Tentative

HITACHI

Hitachi Power Solutions Co.,Ltd.
3300, Hayano Mobara-shi Chiba-ken
297-8622 Japan
Tel : +81-475-25-9006
Fax : +81-475-24-5640

For Messrs. APC TECHNOLOGIES, INC. Date Sep. 27, 2013

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

MAGNETRON 2M256-01

CONTENTS

Accepted by ; _____ Proposed by ; Yuichi Ito

Date ; _____ Y. Ito

RECORD OF REVISION

Date	Sheet No.	Summary

TEST SPECIFICATIONS

Type : 2M256

Description : Continuous Wave Magnetron intended for use in Industrial microwave heating applications 2455MHz, Fixed Frequency.

Absolute Maximum Ratings :

Item	Symbol	Min.	Max.	Unit	Note
Filament Surge Current	—	—	100	Aac	
Filament Voltage, Stand-by	Ef	4.40	5.00	Vac	
Filament Voltage, Operation	Ef	(See Fig. 1)		Vac	1, 2
Pre-heating Time	Tk	5	—	sec	1, 3
Peak Anode Voltage	ebm	—	4.3	kVp	1
Peak Anode Current	ibm	—	2.1	Ap	1
Average Anode Current	Ib	—	750	mAdc	1
Average Anode Input	Pi	—	3.1	kW	1
Load VSWR	σL	—	4	—	1, 7
Anode Core Temperature	Tp	—	100	℃	
Case Temperature	Tcase	—	100	℃	
Storage Temperature	—	-30	60	℃	

Test conditions for electrical characteristics :

Filament Voltage	Ef = 4.6 V (Stand-by), Ef = 3.4 V (Operation)
Average Anode Current	Ib = 725 mAdc
Load VSWR	σL = 1.1 or less
Cooling Water Flow	Q = 3L/min
Cooling Water Temperature at inlet	25℃

Limits and characteristics :

Item	Conditions	Symbol	Bogie	Min.	Max.	Unit	Note
Filament Current, Stand-by	tk=120secMin.	If	20	18.5	21.5	Aac	1, 4, 5
Peak Anode Voltage		ebm	4.00	3.85	4.20	kVp	1, 4, 5, 10
Average Power Output		Po	1950	1750	—	W	1, 4, 5, 10
Frequency		fo	2455	2440	2470	MHz	1, 4, 5, 10
Stability	σL=3 or less	ST	—	700	—	mAdc	1, 4, 5, 6, 8
Breakdown Voltage		Et	—	10	—	kVdc	9

Notes :

1. Power supply should be single-phase, full-wave rectifier without filter.
2. Filament Voltage should be regulated as shown in Fig. 1 for continuous operation.
3. To apply to single phase fullwave rectifier without filter. If power supply is different, the figure shall be reviewed.
4. Block diagram of the test equipment is shown in Sheet No. 1609-0002-4.
5. Launcher and tapered waveguides are shown in Sheet No. 1609-0007-2.
6. Any instability such as mode jump, run away, should not be observed at any phase of the specified VSWR.
7. The load impedance should be kept outside the restricted region on the Rieke diagram shown in Fig. 3.
8. Operate momentarily 5 sec maximum to avoid destruction of the tube.
9. No continuous spark at 10 kVdc after gradual voltage up.
   (RL =100 k ohms. Potential of anode shall be plus.)
10. Figures are specified at 20± 1℃ of the magnets' temperature.
    If the magnets' temperature is T ℃, ebm(T), Po(T) and fo shall be :

    $ebm(T)=\{1-0.002(T-20)\}ebm$

    $Po(T)=\{1-0.002(T-20)\}Po$

    $fo(T)=fo$

    Measurement shall be done Within 15 sec after ebm is supplied.
11. Recommending power supply : Fullwave rectifier without filter and halfwave doubler.
12. Performance chart is shown in Fig. 2.
13. Cooling characteristics are shown in Fig. 4.

