



DELFT ELECTRONISCHE PRODUCTEN

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GENERAL NOTES

IMAGE INTENSIFIERS

1 GENERAL

Image intensifiers may be used in those instances where the signal of an image to be detected, is low compared with the equivalent noise level of the detecting system without the intensifier.

Depending on its particular requirements the image intensifier may be supplied as

- a. single stage tubes,
- b. multi stage tubes.

Multi stage tubes, which consist of one or more coupled single stage tubes may be provided with or without powersupplies, electrical insulation, and/or provisions for mounting.

2 COUPLING OF IMAGE INTENSIFIERS

If an image intensifier is to be coupled to another image intensifier or to another device it is advisable to contact the image intensifier manufacturer.

3 MOUNTING

The image intensifiers may be mounted in any orientation. However, it is advisable to contact the image intensifier manufacturer with respect to the way in which the image intensifier is to be mounted in the equipment.

4 LIMITING VALUES

Unless otherwise stated the image intensifier is rated according to the absolute maximum rating system (I.E.C. publication 134).



ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

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

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

5 TYPE DESIGNATION

The Pro-Electron type designation code is used.

6 SPECIFIED VALUES

Unless otherwise stated the data are given for a nominal image intensifier.

7 PHOTOMETRIC AND RADIOMETRIC UNITS

(refer also to 'International Lighting Vocabulary, 3rd edition, publication of CIE no. 17 (E.I.I.), 1970').



The photometric units used are:

the lumen (lm) as the unit of luminous flux from a source with a specified spectral distribution;

the candela per meter squared ($\text{cd} \cdot \text{m}^{-2}$) as the unit of luminance;

the lux (lx) as the unit of illuminance.

The radiometric unit used is:

the watt (W) as the unit of a radiant flux from a source with a specified spectral distribution.

Other units are

for luminous flux : $1 \text{ lm} = 1 \text{ cd} \cdot \text{sr}$.

for luminance : $1 \text{ cd} \cdot \text{m}^{-2} = \pi \text{ asb.} = 1 \text{ nit} = \frac{\pi}{10,76} \text{ fL}$.

for illuminance : $1 \text{ lx} = 1 \text{ lm} \cdot \text{m}^{-2} = 1 \text{ cd} \cdot \text{sr} \cdot \text{m}^{-2}$

8 LIST OF RELEVANT TERMS AND DEFINITIONS

8.1 *Automatic Brightness Control (ABC)*

Those image intensifiers which have been provided with ABC are protected by means of a suitable powersupply incorporated in the tube against the adverse effects of high mean illumination levels which might otherwise damage or hinder the detector/observer, by limiting the output luminance at higher input illuminance levels, to a maximum value (MOB).

8.2 *Axial eccentricity*

Axial eccentricity is the distance, as measured on the output window between the image of the specified input centre on the output window and the specified output centre.

8.3 *Axis*

The axis of an image intensifier is the line through the specified input centre and the specified output centre.



8.4 *Distortion*

The distortion of an image intensifier at a specified radius, is the relative increase in magnification at the specified radius on the input, with respect to the magnification on axis, expressed as a percentage.

8.5 *Equivalent background illumination (E.B.I.)*

The equivalent background illumination of a image intensifier is the uniform input illuminance from a source with a specified spectral distribution illuminating a circular area of specified diameter about the centre of the input needed to double the output luminance without any input illuminance and without any contribution to the output luminance due to the persistence of the output.

8.6 *Luminance gain*

The luminance gain of an image intensifier is

- (1) the increase in output luminance (in $\text{cd} \cdot \text{m}^{-2}$) as a ratio of
- (2) the increase in input illuminance (in lx) from a source of specified spectral distribution, illuminating a circular area of specified diameter about the input centre up to a specified maximum illuminance,

or:

The luminance gain of an image intensifier is

- (1) the increase in output luminous flux (in lm) as a ratio of
- (2) the increase in input luminous flux (in lm) from a source of specified spectral distribution, illuminating a circular area of specified diameter about the input centre up to a specified illuminance.

8.7 *Luminance sensitivity of modules*

The luminance sensitivity of the input of a module is

- (1) the increase in current through the module (in μA), with a voltage applied across the module of not less than the saturation voltage as a ratio of



- (2) the increase in incident luminous flux (in lm) from a source with a specified spectral distribution, illuminating a circular area with a specified diameter about the input centre.

8.8 *Magnification*

The magnification of an image intensifier at a specified diameter is the ratio of the image output diameter to the image input diameter.

8.9 *Maximum output brightness (MOB)*

The maximum output brightness of an image intensifier is the maximum luminance of the image intensifier output when the input is illuminated to a high light level. Increasing the illumination level beyond this level does not result in an increase in output luminance. The MOB feature is not standard on all tubes as manufactured by D.E.P..

8.10 *Modulation transfer function*

The modulation transfer function of an image intensifier is the inverse ratio, expressed as a percentage of

- (1) the modulation factor of a sinusoidal pattern, projected on the input at a specified radius to
- (2) the modulation factor of the sinusoidal image on the output as a function of the spatial frequency of the pattern on the output, normalized to 100 % for zero frequency.

The modulation factor is the ratio of

- (1) the difference between the maximum and minimum brightness of the pattern (peak-to-peak value).
to
- (2) the sum of the maximum and minimum brightness of the pattern (twice the average value).

The modulation transfer function is measured as the modulus of the Fourier transform of the line spread function of the image intensifier.



8.11 *Numerical aperture*

The numerical aperture of a plane fibre-optic input or output window of an image intensifier is the sine of half angle of the acceptance cone. The acceptance cone is the cone which contains all directions in which light will be accepted and transmitted by the fibre-optic window.

8.12 *Persistence*

The persistence of a phosphor is a measure of the phosphorescence of that phosphor and is, generally, specified as the period of time between the moment the excitation energy at a specified steady output is removed to the moment the output has decayed to 10 % of the, above mentioned, steady output. For instance the persistence for P 20 phosphor is qualified as being 'Medium short' and is in the range of 10^{-6} to $100 \cdot 10^{-6}$ seconds.

8.13 *Radiant sensitivity of modules*

The radiant sensitivity of the input of a module is

- (1) the increase in current through the module (in mA), at a voltage not less than the saturation voltage as a ratio of
- (2) an increase in incident radiant flux (in W) from a source of light of specified wavelength and specified bandwidth, illuminating a circular area or specified diameter about the input centre.

8.14 *Resolution*

The resolution of an image intensifier is the spatial frequency (in line pairs per millimeter, lp/mm) of the smallest perceptible pattern on the output.

The pattern on the output is the image of a pattern of high contrast, parallel lines focussed on the input of the image intensifier and is called perceptible when all elements of that pattern can be observed as being separate.



Note:

This test is subjective and it is therefore advisable to express resolving abilities of the image intensifiers in terms of MTF-values.

8.15 *Saturation voltage*

The saturation voltage is that minimum voltage applied across the module for which an increase in the applied voltage does not result in an increase in the photocurrent through that module, provided the input illumination remains constant.

8.16 *Uniformity*

Even with the input uniformly illuminated the output luminance will not be uniform over the whole output area.

These non-uniformities can be defined as:

- 'vignetting'
- shading
- spots.

Vignetting is an effect due to the construction of the image intensifier and closely resembles vignetting as with optical lens systems.

Shading is due to irregularities in photocathode sensitivity (-ties) and/or inhomogenities in the output screen(s). Together with 'vignetting', shading leads to low contrast non-uniformities.

Spots are usually black or coloured irregularities of small dimension resulting in high contrast non-uniformities.

Accept/reject criteria for these non-uniformities will depend mainly upon the application of the image intensifier concerned.

8.17 *Useful input diameter*

The useful input diameter of an image intensifier is the maximum diameter of a circular area concentric with the centre of the input which, when illuminated, will be fully imaged on the output.



8.18 *Useful output diameter*

The useful output diameter of an image intensifier is the diameter of a circular area at output which contains the image of the useful input diameter.

8.19 *Veiling glare*

The veiling glare of an image intensifier is the ratio, expressed as a percentage, of

- (1) the luminance of the centre of the output, when the input is uniformly but only partially illuminated, (at least no illumination on the centre part of the input)
- to
- (2) the luminance of the centre of the output when the whole input is uniformly illuminated.

In both cases the illuminance level at the input plane shall be the same.

9 TEST CONDITIONS

9.1 *Equivalent background illumination.*

The E.B.I. value is calculated from the expression:

$$\text{E.B.I.} = \frac{M_b}{M_a - M_b} \cdot E_k \text{ lux.}$$

where: M_b : output luminance at no input illuminance

M_a : output luminance at input illuminance of E_k lux.

The input illumination (E_k) is of the order of 0.1×10^{-6} lux with a colour temperature 2850 K.

9.2 *Luminance gain*

At measuring luminance gain input illuminance shall not exceed 10^{-3} lux. Voltage(s) applied to the image intensifier shall be of nominal value(s).



9.3 *Luminance sensitivity*

Luminance sensitivity can be measured on at modules only. An input luminous flux of 0,01 to 0,02 lm at colour temperature of 2850 K is used to measure the sensitivity. The module shall be operated at a voltage not less than the saturation voltage.

9.4 *Magnification*

Crosswires, provided with a mm scale, are projected concentrically onto the input. A calibrated travelling microscope of sufficient power (approx. 10 ×) is used to measure distances at the output.

9.5 *Modulation transfer function*

B.V. Delft Electronische Producten derives the MTF values from MTF measuring equipment as manufactured by N.V. Optische Industrie 'De Oude Delft'. Holland.

9.6 *Radiant sensitivity*

Radiant sensitivity is measured using radiation with a colour temperature of 2850 K, and filtered by suitable filters for 800 nm and 850 nm. The radiation level is of the order of 1 to 50 μ W.

The filters to be used are specified as follows:

800 nm: peak transmission at $800 \pm 2,5$ nm

850 nm: peak transmission at $850 \pm 1,0$ nm.

Both filters:

- far infrared blocking out to 4000 nm
- bandwidth at 10 % points: $12,5 \text{ nm} \pm 1,5 \text{ nm}$
- minimum transmission at peak transmission: 50 % approx..



9.7 *Uniformity*

9.7.1 Vignetting and shading are measured at a uniform input illuminance using radiation with a colour temperature of 2850 K. The output luminance is measured, with a scanning spot, in one direction through the image of the input centre. The diameter of this spot does not exceed 3 % of the image intensifiers useful output diameter. The luminance measured at the image of the input centre is normalized to 100 %; luminances measured at radii are then expressed relative to the centre luminance.

9.7.2 Spots are measured using a microscope with a calibrated eyepiece. Zone boundaries are specified by circles of specified radii projected onto the input, concentric with the input centre.

9.8 *Veiling glare*

The partial illuminance is achieved by covering part of the input with an opaque band, width equal to 25 % of useful input diameter and positioned across the input, symmetrical to the input centre.

The output luminance at the image intensifiers output centre is measured with a spot which has a diameter not exceeding 3 % of the useful output diameter.

10 ENVIRONMENTAL CONDITIONS

Image intensifiers are often used in circumstances where chemical, physical and/or mechanical deterioration might occur. Conditions during storage, transport and use are simulated by standardized environmental tests. In those cases where the requirements are not simulated by these tests it is advisable to contact the image intensifier manufacturer.

Unless otherwise specified the following applies:



10.1 *Vibration*

10.1.1 *Requirement*

The image intensifier shall not be damaged and shall meet all operational requirements after being vibrated with simple harmonic motion parallel and perpendicular to the axis of the image intensifier over a frequency range of 10 to 55 Hertz (Hz) at an amplitude of not less than 1,25 mm (total excursion 2,5 mm) for 10 minutes in each direction with no voltage applied during the vibration.

10.1.2 *Test*

The operating potential shall not be applied to the image intensifier during vibration testing. Tolerance on specified frequencies shall be plus or minus 2 Hz and tolerance on total excursion shall be plus or minus 0,1 mm. Prior to beginning vibration testing the image intensifier shall be visually inspected for physical damage and missing components. No image intensifier shall be vibrated which shows evidence of damage or has missing components.

Mount the image intensifiers rigidly, singly or in groups, in a mounting fixture which is approved by the image intensifier manufacturer.

Subject the image intensifier to simple harmonic motion applied in a direction parallel to the axis of the image intensifier at a varying frequency of 10 to 55 Hz. In one minute, vary the frequency from 10 Hz to 55 Hz and return to 10 Hz.

The amplitude of vibration shall be 1,25 mm (2,50 mm total excursion). Repeat this frequency sweep 10 times. At the conclusion of the 10 frequency sweeps, apply the simple harmonic motion to the image intensifier in a direction perpendicular to the axis of the image intensifier and repeat the above 10 frequency sweeps. At the conclusion of the vibration testing, inspect the image intensifier for damage.



10.1.3 *Inspection*

Inspect the image intensifier which has been subjected to vibration testing for:

- a. cracks, breakage, deformation or deterioration of any part or finish, or missing or loose components.
- b. (with operating voltage applied) electrical failure or malfunctioning including arcing, corona, flashing, flickering or blanking.

Evidence of damage (see above) shall constitute failure of this test.

10.2 *Shock*

10.2.1 *Requirement*

The image intensifier shall not be damaged and shall exhibit no flashing, flickering, or electrical breakdown when subjected to six (6) shock impacts applied perpendicular to the axis and six (6) shock impacts applied parallel to the axis of the image intensifier. Peak acceleration shall not be less than 736 m.s^{-2} .

10.2.2 *Test*

This test shall be conducted in a darkened room. Apply the operating potential to the image intensifier for a minimum stabilization period of one minute. At the end of this stabilization period, with the operating potential applied and no light incident on the input subject the image intensifier to six (6) shock impacts parallel to the axis and six (6) shock impacts perpendicular to the axis.

The image intensifier(s) shall be mounted rigidly, singly or in groups, in a mounting fixture which is approved by the image intensifier manufacturer. Apply the shock impacts in such a way as to generate nominal half-sine wave pulses having a minimum amplitude of 75 g's on the image intensifier. The duration of each shock pulse shall be 6 milliseconds \pm 2 milliseconds measured between the 10 percent values of peak amplitude. The energy under the shock curve shall be not less than



0,25 g-seconds and the after-oscillations shall be not greater than 15 percent of peak amplitude of the nominal half-sine wave pulse.

10.2.3 *Inspection*

Internal flashing, flickering, or electrical breakdown or evidence of damage during or at the conclusion of the shock test shall constitute failure of this test.

10.3 *Environmental temperatures and humidity.*

10.3.1 *Requirements*

a Storage

To prove the ability to withstand storage at $+40\text{ }^{\circ}\text{C}$ or at $-54\text{ }^{\circ}\text{C}$, the image intensifier shall not be damaged after having been stored at $+68\text{ }^{\circ}\text{C}$ and 90 percent relative humidity for 2 hours and at $-54\text{ }^{\circ}\text{C}$ for 2 hours.

b Operational temperature extremes.

The image intensifier shall operate

a when connected to nominal input voltage after having been exposed to an ambient temperature of $+52\text{ }^{\circ}\text{C}$ for a period of two hours;

b when connected to nominal input voltage after having been exposed to an ambient temperature of $-54\text{ }^{\circ}\text{C}$ for a period of two hours.

c Temperature shock

The image intensifier shall not be damaged when subjected to thermal shock from $+52\text{ }^{\circ}\text{C}$ to room temperature and from $-54\text{ }^{\circ}\text{C}$ to room temperature ($20^{\circ} \pm 2\text{ }^{\circ}\text{C}$).

10.3.2 *Test*

Note: When precautions are taken not to expose an image intensifier to test conditions more often than required, and when proper stabilization periods are taken care of, the below mentioned testprogram can be subdivided in separate steps, or can be run at a different succession of the steps.



10.3.3 *Inspection*

a Damage

Inspect for cracks and breakages, deformations or deteriorations of any part or finish and/or missing or loose components.

b Operation

With operating voltage applied, the image intensifier shall demonstrate no electrical failure or malfunctioning including arcing, corona, flashing, flickering or blanking.

Evidence of damage or electrical failure or malfunctioning shall constitute failure of this test.



Procedures

Test step	Test conditions	Stabilization time	Temp. change rate before or after test	Inspection
1. Storage temp. max.	68 °C, RH 90 %	2 h.	< 1,6 °C per min.	roomtemp. 10.3.3.a.
2. Max. operat. temp.	52 °C, RH 90 %	2 h.	< 1,2 °C per min.	+52 °C 10.3.3.b.
3. Temp. shock, part 1	52 °C → roomtemp. in less than 5 mins.	n.a.	n.a.	roomtemp. 10.3.3.a. after > 1 h.
4. Storage temp. min.	-54 °C	2 h.	< 2,5 °C per min.	roomtemp. 10.3.3.a.
5. Min. operat. temp.	-54 °C	2 h.	< 2,5 °C per min.	-54 °C 10.3.3.b.
6. Temp. shock, part 2	-54 °C → roomtemp. in less than 5 mins.	n.a.	n.a.	roomtemp. 10.3.3.a. after > 1 h.

Note:

When, as indicated in the table, the storage temp. min. and the min. operating temp. are equal, and when the stabilization periode at this temperature is equal too, steps 4 and 5 may be combined into one single step, if a combination of the indicated inspection also allows for it.





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TECHNICAL DATA

IMAGE INTENSIFIERS

QUICK REFERENCE DATA

Electrostatically focussed distortion corrected three-stage assembly with protected fibre-optic output window, and with build-in power supply.

Useful input and output diameter	18 and 18 mm
Minimum luminance gain	$12.700 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	2,65 V
Overall dimensions (approx. length & diam.)	147 mm and 53 mm
Weight (approx.)	435 g

INPUT

Fibre optic window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on \varnothing 12,7 mm)

at 2850 K min. $225 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $15 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $10 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Protected fibre-optic window

Useful diameter 18 mm

Numerical aperture 1

Phosphor P20

Screen output colour green/yellow

Screen persistence medium/short

Output luminance max. $1000 \text{ cd} \cdot \text{m}^{-2}$

Protective window is anti reflex coated for 540 mm



TRANSFER at nominal operating conditions

Luminance gain (\varnothing 12,7 mm, 2850 K, input illuminance max. 10^{-3} lux)	min.	12.700 cd · m ⁻² lx ⁻¹
Resolution		
on axis	min.	34 lp · mm ⁻¹
at r = 7 mm	min.	28 lp · mm ⁻¹
Modulation transfer		
at 7,5 lp/mm	min.	65 %
at 16,0 lp/mm	min.	35 %
at 20,0 lp/mm	min.	20 %
Veiling glare	max.	6 %
Magnification (on axis)	min.	0,82
	max.	0,90
Distortion (at r = 7,0 mm)	max.	4 %
	typ.	3,5 %
Equivalent background illumination, (\varnothing 12,7 mm, 2850 K)	max.	0,2 μ lx
Axial eccentricity	max.	1,0 mm
Uniformity		see page 3

OPERATING CONDITIONS

Supply voltage	min.	2,60 V
	nom.	2,65 V
	max.	2,70 V
Input current	typ.	40 mA
Ambient temperature	min.	-54 °C
	nom.	+20 °C
	max.	+52 °C



LIMITING VALUES

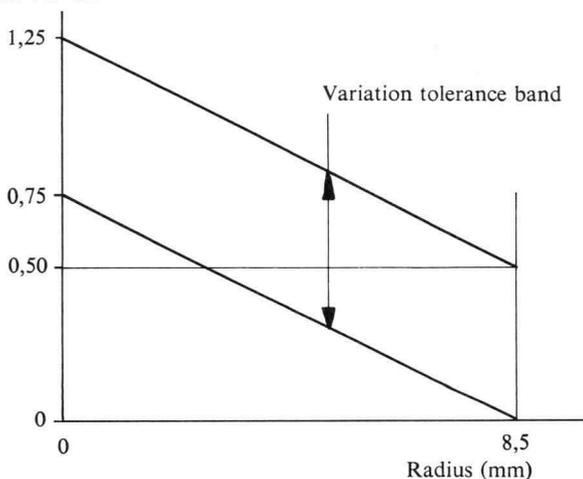
Supply voltage	min.	2,0 V
	max.	3,0 V
Input illumination (at extended and uniform exposure)	max.	1,0 lx
Ambient temperature (operation)	min.	-54 °C
	max.	+52 °C
Ambient temperature (storage)	min.	-54 °C
	max.	+40 °C
Reverse polarity time	max.	60 sec.

UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K the output luminance uniformity varies; variations in output luminance over a circular input area \varnothing 17 mm fall within the tolerance band shown below.

OUTPUT LUMINANCE

(rel.)



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots.

When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.

size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
>375 μm	0	0	0
300—375 μm	0	1	2
225—300 μm	0	3	8
150—225 μm	0	9	18
75—150 μm	3	minimal	minimal
< 75 μm	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

see general notes.

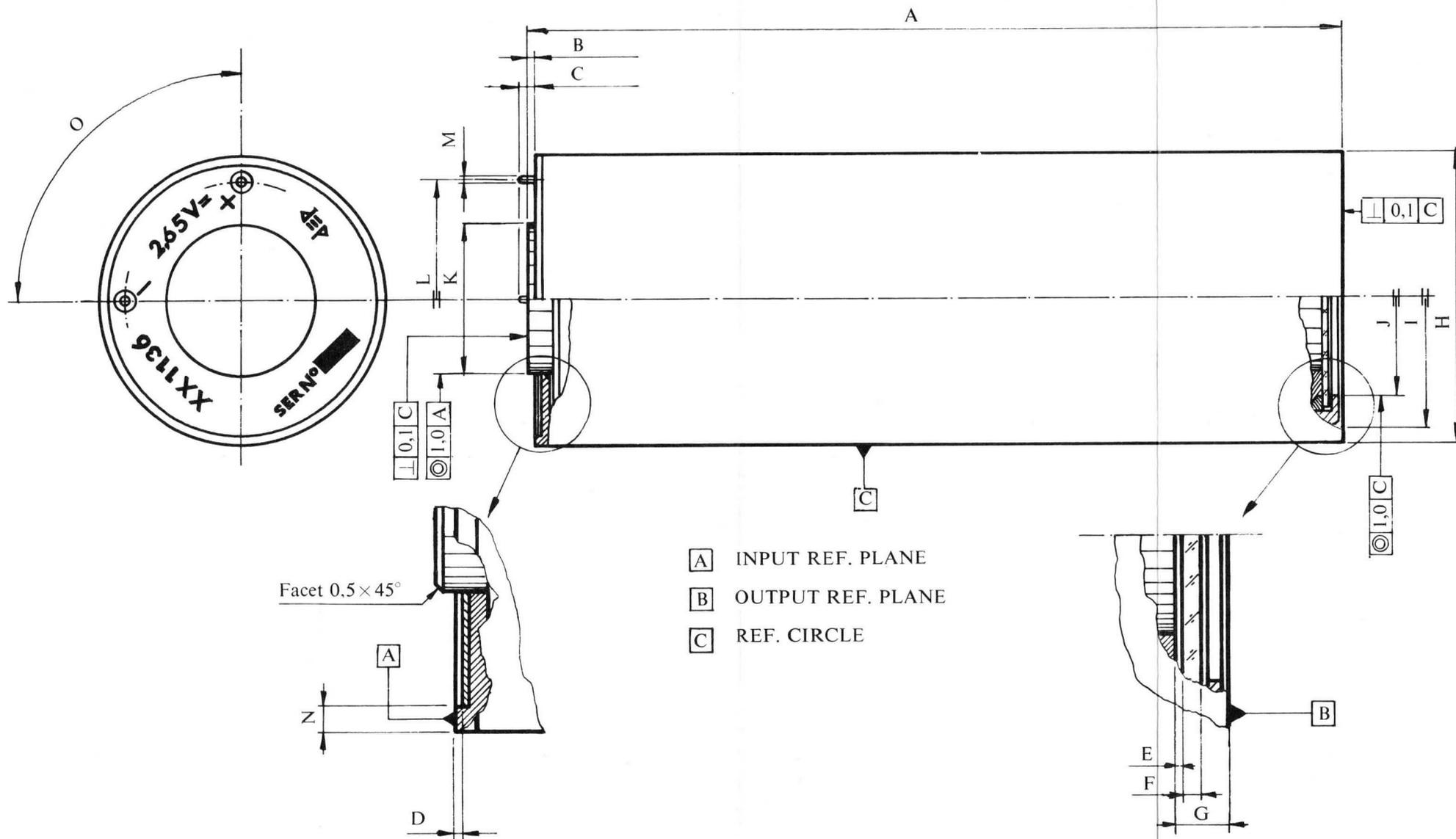
NOTE:

All radii (r) and diameters (\varnothing) refer to input.



	min.	max.	note
A	145	150	
B	0,69	0,83	
C	1,8	2,8	
D	0,1	—	
E	—	0,3	
F	1,6	1,7	$n_d = 1,52$
G	3,3	3,7	
H	\varnothing 52,6	\varnothing 52,8	
I	\varnothing 46,7	\varnothing 46,9	
J	\varnothing 35,3	\varnothing 35,7	
K	—	26,8	
L	\varnothing 42,6	\varnothing 43,0	
M	\varnothing 1,47	\varnothing 1,57	(2x)
N	0,8	1,4	
O	89°	91°	





QUICK REFERENCE DATA

Electrostatically focussed three-stage tube with fibre-optic input and protected fibre-optic output window and with built-in power supply.

Useful input and output diameter	25 and 25 mm
Minimum luminance gain	12.700 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	6,75 V
Overall dimensions (approx. length & diam.)	194 × 70 mm
Weight (approx.)	900 g

INPUT

Fibre-optic window		
Useful diameter		25 mm
Numerical aperture		1
Photocathode		S 25
Input sensitivity (measured on \varnothing 19 mm)		
at 2850 K	min.	175 $\mu\text{A} \cdot \text{lm}^{-1}$
at 800 nm	min.	12 $\text{mA} \cdot \text{W}^{-1}$
at 850 nm	min.	5 $\text{mA} \cdot \text{W}^{-1}$

OUTPUT

Protected fibre-optic window	
Useful diameter	25 mm
Numerical aperture	1
Phosphor	P 20
Screen output colour	green/yellow
Screen persistence	medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 19 mm, 2850 K, input illuminance max. 10^{-3} lux)	min.	12.700 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution		
on axis	min.	28 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 7$ mm	min.	25 $\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer (on axis)		
at 7,5 lp/mm	min.	60 %
at 16,0 lp/mm	min.	20 %
Magnification (on axis)	min.	0,82
	max.	1,00
Distortion ($r = 10$ mm)	max.	8 %
Equivalent background illumination (\varnothing 19 mm, 2850 K)	max.	0,2 μlx
Axial eccentricity	max.	0,75 mm
Uniformity		see page 3

OPERATING CONDITIONS

supply voltage	min.	6,50 V
	nom.	6,75 V
Input current	typ.	25 mA
Ambient temperature	min.	-35 °C
	nom.	+20 °C
	max.	+35 °C



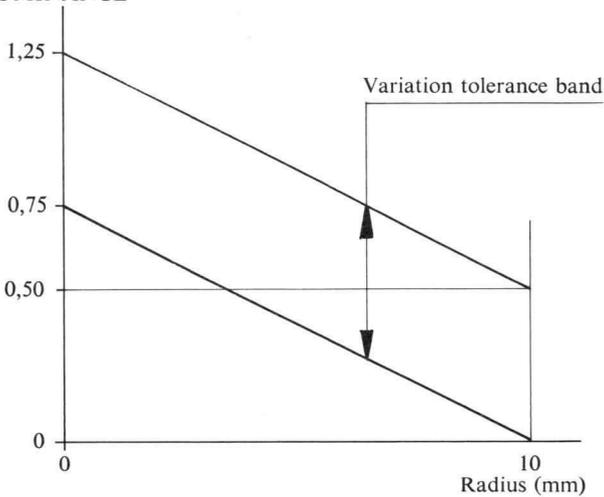
LIMITING VALUES

Supply voltage	max.	6,75 V
Input illumination (at extended and uniform exposure)	max.	1 lx
Ambient temperature (operation)	min.	-54 °C
	max.	+68 °C
Ambient temperature (storage)	min.	-35 °C
	max.	+35 °C

UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K the output luminance uniformity varies; variations in output luminance over a circular input area \varnothing 20 mm fall within the tolerance band shown below.

OUTPUT LUMINANCE (Rel.)



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 % is less or equal to the numbers indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.

size of spot on output	maximum number of spots		
	within \varnothing 7,6 mm	within area bounded by \varnothing 7,6 mm and \varnothing 20,5 mm	within area bounded by \varnothing 20,5 mm and \varnothing 24,8 mm
>375 μm	0	0	0
300—375 μm	0	1	2
225—300 μm	0	3	8
150—225 μm	0	12	26
75—150 μm	3	minimal	minimal
< 75 μm	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

see general notes

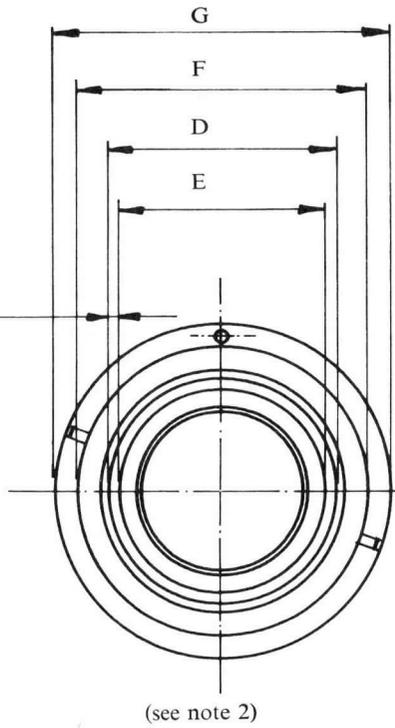
NOTE:

All radii (r) and diameters (\varnothing) refer to input.

