CAMERA TUBES

25,4 mm (1 in) diameter Plumbicon® television camera tubes, with high resolution lead-oxide photoconductive target, for use in high quality monochrome or colour cameras for broadcast, educational or industrial applications.

The XQ3070 series comprises the following front loading versions:

XQ3070	for use in monochrome cameras
XQ3070L	for use in the luminance channel of colour cameras
XQ3070R	for use in the red channel
XQ3070G	for use in the green channel
XQ3070B	for use in the blue channel
XQ3071	as XQ3070 series; only difference being the degree of freedom from blemishes on the target (industrial quality tubes)
XQ3073R	for use in the red channel; extended red response
XQ3074	as XQ3073. Industrial grade
XQ3075R	for use in the red channel; extended red response and IR filter
XQ3076	as XQ3075. Industrial grade

These tubes are available in rear loading versions (/02,/05,/12 and /15) only.

Special features are:

- New photoconductive target for increased resolution
- "Diode" electron gun with high beam reserve for dynamic beam control (DBC) to minimize comet-tailing and blooming (notes 1, 2, 3)
- Provision for light bias to reduce lag
- Low output capacitance (LOC) for high signal-to-noise ratio

QUICK REFERENCE DATA

"Diode" electron gun		
Diameter		25,4 mm (1 inch)
Length	approx.	170 mm
Provided with anti-halation glass disc		
Focusing	magnetic	
Deflection	magnetic	
Useful target area (scanning area)		9,6 x 12,8 mm
Spectral response		
max. at	approx.	500 nm
cut-off: XQ3070	approx.	650 nm
XQ3073	approx.	850 to 950 nm
XQ3075	approx.	750 nm
Sensitivity		
XQ3070, XQ3070L	typ.	350 μA/lm
XQ3070R	typ.	70 μA/lmF
XQ3070G	typ.	145 μA/lmF
XQ3070B	typ.	38 μA/lmF
XQ3073R, XQ3075R	typ.	100 μA/lmF
Resolution at 400 TV lines (5 MHz)		
XQ3070, XQ3070L	typ.	60 %
XQ3070R	typ.	45 %
XQ3070G	typ.	60 %
XQ3070B	typ.	60 %
XQ3073R, XQ3075R	typ.	55 %
Heater		6,3 V, 95 mA

® Registered trademark for television camera tubes.

MECHANICAL VARIANTS

Variants are defined by a suffix as follows:

XQ . . . ./02, R, G, B, L: rear loading versions with provision for internal light bias, target contact ring with 1 target contact, metal sleeve on pumping stem to mount light bias lamp.
XQ . . . ./05, R, G, B, L: as /02, however without provision for light bias lamp.
XQ . . . ./12, R, G, B, L: as /02, however with 2 contacts on the target ring.
XQ . . . ./15, R, G, B, L: as /05, however with 2 contacts on the target ring.

OPTICAL DATA

		notes
Quality rectangle on photoconductive target (aspect ratio 3 : 4)	9,6 x 12,8 mm	
Orientation of image on target: For correct orientation of the image on the target the vertical scan should be essentially parallel to the plane passing through the tube axis and the marker line on the protecting sleeve at the base.		
Faceplate		
Thickness	1,2 ± 0,1 mm	
Refractive index	n = 1,49	
Anti-halation glass disc provided with anti reflective coating		
Thickness	5 ± 0,1 mm	
Refractive index	n = 1,52	
XQ3075R is provided with infrared reflecting filter		

ACCESSORIES

		notes
Socket	type 56098	
Deflection and focusing coil unit:		
Black/white	type AT1126S	
Colour	type AT1126T	
Mask for flare reduction	type 56028	
Light bias lamp in holder	type 56106	4

ELECTRICAL DATA

Deflection		magnetic
Focusing		magnetic
Heating, indirect by a.c. or d.c.; parallel supply		
Heater voltage	V_f	6,3 V ± 5%
Heater current at V_f = 6,3 V	I_f nom.	95 mA
The heater current and the heater voltage must not exceed r.m.s. values of 150 mA and 9,5 V. For optimum performance (lifetime and registration stability) stabilization of the heater voltage is recommended.		
Capacitance		
Signal electrode to all		
rear loading types /02 and /05	C_{as}	approx. 2,1 pF
rear loading types /12 and /15	C_{as}	approx. 2,5 pF
This capacitance, which is effectively the output impedance, increases when the tube is inserted in the coil unit.		