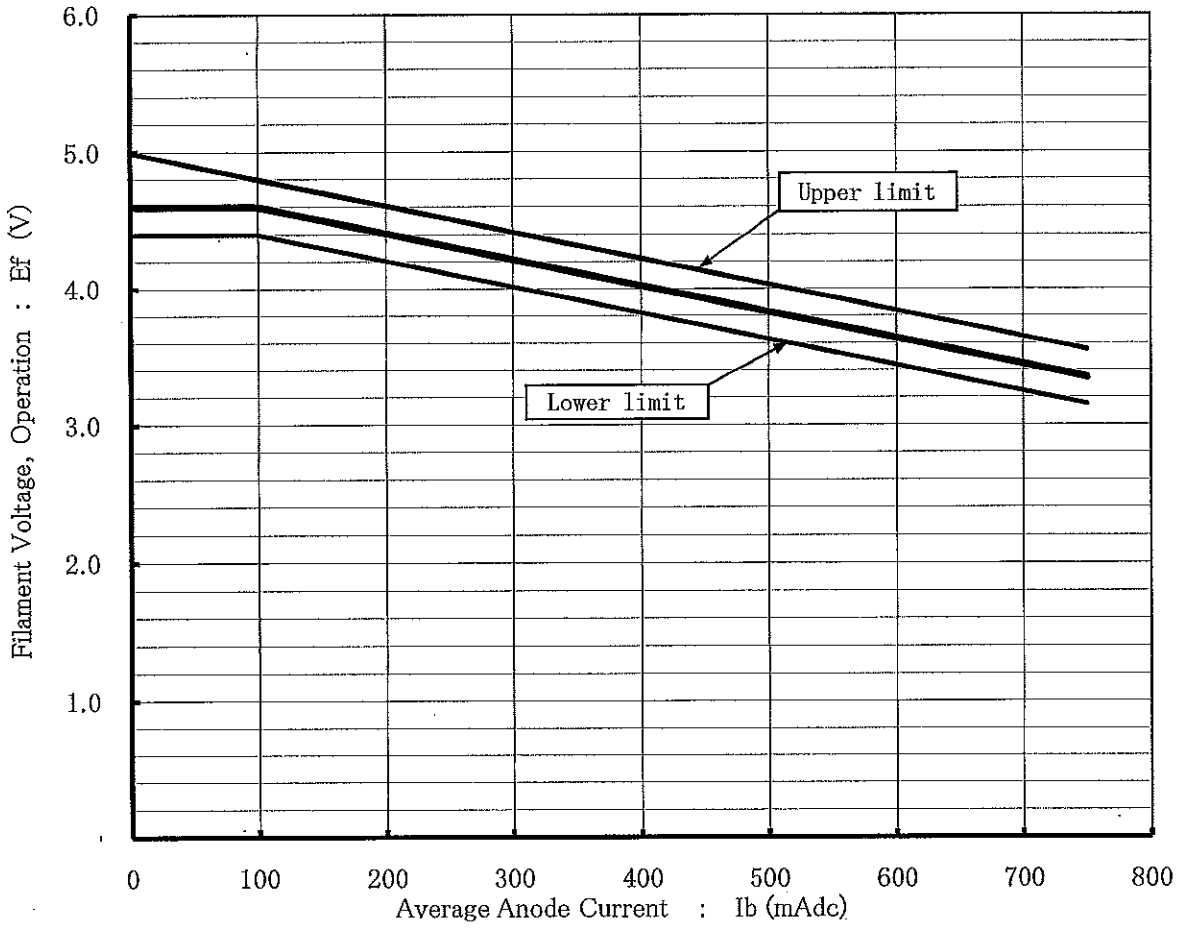
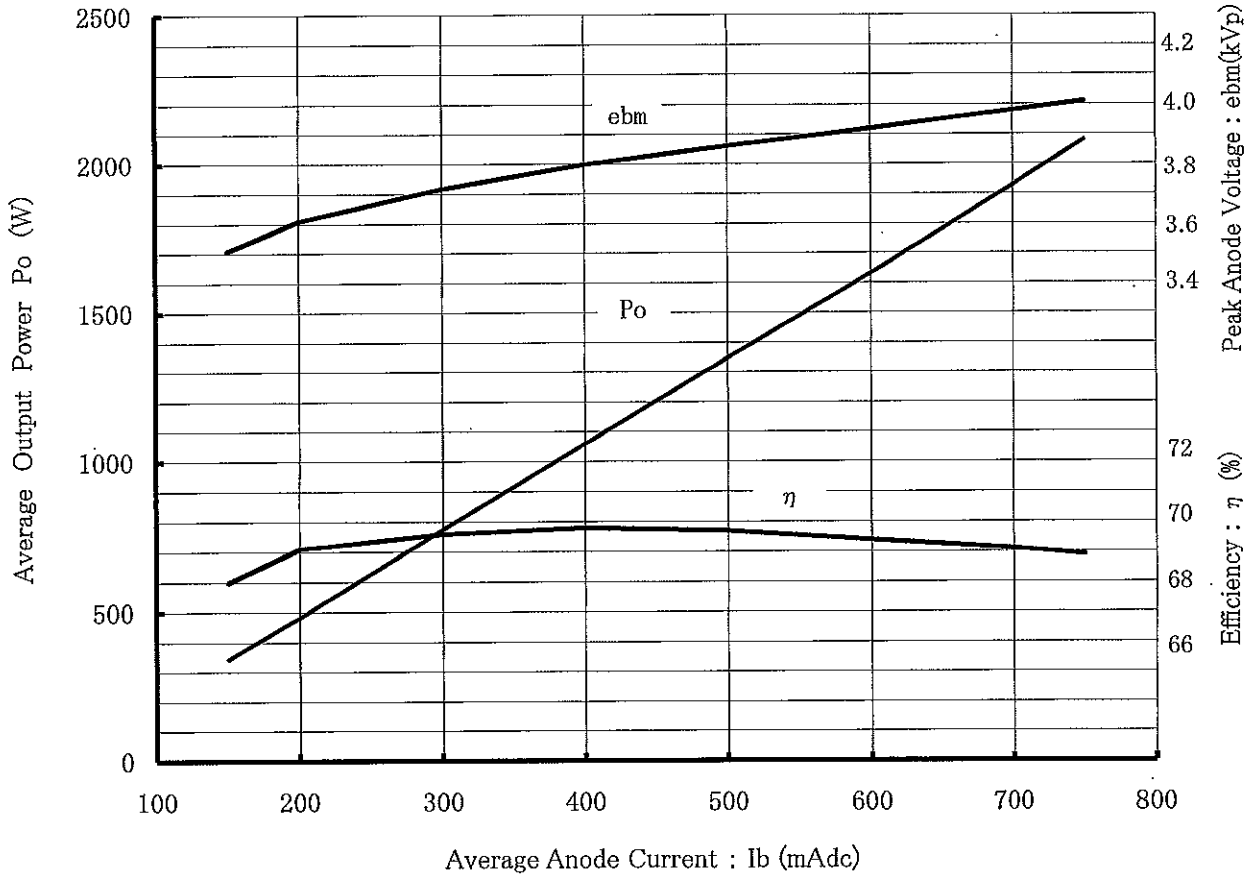


