TOSHIBA

Electron Tube, Device & Equipment

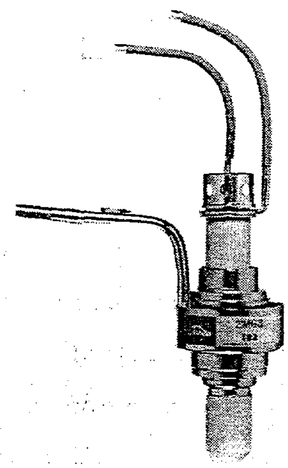
TECHNICAL DATA

MAGNETRON

2M68

NOV -4 1983

The Toshiba 2M68 is a fixed frequency continuous wave magnetron developed for microwave heating and can deliver 5.3 kW r.f. power at 2450 MHz. The magnetron anode must be cooled by water, and filament bushings by forced air. The recommended electro-magnet VM00900 and waveguide coupler VM01000 are available from Toshiba Corporation.



GENERAL DATA

ELECTRICAL:

Cathode	Directly heated tungsten filament
Frequency	2450 ± 30 MHz
Output Power	5.3 kW
Filament Voltage (r.m.s.) (See Note 1)	9 V
Filament Current (for filament voltage of 9 V r.m.s.) (r.m.s.)	46 A
Filament Cold Resistance	0.015 Ω approx
Filament Pre-heating Time	15 sec
Electro-magnet Resistance at 20°C	50 Ω approx
Magnetic Field	1640 G approx

MECHANICAL:

2M68 Magnetron

Overall dimensions	See outline drawing (Fig. 1)
Mounting position	Axis vertical, output down

* The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by

Net weight	....	1 kg approx

Electro-magnet VM00900 and Waveguide Coupler VM01000

Overall dimensions	....	See outline drawing (Fig. 2)
Waveguide frange	....	UG-437B/U or UG435B/U
Net weight		
VM00900	....	18 kg approx
VM01000	....	2 kg approx

COOLING

The magnetron anode must be cooled by water, and the output dome and filament bushing by forced air so that the anode temperature be kept below 100°C and the ceramic surface temperature below 150°C.
The anode water supply should be interlocked so that neither filament nor h.t. power can be applied without the minimum water rate, and the equipment cannot run if the water outlet temperature exceeds 60°C.
The water outlet pipe have a tab for thermal switch.
All cooling supplies must be turned on before and during the applications of any voltage and continued for at least 3 minutes after the removal of these voltages.

Magnetron

Anode Cooling Water Flow Rate	....	5 ℓ /min
Anode Water Pressure Drop	....	0.35 kg/m^2 approx
Anode Water Outlet Temperature	....	60°C max
Output Dome Cooling Air Flow	....	1000 ℓ /min
Filament Bushings Cooling Air Flow	....	2000 ℓ /min
Anode Temperature (see outline drawing)	....	100°C max
Filament Bushings Temperature	....	150°C max
Output Dome Temperature	....	150°C max

MAXIMUM RATINGS

	Minimum	Maximum	
Filament Voltage (pre-heat)	8.7	9.3	V
Filament Starting Current	-	120	A
Filament Pre-heating Time	12	-	sec
Peak Anode Voltage	-	7.5	kV
Anode Current (see Note 2)	-	1.2	Adc
Peak Anode Current (see Note 2)	-	1.6	A
Anode Input Power	-	9	kW
Load v.s.w.r.	-	4 : 1	
Anode Temperature	-	100	°C
Anode Water Outlet Temperature	-	60	°C
Filament Bushings Temperature	-	150	°C
Output Dome Temperature	-	150	°C

TYPICAL OPERATION

Operating Condition	
Filament voltage	5.0 V
Anode current	1.1 A
Magnetic flux density	1640 G
Electro-magnet current (see Note 3)	1.05 A
Load v.s.w.r.	1.1 : 1 max
Typical Performance	
Filament current (r.m.s.)	33 A
Anode voltage	7 kV
Output power	5.3 kW

Note 1. With no input power.

Prior to the application of anode voltage, the filament must be preheated by the application of 9 V for at least 12 seconds.

On the application of anode voltage, the filament voltage must be

reduced within 2 seconds in accordance with Fig. 6.
The upper and lower limits in this figure are absolute.
The filament voltage should be measured between the terminals F and FK, which are showed in outline drowing.

