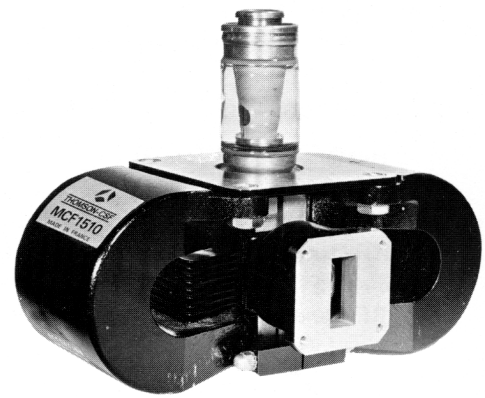
MCF 1510 MAGNETRON

The MCF 1510 is a highly stable, fixed-tuned magnetron, designed for use as high power pulsed oscillator. This tube delivers a peak output power of a least 225 kW at a wavelength of about 3. 2 cm.

The MCF 1510 includes an integral permanent magnet; fins are provided for cooling by forced air. The RF output is a waveguide mating with a standard flange.

The MCF 1510 is an improved version of the 4J50 magnetron, designed for use under severe environmental conditions, particularly in airborne systems.



GENERAL CHARACTERISTICS

Electrical

Frequency (Note 1)	9375 ± 30	MHz
Pulse voltage (Note 1)	20 to 23	kV
Peak output power	min. 225	kW
Cathode	Impregnated, indirectly heated	
Heater voltage at switch-on	13. 75	V
Heater current (Note 2)	3 to 3. 5	A

Mechanical

Mounting position	Any
Cooling (Note 3)	By forced air
RF Output	Couples to a UG-52 A/U choke flange
Weight	4. 6 kg
Dimensions	See the Outline Drawing

ABSOLUTE RATINGS (Note 4)
(non-simultaneous)

	Min.	Max.	Units
Heater voltage at switch-on	–	15	V
Heater surge current	–	15	A
Heater warm-up time	180	–	s
Pulse duration (Note 5)	0. 2	6	µs
Duty cycle (Note 6)	–	0. 001	
Rate-of-rise of voltage (Note 7)	60	160	kV/µs
Repetition rate	160	5000	Hz
Peak input power	–	630	kW
Average input power	–	630	W
Peak anode voltage	–	23	kV
Peak anode current (Note 8)	–	27. 5	A
Load VSWR	–	1. 5 : 1	
Anode temperature (Note 9)	–	150	°C
Cathode temperature	–	165	°C
Output pressurization (Note 10)	–	0. 31	MPa

TYPICAL OPERATION

Operating Parameters

Pulse duration (Note 5)	0.5	µs
Duty cycle (Note 6)	0.001	
Rate-of-rise of voltage (Note 7)	160	kV/µs
Average anode current	27.5	mA
Heater voltage at switch-on	13.75	V
Heater warm-up time	180	s
Heater voltage in operation (Note 11)	6.6	V

Measured Values

Heater current (Note 2)	3.2	A
Frequency	9375	MHz
Peak anode voltage	22	kV
RF Output power, peak	235	kW
Pulling factor	13	MHz
RF Bandwidth	3	MHz
Side-lobe level	10	dB

NOTES

1 - For peak anode current = 27.5 A.
2 - After 180 seconds at V_f = 13.75 V.
3 - Cooling arrangements must be provided so that the anode temperature does not exceed 150 °C.
4 - No one value ever to be exceeded, even under transient conditions, and operation at more than one absolute rating at the same time may cause tube damage. Equipment must be designed so that these limits are never exceeded.
5 - Pulse duration at 50 % of pulse current.
6 - Duty cycle = Pulse duration (seconds) X Repetition rate (hertz).
7 - Rate-of-rise of voltage = Steepest tangent to the leading edge of the voltage pulse above 80 % amplitude.
8 - Peak anode current = Average anode current/Duty cycle.
9 - To be measured at the point specified on the Outline Drawing.
10 - Pressurization : Air at 20 °C.
11 - On the application of anode voltage, the heater voltage should be lowered in accordance with Figure 2.

OPERATING INSTRUCTIONS

These instructions provide basic information for installing and operating the MCF 1510 magnetron.

Installation

During mounting and handling the magnetron, care must be taken to prevent shocks or strains on the glass insulator and output waveguide.

A minimum distance of 5 cm should be maintained between tube and magnetic materials. Other magnets should be kept at least 15 cm away from the magnetron. Only non-magnetic tools should be used during installation.

Electrical Connections

The center terminal of the magnetron connector is the heater return and the outer terminal is the common heater-cathode connection.

The connector center terminal should be flexible enough to avoid stresses on the glass part.

In order to protect the heater, it is necessary to connect an inductor (a few µH) in series with it, bypassed to the cathode by capacitors of 10 000 to 20 000 pF.

Proper grounding, ensured by the mounting plate, is essential for satisfactory performance.

Application of Voltages

An adequate air flow should be directed along the cooling fins on the magnetron in order to keep the anode temperature preferably below 100 °C.

