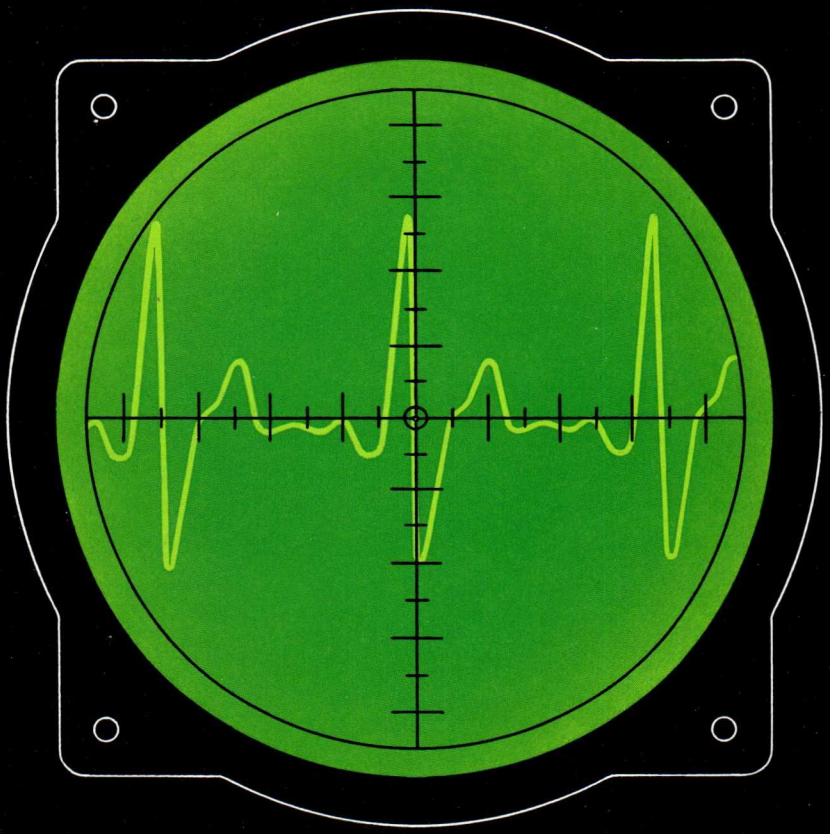
Base connections



Outline drawing of the DG 10-6

PHILIPS CATHODE-RAY TUBES

for measuring equipment



PHILIPS ELECTRON TUBE DIVISION

GENERAL-PURPOSE

Cathode-Ray Tube

DG 10-74

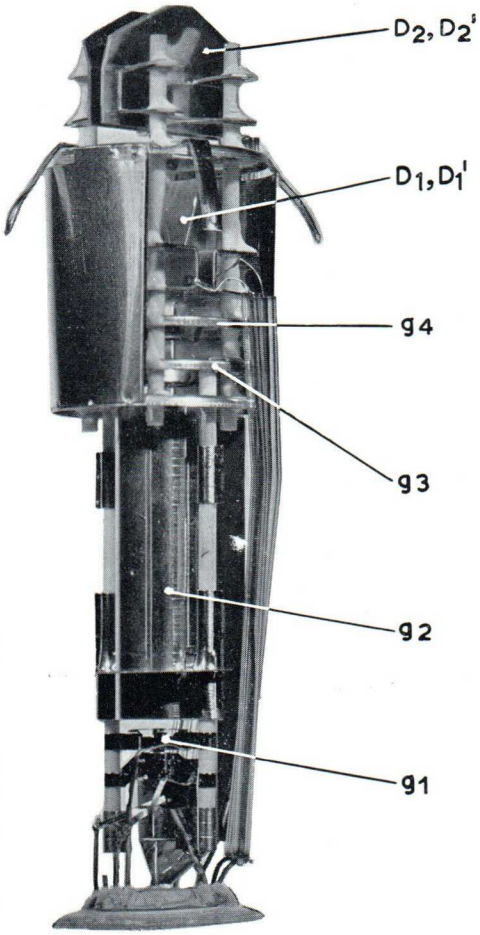
PHILIPS

CATHODE-RAY TUBE WITH FLAT FACEPLATE

DG 10-74

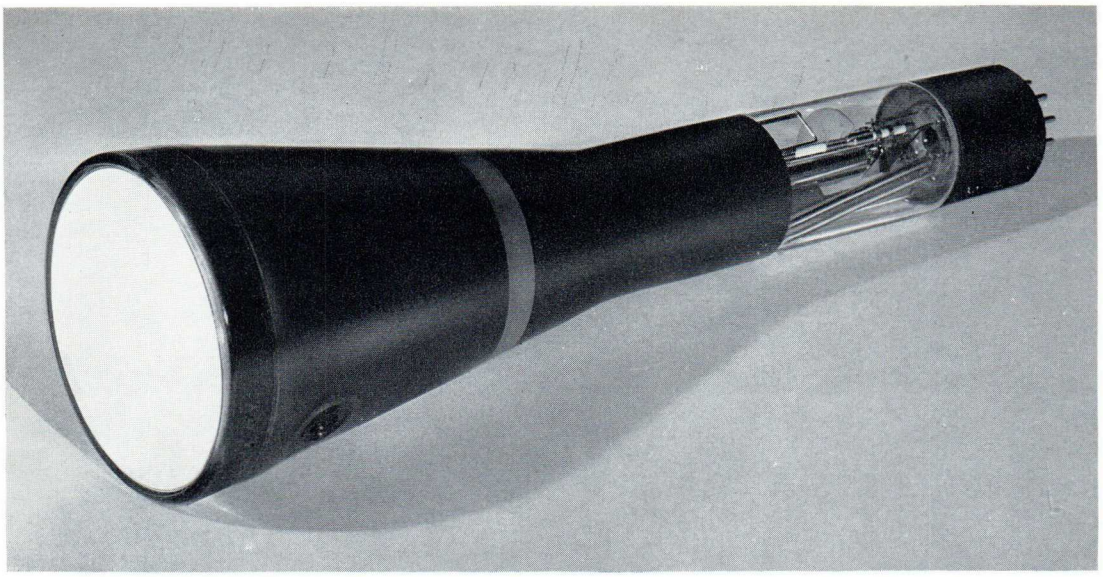
- *Plane parallel faceplate*
- *Symmetrical deflection*
- *High-tension post acceleration*
- *Large screen diameter; 10 cm (4")*
- *Interchangeable with the DG 10-6*

The DG 10-74 is a general-purpose Cathode-Ray Oscilloscope Tube, with a flat faceplate of 10 cm diameter, double symmetrical deflection and extra high-tension post acceleration.



Electron gun of the cathode-ray tube DG 10-74

D_2D_2' — plates for horizontal deflection.
D_1D_1' — plates for vertical deflection
g_1 — control grid
g_2,g_4 — electrodes for pre-deflection acceleration
g_3 — focusing electrode



The plane parallel faceplate of high-quality glass ensures correct reading, drawing or photographic recording of the oscillograms without parallax.

The symmetrical deflection minimizes the occurrence of distortion.

Thanks to the high-grade phosphor screen and extra high-tension post acceleration, high brilliancy at small spot dimensions is achieved.

The G-phosphor of the DG 10-74 gives a green phosphorescence with medium persistence on which full particulars are given in this folder.

The tube, which is interchangeable with the DG 10-6, is particularly suitable for measuring equipment, as a result of the electrical and mechanical characteristics.

ELECTRICAL DATA

Screen
Fluorescence: green
Persistence : medium

Heating indirect by a.c. or d.c.; series or parallel supply

Heater voltage	V_f =	6.3	V
Heater current	I_f =	0.3	A

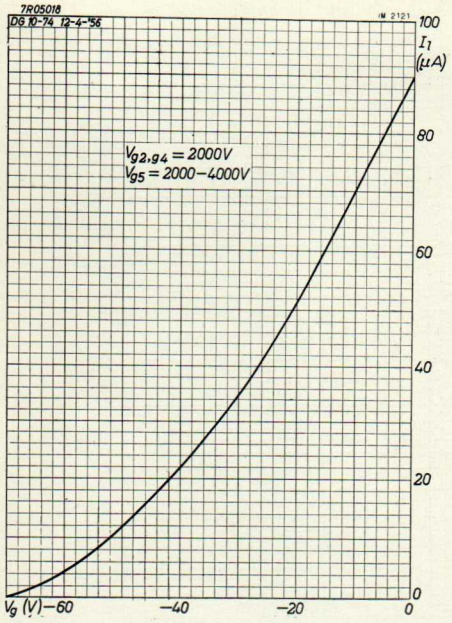
Focusing electrostatic

Deflection double electrostatic = D_1D_1' symmetric / D_2D_2' symmetric

Line width at

Grid No. 5 voltage	V_{g3}	= 2000	V	
Grid No. 2 and grid No. 4 voltage	$V_{(g3+g4)}$	= 2000	V	0.4 mm*)
Screen current	I_l	= 0.5	μA	
Grid No. 5 voltage	V_{g5}	= 4000	V	
Grid No. 2 and grid No. 4 voltage	$V_{(g2+g4)}$	= 2000	V	0.3 mm*)
Screen current	I_l	= 0.5	μA	

*) Measured on a circle of 50 mm diameter.