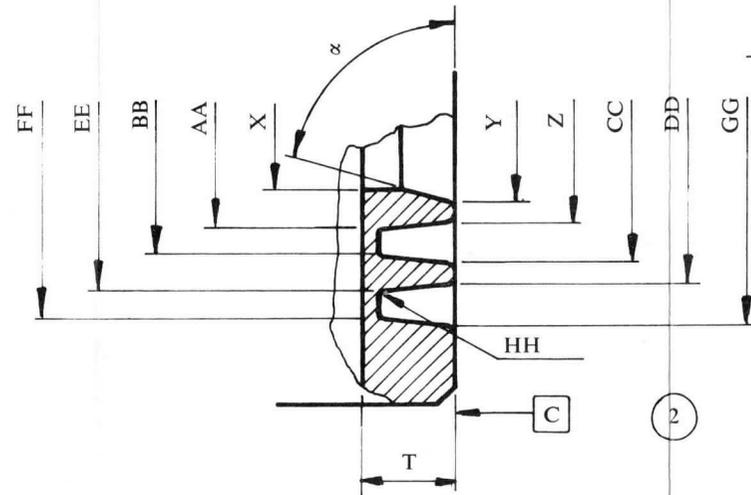
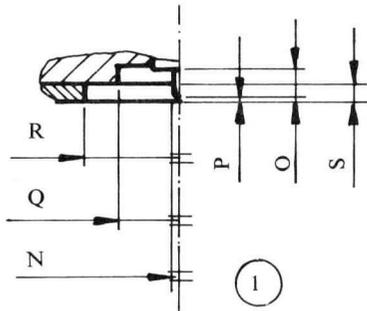
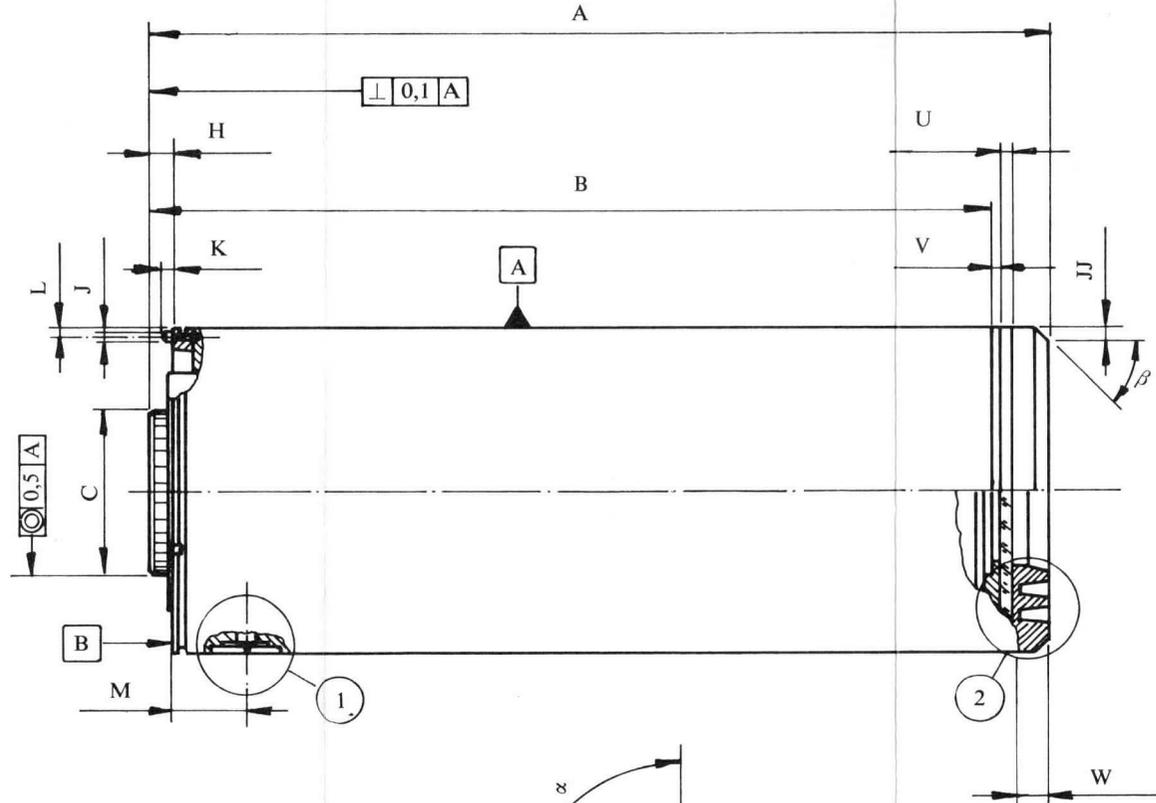


	min.	max.	note
A	192,23	195,17	
B	180,67	182,96	
C	∅ 35,43	∅ 35,69	
D	∅ 47,24	∅ 48,26	
E	∅ 42,2	∅ 43,4	
F	∅ 61,0	∅ 61,2	
G	∅ 69,60	∅ 69,85	
H	6,02	6,17	
J	∅ 2,21	∅ 2,36	
K	2,41	2,54	
L	1,57	1,83	
M	15,38	16,38	
N	∅ 0,97	∅ 1,09	
O	2,27	2,47	
P	0	0,3	
Q	∅ 9,81	∅ 10,01	
R	∅ 15,75	∅ 16,01	
S	1,47	1,67	
T	7,30	7,80	
U	2,20	2,60	
V	1,40	1,54	
W	6,30	6,50	
X	∅ 32,75	∅ 33,0	
Y	∅ 35,25	∅ 35,35	
Z	∅ 38,35	∅ 38,6	
AA	∅ 39,50	∅ 39,75	
BB	∅ 44,75	∅ 45,15	
CC	∅ 45,85	∅ 46,25	
DD	∅ 48,80	∅ 49,20	
EE	∅ 49,90	∅ 50,30	
FF	∅ 55,30	∅ 55,70	
GG	∅ 56,35	∅ 56,80	
HH		0,3	nom.
JJ		1,5	nom.
α	70°	80°	
β		45°	nom.





note 1: metal flange for ground contact
 note 2: locating pin $180^\circ \pm 0,5$ from contact pin



- A REFERENCE CIRCLE
- B INPUT REF. PLANE
- C OUTPUT REF. PLANE



QUICK REFERENCE DATA

Electrostatically focussed three-stage tube with fibre-optic input and protected fibre-optic output window and with built-in power supply.

Useful input and output diameter	25 and 25 mm
Minimum luminance gain	$16.000 \cdot \text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	6,75 V
Overall dimensions (approx. length & diam.)	195 × 70 mm
Weight (approx.)	900 g

INPUT

Fibre-optic window

Useful diameter 25 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on \varnothing 19 mm)

at 2850 K min. $275 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $20 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $10 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Protected fibre-optic window

Useful diameter 25 mm

Numerical aperture 1

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 19 mm, 2850 K, input illumination max. 10^{-3} lux)	min.	16.000 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution		
on axis	min.	30 lp/mm^{-1}
at $r = 7$ mm	min.	28 lp/mm^{-1}
Modulation transfer (on axis)		
at 7,5 lp/mm	min.	60 %
at 16,01 lp/mm	min.	20 %
Magnification (on axis)	min.	0,82
	max.	1,0
Distortion ($r = 10$ mm)	max.	25 %
Equivalent background illumination (\varnothing 19 mm, 2850 K)	max.	0,2 μlx
Axial eccentricity	max.	0,75 mm
Uniformity		see page 3



FLASH PROTECTION

No data were available at the date of publishing.

Contact D.E.P. if information is required.





OPERATING CONDITIONS

Supply voltage	nom.	6,75 V
Input current	typ.	25 mA
Ambient temperature	min.	-35 °C
	nom.	+20 °C
	max.	+35 °C

LIMITING VALUES

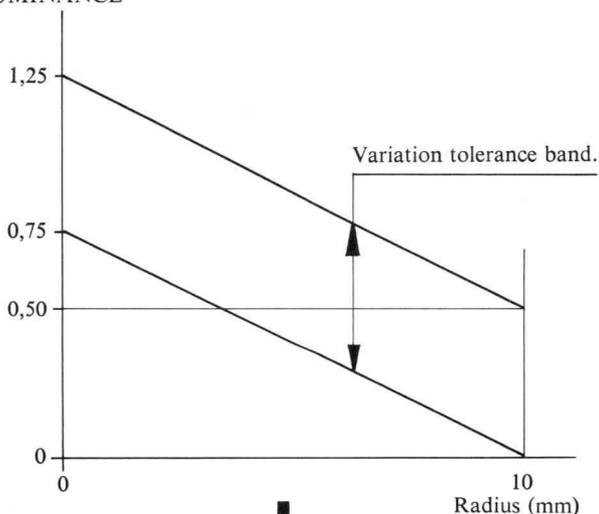
Supply voltage	min.	6,50 V
	max.	6,75 V
Input illumination (at extended and uniform exposure)	max.	1 lx
Ambient temperature (operation)	min.	-54 °C
	max.	+68 °C
Ambient temperature (storage)	min.	-35 °C
	max.	+35 °C

UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K the output luminance uniformity varies; variations in output luminance over a circular area \varnothing 20 mm fall within the tolerance band shown below.

OUTPUT LUMINANCE

(Rel.)



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 % is less or equal to the numbers indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot the two spots are considered as one spot.

size of spots on output	maximum number of spots		
	within \varnothing 7,6 mm	within area bounded by \varnothing 7,6 mm and \varnothing 20,5 mm	within area bounded by \varnothing 20,5 mm and \varnothing 24,8 mm
$>375 \mu\text{m}$	0	0	0
300—375 μm	0	1	2
225—300 μm	0	3	8
150—225 μm	0	12	26
75—150 μm	3	minimal	minimal
$< 75 \mu\text{m}$	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

see general notes

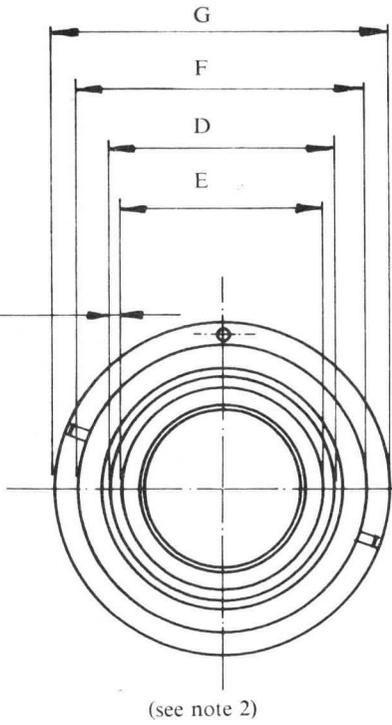
NOTE

All radii (r) and diameters (\varnothing) refer to input.

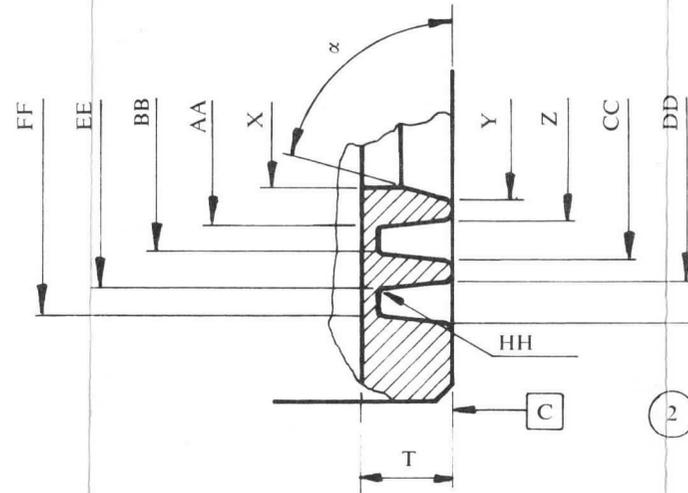
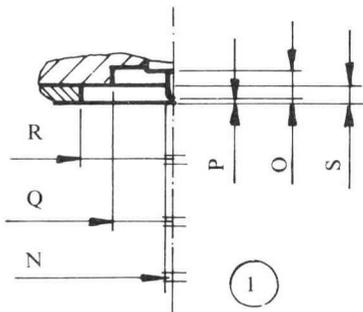
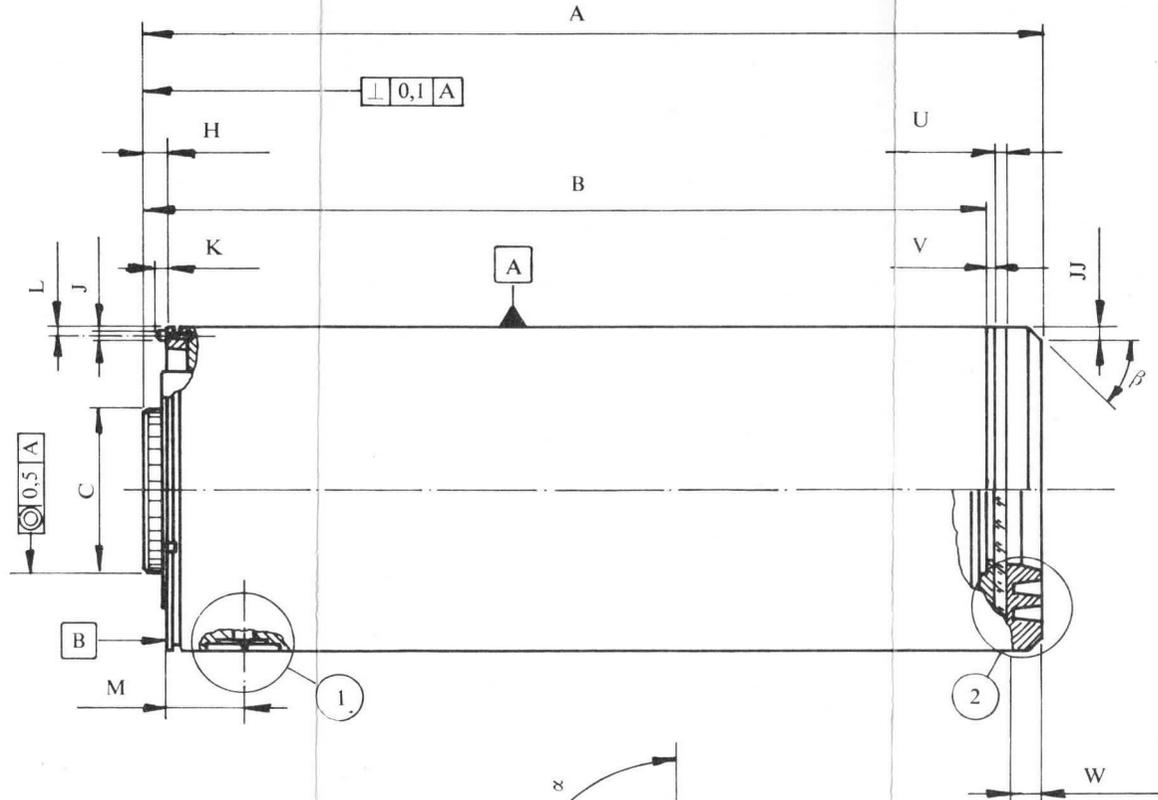


	min.	max.	note
A	192,23	195,17	
B	180,67	182,96	
C	∅ 35,43	∅ 35,69	
D	∅ 47,24	∅ 48,26	
E	∅ 42,2	∅ 43,4	
F	∅ 61,0	∅ 61,2	
G	∅ 69,60	∅ 69,85	
H	6,02	6,17	
J	∅ 2,21	∅ 2,36	
K	2,41	2,54	
L	1,57	1,83	
M	15,38	16,38	
N	∅ 0,97	∅ 1,09	
O	2,27	2,47	
P	0	0,3	
Q	∅ 9,81	∅ 10,01	
R	∅ 15,75	∅ 16,01	
S	1,47	1,67	
T	7,30	7,80	
U	2,20	2,60	
V	1,40	1,54	
W	6,30	6,50	
X	∅ 32,75	∅ 33,0	
Y	∅ 35,25	∅ 35,35	
Z	∅ 38,35	∅ 38,6	
AA	∅ 39,50	∅ 39,75	
BB	∅ 44,75	∅ 45,15	
CC	∅ 45,85	∅ 46,25	
DD	∅ 48,80	∅ 49,20	
EE	∅ 49,90	∅ 50,30	
FF	∅ 55,30	∅ 55,70	
GG	∅ 56,35	∅ 56,80	
HH		0,3	nom.
JJ		1,5	nom.
α	70°	80°	
β		45°	nom.





note 1: metal flange for ground contact
 note 2: locating pin $180^\circ \pm 0,5$ from contact pin



- A REFERENCE CIRCLE
- B INPUT REF. PLANE
- C OUTPUT REF. PLANE



QUICK REFERENCE DATA

Electrostatically focussed tube with fibre-optic input and glass output window.

Useful input and output diameter	18 mm and 7 mm resp.
Minimum luminance gain	$220 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	12 kV
Overall dimensions (approx. length & diam.)	48 mm and 50 mm
Weight (approx.)	70 g

INPUT

Fibre-optic window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 12,7 \text{ mm}$)

at 2850 K min. $225 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $15 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $10 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Useful diameter 7 mm

Refractive index n_d see outline drawing

Window thickness see outline drawing

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2850 K, input illumination max. 10^{-2} lux)	min.	220 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution on axis	typ.	100 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 7$ mm	typ.	90 $\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer		
at 12,5 lp/mm	min.	80 %
at 25 lp/mm	min.	58 %
at 50 lp/mm	min.	25 %
at 75 lp/mm	min.	9 %
Magnification (on axis)	min.	0,37
	max.	0,38
Distortion (at $r = 7$ mm)	max.	6 %
Equivalent background illumination (\varnothing 12,7 mm, 2850 K)	typ.	0,2 μlx
	max.	0,6 μlx
		provided the background is uniform and stable
Axial eccentricity	max.	0,5 mm
Uniformity		see page 3

NOMINAL OPERATING CONDITIONS

Supply voltage		12 kV
Ambient temperature	nom.	+20 °C

LIMITING VALUES

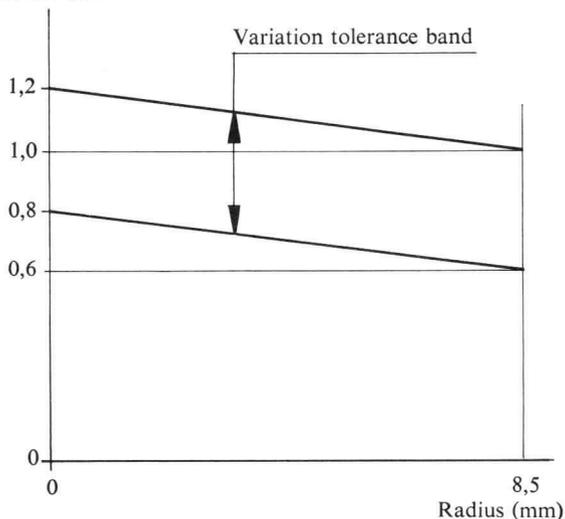
Supply voltage	max.	14 kV
Input illumination (at extended and uniform illumination)	max.	1 lx
Ambient temperature (Operation)	min.	-54 °C
	max.	+52 °C
Ambient temperature (storage)	min.	-54 °C
	max.	+40 °C



UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K the output luminance uniformity varies; variations in output luminance over a circular input area \varnothing 17 mm fall within the tolerance band shown below.

OUTPUT LUMINANCE
(Rel.)



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
>90 μm	0	0	0
60—90 μm	1	1	3
30—60 μm	2	minimal	minimal
<30 μm	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

See general notes. The relative humidity however, shall not exceed 50 % at any environmental test.

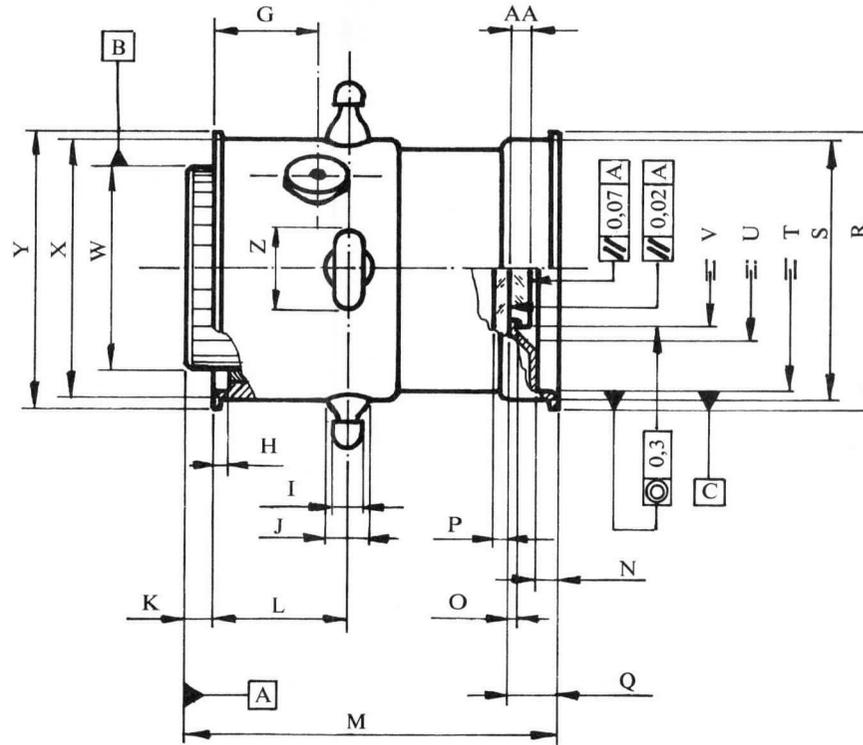
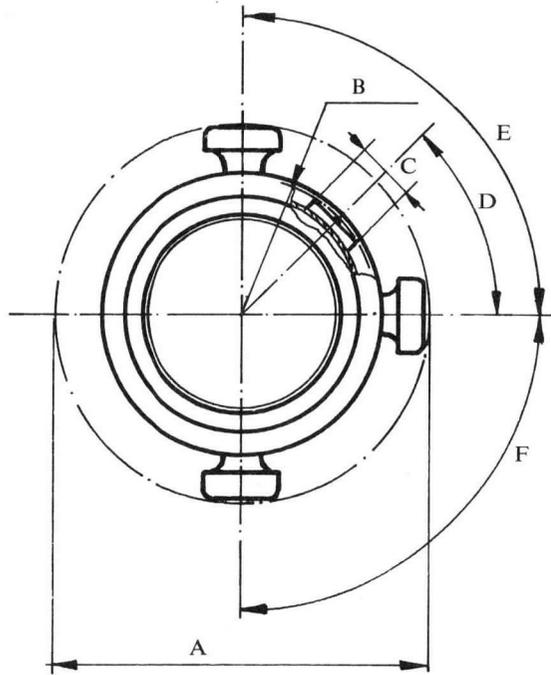
NOTES:

- 1 All radii (r) and diameters (\varnothing) refer to input.
- 2 In the case an anode coverglass with different physical properties and/or different dimensions is required, it is advisable to contact the manufacturer.



	min.	max.	note
A	—	∅ 50,0	
B	—	R = 18,5	
C	—	∅ 8,0	
D	43°	47°	
E	87°	93°	
F	87°	93°	
G	—	14,1	
H	1,5	2,5	
I	3,6	3,8	
J	—	6,5	
K	2,5	3,5	
L	16,7	17,9	
M	47,5	48,9	
N	3,5	4,2	
O	—	0,9	
P	1,2	1,3	ZK 1 (533 580)
Q	7,1	7,8	
R	∅ 36,7	∅ 37,7	
S	∅ 33,9	∅ 34,3	
T	∅ 31,0	∅ 31,4	
U	∅ 18,5	∅ 19,5	
V	∅ 11,5	∅ 11,7	
W	∅ 26,6	∅ 26,7	
X	∅ 33,9	∅ 34,3	
Y	∅ 36,7	∅ 37,7	
Z	11,5	11,7	3 x
AA	2,3	2,5	F 11 (620 357)





- A** REFERENCE CIRCLE
- B** REFERENCE CIRCLE
- C** REFERENCE PLANE



QUICK REFERENCE DATA

Electrostatically focussed tube with fibre-optic input and glass output window.

Useful input and output diameter	18 mm and 7 mm resp.
Minimum luminance gain	$375 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	15 kV
Overall dimensions (approx. length & diam.)	48 mm and 50 mm
Weight (approx.)	70 g

INPUT

Fibre optic-window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 12,7 \text{ mm}$)

at 2850 K min. $225 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $15 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $10 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Useful diameter 7 mm

Refractive index n_d see outline drawing

Window thickness see outline drawing

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2850 K, input illumination max. 10^{-2} lux)	min.	375 cd \cdot m $^{-2}$ \cdot lx $^{-1}$
Resolution		
on axis	typ.	100 lp \cdot mm $^{-1}$
at r = 7 mm	typ.	90 lp \cdot mm $^{-1}$
Modulation transfer (on axis)		
at 12,5 lp/mm	min.	80 %
at 25 lp/mm	min.	58 %
at 50 lp/mm	min.	25 %
at 75 lp/mm	min.	9 %
Magnification (on axis)	min.	0,37
	max.	0,38
Distortion (r = 7,0 mm)	max.	6 %
Equivalent background illumination (\varnothing 12,7 mm, 2850 K)	typ.	0,2 μ lx
	max.	0,7 μ lx
		provided the background is uniform and stable
Axial eccentricity	max.	0,5 mm
Uniformity		see page 3

NOMINAL OPERATING CONDITIONS

Supply voltage		15 kV
Ambient temperature	nom.	+20 $^{\circ}$ C

LIMITING VALUES

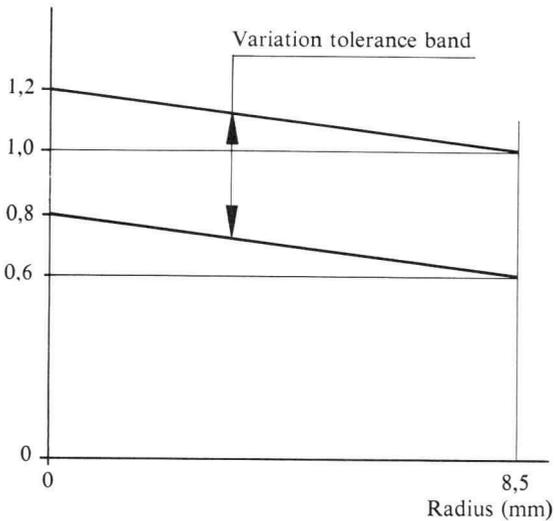
Supply voltage	max.	16 kV
Input illumination (at extended and uniform exposure)	max.	1 lx
Ambient temperature (operation)	min.	-54 $^{\circ}$ C
	min.	+52 $^{\circ}$ C
Ambient temperature (storage)	min.	-54 $^{\circ}$ C
	max.	+40 $^{\circ}$ C



UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K the output luminance uniformity varies; variations in output luminance over a circular area \varnothing 17 mm fall within the tolerance band shown below.

OUTPUT LUMINANCE
(Rel.)



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
>90 μm	0	0	0
60—90 μm	1	2	3
30—60 μm	2	minimal	minimal
<30 μm	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

See general notes. The relative humidity however, shall not exceed 50 % at any environmental test.

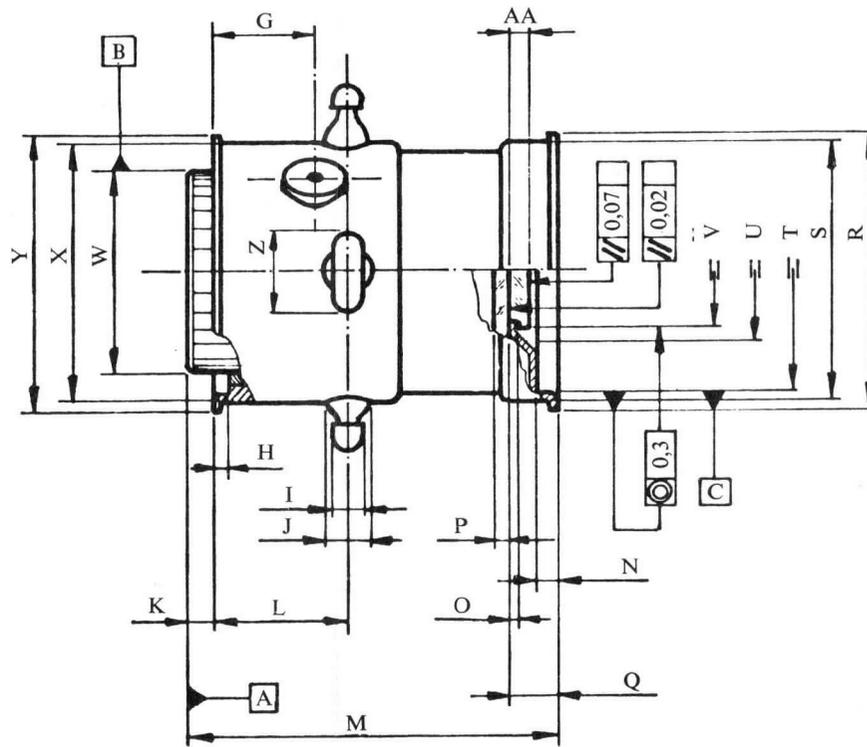
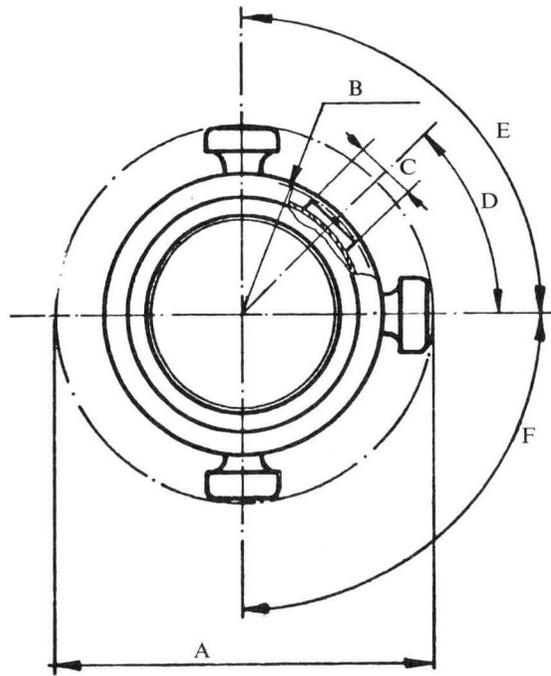
NOTES

- 1 All radii (r) and diameters (\varnothing) refer to input.
- 2 In the case an anode coverglass with different physical properties and/or different dimensions is required, it is advisable to contact the manufacturer.



	min.	max.	note
A	—	∅ 50,0	
B	—	R = 18,5	
C	—	∅ 8,0	
D	43°	47°	
E	87°	93°	
F	87°	93°	
G	—	14,1	
H	1,5	2,5	
I	3,6	3,8	
J	—	6,5	
K	2,5	3,5	
L	16,7	17,9	
M	47,5	48,9	
N	3,5	4,2	
O	—	0,9	
P	1,2	1,3	ZK 1 (533 580)
Q	7,1	7,8	
R	∅ 36,7	∅ 37,7	
S	∅ 33,9	∅ 34,3	
T	∅ 31,0	∅ 31,4	
U	∅ 18,5	∅ 19,5	
V	∅ 11,5	∅ 11,7	
W	∅ 26,6	∅ 26,7	
X	∅ 33,9	∅ 34,3	
Y	∅ 36,7	∅ 37,7	
Z	11,5	11,7	3 x
AA	2,3	2,5	F 11 (620 357)





- A** REFERENCE PLANE
- B** REFERENCE CIRCLE
- C** REFERENCE CIRCLE



QUICK REFERENCE DATA

Electrostatically focussed tube with fibre-optic input and glass output window.