2. The magnetron should be opperated from a 3-phase bridge rectified supply, with a smoothing choke of 2.0 H minimum. Anode current ripple must be within the following formula.

$$\text{Anode current ripple} = \frac{\triangle ib}{Ib} \leqq 30\%$$

where $\triangle ib$: peak to peak of anode current ripple
Ib : average anode current

Peak anode current should not be exceed 1.6 A.

3. Using VM00900, the anode current curcuit is series with feedback coil, and the magnetic field by anode current is superposed on by electro-magnet biasing current for stable operation.

HANDLING

The magnetron may appear to be solid and robust, but it contains a tungsten filament and hence requires to be as carefully handled as a broadcast transmitting tube. It is supplied in a pack designed to insulate it from shocks and vibration, but once it is removed from this pack great care must be taken to avoid giving it mechanical shocks by knocking against a bench or the electro-magnet. If a magnetron is taken out of its socket, it should be stored in its shipping container. It may be necessary to insulate the electro-magnet against vibration from adjacent machinery.

INSTALLATION

Care should be taken to protect the tube from excessive shocks during and after installation, with particular regard to the metal-ceramic seals.

The installation is as follows;

(1) Support the electro-magnet VM00900 with rack used 8 mm holes and attach the waveguide coupler VM01000 to the electro-magnet.
The electro-magnet should not be supported by waveguide coupler.
RF conection between the electro-magnet and the waveguide coupler is by a monel-metal ribon gasket and cuppor washer gasket, which are parts of VM00900 and VM01000.

(2) Set the copper gasket 3616-906A into the electro-magnet. Insert the magnetron into the electro-magnet and seat on it carefully, and attach the magnet pole-piece, a part of VM00900, on the tube. Tighten the mounting screws uniformly to ensure proper contact. A new copper gasket should be fitted if the magnetron is removed and replaced.

(3) Tighten the filament terminals securely, and connect the cooling water hoses to the inlet and outlet pipe of the tube.

OPERATING CIRCUIT (See Fig. 9)

Since magnetron anode current is greatly influenced with slight change in load condition and anode voltage, it is recommended to superpose the magnetic flux by anode current on by electro-magnet bias current as shown in the typical operating circuit.
The electro-magnet VM00900 have two main coils for biasing current, and one feedback coil for anode current. These turns are in the ratio of
4060 : 406
The magnetic flux of the main coil and the feed back coil should be same direction. When it is operated in this way, 2M68 operates stably with little change of anode current in spite of considerable variation of line voltage. Two voltage suppressions are necessary across the main coil and feed back coil against the high voltage surge that might be generated by switching its current supply.

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SEQUENTIAL STEPS OF OPERATION

Starting the operation

(1) Operate cooling system : Forced air cooling for filament bushing and output dome, and water cooling for anode.

(2) Raise and adjust the magnet biasing current to 1.5 A.

(3) Preheat the filament for 15 seconds keeping the filament voltage 9 volts. Then apply the high voltage to the anode. The spike voltage due to transformer requration must be less than 14 kilovolts to guard against the break down.

(4) Raise the anode voltage a little higher than the operating voltage. Then adjust the electro-magnet current and the andoe voltage to obtain proper operating voltage and current.

(5) Reduce immediately the filament current to the specified value after anode current raised to proper value.

Turn off the operation

(1) Turn off the anode voltage

(2) Turn off the filament supply

(3) Turn off the electro-magnet field supply

(4) All cooling system must be on for 3 minutes minimum after filament supply is turned off.

For more information, write to

Electronic Components Dept.
International Operations-Consumer Products,
Businessmachine & Electronic Components.
TOSHIBA CORPORATION
2-1 Ginza, 5-chome, Chuo-ku
Tokyo 104, Japan

