E2V Technologies
MG5349
Tunable S-Band Magnetron

The data should be read in conjunction with the Magnetron Preamble and with British Standard BS9030 : 1971.

ABRIDGED DATA

Mechanically tuned pulse magnetron intended primarily for linear accelerators.

Frequency range	2992 to 3001	MHz
Peak output power	3.1	MW
Magnet	electromagnet MG6053	
Output	to no. 10 waveguide (72.140 x 34.04 mm internal)	
Isolator	the use of an isolator is recommended, see note 7	
Cooling	water	

GENERAL

Electrical

Cathode	indirectly heated	
Heater voltage (see note 1)	14	V
Heater current at 14 V	8.0	A
Heater starting current, peak value, not to be exceeded	20	A max
Cathode pre-heating time (minimum)	10	min

Mechanical

Overall dimensions	see outline	
Net weight	7.3 kg approx	
Tuner revolutions to cover frequency range (see note 2)	4	approx
Method of mounting	see note 3	
Mounting position (see note 4)	any	

Cooling

The magnetron is water cooled and has an integral water jacket. The recommended water flow is 5 litres per minute or more; a pressure of approximately 1.25 kg/cm^2 will be necessary to give this rate of flow. The outlet water temperature must not exceed 50 °C.

The cooling fins on the cathode stem must be cooled by an air flow of at least 0.28 m^3/min.

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MAXIMUM AND MINIMUM RATINGS
(Absolute values)

These ratings cannot necessarily be used simultaneously, and no individual rating should be exceeded.

	Min	Max	
Magnetic field (see note 5)	100.0	165.0	mT
	1000	1650	gauss
Heater voltage (see note 1)	–	14	V
Heater starting current (peak)	–	20	A
Anode voltage (peak)	–	52	kV
Anode current (peak)	60	120	A
Input power (mean)	–	8.0	kW
Pulse duration	–	5.0	µs
Rate of rise of voltage pulse (see note 6)	–	120	kV/µs
Outlet water temperature	–	50	°C
VSWR at the output coupler (see note 7)	–	1.5:1	
Pressurising of waveguide (see note 8)	–	3.1 kg/cm^2 g	

TYPICAL OPERATION
Operational Conditions

Magnetic field	160.0 ± 0.5 mT
	1600 ± 5 gauss
Heater voltage	0 V
Anode current (peak)	115 A
Pulse duration	4.0 µs
Pulse repetition rate	325 pps
Rate of rise of voltage pulse	120 kV/µs

Typical Performance

Anode voltage (peak)	49.8 kV
Output power (peak)	3.1 MW
Output power (mean)	4.0 kW
Frequency drift	see note 9

TEST CONDITIONS AND LIMITS

The magnetron is tested to comply with the following electrical specification.

Test Conditions

Magnetic field (see note 5)	160.0 ± 0.5 mT
	1600 ± 5 gauss
Heater voltage (for test)	0 V
Anode current (peak)	115 A
Pulse repetition rate	250 pps
Pulse duration	4.0 µs
VSWR at the output coupler	1.1:1
Rate of rise of voltage pulse (see note 6)	120 kV/µs

Limits

	Min	Max	
Anode voltage (peak)	46	52	kV
Output power (peak) (see note 10)	3.0	–	MW
Frequency (see notes 11 and 12):			
lower end of tuning range	–	2992	MHz
upper end of tuning range	3001	–	MHz
RF bandwidth at $^1/_4$ power	–	1.5	MHz
Frequency pulling (VSWR not less than 1.5:1)	–	7.0	MHz
Stability (see note 13)	–	0.5	%
Heater current		see note 14	

LIFE TEST

The quality of all production is monitored by the random selection of tubes which are then life-tested under Typical Operation Conditions. If the tube is to be operated under conditions other than those specified herein, E2V Technologies should be consulted to verify that the life of the magnetron will not be impaired.

End of Life Criteria

(Under the test conditions specified above)

Output power (peak)	2.7 MW min
RF bandwidth at $^1/_4$ power	1.2 MHz max
Frequency	within test limits above.

