

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

ABRIDGED DATA

Two RF power triodes of coaxial ceramic/metal construction, intended primarily for industrial service. They are electrically identical and differ only in the method of anode cooling and anode dissipation.

Anode cooling:			
BR1606F	. . . . .	forced-air	
BW1606J2F	. . . . .	water; integral jacket	
Anode dissipation:			
BR1606F	. . . . .	10	kW max
BW1606J2F	. . . . .	15	kW max
Anode voltage	. . . . .	10	kV max
Frequency for full ratings	. . . . .	30	MHz max
Output power (class C oscillator, less drive)	. . . . .	30	kW

GENERAL

Electrical

Filament	. . . . .	thoriated tungsten	
Filament voltage (see note 1)	. . . . .	6.6	V
Filament current	. . . . .	100	A
Filament cold resistance	. . . . .	8.0	mΩ
Peak usable cathode current	. . . . .	25	A
Perveance	. . . . .	4.0	mA/V ^{3/2}
Amplification factor			
(V _a = 2.25 kV, I _a = 1.0 A)	. . . . .	24	
Mutual conductance			
(V _a = 2.25 kV, I _a = 1.0 A)	. . . . .	38	mA/V
Inter-electrode capacitances:			
grid to anode	. . . . .	35	pF
grid to filament	. . . . .	67	pF
anode to filament	. . . . .	2.0	pF

Mechanical

Overall dimensions	. . . . .	see outline drawings
Net weight:		
BR1606F	. . . . .	4.3 kg approx
BW1606J2F	. . . . .	3.3 kg approx
Mounting position	. . . . .	vertical, either way up

Accessories

Water coupling, supplied with BW1606J2F	. . . . .	MA323A
Thermal fuses, available for BW1606J2F	. . . . .	MA85E
Cathode connector	. . . . .	MA830
Air chimney	. . . . .	BR4080B

For frequencies above 2 MHz, MA830 should be used in conjunction with a strip connection to provide a low inductance cathode return.

COOLING

Anode

The BR1606F air cooling requirements are shown on page 5. The required air flow should be delivered through the radiator immediately before and during the application of any voltages. Filament power, anode power and air flow may be removed simultaneously.

BW1606J2F has an integral water jacket. Minimum water cooling requirements are shown on page 4; higher rates of flow should be used where possible. The water pressure in the jacket must not exceed 600 kPa.

A thermal fuse, part number MA85E (melting point 103 °C), is available for BW1606J2F to give protection against anode overheating. Two fuses should be used for maximum protection, screwed into the holes indicated on the anode mounting plate (see page 7). The fuses should be connected by a non-conducting cord to a suitable switching device; a tension of about 450 g should be applied to the fuses via the cord. If the temperature exceeds the safe limit, one or both fuses will release and the fuse cord is pulled outwards; this should actuate the switching device and remove all electrical supplies to the tube. Replacement fuses can be supplied to order.

Filament and Grid Seals

The temperature of the filament and grid seals must not exceed 200 °C. A flow of air of 0.42 m³/min directed onto the terminals via a 25 mm diameter nozzle from a distance of 150 mm before and during the application of any voltages is usually adequate for limiting the temperature of the seals.

RADIO FREQUENCY OSCILLATOR FOR INDUSTRIAL SERVICE (Class C conditions, one tube)

MAXIMUM RATINGS (Absolute values)

Anode voltage	. . . . .	10	kV max
Anode current	. . . . .	4.5	A max
Anode dissipation:			
BR1606F	. . . . .	10	kW max
BW1606J2F	. . . . .	15	kW max
Grid voltage (negative value)	. . . . .	-1.5	kV max
Off-load grid current	. . . . .	1.7	A max
Grid dissipation	. . . . .	600	W max
Frequency	. . . . .	30	MHz max