Apply heater voltage gradually. The heater surge current must not exceed 15 A. Allow at least 3 minutes for the cathode to warm-up before applying the high voltage.

After 3 minutes at full heater voltage, apply the high voltage negative pulses to the cathode. The heater voltage must be reduced in accordance with Figure 2.

The MCF 1510 magnetron has been designed for operation under the following pulse conditions :

- Any spike on the pulse front is to be clipped off.
- The ripple over the top portion of the current pulse must not exceed 7 % of the peak current average value.
- Reverse voltage must not exceed 20 % of the forward voltage.
- The load VSWR must not exceed 1. 5 : 1.

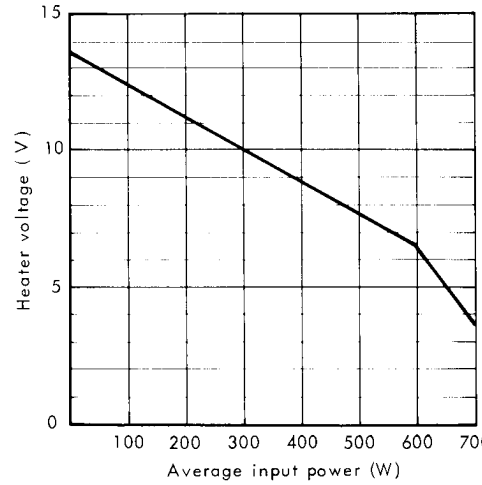
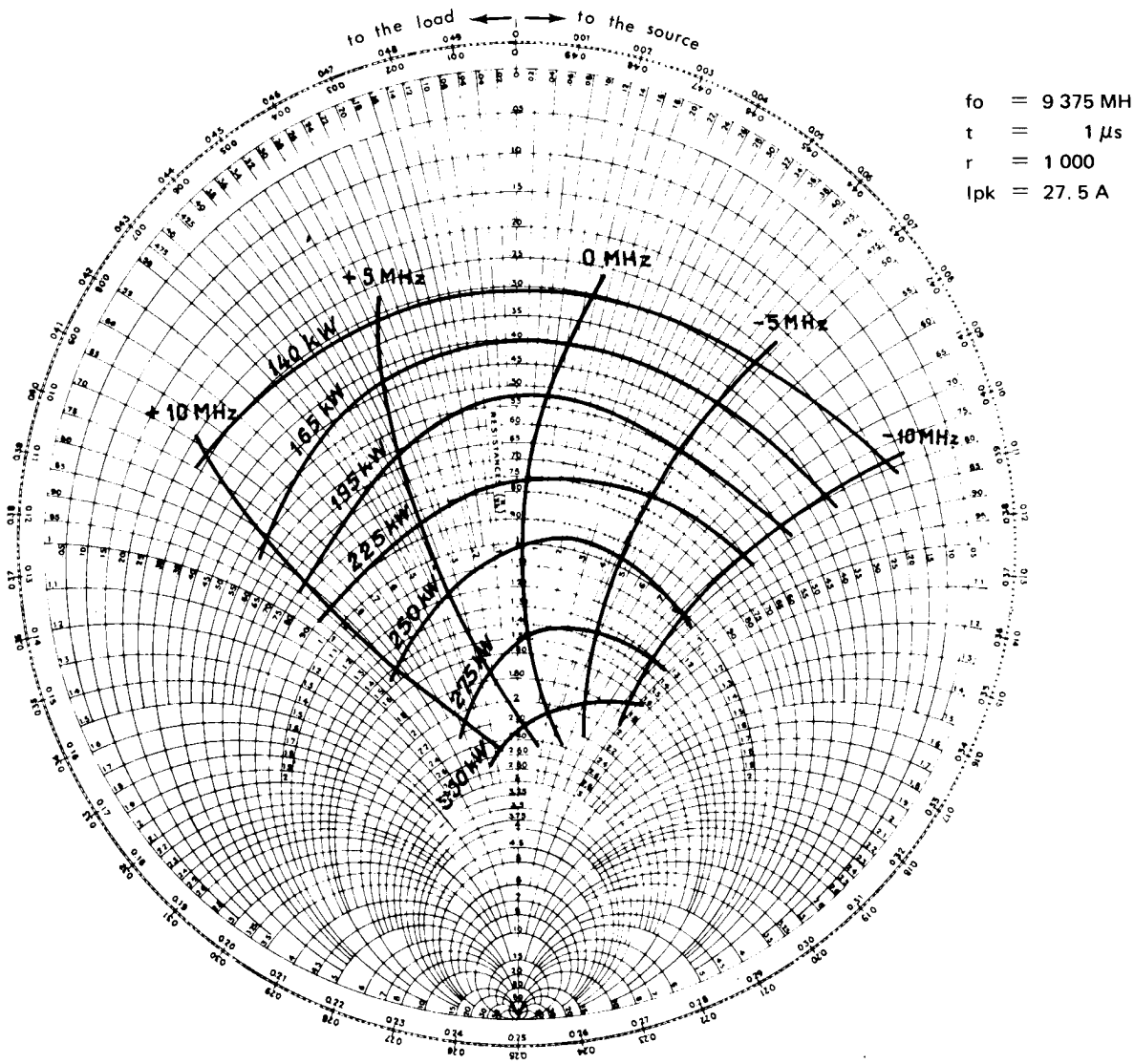


Figure 2 - Plot of heater voltage to apply versus average drive power.

