

E2V Technologies

CW1600J2

RF Power Tetrode

The data should be read in conjunction with the Power Tetrode Preamble.

ABRIDGED DATA

Water cooled tetrode of coaxial metal-ceramic construction, with an integral water jacket. It is intended for use in audio amplifiers, RF linear amplifiers or class C amplifiers and oscillators.

Anode dissipation	100	kW max
Anode voltage	20	kV max
Frequency for full ratings	30	MHz max
Output power (class C telegraphy)	165	kW

GENERAL

Electrical

Filament	thoriated tungsten
Filament voltage (see note 1)	10 V
Filament current	300 A
Peak usable cathode current	120 A
Grid-screen amplification factor	4.5
Inter-electrode capacitances, grounded filament:	
grid to anode	2.4 pF
input	465 pF
output	55 pF

Mechanical

Overall length	492.0 mm max
Overall diameter	237.5 mm max
Net weight	19 kg approx
Mounting position	vertical, either way up

Accessories

Socket (see page 8)	MA166B
Clamping device to secure tube in socket (optional)	MA233

COOLING

The CW1600J2 has an integral water jacket; the minimum water requirements are given on page 4.

Sufficient air must be passed over the base terminals to maintain the temperatures of the ceramic to metal seals below the maximum rated value of 250 °C. Using socket type MA166B, 1.70 to 2.83 m³/min of air will be required for base cooling, blown horizontally through the socket from two diametrically opposed nozzles. It is also necessary to direct 0.06 m³/min of air into the centre hole of the socket.

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR (Class AB1) (See Note 2)

MAXIMUM RATINGS (Absolute values)

Anode voltage	20	kV
Anode current	15	A
Anode dissipation	100	kW
Screen voltage	2.5	kV
Screen dissipation	1750	W
Grid dissipation	500	W
Grid circuit resistance	0.1	MΩ

TYPICAL OPERATING CONDITIONS (Class AB1, two tubes)

Anode voltage	10	12	15	18	kV
Screen voltage	1.5	1.5	1.5	1.5	kV
Grid voltage	-290	-450	-360	-380	V
Peak AF grid voltage	270	320	350	380	V
Anode current (zero signal)	4.0	1.0	6.0	6.0	A
Anode current (maximum signal)	17.4	8.6	18.8	20.0	A
Screen current (zero signal)	0	0	0	0	A
Screen current (maximum signal)	0.77	0.50	0.69	0.7	A
Anode dissipation per tube (maximum signal)	33.0	19.0	47.3	56.8	kW
Effective load (anode to anode)	1.15	2.86	1.8	2.08	kΩ
Nominal driving power (maximum signal)	0	0	0	0	W
Output power (maximum signal)	110	65	187.4	246.4	kW

RADIO FREQUENCY LINEAR AMPLIFIER (Class AB1) (See Note 2)

MAXIMUM RATINGS (Absolute values)

Anode voltage	20	kV
Anode current	15	A
Anode dissipation	100	kW
Screen voltage	2.5	kV
Screen dissipation	1750	W
Grid dissipation	500	W
Grid circuit resistance	0.1	MΩ

TYPICAL OPERATING CONDITIONS

(Peak envelope or modulation crest conditions, below 30 MHz)

Anode voltage	10	15	18	kV
Screen voltage	1.5	1.5	1.5	kV
Grid voltage (see note 3)	-290	-360	-380	V
Peak RF grid voltage	270	350	380	V
Anode current (zero signal)	2.0	3.0	3.0	A
Anode current (maximum signal)	8.7	9.4	10	A
Screen current (maximum signal)	0.385	0.345	0.35	A
Anode dissipation	33.0	47.3	56.8	kW
Nominal driving power	0	0	0	W
Output power (see note 4)	55.0	93.7	123.2	kW

**ANODE MODULATED RF POWER AMPLIFIER
(Class C Telephony, carrier conditions per tube
for use with a maximum modulation factor of 1.0)**

MAXIMUM RATINGS (Absolute values)

Anode voltage	17.5	kV
Anode current	15	A
Anode dissipation (see note 5)	67	kW
Screen voltage	2.0	kV
Screen dissipation	1750	W
Grid dissipation	500	W