**OPERATING CONDITIONS
(At maximum anode current)**

Anode voltage	9.5	9.0	8.0	7.0	6.0	kV
Grid voltage	-780	-740	-650	-575	-500	V
from grid resistor	867	822	625	553	500	Ω
Peak RF grid drive voltage	1125	1085	1000	915	830	V
Peak positive grid voltage	345	345	345	340	330	V
Anode current	4.5	4.5	4.5	4.5	4.5	A
Grid current	0.9	0.9	1.04	1.04	1.0	A
Anode dissipation	6.9	6.9	6.1	5.8	5.4	kW
Grid dissipation	319	326	364	353	300	W
Driving power	1000	1000	1040	952	830	W
Feedback ratio (see note 2)	12.8	13.1	13.4	14.2	15.2	%
Anode output power	35.6	33.9	30.3	25.9	21.6	kW
Anode efficiency	83.7	83.1	83.0	81.6	80.0	%
Oscillator output power (see note 3)	34.6	32.9	29.2	24.9	20.8	kW
Oscillator efficiency	81.4	80.6	80.2	78.6	76.9	%
Load resistance	1088	1016	915	802	684	Ω

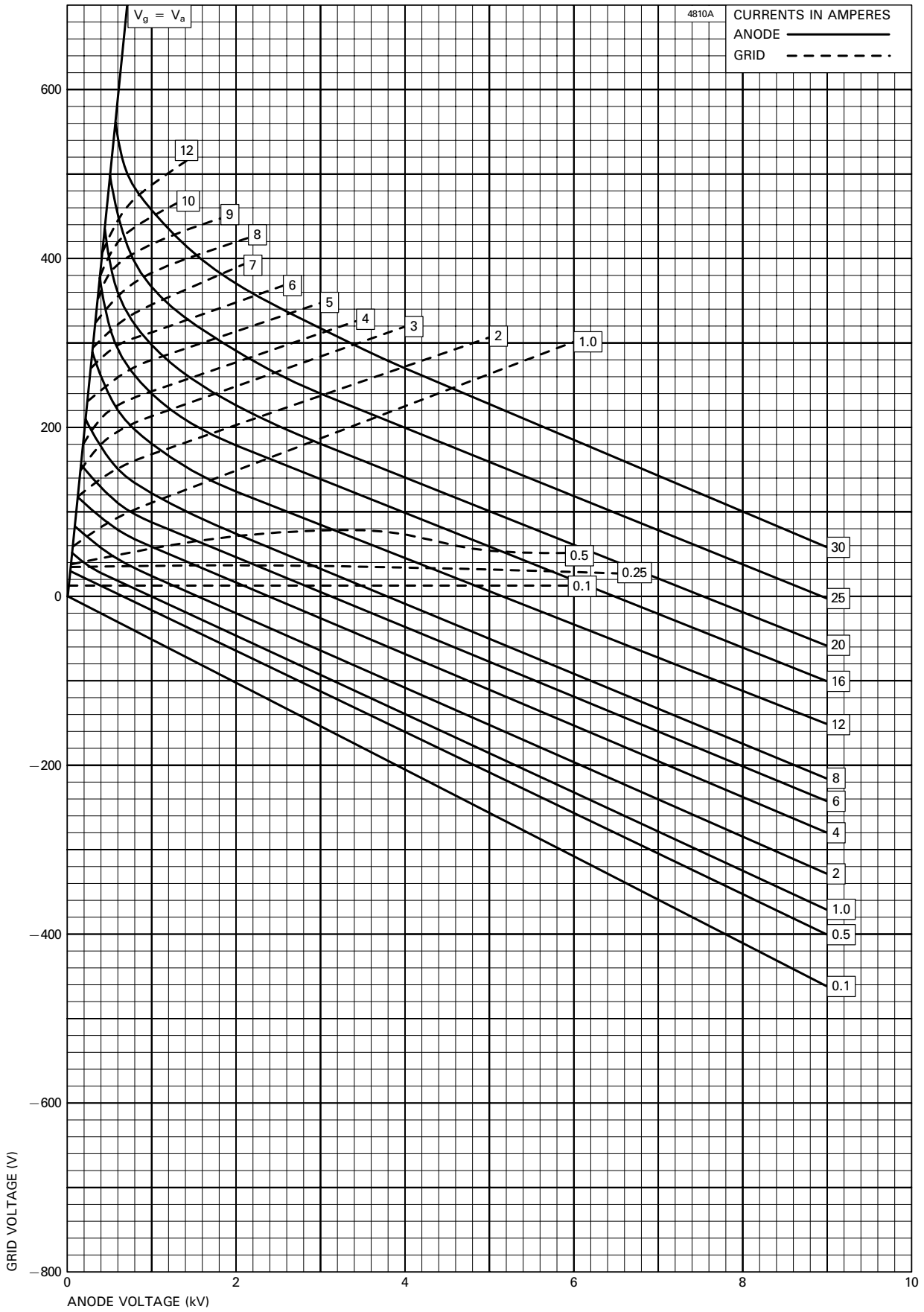
**OPERATING CONDITIONS
(With reduced input power)**