Negative grid No. 1 voltage, for visual extinction of the focused spot, as a function of the screen current

INTERELECTRODE CAPACITANCES

Electrodes	Symbol	Value (pF)
D_1 to D_1'	$C_{D_1D_1'}$	1.9
D_2 to D_2'	$C_{D_2D_2'}$	2.5
$D_1 + D_1'$ to $D_2 + D_2'$	$C_{D_1D_1'\text{-}D_2D_2'}$	0.2
D_1 to all	C_{D_1}	4.7**)
D_1' to all	$C_{D_1'}$	4.7**)
D_2 to all	C_{D_2}	5.5**)
D_2' to all	$C_{D_2'}$	5.5**)
Grid 1 to all	C_{g1}	4.6
Cathode to all	C_k	6.0
Grid 1 to $D_1D_1'D_2D_2'$	$C_{g1\text{-}D_1D_1'D_2D_2'}$	0.15
Cathode to $D_1D_1'D_2D_2'$	$C_{k\text{-}D_1D_1'D_2D_2'}$	0.35

		with post acceleration	without post acceleration
Operating characteristics			
Grid No. 5 voltage	V_{g5} =	4000	2000 V
Grid No. 2 grid No. 4 voltage	$V_{(g_2+g_4)}$ =	2000	2000 V
Grid No. 3 voltage	V_{g3} =	400 — 720	400 — 720 V
Grid No. 3 current	I_{g3} =	− 15 to + 10	− 15 to + 10 μA
Negative grid No. 1 voltage***)	$-V_{g1}$ =	45 — 100	45 — 100 V
Deflection sensitivity	D_1D_1' =	0.25 - 0.31	0.32 - 0.38 mm/V
Deflection sensitivity	D_2D_2' =	0.19 - 0.25	0.24 - 0.30 mm/V

Limiting values (design center values)

Grid No. 5 voltage	V_{g5}	= max.	5000 V
Grid No. 2 and grid No. 4 voltage	$V_{(g_2+g_4)}$	= max.	2500 V
Grid No. 3 voltage	V_{g3}	= max.	1000 V
Grid No. 1 voltage (negative value)	$-V_{g1}$	= max.	150 V
Grid No. 1 voltage (positive value)	$+V_{g1}$	= max.	0 V
Peak voltage on D_1D_1'	$V_{D_1D_1'p}$	= max.	450 V
Peak voltage on D_2D_2'	$V_{D_2D_2'p}$	= max.	450 V
Voltage between cathode and heater	V_{kf}	= max.	125 V
Screen dissipation	W_l	= max.	3 mW/cm²
Grid No. 2 and grid No. 4 dissipation	$W_{(g_2+g_4)}$	= max.	4 W

Maximum circuit values

Deflection plate circuit resistance	R_D	= max.	5 MΩ
Grid No. 1 circuit resistance	R_{g1}	= max.	1.5 MΩ

MECHANICAL DATA

Mounting position any

Dimensions Overall length 341 mm ($13^7/_{16}$″)
Screen diameter 10 cm (4″)

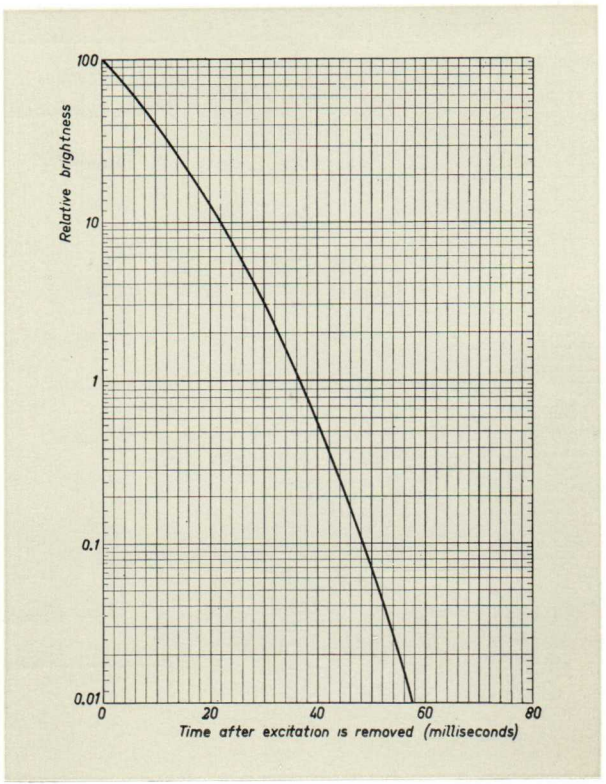
Anode contact B1.885.06

Net weight 330 g. (11.5 ounces)

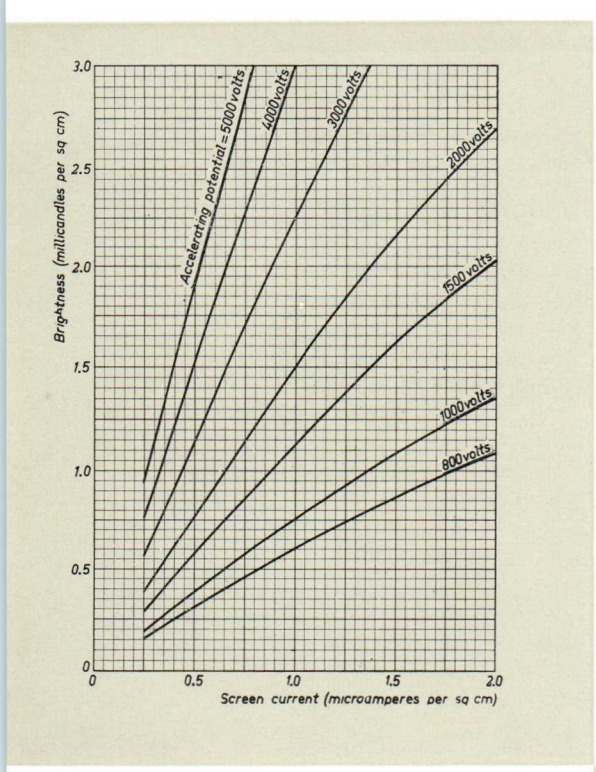
**) Except the opposite deflection plate.
***) For visual extinction of the focused spot.

G-screen

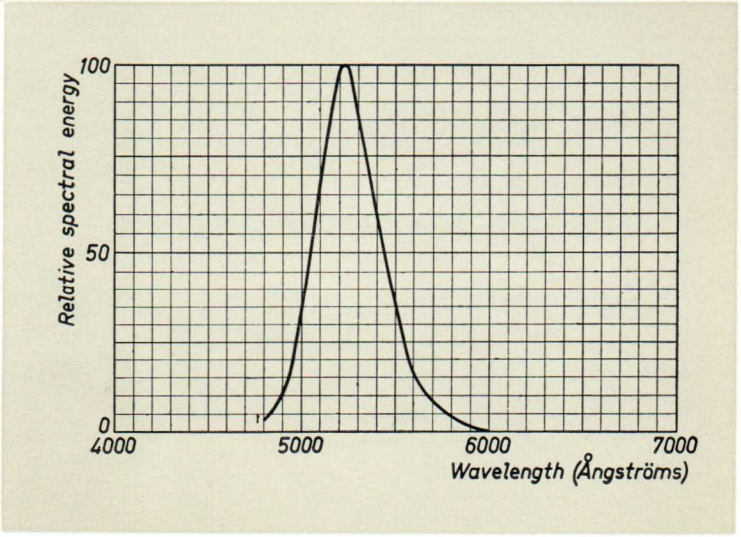
The green fluorescent G-screen provides high visual contrast under conditions of normal ambient illumination. It has medium persistence and can be used for visual observation of recurrent phenomena in the majority of applications.



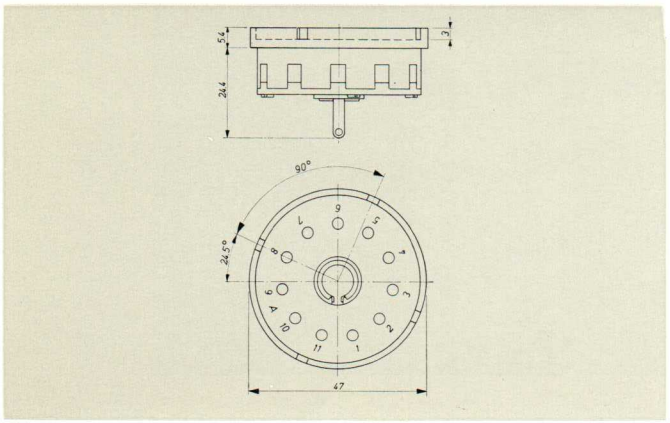
Persistence characteristic of a G-screen.



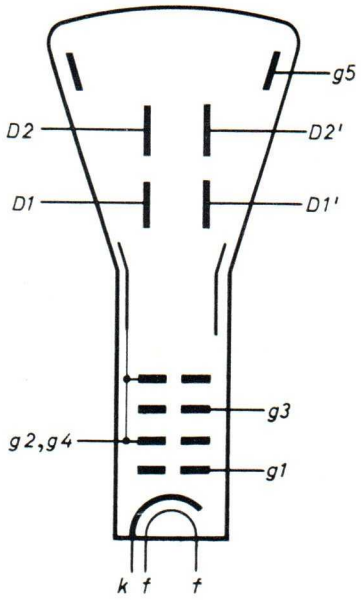
Brightness of a G-screen as a function of the screen current per square cm screen area, with the accelerating potential as a parameter.



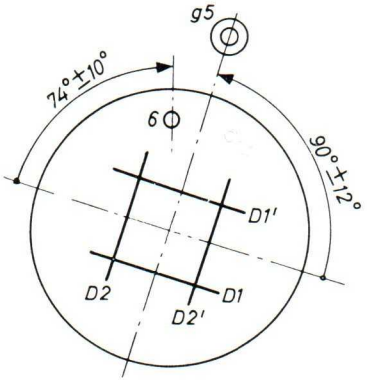
Relative spectral energy distribution of a G-screen



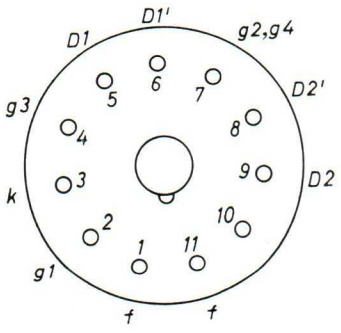
Base: Magnal 11 pins



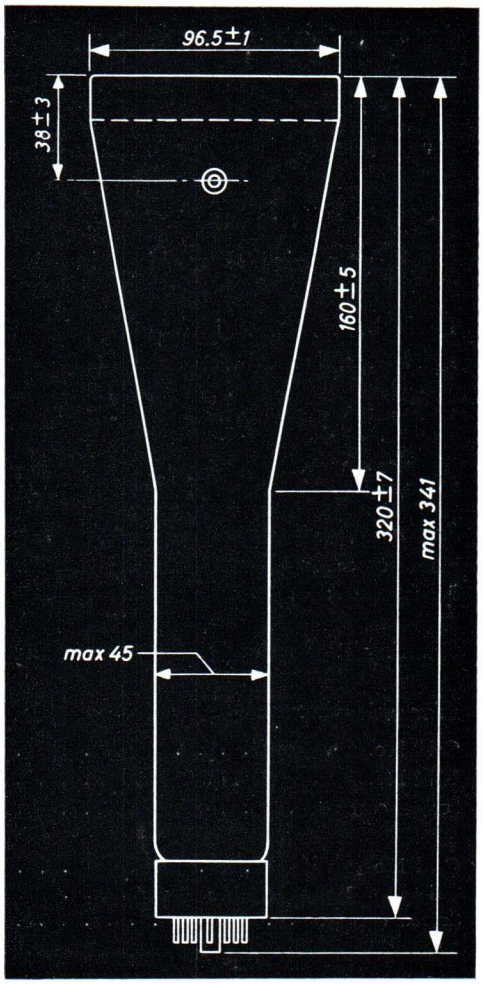
Electrode arrangement



Position of the deflection plates



Base connections



Outline drawing of the DG 10-74 (dimensions in mm)

PHILIPS ELECTRON TUBES AND SEMI CONDUCTORS

Information Release

DG 10-78

PHILIPS ELECTRON TUBE DIVISION

Eindhoven, February 1958

Dear Sirs,

We have pleasure in introducing herewith a new type in our range of tight-tolerance oscilloscope cathode-ray tubes, viz. the DG 10-78.