NOTES

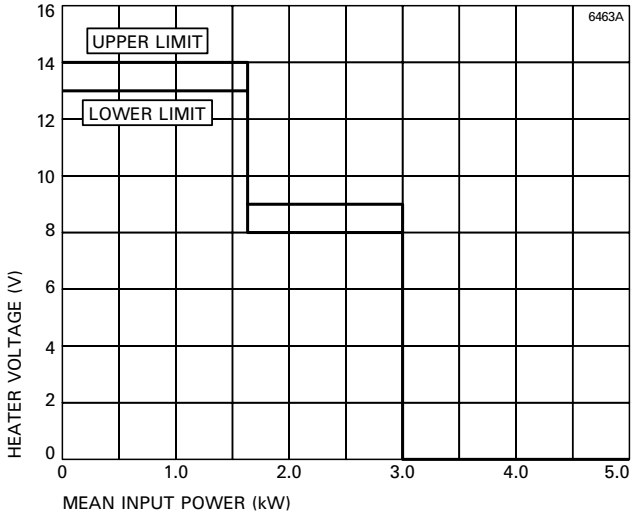
1. With no anode input power.

   The heater voltage must be reduced within 5 seconds after the application of HT according to the schedule shown on page 3.

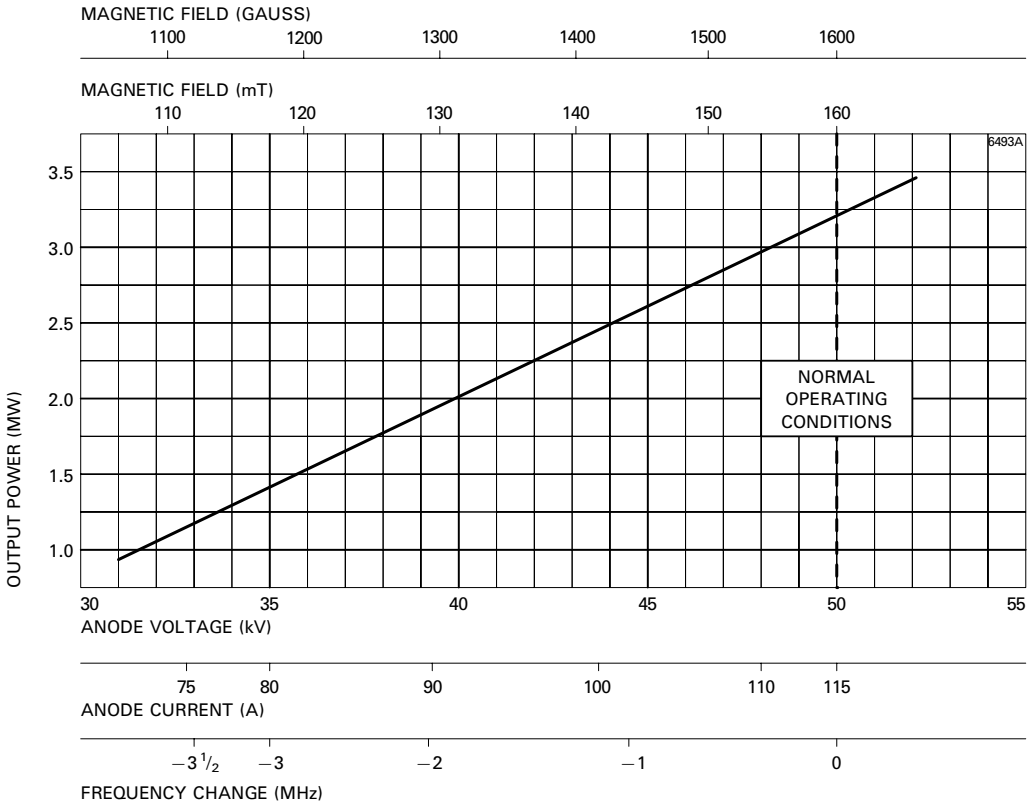
   The magnetron heater must be protected against arcing by the use of a minimum capacitance of 4000 pF shunted across the heater directly at the input terminals; in some cases a capacitance as high as 2 µF may be necessary depending on the equipment design. For further details see the Magnetron Preamble.
2. The tuner mechanism is driven by means of the three threaded holes in the tuner knob (see outline) via a flexible drive. The minimum torque required is 0.7 kg-cm; the torque applied must not exceed 5.0 kg-cm.
3. It is recommended that the magnetron is mounted in the electromagnet by flange B so that the external polepiece is in contact with the electromagnet poleface. Care should be taken in mounting the electromagnet, so that no mechanical stress is applied to the magnetron stem protruding through the electromagnet poleface.
4. To minimise frequency deviation when the magnetron is rotated about a horizontal axis, this axis should be parallel to the axis of the tuner.
5. The magnetron is designed for use with an electromagnet type MG6053 which can be supplied if required. The north seeking poleface of the magnet must be adjacent to the magnetron anode face which is opposite the cathode stem. The axis of the field is in line with the axis of the anode and is at right angles to the H plane of the system waveguide. The user is invited to consult E2V Technologies on the choice of electromagnets.
6. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude. Any capacitance in the viewing system must not exceed 6.0 pF.
7. It is recommended that the magnetron should be isolated from the load by means of an isolator of approved design. Information on the characteristics of a suitable isolator may be obtained from E2V Technologies.
8. At the maximum pressure of 3.1 kg/cm^2 gauge the maximum leakage will be such that with an enclosed volume of 1 litre the pressure will not drop by more than 70 kPa in 7 days.

