e2v technologies

BW1602J2F
RF Power Triode

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

ABRIDGED DATA

The BW1602J2F is a water cooled power triode of coaxial ceramic/metal construction, intended primarily for industrial service. It has an integral water jacket and integral filament leads.

Anode dissipation	200	kW max
Anode voltage	18	kV max
Frequency for full ratings	30	MHz max
Output power (class C oscillator, less drive)	400	kW

GENERAL

Electrical

Filament	thoriated tungsten	
Filament voltage (see note 1)	18	V
Filament current	330	A
Surge filament current (peak) (see note 2)	1200	A max
Filament cold resistance	6.8	mΩ
Peak usable cathode current	200	A max
Amplification factor (V_a = 9.0 kV, I_a = 10 A)	35	
Inter-electrode capacitances:		
grid to anode	92	pF
grid to filament	240	pF
anode to filament	4.5	pF

Mechanical

Overall length	639 mm nom
Overall diameter	250 mm nom
Net weight	30 kg approx
Mounting position	vertical, anode up or down

Accessories

Grid adaptor plate	MA927A
Water union coupling (hose connection)	MA709E

COOLING

Anode

The BW1602J2F has an integral water jacket; the water cooling requirements are given in the following table.

Anode plus grid dissipation (kW)	Inlet temperature (°C)	Minimum water flow rate (l./min)	Pressure drop (bar)	Outlet temperature (°C)
200	20	80	1.73	59
200	50	120	3.81	76
150	20	54	0.78	64
150	50	84	1.92	78
100	20	34	0.33	67
100	50	54	0.78	80

The inlet water temperature must not exceed 50 °C.

The pressure in the water jacket must not exceed 6.8 bar.

Seals and Envelope

The temperature of the seals and envelope must not exceed 220 °C. Cooling of the seals by low velocity air flow is required.

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RADIO FREQUENCY OSCILLATOR FOR INDUSTRIAL SERVICE

(Class C conditions, one tube)

MAXIMUM RATINGS (Absolute values)

Frequency	30	MHz
Anode voltage	18	kV max
Anode input power (see note 3)	575	kW max
Anode dissipation	200	kW max
Grid voltage (negative value)	2.5	kV max
Grid current:		
on load	8.5	A max
off load	11	A max
Grid dissipation	6.0	kW max
Grid circuit resistance	3.0	kΩ max
Cathode current (peak)	200	A max
Cathode current (mean)	44	A max

TYPICAL OPERATING CONDITIONS

Frequency	30	30	30	MHz
Anode voltage	12	14	16	kV
Anode current	27	32	32	A
Anode dissipation	67	89	102	kW
Grid voltage	−700	−800	−911	V
Grid resistor	120	127	134	Ω
Grid current	5.8	6.3	6.8	A
Grid dissipation	3.1	3.7	4.0	kW
Feedback ratio (see note 4)	11.1	10.8	11.0	%
Peak RF grid voltage	1230	1390	1500	V
Drive power	7.2	8.7	10.2	kW
Oscillator output power (see note 5)	250	350	400	kW
Efficiency	77	78	78	%
Anode load resistance	235	230	240	Ω

NOTES

1. Temporary fluctuations up to +5% or −10% in filament voltage are permissible.
2. The filament current must not exceed 1200 A, even momentarily, at any time.
3. A fast-acting overcurrent cutout, acting on the anode supply, is essential for protecting the tube in the event of an internal flashover. One or both of the following tests on the anode power supply may be used to check that the overcurrent cutout is fast enough. In both tests the applied anode voltage is short-circuited by means of a high voltage switch directly at the tube anode.

   Test 1 In this test the short-circuit current flows through a length of copper wire (approximately 2 to 3 cm/kV of applied anode voltage). A copper wire of 0.4 mm diameter should not fuse.

   Test 2 In this test the short-circuit current flows through a current transformer or a meter shunt of low resistance and is measured with an oscilloscope.

   The integral $\int I^2 dt$ over the time that the current is flowing should not exceed 1500 A^2sec.

4. The feedback ratio is defined as $\frac{V_{g(pk)}}{V_{a(pk)}} \times 100$

   where $V_{g(pk)}$ = peak RF grid voltage in volts

   and $V_{a(pk)}$ = peak RF anode voltage in volts.

5. Oscillator output power = $P_{out} - P_{drive}$

   where P_{out} = output power of tube to anode circuit

   and P_{drive} = drive power fed back to grid circuit.

