

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 differ only in the method of anode cooling and anode dissipation.

#### Anode cooling:

BR1647F . . . . .	forced-air
BW1647J2F . . . . .	water; integral jacket

#### Anode dissipation:

BR1647F . . . . .	30	kW max
BW1647J2F . . . . .	50	kW max
Anode voltage . . . . .	13	kV max
Frequency for full ratings . . . . .	30	MHz max
Output power (class C oscillator, less drive) . . . . .	118	kW

### GENERAL

#### Electrical

Filament . . . . .	thoriated tungsten
Filament voltage (see note 1) . . . . .	8.2 V
Filament current . . . . .	238 A
Surge filament current (peak (see note 2) . . . . .	1200 A max
Filament cold resistance . . . . .	4.0 mΩ
Peak usable cathode current . . . . .	70 A
Amplification factor ( $V_a = 10$ kV, $I_a = 5.0$ A) . . . . .	28
Mutual conductance ( $V_a = 10$ kV, $I_a = 5.0$ A) . . . . .	51 mA/V
Inter-electrode capacitances:	
grid to anode . . . . .	47 pF
grid to filament . . . . .	126 pF
anode to filament . . . . .	2.0 pF

#### Mechanical

Overall dimensions . . . . .	see outline drawings
Net weight:	
BR1647F . . . . .	16 kg approx
BW1647J2F . . . . .	12 kg approx
Mounting position (see note 3) . . . . .	vertical, either way up

#### Accessories

Water coupling, supplied with BW1647J2F . . . . .	MA709B
Thermal fuse for BW1647J2F . . . . .	MA85E or MA85G
Cathode connector . . . . .	MA830

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 BR1647F 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.

The BW1647J2F has an integral water jacket. See table for water cooling requirements. The BW1647J2F can be supplied fitted with a thermal fuse MA85E or MA85G if required.

### Seals and Envelope

The temperature of the seals and envelope must not exceed 200 °C. Cooling of the seals by low velocity air flow is required.

### Water Cooling Requirements for the BW1647J2F

Anode plus grid dissipation (kW)	Inlet temperature (°C)	Minimum rate of water flow (l/min)	Pressure drop (bar)	Outlet temperature (°C)
50	20	30	0.27	45
50	50	73	1.38	60
30	20	20	0.10	43
30	50	45	0.72	60
15	20	10	0.07	45
15	50	24	0.15	60

The inlet water temperature must never exceed 50 °C.

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

## RADIO FREQUENCY OSCILLATOR FOR INDUSTRIAL SERVICE

(Class C conditions, one tube)

### MAXIMUM RATINGS (Absolute values)

Frequency . . . . .	30	MHz
Anode voltage . . . . .	13	kV max
Anode input power . . . . .	150	kW max
Anode dissipation:		
BR1647F . . . . .	30	kW max
BW1647J2F . . . . .	50	kW max
Grid voltage (negative value) . . . . .	2.0	kV max
Grid current:		
on load . . . . .	3.0	A max
off load . . . . .	3.8	A max
Grid dissipation . . . . .	1.8	kW max
Grid circuit resistance . . . . .	10	kΩ max
Cathode current . . . . .	16	A max

## TYPICAL OPERATING CONDITIONS

	BW1647J2F only				
Frequency . . . . .	30	30	30	30	MHz
Anode voltage . . . . .	8.0	10	12	12	kV
Anode current . . . . .	8.2	10.6	10.4	12.3	A
Anode dissipation . . . . .	13.6	21.1	21.3	26.3	kW
Grid voltage . . . . .	-580	-700	-860	-860	V
Grid resistor . . . . .	322	318	390	318	Ω
Grid current, on load . . . . .	1.8	2.2	2.2	2.7	A
Grid current, off load . . . . .	2.8	3.4	3.4	3.5	A
Grid dissipation . . . . .	711	1100	1100	1600	W
Feedback ratio (see note 4) . . . . .	13.7	13	12.2	12.8	%
Drive power . . . . .	1.7	2.6	3.0	3.9	kW
Output power . . . . .	51.9	84.6	102.9	121.9	kW
Efficiency . . . . .	79.3	80	82.8	82.3	%
Oscillator output power (see note 5) . . . . .	50.2	82	100	118	kW

## 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. If BW1647J2F is mounted with the anode uppermost, the water inlet and outlet connections should be reversed (see page 7).