Fig. 1 OUTLINE DRAWING

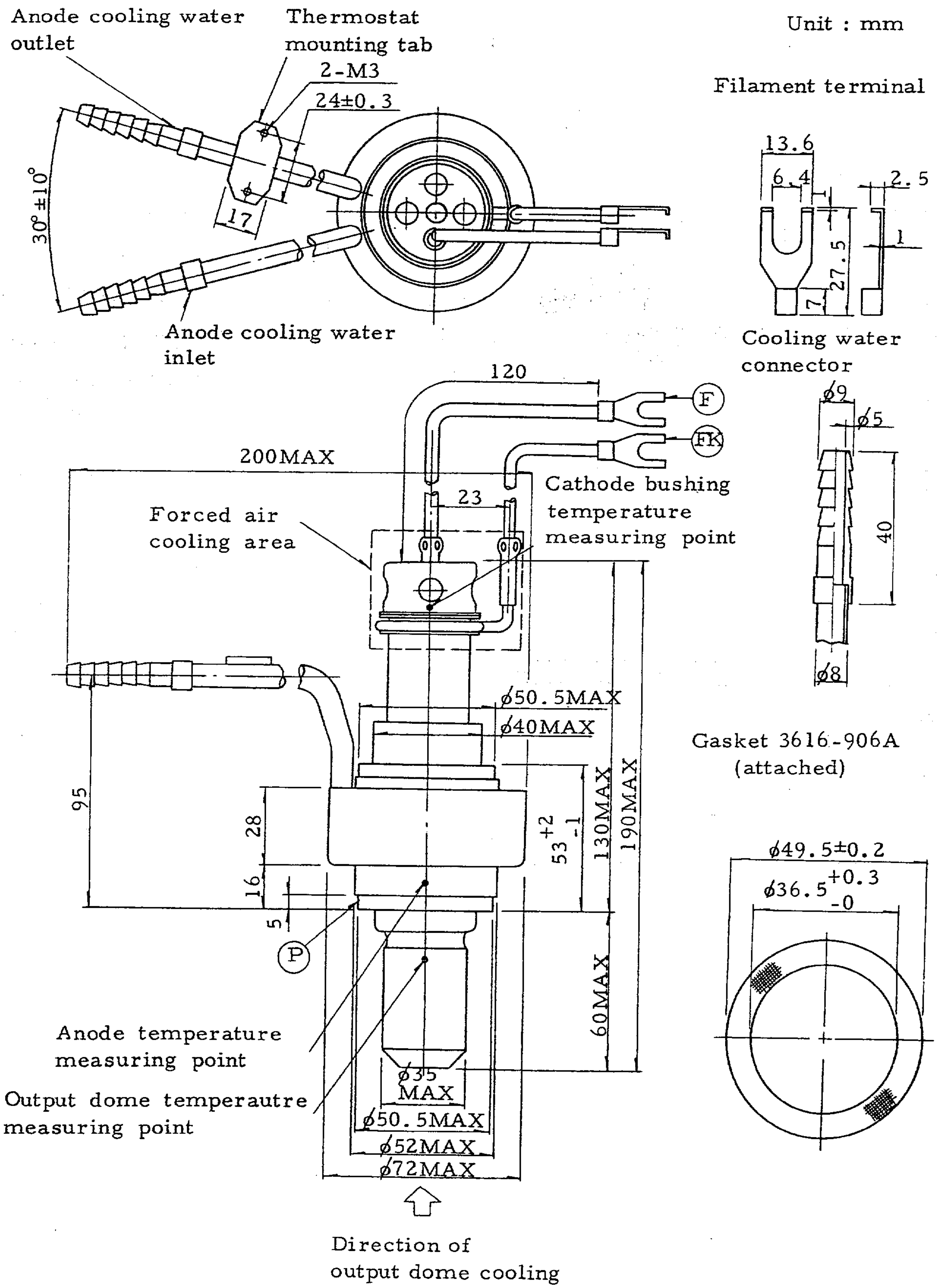

Fig. 2 OUTLINE OF ELECTRO-MAGNET VM00900 AND WAVEGUIDE COUPLER VM01000 Unit : mm