The tube is protected against visible defects resulting from local high light intensities of short duration which may occur when detonations of armour piercing ammunition are imaged on the photocathode while the tube operates under otherwise nominal conditions.

Useful input and output diameter	18 mm and 7 mm resp.
Minimum luminance gain	220 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	12 kV
Overall dimensions (approx. length & diam.)	48 mm and 50 mm
Weight (Approx.)	70 g

INPUT

Fibre-window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on \varnothing 12,7 mm)

at 2850 K min. 250 $\mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. 15 $\text{mA} \cdot \text{W}^{-1}$

at 850 nm min. 10 $\text{mA} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Useful diameter 7 mm

Refractive index n_d see outline drawing

Window thickness see outline drawing

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2280 K, input illuminance max. 10^{-2} lux)	min.	220 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lX}^{-1}$
Resolution		
on axis	typ.	100 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 7$ mm	typ.	90 $\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer		
at 12,5 lp/mm	min.	80 %
at 25 lp/mm	min.	58 %
at 50 lp/mm	min.	25 %
at 75 lp/mm	min.	9 %
Magnification (on axis)	min.	0,37
	max.	0,38
Distortion (at $r = 7,0$ mm)	max.	6 %
Equivalent background illumination (\varnothing 12,7 mm, 2850 K)	typ.	0,2 μlX
	max.	0,6 μlX
		provided the background is uniform and stable
Axial eccentricity	max.	0,5 mm
Uniformity		see pag. 3



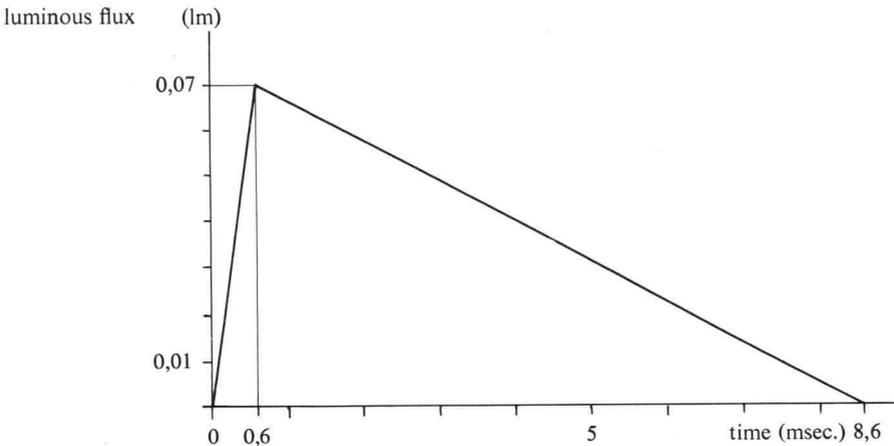
FLASH PROTECTION

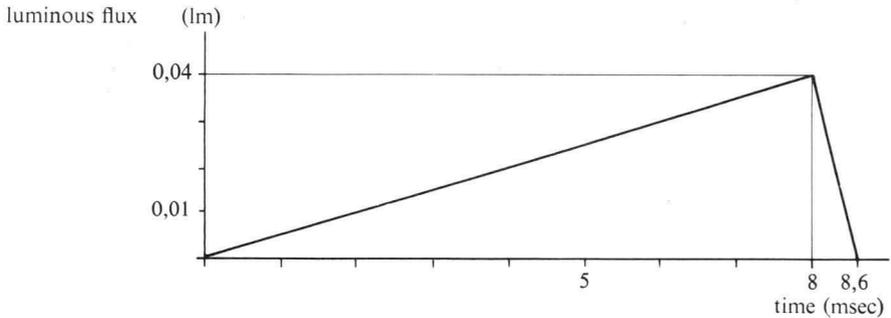
In order to simulate the light bursts of high intensity and short duration which may occur at the detonation of armour piercing ammunition, laboratory tests for the inspection of the image intensifiers ability to withstand the adverse effects of such a light bursts have been defined as follows:

A $2 \times 3,5$ mm filament of a 100 Watt quartz-iodine lamp, operating at simulated colour temperatures of either 3500 K or 2500 K is imaged on the photocathode of the image intensifier resulting in an image area of approx.

$0,01 \text{ mm}^2$ and a luminous flux of approx. $0,07 \text{ lm}$ (at 3500 K) or $0,04 \text{ lm}$ (at 2500 K).

The flashes are generated with a shutter disc, operating in the light beam, giving light pulses of approx. $8,6 \text{ msec.}$ duration. The pulses shall have a triangular shape and either a short rise time of $0,6 \text{ msec.}$ (at 3500 K) or a long rise time of approx. $8,0 \text{ msec.}$ (at 2500 K); see fig. 1 and fig. 2.





An image intensifier when inspected under nominal operating conditions shall meet the specifications (uniformity, spots) when the image intensifier has been subjected to light bursts as generated with the above described test set-up, each burst at a different spot of the image intensifiers input.

Between the bursts a regeneration time of at least 5 sec. should be allowed for. In this test a burst has to be understood as series up to 10 light flashes at a rate of 10 per sec.

The image intensifier shall not show any decrease in resolution, when the input illuminance on the photocathode is increased up to 1 lux.



NOMINAL OPERATING CONDITIONS

Supply voltage		12 kV
Ambient temperature	nom.	+20 °C

LIMITING VALUES

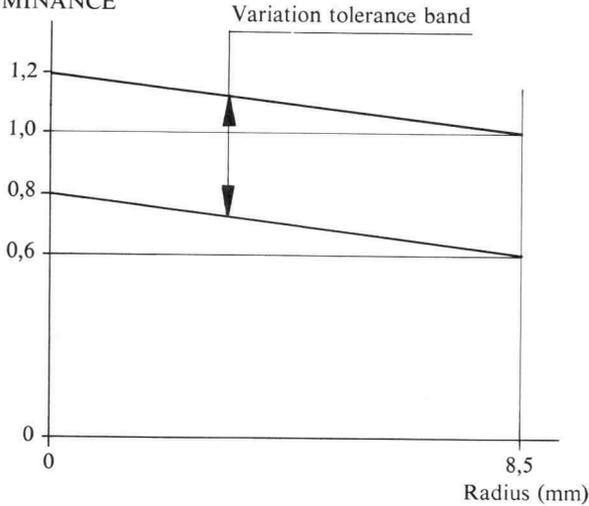
Supply voltage	max.	14 kV
Input illumination (at extended and uniform exposure)	max.	1 lx
Ambient temperature (operation)	min.	-54 °C
	max.	+52 °C
Ambient temperature (storage)	min.	-54 °C
	max.	+40 °C

UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K the output luminance uniformity varies; variations in output luminance over a circular input area \varnothing 17 mm fall within the tolerance band shown below.



OUTPUT LUMINANCE
(Rel.)



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
>90 μm	0	0	0
60—90 μm	1	2	3
30—60 μm	2	minimal	minimal
<30 μm	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

See general notes.

The relative humidity however, shall not exceed 50 % at any environmental test.

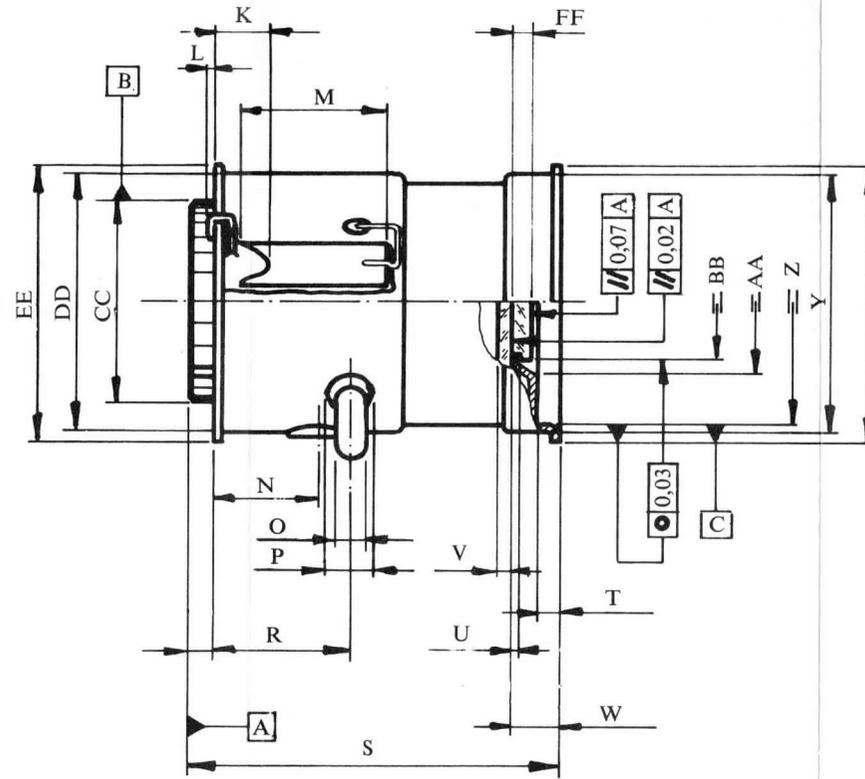
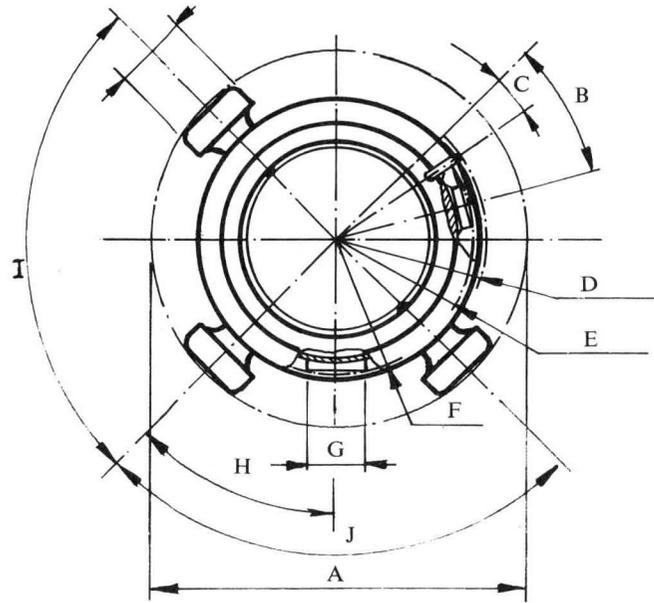
NOTES:

- 1 All radii (r) and diameters (\varnothing) refer to input.
- 2 In the case an anode coverglass with different physical properties and/or different dimensions is required, it is advisable to contact the manufacturer.



	min.	max.	note
A	—	∅ 50,0	
B	25°	30°	
C	—	10°	nom.
D	—	R = 19,6	
E	—	R = 18,6	
F	—	R = 18,5	
G	—	∅ 8,0	
H	43°	47°	
I	87°	93°	
J	87°	93°	
K	—	5,0	
L	1,0	1,3	
M	—	20	nom.
N	—	14,1	
O	3,6	3,8	
P	—	6,5	3 x
Q	2,5	3,5	
R	16,7	17,9	
S	47,5	48,9	
T	3,5	4,2	
U	—	0,9	
V	1,2	1,3	ZK 1 (533 580)
W	7,1	7,8	
X	∅ 36,7	∅ 37,7	
Y	∅ 33,9	∅ 34,3	
Z	∅ 31,0	∅ 31,4	
AA	∅ 18,5	∅ 19,5	
BB	∅ 11,5	∅ 11,7	
CC	∅ 26,6	∅ 26,7	
DD	∅ 33,9	∅ 34,3	
EE	∅ 36,7	∅ 37,7	
FF	∅ 2,3	∅ 2,5	F 11 (533 580)
GG	11,5	11,7	





- A REFERENCE PLANE
- B REFERENCE CIRCLE
- C REFERENCE CIRCLE



QUICK REFERENCE DATA

Electrostatically focussed distortion corrected two stage tube with fibre-optic input and glass output window.

Useful input and output diameter	18 and 7 mm resp.
Minimum luminance gain	5700 cd · m ⁻² · lx ⁻¹
Supply voltage	2,65 V
Overall dimensions (approx. length & diam.)	104 × 54 mm
Weight (approx.)	300 g

INPUT

Fibre-optic window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on \varnothing 12,7 mm)

at 2850 K min. 225 μ A · lm⁻¹

at 800 nm min. 15 mA · W⁻¹

at 850 nm min. 10 mA · W⁻¹

OUTPUT

Glass window

Useful diameter 7 mm

Refractive index n_d see outline drawing

Window thickness see outline drawing

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short

TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2850 K, input illuminance max. 10^{-3} lux)	min.	5700	$\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution			
on axis	typ.	70	$\text{lp} \cdot \text{mm}^{-1}$
at $r = 7$ mm	typ.	60	$\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer			
at 12.5 lp/mm	min.	75	%
at 25 lp/mm	min.	45	%
at 50 lp/mm	min.	10	%
Magnification (on axis)	min.	0,35	
	max.	0,37	
Distortion (at 7,10 mm)	max.	7,5	%
Equivalent background illumination (\varnothing 12,7 mm, 2850 K)	max.	0,2	μlx
Axial eccentricity	max.	0,5	mm
Uniformity		see page 3	

OPERATING CONDITIONS

Supply voltage		2,65	V
Input current	typ.	30	mA
	max.	50	mA
Ambient temperature		+20	$^{\circ}\text{C}$

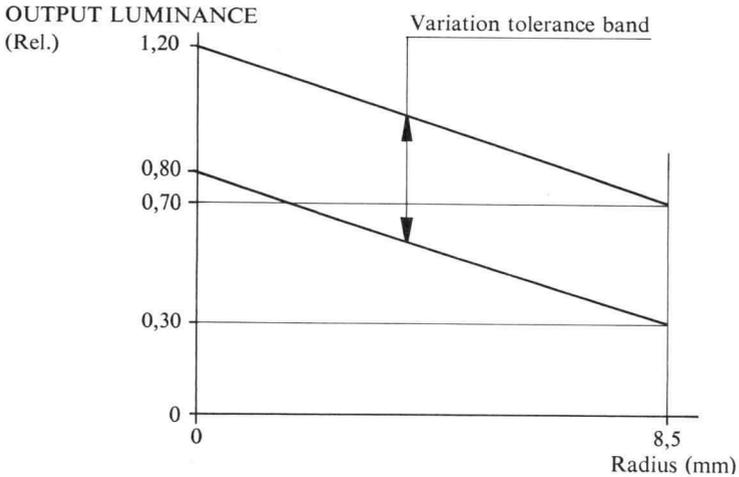
LIMITING VALUES

Supply voltage	min.	2,0	V
	max.	3,0	V
Input illumination (at extended and uniform exposure)	max.	1	lx
Ambient temperature (operation)	min.	-54	$^{\circ}\text{C}$
	max.	+52	$^{\circ}\text{C}$
Ambient temperature (storage)	min.	-54	$^{\circ}\text{C}$
	max.	+40	$^{\circ}\text{C}$
Reverse polarity time	max.	60	sec.



UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K, the output luminance uniformity varies; variations in output luminance over a circular input area \varnothing 17 mm fall within the tolerance band shown below.



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
$>150 \mu\text{m}$	0	0	0
120—150 μm	0	1	2
90—120 μm	0	3	8
60—90 μm	0	9	18
30—60 μm	3	minimal	minimal
$< 30 \mu\text{m}$	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

See general notes

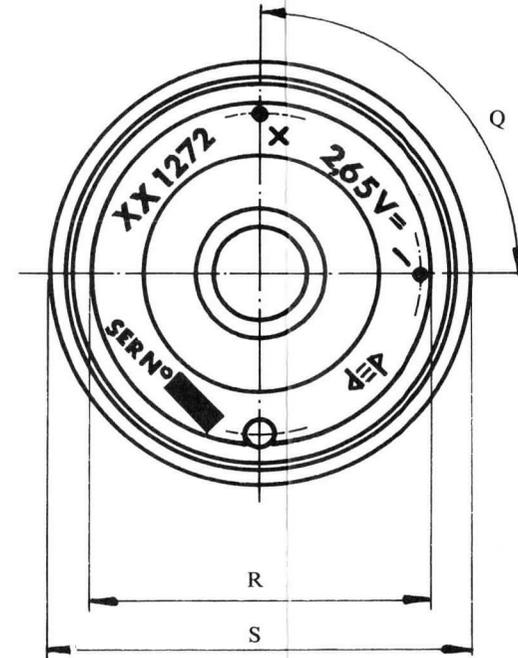
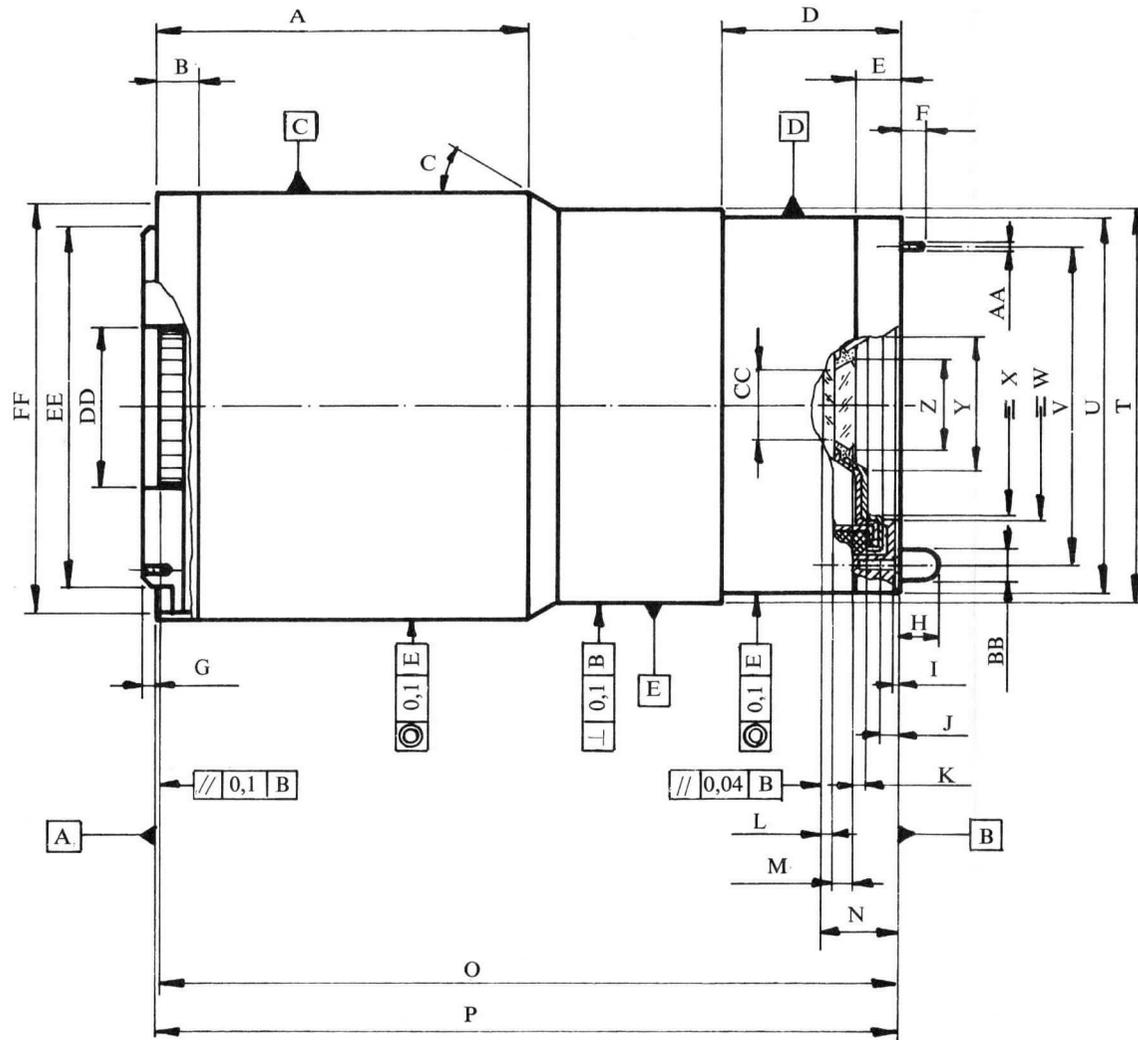
NOTE

All radii (r) and diameters (\varnothing) refer to input.



	min.	max.	note
A	49,5	50,5	
B	6	—	
C	25°	35°	
D	24	25	
E	6,4	7,0	
F	3,3	3,9	
G	—	2,1	
H	5,3	5,7	
I	0,15	—	
J	2,6	—	
K	—	1,9	
L	1,27	1,30	$n_d = 1,535$
M	3,18	3,23	$n_d = 1,856$
N	10,01	10,07	
O	98,5	101,0	
P	99,0	100,0	
Q	89°	91°	
R	∅ 45,0	∅ 45,6	
S	∅ 56,3	∅ 56,7	
T	—	∅ 52,05	
U	∅ 49,2	∅ 49,4	
V	∅ 42,0	∅ 42,4	
W	∅ 31,0	∅ 31,4	
X	∅ 29,0	—	
Y	∅ 17,5	—	
Z	∅ 12,3	∅ 12,5	
AA	∅ 1,00	∅ 1,10	
BB	∅ 3,9	∅ 4,0	
CC	∅ 9,8	∅ 10	
DD	∅ 21	—	
EE	—	∅ 47	
FF	∅ 53,8	∅ 54,2	





- A** INPUT REF. PLANE
- B** OUTPUT REF. PLANE
- C** INPUT REF. CIRCLE
- D** OUTPUT REF. CIRCLE



QUICK REFERENCE DATA

Electrostatically focussed distortion corrected two-stage tube with fibre-input and glass output window. The tube is protected against visible defects resulting from local high light intensities of short duration which may occur when detonations of armour piercing ammunition are imaged on the photocathode while the tube operates under otherwise nominal conditions.

Useful input and output diameter	18 and 7 mm resp.
Minimum luminance gain	$5700 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	2,65 V
Overall dimensions (approx. length & diam.)	$104 \times 54 \text{ mm}$
Weight (approx.)	300 g

INPUT

Fibre-optic window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 12,7 \text{ mm}$)

at 2850 K min. $225 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $15 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $10 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Useful diameter 7 mm

Refractive index n_d see outline drawing

Window thickness see outline drawing

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

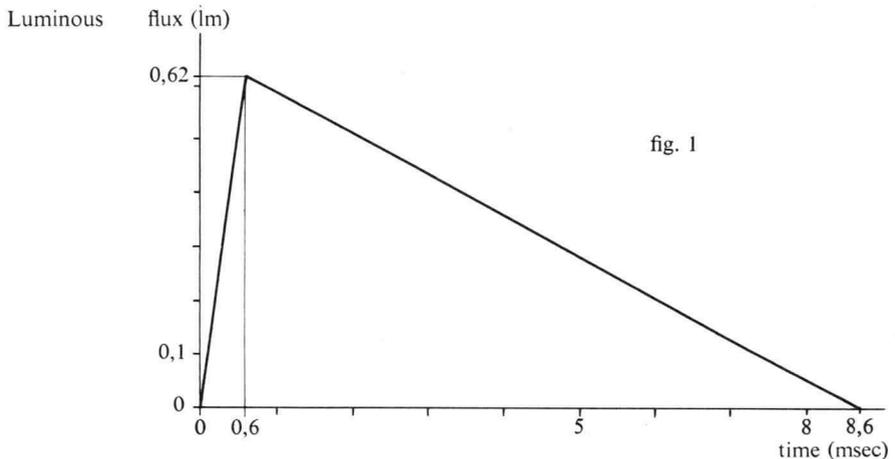
Luminance gain (\varnothing 12,7 mm, 2850 K, input illuminance max. 10^{-3} lux)	min.	5700 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$	
Resolution			
on axis	typ.	70	$\text{lp} \cdot \text{mm}^{-1}$
at $r = 7$ mm	typ.	60	$\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer			
at 12,5 lp/mm	min.	75	%
at 25 lp/mm	min.	50	%
at 50 lp/mm	min.	10	%
Magnification (on axis)	min.	0,35	
	max.	0,37	
Distortion (at $r = 7,0$ mm)	max.	7,5 %	
Equivalent background illumination (\varnothing 12,7 mm, 2850 K)	max.	0,2 μlx	
Axial eccentricity	max.	0,5 mm	
Uniformity		see page 3	

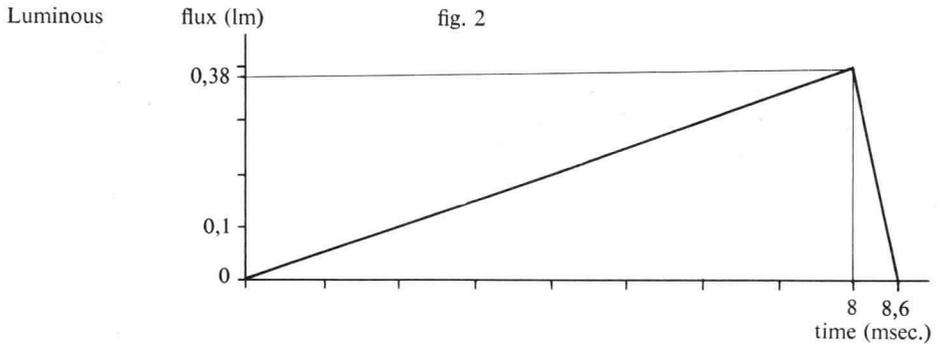


FLASH PROTECTION

In order to simulate in laboratory tests the light bursts of high intensity and short duration which may occur at the detonation of armour piercing ammunition in order to inspect the image intensifiers ability to withstand the adverse effects of such light bursts, test set-ups have been defined as follows:

A $2 \times 3,5$ mm filament of a 100 Watt quartz-iodine lamp, operating at simulated colour temperatures of either 3500 K or 2500 K is imaged on the photocathode of the image intensifier resulting in an image area of $0,3 \text{ mm}^2 \pm 0,1 \text{ mm}^2$ and a luminous flux of approx. 0,62 lm (at 3500 K) or 0,38 lm (at 2500 K). The flashes are generated with a shutter disc, operating in the light beam, giving light pulses of approx. 8,6 msec. duration. The pulses shall have a triangular shape and either a short rise time of 0,6 msec. (at 3500 K) or a long rise time of approx. 8,0 msec. (at 2500 K); see fig. 1 and fig. 2.





An image intensifier when inspected under nominal operating conditions shall meet the specifications (uniformity, spots) when the image intensifier has been subjected to light bursts as generated with the above described test set-up, each burst at a different spot of the image intensifiers input.

Between the bursts a regeneration time of at least 5 sec. should be allowed for. In this test a burst has to be understood as series of up to 10 light flashes at a rate of 10 per sec.

The image intensifier shall not show any decrease in resolution, when the input illuminance on the photocathode is increased up to 1 lux.



OPERATING CONDITIONS

Supply voltage		2,65 V
Input current	typ.	30 mA
	max.	50 mA
Ambient temperature		+20 °C

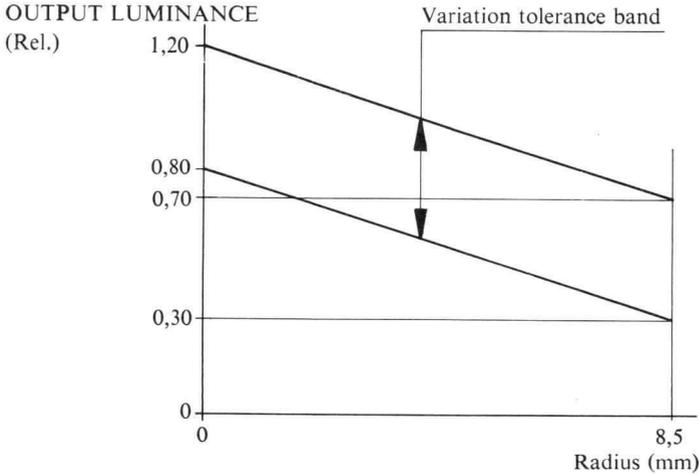
LIMITING VALUES

Supply voltage	min.	2,0 V
	max.	3,0 V
Input illumination (at extended and uniform exposure)	max.	1 lx
Ambient temperature (operation)	min.	-54 °C
	max.	+52 °C
Ambient temperature (storage)	min.	-54 °C
	max.	+40 °C
Reverse polarity time	max.	60 sec.



UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K, the output luminance uniformity varies; variations in output luminance over a circular input area \varnothing 17 mm fall within the tolerance band shown below.