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.



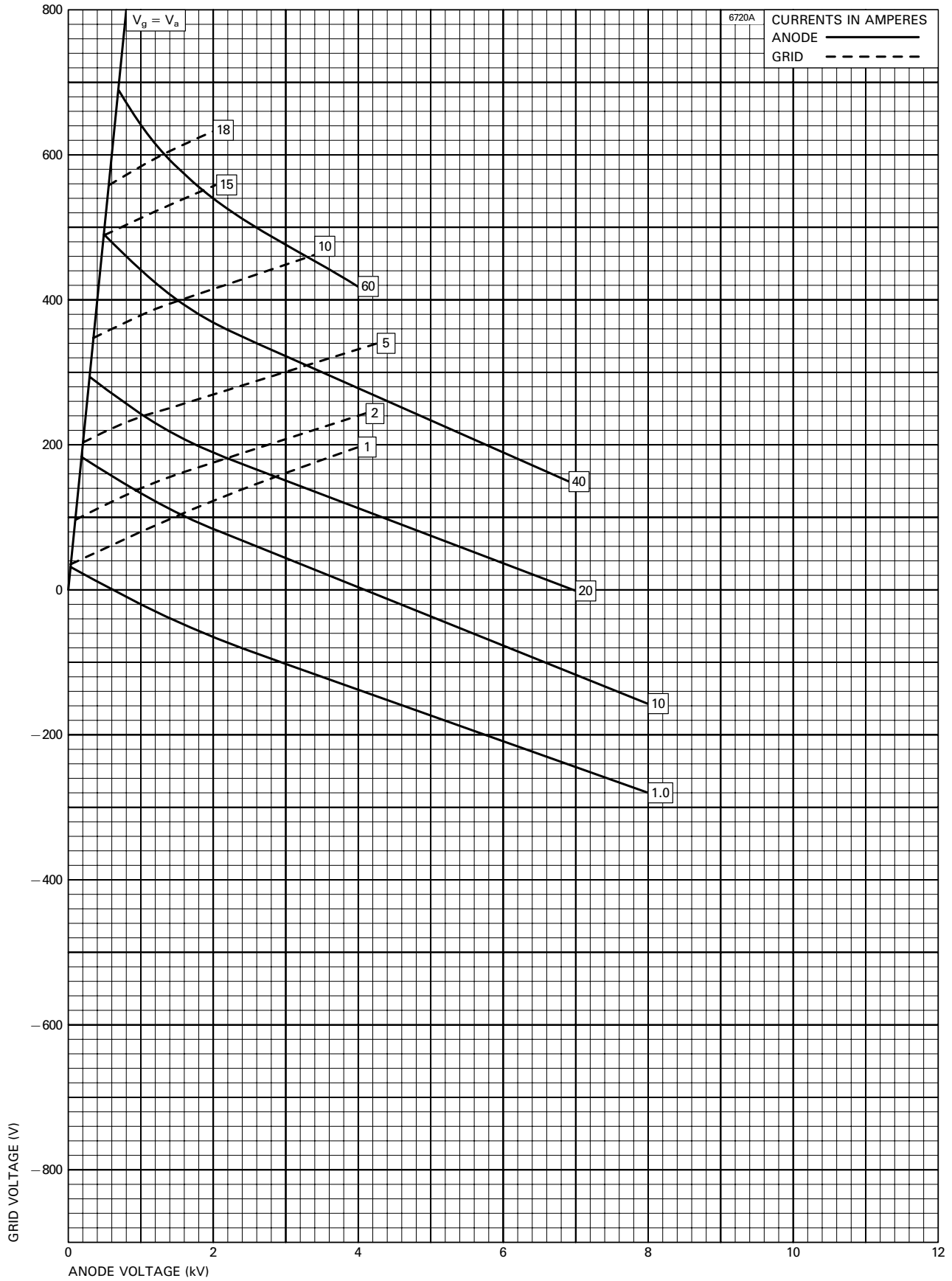
### Implosion

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.