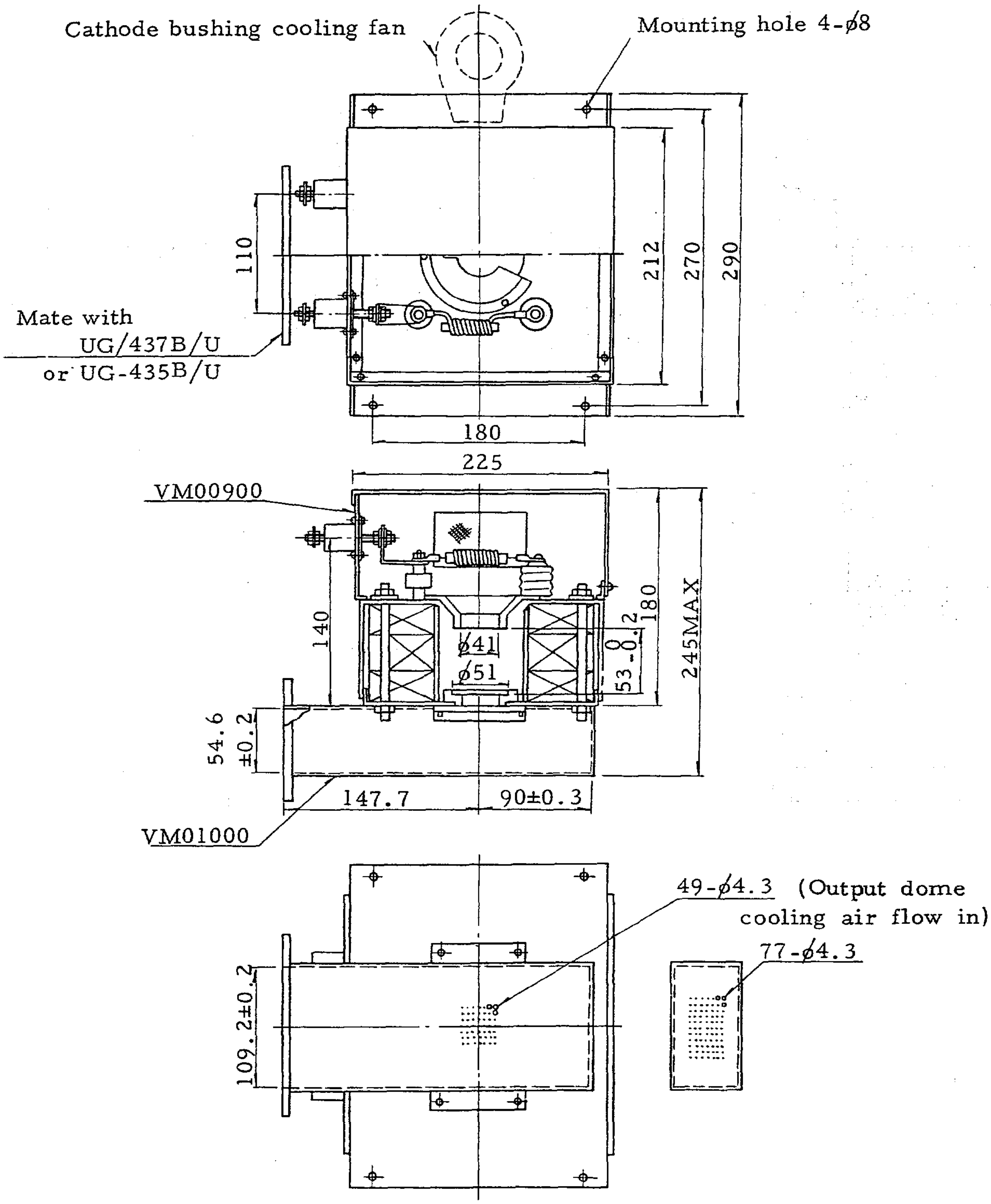

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Fig. 3 TYPICAL PERFORMANCE CHART