9. The frequency of the magnetron will vary during the first 30 seconds after the application of anode voltage. Typically the frequency will be 1.0 MHz high 5 seconds after switching on HT and 0.2 MHz high 60 seconds after switching on.
10. The maximum variation of peak output power when the magnetron is rotated through 360° around any axis of the magnetron will not be greater than 4%.
11. With a water flow rate 5.0 litres per minute. Other frequency ranges can be supplied on request.
12. The maximum variation of frequency when the magnetron is rotated through 360° around any axis of the magnetron will not be greater than 0.7 MHz.
13. With the magnetron operating into a VSWR of 1.15:1. Pulses are defined as missing when the RF energy level is less than 70% of the normal energy level in a 0.5% frequency range. Missing pulses are expressed as a percentage of the number of input pulses applied during the period of observation after a period of 10 minutes operation.
14. Measured with heater voltage of 14 V and no anode input power, the heater current limits are 7.0 A minimum, 9.0 A maximum.

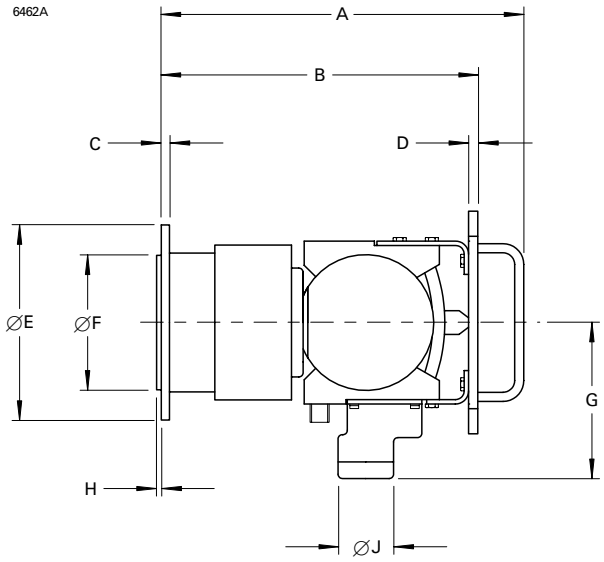
HEATER VOLTAGE REDUCTION SCHEDULE

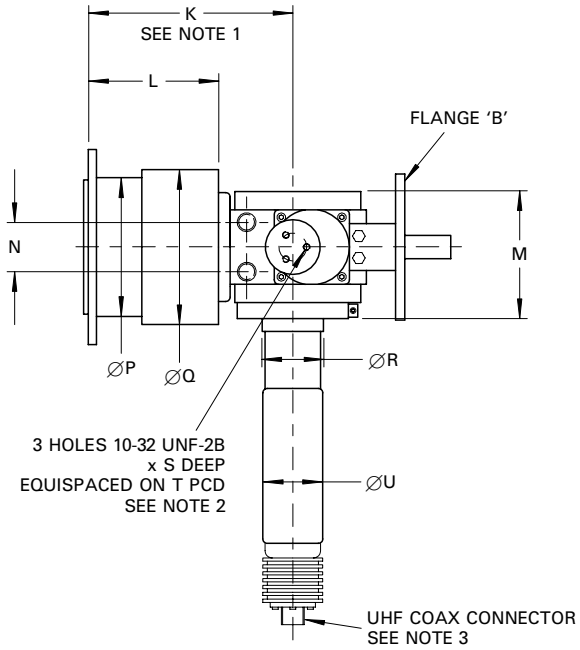


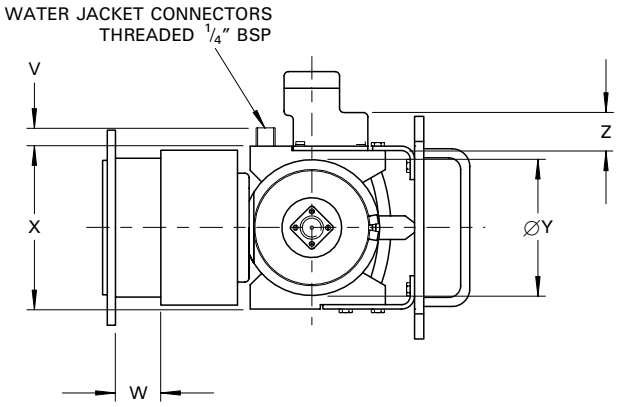
RECOMMENDED PARAMETERS FOR VARIOUS POWER LEVELS