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
>150 μm	0	0	0
120—150 μm	0	1	2
90—120 μm	0	3	8
60— 90 μm	0	9	18
30— 60 μm	3	minimal	minimal
< 30 μm	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

See general notes

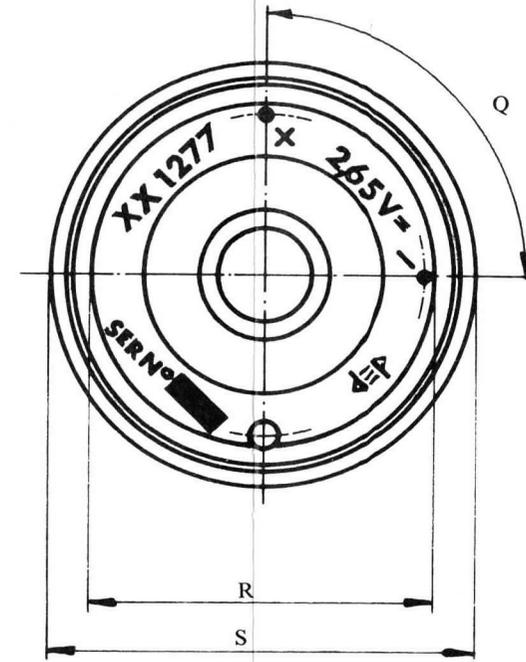
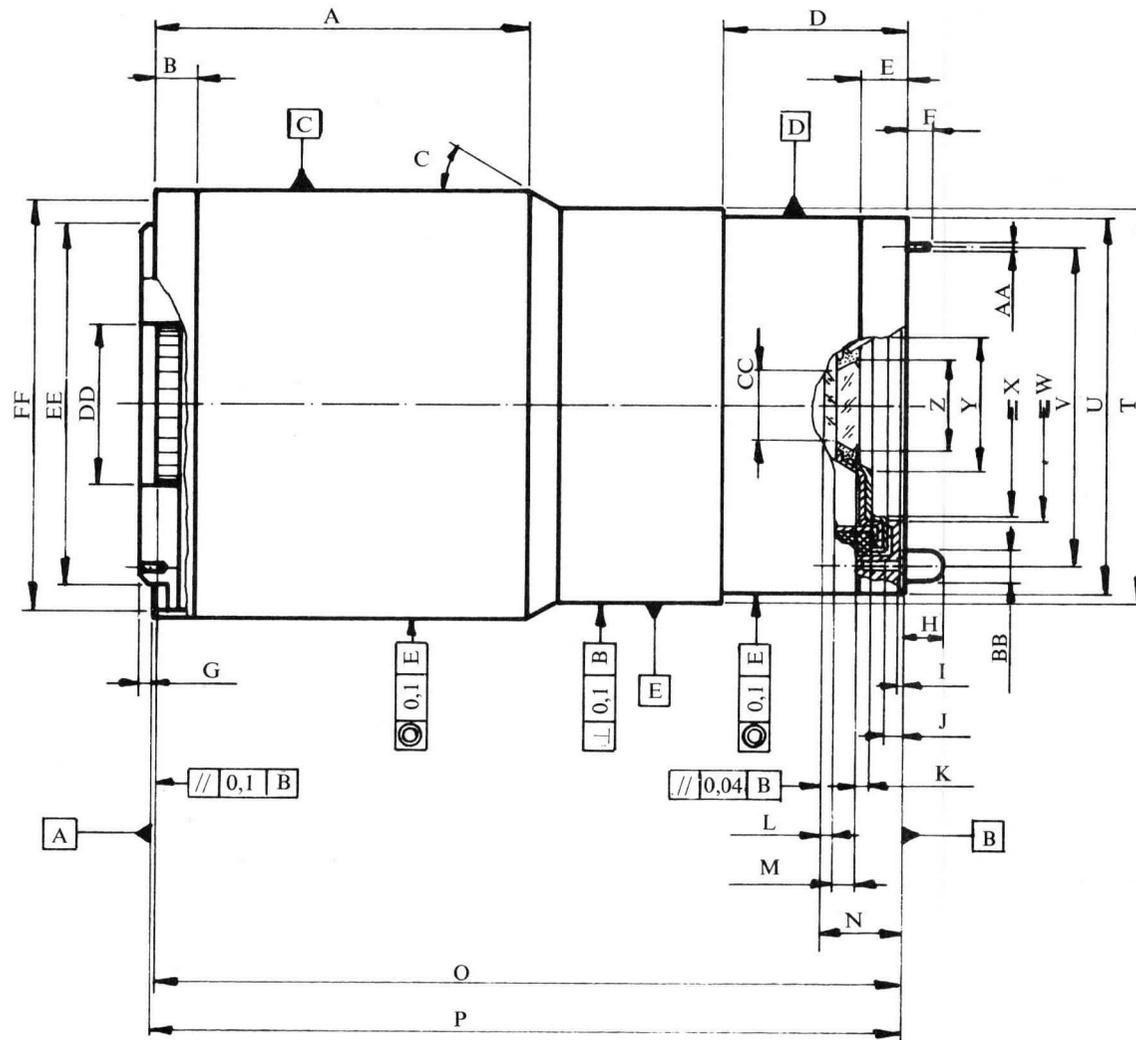
NOTE

All radii (r) and diameters (\varnothing) refer to input.



	min.	max.	note
A	49,5	50,5	
B	6	—	
C	25°	35°	
D	24	25	
E	6,4	7,0	
F	3,3	3,9	
G	—	2,1	
H	5,3	5,7	
I	0,15	—	
J	2,6	—	
K	—	1,9	
L	1,27	1,30	$n_d = 1,535$
M	3,18	3,23	$n_d = 1,856$
N	10,01	10,07	
O	98,5	101,0	
P	99,0	100,0	
Q	89°	91°	
R	∅ 45,0	∅ 45,6	
S	∅ 56,3	∅ 56,7	
T	—	∅ 52,05	
U	∅ 49,2	∅ 49,4	
V	∅ 42,0	∅ 42,4	
W	∅ 31,0	∅ 31,4	
X	∅ 29,0	—	
Y	∅ 17,5	—	
Z	∅ 12,3	∅ 12,5	
AA	∅ 1,00	∅ 1,10	
BB	∅ 3,9	∅ 4,0	
CC	∅ 9,8	∅ 10	
DD	∅ 21	—	
EE	—	∅ 47	
FF	∅ 53,8	∅ 54,2	





- A** INPUT REF. PLANE
- B** OUTPUT REF. PLANE
- C** INPUT REF. CIRCLE
- D** OUTPUT REF. PLANE



QUICK REFERENCE DATA

Electrostatically focussed distortion corrected two stage tube with fibre-optic input and output window.

Useful input and output diameter	18 and 18 mm
Minimum luminance gain	1250 cd · m ⁻² · lx ⁻¹
Supply voltage	14 kV + 14 kV
Overall dimensions (approx. length & diam.)	96 × 51 mm
Weight (approx.)	150 g

INPUT

Fibre-optic window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on \varnothing 12,7 mm)

at 2850 K min. 250 μ A · lm⁻¹

at 800 nm min. 20 mA · W⁻¹

at 850 nm min. 15 mA · W⁻¹

OUTPUT

Protected fibre-optic window

Useful diameter 18 mm

Numerical aperture 1

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2850 K, input illuminance max. 10^{-3} lux)	min.	1250 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution		
on axis	min.	42 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 7$ mm	min.	36 $\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer (on axis)		
at 7,5 lp/mm	min.	75 %
at 16,0 lp/mm	min.	48 %
at 20,0 lp/mm	min.	35 %
Magnification		
on axis	min.	0,85
	max.	0,95
Distortion		
$r = 7$ mm	max.	3 %
Equivalent background illumination (\varnothing 12,7 mm, 2850 K)	max.	0,2 μlx
Axial eccentricity	max.	1,0 mm
Uniformity		see page. 3

OPERATING CONDITIONS

Supply voltage	nom.	14 kV + 14 kV
Ambient temperature	min.	-54 °C
	nom.	+20 °C
	max.	+53 °C

LIMITING VALUES

Supply voltage	max.	14,5 kV + 14,5 kV
Input illumination (at extended and uniform exposure)	max.	1,0 lx
Ambient temperature (operation)	min.	-54 °C
	max.	+52 °C
Ambient temperature (storage)	min.	-54 °C
	max.	+40 °C

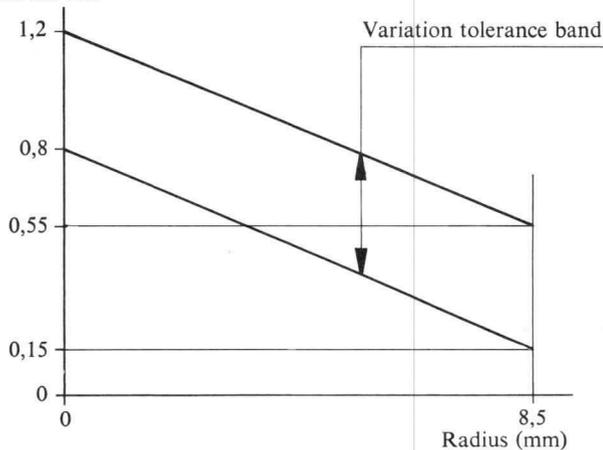


UNIFORMITY

Vignetting and shading

When the input is uniformly illuminated with light having a colour temperature of 2850 K the output luminance uniformity varies; variations in output luminance over a circular input area of \varnothing 17 mm fall within the tolerance band shown below.

OUTPUT LUMINANCE (Rel.)



The number of spots, exceeding a contrast with their surrounding of area 30%, is less or equal to the numbers indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
$>375 \mu\text{m}$	0	0	0
300—375 μm	0	1	2
225—300 μm	0	3	8
150—225 μm	0	9	18
75—150 μm	3	minimal	minimal
$< 75 \mu\text{m}$	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

See general notes

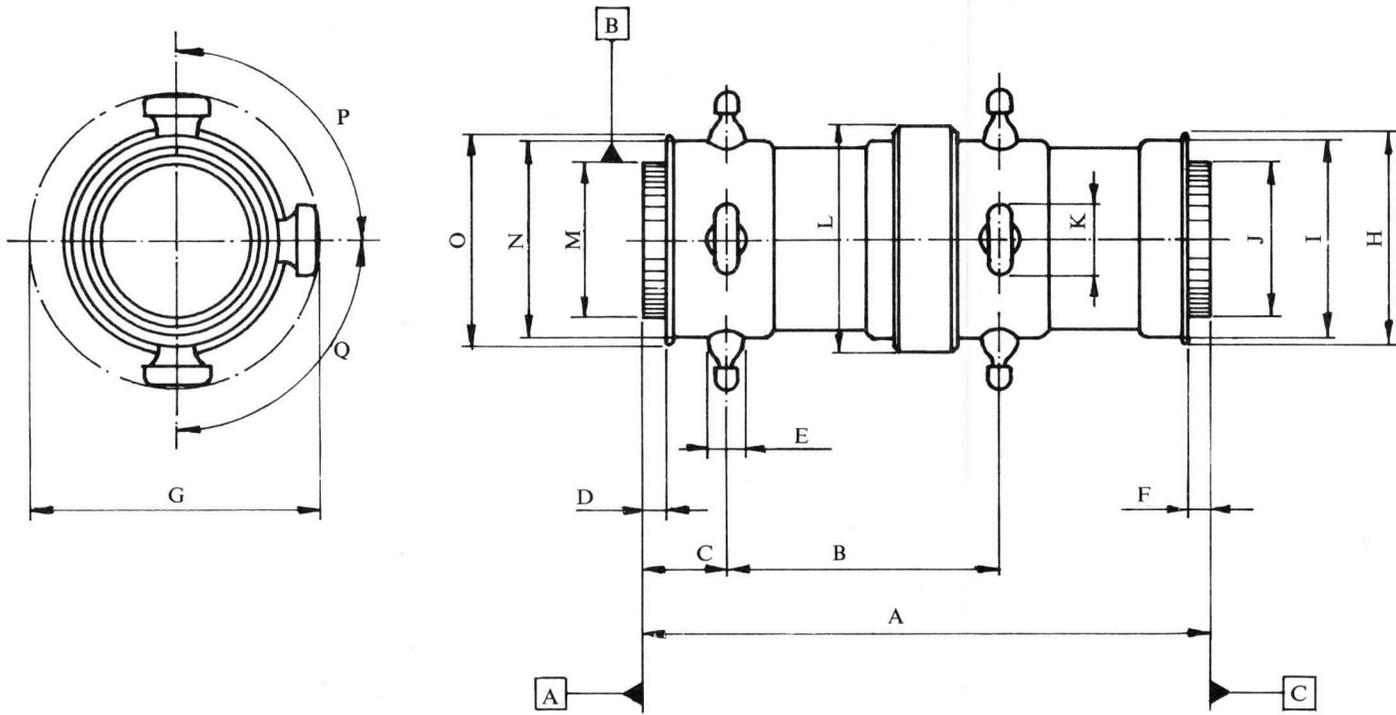
NOTE

All radii (r) and diameters (\varnothing) refer to input.



	min.	max.	note
A	94,0	98,0	
B	46,0	50,0	
C	12,0	14,4	
D	2,6	4,1	
E	6,4	7,4	6x
F	2,6	4,1	
G	—	50,0	
H	∅ 37,0	∅ 38,0	
I	∅ 33,9	∅ 34,3	
J	∅ 26,55	∅ 26,75	
K	11,4	11,8	6x
L	∅ 37,5	∅ 38,5	
M	∅ 26,55	∅ 26,75	
N	∅ 33,9	∅ 34,3	
O	∅ 37,0	∅ 38,0	
P	87°	93°	
Q	87°	93°	





- A REFERENCE PLANE
- B REFERENCE CIRCLE
- C REFERENCE PLANE



QUICK REFERENCE DATA

Electrostatically focussed tube with fibre-optic input and glass output window.

Useful input and output diameter	40 and 13 mm
Minimum luminance gain	$450 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	16 kV
Overall dimensions	$\varnothing 78 \times 81 \text{ mm}$
Weight (approx.)	250 g

INPUT

Fibre-optic window

Useful diameter 40 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 28 \text{ mm}$)

at 2850 K min. $200 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $13 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $8 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Refractive index n_d see outline drawing

Nominal window thickness see outline drawing

Useful diameter 13 mm

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 28 mm, 2850 K, input illuminance max. 10^{-2} lux)	min.	450 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution		
on axis	typ.	95 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 10$ mm	typ.	95 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 20$ mm	typ.	70 $\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer		
at 12,5 lp/mm	min.	80 %
at 15 lp/mm	min.	55 %
at 50 lp/mm	min.	20 %
Veiling glare	max.	7,5 %
Magnification (on axis)	min.	0,285
	max.	0,295
Distortion (at $r = 16$ mm)	max.	7,5 %
Equivalent background illumination (\varnothing 28 mm, 2850 K)	typ.	0,2 μlx
	max.	0,4 μlx
		provided the background is uniform and stable
Axial eccentricity	max.	0,5 mm

NOMINAL OPERATING CONDITIONS

Supply voltage	16 kV
Ambient temperature	+20 °C



LIMITING VALUES

Supply voltage	max.	18 kV
Ambient temperature (operational)	min.	-54 °C
	max.	+52 °C
Ambient relative humidity (operational)		50 %
	min.	-54 °C
Ambient temperature (storage)	max.	-40 °C
	max.	1 lx

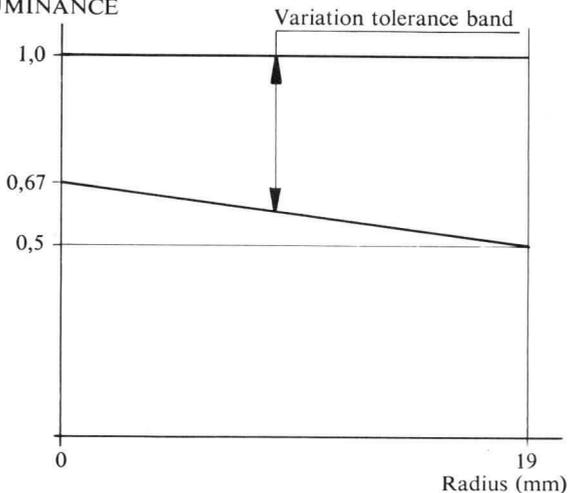


UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light having a colour temperature of 2850 K, the output luminance varies less than 1 to 0,5 over a circular input area \varnothing 38 mm.

On axis the output luminance is more than 0,67 times the maximum luminance. The variations in output luminance fall within the tolerance area shown below.

OUTPUT LUMINANCE (Rel.)



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 15 mm	within area bounded by \varnothing 15 mm and \varnothing 30 mm	within area bounded by \varnothing 30 mm and \varnothing 40 mm
$>125 \mu\text{m}$	0	0	0
100—125 μm	0	1	1
75—100 μm	1	2	4
50— 75 μm	2	5	9
25— 50 μm	3	minimal	minimal
$< 25 \mu\text{m}$	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

Shocks

See general notes

Vibration

See general notes

Temperature

See general notes. The operational tests, steps 2 and 5, shall be excluded. The relative humidity at $+54^\circ\text{C}$ shall not exceed 50 %.



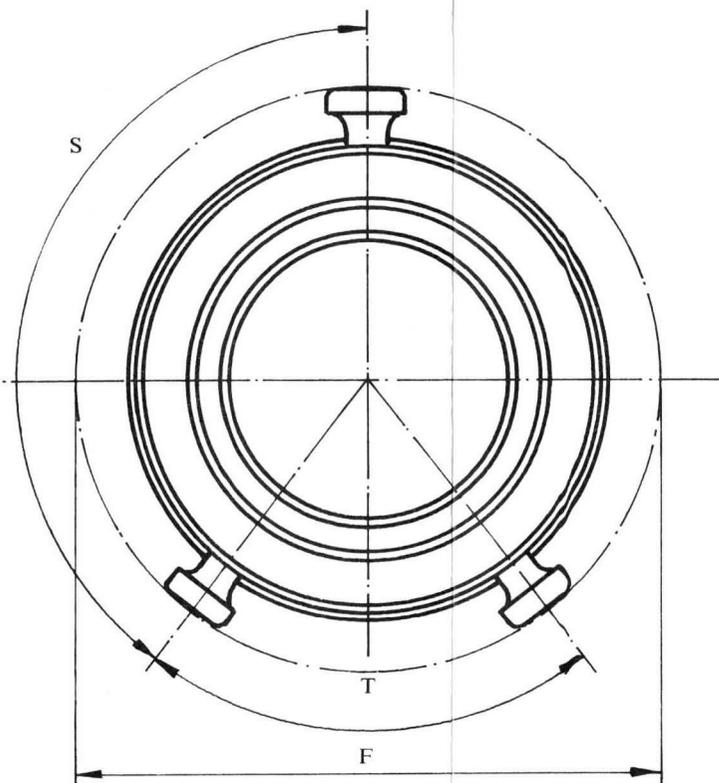
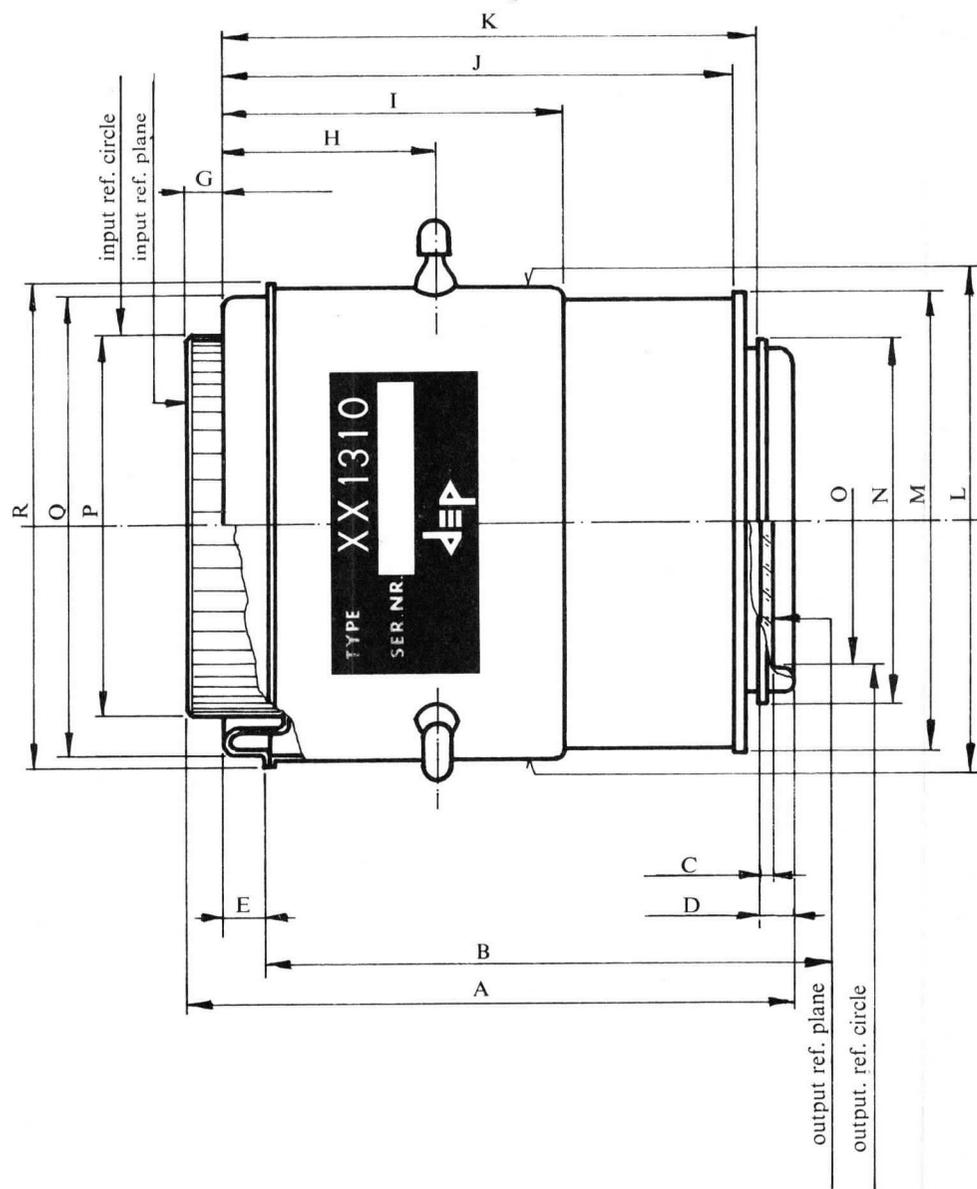
NOTES

- 1 All radii (r) and diameters (\varnothing) refer to input.
- 2 Input centre and output centre are specified by reference circles and reference planes as indicated on the outline drawing.



	min.	max.	note
A	79,45	81,45	
B	65,6	67,2	
C	2,35	2,45	$n_d = 1,53$
D	3,3	3,9	
E	6,3	6,7	
F	—	\varnothing 78,0	
G	4,0	5,0	
H	27,5	28,5	
I	44,5	45,5	
J	67,0	69,0	
K	70,7	72,3	
L	\varnothing 62,2	\varnothing 62,4	
M	\varnothing 60,9	\varnothing 61,1	
N	\varnothing 47,65	\varnothing 47,85	
O	\varnothing 38,0	\varnothing 38,2	
P	\varnothing 50,4	\varnothing 50,8	
Q	\varnothing 59,5	\varnothing 59,7	
R	\varnothing 64,2	\varnothing 64,4	
S	142,2°	142,8°	
T	72°	78°	





QUICK REFERENCE DATA

Electrostatically focussed tube with fibre-optic input and glass output window.

Useful input and output diameter	40 and 13 mm
Minimum luminance gain	$450 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	16 kV
Overall dimensions (approx.)	$\varnothing 85 \times 85 \text{ mm}$
Weight (approx.)	285 g

INPUT

Fibre-optic window

Useful diameter 40 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 28 \text{ mm}$)

at 2850 K	min.	$200 \mu\text{A} \cdot \text{lm}^{-1}$
at 800 K	min.	$13 \mu\text{A} \cdot \text{W}^{-1}$
at 850 K	min.	$8 \mu\text{A} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Refractive index see outline drawing

Nominal window thickness see outline drawing

Useful diameter 13 mm

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 28 mm, 2850 K, input illuminance max. 10^{-2} lux)	min.	450 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution		
on axis	typ.	95 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 10$ mm	typ.	95 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 20$ mm	typ.	70 $\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer (on axis)		
at 12,5 lp/mm	min.	80 %
at 25 lp/mm	min.	55 %
at 50 lp/mm	min.	20 %
Veiling glare	max.	7,5 %
Magnification (on axis)	min.	0,285
	max.	0,295
Distortion (at $r = 16$ mm)	max.	7,5 %
Equivalent background illumination (\varnothing 28 mm, 2850 K)	typ.	0,2 μlx
	max.	0,4 μlx
		provided the background is uniform and stable
Axial eccentricity (see note 2)	max.	0,5 mm

NOMINAL OPERATING CONDITIONS

Supply voltage	16 kV
Ambient temperature	+20 °C

LIMITING VALUES

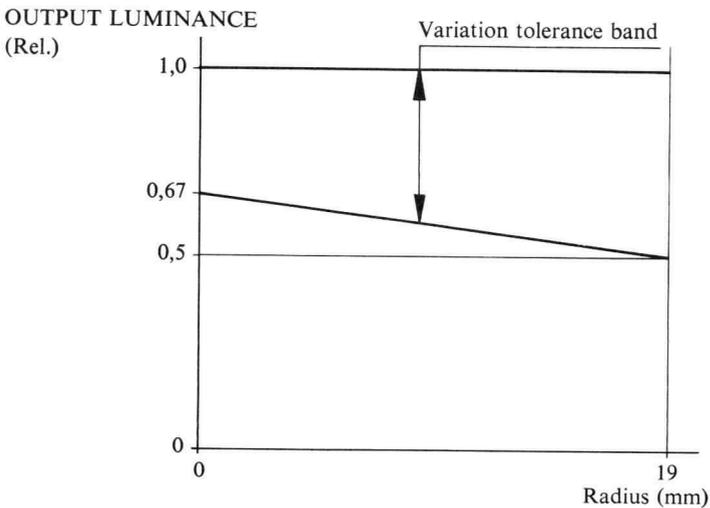
Supply voltage	max.	18 kV
Ambient temperature (operational)	min.	-54 °C
	max.	+52 °C
Ambient temperature (storage)	min.	-54 °C
	max.	+40 °C
Input illuminance	max.	1 lx



UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light having a colour temperature of 2850 K, the output luminance varies less than 1 to 0,5 over a circular input area \varnothing 38 mm.

On axis the output luminance is more than 0,67 times the maximum luminance. The variations in output luminance fall within the tolerance area shown below.



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 15 mm	within area bounded by \varnothing 15 mm and \varnothing 30 mm	within area bounded by \varnothing 30 mm and \varnothing 40 mm
$>125 \mu\text{m}$	0	0	0
100—125 μm	0	1	1
75—100 μm	1	2	4
50— 75 μm	2	5	9
25— 50 μm	3	minimal	minimal
$< 25 \mu\text{m}$	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

Shocks

See general notes

Vibration

See general notes

Temperature

See general notes.

The operational tests, steps 2 and 5, shall be excluded.



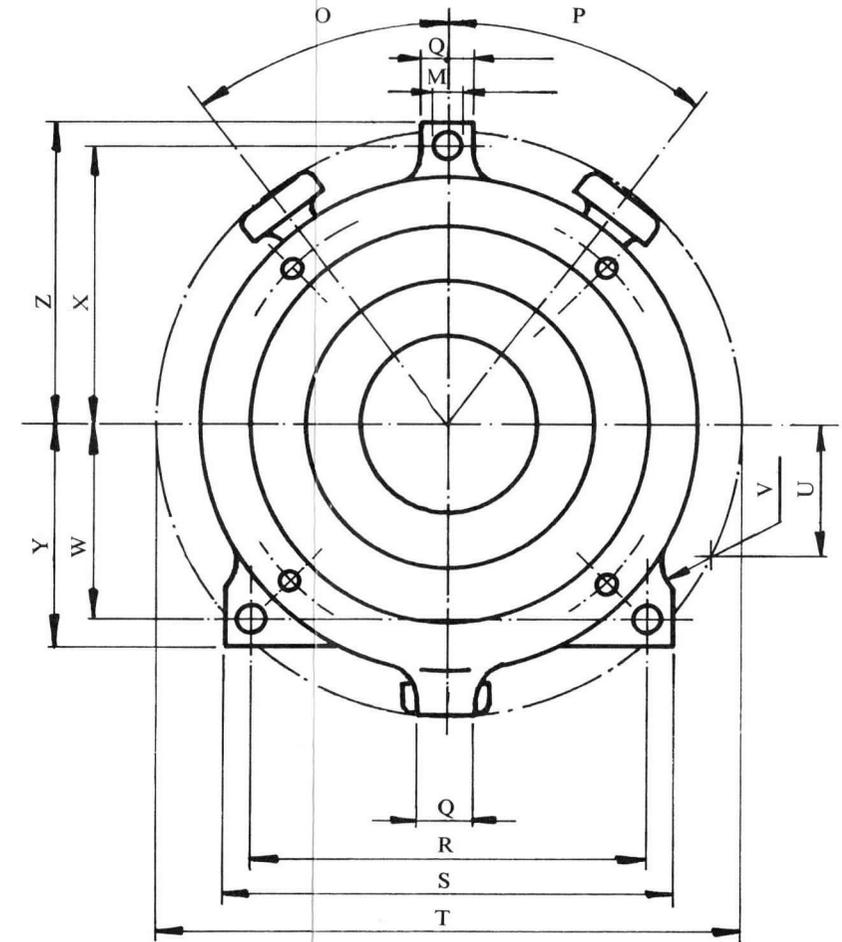
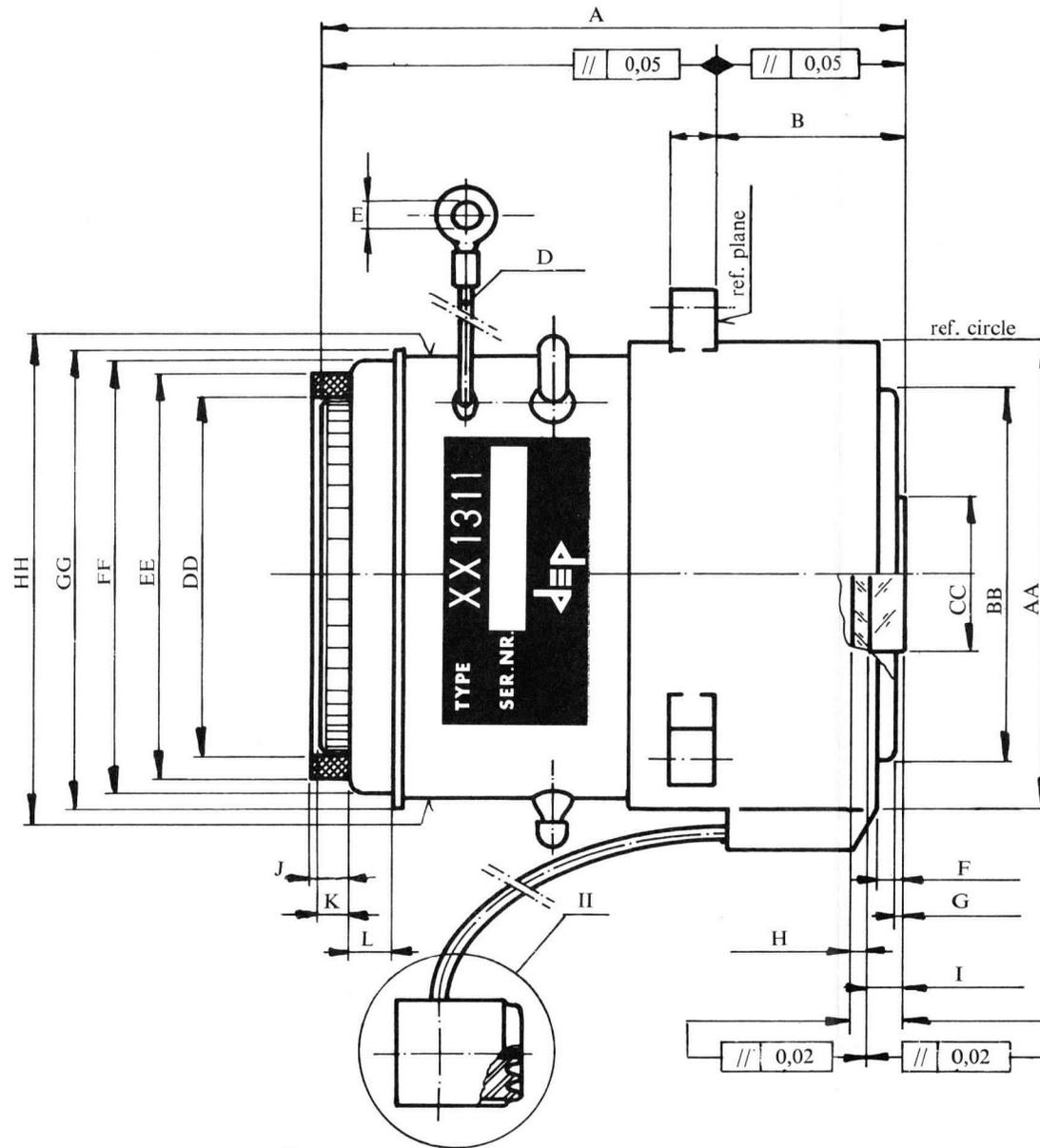
NOTES

- 1 All radii (r) and diameters (\varnothing) refer to input.
- 2 Input centre and output centre are specified by a reference circle and a reference plane as indicated on the outline drawing.



