



Photomultipliers

Photomultiplier list

type	page	type	page	type	page
6097B	26	9265B	20	9558B	30
6097KB	26	9265FLB	20	9558QB	30
9078B	12	9265KB	20	9658B	30
9079B	28	9265XXXB	20	9670B	28 new
9079QB	28	9266B	16	9727B	38
9085B	24	9266FLB	16	9780B	12
9102B	14	9266KB	16	9781B	12
9102FLB	14	9266QB	16	9783B	12
9102KB	14	9266XXXB	16	9789B	16
9106B	24	9269B	26	9789QB	16
9106QB	24	9269KB	26	9798B	28
9107B	12	9272B	36	9798QB	28
9107FLB	12	9273B	36	9807B	18
9107QB	12	9274B	36	9813B	18
9108B	24	9275B	36	9813KB	18
9110FLB	38	9276B	36	9813QB	18
9110V02	38	9302B	20	9814B	18
9110V15	38	9302FLB	20	9814KB	18
9110V16	38	9302KB	20	9815B	18
9111B	12	9305FLB	20	9815KB	18
9111FLB	12	9305KB	20	9816B	30
9111WB	12	9306FLB	20	9816KB	30
9112B	24	9306KB	20	9817B	30
9112FLB	24	9307B	32	9817KB	30
9112WB	24	9311FLB	32 new	9821B	20
9113B	28	9311KB	32 new	9821KB	20
9113FLB	28	9312KB	32 new	9821QB	20
9113WB	28	9312WKB	32 new	9822B	20
9114B	12	9313QFLB	40 new	9822KB	20
9114FLB	12	9313UFLB	40 new	9823B	22
9116B	24	9318B	20 new	9823KB	22
9116WB	24	9318KB	20 new	9823QB	22
9124B	24	9325FLB	40 new	9828B	28
9124QB	24	9325QFLB	40 new	9828WB	28 new
9125B	12	9326FLB	40 new	9829B	18
9125QB	12	9330B	22	9829QB	18
9125WB	12	9330KB	22	9845B	36
9128B	14	9354FLB	22	9845KB	36
9128QB	14	9354KB	22	9850B	30
9130/100B	28	9357FLB	40	9863/100B	32
9130/350B	28	9361FLB	40 new	9863/100KB	32
9131/100B	14	9361QFLB	40 new	9863/350B	32
9134B	14	9362FLB	40 new	9863/350KB	32
9136B	28	9362QFLB	40 new	9878B	38
9142B	14	9364QFLB	40 new	9879B	32
9142QB	14	9364UFLB	40 new	9888B	38
9142WB	14	9367FLB	40 new	9893/350B	18
9143B	14	9367QFLB	40 new	9893/350KB	18
9143WB	14	9369FLB	40 new	9900B	24
9201B	30	9390B	22	9902B	26
9201KB	30	9390FLB	22	9902FLB	26
9202B	30	9390KB	22	9902KB	26
9202QB	30	9402B	34	9902XB	26
9205B	16	9403B	34	9903KB	26
9213FLB	40 new	9405B	34	9924B	24
9213QFLB	40 new	9406B	34	9924QB	24
9213UFLB	40 new	9407B	34	9939B	26
9214B	16	9408B	34	9939KB	26
9214KB	16	9422B	34	9954B	26
9215B	16	9422QB	34 new	9954KB	26
9215KB	16	9423B	34	9956B	26
9222	38	9424B	34	9956KB	26
9223	38	9425B	34	9972B	28
9224	38	9426B	34	9972KB	28
9226	38	9427B	34	B29B02H	12 new
9235B	16	9428B	34	B29B03H	12 new
9235QB	16	9442B	24 new	B29B06H	12 new
9250B	16	9442QB	24 new	B38B01S	14 new
9250KB	16	9442WB	24 new	B38B01V	14 new
9250QB	16	9490B	26 new	B51D03S	18 new
9256B	26	9490KB	26 new	B51D03V	18 new
9256KB	26	9524B	24	PB29B03H	12 new

Contents:

page

1	introduction	1
2	how to use this brochure	1
3	choosing your photomultiplier	1
4	selection steps	2
5	photomultiplier ordering information	10
6	photomultiplier specifications	11
	blue / green sensitive bialkali	12
	green enhanced bialkali	24
	red / infra red sensitive trialkali	28
	vacuum ultra-violet sensitive	34
	rugged blue / green sensitive bialkali	36
	high temperature bialkali	38
	low temperature bialkali	40
7	voltage dividers	42
8	magnetic shields	44
9	sockets	46
10	photocathode spectral response curves	48
11	terms of guarantee and RoHS compliance	49

Contact

ET Enterprises Limited
 Riverside Way, Uxbridge, UB8 2YF, UK
 Tel: +44 (0)1895 200 880
 Fax: +44 (0)1895 270 873
 Email: sales@et-enterprises.com
www.et-enterprises.com

Electron Tubes
 100 Forge Way, Unit F, Rockaway, NJ 07866, USA
 Tel: (973) 586 9594 Toll free: (800) 521 8382
 Fax: (973) 586 9771
 Email: sales@electron tubes.com
www.electrontubes.com



ISO9001 FM517847



1. Introduction

This brochure aims to guide you through the selection process to help you choose a suitable photomultiplier (pmt) for a particular application. It contains sufficient detail for you to narrow your selection to the most appropriate type, or at least to within a few types.

Individual data sheets are available for each product, giving additional, detailed, technical information. Data sheets can be downloaded from our **website**, www.et-enterprises.com, or we can **fax** the information to you.



part of the ET Enterprises range of product brochures and supporting datasheets

We also draw your attention to our range of photomultiplier accessories and instrumentation. These provide different levels of system functionality combined with flexibility and minimum setting-up time:

- voltage dividers**
- ambient temperature and cooled housings**
- analogue amplifiers**
- photon counting modules and systems**
- laboratory power supplies**

For further information please refer to our brochure:

photomultiplier accessories.

Most importantly, we invite you to speak to us directly about your application so that we can advise you on the best solution. **We offer technical support from the company headquarters in the UK and from our office in the USA.**

The specifications given in this brochure provide the primary information for selection. You will notice that there are options and variants offered to ensure that you can best meet the demands of your application. In addition **ET Enterprises** can provide pmts selected for one or more parameters tailored to your specific requirements. **The options and variants are covered under the heading 'Photomultiplier ordering information'.**

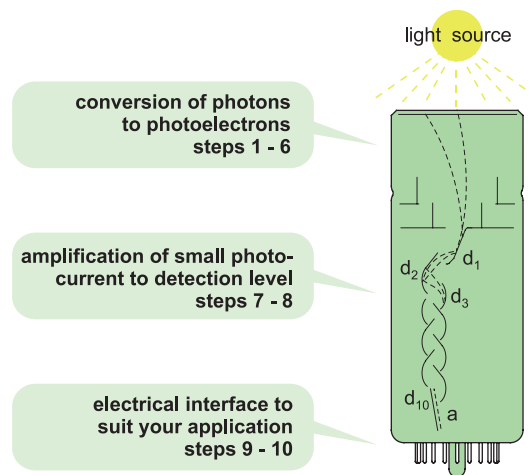
2. How to use this brochure

We present a step by step procedure for choosing a photomultiplier. If you feel you need to understand more about a particular aspect of photomultiplier theory and practice, then please refer to our technical document: **understanding photomultipliers** and to our **technical reprints** series. You may request these via the **website**, but we are always pleased to discuss technical matters directly.

3. Choosing your photomultiplier

Although **photomultipliers** are extremely sensitive light detectors, capable of detecting single photons, they are also used in applications where the requirement is to detect much higher light levels, such as pulses containing tens of thousands of photons. The wide range of performance requirements has led to diverse and, on occasion, confusing product choice. This brochure streamlines the selection process into a number of steps.

To assist the selection process we have categorised the operation of the pmt as follows:



The initial selection is always the choice of photocathode, together with a decision on the preferred size. That is why the data is organised in this way – all pmts of the same photocathode type are grouped and listed in order of photocathode diameter. Once these two attributes have been decided, the number of tubes to choose from is substantially reduced. By taking account of such parameters as gain, dark current, speed of response and any special requirements, the selection becomes progressively more manageable.

The selection process is summarised in **section 4**. Please use this list, noting which questions are relevant to your purpose and then refer to the detailed sections that apply. If you prefer to do this via our website, you can go to the Photomultiplier search tool at www.et-enterprises.com.



4. Selection Steps

step 1

what is the wavelength range of your source ?

step 2

do you want to detect at wavelengths below 300 nm ?

step 3

is low background glass an advantage ?

step 4

what detection area and geometry do you require ?

step 5

are high light levels or low temperatures a consideration?

step 6

have you considered signal / background ?

step 7

what is the optimum photomultiplier gain ?

step 8

which dynode structure best meets your performance demands ?

step 9

are you operating in a harsh environment ?

step 10

which mechanical configuration for the base is best for you ?

note that selecting performance parameters you don't actually need may compromise some other aspect of performance that is important.

Step 1

what is the wavelength range of your source ?

Photocathodes are manufactured from a variety of compounds and each type has a characteristic spectral response. You should aim to select the pmt with the spectral response that best matches the spectrum of the light to be detected (**see figures 1 – 4**). In this way you will maximise the pmt signal.

Photocathode materials and descriptions used in **ET Enterprises** pmts are:

bialkali (K – Cs – Sb)
offers high blue and good green response with low dark current.

rubidium bialkali (Rb – Cs – Sb)
offers high blue and enhanced green response but with twice the dark current of the bialkali.

multialkali S20 (Na – K – Cs – Sb)
Sensitivity extends from uv to near infrared but may require cooling to reduce dark current.

high temperature bialkali (Na – K – Sb)
recommended for high temperature operation at temperatures above 60°C.

solar blind (KBr, CsI, RbTe, CsTe)
when sensitivity in the uv and vuv only is required

In order to choose from the list above you need to be aware of the way photocathode response is characterised.

Photocathode sensitivity quantifies the conversion efficiency for photons to photoelectrons and may be expressed in several ways; those which predominate are explained below. The relationship between photocathode sensitivity and wavelength is called the spectral response.

Quantum Efficiency (QE), usually designated by $\eta(\lambda)$, is the average percentage of incident photons of wavelength that converts to photoelectrons.

Luminous Sensitivity (S) is a traditional unit for spectral response and is measured in units of $\mu\text{A} / \text{lumen}$. Nowadays, it is used primarily to specify photocathodes with high infrared response. Filter measurements, however, based on **luminous** sensitivity, are frequently used. Three specific colour filters in turn can be placed between a white-light source and the photocathode. The Corning Blue (CB), Corning Red (CR) and infrared (IR) numbers are used as industry standard photocathode parameters and are quoted on the test ticket supplied with every pmt. The filter transmission curves are shown in **figure 4**.

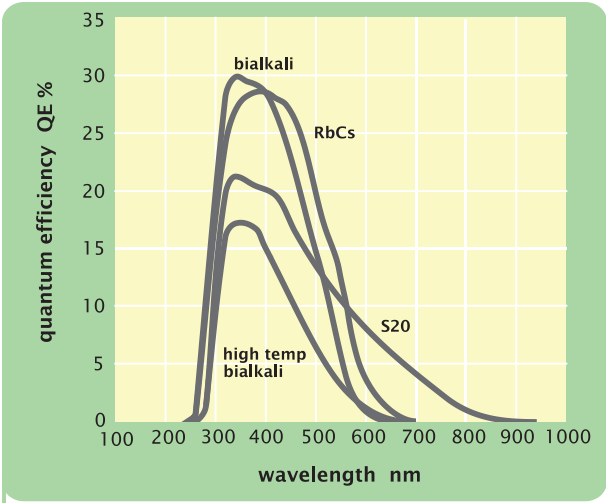


figure 1

Spectral response curves for various photocathodes deposited on borosilicate glass. The naming of photocathode types is historical. Measured values of QE against wavelength can be provided (see under heading 'Photomultiplier ordering information', code M).

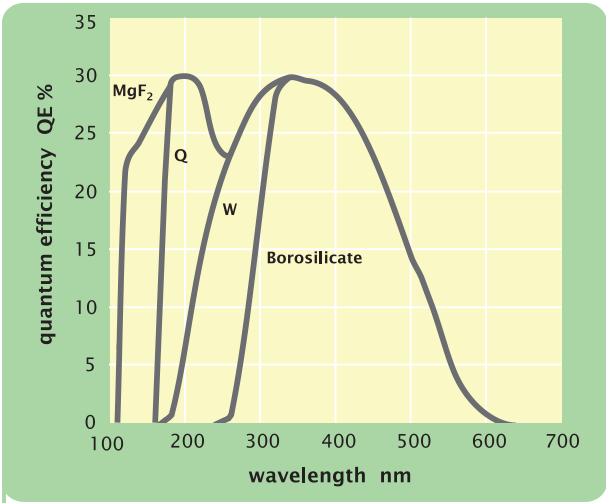


figure 2

Response to uv light can be increased by choosing the appropriate window material. This is illustrated for the bialkali photocathode.

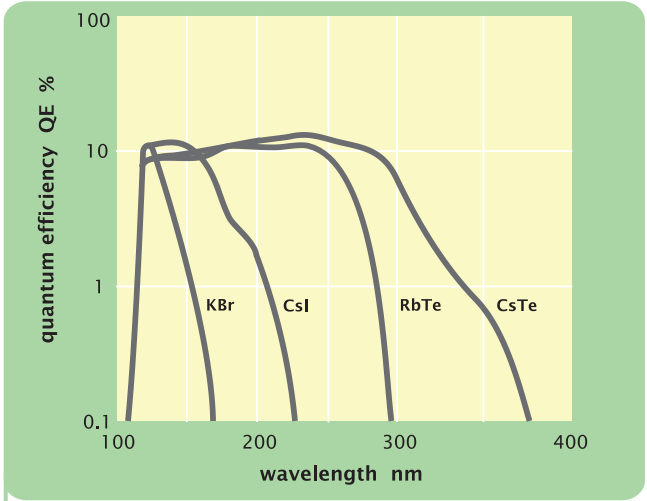


figure 3

Solar blind photocathodes deposited on MgF₂ are sensitive to uv light only.

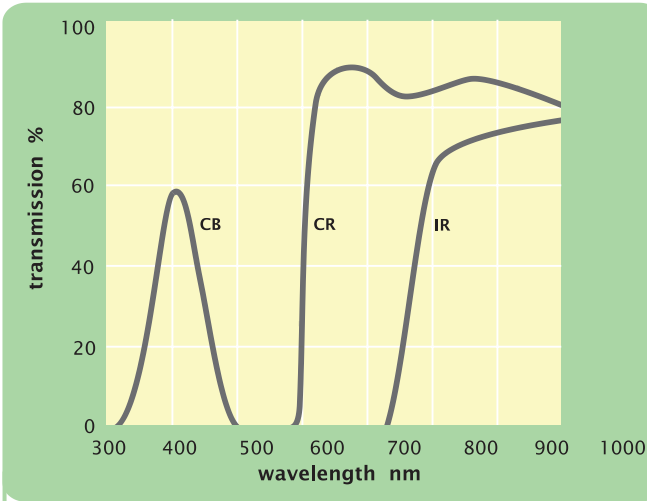


figure 4

Filter transmission characteristics give a measure of the blue, red and infrared response of photocathodes.

Step 2

Do you want to detect at wavelengths below 300 nm ?

The short wavelength limit depends on the window transmission so when deciding upon the photocathode type you will also need to choose the material for the pmt window.

Borosilicate glass is the standard window material used by **ET Enterprises**. For some of the entries in the specifications section we use other more specialised glass and this is always stated in the special features column. Most pmts that are available in borosilicate glass are also available in uv glass (**see code W, ordering information**) and in quartz (**see code Q, ordering information**).

borosilicate glass

this is the standard, lowest cost, window material and is suitable for all wavelengths greater than 260 nm

uv glass (W)

extends sensitivity down to 180 nm

quartz (Q)

made from fused silica, this material transmits down to 160 nm. Not available in the 25 mm 9111B series.

In addition, we offer a range of pmts with magnesium fluoride windows, **MgF₂**, which transmits uv radiation down to 110 nm.

The window material used for metal ceramic photomultipliers is sapphire, **S**.

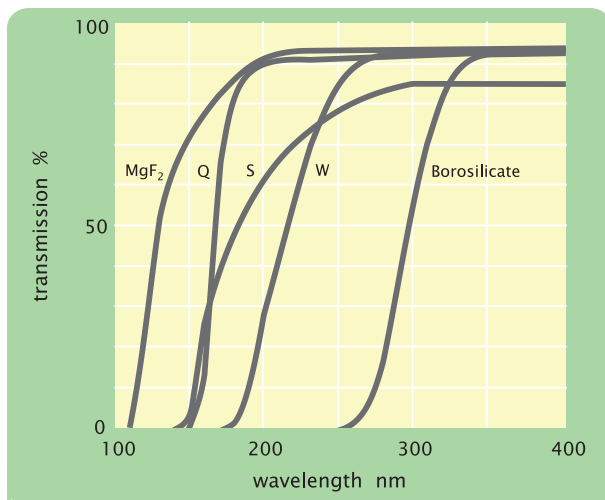


figure 5

Light transmission curves for pmt window materials of thickness 2.25 mm.

Step 3

Is low background glass an advantage ?

ET Enterprises is the leading supplier of photomultipliers with very low levels of natural radioactivity.

Pmts with minimal levels of naturally occurring K, Th and U are recommended for low background scintillation counting and most pmts from **ET Enterprises** are made with low background glass windows. Radionuclide activities are given in **table 1**.

In quartz pmts the window has extremely low levels of activity, but other parts of the envelope are made from borosilicate glass of higher activity. In some whole-body applications, therefore, quartz may not be the preferred choice. Please speak to us about this if you need more information.

For the most critical applications the entire pmt envelope is made in ultra-low background glass, and the materials within the envelope are also selected for low activity. We have a range of special pmts constructed in this way and these are highlighted in the special features column of the specifications section. In addition we can provide most of our standard product in ultra-low background glass (**designated U**), subject to special order.

table 1

Background levels of elements containing radionuclides. Gamma decays per minute refer to a 50 mm diameter window of weight 30 g.

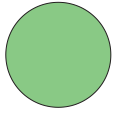
material	K ppm	Th ppb	U ppb	total decays/ minute
standard borosilicate	< 60,000	< 1000	< 1000	< 400
low background	300	250	100	25
ultra-low background	60	20	10	5
quartz	< 5	< 5	< 5	< 0.1

Step 4

What detection area and geometry do you require ?

For light sources remote from the pmt, such as a star, you can choose from the full range of available window geometries. When the light source is directly coupled to the pmt, as in the case of a scintillation crystal, a flat window is best. The range of window geometries is shown below. Details are shown for each pmt type in the outline drawings in the specifications section.

The range of **photomultiplier** window geometries is:



circular

Diameters from 15 to 135 mm available to suit diffuse and directly coupled light sources. Typical applications include scintillation and general purpose uses.



reduced area

Sensitive diameters of 2.5 mm and 10 mm for applications where the light can be concentrated or focused. The reduced photocathode area provides the benefit of lower dark current (see **step 6**).



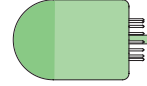
domed window

The inherent strength of this construction allows us to use a very thin, and consequently low radioactivity, window. The window is often supplied shot blasted to enhance quantum efficiency.



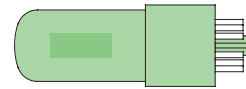
2 pi

Sidewall sensitivity allows wide angle light detection. A typical application is in probes for scintillation counting.



hemispherical

Wide angle light detection from diffuse light sources such as the atmosphere or large liquid scintillation counters. Applications are mainly in fundamental scientific research.



side window

A geometry that offers a small footprint in analytical instruments, such as spectrophotometers.

Photosensitivities can often be increased by choosing a shot blasted window or a prismatic window. The prismatic window has a series of small prisms on the inside surface. Some pmts use shot blasted windows as standard and others can be supplied in this form to special order.

a selection of pmt windows



Step 5

Are high light levels or low temperatures a consideration ?

For the purposes of pmt selection, high light levels are defined in terms of the magnitude of the expected photocurrent or, more directly, in relation to the sensitivity of the human eye. If you can see the light, no matter how faint, then you are dealing with high light levels! Equivalently, if the photocathode current is greater than 1 nA then light levels are high.

The current carrying capability of a photocathode depends on its conductivity, which is related to cathode type and temperature.

Photocathodes are ranked in order of increasing conductivity as follows: solar blind, bialkali, rubidium bialkali, high temperature bialkali and S20.

Current carrying ranking is given in **table 2** below. All become less conductive with decreasing temperature. You may therefore need to modify your choice of photocathode to account for other factors demanded by the application, such as high light levels or low temperature operation. This sometimes means using an S20 photocathode even though the best spectral match is a bialkali, for example.

table 2

Maximum current carrying capability and typical dark count emission (at 20 °C) of photocathodes in 52 mm diameter pmts

photocathode	Ik (nA/cm ²)	dark counts s ⁻¹
solar blind	2.0	100
bialkali	7.5	300
rubidium bialkali	15	800
high temperature bialkali	5.0	200
multialkali, S20	250	15,000

Step 6

Have you considered signal / background ?

How to maximise signal is covered in **step 1**, but it may be equally important to optimise signal / background, in which case you need to consider some of the important aspects of pmt background. Background is the unwanted output from the pmt when it is operating in the absence of signal - that is in the dark. Dark current or dark count is always a consideration in low light level applications or where the dynamic range exceeds 10⁵ (dynamic range is simply the ratio of the highest to the lowest light level to be measured). The following points are important when choosing a pmt:

dark current and dark count rate increase with pmt diameter

dark current and dark count increase with temperature

dark current increases approximately linearly with gain

dark count rate is essentially independent of gain

Typical dark count rate figures are given in **table 2** showing that dark counts are highest in cathodes with high red or infrared response (which are also those with the highest conductivity). In low light level applications where dark counts or dark current are important considerations, the choice of photocathode is invariably decided by signal / background considerations. In view of this you may need to reconsider your original choice of photocathode in **step 1**.

a selection of ET Enterprises pmts



Step 7

What is the optimum photomultiplier gain ?

The sensitivity of any light detection system is related to the product of the pmt gain and the electronics gain. The importance of correctly allocating the gain between these two cannot be over emphasised. Calculating the maximum gain available from the electronics is usually straightforward and the required pmt gain should then follow. However, operating both the pmt and the electronics below their maximum capability is always advised.

It is important to choose a pmt with the right number of dynode stages to provide the required pmt gain. For very low light intensities, down to single photon counting levels, between 10 and 14 dynode stages will be required. For high light levels, 6 to 9 dynode stages are sufficient.

Pmts are available with gain capability ranging from 10^3 to 10^8 - the more dynode stages in the pmt, the higher the gain capability, as illustrated in **figure 6**.

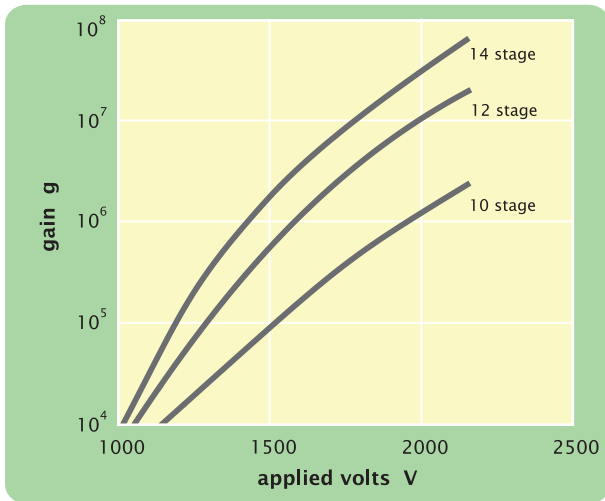


figure 6

Variation of pmt gain, g, with applied voltage for the family of fast, BeCu, 52 mm pmts, illustrating the effect of increasing the number of dynodes.

table 3

Recommended and maximum gain capability of photomultipliers

number of stages	recommended		maximum	
	A/lm	gain	A/lm	gain
6	1	2×10^4	5	10^5
7	1	2×10^4	10	2×10^5
8	10	2×10^5	50	10^6
9	50	10^6	200	4×10^6
10	50	10^6	500	10^7
11	200	4×10^6	2000	4×10^7
12	500	10^7	2000	4×10^7
13	2000	4×10^7	5000	10^8
14	5000	10^8	10000	2×10^8

table 4

The relationship between incident light levels, pmt gain and number of dynodes required.

light level	high	medium	low
photocurrent	$I_k > 1 \text{ nA}$	$1 \text{ nA} > I_k > 10 \text{ pA}$	$I_k < 10 \text{ pA}$
pmt gain	$g < 10^4$	$10^4 < g < 10^6$	$10^6 < g < 10^8$
number of SbCs stages	$n < 8$	$8 < n < 10$	$8 < n < 12$
number of BeCu stages	$Bn < 10$	$10 < n < 12$	$12 < n < 14$

Choose the right gain

benefits of operating a high gain pmt at high gain:

- best photoelectron collection
- high gain for low light levels
- best time response
- signal / background optimised

benefits of operating a low gain pmt at low gain:

- extended lifetime
- good gain linearity
- best signal / noise performance



consequences of operating a high gain pmt at low gain:

- poor photoelectron collection
- poor gain linearity
- slower time response
- restricted dynamic range

consequences of operating a low gain pmt at high gain:

- unstable if maximum ratings are exceeded

Step 8

Which dynode structure best meets your performance demands?

Photomultipliers are manufactured from any of four dynode structures:

venetian blind (VB)

circular focused (CF)

box and grid (BG)

linear focused (LF)

with many available in a choice of two dynode surface materials;

decide

the gain required

select

the dynode structure using tables 5 and 6

select

the number of stages to best meet the performance demands of your application.

Pmts with plano-concave windows and circular focused multipliers give the best timing performance. Other considerations such as the number and type of dynodes, the overall voltage, and the diameter of the photocathode, are also relevant.

