

Amperex®

SCIENTIFIC PRODUCTS

- ▀ Photomultiplier Tubes
 - ▀ Radiation Counter Tubes
 - ▀ Channel Electron Multipliers
- ▀ Coaxial Thermocouple and Heater Wire
 - ▀ Semiconductor Radiation Detectors
 - ▀ Rectifier Stacks
- ▀ X-Ray Components

Amperex[®] Electronic Corporation...

is a pioneer in the development of industrial electronic components and for four decades has been producing high quality devices for industrial, military and commercial equipment manufacturers.

Creative engineering and precision manufacturing have been responsible for a steady growth in the facilities and operations of Amperex. Founded in 1932, the Company originally manufactured special purpose tubes. Today, the Hicksville Division of Amperex manufactures and markets computer components, instrumentation components, microwave devices, scientific products, industrial power components, and communication components.

This catalog is one in a series of six containing condensed technical data on these products. The contents of this catalog as well as the others in the series is listed below:

COMMUNICATION COMPONENTS

RF POWER TRANSISTORS
RF POWER TUBES (LARGE)
RF POWER TUBES (SMALL)
TV TETRODE CAVITIES
TEMPERATURE COMPENSATED—
CRYSTAL OSCILLATORS
VACUUM CAPACITORS
MICROWAVE DIODES AND ASSEMBLIES
RF CIRCULATORS
RECTIFIERS
KLYSTRONS

SCIENTIFIC PRODUCTS

PHOTOMULTIPLIER TUBES
RADIATION COUNTER TUBES
CHANNEL ELECTRON MULTIPLIERS
COAXIAL THERMOCOUPLE AND HEATER WIRE
SEMICONDUCTOR RADIATION DETECTORS
RECTIFIER STACKS
X-RAY COMPONENTS

MICROWAVE DEVICES

MICROWAVE DIODES AND ASSEMBLIES
INDUSTRIAL MAGNETRONS
RADAR TUBES
RECTIFIER STACKS
KLYSTRONS

INDUSTRIAL POWER COMPONENTS

RF POWER TUBES (LARGE)
VACUUM CAPACITORS
RECTIFIER STACKS
INDUSTRIAL MAGNETRONS
MERCURY RECTIFIERS
THYRATRONS
IGNITRONS

INSTRUMENTATION COMPONENTS

TEMPERATURE COMPENSATED—
CRYSTAL OSCILLATORS
REED SWITCHES
TRIGGER TUBES
PREMIUM QUALITY TUBES

COMPUTER COMPONENTS

REED SWITCHES
TEMPERATURE COMPENSATED—
CRYSTAL OSCILLATORS
TRIGGER TUBES

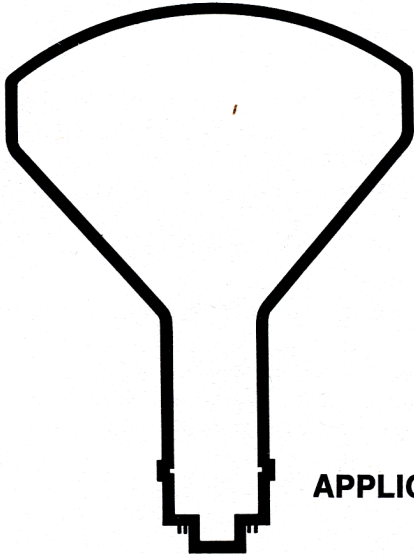
The Hicksville Division...



occupies seven acres in Hicksville, Long Island, New York and contains 140,000 square feet of manufacturing space and 17,000 square feet devoted to research and development activities.

Amperex is a wholly owned subsidiary of the North American Philips Corporation, an affiliation that supplements its general capabilities in electronics technology and gives it ready access to the basic product technology and international research facilities of the renowned N.V. Philips of Holland.

Photomultiplier Tubes



APPLICATIONS

GENERAL PURPOSE scintillation counters health physics and survey instruments industrial applications	53AVP XP1030 XP1011* XP1115*	54AVP XP1110 XP1015* 57AVP	150AVP XP1180 XP1032	XP1000 XP1006 XP1034	
GAMMA- AND X-RAY SPECTROMETRY	XP2000 XP1010 XP1180	XP2030 XP1031 153AVP	XP1001 54AVP/SP		
TOTAL BODY COUNTERS GAMMA CAMERAS	54AVP XP1030	54UVP XP1031	57AVP XP1032	XP2030	
SINGLE PHOTON AND TRITIUM COUNTING	56AVP/03 56DVP/03	XP1230	56DUVP/03		
FAST COINCIDENCE TECHNIQUES CERENKOV DETECTORS	XP1210 56DUVP XP1020	56AVP 58AVP 60DVP XP1033	56AVP/05 58UVP PM2106	56UVP 60AVP 56DVP 57AVP	58DVP XP1021 XP1023
OPTICAL SPECTROMETRY PHOTOMETRY COLORIMETRY	53AVP 56DVP XP1000 XP1110 XP1116* XP1015*	53UVP 150AVP XP1002 XP1111 XP1117* XP1016*	54UVP 150CVP XP1003 XP1113 XP1118 PM2007	56CVP 150UVP XP1004 XP1114 XP1180	56DUVP 56TUVP XP1005 XP1115* XP1011*
FLYING SPOT SCANNERS	150AVP XP1000	150CVP XP1002	53AVP XP1005	54AVP	
LASER DETECTION	PM2007 56TVP 56TUVP	56CVP XP1116*	56TVP XP1117*	150CVP XP1002	XP1016* XP1003
SPACE RESEARCH	XP1011 XP1115	XP1015 XP1116	XP1016 XP1117		

*Ruggedized

Photomultiplier Tubes (Continued)

RUGGEDIZED PHOTOMULTIPLIER TUBES

These photomultipliers have been designed to operate under conditions of very severe shock and vibration, such as found in mobile equipment, rockets, satellites, etc. They are available in a variety of photocathodes, and in two ruggedness classes.

CLASS I: These are ruggedized tubes that will withstand the following:

Shock: 30g, half-wave sinusoidal, 11ms duration, 3 shocks in each of 3 orthogonal axes.

Vibration: 5 to 20g, 20 to 2000Hz, 30 min. duration in each of 3 orthogonal axes.

CLASS II: These are specially-designed extremely rugged

photomultipliers, with short connections through the sides of the tube for mechanical rigidity. They will withstand the following:

Shock: 100g, 11ms duration, 3 shocks in each of 3 orthogonal axes.

Vibration: 30g, 20 to 2000Hz, 20 sec. duration in each of 3 orthogonal axes.

Acceleration: 45g, 30 sec. duration in each of 3 orthogonal axes.

All Class II types except XP1220 come potted in soft rubber, with a voltage divider inside. However, they are available without the potting; add suffix /00 to the type number.

CLASS I		
SPECTRAL RESPONSE	NUMBER OF STAGES	TYPE
S 1 (C)	10	XP1116
S 11 (A)	10	XP1115
S 20 (T)	9	XP1117

CLASS II										
WINDOW	PHOTOCATHODE		SPECTRAL DOMAIN (nm)	NUMBER OF STAGES	TYPE	QUANTUM EFFICIENCY AT WAVELENGTH (nm)		DARK CURRENT AT GAIN OF 10 ⁶	PHOTO-CATHODE DIAMETER (mm)	DIAMETER X LENGTH (mm)
Sapphire	S4	opaque	145-680	12	PM401L	23%	410	4 nA	10	34 x 105
Borosilicate Glass	S11 (A)	semi-transparent	320-680	10	PM401F	20%	420	2	13	34 x 105
				11	XP1220	15%	420	2	13	25 x 95
					PM402F	15%	410	2	23	34 x 105
	S20 (T)	semi-transparent	320-800	11	PM450FQ**				40	
					PM443F	25%	420	0.4	44	65 x 140
				12	PM450FH*	4%	656.3	0.2	40	66 x 170
					PM404F	25%	420	0.2	23	34 x 105
Sb-K-Cs (D)	opaque	320-800	12	PM404L	26%	420	0.04	10	34 x 105	
	semi-transparent	320-650	12	PM403F	20%	410	0.1	23	34 x 105	
Sb-Na-K S24	semi-transparent	320-640	12	PM406F				23		
Sapphire	Te Cs (SB)	semi-transparent	145-350	12	PM405F	7%	253.7	0.04	23	34 x 105
		opaque	145-350	12	PM405L	18%	253.7	0.02	10	34 x 105
Lithium Fluoride	Cs I	opaque	105-220	14	PM423L	20%	121.6	0.003	10	34 x 140
		semi-transparent	105-250	14	PM422F	7%	121.6	0.003	10	34 x 140
					PM432F	8%	121.6	0.006	28	51 x 140
	KBr	opaque	105-180	14	PM425L	20%	121.6	0.003	10	34 x 140
		semi-transparent	105-180	14	PM425F	5%	121.6	0.003	10	34 x 140

*This photomultiplier consists of two semi-circular photocathodes separated by a distance of 1mm.

**This photomultiplier consists of a circular photocathode divided into four quarters, each separated by a distance of 1mm.

Photomultiplier Tubes (Continued)

HEAD-ON TYPES

NOMINAL TUBE DIAMETER INCHES	SPECTRAL RESPONSE	NUMBER OF STAGES	TYPE	TYPICAL CHARACTERISTICS				DARK CURRENT		RISE TIME nS	CURRENT LINEARITY	ABSOLUTE-MAXIMUM RATINGS	
				PHOTOCATHODE		ANODE		AVERAGE (MAXIMUM) VALUE μ A	AT A/lm or GAIN or SUPPLY VOLTAGE			SUPPLY VOLTAGE V	CONTINUOUS ANODE CURRENT mA
				LUMINOUS μ A/lm	RADIANT mA/W	LUMINOUS A/lm or GAIN (AVG. VALUE)	AT SUPPLY VOLTAGE V (AVG. VALUE)						
3/4	A (S 11)	10	XP1110	60	60	(250)	1800	(0.1)	30	2.6	30	1800	0.2
	A (S 11)	6	XP1113	70	60	(0.7)	1200	(0.01)	1200V	2.6	30	1200	0.2
	A (S 11)	4	XP1114	70	60	(0.015)	800	(0.0001)	800V	2	30	900	0.2
	A (S 11)	10	XP1115	60	60	(250)	1800	0.02 (0.1)	30	2.6	30	1800	0.2
	C (S 1)	10	XP1116	20	2	(20)	1800	(10)	10	2.6	30	1800	0.03
	T (S 20)	9	XP1117	100	60	(100)	1800	(0.1)	30	3	30	1800	0.2
	U (S 13)	10	XP1118	70	60	(250)	1800	0.02 (0.1)	30	3	30	1800	0.2
	D	9	XP1119	70	60	(100)	1800	(0.1)	30	3	30	1800	0.2
1	A (S 11)	10	XP1180	65	50	(200)	1800	0.005 (0.1)	30	4	10	1800	0.2
1 1/2	A (S 11)	10	150AVP	70	60	(700)	1800	0.01 (0.05)	60	4	100	1800	0.1
	C (S 1)	10	150CVP	25	2.5	(100)	1800	(10)	20	4	10	1800	0.03
	D	10	150DVP	70	60	(700)	1800	0.01 (0.05)	60	4	100	1800	0.1
	U (S 13)	10	150UVP	70	60	(700)	1800	0.01 (0.05)	60	4	100	1800	0.1
	A (S 11)	10	XP1010	80	65	(700)	1800	0.01 (0.05)	60	4	100	1800	0.1
	A (S 11)	10	XP1011	70	60	(700)	1800	0.01 (0.05)	60	4	100	1800	0.1
	T (S 20)	10	XP1016	140	13	(400)	1800	0.05	60	4	100	1800	0.2
	S-20R	10	PM2007	210	30	(500)	1800	0.003	60	3.5	100	1800	0.1
2	A (S 11)	14	56AVP	65	55	10 ⁸	(2200)	0.5 (5)	10 ⁸	2	300	2500	0.2
	C (S 1)	10	56CVP	25	2	20	(2000)	(10)	20	2	300	3000	0.03
	D	14	56DVP		75	10 ⁸	(2100)	0.05 (0.2)	10 ⁸	2	300	2500	0.2
	DU	14	56DUVP		75	10 ⁸	(2100)	0.05 (0.2)	10 ⁸	2	300	2500	0.2
	SB	14	56SBVVP		15	10 ⁸	(2100)	0.1	10 ⁸	2	300	2500	0.2
	T (S 20)	14	56TVP	115	65	10 ⁸	(2200)	(5)	10 ⁸	2	300	2750	0.2
	TU	14	56TUVVP	115	65	10 ⁸	(2200)	(5)	10 ⁸	2	300	2750	0.2
	U (S 13)	14	56UVP	65	55	10 ⁸	(2200)	0.5 (5)	10 ⁸	2	300	2500	0.2
	D	12	PM2106		85	10 ⁸	2600	(0.5)	10 ⁸	<1.8	250	3000	0.2
	A (S 11)	12	XP1020	65		10 ⁸	(2500)	(5)	10 ⁸	<1.8	300	3000	0.1
	A (S 11)	12	XP1021	65	55	10 ⁸	(2500)	(5)	10 ⁸	<1.8	300	3000	0.2
	U (S 13)	12	XP1023	65	55	10 ⁸	(2500)	(5)	10 ⁸	<1.8	300	3000	0.2
	A (S 11)	10	XP1210	45	45	10 ⁷	(4000)	(1)	10 ⁷	1.2	300	5000	0.2
	D	12	XP1230		80	10 ⁸	(2100)	(0.2)	10 ⁸	2.5	300	2600	0.1
2	A (S 11)	11	53AVP	70		(400)	1800	(0.05)	60		100	1800	0.1
	D	11	53DVP	70		(400)	1800	(0.05)	60		100	1800	0.1
	U (S 13)	11	53UVP	70		(400)	1800	(0.05)	60		100	1800	0.1
	D	10	XP2000	60	70	10 ⁶	(1800)	0.015	60	8	100	2000	0.2
	A (S 11)	10	XP1000	70	60	(350)	1800	0.015 (0.05)	100	4	100	1800	0.1
	T (S 20)	10	XP1002	150	70	(400)	1800	0.015 (0.05)	60	4	100	1800	0.1
	TU	10	XP1003	150	70	(350)	1800	0.015 (0.05)	60	4	100	1800	0.1
	U (S 13)	10	XP1004	70	60	(350)	1800	0.015 (0.05)	100	4	100	1800	0.1
	C (S 1)	10	XP1005	20	2	(100)	1800	(10)	20	4	10	1800	0.03
	D	10	XP1006	50	75	(250)	1800	0.02 (0.05)	60	4.8	100	1800	0.2
3	D	10	XP2030	60	70	10 ⁶	1800	0.015	60	9	100	2000	0.2
	A (S 11)	10	XP1030	70	60	(250)	1800	(0.2)	100	6	100	2000	0.1
	U (S 13)	10	XP1032	70	60	(250)	1800	(0.2)	100	6	100	2000	0.1
	D	10	XP1034	50	75	(250)	1800	0.02 (0.05)	60	6	100	1800	0.2

