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Contributors

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Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

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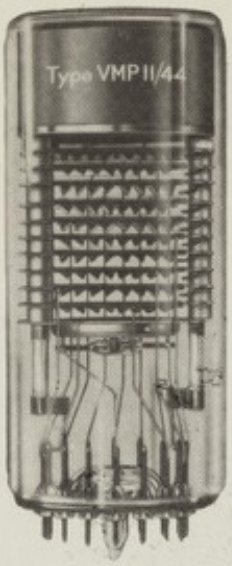
20th CENTURY ELECTRONICS LIMITED

PHOTOMULTIPLIER TUBES

Printed in England



VENETIAN BLIND
PHOTOMULTIPLIER TUBES

VM Series

This range of high quality venetian blind photomultiplier tubes incorporates an improved design of dynode assembly which is robust and gives a very low noise level. The tubes are available with a variety of cathode diameters and with windows of kodial, pyrex or quartz.

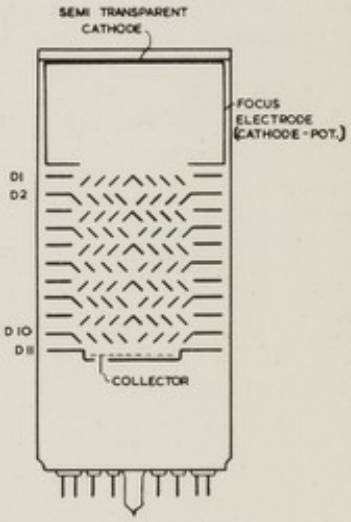
Type VMP.11/44 (illustrated) is a high sensitivity tube designed for scintillation counting. An overall sensitivity of 200 A/L with a dark current of less than 0.1 μA is given for an H.T. voltage below 160 v. per stage.

Type VMP.13/44 is a high gain tube similar to VMP.11/44 but with 13 stages. An overall sensitivity of 2000 A/L may be obtained.

Selected tubes for good energy resolution can be supplied on request. For Tritium and other low energy counting, special cathodes of low thermal noise are available.

The VMP.11/111 (illustrated) is of similar construction to VMP.11/44 above but has a cathode of 5" (111 mm.) diameter. It is intended for use with large crystals for scintillation counting and has a high sensitivity uniform cathode.

All tubes in the VM series have a 15-pin pressed glass base (B15B)—connections are shown overleaf.



Schematic view of V.M. Series

VM Series

TYPE	CATHODE (S.11)			MULTIPLIER SYSTEM CHARACTERISTICS								DIMENSIONS		PRICE
				Specification			Average Performance			Continuous Output Current				
	Window	Diam. mm	Sens. Min. Av. μA/L	Max. V/Stage V	Min. o/a Sens. A/L	Max. Dark Current μA	V/Stage V	o/a Sens. A/L	Dark Current μA	Max. mA	Normal mA	Max. Diam. mm	Seated Length mm	Sterling
11 Stage														
VMP11/44	Pyrex	44	30–50	160	200	0·1	145	500	0·3	1·0	0·1	51	111±2	£35
VMQ11/44	Quartz						130	200	0·05					£42–10–0
VMK11/44	Kodial						95	20	<0·01					£32–10–0
VMP11/111	Pyrex	111	25–40	160	200	1·0	130	200	0·5	1·0	0·1	127	171±5	£45
VMP11/10	Pyrex	10	30–50	160	200	0·01	145	500	0·01	1·0	0·1	51	92±2	£35
VMK11/10	Kodial						130	200	<0·01					£32–10–0
							95	20	<0·01					
13 Stage														
VMP13/44	Pyrex	44	30–50	160	2000	1·0	115	2000	0·5	1·0	0·1	51	111±2	£40
VMQ13/44	Quartz						85	200	0·05					£47–10–0
VMP13/10	Pyrex	10	30–50	160	2000	0·1	115	2000	0·02	1·0	0·1	51	92±2	£40
							85	200	<0·01					

BOX TYPE

PHOTOMULTIPLIER TUBES

BMS.11/23

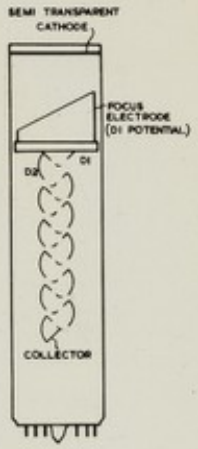
BMS.7/14

BMS Series

This series of tubes has been developed from the familiar American Box Type structure but incorporates certain improvements. The dynodes have very high gain/voltage ratios combined with low noise characteristics. Both tubes have semi-transparent Antimony Caesium (S.11) cathodes and the flat faces provide excellent optical coupling when used with scintillators. Windows are normally lime-soda glass although other windows can be supplied on request.

Amongst the most important uses are scintillation counting, bore-hole monitoring and medical probe application.

These tubes are supplied with an S11 cathode, but low thermal noise cathodes are also available.

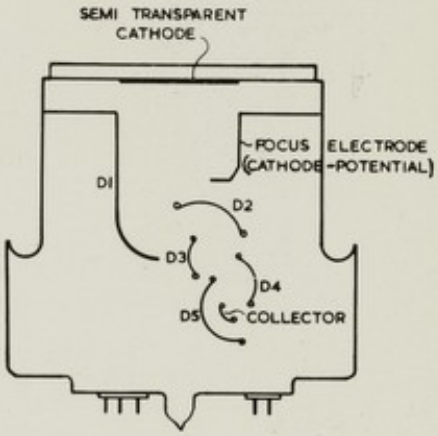


Schematic view of BMS Series

Type	Cathode (S.11)		Multiplier				Dimensions		Price Sterling
	Av. Sens.	Dia.	No. of stages	Min. o/a Sens.	Av. V/Stage	Max. Dark Current	Max. Ext. Dia.	Seated Length	
BMS.11/23	50 μA/L	23 mm	11	200 A/L	95	·1 μA	28 mm	115 mm	£25
BMS.7/14	50 μA/L	14 mm	7	1 A/L	120	·001 μA	19 mm	80 mm	£25

FOCUSED TYPE

HIGH SPEED PHOTOMULTIPLIER



This tube (Type No. FMK.5/R10) is of unique design and has been developed for the U.K.A.E.A. under a C.V.D. Development Contract.