Pulsed anode currents, of peak amplitude up to 150 mA, can be drawn from the pmt, depending on the type of dynode and on the type of secondary emitting surface.

table 5

Timing and linearity performance of the range of dynode structures. The transit time jitter for single photoelectron events is given as fwhm. There is a 5 % departure from linear gain at the peak anode current and interdynode voltage (V_{d-d}) given in the table.

dynode structure	rise time ns	jitter, ns fwhm	peak anode current mA			
			at $V_{d-d} = 100\text{ V}$		at $V_{d-d} = 300\text{ V}$	
			dynode SbCs	surface BeCu	dynode SbCs	surface BeCu
LF	1.8 – 2.7	1.0 – 2.5	30	50	100	150
CF	1.5 – 2.5	0.8 – 2.0	10	20	30	50
BG	12 – 18	8.0 – 16.0	0.1	0.2	0.5	1.0
VB	8 – 15	5.0 – 12.0	2	4	5	20

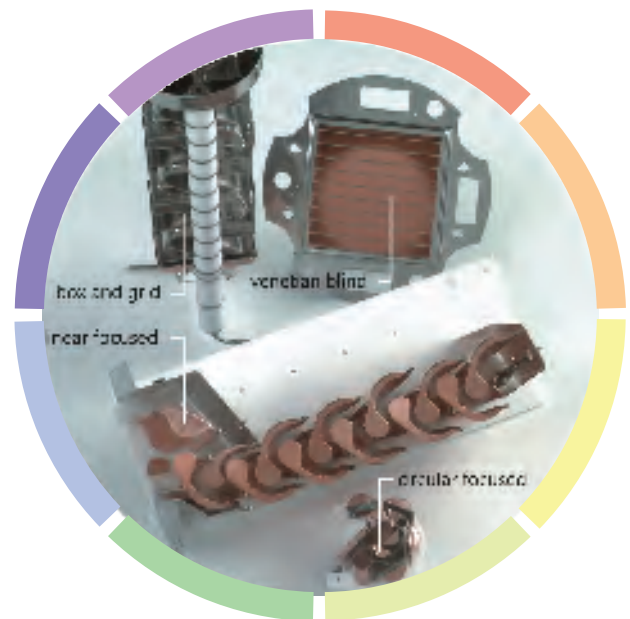
table 6

Ranking the attributes of multiplier structures and surface materials (•••• = best)

type	size most compact	gain max	timing fastest	linearity best	Magnetic immunity best	ap(t) lowest
LF	•••	••••	•••	••••	••	•••
CF	••••	•	••••	•••	••••	•
BG	••	••	•	•	•	•••
VB	•	•••	••	••	•••	••••

ap(t) is the afterpulse rate

dynode material	gain max	linearity best	stability highest	rate effect lowest
SbCs	••••	••	••••	••••
BeCu	•	••••	••	•



the four photomultiplier dynode types

Step 9

Are you operating in a harsh environment ?

A harsh environment has two aspects - operating temperature and mechanical stress.

Pmts with high temperature bialkali cathodes are capable of operating from -60 °C up to temperatures of +175 °C. We have developed special photocathodes that operate at liquid nitrogen temperatures (-200 °C) but you will need to speak to us about your application.

We offer a range of **ruggedised**, conventional pmts for severe industrial and space applications and a range of **ultra-rugged** high temperature types, of metal-ceramic construction, intended for the oil well logging industry. These types are highlighted in the special features column in the specification section. Detailed shock and vibration specifications are provided in the **data sheets** for these products.



examples from ET Enterprises metal ceramic photomultiplier range

Step 10

Which base configuration is best for you ?

There are three base configurations for our photomultipliers, although not all of these are available on all types. The options for any particular pmt type are listed in the specifications section. Select the base option that best suits your requirement, noting that:

In the **hardpin base**, the pins exit directly from the glass envelope to match a mating socket. These pmts have the shortest length.

The **capped base (K)** has more-robust pins set in a blue, opaque thermoplastic cap. These pmts are longer than the hardpin version but offer the advantage of best electrical contact and mechanical support.

The **flexible lead base (FL)** has a set of flexible wires for soldering to a printed circuit board. These wires can also be terminated in a blue cap, either loosely or closely fitted to the pmt. Types supplied with loosely fitted caps are designated **KFLB**.

ET Enterprises can offer all hardpin pmts with welded-on flying leads to special order.



the ET Enterprises range of pmt bases – the caps and sockets are made in material of low radioactivity

5. Photomultiplier ordering information

In addition to the basic type number, we use letter suffixes to denote electrical characteristics and/or mechanical features. Special selection to non standard specification limits can be provided to meet your particular requirements. If this is a one-off requirement we add the suffix A to the pmt type number. For a continuing requirement we use a number suffix to identify a specification selection that is unique to you. Examples are given at the end of this section.

suffix designations

A

selection to an agreed one-off requirement

B

basic published specification

E

with electrostatic shielding protected by a black insulating sleeve.

FL

pmt supplied with flexible wire lead base

G

selected for gating

K

pmt supplied capped with blue plastic base

KFL

as FL with a temporary base for subsequent removal or positioning on installation

M

supplied with spectral response calibration

Q

variant with quartz (fused silica) window

S

with electrostatic and magnetic shielding protected by a black insulating sleeve

U

variant with ultra low background glass window and envelope

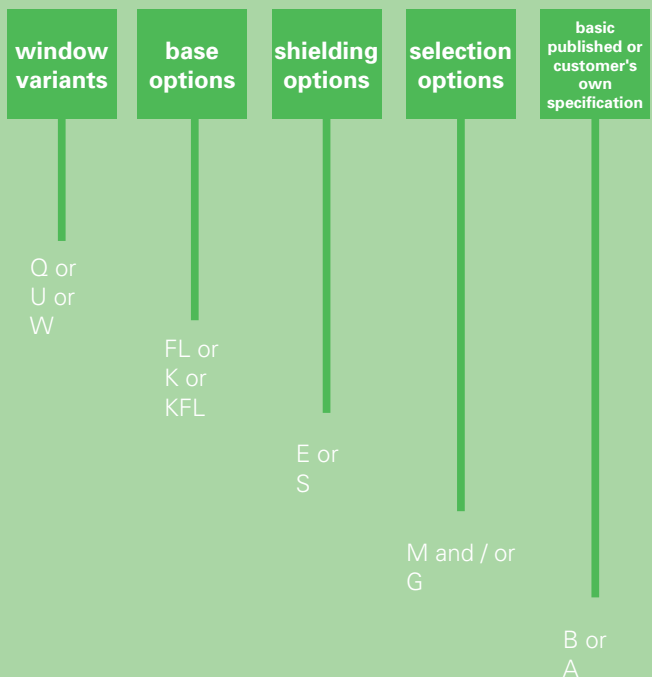
W

variant with UV transmitting glass window

use of suffixes

Basic type no.

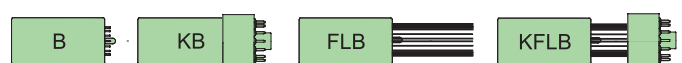
e.g 9266



examples:

- 9266B** - supplied to basic published specification, hardpin
- 9266QKB** - variant with quartz window, capped
- 9266KEB** - capped including electrostatic shield
- 9266B04** - supplied to customer's unique specification, 04

base variants:



Where flexible lead variants are available they are normally supplied fitted with a temporary cap (KFLB variant) and have the same pin connections as KB variants.

The exceptions to the above base variant designations are photomultipliers in the B29, B38, B51 and PB29 series where the suffix H is hard pin (as B above), suffix S is hard capped (as KB above), suffix L is a temporary cap (as KFLB above) and W is flexible leads (as FLB above).

6. Photomultiplier specifications

all pmts of the same photocathode type are grouped

all pmts are listed in order of increasing window diameter

individual datasheets are available for each product giving additional detailed technical information, these can be downloaded from our **website**, www.et-enterprises.com

we can fax data sheets to you, if you prefer

we offer technical support from the company headquarters in the UK and from our office in the USA

electrical specifications apply to standard voltage dividers, details of which are given in the individual data sheets

photocathode sensitivity

performance data

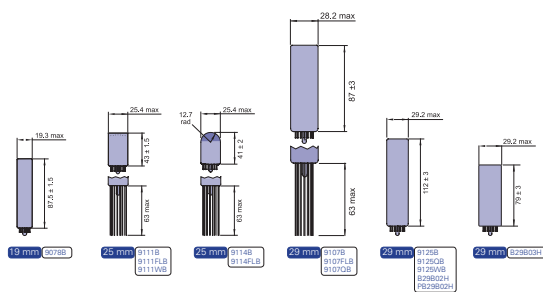
special features

Blue-green sensitive bialkali 19 - 29mm (¾" - 1 1/8") diameter

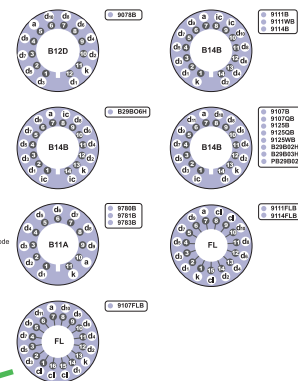
type	Characteristics				Photocathode sensitivity				Photomultiplier performance							Special features			Accessories								
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB mm	CR typical	nominal A/Lm or (eC/MeV)	V _{ka} typical	V _{ka} max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹	max rated A/Lm (gain)	pulse rise time ns	pulse width ns	type	Socket	Shield	Voltage divider series	passive	active		
9078B	19	15	10 LF	SbCs	26	B-c	66	9	11	1	50	800	1200	0.8	0.05	1	50	200	1.8	2.7	9078B	fast, high gain, good overall performance.	B12D	MS19A	C669	C669	
9111B	25	22	10 CF	SbCs	26	B-c	70	7	11	2	50	800	1300	0.7	0.3	1	100	500	1.8	3.1	9111B	compact type, short length and fast response time.	B14B	MS25A	C673	C6702	
9111FLB	25	22	10 CF	SbCs	26	B-c	70	7	11	2	50	800	1300	0.7	0.3	1	100	500	1.8	3.1	9111FLB	variant of 9111B with flexible leads.	wires	MS25A	C671	C6702	
9111WB	25	22	10 CF	SbCs	26	W-c	70	7	11	2	50	800	1300	0.7	0.3	1	100	500	1.8	3.1	9111WB	variant of 9111B with UV sensitivity to 185nm.	B14B	MS25A	C673	C6702	
9114B	25	22	10 CF	SbCs	26	B-c	70	7	11	2	50	800	1300	0.7	0.3	1	100	500	1.8	3.1	9114B	variant of 9111B, hemispherical window for wide angle light detection.	B14B	n/a	C673	C6702	
9114FLB	25	22	10 CF	SbCs	26	B-c	70	7	11	2	50	800	1300	0.7	0.3	1	100	500	1.8	3.1	9114FLB	variant of 9114B with flexible leads.	wires	n/a	C671	C6702	
9125B	29	25	11 LF	SbCs	28	B-c	65	7	11	1	200	850	1150	3	0.2	5	100	2000	4.5	7.5	9125B	variant of 9125B with shorter length (87 mm)	B14B	MS30A	C637	C696	
9125FLB	29	25	11 LF	SbCs	28	B-c	65	7	11	1	200	850	1150	3	0.2	5	100	2000	4.5	7.5	9125FLB	variant of 9125B with flexible leads.	wires	MS30A	C637	C696	
9125CB	29	26	11 LF	SbCs	28	O-c	65	7	11	1	200	850	1150	3	0.2	5	100	2000	4.5	7.5	9125CB	variant of 9125B with UV sensitivity to 165nm.	B14B	MS30A	C637	C696	
9125CB	29	25	11 LF	SbCs	28	O-c	65	7	11	1	200	850	1150	3	0.2	5	100	2000	4.5	7.5	9125CB	high performance parent type.	B14B	MS30B	C637	C696	
9125CB	29	25	11 LF	SbCs	28	O-c	65	7	11	1	200	850	1150	3	0.2	5	100	2000	4.5	7.5	9125CB	variant of 9125B with UV sensitivity to 165nm.	B14B	MS30B	C637	C696	
9125WB	29	25	11 LF	SbCs	28	W-c	65	7	11	1	200	850	1150	3	0.2	5	100	2000	4.5	7.5	9125WB	variant of 9125B with UV sensitivity to 185nm.	B14B	MS30B	C637	C696	
B29B02H	29	25	11 BG	SbCs	25	B-c	50	5	9.5	1	200	800	1100	4	0.2	5	200	2000	15	30	B29B02H	general purpose, good overall performance.	B14B	MS30B	C637	C686	
B29B03H	29	25	11 BG	SbCs	25	B-c	50	5	9.5	1	200	800	1100	4	0.2	5	200	2000	15	30	B29B03H	variant of B29B02H with shorter length (79 mm).	B14B	MS30A	C637	C686	
B29B06H	29	25	9 BG	SbCs	25	B-c	50	5	9.5	1	50	800	1000	1	0.05	2	200	200	15	30	B29B06H	variant of B29B02H for higher light levels, shorter length (87 mm).	B14B	MS30A	C615	-	
P829B02H	29	25	11 BG	SbCs	25	B-c	50	5	9.5	1	200	800	1100	4	0.2	5	200	2000	15	30	P829B02H	variant of B29B02H with sidewall sensitivity.	B14B	MS30A	C637	C686	
9782B	side window	8 x 24	9 CF	SbCs	22	W-c	50	5	9	2	50	750	1200	1	0.1	20	100	2000	3.5	5	9782B	variant of 9781B, replace 931A, (P21 and P28)	B11A	MS5W	C638A	-	
9781B	side window	8 x 24	9 CF	SbCs	25	W-c	75	5	10	5	50	850	800	0.7	0.2	5	10	2000	3.5	5	9781B	good overall performance, can be selected for high CR	B11A	MS5W	C638A	-	
9783B	side window	8 x 24	9 CF	SbCs	25	O-c	75	5	10	5	50	850	800	0.7	0.5	5	-	200	4.5	7.5	9783B	variant of 9781B, with UV sensitivity to 165 nm.	B11A	MS5W	C638A	-	

Comprehensive data sheets for all of the above types are available on request, or can be downloaded from www.et-enterprises.com

Outline drawings mm



Base configurations



outline drawings

base configurations

colour coded page tabs by cathode type

The base configuration diagrams show the photomultiplier pin or socket contact connections. They are viewed from below and are numbered with reference to the cut pin or wire(s), gap or key. The labelling of the connections is explained below:
a=anode; **cl**=cut lead; **d1, d2** etc = dynode; **f**=focus; **ic**=internal connection (not to be used); **k**=photocathode.

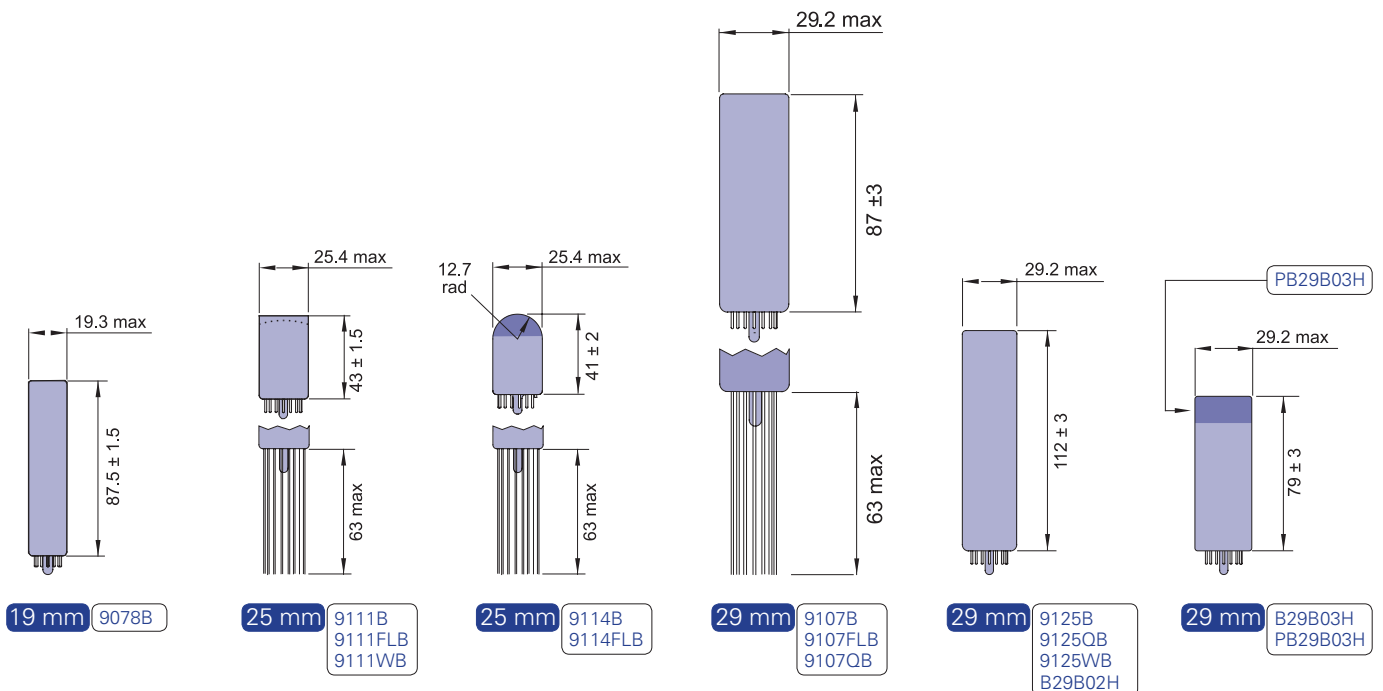
Blue-green sensitive bialkali 19 to 29mm (3/4" to 1 1/8") diameter

type	Characteristics				Photocathode sensitivity						Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹
9078B	19	15	10 LF	SbCs	28	B - c	65	9	11	1	50	800	1200	0.8	0.05	1	50
9111B	25	22	10 CF	SbCs	28	B - c	70	7	11	2	50	800	1300	0.7	0.3	1	100
9111FLB	25	22	10 CF	SbCs	28	B - c	70	7	11	2	50	800	1300	0.7	0.3	1	100
9111WB	25	22	10 CF	SbCs	28	W - c	70	7	11	2	50	800	1300	0.7	0.3	1	100
9114B	25	22	10 CF	SbCs	28	B - c	70	7	11	2	50	800	1300	0.7	0.3	1	100
9114FLB	25	22	10 CF	SbCs	28	B - c	70	7	11	2	50	800	1300	0.7	0.3	1	100
9107B	29	25	11 LF	SbCs	28	B - c	65	7	11	1	200	850	1150	3	0.2	5	100
9107FLB	29	25	11 LF	SbCs	28	B - c	65	7	11	1	200	850	1150	3	0.2	5	100
9107QB	29	25	11 LF	SbCs	28	Q - c	65	7	11	1	200	850	1150	3	0.2	5	100
9125B	29	25	11 LF	SbCs	28	B - c	65	7	11	1	200	850	1150	3	0.2	5	100
9125QB	29	25	11 LF	SbCs	28	Q - c	65	7	11	1	200	850	1150	3	0.2	5	100
9125WB	29	25	11 LF	SbCs	28	W - c	65	7	11	1	200	850	1150	3	0.2	5	100
B29B02H	29	25	11 BG	SbCs	25	B - c	50	5	9.5	1	200	800	1100	4	0.2	5	200
B29B03H	29	25	11 BG	SbCs	25	B - c	50	5	9.5	1	200	800	1100	4	0.2	5	200
B29B06H	29	25	9 BG	SbCs	25	B - c	50	5	9.5	1	50	800	1000	1	0.05	2	200
PB29B02H	29	25	11 BG	SbCs	25	B - c	50	5	9.5	1	200	800	1100	4	0.2	5	200
9780B	side window	8 x 24	9 CF	SbCs	22	W - a	50	5	9	2	50	750	1200	1	0.1	20	-
9781B	side window	8 x 24	9 CF	SbCs	25	W - a	75	5	10	5	50	650	800	0.7	0.2	5	-
9783B	side window	8 x 24	9 CF	SbCs	25	Q - a	75	5	10	5	50	650	800	0.7	0.5	5	-

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

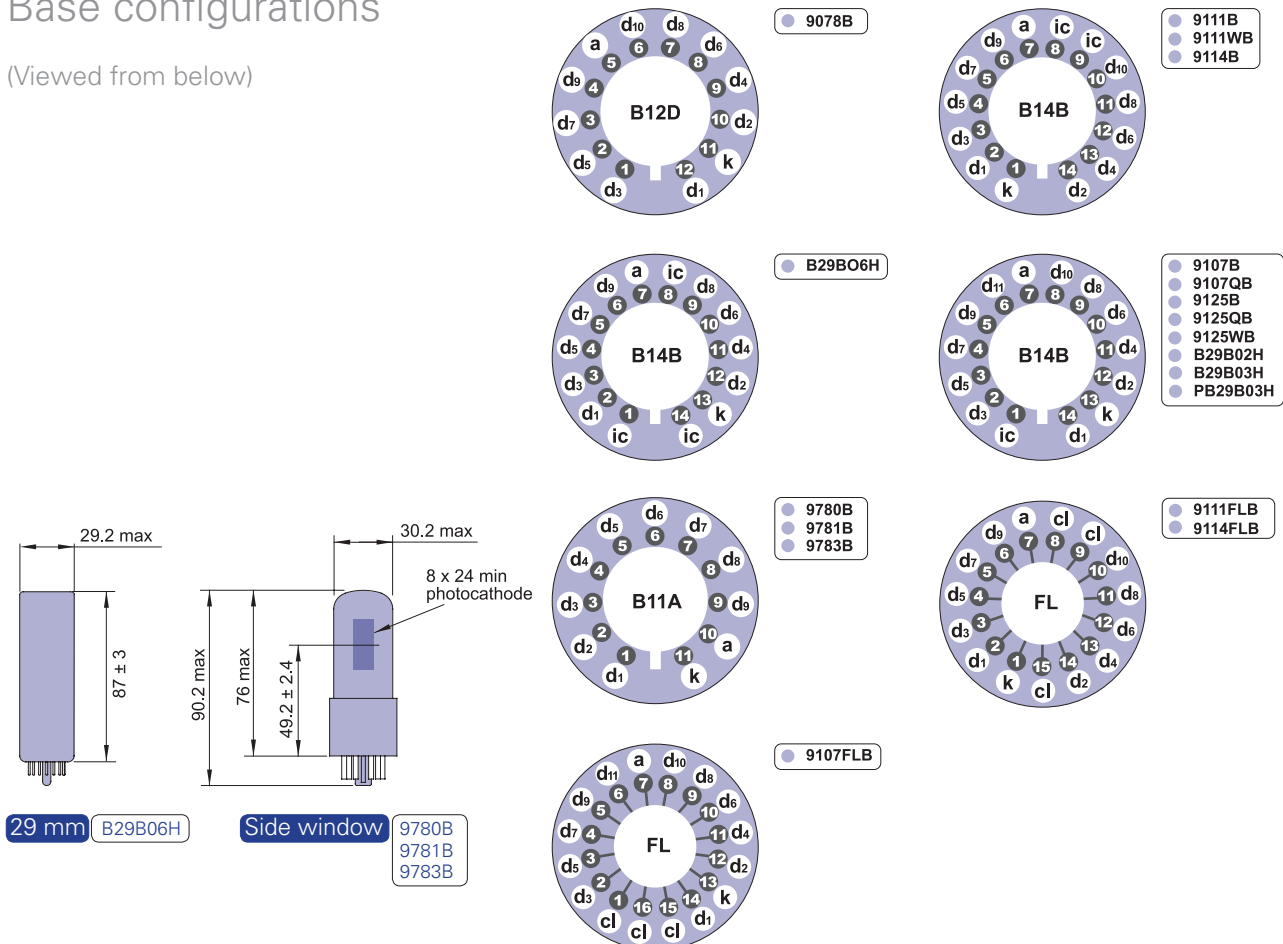


max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
					Socket	Shield	Voltage divider series	
							passive	active
200	1.8	2.7	9078B	fast, high gain, good overall performance.	B12D	MS19A	C669	C669
500	1.8	3.1	9111B	compact type, short length and fast response time.	B14B	MS25A	C673	C6002
500	1.8	3.1	9111FLB	variant of 9111B with flexible leads.	FL	MS25A	C651	C6002
500	1.8	3.1	9111WB	variant of 9111B with UV sensitivity to 185nm.	B14B	MS25A	C673	C6002
500	1.8	3.1	9114B	variant of 9111B, hemispherical window for wide angle light detection.	B14B	-	C673	C6002
500	1.8	3.1	9114FLB	variant of 9114B with flexible leads.	FL	-	C651	C6002
2000	4.5	7.5	9107B	variant of 9125B with shorter length (87 mm).	B14B	MS30A	C637	C686
2000	4.5	7.5	9107FLB	variant of 9107B with flexible leads.	FL	MS30A	C637	C686
2000	4.5	7.5	9107QB	variant of 9107B with UV sensitivity to 165nm.	B14B	MS30A	C637	C686
2000	4.5	7.5	9125B	high performance parent type.	B14B	MS30B	C637	C686
2000	4.5	7.5	9125QB	variant of 9125B with UV sensitivity to 165nm.	B14B	MS30B	C637	C686
2000	4.5	7.5	9125WB	variant of 9125B with UV sensitivity to 185nm.	B14B	MS30B	C637	C686
2000	15	30	B29B02H	general purpose, good overall performance.	B14B	MS30B	C637	C686
2000	15	30	B29B03H	variant of B29B02H with shorter length (79 mm).	B14B	MS30A	C637	C686
200	15	30	B29B06H	variant of B29B02H for higher light levels, shorter length (87 mm).	B14B	MS30A	C615	-
2000	15	30	PB29B03H	variant of B29B03H with sidewall sensitivity.	B14B	MS30A	C637	C686
500	2	4	9780B	variant of 9781B, replaces 931A, IP21 and IP28.	B11A	MSSW	C639A	-
500	2	4	9781B	good overall performance, can be selected for high CR.	B11A	MSSW	C639A	-
500	2	4	9783B	variant of 9781B, with UV sensitivity to 165 nm.	B11A	MSSW	C639A	-

ordered from www.et-enterprises.com

Base configurations

(Viewed from below)



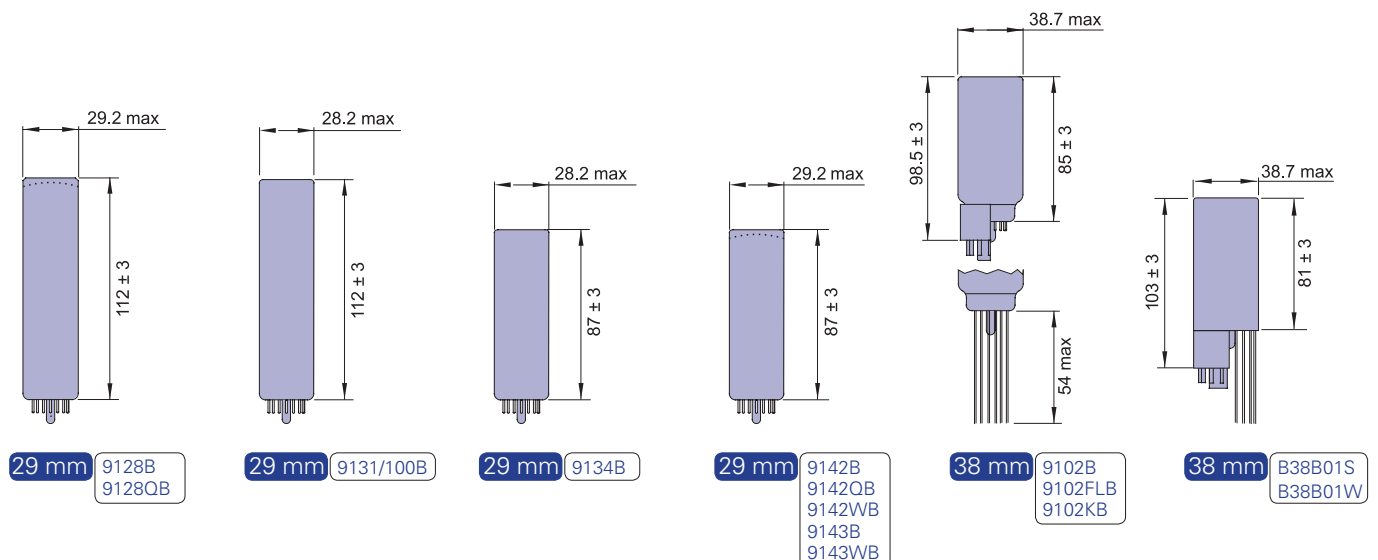
blue-green sensitive bialkali 29 and 38mm (1 1/8" and 1 1/2") diameter

type	Characteristics				Photocathode sensitivity						Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹
9128B	29	25	11 LF	BeCu	28	B - c	65	7	11	1	200	1400	1650	3	0.2	5	100
9128QB	29	25	11 LF	BeCu	28	Q - c	65	7	11	1	200	1400	1650	3	0.2	5	100
9131/100B	29	2.5	11 LF	BeCu	25	B - c	60	6	10	2	200	1600	1800	3	0.03	0.5	10
9134B	29	25	9 LF	SbCs	28	B - c	65	7	11	2	50	900	1100	0.8	0.05	2	-
9142B	29	25	10 LF	SbCs	28	B - c	65	7	11	1	50	850	1200	0.8	0.1	1	100
9142QB	29	25	10 LF	SbCs	28	Q - c	65	7	11	1	50	850	1200	0.8	0.1	1	100
9142WB	29	25	10 LF	SbCs	28	W - c	65	7	11	1	50	850	1200	0.8	0.1	1	100
9143B	29	25	11 LF	SbCs	28	B - c	65	7	11	1	200	850	1200	3	0.2	5	100
9143WB	29	25	11 LF	SbCs	28	W - c	65	7	11	1	200	850	1200	3	0.2	5	100
9102B	38	32	10 LF	SbCs	30	B - c	90	8	12.5	4	20	700	900	0.2	0.05	1	200
9102FLB	38	32	10 LF	SbCs	30	B - c	90	8	12.5	4	20	700	900	0.2	0.05	1	200
9102KB	38	32	10 LF	SbCs	30	B - c	90	8	12.5	4	20	700	900	0.2	0.05	1	200
B38B01S	38	32	10 BG	SbCs	25	B - c	60	5	10	1	20	650	800	0.3	1	5	300
B38B01W	38	32	10 BG	SbCs	25	B - c	60	5	10	1	20	650	800	0.3	1	5	300