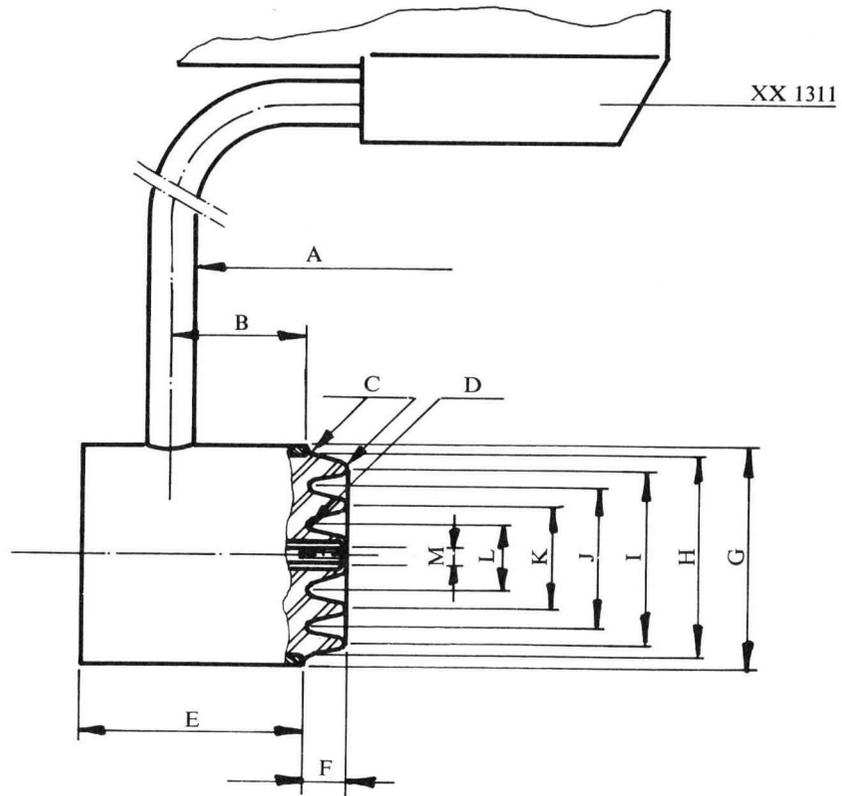
	min.	max.	note
A	80,0	82,5	
B	26,0	26,05	
C	5,8	6,2	(3x)
D	67,0	73,0	length of wire
E	∅ 3,5	—	nom.
F	3,0	—	
G	0,1	—	
H	2,4	2,45	ZK 1 (533 580)
I	4,75	4,8	SFM (785 258)
J	5,3	5,7	
K	4,0	5,0	
L	5,8	6,2	
M	∅ 4,2	∅ 4,4	(3x)
N	7,5	8,5	
O	36,5°	38,5°	
P	36,5°	38,5°	
Q	7,5	8,5	
R	51,5	51,7	
S	58,8	59,2	
T	—	∅ 78	
U	17,8	18,2	(2x)
V	R = 4	R = 6	(6x)
W	25,7	25,9	(2x)
X	36,4	36,6	
Y	29,3	29,7	(2x)
Z	39,8	40,2	
AA	∅ 64,8	∅ 64,9	
BB	—	∅ 53	
CC	∅ 21,8	∅ 22,2	
DD	∅ 50,4	∅ 50,8	
EE	∅ 56,8	∅ 57,2	
FF	∅ 59,4	∅ 59,6	
GG	—	∅ 64,3	
HH	—	∅ 62,5	
II	—	—	see sep. drawing





	min.	max.	
A	75	85	
B	8,5	9,5	
C	R = 0,45	R = 0,50	
D	R = 0,60	R = 0,65	
E	14,8	15,2	
F	2,8	3,0	
G	∅ 14,3	∅ 14,7	
H	∅ 12,6	∅ 12,8	
I	∅ 11,55	∅ 11,65	
J	∅ 9,15	∅ 9,25	
K	∅ 6,75	∅ 6,85	
L	∅ 4,35	∅ 4,45	
M	∅ 1,2	∅ 1,3	





QUICK REFERENCE DATA

Electrostatically focussed distortion corrected three-stage tube with fibre-optic input and output window.

The tube is protected against visible defects resulting from local high light intensities of short duration which may occur when detonations of armour piercing ammunition are imaged on the photocathode while the tube is operating.

The tubes internal power supply has been designed to be independent of changes in battery voltages and has an improved ABC and environmental temperature characteristic.

The XX 1340 tube is fully interchangeable with the XX 1136 or equivalent tube. Equipment designed for XX 1136 or equivalent tube can be equipped with XX 1340 tubes, requiring no modifications.

Useful input and output diameter	18 and 18 mm
Minimum luminance gain	$16.500 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	2,65 V
Overall dimensions (approx. length & diam.)	$147 \times 53 \text{ mm}$
Weight (approx.)	475 g

INPUT

Fibre-optic window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 12,7 \text{ mm}$)

at 2850 K min. $250 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $20 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $15 \text{ mA} \cdot \text{W}^{-1}$



OUTPUT

Protected fibre-optic window

Useful diameter

18 mm

Refractive index n_d

see outline drawing

Window thickness

see outline drawing

Phosphor

P 20

Screen output colour

green/yellow

Screen persistence

medium/short

Output luminance

max.

500 $\text{cd} \cdot \text{m}^{-2}$

TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2850 K,
input illuminance max. 10^{-3} lux)

min.

16.500 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$

Resolution

on axis

min.

37 $\text{lp} \cdot \text{mm}^{-1}$ at $r = 7$ mm

min.

32 $\text{lp} \cdot \text{mm}^{-1}$

Modulation transfer (on axis)

at 7,5 lp/mm

min.

70 %

at 16,0 lp/mm

min.

40 %

at 20,0 lp/mm

min.

25 %

Magnification (on axis)

min.

0,82

max.

0,90

Distortion ($r = 7$ mm)

max.

4 %

typ.

3,5 %

Equivalent background illumination
(\varnothing 12,7 mm, 2850 K)

max.

0,2 μlx

Veiling glare

max.

6 %

Axial eccentricity

max.

1,0 mm

Uniformity

see page 4



FLASH PROTECTION

In order to simulate the light bursts of high intensity and short duration which may occur at the detonation of armour piercing ammunition in laboratory tests for the inspection of the image intensifiers ability to withstand the adverse effects of such light bursts, test set-ups have been defined as follows:

- 1 A $2 \times 3,5$ mm filament of a 100 Watt quartz-iodine lamp, operating at simulated colour temperatures of either 3500 K or 2500 K is imaged on the photocathode of the image intensifier resulting in an image area of $0,3 \text{ mm}^2 \pm 0,1 \text{ mm}^2$ and a luminous flux of approx. 0,62 lm (at 3500 K) or 0,38 lm (at 2500 K).

The flashes are generated with a shutter disc, operating in the light beam, giving light pulses of approx. 8,6 msec. duration. The pulses shall have a triangular shape and either a short rise time of 0,6 msec. (at 3500 K) or a long rise time of approx. 8,0 msec. (at 2500 K); see fig. 1 and fig. 2.

- 2 A xenon flash tube, colourtemperature 5500 K is imaged on the input of the image intensifier resulting in an image area of 1 mm^2 and a luminous flux of approx. 28 lm.

The flash duration is 1 msec. approx.

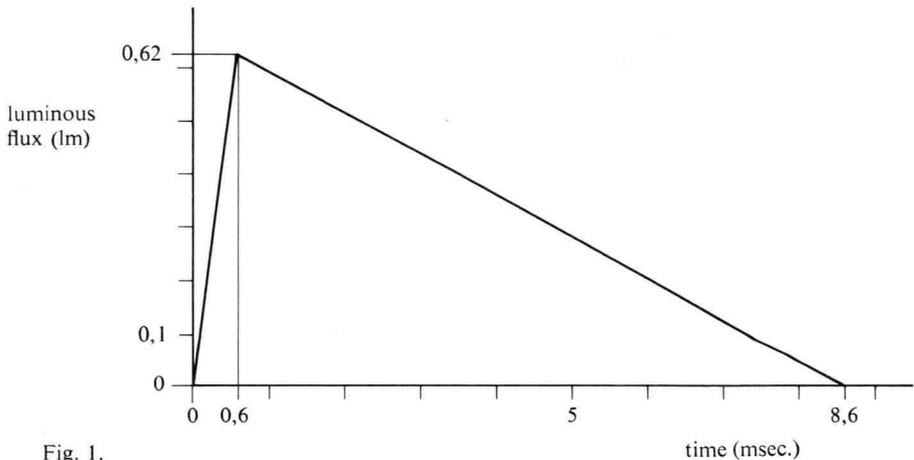


Fig. 1.



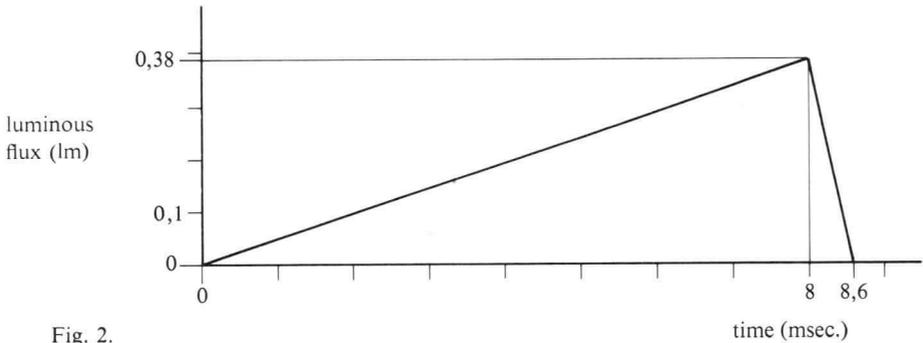


Fig. 2.

An image intensifier when inspected under nominal operating conditions shall meet the specifications (uniformity, spots) when the image intensifier has been subjected to light bursts as generated with the above described test set-ups, each burst at a different spot of the image intensifiers input.

Between the bursts a regeneration time of at least 5 sec. should be allowed for. In this test a burst has to be understood as series of up to 10 light flashes at a rate of 10 per sec.

The image intensifier shall not show any decrease in resolution, when the input illuminance on the photocathode is increased up to 1 lux.



OPERATING CONDITIONS

Supply voltage	min.	2,2	V
	nom.	2,65	V
	max.	3,2	V
Input current	typ.	40	mA
Ambient temperature	min.	-54	°C
	nom.	+20	°C
	max.	+52	°C

LIMITING VALUES

Supply voltage	max.	3,4	V
Input illumination (at extended and uniform exposure)	max.	1,0	lx
	min.	-54	°C
Ambient temperature (operation)	max.	+52	°C
	min.	-54	°C
Ambient temperature (storage)	max.	+40	°C
	max.	60	sec.

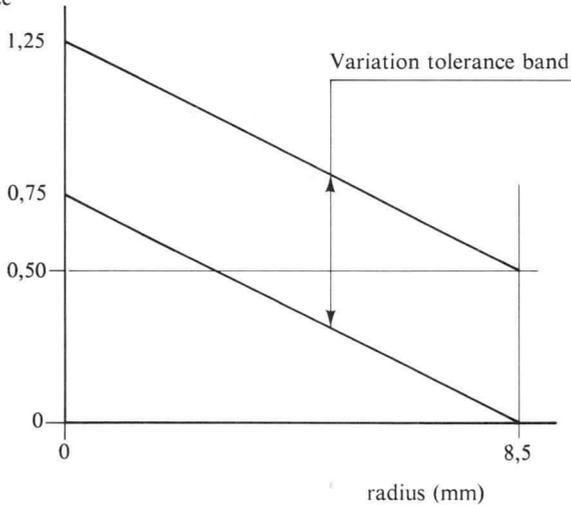


UNIFORMITY

Vignetting and shading

When the input is uniformly illuminated with light with a colour temperature of 2850 K the output luminance uniformity varies; variations in output luminance over a circular input area of \varnothing 17 mm fall within the tolerance band shown below.

Output luminance
(Rel.)



Spots

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within ∅ 5,6 mm	within area bounded by ∅ 5,6 mm and ∅ 14,7 mm	within area bounded by ∅ 14,7 mm and ∅ 17,8 mm
> 375 μm	0	0	0
300—375 μm	0	1	2
225—300 μm	0	3	8
150—225 μm	0	9	18
75—150 μm	3	30	40
< 75 μm	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

Refer to 'General notes' for test methods to check whether the tubes will withstand adverse environmental conditions. These tests, which are based on tests as described in MIL-I-55553 (EL), are adapted to be more practicable.

Other testmethods which differ slightly from D.E.P.'s standardized testmethods can be found in:

a MIL-I-55553 (EL) of 20-02-1970

For

- | | | |
|---------------------------|---|--|
| Vibration test | : | refer to
para 3.10 (requirements) and
para 4.6.4. (test) |
| Shock test | : | refer to
para 3.11 (requirements) and
para 4.6.5. (test) |
| Environmental temperature | : | refer to
para 3.12 (requirements) and
para 4.6.6. (test) |



b A schedule for tests, derived from german military requirements which is specified as follows:

Test	Requirement
Dry heat	DIN 58 390, Bl.2, test cond. 11.1* and 11.2
Low temperature	VG 58 390, Bl.2, test cond. 10.3* and 10.4
Temp. change (slow)	VG 58 390, Bl.2, test cond. 14.2
Temp. shock	VG 58 390, Bl.2, test cond. 15.2
Mech. shock	VG 95210 (V), Bl. 28, test cond. B*
Vibration	VG 95210 (V), Bl. 19, test cond. A

*Test conditions, including operational conditions, are performed without illumination of the image intensifiers input.

NOTE

All radii (r) and diameters (\varnothing) refer to input

POWERSUPPLY CHARACTERISTICS

1 Temperature influences on tube gain.

The influence of environmental temperature has been reduced by using a specially designed powersupply. Changes in tube gain, due to a deviation of the operating temperature from nominal temperature are small compared with gain changes which might occur in tubes fitted with a conventional powersupply. (See also fig. 3.)

2 Gain versus battery life.

The image intensifiers powersupply has been designed to reduce the influence of the battery voltage on tube gain. Since this voltage decreases during battery life, the gain of a conventional tube also decreases.

The XX 1340 powersupply guarantees an almost constant gain even when the battery voltage varies between 3,2 Volts (as with two new 1,5 V batteries) to 2,2 Volts (as with nearly exhausted batteries).

(See also fig. 4 and 5.)



3 ABC and MOB.

The output luminance of XX 1340 tubes will never exceed a maximum of $500 \text{ cd} \cdot \text{m}^{-2}$. This prevents blinding of the observer, which otherwise might occur at high input illuminance levels.

Furthermore, as can be derived from fig. 6, the automatic brightness control (ABC) keeps the output luminance within practical limits at high input illumination.

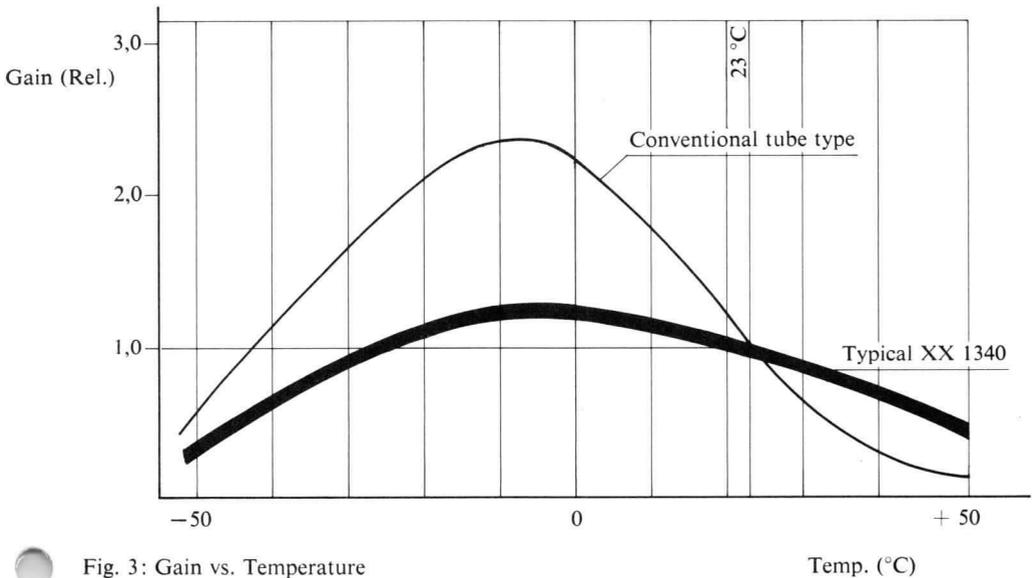


Fig. 3: Gain vs. Temperature



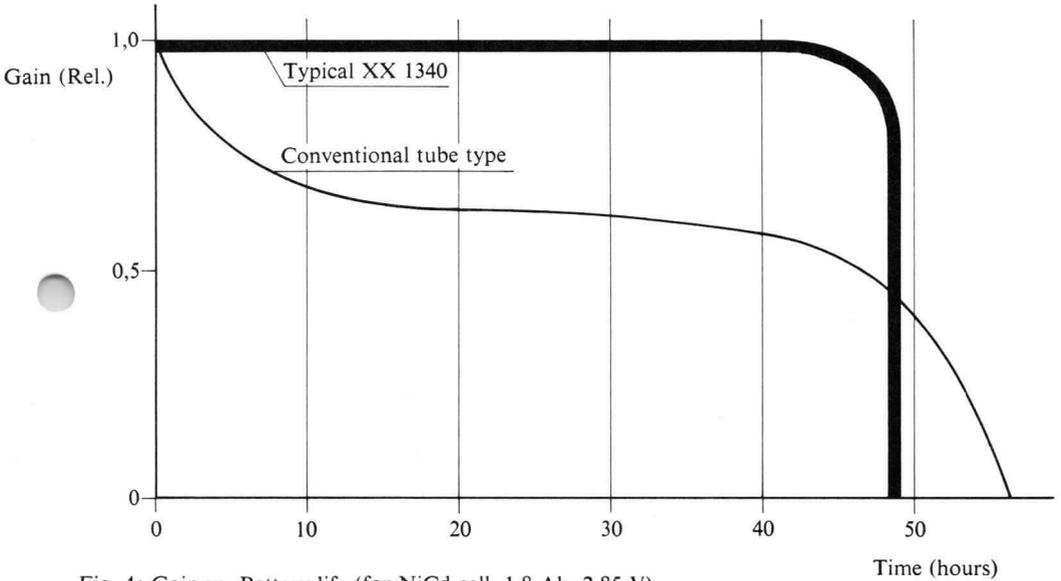


Fig. 4: Gain vs. Battery life (for NiCd cell, 1.8 Ah, 2,85 V)

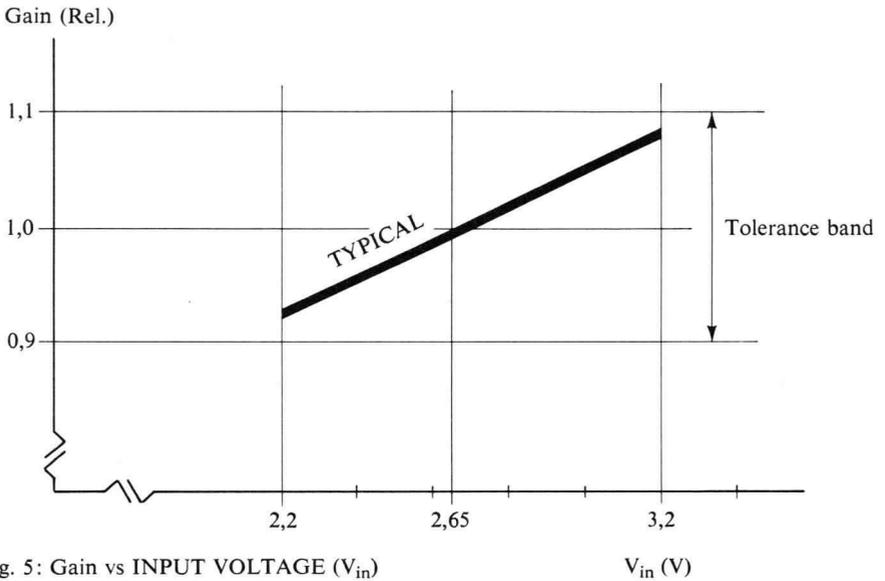


Fig. 5: Gain vs INPUT VOLTAGE (V_{in})

V_{in} (V)



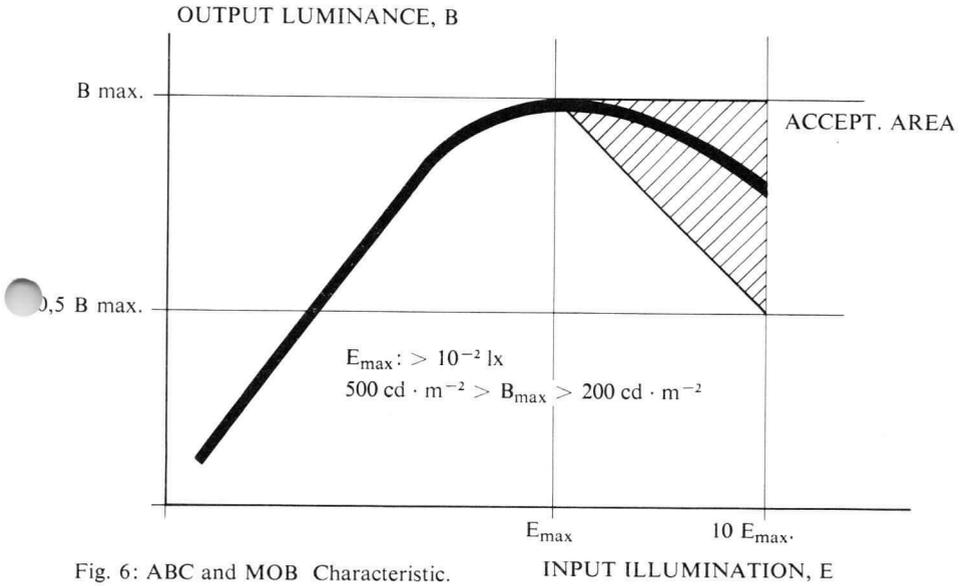
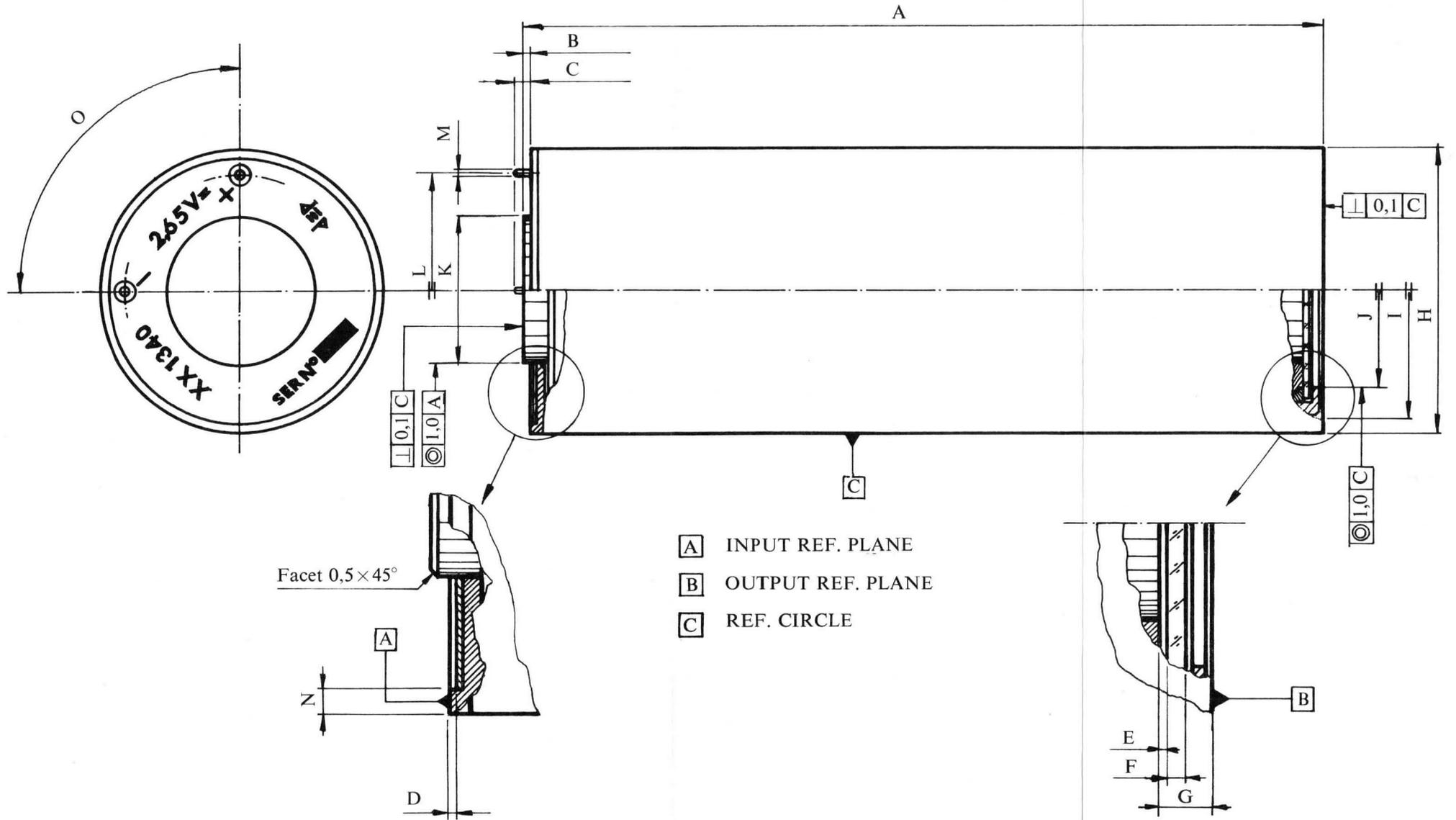


Fig. 6: ABC and MOB Characteristic.



	min.	max.	note
A	145	150	
B	0,69	0,83	
C	1,8	2,8	
D	0,1	—	
E	—	0,3	
F	1,6	1,7	$n_d = 1,52$
G	3,3	3,7	
H	∅ 52,6	∅ 52,8	
I	∅ 46,7	∅ 46,9	
J	∅ 35,3	∅ 35,7	
K	—	26,8	
L	∅ 42,6	∅ 43,0	
M	∅ 1,47	∅ 1,57	(2x)
N	0,8	1,4	
O	89°	91°	





QUICK REFERENCE DATA

Electrostatically focussed three-stage tube with fibre-optic input and protected fibre-optic output window and with built-in power supply.

Useful input and output diameter	25 and 25 mm
Minimum luminance gain	$16.000 \cdot \text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	6,75 V
Overall dimensions (approx. length & diam.)	$195 \times 70 \text{ mm}$
Weight (approx.)	900 g

INPUT

Fibre-optic window		
Useful diameter		25 mm
Numerical aperture		1
Photocathode		S 25
Input sensitivity (measured on $\varnothing 19 \text{ mm}$)		
at 2850 K	min.	$275 \mu\text{A} \cdot \text{lm}^{-1}$
at 800 nm	min.	$20 \text{ mA} \cdot \text{W}^{-1}$
at 850 nm	min.	$10 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Protected fibre-optic window		
Useful diameter		25 mm
Numerical aperture		1
Phosphor		P 20
Screen output colour		green/yellow
Screen persistence		medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 19 mm, 2850 K, input illumination max. 10^{-3} lux)	min.	16.000 cd \cdot m $^{-2}$ \cdot lx $^{-1}$
Resolution		
on axis	min.	30 lp/mm $^{-1}$
at r = 7 mm	min.	28 lp/mm $^{-1}$
Modulation transfer (on axis)		
at 7,5 lp/mm	min.	60 %
at 16,01 lp/mm	min.	20 %
Magnification (on axis)	min.	0,82
	max.	1,0
Distortion (r = 10 mm)	max.	25 %
Equivalent background illumination (\varnothing 19 mm, 2850 K)	max.	0,2 μ lx
Axial eccentricity	max.	0,75 mm
Uniformity		see page 3

FLASH PROTECTION

No data were available at the date of publishing.