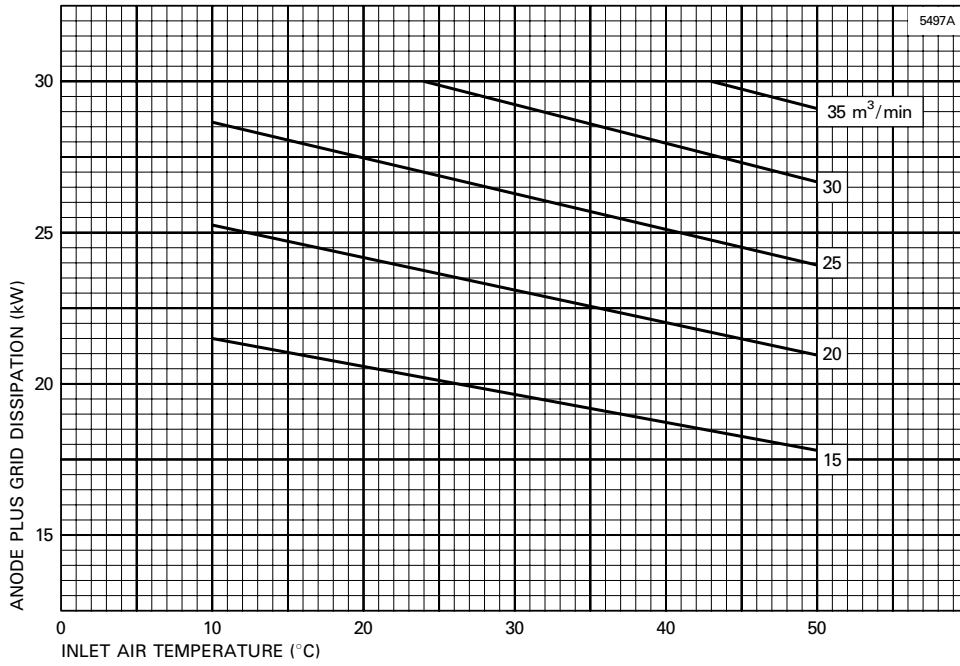
## References

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 high power tubes.

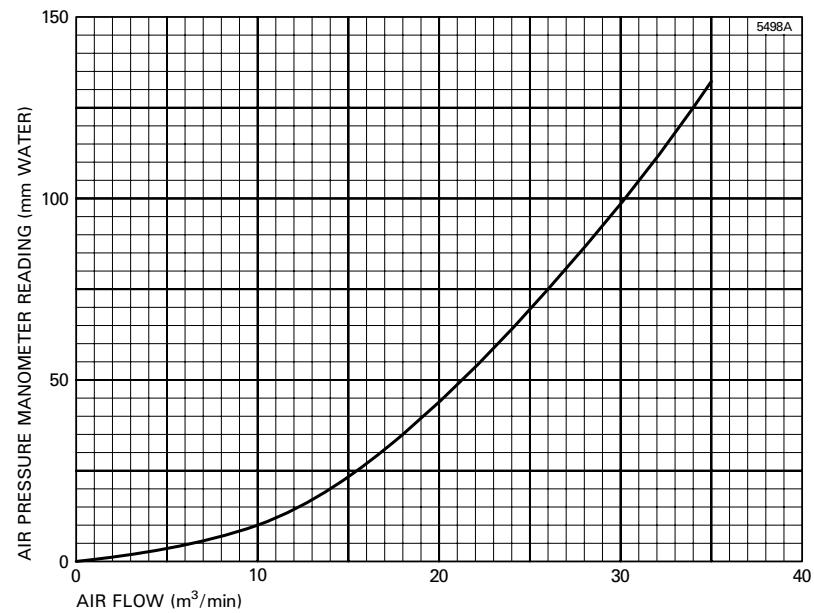
# TYPICAL CONSTANT CURRENT CHARACTERISTICS