(continued)

Photo Multiplier Tubes (Continued)

HEAD-ON TYPES Continued

NOMINAL TUBE DIAMETER INCHES	SPECTRAL RESPONSE	NUMBER OF STAGES	TYPE	TYPICAL CHARACTERISTICS				DARK CURRENT		RISE TIME nS	CURRENT LINEARITY	ABSOLUTE-MAXIMUM RATINGS	
				PHOTOCATHODE		ANODE		AVERAGE (MAXIMUM) VALUE μ A	AT A/Im or GAIN or SUPPLY VOLTAGE			SUPPLY VOLTAGE V	CONTINUOUS ANODE CURRENT mA
				LUMINOUS μ A/Im	RADIANT mA/W	LUMINOUS A/Im or GAIN (AVG. VALUE)	AT SUPPLY VOLTAGE V (AVG. VALUE)						
5	A (S 11)	11	54AVP	60	50	(500)	1800	0.2 (0.5)	250	7	100	2000	0.1
	D	11	54DVP	60	50	(500)	1800	0.2 (0.5)	250	7	100	2000	0.1
	U (S 13)	11	54UVP	60	50	(500)	1800	0.2 (0.5)	250	7	100	2000	0.1
	A (S 11)	14	58AVP	70	60	10^8	(2400)	2 (12)	10^8	2	300	3000	0.2
	D	14	58DVP	70	75	10^8	(2250)	(2)	10^8	2	300	3000	0.2
	U (S 13)	14	58UVP	70	60	10^8	(2400)	2 (12)	10^8	2	300	3000	0.2
9	A (S 11)	11	57AVP	50	45	(250)	(1800)	(1)	60	5	100	2500	0.1
	A (S 11)	12	60AVP	50	45	10^8	(3000)	(20)	10^8	2.2	300	3500	0.2
	D	12	60DVP	65	70	10^8	(3300)	(1)	10^8	2.5	200	3700	0.1

SIDE-WINDOW TYPES

NOMINAL TUBE DIAMETER INCHES	SPECTRAL RESPONSE	NUMBER OF STAGES	TYPE	DYNODE STRUC- TURE	TYPICAL CHARACTERISTICS				DARK CURRENT		TIMING CHARACTERISTICS			LINEARITY		ABSOLUTE-MAX. RATINGS	
					PHOTOCATHODE		ANODE		AVERAGE (MAXIMUM) VALUE μ A	AT A/Im OR GAIN OR SUPPLY VOLTAGE	TRANSIT TIME nS	RISE TIME nS	TRANSIT TIME DIFFER- ENCE nS	HIGH GAIN mA	HIGH CURRENT mA	SUPPLY VOLTAGE V	CONTINU- OUS ANODE CURRENT mA
					LUMINOUS μ A/Im	RADIANT mA/W	LUMINOUS A/Im OR GAIN (AVG. VALUE)	AT SUPPLY VOLTAGE V (AVG. VALUE)									
1 1/8	S4	9	DX-448	C	60		120	1000	(0.2)	1000V						1250	1.0
3 1/2	S4	6	XP1143	I	40	40	10^4	(3500)	(6)	10^4	10	1.5		500	5000	7500	0.2

NOTES

- (1) XP1115, Ruggedized type with flying leads of nickel 0.1 x 1mm.
- (2) XP1010 and 53AVP/02, X-Ray selection with Fe-55 source and thin NaI(TL).
- (3) 56DVP/03, Selection for single photon counting and detection of ^{14}C and ^3H .
- (4) 56DUVP/03, Selection for single photon counting and de-

tection of ^{14}C and ^3H . The spectral response extends to the near ultra-violet.

- (5) XP1020, 100 Ω coaxial output.
- (6) XP1021 and XP1023, 50 Ω coaxial output.
- (7) XP1210, Special Socket No. 56040; 50 Ω coaxial output.
- (8) XP1143, 50 Ω coaxial output plus tube with metal container.

REMARK

There are also types 153AVP, 54AVP/Sp, 150AVP/Sp, XP1001, XP1031, 56AVP/Sp which are the versions for nuclear spectrometry of types 53AVP, 54AVP, 150AVP, XP1000, XP1030, and 56AVP respectively.

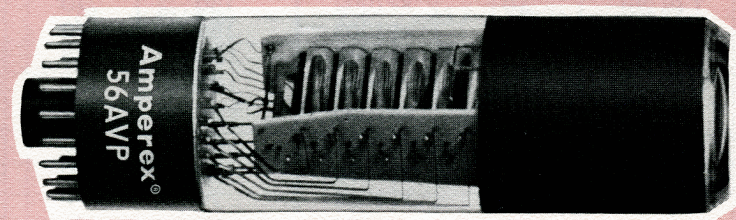
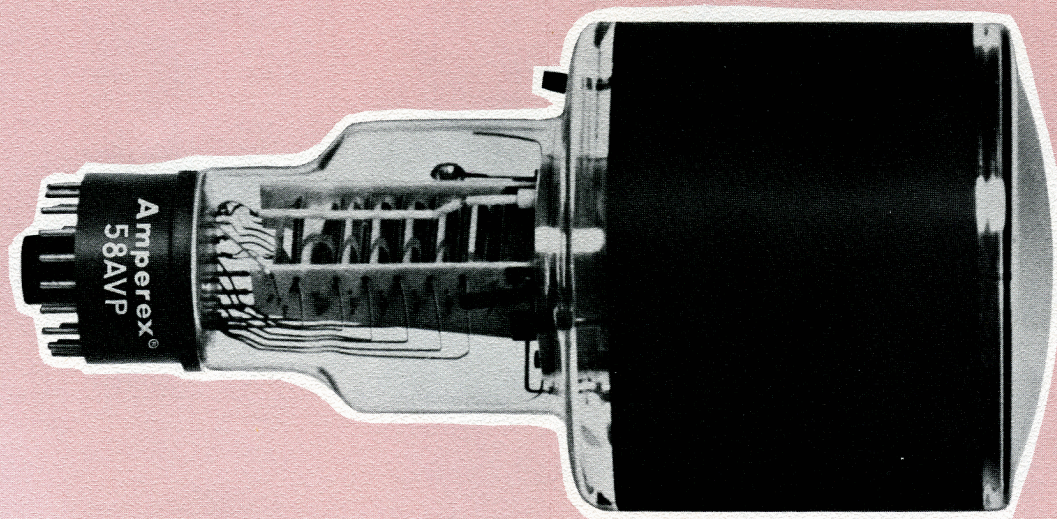
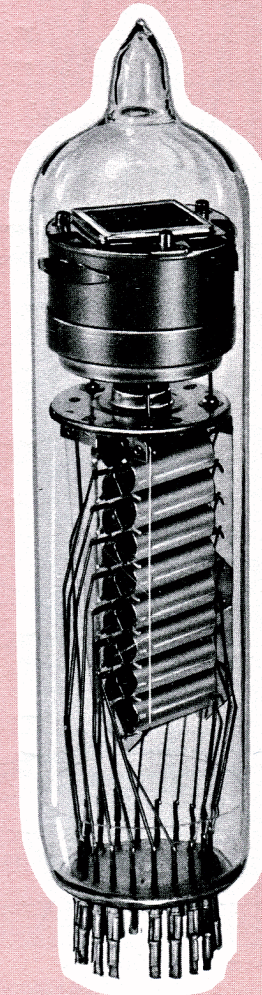


Photo Multiplier Tubes (Continued)

WINDOWLESS PHOTOMULTIPLIERS

TYPE	USEFUL SURFACE OF PHOTO-CATHODE CM ²	NO. OF STAGES CU-BE	SENSITIVITY		PHOTO-CATHODE	SPECTRAL DOMAIN nm	ENERGY FOR PARTICLE DETECTION KeV	MAXIMUM SUPPLY VOLTAGE KV	QUANTUM EFFICIENCY AT λ MAX.	DARK CURRENT AT 4000V
			GAIN	SUPPLY VOLTAGE V						
152 P2	0.4	11	3 x 10 ⁴	2500	Copper-Beryllium	UV λ < 140	> 10 IONS 0.1 to 10 Electrons	5	20% at 68nm	10 ⁻¹⁰ A
152 P2W3	0.4	15	10 ⁶	3000						
56 P17/2	4.8	17	10 ⁷	3500						
XP1121	4.8	17	5 x 10 ⁷	4000						
XP1123	4.8	17	5 x 10 ⁷	4000						
XP1131*	4.8	17	5 x 10 ⁷	4000						
50 P2	0.2	11	10 ⁶	3500	Nickel	UV λ < 150 Soft X-Rays λ > 0.2 E < 6.2 KeV	5	10% at 80nm	10 ⁻¹⁰ A	
56 P17/3	4.8	17	10 ⁷	3500						
XP1120	4.8	17	5 x 10 ⁷	4000						
XP1122	4.8	17	5 x 10 ⁷	4000						
XP1130*	4.8	17	5 x 10 ⁷	4000						

*BAKEABLE



56P17

Photomultiplier Tubes (Continued)

