PHILIPS

RADIATION COUNTER TUBES

1965

PHILIPS ELECTRON TUBE DIVISION

TECHNICAL DATA OF RADIATION COUNTER TUBES

1965

PHILIPS ELECTRON TUBE DIVISION

This booklet contains a type selection from the Philips Electron Tube Handbook. It is primarily intended for equipment design.
The fact that a type is included does not imply that it can always be supplied at short notice.

RADIATION COUNTER TUBES
APPLICATION DIRECTIONS

1. GENERAL

1.1 A radiation counter tube is a gas-filled device intended for counting ionizing radiation.

1.2 A radiation counter tube basically consists of an electrode at a positive potential (anode), surrounded by a negative metal cylinder (cathode).
The cathode forms part of the envelope or is enclosed in a glass envelope filled with a gas.
Quanta or particles may be shot in either through a foil, the window, or through the cylinder wall itself.

1.3 Typical quanta or particles are:

alpha rays,
beta rays,
X or gamma rays,
thermal neutrons.

1.4 The gas filling normally consists of a mixture of rare gases and a quenching agent.

1.5 Quenching is the process of terminating the discharge in the counter tube.

1.5.1 For tubes with a quenching agent the voltage drop across the load resistor normally used is sufficient for terminating the discharge.

2. CAPACITANCES

The capacitance of a counter tube is the capacitance between anode and cathode, the connections being completely shielded.

3. OPERATING CHARACTERISTICS

3.1 Starting voltage. This is the minimum supply voltage which must be applied to a radiation counter tube circuit with a specific load resistor in order that an output pulse of a given value be obtained. In the published data, the starting voltage stated is measured at a detecting-circuit sensitivity of 0.1 V.

3.2 Operating voltage. This is the anode supply voltage at which the radiation counter tube should be operated.

3.3 Plateau. This is the anode supply voltage region in which the number of output pulses is substantially independent of the anode supply voltage. Unless otherwise stated, the plateau is measured at a counting rate of approximately 100 counts/s.

3.4 Plateau slope. This is the average slope of the curve: counting rate = f (V_b) at a specific load resistor, measured over the complete plateau and given in %/V. Unless otherwise stated the plateau slope is measured at approximately 100 counts/s.

3.5 Background. This is the counting rate caused by any agency other than that which is desired to be detected (e.g. cosmic radiation, radioactive contamination of counting area).

3.6 Dead time. This is the time interval, after a count has been recorded, during which the radiation counter tube is insensitive to radiation. Thus the tube does not detect ionizing events within this interval. Unless otherwise stated the dead time is measured at approximately 100 counts/s.

4. OPERATIONAL NOTES

4.1 Pulse amplitude. The pulse amplitude of the radiation counter tubes may generally be estimated at $P \geq 1/10\ (V_b - V_{ign})$. In this formula V_b is the applied supply voltage and V_{ign} the tube starting voltage. The factor 1/10 originates from the tapping on the anode resistor, as indicated in the recommended circuit. The influence of the connected capacitive loss is thus minimized.

4.2 Scaler or amplifier. For normal use in the recommended circuit and at moderate counting rates, an input sensitivity of approximately 0.5 V will be sufficient. At very high counting rates the mean level of the anode voltage of the counter tube will drop appreciably below V_b, and the pulse amplitude will decrease accordingly so that the smallest pulses will be lost at the input of the scaler or the amplifier. In this case it is possible that the plateau will show a sudden drop, so that a higher input sensitivity combined with pulse shaping circuits may be necessary.

4.3 Load. Normally the tubes should be operated with a resistance having a value as indiacted in the published data sheets, or a higher value. Decrease of the anode resistor not only shortens the dead time, but also the plateau length. In general a decrease of the resistance below the indicated minimum value causes the tube to oscillate.

The anode resistance should be connected directly to the anode clip, this prevents parasitic capacitances of leads from considerably increasing the capacitive load of the tube. An increase of the capacitive load has the tendency of increasing the pulse amplitude, the pulse duration, the dead time, the charge per pulse and the plateau slope, whereas the plateau length will be shortened appreciably. Shunt capacitances of 20 pF or more may destruct the tube.

4.4 Counting rate. After every pulse the tube is temporarily insensitive during a period called the dead time. Consequently, the pulses that occur during this period are not counted. At a counting rate of N counts/s the tube will be dead during $100N\tau\%$ of the time, so that approximately $100N\tau\%$ of the counts will be lost. If the accury must be greater than 1%, N should be less that $1/100\tau$ counts/s. The maximum counting rate is approximately $1/\tau$.

5. BF3 PROPORTIONAL COUNTERS

The range of neutron proportional counters makes use of the B(n, α) Li reaction to detect slow neutrons in the flux range of from 10^{-4} to 10^{5} n/cm^2/s. The counters in this range provide effective discrimination against γ radiation. The life expectancy of the tubes is in excess of 10^{11} counts, their life being finally determined by the consumption of borontrifluoride gas in the reaction referred to, and by the effects of ionisation.

6. LIMITING VALUES

6.1 The limiting values of radiation counter tubes given in the absolute maximum rating system.

6.2 Ambient temperature. The ambient temperature is the temperature of the surroundings of the tube.

7. MOUNTING

7.1 If not otherwise stated, any mounting position is permissible.

7.2 Low-capacitance mounting of the tube is required (shortest possible connection between output electrode and load resistor and small capacitance between anode and cathode leads).

7.3 No attempt should be made to solder directly to the stainless steel cathode, since this will destroy the tube.

8. STORAGE AND HANDLING

8.1 The tubes should not be stored at ambient temperatures outside the limits given under the heading "Limiting values" on the published data sheets.

8.2 In order to prevent leakage, the tube should be kept dry and well cleaned. At low temperature care should be taken to avoid condensation of water vapour in the connectors.

8.3 Some types of radiation counter tubes have thin windows and/or thin cathode walls. In order to prevent damage, these tubes should be handled and mounted with utmost care. The mica-window types are provided with an aluminium cap to protect the window when not in operation.

9. OUTSIDE PRESSURE

9.1 Tubes provided with a window. To prevent damage to the tube, the following precautions should be observed.

9.1.1 If not otherwise stated, the gas pressure outside the tube should not be lower than 25 cmHg nor higher than the atmospheric pressure.

9.1.2 Variations in pressure should be gradual.

9.2 Tubes not provided with a window. With tubes having very thin envelopes care should be taken when pressures higher than atmospheric are applied.

10. OUTLINE DIMENSIONS

The outline dimensions are given in mm.

RATING SYSTEMS

(in accordance with 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 device 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.

Design-maximum rating system

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

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

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

Design-centre rating system

Design-centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design-centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply-voltage.

RADIATION COUNTER TUBES
LIST OF SYMBOLS

Anode supply voltage	V_b
Voltage at the beginning of the plateau	V_{b_1}
Voltage at the end of the plateau	V_{b_2}
Plateau length (= $V_{b_2} - V_{b_1}$)	V_{pl}
Starting voltage	V_{ign}
Counting rate (= counts/unit of time)	N
Counting rate at V_{b_1}	N_1
Counting rate at V_{b_2}	N_2
Background	N_o
Plateau slope (= $\frac{N_2 - N_1}{\frac{1}{2}(N_1 + N_2)} \times \frac{1}{V_{pl}} \times 100\ \%$)	S_{pl}
Dead time	τ
Capacitance (anode to cathode)	C_{ak}
Ambient temperature	t_{amb}
Gas multiplication factor	A

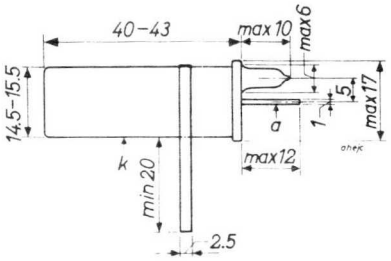
18503

GAMMA RADIATION COUNTER TUBE

Halogen quenched γ radiation counter tube

QUICK REFERENCE DATA		
Range (Co 60 γ radiation)	10^{-4} to 1	R/h
Operating voltage	375 to 600	V

DIMENSIONS AND CONNECTIONS



CATHODE

Thickness	=	250	mg/cm^2
Effective length	=	40	mm
Material		28% Cr, 72% Fe	

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	2	pF

18503

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Anode resistor (See fig.1)	R	=	10	MΩ
Starting voltage	V_{ign}	= max.	325	V [1])
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	= 375 to	600	V
Plateau slope	S_{pl}	= max.	0.02	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	= max.	10	counts/min.
Dead time	τ	= max.	100	μs

LIMITING VALUES (Absolute max. rating system)

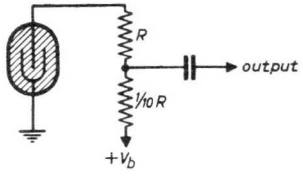
Anode voltage	V_a	= max.	600	V
Ambient temperature	t_{amb}	= min.	-55	°C
		= max.	+75	°C

LIFE EXPECTANCY

Life expectancy		=	5.10^{10}	counts.

MOUNTING

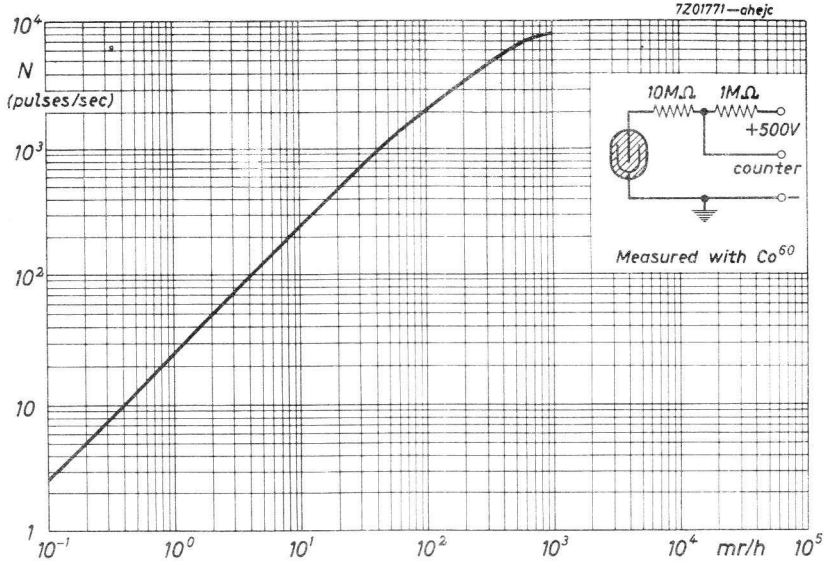
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.

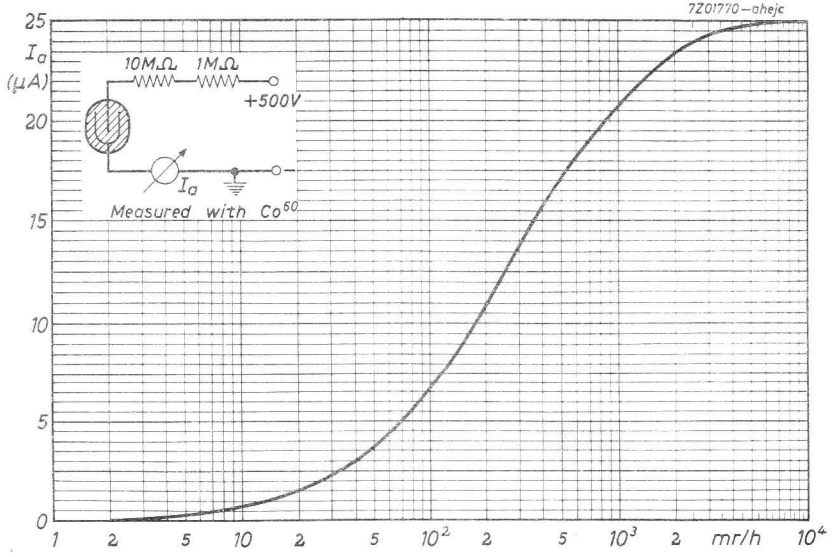


REMARK

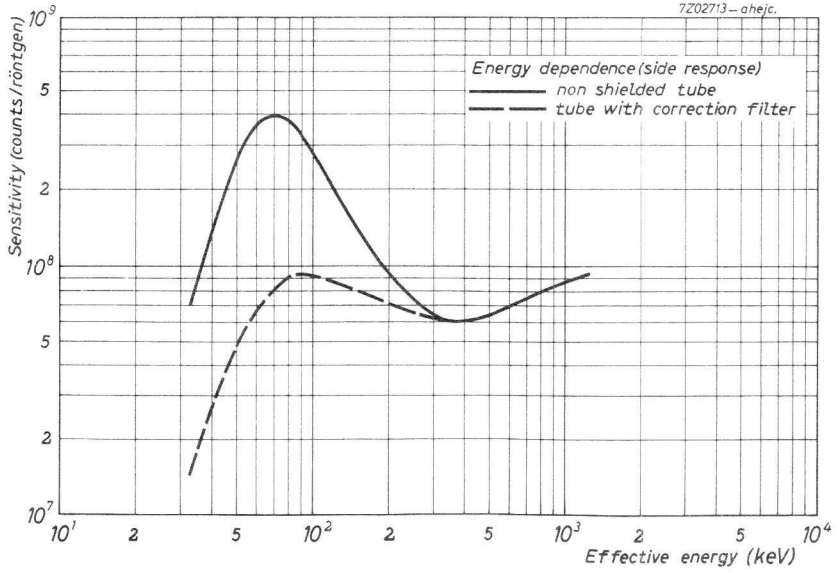
In order to prevent leakage the tube should be kept dry and well cleaned.

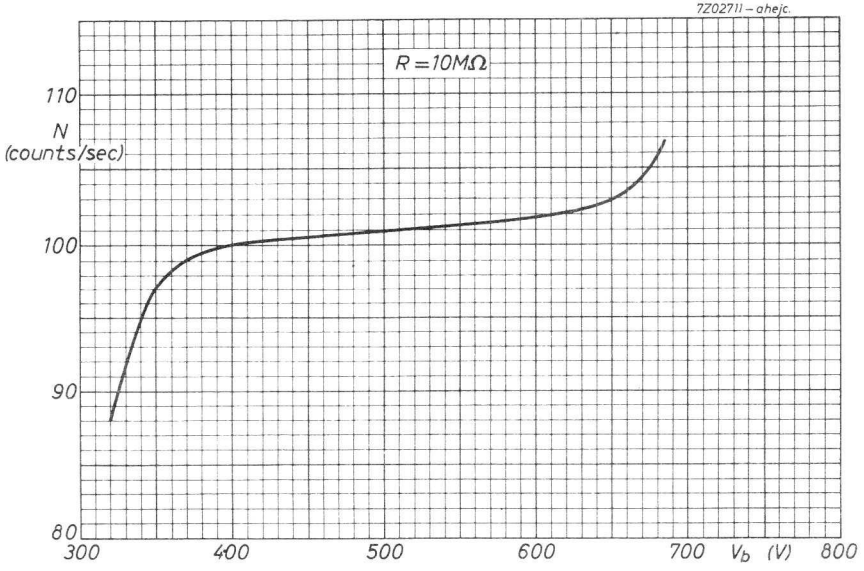
[1]) Temperature coefficient of starting voltage = 0.5 V/°C

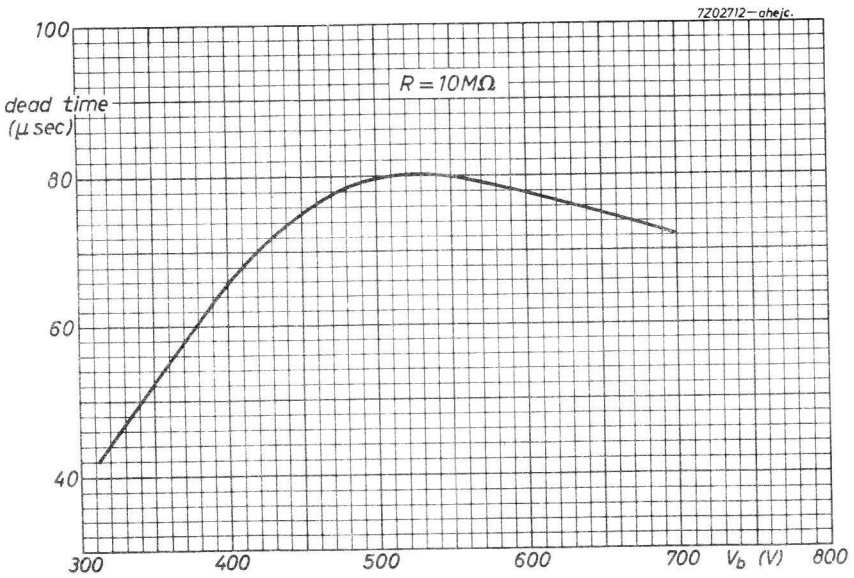

7Z01771—ahejc
N
(pulses/sec)
10M.Ω
1M.Ω
+500V
counter
Measured with Co60
mr/h


7Z01770—ahejc
Ia
(μA)
10MΩ
1MΩ
+500V
Ia
Measured with Co60
mr/h

18503


7Z02713 – ahejc.
Energy dependence (side response)
non shielded tube
tube with correction filter
Sensitivity (counts/röntgen)
10^9
5
2
10^8
5
2
10^7
10^1
2
5
10^2
2
5
10^3
2
5
10^4
Effective energy (keV)


7Z02711 – ahejc.
R = 10MΩ
110
N
(counts/sec)
100
90
80
300
400
500
600
700
V_b (V)
800


7Z02712-ahejc.
100
dead time
(μsec)
80
60
40
R = 10MΩ
300
400
500
600
700
V_b (V)
800

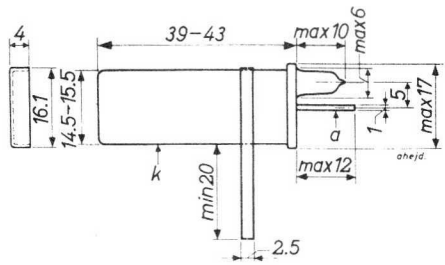
18504

BETA AND GAMMA RADIATION COUNTER TUBE

End window halogen quenched β and γ radiation counter tube

QUICK REFERENCE DATA		
Window thickness	2 to 3	mg/cm^2
Window diameter	9	mm
Operating voltage	375 to 600	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	2 to 3	mg/cm^2
Effective diameter	=	9	mm
Material		mica	

CATHODE

Thickness	=	250	mg/cm^2
Effective length	=	40	mm
Material		28% Cr, 72% Fe	

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	2	pF

18504

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Anode resistor (See fig.1)	R	=	10	MΩ
Starting voltage	V_{ign}	= max.	325	V [1])
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	= 375 to	600	V
Plateau slope	S_{pl}	= max.	0.02	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	= max.	10	counts/min.
Dead time	τ	= max.	100	μs

LIMITING VALUES (Absolute max. rating system)

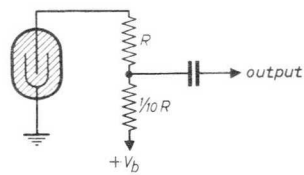
Anode voltage	V_a	= max.	600	V
Ambient temperature	t_{amb}	= min.	−55	°C
		= max.	+75	°C

LIFE EXPECTANCY

Life expectancy		=	5.10^{10}	counts.

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.

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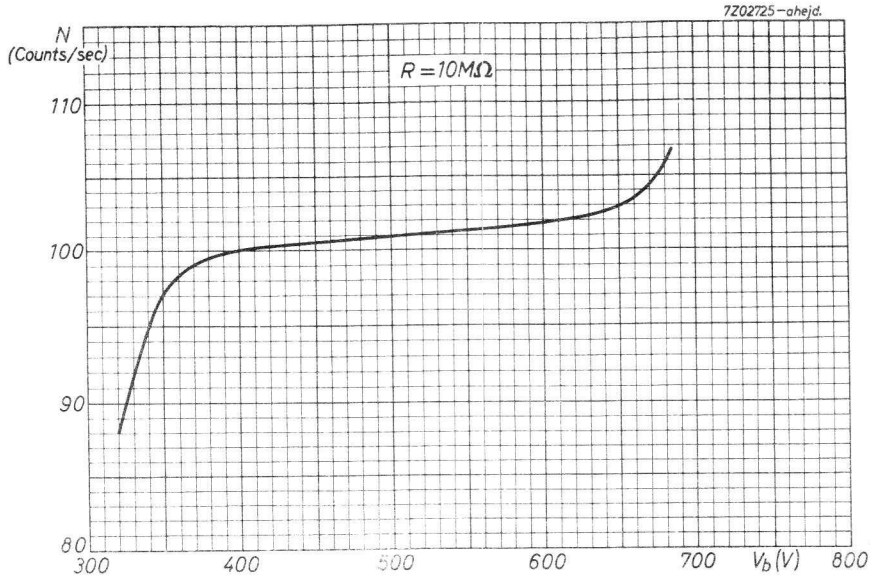
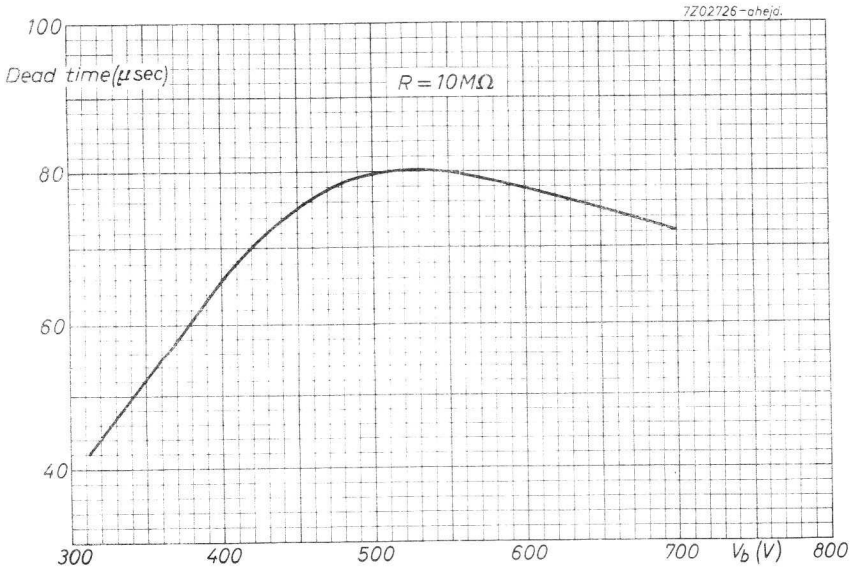
[1]) Temperature coefficient of starting voltage = 0.5 V/°C


7Z02725-ahejd.
N
(Counts/sec)
R = 10MΩ
110
100
90
80
300
400
500
600
700
V_b (V)
800

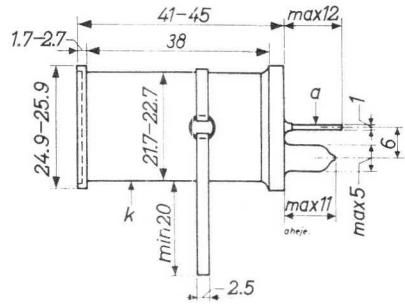

7Z02725-ahejd.
100
Dead time(μsec)
R = 10MΩ
80
60
40
300
400
500
600
700
V_b (V)
800

ALPHA, BETA AND GAMMA RADIATION COUNTER TUBE

End window halogen quenched α, β and γ radiation counter tube

QUICK REFERENCE DATA		
Window thickness	1.5 to 2	mg/cm^2
Window diameter	19.8	mm
Operating voltage	450 to 700	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	1.5 to 2	mg/cm^2
Effective diameter	=	19.8	mm
Material		mica	

CATHODE

Thickness	=	1.2	mm
Effective length	=	37	mm
Material		28% Cr, 72% Fe	

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	2.5	pF

7Z2 5008

18505

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Anode resistor (See fig.1)	R	=	10	MΩ
Starting voltage	V_{ign}	= max.	350	V
Recommended operating voltage	V_b		arbitrary within plateau	
Plateau	V_{pl}	=	450 to 700	V
Plateau slope	S_{pl}	= max.	0.02	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	= max.	15	counts/min.
Dead time	τ	= max.	160	μs

LIMITING VALUES (Absolute max. rating system)

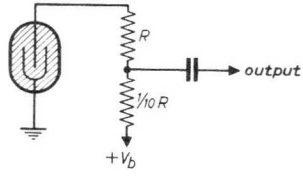
Anode voltage	V_a	= max.	700	V
Anode resistor	R	= min.	2	MΩ
Ambient temperature	t_{amb}	= min.	−55	°C
		= max.	+75	°C

LIFE EXPECTANCY

Life expectancy		=	5.10^{10}	counts.

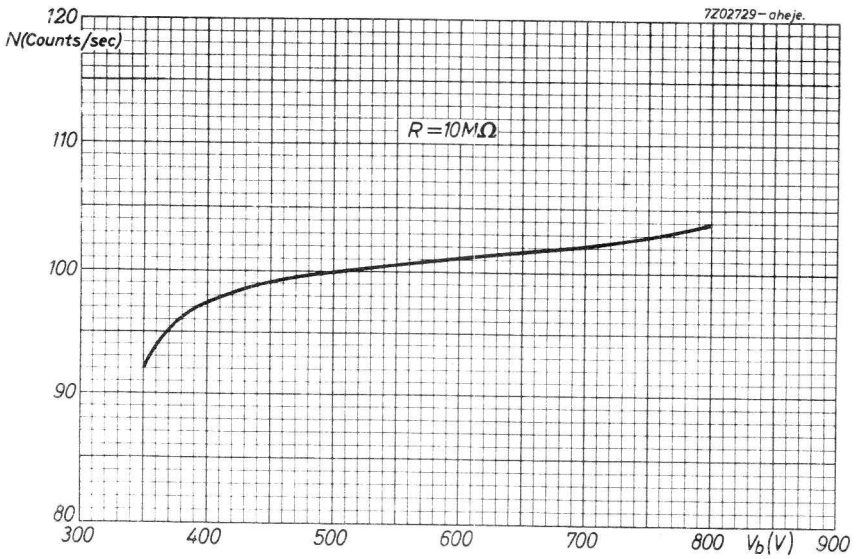
MOUNTING

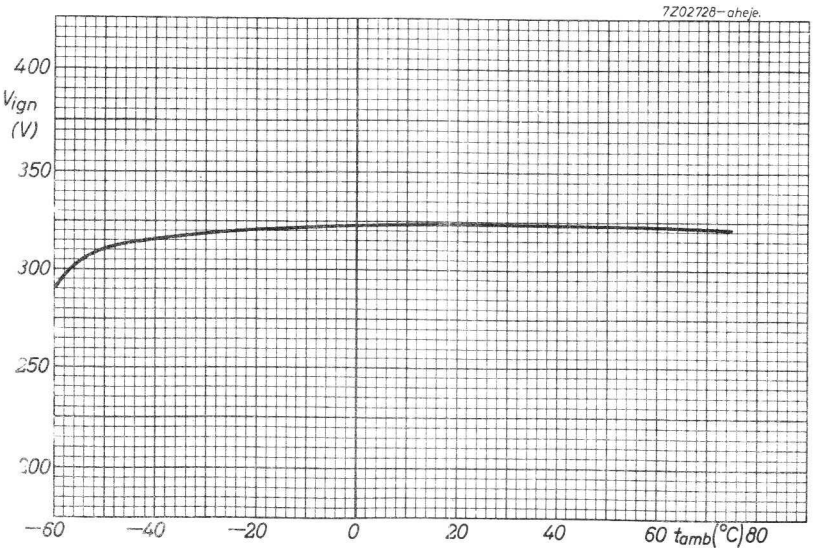
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



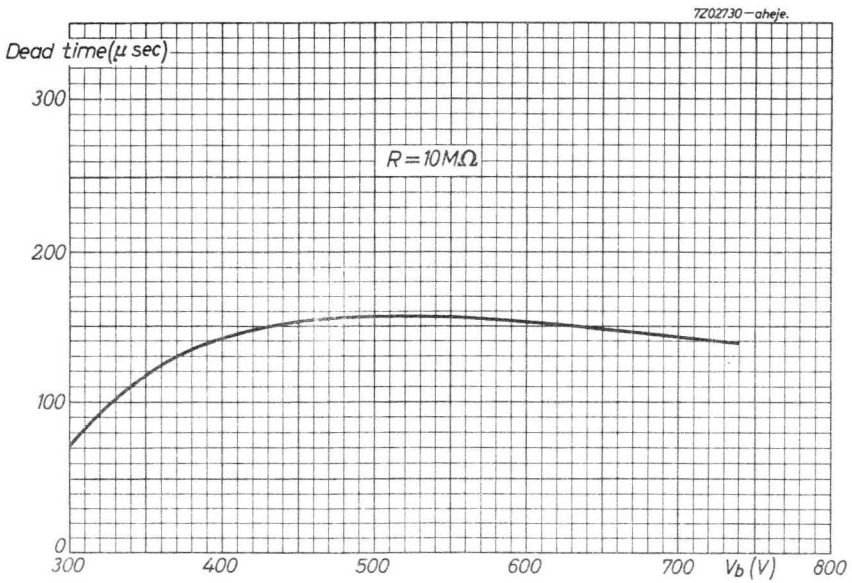
REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02729-aheje.
N(Counts/sec)
120
110
100
90
80
R=10MΩ
300
400
500
600
700
800
Vb(V)
900