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.

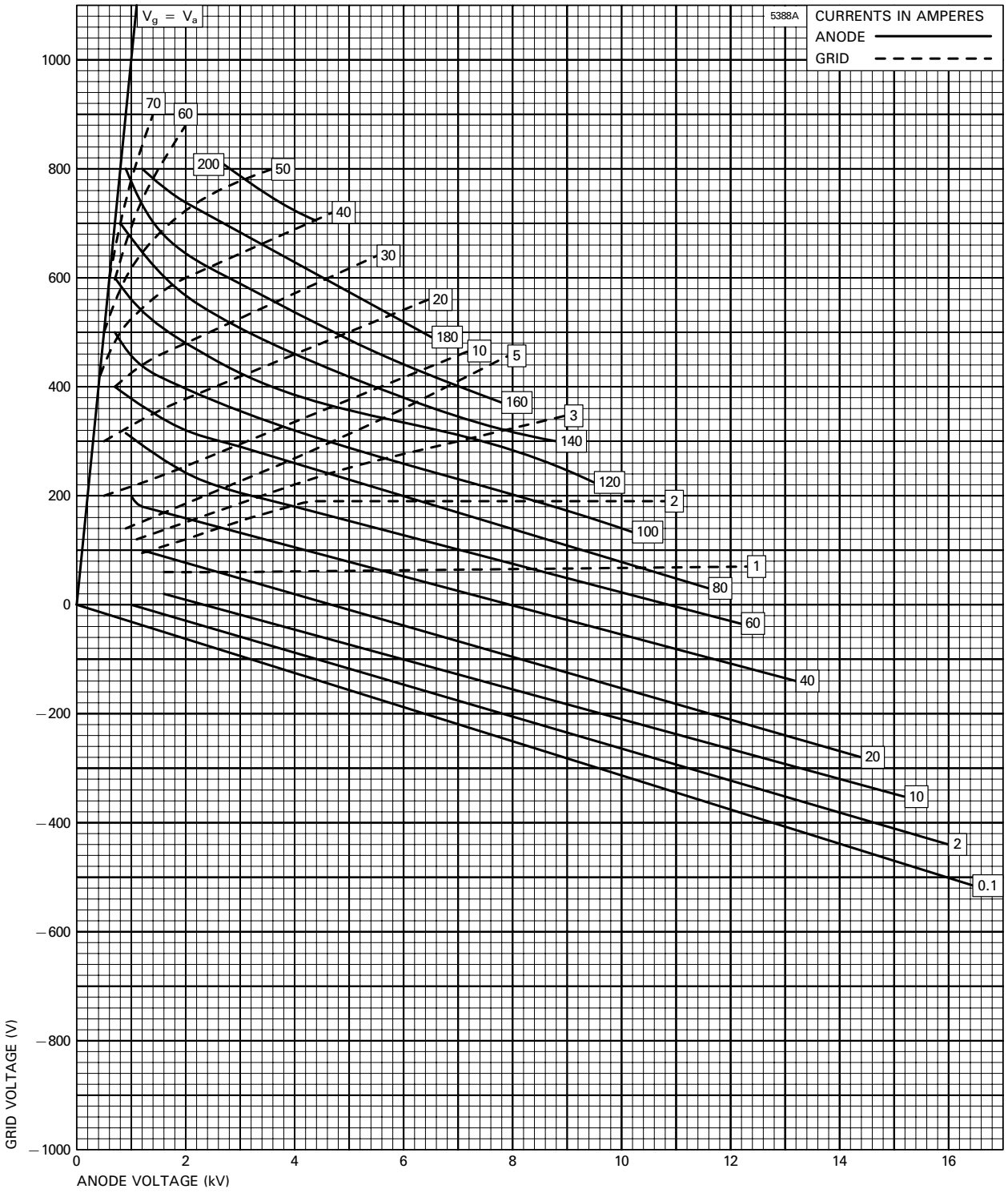
Implosion

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.

