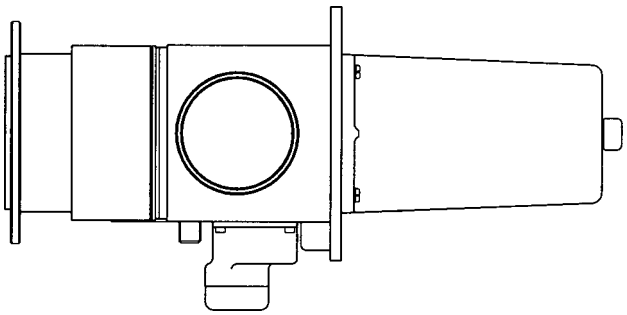

PM5193

Tunable S-Band Magnetron

The Penta Laboratories PM5193 is a mechanically tuneable pulse magnetron designed primarily for use in linear accerator service. The PM5193 is covers the frequency range of 2993 to 3002 MHz and will output up to 2.6 megawatts of peak power.

Electrical Characteristics

Cathode	Indirectly Heated	
Heater Voltage[2]	8.5	Volts
Heater Current	9.0	Amperes
Maximum Heater Starting Current	20	Amperes
Minimum Cathode Pre-heating Time	3.0	Minutes
Frequency Range (cooling water at 40°C)	2993-3002	MHz
Peak Output Power	2.6	MW

Mechanical Characteristics

Cooling	Water	
Magnet	Separate	
Output Coupling	No. 10 waveguide (WR 284)	
Net Weight (approx.)	8	kg
Tuner Revolutions[3]	4.75	
Mounting Position[4]	Any	

Minimum and Maximum Ratings (absolute values)

	Min	Max	
Magnetic Field[5,7]	100	157.5	mT
	1000	1575	Gauss

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P E N T A L A B O R A T O R I E S

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ELECTRON TUBES FOR INDUSTRY

Heater Voltage[2]	8.0	10	Volts
Heater Starting Current (peak)	-	20	Amperes
Anode Voltage (peak)	-	48	kV
Anode Current (peak)	60	110	Amperes
Input Power (mean)	-	6.0	kW
Pulse Duration	-	5.0	Seconds
Rate of Rise of Voltage Pulse[8]	80	120	kV/s
Outlet Water Temperature	-	50	°C
VSWR at Ouput Coupler[1]	-	1.5:1	
Pressure of Waveguide[9]	-	3.1	kg/cm2

Test Conditions and Limits

Test Conditions

Magnetic Field[5,7]	155.0	2.5	mT
	1550	25	Guass
Heater Voltage (for test)	0		Volts
Anode Current (peak)	110		Amperes
Duty[10]	0.001		
Pulse Duration	5.0		Seconds
VSWR at Output Coupler	1.1:1		
Minimum Rate of Rise of Voltage Pulse[8]	120		kV/s

Limits

	Min	Max	
Anode Voltage (peak)	42	48	kV
Output Power (peak)[11]	2.5	-	MW
Frequency[12, 13, 14]			
Lower	-	2993	MHz
Upper	3002	-	Mhz
RF Bandwidth at 1/4 Power	-	1.5	MHz
Frequency Pulling (VSWR not less than 1.5:1)	-	7.0	MHz
Stability[15]	-	0.5	%
Heater Current (Ef = 8.5 volts, no anode input)	8.0	10.0	Amperes

Notes

1 It is recommended that the magnetron should be isolated from the load by means of an isolator of suitable design.

2 With no anode input power.
The heater voltage must be reduced within 5 seconds after the application of anode power according to Chart 1.
The magnetron heater must be protected against arcing by the use of a minimum capacitance of 4,000 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 equipment desing.

3 The tuner mechanism is driven by means of three tapped holes in the tuner knob (see outline drawing) via a flexible drive. The torgue required is 0.7 kg-cm minimum; the torgue applied must not exceed 5.0 kg-cm.

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 a separate permanent or electromagnet. The north seeking pole of the magnet must be adjacent to the cathode terminal, marked C. The position of hte magnet must be adjusted so that 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.

6 The PM5193 can be used at lower power levels by reducing both the magnetic field (which controls the peak voltage) and the peak current (see graph); this is necessary for maintaing a good RF spectrum and constant impedance.