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

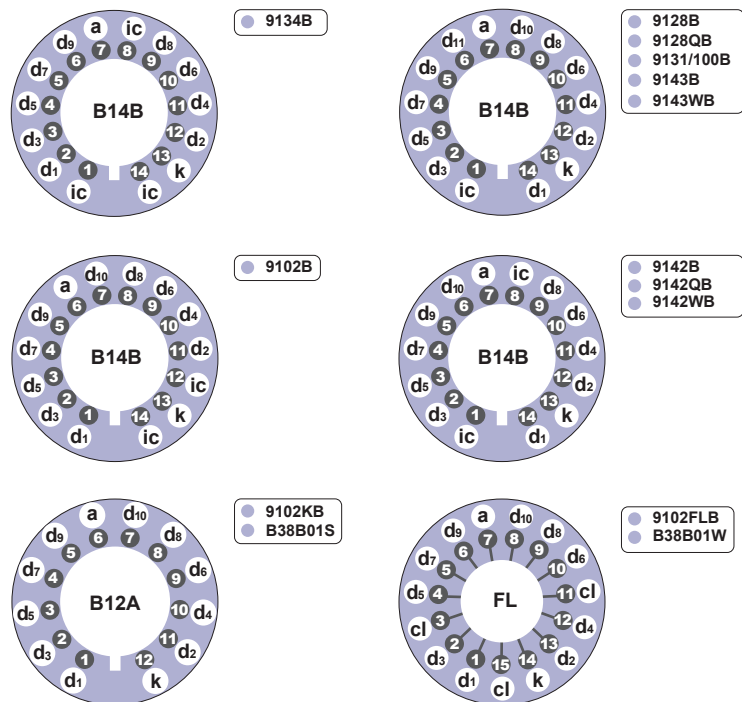


max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
					Socket	Shield	Voltage divider series	
							passive	active
2000	3.5	5	9128B	variant of 9125, fast response, high peak current linearity.	B14B	MS30B	C637	C686
2000	3.5	5	9128QB	variant of 9128B with UV sensitivity to 165nm.	B14B	MS30B	C637	C686
2000	3.5	5	9131/100B	variant of 9125B, 2.5 mm effective diameter, low dark count and afterpulse rate.	B14B	MS30B	C637	C686
200	4.5	7.5	9134B	variant of 9125B, lower gain for higher light level applications.	B14B	MS30A	C615	-
500	1.5	2.1	9142B	ultra fast, linear focused 10 stage pmtd.	B14B	MS30A	C620	-
500	1.5	2.1	9142QB	variant of 9142B with UV sensitivity to 165nm.	B14B	MS30A	C620	-
500	1.5	2.1	9142WB	variant of 9142B with UV sensitivity to 185nm.	B14B	MS30A	C620	-
2000	1.6	2.2	9143B	ultra fast, linear focused 11 stage pmtd.	B14B	MS30A	C637	-
2000	1.6	2.2	9143WB	variant of 9143B with UV sensitivity to 185nm.	B14B	MS30A	C637	-
500	3	6	9102B	high performance parent type.	B14B	MS38A	C646	C6004
500	3	6	9102FLB	variant of 9102B with flexible leads.	FL	MS38A	C653	C6004
500	3	6	9102KB	variant of 9102B with capped base.	B12A	MS38A	C674	C6004
500	15	30	B38B01S	general purpose, good overall performance, capped base.	B12A	MS38A	C674	C6004
500	15	30	B38B01W	variant of B38B01S with flexible leads.	FL	MS38A	C653	C6004

aded from www.et-enterprises.com

Base configurations

(Viewed from below)



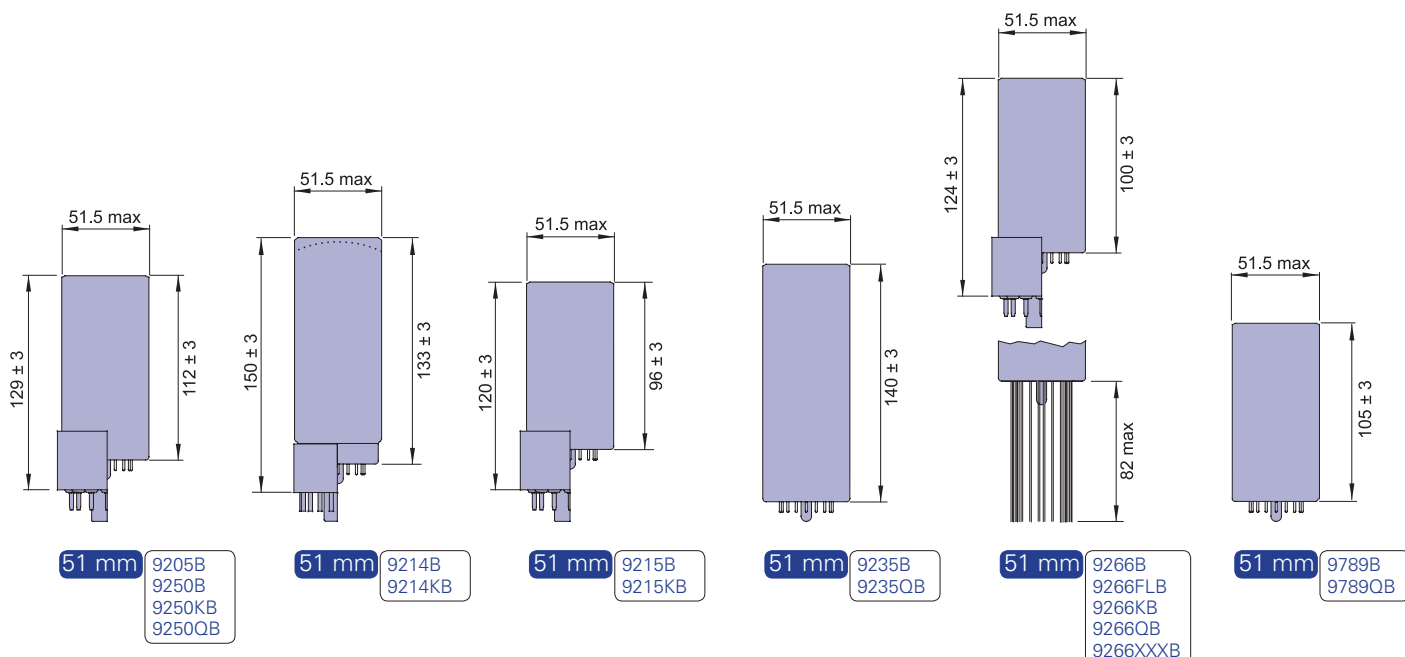
blue-green sensitive bialkali 51mm (2") diameter

type	Characteristics				Photocathode sensitivity							Photomultiplier performance					
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹
9205B	51	48	10 LF	SbCs	30	B - c	70	8	11.5	2	200	1000	1350	3	0.5	10	300
9214B	51	46	12 LF	SbCs	30	B - c	70	8	11.5	2	500	1250	1800	7	1	10	300
9214KB	51	48	12 LF	SbCs	30	B - c	70	8	11.5	2	500	1250	1800	7	1	10	300
9215B	51	48	8 LF	SbCs	30	B - c	80	9	12.5	2	10	900	1150	0.1	0.01	1	-
9215KB	51	48	8 LF	SbCs	30	B - c	80	9	12.5	2	10	900	1150	0.1	0.01	1	-
9235B	51	48	13 LF	SbCs	30	B - c	80	9	12.5	2	2000	1000	1400	25	6	50	300
9235QB	51	48	13 LF	SbCs	30	Q - c	80	9	12.5	2	2000	1000	1400	25	6	50	300
9250B	51	48	10 LF	SbCs	30	B - c	80	9	12.5	2	50	850	1150	0.6	0.3	1.5	300
9250KB	51	48	10 LF	SbCs	30	B - c	80	9	12.5	2	50	850	1150	0.6	0.3	1.5	300
9250QB	51	48	10 LF	SbCs	30	Q - c	80	9	12.5	2	50	850	1150	0.6	0.3	1.5	300
9266B	51	48	10 LF	SbCs	30	B - c	70	8	11.5	2	50	850	1100	0.6	0.3	1.5	300
9266FLB	51	48	10 LF	SbCs	30	B - c	70	8	11.5	2	50	850	1100	0.6	0.3	1.5	300
9266KB	51	48	10 LF	SbCs	30	B - c	70	8	11.5	2	50	850	1100	0.6	0.3	1.5	300
9266QB	51	48	10 LF	SbCs	30	Q - c	70	8	11.5	2	50	850	1100	0.6	0.3	1.5	300
9266XXXB	51	48	10 LF	SbCs	30	B - c	70	8	11.5	2	50	850	1100	0.6	0.3	1.5	300
9789B	51	10	13 VB	SbCs	25	B - c	80	7	10	2.5	2000	1100	1500	25	0.5	2	60
9789QB	51	10	13 VB	SbCs	25	Q - c	80	7	10	2.5	2000	1100	1500	25	0.5	2	60

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

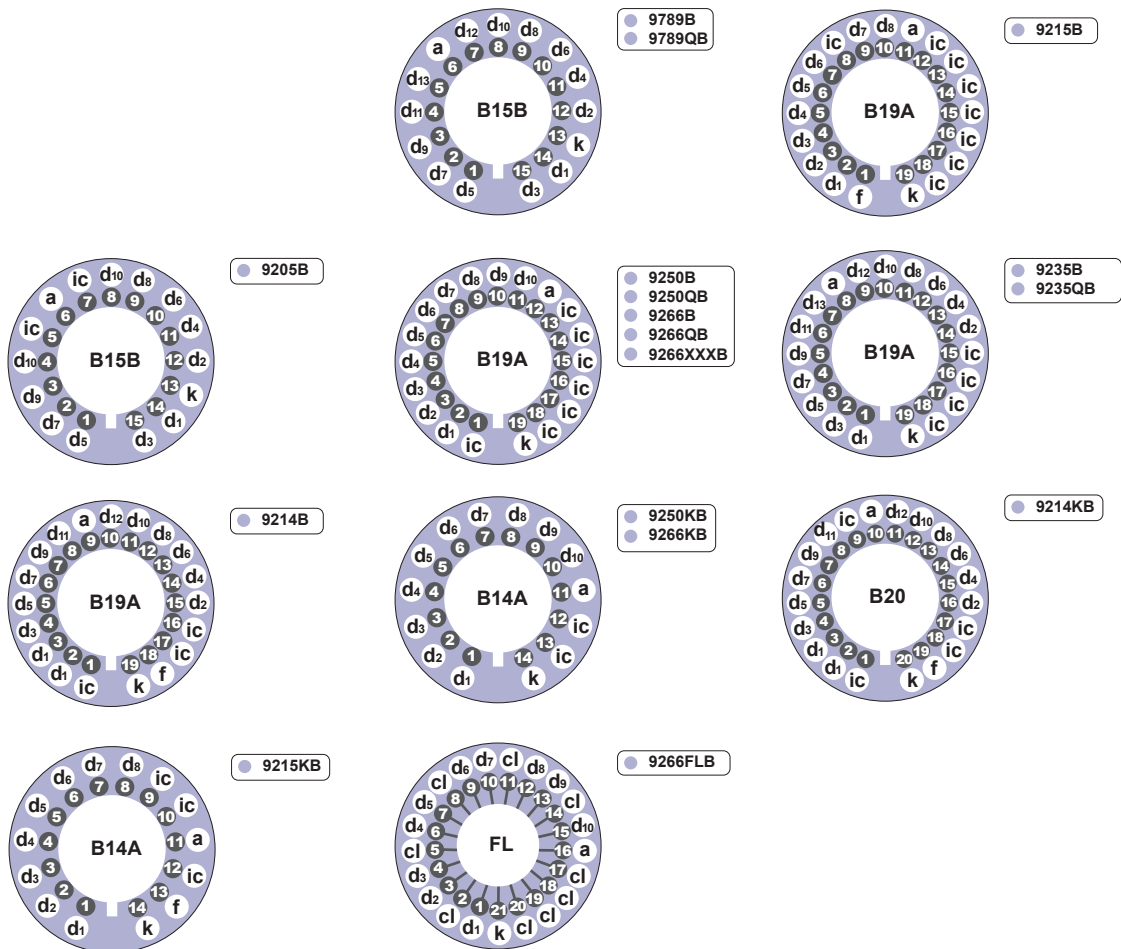


max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
					Socket	Shield	Voltage divider series	
							passive	active
2000	4	6.5	9205B	10 stage plug-in replacement for 11 stage 6097B.	B15B	MS52A(F)	C621	-
2000	2	3	9214B	variant of 9814B, SbCs dynodes to minimise rate effect.	B19A	MS52B(F)	C638	-
2000	2	3	9214KB	variant of 9214B with capped base.	B20	MS52B(F)	C640	-
50	4	6.5	9215B	variant of 9266B, short length and 8 dynodes for higher light levels.	B19A	MS52A(F)	C684	-
50	4	6.5	9215KB	variant of 9215B with capped base.	B14A	MS52E	C633	-
5000	5	10	9235B	variant of 9266B, high gain, replaces 9635B.	B19A	MS52C(F)	C679	-
5000	5	10	9235QB	variant of 9235B with UV sensitivity to 165nm.	B19A	MS52C(F)	C679	-
500	4	6.5	9250B	variant of 9266B, higher sensitivity, low dark count, replaces 9750B.	B19A	MS52A(F)	C647	-
500	4	6.5	9250KB	variant of 9250B with capped base.	B14A	MS52E	C636	-
500	4	6.5	9250QB	variant of 9250B with UV sensitivity to 165nm.	B19A	MS52A(F)	C647	-
500	4	6.5	9266B	10 stage, high performance parent type.	B19A	MS52A(F)	C647	-
500	4	6.5	9266FLB	variant of 9266B with flexible leads.	FL	MS52A	C655	-
500	4	6.5	9266KB	variant of 9266B with capped base.	B14A	MS52E	C636	-
500	4	6.5	9266QB	variant of 9266B with UV sensitivity to 165nm.	B19A	MS52A(F)	C647	-
500	4	6.5	9266XXXB	variant of 9266B with low background glass .	B19A	MS52A(F)	C647	-
5000	10	20	9789B	variant of 9235, 10mm effective cathode diameter, shorter length, 15 pin base	B15B	MS52A	-	-
5000	10	20	9789QB	variant of 9789B with UV sensitivity to 165nm.	B15B	MS52A	-	-

aded from www.et-enterprises.com

Base configurations

(Viewed from below)



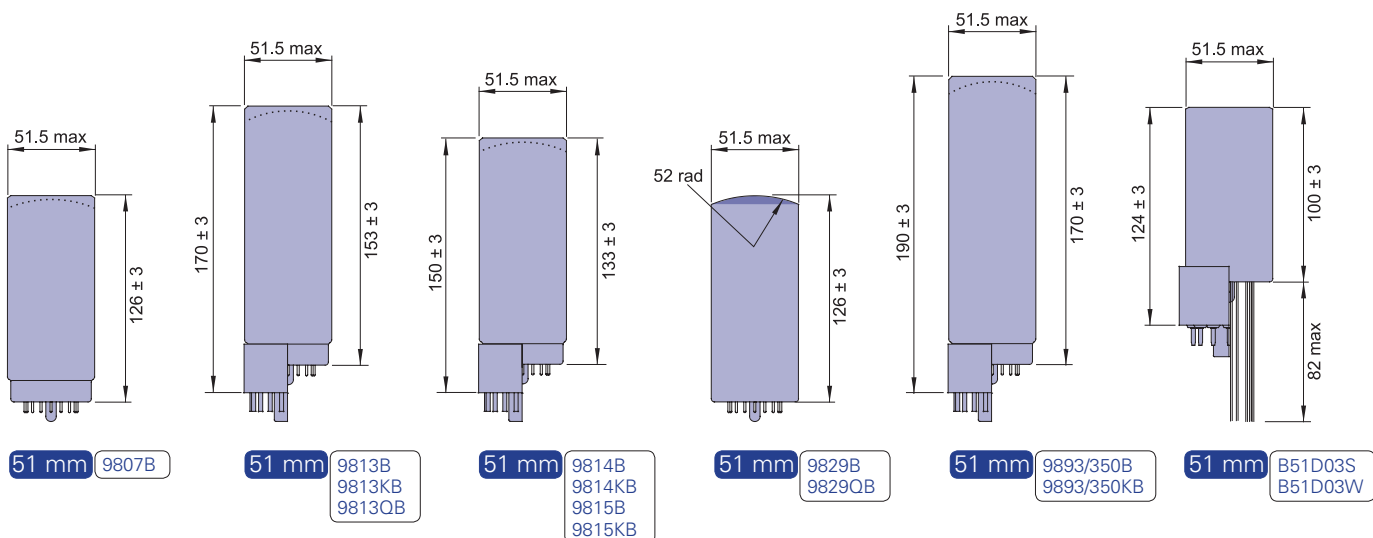
blue-green sensitive bialkali 51mm (2") diameter

type	Characteristics				Photocathode sensitivity						Photomultiplier performance					
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA
9807B	51	46	12 LF	BeCu	30	B - c	70	8	11.5	2	500	1650	2300	7	3	20
9813B	51	46	14 LF	BeCu	30	B - c	70	8	11.5	2	5000	2100	2500	70	10	200
9813KB	51	46	14 LF	BeCu	30	B - c	70	8	11.5	2	5000	2100	2500	70	10	200
9813QB	51	46	14 LF	BeCu	30	Q - c	70	8	11.5	2	5000	2100	2500	70	10	200
9814B	51	46	12 LF	BeCu	30	B - c	70	8	11.5	2	500	1950	2300	7	3	20
9814KB	51	46	12 LF	BeCu	30	B - c	70	8	11.5	2	500	1950	2300	7	3	20
9815B	51	46	10 LF	BeCu	30	B - c	70	8	11.5	2	50	1800	2300	0.7	0.3	10
9815KB	51	46	10 LF	BeCu	30	B - c	70	8	11.5	2	50	1800	2300	0.7	0.3	10
9829B	51	46	12 LF	BeCu	30	B - c	85	9.5	12.5	2	500	1600	1900	6	3	10
9829QB	51	46	12 LF	BeCu	30	Q - c	85	9.5	12.5	2	500	1600	1900	6	3	10
9893/350B	51	9	14 LF	BeCu	25	B - c	60	7	10	2	5000	2200	2700	80	0.5	1
9893/350KB	51	9	14 LF	BeCu	25	B - c	60	7	10	2	5000	2200	2700	80	0.5	1
B51D03S	51	46	10 BG	BeCu	23	B - c	70	5	10	3	2	800	1200	0.03	0.2	1
B51D03W	51	46	10 BG	BeCu	25	B - c	70	5	10	3	2	800	1200	0.03	0.2	1

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

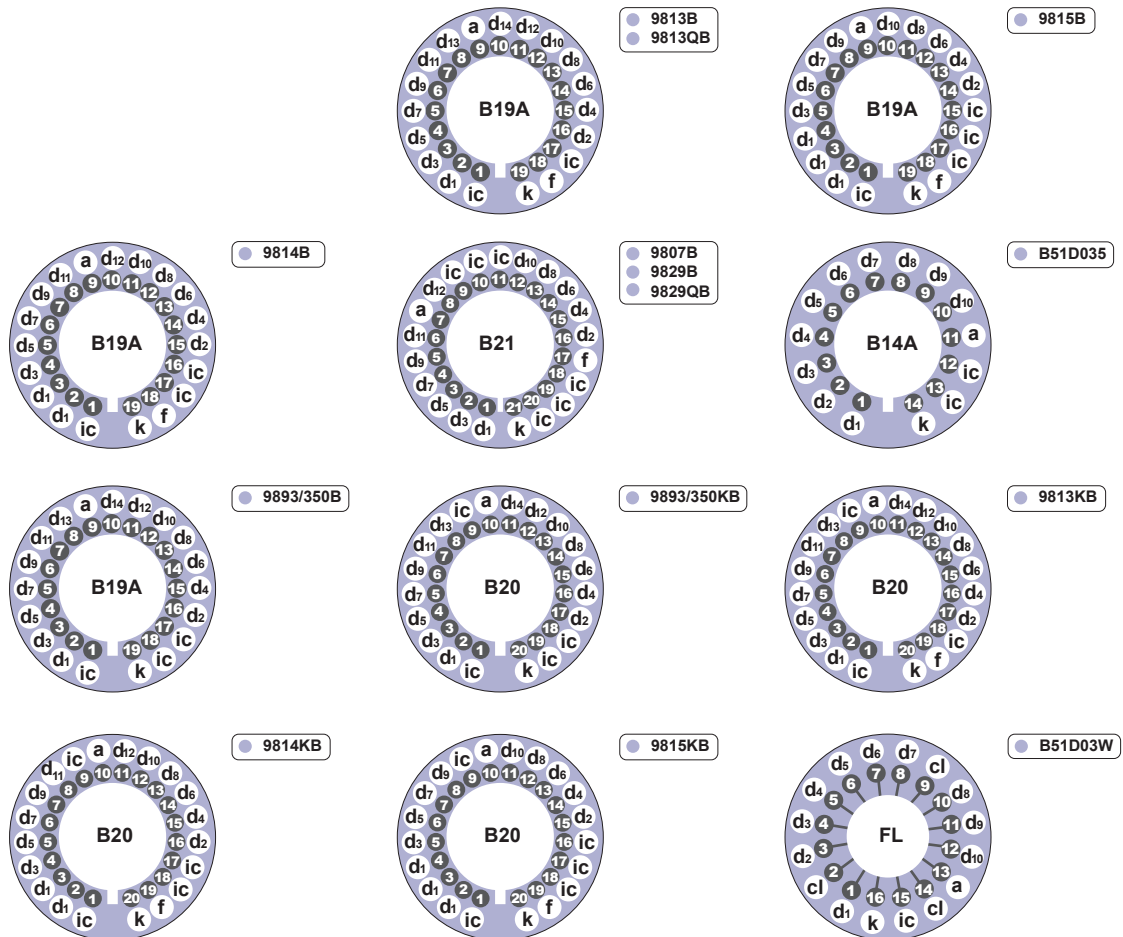


dark rate typical s ⁻¹	max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
						Socket	Shield	Voltage divider series	
								passive	active
300	2000	2	3	9807B	variant of 9829B, plano-concave window, replaces 8575 type.	B21	MS52B(E)	C628	-
300	10000	2	3	9813B	variant of 9814B, 14 dynodes for higher gain capability.	B19A	MS52C(F)	C638	-
300	10000	2	3	9813KB	variant of 9813B with capped base.	B20	MS52C	C643	-
300	10000	2	3	9813QB	variant of 9813B with UV sensitivity to 165nm.	B19A	MS52C(F)	C638	-
300	2000	2	3	9814B	12 stage fast linear focused type with good linearity.	B19A	MS52B(F)	C638	-
300	2000	2	3	9814KB	variant of 9814B with capped base.	B20	MS52B	C640	-
300	500	2	3	9815B	variant of 9814B, 10 dynodes for higher light levels.	B19A	MS52B(F)	C638	-
300	500	2	3	9815KB	variant of 9815B with capped base.	B20	MS52B	C644	-
300	2000	2	3	9829B	for low light levels, thin low background glass window.	B21	MS52B(E)	C628	-
300	2000	2	3	9829QB	variant of 9829B with fused silica window for very low background.	B21	MS52B(E)	C628	-
40	10000	2.5	3.5	9893/350B	variant of 9813B, small effective dia, low dark count, low afterpulses.	B19A	MS52D(F)	C638	-
40	10000	2.5	3.5	9893/350KB	variant of 9893/350B with capped base.	B20	MS52D	C641	-
300	20	15	30	B51D03S	general purpose scintillation counting.	B14A	MS52E	C636	-
300	20	15	30	B51D03W	general purpose scintillation counting, flexible wires	FL	MS52A	C647	-

ordered from www.et-enterprises.com

Base configurations

(Viewed from below)



