

TOSHIBA

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TO : GD Midea Microwave Oven MFG. Co., Ltd.

APPROVAL SIGNATURE

SPECIFICATION

FOR
MAGNETRON
2M248J(MT)-B

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ELECTRON TUBES DIVISION

SPECIFICATION NUMBER : E060024-K15 May 22, 2006
REVISION STATUS :

This specification is based on the testing methods for continuous wave magnetrons ED-1501 set by the Electronic Industries Association of Japan (EIAJ).

Continuous Wave Magnetron												
DESCRIPTION	Magnetron (Fixed Frequency, Integral Magnet, Forced Air Cooled)											
FUNCTION	2450 MHz band continuous wave oscillation											
OUTER DIMENSIONS	See outline drawing											
ABSOLUTE MAXIMUM RATING			(²)	(¹⁰)		(³)	(⁴)		(⁵)			
	Term	Ef	tk	ebm	lb	ibm	Pi	σ_L	Tp	Tcon	Tstorage	Tseal
	Unit	V	s	kV	mAdc	A	kW	-	°C	°C	°C	°C
	Max	3.60	-	4.85	380	1.5	1.7	4	300	120	60	320
Min	2.70	0	-	-	-	-	-	-	-	-30	-	
STANDARD TEST CONDITION: (¹)(²)(³)		3.15	5	-	330	-	-	1.1Max	-	-	-	-
TEST SPECIFICATIONS												
TEST TERM (⁶)	TEST METHOD (EIAJ ED-1501)	TEST CONDITION	SYMBOL	NOMINAL	LIMIT		UNIT					
					Min	Max						
** Vibration	5.4.1		-	-	-	-	-					
Breakdown Voltage	4.2	Et=10kVdc (¹¹)	-	-	-	-	-					
Insulation	-	Et=1kVdc (⁷)	-	-	-	-	-					
* Cold Start Voltage Transient	-	(⁸)	-	-	-	8.5	kV					
* Filament Current	4.1.1	tk=120s	If	10.0	8.0	12.0	A					
Peak Anode Voltage	4.3.1	(⁹)	ebm	4.35	4.15	4.55	kV					
Average Output Power (¹)	4.3.3.1	(⁹)	Po	1030	980	1080	W					
Frequency	4.3.4	(⁹)	f	2460	2450	2470	MHz					
* Stability/Moding	4.3.11.2	$\sigma_L=2,3,4$	-	-	-	-	-					
* Stability/Runaway	4.3.11.1	$\sigma_L=6, t=30s$	-	-	-	-	-					
* Pulling Factor	4.3.6	$\sigma_L=2$	fpl	-	-	25	MHz					
* Sink Phase	4.3.7	$\sigma_L=2$	$\lambda_{\text{sink}} / \lambda_g$	0.235	-	-	-					
Power Leakage	4.3.15	$\sigma_L=3$	S ₁	-	-	10	W/m ²					
** Life Test	4.5.1	(¹²)	t	-	500	-	h					
** Life Test End Point	Average output power (1)	4.3.3.1	(⁹)	Po	-	20%	W					
	Stability/ Moding	4.3.11.2	$\sigma_L=2,3,4$	-	-	-	-					
	Stability/ Runaway	4.3.11.1	$\sigma_L=6, t=30s$	-	-	-	-					

Note (¹) The tube shall be mounted on the output coupler (containing tapered wave-guide) shown in the attached drawing (Page-4) and cooled by forced air of 800 L/min. Single phase full wave rectifier without filter shall be used for power supply. The diagram of the test equipment is shown in the attached drawing (Page-3).

(²) During normal oscillation.

(³) The points for measuring anode temperature is shown in the outline drawing. Maximum anode temperature for normal condition (with load in the cavity) should be 250 °C

(⁴) The point for measuring feed through capacitor temperature is shown in the outline drawing.

(⁵) Tseal means temperature of ceramic-to-metal seal position of the tube. Maximum allowable build-up curve of seal temperature is shown in the attached drawing (Page-6).

(⁶) Tests shall be classified as follows:

Class	Mark†	Remarks
Production test	None	This test is intended to ensure if the production line is being processed in compliance with the standard, and shall be conducted on some typical characteristics which are considered to be affected by changes in the process.
Design test	*	This test is intended to ensure the standard design, and shall be conducted on such characteristics which are not affected by the ordinary production line as long as the design is
Type approval test	**	This test is intended to ensure the compliance of the standard design with given specifications, and may be omitted unless a substantial change in the design is made.

†: The Mark is placed on the left of each test item, for instance, **Vibration

(⁷) See the attached drawing (Page-6, Insulation).

(⁸) Measurement shall be conducted by standard oven which has a single phase half wave doubler power supply without filter, where no load voltage of the transformer shall be less than 2.4 kV rms. The voltage transient just before start of oscillation shall be measured.

(⁹) Measurement shall be conducted within 15 seconds after anode power is turned on. Magnetron is kept in the constant ambient temperature for more than 4 hours before testing. Standard ambient temperature is 25 °C. Correction factor of peak anode voltage (ebm) and output power (Po) vs. temperature is shown in the attached drawing (Page-6).

(¹⁰) For each oven model, both microwave oven manufacturer and Toshiba Hokuto should evaluate and agree on the stability characteristics in the design stage of the oven.

(¹¹) Test equipment should have a protect resistance specified in the table connecting in series to the products under the test. Leakage current should not exceed the limit specified in the table during the test of 10 seconds.

Leakage current	Protect resistance
100mA	200k-300kΩ

Connection of a magnetron should be as follows.