Thanks to advanced engineering, the characteristics of this tube are such as to enable the user to choose from a great variety of possibilities that particular combination of operating conditions which is optimal for a given application.

The envelope of the DG 10-78 has a flat face-plate of 10 cm (4") in diameter, which on the one hand ensures an inexpensive and short tube (overall-length 300 mm), and on the other an ample screen area to meet the requirements for use in various applications, ranging from simple, low-priced oscilloscopes to expensive precision apparatus.

The most interesting features of the DG 10-78 are:

1. the post-deflection acceleration, made possible by the electrode that is helically applied on the inside of the envelope, can be stepped up to a ratio 1: 4, so that high sensitivity as well as high brightness are obtainable;
2. a maximum post-deflection acceleration voltage of 8 kV;
3. a sensitivity of up to 1.15 mm/V;
4. the screening plate between both pairs of deflection plates is separately connected, which makes correction of both astigmatism and pattern distortion possible.

The excellent properties of the DG 10-78 make it a very useful element, not only in the field of radio and television service, but also in almost every branch of industry and research.

For an extensive description, reference is made to the enclosed Tentative Data sheet.

Yours faithfully,

p.p. N.V. PHILIPS' GLOEILAMPENFABRIEKEN. p.o.

J.N. Schot

H.M. Hofstede

PHILIPS DG 10-78

CATHODE-RAY TUBE

WITH A

HELICAL POST-ACCELERATION ELECTRODE

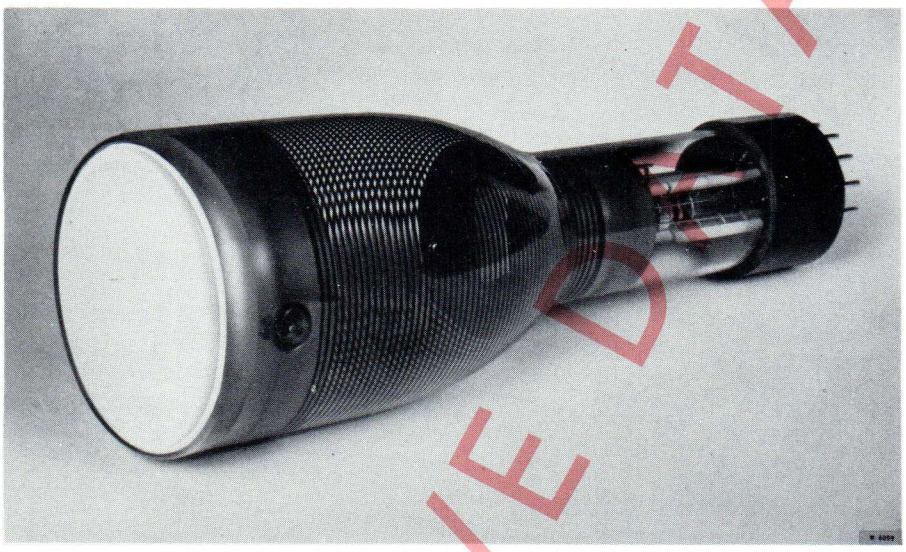


Fig.1. Photograph of the DG 10-78

The DG 10-78 is a new type in our range of "tight-tolerance" cathode-ray tubes, featuring a flat faceplate with a diameter of 10 cm(4"), electrostatic focusing and highly sensitive electrostatic double-symmetric deflection.

Thanks to some special characteristics this cathode-ray tube can be used in a wide variety of applications.

1. The post-deflection acceleration electrode is formed by a high-resistance coating applied helically on the inside of the bulb. This method ensures a continuous rise of the potential and hence considerably less pattern distortion than the normal single-step post-deflection acceleration. In addition, the ratio of post-deflection voltage to grid No.2 and 4 voltage can be stepped up to four. This means that the sensitivity-determining accelerator voltage ($V_{g2,g4}$) can be kept low, whereas the brightness determining post-accelerator voltage (V_{g6}) can be raised to a high value, so that a combination of high deflection sensitivity and high light output is achieved.

2. The isolation-screen between the two pairs of deflection plates is brought out separately. By varying the potential of this screen possible occurrence of pin-cushion and barrel-effects can entirely be eliminated.

3. To achieve optimum performance in all circumstances it may be desirable to apply a voltage for "astigmatism" control (the difference in potential between grid No.4 and the D_1D_1' plates). For controlling astigmatism in all cases where the use of D.C. amplifiers for the D_1D_1' plates is involved, it is desirable to keep the average potential of the D_1D_1' plates constant and to vary the potential of grid No.4. If, as is normal in conventional tubes, the isolation-screen is internally connected to grid No.4, a variation of grid No.4 voltage will cause a change of deflection sensitivity as a result of interaction between the isolation-screen and the deflection plates. Thanks to the fact that the isolation-screen is brought out separately, no such phenomena need be feared with the DG 10-78.

In the present data some diagrams have been included (see pages 6 and 7), indicating respectively:

1. The useful scan plotted against the ratio of $V_{g6}/V_{g2,g4}$.
2. The sensitivity, plotted against the accelerator voltage $V_{g2,g4}$.
3. The relative sensitivity plotted against the ratio of V_{g6} to $V_{g2,g4}$.

To illustrate how these diagrams can be interpreted, an example is given on page 6.

TECHNICAL DATA OF THE DG 10-78

ELECTRICAL

Heating

Indirect by A.C. or D.C.; parallel supply

heater voltage	V_f	= 6.3 V
heater current	I_f	= 0.3 A

Capacitances

D_1 to all other electrodes	C_{D1}	= 3.5 pF[1]
D_1' to all other electrodes	$C_{D1'}$	= 3.5 pF[1]
D_2 to all other electrodes	C_{D2}	= 4.5 pF[1]
D_2' to all other electrodes	$C_{D2'}$	= 4.5 pF[1]
D_1 to D_1'	$C_{D1D1'}$	= 1.7 pF
D_2 to D_2'	$C_{D2D2'}$	= 2.1 pF
Grid No.1 to all other electrodes	C_{g1}	= 5 pF
Cathode to all other electrodes	C_k	= 3.4 pF

Screen

Colour	green
Persistence	medium
Useful screen diameter	90 mm

Useful scan for:

Ratio $V_{g6}/V_{g2,g4} = 1$	D_1D_1'	= 75 mm[2]
	D_2D_2'	= 90 mm
Ratio $V_{g6}/V_{g2,g4} = 2$	D_1D_1'	= 65 mm[2]
	D_2D_2'	= 90 mm
Ratio $V_{g6}/V_{g_2,g4} = 4$	D_1D_1'	= 55 mm[2]
	D_2D_2'	= 75 mm

Focusing

electrostatic

Deflection

double electrostatic

D_1D_1'	symmetrical
D_2D_2'	symmetrical

Angle between D_1D_1' and D_2D_2' traces $90^\circ \pm 1^\circ$

---

[1]) Except the opposite deflection plate.

[2]) This useful scan can be max. 3 mm shifted with respect to the geometric centre of the faceplate.

Line width

V_{g6} = 2000 V $V_{g2,g4}$ = 2000 V I_{ℓ} = 0.5 μA		0.45 mm [3]
V_{g6} = 2000 V $V_{g2,g4}$ = 4000 V I_{ℓ} = 0.5 μA		0.35 mm [3]
V_{g6} = 1000 V $V_{g2,g4}$ = 4000 V I_{ℓ} = 0.5 μA		0.45 mm [3]

Helix resistance

Post-deflection acceleration helix resistance	min.	50 MΩ

Typical operating conditions

Post-accelerator voltage	V_{g6}	=	2000	4000	4000 V
Isolation-screen voltage	V_{g5}	=	2000	2000	1000 V [4]
Accelerator voltage	$V_{g2,g4}$	=	2000	2000	1000 V
Focusing voltage	V_{g3}	=	400-700	400-700	200-350 V [5]
Negative grid No.1 voltage	$-V_{g1}$	=	45-75	45-75	22.5-37.5 V [6]
Deflection sensitivity					
Vertical D_1D_1'			0.57-0.69	0.50-0.60	0.84-1.02 mm/V
Horizontal D_2D_2'			0.23-0.29	0.18-0.23	0.26-0.33 mm/V
Deviation of the linearity of deflection				max.	2 % [7]
Pattern distortion				<	2 % [8] [4]
Spot position (undeflected)					5 mm radius [9]

Limiting values (design centre values)

Post-accelerator voltage	V_{g6}	= max. 8000 V min. 1500 V
Isolation-shield voltage	V_{g5}	= max. 3000 V
Accelerator voltage	$V_{g2,g4}$	= max. 3000 V = min. 1000 V
Ratio	$V_{g6}/V_{g2,g4}$	= max. 4
Focusing voltage	V_{g3}	= max. 1500 V

[3]) Measured on a circle of 50 mm diameter.

[4], [5], [6], [7], [8], [9]) See page 6.

Grid No.1 voltage			
negative value	$-V_{g1}$	= max.	200 V
positive value	$+V_{g1}$	= max.	0 V
positive peak value	$+V_{g1p}$	= max.	2 V
Peak voltage between accelerator and any deflection plate	$V_{D-(g2,g4)p}$	= max.	500 V
Voltage between cathode and heater	V_{kf}	= max.	180 V
Grid No.2 and 4 dissipation	W_{g2+g4}	= max.	6 W
Screen dissipation	W_{ℓ}	= max.	3 mW/cm^2

Circuit design values

Focusing voltage	V_{g3}	= 200 - 350 V [10]
Negative grid No.1 voltage	$-V_{g1}$	= 22.5-37.5 V [10]
Deflection factor for:		
Ratio $V_{g6}/V_{g2,g4}$ = 1	D_1D_1'	= 0.72-0.89 V/mm
	D_2D_2'	= 1.72-2.17 V/mm [10]
Ratio $V_{g6}/V_{g2,g4}$ = 2	D_1D_1'	= 0.83-1.00 V/mm
	D_2D_2'	= 2.17-2.78 V/mm [10]
Ratio $V_{g6}/V_{g2,g4}$ = 4	D_1D_1'	= 0.98-1.19 V/mm [10]
	D_2D_2'	= 3.03-3.85 V/mm
Grid No.1 circuit resistance	R_{g1}	= 1.5 MΩ
Deflection plate resistance	R_D	= 5 MΩ
Grid No.3 current	I_{g3}	= -30/+15 µA