Contact D.E.P. if information is required.

AL/1977/3
Annex PT
- 42 -



OPERATING CONDITIONS

Supply voltage	nom.	6,75 V
Input current	typ.	25 mA
Ambient temperature	min.	-35 °C
	nom.	+20 °C
	max.	+35 °C

LIMITING VALUES

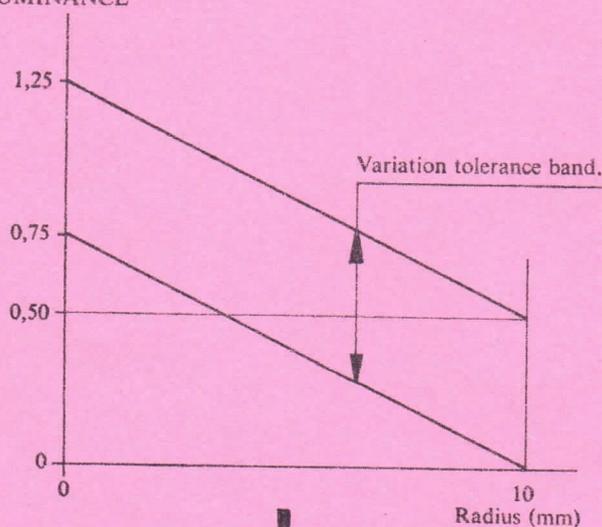
Supply voltage	min.	6,50 V
	max.	6,75 V
Input illumination (at extended and uniform exposure)	max.	1 lx
Ambient temperature (operation)	min.	-54 °C
	max.	+68 °C
Ambient temperature (storage)	min.	-35 °C
	max.	+35 °C

UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K the output luminance uniformity varies; variations in output luminance over a circular area \varnothing 20 mm fall within the tolerance band shown below.

OUTPUT LUMINANCE

(Rel.)



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 % is less or equal to the numbers indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot the two spots are considered as one spot.

size of spots on output	maximum number of spots		
	within \varnothing 7,6 mm	within area bounded by \varnothing 7,6 mm and \varnothing 20,5 mm	within area bounded by \varnothing 20,5 mm and \varnothing 24,8 mm
$> 375 \mu\text{m}$	0	0	0
300—375 μm	0	1	2
225—300 μm	0	3	8
150—225 μm	0	12	26
75—150 μm	3	minimal	minimal
$< 75 \mu\text{m}$	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

general notes

NOTE

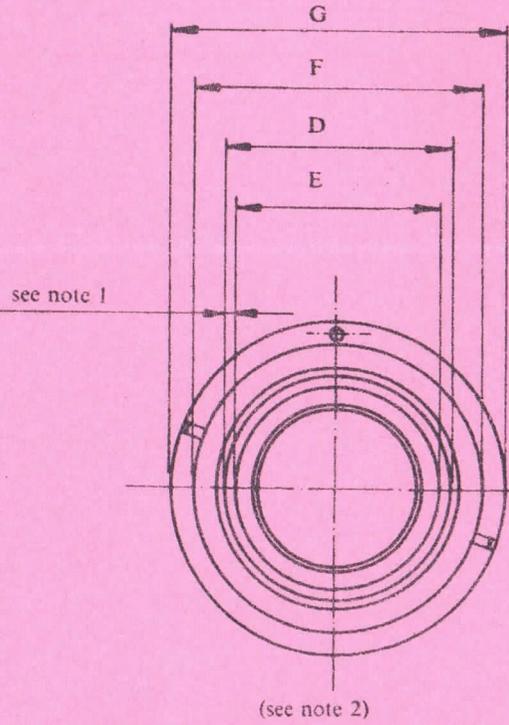
All radii (r) and diameters (\varnothing) refer to input.

AL/1977/3
Annex PT
- 43 -

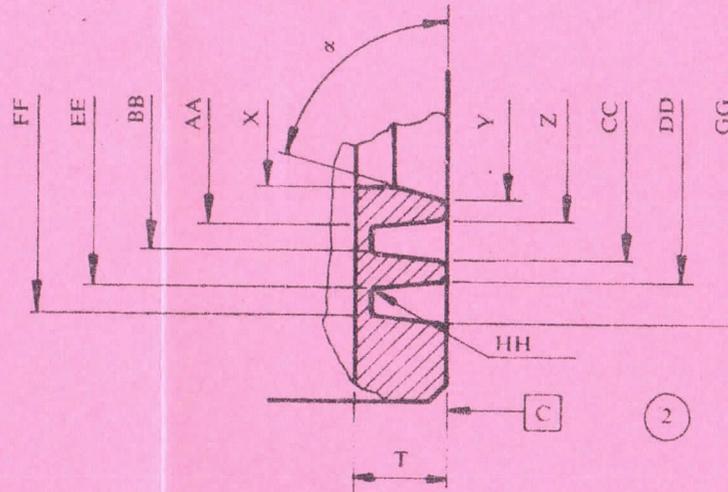
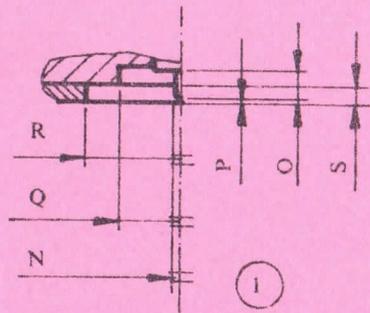
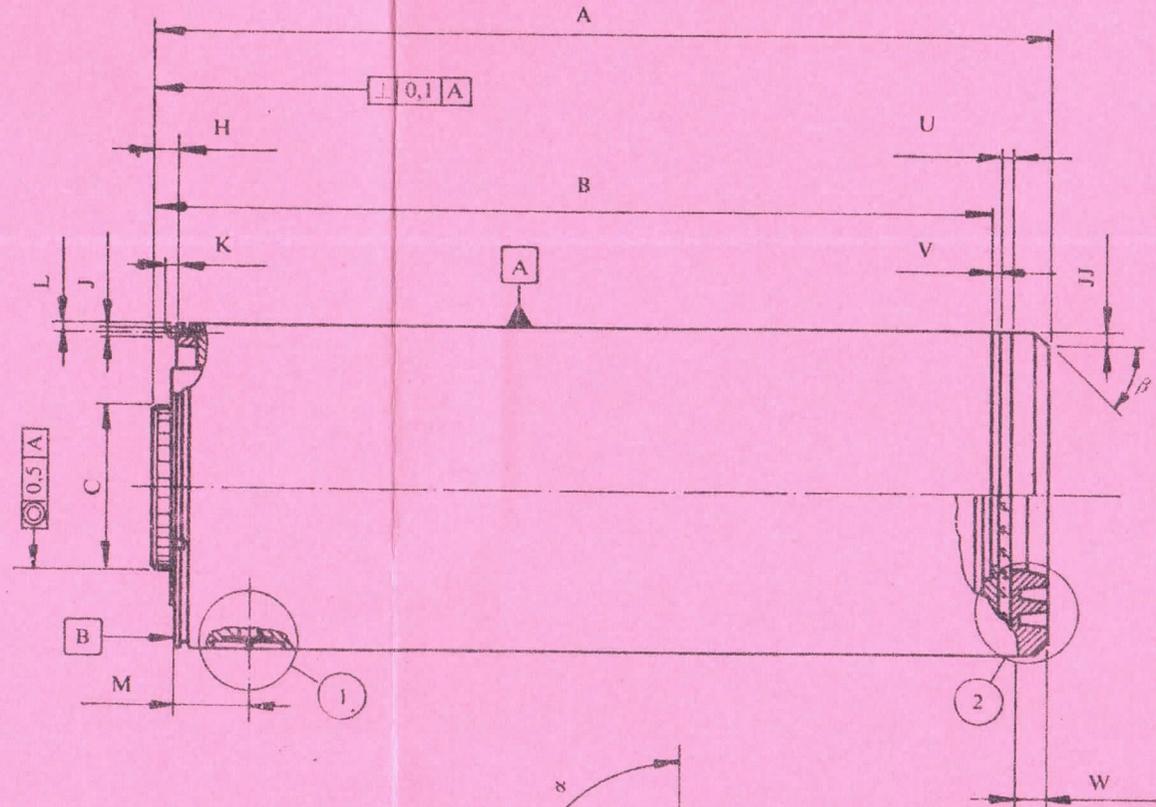


	min.	max.	note
A	192,23	195,17	
B	180,67	182,96	
C	∅ 35,43	∅ 35,69	
D	∅ 47,24	∅ 48,26	
E	∅ 42,2	∅ 43,4	
F	∅ 61,0	∅ 61,2	
G	∅ 69,60	∅ 69,85	
H	6,02	6,17	
J	∅ 2,21	∅ 2,36	
K	2,41	2,54	
L	1,57	1,83	
M	15,38	16,38	
N	∅ 0,97	∅ 1,09	
O	2,27	2,47	
P	0	0,3	
Q	∅ 9,81	∅ 10,01	
R	∅ 15,75	∅ 16,01	
S	1,47	1,67	
T	7,30	7,80	
U	2,20	2,60	
V	1,40	1,54	
W	6,30	6,50	
X	∅ 32,75	∅ 33,0	
Y	∅ 35,25	∅ 35,35	
Z	∅ 38,35	∅ 38,6	
AA	∅ 39,50	∅ 39,75	
BB	∅ 44,75	∅ 45,15	
CC	∅ 45,85	∅ 46,25	
DD	∅ 48,80	∅ 49,20	
EE	∅ 49,90	∅ 50,30	
FF	∅ 55,30	∅ 55,70	
GG	∅ 56,35	∅ 56,80	
HH		0,3	nom.
JJ		1,5	nom.
α	70°	80°	
β		45°	nom.





note 1: metal flange for ground contact
 note 2: locating pin $180^\circ \pm 0,5$ from contact pin



A REFERENCE CIRCLE
B INPUT REF. PLANE
C OUTPUT REF. PLANE

QUICK REFERENCE DATA

Electrostatically focussed tube with fibre-optic input and glass output window.

The tube is protected against visible defects resulting from local high light intensities of short duration which may occur when detonations of armour piercing ammunition are imaged on the photocathode while the tube operates under otherwise nominal conditions.

Useful input and output diameter	18 mm and 7 mm resp.
Minimum luminance gain	$220 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	12 kV
Overall dimensions (approx. length & diam.)	48 mm and 50 mm
Weight (Approx.)	70 g

INPUT

Fibre-window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 12,7 \text{ mm}$)

at 2850 K min. $250 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $15 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $10 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Useful diameter 7 mm

Refractive index n_d see outline drawing

Window thickness see outline drawing

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2280 K,
input illumination max. 10^{-2} lux) min. 220 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$

Resolution

on axis typ. 100 $\text{lp} \cdot \text{mm}^{-1}$

at $r = 7$ mm typ. 90 $\text{lp} \cdot \text{mm}^{-1}$

Modulation transfer

at 12,5 lp/mm min. 80 %

at 25 lp/mm min. 58 %

at 50 lp/mm min. 25 %

at 75 lp/mm min. 9 %

Magnification (on axis) min. 0,37

max. 0,38

Distortion (at $r = 7,0$ mm) max. 6 %

Equivalent background illumination typ. 0,2 μx

(\varnothing 12,7 mm, 2850 K) max. 0,6 μx

provided the background is
uniform and stable

Axial eccentricity max. 0,5 mm

Uniformity see pag. 3

AL/1977/3
Annex PT
- 46 -



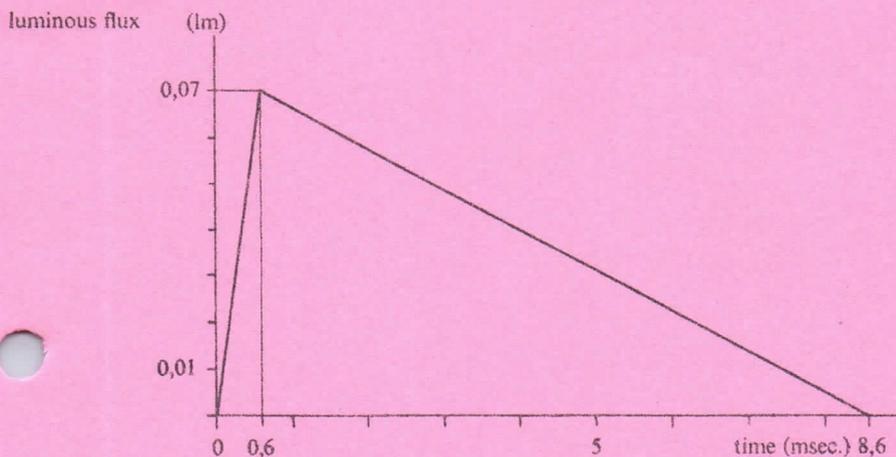
FLASH PROTECTION

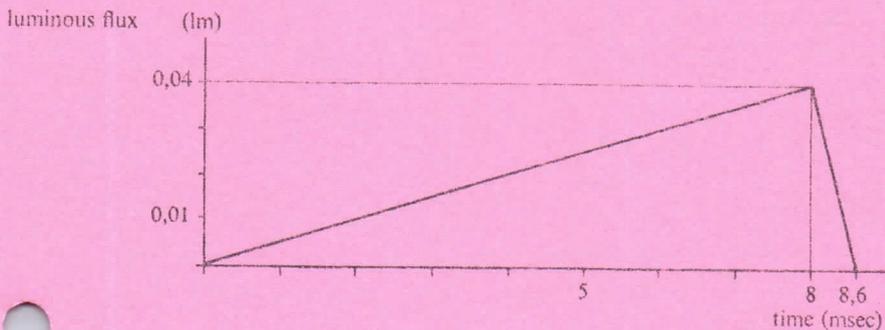
In order to simulate the light bursts of high intensity and short duration which may occur at the detonation of armour piercing ammunition, laboratory tests for the inspection of the image intensifier's ability to withstand the adverse effects of such a light burst have been defined as follows:

A $2 \times 3,5$ mm filament of a 100 Watt quartz-iodine lamp, operating at simulated colour temperatures of either 3500 K or 2500 K is imaged on the photocathode of the image intensifier resulting in an image area of approx.

1 mm² and a luminous flux of approx. 0,07 lm (at 3500 K) or 0,04 lm (at 2500 K).

The flashes are generated with a shutter disc, operating in the light beam, giving light pulses of approx. 8,6 msec. duration. The pulses shall have a triangular shape and either a short rise time of 0,6 msec. (at 3500 K) or a long rise time of approx. 8,0 msec. (at 2500 K); see fig. 1 and fig. 2.





An image intensifier when inspected under nominal operating conditions shall meet the specifications (uniformity, spots) when the image intensifier has been subjected to light bursts as generated with the above described test set-up, each burst at a different spot of the image intensifiers input.

Between the bursts a regeneration time of at least 5 sec. should be allowed for. In this test a burst has to be understood as series up to 10 light flashes at a rate of 10 per sec.

The image intensifier shall not show any decrease in resolution, when the input illuminance on the photocathode is increased up to 1 lux.

AL/1977/3
Annex PT
- 47 -



NOMINAL OPERATING CONDITIONS

Supply voltage		12 kV
Ambient temperature	nom.	+20 °C

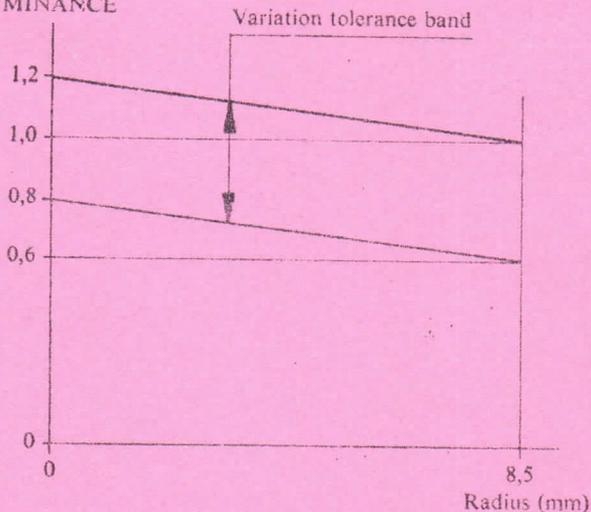
LIMITING VALUES

Supply voltage	max.	14 kV
Input illumination (at extended and uniform exposure)	max.	1 lx
Ambient temperature (operation)	min.	-54 °C
	max.	+52 °C
Ambient temperature (storage)	min.	-54 °C
	max.	+40 °C

UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K the output luminance uniformity varies; variations in output luminance over a circular input area \varnothing 17 mm fall within the tolerance band shown below.

OUTPUT LUMINANCE
(Rel.)



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.

AL/1977/3
Annex PT
- 48 -



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
>90 μ m	0	0	0
60—90 μ m	1	2	3
30—60 μ m	2	minimal	minimal
<30 μ m	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

See general notes.

The relative humidity however, shall not exceed 50 % at any environmental test.

NOTES:

- 1 All radii (r) and diameters (\varnothing) refer to input.
- 2 In the case an anode coverglass with different physical properties and/or different dimensions is required, it is advisable to contact the manufacturer.

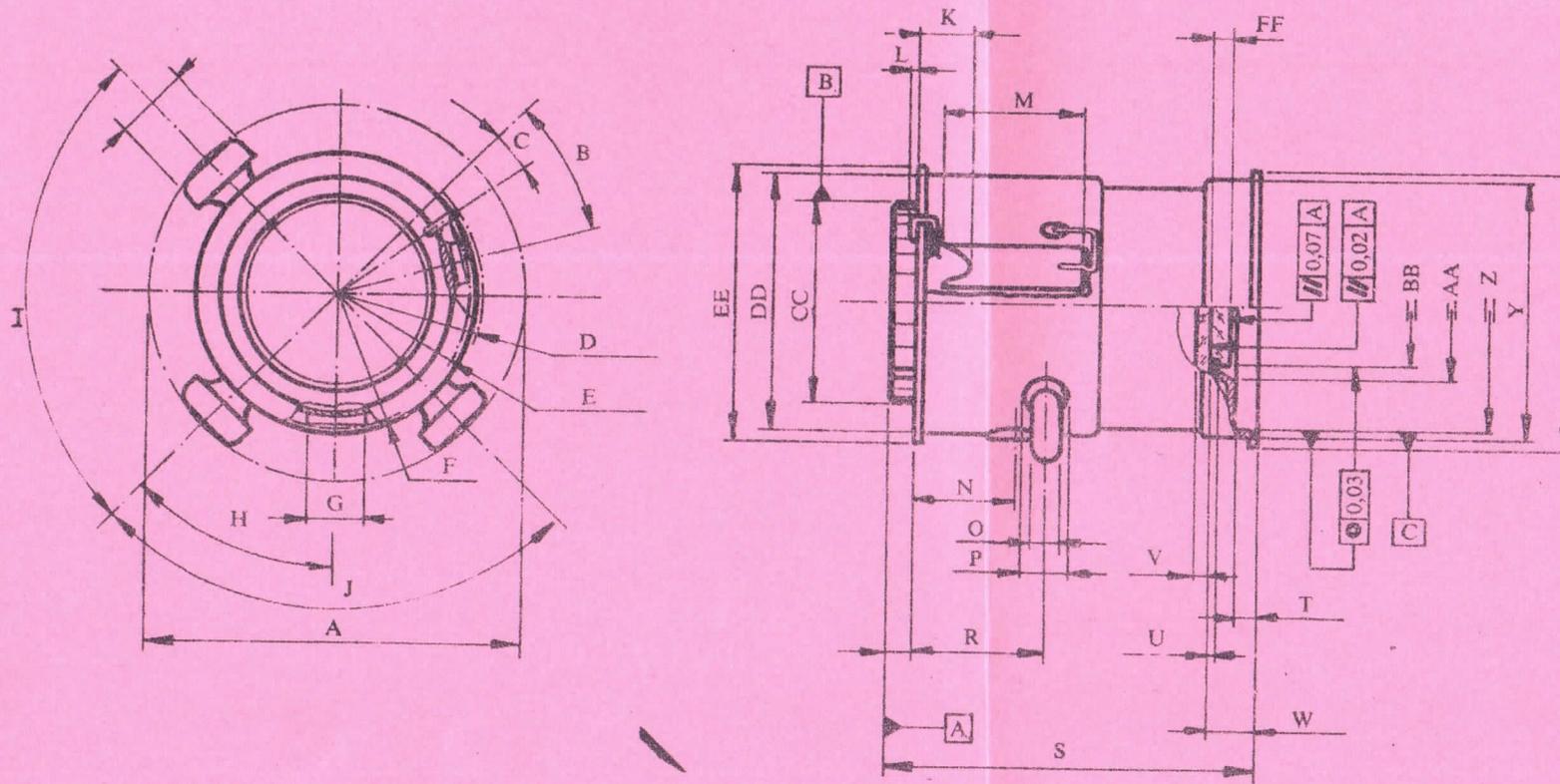
AL/1977/3
Annex PT

- 49 -



	min.	max.	note
A	—	∅ 50,0	
B	25°	30°	
C	—	10°	nom.
D	—	R = 19,6	
E	—	R = 18,6	
F	—	R = 18,5	
G	—	∅ 8,0	
H	43°	47°	
I	87°	93°	
J	87°	93°	
K	—	5,0	
L	1,0	1,3	
M	—	20	nom.
N	—	14,1	
O	3,6	3,8	
P	—	6,5	3 x
Q	2,5	3,5	
R	16,7	17,9	
S	47,5	48,9	
T	3,5	4,2	
U	—	0,9	
V	1,2	1,3	ZK 1 (533 580)
W	7,1	7,8	
X	∅ 36,7	∅ 37,7	
Y	∅ 33,9	∅ 34,3	
Z	∅ 31,0	∅ 31,4	
AA	∅ 18,5	∅ 19,5	
BB	∅ 11,5	∅ 11,7	
CC	∅ 26,6	∅ 26,7	
DD	∅ 33,9	∅ 34,3	
EE	∅ 36,7	∅ 37,7	
FF	∅ 2,3	∅ 2,5	F 11 (533 580)
GG	11,5	11,7	





- A REFERENCE PLANE
- B REFERENCE CIRCLE
- C REFERENCE CIRCLE

AL/1977/3
 Annex PT
 - 51 -



QUICK REFERENCE DATA

Electrostatically focussed distortion corrected two stage tube with fibre-optic input and glass output window.

Useful input and output diameter	18 and 7 mm resp.
Minimum luminance gain	$5700 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	2,65 V
Overall dimensions (approx. length & diam.)	$104 \times 54 \text{ mm}$
Weight (approx.)	300 g

INPUT

Fibre-optic window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 12,7 \text{ mm}$)

at 2850 K min. $225 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $15 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $10 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Useful diameter 7 mm

refractive index n_d see outline drawing

Window thickness see outline drawing

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2850 K, min. 5700 cd · m⁻² · lx⁻¹
input illuminance max. 10⁻³ lux)

Resolution

on axis typ. 70 lp · mm⁻¹

at r = 7 mm typ. 60 lp · mm⁻¹

Modulation transfer

at 12.5 lp/mm min. 75 %

at 25 lp/mm min. 45 %

at 50 lp/mm min. 10 %

Magnification (on axis) min. 0,35

max. 0,37

Distortion (at 7,10 mm) max. 7,5 %

Equivalent background illumination

(\varnothing 12,7 mm, 2850 K) max. 0,2 μ lx

Axial eccentricity max. 0,5 mm

Uniformity see page 3

OPERATING CONDITIONS

Supply voltage 2,65 V

Input current typ. 30 mA

max. 50 mA

Ambient temperature +20 °C

LIMITING VALUES

Supply voltage min. 2,0 V

max. 3,0 V

Input illumination (at extended and uniform exposure) max. 1 lx

Ambient temperature (operation) min. -54 °C

max. +52 °C

Ambient temperature (storage) min. -54 °C

max. +40 °C

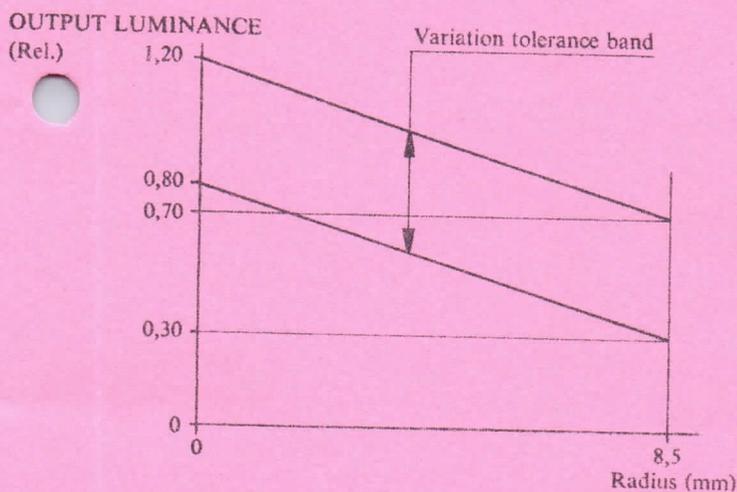
Reverse polarity time max. 60 sec.



PL 1272/3
 Annex PT
 - 52 -

UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K, the output luminance uniformity varies; variations in output luminance over a circular input area \varnothing 17 mm fall within the tolerance band shown below.



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
$>150 \mu\text{m}$	0	0	0
120—150 μm	0	1	2
90—120 μm	0	3	8
60—90 μm	0	9	18
30—60 μm	3	minimal	minimal
$< 30 \mu\text{m}$	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

See general notes

NOTE

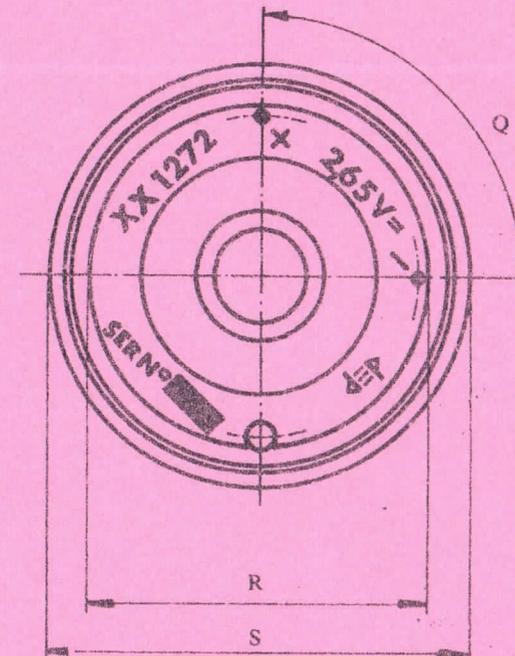
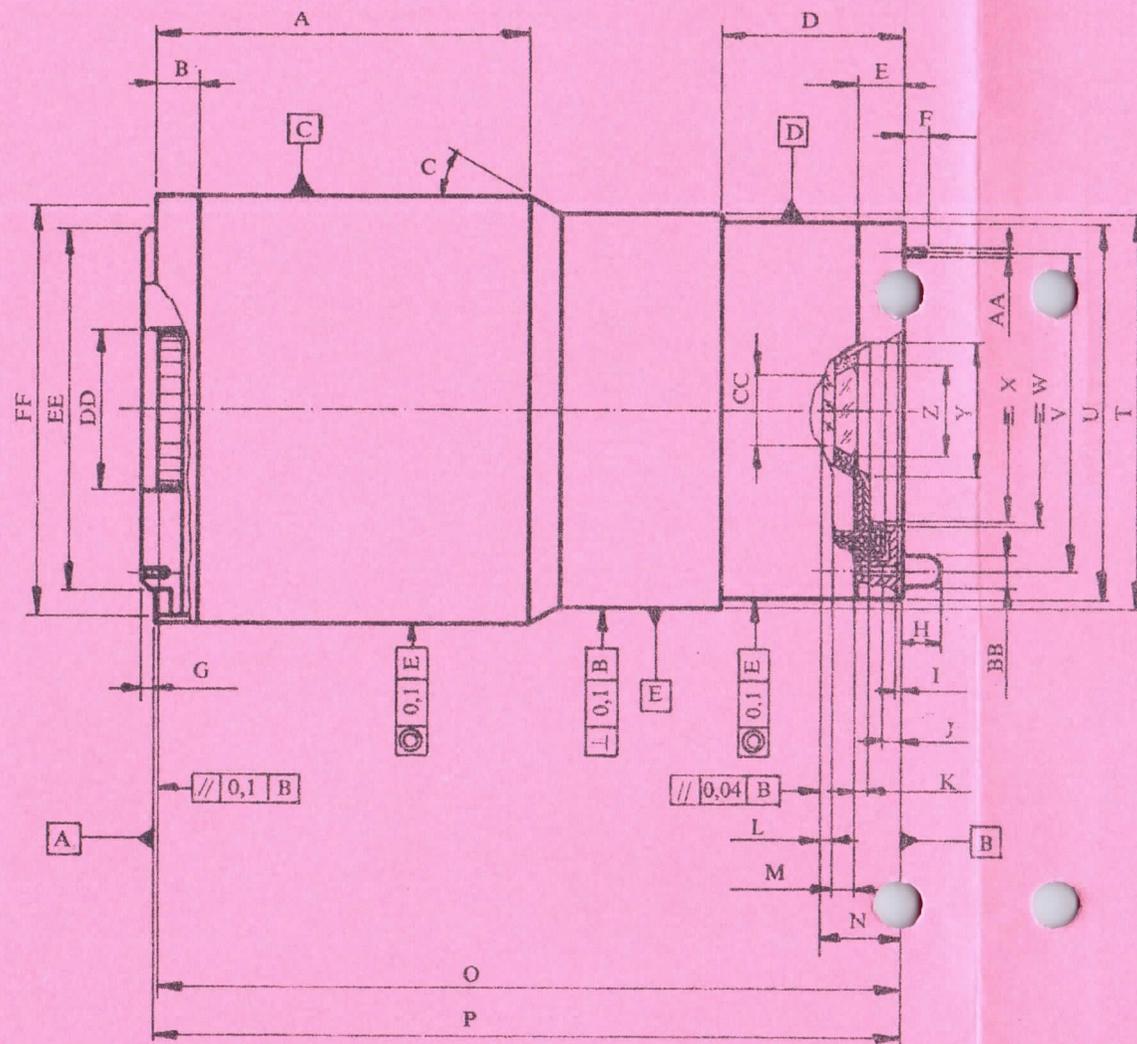
All radii (r) and diameters (\varnothing) refer to input.