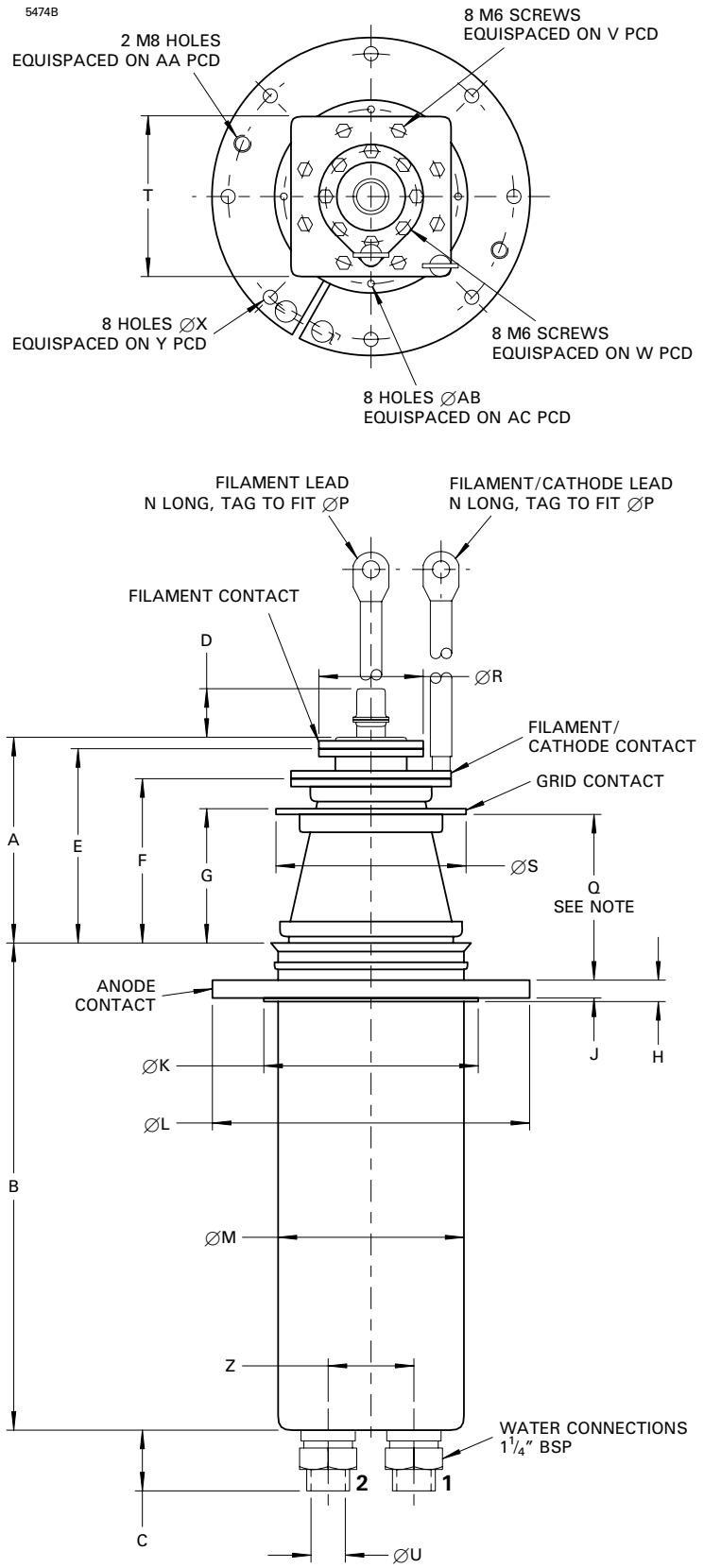
References

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.

TYPICAL CONSTANT CURRENT CHARACTERISTICS



OUTLINE (All dimensions without limits are nominal)



Ref	Millimetres
A	163.0 ± 1.0
B	389.0 ± 2.0
C	52.0 ± 2.0
D	35.0
E	155.0 ± 1.0
F	130.0 ± 1.0
G	106.0 ± 1.0
H	23.5 ± 0.5
J	20.8
K	170.0 ± 0.5
L	250.0 ± 1.0
M	143.0 ± 0.3
N	425.0 min
P	13.1
Q	130.0 min
R	82.0 ± 0.5
S	150.0 ± 0.5
T	126.0 ± 0.5
U	28.0 ± 0.2
V	111.0 ± 0.2
W	70.0 ± 0.2
X	11.0
Y	224.0 ± 0.4
Z	70.0 ± 0.3
AA	216.0 ± 0.4
AB	6.3
AC	138.0 ± 0.2

Outline Note

The position of the mounting flange may be readjusted between 130.0 mm and 353.0 mm by the customer.

Water Connections

	Anode down	**Anode up**
Inlet	1	2
Outlet	2	1