7Z02728-aheje.
400
Vign
(V)
350
300
250
200
-60
-40
-20
0
20
40
60
tamb(°C)
80

18505

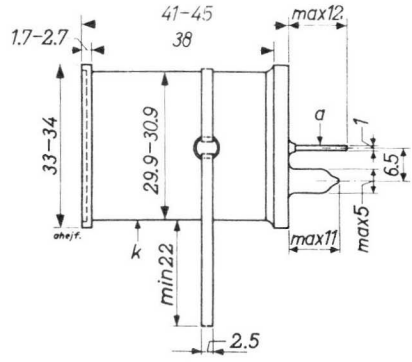

7Z02730—aheje.
Dead time(μ sec)
300
200
100
0
R=10MΩ
300
400
500
600
700
Vb (V)
800

BETA AND GAMMA RADIATION COUNTER TUBE

End window halogen quenched β and γ radiation counter tube

QUICK REFERENCE DATA		
Window thickness	2.5 to 3.5	mg/cm^2
Window diameter	27.8	mm
Operating voltage	450 to 750	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	2.5 to 3.5	mg/cm^2
Effective diameter	=	27.8	mm
Material		mica	

CATHODE

Thickness	=	1.3	mm
Effective length	=	37	mm
Material		28% Cr, 72% Fe	

FILLING Ne, Ar, halogen

7Z2 5010

18506

CAPACITANCE

Anode to cathode	C_{ak}	=	3.5	pF

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Anode resistor (See fig.1)	R	=	10	MΩ
Starting voltage	V_{ign}	=	max. 375	V
Recommended operating voltage	V_b		arbitrary within plateau	
Plateau	V_{pl}	=	450 to 750	V
Plateau slope	S_{pl}	=	max. 0.02	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	=	max. 25	counts/min.
Dead time at V_b = 450 V	τ	=	180	μs

LIMITING VALUES (Absolute max. rating system)

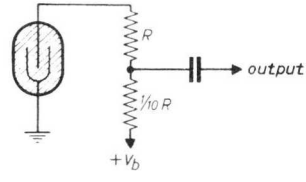
Anode voltage	V_a	=	max. 750	V
Anode resistor	R	=	min. 2	MΩ
Ambient temperature	t_{amb}	=	min. −50	°C
		=	max. +75	°C

LIFE EXPECTANCY

Life expectancy		=	5.10^{10}	counts

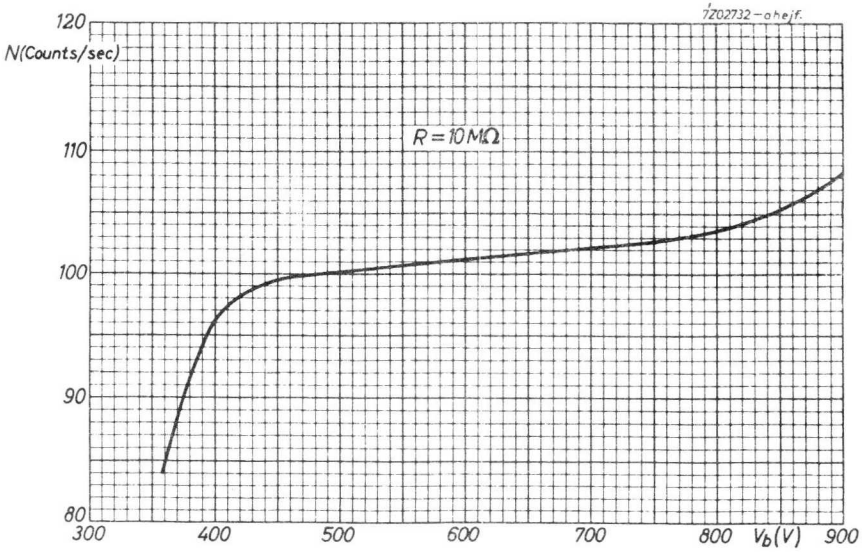
MOUNTING

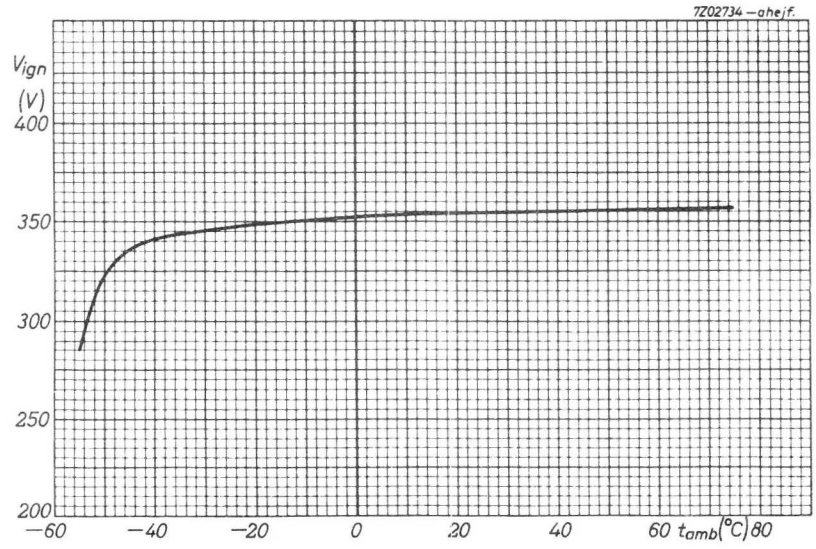
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



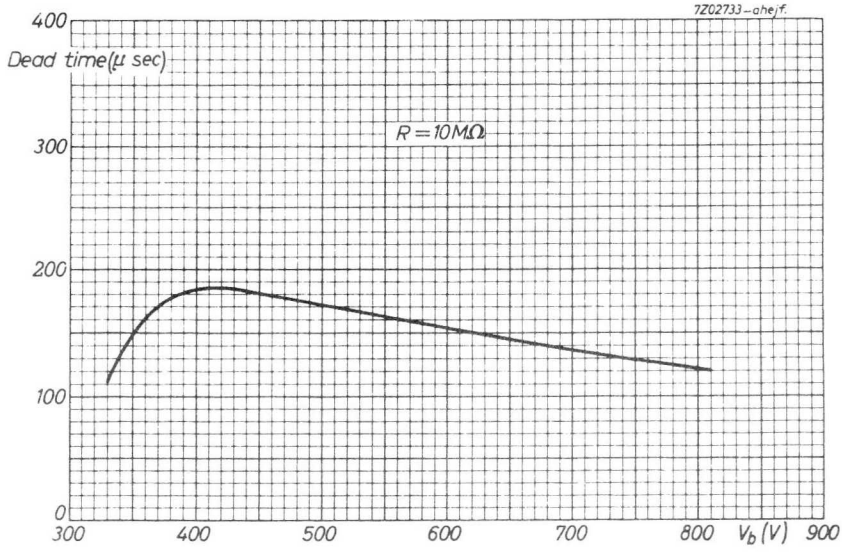
REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02732—ahejf.
N(Counts/sec)
120
110
100
90
80
R = 10 MΩ
300
400
500
600
700
800
Vb(V)
900


7Z02734—ahejf.
Vign
(V)
400
350
300
250
200
—60
—40
—20
0
20
40
60
tamb(°C)
80

18506

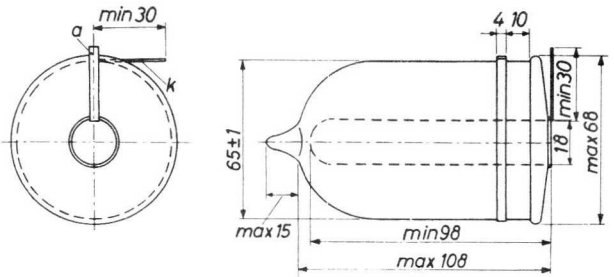

7Z02733 – ahejf.
400
Dead time(μ sec)
300
200
100
0
R = 10MΩ
300
400
500
600
700
800
V_b (V)
900

WELL TYPE GAMMA RADIATION COUNTER TUBE

Well type anode halogen quenched γ radiation counter tube for liquid or solid samples. A test glass containing the sample can be inserted in the anode of the tube.

QUICK REFERENCE DATA		
Sensitivity for I^{131} (1 μC in 10 ml H_2O)	3600	c/min
Operating voltage	800 to 1100	V

DIMENSIONS AND CONNECTIONS



CATHODE AND ANODE

Thickness		=	1 mm
Effective length of anode		=	90 mm
Material			28% Cr, 72% Fe

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak}	=	7 pF

18508

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

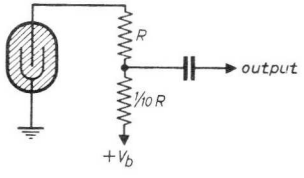
Anode resistor (See fig 1)	R	=	5 to 10	MΩ
Starting voltage	V_{ign}	=	max. 450	V
Recommended operating voltage	V_b		arbitrary within plateau	
Plateau	V_{pl}	=	800 to 1100	V
Plateau slope	S_{pl}	=	max. 0.04	%/V
Background, shielded with 50 mm Pb	N_o	=	max. 100	counts/min.
Dead time at V_b = 1000 V and R = 5 MΩ	τ	=	100	μs
Sensitivity for I^{131} (1 μC in 10 ml H_2O)	N	=	3600	counts/min.

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	=	max. 1200	V
Anode resistor	R	=	min. 5	MΩ
Ambient temperature	t_{amb}	=	min. -50	°C
		=	max. +75	°C

MOUNTING

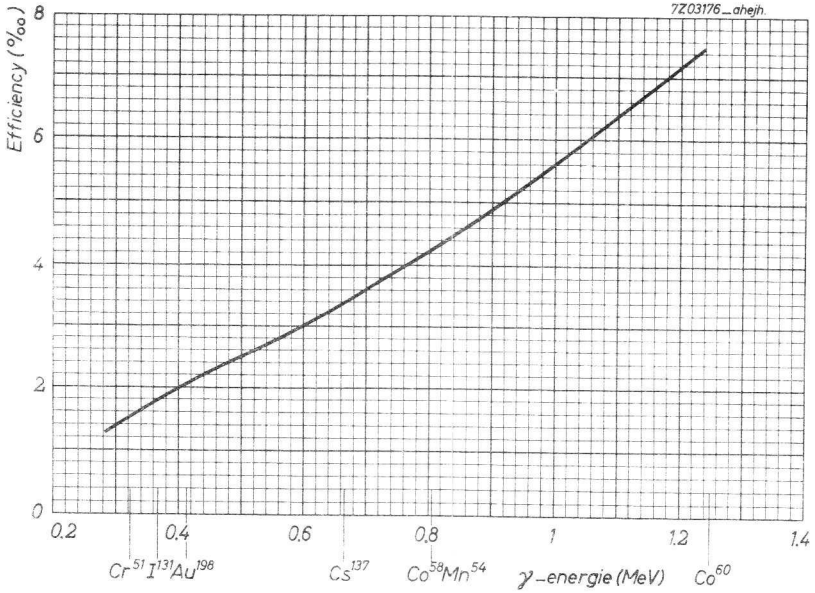
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



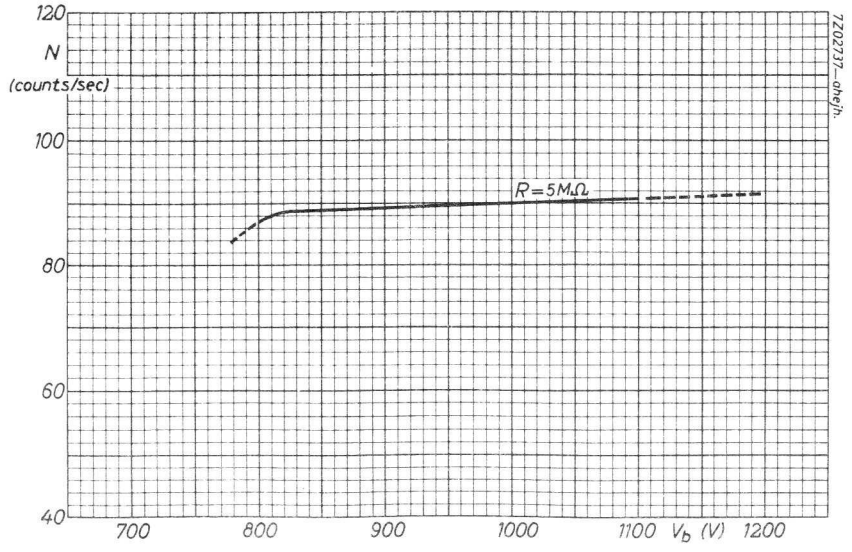
REMARK

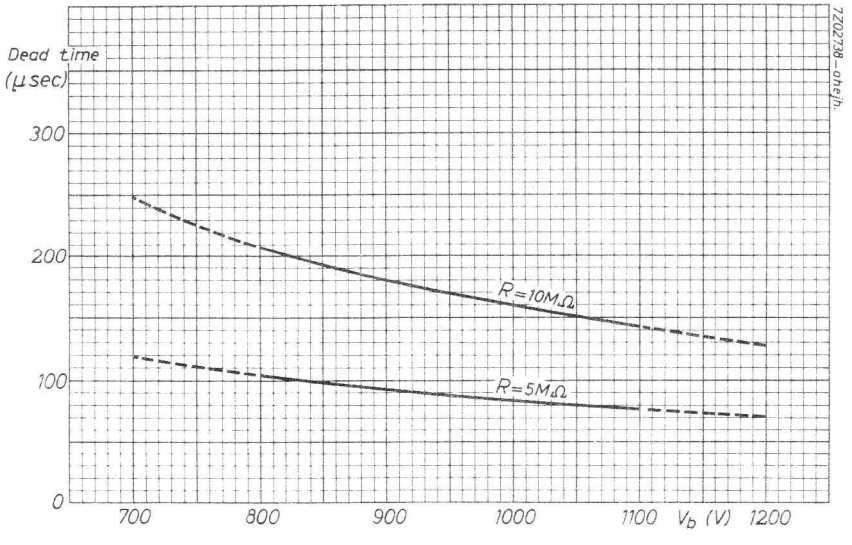
In order to prevent leakage the tube should be kept dry and well cleaned. To prevent contamination with radio-active materials it is recommended to use test glasses for the liquid samples.

7Z2 5013


7Z03176_ahejh.
Efficiency (‰)
8
6
4
2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Cr51 I131 Au198
Cs137
Co58 Mn54
γ-energie (MeV)
Co60

18508


120
N
(counts/sec)
100
80
60
40
700
800
900
1000
1100
V_b (V)
1200
R=5MΩ
7Z02737-ohejh.

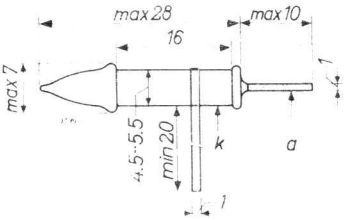

Dead time
(μsec)
300
200
100
0
700
800
900
1000
1100
V_b (V)
1200
R=10MΩ
R=5MΩ
7Z02738-ohejh.

BETA AND GAMMA RADIATION COUNTER TUBE

Halogen quenched radiation counter tube for the measurement of γ and high energy β (>0.5 MeV) radiation.

QUICK REFERENCE DATA	
Range (Co 60 γ radiation)	10^{-3} to 3.10^{2} R/h
Operating voltage	500 to 650 V

DIMENSIONS AND CONNECTIONS



CATHODE

Thickness	=	80 to 100 mg/cm^2
Effective length	=	16 mm
Material		28% Cr, 72% Fe

FILLING He, Ne, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	1 pF

TENTATIVE DATA

18509

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Anode resistor (See fig.1)	R	=	2	MΩ
Starting voltage	V_{ign}	= max.	380	V
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	=	500 to 650	V
Plateau slope	S_{pl}	= max.	0.15	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	= max.	2	counts/min.
Dead time at V_b = 600 V	τ	= max.	20	μs

LIMITING VALUES (Absolute max. rating system)

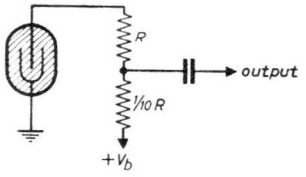
Anode voltage	V_a	= max.	650	V
Anode resistor	R	= min.	2	MΩ
Ambient temperature	t_{amb}	= min.	-40	°C
		= max.	+75	°C

LIFE EXPECTANCY

Life expectancy 5.10^{10} counts.

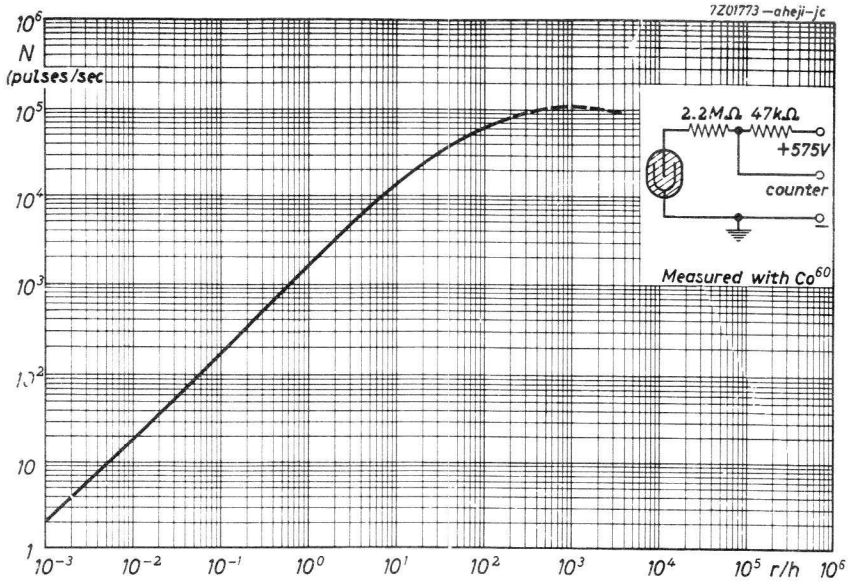
MOUNTING

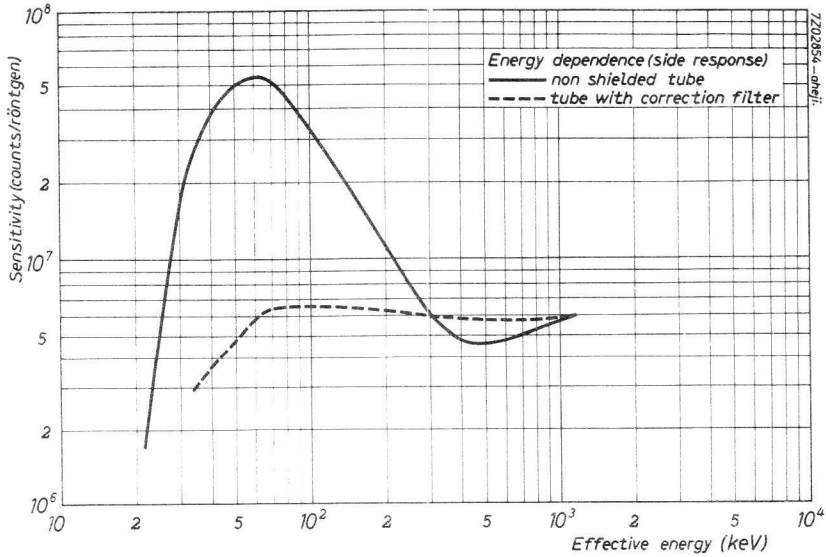
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



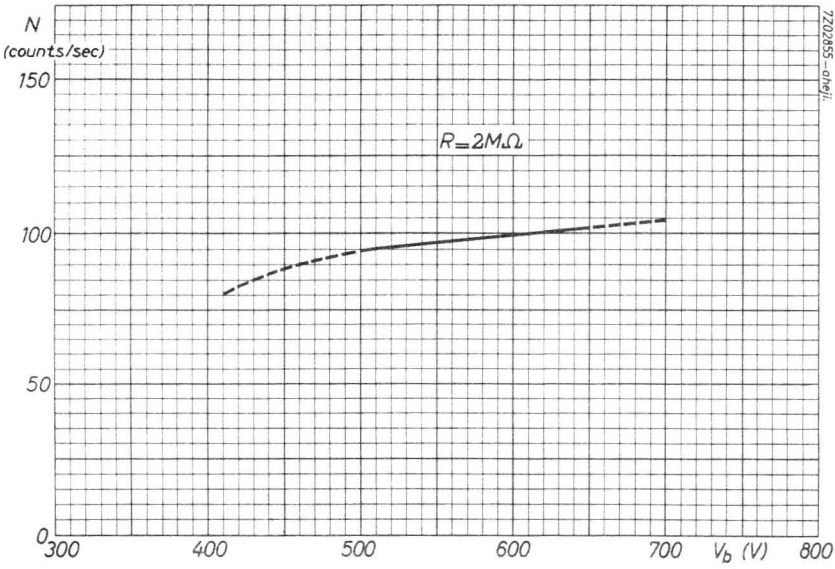
REMARK

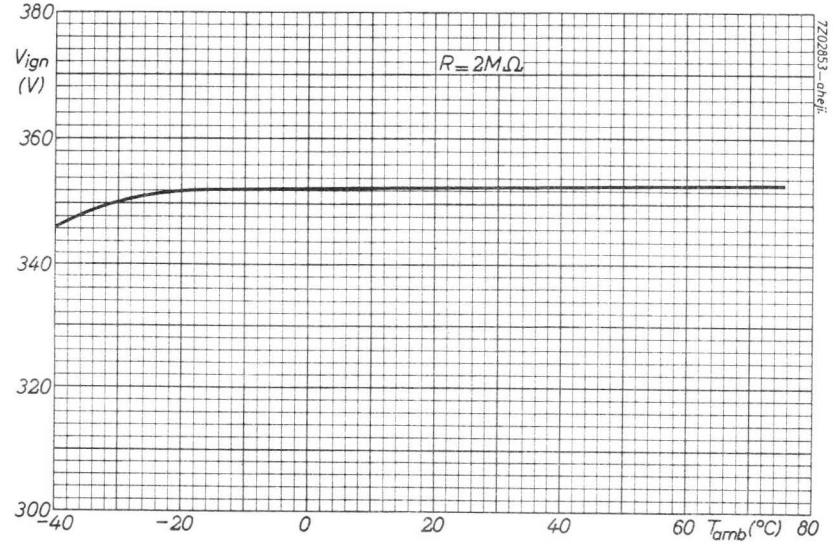
In order to prevent leakage the tube should be kept dry and well cleaned. Because of the thin cathode wall (0.1 mm) the tube should be handled and mounted with utmost care.

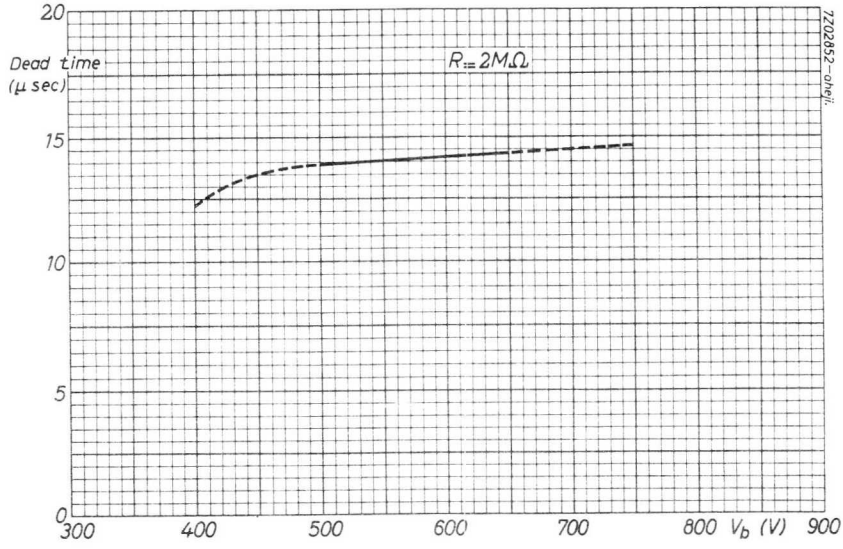

7Z01773—aheji—jc
N
(pulses/sec
2.2MΩ 47kΩ
+575V
counter
Measured with Co60
r/h


7Z02854—aheji
Energy dependence (side response)
non shielded tube
tube with correction filter
Sensitivity (counts/röntgen)
Effective energy (keV)

18509


N
(counts/sec)
150
100
50
0
300
400
500
600
700
800
V_b (V)
R = 2MΩ
7202855—aheji.


380
Vign
(V)
360
340
320
300
−40
−20
0
20
40
60
80
T_{amb}(°C)
R = 2MΩ
7202853—aheji.


20
Dead time
(μ sec)
15
10
5
0
300
400
500
600
700
800
900
V_b (V)
$R_= 2M\Omega$
7Z02852-oheji.

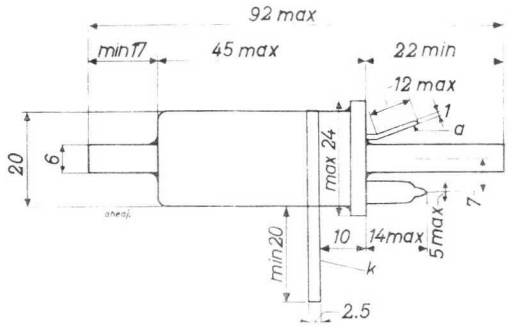
18510

BETA RADIATION LIQUID FLOW COUNTER TUBE

Halogen quenched β radiation liquid flow counter tube.

QUICK REFERENCE DATA		
Thickness of the internal glass tubing	30	mg/cm^2
Operating voltage	500 to 650	V

DIMENSIONS AND CONNECTIONS



INTERNAL GLASS TUBING

Thickness	=	30	mg/cm^2
Effective length	=	36	mm
Inside diameter	=	5.5	mm

CATHODE

Material: 28% Cr, 72% Fe

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode: C_{ak} = 4 pF

18510

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

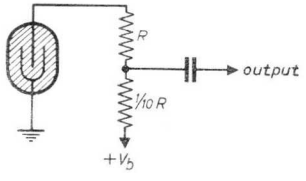
Anode resistor (See fig.1)	R	=	5	MΩ
Starting voltage	V_{ign}	=	max. 375	V
Recommended operating voltage	V_b		arbitrary within plateau	
Plateau	V_{pl}	=	500 to 650	
Plateau slope	S_{pl}	=	max. 0.07	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	=	max. 15	counts/min.
Dead time	τ	=	max. 125	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	=	max. 650	V
Anode resistor	R	=	min. 5	MΩ
Ambient temperature	t_{amb}	=	min. −50	°C
		=	max. +75	°C
Pressure of the liquid inside the glass tubing	P	=	max. 120	cm Hg (abs.)