TYPICAL OPERATING CONDITIONS (below 30 MHz)

Anode voltage	10	14	16	kV
Screen voltage	750	750	750	V
Grid voltage	-520	-700	-700	V
Peak AF screen voltage (for 100% modulation)	675	750	750	V
Peak RF grid voltage	680	1000	1050	V
Anode current	6.6	9.1	12	A
Screen current	0.985	2.0	1.75	A
Grid current	0.370	1.0	1.2	A
Anode dissipation	11.0	20.4	54.0	kW
Nominal driving power	250	1000	1260	W
Output power	55	107	138.5	kW

ANODE AND SCREEN MODULATED RF POWER AMPLIFIER
(Class D Tyler high efficiency circuit, carrier conditions per tube
for use with a maximum modulation factor of 1.0)

MAXIMUM RATINGS (Absolute values)

Anode voltage	13.5	kV
Anode current	15	A
Anode dissipation (see note 5)	67	kW
Screen voltage	2.0	kV
Screen dissipation	1750	W
Grid dissipation	500	W

TYPICAL OPERATING CONDITIONS (below 3 MHz)

Anode voltage	12	kV
Screen voltage (see note 6)	750	V
Grid voltage (see note 7)	-600	V
Peak RF grid voltage	750	V
Anode current	10.3	A
Screen current	1.6	A
Grid current	0.7	A
Anode dissipation	19	kW
Nominal driving power	520	W
Output power	105	kW
Anode efficiency	85	%

RF POWER AMPLIFIER OR OSCILLATOR
(Class C Telegraphy, key down conditions, one tube)

MAXIMUM RATINGS (Absolute values)

Anode voltage	20	kV
Anode current	15	A
Anode dissipation	100	kW
Screen voltage	2.5	kV
Screen dissipation	1750	W
Grid dissipation	500	W

TYPICAL OPERATING CONDITIONS (below 30 MHz)

Anode voltage	10	15	17	19	kV
Screen voltage	750	750	750	750	V
Grid voltage	-425	-480	-700	-700	V
Peak RF grid voltage	575	640	1020	1040	V
Anode current	6.70	6.45	9.8	10.6	A
Screen current	0.925	0.810	1.67	1.83	A
Grid current	0.320	0.355	1.0	1.12	A
Anode dissipation	12	14	30	35	kW
Nominal driving power	185	225	1020	1165	W
Output power	55	82.5	137.5	165	kW

NOTES

1. The tube must be operated at the stated filament voltage. Fluctuations in filament voltage must not exceed $\pm 5\%$.
2. Grid current does not flow during any part of the drive cycle.
3. The grid voltage is adjusted to obtain the specified zero-signal anode current.
4. The peak envelope or RF output power at the crest of the modulation envelope.
5. This corresponds to 100 kW anode dissipation at 100% sine wave modulation.
6. Derived via a series resistor of 470 Ω from a 1500 V HT line which is modulated by means of a tertiary winding on the anode modulation transformer.
7. The bias is obtained from a -400 V supply and 270 Ω grid resistor.

HEALTH AND SAFETY HAZARDS

E2V Technologies electronic devices are safe to handle and operate, provided that the precautions stated are observed. E2V Technologies does not accept responsibility for damage or injury resulting from the use of electronic devices it produces. Equipment manufacturers and users must ensure that adequate precautions are taken. Appropriate warning labels and notices must be provided on equipments incorporating E2V Technologies devices and in operating manuals.



High Voltage

Equipment must be designed so that personnel cannot come into contact with high voltage circuits. All high voltage circuits and terminals must be enclosed and fail-safe interlock switches must be fitted to disconnect the primary power supply and discharge all high voltage capacitors and other stored energy before allowing access. Interlock switches must not be bypassed to allow operation with access doors open.



RF Radiation

Personnel must not be exposed to excessive RF radiation. A properly designed equipment cabinet with good RF electrical connection between panels will normally provide sufficient protection.