Figure 1 - Rieke diagram for the MCF 1510.



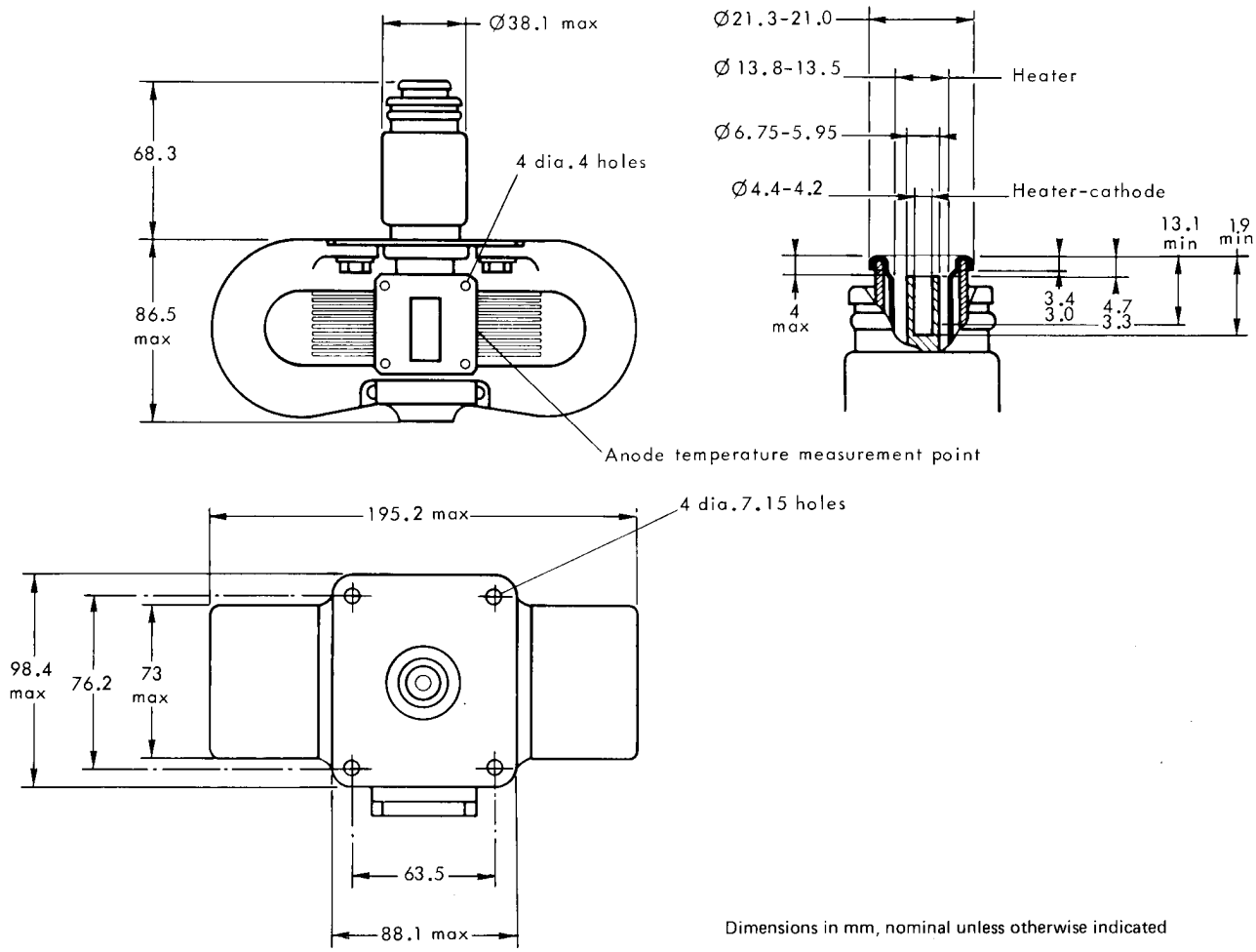
STARTING A NEW MAGNETRON

When a new magnetron, or a magnetron that has been idle or stored for a period of time, is put into operation, some sparking and instability may occur.

If instability occurs at any step, as evidenced by arcing or erratic average anode current, it is recommended that the magnetron be started up in the following way :

- After a warm-up time of three minutes at 13. 75 V, raise the anode voltage gradually (preferably at the shortest pulse duration) until one half of normal operating power is reached. The heater voltage must be reduced in accordance with the curve on Page 3.
- As soon as the average anode current indicates stable operation, gradually raise the anode current until the normal operating conditions are reached. If sparking occurs, stop raising anode current until the magnetron operates stably again. Care should be taken that the absolute ratings are not exceeded.

OUTLINE DRAWING



Dimensions in mm, nominal unless otherwise indicated