Fig. 1 Reduction Chart of Filament Voltage



Test conditions

1. Load VSWR : $\sigma L \leqq 1.1$
2. Power supply : Single phase, full wave rectifier without filter

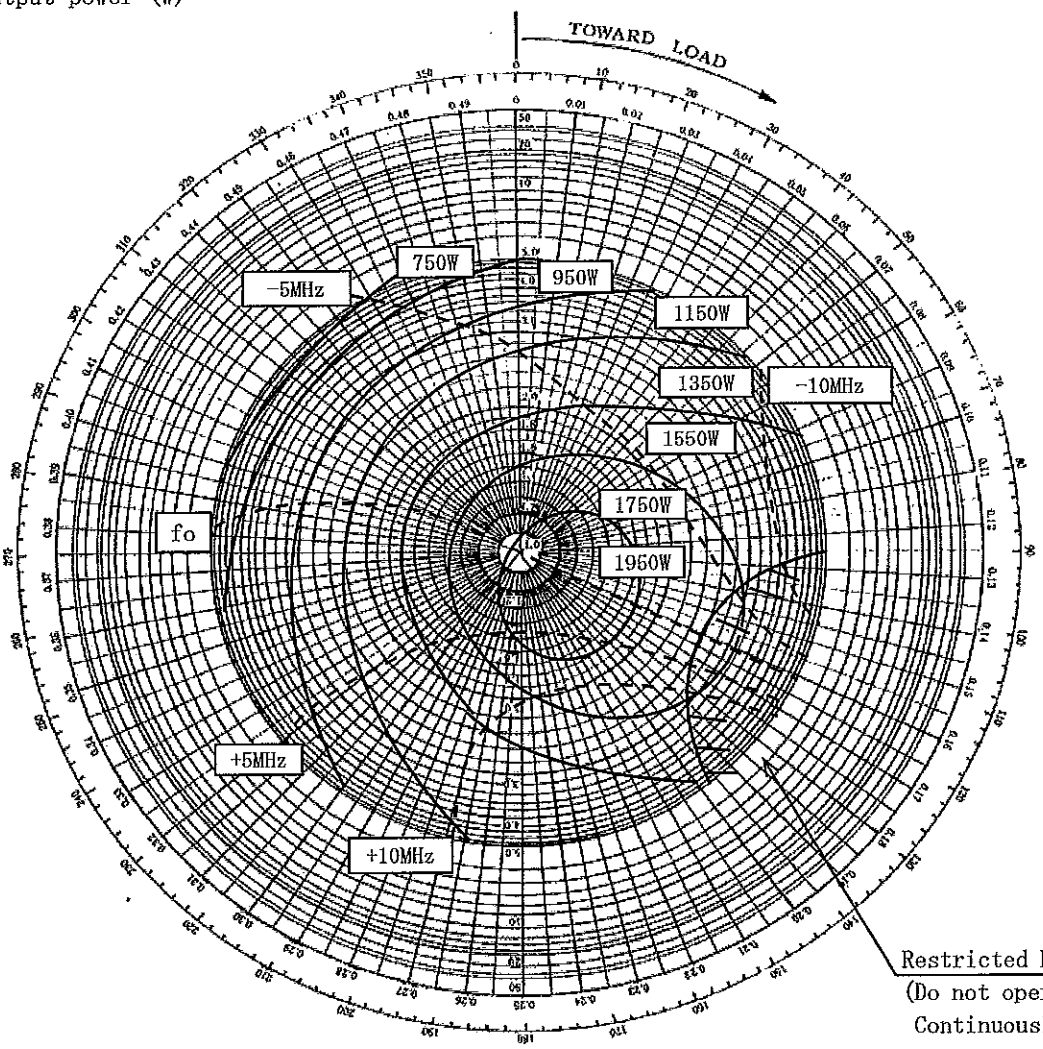
Fig. 2 2M256 Performance chart

RIEKE DIAGRAM

---- Frequency (MHz)

fo=2455 MHz

—— Output power (W)

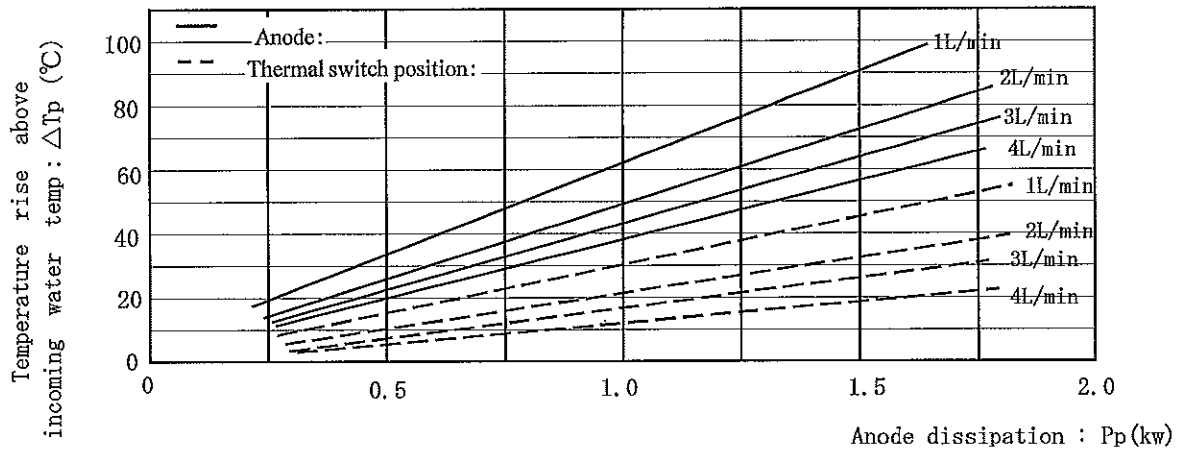


Operation g Conditions :