X-Ray Radiation

This device, when operating at voltages above 5 kV, produces progressively more dangerous X-rays as the voltage is increased; the radiation varies greatly during life. The device envelope provides only limited protection and further shielding may be required. A metal equipment cabinet with overlapping joints will usually provide sufficient shielding, but if there is any doubt an expert in this field should perform an X-ray survey of the equipment.



Implosion

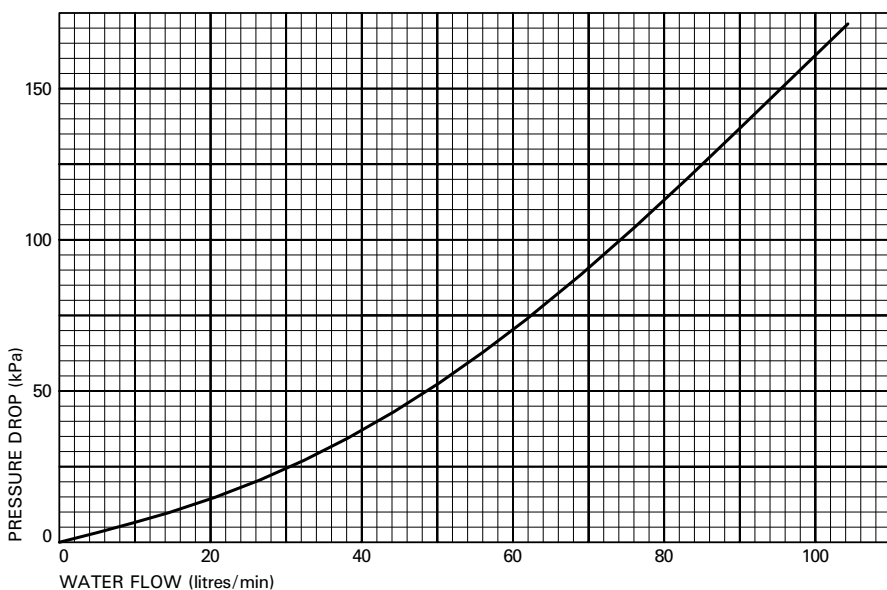
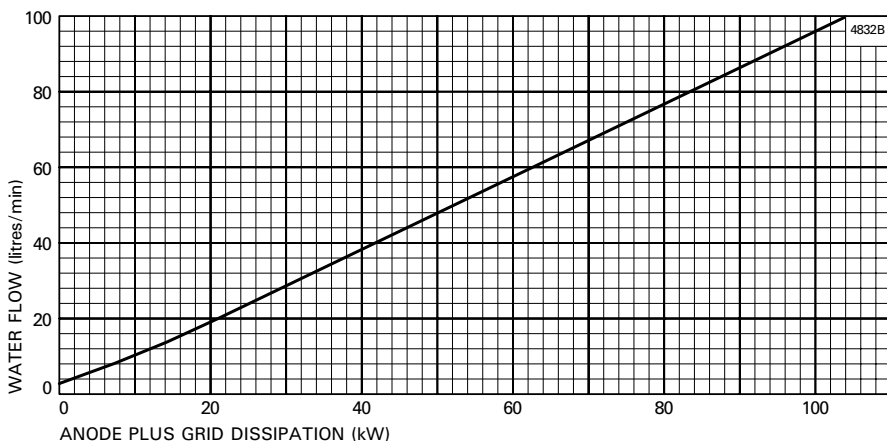
This tube stores potential energy by virtue of its vacuum. The energy level is low, but there is some hazard from flying fragments if the tube is dropped or subjected to violent impact. The tube must be stored and transported in its approved pack. During installation or replacement the tube must not be scratched or damaged in any way likely to reduce the strength of the ceramic envelope.