Anode : Plus

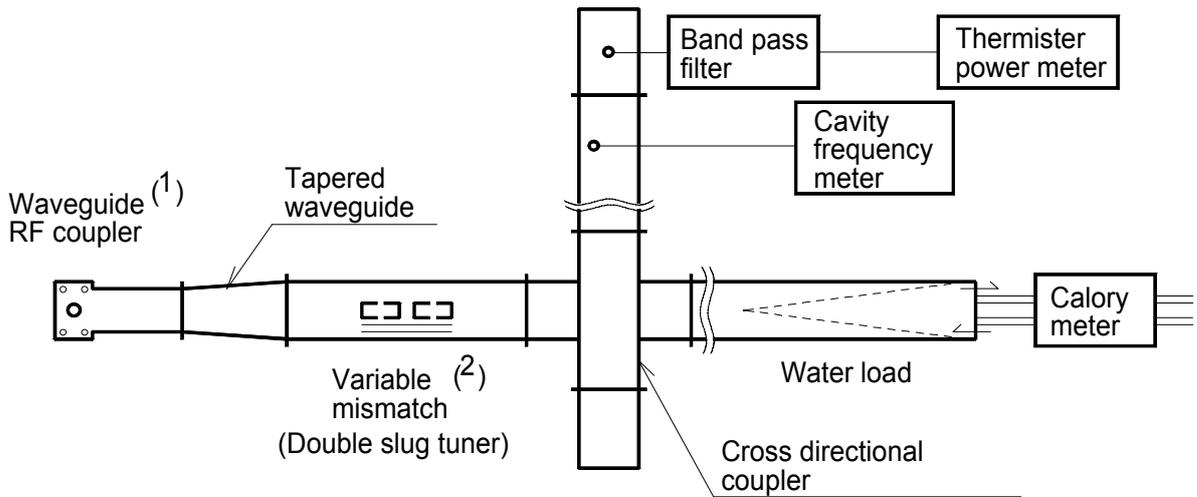
Cathode (terminal): Minus

(¹²) The tube shall not appreciably be damaged in the following abnormal test.

Anode temperature(Tp)	Cycle(Time)	Corresponding operating condition
350°C MAX	10 cycles (15minutes / cycle)	No load

TEST EQUIPMENT

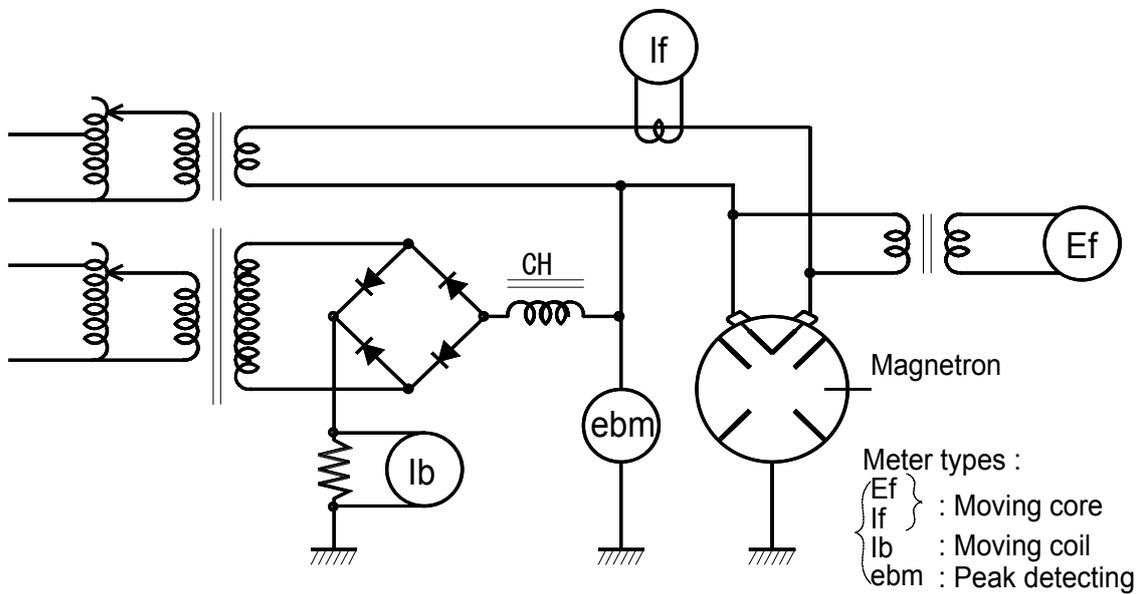
A. Waveguide configuration



Note

- (¹) Details are shown in the attached drawing (Page-4).
- (²) Calibrated with the standard standing wave detector.
- (³) WR430 waveguides are used from the double slug tuner to the water load.

B. Power supply connection



Meter types :
 { Ef } : Moving core
 { If } : Moving coil
 lb : Moving coil
 ebm : Peak detecting

Note

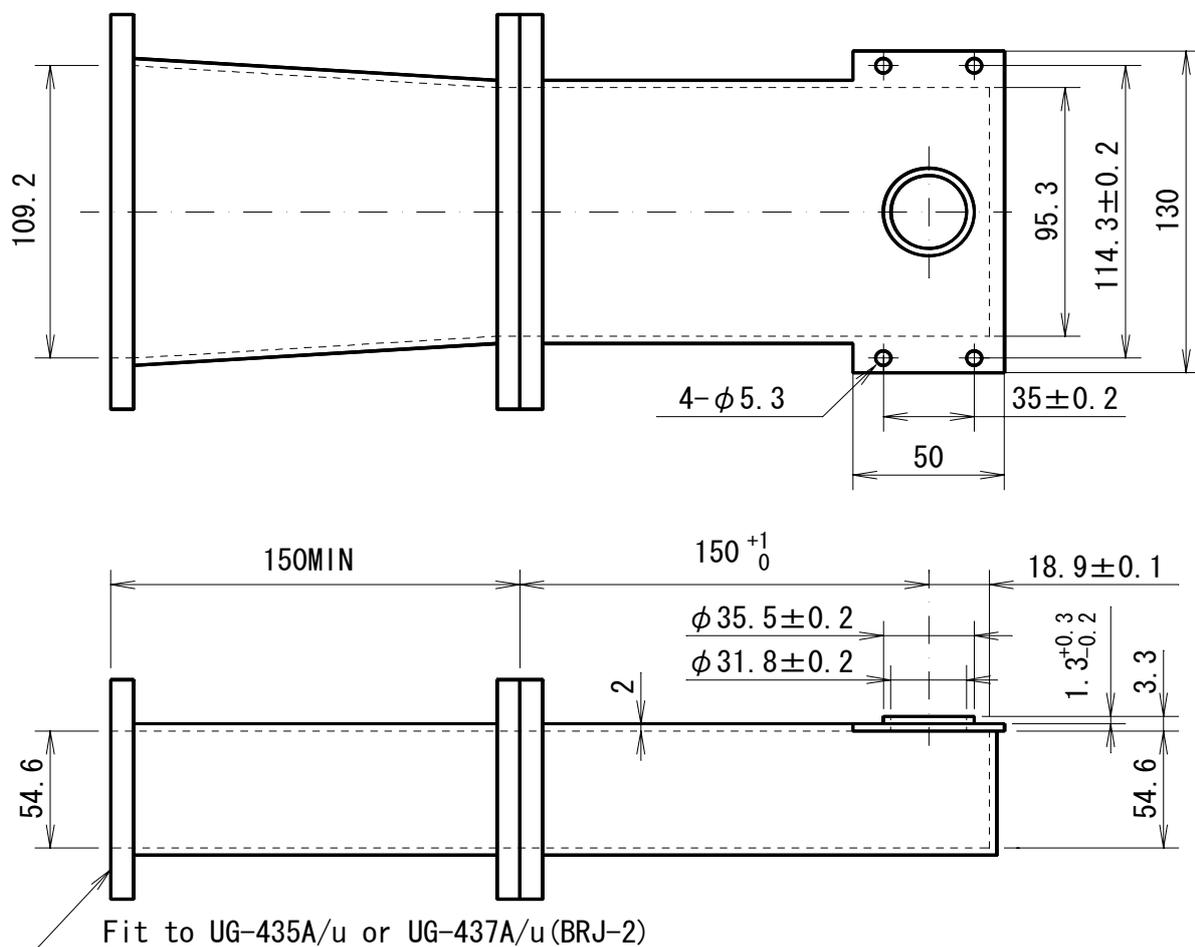
- (¹) Choke coil is adjusted such that the peak anode current value becomes three times the average value.