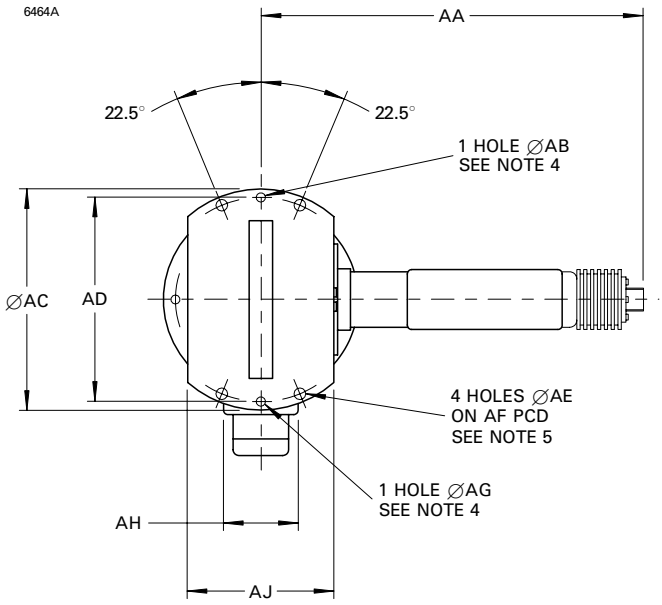


OUTLINE (All dimensions without limits are nominal)



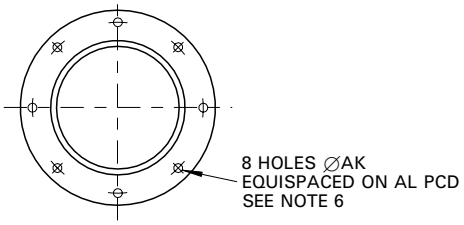






Ref	Millimetres
A	243.0 max
B	210.0 max
C	6.30 max 5.00 min
D	6.35 ± 0.15
E	133.5 ± 1.5
F	92.0 ± 0.1
G	105.0 ± 5.0
H	3.30 max 3.05 min
J	38.0 ± 0.5
K	135.75 ± 0.50
L	90.0 max
M	88.0 max
N	35.0 ± 1.0
P	95.0 max
Q	106.0 max
R	42.0 max
S	6.5 min
T	19.05
U	41.5 max
V	12.5 ± 0.5
W	30.0 min
X	113.0 max
Y	93.0 max
Z	30.0 max
AA	260.0 max
AB	8.0 ± 0.05
AC	152.40 max 152.15 min
AD	139.7
AE	8.0 ± 0.1
AF	139.7
AG	6.40 ± 0.05
AH	54.0 max
AJ	100.0 max
AK	6.4 ± 0.1
AL	120.65

Detail of RF Output Flange



Outline Notes

1. The tolerance on this dimension applies only to the tuner drive.
2. Positional tolerance 0.05 mm diameter.
3. Heater-cathode connector is a UHF 50 Ω coaxial socket; the corresponding plug is MIL STD PL259 with PTFE insulator. The cathode connection is the outer shell of the socket.
4. Positional tolerance 0.5 mm diameter.
5. The 4 holes will clear studs 6.35 mm diameter spaced as shown on 139.7 mm pitch circle diameter and within 0.127 mm of their normal positions, with the magnetron located by dowel pins 7.80 mm diameter and 6.22 mm diameter spaced 139.700 ± 0.051 mm apart.
6. Positional tolerance 0.15 mm diameter.

HEALTH AND SAFETY HAZARDS

E2V Technologies magnetrons are safe to handle and operate, provided that the relevant precautions stated herein 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 charges 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. All RF connectors must be correctly fitted before operation so that no leakage of RF. energy can occur and the RF output must be coupled efficiently to the load. It is particularly dangerous to look into open waveguide or coaxial feeders while the device is energised. Screening of the cathode sidearm of high power magnetrons may be necessary.

X-Ray Radiation

High voltage magnetrons emit a significant intensity of X-rays not only from the cathode sidearm but also from the output waveguide. These rays can constitute a health hazard unless adequate shielding for X-ray radiation is provided. This is a characteristic of all magnetrons and the X-rays emitted correspond to a voltage much higher than that of the anode.