References

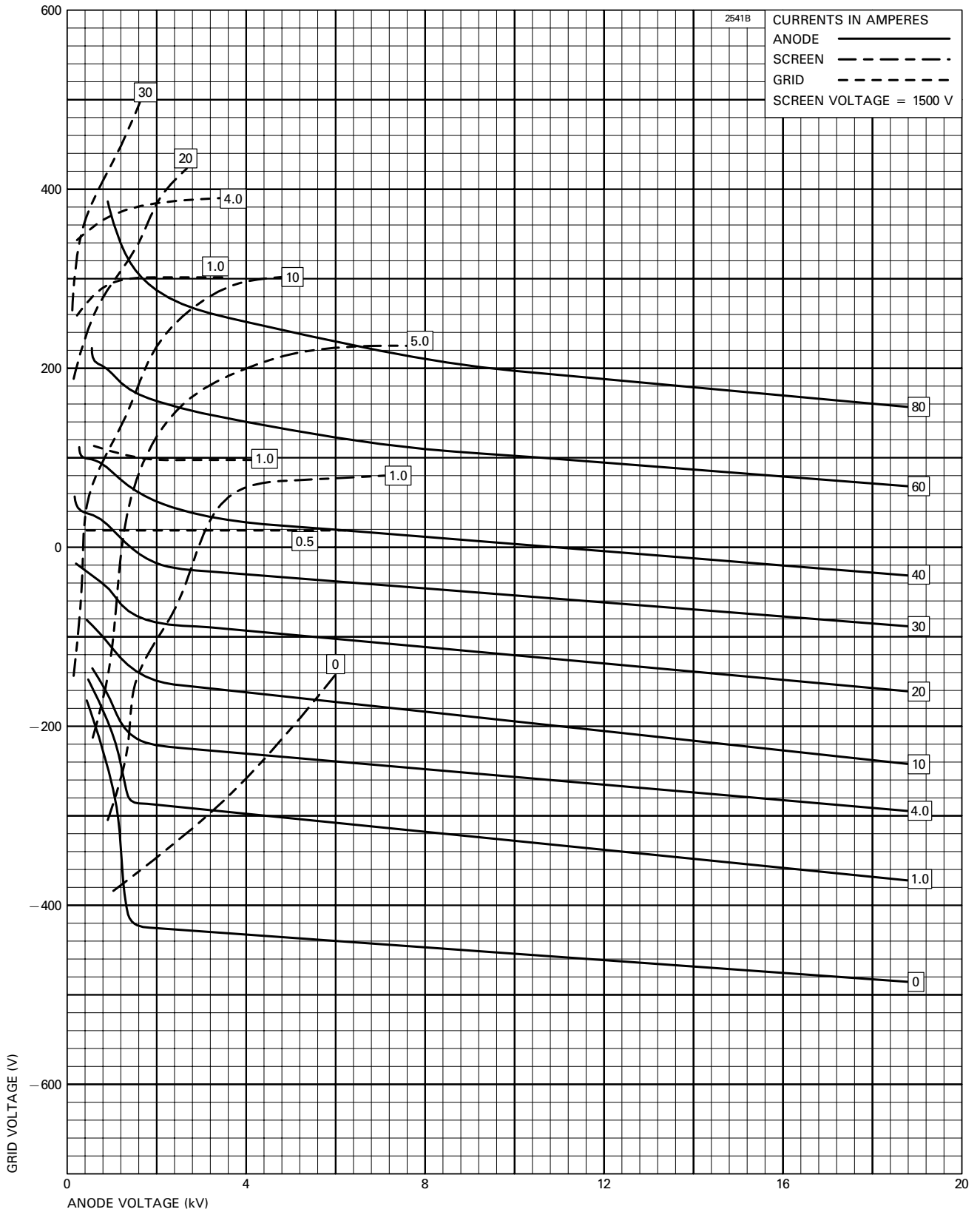
1. BS 3192. Specification for safety requirements for radio (including television) transmitting apparatus.
2. TEPAC Publication no. 181. Recommended practice for measurement of X-radiation from power tubes