SPECTRAL RESPONSE CURVES OF THE PRINCIPAL PHOTOCATHODES

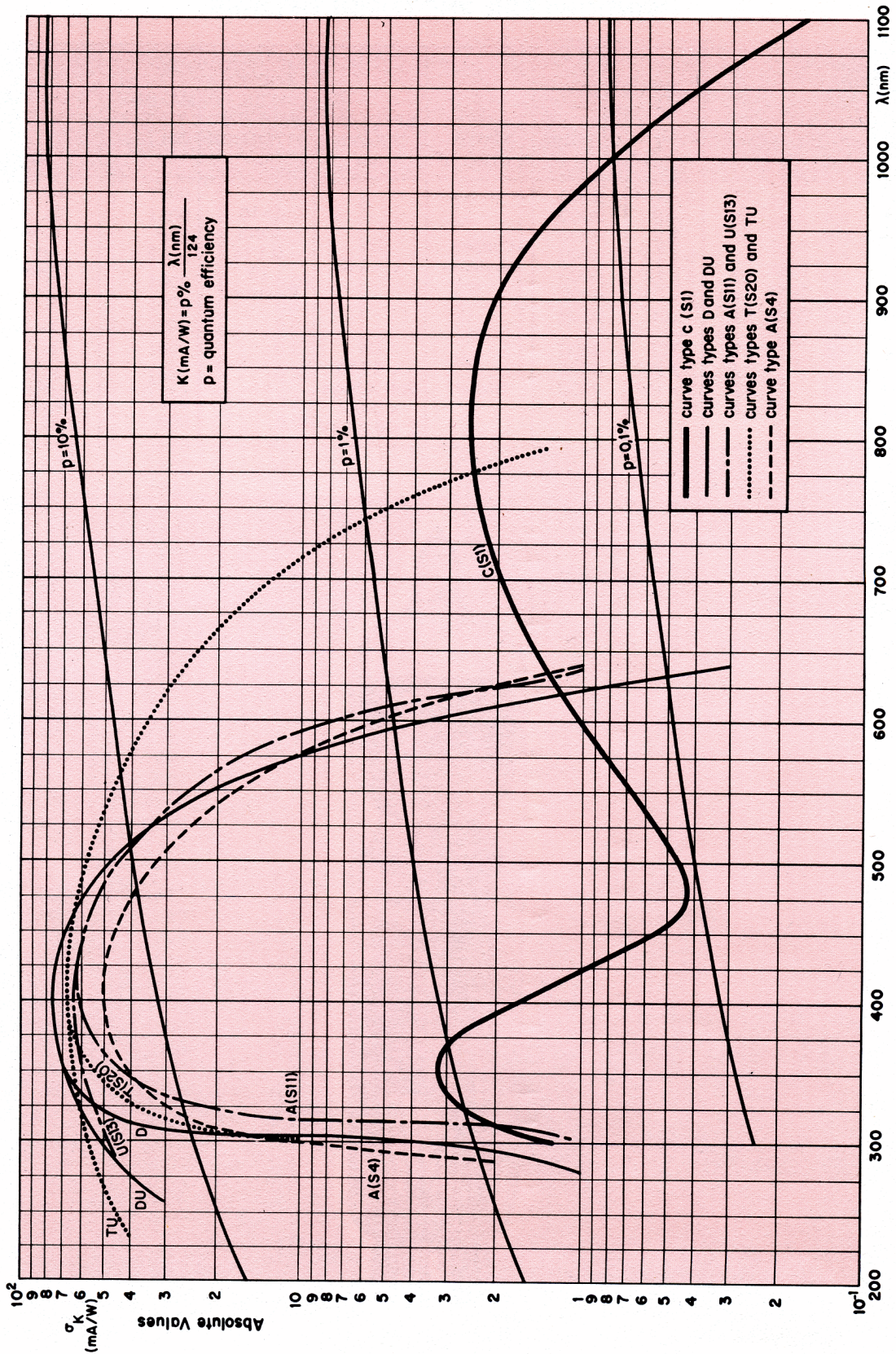


Photo Multiplier Tubes (Continued)

DIMENSIONS

TYPE	DIMENSIONS			NUMBER OF PINS	TYPE OF SOCKET
	LENGTH MAX. (mm)	LENGTH MAX. (mm) WITHOUT PINS	DIAM. MAX. (mm)		
XP1110	105	91	20	12	FE 1004
XP1113	70	60	22	9	noval
XP1114	65	55	22	9	noval
XP1115	105 + Leads	91	20	12	
XP1116	105	91	20.5	12	FE 1004
XP1117	105	91	20.5	12	FE 1004
XP1118	105	91	20	12	FE 1004
XP1119	105	91	20.5	12	FE 1004
XP1180	98	88	25	13	B8700/67
150AVP	127	114	39.5	12	FE 1002
150CVP	127	114	39.5	12	FE 1002
150DVP	127	114	39.5	12	FE 1002
150UVP	127	114	39.5	12	FE 1002
XP1010	127	114	39.5	12	FE 1002
XP1011	127	114	39.5	12	FE 1002
XP1016	127	114	39.5	12	FE 1002
PM2007	127	114	39.5	12	FE 1002
56AVP	192	175	52.5	20	FE 1003
56CVP	174	157	52.5	20	FE 1003
56DVP	192	175	53.5	20	FE 1003
56DUVP	192	175	53.5	20	FE 1003
56SBUVP	192	175	53.8	20	FE 1003
56TVP	192	175	52.5	20	FE 1003
56TUVP	192	175	52.5	20	FE 1003
56UVP	192	175	52.5	20	FE 1003
PM2106	192	175	55	20	FE 1003
XP1020	197	180	55	20	FE 1003
XP1021	207	180	55	20	FE 1003
XP1023	207	180	55	20	FE 1003
XP1210	177		68		56040
XP1230	141	126	53.5	21	FE 1003
53AVP	153	134	52.5	14	FE 1001
53DVP	153	134	52.5	14	FE 1001
53UVP	153	134	52.5	14	FE 1001
XP2000	148	129	52.5	14	FE 1001
XP1000	148	123	52.5	14	FE 1001
XP1002	148	123	52.5	14	FE 1001
XP1003	148	123	52.5	14	FE 1001
XP1004	148	123	52.5	14	FE 1001
XP1005	148	123	52.5	14	FE 1001
XP1006	148	123	52.5	14	FE 1001
PM2034	160	142	76.2	14	FE 1001
XP1030	159	140	75.5	14	FE 1001
XP1032	199	179	75.5	14	FE 1001
XP1034	159	140	75.5	14	FE 1001
54AVP	235	215	130	14	FE 1001
54DVP	235	215	130	14	FE 1001
54UVP	235	215	130	14	FE 1001
58AVP	281	264	136.5	20	FE 1003
58DVP	281	264	136.5	20	FE 1003
58UVP	340	323	145	20	FE 1003
57AVP	328	301	231.5	14	FE 1001
60AVP	318	301	231.5	20	FE 1003
60DVP	318	301	231.5	20	FE 1003
DX-448	78	66	30.1	12	Compactron
XP1143	160	123.5	90	8	

TECHNICAL DATA FOR SOCKETS

Insulation Material: Diallyl—Phthalate
 Contacts: Silver-Plated Phosphor Bronze
 Contact Resistance: $< 0.05\Omega$

Insulation Resistance between two successive contacts:

FE1001, FE1002, FE1003 : $> 10^6 M\Omega$
 FE1004 : $> 5 \times 10^3 M\Omega$

Maximum Working Temperature:

FE1001 : $60^\circ C$
 FE1002, FE1003 : $80^\circ C$
 FE1004 : $100^\circ C$

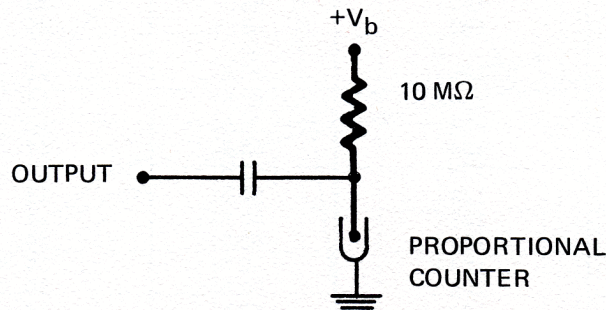
Radiation Counter Tubes

X-RAY PROPORTIONAL COUNTERS

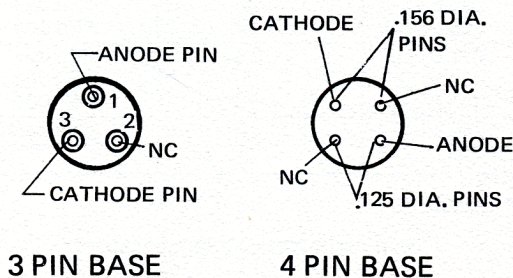
TYPE NUMBER	310PC 210*	300PC 452	303PC 331	303PC 431
Window Type Thickness (mg/cm ² or in.) Dimensions (in.) Material	end window .002 1/2 dia. Beryllium	side window 3-4 .812 x .25 Mica	side window .010 1.0 dia. Beryllium	side window .010 1.0 dia. Beryllium
Wall Material	Cr Fe	Cr Fe	Cu Ni	Cu Ni
Tube Dimensions Inside diameter (in.) Path length (in.) Max. diameter (in.) Max. overall length (in.)	1/2 1/2 1 1 3/4	25/32 13/16 1 49/32	1 7/8 2 2 8 1/8	1 7/8 2 2 8 1/8
Gas filling Gas pressure (cm Hg) Operating Voltage, B _v (V.) Max. resolution (Mn-K α) (%) (5.898 KeV) Tube Capacitance (pF) Weight (g)	A (org) 72 1250-1500 25 3 25	Xe (org) 34 1700-2000 20 4.5 135	Kr (org) 72 1700-2200 18 8 420	Xe (org) 72 1800-2400 18 8 420

*Other combinations of gas filling, gas pressure, window configuration, and window thickness available on request.

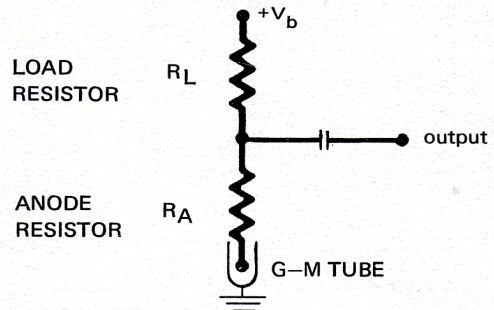
RECOMMENDED CIRCUIT FOR PROPORTIONAL COUNTERS



BASING DIAGRAMS



G-M TUBES RECOMMENDED CIRCUIT



Radiation Counter Tubes (Continued)

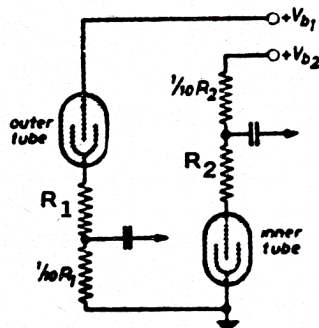
COSMIC-RAY GUARD TUBE FOR LOW-LEVEL β -COUNTING

TYPE NUMBER	18518
Application	In anti-coincidence with 18536
Wall Thickness (mg/cm ² or mm) Eff. length (mm) Outside diameter (mm) Material	1 mm 78 90 Cr Fe
Tube Dimensions Max. diameter (mm) Max. overall length (mm)	80 90
Gas-filling Max. starting voltage (V) Plateau (V) Maximum slope (%/100V) Maximum dead time (μ s) Maximum background (c/m)	NeA (halog.) 650 800-1200 ³⁾ 3 ³⁾ 1000 ³⁾ 70 ⁶⁾¹¹⁾
Recommended Resistance R_1 (M Ω) Tube capacitance (pF) Weight (g)	10 8 190

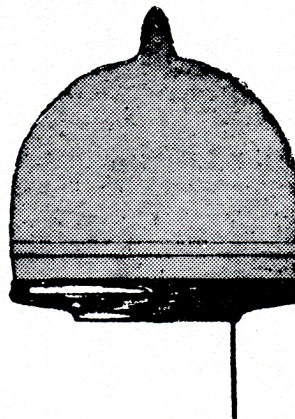
NOTES TO TABLES

- 1) Measured at 100 c/s and $R_A=10$ M Ω .
- 2) Measured at 100 c/s and $R_A= 2$ M Ω .
- 3) Measured at 50 c/s and $R_A=10$ M Ω .
- 4) Shielded with 5 cm Pb and 3 mm Al.
- 5) Measured at 100 c/s and $R_A=2.7$ M Ω .
- 6) Shielded with 10 cm Fe and 5 cm Hg (Fe outside).
- 7) Shielded with 5 cm Pb and 6 mm Al; 18520 unshielded: 90 c/m avg.
- 8) If the ambient temperature fluctuates greatly during operation, it is strongly recommended to keep the operation voltage at 500 V for type 18509.
- 9) Measured at 100 c/s and $R_A=5$ M Ω .
- 10) Unshielded: 160 c/m (avg.).
- 11) Max. background in a.c. combination 18536 - 18:2 c/m.