LIMITING VALUES (Absolute maximum rating system)

Unless otherwise stated, all voltages are referred to the cathode.

					notes
Signal electrode voltage	V_{as}	max.	50	V	
Grid 4 voltage	V_{g4}	max.	1100	V	
Grid 3 voltage	V_{g3}	max.	800	V	
Voltage between grid 4 and grid 3	$V_{g4/g3}$	max.	450	V	
Grid 2 voltage	V_{g2}	max.	340	V	
Grid 1 voltage,					
positive	V_{g1}	max.	25	V	
negative	$-V_{g1}$	max.	200	V	
Grid 1 current					
$\approx I_k$ current, without blanking	I_{g1}	max.	5	mA	
peak to peak with DBC	I_{g1p}	max.	8	mA	2
Cathode to heater voltage					
positive peak	V_{kfp}	max.	125	V	
negative peak	$-V_{kfp}$	max.	50	V	
Cathode heating time before drawing current	t_h	min.	1	min	
External resistance between cathode and heater at $V_{kfp} > 10$ V	R_{kf}	min.	2	kΩ	
Ambient temperature, storage and operation	T_{amb}	max.	50	°C	
		min.	−30	°C	
Faceplate temperature, storage and operation	T	max.	50	°C	
		min.	−30	°C	
Faceplate illuminance	E	max.	500	lx	5

OPERATING CONDITIONS

				notes
For a scanned area of 9,6 x 12,8 mm				6
Cathode voltage	V_k	0	V	
Signal electrode voltage	V_{as}	45	V	
Beam current	I_b			7
Grid 4 voltage	V_{g4}	960	V	
Grid 3 voltage	V_{g3}	600	V	
Grid 2 voltage	V_{g2}	300	V	
Grid 1 voltage	V_{g1}		V	7
Blanking voltage on grid 1, peak to peak	V_{g1p-p}	25	V	
Faceplate illuminance	E	0 to 10	lx	8
Faceplate temperature	T	20 to 45	°C	9

ELECTRON GUN CHARACTERISTICS

					notes
Cut off					
Grid 1 voltage for cut-off at V_{g2} = 300 V, without blanking	V_{g1}	−10 to 0		V	
Grid 1 voltage for normal beam setting	V_{g1w}	⩽	15	V	
Blanking voltage, peak to peak					
on grid 1	V_{g1p-p}		25	V	
on cathode	V_{kp-p}		25	V	
Grid 1 current at normally required beam currents	I_{g1}	⩽	1,5	mA	2
Grid 2 current at normally required beam currents	I_{g2}	⩽	0,1	mA	2

PERFORMANCE

					notes
Dark current	I_d		⩽	2 nA	
Sensitivity at colour temperature of illuminance = 2856 K					10
XQ3070, L	min.	300	typ.	350 μA/lm	
XQ3070R	min.	63	typ.	70 μA/lmF	
XQ3070G	min.	130	typ.	145 μA/lmF	
XQ3070B	min.	35	typ.	38 μA/lmF	
XQ3073R, XQ3075R	min.	80	typ.	100 μA/lmF	
Gamma of transfer characteristic			0,95 ± 0,05		
Spectral response, max. at			500 nm		
Spectral response, cut-off at			650 to 950 nm		
Spectral response curves	see Figs 1, 2				
Resolution					11

Modulation depth, i.e. uncompensated amplitude response at 400 TV lines at the centre of the picture.

		XQ3070 XQ3070L XQ3070G	XQ3070R	XQ3070B	XQ3073R XQ3075R	7, 11
Highlight signal current	I_s	200	100	100	100	nA
Beam current	I_b	400	200	200	200	nA
Modulation depth at 400 TV lines						
typ.		60	45	60	55	%
min.		55	40	55	50	%

Modulation transfer characteristics: see Figs 3 and 4

Lag (typical values, with light bias of 3 nA) 12, 13

Light source with a colour temperature of 2856 K. Appropriate filter inserted in the light path for the chrominance tubes R, G and B

LOW KEY CONDITIONS

	build-up lag		decay lag	
	I_s/I_b = 20/300 nA		I_s/I_b = 20/300 nA	
	60 ms	200 ms	60 ms	200 ms
XQ3070, L	95%	~ 100%	9%	2,5%
XQ3070G	95%	~ 100%	9%	2,5%
XQ3070R	95%	~ 100%	9%	2,5%
XQ3070B	90%	~ 100%	12%	4%
XQ3073R, XQ3075R	90%	~ 100%	11%	3%