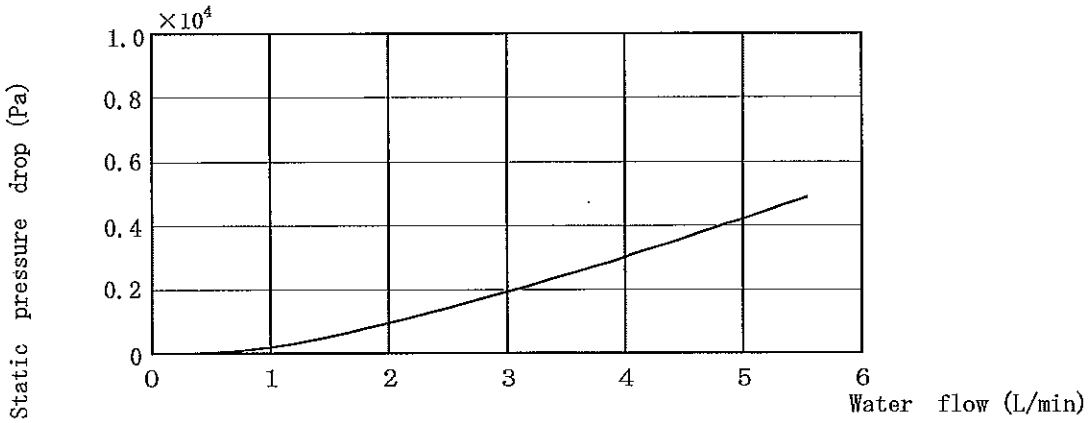
Power Supply : Single phase, fullwave rectifier without filter

Average Anode Current = 725mA

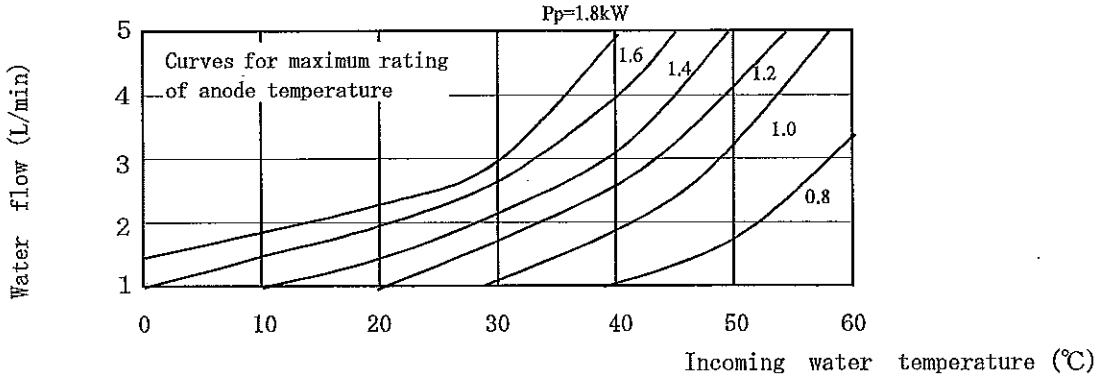
Fig. 3 Rieke Diagram of the 2M256



(A) ANODE DISSIPATION VS ANODE CORE TEMPERATURE RISE



(B) WATER FLOW VS STATIC PRESSURE DROP



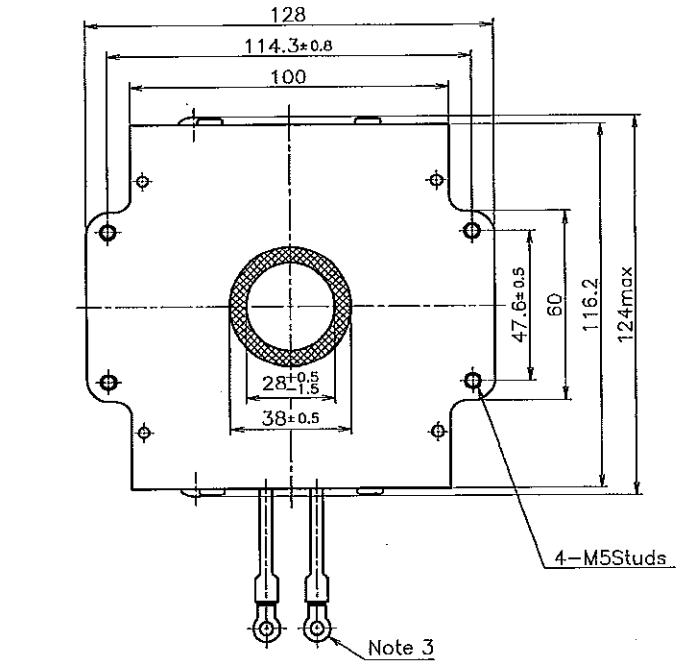
(C) WATER TEMPERATURE VS WATER FLOW (ABSOLUTE MAXIMUM RATING)