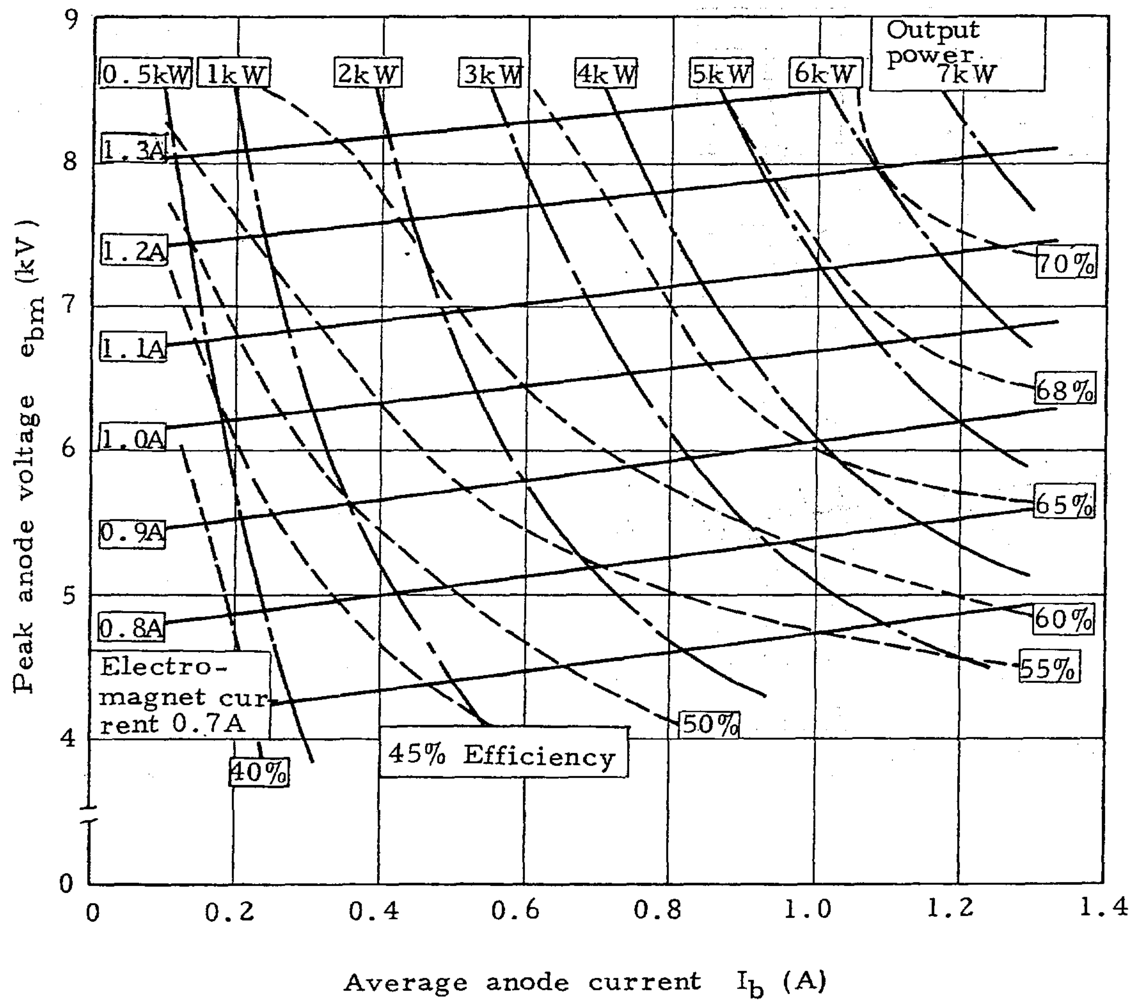


Fig. 4 TYPICAL RIEKE DIAGRAM

Test condition

Average anode current	:	1.1 A
Peak anode voltage	:	7.0 kV
Frequency (at matched load)	:	2450 MHz
Phase reference plane	:	Center of output dome

