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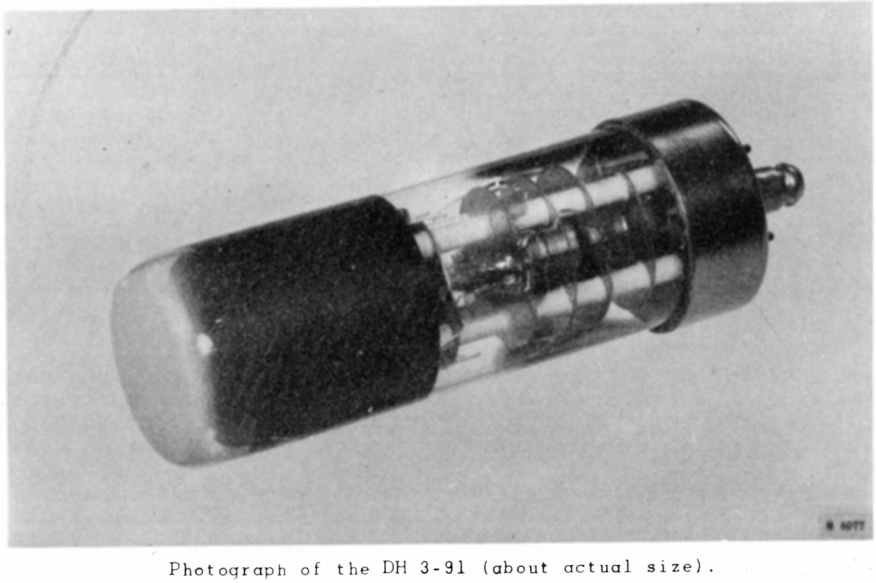
PHILIPS

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

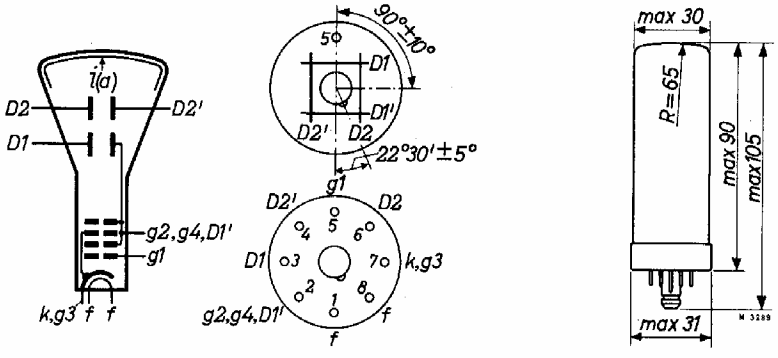


Fig.1. Electrode arrangement, electrode connections and maximum dimensions (in mm) of the DH 3-91.

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.

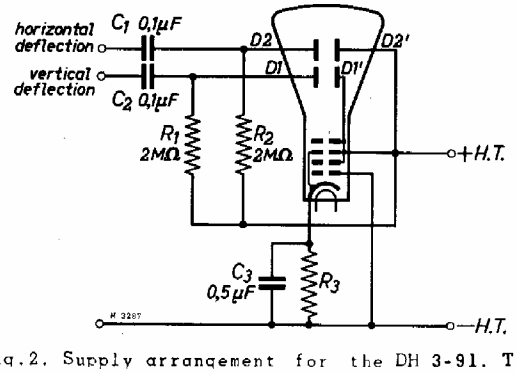


Fig.2. Supply arrangement for the DH 3-91. The value of the cathode resistor R_3 can be chosen from Fig.4.

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 D1 plates a.c. connected. No horizontal shift network is included. V_1 is the actual working voltage of the tube.

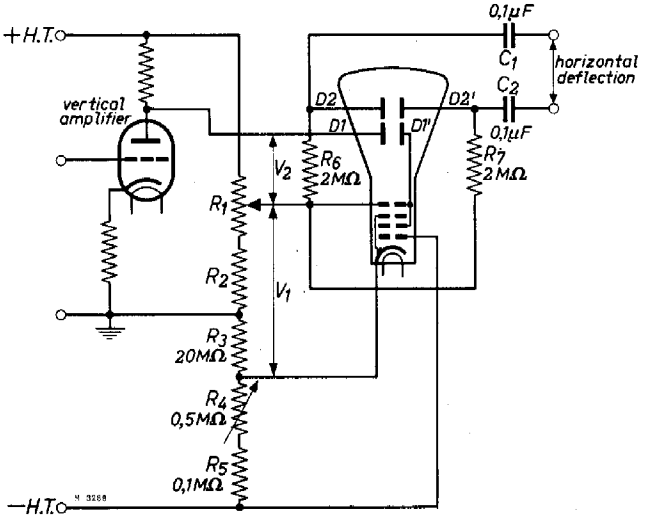


Fig.3. Supply arrangement for d.c. connected D_2 plates (horizontal deflection) and a.c. connected D_1 plates (vertical deflection). R_1 and R_2 are chosen such that the mean value of V_2 = 0 V. Brilliance control is possible by means of the variable cathode resistor.

Remark

If it is required to run the D1 plate only from a d.c. signal the anode tap can be used as a centering device.

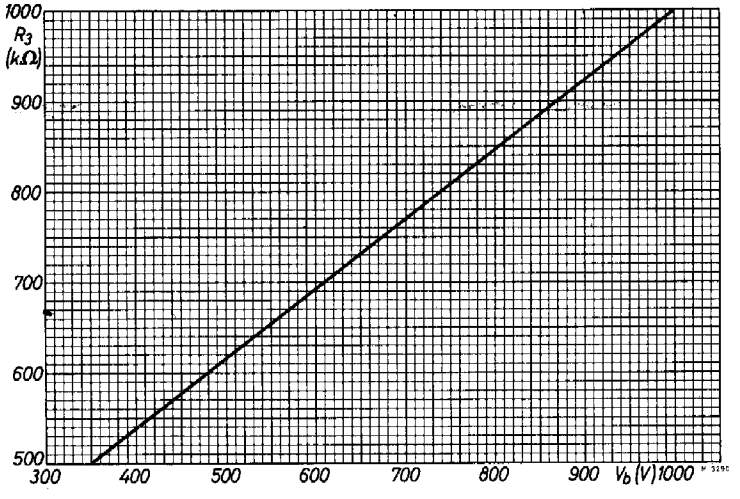


Fig.4. Cathode resistor R_3 as a function of the supply voltage for the circuit diagram of Fig.2.