Shading of light bias induced dark current 12,5% 14

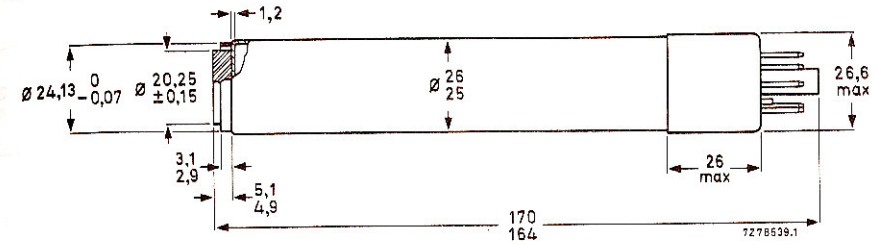
Highlight handling capability with DBC 15

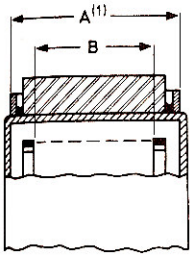
MECHANICAL DATA

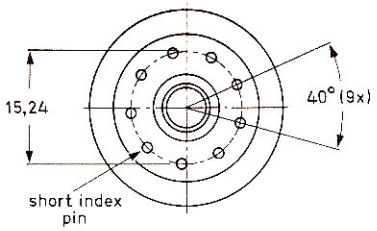
Rear loading tubes XQ3070/02 and XQ3070/12

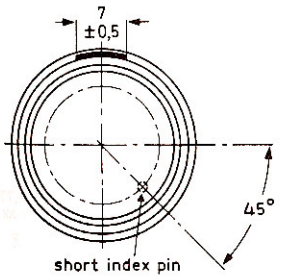
Mounting position: any

Mass: ≈ 70 g

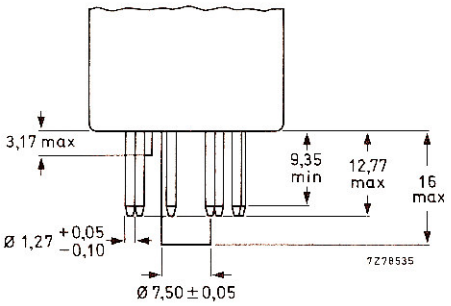


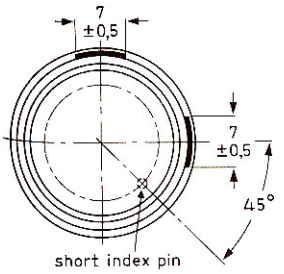




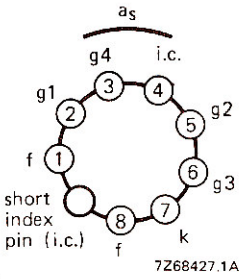


FRONT VIEW 7Z83927 XQ . . . . /02





FRONT VIEW 7Z61433.3 XQ . . . . /12



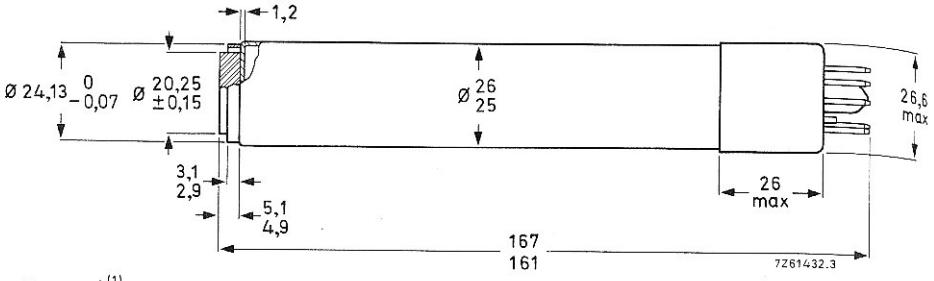
(1) The distance between the geometrical centres of diameter A of the reference ring and diameter B of the mesh electrode ring is < 100 μm.