Recommended circuit



for anti-coincidence set 18536/18



Radiation Counter Tubes (Continued)

CYLINDRICAL COUNTERS

TYPE NUMBER	18529	18509	18550	18503	18552	18520	18545	18553	554N	560N
APPLICATION	γ -Count or Current ≤ 1000 r/h $\beta > 0.5$ MeV	γ -Count or Current ≤ 300 r/h $\beta > 0.5$ MeV	$\beta > 0.25$ MeV γ -Count or Current	γ	$\beta > 0.3$ MeV γ	γ	γ	$\beta > 0.3$ MeV γ	γ	γ
WALL Thickness (mg/Cm ² or mm) Eff. Length (Inches) Outside Diameter (Inches) Material	90 \pm 10 8mm 5mm Cr Fe	90 \pm 10 17.5mm 5mm Cr Fe	36 \pm 4 28mm 8mm Cr Fe	250 40mm 15mm Cr Fe	50 \pm 10 75mm 15.5mm Cr Fe	0.7mm 140mm 22.2mm Cr Fe	525 240mm 22.2mm Cr Fe	50 \pm 10 192mm 15.5mm Cr Fe	1.2mm $1\frac{1}{16}$ $1\frac{1}{32}$ Cr Fe Pt. Plt.	1.2mm $1\frac{1}{4}$ $1\frac{1}{32}$ Cr Fe Pt. Plt.
TUBE DIMENSIONS Max. Diameter (Inches) Max. Overall Length (Inches)	7mm 27mm	7mm 38mm	10mm 52mm	17mm 55mm	18mm 146mm	22.2mm 170mm	22.2mm 270mm	18mm 280mm	$1\frac{1}{32}$ $2\frac{1}{16}$	$1\frac{1}{32}$ $3\frac{1}{2}$
GAS FILLING (Halog.)	HeNe	HeNe	NeA	NeA	NeA	NeA	NeA	NeA	NeA	NeA
ELECTRICAL Max. Starting Voltage (V) Plateau Length (V) Max. Plateau Slope (%/100V) Max. Dead Time (μ s) Max. Background (c/m) Anode Resistor R _a (M Ω) Load Resistor R _L (M Ω) Tube Capacitance (PF) Weight (g)	400 500-650 ² 25 ² 20 ² 1 ⁴ >2 >0.2 0.5 1	375 500-650 ^{2,8} 15 ² 30 ² 2 ⁴ >2 >0.2 1 1	380 500-650 ⁹ 4 ⁹ 50 ⁹ 4 ⁴ >2 >0.2 1.1 1.2	325 375-600 ¹ 2 ¹ 100 ¹ 10 ⁴ 10 1 2 7	400 450-800 ² 2 ² 70 ² 30 ⁴ >1 >0.1 4 8	345 375-475 ⁵ 15 ⁵ 200 ⁵ 40 (avg.) ⁷ 2.7 2.7 4.5 75	350 380-480 ⁵ 10 ⁵ 200 ⁵ 75 ^{7,10} 2.7 2.7 10 135	400 450-800 ² 2 ² 150 ² 60 ⁴ >1 >0.1 8 15	475 500-650 8 75 15 >5 1 2.5 14	825 850-1050 8 50 15 >1 >0.1 2.5 14

CYLINDRICAL COUNTERS

TYPE NUMBER	160G	85NB3	75NB3	75NTB3	163G	90NB3	76NB3	912NB3	78L	79L
APPLICATION	γ	γ, β	γ	β, γ	γ	β, γ	γ	β, γ	γ	γ
WALL Thickness (mg/Cm ² or mm) Eff. Length (Inches) Outside Diameter (Inches) Material	0.5mm $5\frac{1}{2}$ $1\frac{3}{32}$ Cr Fe	30-40 $\frac{3}{4}$ $\frac{5}{8}$ Cr Fe	0.25mm $2\frac{1}{16}$ $\frac{5}{8}$ Cr Fe	30-40 $2\frac{1}{16}$ $\frac{5}{8}$ Cr Fe	0.25mm $3\frac{3}{16}$ $\frac{5}{8}$ Cr Fe Pt. Plt.	30-40 $3\frac{1}{2}$ $\frac{5}{8}$ Cr Fe	0.25mm $5\frac{3}{4}$ $\frac{5}{8}$ Cr Fe	30-40 $8\frac{1}{16}$ $\frac{5}{8}$ Cr Fe	0.25mm 8 $\frac{5}{8}$ Cr Fe	0.25mm $12\frac{3}{16}$ $\frac{5}{8}$ Cr Fe
TUBE DIMENSIONS Max. Diameter (Inches) Max. Overall Length (Inches)	$1\frac{3}{32}$ $8\frac{1}{8}$	$\frac{5}{8}$ $3\frac{7}{8}$	$\frac{5}{8}$ $4\frac{9}{16}$	$\frac{5}{8}$ $4\frac{9}{16}$	$\frac{5}{8}$ $5\frac{1}{2}$	$\frac{5}{8}$ $5\frac{9}{16}$	$\frac{5}{8}$ $7\frac{7}{16}$	$\frac{5}{8}$ $11\frac{1}{4}$	$\frac{5}{8}$ 11	$\frac{5}{8}$ $14\frac{1}{4}$
GAS FILLING (Halog.)	NeA	NeA	NeA	NeA	NeA	NeA	NeA	NeA	NeA	NeA
ELECTRICAL Max. Starting Voltage (V) Plateau Length (V) Max. Plateau Slope (%/100V) Max. Dead Time (μ s) Max. Background (c/m) Anode Resistor R _a (M Ω) Load Resistor R _L (M Ω) Tube Capacitance (PF) Weight (g)	630 700-850 8 75 25 1 5.0 28	825 850-1050 15 100 50 1 3 15	825 850-1050 15 100 50 1 3.5 17	825 850-1050 15 100 50 1 3.5 15	425 450-650 6 100 50 10 1 4 23	825 875-1075 10 100 50 1 1 4 15	825 875-1075 10 100 50 1 4.5 27	825 875-1075 10 100 75 1 6 20	400 450-700 6 100 65 10 1 6 34	400 450-700 6 100 100 10 1 8 45

Radiation Counter Tubes (Continued)

END WINDOW COUNTERS

TYPE NUMBER	18504	18505	18506	18526	18515	18536	18546	500N
APPLICATION	β, γ	α, β, γ	β, γ	α, β, γ	α, β	α, β	β	α, β, γ
WINDOW								
Thickness (mg/Cm ²)	2-3	1.5-2	2.5-3.5	1.5-2	1.5-2	1.5-2	3.5-4	1-1.5
Effective Dia. (mm)	9	19.8	27.8	27.8	19.8	27.8	51	$\frac{1}{4}$
Inches								Mica
Material	Mica	Mica	Mica	Mica	Mica	Mica	Mica	Mica
WALL								
Thickness (mg/Cm ² or mm)	250	1.2 mm	1.3 mm	1.3 mm	1.2 mm	1.2 mm	1.25 mm	1.2 mm
Eff. Length (mm)	40	37	37	37	13	18	26	$1\frac{5}{16}$
Inches								$1\frac{1}{32}$
Outside Diameter (mm)	15	22	30.5	30.5	22	30.5	54	$1\frac{1}{32}$
Inches								Cr Fe
Material	Cr Fe	Cr Fe	Cr Fe	Cr Fe	Cr Fe	Cr Fe	Cr Fe	Cr Fe
TUBE DIMENSIONS								
Max. Diameter (mm)	17	25.9	34	34	26	34	58.5	$1\frac{1}{32}$
Inches								$2\frac{1}{16}$
Max. Overall Length (mm)	55	57	57	57	30	34	45	$2\frac{1}{16}$
Inches								
GAS FILLING								
Halog.	NeA	NeA	NeA	NeA	NeA	NeA	NeA	NeA
ELECTRICAL								
Max. Starting Voltage (V)	325	350	375	375	350	375	400	400
Plateau Length (V)	375-600 ¹	450-700 ¹	450-750 ¹	450-750 ¹	500-700 ¹	500-750 ¹	700-1100 ⁹	450-650
Max. Plateau Slope (%/100V)	2 ¹	2 ¹	2 ¹	2 ¹	3 ¹	3 ¹	4 ⁹	6
Max. Dead Time (μ s)	100 ¹	160 ¹	180 ¹	200 ¹	70 ¹	70 ¹	45 ⁹	75
Max. Background (c/m)	10 ⁴	15 ⁴	25 ⁴	20 ⁴	5 ^{6.11}	10 ^{6.11}	30 ^{6.11}	15
Anode Resistor Ra (M Ω)	10	>2	>2	>2	>2	>4.7	>4.7	10
Load Resistor Rl (M Ω)	1	>0.2	>0.2	>0.2	>0.2	>04.7	>0.47	1
Tube Capacitance (PF)	2	2.5	3.5	3.5	1.5	1.3	5	2.5
Weight (g)	7	40	50	50	15	27	75	14

END WINDOW COUNTERS

TYPE NUMBER	150N	153C	155N	200LB	200NB	200CB	200HB	120NB
APPLICATION	β, γ	β, γ	β, γ	α, β, γ	α, β, γ	α, β, γ	α, β, γ	β, γ
WINDOW								
Thickness (mg/Cm ²)	1.9-2.2	3-4	3-4	1.5-2	1.9-2.2	1.9-2.2	1.9-2.2	5-6
Effective Dia. (mm)				27.8				$1\frac{7}{8}$
Inches	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$		$1\frac{3}{32}$	$1\frac{3}{32}$	$1\frac{3}{32}$	Mica
Material	Mica	Mica	Mica	Mica	Mica	Mica	Mica	Mica
WALL								
Thickness (mg/Cm ² or mm)	1.6 mm	1.6 mm	1.6 mm	1.3 mm	1.2 mm	1.2 mm	1.2 mm	1.4 mm
Eff. Length (mm)				37				$2\frac{3}{8}$
Inches	$4\frac{9}{32}$	$4\frac{9}{32}$	$4\frac{1}{8}$		$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	
Outside Diameter (mm)				30				2
Inches	$\frac{7}{8}$	$\frac{7}{8}$	$\frac{7}{8}$		$1\frac{3}{16}$	$1\frac{3}{16}$	$1\frac{3}{16}$	Cr Fe
Material	Cr Fe	Cr Fe	Cr Fe	Cr Fe	Cr Fe	Cr Fe	Cr Fe	Cr Fe
TUBE DIMENSIONS								
Max. Diameter (mm)				38.1				$2\frac{5}{16}$
Inches	1	1	1		$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{3}{8}$	
Max. Overall Length (mm)				110.3				$5\frac{3}{4}$
Inches	6	6	6		$4\frac{11}{32}$	$4\frac{11}{32}$	$4\frac{11}{32}$	
GAS FILLING								
Halog.	NeA	A	NeA	NeA	NeA	A	He (org.)	NeA

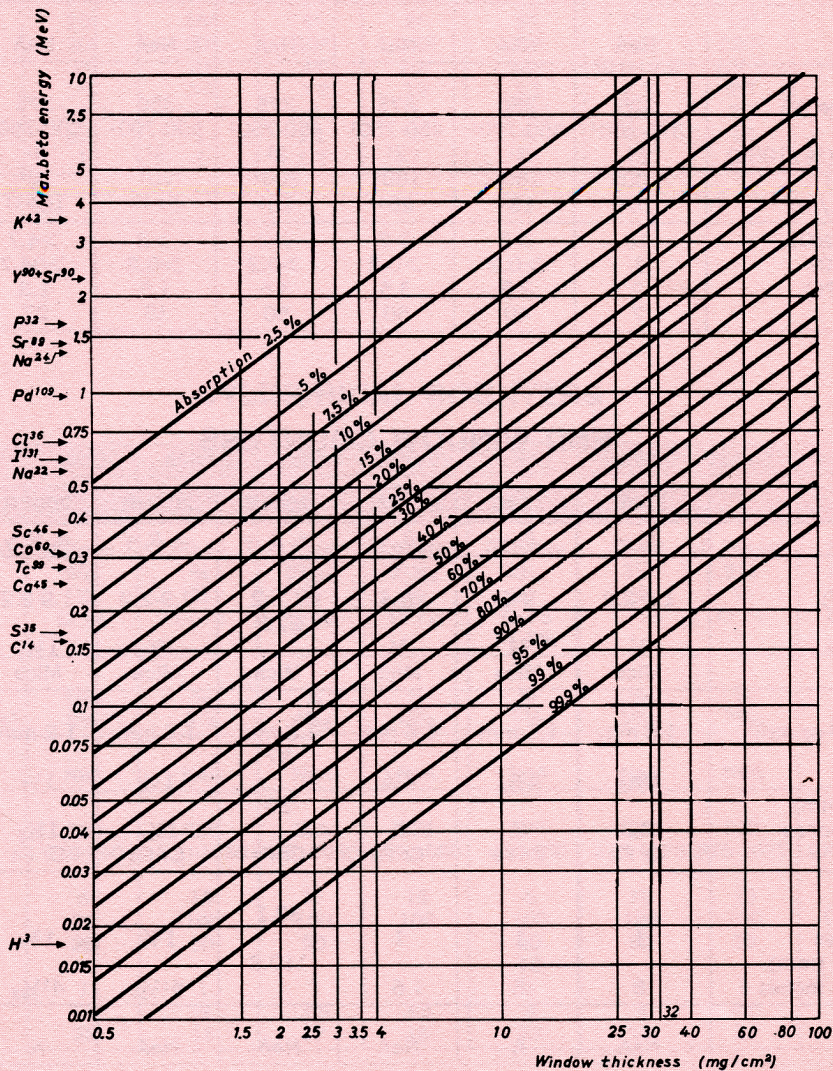
(continued)