MINIMUM WATER COOLING REQUIREMENTS

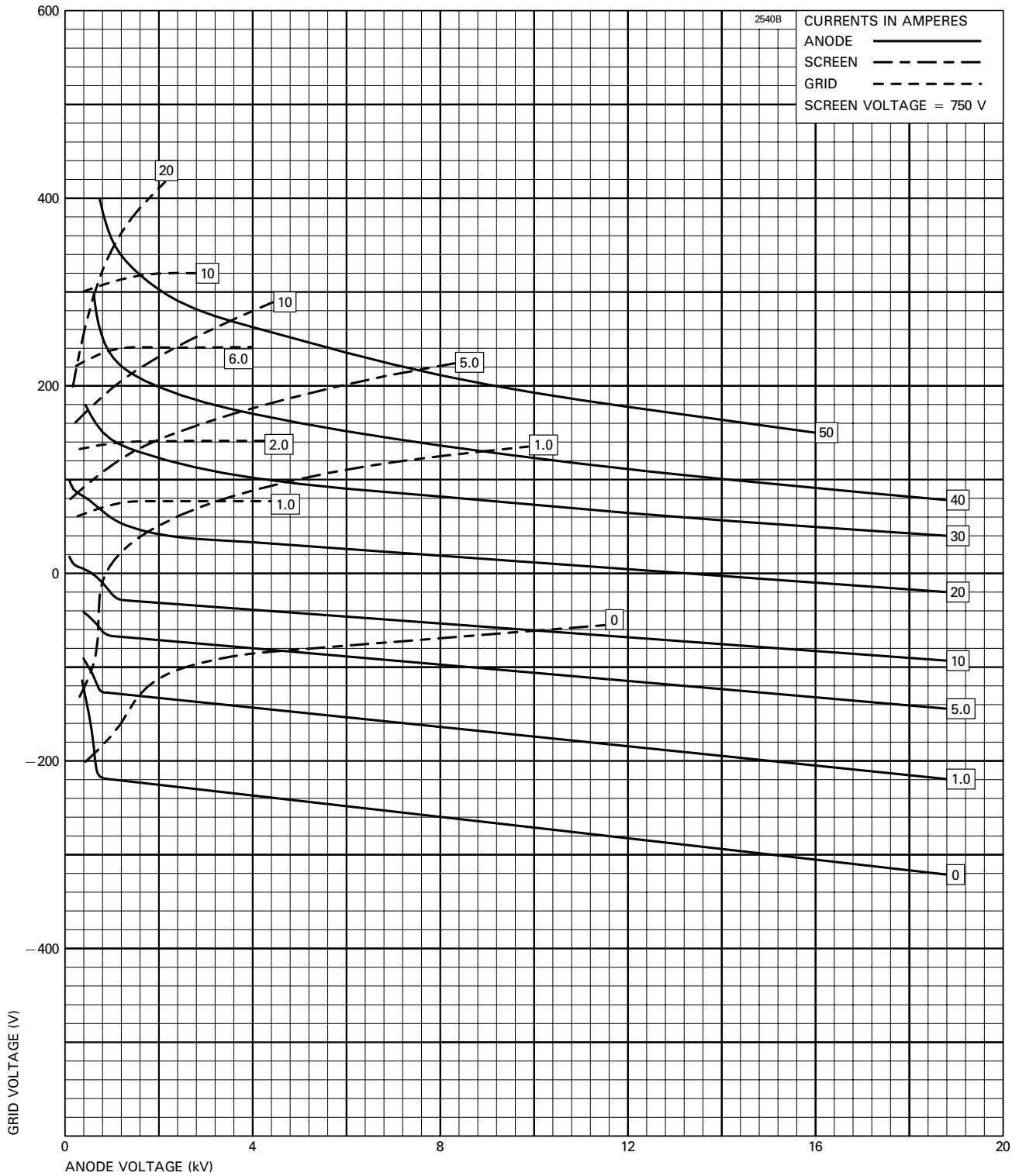
Higher rates of flow should be used where possible, but inlet pressure should not exceed 6 Bar.