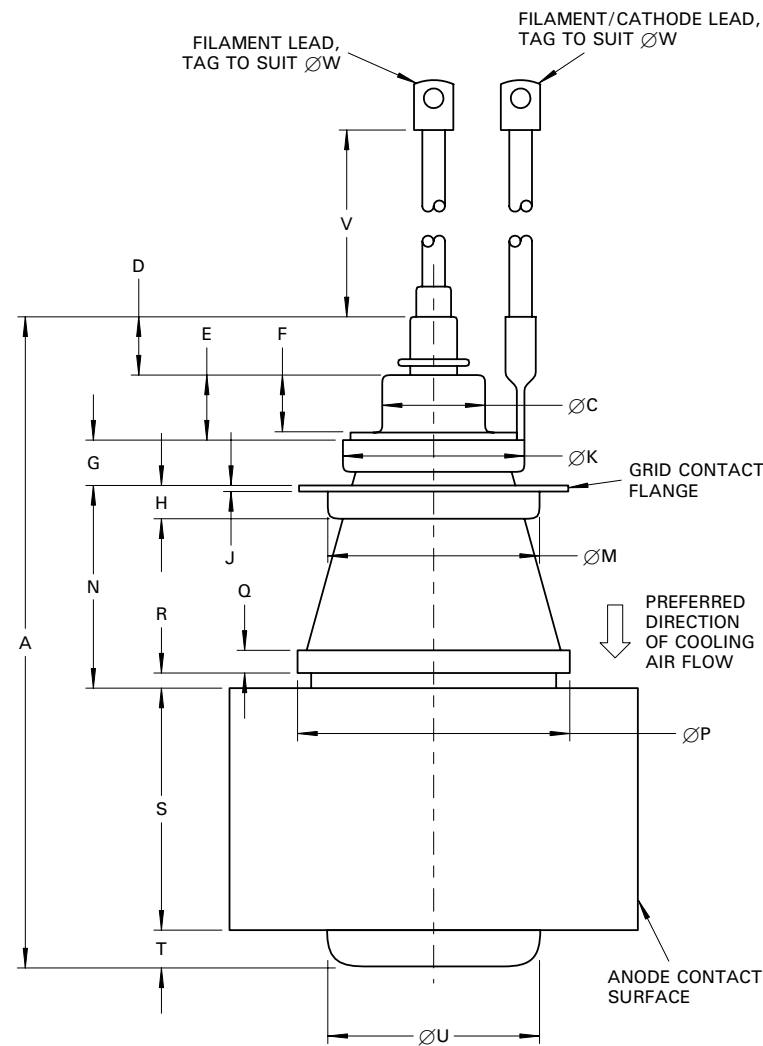
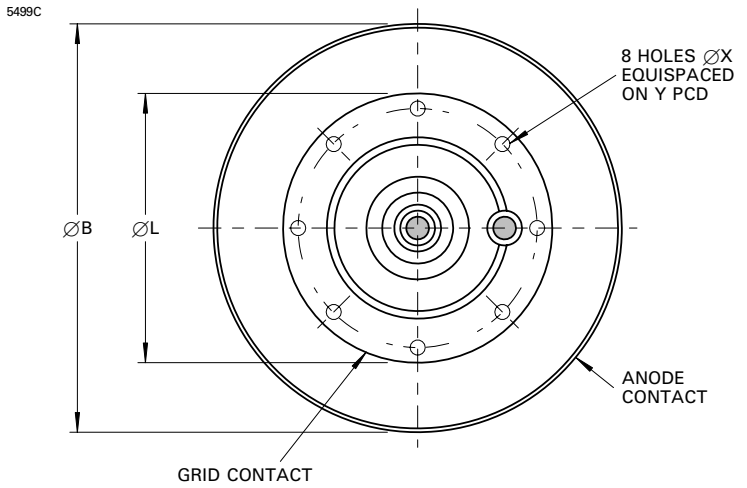
## AIR COOLING REQUIREMENTS FOR BR1647F