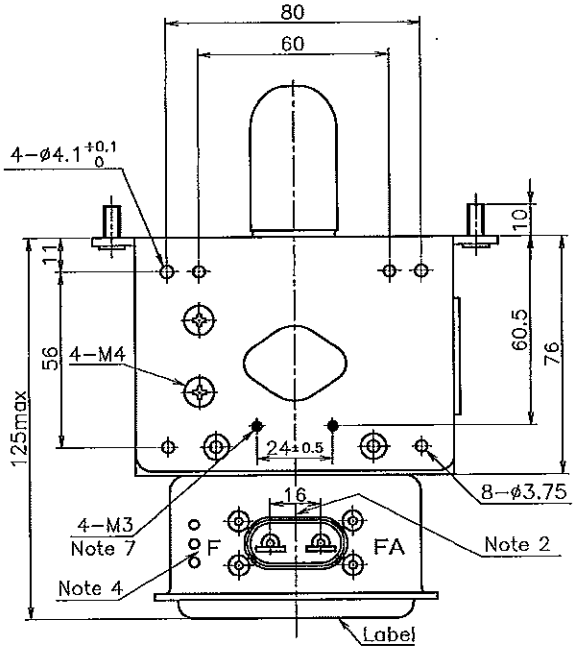
Fig. 4 2M256 COOLING CHARACTERISTICS

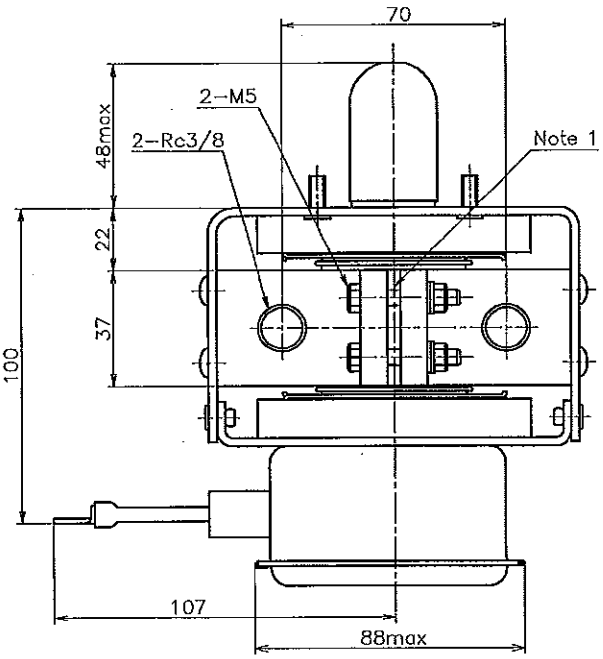
Hitachi Power Solutions Co.,Ltd	Date	Sep. 27, 2013	Sh. No.	3 2 8 4 P S 1603 - 2M256 - 4	頁	6/6

DIMENSIONAL OUTLINE OF 2M256

Dimensions in millimeters



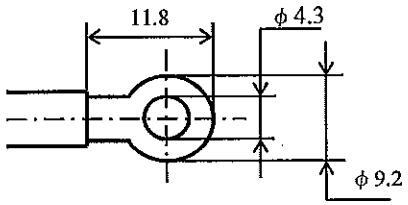




Hitachi Power Solutions Co., Ltd.	Date	Sep. 27, 2013	Sh. No.	3 2 8 4 P S 1604 – 2M256 – 11	Page	1/2

Note :

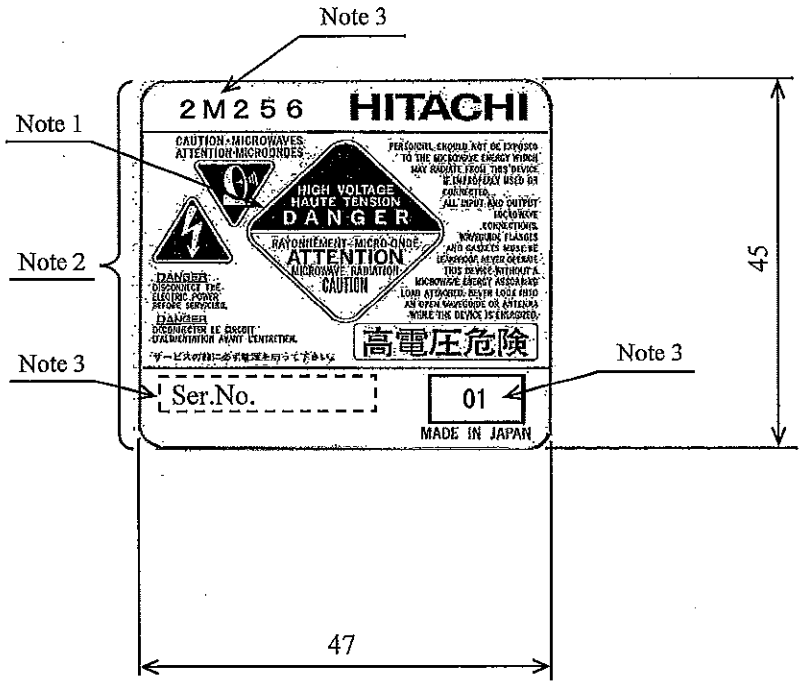
1. Anode core temperature measuring point.
2. Case temperature measuring point.
3. Detailed drawing of the filament terminal :



4. Filament terminal near this mark (three serial holes) shall be connected with filament transformer so as to be positive polarity when anode current flows.
5. Change of numbers and dimensions of holes on the yoke which are not specified in the drawing should be accepted.
6. With silicone encapsulation of the filament stud connection on the ceramic stem.
7. Thermal switch mounting position.