Anode voltage	9.5	9.0	8.0	7.0	6.0	kV
Grid voltage	-780	-740	-650	-575	-500	V
from grid resistor	1560	1233	1083	958	714	Ω
Peak RF grid drive voltage	1035	1000	905	830	760	V
Peak positive grid voltage	255	260	255	255	260	V
Anode current	3.0	3.0	3.0	3.0	3.0	A
Grid current	0.5	0.6	0.6	0.6	0.7	A
Anode dissipation	4.5	4.1	4.0	3.6	3.2	kW
Grid dissipation	130	145	144	156	180	W
Driving power	530	556	513	507	524	W
Feedback ratio (see note 2)	11.9	12	12.4	13	13.8	%
Anode output power	24.1	23.0	20.3	17.4	15.0	kW
Anode efficiency	84.4	84.8	83.4	83.0	82.6	%
Oscillator output power (see note 3)	23.6	22.4	19.8	16.9	14.5	kW
Oscillator efficiency	82.4	82.5	81.4	80.8	79.5	%
Load resistance	1570	1495	1315	1180	1008	Ω

NOTES

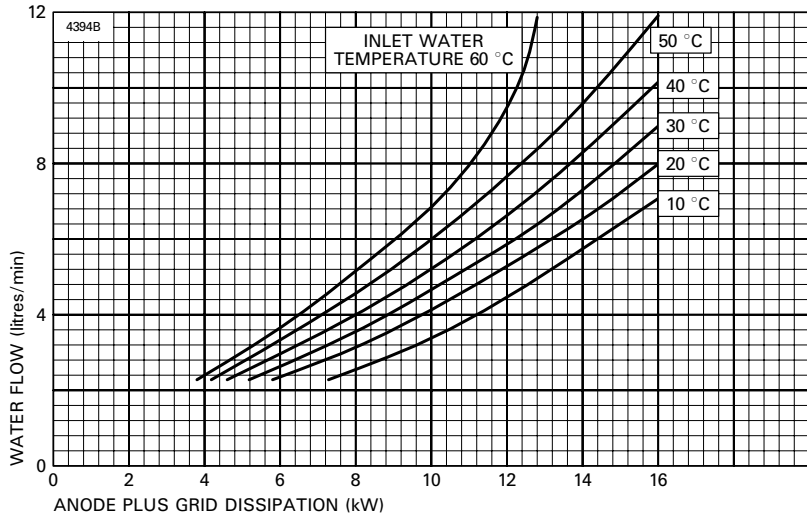
- The tube must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%. The filament may be switched on at its operating voltage and no surge limiting devices need be incorporated in the filament circuit. The voltage drop in the integral filament leads is less than 1% of the filament voltage.
- 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.
- 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.