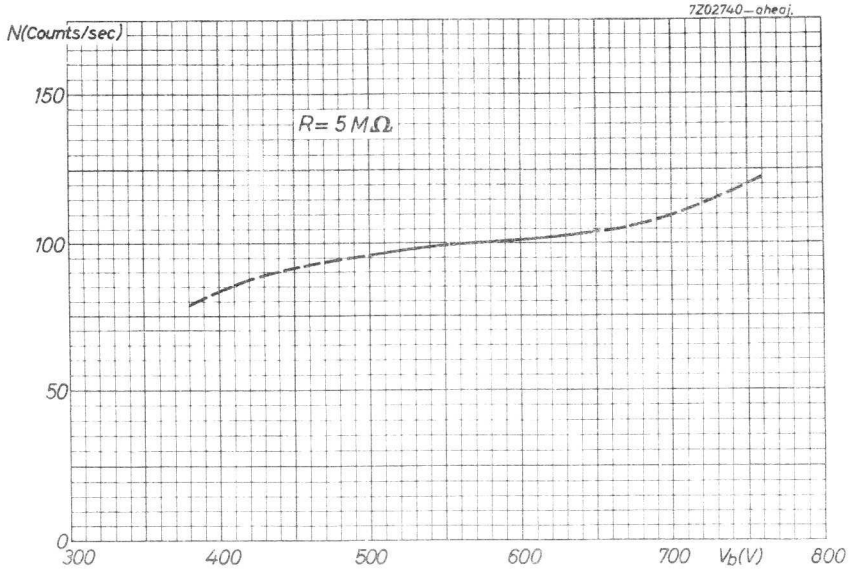
MOUNTING

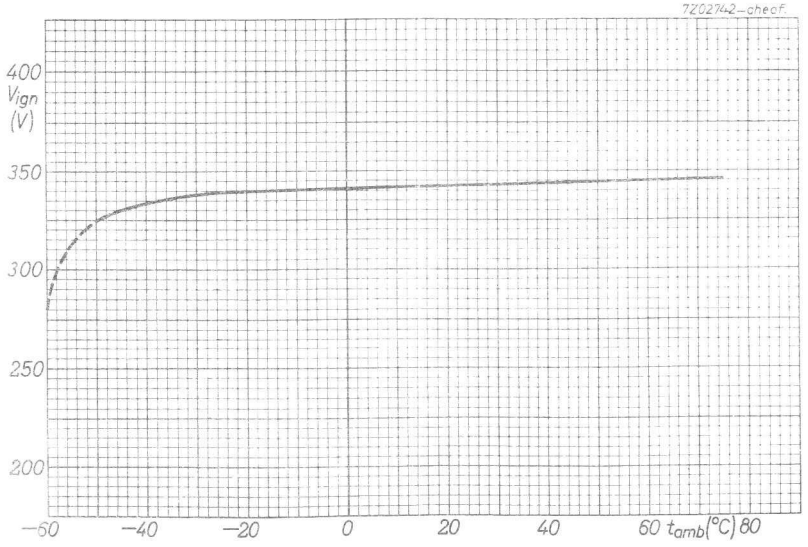
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



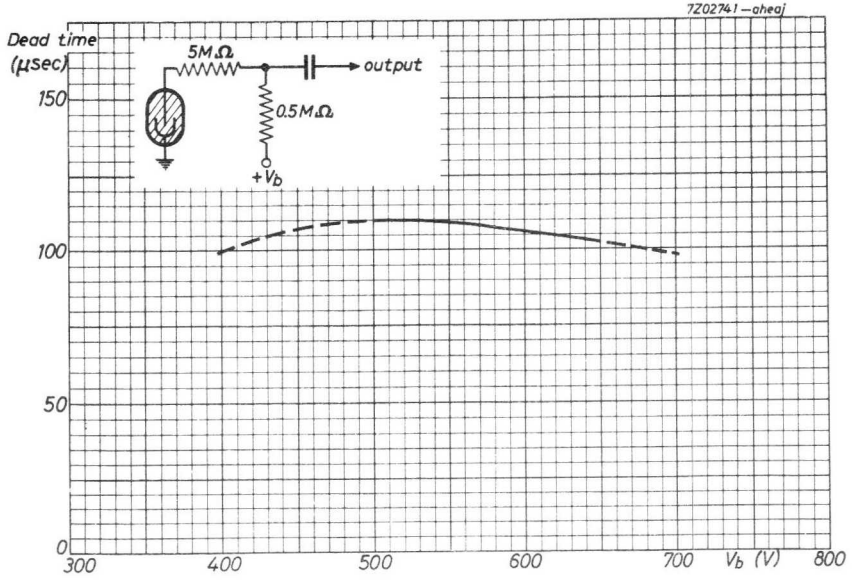
REMARK

The tube with its fragile thin-wall glass tubing should be handled with utmost care. Sudden changes of temperature should be avoided.


7Z02740-aheaj.
N(Counts/sec)
150
100
50
0
R= 5 MΩ
300
400
500
600
700
Vb(V)
800


7Z02742-aheaF.
400
Vign
(V)
350
300
250
200
−60
−40
−20
0
20
40
60
tamb(°C)
80

18510

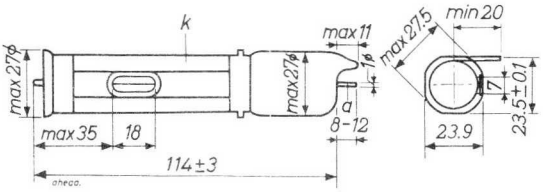

7Z02741—aheaj
Dead time
(μsec)
150
100
50
0
5MΩ
output
0.5MΩ
+Vb
300
400
500
600
700
Vb (V)
800

X-RAY COUNTER TUBE

Side window organic quenched X-ray counter tube

QUICK REFERENCE DATA		
X-Ray energy	2.5 to 40 keV; 0.3 to 5	Å
Window thickness	2 to 2.5	mg/cm^2
Operating voltage	1500 to 1850	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	2 to 2.5	mg/cm^2
Dimensions	=	7x18	mm^2
Material		mica	

CATHODE

Effective length	=	67	mm
Material		28% Cr, 72% Fe	

FILLING

Xenon, organic

Xenon pressure 25 cm Hg

CAPACITANCE

Anode to cathode	C_{ak}	=	2	pF

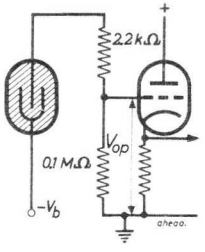
18511

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Operating voltage	V_b	= 1500 to 1850	V	[1]
Geiger treshold		= min. 1900	V	
Operating voltage for pulse amplitude (V_{op}) = 1 mV	V_b	= 1500 to 1550	V	[2]
Operating voltage for pulse amplitude (V_{op}) = 10 mV	V_b	= 1690 to 1770	V	[2]
Energy resolution	$\Delta P/P$	= max. 22	%	[2][3]
Integrated background for pulses 50% of the pulse amplitude P (unshielded)		= 15	counts/min.	[2]

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



REMARK

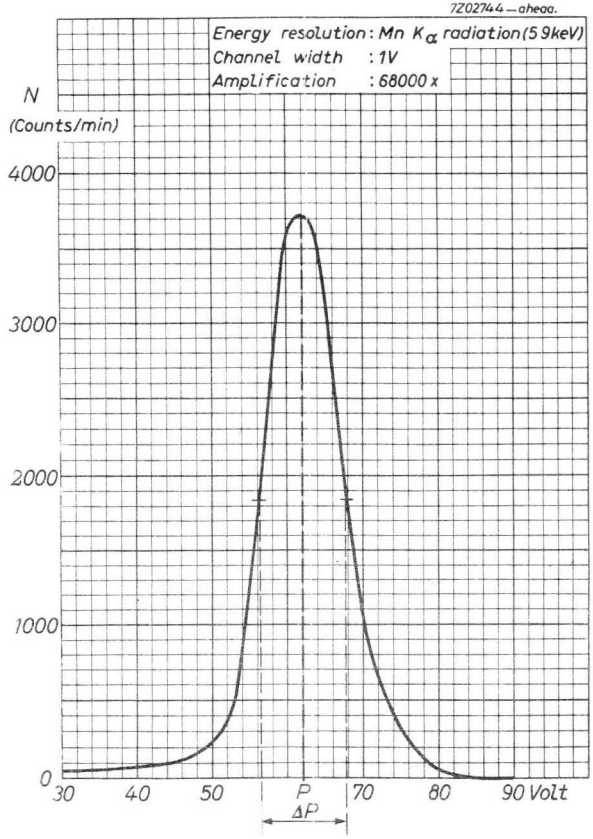
In order to prevent leakage the tube should be kept dry and well cleaned.

---

[1]) To obtain max. tube life V_b should be kept as low as possible.

[2]) For Mn Kα radiation (5.9 keV)

[3]) P = average pulse height, ΔP = width of the pulse height distribution at half of the max. value.

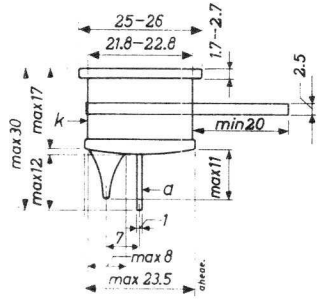

7Z02744 — ahega.
Energy resolution: Mn K_α radiation (5.9keV)
Channel width : 1V
Amplification : 68000 x
N
(Counts/min)
4000
3000
2000
1000
0
30
40
50
P
ΔP
70
80
90 Volt

ALPHA AND BETA RADIATION COUNTER TUBE

End window halogen quenched α and β radiation counter tube for low level measurements in combination with a guard counter (e.g. type 18517).

QUICK REFERENCE DATA		
Window thickness	1.5 to 2	mg/cm^2
Window diameter	19.8	mm
Operating voltage	500 to 700	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	1.5 to 2	mg/cm^2
Effective diameter	=	19.8	mm
Material		mica	

CATHODE

Thickness	=	1.2	mm
Effective length	=	13	mm
Material		28% Cr, 72% Fe	

FILLING Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak}	=	1	pF

7Z2 5014

18515

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

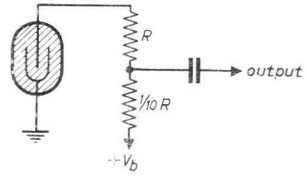
Anode resistor (See fig.1)	R	= 5	10	MΩ
Starting voltage	V_{ign}	= max. 350	350	V
Recommended operating voltage	V_b		arbitrary within plateau [1])	
Plateau	V_{pl}	= 500 to 700	500 to 700	V
Plateau slope	S_{pl}	= max. 0.04	0.03	%/V
Background, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	= max. 5	5	counts/min.
Background in anticoincidence circuit with guard counter 18517, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	= max. 1.2	1.2	counts/min.
Dead time	τ	= max. 35	70	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	700	V
Anode resistor	R	= min.	2	MΩ
Ambient temperature	t_{amb}	= min.	−50	°C
		= max.	+75	°C

MOUNTING

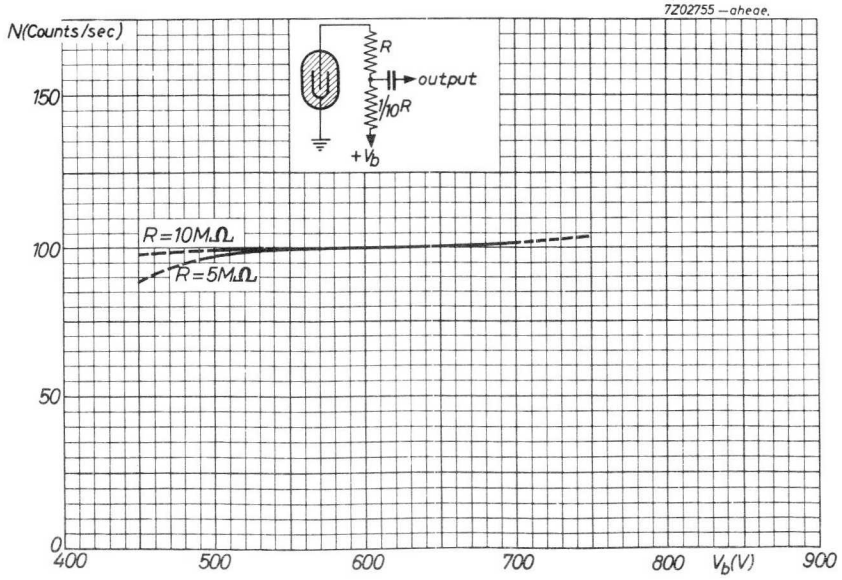
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.

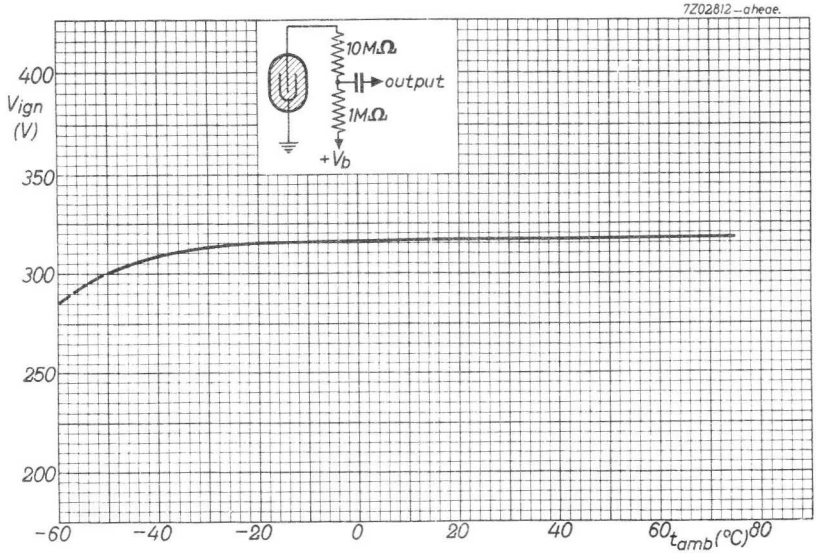


REMARK

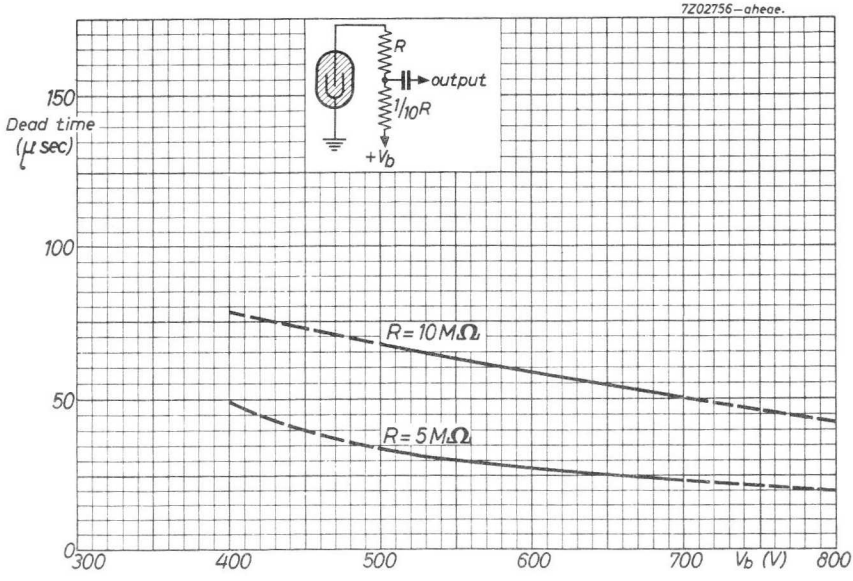
In order to prevent leakage the tube should be kept dry and well cleaned.

[1]) For application in anticoincidence circuits the recommended value of V_b = 600 V


7Z02755—aheae.
N(Counts/sec)
150
100
50
0
400
500
600
700
800
900
V_b(V)
R
output
1/10R
+V_b
R=10MΩ
R=5MΩ


7Z02812—aheae.
400
Vign
(V)
350
300
250
200
-60
-40
-20
0
20
40
60
80
t_{amb}(°C)
10MΩ
output
1MΩ
+V_b

18515


7Z02756—aheae.
R
output
1/10R
+Vb
150
Dead time
(μ sec)
100
50
0
R = 10 MΩ
R = 5 MΩ
300
400
500
600
700
Vb (V)
800

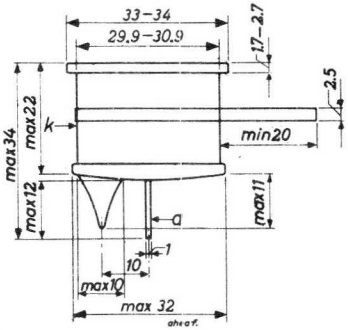
18516

BETA RADIATION COUNTER TUBE

End window halogen quenched β radiation counter tube for low level measurements in combination with a guard counter (e.g. type 18518)

QUICK REFERENCE DATA		
Window thickness	10	mg/cm^2
Window diameter	27.8	mm
Operating voltage	500 to 750	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	10	mg/cm^2
Effective diameter	=	27.8	mm
Material		Ferrochromium	

CATHODE

Thickness	=	1.2	mm
Effective length	=	18	mm
Material		28% Cr, 72% Fe	

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak}	=	1.3	pF

7Z2 5022

18516

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

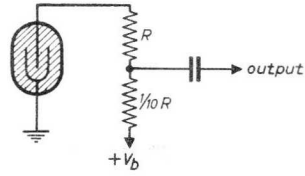
Anode resistor (See fig.1)	R	= 10	5	MΩ
Starting voltage	V_{ign}	= max. 375	375	V
Recommended operating voltage	V_b		arbitrary within plateau [1]	
Plateau	V_{pl}	= 500 to 750	500 to 750	V
Plateau slope	S_{pl}	= max. 0.03	0.04	%/V
Background, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	= max. 9	9	counts/min.
Background in anticoincidence circuit with guard counter 18518, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	= max. 1.3	1.3	counts/min.
Dead time at V_b = 600 V	τ	= max. 70	40	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	750	V
Anode resistor	R	= min.	4.7	MΩ
Ambient temperature	t_{amb}	= min.	−50	°C
		= max.	+75	°C

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.

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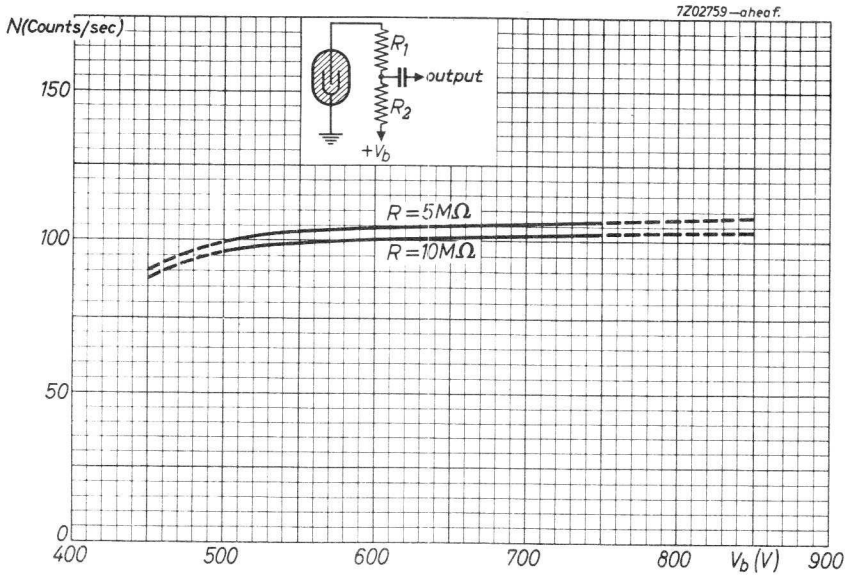
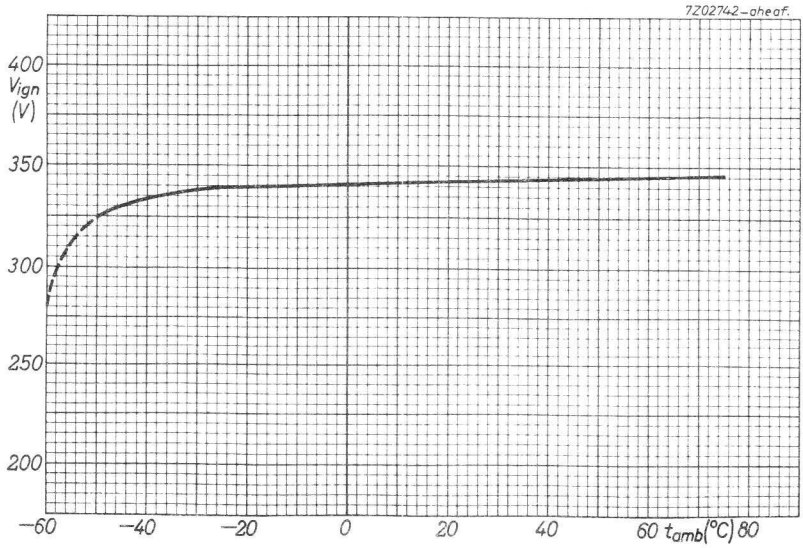
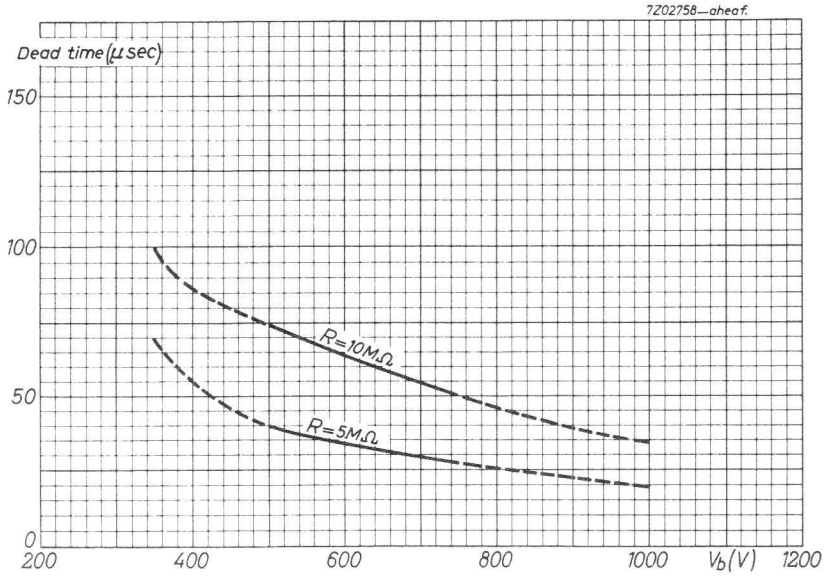
[1]) For application in anticoincidence circuits the recommended value of V_b = 600 V


7Z02759—aheaf.
N(Counts/sec)
150
100
50
0
400
500
600
700
800
900
V_b (V)
R_1
output
R_2
$+V_b$
R = 5MΩ
R = 10MΩ


7Z02742—aheaf.
400
V_{ign} (V)
350
300
250
200
−60
−40
−20
0
20
40
60
80
t_{amb}(°C)

18516

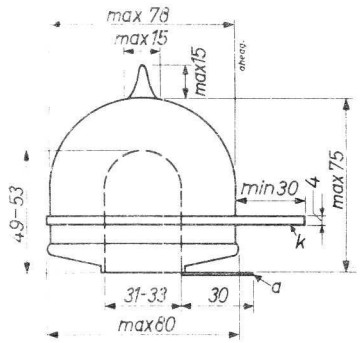

7Z02758—aheaf.
Dead time (μsec)
150
100
50
0
200
400
600
800
1000
1200
Vb (V)
R=10MΩ
R=5MΩ

ANTICOINCIDENCE GUARD COUNTER TUBE

Halogen quenched cosmic ray guard counter tube for low background measurements together with a β counter tube (e.g. type 18515)

QUICK REFERENCE DATA		
Hollow anode diameter	31	mm
Operating voltage	800 to 1200	V

DIMENSIONS AND CONNECTIONS



CATHODE AND ANODE

Thickness	=	1 mm
Material		28% Cr, 72% Fe

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	5.5 pF

18517

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

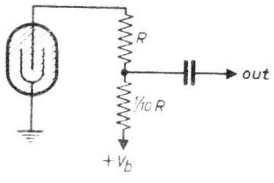
Anode resistor (See fig.1)	R	=	10	MΩ
Starting voltage	V_{ign}	= max.	650	V
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau (at 50 counts/s)	V_{pl}	= 800 to	1200	V
Plateau slope (at 50 counts/s)	S_{pl}	= max.	0.03	%/V
Background, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	= max.	75	counts/min.
Dead time (at 50 counts/s)	τ	= max.	1	ms

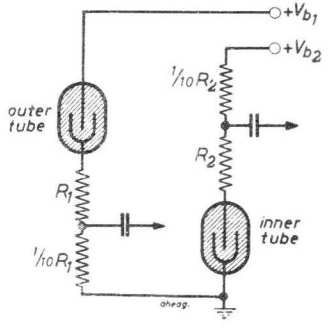
LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	1200	V
Ambient temperature	t_{amb}	= min.	-50	°C
		= max.	+75	°C

MOUNTING

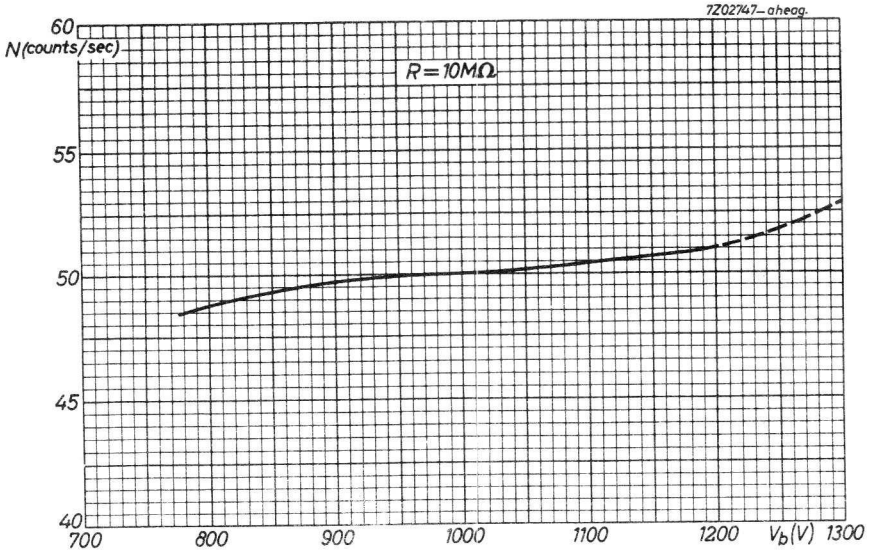
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1. For use as guard counter tube in anticoincidence circuits in combination with 18515: recommended circuit see fig.2.

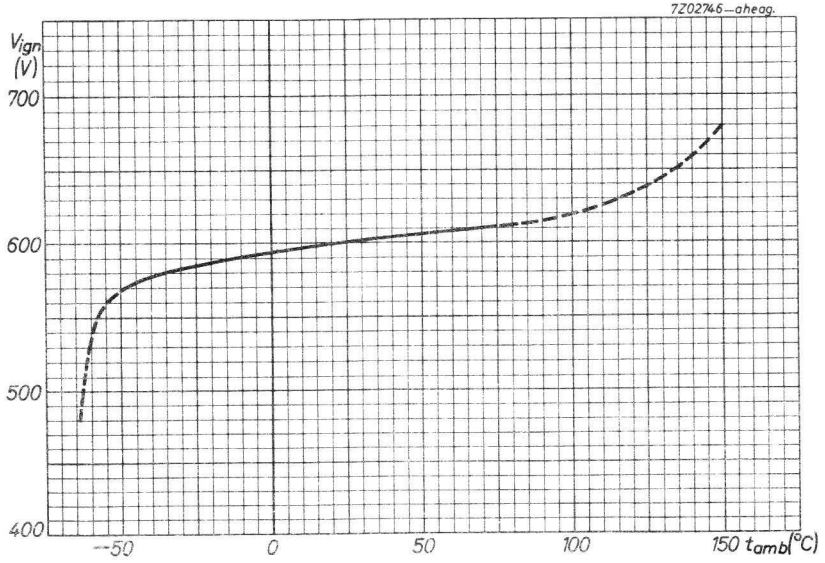




REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02747—aheag.
N(counts/sec)
R=10MΩ
60
55
50
45
40
700
800
900
1000
1100
1200
Vb(V)
1300

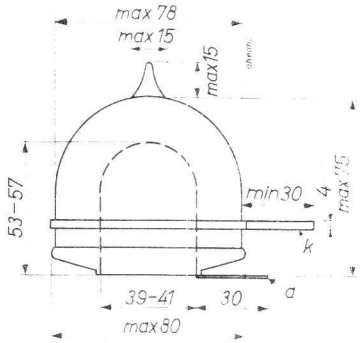

7Z02746—aheag.
Vign (V)
700
600
500
400
−50
0
50
100
150
tamb(°C)

ANTICOINCIDENCE GUARD COUNTER TUBE

Halogen quenched cosmic ray guard counter tube for low background measurements in combination with β counter (e.g. type 18516 or 18536). It can also be used in combination with a gas-flow counter.

QUICK REFERENCE DATA		
Hollow anode diameter	39	mm
Operating voltage	800 to 1200	V

DIMENSIONS AND CONNECTIONS



CATHODE AND ANODE

Thickness		=	1 mm
Material			28% Cr, 72% Fe

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak}	=	8 pF

18518

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Anode resistor (See fig.1)	R	=	10	MΩ
Starting voltage	V_{ign}	=	max. 650	V
Recommended operating voltage	V_b		arbitrary within plateau	
Plateau (at 50 counts/s)	V_{pl}	=	800 to 1200	V
Plateau slope (at 50 counts/s)	S_{pl}	=	max. 0.03	%/V
Background, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	=	max. 70	counts/min.
Dead time (at 50 counts/s)	τ	=	max. 1	ms

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	=	max. 1200	V
Ambient temperature	t_{amb}	=	min. −50	°C
		=	max. +75	°C

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1. For use as guard counter tube in anticoincidence circuits in combination with 18516: recommended circuit see fig.2.