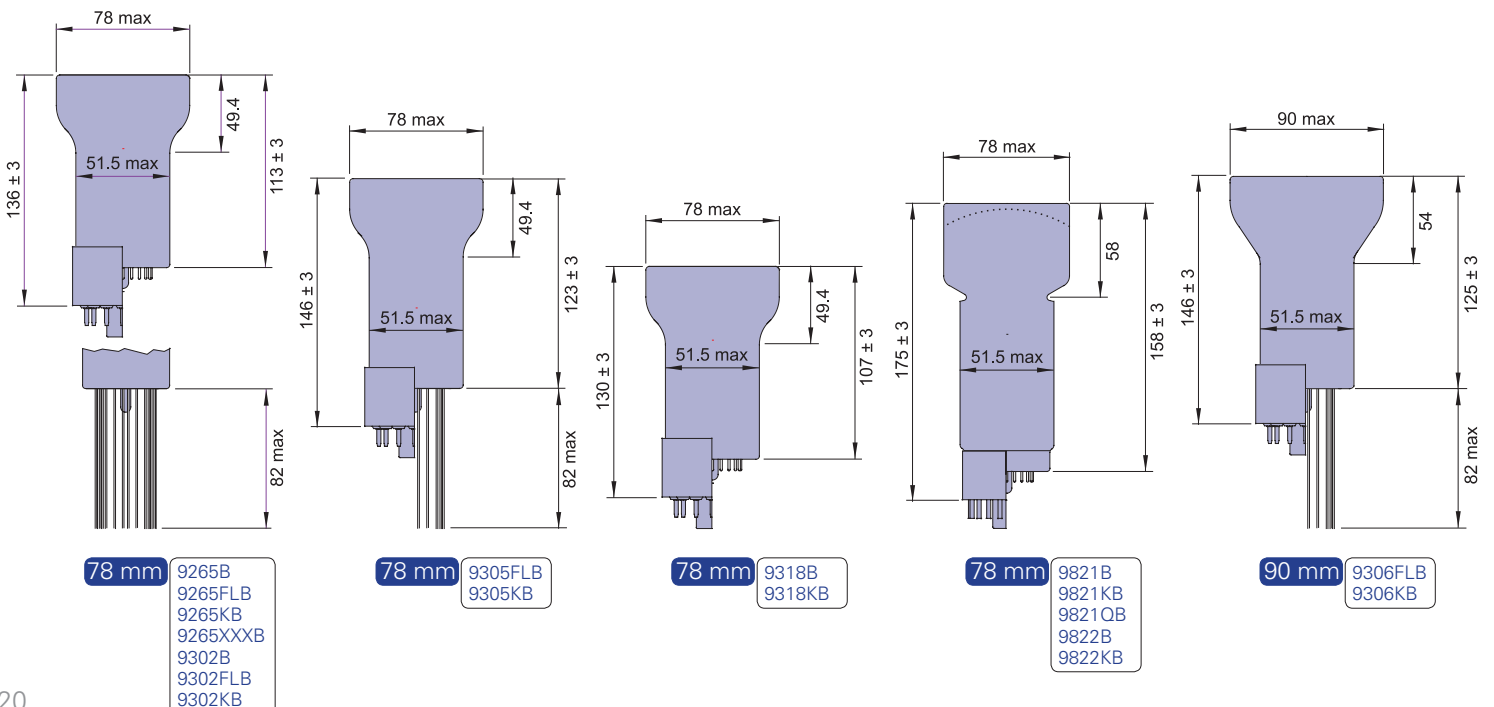
blue-green sensitive bialkali 78 and 90mm (3" and 3½") diameter

type	Characteristics				Photocathode sensitivity						Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹
9265B	78	70	9 LF	SbCs	30	B - c	75	8	12	2	50	950	1300	0.7	0.5	5	-
9265FLB	78	70	9 LF	SbCs	30	B - c	75	8	12	2	50	950	1300	0.7	0.5	5	-
9265KB	78	70	9 LF	SbCs	30	B - c	75	8	12	2	50	950	1300	0.7	0.5	5	-
9265XXB	78	70	9 LF	SbCs	30	B - c	75	8	12	2	50	950	1300	0.7	0.5	5	-
9302B	78	70	9 LF	SbCs	30	B - c	75	8	12	2	50	950	1300	0.7	0.5	5	-
9302FLB	78	70	9 LF	SbCs	30	B - c	75	8	12	2	50	950	1300	0.7	0.5	5	-
9302KB	78	70	9 LF	SbCs	30	B - c	75	8	12	2	50	950	1300	0.7	0.5	5	-
9305FLB	78	70	10 LF	SbCs	30	B - c	75	8	12	2	50	850	1700	0.7	0.5	10	500
9305KB	78	70	10 LF	SbCs	30	B - c	75	8	12	2	50	850	1700	0.7	0.5	10	500
9318B	78	70	8 LF	SbCs	30	B - c	75	8	12	2	10	900	2000	0.13	0.05	2	-
9318KB	78	70	8 LF	SbCs	30	B - c	75	8	12	2	10	900	2000	0.13	0.05	2	-
9821B	78	67	12 LF	BeCu	30	B - c	75	8	12	2	500	2000	2600	7	10	50	500
9821KB	78	67	12 LF	BeCu	30	B - c	75	8	12	2	500	2000	2600	7	10	50	500
9821QB	78	67	12 LF	BeCu	30	Q - c	75	8	12	2	500	2000	2600	7	10	50	500
9822B	78	67	10 LF	BeCu	30	B - c	75	8	12	2	50	1800	2300	0.7	1	10	500
9822KB	78	67	10 LF	BeCu	30	B - c	75	8	12	2	50	1800	2300	0.7	1	10	500
9306FLB	90	80	10 LF	SbCs	30	B - c	75	8	12	2	50	1200	1450	0.7	1	10	1000
9306KB	90	80	10 LF	SbCs	30	B - c	75	8	12	2	50	1200	1450	0.7	1	10	1000

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

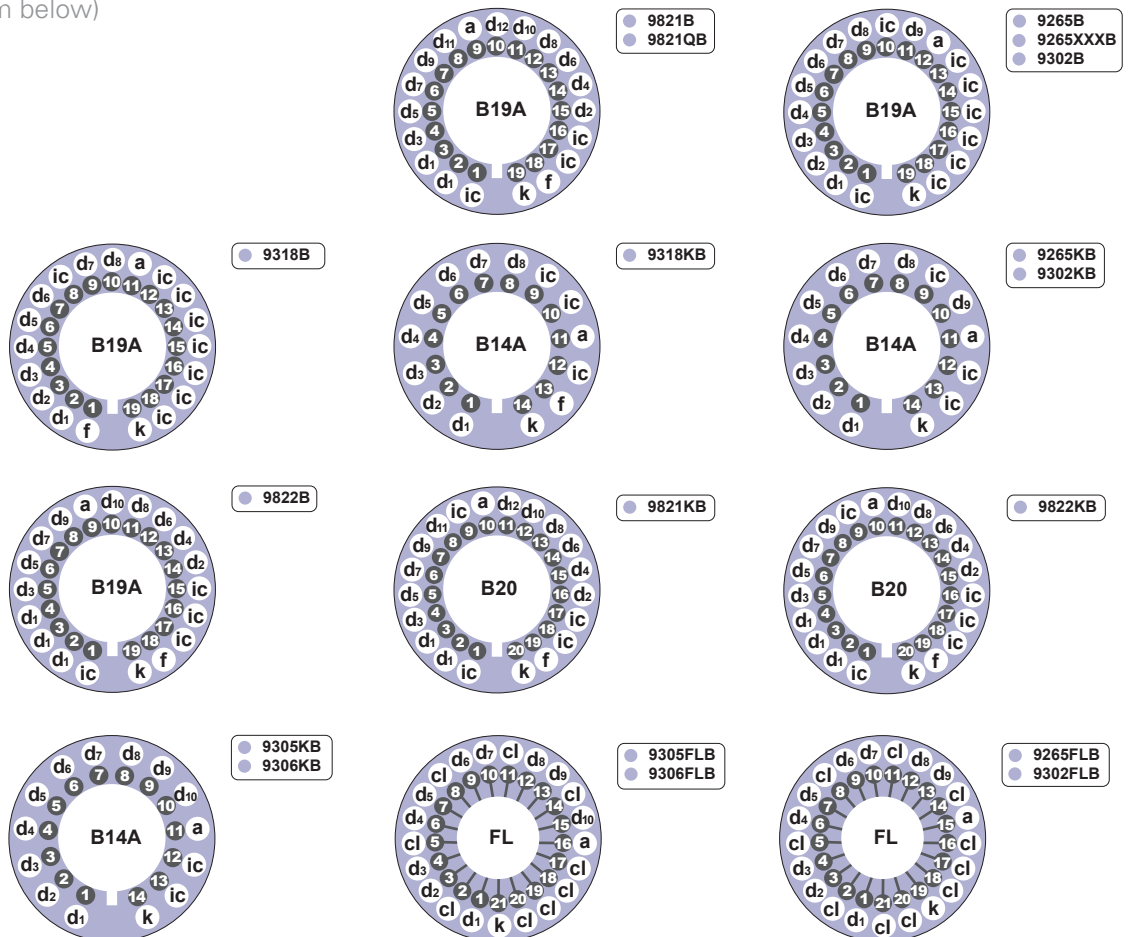


max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
					Socket	Shield	Voltage divider series	
							passive	active
200	7.5	15	9265B	high performance type, good energy resolution.	B19A	MS75/90	C648	-
200	7.5	15	9265FLB	variant of 9265B with flexible leads.	FL	MS75/90	C656	-
200	7.5	15	9265KB	variant of 9265B with capped base.	B14A	-	C634	-
200	7.5	15	9265XXXB	variant of 9265B with low background glass.	B19A	MS75/90	C648	-
200	7.5	15	9302B	variant of 9265B, ultra low background glass window and envelope.	B19A	MS75/90	C648	-
200	7.5	15	9302FLB	variant of 9302B with flexible leads.	FL	MS75/90	C656	-
200	7.5	15	9302KB	variant of 9302FLB with capped base.	B14A	-	C634	-
200	7.5	15	9305FLB	variant of 9265B, 10 dynodes for higher gain.	FL	MS75/90	C655	-
200	7.5	15	9305KB	variant of 9305FLB with capped base.	B14A	-	C636	-
50	7.5	15	9318B	variant of 9305FLB, short length, 8 dynodes for high light levels.	B19A	MS75/90	C684	-
50	7.5	15	9318KB	variant of 9318B with capped base.	B14A	-	C633	-
2000	2.1	3.2	9821B	12 stage fast linear focused type, good SER.	B19A	MS75/90	C638	-
2000	2.1	3.2	9821KB	variant of 9821B with capped base.	B20	-	C640	-
2000	2.1	3.2	9821QB	variant of 9821B with UV sensitivity to 165nm.	B19A	MS75/90	C638	-
500	2	3	9822B	variant of 9821B, 10 dynodes for higher light levels.	B19A	MS75/90	C638	-
500	2	3	9822KB	variant of 9822B with capped base.	B20	-	C644	-
200	7.5	16	9306FLB	variant of 9305FLB with larger (90 mm) diameter.	FL	MS75/90	C655	-
200	7.5	16	9306KB	variant of 9306FLB with capped base.	B14A	-	C636	-

ordered from www.et-enterprises.com

Base configurations

(Viewed from below)



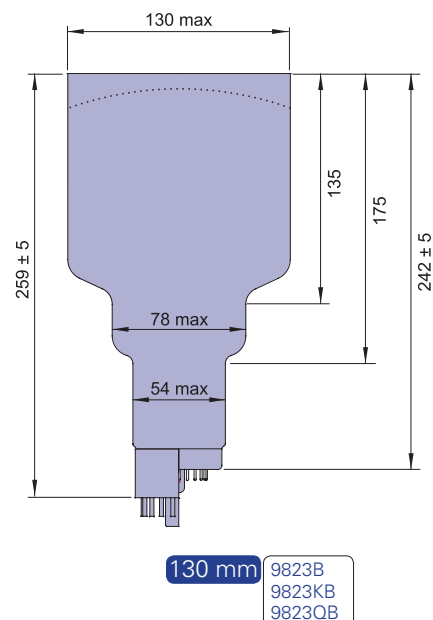
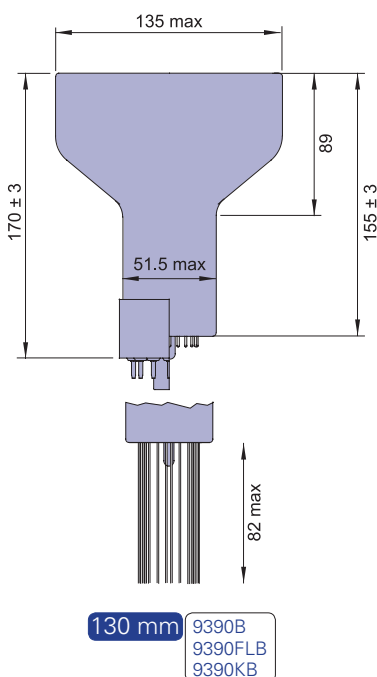
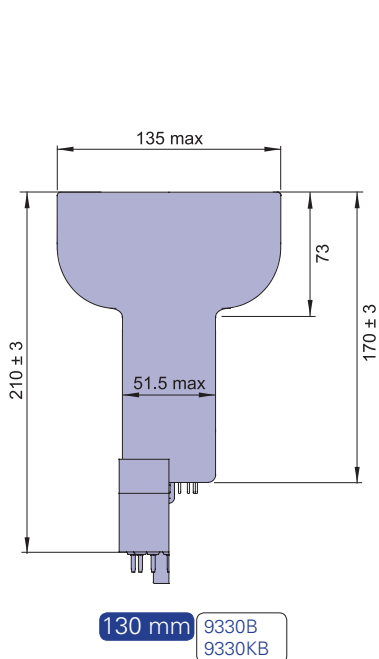
blue-green sensitive bialkali 130 and 200mm (5" and 8") diameter

type	Characteristics				Photocathode sensitivity						Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹
9330B	130	115	11 LF	SbCs	30	B - c	75	8	12	2	200	1200	1700	3	4	100	1500
9330KB	130	115	11 LF	SbCs	30	B - c	75	8	12	2	200	1200	1700	3	4	100	1500
9390B	130	115	10 LF	SbCs	28	B - c	75	9	12	2	50	1000	1500	0.7	1	20	1500
9390FLB	130	115	10 LF	SbCs	28	B - c	75	9	12	2	50	1000	1500	0.7	1	20	1500
9390KB	130	115	10 LF	SbCs	28	B - c	75	9	12	2	50	1000	1500	0.7	1	20	1500
9823B	130	110	14 LF	BeCu	30	B - c	65	7	11	1	5000	2400	3000	80	100	1000	1500
9823KB	130	110	14 LF	BeCu	30	B - c	65	7	11	1	5000	2400	3000	80	100	1000	1500
9823QB	130	110	14 LF	BeCu	30	Q - c	65	7	11	1	5000	2400	3000	80	100	1000	1500
9354FLB	200	190	12 LF	SbCs	30	B - c	70	70	9	1	500	1300	1700	7	10	200	4000
9354KB	200	190	12 LF	SbCs	30	B - c	70	70	9	1	500	1300	1700	7	10	200	4000

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

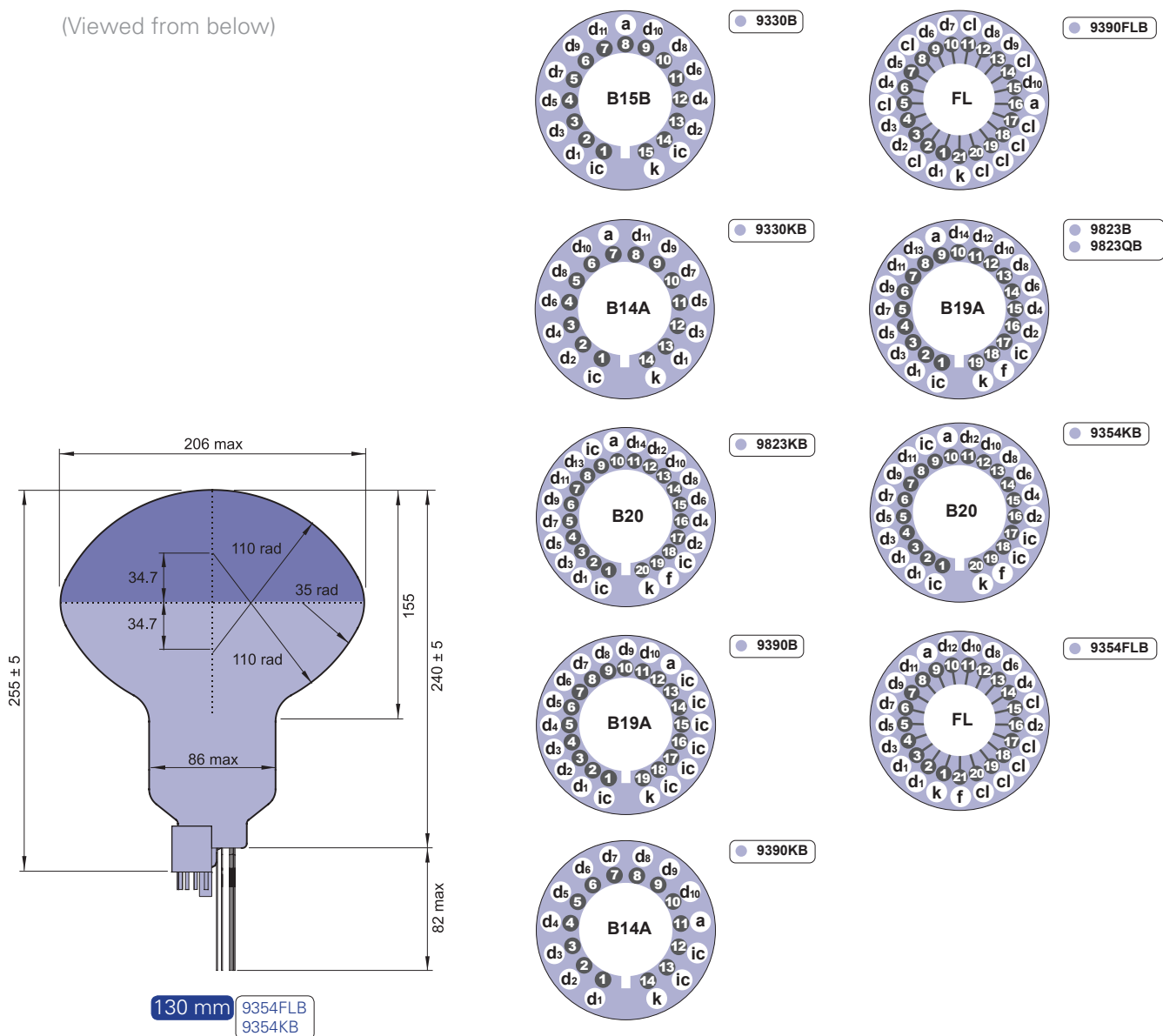


max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Socket	Shield	Accessories		
							Voltage divider series	passive	active
2000	10	15	9330B	variant of 9390B, higher gain capability replacing 9530B and 9930B.	B19A	MS130A	C623	-	
2000	10	15	9330KB	variant of 9330B with capped base.	B14A	MS130B	C632	-	
200	10	15	9390B	high performance parent type with good energy resolution.	B19A	MS130A	C647	-	
200	10	15	9390FLB	variant of 9390B with flexible wires.	FL	MS130A	C655	-	
200	10	15	9390KB	variant of 9390B with capped base.	B14A	MS130B	C636	-	
10000	2.7	3.6	9823B	very high gain capability and fast response.	B19A	MS130A	C638	-	
10000	2.7	3.6	9823KB	variant of 9823B with capped base.	B20	-	C643	-	
10000	2.7	3.6	9823QB	variant of 9823B with UV sensitivity to 165nm.	B19A	MS130A	C638	-	
2000	4	6	9354FLB	hemispherical, ultra low background, water and pressure resistant envelope.	FL	-	C690	-	
2000	4	6	9354KB	variant of 9354FLB with capped base.	B20	MS200A	C640	-	

ordered from www.et-enterprises.com

Base configurations

(Viewed from below)



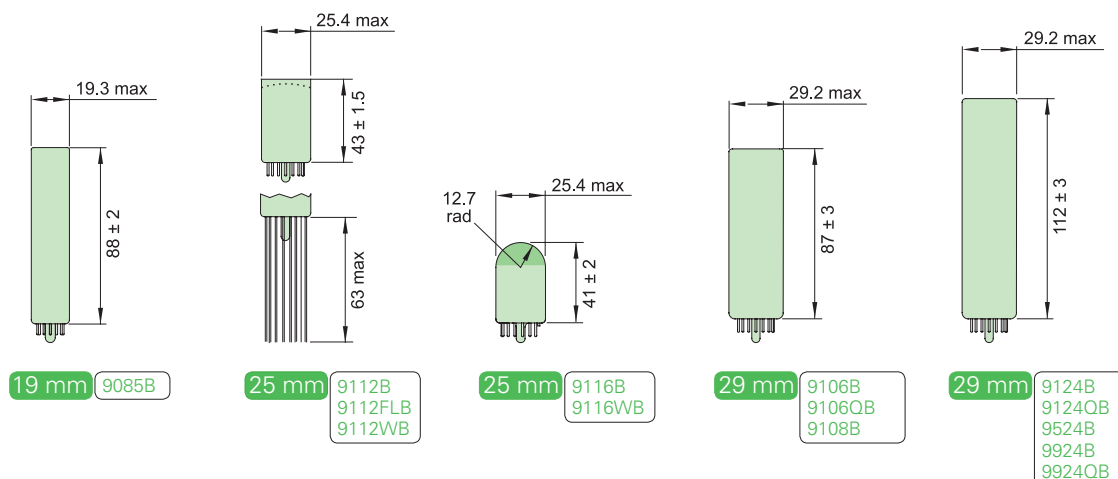
green enhanced bialkali 19 to 29mm (3/4" to 1 1/8") diameter

type	Characteristics				Photocathode sensitivity						Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹
9085B	19	15	10 LF	SbCs	25	B - d	85	7	10.5	7	50	1000	1200	0.6	0.1	2	100
9112B	25	22	10 CF	SbCs	26	B - d	90	7	11	5	50	1000	1300	0.6	0.2	2	200
9112FLB	25	22	10 CF	SbCs	26	B - d	90	7	11	5	50	1000	1300	0.6	0.2	2	200
9112WB	25	22	10 CF	SbCs	26	W - d	90	7	11	5	50	1000	1300	0.6	0.2	2	200
9116B	25	22	6 CF	SbCs	26	B - d	90	7	11	5	1	850	1200	0.01	0.3	5	-
9116WB	25	22	6 CF	SbCs	26	W - d	90	7	11	5	1	850	1200	0.01	0.3	5	-
9106B	29	25	7 LF	SbCs	28	B - d	110	8	12	7.5	1	500	650	0.01	0.02	0.8	-
9106QB	29	25	7 LF	SbCs	28	Q - d	110	8	12	7.5	1	500	650	0.01	0.02	0.8	-
9108B	29	25	11 LF	SbCs	26	B - d	90	7	11	5	200	1050	1250	2	0.3	5	200
9124B	29	25	11 LF	SbCs	26	B - d	90	7	11	5	200	1050	1300	2	0.3	5	200
9124QB	29	25	11 LF	SbCs	26	Q - d	90	7	11	5	200	1050	1300	2	0.3	5	200
9442B	29	25	10 LF	SbCs	26	B - d	90	7	11	5	50	1050	1400	0.6	0.1	2	200
9442QB	29	25	10 LF	SbCs	26	Q - d	90	7	11	5	50	1050	1400	0.6	0.1	2	200
9442WB	29	25	10 LF	SbCs	26	W - d	90	7	11	5	50	1050	1400	0.6	0.1	2	200
9524B	29	25	11 BG	SbCs	24	B - d	90	7	10	6	200	900	1150	2.2	2	15	-
9900B	29	25	11 BG	SbCs	26	B - d	80	7	11	7.5	200	800	1050	2.5	0.3	5	300
9924B	29	25	11 BG	SbCs	28	B - d	95	8	12	7.5	200	900	1050	2	0.2	5	200
9924QB	29	25	11 BG	SbCs	28	Q - d	95	8	12	7.5	200	900	1050	2	0.2	5	200

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

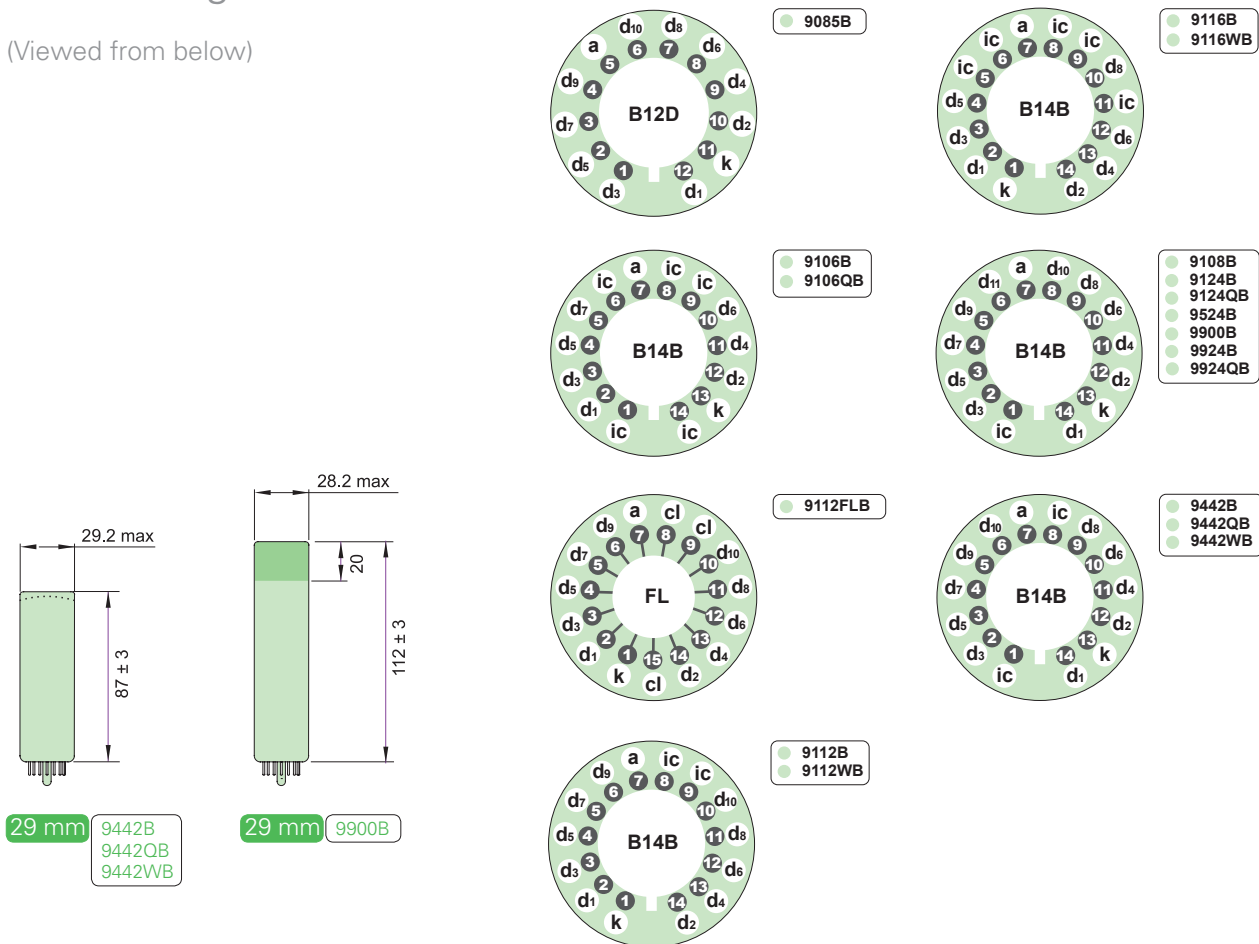


max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
					Socket	Shield	Voltage divider series	
							passive	active
200	1.8	2.7	9085B	fast, high gain. Variant of the 9078B and 9079B.	B12D	MS19A	C669	-
500	1.8	3.1	9112B	compact, fast. Variant of the 9111B.	B14B	MS25A	C651	C669
500	1.8	3.1	9112FLB	variant of 9112B with flexible wires.	FL	MS25A	C673	C6002
500	1.8	3.1	9112WB	variant of 9112 with UV sensitivity to 185nm.	B14B	MS25A	C673	C6002
5	1.8	3.1	9116B	variant of 9114B, lower gain for higher light level applications.	B14B	n/a	C617	C6002
5	1.8	3.1	9116WB	variant of 9116B with UV sensitivity to 185nm.	B14B	MS25A	C617	-
10	4.5	7.5	9106B	7 stage variant of 9124B for high light level applications.	B14B	MS30A	C616	-
10	4.5	7.5	9106QB	variant of 9106B with UV sensitivity to 165nm.	B14B	MS30A	C616	-
2000	4.5	7.5	9108B	short version of 9124B, length 87 mm.	B14B	MS30A	C637	-
2000	4.5	7.5	9124B	variant of 9125B, low dark current.	B14B	MS30B	C637	C686
2000	4.5	7.5	9124QB	variant of 9124B with UV sensitivity to 165nm.	B14B	MS30B	C637	C686
500	1.5	2.1	9442B	variant of 9142. Was D859	B14B	MS30B	C620	C686
500	1.5	2.1	9442QB	variant of 9442B with UV sensitivity to 165nm. Was D859Q	B14B	MS30B	C620	-
500	1.5	2.1	9442WB	variant of 9442B with UV sensitivity to 185nm. Was D859W.	B14B	MS30B	C620	-
2000	15	30	9524B	superseded by 9924B but still available for replacement requirements.	B14B	MS30B	C637	-
2000	15	30	9900B	variant of 9924B, sidewall sensitivity for wide angle light collection.	B14B	-	C637	C686
2000	15	30	9924B	used instead of 9124B where slower time response required.	B14B	MS30B	C637	C686
2000	15	30	9924QB	variant of 9924B with UV sensitivity to 165nm.	B14B	MS30B	C637	C686

aded from www.et-enterprises.com

Base configurations

(Viewed from below)