Radiation Counter Tubes (Continued)

END WINDOW COUNTERS continued

TYPE NUMBER	150N	153C	155N	200LB	200NB	200CB	200HB	120NB
APPLICATION	β, γ	β, γ	β, γ	α, β, γ	α, β, γ	α, β, γ	α, β, γ	β, γ
ELECTRICAL								
Max. Starting Voltage (V)	825	1400	825	375	825	1100	1150	825
Plateau Length (V)	875-1075	1475-1875	875-1055	450-750	875-1075	1150-1450	1200-1450	875-1075
Max. Plateau Slope (%/100V)	10	8	10	2	10	10	2	10
Max. Dead Time (μ s)	150	150	75	200	200	200	200	300
Max. Background (c/m)	75	60	75	25	50	50	50	100
Anode Resistor R_a ($M\Omega$)			0	10				
Load Resistor R_L ($M\Omega$)	1	1	1	1	1	1	1	1
Tube Capacitance (PF)	2.6	3.5		3.5	2.5	2.5	2.5	3.5
Weight (g)	90	80		95	85	85	85	260

β -RAY ABSORPTION IN WINDOW OR WALL



Channel Electron Multipliers

CHARACTERISTICS (AT 1000 PULSES/SEC. WHERE APPLICABLE)	TYPE NUMBERS						
		B310AL B310BL	B312AL B312BL	B318AL B318BL	B330AL B330BL	B410AL B410BL	B419AL B419BL
Resistance (x 10 ⁹ ohms)	Min. Typ. Max.	2.0 3.0 5.0	2.0 3.0 5.0	2.0 3.0 5.0	2.0 3.0 5.0	2.0 3.0 5.0	2.0 3.0 5.0
Gain (Note 1) (x 10 ⁸)	Min. Typ. Max.	1.0 1.3 — @ 3kV	1.0 1.3 — @ 3kV	1.0 1.3 — @ 3kV	1.0 1.5 — @ 3kV	1.0 1.5 — @ 2.5kV	1.0 1.7 — @ 2.5kV
Background above an equivalent threshold of 2 x 10 ⁷ electrons. (pulse/sec.)	Min. Typ. Max.	— 0.1 0.2 @ 3kV	— 0.2 0.5 @ 3kV	— 0.25 0.5 @ 3kV	— 0.1 0.2 @ 3kV	— 0.1 0.2 @ 2.5kV	— 0.25 0.5 @ 2.5kV
Starting Voltage (kV) with an equivalent threshold of 2 x 10 ⁷ electrons	Min. Typ. Max.	2.0 2.5 2.6	2.0 2.5 2.6	2.0 2.5 2.6	2.0 2.5 2.6	1.7 2.0 2.2	1.7 2.0 2.2
Resolution (FWHM) —% at an average gain of 10 ⁸	Min. Typ. Max.	— 50 70	— 50 70	— 50 70	— 50 70	— 50 70	— 50 70
Effective Input Aperture (mm)	Min. Typ. Max.	1.1 1.25 —	1.7x7.5 2.0x8.0	4.0 5.0	1.1 1.25	2.0 2.2 —	9.0 10.0 —
ABSOLUTE MAXIMUM RATINGS							
Operating Voltage (kV)		4.0	4.0	4.0	4.0	3.5	3.5
Temperature, Operating and Storage (°C)		70	70	70	70	70	70
Bake Temperatures (Note 2) (°C) ——AL, ——BL ——AL/01, ——BL/01		120 400	120 400	120 400	120 400	120 400	120 400
Ambient Pressure With High Voltage Applied (x 10 ⁻⁴ Torr)		Torr. 3.7	3.7	3.7	3.7	3.7	3.7
Weight (g)		1.0	1.0	1.3	1.3	3.0	4.0

Note 1: The gain of a typical multiplier will increase by a factor of 2 for an increase of operating voltage of 500V.

Note 2: Baking will cause a permanent slight loss in gain and

it is advisable to keep the baking time to a minimum. For example, baking for 16 hours at 400°C will reduce gain by approximately a factor of two (2).

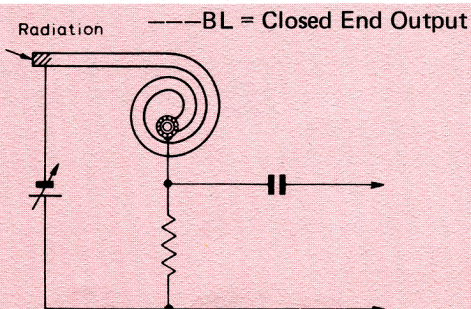


Fig. 1 - Typical pulse-counting circuit

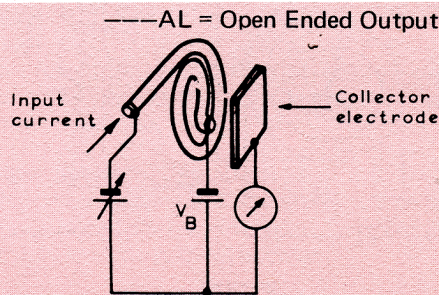
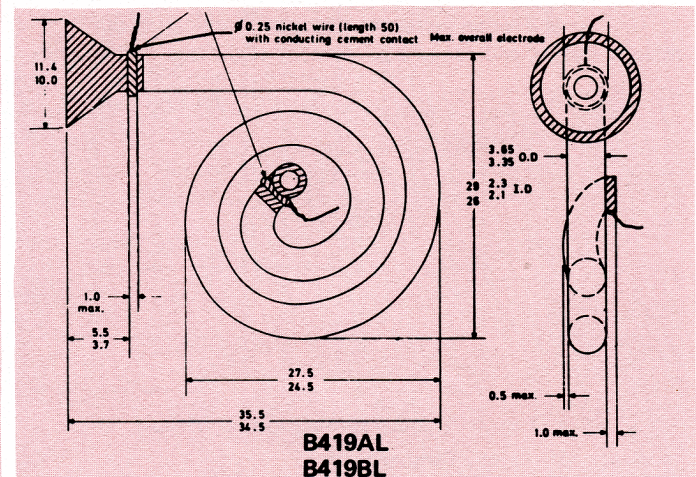
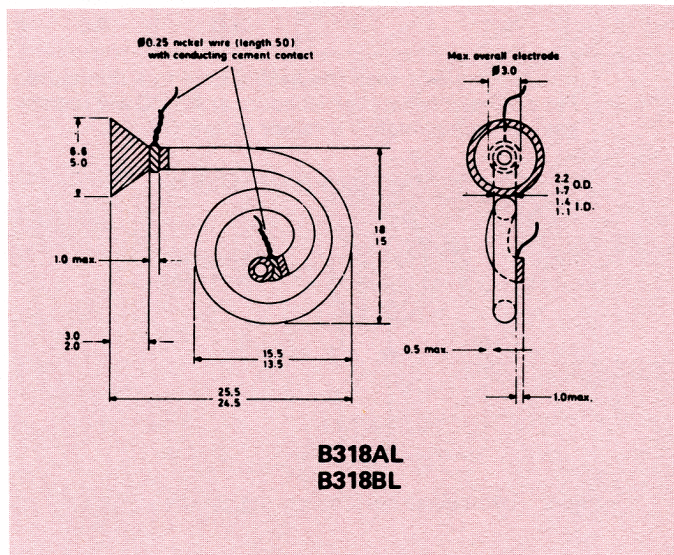
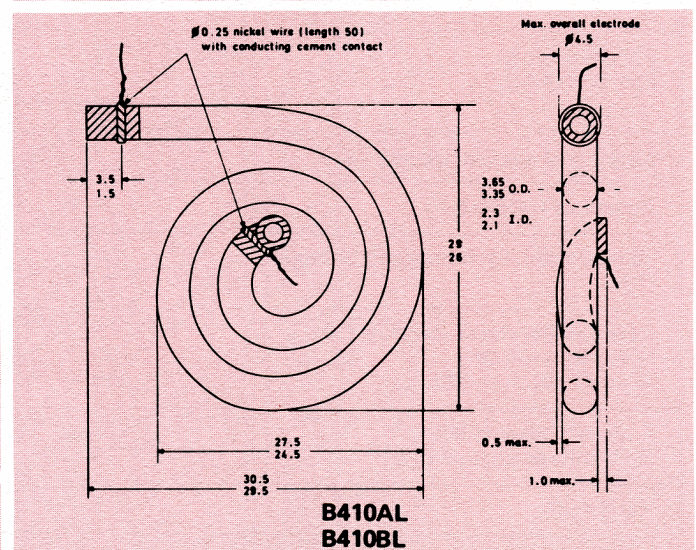
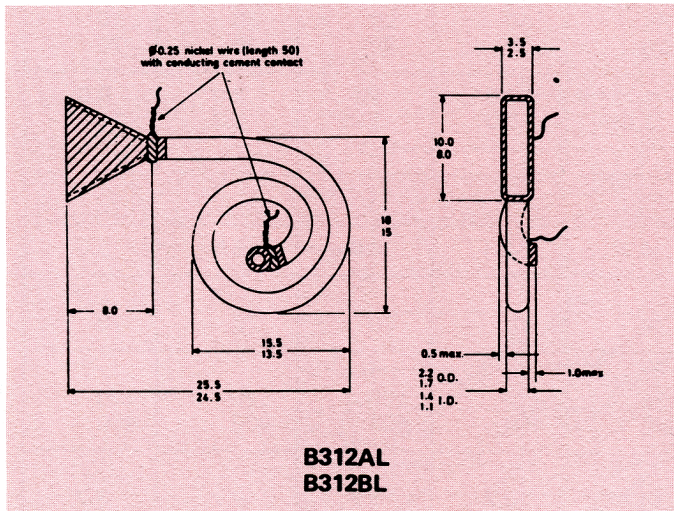
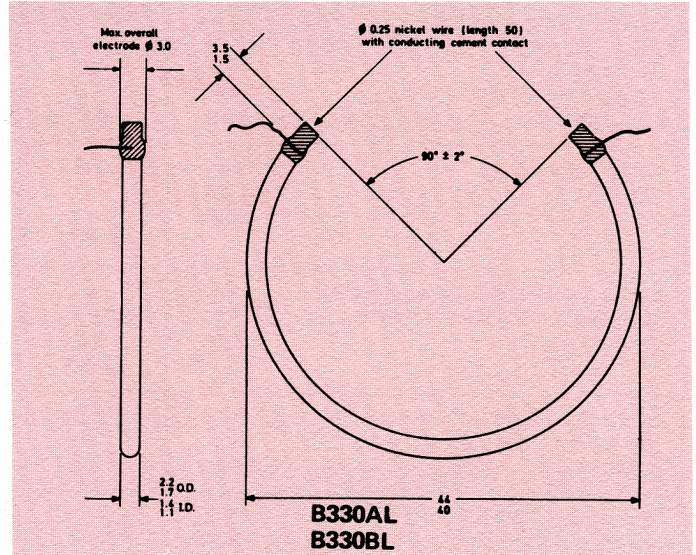
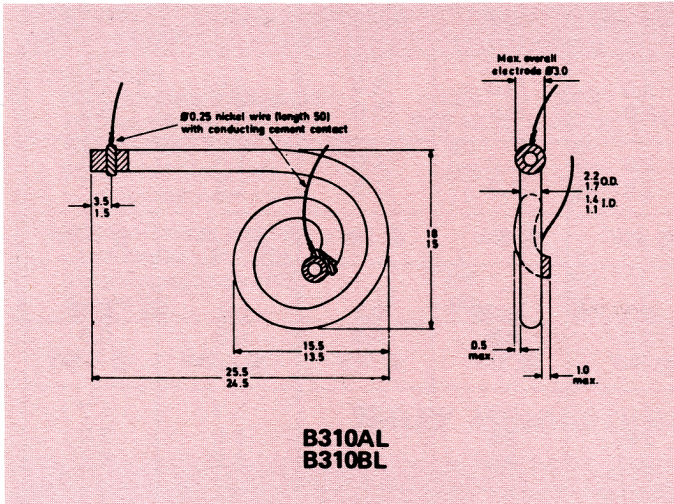


Fig. 2 - Typical current-measuring circuit

——AL/01 = High Temperature
——BL/01 Bakable Version

Channel Electron Multipliers (Continued)

OUTLINE DRAWINGS DIMENSIONS IN MM.



Channel Electron Multipliers (Continued)

CHANNEL ELECTRON MULTIPLIER PLATES

An array of channel electron multipliers fused into the shape of a disc. The multipliers are electrically connected in parallel by means of nickel-chromium electrodes evaporated on to the faces of the disc.