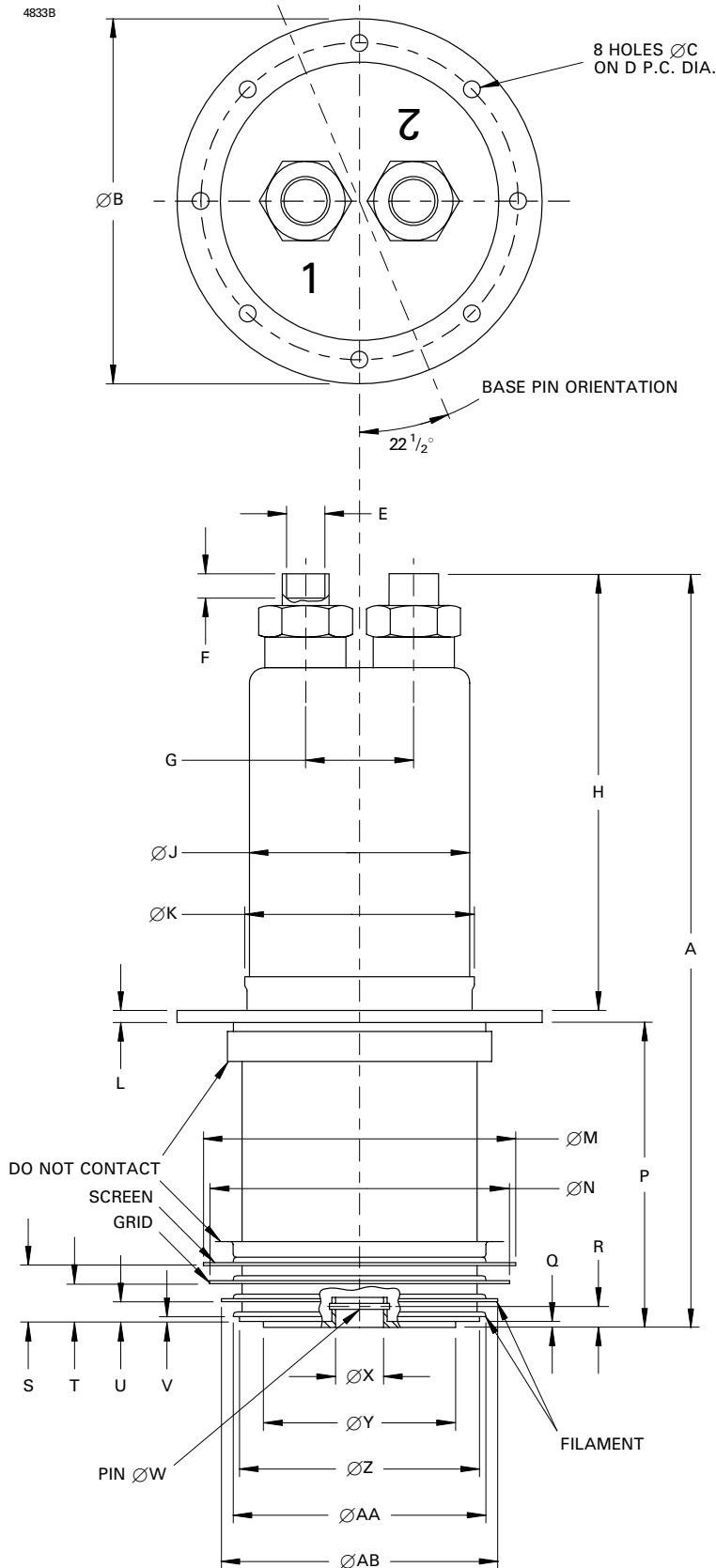
TYPICAL CONSTANT CURRENT CHARACTERISTICS



TYPICAL CONSTANT CURRENT CHARACTERISTICS



OUTLINE (All dimensions without limits are nominal)



Ref	Millimetres
A	492.0 max
B	237.0 ± 0.5
C	11.0
D	206.0 ± 0.2
E	28.0 ± 0.2
F	18.5 ± 0.5
G	70.0 ± 0.5
H	283.0 max
J	143.0 ± 1.0
K	149.0 max
L	11.3 ± 0.2
M	203.1 ± 0.5
N	190.5 ± 0.5
P	198.0 ± 1.0
Q	1.90 max
R	12.95 ± 0.50
S	44.5 ± 0.6
T	30.8 ± 0.6
U	17.4 ± 0.7
V	3.0 ± 0.5
W	3.43
X	32.00 ± 0.25
Y	127.0 ± 0.5
Z	152.4 ± 0.5
AA	165.86 ± 0.76
AB	177.8 ± 0.5