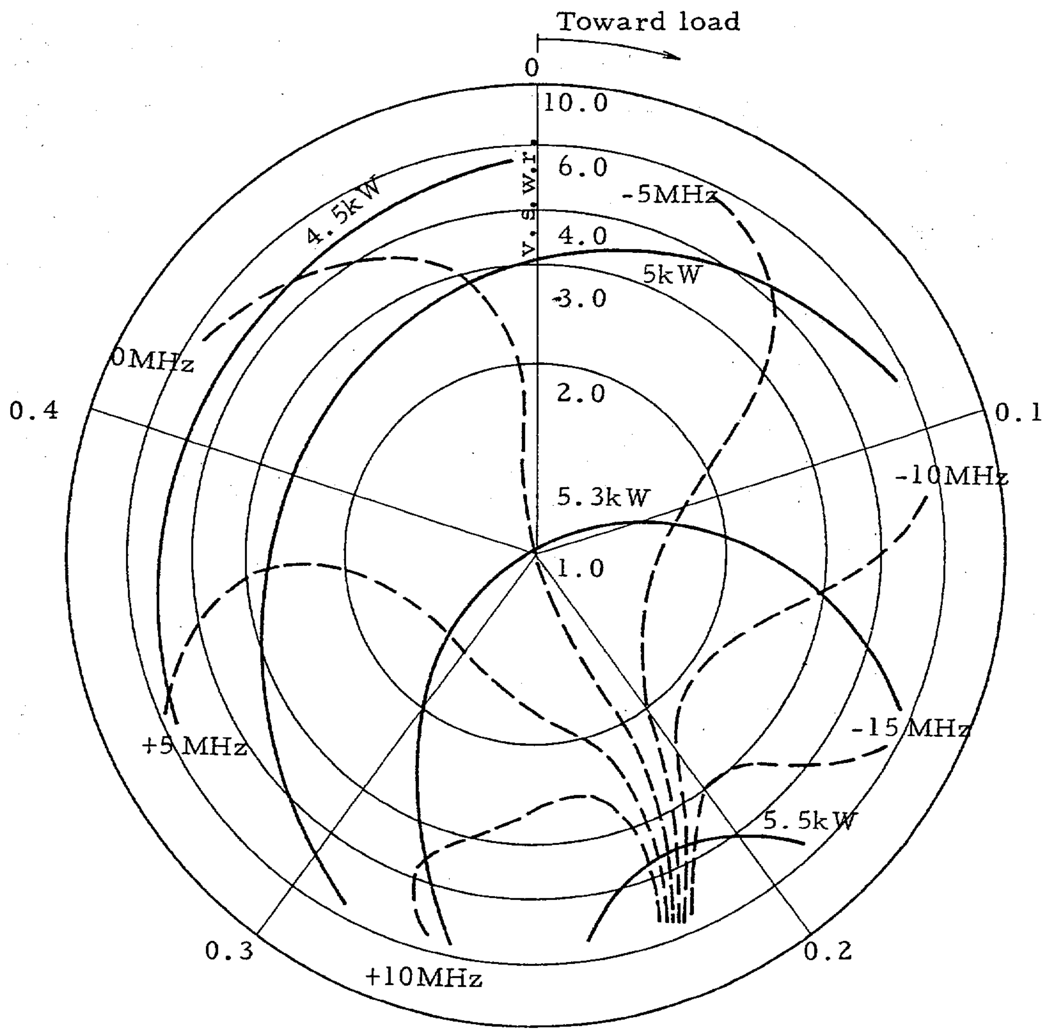


Fig. 5 FILAMENT CHARACTERISTICS

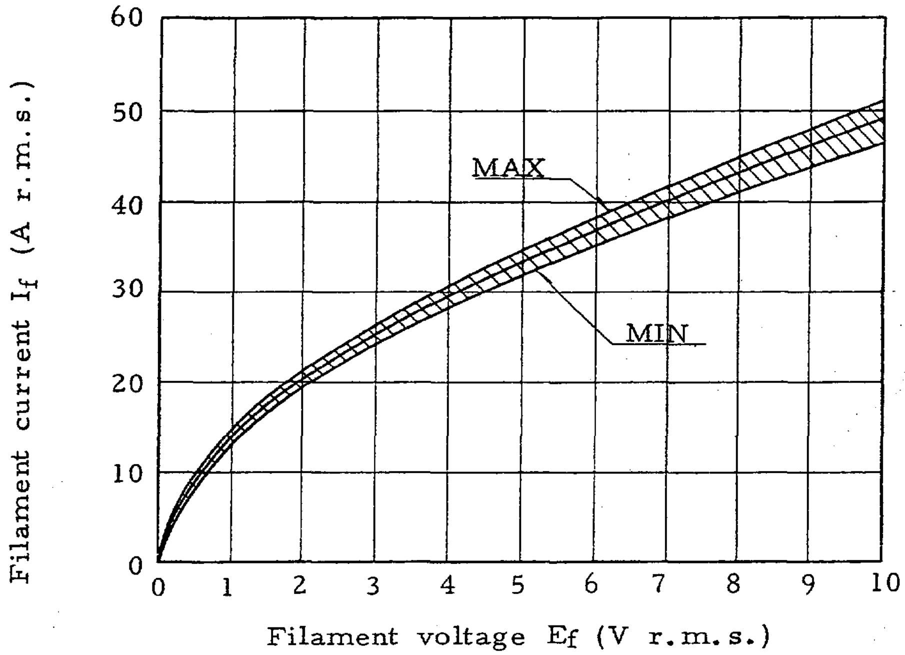


Fig. 6 FILAMENT VOLTAGE REDUCING CURVE

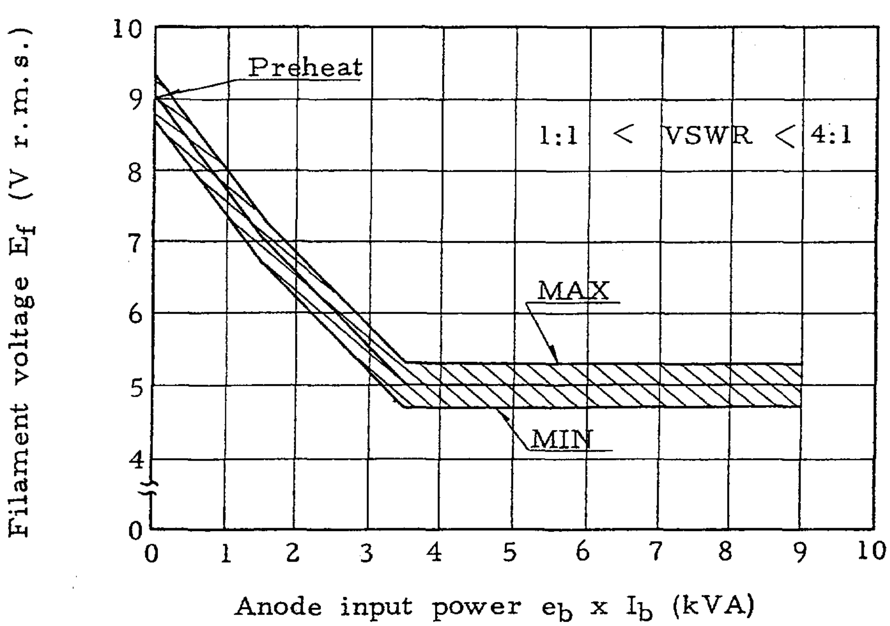


Fig. 7 FLOW RATE vs PRESSURE DROP OF ANODE COOLING WATER

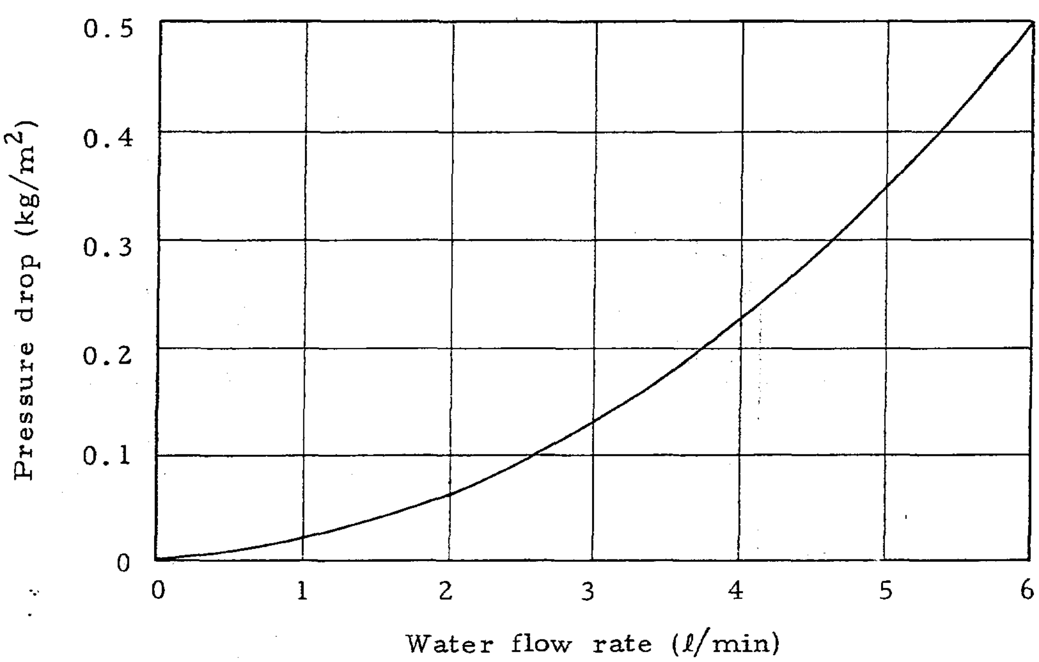


Fig. 8 REQUISITE QUANTITY OF ANODE COOLING WATER FLOW