AL/1977/3
Annex PT
- 53 -



	min.	max.	note
A	49,5	50,5	
B	6	—	
C	25°	35°	
D	24	25	
E	6,4	7,0	
F	3,3	3,9	
G	—	2,1	
H	5,3	5,7	
I	0,15	—	
J	2,6	—	
K	—	1,9	
L	1,27	1,30	$n_d = 1,535$
M	3,18	3,23	$n_d = 1,856$
N	10,01	10,07	
O	98,5	101,0	
P	99,0	100,0	
Q	89°	91°	
R	∅ 45,0	∅ 45,6	
S	∅ 56,3	∅ 56,7	
T	—	∅ 52,05	
U	∅ 49,2	∅ 49,4	
V	∅ 42,0	∅ 42,4	
W	∅ 31,0	∅ 31,4	
X	∅ 29,0	—	
Y	∅ 17,5	—	
Z	∅ 12,3	∅ 12,5	
AA	∅ 1,00	∅ 1,10	
BB	∅ 3,9	∅ 4,0	
CC	∅ 9,8	∅ 10	
DD	∅ 21	—	
EE	—	∅ 47	
FF	∅ 53,8	∅ 54,2	





- A INPUT REF. PLANE
- B OUTPUT REF. PLANE
- C INPUT REF. CIRCLE
- D OUTPUT REF. CIRCLE



QUICK REFERENCE DATA

Electrostatically focussed distortion corrected two-stage tube with fibre-input and glass output window. The tube is protected against visible defects resulting from local high light intensities of short duration which may occur when detonations of armour piercing ammunition are imaged on the photocathode while the tube operates under otherwise nominal conditions.

Useful input and output diameter	18 and 7 mm resp.
Minimum luminance gain	5700 cd · m ⁻² · lx ⁻¹
Supply voltage	2,65 V
Overall dimensions (approx. length & diam.)	104 × 54 mm
Weight (approx.)	300 g

INPUT

Fibre-optic window	
Useful diameter	18 mm
Numerical aperture	1
Photocathode	S 25
Input sensitivity (measured on ø 12,7 mm)	
at 2850 K	min. 225 μA · lm ⁻¹
at 800 nm	min. 15 mA · W ⁻¹
at 850 nm	min. 10 mA · W ⁻¹

OUTPUT

Glass window	
Useful diameter	7 mm
Refractive index n _d	see outline drawing
Window thickness	see outline drawing
Phosphor	P 20
Screen output colour	green/yellow
Screen persistence	medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2850 K, input illuminance max. 10^{-3} lux)	min.	5700 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution		
on axis	typ.	70 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 7$ mm	typ.	60 $\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer		
at 12,5 lp/mm	min.	75 %
at 25 lp/mm	min.	50 %
at 50 lp/mm	min.	10 %
Magnification (on axis)	min.	0,35
	max.	0,37
Distortion (at $r = 7,0$ mm)	max.	7,5 %
Equivalent background illumination (\varnothing 12,7 mm, 2850 K)	max.	0,2 μlx
Axial eccentricity	max.	0,5 mm
Uniformity		see page 3

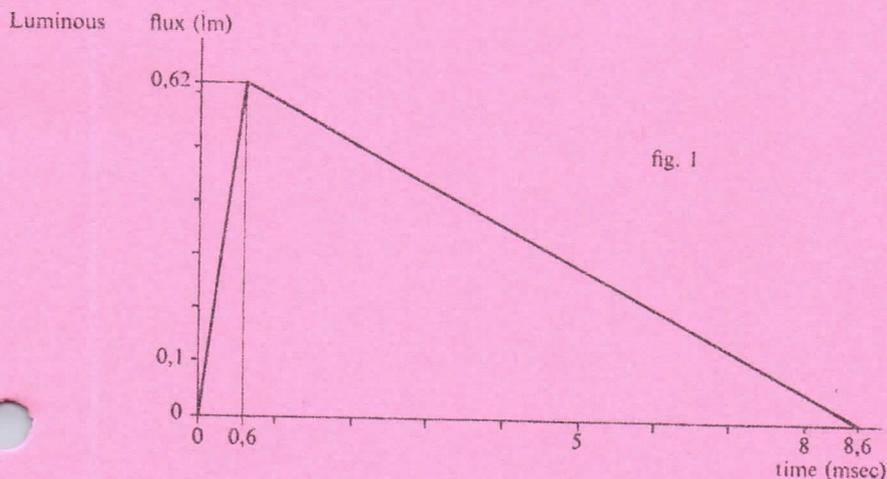
AL/1977/3
Annex PT
- 56 -

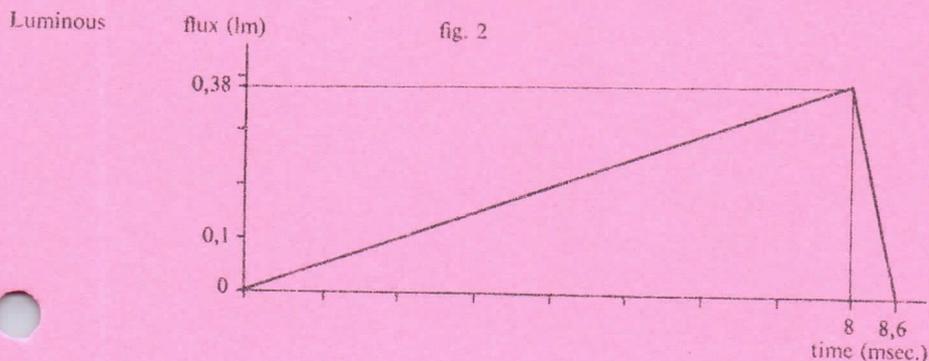


FLASH PROTECTION

In order to stimulate in laboratory tests the light bursts of high intensity and short duration which may occur at the detonation of armour piercing ammunition in order to inspect the image intensifiers ability to withstand the adverse effects of such light bursts, test set-ups have been defined as follows:

A $2 \times 3,5$ mm filament of a 100 Watt quartz-iodine lamp, operating at simulated colour temperatures of either 3500 K or 2500 K is imaged on the photocathode of the image intensifier resulting in an image area of $0,3 \text{ mm}^2 \pm 0,1 \text{ mm}^2$ and a luminous flux of approx. 0,62 lm (at 3500 K) or 0,38 lm (at 2500 K). The flashes are generated with a shutter disc, operating in the light beam, giving light pulses of approx. 8,6 msec. duration. The pulses shall have a triangular shape and either a short rise time of 0,6 msec. (at 3500 K) or a long rise time of approx. 8,0 msec. (at 2500 K); see fig. 1 and fig. 2.





An image intensifier when inspected under nominal operating conditions shall meet the specifications (uniformity, spots) when the image intensifier has been subjected to light bursts as generated with the above described test set-up, each burst at a different spot of the image intensifiers input.

Between the bursts a regeneration time of at least 5 sec. should be allowed for. In this test a burst has to be understood as series of up to 10 light flashes at a rate of 10 per sec.

The image intensifier shall not show any decrease in resolution, when the input illuminance on the photocathode is increased up to 1 lux.

AL/1977/3
Annex PT
- 57 -



OPERATING CONDITIONS

Supply voltage		2,65 V
Input current	typ.	30 mA
	max.	50 mA
Ambient temperature		+20 °C

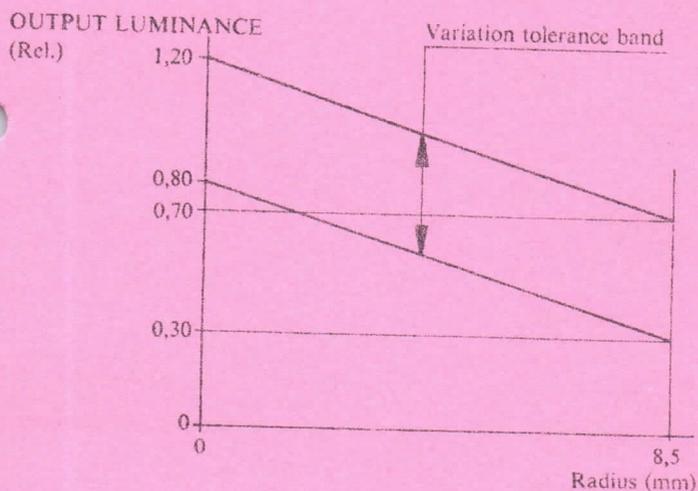
LIMITING VALUES

Supply voltage	min.	2,0 V
	max.	3,0 V
Input illumination (at extended and uniform exposure)	max.	1 lx
Ambient temperature (operation)	min.	-54 °C
	max.	+52 °C
Ambient temperature (storage)	min.	-54 °C
	max.	+40 °C
Reverse polarity time	max.	60 sec.



UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light with a colour temperature 2850 K, the output luminance uniformity varies; variations in output luminance over a circular input area $\varnothing 17$ mm fall within the tolerance band shown below.



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, is less or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
> 150 μm	0	0	0
120—150 μm	0	1	2
90—120 μm	0	3	8
60—90 μm	0	9	18
30—60 μm	3	minimal	minimal
< 30 μm	minimal	minimal	minimal

AL/1977/3
Annex PT

ENVIRONMENTAL CONDITIONS

- 59 -

See general notes

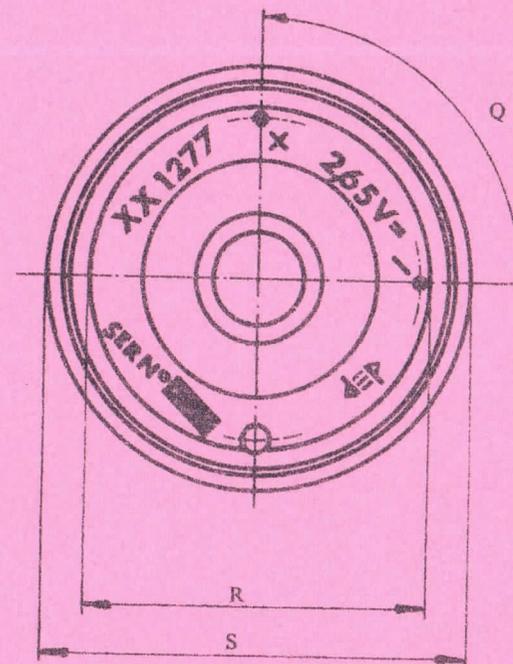
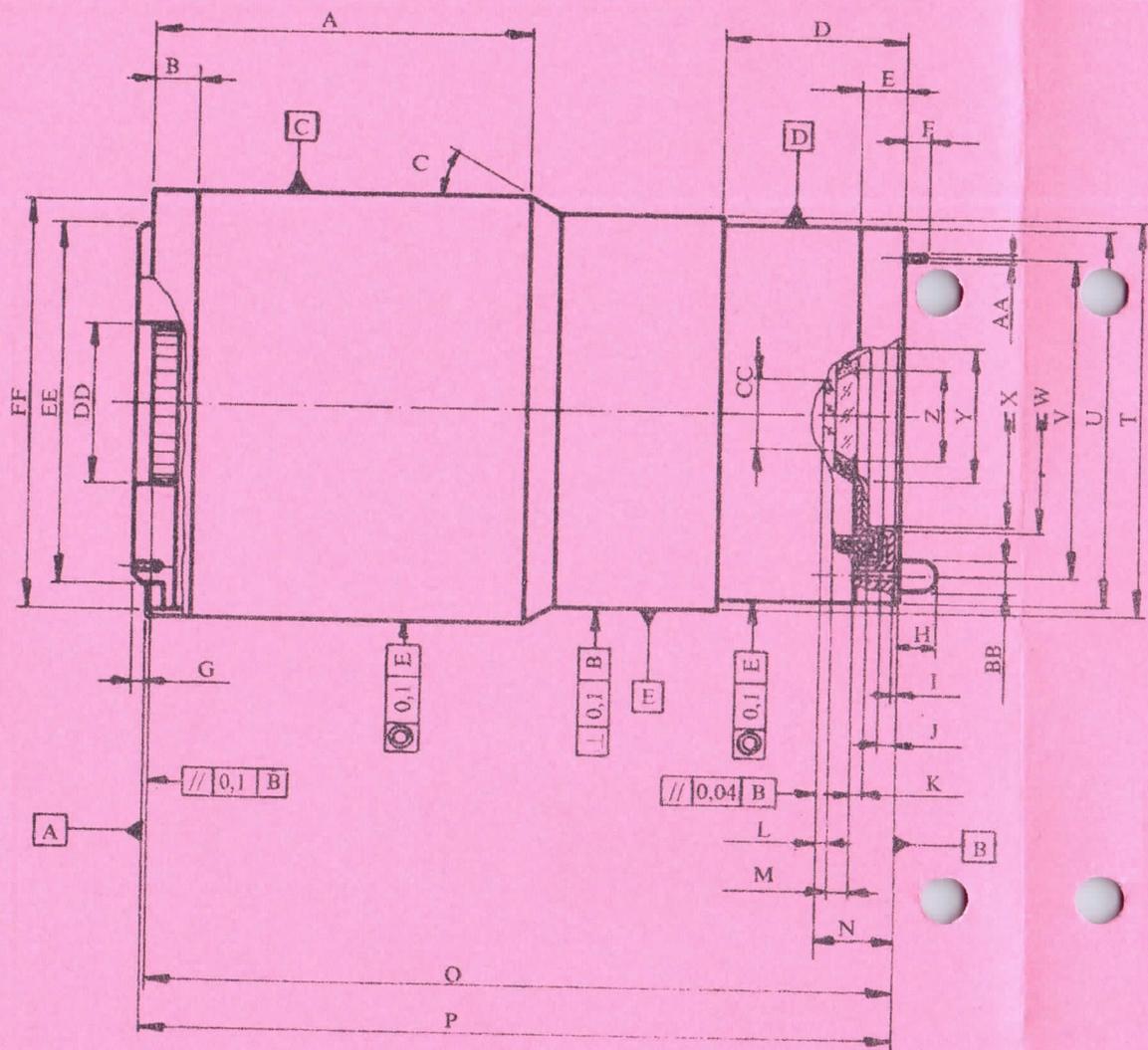
NOTE

All radii (r) and diameters (\varnothing) refer to input.



	min.	max.	note
A	49,5	50,5	
B	6	—	
C	25°	35°	
D	24	25	
E	6,4	7,0	
F	3,3	3,9	
G	—	2,1	
H	5,3	5,7	
I	0,15	—	
J	2,6	—	
K	—	1,9	
L	1,27	1,30	$n_d = 1,535$
M	3,18	3,23	$n_d = 1,856$
N	10,01	10,07	
O	98,5	101,0	
P	99,0	100,0	
Q	89°	91°	
R	∅ 45,0	∅ 45,6	
S	∅ 56,3	∅ 56,7	
T	—	∅ 52,05	
U	∅ 49,2	∅ 49,4	
V	∅ 42,0	∅ 42,4	
W	∅ 31,0	∅ 31,4	
X	∅ 29,0	—	
Y	∅ 17,5	—	
Z	∅ 12,3	∅ 12,5	
AA	∅ 1,00	∅ 1,10	
BB	∅ 3,9	∅ 4,0	
CC	∅ 9,8	∅ 10	
DD	∅ 21	—	
EE	—	∅ 47	
FF	∅ 53,8	∅ 54,2	





- [A] INPUT REF. PLANE
- [B] OUTPUT REF. PLANE
- [C] INPUT REF. CIRCLE
- [D] OUTPUT REF. PLANE

AL/19/7/3
Annex PT
- 61 -



QUICK REFERENCE DATA

Electrostatically focussed tube with fibre-optic input and glass output window.

Useful input and output diameter	40 and 13 mm
Minimum luminance gain	$450 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	16 kV
Overall dimensions	$\varnothing 78 \times 81 \text{ mm}$
Weight (approx.)	250 g

INPUT

Fibre-optic window

Useful diameter 40 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 28 \text{ mm}$)

at 2850 K min. $200 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $13 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $8 \text{ mA} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Refractive index n_d see outline drawing

Central window thickness see outline drawing

Useful diameter 13 mm

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 28 mm, 2850 K, input illuminance max. 10^{-2} lux)	min.	450 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution		
on axis	typ.	95 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 10$ mm	typ.	95 $\text{lp} \cdot \text{mm}^{-1}$
at $r = 20$ mm	typ.	70 $\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer		
at 0,5 lp/mm	min.	80 %
at 15 lp/mm	min.	55 %
at 50 lp/mm	min.	20 %
Veiling glare	max.	7,5 %
Magnification (on axis)	min.	0,285
	max.	0,295
Distortion (at $r = 16$ mm)	max.	7,5 %
Equivalent background illumination (\varnothing 28 mm, 2850 K)	typ.	0,2 μlx
	max.	0,4 μlx
		provided the background is uniform and stable
Axial eccentricity	max.	0,5 mm

NOMINAL OPERATING CONDITIONS

Supply voltage	16 kV
Ambient temperature	+20 °C

AL/1977/3
Annex PT
- 62 -



LIMITING VALUES

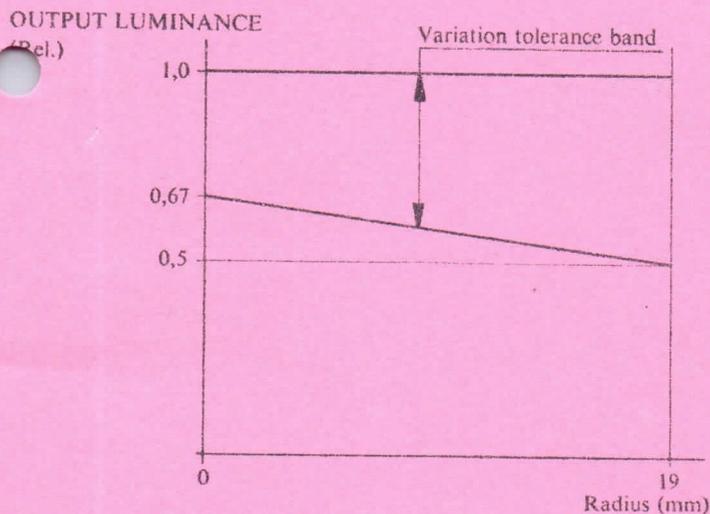
Supply voltage	max.	18 kV
Ambient temperature (operational)	min.	-54 °C
	max.	+52 °C
Ambient relative humidity (operational)		50 %
	min.	-54 °C
Ambient temperature (storage)	max.	-40 °C
	max.	1 lx



UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light having a colour temperature of 2850 K, the output luminance varies less than 1 to 0,5 over a circular input area \varnothing 38 mm.

On axis the output luminance is more than 0,67 times the maximum luminance. The variations in output luminance fall within the tolerance area shown below.



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 %, less or equal to the numbers indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.

AL/1977/3
Annex PT
- 63 -



size of spots on output	maximum number of spots		
	within \varnothing 15 mm	within area bounded by \varnothing 15 mm and \varnothing 30 mm	within area bounded by \varnothing 30 mm and \varnothing 40 mm
>125 μ m	0	0	0
100—125 μ m	0	1	1
75—100 μ m	1	2	4
50— 75 μ m	2	5	9
25— 50 μ m	3	minimal	minimal
< 25 μ m	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

Shocks

See general notes

Vibration

See general notes

Temperature

See general notes. The operational tests, steps 2 and 5, shall be excluded. The relative humidity at +54 °C shall not exceed 50%.



NOTES

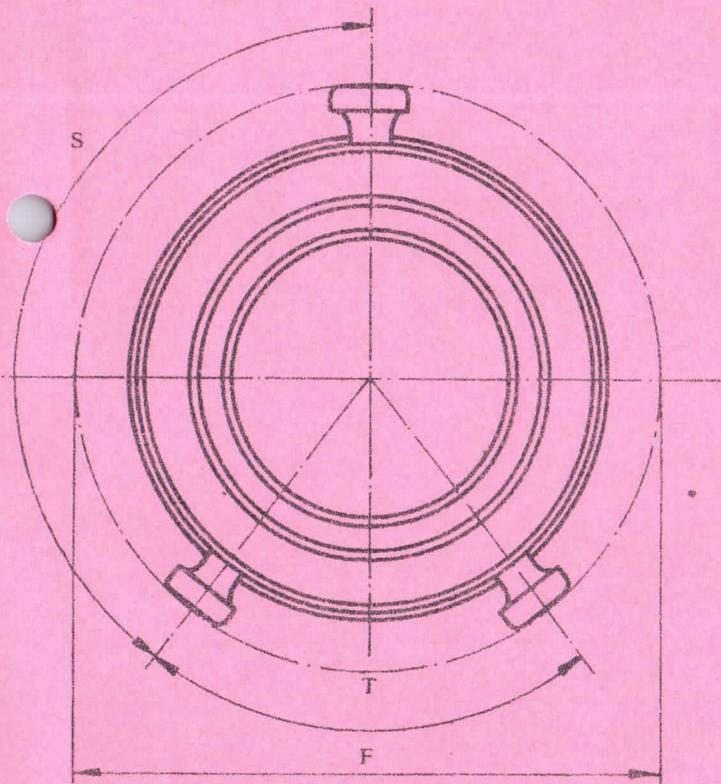
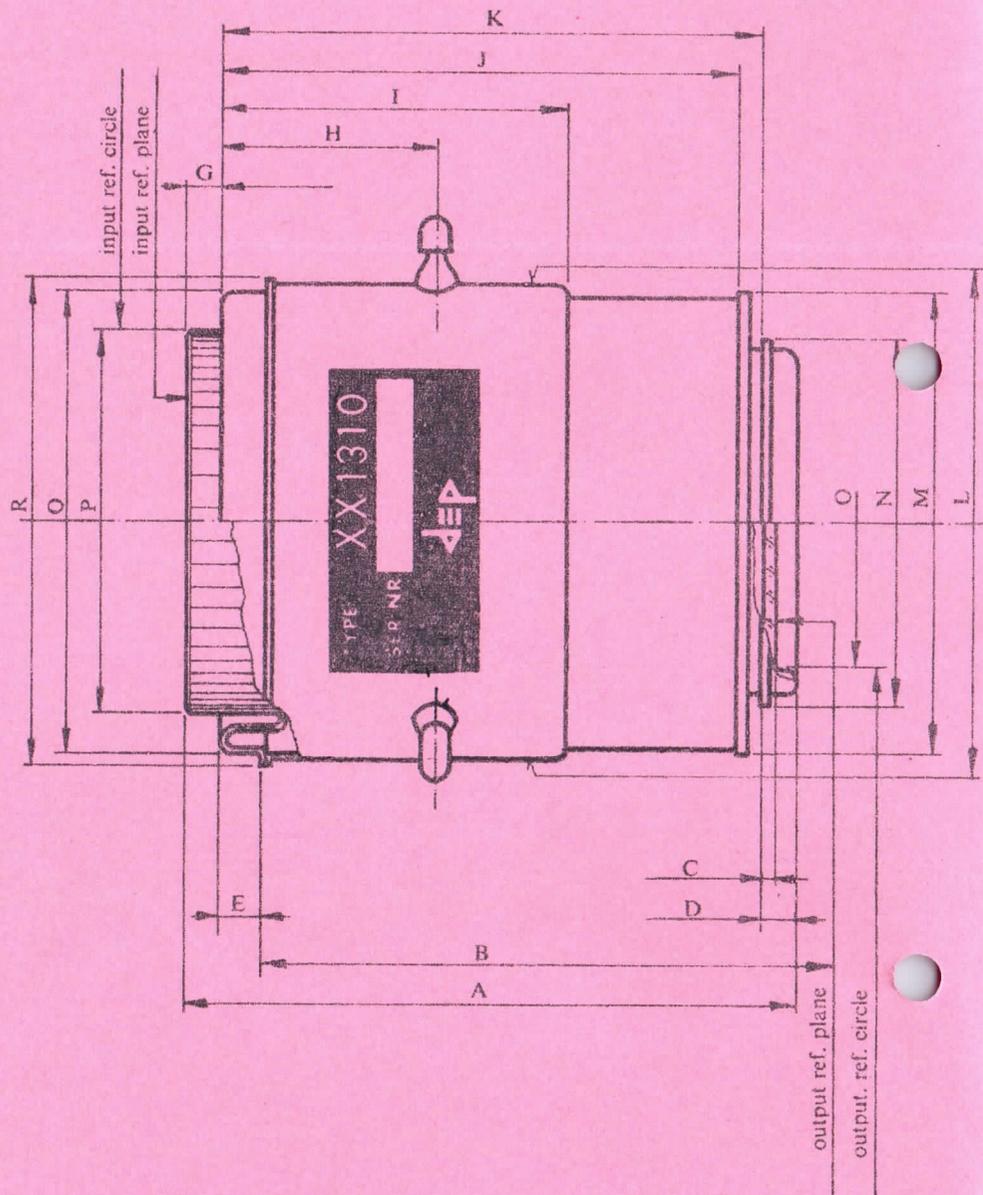
- 1 All radii (r) and diameters (ϕ) refer to input.
- 2 Input centre and output centre are specified by reference circles and reference planes as indicated on the outline drawing.

AL/1977/3
Annex PT
- 64 -



	min.	max.	note
A	79,45	81,45	
B	65,6	67,2	
C	2,35	2,45	$n_d = 1,53$
D	3,3	3,9	
E	6,3	6,7	
F	—	∅ 78,0	
G	4,0	5,0	
H	27,5	28,5	
I	44,5	45,5	
J	67,0	69,0	
K	70,7	72,3	
L	∅ 62,2	∅ 62,4	
M	∅ 60,9	∅ 61,1	
N	∅ 47,65	∅ 47,85	
O	∅ 38,0	∅ 38,2	
P	∅ 50,4	∅ 50,8	
Q	∅ 59,5	∅ 59,7	
R	∅ 64,2	∅ 64,4	
S	142,2°	142,8°	
T	72°	78°	





QUICK REFERENCE DATA

Electrostatically focussed tube with fibre-optic input and glass output window.

Useful input and output diameter	40 and 13 mm
Minimum luminance gain	$450 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	16 kV
Overall dimensions (approx.)	$\varnothing 85 \times 85 \text{ mm}$
Weight (approx.)	285 g

INPUT

Fibre-optic window

Useful diameter 40 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 28 \text{ mm}$)

at 2850 K min. $200 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 K min. $13 \mu\text{A} \cdot \text{W}^{-1}$

at 850 K min. $8 \mu\text{A} \cdot \text{W}^{-1}$

OUTPUT

Glass window

Refractive index see outline drawing

Nominal window thickness see outline drawing

Useful diameter 13 mm

Phosphor P 20

Screen output colour green/yellow

Screen persistence medium/short



TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 28 mm, 2850 K, input illuminance max. 10^{-2} lux)	min.	450 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$	
Resolution			
on axis	typ.	95	$\text{lp} \cdot \text{mm}^{-1}$
at $r = 10$ mm	typ.	95	$\text{lp} \cdot \text{mm}^{-1}$
at $r = 20$ mm	typ.	70	$\text{lp} \cdot \text{mm}^{-1}$
Modulation transfer (on axis)			
at 12,5 lp/mm	min.	80	%
at 25 lp/mm	min.	55	%
at 50 lp/mm	min.	20	%
Veiling glare	max.	7,5	%
Magnification (on axis)	min.	0,285	
	max.	0,295	
Distortion (at $r = 16$ mm)	max.	7,5 %	
Equivalent background illumination (\varnothing 28 mm, 2850 K)	typ.	0,2	μlx
	max.	0,4	μlx
		provided the background is uniform and stable	
Axial eccentricity (see note 2)	max.	0,5 mm	

NOMINAL OPERATING CONDITIONS

Supply voltage	16 kV
Ambient temperature	+20 °C

LIMITING VALUES

Supply voltage	max.	18 kV
Ambient temperature (operational)	min.	-54 °C
	max.	+52 °C
Ambient temperature (storage)	min.	-54 °C
	max.	+40 °C
Input illuminance	max.	1 lx

AL/1977/3
Annex PT
- 67 -

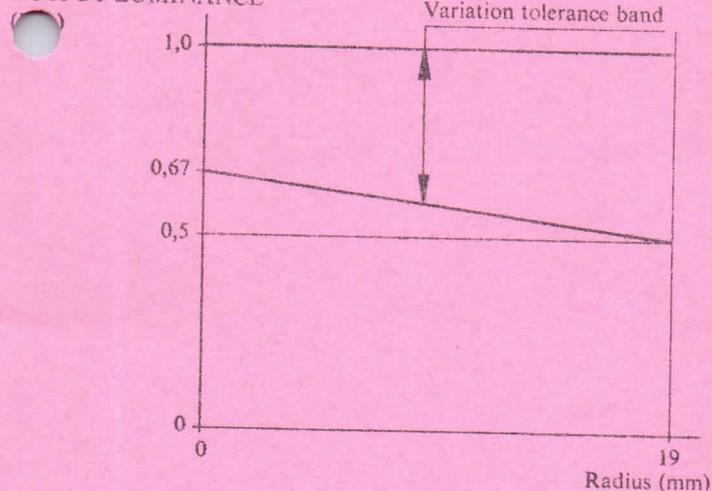


UNIFORMITY (vignetting and shading)

When the input is uniformly illuminated with light having a colour temperature of 2850 K, the output luminance varies less than 1 to 0,5 over a circular input area \varnothing 38 mm.

On axis the output luminance is more than 0,67 times the maximum luminance. The variations in output luminance fall within the tolerance area shown below.

OUTPUT LUMINANCE



UNIFORMITY (spots)

The number of spots, exceeding a contrast with their surrounding area of 30 % is \leq or equal to the numbers indicated in the table below. The size of non-circular spots determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot, the two spots are considered as one spot.



size of spots on output	maximum number of spots		
	within \varnothing 15 mm	within area bounded by \varnothing 15 mm and \varnothing 30 mm	within area bounded by \varnothing 30 mm and \varnothing 40 mm
>125 μ m	0	0	0
100—125 μ m	0	1	1
75—100 μ m	1	2	4
50— 75 μ m	2	5	9
25— 50 μ m	3	minimal	minimal
< 25 μ m	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

Shocks

See general notes

Vibration

See general notes

Temperature

See general notes.

The operational tests, steps 2 and 5, shall be excluded.