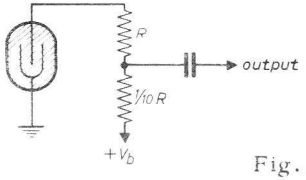


Fig.1

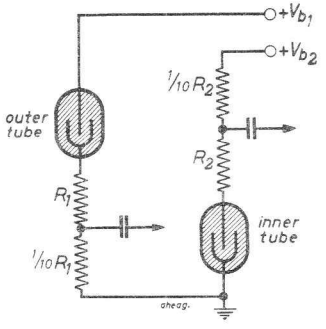
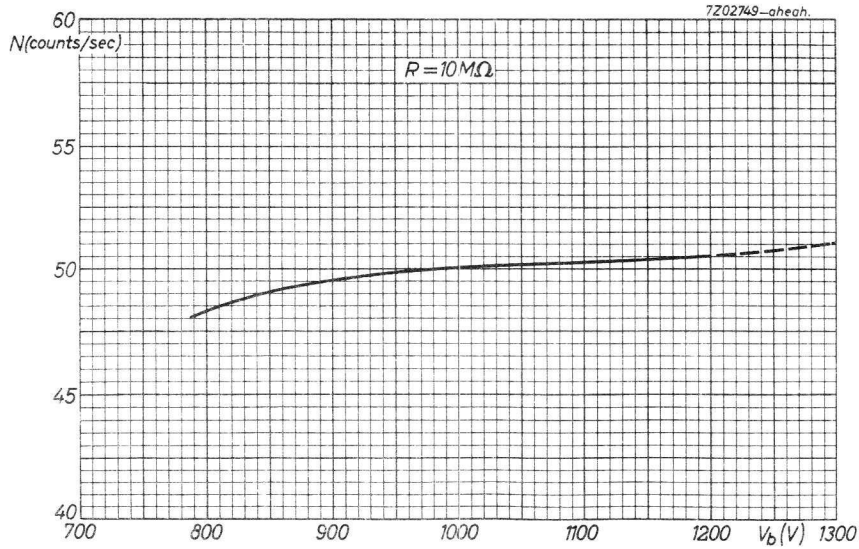
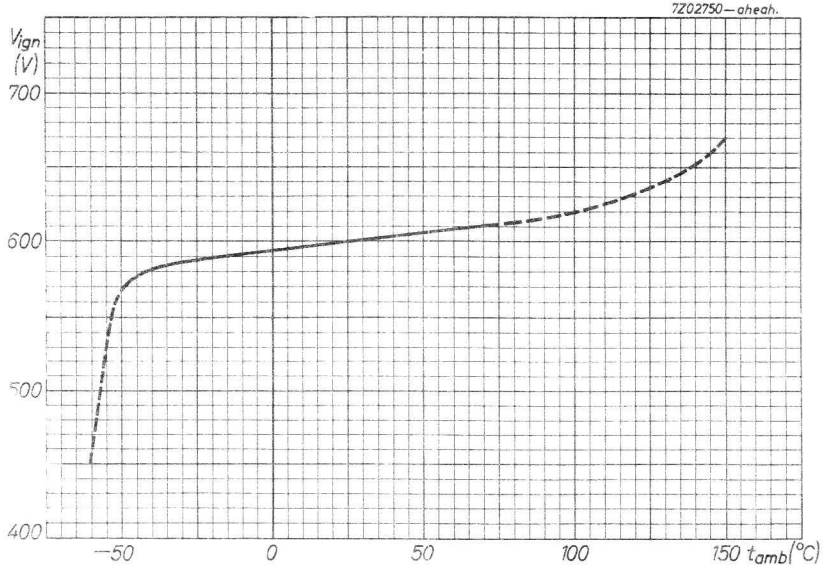


Fig.2

REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02749—aheah.
60
N(counts/sec)
R = 10 MΩ
55
50
45
40
700
800
900
1000
1100
1200
Vb (V)
1300


7Z02750—aheah.
Vign
(V)
700
600
500
400
−50
0
50
100
150
tamb (°C)

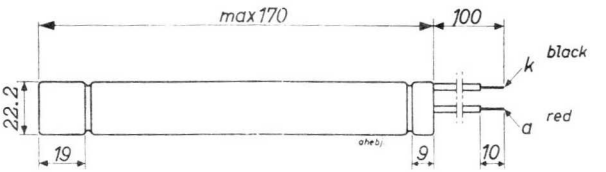
18520

GAMMA RADIATION COUNTER TUBE

Halogen quenched γ radiation counter tube.

QUICK REFERENCE DATA		
Range (Co 60 γ radiation)	5.10^{-4} to 2.10^{-1}	R/h
Operating voltage	375 to 475	V

DIMENSIONS AND CONNECTIONS



CATHODE

Thickness		=	0.7 mm
Effective length		=	140 mm
Material			27% Cr, 73% Fe

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak}	=	4.5 pF

18520

OPERATING CHARACTERISTICS (t_{amb} = 20 °C)

Anode resistor (See fig.1)	R	=	2.7	MΩ
Starting voltage	V_{ign}	=	max. 345	V
Recommended operating voltage	V_b		arbitrary within plateau	
Plateau	V_{pl}	=	375 to 475	V
Plateau slope	S_{pl}	=	max. 0.15	%/V
Background, shielded with 50 mm Pb and 6 mm Al	N_o	=	40	counts/min.
Background, unshielded	N_o	=	90	counts/min.
Dead time	τ	=	max. 200	μs

LIMITING VALUES (Absolute max. rating system)

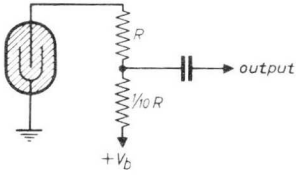
Anode voltage	V_a	=	max. 475	V
Anode resistor	R	=	min. 2	MΩ
Ambient temperature	t_{amb}	=	min. −55	°C
		=	max. +75	°C

LIFE EXPECTANCY

Life expectancy	5.10^{10}	counts

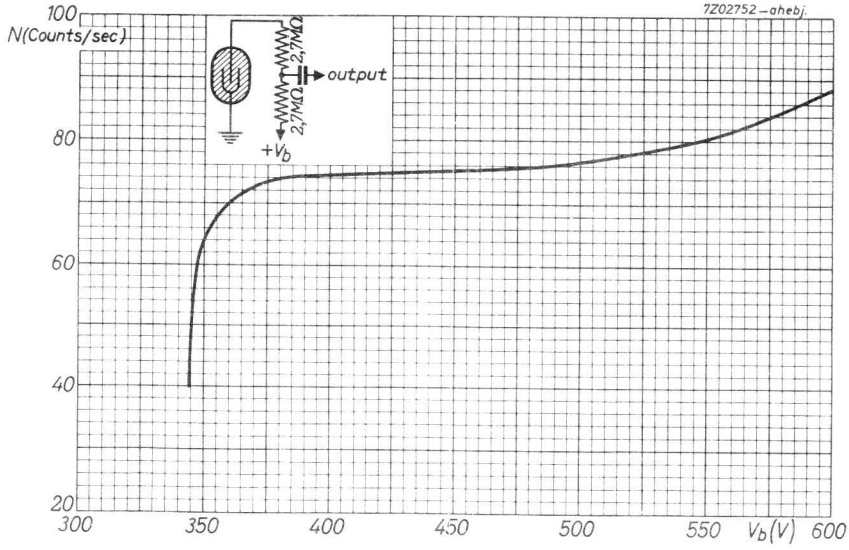
MOUNTING

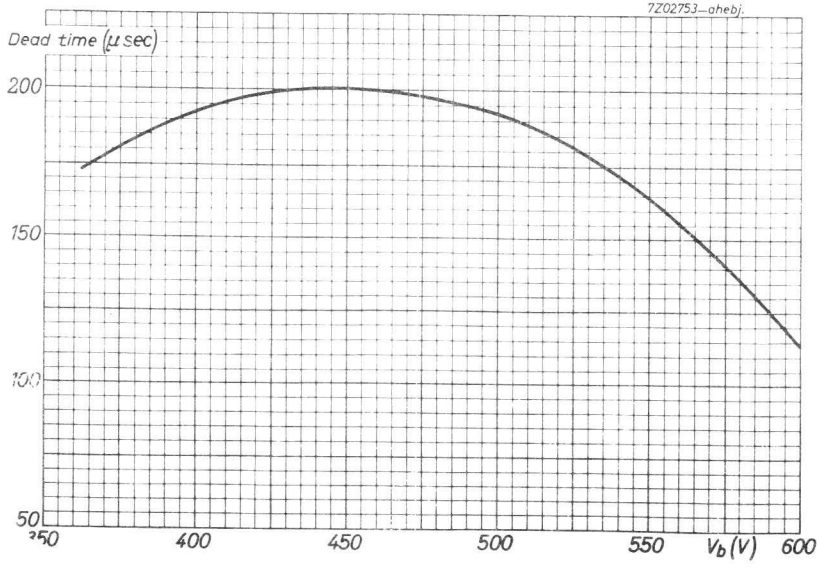
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02752—ahebj.
N(Counts/sec)
100
80
60
40
20
2,7MΩ
2,7MΩ
output
+Vb
300
350
400
450
500
550
Vb(V)
600

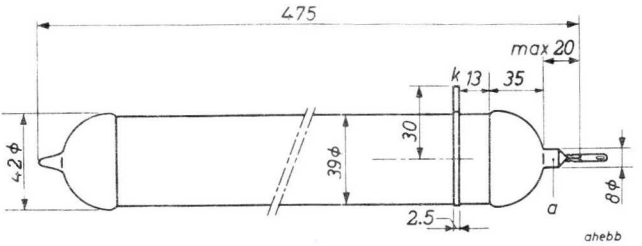

7Z02753—ahebj.
Dead time (μsec)
200
150
100
50
350
400
450
500
550
Vb(V)
600

GAMMA RADIATION COUNTER TUBE

Halogen quenched γ radiation counter tube.

QUICK REFERENCE DATA		
Range (Co 60 γ radiation)	10^{-5} to 3.10^{-2}	R/h
Operating voltage	600 to 1000	V

DIMENSIONS AND CONNECTIONS



CATHODE

Thickness		=	0.5 mm
Effective length		=	400 mm
Material			28% Cr, 72% Fe

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak}	=	15 pF

18522

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

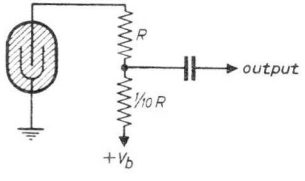
Anode resistor (See fig.1)	R	=	10	MΩ
Starting voltage	V_{ign}	= max.	500	V
Recommended operating voltage	V_b		arbitrary within plateau	
Plateau	V_{pl}	=	600 to 1000	V
Plateau slope	S_{pl}	= max.	0.03	%/V
Background, shielded with 50 mm Pb	N_o	= max.	160	counts/min.
Dead time at V_b = 800 V	τ	= max.	550	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	1000	V
Anode resistor	R	= min.	9	MΩ
Ambient temperature	t_{amb}	= min.	−50	°C
		= max.	+75	°C

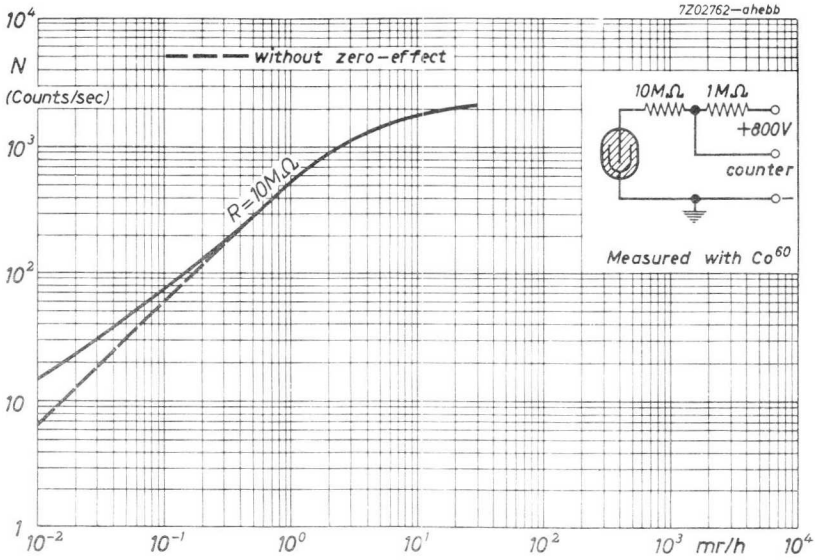
MOUNTING

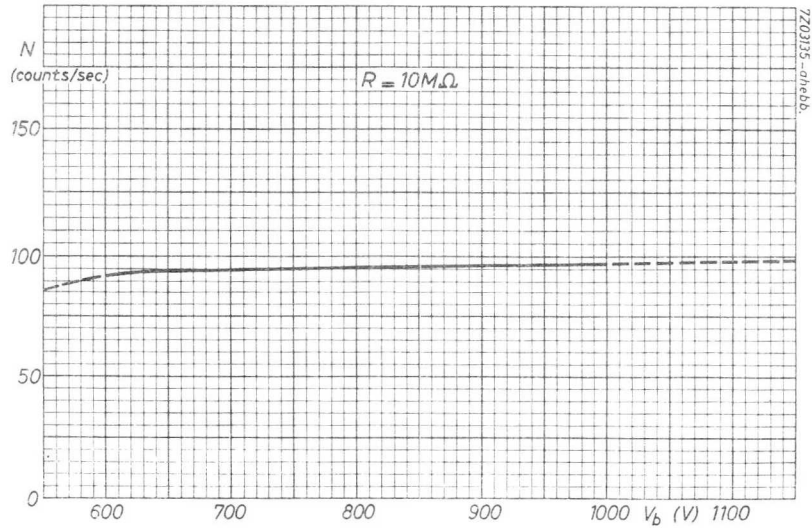
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig 1.



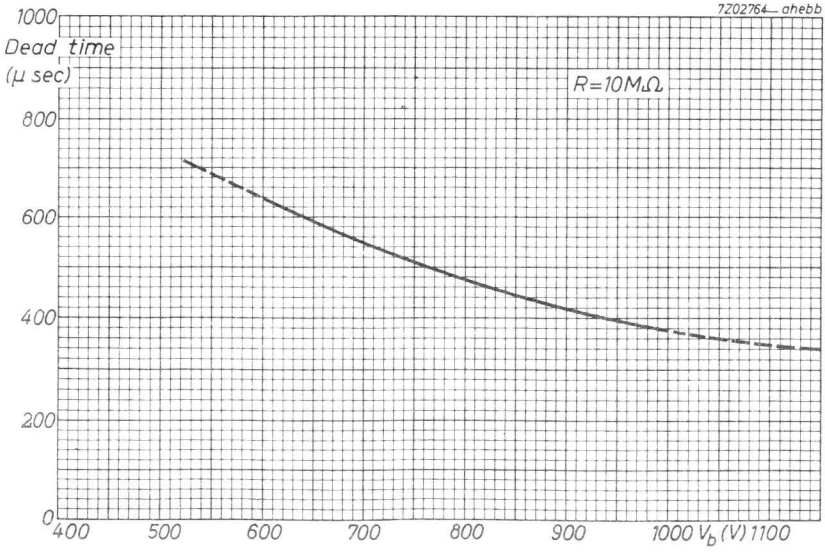
REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02762—ahebb
N
(Counts/sec)
without zero-effect
R=10MΩ
10MΩ
1MΩ
+800V
counter
Measured with Co60
mr/h


7Z02135—ahebb
N
(counts/sec)
R = 10MΩ
Vb (V)

18522


7Z02764 ohebb
1000
Dead time
(μ sec)
800
600
400
200
0
R=10MΩ
400
500
600
700
800
900
1000 V_b (V) 1100

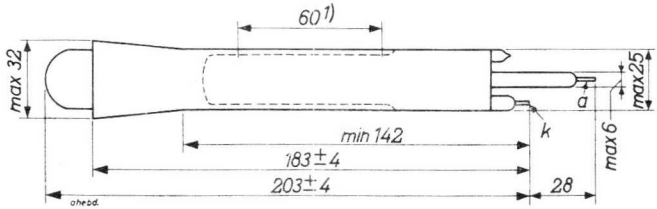
18524
18525

BETA AND GAMMA RADIATION COUNTER TUBE

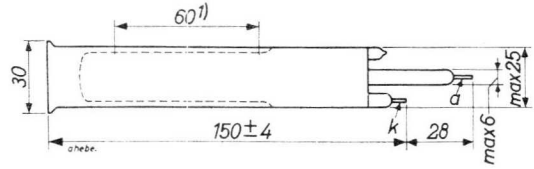
Halogen quenched β and γ radiation counter tube for liquid samples.

QUICK REFERENCE DATA		
Glass wall thickness	25	mg/cm^2
Operating voltage	400 to 500	V

DIMENSIONS AND CONNECTIONS



18524



18525

GLASS WALL

Thickness	=	25	mg/cm^2
Effective length	=	60	mm
Liquid capacity	=	9 to 10	cm^3

FILLING Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	2.5	pF

---

1) Thin wall

18524
18525

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Anode resistor (See fig.1)	R	=	2.7	MΩ
Starting voltage	V_{ign}	=	max. 350	V
Recommended operating voltage	V_b		arbitrary within plateau	
Plateau	V_{pl}	=	400 to 500	V
Plateau slope	S_{pl}	=	max. 0.15	%/V
Background, shielded with 50 mm Pb and 6 mm Al	N_o	=	12	counts/min.
Dead time	τ	=	max. 100	μs

LIMITING VALUES (Absolute max. rating system)

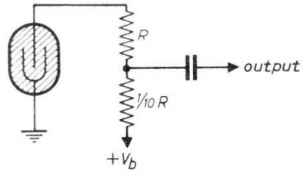
Anode voltage	V_a	=	max. 500	V
Anode resistor	R	=	min. 2	MΩ
Ambient temperature	t_{amb}	=	min. −55	°C
		=	**max.** +75	°C

LIFE EXPECTANCY

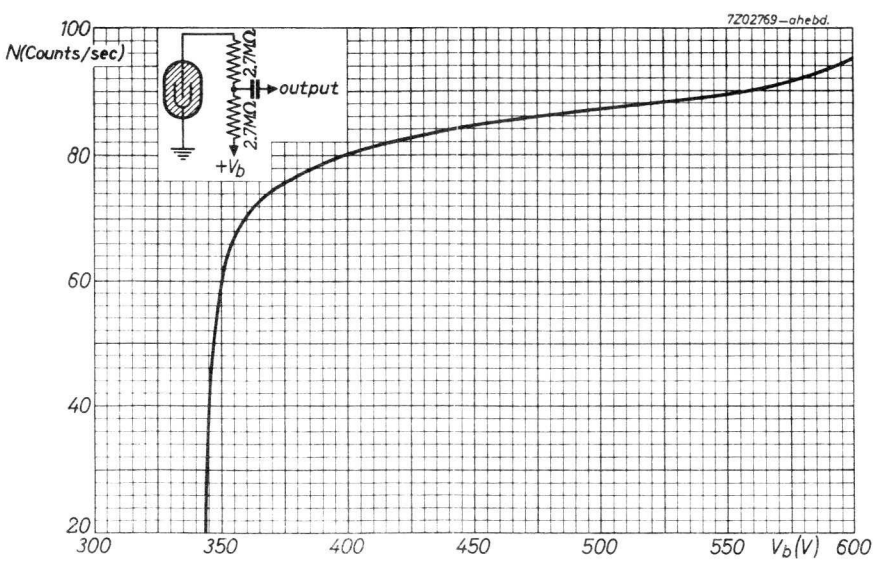
Life expectancy		=	5.10^{10}	counts.

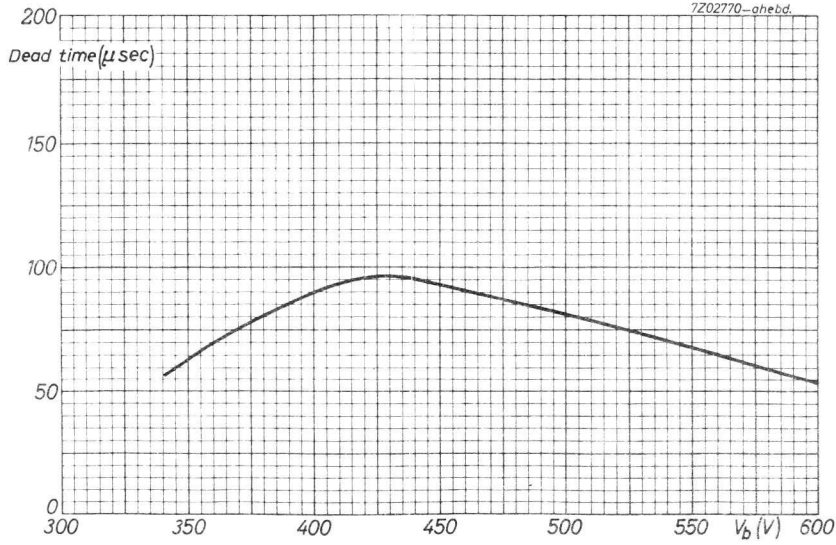
MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



18524
18525


7Z02769—ahebd.
N(Counts/sec)
100
80
60
40
20
2.7MΩ
2.7MΩ
output
+Vb
300
350
400
450
500
550
Vb(V)
600

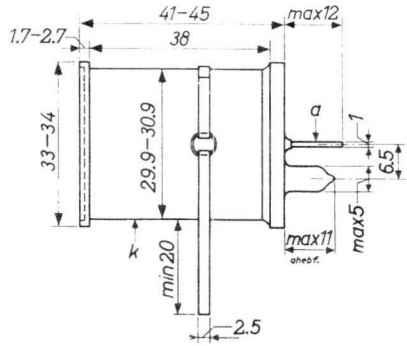

7Z02770—ahebd.
Dead time(μsec)
200
150
100
50
0
300
350
400
450
500
550
Vb(V)
600

ALPHA, BETA AND GAMMA RADIATION COUNTER TUBE

End window halogen quenched α, β and γ radiation counter tube.

QUICK REFERENCE DATA		
Window thickness	1.5 to 2	mg/cm^2
Window diameter	27.8	mm
Operating voltage	450 to 750	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	1.5 to 2	mg/cm^2
Effective diameter	=	27.8	mm
Material	=	mica	

CATHODE

Thickness	=	1.3	mm
Effective length	=	37	mm
Material		28% Cr, 72% Fe	

FILLING

Ne, Ar, halogen

18526

CAPACITANCE

Anode to cathode	C_{ak}	=	3.5	pF

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

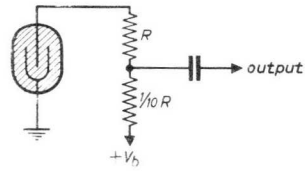
Anode resistor (See fig.1)	R	=	10	MΩ
Starting voltage	V_{ign}	= max.	375	V
Recommended operating voltage	V_b	= arbitrary within plateau		
Plateau	V_{pl}	= 450 to	750	V
Plateau slope	S_{pl}	= max.	0.02	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	= max.	25	counts/min.
Dead time	τ	= max.	200	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	750	V
Anode resistor	R	= min.	2	MΩ
Ambient temperature	t_{amb}	= min.	−50	°C
		= max.	+75	°C

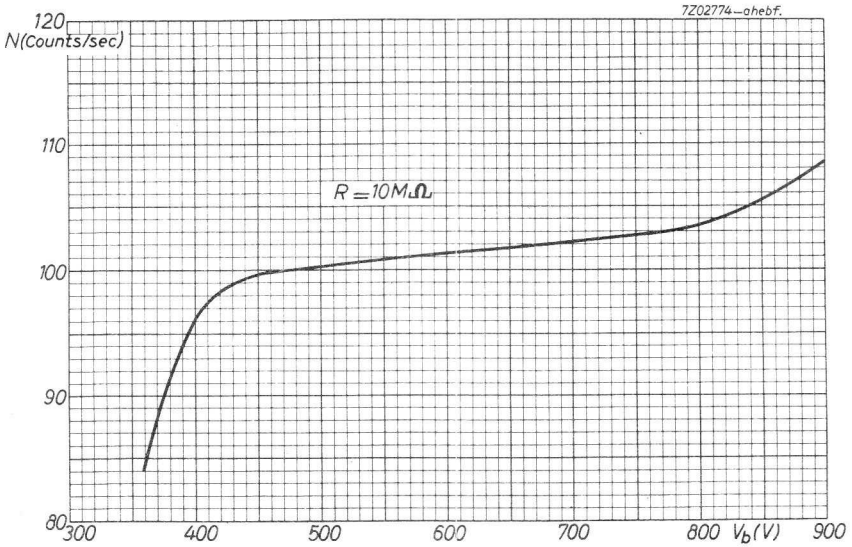
MOUNTING

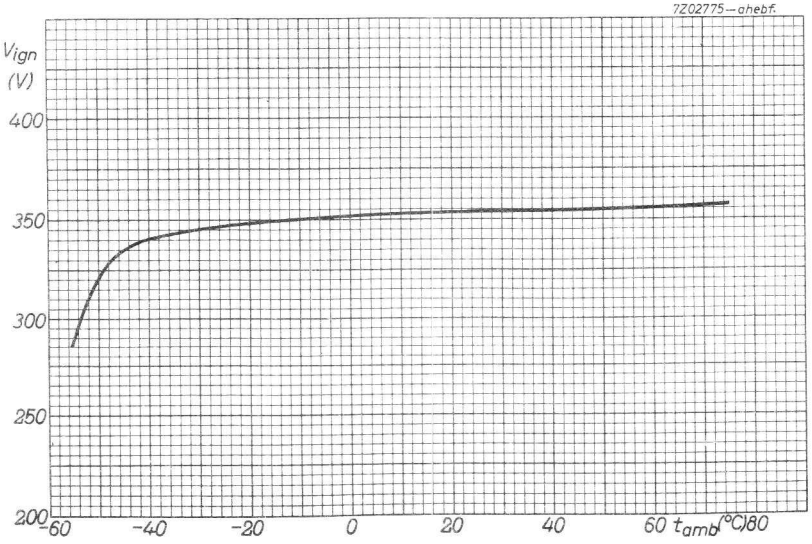
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



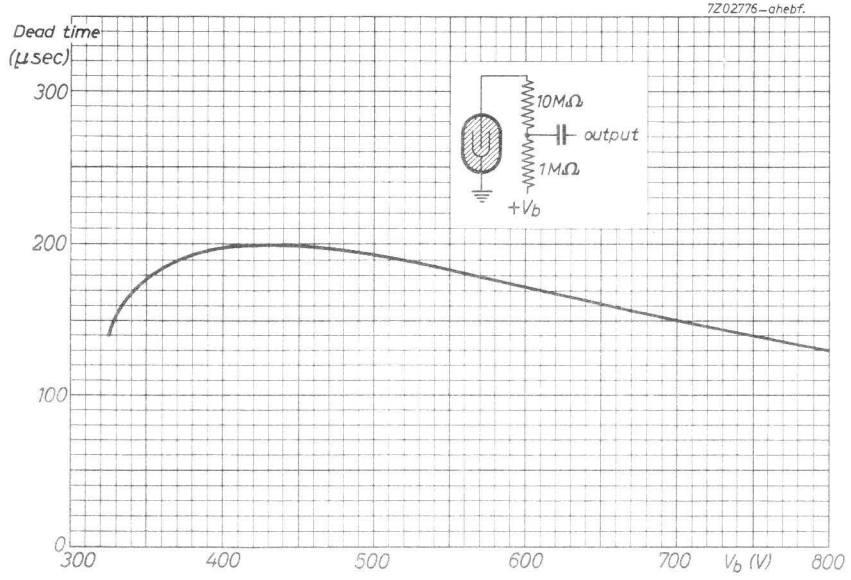
REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02774—ahebf.
120
N(Counts/sec)
110
100
90
80
R = 10MΩ
300
400
500
600
700
800
V_b(V)
900


7Z02775—ahebf.
V_{ign}
(V)
400
350
300
250
200
-60
-40
-20
0
20
40
60
t_{amb}(°C)80

18526

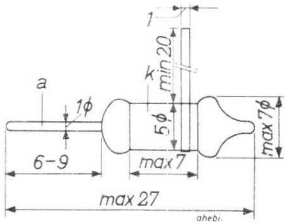

7Z02776–ahebf.
Dead time
(μsec)
300
200
100
0
300
400
500
600
700
800
V_b (V)
10MΩ
output
1MΩ
+V_b

BETA AND GAMMA RADIATION COUNTER TUBE

Halogen quenched radiation counter tube for the measurement of γ and high energy β (> 0.5 Me V) radiation.

QUICK REFERENCE DATA		
Range (Co 60 γ radiation)	10^{-2} to 2.10^{3}	R/h
Operating voltage	500 to 650	V

DIMENSIONS AND CONNECTIONS



CATHODE

Thickness	=	80 to 100	mg/cm^2
Effective length	=	8	mm
Material		28% Cr, 72% Fe	

FILLING

He, Ne, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	0.5	pF

18529

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Anode resistor (See fig.1.)	R	=	2	MΩ
Starting voltage	V_{ign}	=	max. 400	V
Recommended operating voltage	V_b		arbitrary within plateau	
Plateau	V_{pl}	=	500 to 650	V
Plateau slope	S_{pl}	=	max. 0.25	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	=	max. 1	count/min.
Dead time	τ	=	max. 20	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	=	max. 650	V
Anode resistor	R	=	min. 2	MΩ
Ambient temperature	t_{amb}	=	min. -40	°C
		=	max. +75	°C

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuits see fig.1 and 2.