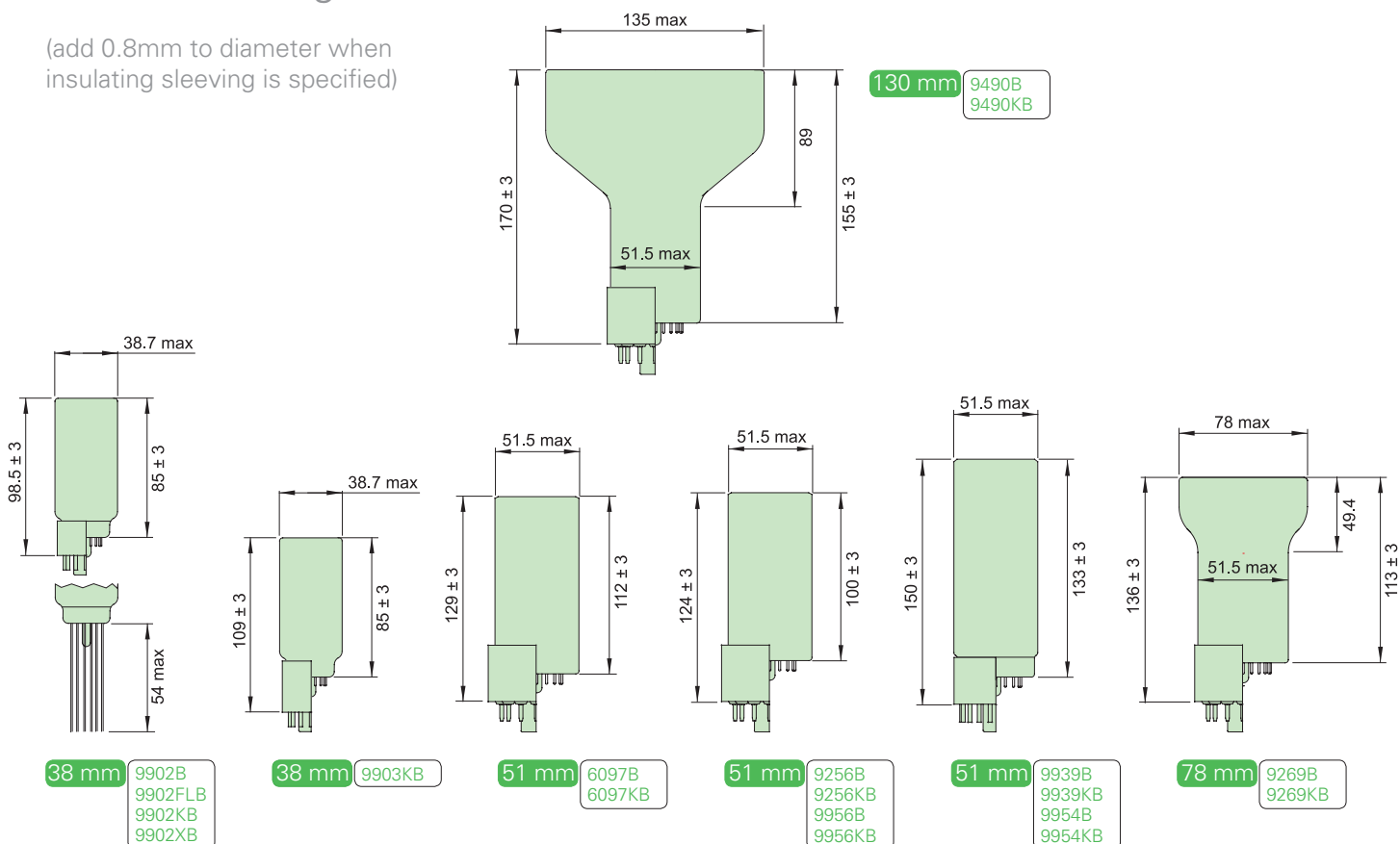
green enhanced bialkali 38 to 130mm (1½" to 5") diameter

type	Characteristics				Photocathode sensitivity						Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹
9902B	38	32	10 LF	SbCs	28	B - d	100	8	12	9	20	750	900	0.2	0.1	3	300
9902FLB	38	32	10 LF	SbCs	28	B - d	100	8	12	9	20	750	900	0.2	0.1	3	300
9902KB	38	32	10 LF	SbCs	28	B - d	100	8	12	9	20	750	900	0.2	0.1	3	300
9902XB	38	32	10 LF	SbCs	28	B - d	100	8	12	9	20	750	900	0.2	0.1	3	300
9903KB	38	32	10 LF	BeCu	28	B - d	100	8	12	9	20	1000	1100	0.2	0.1	3	300
6097B	51	46	11 VB	SbCs	25	B - d	95	7	11	7	200	1030	1350	2	1.2	20	1000
6097KB	51	46	11 VB	SbCs	25	B - d	95	7	11	7	200	1030	1350	2	1.2	20	1000
9256B	51	48	10 LF	SbCs	28	B - d	110	8	12	9	50	900	1000	0.5	0.3	3	800
9256KB	51	48	10 LF	SbCs	28	B - d	110	8	12	9	50	900	1000	0.5	0.3	3	800
9939B	51	46	12 LF	BeCu	28	B - d	100	8	11.5	8	500	1800	2300	5	2	20	800
9939KB	51	46	12 LF	BeCu	28	B - d	100	8	11.5	8	500	1800	2300	5	2	20	800
9954B	51	46	12 LF	BeCu	28	B - d	110	8	12	9	500	1800	2300	5	2	20	800
9954KB	51	46	12 LF	BeCu	28	B - d	110	8	12	9	500	1800	2300	5	2	20	800
9956B	51	46	10 VB	SbCs	28	B - d	90	8	12	6	50	900	1150	0.6	0.3	3	800
9956KB	51	46	10 VB	SbCs	28	B - d	90	8	12	6	50	900	1150	0.6	0.3	3	800
9269B	78	70	9 LF	SbCs	26	B - d	110	7	11	9	50	1100	1400	0.5	1	10	2000
9269KB	78	70	9 LF	SbCs	26	B - d	110	7	11	9	50	1100	1400	0.5	1	10	2000
9490B	130	115	10 LF	SbCs	25	B - d	90	8	11.5	6	50	1100	1600	0.6	2	20	3000
9490KB	130	115	10 LF	SbCs	25	B - d	90	8	11.5	6	50	1100	1600	0.6	2	20	3000

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

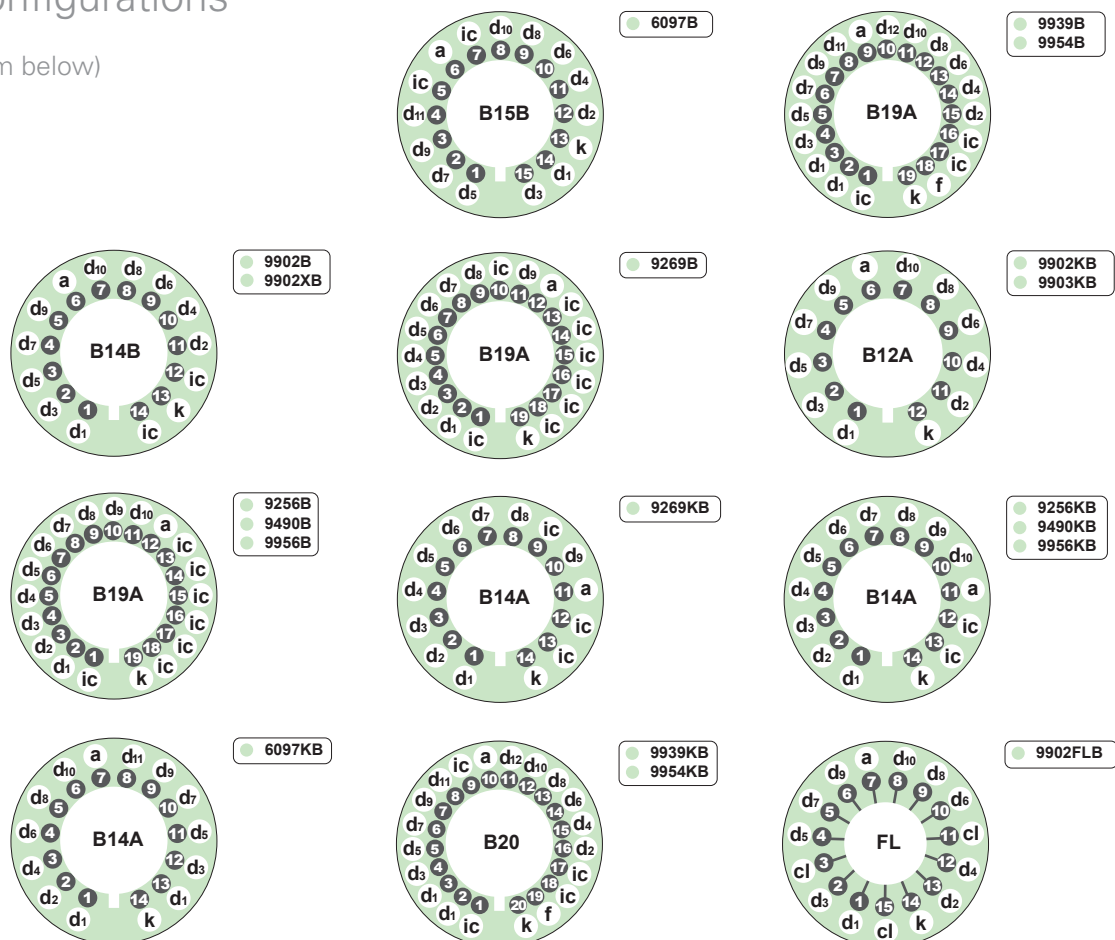


max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Socket	Shield	Accessories	
							passive	active
500	3	6	9902B	variant of 9102B, high gain, fast response and good linearity.	B14B	MS38A	C646	C686
500	3	6	9902FLB	variant of 9902B with flexible wires.	wires	MS38A	C653	C6004
500	3	6	9902KB	variant of 9902B with capped base.	B12A	MS38A	C674	C6004
500	3	6	9902XB	variant of 9902B, low background glass window.	B14B	MS38A	C646	C6004
500	3	6	9903KB	variant of 9902KB, longer, extended linearity	B12A	MS38A	C674	C6004
2000	10	22	6097B	established venetian blind dynode type, high gain.	B15B	MS52B(F)	C621	C6004
2000	10	22	6097KB	variant of 6097B with capped base.	B14A	MS52E	C631	-
500	4	6.5	9256B	variant of 9266B, enhanced green sensitivity.	B19A	MS52A(F)	C647	-
500	4	6.5	9256KB	variant of 9256B with capped base.	B14A	MS52E	C636	-
2000	3	4.5	9939B	lower cost version of 9954B. Good SER, green response and linearity.	B19A	MS52B(F)	C638	-
2000	3	4.5	9939KB	variant of 9939B with capped base.	B20	MS52B	C640	-
2000	2	3	9954B	variant of 9814B, enhanced green sensitivity.	B19A	MS52C(E)	C638	-
2000	2	3	9954KB	variant of 9954B with capped base.	B20	MS52C	C640	-
500	10	22	9956B	superseded by 9256B but still available for replacement requirements.	B19A	MS52A(F)	C647	-
500	10	22	9956KB	variant of 9956B with capped base.	B14A	MS52E	C636	-
200	7.5	15	9269B	variant of 9265B, enhanced green sensitivity, high cathode current capability.	B19A	MS75/90	C648	-
200	7.5	15	9269KB	variant of 9269B with capped base.	B14A	-	C634	-
200	13	25	9490B	variant of 9390B. Was D724	B19A	MS130A	C647	-
200	13	25	9490KB	variant of 9490B with capped base. Was D724KB	B14A	MS130B	C636	-

ded from www.et-enterprises.com

Base configurations

(Viewed from below)



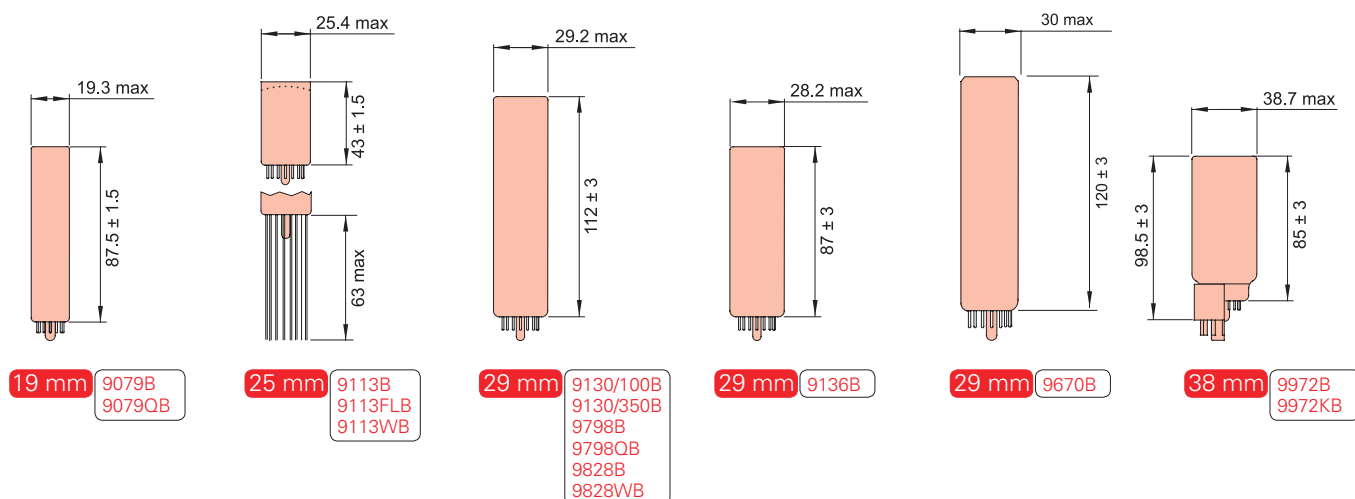
red/infra-red sensitive trialkali 19 to 38mm (3/4" to 1 1/2") diameter

type	Characteristics				Photocathode sensitivity								Photomultiplier performance					
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm min	uA/Lm typical	CB typical	CR typical	IR min	IR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA
9079B	19	15	10 LF	SbCs	21	B - f	80	120	9	40	-	2	50	1000	1200	0.4	0.1	2
9079QB	19	15	10 LF	SbCs	21	Q - f	80	120	9	40	-	2	50	1000	1200	0.4	0.1	2
9113B	25	22	10 CF	SbCs	21	B - f	80	160	9	60	-	5	50	1100	1300	0.3	0.5	5
9113FLB	25	22	10 CF	SbCs	21	B - f	80	160	9	60	-	5	50	1100	1300	0.3	0.5	5
9113WB	25	22	10 CF	SbCs	21	W - f	80	160	9	60	-	5	50	1100	1300	0.3	0.5	5
9130/100B	29	2.5	11 LF	BeCu	21	B - f	80	150	8	60	-	6	200	1550	1800	1.3	0.05	1
9130/350B	29	9	11 LF	BeCu	21	B - f	80	150	8	60	-	6	200	1400	1800	1.3	0.2	2
9136B	29	25	11 LF	SbCs	21	B - f	130	170	8	80	-	7	200	900	1100	1	2	10
9670B	29	special	9 LF	BeCu	21	B - f	80	150	7	70	-	7	3	900	-	0.02	1	100
9798B	29	25	11 BG	SbCs	21	B - f	130	170	8	80	-	9	200	900	1100	1.2	2	10
9798QB	29	25	11 BG	SbCs	21	Q - f	130	170	8	80	-	9	200	900	1100	1.2	2	10
9828B	29	25	11 BG	SbCs	21	B - g	-	220	8	100	6	12	200	850	1100	0.9	2	10
9828WB	29	25	11 BG	SbCs	21	W - g	-	220	8	100	6	12	200	850	1100	0.9	2	10
9972B	38	32	10 LF	SbCs	21	B - f	130	180	8	80	-	10	20	850	1100	0.1	0.2	2
9972KB	38	32	10 LF	SbCs	21	B - f	130	180	8	80	-	10	20	850	1100	0.1	0.2	2

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

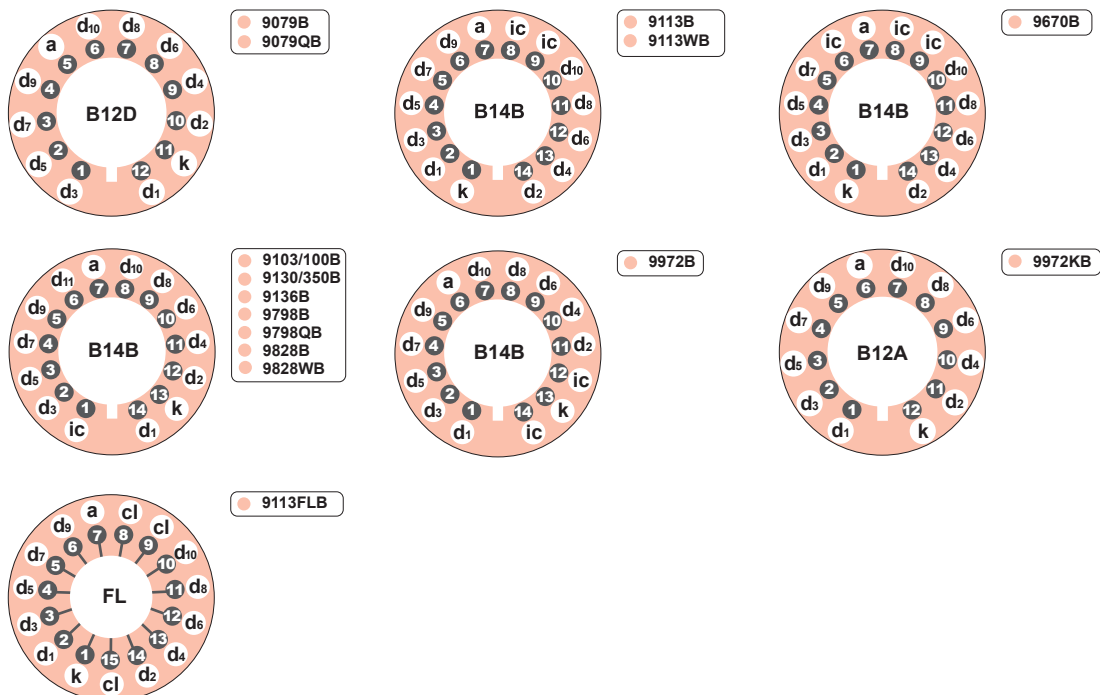


dark rate typical s ⁻¹	max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
						Socket	Shield	Voltage divider series	
								passive	active
1000	200	1.8	2.7	9079B	red sensitive variant of 9078B, fast, high gain, good overall performance.	B12D	MS19A	C669	-
1000	200	1.8	2.7	9079QB	red sensitive variant of 9079B with UV sensitivity to 165nm.	B12D	MS19A	C669	-
3000	500	1.8	3.1	9113B	red sensitive variant of 9111B, compact, fast response time.	B14B	MS25A	C673	C6002
3000	500	1.8	3.1	9113FLB	variant of 9113B with flexible leads.	wires	MS25A	C651	C6002
3000	500	1.8	3.1	9113WB	variant of 9113B with UV sensitivity to 185nm.	B14B	MS25A	C673	C6002
40	2000	3.5	5	9130/100B	photon counting pmt, 2.5 mm effective diameter, very low afterpulse rate.	B14B	MS30B	C637	-
300	2000	3.5	5	9130/350B	photon counting pmt, 9 mm effective diameter, very low afterpulse rate.	B14B	MS30B	C637	-
5000	2000	4.5	7.5	9136B	red sensitive variant of 9107B, length 87mm	B14B	MS30A	C637	-
-	(1x 10 ⁶)	5	10	9670B	Position sensitive type - 120mm long.	B14B	MS30B	C615	-
5000	2000	15	30	9798B	red sensitive sensitive variant of the 9924B.	B14B	MS30B	C637	C686
5000	2000	15	30	9798QB	variant of 9798B with UV sensitivity to 165nm.	B14B	MS30B	C637	C686
5000	2000	15	30	9828B	variant of 9798B, prismatic window giving enhanced red and IR sensitivity.	B14B	MS30B	C637	C686
5000	2000	15	30	9828WB	variant of 9828B with UV sensitivity to 185nm.	B14B	MS30B	C637	C686
7000	200	3	6	9972B	red sensitive variant of 9902B, high gain, fast response and good linearity.	B14B	MS38A	C646	C6004
7000	200	3	6	9972KB	variant of 9972B with capped base.	B12A	MS38A	C674	C6004

aded from www.et-enterprises.com

Base configurations

(Viewed from below)



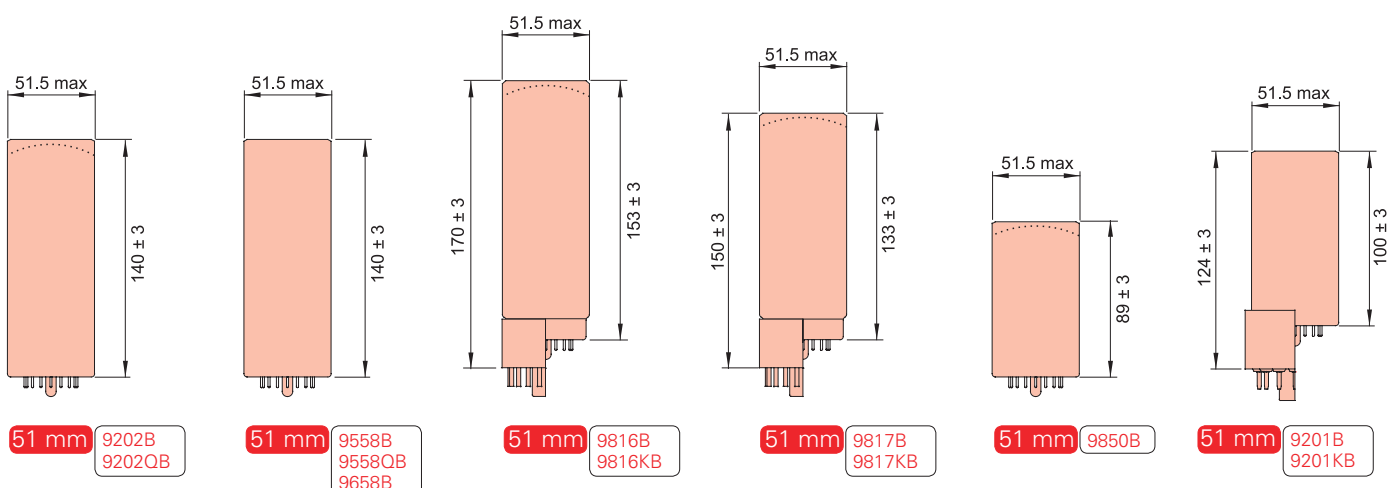
red/infra-red sensitive trialkali 51mm (2") diameter

type	Characteristics				Photocathode sensitivity								Photomultiplier performance					
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm min	uA/Lm typical	CB typical	CR typical	IR min	IR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA
9201B	51	46	10 LF	BeCu	21	B - f	150	200	9	90	-	12	50	1200	1600	1	1	10
9201KB	51	46	10 LF	BeCu	21	B - f	150	200	9	90	-	12	50	1200	1600	1	1	10
9202B	51	46	11 LF	SbCs	21	B - f	-	250	9	120	7	12	200	1050	1500	0.8	2	20
9202QB	51	46	11 LF	SbCs	21	Q - f	-	250	9	120	7	12	200	1050	1500	0.8	2	20
9558B	51	46	11 VB	SbCs	21	B - f	-	200	9	90	7	13	200	1050	1500	1	2	20
9558QB	51	46	11 VB	SbCs	21	Q - f	-	200	9	90	7	13	200	1050	1500	1	2	20
9658B	51	46	11 VB	SbCs	21	B - g	-	250	9	130	12	18	200	950	1400	0.8	2	20
9816B	51	46	14 LF	BeCu	21	B - f	120	200	9	90	-	12	5000	2200	2500	25	50	500
9816KB	51	46	14 LF	BeCu	21	B - f	120	200	9	90	-	12	5000	2200	2500	25	50	500
9817B	51	46	12 LF	BeCu	21	B - f	120	200	9	90	-	12	500	2000	2400	2.5	10	100
9817KB	51	46	12 LF	BeCu	21	B - f	120	200	9	90	-	12	500	2000	2400	2.5	10	100
9850B	51	46	6 LF	BeCu	21	B - f	150	220	9	100	-	13	1	800	1100	0.005	0.1	1