LABEL

Dimensions in millimeters

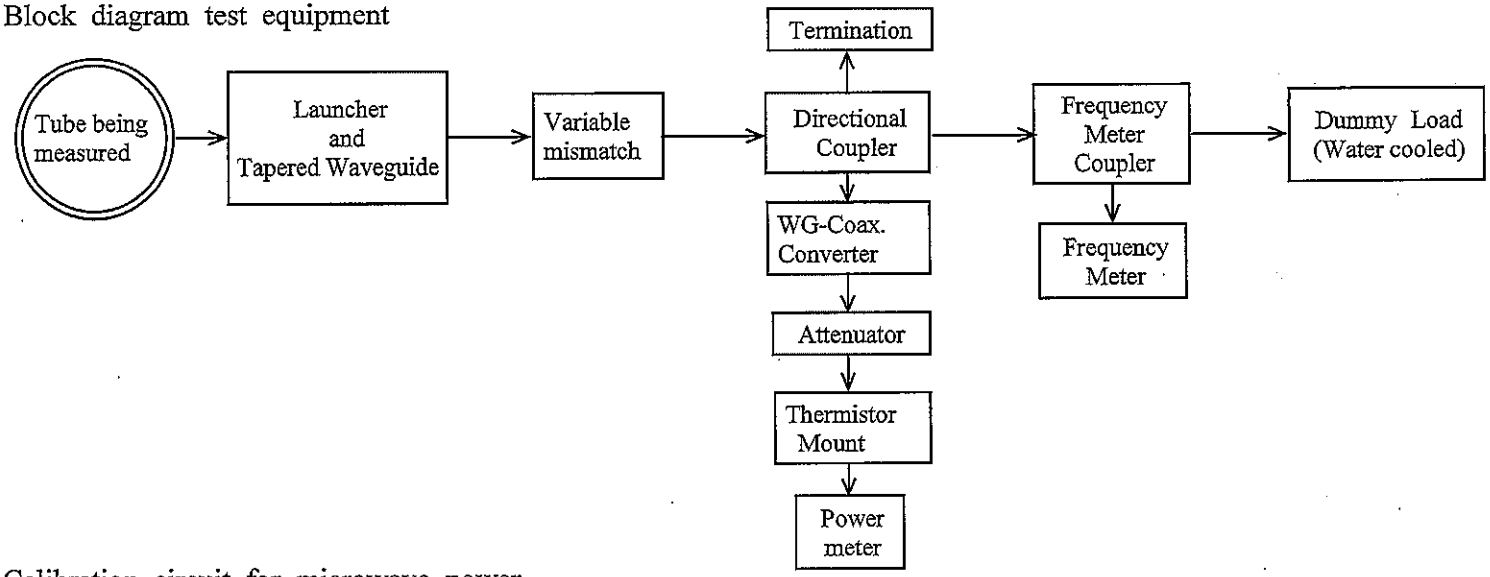


Note :

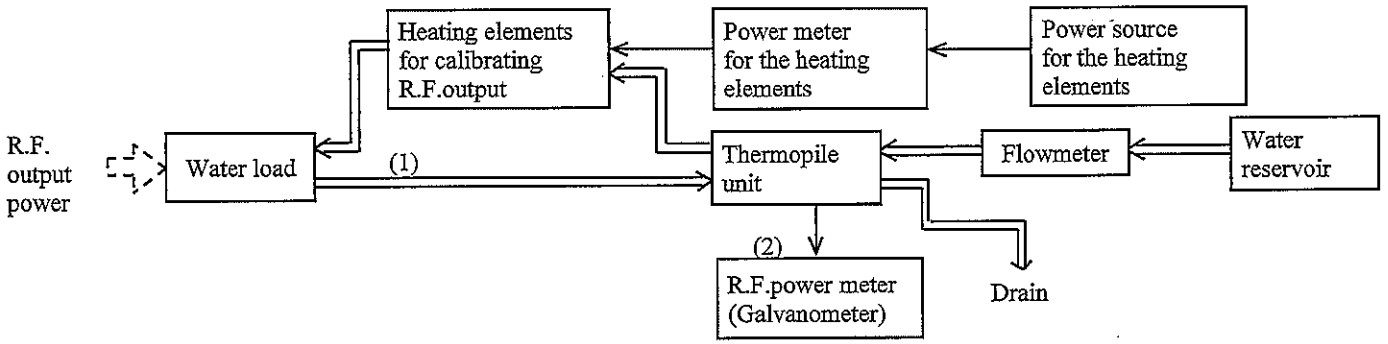
1. Area indicated to be white with red letters.
2. Area indicated to be red with white letters.
3. Type name " 2M256 " , suffix number " 01 " and "Ser No. "to be stamped with black letters.