## TYPICAL AIR FLOW CHARACTERISTICS FOR BR1647F

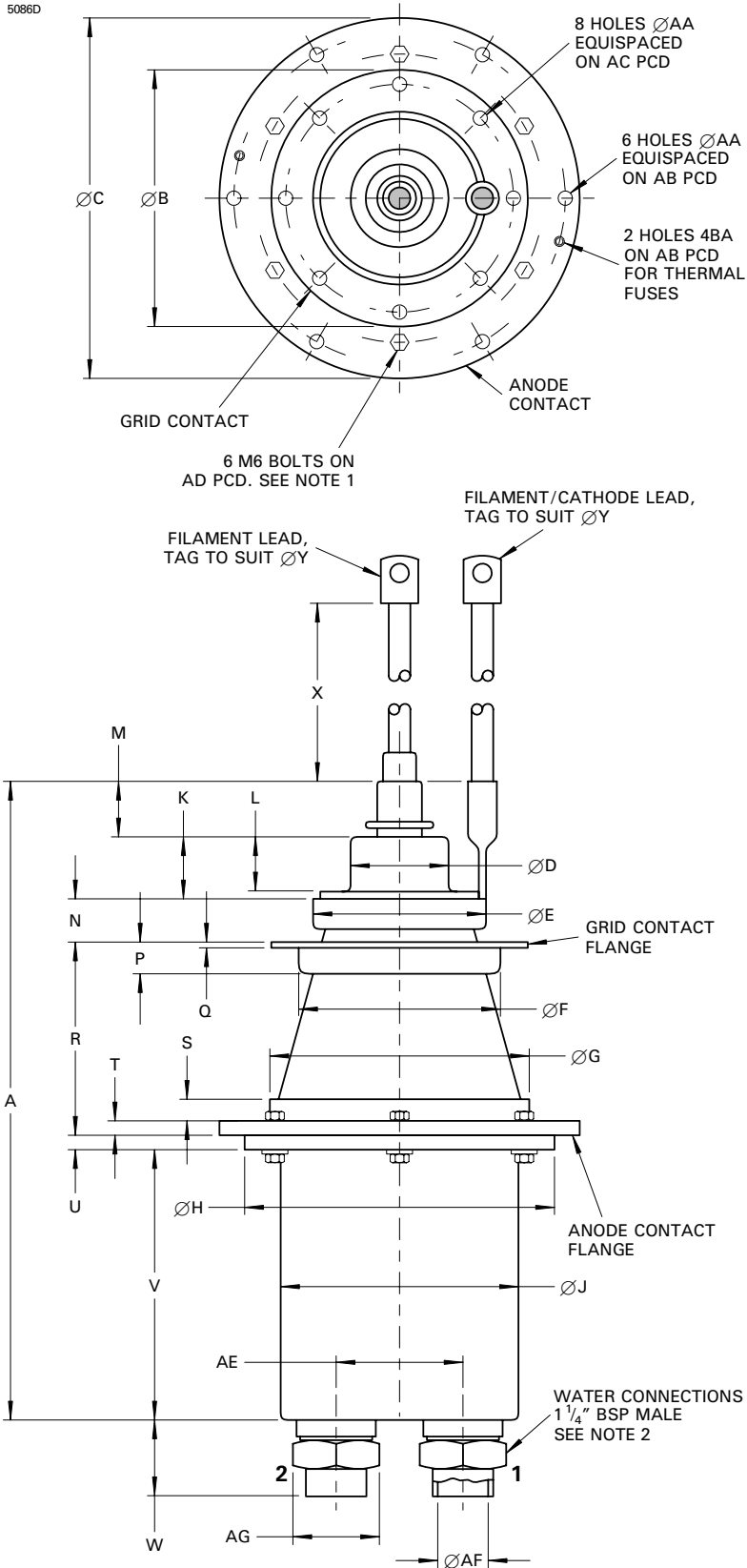


# OUTLINE FOR BR1647F (All dimensions nominal)



Ref	Millimetres
A	349.0
B	215.0
C	54.0
D	36.0
E	33.0
F	29.0
G	24.0
H	18.0
J	3.0
K	96.0
L	142.0
M	112.0
N	108.0
P	145.0
Q	11.5
R	10.0
S	130.0
T	18.0
U	112.0
V	400.0
W	13.1
X	6.3
Y	127.0

# OUTLINE FOR BW1647J2F (All dimensions nominal)



Ref	Millimetres
A	370.0
B	142.0
C	200.0
D	54.0
E	96.0
F	112.0
G	145.0
H	172.0
J	133.0
K	33.0
L	29.0
M	36.0
N	24.0
P	18.0
Q	3.0
R	105.0
S	12.5
T	7.0
U	6.3
V	166.7
W	46.0
X	330.0
Y	13.1
AA	6.3
AB	186.0
AC	127.0
AD	160.0
AE	70.0
AF	28.0
AG	46.0

## Outline Notes

1. The six M6 bolts enable the water jacket to be removed by the customer if required
2. The water connections must be made as follows, depending on the mounting position.

	Anode down	Anode up
Inlet	1	2
Outlet	2	1

Whilst e2v technologies has taken care to ensure the accuracy of the information contained herein it accepts no responsibility for the consequences of any use thereof and also reserves the right to change the specification of goods without notice. e2v technologies accepts no liability beyond that set out in its standard conditions of sale in respect of infringement of third party patents arising from the use of tubes or other devices in accordance with information contained herein.