TOSHIBA ELECTRON
TUBES & DEVICES

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To : Lyncean Technologies, Inc.

Receipt Signature and Date

Please return one of specification after your receipt signature.

This specification will be applied to the serial delivery or lot delivery until obtaining your signed specification or your counter proposal to be agreed.

SPECIFICATION

FOR

VT-68934,E

Shinji Ohama

General Manager

Sales Department

Specification Number : T180157-L973 Rev.0

Issued : 2018-10-23
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To : Lyncean Technologies, Inc.

SPECIFICATION

FOR

VT-68934,E

Toshiba Focusing Magnet

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Limitation of Product Liability

In case you receive a claim from a third party that any loss or damage to property, bodily injury or death of a person was caused by a defect of the Component, you shall immediately notify Toshiba Electron Tubes & Devices Co., Ltd. (TETD) of such claim and consult with TETD for any actions to be taken. In any event, liability of TETD shall be confined to the extent reasonably foreseeable and proximately caused by the defect of Component with a limitation of aggregated amount paid by you for the Components.

Provided, however, TETD shall not be liable in the cases, where,

(1) it was impossible for TETD to discover the defect based upon the state of scientific or technical knowledge at the time of delivery to you,

(2) the defect is due to the compliance with your instruction regarding the specification or design,

(3) you failed to incorporate fail-safe design to your products in consideration of the reasonably expected failure ratio/pattern of the Components incorporated therein,

(4) the defect is due to the compliance with mandatory regulations/standards issued by the public authorities; or

(5) the defect did not exist at the time of delivery.

About the sales of this product and combination devices

Export Control

1. US Export Administration Regulations: This product is free from the U.S. Export Administration Regulations.
2. Others: Distribution of the products and/or devices which incorporate the products may require prior approval of or notification to the regulatory authorities and/or the relevant government authorities. When distributing the product, all the laws and/or regulations applicable in the country and/or the region must be observed.

PRODUCT SPECIFICATION FOR VT-68934,E

Description: Liquid cooled focusing magnet for use with Toshiba E3772A,A high power pulse klystron. The electromagnet consists of a main coil and an auxiliary coil which are connected to each connector. When the solenoid coils are energized with the proper current specified by the tube manufacturer, the focusing magnet provides the shaped field required to properly operate for the klystron.

ABSOLUTE RATINGS: Note 1

Parameters	Symbol	Unit	Min.	Max.	Note(s)
Solenoid Current	Isol,main	Adc	---	42	2
	Isol,cc	Adc	---	32	2
Coil Voltage to Case	Esol,case	V	---	1500	
Coolant Flow	Qw	L/min	10	---	3
Coolant Pressure	Pw	MPa	---	0.8	
(Gauge Pressure)		(kgf/cm^2	---	8.0)	
Drop of Coolant Pressure	ΔPw	MPa	---	0.3	
		(kgf/cm^2	---	3.0)	
Inlet Coolant Temperature	Tw	Centigrade	0	40	4,5
Environmental Temperature	Ta	Centigrade	0	40	5
Environmental Humidity	H	%	0	90	4,6

PHYSICAL RATINGS:

Dimensions:	See “OUTLINE DRAWING of VT-68934,E”
Marking:	See “Marking Label of VT-68934,E”
Electrical Connectors:	See “Detail Drawing of Electrical Terminal”
Mounting Position:	Vertical, collector end up
Cooling:	Water Notes 3,4,5 and 7
Coolant Connector:	PT 1/2 (Rc 1/2) inch female
Weight:	Approx. 440 kg
Packing:	Standard commercial transport of TETD Note 9

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ELECTRICAL RATINGS:

Item	Condition	Symbol	Min.	Max.	Unit	Note(s)
Operating Voltage	Isol,main=40 Adc	Esol,main	---	160	Vdc	
	Isol,cc=30 Adc	Esol,cc	---	5	Vdc	
Field Polarity:	See “Detail Drawing of Electrical Terminal”					
Insulation Resistance			20	---	MΩ	8

ATTACHED ACCESORIES:

Parts Name	Dimensions	Quantity
Clamps	Per Outline Drawing	4pcs

QUALITY CONFORMANCE INSPECTION:

Test	Condition	Symbol	Min.	Max.	Unit	Note(s)
Dimensions	Per outline drawing					
Insulation Resistance	DC1500V for 30 seconds between solenoid terminal and magnet shell	No discharge				8
Hydrostatic Pressure	Pw=0.8 MPa (8 kgf/cm^2) water for 15 minutes	No visible leaks and no damage				
Drop of Coolant Pressure	Qw=10 L/min	ΔPw	---	0.3	MPa	
			(---	3.0	kgf/cm^2)	
Operating Voltage	Test Condition (1)	Esol,main	---	160	Vdc	
		Esol,cc	---	5	Vdc	

Test Condition (1) : Isol,main = 40 Adc
Isol,cc = 30 Adc
Qw = 10 L/min
Ta = room temperature
Te = 40 degrees centigrade

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WARRANTY:

1. TETD warrants the focusing magnet to be free of manufacturing defects which will impair their normal operation life during the warranty period, provided that the focusing magnet is used within the ratings and in accordance with instructions and specifications issued by TETD.

2. The warranty period extends for twelve (12) months from the date of departure at the factory. If the focusing magnet shall prove to be defective during the warranty period, TETD shall repair or replace the product with free of payment.

3. Notification of the claim shall be received by TETD within three (3) months after discovery of failure. If TETD requires return of the defective magnet, each return shall be made without delay, and in accordance with the instruction of TETD.

4. The warranty shall not apply to defects resulting from accidents, alterations, abuse or misuse, or improper installation.

Be sure to refer to “E3772A,A Operating Instructions”, before installing or operating the focusing magnet and the klystron tube. Interlocks and the necessary action speed are described in this specification or “E3772A,A Operating Instructions”.

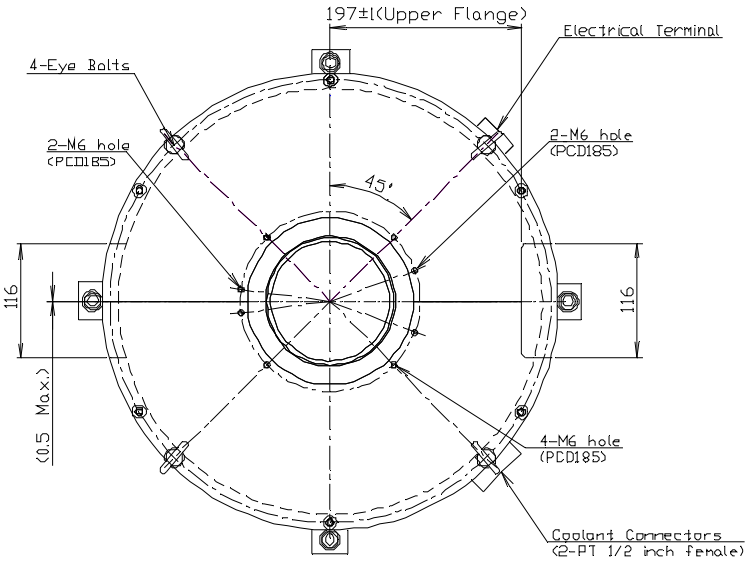
SHIPMENT CONTENTS

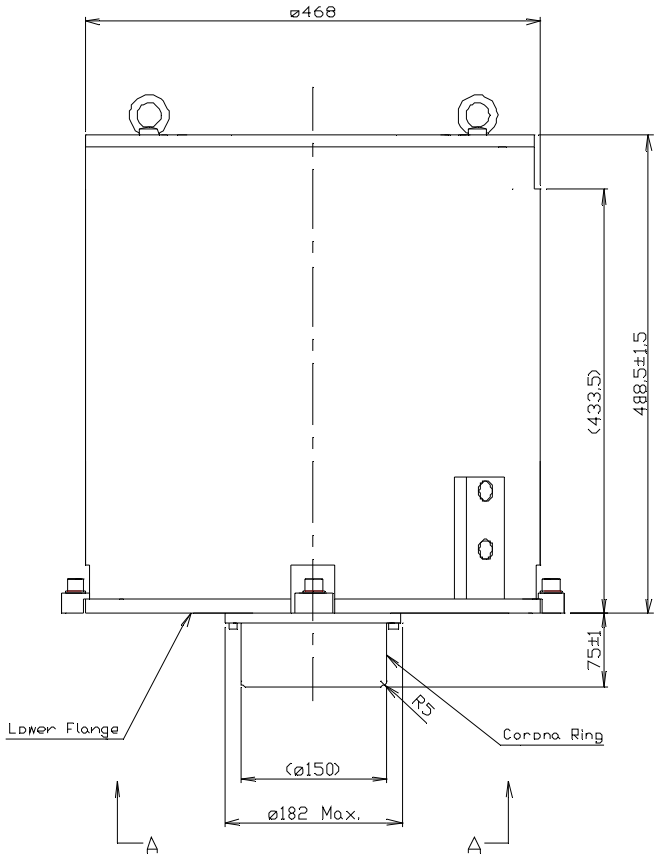
Each shipment contains the following, as a minimum:

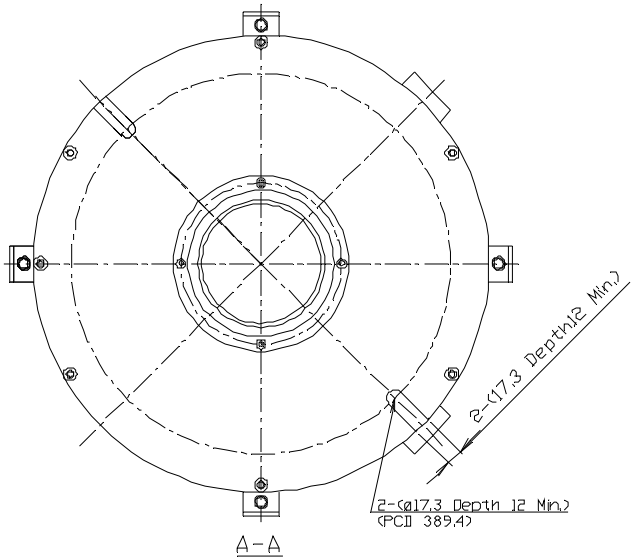
1. Focusing magnet ---------- One (1) unit
2. Submission documents
   Inspection Data Sheet ---------- Three (3) copies

OUTLINE DRAWING of VT-68934,E

Unit: mm







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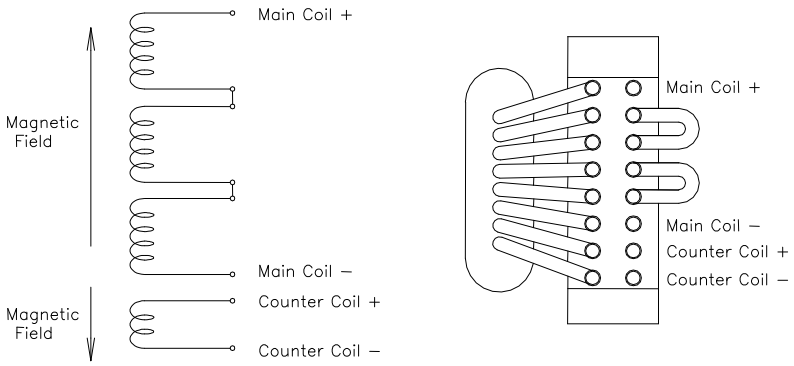
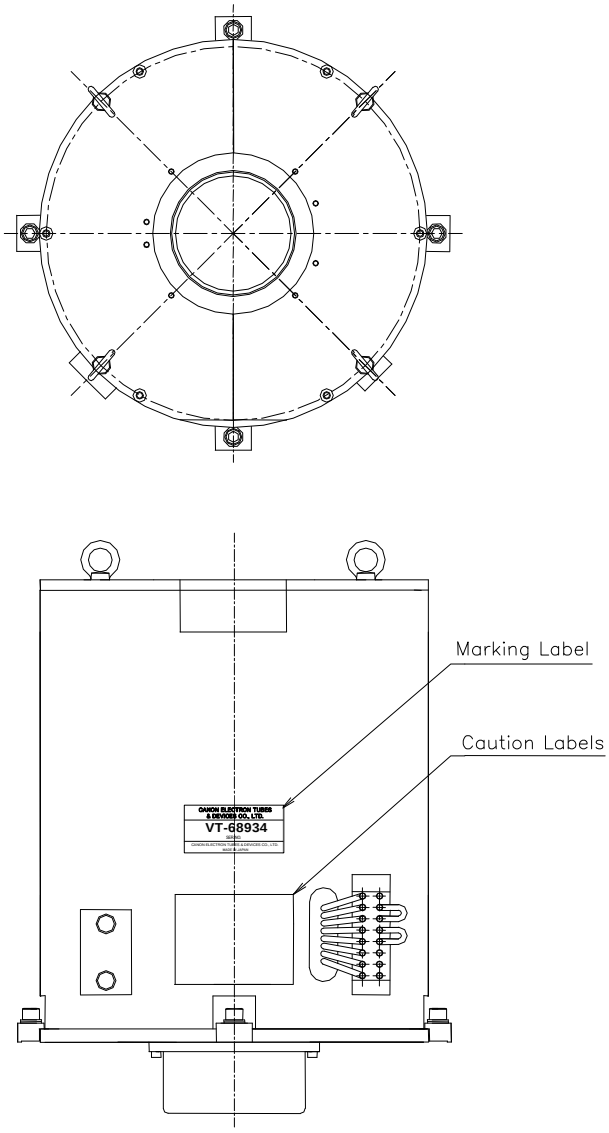
Detail Drawing of Electrical Terminal