MECHANICAL DATA

Mounting position	Any
Net weight approx.	660 g (1 lbs 7.2 oz)
Base	Diheptal

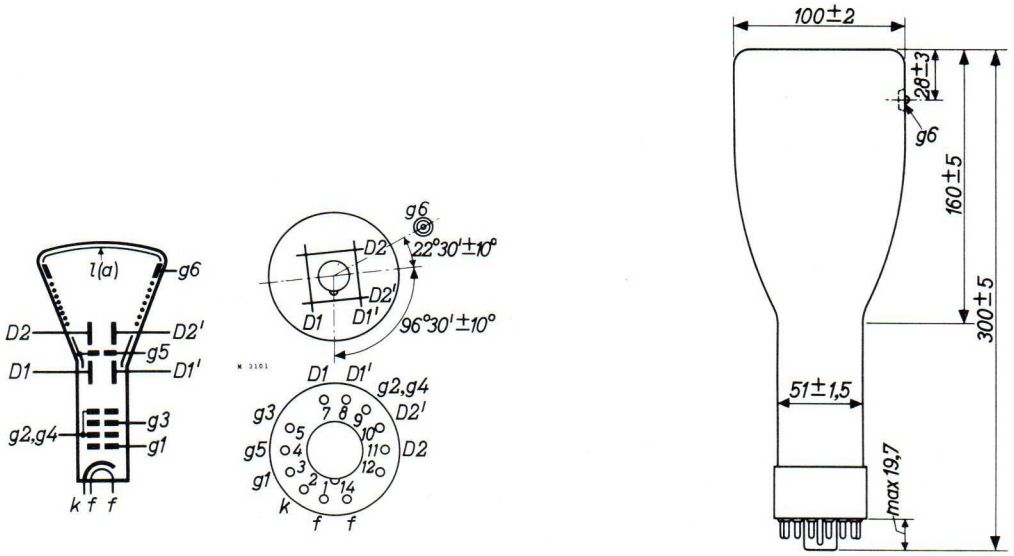


Fig.2. Dimensional outline (in mm) and electrode connections of the DG 10-78.

[10]) Per kV of the accelerator voltage $V_{g2,g4}$.

EXAMPLE

If it is assumed that a tube must be used at a post-accelerator voltage (V_{g6}) of 2600 V and an accelerator voltage ($V_{g2,g4}$) of 1100 V,

from Fig.3 can be seen that for the ratio

$$V_{g6}/V_{g2,g4} = 2.36 \ (2600/1100),$$

the useful scan for

$$D_1D_1' = 63 \text{ mm}$$
$$\text{and } D_2D_2' = 90 \text{ mm};$$

Fig.3. Useful scan plotted against the ratio $V_{g6}/V_{g2,g4}$

Notes from page 4.

[4]) In general the isolation-screen voltage and the average potential of the deflection plates should be equal. Variation of the isolation-shield voltage (max. ± 10% of $V_{g2,g4}$) serves to correct pincushion and barrel pattern distortion. The isolation-shield is also connected to the lower end of the post-accelerator helix.

[5]) In general the average potential of the deflection plates and grid 2 and 4 should be equal. For optimum sharpness it may be desirable to apply a small potential difference (max. ± 5% of $V_{g2,g4}$) between the D_1D_1' plates and grid No.2 and 4.

[6]) For visual extinction of the focused spot.

[7]) The sensitivity (for both D_1D_1' and D_2D_2' plate pairs separatively) for a deflection of less than 75% of the useful scan will not differ from the sensitivity for a deflection at 25% of the useful scan by more than the indicated value.

[8]) With a raster pattern the size of which is adjusted so that the widest points of the pattern just touch the sides of a square 51 mm on a side, no point of these pattern sides will be within an inscribed square of 49 mm on a side.

[9]) With the tube shielded the spot will be within a circle of 5 mm radius that is centred with respect to the tube face.

Fig.4 shows that for $V_{g2,g4}$ = 1100 V without post-acceleration, the sensitivity for the D_1D_1' plates = 1.15 mm/V and for the D_2D_2' plates = 0.485 mm/V;

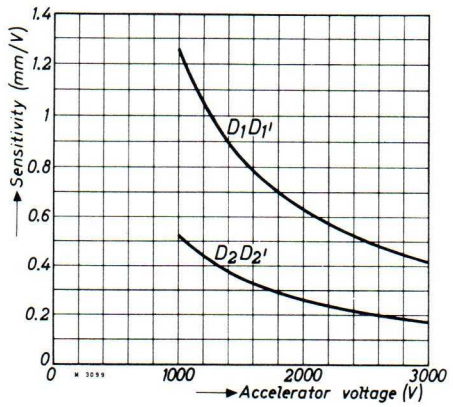


Fig.4. Sensitivity plotted against the accelerator voltage $V_{g2,g4}$.

Fig.5 shows the correction factor, which has become necessary due to the influence of the post-acceleration, on these sensitivities. For the ratio $V_{g6}/V_{g2,g4}$ = 2.36 this correction factor is 0.84 for the D_1D_1' plates and 0.73 for the D_2D_2' plates. The sensitivity with post-acceleration becomes therefore:

for D_1D_1' = 0.84 x 1.15 mm/V = 0.966 mm/V
for D_2D_2' = 0.73 x 0.485 mm/V = 0.354 mm/V

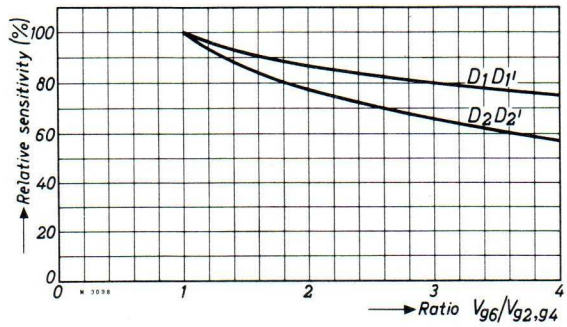


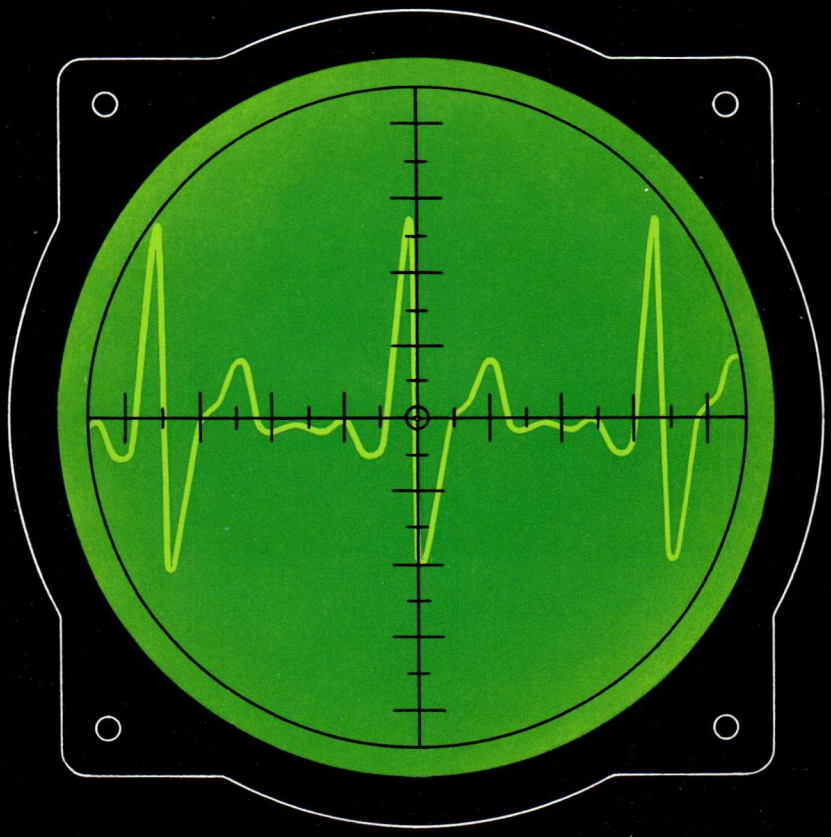
Fig.5. Relative sensitivity plotted against the ratio $V_{g6}/V_{g2,g4}$.

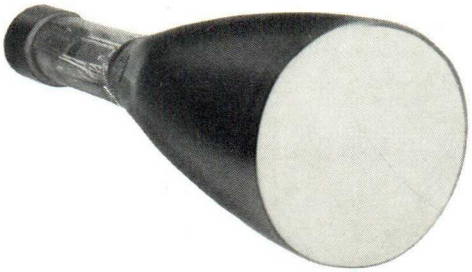
Summarizing, at a post-accelerator voltage of 2600 V and an accelerator voltage of 1100 V the following values can be found with reference to the diagrams from Figs. 3, 4 and 5:

The useful scan D_1D_1' - 63 mm
D_2D_2' - 90 mm
The sensitivity D_1D_1' - 0.966 mm/V
D_2D_2' - 0.354 mm/V

