# Standard, 10-stage, 19 mm (3/4") round tube

| | | | |
|---|---|---|---|
| **Applications** : | For high energy physics and scintillation counting under limited dimensional conditions. | | |
| **Description** : | Window : | Material : | lime glass |
| | | Photocathode : | bi-alkali |
| | | Refr. index at 420 nm : | 1.54 |
| | Multiplier : | Structure : | linear focused |
| | | Nb of stages : | 10 |
| | Mass : | 25 g | |

## Photocathode characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| | Spectral range: | | | | 290-650 | nm |
| | Maximum sensitivity at : | | | | 420 | nm |
| | Sensitivity ① : | | | | | |
| | Luminous : | | | | 100 | µA/lm |
| ☑ | Blue : | min.: | 9.0 | typ.: | 11 | µA/lmF |
| | Radiant, at 420 nm : | | | typ.: | 85 | mA/W |

## Characteristics with voltage divider A

| | | | | | | |
|---|---|---|---|---|---|---|
| | Gain slope (vs supp. volt., log/log) : | | | | 7.5 | |
| | For an anode blue sensitivity of : | | | | 10 | A/lmF |
| ☑ | Supply voltage : | max.: | 1350 | typ.: | 1200 | V |
| | | min.: | 1000 | | | |
| | Gain : | | | | $9.5 \times 10^5$ | |
| ☑ | Anode dark current ② : | max.: | 10 | typ.: | 2 | nA |
| | Pulse amplitude resolution for $^{137}$Cs ③ : | | | | 7.5 | % |
| | Mean anode sensitivity deviation ④ : | | | | | |
| | long term (16 h) : | | | | 1.5 | % |
| | after change of count rate : | | | | 1.5 | % |
| | Gain halved for a magnetic field : perpendicular to axis "n" of : | | | | 0.3 | mT |

## Characteristics with voltage divider ⑤

| | | B | A | |
|---|---|---|---|---|
| | For a supply voltage of : | 1700 | 1500 | V |
| | Gain : | $4.5 \times 10^6$ | $5.1 \times 10^6$ | |
| | Linearity (2%) of anode current up to : | 80 | 20 | mA |
| | Anode pulse ⑥ : | | | |
| | Rise time : | 2.4 | 2.3 | ns |
| | Duration at half height : | 3.8 | 3.5 | ns |
| | Transit Time : | 23 | 22 | ns |
| | Transit Time Difference centre of photocathode up to 7 mm from it : | 1.5 | 1.5 | ns |
| | Capacitance anode to all : | 4 | 4 | pF |

## Recommended voltage divider

**Type A** for maximum gain

| K | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 | 1.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | (total :12.5) |

**Type B** for best timing and linearity

| K | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 | 1.5 | 1 | 1.25 | 1.25 | 1.5 | 2.25 | 2.25 | 2.5 | 3 | (total :19.5) |

K: photocathode Dn: dynode A: anode

## Limiting values

| | | | | | |
|---|---|---|---|---|---|
| Anode luminous sensitivity : | | | max.: | 100 | A/lmF |
| Supply voltage : | | | max.: | 1900 | V |
| Continuous anode current : | | | max.: | 0.2 | mA |
| Voltage between | | | | | |
| | D1 and photocathode : | min.: 100 | max.: | 350 | V |
| | consecutive dynodes : | | max.: | 250 | V |
| | anode and D10 : | min.: 30 | max.: | 300 | V |
| Ambient temperature | | | | | |
| | short operation (< 30 mn) : | min.: -30 | max.: | +80 | °C |
| | continuous operation & storage : | min.: -30 | max.: | +50 | °C |

### Notes

☑ Characteristic measured and mentioned on the test ticket of each tube.

① Luminous sensitivity is measured with a tungsten filament lamp with a colour temperature of 2856 ± 5 K. The blue sensitivity, expressed in A/lmF ("F" as in Filtered) is measured with a tungsten filament lamp with a colour temperature of 2856 ± 5 K. Light is transmitted through a blue filter Corning CS no.5-58, polished to half stock thickness. The radiant sensitivity is measured with a tungsten filament lamp with a colour temperature of 2856 ± 5 K. Light is transmitted through an interference filter. Radiant sensitivity at 420 nm, expressed in mA/W, can be estimated by multiplying the blue sensitivity, expressed in µA/lmF, by 7.5 for this type of tube.

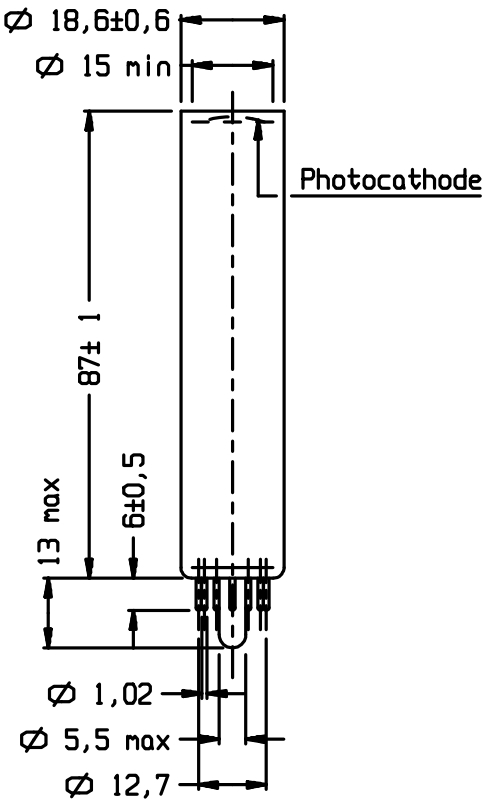
② Dark current is measured at ambient temperature, after the tube has been in darkness for approximately 1 min. Lower value can be obtained after a longer stabilisation period in darkness (approx. 30 min.).