FILAMENT CONNECTION

To minimize possible transient voltage, the terminals F and FA should be connected to the transformer in such a way that the anode voltage increases and anode current decreases compared with those for reversed connection when a single phase half wave doubler without filter is used as a power supply.

OUTPUT COUPLER (The output coupler used in Toshiba Hokuto inspection)

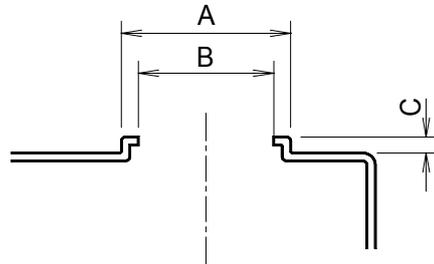
Unit : mm



DIMENSION OF WAVEGUIDE COUPLER

(1) Dimension of a lip of waveguide

Dimension of a lip (contact portion with a magnetron gasket on a waveguide coupler) should be kept as below to avoid power leakage and arcing on antenna.

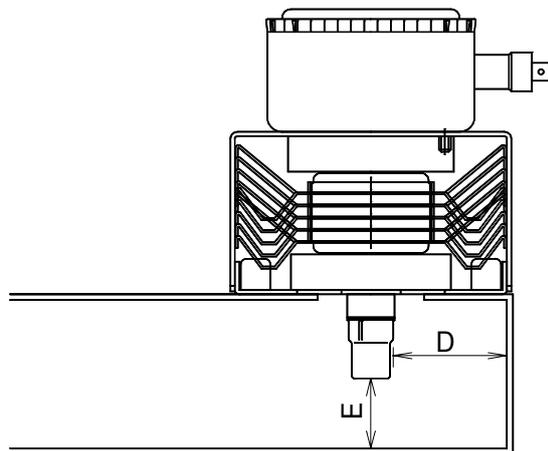


- A: ϕ 35mm Max.
- B: ϕ 24mm Min.
- C: 1.0 to 1.5 mm

Electrical contact around a lip with a magnetron gasket should be kept perfectly. Therefore the surface of a lip contacting to a magnetron gasket should not be painted or covered.

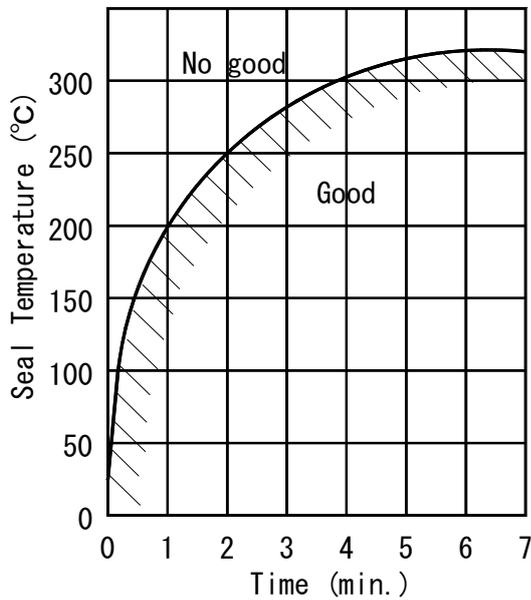
(2) Distance between antenna and waveguide

Distance between an antenna of magnetron and a waveguide coupler should be kept more than 10mm as below in order to avoid the arcing between them.

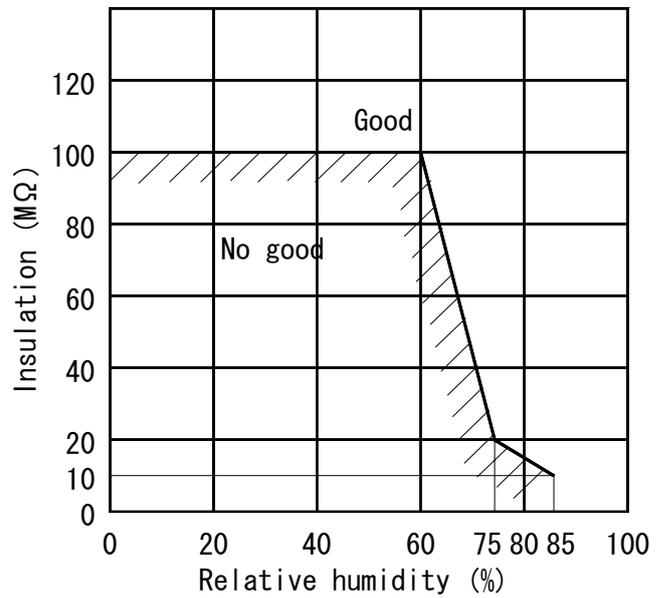


D,E: 10 mm Min.