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

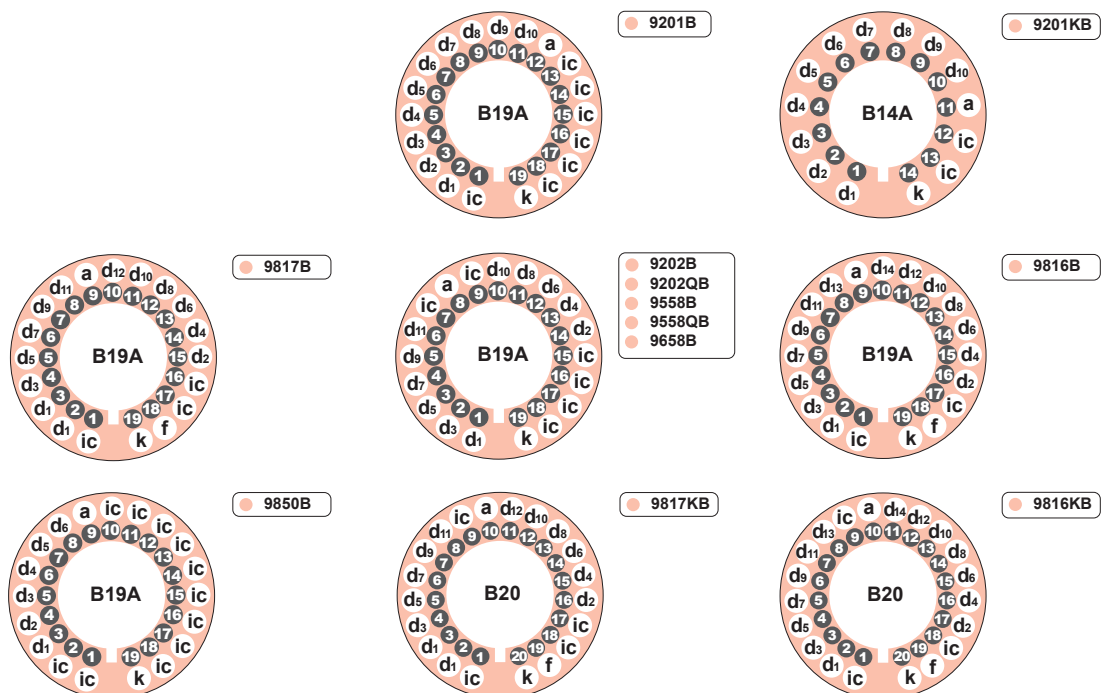


dark rate typical s ⁻¹	max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
						Socket	Shield	Voltage divider series	
								passive	active
15000	200	4	6.5	9201B	variant of 9266B.	B19A	MS52A(F)	C647	-
15000	200	4	6.5	9201KB	variant of 9201B with capped base.	B14A	MS52E	C636	-
15000	2000	3.5	5	9202B	fast, pin compatible version of 9558B, high gain and good linearity.	B19A	MS52C(F)	C625	-
15000	2000	3.5	5	9202QB	variant of 9202B with UV sensitivity to 165nm.	B19A	MS52C(F)	C625	-
15000	2000	10	22	9558B	established high gain venetian blind type, superseded by 9202B.	B19A	MS52C(F)	C625	-
15000	2000	10	22	9558QB	variant of 9558B with UV sensitivity to 165nm.	B19A	MS52C(F)	C625	-
15000	2000	10	22	9658B	variant of 9558B, prismatic window giving enhanced red and IR sensitivity.	B19A	MS52B(F)	C625	-
15000	10000	2	3	9816B	variant of 9817B with 14 dynodes for high gain capability.	B19A	MS52C(F)	C638	-
15000	10000	2	3	9816KB	variant of 9816B with capped base.	B20	MS52C	C643	-
15000	2000	2	3	9817B	12 stage fast linear focused type with good linearity.	B19A	MS52B(F)	C638	-
15000	2000	2	3	9817KB	variant of 9817B with capped base.	B20	MS52B	C640	-
	5	3	4.5	9850B	6 stage fast pmt for high light level applications.	B19A	MS52A(F)	C626	-

Adapted from www.et-enterprises.com

Base configurations

(Viewed from below)



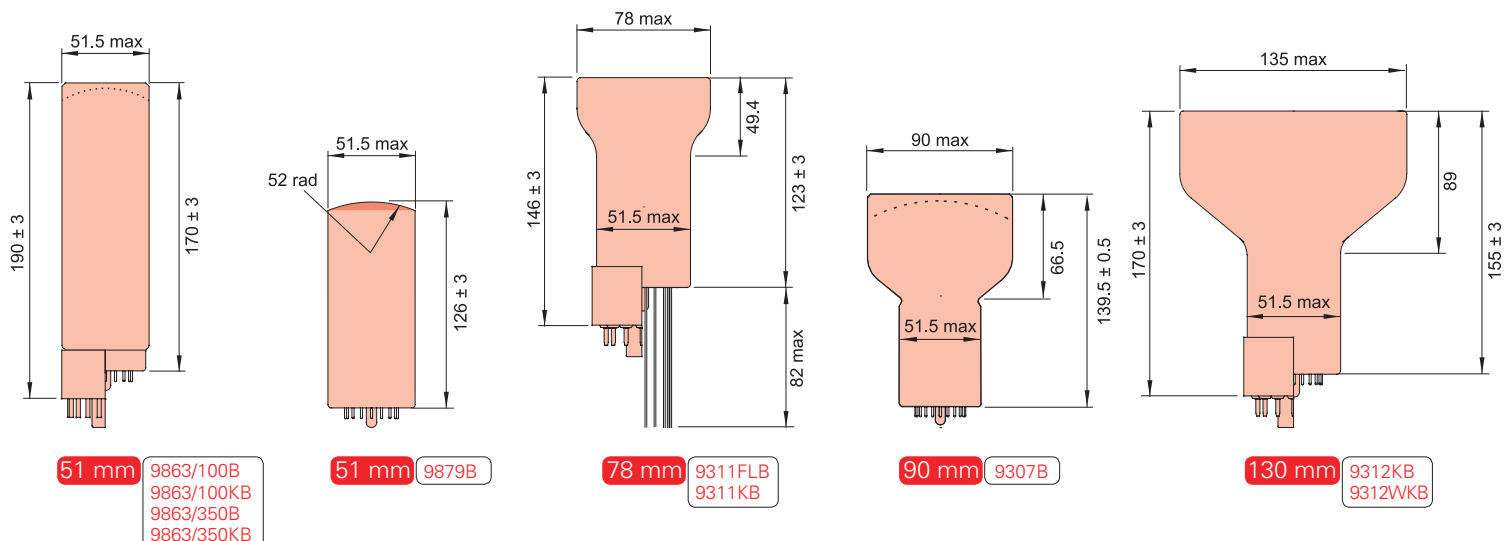
red/infra-red sensitive trialkali 51 to 130mm (2" to 5") diameter

type	Characteristics				Photocathode sensitivity								Photomultiplier performance					
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm min	uA/Lm typical	CB typical	CR typical	IR min	IR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA
9863/100B	51	2.5	14 LF	BeCu	21	B - f	125	180	9	75	-	6	5000	2200	2500	30	0.5	5
9863/100KB	51	2.5	14 LF	BeCu	21	B - f	125	180	9	75	-	6	5000	2200	2500	30	0.5	5
9863/350B	51	9	14 LF	BeCu	21	B - f	125	180	9	75	-	6	5000	2000	2500	30	2	20
9863/350KB	51	9	14 LF	BeCu	21	B - f	125	180	9	75	-	6	5000	2000	2500	30	2	20
9879B	51	46	12 LF	BeCu	21	B - f	110	200	9	90	-	12	500	1750	2200	2.5	10	100
9311FLB	78	70	10 LF	SbCs	23	B - f	120	220	10	95	-	10	50	800	1400	0.25	2	20
9311KB	78	70	10 LF	SbCs	23	B - f	120	220	10	95	-	10	50	800	1400	0.25	2	20
9307B	90	80	6 LF	SbCs	23	B - f	150	180	8	80	-	10	1	700	1300	0.006	0.2	3
9312KB	130	115	10 LF	SbCs	21	B - f	90	150	9	60	-	6	50	1100	1500	0.33	10	100
9312WKB	130	115	10 LF	SbCs	21	W - f	90	150	9	60	-	6	50	1100	1500	0.33	10	100

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

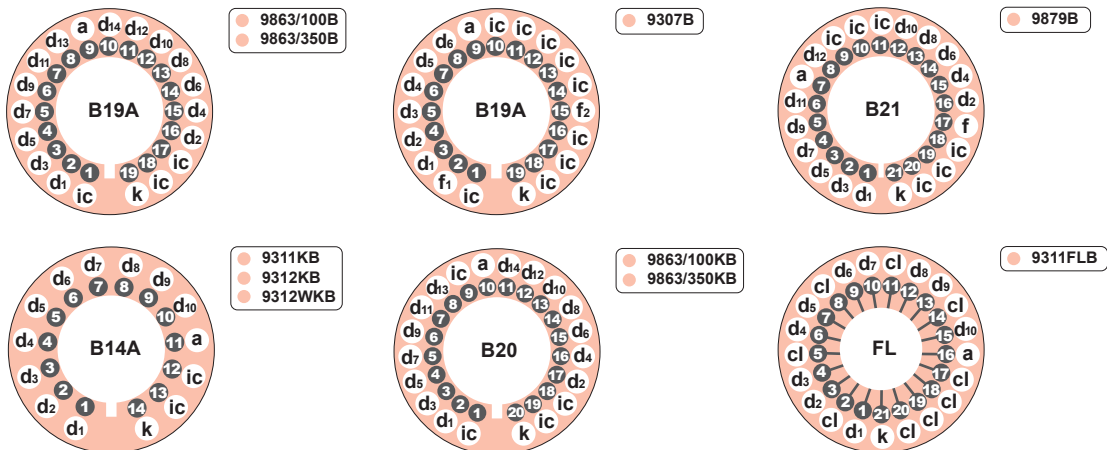


dark rate typical s ⁻¹	max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
						Socket	Shield	Voltage divider series	
								passive	active
40	10000	2.5	3.5	9863/100B	variant of 9816B, 2.5 mm effective diameter, low dark count and afterpulse.	B19A	MS52D(F)	C638	-
40	10000	2.5	3.5	9863/100KB	variant of 9863/100B with capped base.	B 20	MS52D	C641	-
300	10000	2.5	3.5	9863/350B	variant of 9816B, 9mm effective diameter, low dark count and afterpulse.	B19A	MS52D(F)	C638	-
300	10000	2.5	3.5	9863/350KB	variant of 9863/350B with capped base.	B20	MS52D	C641	-
15000	2000	2	3	9879B	variant of 9807B, thin blown window, shot blasted for enhanced sensitivity.	B21	MS52B(E)	C628	-
35000	200	7.5	15	9311FLB	S20 version of 9305FLB	wires	-	C655	-
35000	200	7.5	15	9311KB	variant of 9311FLB with capped base.	B 20	-	C636	-
-	5	4.6	14.5	9307B	90mm diameter variant of 9821, S20, 6 dynodes for high light levels.	B19A	MS75/90	C627	-
-	200	13	25	9312KB	S20 version of 9390KB. Was D753KB.	B14A	MS130B	C636	-
-	200	13	25	9312WKB	variant of 9312KB with UV sensitivity to 185nm. Was D753WKB.	B14A	MS130B	C636	-

aded from www.et-enterprises.com

Base configurations

(Viewed from below)



vacuum ultra-violet sensitive 29 and 51 mm (1 1/8" and 2") diameter

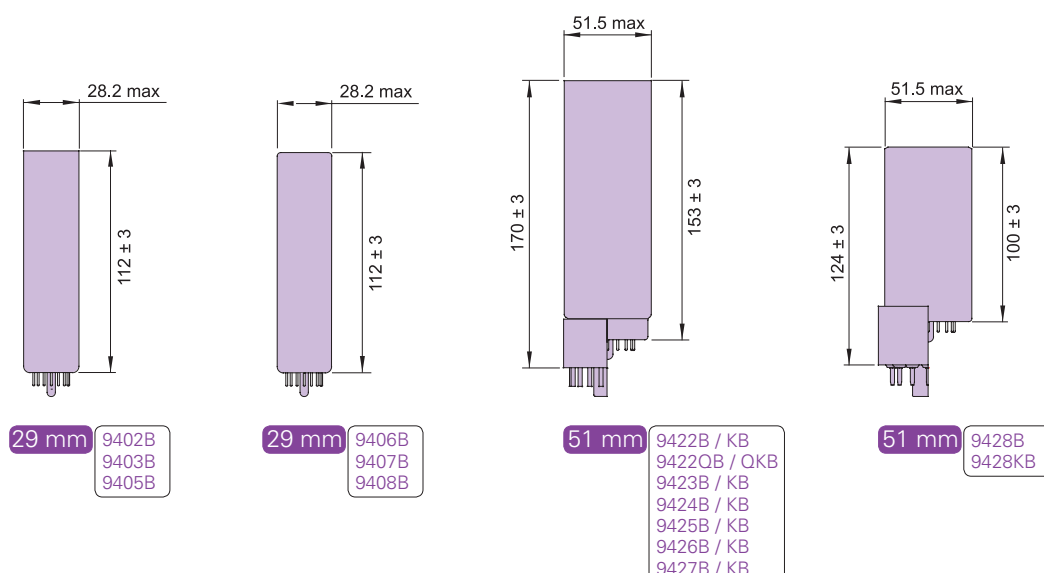
type	Characteristics				Photocathode sensitivity							Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm min	uA/Lm typical	CB typical	CR typical	IR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹
9402B	29	25	11 LF	BeCu	12	MF-CsTe	-	-	-	-	-	-	2000	3000	10	0.5	5	150
9403B	29	25	11 LF	BeCu	10	MF-Csl	-	-	-	-	-	-	4000	5000	10	0.05	0.5	10
9405B	29	25	11 LF	BeCu	10	MF-RbTe	-	-	-	-	-	-	2200	3000	10	0.3	5	50
9406B	29	25	11 LF	SbCs	28	MF - c	-	50	8	1	-	200	900	1150	4	0.2	5	100
9407B	29	25	11 LF	SbCs	25	MF - a	-	75	10	5	-	200	1050	1300	3	0.3	5	200
9408B	29	25	11 LF	BeCu	21	MF - f	90	170	8	75	6	200	1300	1800	1	1	10	5000
9422B	51	46	14 LF	BeCu	12	MF-CsTe	-	-	-	-	-	-	1800	2500	10	1	10	300
9822QB	51	46	14 LF	BeCu	12	Q-CsTe	-	-	-	-	-	-	1800	2500	10	1	10	300
9423B	51	46	14 LF	BeCu	10	MF-Csl	-	-	-	-	-	-	3400	4500	10	0.1	1	20
9424B	51	46	14 LF	BeCu	8	MF-KBr	-	-	-	-	-	-	3800	4500	10	0.1	1	10
9425B	51	46	14 LF	BeCu	10	MF-RbTe	-	-	-	-	-	-	2000	2500	10	0.5	10	100
9426B	51	46	14 LF	BeCu	26	MF - c	-	50	8	1	-	500	1800	2500	10	3	30	1500
9427B	51	46	14 LF	BeCu	20	MF - f	-	170	8	75	6	500	2000	2500	2.9	30	300	20000
9428B	51	46	10 LF	SbCs	28	MF - c	-	60	2	10	-	50	900	1100	0.8	0.3	1.5	300

All types in the 9422 series are available in capped base format, eg. 9422KB.

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

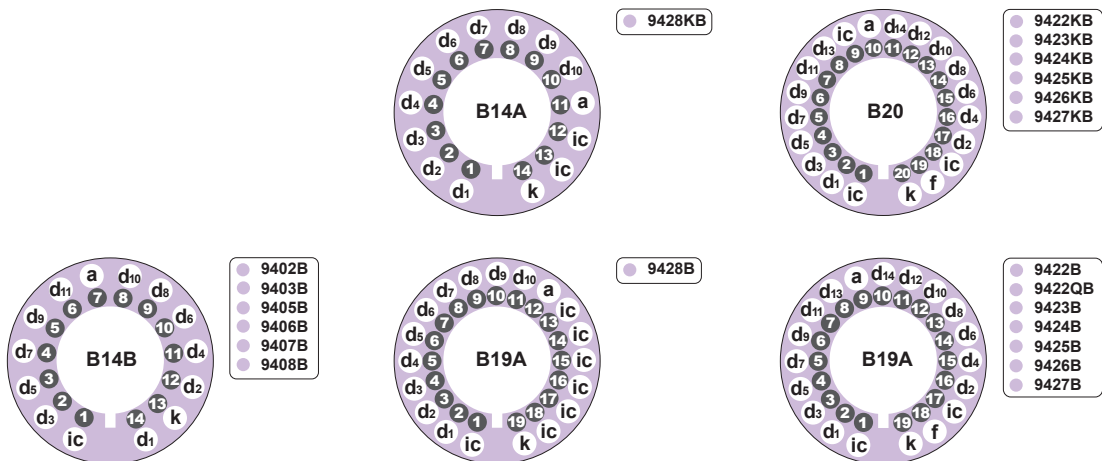


max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
					Socket	Shield	Voltage divider series	
							passive	active
(2X10 ⁷)	4.5	7.5	9402B	solar blind, MgF2 window, sensitivity from 110 to 360 nm.	B14B	MS30B	C670	-
(2X10 ⁷)	4.5	7.5	9403B	solar blind, MgF2 window, sensitivity from 110 to 230 nm.	B14B	MS30B	C670	-
(2X10 ⁷)	4.5	7.5	9405B	solar blind, MgF2 window, sensitivity from 110 to 310 nm.	B14B	MS30B	C670	-
2000	4.5	7.5	9406B	variant of 9125B, MgF2 window to extend UV sensitivity to 110 nm.	B14B	MS30B	C670	-
2000	4.5	7.5	9407B	variant of 9124B, MgF2 window to extend UV sensitivity to 110 nm.	B14B	MS30B	C670	-
2000	3.5	5	9408B	variant of 9129B, MgF2 planar window, sensitivity from 110 to 850 nm.	B14B	MS30B	C670	-
(2X10 ⁷)	2	3	9422B	solar blind pmt, MgF2 window, sensitivity from 110 to 360 nm.	B19A	MS52C	C638	-
(2X10 ⁷)	2	3	9422QB	version of 9422B, sensitivity from 165 to 360 nm.	B19A	MS52C	C638	-
(2X10 ⁷)	2	3	9423B	solar blind pmt, MgF2 window, sensitivity from 110 to 230 nm.	B19A	MS52C	C638	-
(2X10 ⁷)	2	3	9424B	solar blind pmt, MgF2 window, sensitivity from 110 to 160 nm.	B19A	MS52C	C638	-
(2X10 ⁷)	2	3	9425B	solar blind pmt, MgF2 window, sensitivity from 110 to 310 nm.	B19A	MS52C	C638	-
5000	2	3	9426B	variant of 9813B, MgF2 window, sensitivity from 110 to 630 nm.	B19A	MS52C	C638	-
5000	2	3	9427B	variant of 9816B, MgF2 window, sensitivity from 110 to 850 nm.	B19A	MS52C	C638	-
500	4	6.5	9428B	variant of 9266B, MgF2 window to extend UV sensitivity to 110 nm.	B19A	MS52B	C647	-

aded from www.et-enterprises.com

Base configurations

(Viewed from below)



rugged blue-green sensitive bialkali 38 to 130mm (1½" to 5") diameter

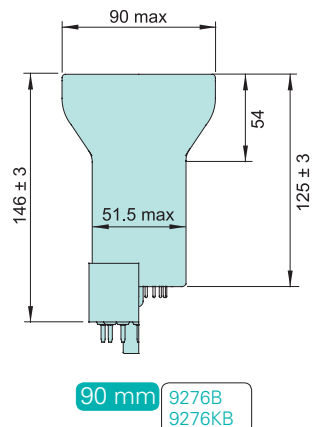
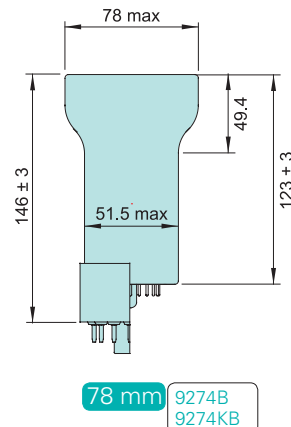
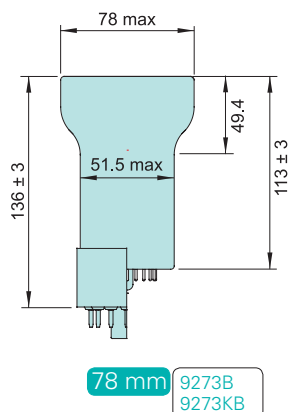
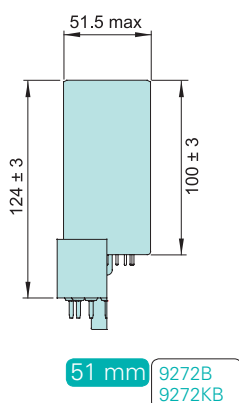
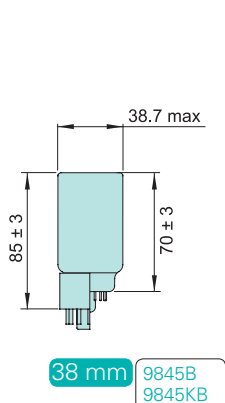
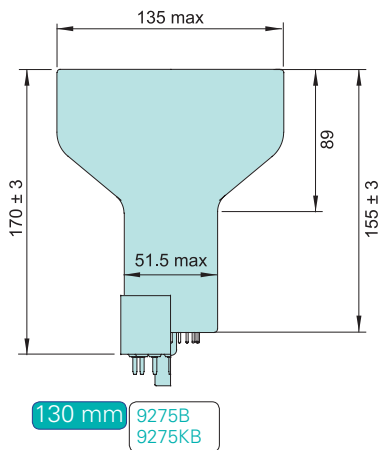
type	Characteristics				Photocathode sensitivity						Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	max rated A/Lm (gain)
9845B	38	32	10 CF	SbCs	28	B - c	65	7	11	1	50	1000	1200	0.8	0.1	5	200
9272B	51	48	10 LF	SbCs	28	B - c	70	8	11.5	2	50	850	1100	0.6	0.3	1.5	300
9273B	78	70	9 LF	SbCs	28	B - c	70	8	11.5	2	50	950	1300	0.7	0.5	5	200
9274B	78	70	10 LF	SbCs	28	B - c	70	8	11.5	2	50	850	1700	0.6	0.5	10	500
9276B	90	80	10 LF	SbCs	28	B - c	70	8	11.5	2	50	1200	1450	0.7	1	10	1000
9275B	130	115	10 LF	SbCs	28	B - c	70	8	11.5	2	50	1000	1500	0.7	1	20	200

Capped base versions are available, subject to qualification.

Comprehensive data sheets for all of the above types are available on request, or can be downloaded from the website.

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)

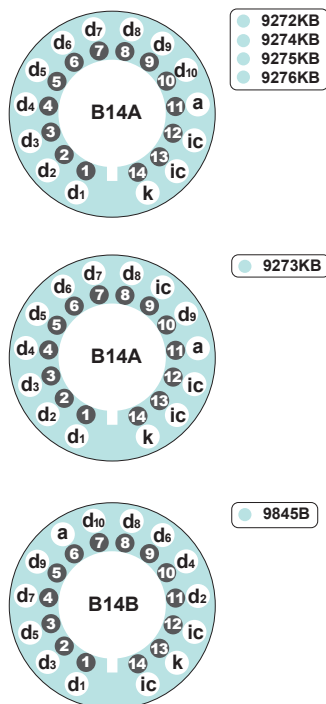


dark rate typical s ⁻¹	pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
					Socket	Shield	Voltage divider series	
							passive	active
500	5	10	9845B	variant of 9102B ruggedised for harsh environments, 70mm long.	B14B	MS38A	C646	-
500	4	6.5	9272B	variant of 9266B ruggedised for harsh environments.	B19A	MS52A(F)	C647	-
200	7.5	15	9273B	variant of 9265B, ruggedised for harsh environments.	B19A	MS75/90	C648	-
500	7.5	15	9274B	variant of 9305B, ruggedised for harsh environments.	B19A	MS75/90	C647	-
200	7.5	15	9276B	variant of 9306FLB, ruggedised for harsh environments.	B19A	MS75/90	C647	-
1500	10	15	9275B	variant of 9390B, ruggedised for harsh environments.	B19A	MS130A	C647	-

aded from www.et-enterprises.com

Base configurations

(Viewed from below)



environmental specifications (non capped versions)

shock & vibration profile	qualification levels		acceptance levels	
(all 3 axis tested)				
sine vibration:				
frequency (Hz)	20 - 2000			
amplitude (g)	20			
sweep rate (octave/min.)	2			
single sweep				
random vibration:				
freq. band (Hz)	PSD (g²/Hz)	overall g rms.	PSD (g²/Hz)	overall g rms.
20	0.045		0.0187	
20 - 60 roll on	+6 dB/oct		+6 dB/oct	
60 - 400	0.4024	20	0.1686	13
400 - 2000 roll off	-3 dB/oct		-3 dB/oct	
2000	0.0805		0.0337	
1 min. duration in each axis				
impact shock (½ sine):				
peak acceleration (g)	250			
duration (ms)	1			
3 shocks per axis (18 shocks total)				

thermal range: operating - -30 °C to +60 °C

non-operating - -30 °C to +90 °C

pressure: 0 - 1.3 atmospheres absolute

high temperature bialkali 19 to 51 mm (3/4" to 2") diameter, glass and metal ce

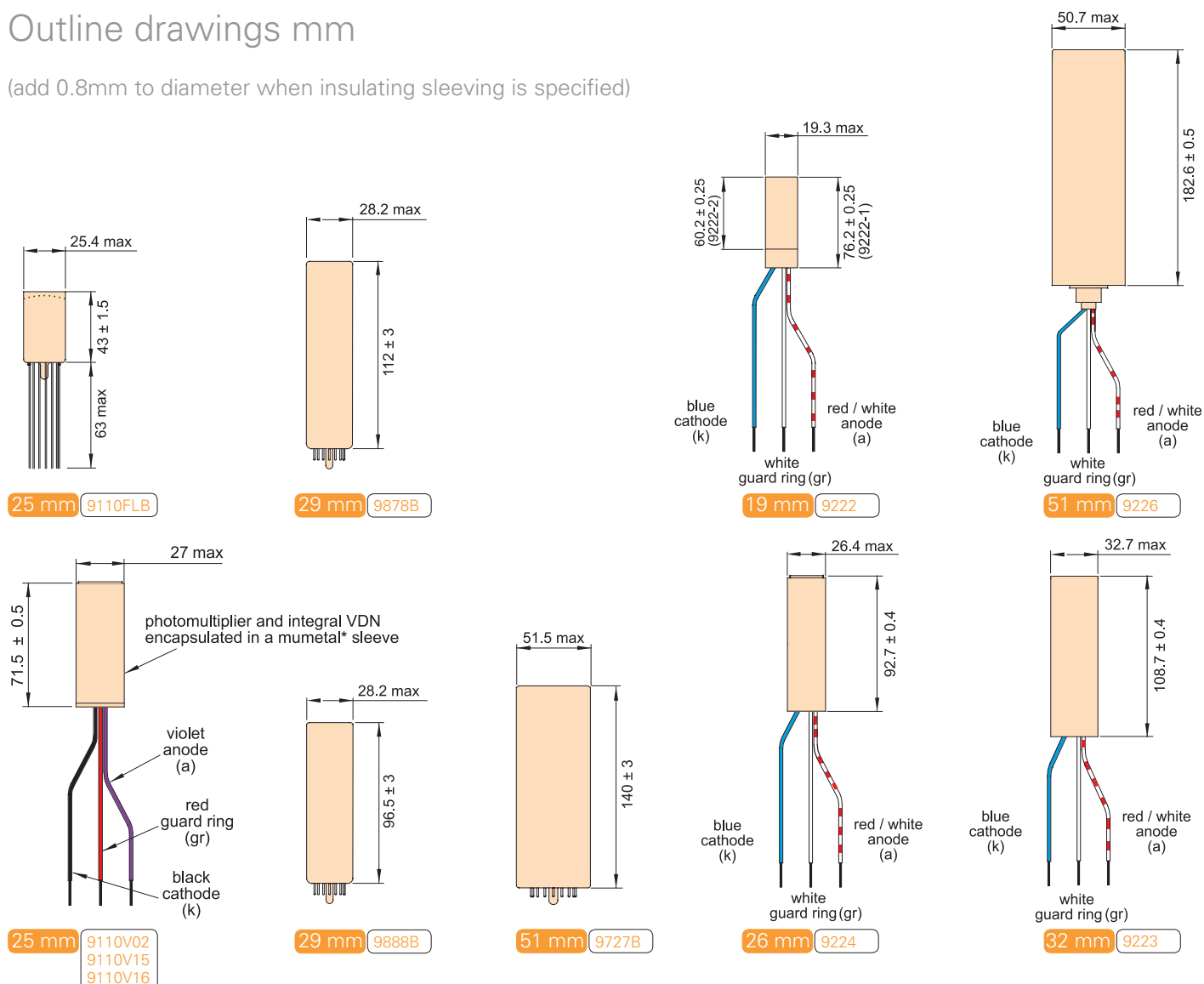
type	Characteristics				Photocathode sensitivity						Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm or (pC/MeV)	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	max rated A/Lm (gain)
9110FLB	25	22	10 CF	BeCu	17	B - e	50	4	6	5	10	1350	1500	0.2	0.1	1	50
9110V02	25	22	10 CF	BeCu	17	B - e	50	4	6	5	10	1350	1500	0.2	0.1	1	50
9110V15	25	22	10 CF	BeCu	17	B - e	50	4	6	5	10	1350	1500	0.2	0.1	1	50
9110V16	25	22	10 CF	BeCu	17	B - e	50	4	6	5	10	1350	1500	0.2	0.1	1	50
9878B	29	25	11 BG	BeCu	17	B - e	50	4	6	5	20	1400	1600	0.4	0.03	1	50
9888B	29	25	11 BG	BeCu	17	B - e	50	4	6	5	20	1400	1600	0.4	0.03	1	50
9727B	51	46	13 VB	BeCu	17	B - e	50	4	6	5	50	1450	1900	1	0.5	5	200
9222	19	11.5	12 VB	BeCu	17	S - e	40	-	6	2	(100)	2100	2400	1	1	-	(5.0X10 ⁶)
9224	26	20	12 VB	BeCu	17	S - e	40	-	6	2	(100)	1800	2200	0.33	2	-	(1.7X10 ⁶)
9223	32	25	12 VB	BeCu	17	S - e	40	-	6	2	(100)	1800	2100	0.33	3	-	(1.7X10 ⁶)
9226	51	45	14 VB	BeCu	17	S - e	40	-	6	2	(100)	1800	2100	0.33	8	-	(1.7X10 ⁶)

Note: unless otherwise stated, all of the above information relates to 20 degrees C.