7 Using a small Hall effects probe, the magnetic field measured at each pole face of the magnet must be within the following limits.
(a) At the center of the pole face and 37.287 mm from the surface, the field must be 155.0 2.5 mT (1550 25 guass).
(b) At four or more points equispaced on a circle of 33 mm diameter concentric with the pole face and 6.35 mm from its surface, including a point nearest the back limb of the magnet, the field must be as follows: At all points the field must be between 9.0 and 27 mT (90 and 270 guass) greater than the field measured at the center of the pole face; the variation between the points must not exceed 13 mT (130 guass).

8 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.

9 At the maximum pressure of 3.1 kg/cm^2 guage the maximum leakage will be such that with an enclosed volume of 1 liter the pressure will not drop by more than 70 kPa in 7 days.

10 The various parameters are related by the formula:

$$Pi = i_{apk} \times V_{apk} \times Du$$

where Pi = mean input power in watts
i_{apk} = peak anode current in amperes
v_{apk} = peak anode volts in volts
Du = duty cycle.

11 The maximum variation of mean output power when the magnetron is rotated through 360° around any axis of the magnetron will not be greater than 4%.

12 The frequency of the magnetron will vary after the applicaiton of anode voltage. Typically the frequency will be 0.5 MHz high 20 seconds after switching on anode power and 0.1 MHz high 5 minutes after swiching on.

13 With a water flow rate of 5.0 liters per minute.

14 The maximum variation of frequency when the magnetron is rotated through 360° aroung and axis of the magnetron will not be greater than 0.7 MHz.

15 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 in a 0.5% frequency range. Missing pulses are express as a percentage of the number of input pulses applied during the period of observation after a period of 10 minutes operations.

Health and Safety Hazards

Penta Laboratories magnetrons are safe to handle and operate, provided that the relevant precautions stated herein are observed. Penta Laboratories does not accept responsibility for damage or injury resulting from the use of electronic devices it produces. Equipment manufactures and users must ensure that adequate precautuions are taken. Appropriate warning labels and notices must be provided on equipment incorporating Penta Laboratores 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.

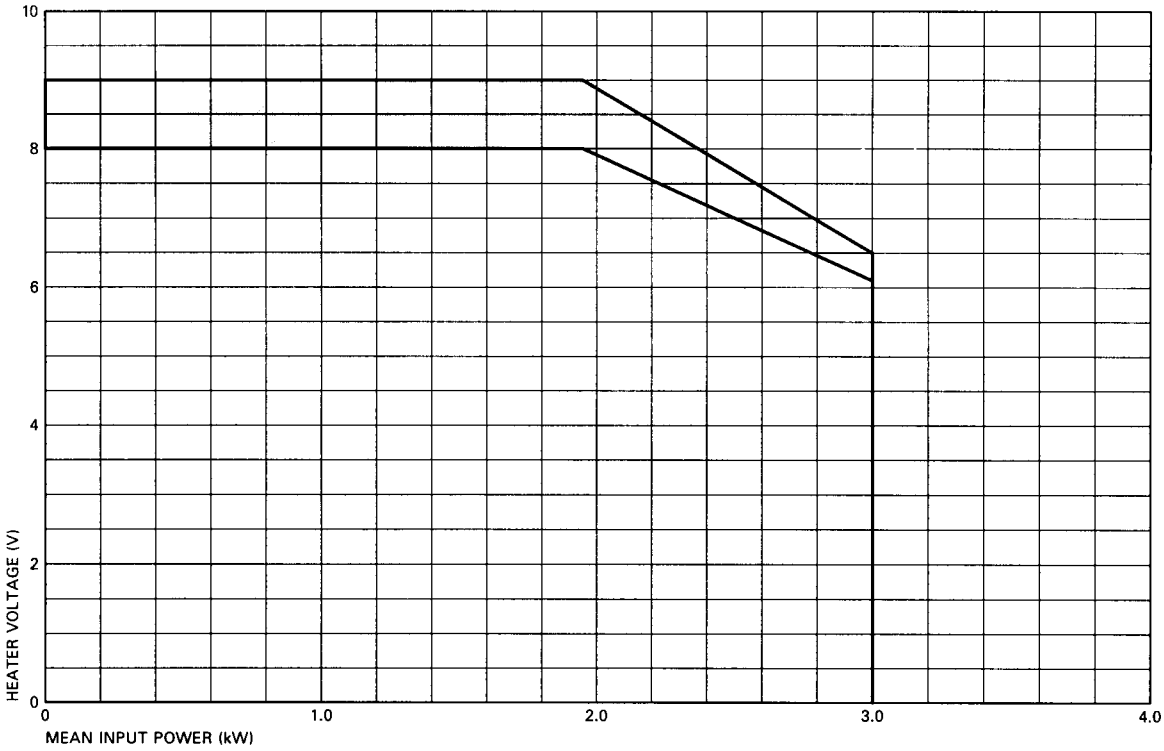
RF Radiation

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 may be necessary.