TYPICAL CONSTANT CURRENT CHARACTERISTICS

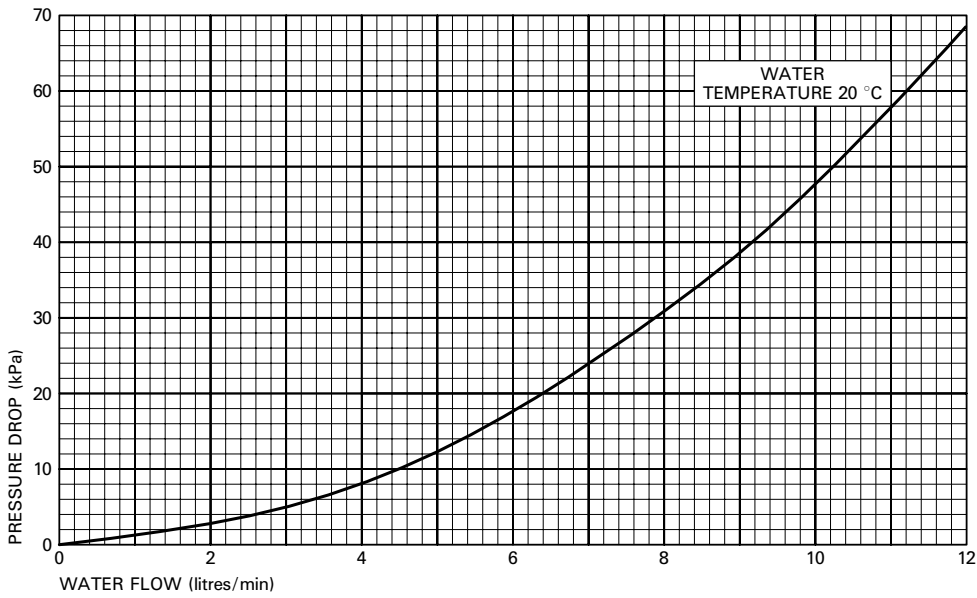


MINIMUM WATER COOLING REQUIREMENTS FOR BW1606J2F

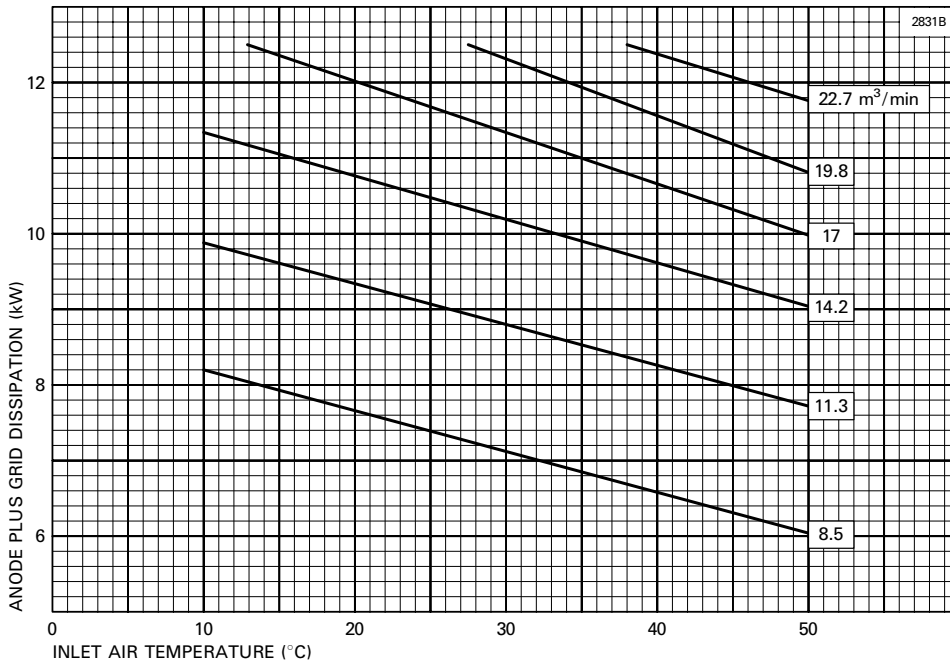
(Higher rates of flow should be used where possible)