Drawing of Label Indication



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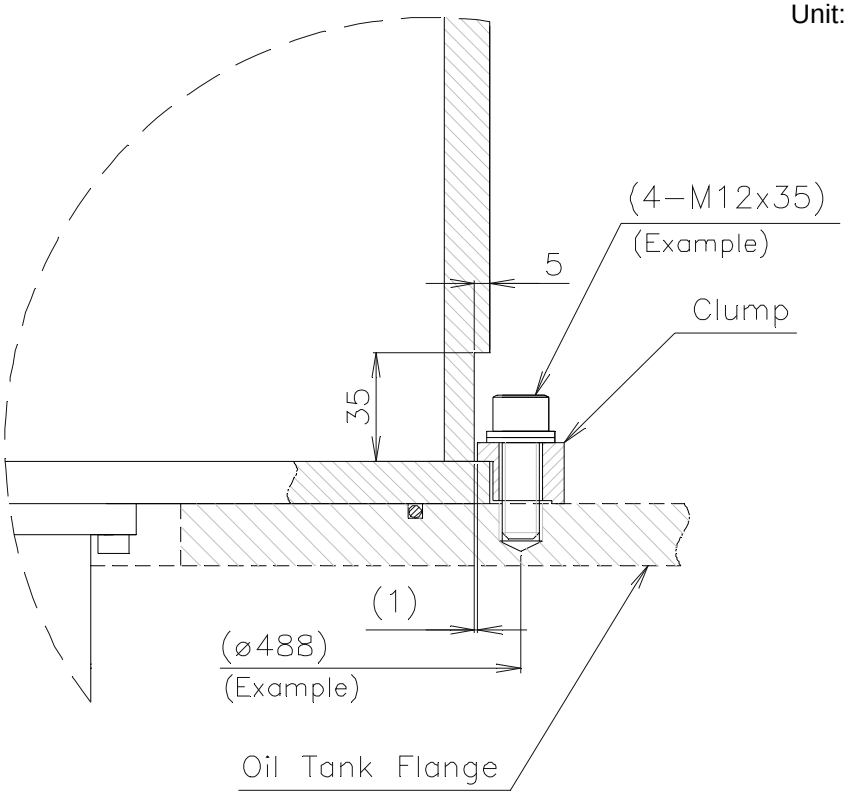
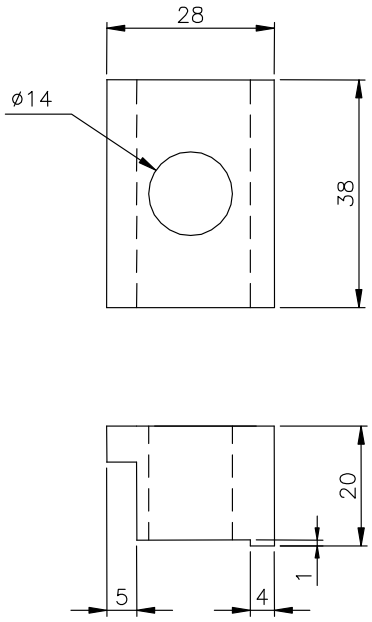
Detail Drawing of Cross Section around the Clamp

Unit: mm



Outline Drawing of the Clamp

Unit: mm



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CANON ELECTRON TUBES
& DEVICES CO., LTD.

VT-68934

SER. NO.

CANON ELECTRON TUBES & DEVICES CO., LTD.

MADE IN JAPAN

Marking Label of VT-68934,E

Caution Label

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NOTES:

Note 1: Referring to paragraph 6.5 of MIL-E-1G, those values are based on the "absolute system" and should not be exceeded under continuous or transient conditions. A single rating may be the limitation and simultaneous operation at another rating may not be possible. Design values for systems should include a safety factor to maintain operation within ratings under voltage and environmental variation.