SPECIFICATIONS		G40-25	G40-50
Diameter of disc (mm)		27.1 ±0.1	53.0 ⁺⁰ _{-0.2}
Useful diameter (mm)	min.	26.5	51.8
Thickness of disc (mm)		1.6 ±0.1	1.6 ±0.1
Channel diameter (μm)		40	40
Channel pitch (μm)		50	50
Open area (%)	approx.	60	60
Electrode material		nickel-chromium	nickel-chromium
Electrical resistance between electrodes	approx.	10 ⁸	10 ⁷
Current gain at 1.0 kV	min.	1000	1000
Current output at 1.0 kV linear operation (μA)	max.	1.0	Note 1

APPLICATIONS

These devices must operate in a vacuum, and may be used to detect electrons, ions, soft X-rays and ultra-violet photons falling on the input face of the disc, by producing electron pulses from the output face of the corresponding channel.

For space experiments the environmental vacuum is adequate for their operation, and they have considerable potential in the field of X-ray and ultra-violet astronomy from rockets and satellites.

In laboratory use they must be incorporated in a vacuum chamber, where they will have important applications in field ion microscopy, electron microscopy and allied areas of work.

ABSOLUTE MAXIMUM RATINGS

Operating voltage (kV)	max.	2.0	2.0
Temperature, operating and storage (see note) (°C)	max.	70	70
Bake Temperature (°C)	max.	300	300
Ambient pressure with high voltage applied —mN/m ²	max.	13.3	13.3
—x 10 ⁻⁴ Torr		1.0 x 10 ⁻⁴	1.0 x 10 ⁻⁴
Diameter of plate clamping rings (mm)	max.	26.6	52.4

DEFINITIONS

Background: The pulses per second above an equivalent output discriminator threshold of 2 x 10⁷ electrons. Measured with the multiplier input closed.

Plateau: The region over which the pulse count rate changes less than 10% per kilovolt.

Starting Voltage: The voltage at which the pulse count rate is 90% of that in the middle of the plateau. Measured using a source to give a fixed count rate at a high applied voltage.

Gain: The ratio of the charge in the output pulse to the electron charge. Highly dependent upon the applied voltage and the count rate.

Resolution: Because of the statistical nature of the multiplication process, the amplitude of the output pulses (for a single electron input) will exhibit a gaussian distribution. The resolution is specified as the full width at half maximum (FWHM) of this distribution, divided by the average pulse amplitude.

Input Aperture: The response of a CEM depends upon the angle of incidence of the input flux. Consequently, fitting a cone on the input may result in an effective aperture smaller than the geometrical aperture.

NOTES

1. For linear relationship between input and output the output current must not exceed 0.1 of the standing current.
2. The plates are cut such that the channel electron multipliers form an angle of 13° to the perpendicular axis of the plate.
3. The plates should be stored in a dry or vacuum environment.

Coaxial Thermocouple And Heater Wire

THERMOCOUPLE WIRE

TYPE	2 AB Ac 10	2 AB Ac 05	2 AB I 10	2 AC I 20
Type of sheathing	304 stainless steel	304 stainless steel	Inconel	Inconel
Thermo-couple wires	Chromel/Alumel			
External diameter	1 mm (.040")	.5 mm (.020")	1 mm (.040")	2 mm (.080")
Approximate diameter of the thermocouple wires2 mm (.008")	.1 mm (0.004")	2 mm (.008")	.4 mm (.016")
Thickness of the sheathing12 mm (.005")	.06 mm (.0025")	.12 mm (.005")	.25 mm (.010")
Insulation between wires and between wires and sheath	More than 100 Megohms per meter			
Approximate resistance per meter at 20°C (Chromel + Alumel) ..	35 Ohms	140 Ohms	35 Ohms	9 Ohms
Approximate resistance per foot at 20° (Chromel + Alumel)	11 Ohms	45 Ohms	11 Ohms	3 Ohms
Temperature range	0—900° C	0—800° C	0—1000° C	0—1,100°C
Highest permissible temperature	1,100° C	1,100° C	1,200° C	1,300° C
Standard length of rolls	35 to 45 m (120' to 160') 75 to 85 m (250' to 280')	30 m (100') 100 to 200 m (300' to 650')	35 to 45 m (120' to 160') 75 to 85 m (250' to 280')	20 to 23 m (65' to 75')

READY TO USE THERMOCOUPLES

TYPE	THERMOCOUPLE	SHEATH MATERIAL	SHEATH DIAM. MM	LENGTH CM	RESISTANCE Ω
TCA 15/10/2	Chromel-Alumel	18-8 Stainless steel	1.5	10	10.5
TCA 20/10/2			2.0	10	10
TCA 15/25/2			1.5	25	12.5
TCA 20/25/2			2.0	25	11
TFA 15/10/2	Iron-Constantan	18-8 Stainless steel	1.5	10	7
TFA 20/10/2			2.0	10	6.5
TFA 15/25/2			1.5	25	9
TFA 20/25/2			2.0	25	7.5
TCI 15/10/2	Chromel-Alumel	Inconel	1.5	10	10.5
TCI 20/10/2			2.0	10	10
TCI 15/25/2			1.5	25	12.5
TCI 20/25/2			2.0	25	11

HEATER WIRE

TYPE	1 Nc I 10	1 Nc I 12	1 Nc I 15	1 Nc I 18	1 Nc I 20
Overall Diameter (mm) (inches)	1.0 .0393	1.2 .0473	1.5 .059	1.8 .071	2.0 .079
Resistance in ohms: (per meter) (per foot)	13 4.0	8.5 2.6	5.9 1.8	3.7 1.1	2.9 .88
Maximum permissible current amps	8	10	17	26	32
Current for sheath temperature of 1,000° C ,amps	5.1	7.5	12	16.5	19.5
Standard length of rolls in meters	80 - 90 40 - 45	55 - 65 28 - 32	35 - 40 18 - 20	25 - 28	20 - 23
Standard length of rolls in feet	250 - 280 125 - 140	170 - 200 85 - 100	110 - 125 55 - 65	80 - 92	65 - 75

Semiconductor Radiation Detectors

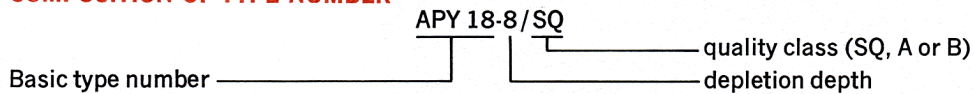
Ge-Li

APY 16 TO APY 19

CHARACTERISTICS

BASIC TYPE NUMBER	ACTIVE AREA (cm ²)	DEPLETION DEPTH (mm)	GAMMA ENERGY RESOLUTION (R) (1.33 MeV) (keV-FWHM) AT 77°K			TOTAL CAPACITANCE (pF)						
			SQ	A	B							
APY16	3	5	R < 2.5 keV	2.5 ≅ R < 3 keV	3 ≅ R < 3.5 keV	11.2						
		8				8.1						
		10				7.0						
		12				6.5						
APY17	5	5				R < 2.5 keV	2.5 ≅ R < 3 keV	3 ≅ R < 3.5 keV	17.3			
		8							12.1			
		10							10.3			
		12							10.4			
APY18	8	5							R < 2.5 keV	2.5 ≅ R < 3 keV	3 ≅ R < 3.5 keV	26.2
		8										17.8
		10										14.7
		12										13.7
APY19	10	5	R < 2.5 keV	2.5 ≅ R < 3 keV	3 ≅ R < 3.5 keV							32.8
		8										22.3
		10										18.0
		12										16.7

COMPOSITION OF TYPE NUMBER



1) These values are approximate as the thickness of the germanium slice differs slightly for a given depletion depth.

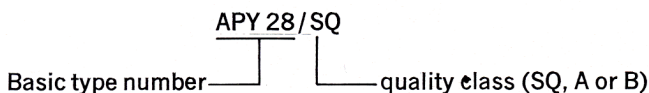
APY 21 TO APY 29

CHARACTERISTICS

BASIC TYPE NUMBER	EFFECTIVE ACTIVE VOLUME (cm ³)	GAMMA ENERGY RESOLUTION (R) (1.33 MeV) (keV-FWHM)		
		SQ	A	B
APY21	20	R ≅ 2.5 keV	2.5 ≅ R < 3 keV	3 ≅ R < 4 keV
APY22	25			
APY23	30			
APY24	35			
APY25	40			
APY26	45			
APY27	50			
APY28	55			
APY29	60			

Detailed information about photo-peak efficiency, photo-peak to compton ratio, resolution, crystal size and drifted depth of each individual detector is given on a stocklist, which is available on request.

COMPOSITION OF TYPE NUMBER



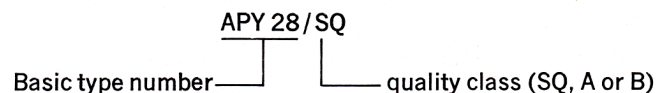
APY 41 TO APY 49

CHARACTERISTICS

BASIC TYPE NUMBER	EFFECTIVE ACTIVE VOLUME (cm ³)	GAMMA ENERGY RESOLUTION (R) (1.33 MeV) (keV-FWHM) at 77°K		
		SQ	A	B
APY41	20	R ≅ 2.5 keV	2.5 ≅ R < 3 keV	3 ≅ R < 4 keV
APY42	25			
APY43	30			
APY44	35			
APY45	40			
APY46	45			
APY47	50			
APY48	55			
APY49	60			

Detailed information about photo-peak efficiency, photo-peak to compton ratio, resolution, crystal size and drifted depth of each individual detector is given on a stocklist, which is available on request.

COMPOSITION OF TYPE NUMBER



Semiconductor Radiation Detectors (Cont'd)

Si-Li

BPX 10 TO BPX 14

BASIC TYPE NUMBER	ACTIVE AREA (mm ²)	DEPLETION DEPTH (mm)	RESOLUTION (keV-FWHM)					
			ALPHA 20°C		BETA 20°C		BETA -30°C	
			SQ	A	SQ	A	SQ	A
			MAX.	MAX.	MAX.	MAX.	MAX.	TYP.
BPX10	25	2	25	30	10	12	5	5
		3	30	35	12	15	6	6
		5	35	50	15	17	8	8
BPX12	100	2	30	40	12	15	6	6
		3	35	50	14	17	7	7
		5	40	60	18	20	9	9
BPX13	200	2	35	50	13	17	7	7
		3	40	60	16	19	9	9
		5	45	70	19	22	11	11
BPX14	300	2	40	60	16	19	8	8
		3	45	70	17	21	10	10
		5	50	90	20	25	12	12

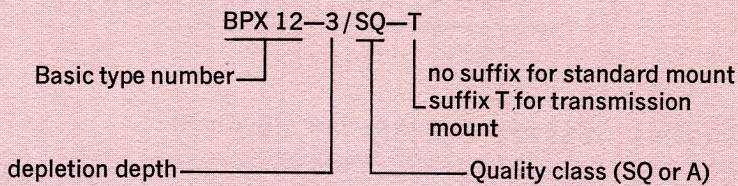
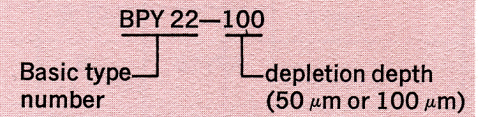
DIFFUSED SILICON

BPY 20 TO BPY 24

Depletion depth

The depletion depth is 50 μm or 100 μm for all types

BASIC TYPE NUMBER	ACTIVE AREA (mm ²)	SHAPE
BPY20	12	circular
BPY22	100	circular
BPY23	200	circular
BPY24	200	square



Semiconductor Radiation Detectors (Cont'd)

SI-SURFACE BARRIER (PARTIALLY DEPLETED)