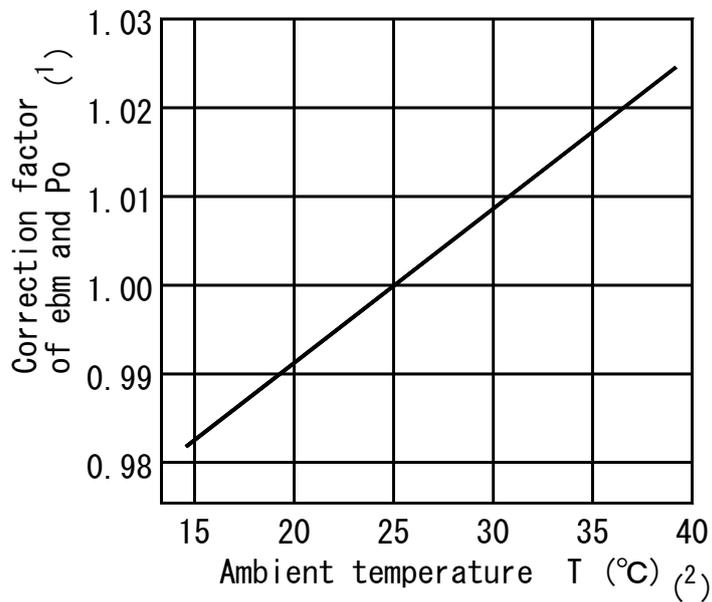
MAXIMUM ALLOWABLE BUILD-UP
CURVE OF SEAL TEMPERATURE



INSULATION



CORRECTION FACTOR OF PEAK ANODE VOLTAGE (ebm)
AND OUTPUT POWER (Po) VS. AMBIENT TEMPERATURE



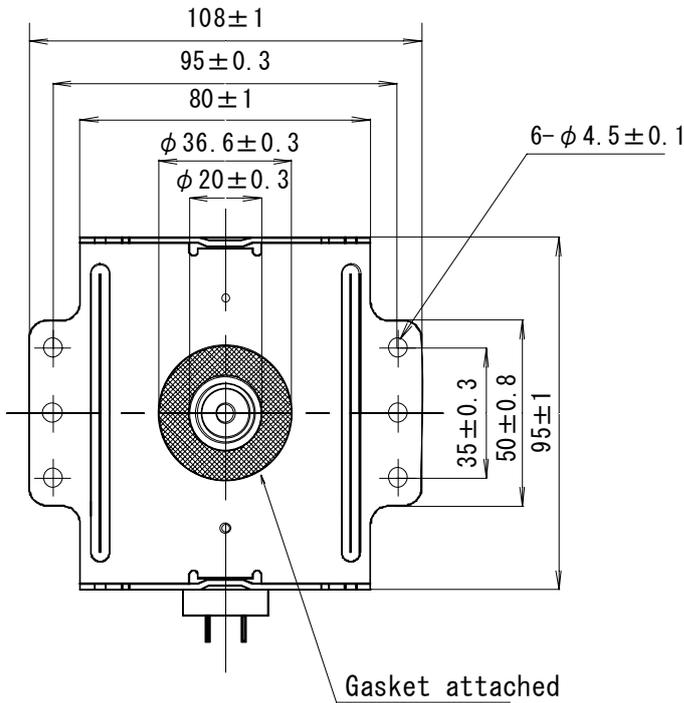
Note

(¹) ebm (or Po) measured at T °C × Correction factor at T °C = ebm (or Po) at 25 °C

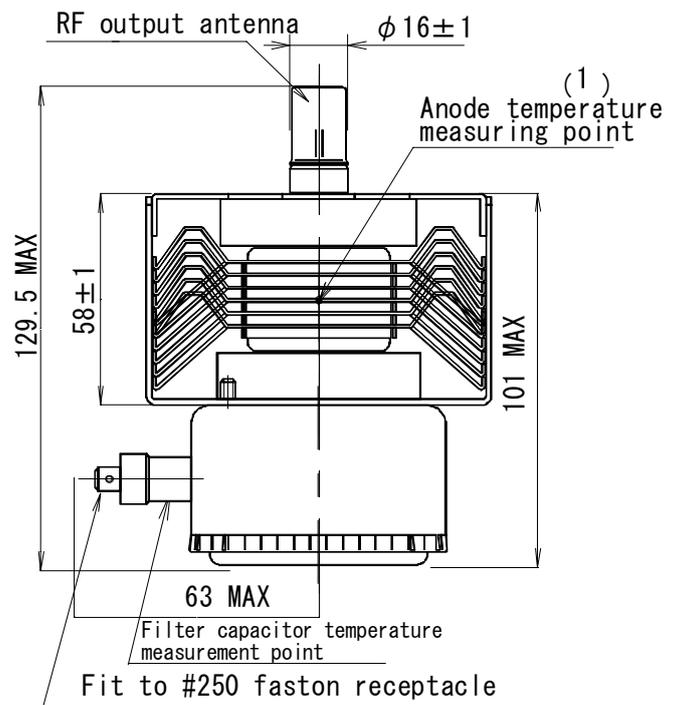
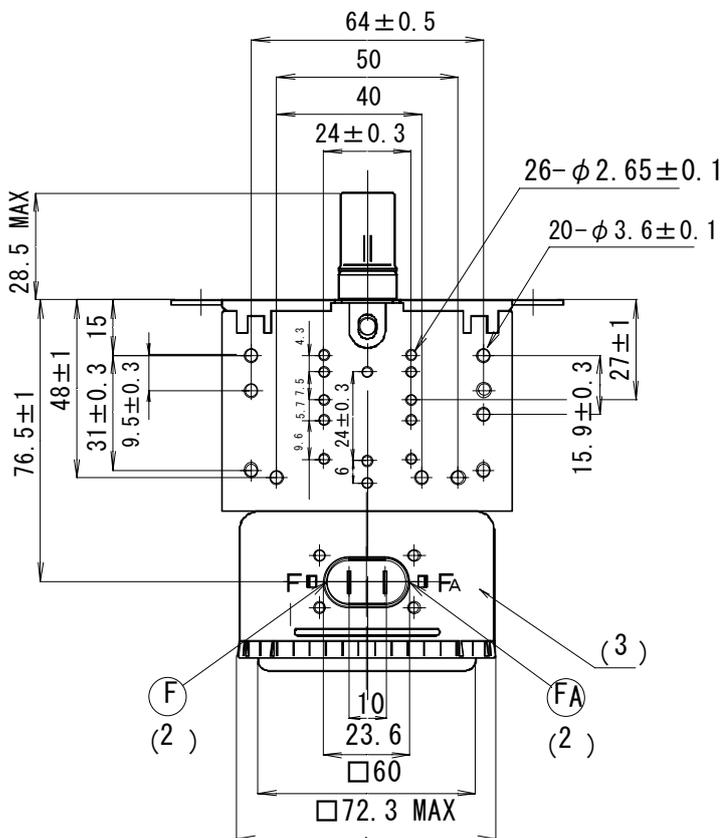
(²) The temperature shown in this figure is the constant room temperature in which the magnetron has been kept for more than 4 hours before testing.