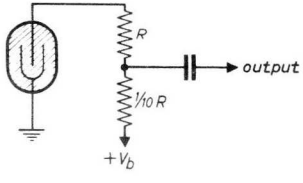
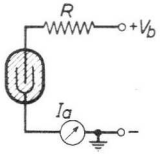


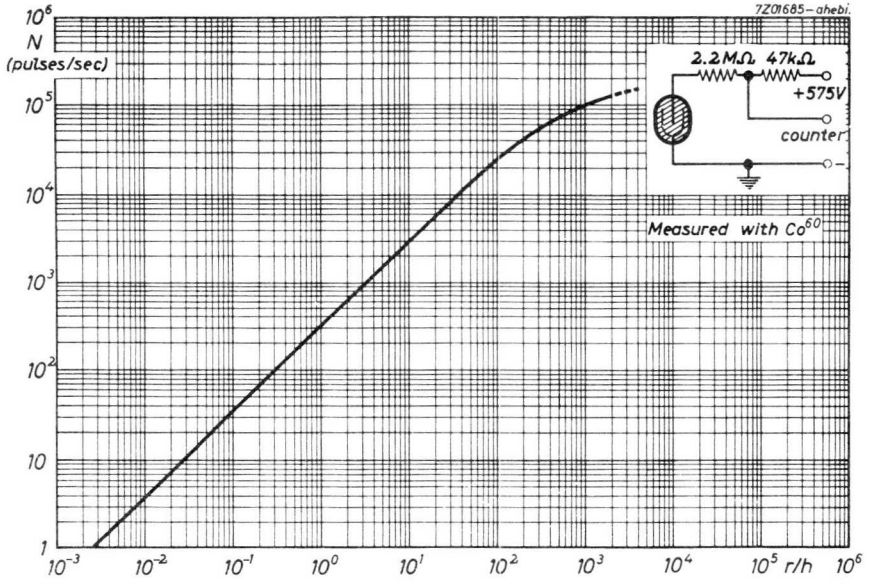
Fig.1

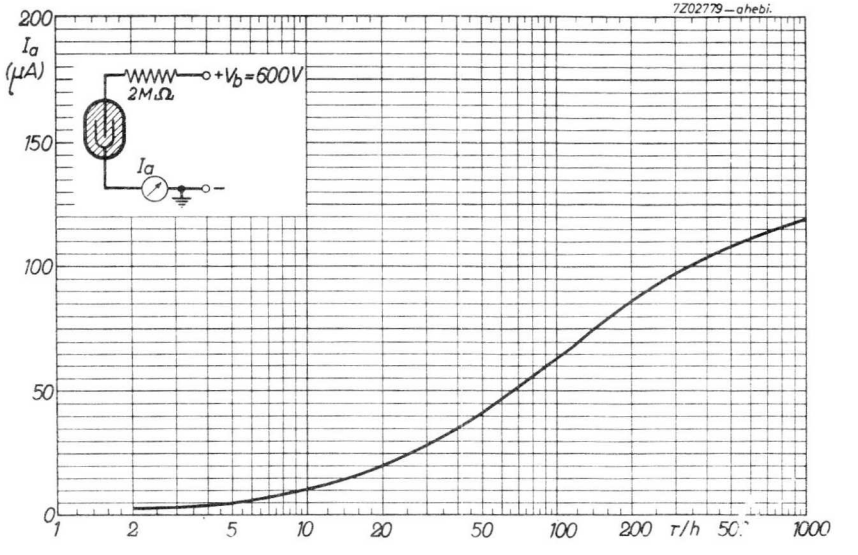
Fig.2



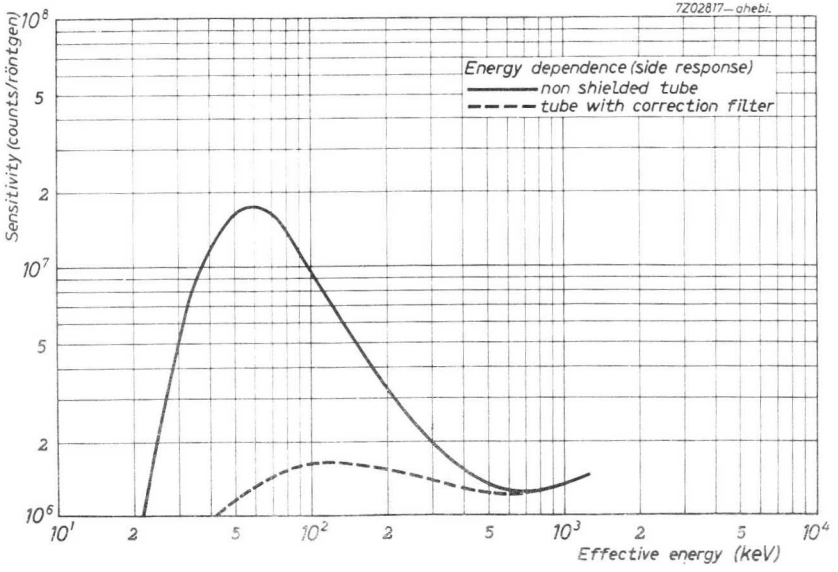
REMARK

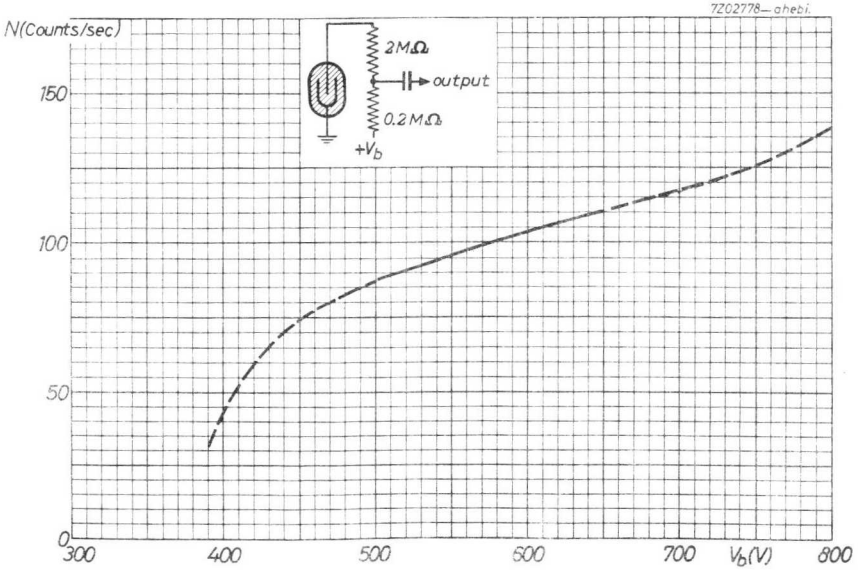
In order to prevent leakage the tube should be kept dry and well cleaned.


7Z01685-ahebi.
N
(pulses/sec)
2.2MΩ 47kΩ
+575V
counter
Measured with Co60
r/h


7Z02779-ahebi.
Ia
(μA)
+Vb=600V
2MΩ
Ia
r/h

18529


7Z02817—ahebi.
Sensitivity (counts/röntgen)
Energy dependence (side response)
non shielded tube
tube with correction filter
Effective energy (keV)

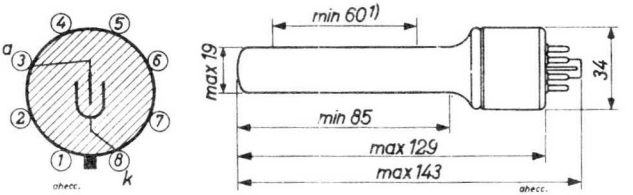

7Z02778—ahebi.
N(Counts/sec)
2MΩ
output
0.2MΩ
+Vb
Vb(V)

BETA AND GAMMA RADIATION COUNTER TUBE

Glass wall halogen quenched β and γ radiation counter tube. The tube may be dipped into liquids.

QUICK REFERENCE DATA		
Glass wall thickness	30	mg/cm^2
Operating voltage	400 to 500	V

DIMENSIONS AND CONNECTIONS



GLASS WALL

Thickness	=	30	mg/cm^2
Effective length	=	60	mm

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	2.5	pF

1) Thin wall

18533

OPERATING CHARACTERISTICS (t_{amb} = 20 °C)

Anode resistor (see fig.1)	R	=	2.7	MΩ
Starting voltage	V_{ign}	= max.	350	V
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	= 400 to	500	V
Plateau slope	S_{pl}	= max.	0.15	%/V
Background, shielded with 50 mm Pb and 6 mm Al	N_o	=	12	counts/min.
Dead time	τ	= max.	100	μs

LIMITING VALUES (Absolute max. rating system)

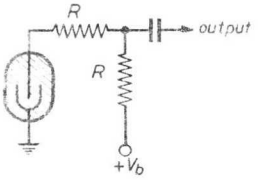
Anode voltage	V_a	= max.	500	V
Ambient temperature	t_{amb}	= min.	−55	°C
		= max.	+75	°C

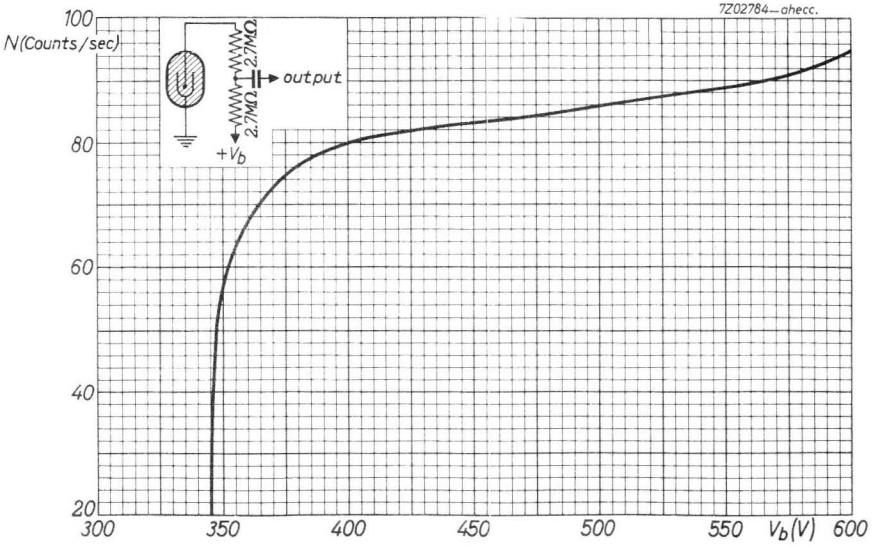
LIFE EXPECTANCY

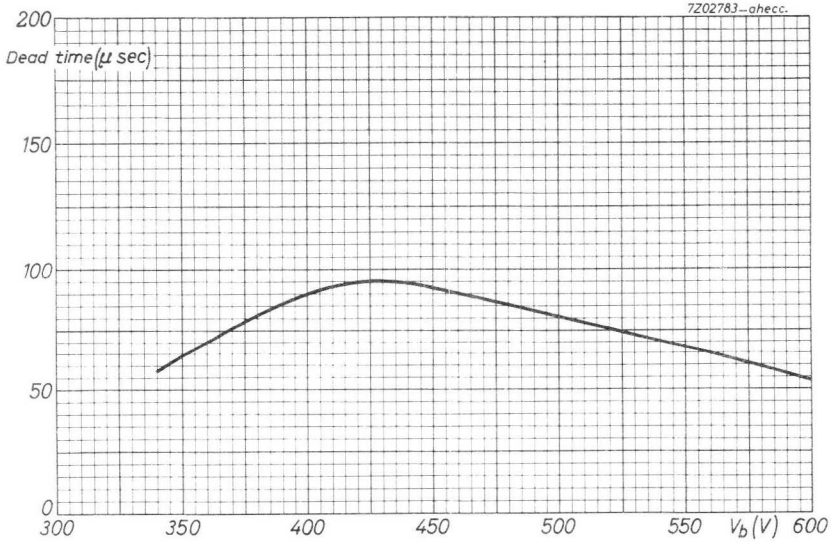
Life expectancy		=	5.10^{10}	counts

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.




7Z02784—ahecc.
N(Counts/sec)
100
80
60
40
20
300
350
400
450
500
550
600
V_b(V)
2.7MΩ
2.7MΩ
output
$+V_b$


7Z02783—ahecc.
Dead time(μ sec)
200
150
100
50
0
300
350
400
450
500
550
600
V_b(V)

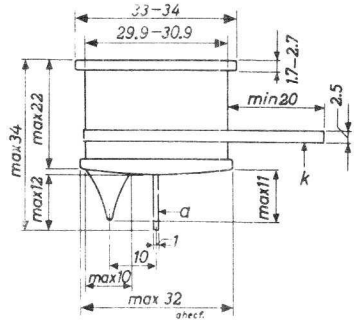
18536

ALPHA AND BETA RADIATION COUNTER TUBE

End window halogen quenched α and β radiation counter tube, for low level measurements in combination with a guard counter (e.g. type 18518)

QUICK REFERENCE DATA		
Window thickness	1.5 to 2	mg/cm^2
Window diameter	27.8	mm
Operating voltage	500 to 750	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	1.5 to 2	mg/cm^2
Effective diameter	=	27.8	mm
Material		mica	

CATHODE

Thickness	=	1.2	mm
Effective length	=	18	mm
Material		28% Cr, 72% Fe	

FILLING Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak}	=	1.4	pF

18536

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

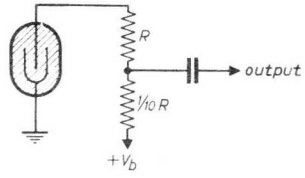
Anode resistor (See fig.1)	R	=	10	5	MΩ
Starting voltage	V_{ign}	=	max. 375	375	V
Recommended operating voltage	V_b			arbitrary within plateau [1]	
Plateau	V_{pl}	=	500 to 750	500 to 750	V
Plateau slope	S_{pl}	=	max. 0.03	0.04	%/V
Background, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	=	max. 10	10	counts/min.
Background in anticoincidence circuit with guard counter 18518, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	=	max. 2	2	counts/min.
Dead time at V_b = 600 V	τ	=	max. 60	30	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	=	max.	750 V
Anode resistor	R	=	min.	5 MΩ
Ambient temperature	t_{amb}	=	min.	−50 °C
		=	max.	+75 °C

MOUNTING

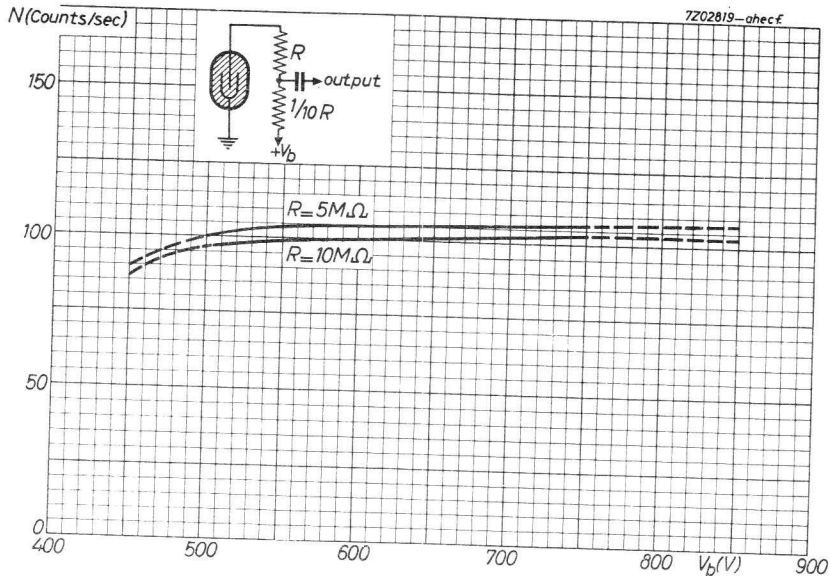
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.

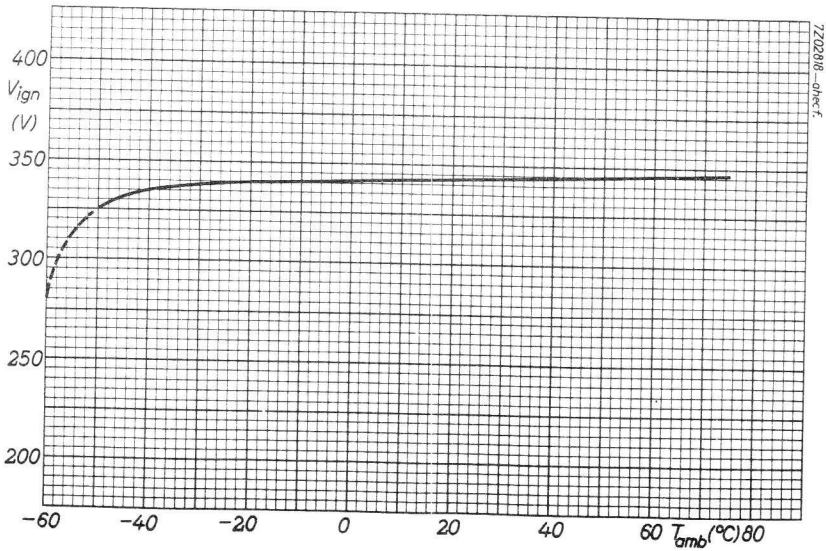


REMARK

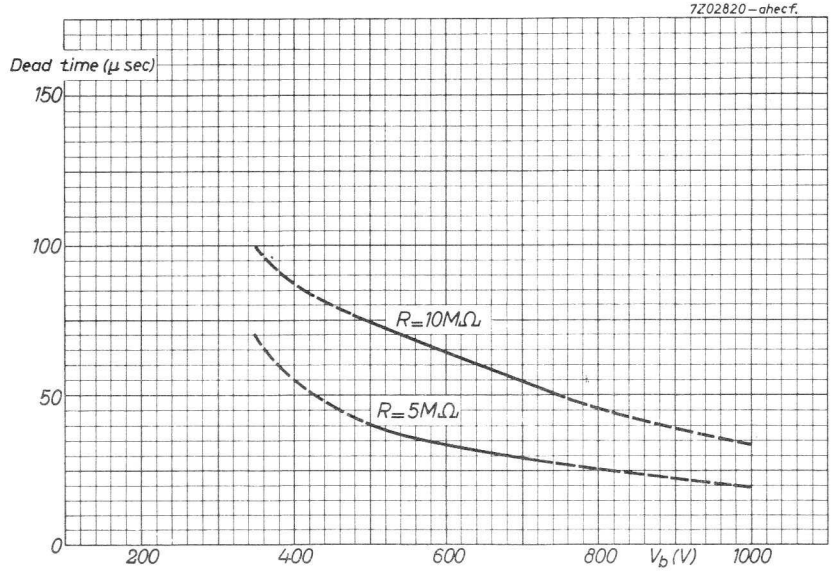
In order to prevent leakage the tube should be kept dry and well cleaned.

[1]) For application in anticoincidence circuits the recommended value of V_b = 600 V


N(Counts/sec)
7Z02819—ahec.f.
R
output
1/10 R
+Vb
R=5MΩ
R=10MΩ
150
100
50
0
400
500
600
700
800
Vb(V)
900


400
Vign
(V)
350
300
250
200
7Z02818—ahec.f.
−60
−40
−20
0
20
40
60
Tamb(°C)
80

18536

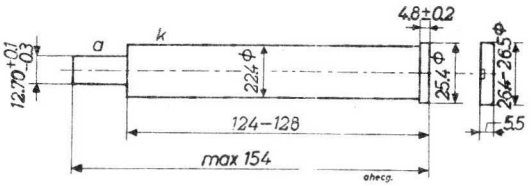

7Z02820 – ahecf.
Dead time (μ sec)
150
100
50
0
200
400
600
800
V_b (V)
1000
R=10MΩ
R=5MΩ

X-RAY COUNTER TUBE

End window halogen quenched X-ray counter tube

QUICK REFERENCE DATA		
X-Ray energy	5 to 10 keV; 1.2 to 2.5	Å
Window thickness	3.5 to 4	mg/cm^2
Operating voltage	1100 to 1300	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	3.5 to 4	mg/cm^2
Effective diameter	=	20	mm
Material		mica	

CATHODE

Thickness	=	1.2	mm
Effective length	=	110	mm
Material		27% Cr, 73% Fe	

FILLING

Ar, halogen
gas pressure 40 cm Hg

CAPACITANCE

Anode to cathode	C_{ak} =	2.7	pF

18537

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

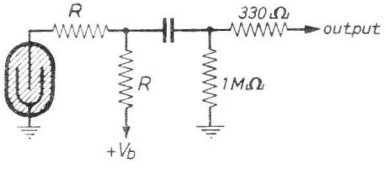
Anode resistor (See fig.1)	R	=		2.7	MΩ
Starting voltage	V_{ign}	=	max.	1000	V
Recommended operating voltage	V_b		arbitrary within plateau		
Plateau	V_{pl}	=	1100 to	1300	V
Plateau slope	S_{pl}	=	max.	0.08	%/V
Background, shielded with 50 mm Pb and 6 mm Al	N_o	=	max.	50	counts/min.
Dead time at V_b = 1200 V	τ	=	max.	150	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	=	max.	1300	V
Anode resistor	R	=	min.	2.7	MΩ
Ambient temperature	t_{amb}	=	min.	−55	°C
		=	max.	+75	°C

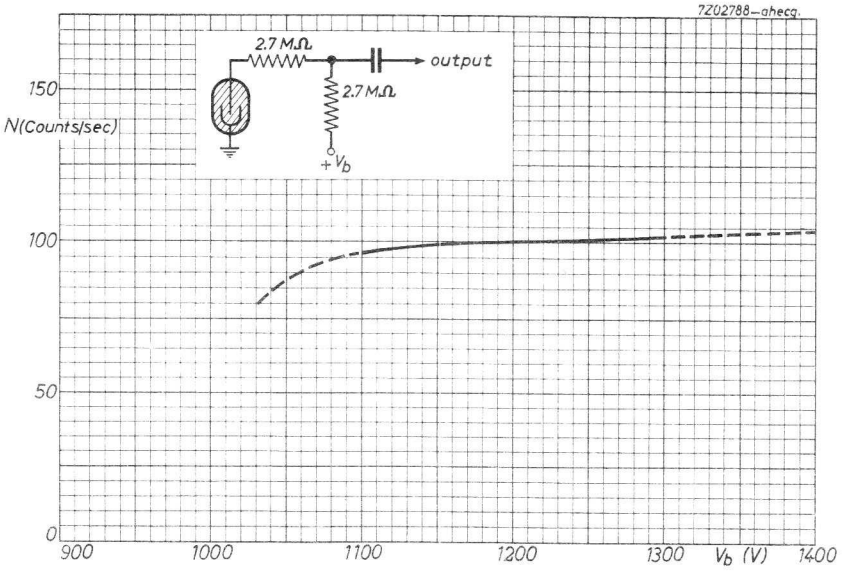
MOUNTING

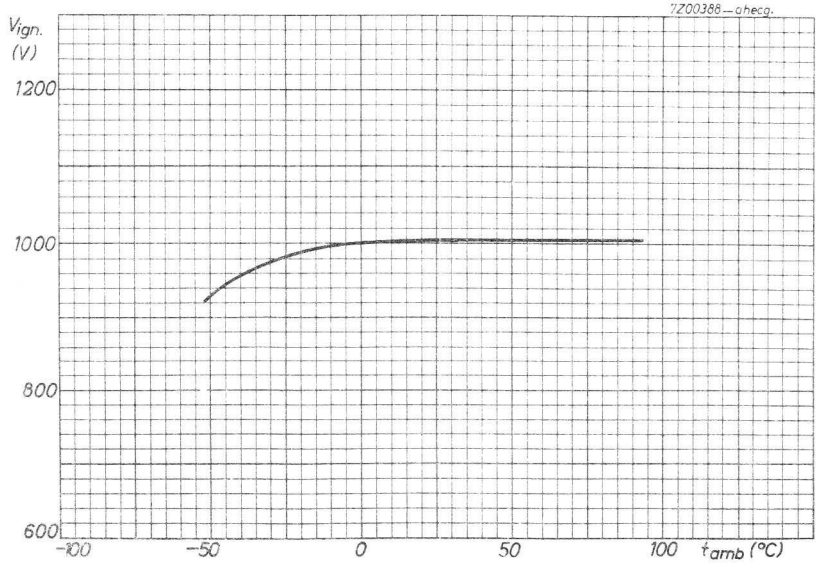
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.

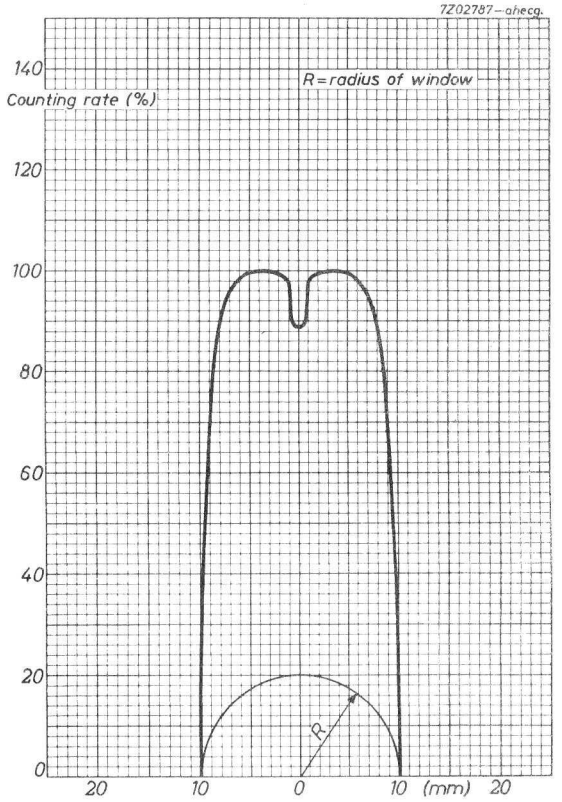


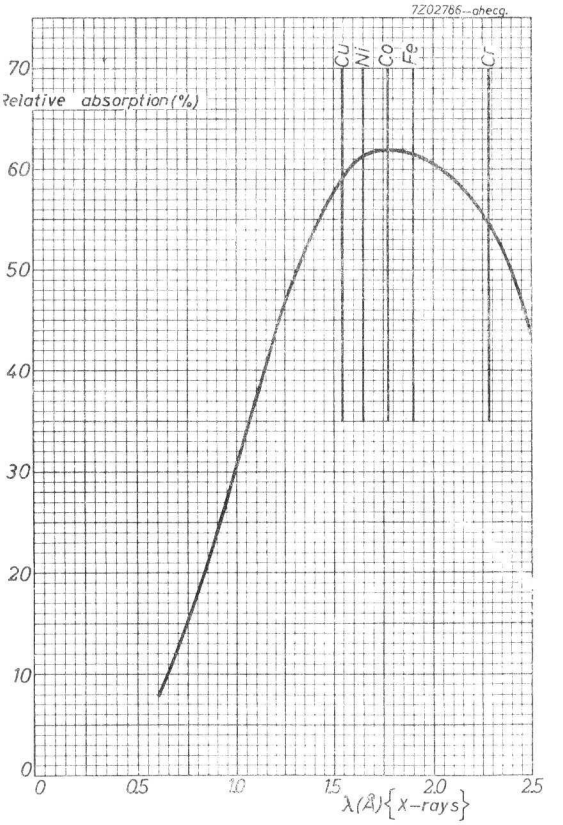
REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02788—ahecg.
2.7 MΩ
output
2.7 MΩ
+Vb
150
N(Counts/sec)
100
50
0
900
1000
1100
1200
1300
Vb (V)
1400


7Z00388—ahecg.
Vign. (V)
1200
1000
800
600
-100
-50
0
50
100
tamb (°C)


7Z02787--ahecg.
R=radius of window
Counting rate (%)
140
120
100
80
60
40
20
0
20
10
0
10
(mm)
20
R

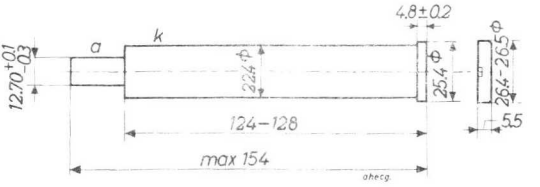

7Z02786--ahecg.
Cu
Ni
Co
Fe
Cr
Relative absorption (%)
70
60
50
40
30
20
10
0
0
0.5
1.0
1.5
2.0
2.5
λ(Å){x-rays}

X-RAY COUNTER TUBE

End window halogen quenched X-ray counter tube

QUICK REFERENCE DATA		
X-Ray energy	15 to 25 keV; 0.5 to 0.86	Å
Window thickness	3.5 to 4	mg/cm^2
Operating voltage	900 to 1100	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	3.5 to 4	mg/cm^2
Effective diameter	=	20	mm
Material		mica	

CATHODE

Thickness	=	1.2	mm
Effective length	=	110	mm
Material		27% Cr, 73% Fe	

FILLING

Kr, halogen

gass pressure 40 cm Hg

CAPACITANCE

Anode to cathode	C_{ak} =	2.7	pF

7Z2 5044

18538

OPERATING CHARACTERISTICS (t_{amb} = 20 °C)

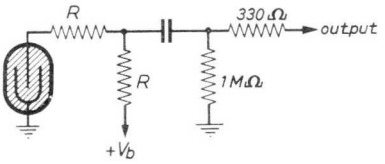
Anode resistor (See fig.1)	R	=	2.7	MΩ
Starting voltage	V_{ign}	= max.	800	V
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	= 900 to	1100	V [1]
Plateau slope	S_{pl}	= max.	0.08	%/V
Background, shielded with 50 mm Pb and 6 mm Al	N_o	= max.	50	counts/min.
Dead time at V_b = 1000 V	τ	= max.	400	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	1100	V
Anode resistor	R	= min.	2.7	MΩ
Ambient temperature	t_{amb}	= min.	+10	°C
		= max.	+75	°C

MOUNTING

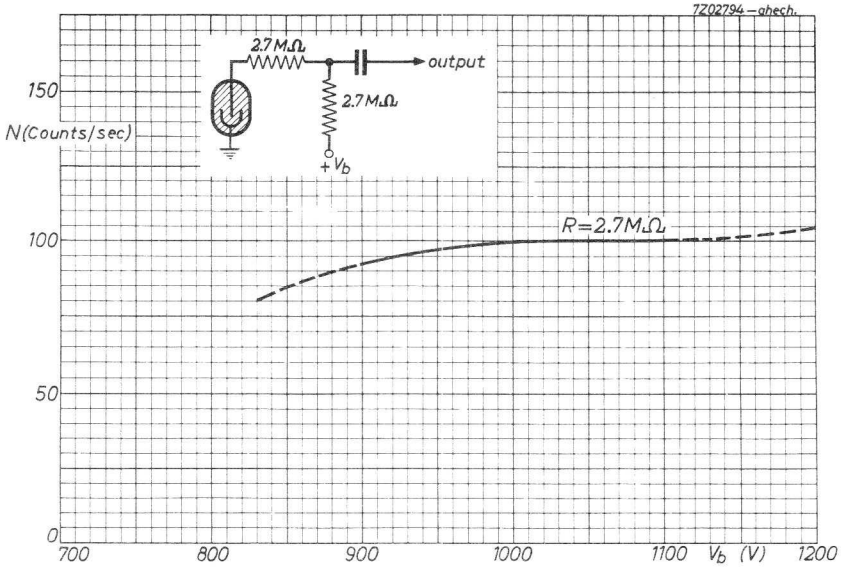
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.