Hitachi Power Solutions Co., Ltd.	Date	Sep. 27, 2013	Sh. No.	3284PS 1605 — 2M256 — 01 — 1	Page	1/1

1. Block diagram test equipment



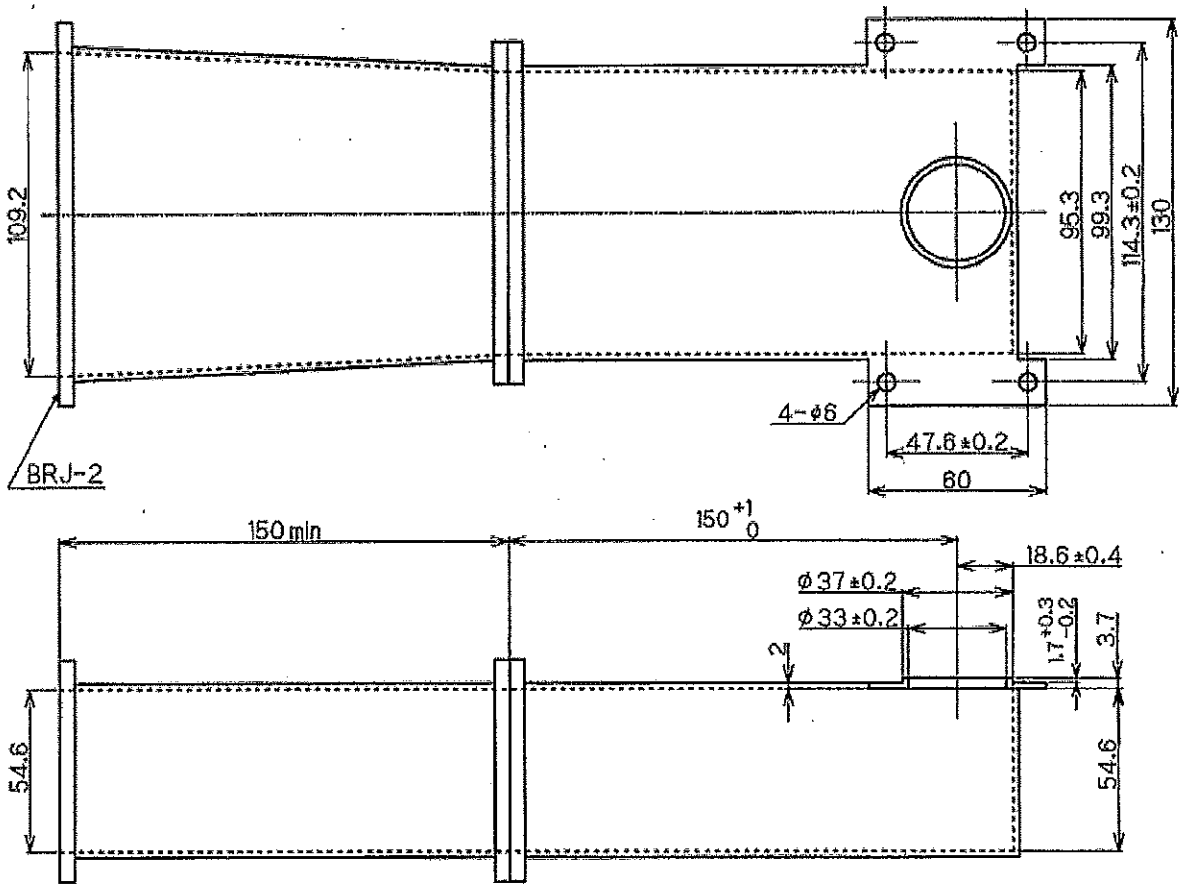
2. Calibration circuit for microwave power



note(1) The mark ⇒ indicates the current of water.
(2) The reading of the R.F.power meter(Galvanometer)should be checked against the power meter for the heating elements.