OUTLINE DRAWING

Unit : mm

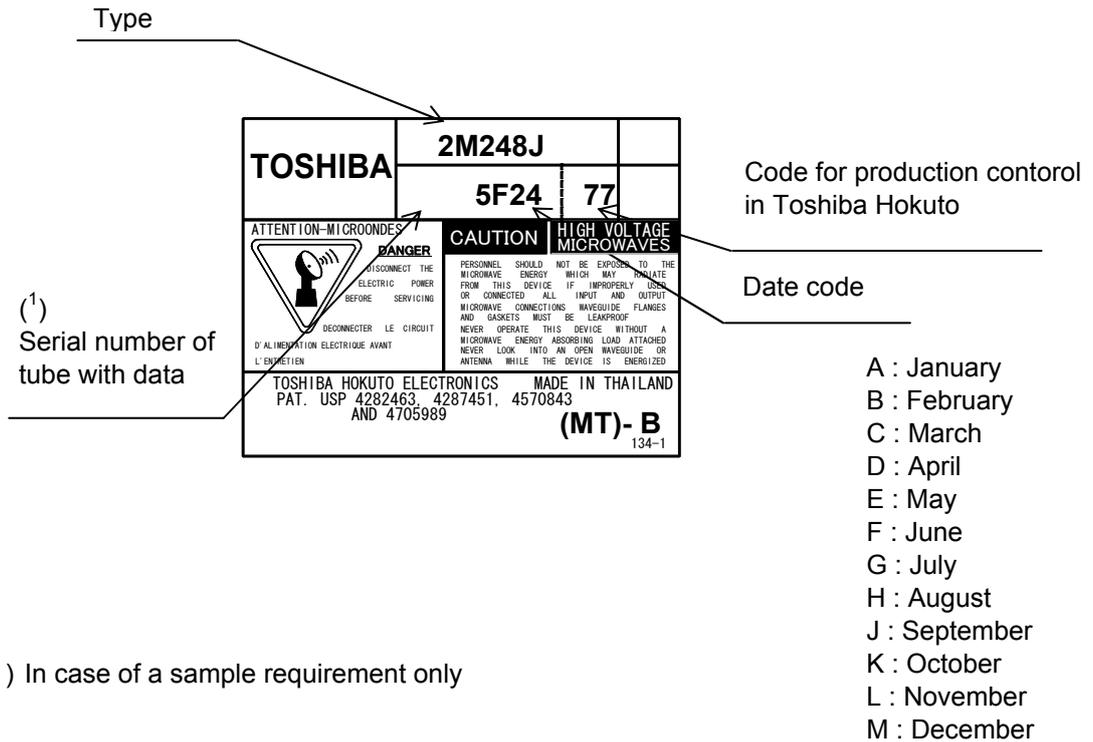


- Note (1) Temperature to be measured at the outlet side air flow.
 (2) Refer filament connection.
 (3) "F" and "FA" are marked at these positions.



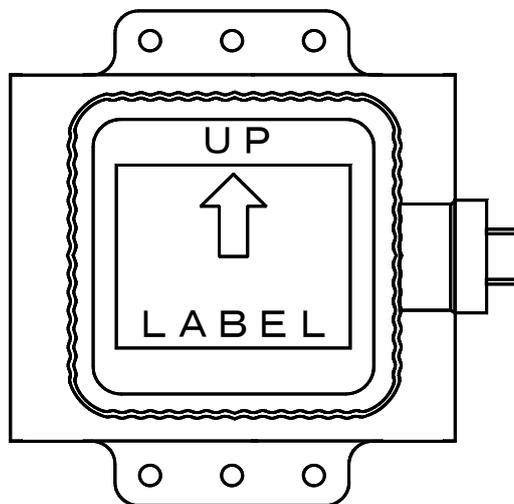
LABEL

The label as shown below shall be put on each tube.
 The code stamped on the indicated position of each label consists of three block numbers ;
 The first block is the serial number of tube data. The second block is the date code in which the preceding one numeral shows the last of the Christian Era and continuing block letter and two numerals indicate the three months after the scheduled date of shipment from a factory.
 The third block is the numerals only for the production control in Toshiba Hokuto.