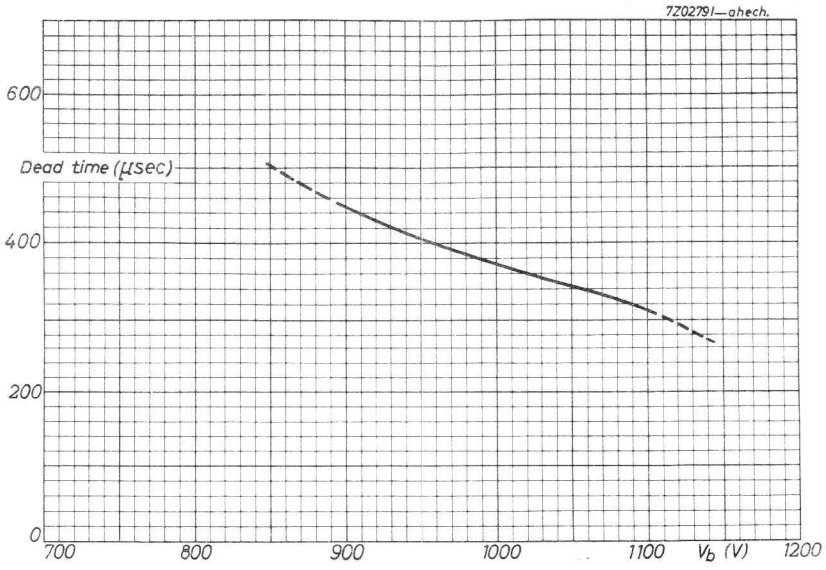


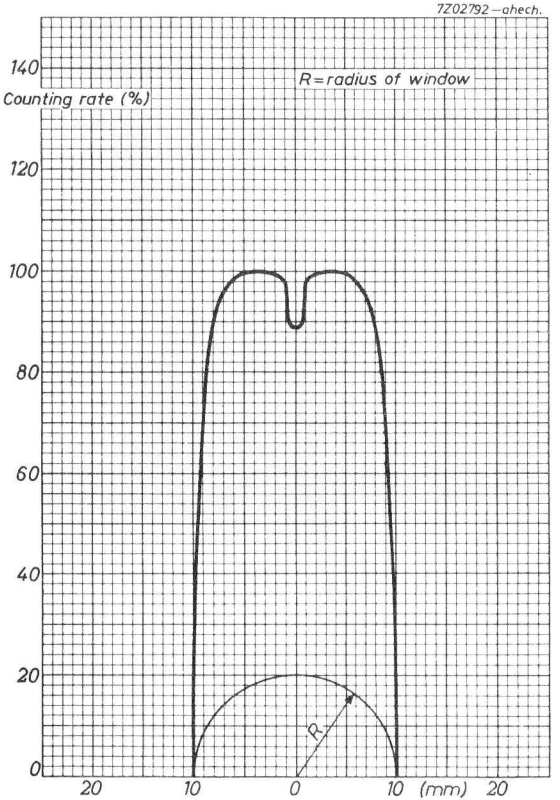
REMARK

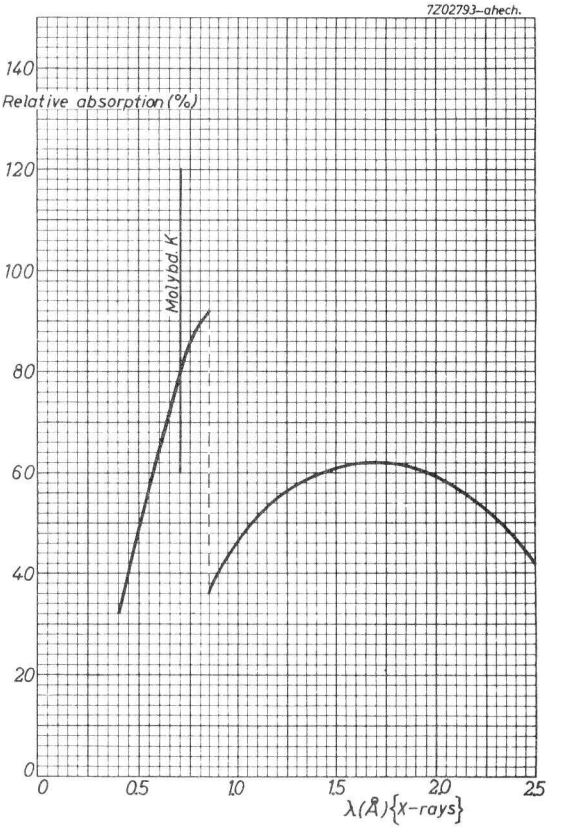
In order to prevent leakage the tube should be kept dry and well cleaned.

[1]) The temperature coefficient of the counting rate is about 2 %/°C.


7Z02794—ahech.
2.7MΩ
output
2.7MΩ
+Vb
150
N(Counts/sec)
100
50
0
R=2.7MΩ
700
800
900
1000
1100
Vb (V)
1200


7Z02791—ahech.
600
Dead time (μsec)
400
200
0
700
800
900
1000
1100
Vb (V)
1200


7Z02792 – ahech.
R = radius of window
Counting rate (%)
140
120
100
80
60
40
20
0
20
10
0
10
20
(mm)
R

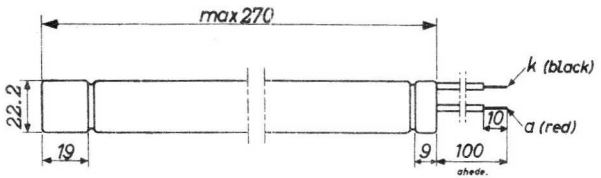

7Z02793 – ahech.
Relative absorption (%)
140
120
100
80
60
40
20
0
Molybd. K
0
0.5
1.0
1.5
2.0
2.5
λ (Å) {X-rays}

GAMMA RADIATION COUNTER TUBE

Halogen quenched γ radiation counter tube

QUICK REFERENCE DATA		
Range (Co 60 γ radiation)	10^{-4} to 10^{-1}	R/h
Operating voltage	380 to 480	V

DIMENSIONS AND CONNECTIONS



CATHODE

Thickness	=	525	mg/cm^2
Effective length	=	240	mm
Material		27% Cr, 73% Fe	

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	10	pF

18545

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

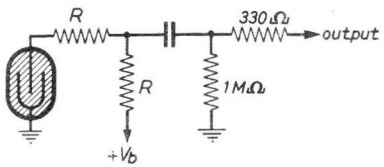
Anode resistor (See fig.1)	R	=	2.7	MΩ
Starting voltage	V_{ign}	= max.	350	V [1]
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	=	380 to 480	V
Plateau slope	S_{pl}	= max.	0.10	%/V
Background, shielded with 50 mm Pb and 6 mm Al	N_o	= max.	75	counts/min.
Dead time at V_b = 420 V	τ	= max.	200	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	480	V
Anode resistor	R	= min.	2.7	MΩ
Ambient temperature	t_{amb}	= min.	−55	°C
		= max.	+75	°C

MOUNTING

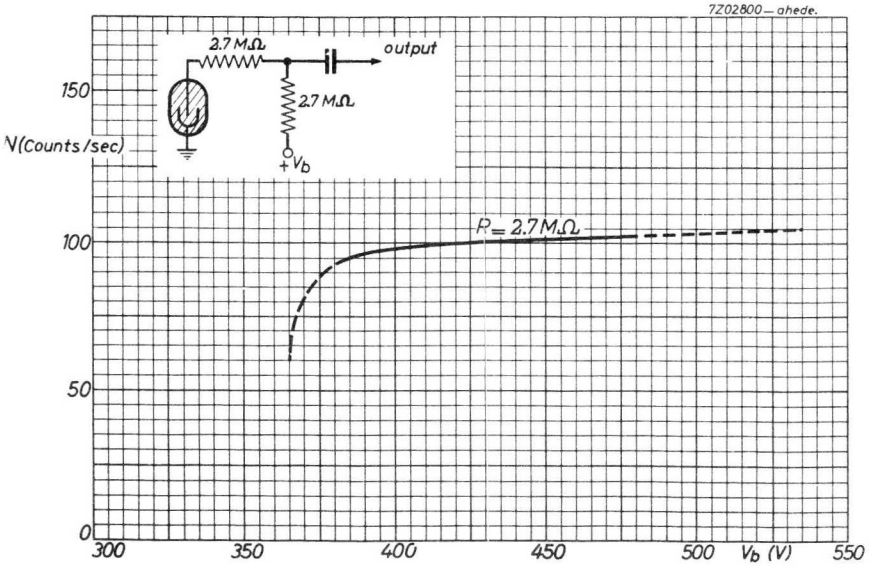
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.

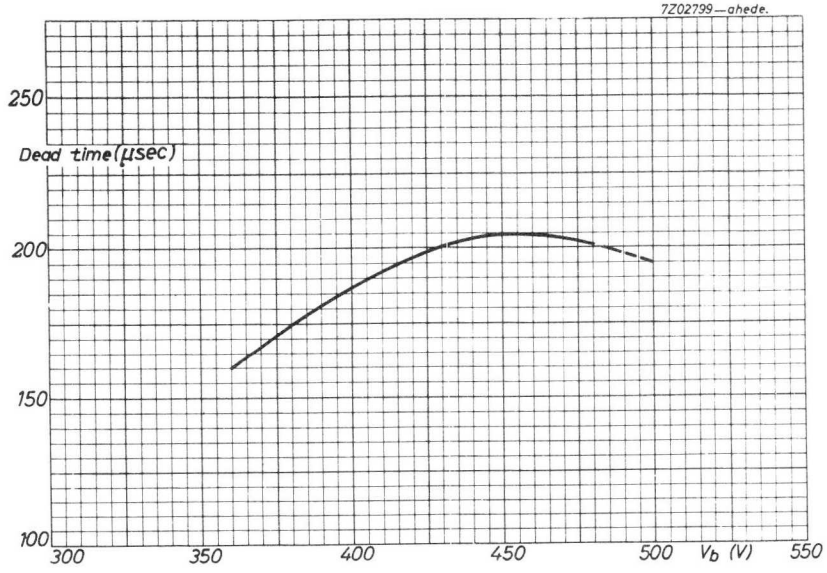


REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.

[1]) The starting voltage is independent of temperature over the operating temperature range.


7Z02800—ahede.
2.7 MΩ
output
2.7 MΩ
+Vb
N(Counts/sec)
150
100
50
0
R = 2.7 MΩ
300
350
400
450
500
Vb (V)
550

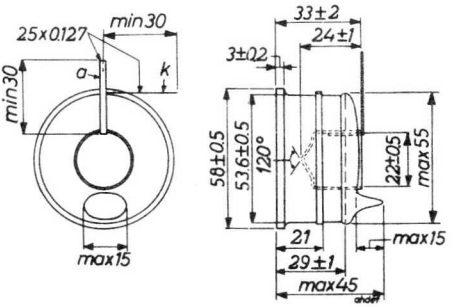

7Z02799—ahede.
250
Dead time(μsec)
200
150
100
300
350
400
450
500
Vb (V)
550

BETA RADIATION COUNTER TUBE

End window halogen quenched β radiation counter tube for low level measurements in combination with a guard counter (e.g. type 18548).

QUICK REFERENCE DATA		
Window thickness	3.5 to 4	mg/cm^2
Window diameter	51	mm
Operating voltage	700 to 1100	V

DIMENSIONS AND CONNECTIONS



WINDOW

Thickness	=	3.5 to 4	mg/cm^2
Effective diameter	=	51	mm
Material		mica	

CATHODE

Thickness	=	1.25	mm
Effective length	=	25	mm
Material		28% Cr, 72% Fe	

FILLING Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	5	pF

7Z2 5048

18546

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

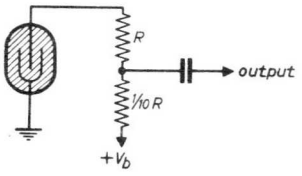
Anode resistor (see fig.1)	R	=	4.7	MΩ
Starting voltage	V_{ign}	= max.	400	V
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	= 700 to	1100	V
Plateau slope	S_{pl}	= max.	0.04	%/V
Background, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	= max.	30	counts/min.
Background in anticoincidence circuit with guard counter 18548, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	= max.	9	counts/min.
Dead time at V_b = 800 V	τ	= max.	45	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	1100	V
Anode resistor	R	= min.	4	MΩ
Ambient temperature	t_{amb}	= min.	−50	°C
		= max.	+75	°C

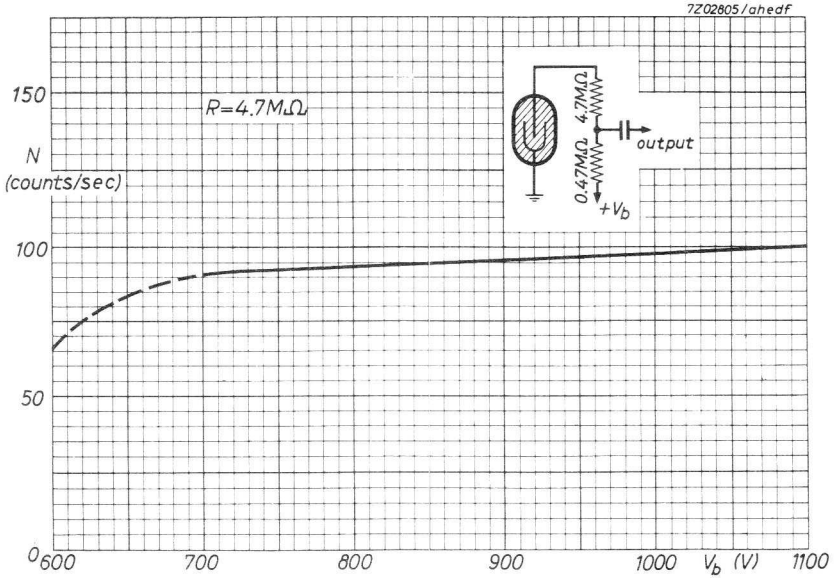
MOUNTING

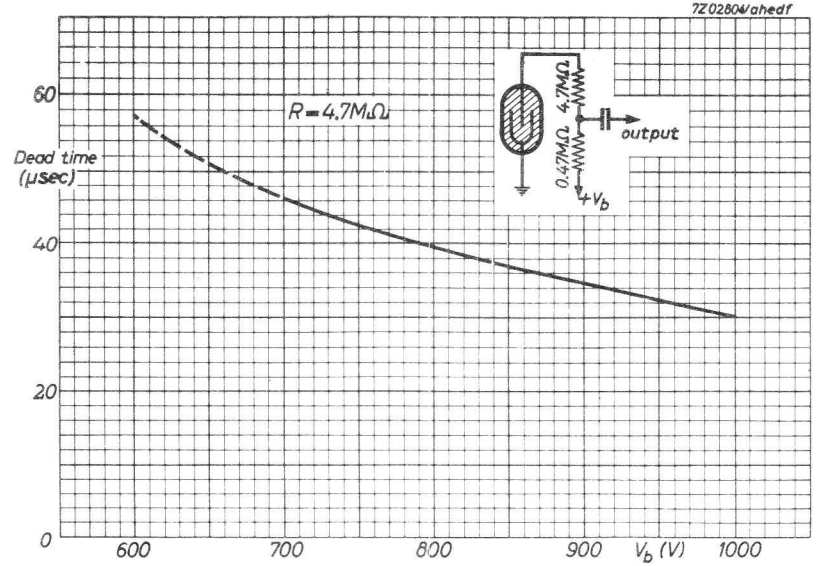
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02805/ahedf
150
N
(counts/sec)
100
50
0
R=4.7MΩ
4.7MΩ
0.47MΩ
output
+Vb
600
700
800
900
1000
Vb (V)
1100


7Z02804/ahedf
60
Dead time
(μsec)
40
20
0
R=4.7MΩ
4.7MΩ
0.47MΩ
output
+Vb
600
700
800
900
Vb (V)
1000

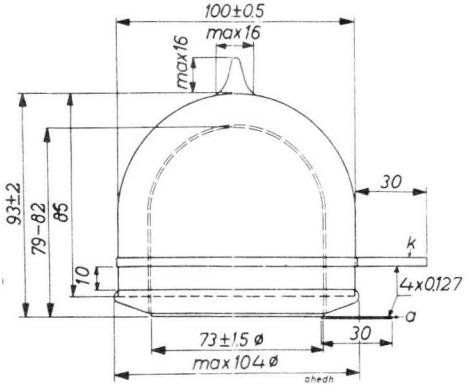
18548

COSMIC RAY GUARD COUNTER TUBE

Halogen quenched cosmic ray guard counter tube for low background measurements in combination with a β counter tube (e.g. type 18546). It can also be used in combination with a gas flow counter.

QUICK REFERENCE DATA		
Hollow anode diameter	73	mm
Operating voltage	800 to 1200	V

DIMENSIONS AND CONNECTIONS



CATHODE

Thickness	=	1 mm
Material		28% Cr, 72% Fe

FILLING Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	20 pF

18548

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Anode resistor (See fig.1)	R	=	10	MΩ
Starting voltage	V_{ign}	= max.	700	V
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	= 800 to	1200	V
Plateau slope	S_{pl}	= max.	0.03	%/V
Background, shielded with 10 cm Fe and 3 cm Pb, Fe outside	N_o	= max.	90	counts/min.
Dead time at V_b = 1000 V	τ	= max.	850	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	1200	V
Anode resistor	R	= min.	7	MΩ
Ambient temperature	t_{amb}	= min.	-50	°C
		= max.	+75	°C

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1. For use as guard counter tube in anticoincidence circuits in combination with 18546: recommended circuit see fig.2.

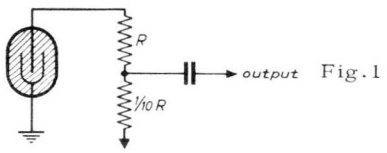
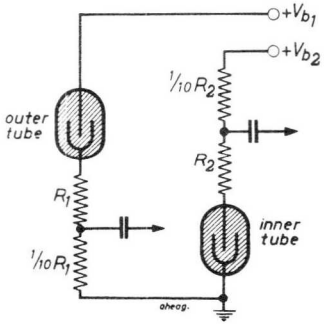


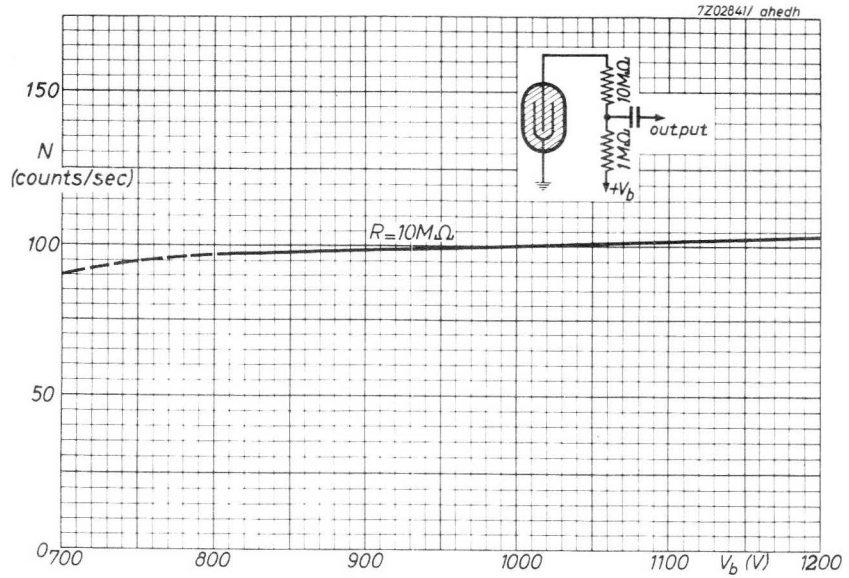
Fig.1

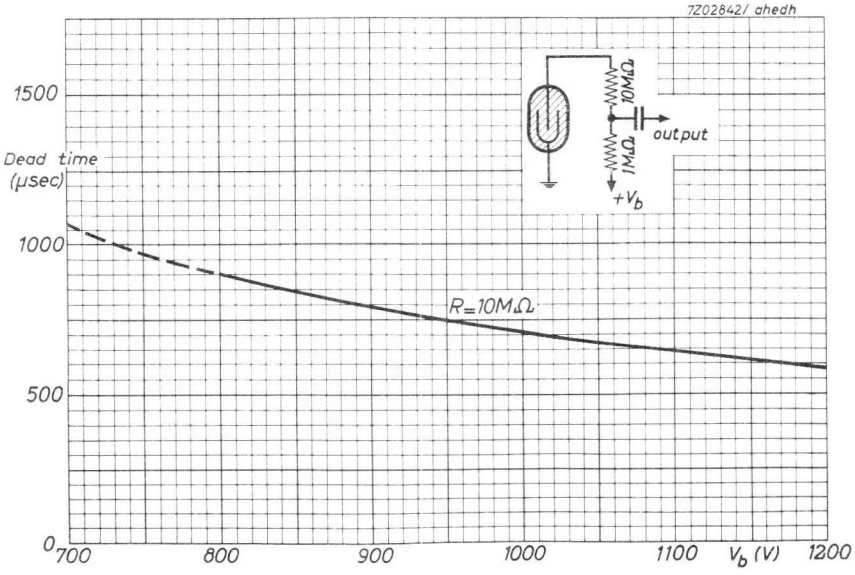
Fig.2



REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.


7Z02841/ ahedh
150
N
(counts/sec)
100
50
0
700
800
900
1000
1100
1200
V_b (V)
R=10MΩ
10MΩ
1MΩ
output
+V_b

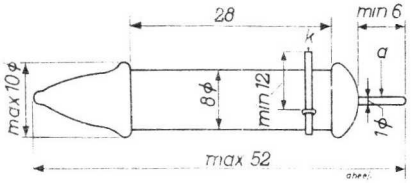

7Z02842/ ahedh
1500
Dead time
(μsec)
1000
500
0
700
800
900
1000
1100
1200
V_b (V)
R=10MΩ
10MΩ
1MΩ
output
+V_b

BETA AND GAMMA RADIATION COUNTER TUBE

Halogen quenched β (>0.25 MeV) and γ radiation counter tube.

QUICK REFERENCE DATA		
Range (Co 60 γ radiation)	10^{-3} to 10^{2}	R/h
Cathode wall thickness	32 to 40	mg/cm^2
Operating voltage	500 to 650	V

DIMENSIONS AND CONNECTIONS



CATHODE

Thickness	=	32 to 40	mg/cm^2
Effective length	=	28	mm
Material		28% Cr, 72% Fe	

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	1.1	pF

18550

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

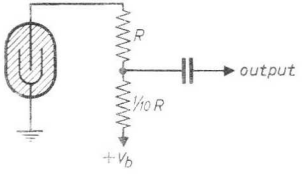
Anode resistor (See fig.1)	R	=	5	MΩ
Starting voltage	V_{ign}	= max.	380	V
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	=	500 to 650	V
Plateau slope	S_{pl}	= max.	0.04	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	= max.	4	counts/min.
Dead time at V_b = 600 V	τ	= max.	50	μs

LIMITING VALUES

Anode voltage	V_a	= max.	700	V
Anode resistor	R	= min.	2	MΩ
Ambient temperature	t_{amb}	= min.	−50	°C
		= max.	+75	°C

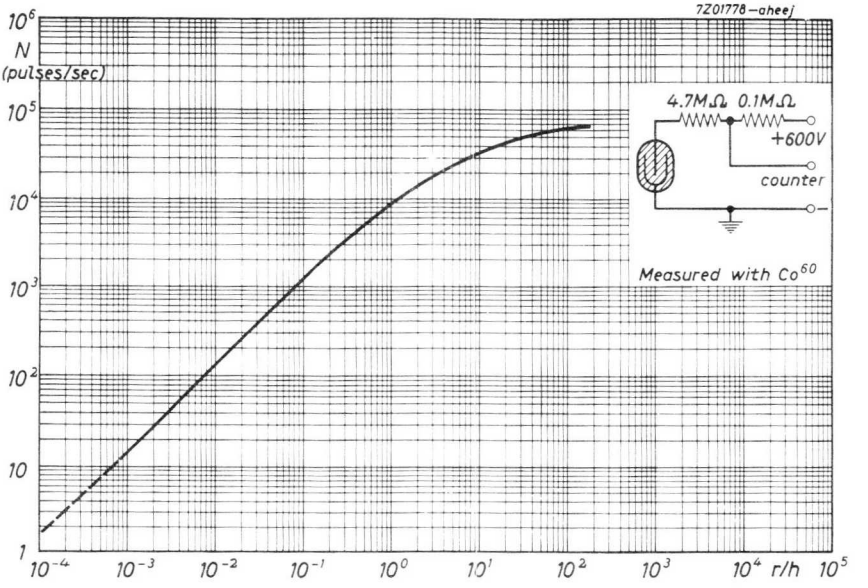
MOUNTING

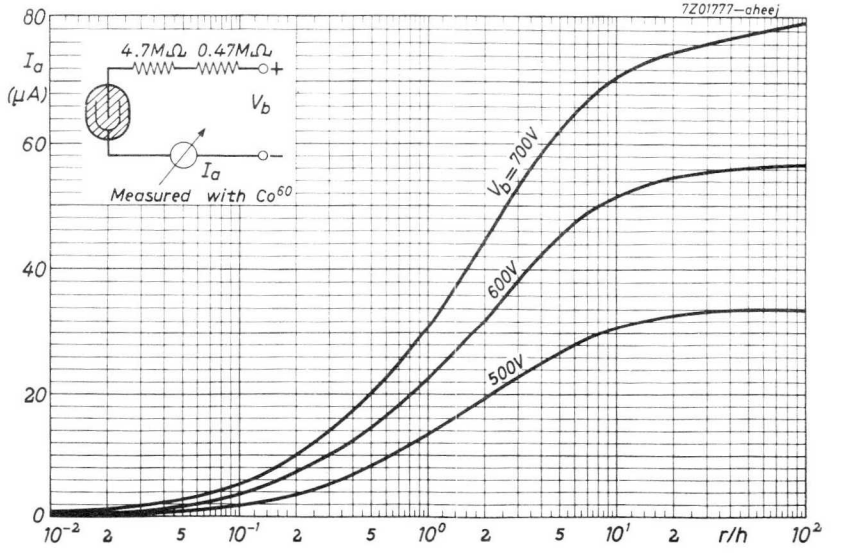
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



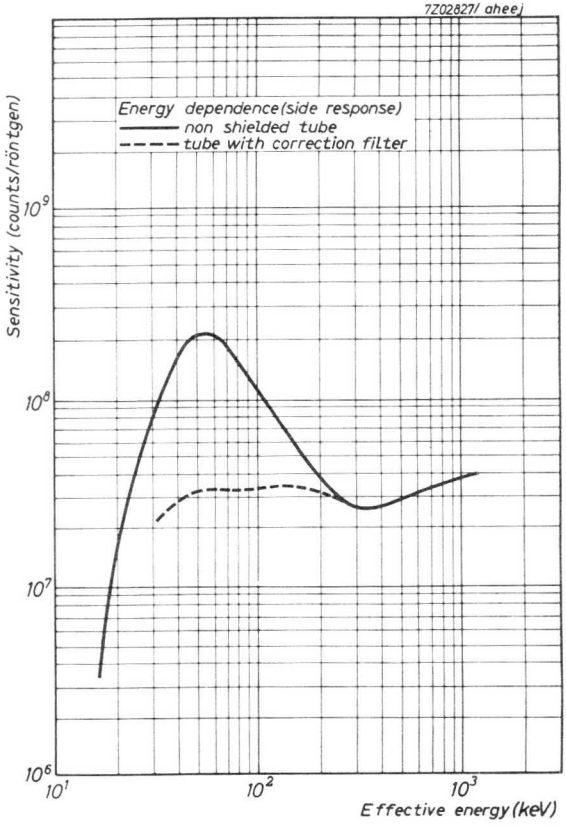
REMARK

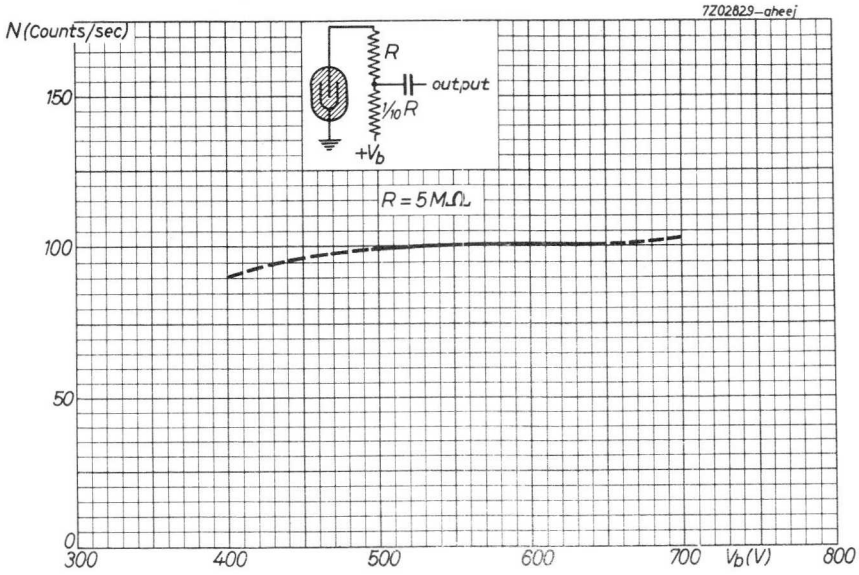
In order to prevent leakage the tube should be kept dry and well cleaned. Due to the thin wall the tube should be handled with utmost care.