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)



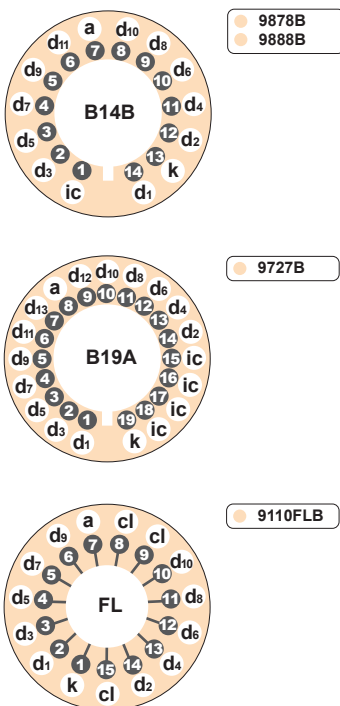
*mumetal is a trademark of Magnetic Shield Corporation.

pulse rise time ns	pulse fwhm ns	type	Special features	Accessories			
				Socket	Shield	Voltage divider series	
						passive	active
1.8	3.1	9110FLB	compact, rugged, operation up to 90 °C. Selected versions for 175 °C.	FL	MS25A	-	-
1.8	3.1	9110V02	encapsulated with voltage divider, for operation up to 150 °C.	wires	included	included	n/a
1.8	3.1	9110V15	encapsulated with voltage divider, for operation up to 175 °C.	wires	included	included	n/a
1.8	3.1	9110V16	encapsulated with voltage divider, for operation up to 90 °C.	wires	included	included	n/a
15	30	9878B	for operation up to 150 °C, length 112 mm.	B14B	MS30B	-	-
15	30	9888B	for operation up to 150 °C, length 96.5 mm.	B14B	MS30A	-	-
10	22	9727B	for operation up to 150 °C.	B19A	MS52C(F)	-	-
6	10	9222	ultra rugged, compact, 12mm input diameter, for operation up to 175 °C.	wires	-	included	n/a
8	13	9224	ultra rugged, 20mm input diameter, for operation up to 175 °C.	wires	-	included	n/a
9	15	9223	ultra rugged, 25mm input diameter, for operation up to 175 °C.	wires	-	included	n/a
12	20	9226	ultra rugged, 45mm input diameter, for operation up to 175 °C.	wires	-	included	n/a

ordered from www.et-enterprises.com

Base configurations

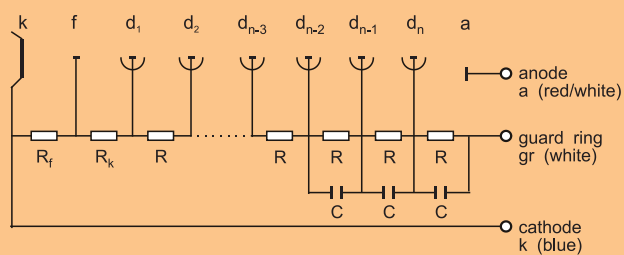
(Viewed from below)



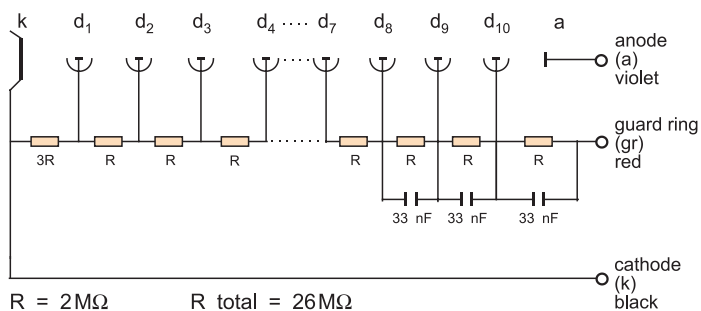
voltage divider distribution for 9222 series

All metal ceramic pmts are supplied as a package, which includes the voltage divider. The standard voltage divider for each type is described by the table and circuit diagram given below. All resistor values in MΩ.

type	R_f	R_k	R	R_{total}	C
9222	0.27	7.8	3.9	56 MΩ	33 nF
9224	0	7.8	3.9	56 MΩ	2.2 nF
9223	0.35	7.8	3.9	56 MΩ	2.2 nF
9226	0.27	9.0	2.4	43 MΩ	2.2 nF



voltage divider distribution for 9110V series



$R = 2\text{ M}\Omega$

$R_{total} = 26\text{ M}\Omega$

25 mm 9110V02
9110V15
9110V16

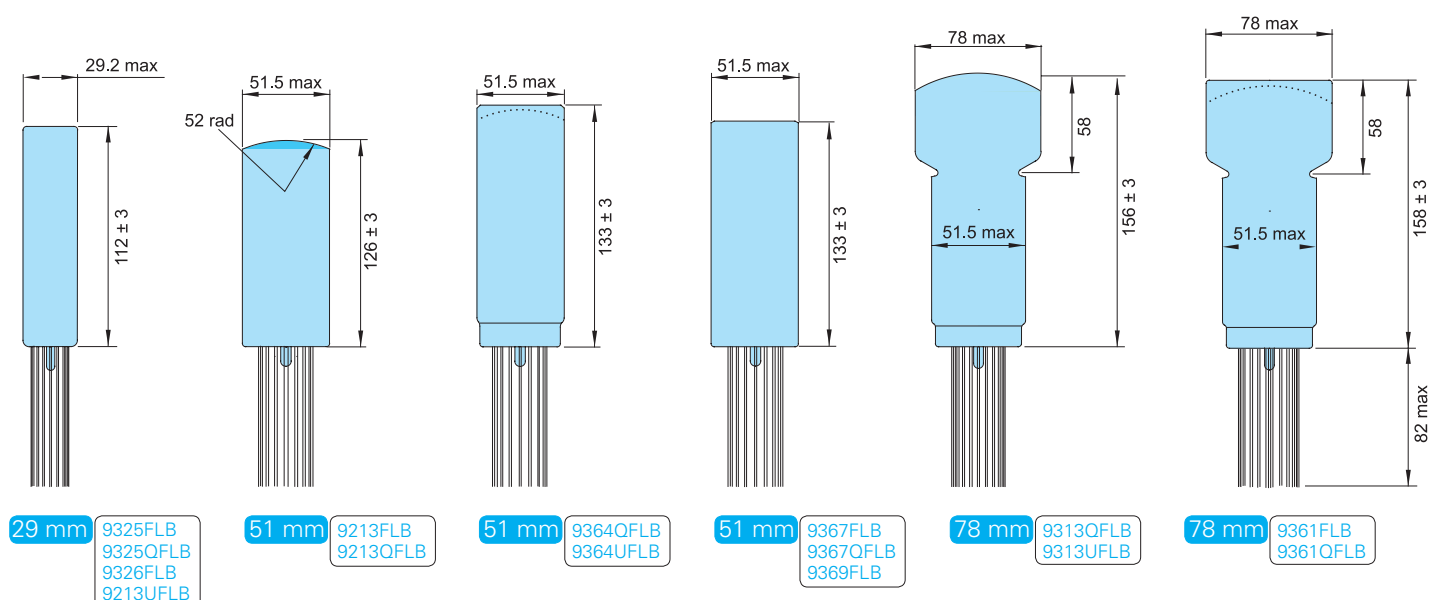
low temperature bialkali 29 to 200mm (1 1/8" to 8") diameter

type	Characteristics				Photocathode sensitivity						Photomultiplier performance						
	diameter nominal mm	active diameter nominal mm	number & type of dynodes	dynode surface	QE (%) peak typical	QE Curve	uA/Lm typical	CB min	CB typical	CR typical	nominal A/Lm	Vk-a typical	Vk-a max	gain X10 ⁶	dark current typical nA	dark current max nA	dark rate typical s ⁻¹
9325FLB	29	25	11 LF	SbCs	17.5	B - c	40	6	8	1	200	900	1150	5	0.2	5	100
9325QFLB	29	25	11 LF	SbCs	17.5	Q - c	40	6	8	1	200	900	1150	5	0.2	5	100
9326FLB	29	25	11 LF	SbCs	15	MF - c	35	5	7	1	200	900	1150	6	0.2	5	100
9213FLB	51	46	12 LF	SbCs	20	B - c	65	7	9	2	500	1300	1800	7.5	5	50	1000
9213QFLB	51	46	12 LF	SbCs	20	Q - c	65	7	9	2	500	1300	1800	7.5	5	50	1000
9213UFLB	51	46	12 LF	SbCs	20	B - c	65	7	9	2	500	1300	1800	7.5	5	50	1000
9364QFLB	51	46	12 LF	SbCs	15	Q - c	40	6	7	1	500	1350	1800	13	2	10	500
9364UFLB	51	46	12 LF	SbCs	15	B - c	40	6	7	1	500	1350	1800	13	2	10	500
9367FLB	51	46	12 LF	SbCs	15	B - c	40	5	7	1	500	1350	1900	13	1	10	300
9367QFLB	51	46	12 LF	SbCs	15	Q - c	40	5	7	1	500	1350	1900	13	1	10	300
9369FLB	51	46	12 LF	SbCs	15	MF - c	40	6	7	1	500	1300	1800	13	5	50	1000
9313QFLB	78	68	12 LF	SbCs	19	Q - c	50	7	8	1.5	500	1500	1800	10	10	50	1000
9313UFLB	78	68	12 LF	SbCs	19	B - c	50	7	8	1.5	500	1500	1800	10	10	50	1000
9361FLB	78	67	12 LF	SbCs	15	B - c	40	6	7	1	500	1500	2000	13	10	50	1000
9361QFLB	78	67	12 LF	SbCs	15	Q - c	40	6	7	1	500	1500	2000	13	10	50	1000
9362FLB	130	120	12 LF	SbCs	15	B - c	40	6	7	1	500	1200	1450	12	10	100	1500
9362QFLB	130	120	12 LF	SbCs	15	Q - c	40	6	7	1	500	1200	1450	12	10	100	1500
9357FLB	200	190	12 LF	SbCs	18	B - c	45	6	7.5	0.5	500	1300	1800	11	10	100	4000

Comprehensive data sheets for all of the above types are available on request, or can be downloaded

Outline drawings mm

(add 0.8mm to diameter when insulating sleeving is specified)



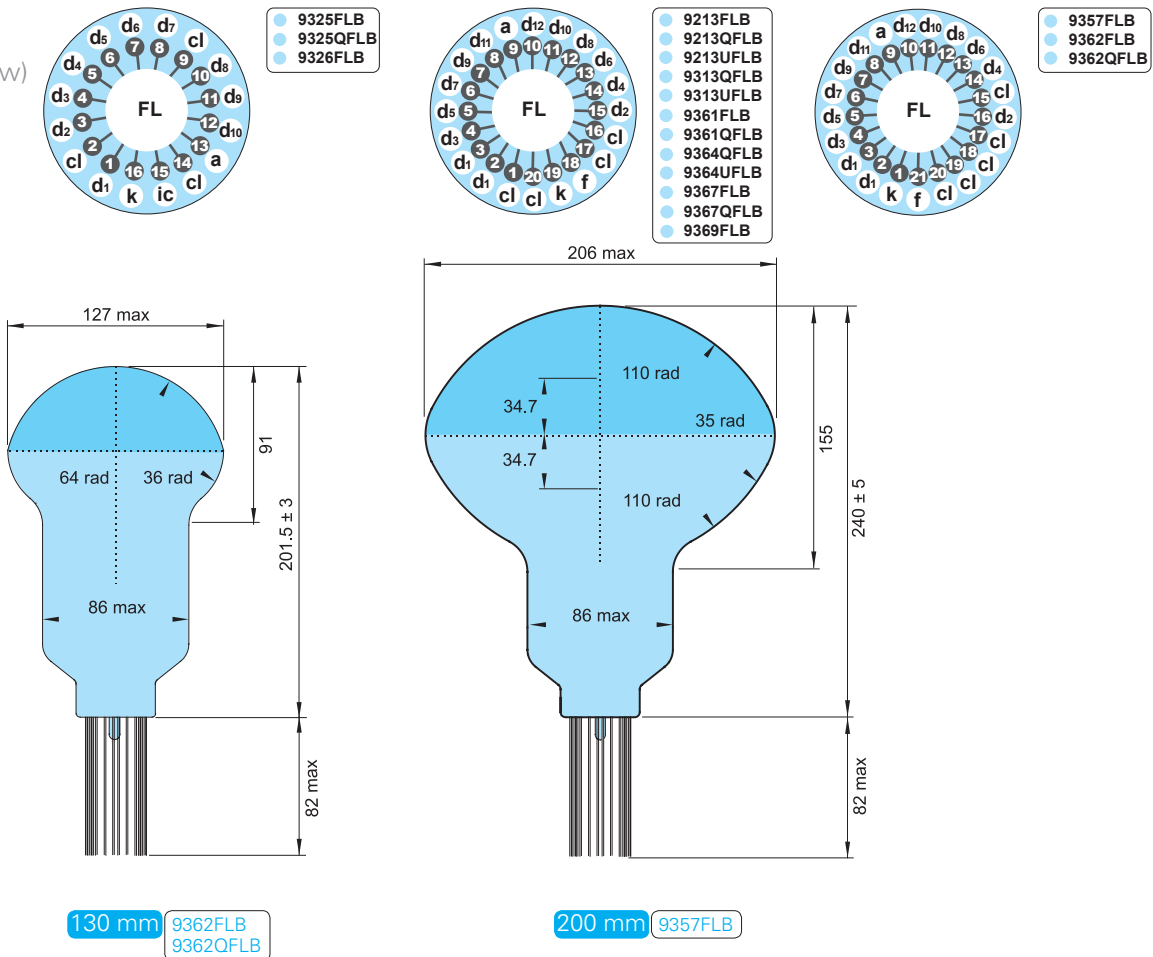
max rated A/Lm (gain)	pulse rise time ns	pulse fwhm ns	type	Special features	Socket	Shield	Accessories		
							Voltage divider series	passive	active
2000	4.5	7.5	9325FLB	ultra low temperature version of 9125FLB. Was D830.	FL	-	C637 *	-	
2000	4.5	7.5	9325QFLB	variant of 9325FLB with UV sensitivity to 165nm. Was D830Q.	FL	-	C637 *	-	
2000	4.5	7.5	9326FLB	ultra low temperature version of 9125B for sensitivity to 110nm. Was D837	FL	-	C637 *	-	
2000	2.5	3.5	9213FLB	ultra low temperature version of 9829. Was D757	FL	-	C638 *	-	
2000	2.5	3.5	9213QFLB	variant of 9213FLB with UV sensitivity to 165nm. Was D757Q.	FL	-	C638 *	-	
2000	2.5	3.5	9213UFLB	ultra low background version of 9213FLB	FL	-	C638 *	-	
2000	2	3	9364QFLB	variant of 9364UFLB with UV sensitivity to 165nm. Was D745Q.	FL	-	C638 *	-	
2000	2	3	9364UFLB	ultra low temperature & low background version of 9214B. Was D745	FL	-	C638 *	-	
2000	3	4.5	9367FLB	ultra low temperature version of 9939B. Was D749	FL	-	C638 *	-	
2000	3	4.5	9367QFLB	variant of 9367FLB with UV sensitivity to 165nm. Was D749Q.	FL	-	C638 *	-	
2000	3	4.5	9369FLB	ultra low temperature variant of 9939B with MgFI window was D775	FL	-	C638 *	-	
2000	2.5	3.5	9313QFLB	variant of 9313UFLB with UV sensitivity to 165nm. Was D750Q.	FL	-	C638 *	-	
2000	2.5	3.5	9313UFLB	ultra low temperature, low background variant of 9921B, domed window. Was D750	FL	-	C638 *	-	
2000	2.5	3.5	9361FLB	ultra low temperature version of 9921B. Was D746.	FL	-	C638 *	-	
2000	2.5	3.5	9361QFLB	variant of 9361FLB with UV sensitivity to 165nm. Was D746Q.	FL	-	C638 *	-	
2000	4	6	9362FLB	ultra low temperature version of 9372B. Was D742.	FL	-	C690 *	-	
2000	4	6	9362QFLB	variant of 9362FLB with UV sensitivity to 165nm. Was D742Q.	FL	-	C690 *	-	
2000	4	6	9357FLB	ultra low temperature version of 9354FLB	FL	-	C690 *	-	

*not rated for use at ultra-low temperatures

ordered from www.et-enterprises.com

Base configurations

(Viewed from below)



7. Voltage dividers

You need to provide a series of voltages to the dynodes of a pmt to make it work.

These voltages can be derived from a single power supply by using a **resistive** voltage divider. This type of divider will give good performance provided the mean anode current is less than 1 % of the divider current. In its most basic form, known as a **uniform** divider (**figure 9a**), each inter-dynode resistor is of the same value. In the **tapered** version (**figure 9b**), resistor values increase towards the anode. This is to overcome space charge effects which lead to non-linearity when dealing with the high current pulses. For optimum performance, $V(k-d_1)$ is often higher than the inter-dynode voltages and hence $R(k-d_1)$ ranges over 2R, 3R....., 8R, depending upon pmt type.

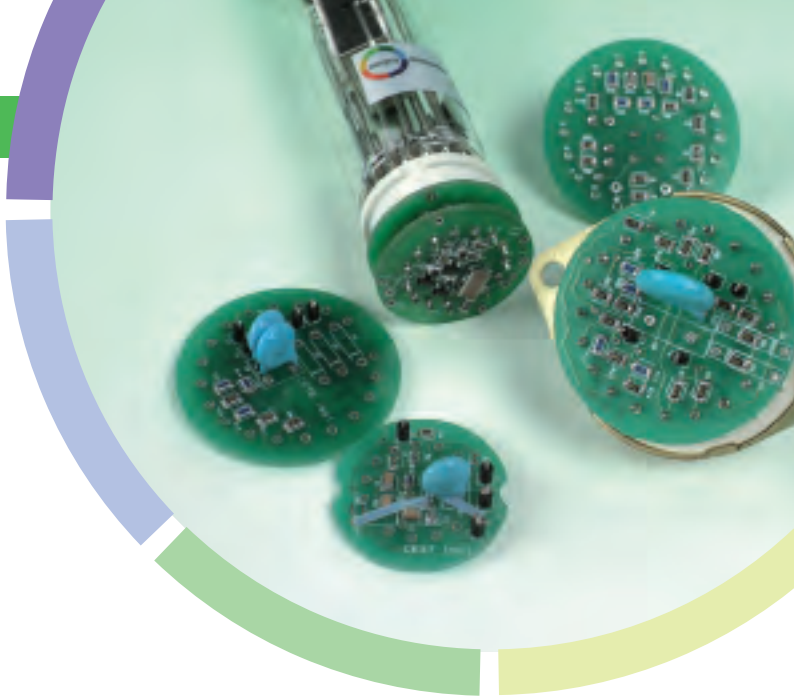
In a variant of the all-resistor divider (**figure 9c**), a **zener diode** replaces the resistor between k and d_1 . This maintains $V(k-d_1)$ constant regardless of the high voltage setting and ensures good collection and fast response when the pmt is operated over a wide range of gain settings.

For pulsed light applications, decoupling capacitors need to be connected across the last three or four dynodes to provide transient signal charge. These may be omitted in dc applications but are normally included in ET Enterprises voltage dividers.

The standard inter-dynode resistor value is 330 k Ω but other values can be supplied to special order. All voltage divider types can be supplied with high voltage and signal leads, with or without connectors, to your specification.

Active dividers (figure 9d), consist of a series of FETs interposed between the dynodes and a high impedance resistor divider. The FETs maintain the dynodes at fixed potentials. This type of divider ensures constant gain up to a mean anode current of 100 μ A, the maximum permitted in most pmt types. Power consumption is typically 100 mW and they are particularly suited to portable instrumentation.

Custom designs can also include encapsulation to facilitate assembly within your equipment. Please contact our sales engineers to discuss your particular requirements.



a selection of ET Enterprises voltage dividers

Section 6 includes information on voltage dividers, where types are available for individual pmts.

Detailed [data sheets](#) are available for all of the voltage dividers listed in the selection guide. You can download them from www.et-enterprises.com or we can **fax** or e-mail a copy to you.

The range is covered by the four voltage divider variants given in **figure 9**. Note that all dividers, except active types, are suitable for positive or negative HV but the polarity must be specified at the time of ordering.

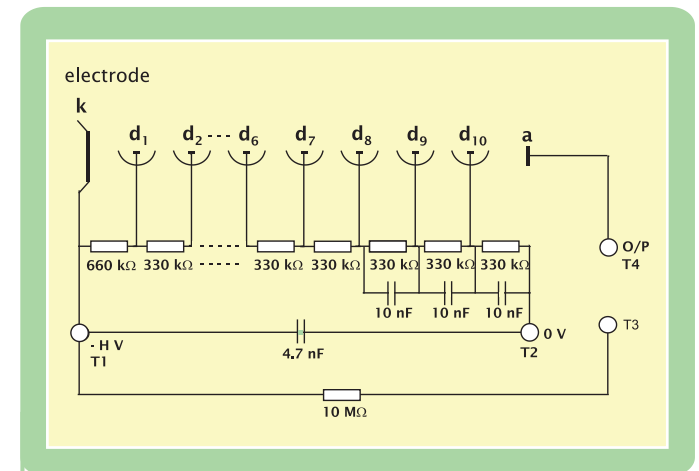


figure 9a

Uniform resistive divider configured for -HV.

configuration

Resistive voltage dividers can be supplied for positive or negative polarity and you need to specify your requirement when ordering. **Table 7** gives the configurations that are available:

table 7

options for resistive voltage dividers options

Configuration	Application example	Connections				Type no. suffix
		T1	T2	T3	T4	
positive HV, ac coupled	scintillation counting	0 V gnd	+HV	signal output	-	P
negative HV, dc coupled no anode load	electrometers	-HV	0 V gnd	-	signal output	N1
negative HV, dc coupled anode load	high energy physics	-HV	0 V gnd	-	signal output	N2

electrode

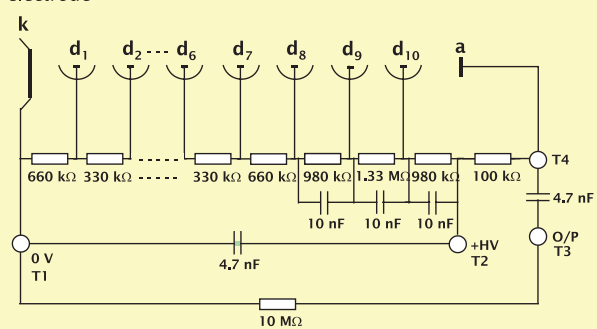


figure 9b

Tapered resistive divider configured for +HV, showing decoupling capacitors for pulsed applications.

electrode

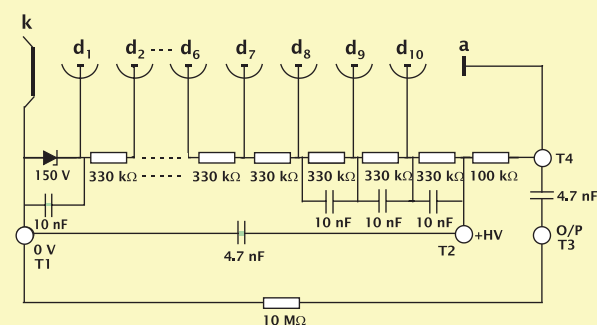


figure 9c

Divider with zener stabilised $V(k-d_1)$ configured for +HV.

electrode

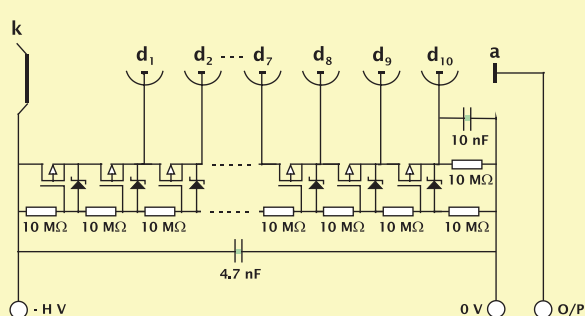


figure 9d

Active uniform divider providing high performance and low power consumption over a wide dynamic range. Available only for -HV.

ordering information

specify full type number, eg. **C647A**

O voltage divider without socket

S voltage divider with socket, no flange

F voltage divider with socket, with flange

A **C647AFN1**, for example is:

C647A fitted with B19A socket, with flange, configured for negative high voltage, dc coupled, no anode load.

8. Magnetic Shields

All photomultipliers are affected to some extent by magnetic fields. In the extreme case even changing the orientation of a pmt in the Earth's field can show a detectable effect. We offer a selection of different types of mumetal shields to cover the entire range of **ET Enterprises** pmts. There is more than one type of shield available for some tube types and the final choice of shield will depend on the magnitude of shielding required. Magnetic fields affect the collection efficiency and the gain of a pmt, to a degree dependant on the type of dynode structure. Performance curves for the four multiplier structures are given in the technical document: [understanding photomultipliers](#). Information is also given in the individual data sheets.