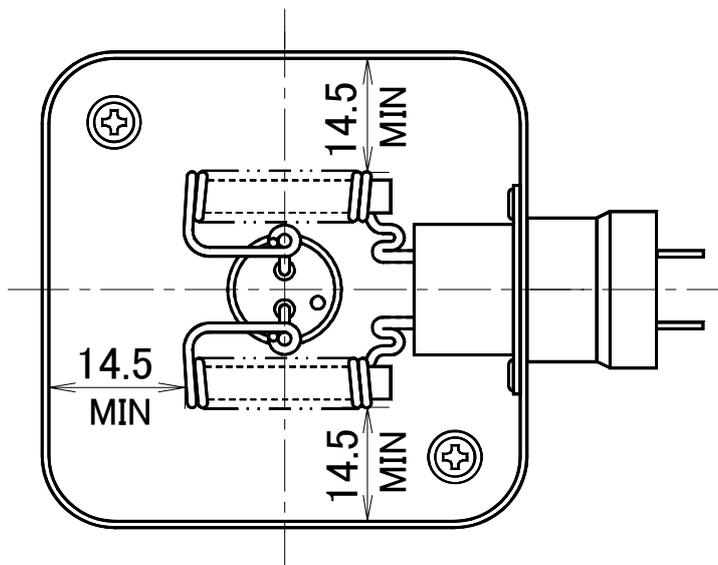
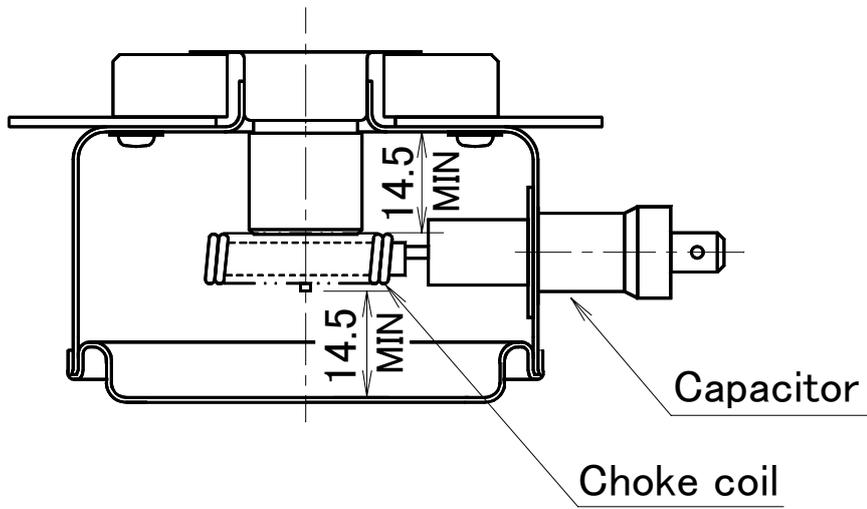
Note
 (¹) In case of a sample requirement only

Labeling



SPACING IN THE FILTER BOX

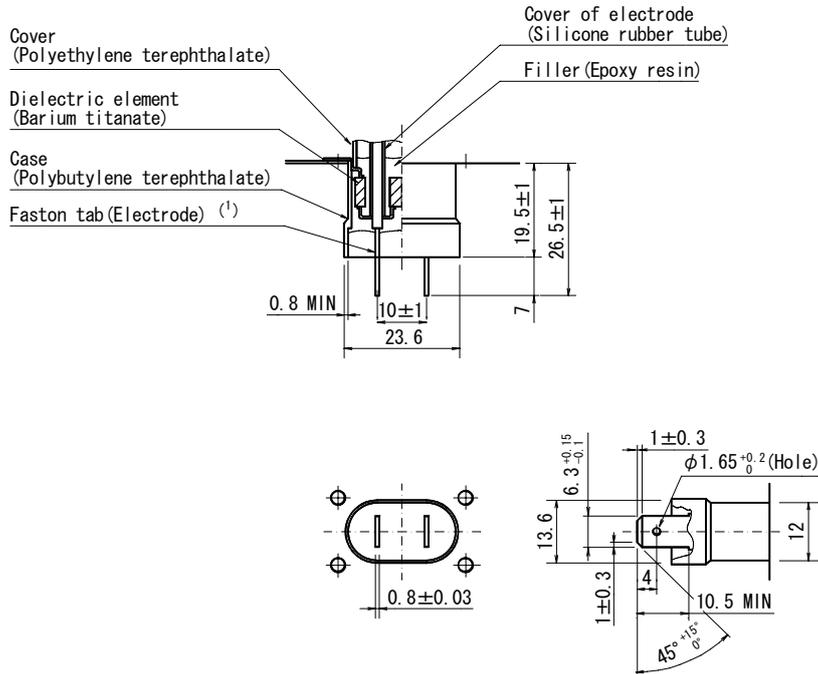
Unit : mm



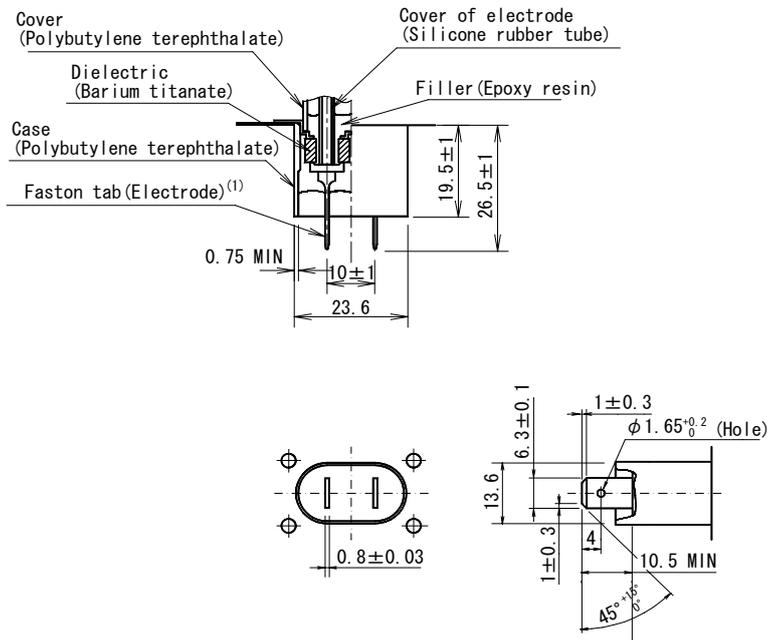
DETAILS OF FILTER CAPACITOR

Unit : mm

TDK Corp.



Ceracom co.,Ltd.



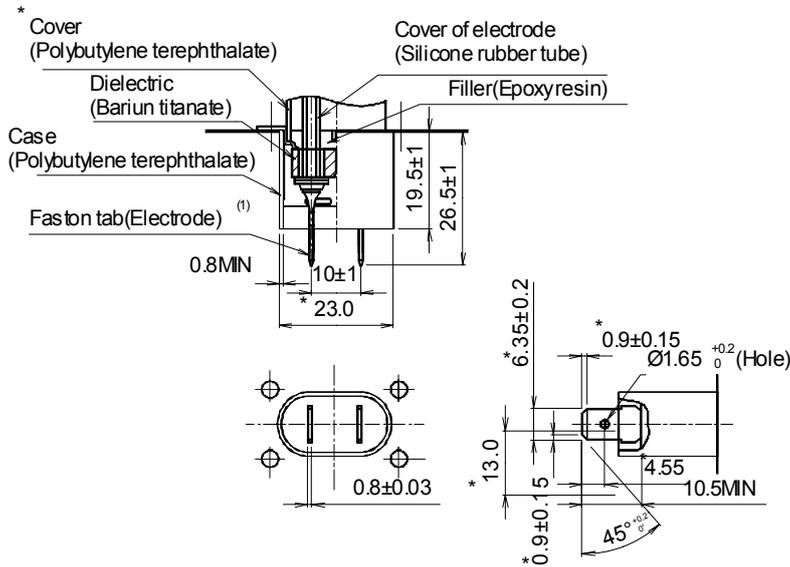
Note

(¹) The faston tab meets to BS 5057 ; 1973 and DIN 46 244 ; April 1980.