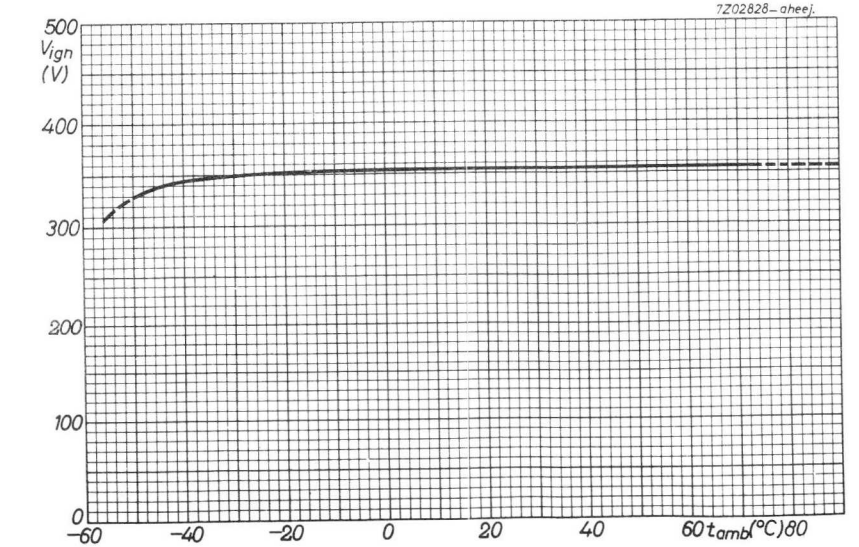

7Z01778—aheej
N
(pulses/sec)
4.7MΩ 0.1MΩ
+600V
counter
Measured with Co60
r/h


7Z01777—aheej
Ia
(μA)
4.7MΩ 0.47MΩ
Vb
Ia
Measured with Co60
Vb= 700V
600V
500V
r/h

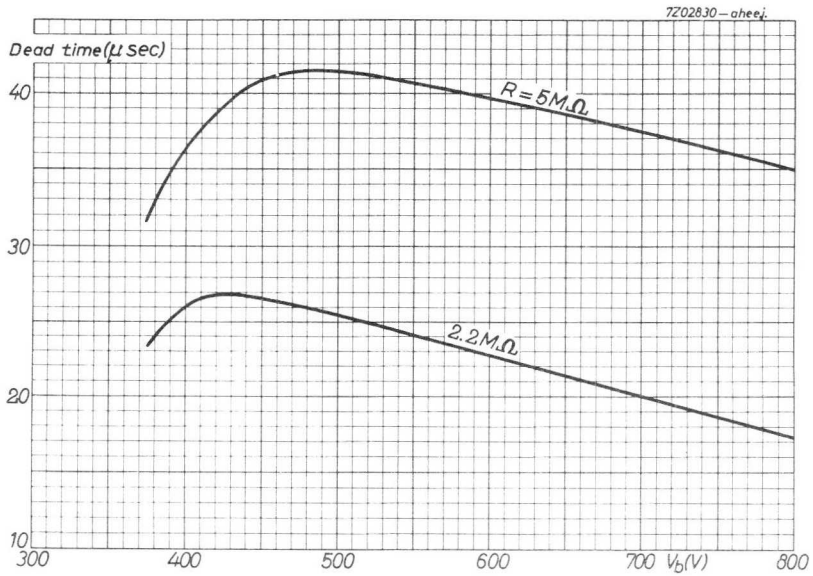
18550

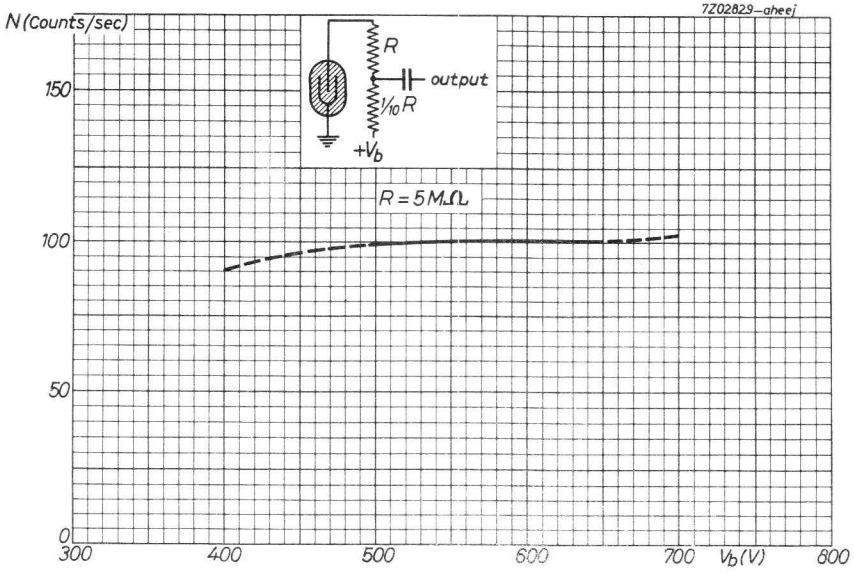

7Z02827/ aheej
Energy dependence(side response)
non shielded tube
tube with correction filter
Sensitivity (counts/röntgen)
10⁹
10⁸
10⁷
10⁶
10¹
10²
10³
Effective energy (keV)

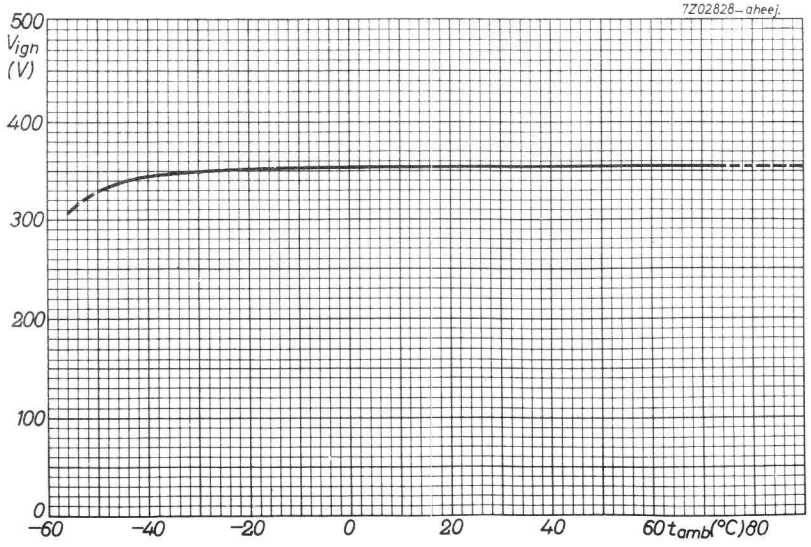

7Z02829–aheej
N (Counts/sec)
150
100
50
0
300
400
500
600
700
800
V_b (V)
R
output
1/10 R
+V_b
R = 5 MΩ


7Z02828–aheej.
500
V_{ign}
(V)
400
300
200
100
0
–60
–40
–20
0
20
40
60
t_{amb} (°C)
80

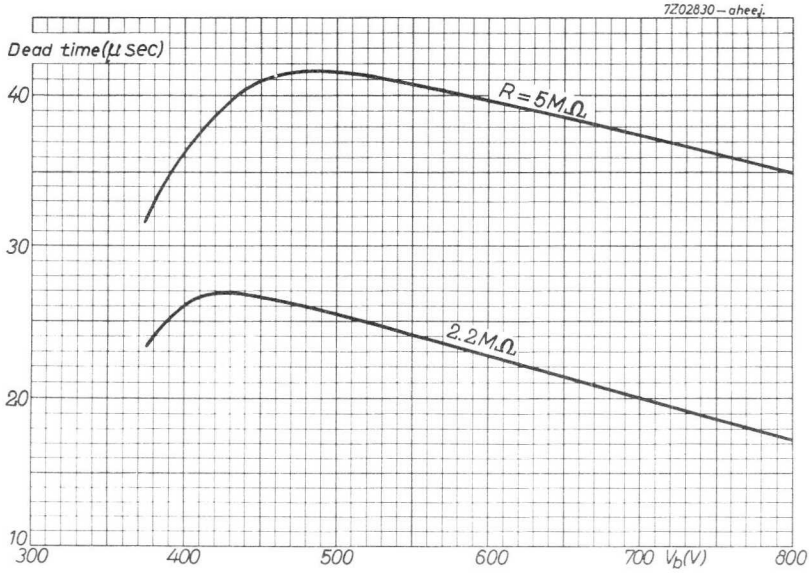
18550


7Z02830—sheet.
Dead time(μ sec)
40
30
20
10
300
400
500
600
700
800
V_b(V)
R = 5 MΩ
2.2 MΩ


7Z02829–aheej
N(Counts/sec)
150
100
50
0
300
400
500
600
700
800
V_b(V)
R
output
1/10 R
+V_b
R = 5 MΩ


7Z02828–aheej
500
V_{ign}
(V)
400
300
200
100
0
−60
−40
−20
0
20
40
60
t_{amb}(°C)
80

18550

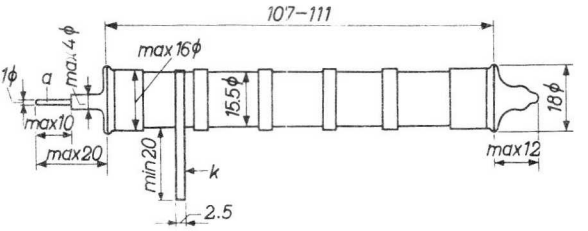

7Z02830—aheej.
Dead time(μsec)
40
30
20
10
R=5MΩ
2.2MΩ
300
400
500
600
700
800
V_b(V)

BETA AND GAMMA RADIATION COUNTER TUBE

Halogen quenched β (>0.3 MeV) and γ radiation counter tube.

QUICK REFERENCE DATA		
Range (Co 60 γ radiation)	10^{-3} to 10	R/h
Cathode wall thickness between the ribbons	40 to 60	mg/cm^2
Operating voltage	450 to 800	V

DIMENSIONS AND CONNECTIONS



CATHODE

Construction		cylindrical wall, ribbon reinforced
Thickness between the ribbons	=	40 to 60 mg/cm^2
Total effective length between the ribbons	=	75 mm
Material		28% Cr, 72% Fe

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	4 pF

18552

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

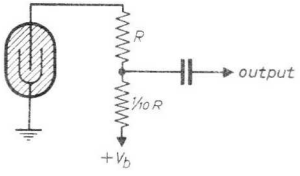
Anode resistor (See fig.1)	R	=	2	MΩ
Starting voltage	V_{ign}	= max.	400	V
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	=	450 to 800	V
Plateau slope	S_{pl}	= max.	0.02	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	= max.	30	counts/min.
Dead time at V_b = 600 V	τ	= max.	70	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	800	V
Anode resistor	R	= min.	1	MΩ
Ambient temperature	t_{amb}	= min.	−50	°C
		= max.	+75	°C

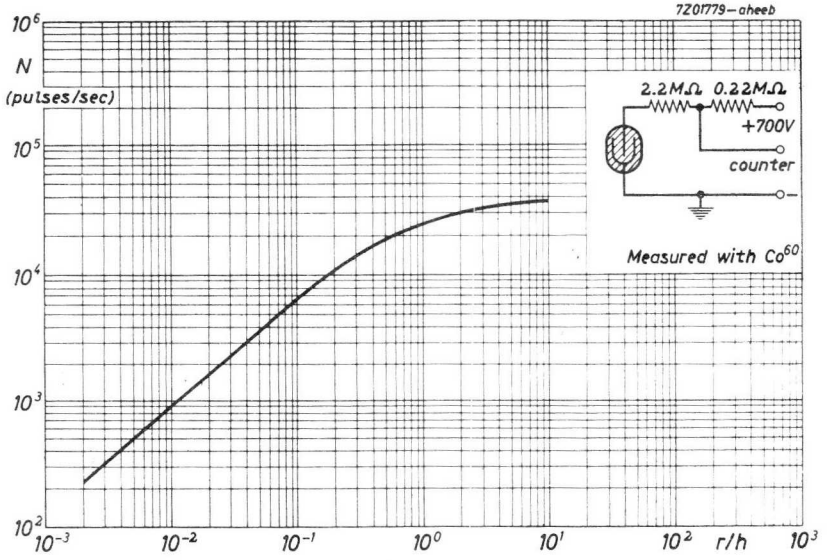
MOUNTING

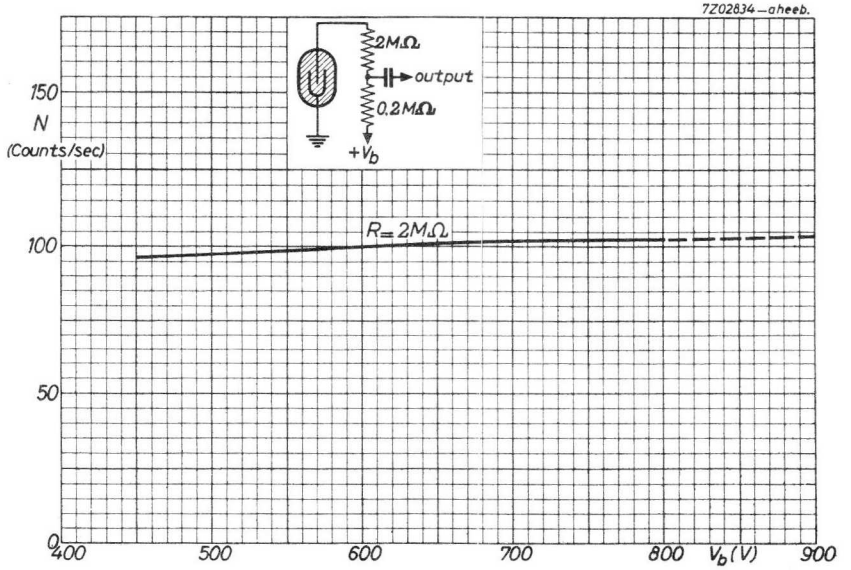
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



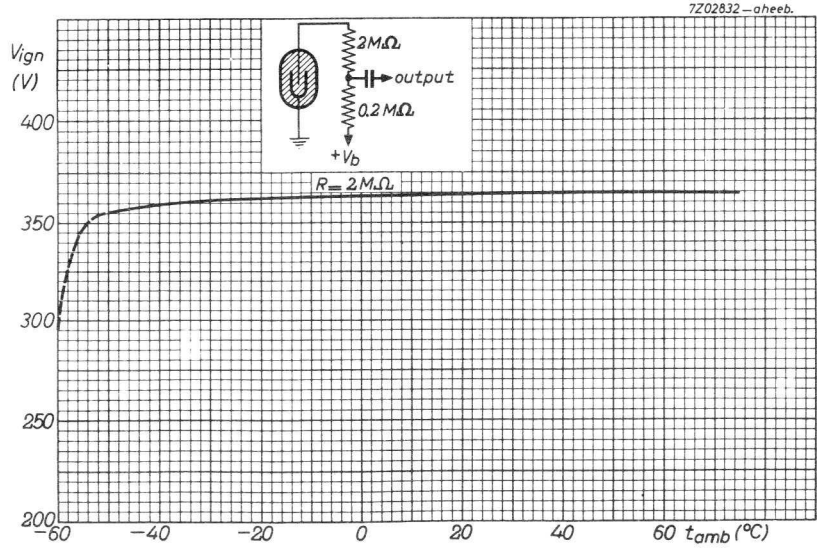
REMARK

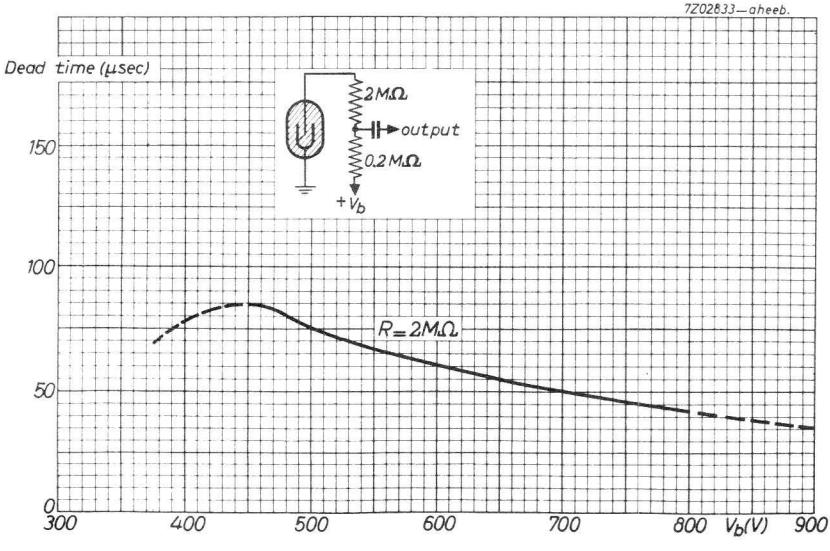
In order to prevent leakage the tube should be kept dry and well cleaned. Due to the thin wall the tube should be handled with utmost care.


7Z01779-aheeb
10^6
N
(pulses/sec)
10^5
10^4
10^3
10^2
10^{-3}
10^{-2}
10^{-1}
10^0
10^1
10^2
r/h
10^3
2.2MΩ
0.22MΩ
+700V
counter
Measured with Co^{60}


7Z02834-aheeb.
150
N
(Counts/sec)
100
50
0
400
500
600
700
800
V_b(V)
900
2MΩ
output
0.2MΩ
$+V_b$
R= 2MΩ

18552


7Z02832—aheeb.
Vign (V)
400
350
300
250
200
−60
−40
−20
0
20
40
60 tamb (°C)
2MΩ
output
0.2 MΩ
+Vb
R = 2 MΩ

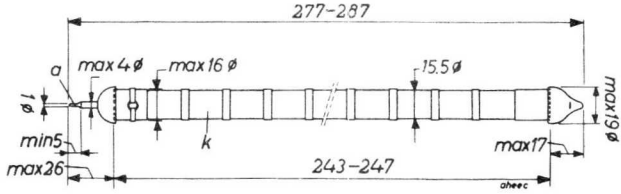

7Z02833—aheeb.
Dead time (μsec)
150
100
50
0
300
400
500
600
700
800
Vb(V)
900
2MΩ
output
0.2 MΩ
+Vb
R = 2MΩ

BETA AND GAMMA RADIATION COUNTER TUBE

Halogen quenched β (>0.3 MeV) and γ radiation counter tube

QUICK REFERENCE DATA				
Range (Co 60 γ radiation)	10^{-4}	to	1	R/h
Cathode wall thickness between the ribbons	40	to	60	mg/cm^2
Operating voltage	450	to	800	V

DIMENSIONS AND CONNECTIONS



CATHODE

Construction		cylindrical wall, ribbon reinforced
Thickness between the ribbons	=	40 to 60 mg/cm^2
Total effective length between the ribbons	=	192 mm
Material		28% Cr, 72% Fe

FILLING

Ne, Ar, halogen

CAPACITANCE

Anode to cathode	C_{ak} =	10 pF

18553

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

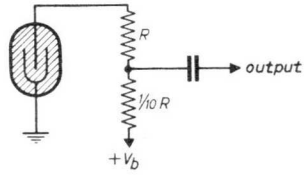
Anode resistor (See fig.1)	R	=	2	MΩ
Starting voltage	V_{ign}	= max.	400	V
Recommended operating voltage	V_b	arbitrary within plateau		
Plateau	V_{pl}	= 450 to	800	V
Plateau slope	S_{pl}	= max.	0.02	%/V
Background, shielded with 50 mm Pb and 3 mm Al	N_o	= max.	60	counts/min.
Dead time at V_b = 600 V	τ	= max.	100	μs

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	= max.	800	V
Anode resistor	R	= min.	2	MΩ
Ambient temperature	t_{amb}	= min.	-50	°C
		= max.	+75	°C

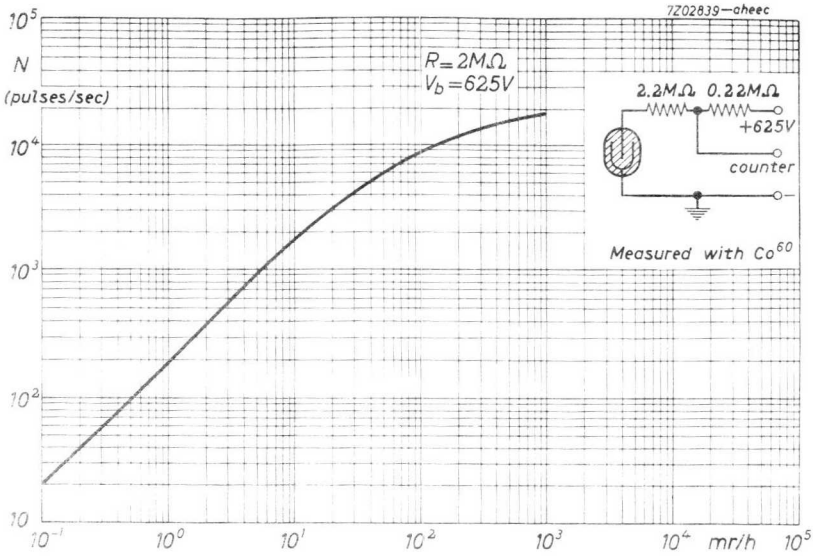
MOUNTING

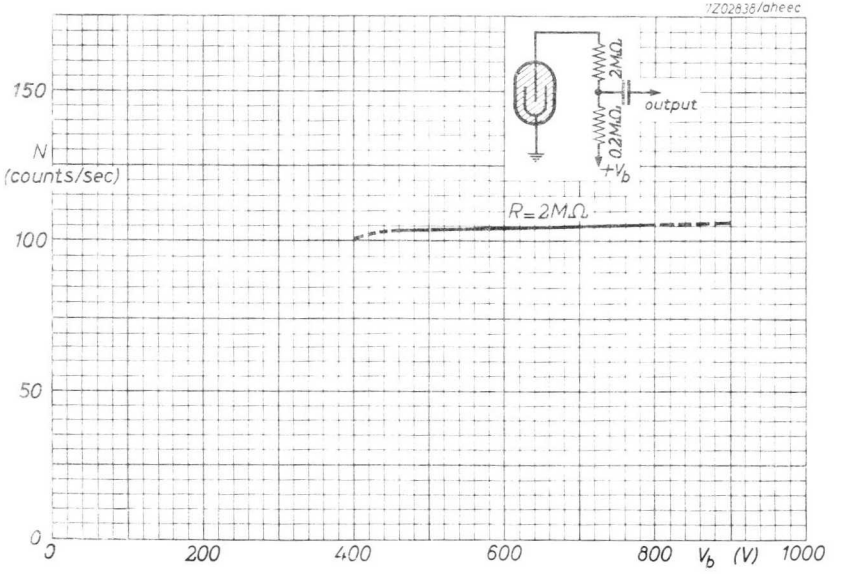
Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.



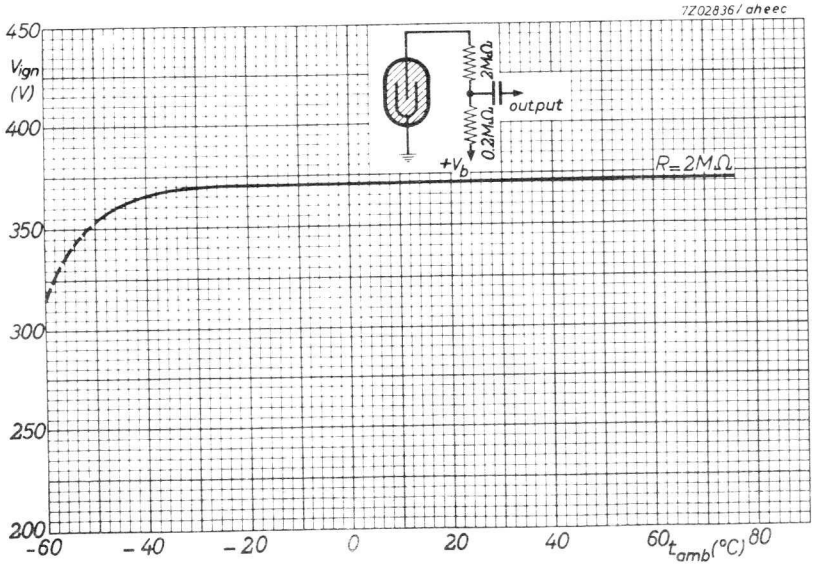
REMARK

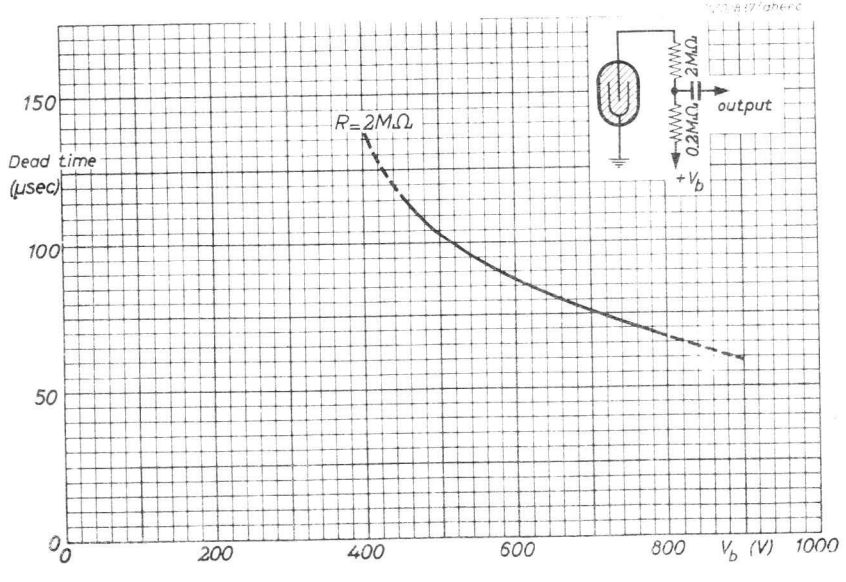
In order to prevent leakage the tube should be kept dry and well cleaned. Due to the thin wall the tube should be handled with utmost care.