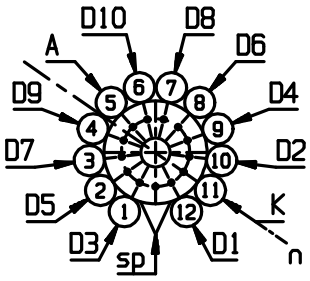
③ Pulse amplitude resolution for $^{137}$Cs is measured with NaI(Tl) cylindrical scintillator with a diameter of 12 mm and a height of 25 mm. The count rate used is ~ $10^4$ c/s.

④ The mean pulse amplitude deviation is measured by coupling a NaI(Tl) scintillator to the window of the tube. Long term (16h) deviation is measured by placing a $^{137}$Cs source at a distance from the scintillator such that the count rate is ~ $10^4$ c/s, corresponding to an anode current of ~ 300 nA. The mean pulse amplitude deviation after change of count rate is measured with a $^{137}$Cs source at a distance from the scintillator such that the count rate can be changed from $10^4$ to $10^3$ c/s, corresponding to an anode current of ~ 1 µA and 0.1 µA respectively. Both tests are carried out according to ANSI-N42-9-1972 of IEEE recommendations.

⑤ To obtain a peak pulse current greater than that obtainable with divider A, it is necessary to increase the inter-dynode voltage progressively. Divider circuit C is an example of a progressive divider, giving a compromise between gain, speed and linearity. other dividers can be conceived to achieve other compromises. It is generally recommended that the voltage ratio between two successive stages is less than 2.

⑥ Measured with a pulse light source, with a pulse duration (FWHM) of approximately 1 ns., the cathode being completely illuminated. The rise time is determined between 10 % and 90 % of the anode pulse amplitude. The signal transit time is measured between the instant at which the illuminating pulse of the cathode becomes maximum, and the instant at which the anode pulse reaches its maximum. Rise time, pulse duration and transit time vary with respect to high tension supply voltage Vht as (Vht)-½.

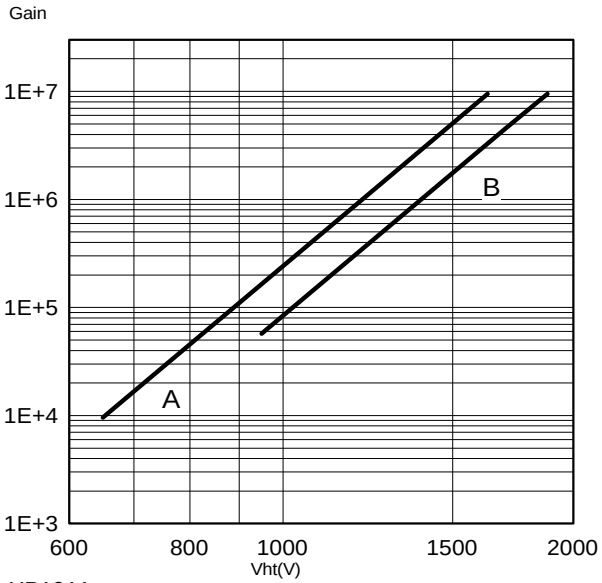



ref.: 90500016
sp: short pin
n: plane of symmetry of the multiplier

K: cathode
Dn: dynode
A: anode

**Typical gain curve**

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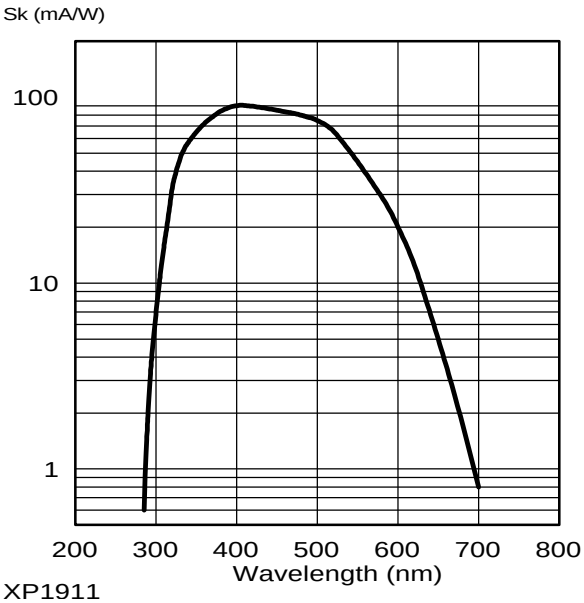
**Typical spectral characteristics**

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## Accessories

Socket: FE1004
Socket for PCB: FE3112
Mu-metal shield: MS178
Voltage divider assemblies:
+HV: VD308
- HV: VD108