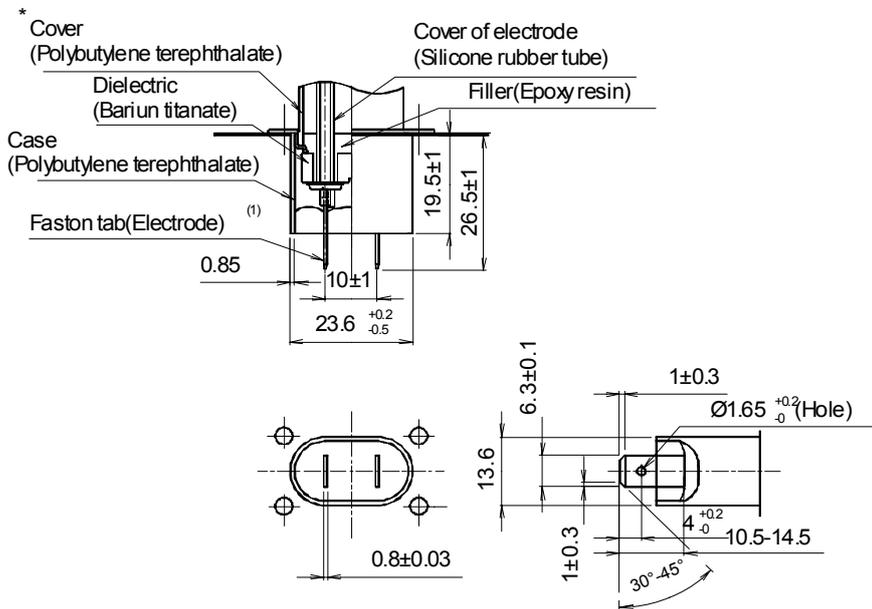
DETAILS OF FILTER CAPACITOR

Unit : mm

Leadone Co., Ltd.



SAMWHA CAPACITOR Co.,Ltd.



Note

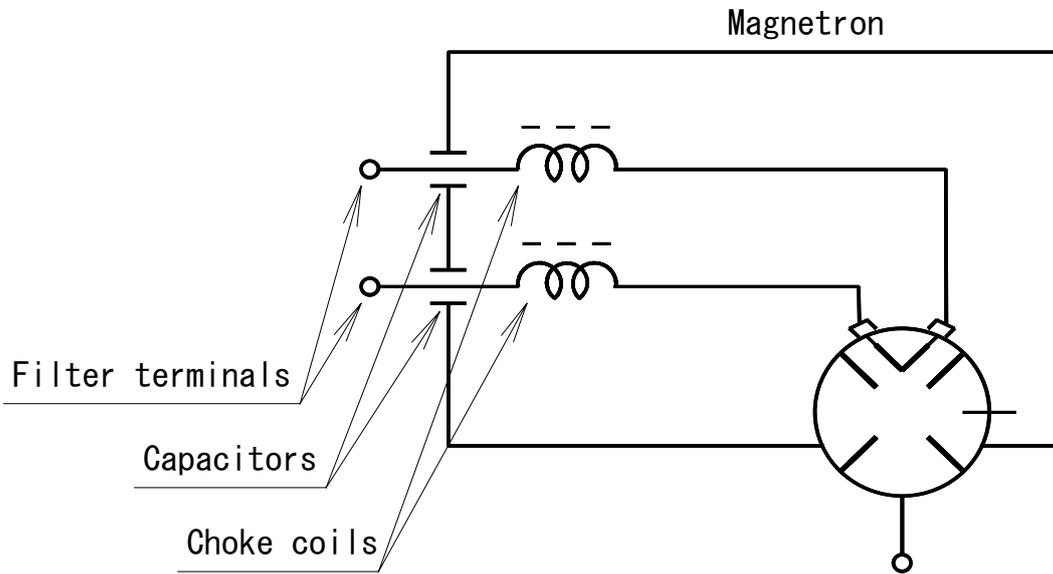
(1) The faston tab meets to BS 5057 ; 1973 and DIN 46 244 ; April 1980.

INSULATING MATERIAL (Refer Page-9 & 10 & 11)

Parts Name	Catalog No./ Manufacturer (²)	Material	Manufacturer of Material	UL No. (¹)		
				Guide No.	File No.	Grade No.
Capacitor	Toshiba Hokuto Spec.	Barium Titanate	TDK Corp.	-	-	-
		Epoxy Resin	Ditto	-	-	-
	HFC-2L-3/ TDK Corp.	Silicone Rubber Tube	Shin-etsu Chemical Co., Ltd. or Toshiba Silicone Co., Ltd.	-	-	-
		Polyethylene- terephthalate	Wintech Polymer Ltd.	QMF-Z2	E213445	CN9015
		Polybutylene- terephthalate	Mitsubishi Rayon Co., Ltd. or Wintech Polymer Ltd.	QMF-Z2	E54695M E213445	G2930 956CT
	Toshiba Hokuto Spec.	Barium Titanate	Ceracom Co.,Ltd.	-	-	-
		Epoxy Resin	Hitachi	-	-	-
	CHC-2P/ Ceracom Co.,Ltd.	Silicone Rubber Tube	Shin-etsu Chemical Co., Ltd.	-	-	-
		Polybutylene- terephthalate	LG Chemical Ltd.	QMF-Z2	E67171	Case:GP-2301F Cover:GP-2151F
	Toshiba Hokuto Spec.	Barium Titanate	LEADONE Co.,Ltd.	-	-	-
		Epoxy Resin	Phelnox	-	-	-
	LF-2T/ LEADONE Co.,Ltd	Silicone Rubber Tube	URI-Silicon Co., Ltd.	-	-	-
		Polybutylene- terephthalate	LG Chemical Ltd.	QMF-Z2	E67171	GP-2151-F
		Barium Titanate	Kyorix	-	-	-
	Toshiba Hokuto Spec. SMC501N10K/ SAMWHA CAPACITOR Co.,Ltd	Epoxy Resin	Phelnox	-	-	-
		Silicone Rubber Tube	Hae Ryoung Silicon	-	-	-
Polybutylene- terephthalate		LG Chemical Ltd.	QMF-Z2	E67171	Case:GP-2156F Cover:GP-2306F	
Barium Titanate		Kyorix	-	-	-	
Choke coil	Toshiba Hokuto Spec. Hakki Sangyo Co., Ltd. or	Ferrite	Ferrite Electronic Ind. Co., Ltd. or Shanxi Taihua Industry & Trade Co., Ltd.	-	-	-
				-	-	-
	Toshiba Hokuto Electronic Devices (Thailand) Co., Ltd.	Formal Coated Wire	Daiichi Denko Co., Ltd. or Thai Hitachi Enamel Wire Co., Ltd. (THDT) or Pacific Electric Wire & Cable (Shenzhen) Co., Ltd. or LG Cable Ltd.	-	-	-
				-	-	-
	Silicone Rubber	Toshiba Silicone Co., Ltd.	-	-	-	