7Z02839—aheec
10^5
N
(pulses/sec)
10^4
10^3
10^2
10
10^{-1}
10^0
10^1
10^2
10^3
10^4
mr/h
10^5
$R = 2M\Omega$
$V_b = 625V$
2.2MΩ
0.22MΩ
+625V
counter
Measured with Co^{60}


7Z02838/aheec
150
N
(counts/sec)
100
50
0
0
200
400
600
800
V_b (V)
1000
2MΩ
output
0.2MΩ
$+V_b$
$R = 2M\Omega$

18553


7Z02836/aheec
450
V_{ign} (V)
400
350
300
250
200
-60
-40
-20
0
20
40
60
80
t_{amb}(°C)
2MΩ
0.2MΩ
output
$+V_b$
R=2MΩ


150
Dead time (µsec)
100
50
0
0
200
400
600
800
V_b (V)
1000
R=2MΩ
2MΩ
0.2MΩ
output
$+V_b$

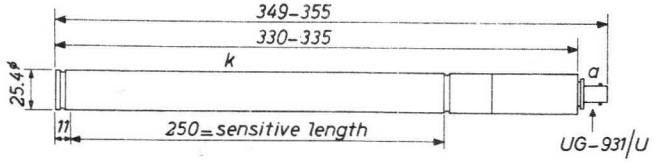
ZP1000
ZP1001

BF_3 PROPORTIONAL COUNTER TUBE

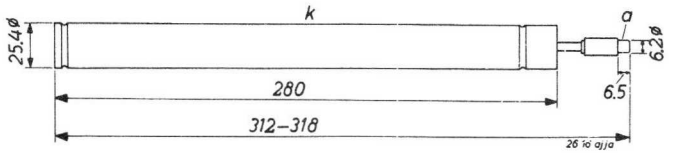
Borium-tri-fluoride filled proportional counters for thermal neutrons

QUICK REFERENCE DATA			
Thermal neutron flux range	10−3 to	10^4	n/cm^2s
Sensitivity		9.8	counts per n/cm^2
Background	max.	1	count/min
Operating voltage	1600 to	2400	V

DIMENSIONS AND CONNECTIONS



ZP1000



ZP1001

CATHODE

Thickness	=	0.4 mm
Effective length	=	250 mm
Material		Oxygen-free copper

ANODE

Diameter	=	50 µm
Material		Tungsten

ZP1000
ZP1001

BOTTOM

Thickness	=	0.5 mm
Material		Fernico

FILLING

BF_3 enriched 96% B^{10}
gas pressure 70 cmHg

CAPACITANCE

Anode to cathode	ZP1000	C_{ak}	=	7.4 pF
	ZP1001	C_{ak}	=	4.4 pF

ACCESSORIES - ZP1000

Cable plug: type 56069 (MIL-UG-932/U)
With this cable plug a cable MIL-RG-59/U is recommended.

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)
Measured in the recommended circuit, fig.1

Thermal neutron flux range		=	10^{-3} to 10^{4}	n/cm^2s
Sensitivity		=	9.8	counts per n/cm^2
Operating voltage range	V_b	=	1600 to 2400	V
Operating voltage for pulse amplitude 1 mV	V_b	=	approx. 1700	V
Operating voltage for pulse amplitude 10 mV	V_b	=	approx. 2300	V
Plateau length	V_{pl}	=	min. 300	V
Plateau slope	S_{pl}	=	max. 1	% per 100 V
Background	N_o	=	max. 1	count/min
Pulse amplitude distribution width (see fig.2)	$\Delta P/P$	=	max. 14	%
Valley-to-peak ratio (see fig.2)	$\Delta N/N$	=	max. 2	%

TYPICAL OPERATION

Operating voltage	V_b	=	2100	V
Gas multiplication factor	A	=	13	
Source (in paraffin moderator)		=	100	mg RaBe
Distance between source and tube		=	10	cm
Accompanying γ dose rate		=	7	R/h
Ambient temperature	t_{amb}	=	25	°C
Pulse amplitude	V_{pulse}	=	approx. 4.5	mV
Neutron counting rate [1])	N	=	5×10^5	counts/min

LIMITING VALUES (Absolute max. rating system)

Supply voltage	V_b	= max.	2500	V
Ambient temperature	t_{amb}	= min.	-80	°C
		= max.	+100	°C

LIFE EXPECTANCY

The life of the tube is determined by consumption of the BF_3 gas, caused by the nuclear reaction B(n, α)Li, and by ionization. The experimentally verified life of the tube under the conditions specified in the section "Typical Operation" is in excess of 10^{11} counts.

In order to extend the life of the tube it is recommended to operate at low values of the gas amplification factor.

RECOMMENDED CIRCUIT

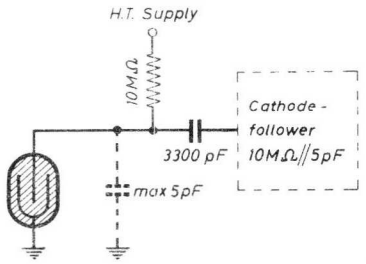


Fig.1

[1]) Bias setting in valley of bias curve (see fig.2).

ZP1000
ZP1001

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth). Recommended circuit see fig.1.

REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.

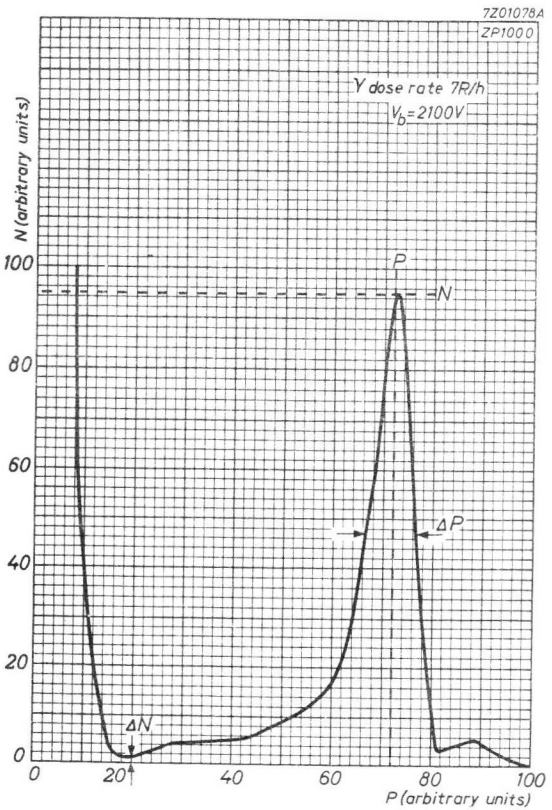
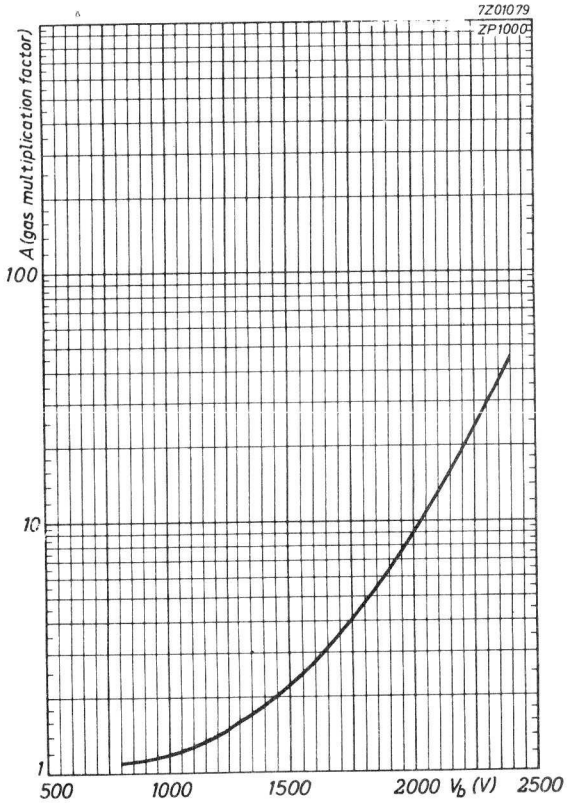
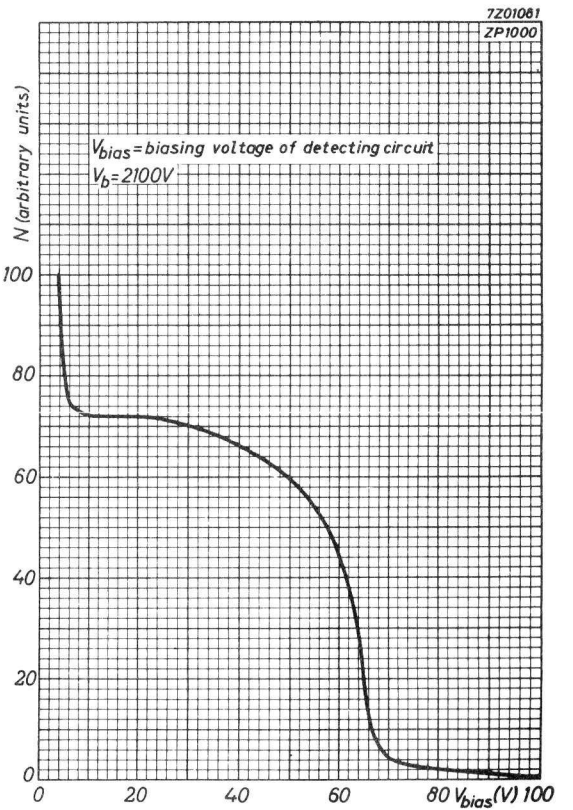


Fig.2

Typical differential bias curve

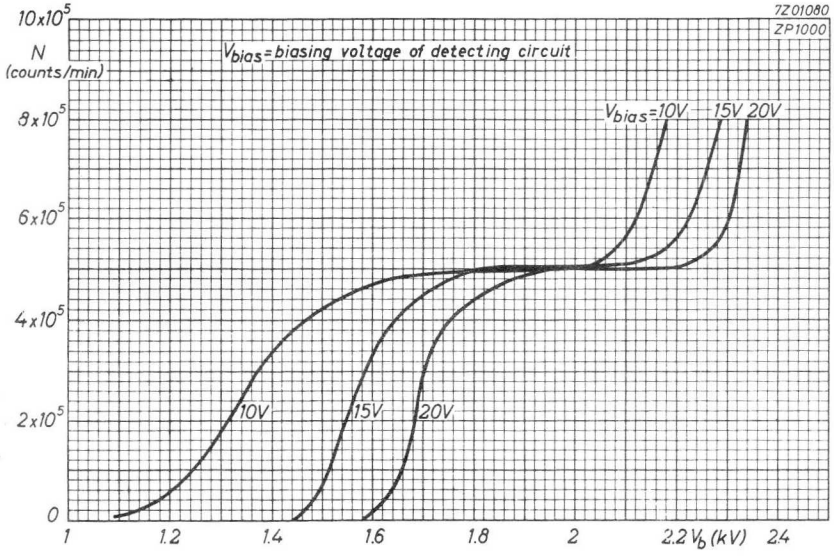


Typical integral bias curve



ZP1000
ZP1001

ZP1000
ZP1001



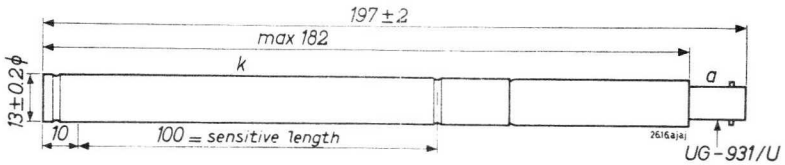
ZP1010

BF_3 PROPORTIONAL COUNTER TUBE

Borium-tri-fluoride filled proportional counter tube for thermal neutrons

QUICK REFERENCE DATA			
Thermal neutron flux range	10^{-2} to	10^5	n/cm^2s
Sensitivity		0.87	count per n/cm^2
Background	max.	0.1	count/min
Operating voltage	900 to	1900	V

DIMENSIONS AND CONNECTIONS



UG-931/U

CATHODE

Thickness	=	0.4 mm
Effective length (outside diameter 12.7 mm)	=	100 mm
Material		Oxygen-free copper

ANODE

Diameter	=	25 μm
Material		Tungsten

BOTTOM

Thickness	=	0.5 mm
Material		Fernico

FILLING BF_3 enriched 96% B^{10}
gas pressure 70 cmHg

∠2 5073

ZP1010

ACCESSORIES

Cable plug	type 56069 (MIL-UG-932/U) With this cable plug a cable MIL-RG-59/U is recommended

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Measured in the recommended circuit, fig.1

Thermal neutron flux range		=	10^{-2} to 10^{5}	n/cm^2 s
Sensitivity		=	0.87	count per n/cm^2
Operating voltage range	V_b	=	900 to 1900	V
Operating voltage for pulse amplitude 1 mV	V_b	=	approx. 1050	V
Operating voltage for pulse amplitude 10 mV	V_b	=	approx. 1600	V
Plateau length	V_{pl}	=	min. 300	V
Plateau slope	S_{pl}	=	max. 1	% per 100 V
Background	N_o	=	max. 0.1	count/min
Pulse amplitude distribution width (see fig.2)	$\Delta P/P$	=	max. 6	%
Valley-to-peak ratio (see fig.2)	$\Delta N/N$	=	max. 2	%

TYPICAL OPERATION

Operating voltage	V_b	=	1400	V
Gas multiplication factor	A	=	14	
Ambient temperature	t_{amb}	=	25	°C
Pulse amplitude	V_{pulse}	=	approx. 4	mV

LIFE EXPECTANCY

The life of the tube is determined by consumption of the BF_3 gas by the nuclear reaction B(n, α) Li and by ionisation. Tube life is expected to be 10^{11} counts.

To prolong the life of the tube it is recommended to operate at low values of gas multiplication factor.

RECOMMENDED CIRCUIT

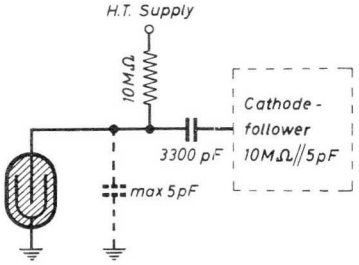


Fig.1

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth).
Recommended circuit see fig.1.

REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.

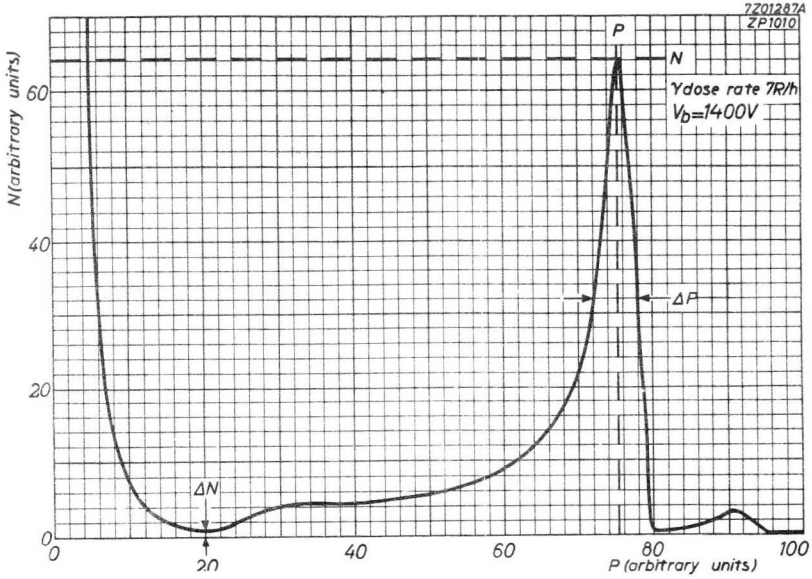
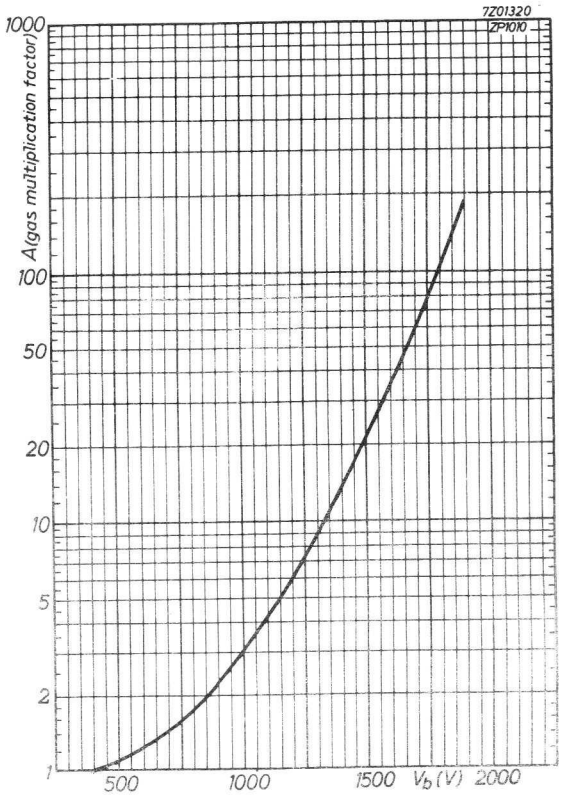


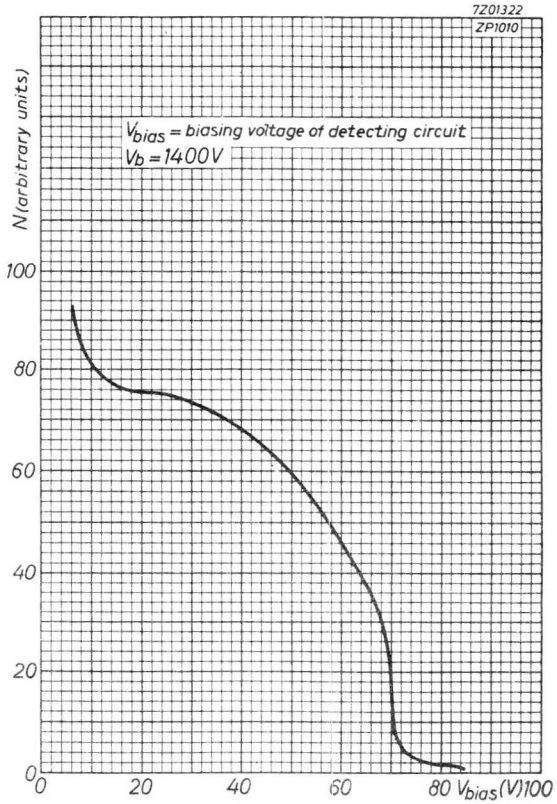
Fig.2

Typical differential bias curve

7Z2 5075

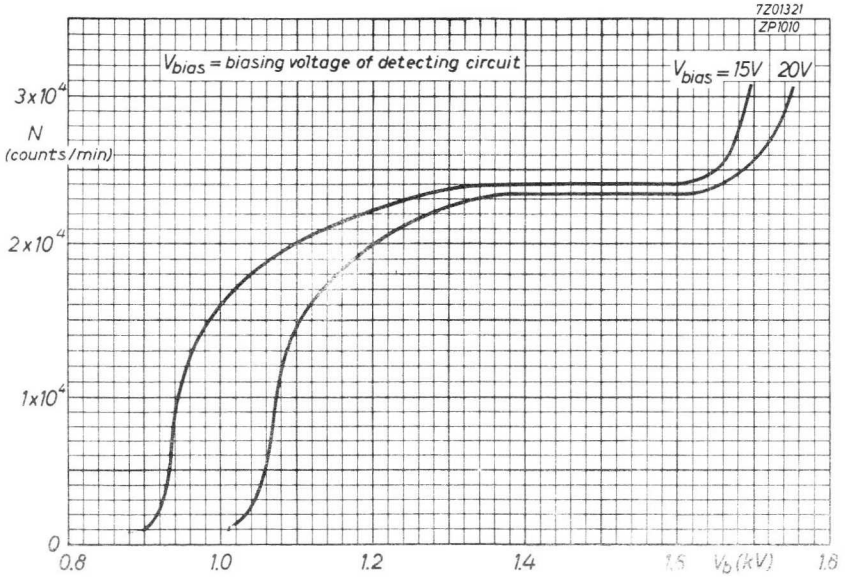
ZP1010


7Z01320
ZP1010
1000
100
50
20
10
5
2
1
Agas multiplication factor)
500
1000
1500
Vb (V)
2000



Typical integral bias curve

ZP1010


7Z01321
ZP1010
V_{bias} = biasing voltage of detecting circuit
V_{bias} = 15V 20V
3x10⁴
N
(counts/min)
2x10⁴
1x10⁴
0
0.8
1.0
1.2
1.4
1.6
V_b (kV)
1.8

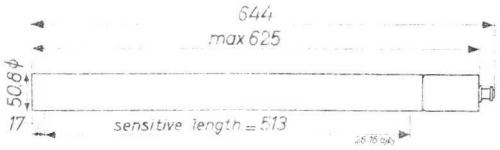
ZP1020

BF_3 PROPORTIONAL COUNTER TUBE

Borium-tri-fluoride filled proportional counter tube for thermal neutrons.

QUICK REFERENCE DATA			
Thermal neutron flux range	10^{-4} to	10^3	n/cm^2s
Sensitivity		75	counts per n/cm^2
Background	max.	3	counts/min
Operating voltage	2300 to	3800	V

DIMENSIONS AND CONNECTIONS



CATHODE

Thickness	=	1 mm
Effective length	=	513 mm
Material		Oxygen-free copper

ANODE

Diameter	=	100 μm
Material		Tungsten

BOTTOM

Thickness	=	1.5 mm
Material		Oxygen-free copper

FILLING

BF_3 enriched 96% B^{10}
gas pressure 70 cmHg
7Z2 5076

ZP1020

ACCESSORIES

Cable plug	type 56069 (MIL-UG-932/U)
	With this cable plug a cable MIL-RG-59/U is recommended.

OPERATING CHARACTERISTICS (t_{amb} = 25 °C)

Measured in the recommended circuit fig. 1

Thermal neutron flux range		=	10^{-4} to 10^{3}	n/cm^2s
Sensitivity		=	75	counts per n/cm^2
Operating voltage range	V_b	=	2300 to 3800	V
Operating voltage for pulse amplitude 1 mV	V_b	=	approx. 2700	V
Operating voltage for pulse amplitude 10 mV	V_b	=	approx. 3600	V
Plateau length	V_{pl}	=	min. 300	V
Plateau slope	S_{pl}	=	max. 1	% per 100 V
Background	N_o	=	max. 3	counts/min
Pulse amplitude distribution width (see fig. 2)	$\Delta P/P$	=	max. 25	%
Valley-to-peak ratio (see fig. 2)	$\Delta N/N$	=	max. 3	%

TYPICAL OPERATION

Operating voltage	V_b	=	3300	V
Gas multiplication factor	A	=	11	
Source (in paraffin moderator)		=	100	mg RaBe
Distance between source and tube		=	6	cm
Accompanying γ dose rate		=	< 10	R/h
Ambient temperature	t_{amb}	=	25	°C
Pulse amplitude	V_{pulse}	=	approx. 4	mV
Neutron count-rate [1])		=	10^6	counts/min

[1]) Bias setting in valley of bias curve (see fig. 2).

LIFE EXPECTANCY

The life of the tube is determined by consumption of the BF_3 gas by the nuclear reaction B(n, α) Li and by ionisation. The tube life is expected to be in excess of 10^{11} counts.

To prolong the life of the tube it is recommended to operate at low values of gas multiplication factor.

RECOMMENDED CIRCUIT

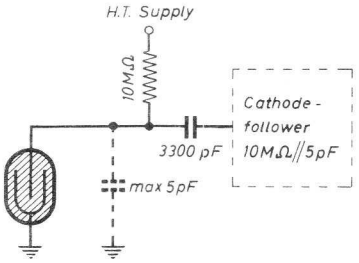


Fig.1

MOUNTING

Low capacity mounting of the tube is required (shortest possible connection between anode and anode resistor and small capacity of anode to earth).

REMARK

In order to prevent leakage the tube should be kept dry and well cleaned.

ZP1020

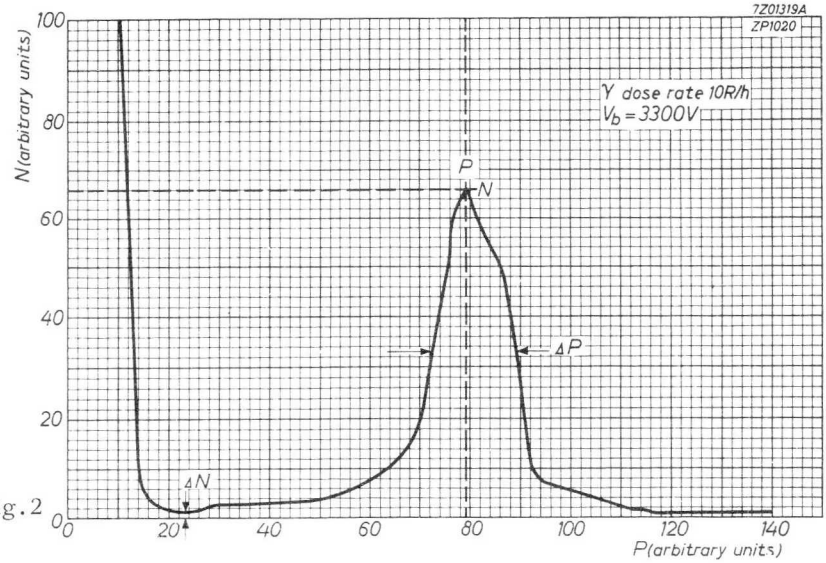
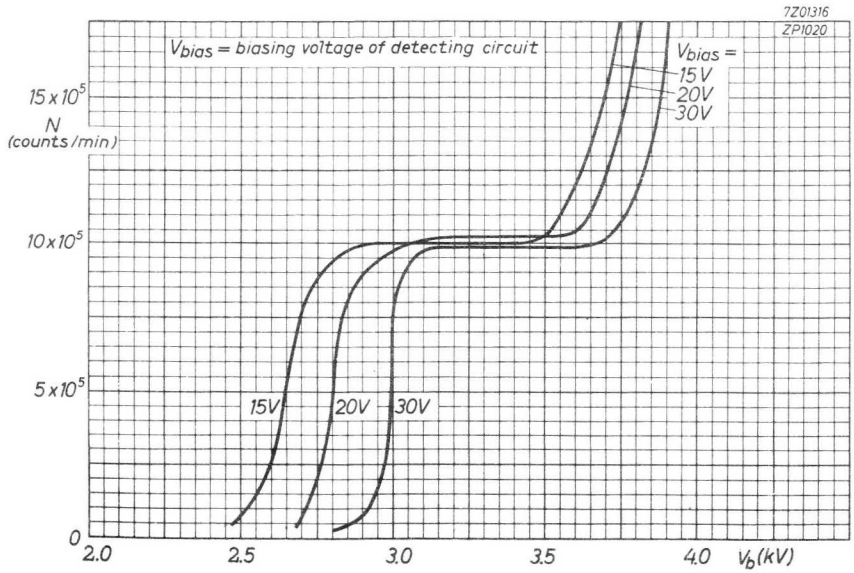
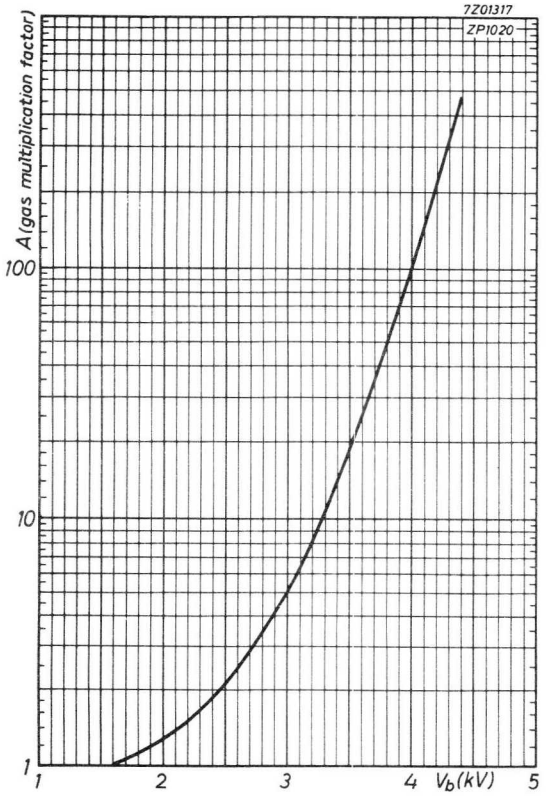


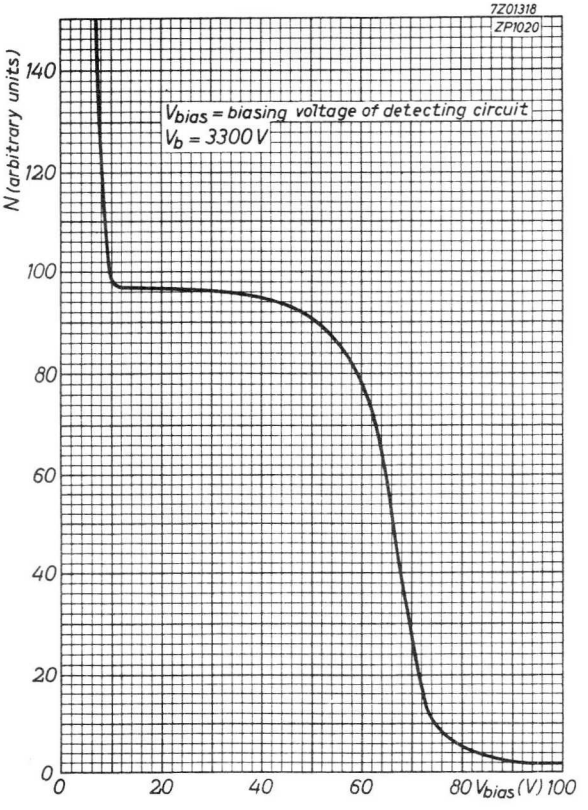
Fig. 2 Typical differential bias curve





Typical integral bias curve

ZP1020


7Z01318
ZP1020
V_{bias} = biasing voltage of detecting circuit
V_b = 3300 V
N (arbitrary units)
140
120
100
80
60
40
20
0
0
20
40
60
80
V_{bias} (V)
100

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