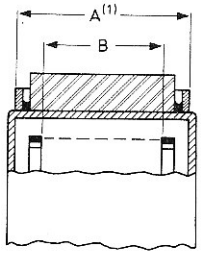
Rear loading tubes XQ3070/05 and XQ3070/15

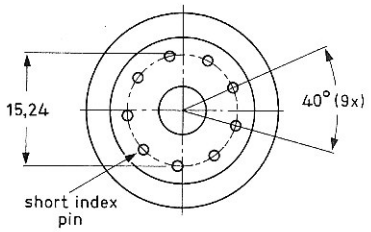
Mounting position: any

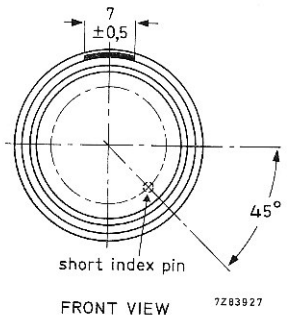
Mass: ≈ 70 g

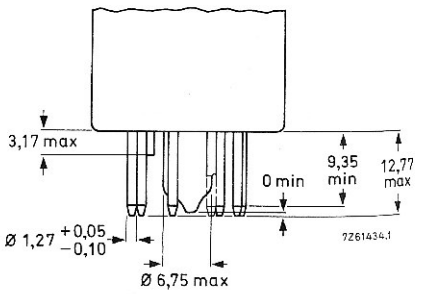
Base: IEC 67-I-33a (JEDEC E8-11)

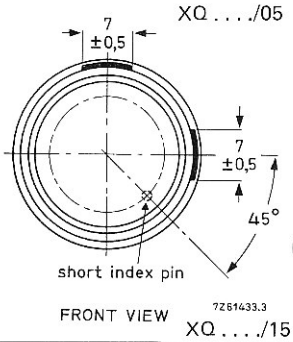


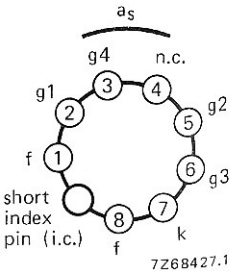












(1) The distance between the geometrical centres of diameter A of the reference ring and diameter B of the mesh electrode ring is < 100 μm.

NOTES, see also General Section

1. "Diode" electron gun is a triode gun operating in a diode mode, providing a very high beam reserve.
   N.B.
   Avoid continuous operation at high beam currents since this will shorten tube life. Full advantage of the high beam reserve to reduce comet-tailing and blooming can be made with DBC circuitry which, during highlights, feeds positive-going pulses derived from the video signal to grid 1, to increase the beam current momentarily.
2. The "diode" gun operates with a positive ($\leqslant$ 15 V) grid 1 voltage (adjusted for correct beam settings, see note 7), hence draws some grid 1 current:
   without DBC: $\leqslant$ 1,5 mA (peak) with blanking
   with DBC: $\leqslant$ 8 mA (peak) with blanking, measured with oscilloscope.
   The DBC circuitry should, in the case of highlights, supply positive-going pulses of 7 V above V_{g1w} (see note 7) and up to 8 mA peak to grid 1.
   N.B.
   Applying higher pulses than 7 V is not recommended since this will shorten tube life, impair resolution and may introduce oscillations.
3. The XQ3070 tubes closely resemble mechanically the tubes of the XQ1080/XQ1500 series. Since, however, the "Diode" electron gun draws some grid 1 current (see note 2), cameras designed around XQ1080/XQ1500 tubes will require some modification.
4. For adjustable light bias in versions /02 and /12. The light bias lamp assembly as supplied with these tubes, type 56106, fits in the metal tube cemented to the pumping stem of the tube. The tube and the light bias lamp assembly will fit properly in the socket, type 56098. The wires should be connected to a source, capable of supplying max. 110 mA at 5 V.
   The desired amount of light bias can be obtained by adjusting the current through the filament of the lamp. For black/white operation a light bias corresponding to 2 to 3 nA extra dark current is usually adequate for excellent speed of response. In a colour camera the speeds of response of the tubes can be balanced by adjusting the amount of light bias per tube. A typical setting in a 3-tube colour camera could be 3 nA (R), 2 nA (G), and 6 nA (B). Infrared light with a wavelength $>$ 600 nm in the light bias should be avoided.
5. For short intervals. During storage the tube face shall be covered with the plastic hood provided; when the camera is idle the lens shall be capped, in stand-by also the beam will be cut-off.
6. The operating conditions and performance data quoted relate to operation of the tube in coil unit AT1126. See relevant data of deflection/focusing assemblies.
7. The beam current I_b, as obtained by adjusting the control grid (grid 1) voltage is set for 1 stop over peak white and is 200 nA for R and B tubes, 400 nA for black/white and G tubes. I_b is not the total current available in the scanning beam, but is defined as the maximum amount of signal current, I_s, that can be obtained with this beam.
   In the performance figures e.g. for lag, the signal current and beam current conditions are given as I_s/I_b = 20/300 nA. This means: with a signal current of 20 nA and a beam setting which just allows a signal current of 300 nA.
8. Typical faceplate illumination level for the XQ3070 and XQ3070L to produce 200 nA signal current will be approx. 4,6 lx. The signal currents stated for the colour tubes R, G and B will be obtained with an incident white light level (2856 K) on the filter of approx. 11 lx. These figures are based on the filters described in note 10. For filter BG12, however, a thickness of 1 mm is chosen.
9. The tube can withstand short excursions up to 70 °C without damage or irreversible degradation in performance.