Note (¹) UL No. is for the material.(²) One of them shall be used by Toshiba Hokuto's option.

FILTER CIRCUIT



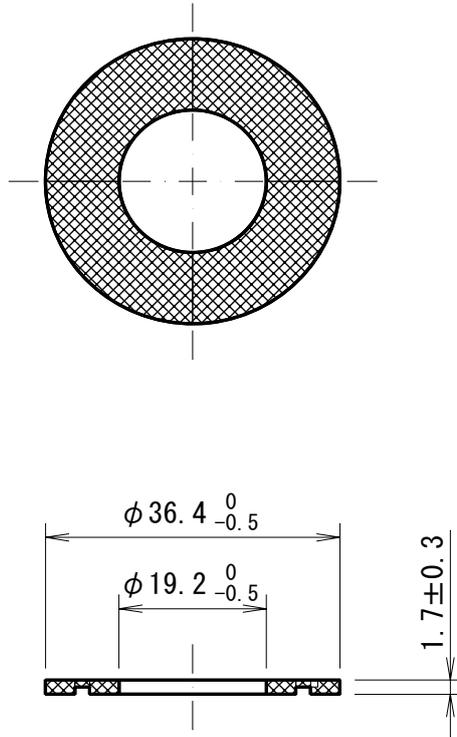
RATING

	Nominal value	Remarks
Capacitor	500pF×2 WV 10kVdc	-
Choke coil	0.8 μH×2	at about 8MHz

GASKET

Unit : mm

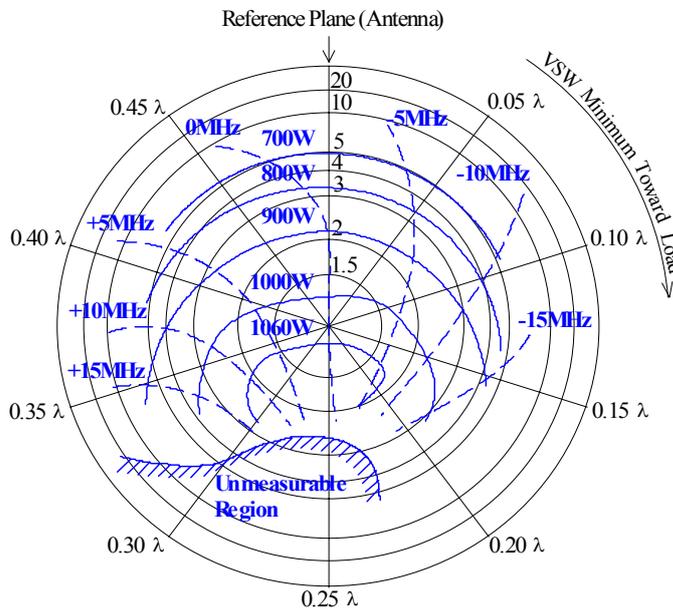
Material : Woven and press formed brass wire



Inspection : By using thick part of slide calipers

RIEKE DIAGRAM

Operating condition: Anode supply: Single phase full wave rectified without filter
Filament voltage: 3.15 V
Average anode current: 330 mA (constant)
Peak anode voltage (matched load): 4.35 kV
Oscillating frequency (matched load): 2460 MHz



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.

Toshiba Hokuto Electronics Corporation cannot be responsible for the interpretation of this information, nor can it be assumed any liability in connection with its use.

1. High Voltage

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

- 1-1 Do not touch nor come close to the cathode terminals or their surroundings during operation.
- 1-2 To avoid shock hazards, never insert metallic wire or like into the filter box, and never operate the magnetron with the lid of filter box open.
- 1-3 Before removing the magnetron from the oven, carefully check that power is turned off, and discharge the cathode terminal or the capacitors in the power supply circuit by using the discharging rod adequately designed for safety.

2. Radiation Leakage

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

- 2-1 Properly install and tightly fasten the magnetron in the oven or in the wave-guide coupler.
- 2-2 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.
- 2-3 Never operate the magnetron without installing it in the over or with the output antenna exposed.
- 2-4 Do not remove the lid of the filter box nor deform the filter box.
- 2-5 Always keep your eyes apart from the operating magnetron in consideration of the unexpected hazardous conditions.

3. Temperature

Although the magnetron is subjected to forced air cooling during operation, high temperature (sometimes more than 200°C) is observed on the enclosure of magnetron. Care should be taken as follows.

- 3-1 Do not touch the magnetron immediately after turning power off. Allow the magnetron to cool before handling.
- 3-2 Putting on cotton gloves or the equivalents is recommended for safe handling.

4. Alteration

Do not alter the magnetron.

ATTENTION ON HANDLING OF MAGNETRON

- 1. The following vibration or shock should not be given, when magnetron is transported and installed.
 - Shock : more than 100G
 - Vibration : more than 2.5G
- 2. Do not hold the antenna of a magnetron nor give any damage to it, which may give stain on the antenna or break seal portion of an antenna. Those may cause arcing or air leak in the antenna.

RECORD OF REVISION

Original Specification : E060024-K15 May 22, 2006

STATUS	PAGE	REVISION	NOTES	EFFECTIVE DATE