PHILIPS CATHODE-RAY TUBES

for measuring equipment





PHILIPS ELECTRON TUBE DIVISION

DG 13-2
DB 13-2
DP 13-2
DR 13-2

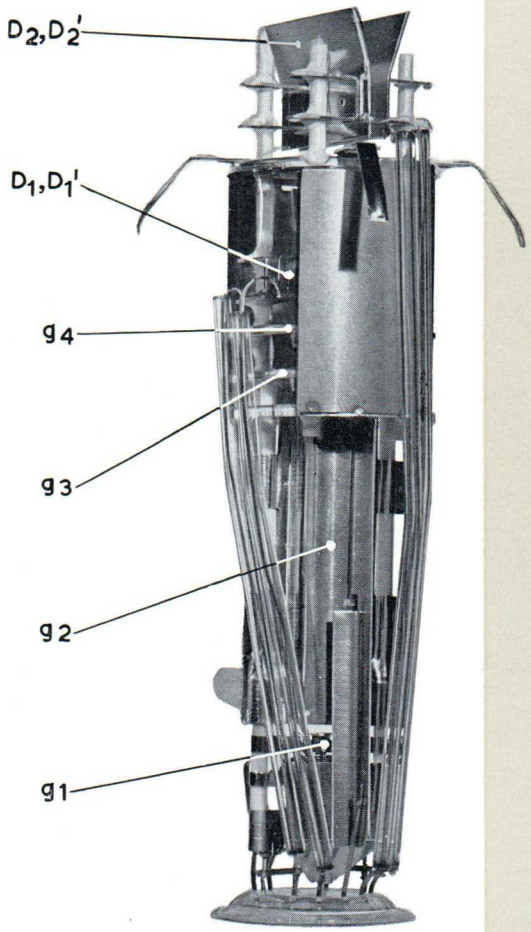
PHILIPS

GENERAL-PURPOSE CATHODE-RAY TUBE

DG 13-2
DB 13-2
DP 13-2
DR 13-2

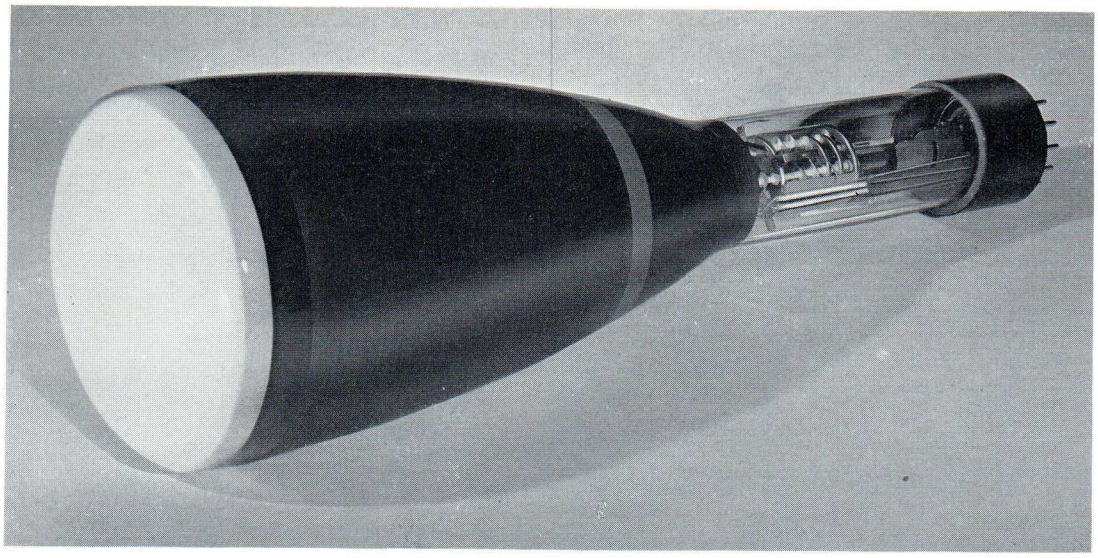
- *Independent focusing control*
- *Large screen diameter; 13 cm (5″)*
- *Symmetrical deflection*

The DG 13-2 is a general-purpose Cathode-Ray Oscilloscope Tube, with a faceplate of 13 cm (5″) diameter, featuring electrostatic double symmetrical deflection and extra high tension post-acceleration



Electron gun of the Cathode-Ray Tube DG 13-2

D_2D_2' — plates for horizontal deflection
D_1D_1' — plates for vertical deflection
g_1 — control grid
g_2,g_4 — electrodes for pre-deflection acceleration
g_3 — focusing electrode



The Philips Cathode-Ray Tube DG 13-2, has the following main features:

The focusing control is independent of the brightness control, so that the spot remains sharp when the beam-current is varied over a wide range. Owing to the very small grid No. 3 current, a low-current voltage-divider system can be used.

A large useful screen-area in relation to bulb diameter.

Symmetrical deflection, which minimizes the occurrence of distortion.

For various applications different screen types available:

G - A green screen for oscilloscopy and recording of medium- and high - frequency phenomena.

B - A blue screen for photographic recording of non-recurrent high-speed phenomena.

P - A double-layer screen with bluish fluorescence for oscilloscopy and recording of low-frequency and low-speed non-recurrent phenomena.

R - A greenish-yellow screen for oscilloscopy and recording of low- and medium-frequency signals. *)

As a result of these electrical and mechanical characteristics, this tube is particularly suitable for measuring equipment.

ELECTRICAL DATA

Screen

Tube type	Fluorescence (colour)	Persistence	
		Character	0.1 % of max. brightness after
DG 13-2	green	medium	50 millisec.
DB 13-2	blue	short	20 millisec.
DP 13-2	blue (afterglow greenish-yellow)	very long	80 sec.
DR 13-2	greenish-yellow	long	20 sec.

Heating indirect by A.C. op D.C.

Heater voltage: . . . . . V_f = 6.3 V

Heater current: . . . . . I_f = 0.3 A

Deflection double electrostatic D_1D_1' symmetric, D_2D_2' symmetric

Focusing electrostatic

Line width at V_{g_5} = 2000 V

$V_{(g_2 + g_4)}$ = 2000 V 0.4 mm **)

I_l = 0.5 µA

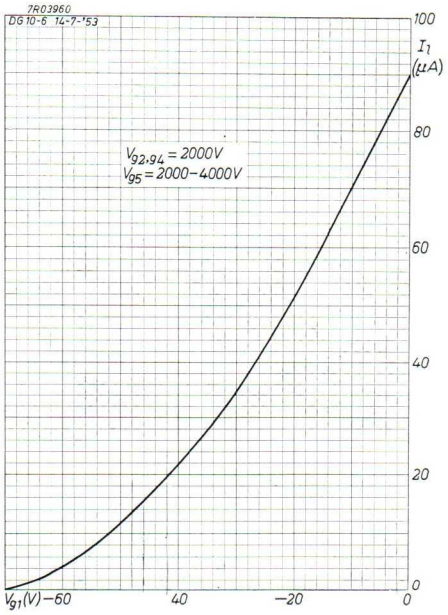
V_{g_5} = 4000 V

$V_{(g_2 + g_4)}$ = 2000 V 0.3 mm **)

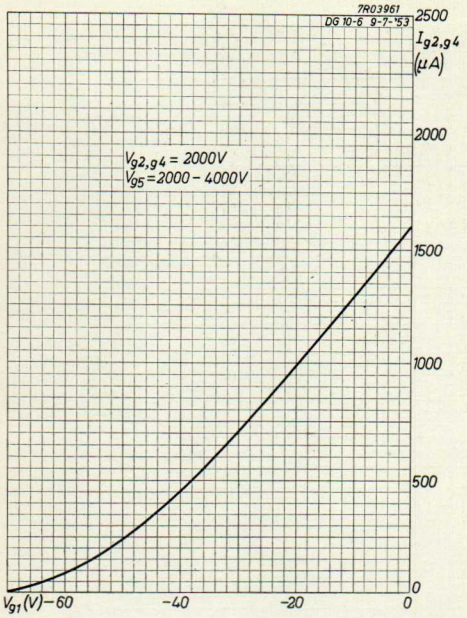
I_l = 0.5 µA

*) Detailed information on all phosphors is given in a folder dealing with data and characteristics of Philips phosphors.

**) Measured on a circle of 50 mm diameter.



Screen current as a function of negative grid cut-off voltage



Final anode current as a function of negative grid cut-off voltage

INTERELECTRODE CAPACITANCES

Electrodes	Symbol	Value (pF)
D_1 to D_1'	$C_{D_1D_1'}$	1.9
D_2 to D_2'	$C_{D_2D_2'}$	2.5
$D_1 + D_1'$ to $D_2 + D_2'$	$C_{D_1D_1'\text{-}D_2D_2'}$	0.2
D_1 to all	C_{D_1}	4.7*)
D_1' to all	$C_{D_1'}$	4.7*)
D_2 to all	C_{D_2}	5.5*)
D_2' to all	$C_{D_2'}$	5.5*)
Grid 1 to all	C_{g1}	4.6
Cathode to all	C_k	6.0
Grid 1 to $D_1D_1'D_2D_2'$	$C_{g1\text{-}D_1D_1'D_2D_2'}$	0.15
Cathode to $D_1D_1'D_2D_2'$	$C_{k\text{-}D_1D_1'D_2D_2'}$	0.35

Operating characteristics

		with post acceleration	without post acceleration
Grid No. 5 voltage	V_{g5}	= 4000	2000 V
Grid No. 2 + No. 4 voltage	$V_{(g_2 + g_4)}$	= 2000	2000 V
Grid No. 3 voltage	V_{g3}	= 400 - 720	400 - 720 V
Grid No. 3 current	I_{g3}	= −15 to +10	−15 to +10 μA
Negative grid No. 1 voltage **)	$-V_{g1}$	= 45 - 100	45 - 100 V
Deflection sensitivity	D_1D_1'	= 0.34 - 0.42	0.43 - 0.51 mm/V
Deflection sensitivity	D_2D_2'	= 0.29 - 0.37	0.37 - 0.45 mm/V

Limiting values (design center values)

Grid No. 5 voltage	V_{g5}	= max.	5000 V
Grid No. 2 + No. 4 voltage	$V_{(g_2 + g_4)}$	= max.	2500 V
Grid No. 3 voltage	V_{g3}	= max.	1000 V
Grid No. 1 voltage (negative value)	$-V_{g1}$	= max.	150 V
Grid No. 1 voltage (positive value)	$+V_{g1}$	= max.	0 V
Peak voltage on D_1D_1'	$V_{D_1D_1'p}$	= max.	450 V
Peak voltage on D_2D_2'	$V_{D_2D_2'p}$	= max.	450 V
Voltage between cathode and heater	V_{kf}	= max.	125 V
Screen dissipation	W_l	= max.	3 mW/cm²
Grid No. 2 and grid No. 4 dissipation	$W_{(g_2 + g_4)}$	= max.	4 W

Maximum circuit values

Deflection plate circuit resistance	R_D	= max.	5 MΩ
Grid No. 1 circuit resistance	R_{g1}	= max.	1.5 MΩ

MECHANICAL DATA

Mounting position any

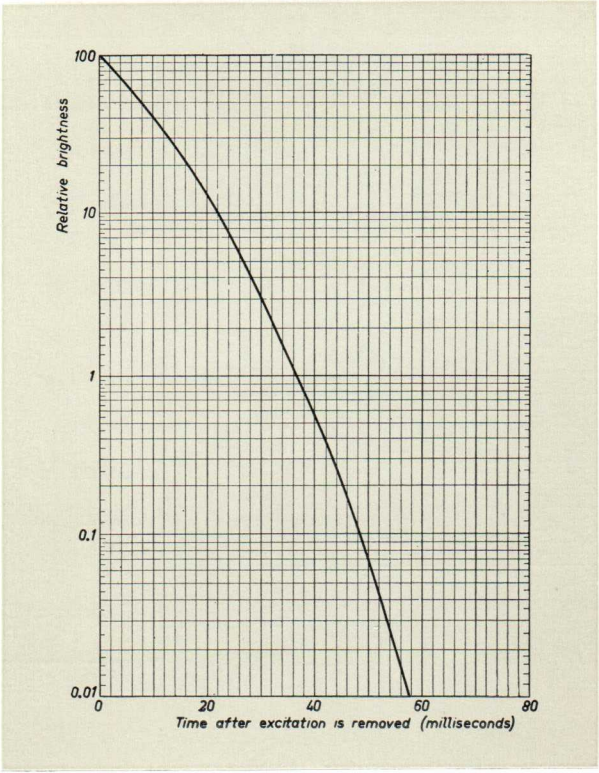
Dimensions overall-length 425 mm ($16\frac{3}{4}$″)
screen diameter 13 cm (5″)

Anode contact B1.885.06.