LAUNCHER AND TAPERED WAVEGUIDE FOR TESTING

Dimensions in millimeters

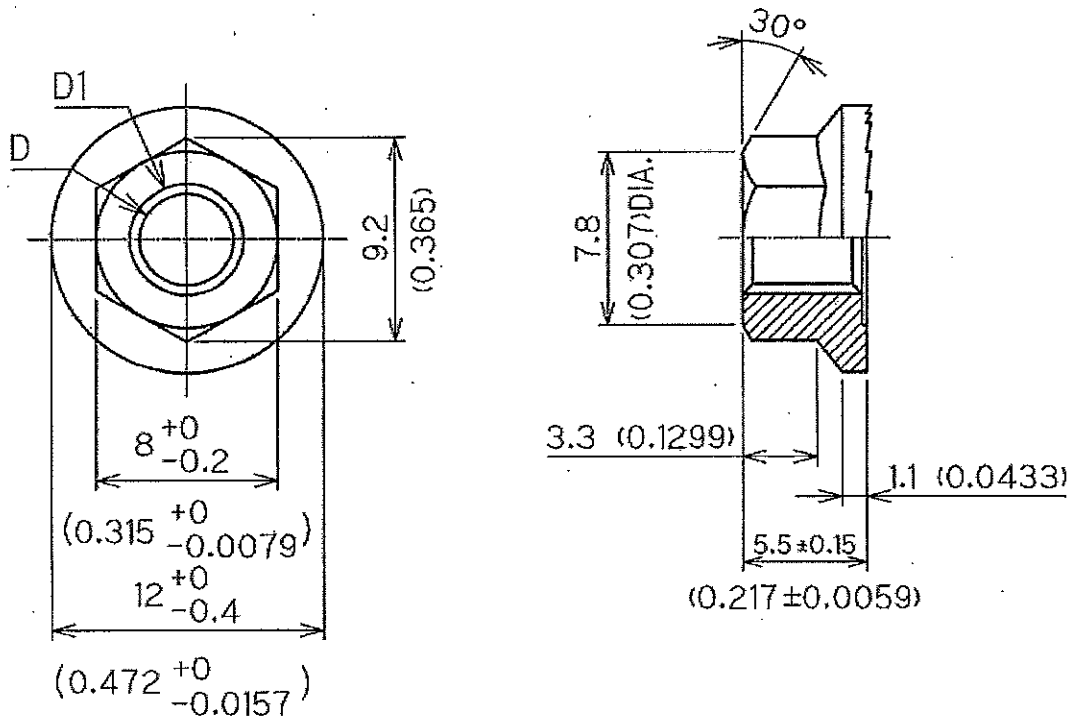


Hitachi Power Solutions Co., Ltd.	Date	Jan. 23, 2008	Sh. No.	3 2 8 4 P S 1609 — 0007 — 2	Page	1/1

ACCESSORY

Dimensions in millimeters
(in inches)

HEXAGONAL NUT WITH FLANGE



D	:	4.134 (0.1628)DIA.
Dl	:	5.0 (0.1969)DIA.
PITCH	:	0.8 (0.0315)
MATERIAL	:	steel
QUANTITY	:	4 pieces per tube.
USAGE	:	Mouting of tube.

Hitachi Power Solutions Co., Ltd.	Date	Jan. 23, 2008	Sh. No.	3284PS 1610 — 0007 — 1	Page	1/1

PRECAUTIONS FOR SAFETY

Carefully take the following precautions for safety in using the magnetrons for microwave ovens or for other applications.

Magnetrons must be handled by individuals possessing adequate backgrounds of electrical, electronic, microwave and mechanical experience.

The filament power supply of the magnetrons, please use a commercial frequency power supply (50Hz/60Hz) or DC power supply. Because you may burn magnetron filter circuit,you should never use of the switching power supply.

Hitachi Power Solutions Co., Ltd. cannot be responsible for the interpretation of this information, nor can it be assumed any liability in connection with its use.

1.Radiation Leakage

Care should be taken for radiation leaked from the magnetron, although the leakage from the input part of magnetron is restricted to a level which human body is not adversely affected.

1-1 Properly install and tightly fasten the magnetron in the oven or in the waveguide launcher.

1-2 Do not deform the gasket or do not operate the magnetron with the gasket removed, to avoid hazardous conditions such as radiation leakage and arcing.

1-3 Never operate the magnetron without installing it in the oven or with the output antenna exposed.

1-4 Do not remove the lid of filter box nor deform the filter box.

1-5 Always keep your eyes apart from the operating magnetron in consideration of the unexpected hazardous conditions.

1-6 Do not use a dropped magnetron because the microwave sealing might be damaged.

2.Temperature

Although the magnetron is subjected to forced air or water cooling during operation, high temperature is observed the enclosure of magnetron, care should be taken as follows:

2-1 Do not touch the magnetron immediately after turning power off.
Allow the magnetron to cool before handling.

2-2 Putting on cotton gloves or the equivalents is recommended for safe handling.

2-3 Install a thermo-protector on the enclosure of magnetron to avoid abnormal temperature rise.

3.High Voltage Shock

Since the magnetron is operated with negative high potential at the filament terminals, a special care must be taken as follows :

3-1 Do not touch nor come close to the filament terminals or their surroundings during operation.

3-2 To avoid shock hazards, never insert metallic wire or line into the filter box, and never operate the magnetron with the lid of filter box open.

3-3 Before removing the magnetron from the oven, carefully check that power is turned off, and discharge the filament terminal or the capacitor in the power supply circuit by using the discharging rod adequately designed safety.

4.High Voltage Break Down

4-1 Contact resistance at connecting point for filament terminals :

Care should be taken for loose connection between filament terminal and receptacle. Because higher contact resistance as connecting point causes both larger ohmic loss and higher temperature, magnetron cannot adequately be operated due to low filament voltage, insulating materials by terminal leads (in a feed through capacitor) can easily be burned, and insulation may be broken down due to burned insulator.

Special care must be taken as follows :

4-1-1 To avoid loose contact, do not use economy type receptacle.
Premier line receptacle is recommended for tight connection.

4-1-2 Properly install receptacle to terminals.

4-1-3 Properly and tightly connect the flying lead to receptacle.

4-2 Surface of insulator of feed through capacitor :

Since the surface of insulator of the feed through capacitor is eventually contaminated by dirty materials which mainly comes from cooked food-stuff and dust in the room, proper care should be taken for the insulator from dirty smudge.

The dirty smudge on the insulator at high humidity conditions may cause the insulator burn due to high voltage.

Special care must be taken as follows :

4-2-1 Do not touch surface of insulator with bare hand or with dirty gloves when you install magnetron in the oven.

4-2-2 Protect the surface of insulator from the polluted air with soot, dust, vaporous oil, moisture, and so on. Do not blow the insulator with polluted cooling air.

4-2-3 Protect the surface of insulator from the contamination by insects, such as cockroach.

4-2-4 Do not place a combustible material near the surface of insulator.
One of solutions is to add an incombustible insulator to cover terminals and capacitor.