It is a special purpose tube capable of giving linear output pulses in excess of 100 ma. The welded metal body has a rectangular polished glass window with 5 x 2 cm. semi-transparent cathode.

An array of five dynodes is mounted between ground glass plates and the potential steps are approximately arithmetical giving a minimum gain of 10,000 at 2,000 volts overall. Good noise characteristics are assured by the metal-walled construction and the small volume of the tube.

PHOTOMULTIPLIER OPERATING NOTES

Working Voltage

The gains of venetian-blind, box and focussed type multipliers tubes rise steeply with increase of overall voltage. This means, firstly, that a highly stabilised source of voltage is required and, secondly, that a great range of current amplification is available by varying the working voltage.

The supply voltage may be divided into equal interstage increments by a potential divider. It may, however, be found advantageous in particular applications to increase the ratio of these increments at cathode — D_1 and $D_1 - D_2$ to ensure complete collection of photo-electrons.

Dark Current

Improved dark current is obtained after running tubes for a short time. Exposure to light will produce high dark currents; dark current falls on storing in the dark. Critical applications, calling for exceptionally low dark current may be met by storing tubes for several days in the dark.

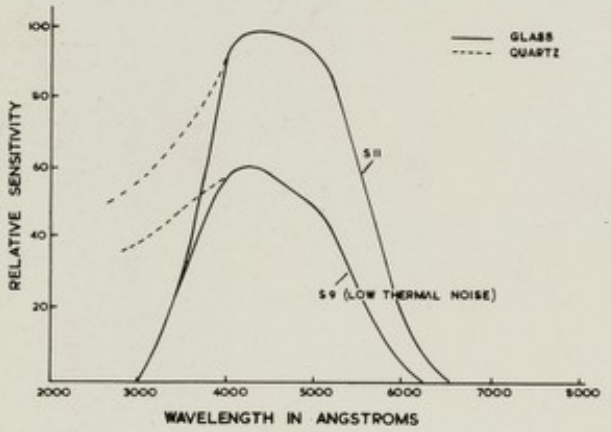
As the working voltage of a tube is increased the noise which is predominantly due to thermionic emission eventually becomes negligible compared with the noise induced by the overall high voltage in the tube. This voltage induced noise which is the result of a variety of random effects eventually becomes regenerative and causes excessive currents. The tube should normally be operated well below this region. The contribution due to both kinds of noise can be greatly reduced by cooling the tube to about −20°C.

Anode Characteristics

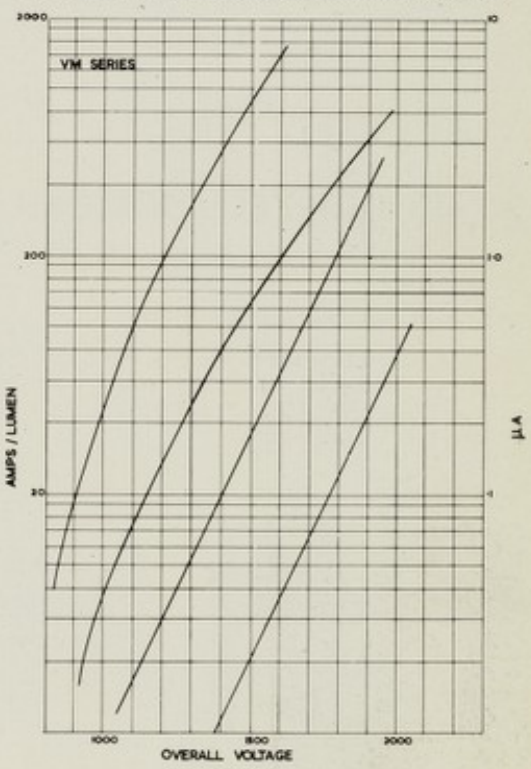
The anode current should be limited to the recommended maximum to ensure stability of the surface. Lower output currents are recommended where extreme stability is required. Space charge saturation does not affect the output current even at pulsed currents of several milliamperes. The anode capacity in all venetian blind types is about 8 ppf.

The output is linear with light input over the range of anode currents recommended. The cathode surface may exhibit non-saturation when the cathode current exceeds 1.0 μA. This is about 1000 times higher than the normal cathode currents. Care must be taken that the tube is not accidentally exposed to light under conditions in which excessive currents would be generated within the tube.

SPECTRAL RESPONSE S.11 CATHODE



TYPICAL OPERATING CHARACTERISTICS



BASE CONNECTIONS

Type	Base	PIN NUMBER														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VM Series	B15B	D5	D7	D9	D11	(D13)	A	(D12)	D10	D8	D6	D4	D2	K	D1	D3
BMS.11	B14A	N.C.	D3	D5	D7	D9	D11	A	D10	D8	D6	D4	D2	K	D1	
BMS.7	B9A	D3	D5	D7	A	D6	D4	D2	K	D1						

20TH CENTURY ELECTRONICS LTD.

CENTRONICS WORKS, KING HENRY'S DRIVE, NEW ADDINGTON, SURREY ENGLAND

Telephone : Lodge Hill 2121-6