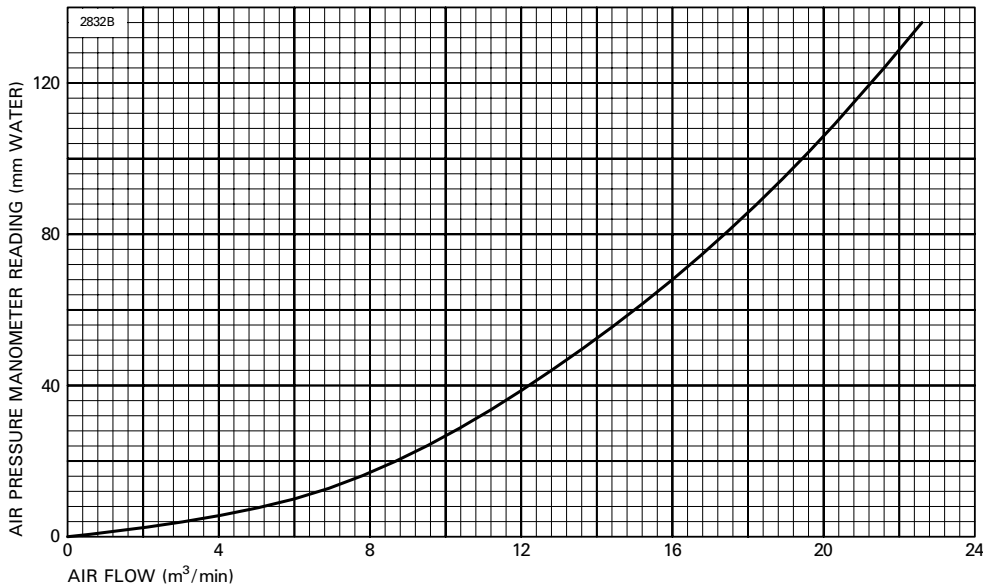
TYPICAL WATER FLOW CHARACTERISTIC FOR BW1606J2F