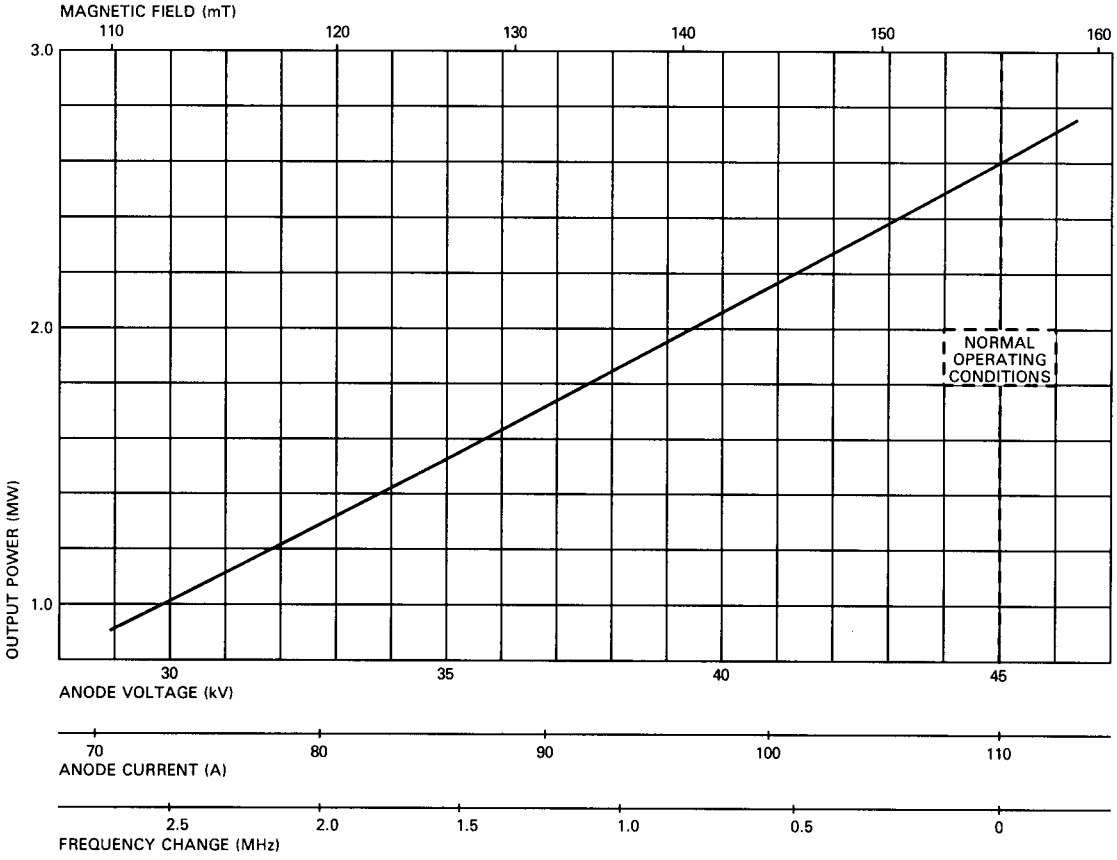
X-Ray Radiation

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

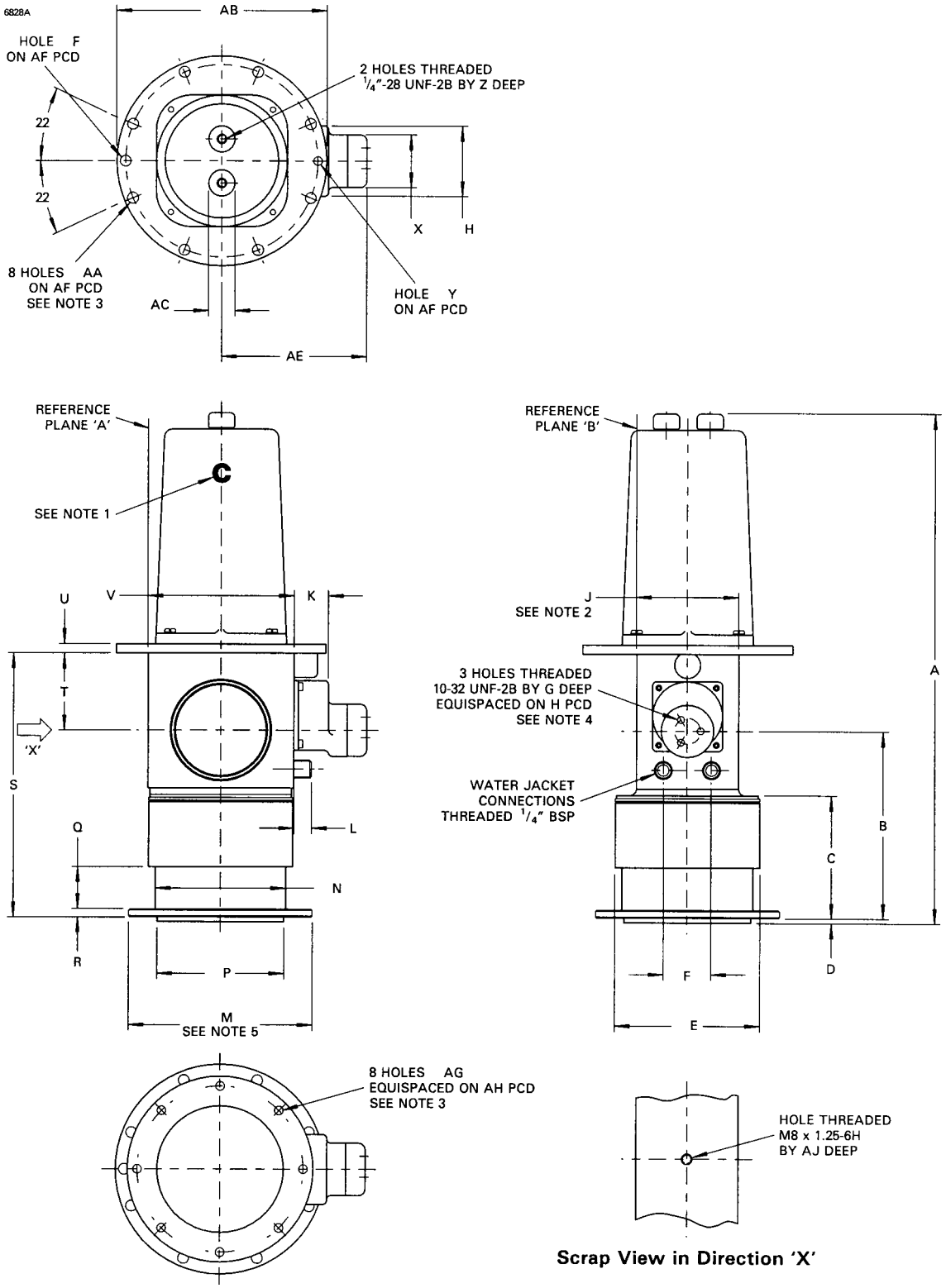
HEATER VOLTAGE REDUCTION SCHEDULE



RECOMMENDED PARAMETERS FOR VARIOUS POWER LEVELS



OUTLINE (All dimensions without limits are nominal)



Scrap View in Direction 'X'

Ref	Millimeters	
A	370.0	
B	135.5	
C	89.0	
D	3.2	
E	104.9	
F	35.0	
G	6.5	
H	19.05	
J	73.82	± 0.20
K	25.0	
L	12.5	± 0.5
M	133.5	
N	94.85	
P	91.82	
Q	5.55	
R	31.4	
S	191.5	
T	55.96	± 0.16
U	6.35	± 0.10
V	107.0	± 0.3
W	51.0	
X	38.0	
Y	6.40	± 0.05
Z	6.0	max.
AA	8.0	± 0.1
AB	152.25	
AC	19.0	
AD	8.00	± 0.05
AE	107.0	
AF	139.7	
AG	6.4	± 0.1
AH	120.65	± 0.13
AJ	15.0	max.

Outline Notes

1 This surface is marked with the letter 'C' to indicate the cathode terminal.

2 The magnetron will fit between magnet poles 76.45 mm diameter and 75.44 mm apart.

3 Positional tolerance of holes 0.15 mm diameter.

4 Positional tolerance of holes 0.05 mm diameter.

5 Positional tolerance of flange 1.5 mm diameter with respect to reference planes A and B.