BPY 51 TO BPY 57, BPY 58 TO BPY 59

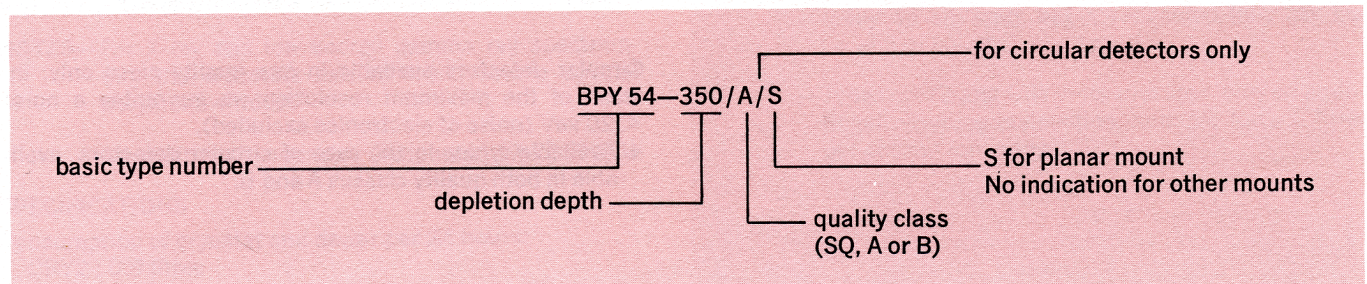
BASIC TYPE NUMBER	ACTIVE AREA (mm ²)	QUALITY CLASS	MAX. RESOLUTION AT 20°C (keV-FWHM)		DEPLETION DEPTH (μm)								
			ALPHA	BETA	100	200	350	500	700	1000	1500	2000	2500
CIRCULAR DETECTORS													
BPY51	25	SQ	15	12	+	+	+	+	+	+			
		A	18	13	+	+	+	+	+	+	+	+	+
		B	25	20	+	+	+	+	+	+	+	+	+
BPY52	50	SQ	18	13	+	+	+	+	+	+			
		A	20	15	+	+	+	+	+	+	+	+	+
		B	25	20	+	+	+	+	+	+	+	+	+
BPY53	100	SQ	18	13	+	+	+	+	+	+			
		A	20	15	+	+	+	+	+	+	+	+	+
		B	25	20	+	+	+	+	+	+	+	+	+
BPY54	200	SQ	20	15	+	+	+	+	+	+			
		A	25	20	+	+	+	+	+	+	+	+	+
		B	30	25	+	+	+	+	+	+	+	+	+
BPY55	300	SQ	20	15			+	+	+	+			
		A	25	20	+	+	+	+	+	+			
		B	30	25	+	+	+	+	+	+			
BPY56	450	SQ	30	25			+	+	+	+			
		A	35	30		+	+	+	+	+			
		B	40	35		+	+	+	+	+			
BPY57	600	SQ	30	25			+	+	+	+			
		A	35	30		+	+	+	+	+			
		B	40	35		+	+	+	+	+			

ANNULAR DETECTORS

BPY58	100		30	25	+	+	+	+	+	+	+	+	
BPY59	200		40	35	+	+	+	+	+	+	+	+	

+ Available types.

COMPOSITION OF TYPE NUMBER



Semiconductor Radiation Detectors (Cont'd)

**SILICON SURFACE BARRIER
(TOTALLY DEPLETED)**

BPY 81 TO BPY 87, BPY 88 TO BPY 89

NOTE

Detectors that are to be stacked must have the same diameter mount. If necessary we will fit totally depleted detectors in a larger than normal transmission mount to match the planar mount of a specific partially depleted detector.

ACCESSORIES

Pre-amplifier

56050-01

CHARACTERISTICS

BASIC TYPE NUMBER	ACTIVE AREA (mm ²)	QUALITY CLASS	MAX. RESOLUTION AT 20°C (keV-FWHM)	
			ALPHA	BETA
CIRCULAR DETECTORS				
BPY81	25	A B	20 25	15 20
BPY82	50	A B	20 25	15 20
BPY83	100	A B	20 25	15 20
BPY84	200	A B	25 30	20 25
BPY85	300	A B	25 30	20 25
BPY86	450	A B	35 40	30 35
BPY87	600	A B	35 40	30 35
ANNULAR DETECTORS				
BPY88	100	—	30	25
BPY89	200	—	40	35

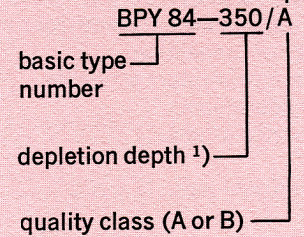
Circular detectors available in one quality class only; instead of the maximum resolution we guarantee a noise < 20 keV (noise of electronics excluded).

+ Available types. In the case of circular detectors, available in both quality classes A and B.

Semiconductor Radiation Detectors (Cont'd)

BASIC TYPE NUMBER	Depletion depth (μm)														
	3 to 7	7 to 12	12 to 17	17 to 22	22 to 30	50	100	200	350	500	700	1000	1500	2000	
CIRCULAR DETECTORS															
BPY81	$\pm 0.25 \mu\text{m}$	$\pm 0.5 \mu\text{m}$				$\pm 1 \mu\text{m}$					$\pm 2 \mu\text{m}$				
	•	•	•	•	•	+	+	+	+	+	+	+	+	+	+
BPY82					$\pm 1 \mu\text{m}$					$\pm 2 \mu\text{m}$					
	•	•	•	•	•	+	+	+	+	+	+	+	+	+	
BPY83					$\pm 1 \mu\text{m}$					$\pm 2 \mu\text{m}$					
	•	•	•	•	•	+	+	+	+	+	+	+	+	+	
BPY84					$\pm 2 \mu\text{m}$										
	•	•	•	•	•	+	+	+	+	+	+	+	+	+	
BPY85					$\pm 2 \mu\text{m}$										
	•	•	•	•	•	+	+	+	+	+	+	+	+	+	
BPY86					$\pm 2 \mu\text{m}$										
	•	•	•	•	•	+	+	+	+	+	+	+	+	+	
BPY87					$\pm 2 \mu\text{m}$										
	•	•	•	•	•	+	+	+	+	+	+	+	+	+	
ANNULAR DETECTOR															
BPY88							+	+	+	+	+	+	+	+	
BPY89							+	+	+	+	+	+	+	+	

for circular detectors with depletion depth $\leq 50 \mu\text{m}$ only



CRY 1 CRY 2 CRY 3 CRY 4 CRYOSTAT

OBSOLEScent TYPES

CRY1 : vertical cryostat supplied without dewar.
 CRY2 : cryostat CRY1 supplied with a 25 litre dewar.
 CRY3 : right-angle cryostat mounted on top of the dewar.
 CRY4 : right-angle cryostat mounted below a 17 litre dewar.

NOTES—For X-ray and low energy gamma ray spectrometry the cryostats can be fitted with a special beryllium window.

—An additional connector (Amphenol 17-20090) is

fitted if the first stage of the pre-amplifier is mounted in the cryostat.

—The horizontal arms of CRY3 and CRY4 are normally 46 cm long, but if requested they can be of any length up to 60 cm.

—Types CRY3 and CRY4 are provided with an additional pumping connection, suitable for a 1 litre per second ion pump.

SPECIFICATIONS

Consumption of cryostat and dewar per 24 hours:

CRY2 : 0.9 litres
 CRY3 : 1.5 litres
 CRY4 : 1.7 litres

Holding time for one charge:

CRY2 : 24 days
 CRY3 : 14 days
 CRY4 : 10 days

Min. liquid nitrogen level (recharging level).....CRY2 and 3:50 mm
 Getter.....Zeolite; type 13X (Union Carbide)

(continued)

Semiconductor Radiation Detectors (Cont'd)

CRY 1 CRY 2 CRY 3 CRY 4 CRYOSTAT Continued

Reactivation of zeolite	
—reactivating intervals.....	approx. 6 to 12 months
—temperature.....	min. 180°C; max. 200°C
—vacuum.....	max. 10 ⁻² torr
—reconditioning time.....	min. 2 hours
Pre-vacuum (before immersion into liquid nitrogen)...	10 ⁻³ (< 10 ⁻²) torr
Vacuum (cryostat, during operation).....	10 ⁻⁵ (< 10 ⁻⁴) torr
Total capacitance of electrical connection.....	4 ± 0.5 pF
Electrical connection.....	modified version MHV UG932/U
Aluminum adaptors available.....	for all types of detectors
Hood (aluminum)	
—entrance window.....	diameter 40 mm
	thickness 0.75 mm
—cylindrical wall.....	thickness 0.50 mm

CRY 101 CRY 103 CRY 104 CRYOSTAT

CRY101 : vertical dipstick cryostat mounted on top of a 34 litre dewar.

CRY103 : right-angle cryostat mounted on top of a 34 litre dewar.

CRY104 : right-angle cryostat mounted below a 17 litre dewar.

NOTES—For X-ray and low energy gamma-ray spectrometry the cryostats can be fitted with a special beryllium window.

—An additional connector (Amphenol 17-20090) is fitted if the first stage of the pre-amplifier is mounted in the cryostat.

—The horizontal arms of CRY103 and CRY104 are normally 46 cm long, but if requested they can be of any length up to 60 cm.

—Types CRY103 and CRY104 are provided with an additional pumping connection, suitable for 1 litre per second ion pump.

SPECIFICATIONS

Consumption of cryostat and dewar per 24 hours:

CRY101 : 0.9 litres

CRY103 : 1.5 litres

CRY104 : 1.7 litres

Holding time for one charge:

CRY101 : 30 days

CRY103 : 20 days

CRY104 : 10 days

Min. liquid nitrogen level (recharging level).....	CRY101 and CRY103: 5 cm
Getter.....	Zeolite; type 13X (Union Carbide)
Reactivation of Zeolite	
—reactivating intervals.....	approx. 12 month
—temperature.....	min. 180°C, max. 200°C
—vacuum.....	max. 10 ⁻² torr
—reconditioning time.....	min. 2 hours
Pre-vacuum (before immersion into liquid nitrogen)...	< 10 ⁻³ torr
Vacuum (cryostat, during operation).....	< 10 ⁻⁵ torr
Total capacitance of electrical connection.....	4 ± 0.5 pF
Electrical connection.....	modified version of MHV UG932/U
Aluminum adaptors available.....	for all types of detectors
Hood (aluminum).....	diameter 80 mm
—entrance window.....	diameter 50 mm
	thickness 0.75 mm
—cylindrical wall.....	thickness 2 mm

Rectifier Stacks

TYPE	MAXIMUM POWER SUPPLY AVG. D.C. OUTPUT VOLTAGE			MINIMUM STACK AVALANCHE VOLTAGE	MAX. POWER SUPPLY AVG. D.C. OUTPUT CURRENT		MAX. PWR. SUPPLY R.M.S. SHORT CIRCUIT CURRENT		
	1 ϕ C.T.	1 ϕ BRIDGE	3 ϕ BRIDGE		1 ϕ C.T. or BRIDGE	3 ϕ BRIDGE	1/2 CYCLE	4 CYCLES	10 CYCLES
RS0.5-12-16M	2870	5740	8550	18,000	1A	1.5A	1 ϕ =35.4 3 ϕ =47.5	1 ϕ =16.3 3 ϕ =21.8	1 ϕ =11.3 3 ϕ =15.2
RS1.5-12-12M	2390	4775	7150	15,000	3A	4.5A	1 ϕ =49.4A 3 ϕ =60.5A	1 ϕ =16.9A 3 ϕ =20.8A	1 ϕ =13.4A 3 ϕ =16.4A
RS3.5-24-9S	1790	3580	5350	11,250	7A	10.5A	1 PHASE 141A 3 PHASE 173A	1 PHASE 33.8A 3 PHASE 41.5A	1 PHASE 25.4A 3 PHASE 31.2A
RS3.5-24-12S	2390	4775	7150	15,000					
RS3.5-24-15S	2985	5970	8930	18,750					
RS3.5-24-18S	3580	7160	10,710	22,500					
RS3.5-24-21S	4180	8360	12,500	26,250					
RS3.5-24-24S	4775	9550	14,300	30,000					
RS3.5-24-27S	5375	10,750	16,100	33,750					
RS3.5-24-30S	5970	11,940	17,880	37,500					
RS3.5-24-33S	6570	13,140	19,650	41,250					
RS3.5-24-36S	7160	14,320	21,420	45,000					
RS3.5-24-39S	7760	15,520	23,200	48,750					
RS4-55-9S	1790	3580	5350	11,250	8A	12A	1 PHASE 282A 3 PHASE 346A	1 PHASE 77.5A 3 PHASE 95.2A	1 PHASE 53.6A 3 PHASE 65.8A
RS4-55-12S	2390	4775	7150	15,000					
RS4-55-15S	2985	5970	8930	18,750					
RS4-55-18S	3580	7160	10,710	22,500					
RS4-55-21S	4180	8360	12,500	26,250					
RS4-55-24S	4775	9550	14,300	30,000					
RS4-55-27S	5375	10,750	16,100	33,750					
RS4-55-30S	5970	11,940	17,880	37,500					
RS4-55-33S	6570	13,140	19,650	41,250					
RS4-55-36S	7160	14,320	21,420	45,000					
RS4-55-39S	7760	15,520	23,200	48,750					
RS5-110-9S	1790	3580	5350	11,250	10A	15A	1 PHASE 508A 3 PHASE 624A	1 PHASE 155A 3 PHASE 190A	1 PHASE 106A 3 PHASE 130A
RS5-110-12S	2390	4775	7150	15,000					
RS5-110-15S	2985	5970	8930	18,750					
RS5-110-18S	3580	7160	10,710	22,500					
RS5-110-21S	4180	8360	12,500	26,250					
RS5-110-24S	4775	9550	14,300	30,000					
RS5-110-27S	5375	10,750	16,100	33,750					
RS5-110-30S	5970	11,940	17,880	37,500					
RS5-110-33S	6570	13,140	19,650	41,250					
RS5-110-36S	7160	14,320	21,420	45,000					
RS5-110-39S	7760	15,520	23,200	48,750					
RS10-310-9S	1790	3580	5350	11,250	20A	30A	1 PHASE 1129A 3 PHASE 1384A	1 PHASE 437A 3 PHASE 536A	1 PHASE 352A 3 PHASE 433A
RS10-310-12S	2390	4775	7150	15,000					
RS10-310-15S	2985	5970	8930	18,750					
RS10-310-18S	3580	7160	10,710	22,500					
RS10-310-21S	4180	8360	12,500	26,250					
RS10-310-24S	4775	9550	14,300	30,000					
RS10-310-27S	5375	10,750	16,100	33,750					
RS10-310-30S	5970	11,940	17,880	37,500					
RS10-310-33S	6570	13,140	19,650	41,250					
RS10-310-36S	7160	14,320	21,420	45,000					
RS10-310-39S	7760	15,520	23,200	48,750					

X Ray Components

BYX 29 SERIES CONTROLLED AVALANCHE HIGH VOLTAGE DIODES

Silicon diodes in a ceramic envelope with metal connectors capable of absorbing transients and primarily intended for high voltage rectifier circuits in X-ray applications.