AIR COOLING REQUIREMENTS FOR BR1606F

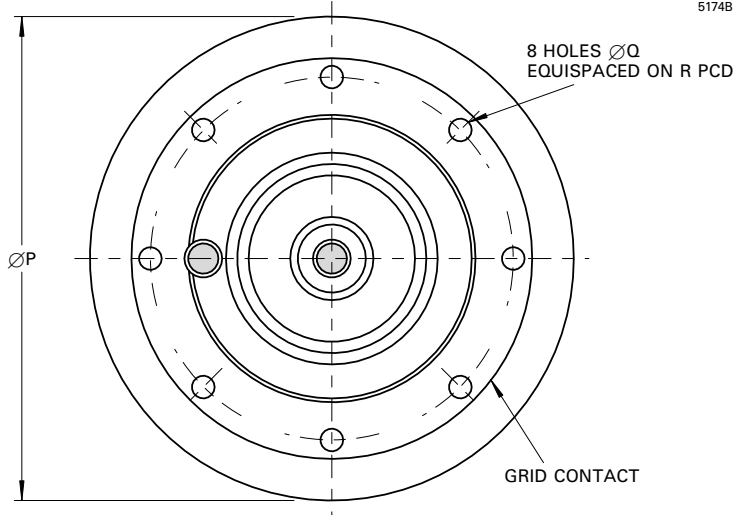


TYPICAL AIR FLOW CHARACTERISTIC FOR BR1606F

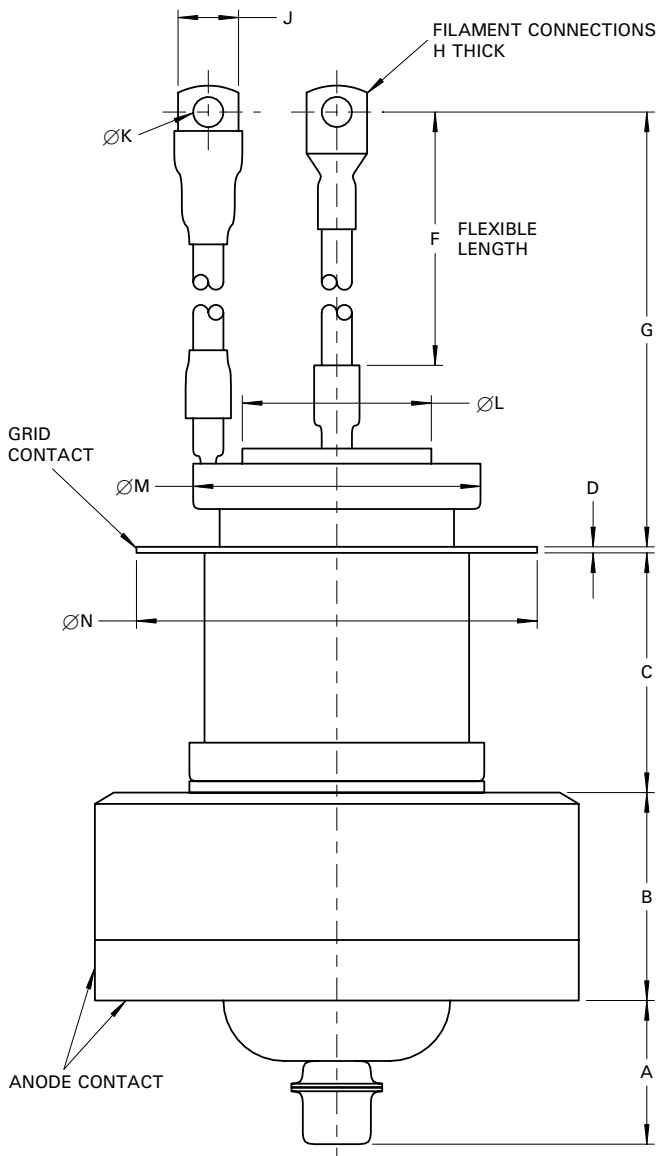


OUTLINE FOR BR1606F (All dimensions without limits are nominal)