10. Measuring conditions: illuminance level 4,54 lx at a colour temperature of 2856 K and the appropriate filter inserted in the light path. Filters used are:

XQ3070R, XQ3075R	Schott	OG570	thickness	3 mm
XQ3070G	Schott	VG9	thickness	1 mm
XQ3070B	Schott	BG12	thickness	3 mm
XQ3073R	Schott	OG570	thickness	3 mm
	and Calflex	B1/K1		

For transmission curves see General Section.

11. As measured with a 50 mm Leitz Summicron lens having a sine response of approximately 85% at 20,6 lp/mm (400 TV lines at 9,6 mm picture height) at f : 5,6 and the appropriate filter inserted in the light path. The amplitude response can be raised by means of suitable correction circuits.
12. Adjusted for sum of dark current, leakage current and light bias current of 3 nA.
13. **Build-up lag**
    After 10 s of darkness. The figures are typical percentages of the ultimate signal current obtained 60 ms and 200 ms, respectively, after the introduction of the illuminance.

    Decay lag
    After the target has been illuminated for at least 5 s. The figures represent typical signals in percentages of the original signal current 60 ms and 200 ms, respectively, after removal of the illuminance.
14. Deviation of the level of any of the four corners, i.e. 10% inwards in L and V direction, from the level in the picture centre. The observed shading is composed of slight parabolic and sawtooth components in both line and frame direction which can be sufficiently compensated by suitable black shading compensation circuitry.
15. a. With DBC applied (see note 2) the tube will properly handle highlights with a diameter of 10% of the picture height and with a brightness corresponding to 16 times peak signal white, I_{sp}.
    b. The maximum peak signal currents in the case of highlights will be 2,5 μA. Video preamplifiers should be designed to accomodate these.

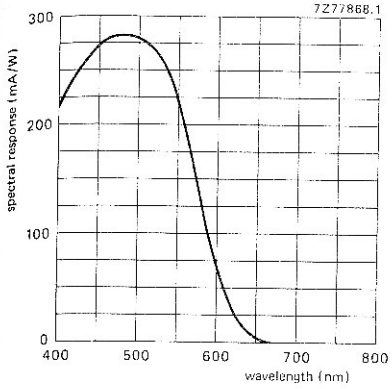


Fig. 1 Typical spectral response XQ3070, R, G, B.

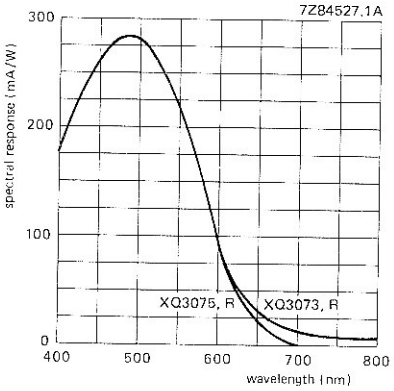


Fig. 2 Typical spectral response XQ3073R, XQ3075R.

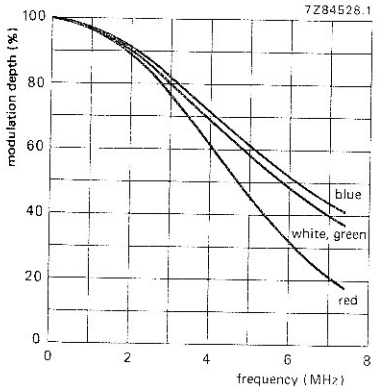


Fig. 3 Typical square-wave response curves XQ3070.

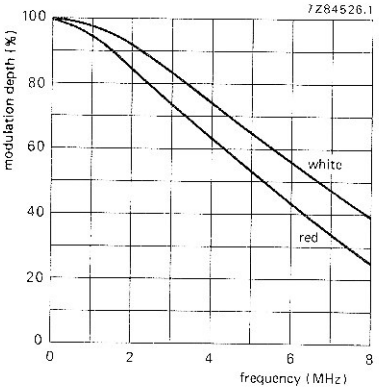


Fig. 4 Typical square-wave response curves XQ3073/XQ3075.