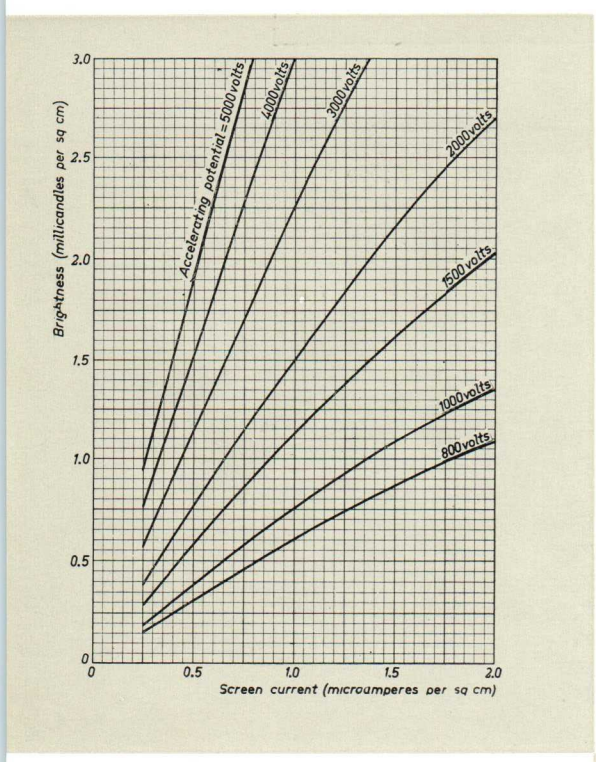
*) Except the opposite deflection plate.
**) For visual extinction of the focused spot.

G-screen

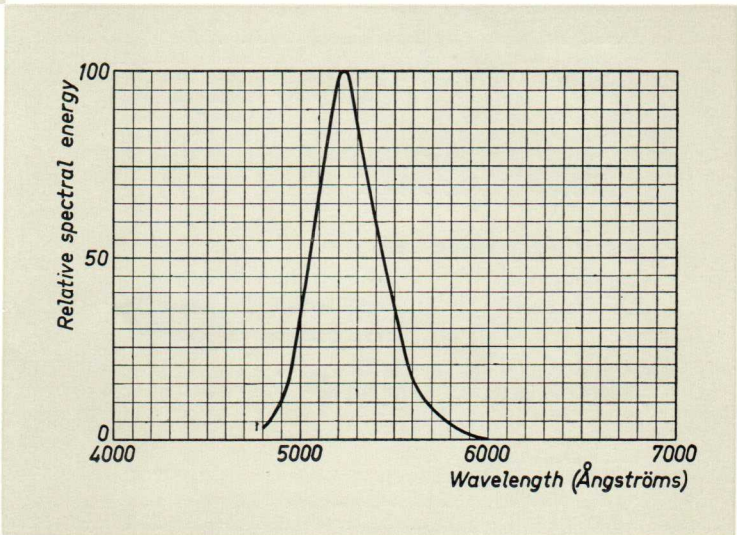
The green fluorescent G-screen provides high visual contrast under conditions of normal ambient illumination. It has medium persistence and can be used for visual observation of recurrent phenomena in the majority of applications.



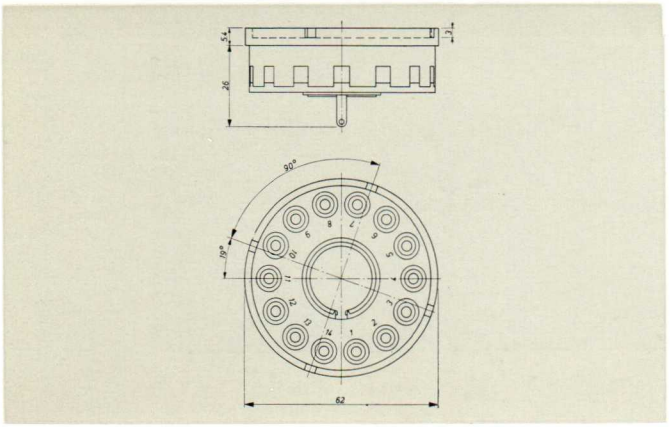
Persistence characteristic of a G-screen.



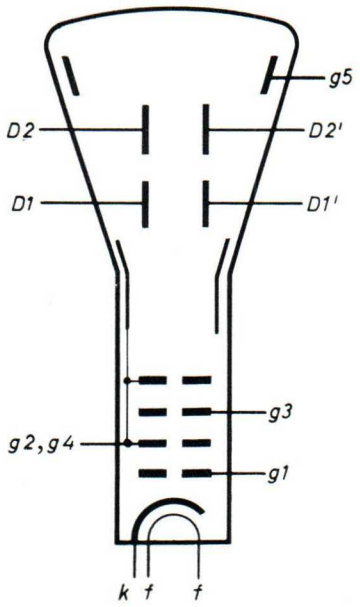
Brightness of a G-screen as a function of the screen current per square cm screen area, with the accelerating potential as a parameter.



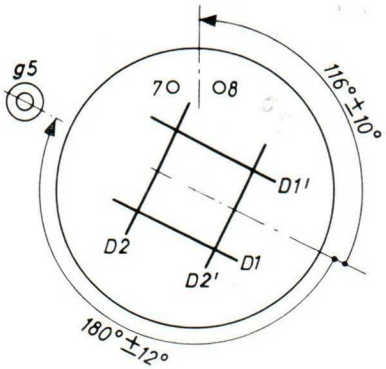
Relative spectral energy distribution of a G-screen



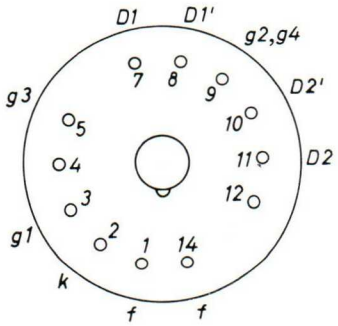
Base: Diheptal



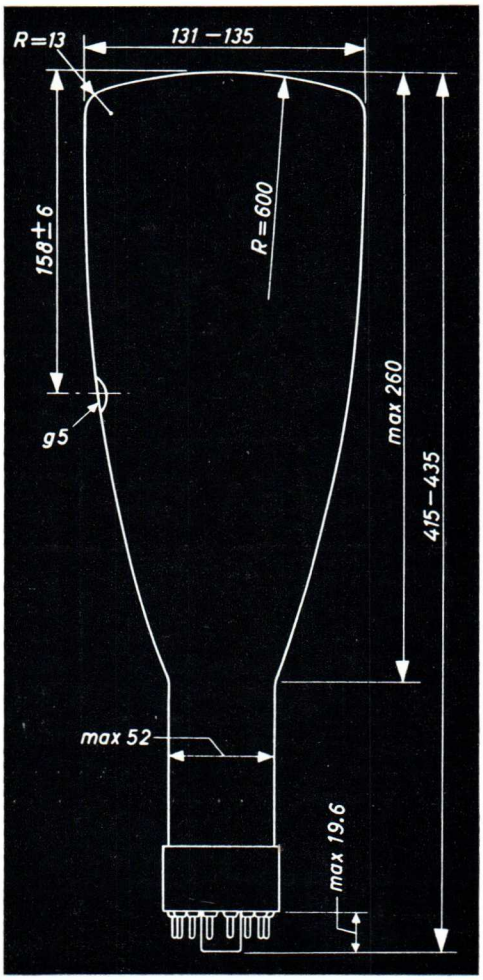
Electrode arrangement



Position of the deflection plates



Base connections



Outline drawing of the DG 13-2 (dimensions in mm)

PHILIPS ELECTRON TUBES AND SEMI CONDUCTORS

Information Release

PHILIPS ELECTRON TUBE DIVISION

Dear Sirs,

We have pleasure in announcing herewith the cathode-ray tube type DG 13-32, which has been incorporated in our programme to suit the requirements for 13 cm tubes for service oscilloscopes and the like.

The cathode-ray tube DG 13-32 is equivalent to the American type 5UP1 and combines a great deflection sensitivity, a small line width and high brilliancy.

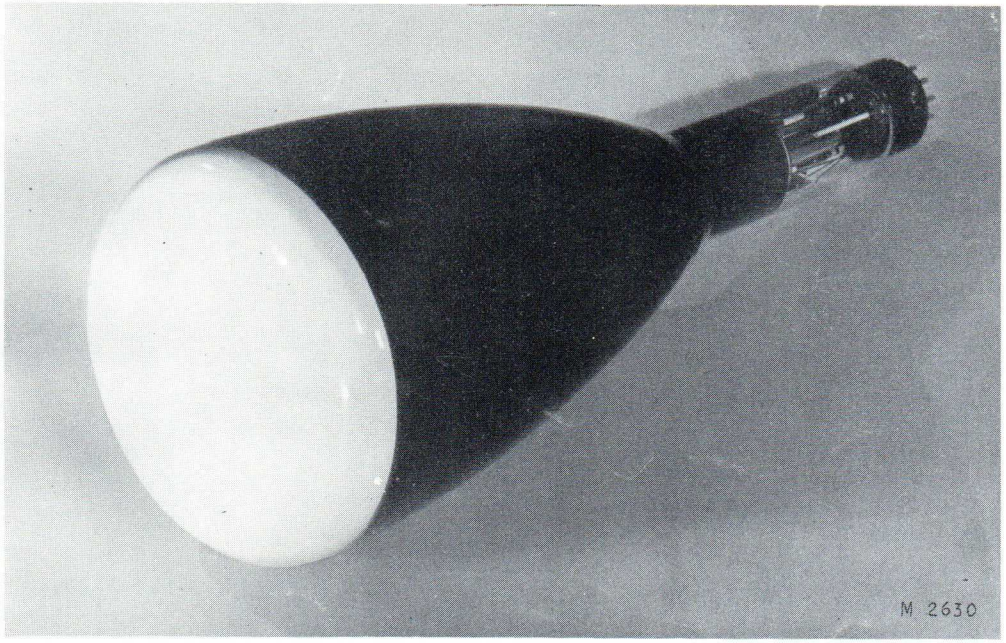
We remain,

Very truly yours,

PHILIPS

DG 13-32

GENERAL-PURPOSE CATHODE-RAY TUBE



The Philips Cathode-Ray Tube DG 13-32 is especially designed to satisfy the requirements for visual observation of oscillographic phenomena.

The characteristic features of the tube are:

- double symmetric electrostatic deflection;
- high deflection sensitivity at full scan;
- brilliant and fine spot at operation beam-current;
- 4 watt cathode adapted to existing circuitry technique;
- equivalent to the Cathode-Ray Tube 5 UP 1.

MARCH 1957

PHILIPS ELECTRON TUBE DIVISION

ELECTRICAL DATA

HEATING

Indirect by a.c. or d.c.