The series consists of the following types: BYX29-75000, BYX29-100000, BYX29-125000 and BYX-29-150000.

BYX29-75000 100000 125000 150000

QUICK REFERENCE DATA					
		BYX29-75000	100000	125000	150000
Crest working reverse voltage	V_{RWM} max.	75	100	125	150 kV
Average forward current	I_{FAV} max.	50	50	50	50 mA
Non repetitive peak forward current; $t=10$ ms	I_{FSM} max.	5000	5000	5000	5000 mA
Junction temperature T_j	max.	125	125	125	125°C
Thermal resistance from junction to cooling oil	$R_{th j-o}$	= 3.2	2.7	1.6	1.6°C/W

Currents

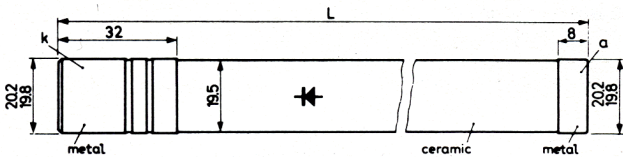
Average forward current (averaged over any 20 ms period) continuous operation	I_{FAV} max.	50 mA
intermittent operation ($t \leq 1$ s, once every 20 s)	I_{FAV} max.	750 mA
Repetitive peak forward current continuous operation	I_{FRM} max.	250 mA
intermittent operation (at an average forward current $I_{FAV}=750$ mA; $t \leq 1$ s, once every 20 s)	I_{FRM} max.	2500 mA
Non repetitive peak forward current ($t = 10$ ms)	I_{FSM} max.	5000 mA
Non repetitive peak reverse current $t < 10 \mu$ s; $T_j = 25^\circ$ C	I_{RSM} max.	500 mA
$T_j = 125^\circ$ C	I_{RSM} max.	400 mA

Temperatures

Storage temperature	T_{stg}	-30 to +125°C
Junction temperature	T_j	max. 125°C

MECHANICAL DATA

Dimensions in mm



BYX29- 75000	L:141 to 143 mm	Weight: 135 g
BYX29-100000	L:169 to 171 mm	Weight: 165 g
BYX29-125000	L:229 to 231 mm	Weight: 225 g
BYX29-150000	L:229 to 231 mm	Weight: 225 g

All information applies to frequencies up to 400 Hz

RATINGS (Limiting values)¹⁾

Voltages	BYX29-75000	100000	125000	150000
Crest working reverse voltage V_{RWM} max.	75	100	125	150 kV

THERMAL RESISTANCE

	BYX29-75000	100000	125000	150000
From junction to cooling oil	$R_{th j-o} = 3.2$	2.7	1.6	1.6°C/W

CHARACTERISTICS

Voltages at $T_j=25^\circ$ C	BYX29-75000	100000	125000	150000
Forward voltage at $I_F=50$ mA	$V_F < 88$	116	145	175 V
Reverse breakdown voltage $I_R=1$ mA	$V_{(BR)R} > 100$	135	165	200 kV
Currents at $T_j=125^\circ$ C	BYX29-75000	100000	125000	150000
Reverse current at $V_R = V_{RWM}$ max I_R	< 33	33	33	33 μ A

¹⁾ Limiting values according to the Absolute Maximum System as defined in IEC publication 134.

X Ray Components (Continued)

BYX 35 SILICON HIGH VOLTAGE DIODE

The BYX35 is primarily intended for the high voltage power supply of X-ray, electron microscope and LASER equipment.

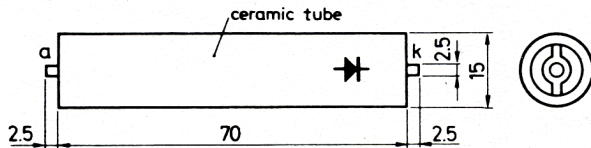
The device is in a ceramic tube and must be immersed in oil for cooling and insulating.

The diodes can be connected in series, without voltage equalizing elements, for high voltage applications.

QUICK REFERENCE DATA			
Crest working reverse voltage	V_{RWM}	max.	25 kV
Repetitive peak reverse voltage	V_{RRM}	max.	37.5 kV
Average forward current	I_{FAV}	max.	0.05 A
Non repetitive peak forward current t=10 ms	I_{FSM}	max.	15 A

MECHANICAL DATA

Dimensions in mm



Net weight : 42 g
With accessories: 44 g

All information applies to frequencies from 40 up to 400 Hz.

RATINGS (Limiting values)¹⁾

Voltages

Crest working reverse voltage	V_{RWM}	max.	25 kV
Repetitive peak reverse voltage	V_{RRM}	max.	37.5 kV
Non repetitive peak reverse voltage (t≤10 ms)	V_{RSM}	max.	40 kV

Currents

Continuous operation

Average forward current (averaged over any 20 ms period) $T_{oil} \leq 50^\circ C$	I_{FAV}	max.	0.05 A
Repetitive peak forward current	I_{FRM}	max.	0.16 A

Non repetitive peak forward current (t=10 ms)

I_{FSM}	max.	15 A
-----------	------	------

Intermittent operation

Average forward current (averaged over any 20 ms period) $T_{oil} \leq 50^\circ C$ •(t ≤ 0.5 s once every 18 s)	I_{FAV}	max.	0.5 A
Repetitive peak forward current (t ≤ 0.5 s once every 18 s)	I_{FRM}	max.	1.6 A

Temperatures

Storage temperature	T_{stg}	-65 to +125 °C
Junction temperature	T_j	max. 125 °C

THERMAL RESISTANCE

From junction to cooling oil	$R_{th\ j-o}$	= 8 °C/W
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CHARACTERISTICS

Forward voltage at $I_F = 10$ mA;
 $T_j = 25^\circ C$

V_F	typ.	25 V
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Diode capacitance at $T = 25^\circ C$

C_d	typ.	45 pF
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¹⁾Limiting values according to the Absolute Maximum System as defined in IEC publication 134.

X Ray Components (Continued)

X-RAY COMPONENT SILICON RECTIFIERS

MECHANICAL DATA

Models:		
with Philips fittings	XF 1024/00	XF 1025/00
with E-fittings	XF 1024/01	XF 1025/01
with K-fittings	XF 1024/02	XF 1025/02
with DE-fittings	XF 1024/03	XF 1025/03
with Müller fittings	XF 1024/04	XF 1025/04

Base: hardpaper plate

Mounting position: base plate preferably vertical

Insulation and cooling: oil

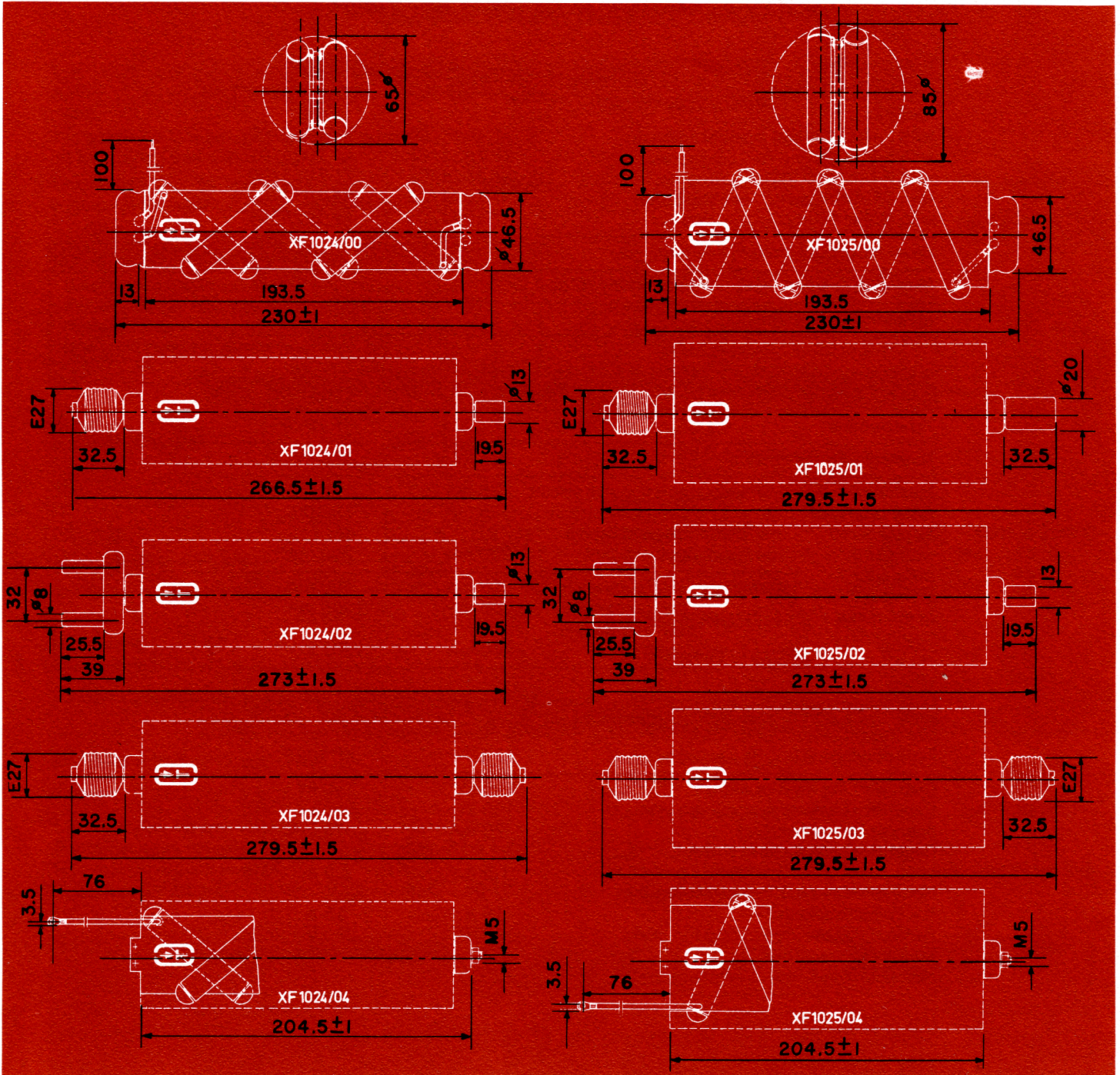
QUICK REFERENCE DATA FOR APPLICATION IN X-RAY GENERATORS

Type number		XF 1024	XF 1025
Nominal working tension		125 kV	150 kV
Maximum X-ray tube load as measured with a D.C. mA-meter expressed in mA mean	continuous	single-pulse circuit 75 mA two-pulse circuit 150 mA six- and twelve-pulse circuit 200 mA	75 mA 150 mA 200 mA
	intermittent	single-pulse circuit 500 mA two-pulse circuit 1000 mA six- and twelve-pulse circuit 1500 mA	500 mA 1000 mA 1500 mA

ELECTRICAL DATA

Type numbers	XF 1024	XF 1025
Crest working reverse voltage	125 kV	150 kV
Repetitive peak reverse voltage	150 kV	180 kV
Average forward current	75 mA	75 mA
Repetitive peak forward current (t=0.5 sec. intermittent)	1.5 A	1.5 A
Non repetitive peak forward current (t=10 milliseconds)	15 A	15 A
Forward voltage drop at 500 mA peak	190 V	230 V
Storage temperature	-65° to +125°C	-65° to +125°C
Maximum operating oil-temperature	70°C	70°C

X Ray Components (Continued)



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