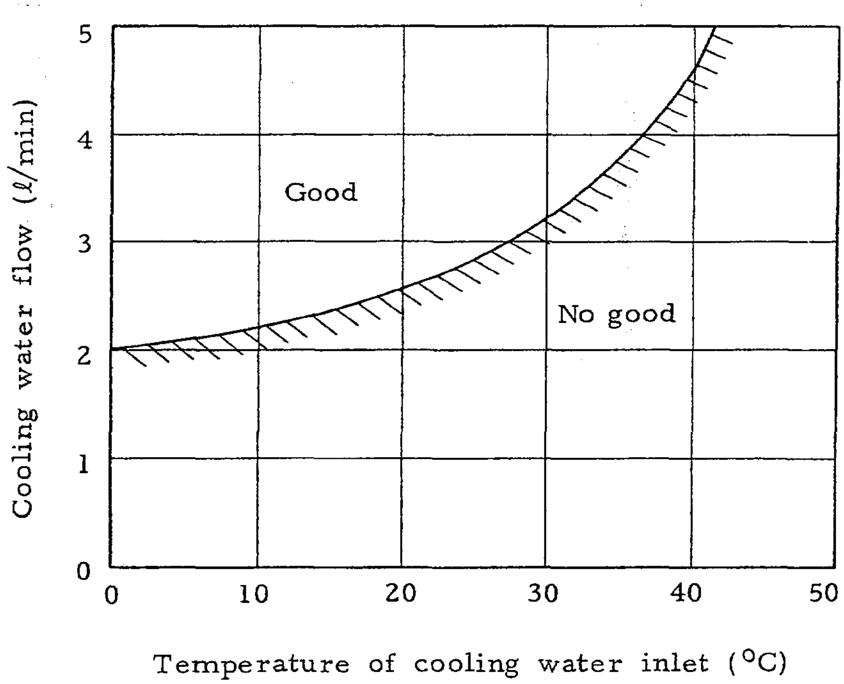
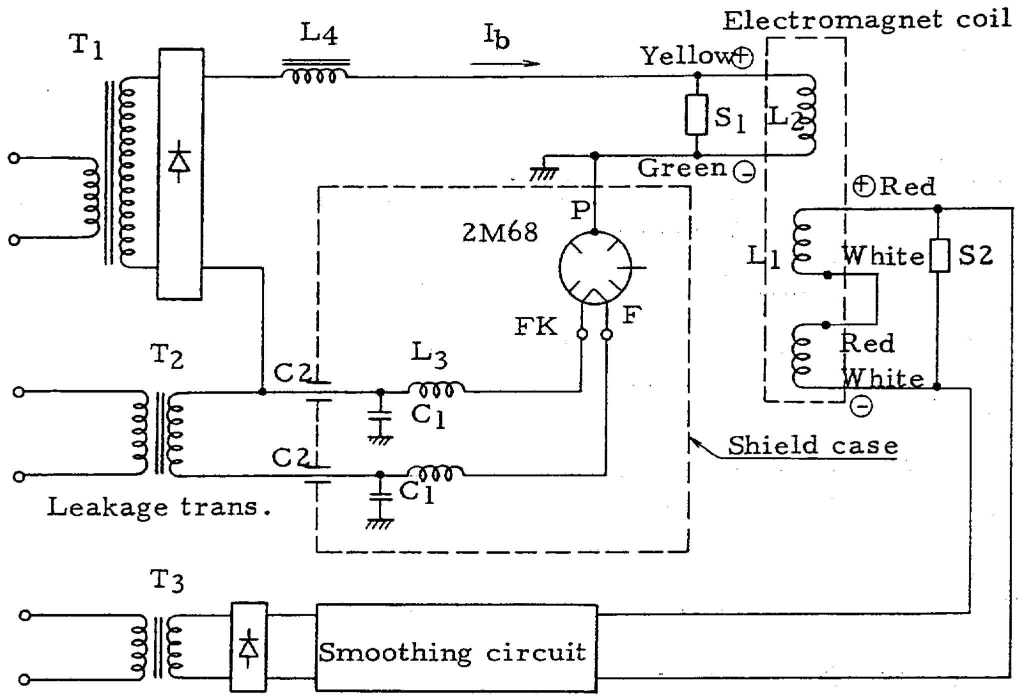


Fig. 9 TYPICAL OPERATING CIRCUIT



T_1: Three phase high voltage transformer for anode power supply

T_2: Transformer for filament power supply

T_3: Transformer for elecgromagnet power supply

L_1: Electromagnet main coil

L_2: Electromagnet feedback coil

L_3: Choke coil (1.5 μH) L_4: Choke coil (2 H)

C_1: Condenser (500 pF) C_2: Through type condenser(500 pF)

S_1, S_2 : Surge absorber (300 V, 20 A)

Note 1. The magnetic field of the feedback coil and main coil should be same direction.

2. Shield case, C_1, C_2 and L_3 are used for suppression of spurious radiation.