Outline Note

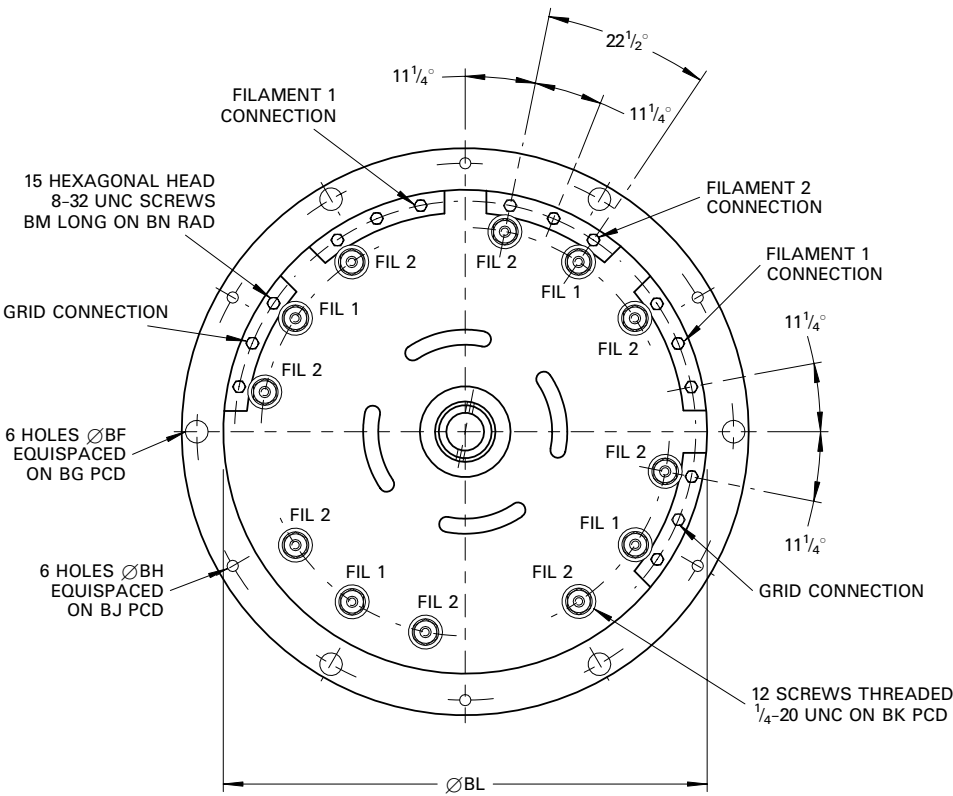
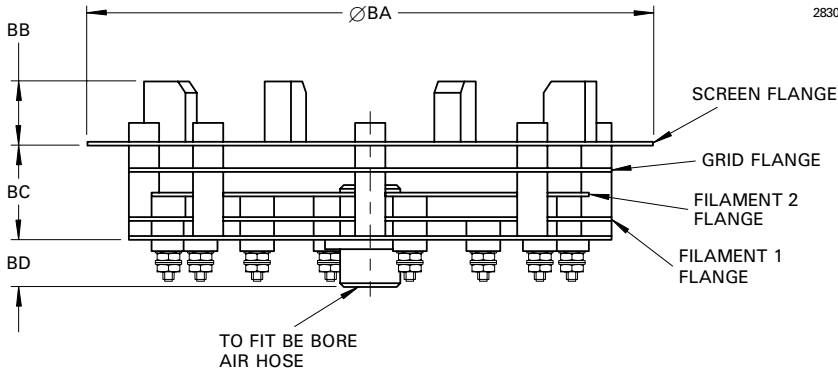
The eccentricity of the filament, grid and screen contact surfaces will not exceed 3.18 mm with respect to dimension X.

Water Connections

	Anode down	Anode up
Inlet	1	2
Outlet	2	1

OUTLINE OF SOCKET MA166B (All dimensions without limits are nominal)

2830D



Ref	Millimetres
BA	304.8 ± 0.4
BB	31.75 ± 3.96
BC	50.80 ± 0.51
BD	25.40 ± 0.51
BE	31.75
BF	11.10
BG	285.8
BH	5.80
BJ	285.8
BK	216.7
BL	257.2 ± 0.8
BM	9.53
BN	122.3

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