5174B

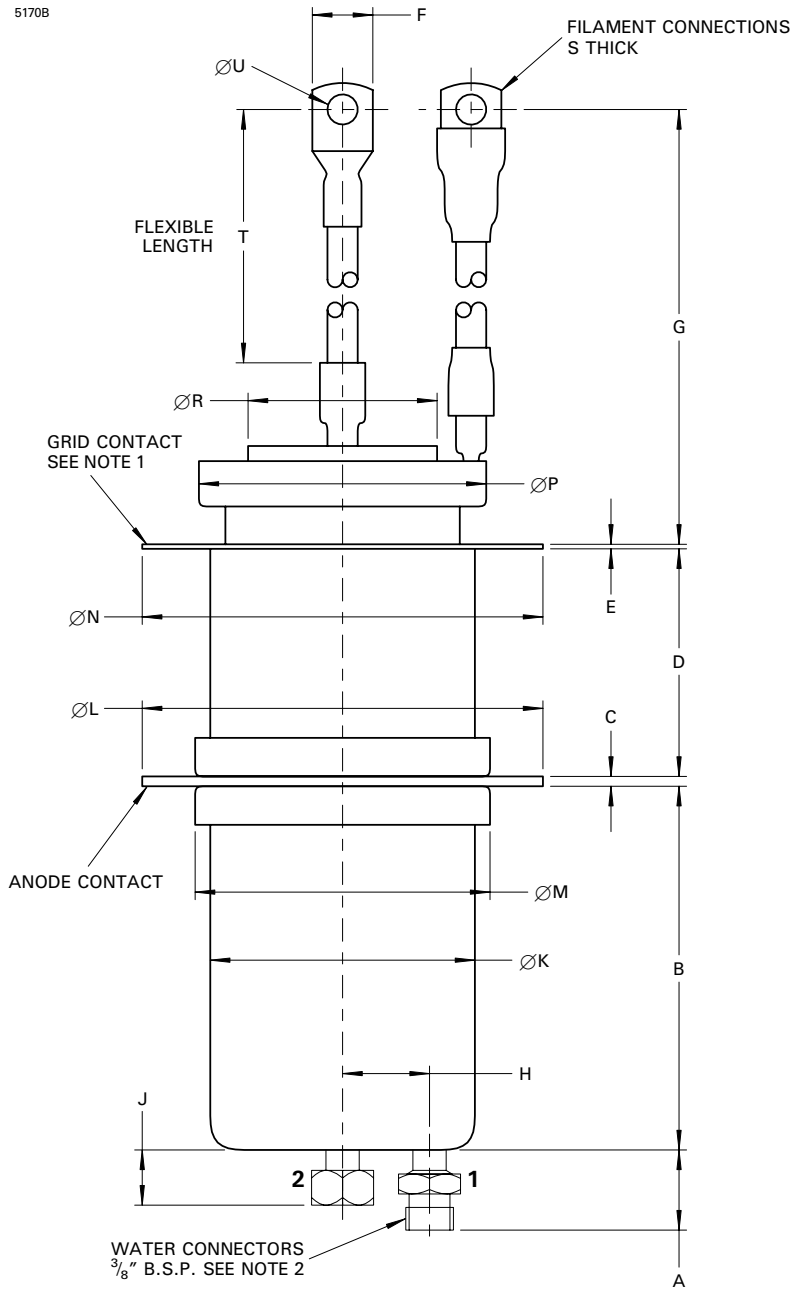


Ref	Millimetres
A	46.6
B	68.0 ± 0.5
C	79.0 ± 1.5
D	1.5
F	212.0
G	325.0 ± 15.0
H	3.0
J	19.0
K	10.5 ± 0.1
L	63.0
M	96.0 ± 0.2
N	133.25 ± 0.50
P	159.0
Q	6.5
R	119.0 ± 0.1



OUTLINE FOR BW1606J2F (All dimensions without limits are nominal)

5170B

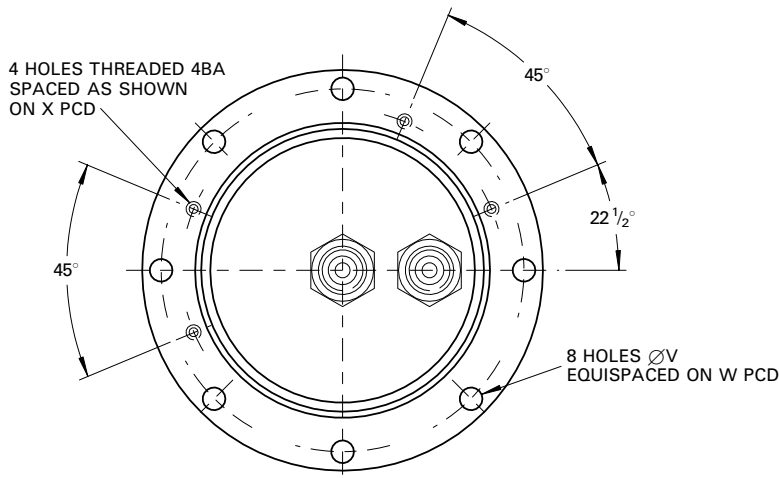


Ref	Millimetres
A	27.0 ± 3.2
B	127.55 ± 2.00
C	3.25 ± 0.20
D	75.86 ± 1.00
E	1.5
F	19.0
G	325.0 ± 15.0
H	27.0 ± 2.0
J	18.0 ± 3.2
K	90.0 ± 1.0
L	133.25 ± 0.50
M	99.0 max
N	133.25 ± 0.50
P	96.0 ± 0.2
R	63.0
S	3.0
T	212.0
U	10.5 + 0.5 - 0.0
V	6.5
W	119.0 ± 0.1
X	112.3 ± 0.5

Outline Notes

1. The grid contact flange has 8 holes of the same size and position as those in the anode contact flange.
2. The water connections must be made as follows, depending on the mounting position.

	Anode down	Anode up
Inlet	2	1
Outlet	1	2



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.

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