Choose from the following three types of magnetic shield:

integral magnetic shields

These are offered for all end window pmts up to 52 mm diameter. The photograph below shows a pmt fitted with an integral magnetic shield: a 0.125 mm mumetal* sheet is wrapped around the envelope and fully protected by an insulating sleeve. There is direct electrical contact from the shield to the cathode pin. These are the most cost effective, but other options with a higher degree of shielding may be necessary in place of, or in addition to, an integral shield.



Cutaway section illustrating the integral mumetal shield – the shield is connected to the cathode pin

split cylinder magnetic shield

These are available for end window pmts up to 52 mm in diameter. The shield is in the form of a split cylinder of thickness 0.5 mm. An internal grip pad is included.

table 8

Split cylinder magnetic shields

type	length A mm	diameter B mm	pmt diameter mm
MS19A	75	22	19
MS25A	39	29	25
MS30A	76	33	30
MS30B	102	33	30
MS38A	83	41	38
MS52A	76	56	52
MS52B	102	56	52
MS52C	133	56	52
MS52D	152	56	52

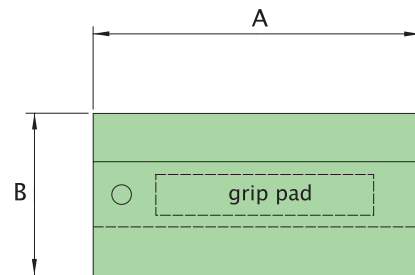


figure 10

Split cylinder magnetic shields

*mumetal is a trademark of Magnetic Shield Corporation.

contoured shield

These 0.5 mm thick shields are available for side window and end window pmts of diameter from 52 mm to 280 mm. The range is listed in **table 9**.

table 9

Contoured shields. Mounting lugs to fit the socket flanges indicated.

type	photomultiplier diameter mm	socket
MSSW	30 (SW)	B11A, no lugs
MS52E	52	B14A, B21
MS52F	52	B15B, B19A
MS75/90	75	B15B, B19A
MS75/90	90	B15B, B19A
MS130A	130	B15B, B19A
MS200A	200	B20



a selection of split cylindrical and contoured shields

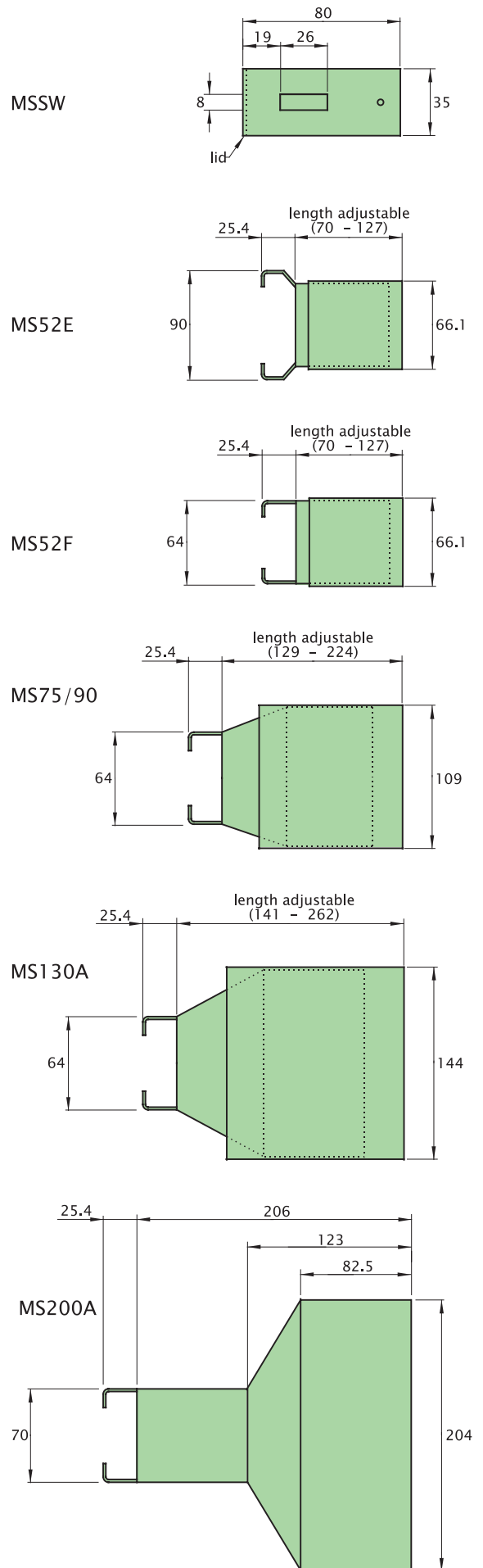


figure 11

Contoured shield dimensions mm

9. Sockets

All hardpin and capped pmts need matching sockets for external electrical connections.

ordering information

The matching socket type number for each listed pmt is given in **section 6**. Sockets are supplied with mounting flanges as standard. Unflanged versions with standard or pcb contacts are also available. The range of ET Enterprises sockets with general dimensions is shown in figure 12; engineering drawings of each socket type can be supplied on request.

Add suffix LF to the type number to order a socket without mounting flange

Add suffix PC to order a pcb version of a socket

precautions

sockets and caps must not come in contact with any of the following:

acetone

cyanoacrylate adhesives

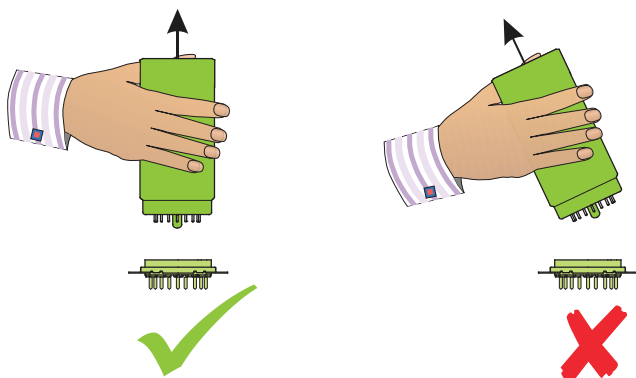
chloroform

dichloromethane

only **alcohol** is recommended for cleaning

adhesives suitable for sockets and caps are epoxy resins (Araldite), polyurethane glue and silicones

when inserting or removing a pmt from a socket, maintain the tube axis at right angles to the plane of the socket as shown in the diagram below:

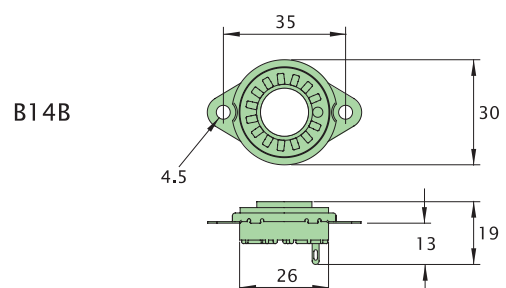
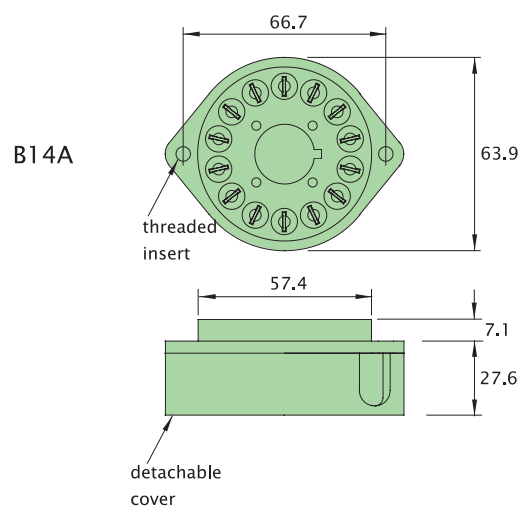
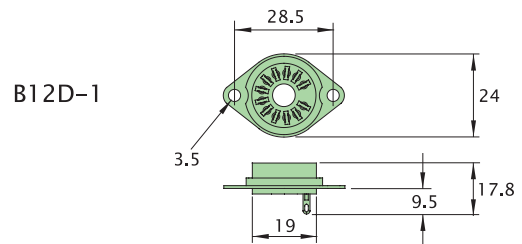
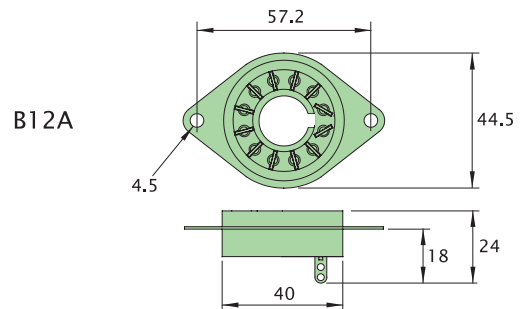
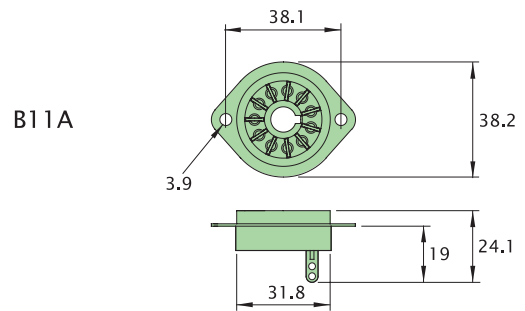


you **must not**, under any circumstances, solder directly to the pins of a hardpin pmt

flexible leads may be soldered directly to a printed circuit board provided adequate heat sinking is used to protect the pmt

electrical connections **must not** be made to socket contacts marked **ic** in the pmt pin connection diagrams

soldering temperatures **must not** exceed 220 °C





a selection of sockets

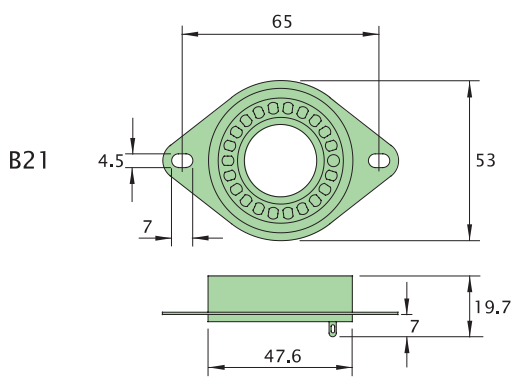
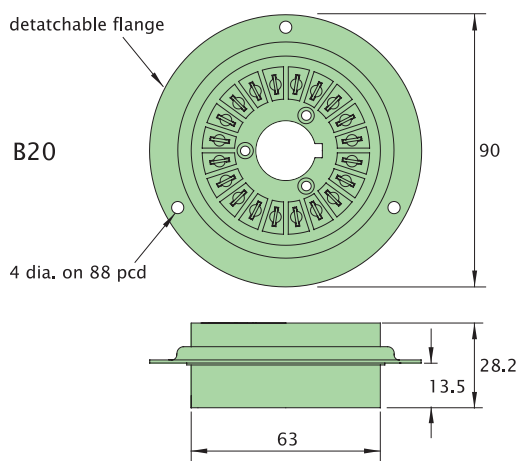
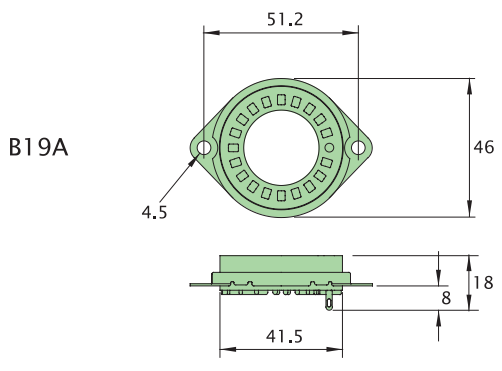
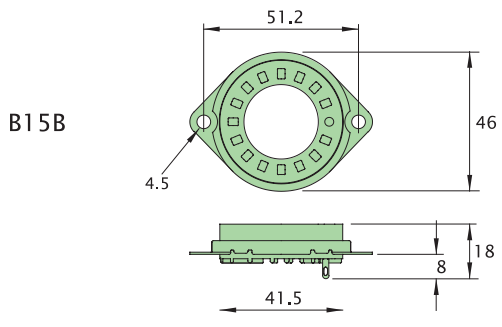


figure 12
Socket dimensions mm

10. Photocathode spectral response curves

The quantum efficiency in %, QE(%), can be calculated from the following formula:

$$QE(\%) = 124 E(\lambda) / \lambda$$

where $E(\lambda)$ is expressed in mA/W and λ is the wavelength in nm

fig 1

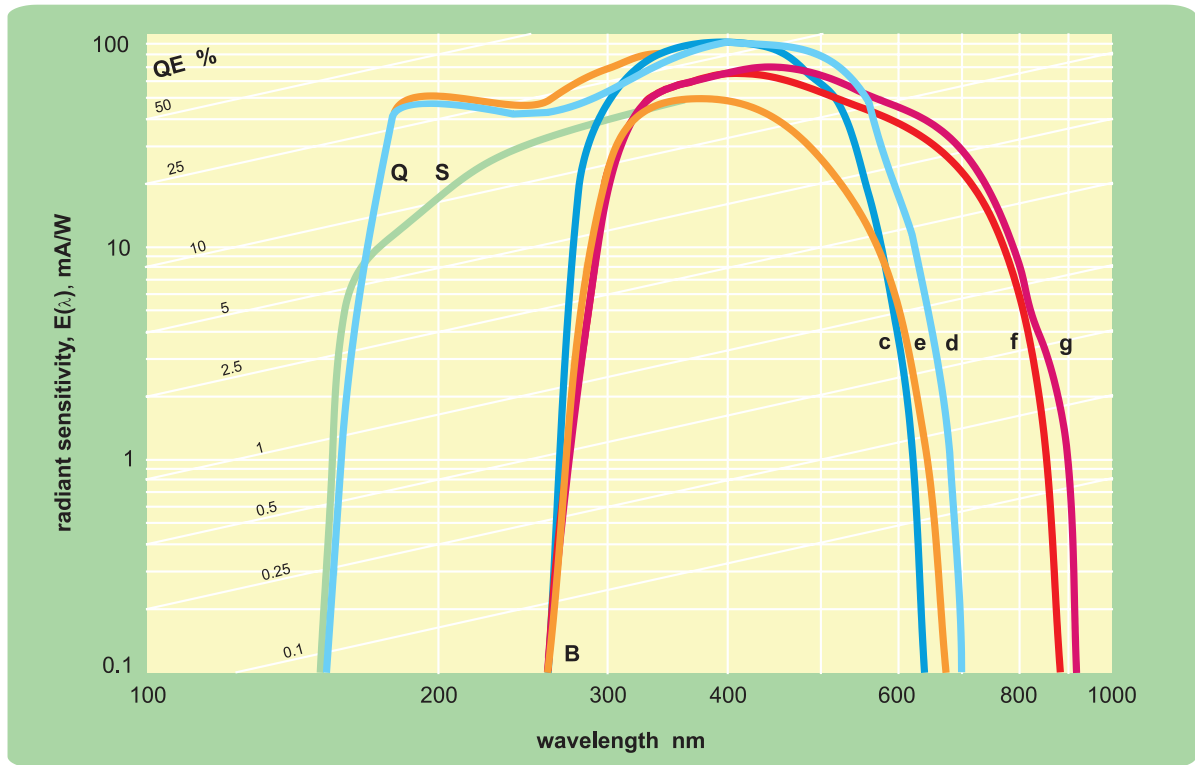
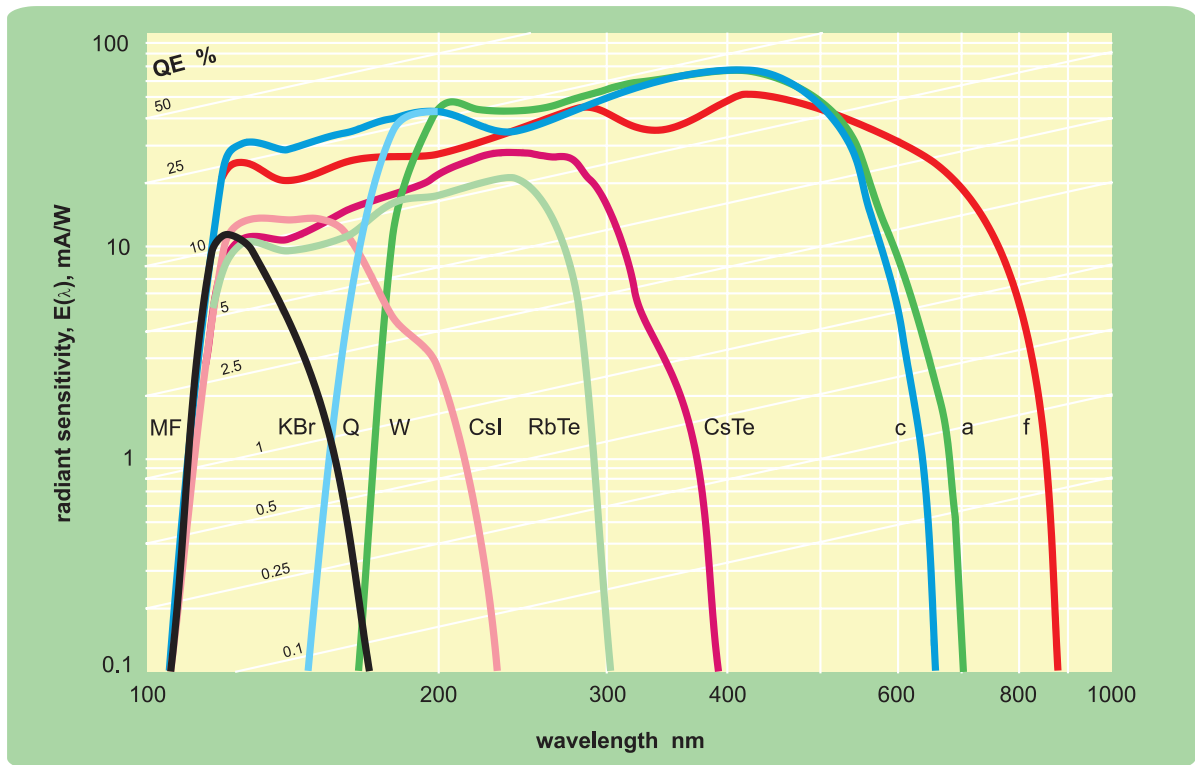


fig 2



Photomultiplier list with spectral response curve reference

type	spectral response curve	figure	page	type	spectral response curve	figure	page	type	spectral response curve	figure	page	type	spectral response curve	figure	page
6097B	B - d	1	26	9213QFLB	Q - c	1	40	9354KB	B - c	1	22	9816KB	B - f	1	30
6097KB	B - d	1	26	9213UFLB	B - c	1	40	9357FLB	B - c	1	40	9817B	B - f	1	30
9078B	B - c	1	12	9214B	B - c	1	16	9361FLB	B - c	1	40	9817KB	B - f	1	30
9079B	B - f	1	28	9214KB	B - c	1	16	9361QFLB	Q - c	1	40	9821B	B - c	1	20
9079QB	Q - f	1	28	9215B	B - c	1	16	9362FLB	B - c	1	40	9821KB	B - c	1	20
9085B	B - d	1	24	9215KB	B - c	1	16	9362QFLB	Q - c	1	40	9821QB	Q - c	1	20
9102B	B - c	1	14	9222	S - e	1	38	9364QFLB	Q - c	1	40	9822B	B - c	1	20
9102FLB	B - c	1	14	9223	S - e	1	38	9364UFLB	B - c	1	40	9822KB	B - c	1	20
9102KB	B - c	1	14	9224	S - e	1	38	9367FLB	B - c	1	40	9823B	B - c	1	22
9106B	B - d	1	24	9226	S - e	1	38	9367QFLB	Q - c	1	40	9823KB	B - c	1	22
9106QB	Q - d	1	24	9235B	B - c	1	16	9369FLB	B - c	1	40	9823QB	Q - c	1	22
9107B	B - c	1	12	9235QB	Q - c	1	16	9390B	B - c	1	22	9828B	B - g	1	28
9107FLB	B - c	1	12	9250B	B - c	1	16	9390FLB	B - c	1	22	9828WB	W - g	1&2	28
9107QB	Q - c	1	12	9250KB	B - c	1	16	9390KB	B - c	1	22	9829B	B - c	1	18
9108B	B - d	1	24	9250QB	Q - c	1	16	9402B	MF - CsTe	2	34	9829QB	Q - c	1	18
9110FLB	B - e	1	38	9256B	B - d	1	26	9403B	MF - CsI	2	34	9845B	B - c	1	36
9110V02	B - e	1	38	9256KB	B - d	1	26	9405B	MF - RbTe	2	34	9845KB	B - c	1	36
9110V15	B - e	1	38	9265B	B - c	1	20	9406B	MF - c	2	34	9850B	B - f	1	30
9110V16	B - e	1	38	9265FLB	B - c	1	20	9407B	MF - a	2	34	9863/100B	B - f	1	32
9111B	B - c	1	12	9265KB	B - c	1	20	9408B	MF - f	2	34	9863/100KB	B - f	1	32
9111FLB	B - c	1	12	9265XXXB	B - c	1	20	9422B	MF - CsTe	2	34	9863/350B	B - f	1	32
9111WB	W - c	2	12	9266B	B - c	1	16	9422QB	Q - CsTe	2	34	9863/350KB	B - f	1	32
9112B	B - d	1	24	9266FLB	B - c	1	16	9423B	MF - CsI	2	34	9878B	B - e	1	38
9112FLB	B - d	1	24	9266KB	B - c	1	16	9424B	MF - KBr	2	34	9879B	B - f	1	32
9112WB	W - d	1&2	24	9266QB	Q - c	1	16	9425B	MF - RbTe	2	34	9888B	B - e	1	38
9113B	B - f	1	28	9266XXXB	B - c	1	16	9426B	MF - c	2	34	9893/350B	B - c	1	18
9113FLB	B - f	1	28	9269B	B - d	1	26	9427B	MF - f	2	34	9893/350KB	B - c	1	18
9113WB	W - f	2	28	9269KB	B - d	1	26	9428B	MF - c	2	34	9900B	B - d	1	24
9114B	B - c	1	12	9272B	B - c	1	36	9442B	B - d	1	24	9902B	B - d	1	26
9114FLB	B - c	1	12	9273B	B - c	1	36	9442QB	Q - d	1	24	9902FLB	B - d	1	26
9116B	B - d	1	24	9274B	B - c	1	36	9442WB	W - d	1&2	24	9902KB	B - d	1	26
9116WB	W - d	1&2	24	9275B	B - c	1	36	9490B	B - d	1	26	9902XB	B - d	1	26
9124B	B - d	1	24	9276B	B - c	1	36	9490KB	B - d	1	26	9903KB	B - d	1	26
9124QB	Q - d	1	24	9302B	B - c	1	20	9524B	B - d	1	24	9924B	B - d	1	24
9125B	B - c	1	12	9302FLB	B - c	1	20	9558B	B - f	1	30	9924QB	Q - d	1	24
9125QB	Q - c	1	12	9302KB	B - c	1	20	9558QB	Q - f	1	30	9939B	B - d	1	26
9125WB	W - c	2	12	9305FLB	B - c	1	20	9658B	B - f	1	30	9939KB	B - d	1	26
9128B	B - c	1	14	9305KB	B - c	1	20	9670B	B - f	1	28	9954B	B - d	1	26
9128QB	Q - c	1	14	9306FLB	B - c	1	20	9727B	B - e	1	38	9954KB	B - d	1	26
9130/100B	B - f	1	28	9306KB	B - c	1	20	9780B	W - a	2	12	9956B	B - d	1	26
9130/350B	B - f	1	28	9307B	B - f	1	32	9781B	W - a	2	12	9956KB	B - d	1	26
9131/100B	B - c	1	14	9311FLB	B - f	1	32	9783B	Q - a	2	12	9972B	B - f	1	28
9134B	B - c	1	14	9311KB	B - f	1	32	9789B	B - c	1	16	9972KB	B - f	1	28
9136B	B - f	1	28	9312KB	B - f	1	32	9789QB	Q - c	1	16	B29B02H	B - c	1	12
9142B	B - c	1	14	9312WKB	W - f	2	32	9798B	B - f	1	28	B29B03H	B - c	1	12
9142QB	Q - c	1	14	9313QFLB	Q - c	1	40	9798QB	Q - f	1	28	B29B06H	B - c	1	12
9142WB	W - c	2	14	9313UFLB	B - c	1	40	9807B	B - c	1	18	B38B01S	B - c	1	14
9143B	B - c	1	14	9318B	B - c	1	20	9813B	B - c	1	18	B38B01W	B - c	1	14
9143WB	W - c	2	14	9318KB	B - c	1	20	9813KB	B - c	1	18	B51D03S	B - c	1	18
9201B	B - f	1	30	9325FLB	B - c	1	40	9813QB	Q - c	1	18	B51D03W	B - c	1	18
9201KB	B - f	1	30	9325QFLB	Q - c	1	40	9814B	B - c	1	18	PB29B03H	B - c	1	12
9202B	B - f	1	30	9326FLB	MF - c	2	40	9814KB	B - c	1	18				
9202QB	Q - f	1	30	9330B	B - c	1	22	9815B	B - c	1	18				
9205B	B - c	1	16	9330KB	B - c	1	22	9815KB	B - c	1	18				
9213FLB	B - c	1	40	9354FLB	B - c	1	22	9816B	B - f	1	30				

11. Terms of guarantee and RoHS compliance

terms of guarantee

Subject to the following provisions ET Enterprises Limited ("the Company") guarantees at its election but at its expense either to replace or repair or refund the price paid for any product which by reason of defect in workmanship or materials fails to perform in accordance with the published specification in force at the time of delivery of such product during the specified guarantee period.

- All products described in this brochure except where otherwise stated are guaranteed for twelve months from the date of delivery
- Responsibility is limited to the product supplied and no liability is accepted for
 - Consequential loss or damage
 - Failure of associated equipment (whether or not supplied or approved by the Company).
 - Installation or use of the product otherwise than in accordance with instructions or recommendations issued by the Company.
 - Defects caused by or resulting from accident or abnormal working conditions occurring after the product is modified except in circumstances expressly approved in writing by or on behalf of the Company.

3 All claims arising under this guarantee must be notified to the Company forthwith upon the happening of the event giving rise to the claim. Products shall only be returned to the Company if it shall so direct. In such event responsibility for safe transit, cost of shipment and, in the event of claims proving not to be substantiated, the cost of re-delivery shall be borne by the customer. This guarantee represents the total liability of the Company in regard to defect or implied conditions warranty statement or representation whether arising under statute or otherwise all or any of which are hereby expressly excluded.

damage in transit

Any claim for damage in transit shall be made directly to the carrier immediately upon receipt, and notified to the Company as soon as possible and in any case within five days

RoHS compliance

Most of the products in this brochure are RoHS compliant. Please refer to our website for latest information.

warning

High voltage used by these products presents a shock hazard. They should be installed and serviced only by qualified personnel and operated in accordance with the operating instructions.

Contact

ET Enterprises Limited
Riverside Way,
Uxbridge, UB8 2YF , UK
Tel: +44 (0)1895 200 880
Fax: +44 (0)1895 270 873
Email: sales@et-enterprises.com
www.et-enterprises.com

Electron Tubes
100 Forge Way, Unit F,
Rockaway, NJ 07866, USA
Tel: (973) 586 9594
Toll free: (800) 521 8382
Fax: (973) 586 9771
Email: sales@electrontubes.com
www.electrontubes.com