Parallel supply

Heater voltage	6.3 V
Heater current	0.6 A

SCREEN

Fluorescence	green
Persistence	medium

FOCUSING

Electrostatic

DEFLECTION

Double electrostatic $D_1 D_1'$ symmetric, $D_2 D_2'$ symmetric

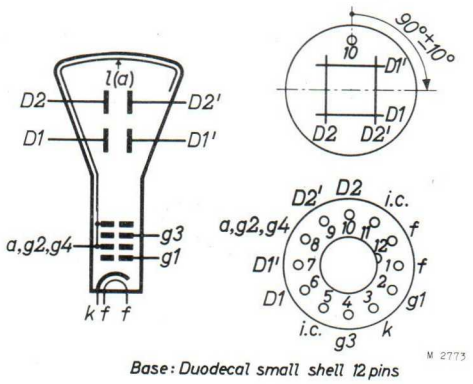
DIRECT INTERELECTRODE CAPACITANCES

Grid No.1 to all other electrodes	C_{g_1}	=	4.3 pF	
Cathode to all other electrodes	C_k	=	6.5 pF	
D_1 to all other electrodes	C_{D_1}	=	4.6 pF	1)
D_1' to all other electrodes	$C_{D_1'}$	=	4.6 pF	1)
D_2 to all other electrodes	C_{D_2}	=	9.3 pF	1)
D_2' to all other electrodes	$C_{D_2'}$	=	5. pF	1)
D_1 to D_1'	$C_{D_1 D_1'}$	=	1.5 pF	
D_2 to D_2'	$C_{D_2 D_2'}$	=	2 pF	

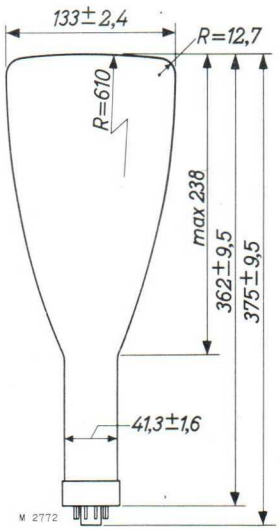
LINE WIDTH at

Grid No.2 + 4 voltage	$V_{(g_2 + g_4)}$	= 2000 V		
Screen current	I_l	= 0.5 µA	0.4 mm	2)

MAXIMUM DIMENSIONS (in mm) AND ELECTRODE CONNECTIONS



Base: Duodecal small shell 12 pins



1) To all electrodes, except the opposite deflection plate.

2) Measured on a circle of 50 mm diameter.

TYPICAL OPERATING CONDITIONS

Grid No.2 and 4 voltage	$V_{g_2 + g_4}$	=	2000 V	
Grid No.3 voltage	V_{g_3}	=	340 - 640 V	3)
Neg. grid No.1 voltage for visual extinction of the focused spot	$-V_{g_1}$	=	max. 90 V	
Sensitivity ($D_1 D_1'$)	N_1	=	0.41 - 0.55 mm/V	
Sensitivity ($D_2 D_2'$)	N_2	=	0.33 - 0.45 mm/V	

LIMITING VALUES (Design centre value)

Grid No.2 and 4 voltage	$V_{g_2 + g_4}$	=	max. 2500 V	
Grid No.3 voltage	V_{g_3}	=	max. 1000 V	3)
Grid No.1 voltage Negative value	$-V_{g_1}$	=	max. 200 V	
Positive value	V_{g_1}	=	max. 0 V	
Peak voltage on deflection plates $D_1 D_1'$	$V_{D_1 D_1' p}$	=	max. 500 V	
Peak voltage on deflection plates $D_2 D_2'$	$V_{D_2 D_2' p}$	=	max. 500 V	
Voltage between cathode and heater	V_{kf}	=	max. 125 V	
Screen dissipation	W_l	=	max. 3 mW/cm²	
Grid No.2 and 4 dissipation	$W_{g_2 + g_4}$	=	max. 4 W	

MAX. CIRCUIT VALUES

Deflection plate resistance	R_D	=	max. 5 MΩ	
Grid No.1 circuit resistance	R_{g_1}	=	max. 1.5 MΩ	

MECHANICAL DATA

MOUNTING POSITION

Any

DIMENSIONS

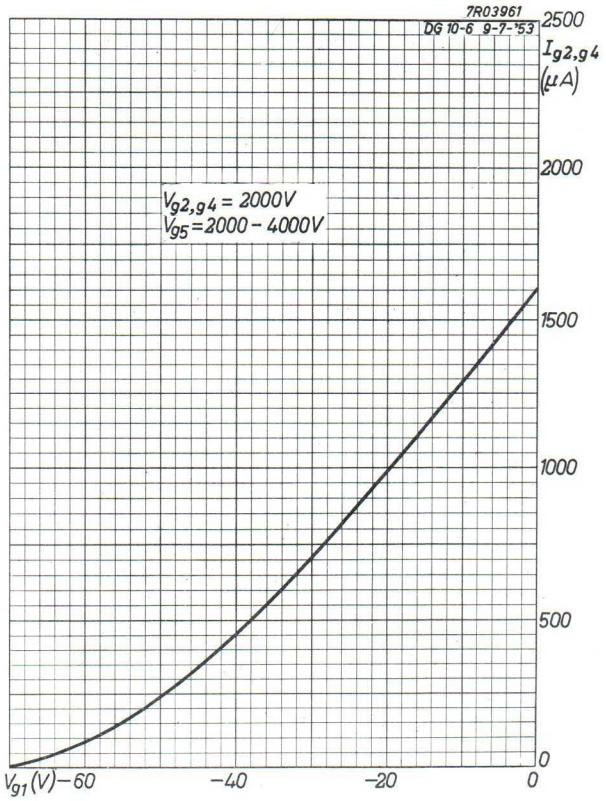
Overall length 375 ± 9.5 mm ($14\frac{3}{4} \pm \frac{3}{8}$")

Screen diameter 13 cm (5")

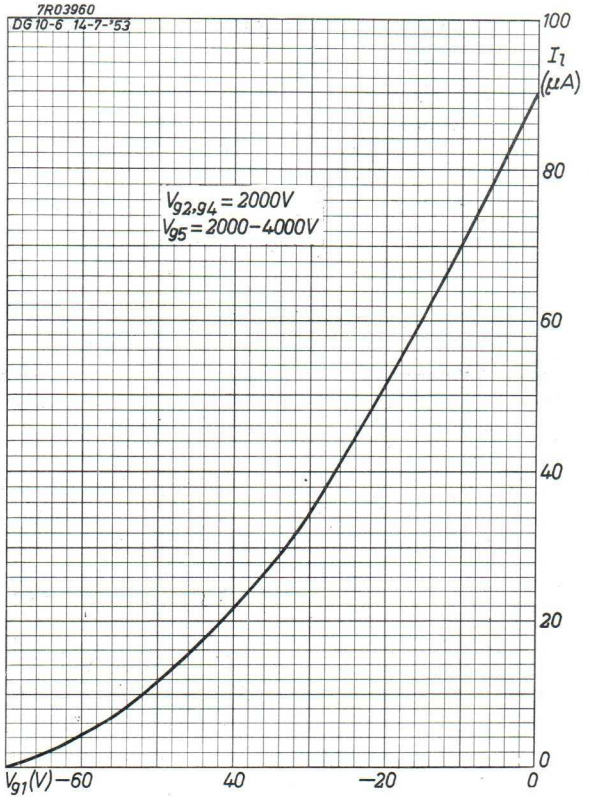
NET WEIGHT

790 g (1 lb 12 oz.)

3) For calculation of the grid No.3 voltage potentiometer, a grid No.3 current of min. -15 μA and max. +10 μA must be taken into account.



Grid No.2 and No.4 current plotted against negative grid No.1 current.



Screen current as a function of negative grid-cut-off voltage.

PHILIPS ELECTRON TUBES AND SEMI CONDUCTORS

Information Release

PHILIPS ELECTRON TUBE DIVISION

Eindhoven, April 1957.

Dear Sirs,

We have the pleasure to introduce herewith the DG 13-34, a high-quality Cathode-Ray Tube with a plane parallel face of 13 cm (5") diameter, designed for measuring equipment.

To meet the present demand of the applications in the measuring field, this Cathode-Ray Tube has a number of outstanding characteristics: improved linearity and raster qualities as well as high deflection sensitivity and independent brightness control.

The DG 13-34 fully answers the requirements of the MIL-Specifications for the American type 5ADP1.

"Tentative Data" giving detailed electrical and mechanical information of the DG 13-34 are enclosed.

We trust that the extension of our programme with this Cathode-Ray Tube will enable you to meet still better the requirements of high-standard measuring equipment.

Yours faithfully,

p.p. N.V. PHILIPS' GLOEILAMPENFABRIEKEN

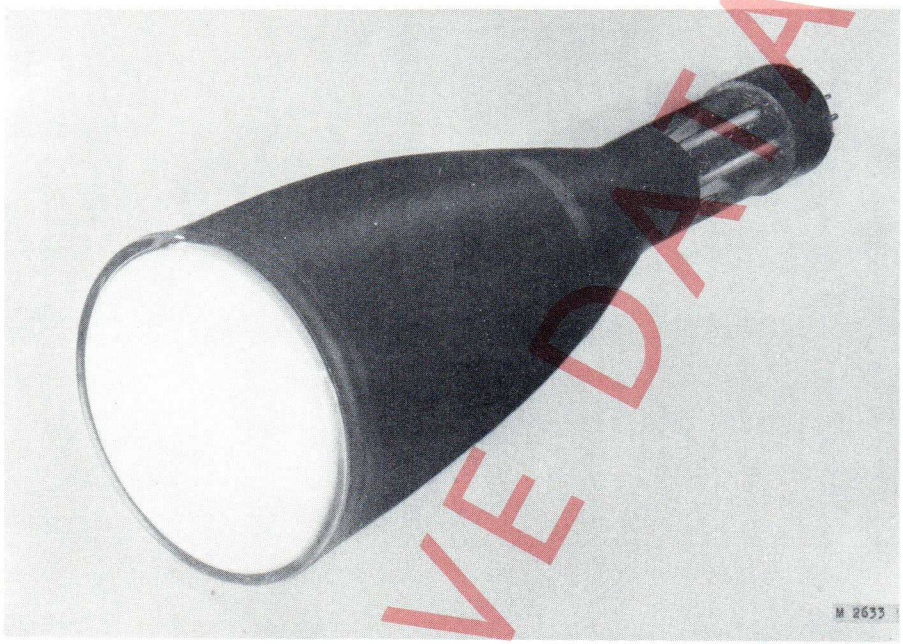
J.N. Schot

J.L. Baartman

PHILIPS

DG 13-34

CATHODE-RAY TUBE FOR MEASURING PURPOSES



The DG 13-34 is a high-quality Cathode-Ray Tube with electrostatic focusing and highly sensitive, electrostatic double-symmetric deflection.