AL/1977/3
Annex PT
- 68 -



NOTES

AL/1977/3
Annex PT

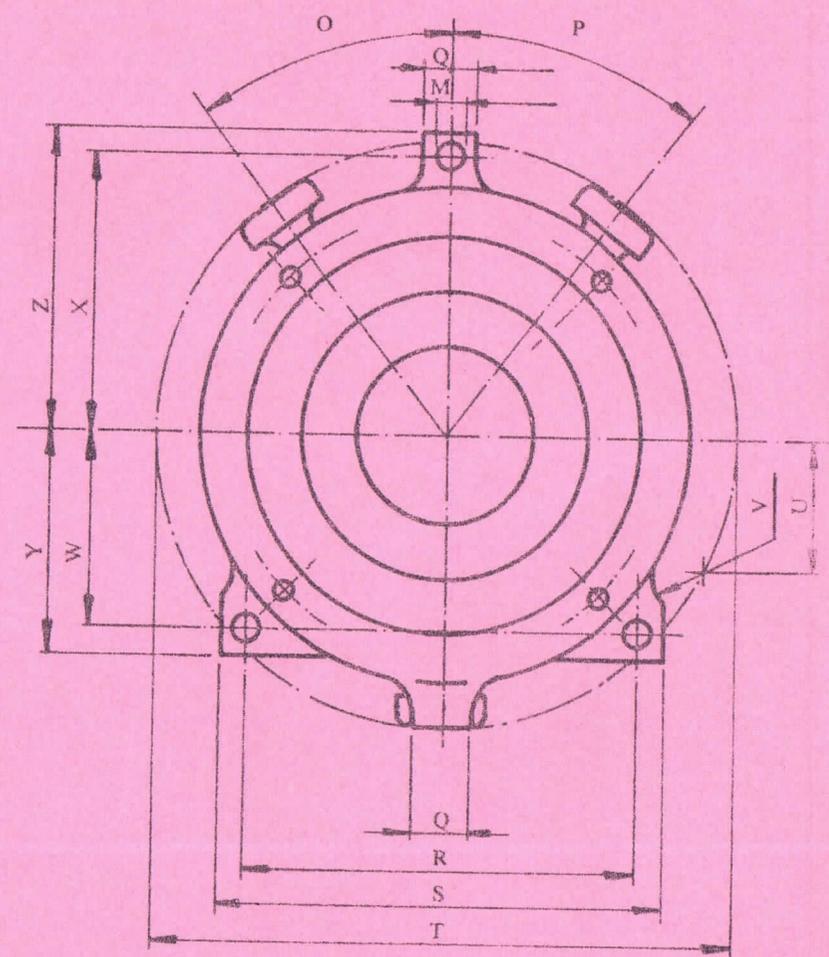
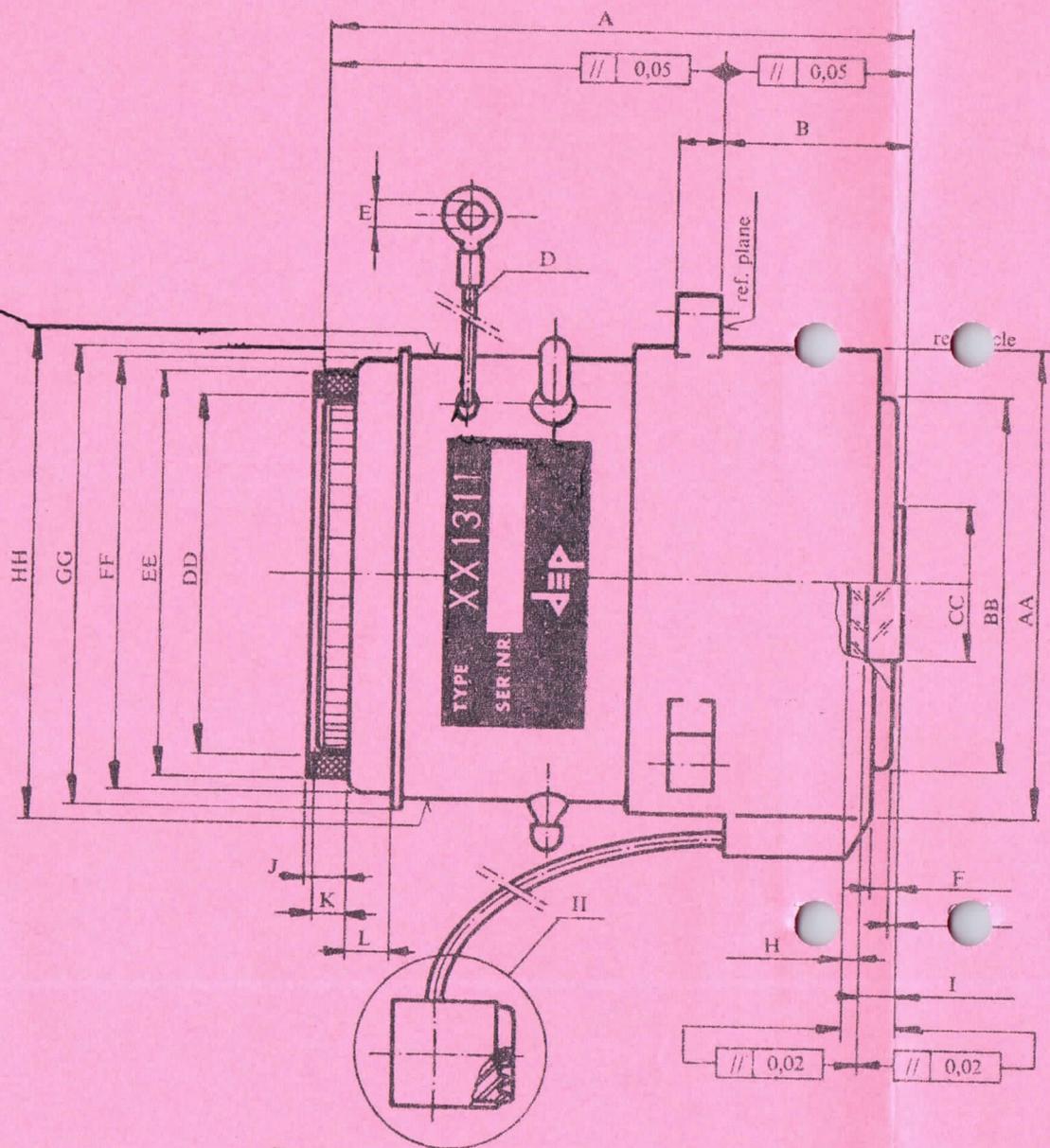
- 69 -

- 1 All radii (r) and diameters (\varnothing) refer to input.
- 2 Input centre and output centre are specified by a reference circle and a reference plane as indicated on the outline drawing.



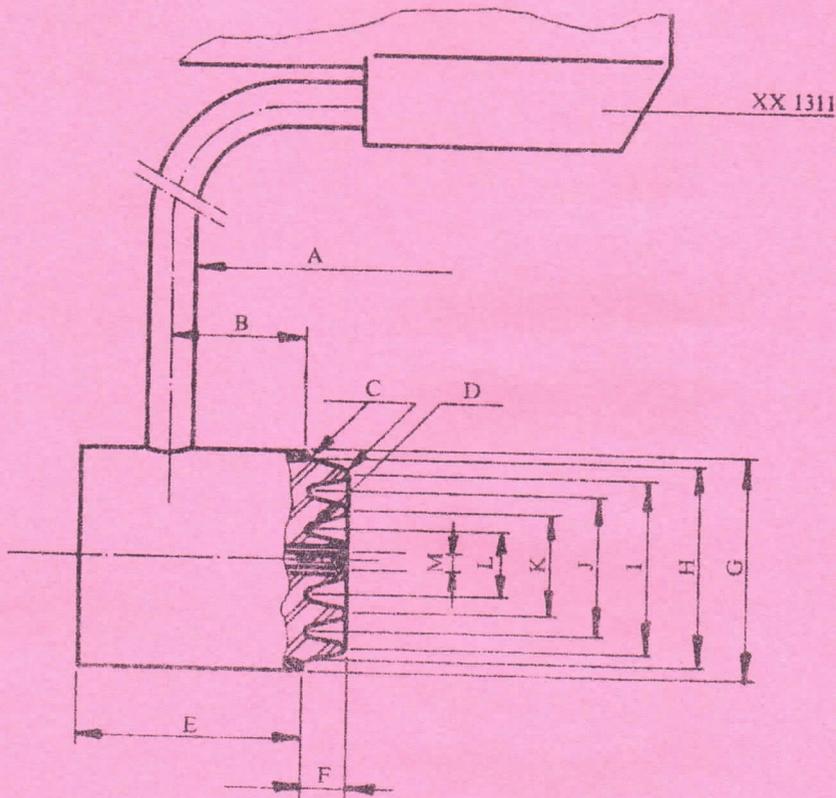
	min.	max.	note
A	80,0	82,5	
B	26,0	26,05	
C	5,8	6,2	(3x)
D	67,0	73,0	length of wire
E	∅ 3,5	—	nom.
F	3,0	—	
G	0,1	—	
H	2,4	2,45	ZK 1 (533 580)
I	4,75	4,8	SFM (785 258)
J	5,3	5,7	
K	4,0	5,0	
L	5,8	6,2	
M	∅ 4,2	∅ 4,4	(3x)
N	7,5	8,5	
O	36,5°	38,5°	
P	36,5°	38,5°	
Q	7,5	8,5	
R	51,5	51,7	
S	58,8	59,2	
T	—	∅ 78	
U	17,8	18,2	(2x)
V	R = 4	R = 6	(6x)
W	25,7	25,9	(2x)
X	36,4	36,6	
Y	29,3	29,7	(2x)
Z	39,8	40,2	
AA	∅ 64,8	∅ 64,9	
BB	—	∅ 53	
CC	∅ 21,8	∅ 22,2	
DD	∅ 50,4	∅ 50,8	
EE	∅ 56,8	∅ 57,2	
FF	∅ 59,4	∅ 59,6	
GG	—	∅ 64,3	
HH	—	∅ 62,5	
II	—	—	see sep. drawing





	min.	max.	
A	75	85	
B	8,5	9,5	
C	R = 0,45	R = 0,50	
D	R = 0,60	R = 0,65	
E	14,8	15,2	
F	2,8	3,0	
G	∅ 14,3	∅ 14,7	
H	∅ 12,6	∅ 12,8	
I	∅ 11,55	∅ 11,65	
J	∅ 9,15	∅ 9,25	
K	∅ 6,75	∅ 6,85	
L	∅ 4,35	∅ 4,45	
M	∅ 1,2	∅ 1,3	





AL/1977/3
Annex PT
- 72 -



QUICK REFERENCE DATA

Electrostatically focussed distortion corrected three-stage tube with fibre-optic input and output window.

The tube is protected against visible defects resulting from local high light intensities of short duration which may occur when detonations of armour piercing ammunition are imaged on the photocathode while the tube is operating.

The tubes internal power supply has been designed to be independent of changes in battery voltages and has an improved ABC and environmental temperature characteristic.

The XX 1340 tube is fully interchangeable with the XX 1136 or equivalent tube. Equipment designed for XX 1136 or equivalent tube can be equipped with XX 1340 tubes, requiring no modifications.

Useful input and output diameter	18 and 18 mm
Minimum luminance gain	$16.500 \text{ cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Supply voltage	2,65 V
Overall dimensions (approx. length & diam.)	$147 \times 53 \text{ mm}$
Weight (approx.)	475 g

INPUT

Fibre-optic window

Useful diameter 18 mm

Numerical aperture 1

Photocathode S 25

Input sensitivity (measured on $\varnothing 12,7 \text{ mm}$)

at 2850 K min. $250 \mu\text{A} \cdot \text{lm}^{-1}$

at 800 nm min. $20 \text{ mA} \cdot \text{W}^{-1}$

at 850 nm min. $15 \text{ mA} \cdot \text{W}^{-1}$



OUTPUT

Protected fibre-optic window	
Useful diameter	18 mm
Refractive index n_d	see outline drawing
Window thickness	see outline drawing
Phosphor	P 20
Screen output colour	green/yellow
Screen persistence	medium/short
Output luminance	max. 500 $\text{cd} \cdot \text{m}^{-2}$

TRANSFER (at nominal operating conditions)

Luminance gain (\varnothing 12,7 mm, 2850 K, input illuminance max. 10^{-3} lux)	min.	16,500 $\text{cd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$
Resolution		
on axis	min.	37 lp $\cdot \text{mm}^{-1}$
at $r = 7$ mm	min.	32 lp $\cdot \text{mm}^{-1}$
Modulation transfer (on axis)		
at 7,5 lp/mm	min.	70 %
at 16,0 lp/mm	min.	40 %
at 20,0 lp/mm	min.	25 %
Magnification (on axis)	min.	0,82
	max.	0,90
Distortion ($r = 7$ mm)	max.	4 %
	typ.	3,5 %
Equivalent background illumination (\varnothing 12,7 mm, 2850 K)	max.	0,2 μlx
Veiling glare	max.	6 %
Axial eccentricity	max.	1,0 mm
Uniformity		see page 4

AL/1977/3
Annex PT
- 73 -



FLASH PROTECTION

In order to simulate the light bursts of high intensity and short duration which may occur at the detonation of armour piercing ammunition in laboratory tests for the inspection of the image intensifiers ability to withstand the adverse effects of such light bursts, test set-ups have been defined as follows:

- 1 A $2 \times 3,5$ mm filament of a 100 Watt quartz-iodine lamp, operating at simulated colour temperatures of either 3500 K or 2500 K is imaged on the photocathode of the image intensifier resulting in an image area of $0,3 \text{ mm}^2 \pm 0,1 \text{ mm}^2$ and a luminous flux of approx. 0,62 lm (at 3500 K) or 0,38 lm (at 2500 K).

The flashes are generated with a shutter disc, operating in the light beam, giving light pulses of approx. 8,6 msec. duration. The pulses shall have a triangular shape and either a short rise time of 0,6 msec. (at 3500 K) or a long rise time of approx. 8,0 msec. (at 2500 K); see fig. 1 and fig. 2.

- 2 A xenon flash tube, colour temperature 5500 K is imaged on the input of the image intensifier resulting in an image area of 1 mm^2 and a luminous flux of approx. 28 lm.

The flash duration is 1 msec. approx.

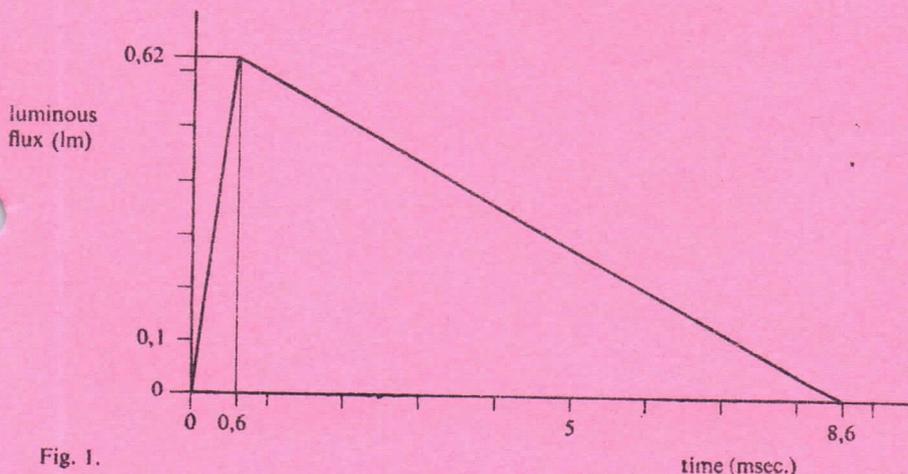


Fig. 1.



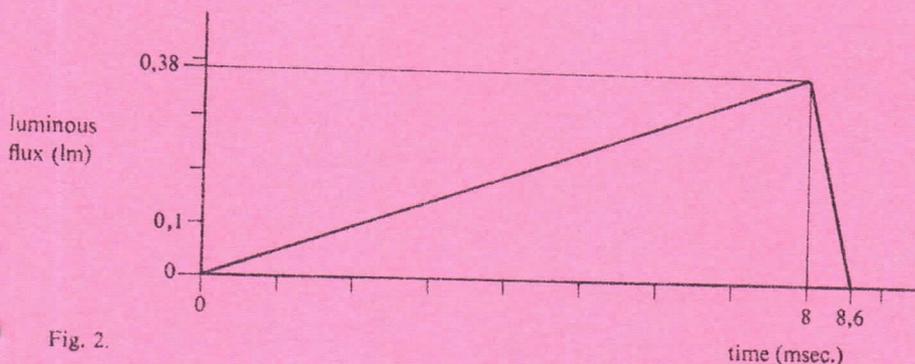


Fig. 2.

An image intensifier when inspected under nominal operating conditions shall meet the specifications (uniformity, spots) when the image intensifier has been subjected to light bursts as generated with the above described test set-ups, each burst at a different spot of the image intensifiers input.

Between the bursts a regeneration time of at least 5 sec. should be allowed for. In this test a burst has to be understood as series of up to 10 light flashes at a rate of 10 per sec.

The image intensifier shall not show any decrease in resolution, when the input illuminance on the photocathode is increased up to 1 lux.

AL/1977/3
Annex PT
- 74 -



OPERATING CONDITIONS

Supply voltage	min.	2,2	V
	nom.	2,65	V
	max.	3,2	V
Input current	typ.	40	mA
Ambient temperature	min.	-54	°C
	nom.	+20	°C
	max.	+52	°C

LIMITING VALUES

Supply voltage	max.	3,4	V
Input illumination (at extended and uniform exposure)	max.	1,0	lx
Ambient temperature (operation)	min.	-54	°C
	max.	+52	°C
Ambient temperature (storage)	min.	-54	°C
	max.	+40	°C
Reverse polarity time	max.	60	sec.

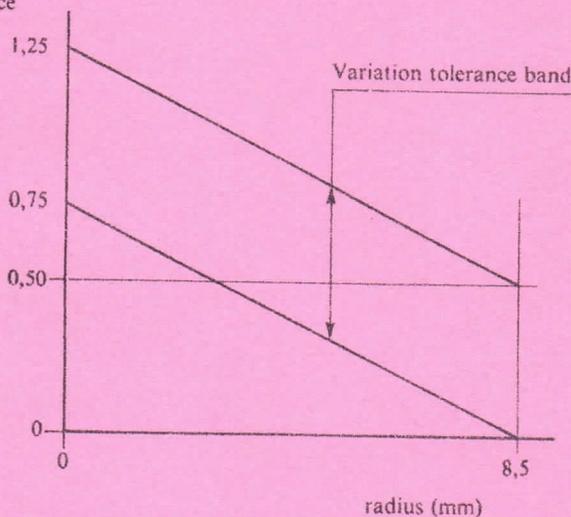


UNIFORMITY

Vignetting and shading

When the input is uniformly illuminated with light with a colour temperature of 2850 K the output luminance uniformity varies; variations in output luminance over a circular input area of $\varnothing 17$ mm fall within the tolerance band shown below.

Output luminance
(Rel.)



Spots

The number of spots, exceeding a contrast with their surrounding area of 30%, is less or equal to the numbers indicated in the table below. The size of non-circular spots is determined on the basis of equal area to circular spots. When the distance between two spots is less than the maximum dimension of either spot the two spots are considered as one spot.

AL/1977/10
Annex PT
- 75 -



size of spots on output	maximum number of spots		
	within \varnothing 5,6 mm	within area bounded by \varnothing 5,6 mm and \varnothing 14,7 mm	within area bounded by \varnothing 14,7 mm and \varnothing 17,8 mm
$> 375 \mu\text{m}$	0	0	0
300—375 μm	0	1	2
225—300 μm	0	3	8
150—225 μm	0	9	18
75—150 μm	3	30	40
$< 75 \mu\text{m}$	minimal	minimal	minimal

ENVIRONMENTAL CONDITIONS

Refer to 'General notes' for test methods to check whether the tubes will withstand adverse environmental conditions. These tests, which are based on tests as described in MIL-I-55553 (EL), are adapted to be more practicable.

Other test methods which differ slightly from D.E.P.'s standardized test methods can be found in:

a MIL-I-55553 (EL) of 20-02-1970

For

Vibration test

: refer to
para 3.10 (requirements) and
para 4.6.4. (test)

Shock test

: refer to
para 3.11 (requirements) and
para 4.6.5. (test)

Environmental temperature

: refer to
para 3.12 (requirements) and
para 4.6.6. (test)



b A schedule for tests, derived from german military requirements which is specified as follows:

Test	Requirement
Dry heat	DIN 58390, Bl.2, test cond. 11.1* and 11.2
Low temperature	VG 58390, Bl.2, test cond. 10.3* and 10.4
Temp. change (slow)	VG 58390, Bl.2, test cond. 14.2
Temp. shock	VG 58390, Bl.2, test cond. 15.2
Mech. shock	VG 95210 (V), Bl. 28, test cond. B*
Vibration	VG 95210 (V), Bl. 19, test cond. A

*Test conditions, including operational conditions, are performed without illumination of the image intensifiers input.

NOTE

All radii (r) and diameters (\varnothing) refer to input

POWERSUPPLY CHARACTERISTICS

1 Temperature influences on tube gain.

The influence of environmental temperature has been reduced by using a specially designed powersupply. Changes in tube gain, due to a deviation of the operating temperature from nominal temperature are small compared with gain changes which might occur in tubes fitted with a conventional powersupply. (See also fig. 3.)

2 Gain versus battery life.

The image intensifiers powersupply has been designed to reduce the influence of the battery voltage on tube gain. Since this voltage decreases during battery life, the gain of a conventional tube also decreases.

The XX 1340 powersupply guarantees an almost constant gain even when the battery voltage varies between 3,2 Volts (as with two new 1,5 V batteries) to 2,2 Volts (as with nearly exhausted batteries).

(See also fig. 4 and 5.)



3 ABC and MOB.

The output luminance of XX 1340 tubes will never exceed a maximum of $500 \text{ cd} \cdot \text{m}^{-2}$. This prevents blinding of the observer, which otherwise might occur at high input illuminance levels.

Furthermore, as can be derived from fig. 6, the automatic brightness control (ABC) keeps the output luminance within practical limits at high input illumination.

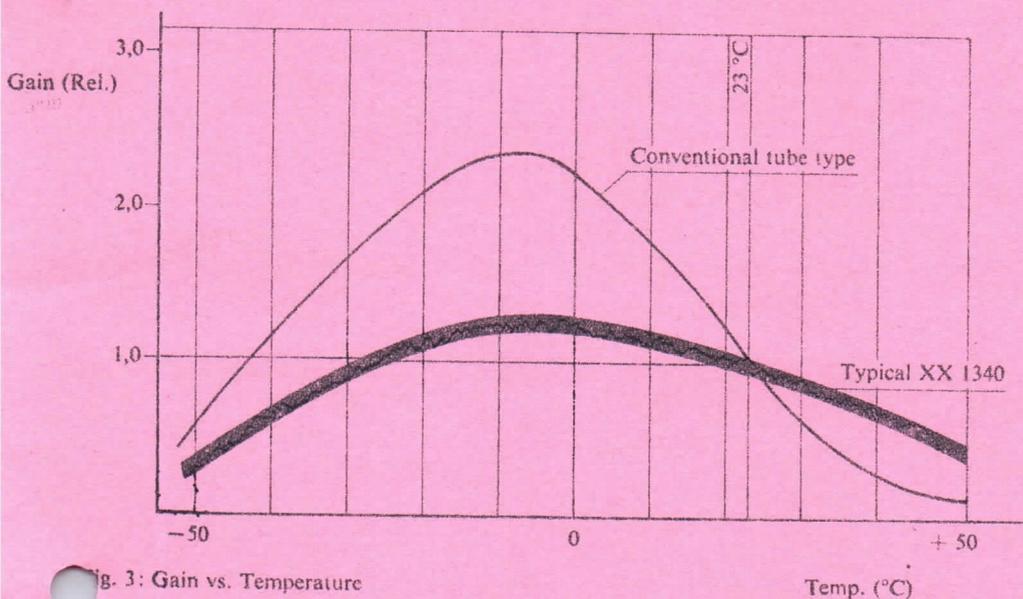


Fig. 3: Gain vs. Temperature

Temp. (°C)

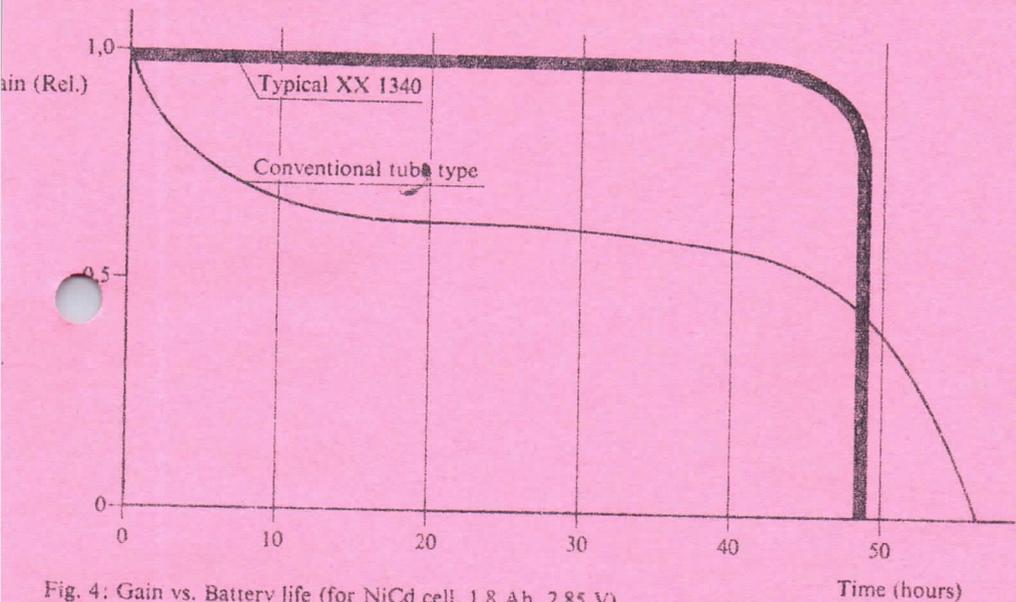


Fig. 4: Gain vs. Battery life (for NiCd cell, 1.8 Ah, 2,85 V)

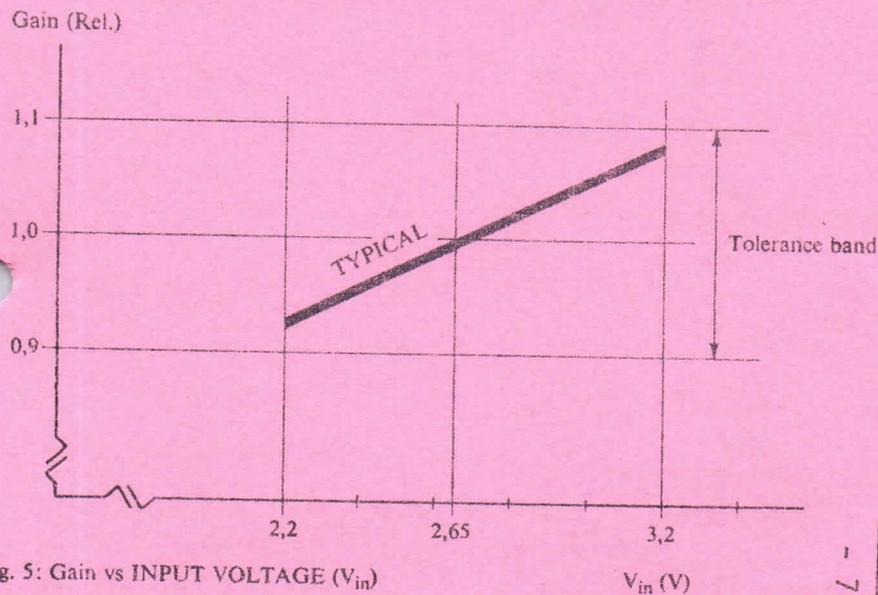


Fig. 5: Gain vs INPUT VOLTAGE (V_{in})

AL/19/1/3
Annex PT
- 77 -



AL/1977/3
Annex PT

- 78 -

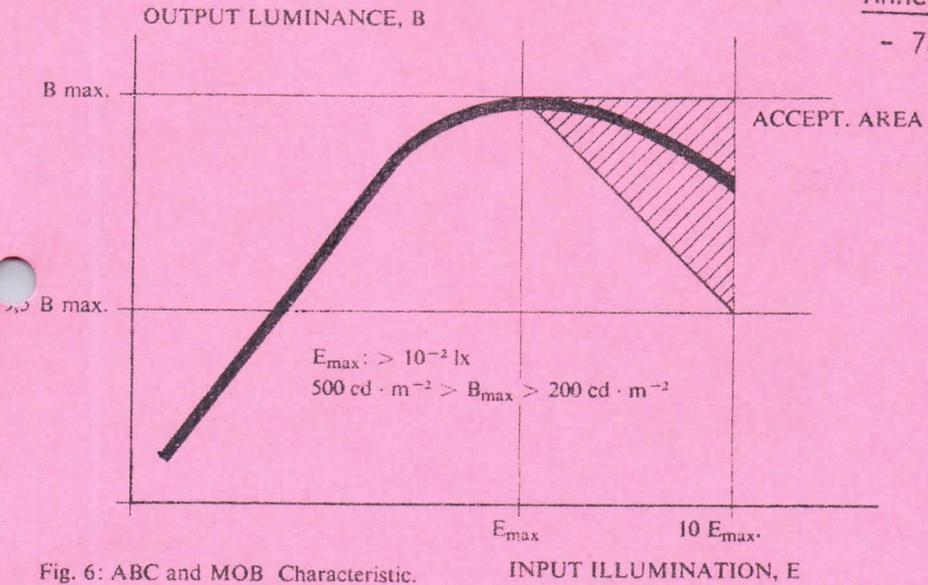


Fig. 6: ABC and MOB Characteristic.



	min.	max.	note
A	145	150	
B	0,69	0,83	
C	1,8	2,8	
D	0,1	—	
E	—	0,3	
F	1,6	1,7	$n_d = 1,52$
G	3,3	3,7	
H	52,6	52,8	
I	46,7	46,9	
J	35,3	35,7	
K	—	26,8	
L	42,6	43,0	
M	1,47	1,57	(2x)
N	0,8	1,4	
O	89	91	