The tube has especially been designed for use in applications where close tolerances in the electrical and mechanical characteristics are of prime importance.

In addition the DG 13-34 has the following features:

- Very high deflection sensitivity, permitting the use of small amplifiers, both for the timebase and the signal under examination.

- The plane parallel faceplate of high-quality glass ensures correct reading, drawing or photographic recording of the oscillograms without parallax.

- The focusing adjustment is completely independent of the brightness control, as the electrostatic focus electrode does not influence the beam current, owing to the preceding and the following electrode being at a higher potential. Moreover a high resistance potentiometer can be used for adjusting the focusing potential.

- Negligible deflection defocusing and raster distortion, thanks to perfect gun design and high precision in production.

- Thanks to the high-grade phosphor screen and high-tension post acceleration, high brilliancy at small spot dimensions is achieved.

As a result of these very interesting electrical and mechanical characteristics, the DG 13-34 is an outstanding type for measuring equipment of exceptional quality.

GENERAL DATA

HEATING

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

Heater voltage	V_f = 6.3 V
Heater current	I_f = 0.6 A

CAPACITANCES

D_1 to all other electrodes [1]	max. 5.0 pF
D_1' to all other electrodes [1]	max. 5.0 pF
D_2 to all other electrodes [1]	max. 6.1 pF
D_2' to all other electrodes [1]	max. 6.1 pF
D_1 to D_1'	max. 1.3 pF
D_2 to D_2'	max. 3.1 pF
Grid No.1 to all other electrodes	max. 7.9 pF
Cathode to all other electrodes	max. 5.8 pF

SCREEN

Colour	green
Persistence	medium
Useful diameter	min. 114 mm

DEFLECTION

Double electrostatic $D_1 D_1'$ symmetrical, $D_2 D_2'$ symmetrical

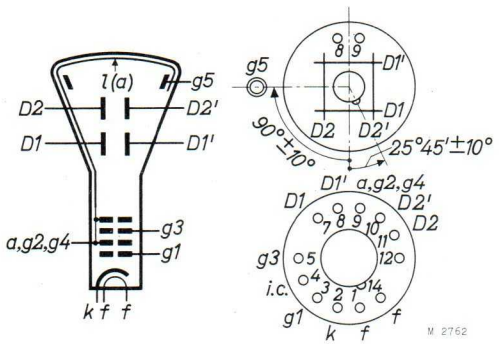
Angle between $D_1 D_1'$ and $D_2 D_2'$ traces $90^\circ \pm 1^\circ$.

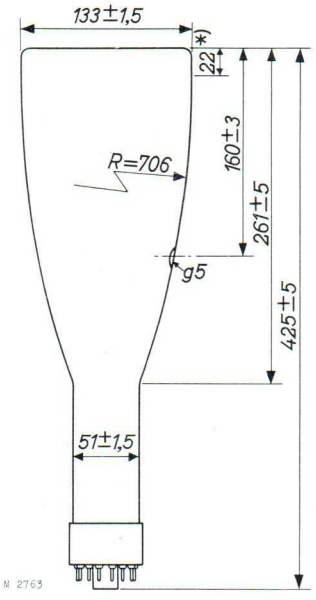
FOCUSING electrostatic

LINE WIDTH

Grid No.5 voltage	V_{g_5}	=	3000 V	
Grid No.2 and grid No.4 voltage	$V_{(g_2+g_4)}$	=	1500 V	0.4 mm [2]
Screen current	I_l	=	0.5 µA	
Grid No.5 voltage	V_{g_5}	=	4000 V	
Grid No.2 and grid No.4 voltage	$V_{(g_2+g_4)}$	=	2000 V	0.3 mm [2]
Screen current	I_l	=	0.5 µA	

MAXIMUM DIMENSIONS (in mm) AND ELECTRODE CONNECTIONS





*) Straight portion

[1]) Except the opposite deflection plate.

[2]) Measured on a circle of 50 mm diameter.

ELECTRICAL DATA

TYPICAL OPERATING CONDITIONS

Post accelerator voltage	V_{g_5}	3000	4000 V	
Accelerator voltage	$V_{g_2+g_4}$	1500	2000 V	
Focusing voltage	V_{g_3}	300 to 515	400 to 690 V	3)+8)
Negative grid No.1 voltage for visual extinction of the focused spot	$-V_{g_1}$	34 to 56	45 to 75 V	
Sensitivity D_1D_1'	N_1	0.68 - 0.84	0.51 - 0.63 mm/V	
Sensitivity D_2D_2'	N_2	0.51 - 0.63	0.38 - 0.47 mm/V	
Useful scan D_1D_1'		min. 102	102 mm	4)
Useful scan D_2D_2'		min. 102	102 mm	4)
Deviation of the linearity of deflection		max. 2	2 %	5)
Pattern distortion		max. 2.5	2.5 %	6)
Spot position (undeflected)		7)	7)	

LIMITING VALUES (design centre)

Post accelerator voltage	V_{g_5}	max. min.	$V_{g_2+g_4}$ 6000 V	
Accelerator voltage	$V_{g_2+g_4}$	max. min.	2600 V 1000 V	
Ratio $V_{g_5}/V_{g_2+g_4}$		max.	2.3	
Focusing voltage	V_{g_3}	max.	1000 V	3)
Grid No.1 voltage				
negative value	$-V_{g_1}$	max.	200 V	
positive value	$+V_{g_1}$	max.	0 V	
positive peak value	$+V_{g_1p}$	max.	2 V	
Peak voltage between accelerator and any deflection plate	$V_{D-(g_2+g_4)p}$	max.	500 V	8)
Voltage between cathode and heater	V_{kf}	max.	180 V	
Grid No.2,4 and 5 dissipation	$W_{g_2+g_4+g_5}$	max.	6 W	

CIRCUIT DESIGN VALUES

Focusing voltage	V_{g_3}	200 to 345 V		10)
Negative grid No.1 voltage for visual extinction of the focused spot	$-V_{g_1}$	22.5 to 37.5 V		10)
Deflection factors for $V_{g_5} = 2(V_{g_2+g_4})$	D_1D_1'	0.79 - 0.98 V/mm		10)
	D_2D_2'	1.06 - 1.32 V/mm		10)
Deflection factors for $V_{g_5} = V_{g_2+g_4}$	D_1D_1'	0.64 - 0.79 V/mm		10)
	D_2D_2'	0.85 - 1.04 V/mm		10)
Grid No.1 circuit resistance	R_{g_1}	max. 1.5 MΩ		
Deflection plate resistance	R_D	max. 5 MΩ		9)

MECHANICAL DATA: see overleaf

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3) For calculation of the grid No.3 voltage potentiometer a grid No.3 current of min. -15 μA and max. +10 μA must be taken into account.

4) ±51 mm from the tube face centre.

5) The sensitivity (for both D_1D_1' and D_2D_2' plate pairs separately) for a deflection of less than 75% of the useful scan will not differ from the sensitivity for a deflection at 25% of the useful scan by more than the indicated value.

6) With a raster pattern which is so adjusted that its widest points just touch a square of 82 mm, no point of its circumference will be within an inscribed square of 78 mm.

7) With the tube shielded the spot will be within a circle of 8 mm radius that is centred with respect to the tube face.

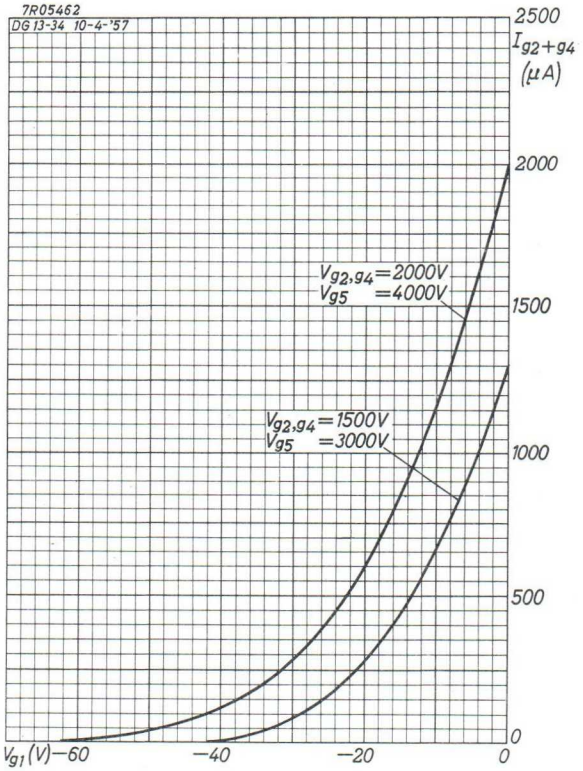
8) For optimum focus the average potentials of the deflection plates and grid No.2 and No.4 should be equal.

9) It is recommended that the deflection plate resistances are approximately equal.

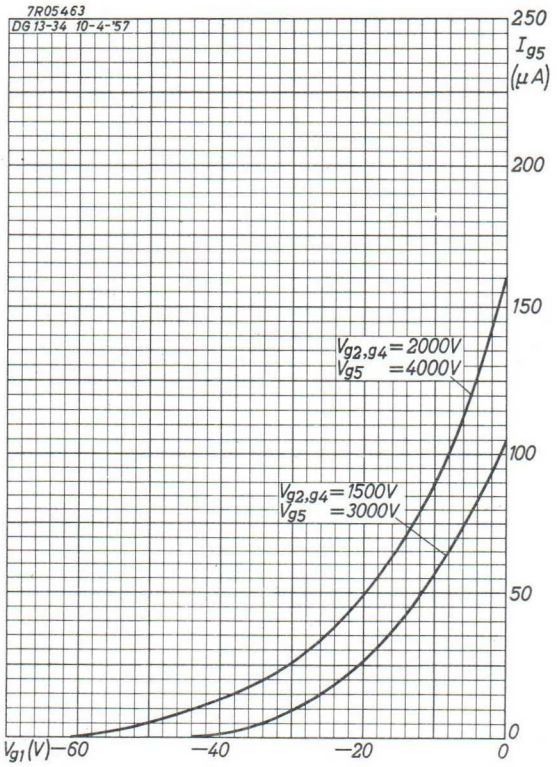
10) Per kV of accelerator voltage $V_{g_2+g_4}$.

MECHANICAL DATA

MOUNTING POSITION	Any
DIMENSIONS	Overall length 425 ± 5 mm (16¾" ± 3/16")
	Screen diameter 13 cm (5")
NET WEIGHT	Approx. 840 g (1 lbs 13½ oz.)
BASE	Diheptal medium shell



Grid No.2 and No.4 current plotted against negative grid cut-off voltage.



Screen current as a function of negative grid cut-off voltage.

Printed in Holland

20/153/B E 12/56