Note 2: The unit is capable of operating continuously at 42Adc in main coil and 32Adc in auxiliary coil under the minimum coolant flow and maximum temperature of inlet coolant without damage.
Be sure that an auxiliary coil for electron gun region is immersed in oil over the proper oil level and coolant flow is above the minimum flow rate, when energize the focusing magnet VT-68934,E.

Note 3: Coolant shall be LCW (Low Conductivity Water).
LCW (Low Conductivity Water) quality requirements:

pH factor	7 - 8
Dissolved oxygen	1 - 6 ppm
Resistivity	min. 10 kΩ-cm
Particle-matter size	max. 50 μm (325 mesh)

The maximum temperature of input coolant must not exceed 40 degree Centigrade. Interlocks in the liquid coolant system should prevent the application of power supplies unless the coolant flow is at, or above the specified minimum flow rate. It is recommended that the maximum coolant flow rate is limited to less than 20 L/min to prevent cavitation and resultant acceleration of corrosion due to high velocity.

Note 4: Temperature of inlet coolant has to be maintained above dew point temperature at the local ambient.

Note 5: Do not freeze the coolant in the magnet. Remove all coolant before shipping or storage and when coolant freezing is anticipated. The unit should be completely drained and dried under the freezing temperature.

Note 6: Non-condensing

Note 7 Small traces of high purity water left in the coolant pipe will cause accelerated corrosion in copper. Dry the coolant pipe thoroughly before storage, especially if high purity water is used in test or operation.

Note 8: The measurement of the insulation resistance shall be conducted after the hydrostatic pressure test. The magnet shell and cooling system constitute a ground for the measurement of the insulation resistance.

Note 9: The packed tube shall not be damaged by a shock of 6 G maximum.

Notes of System Structure

For a system to operate a klystron, please pay attention to the following points.

(1) Fitting

Coolant connector ---------- PT 1/2 (Rc 1/2) inch female
Electrical connector -------- Terminal base

(2) Interlocks

In case the abnormal condition occurs, protection interlocks are required for high voltage power supply to protect the klystron tube and focusing magnet. A table below shows protection setting value, action speed, and shield mode. However, these values are variable by type of the high voltage power supply, so please contact us for the further details, as well as voltage application in normal condition and shield sequence.

Item	Protection action value	Point of action	Action Speed
Solenoid coil current	Out of the specified rating +/-5% for each klystron	Application of beam high voltage to tube paused	High
Solenoid coil voltage	Out of the normal rating of +/-10%	Application of beam high voltage to tube paused	High
Water-coolant Flow for magnet	Less than the specified rating	Power supply for magnet paused Application of beam high voltage to tube paused	Medium
Inlet coolant Temperature for magnet	Less than the specified rating	Power supply for magnet paused Application of beam high voltage to tube paused	Medium

(Attention) The definition of action speed indicated in the table is as following.

Medium Speed - Have a high velocity with about 100ms
High Speed - Activate as fast within 30ms (possibly next pulse will not be applied)

SAFETY PRECAUTIONS AND WARNINGS

This specification describes important information for preventing injury to users, personnel at manufactures employing this focusing magnet, and other personnel, as well as for preventing property loss and ensuring safe operation. Fully understand the meanings of the following indications and symbols before reading this manual and observe all precautions to ensure safe operation.

[Description of indications]

Indication	Meaning
 **DANGER:**	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 **WARNING:**	Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
 **CAUTION:**	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury or extensive property damage (e.g. damage to machinery, units, and accessories or occurrence of a fire).

This focusing magnet is intended and designed for use in combination with a klystron amplifier for industrial devices and scientific equipment.

If this focusing magnet is to be used with equipment other than the above, contact TETD in advance. TETD will not be held responsible for malfunction or damage caused by the use of this focusing magnet in applications other than those specified without prior approval.

When designing or operating equipment employing the focusing magnet, do not attempt to modify the focusing magnet and do not allow the focusing magnet to be operated beyond its ratings. TETD will not be held liable if these precautions are not observed.

［**Warning Labels**］

1. Warning labels as described in the operation manual are attached to this focusing magnet. Confirm that they are attached correctly before operating the focusing magnet. If incorrectly attached or missing labels are found, Contact TETD.
2. Read all the labels and fully understand their meanings to ensure safe operation of the focusing magnet.
3. Maintain the labels so that they can be seen easily. Do not remove any labels or allow them to become dirty, covered, or otherwise obscured.

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[Manufacturing equipment, warning indications for equipment, use of the focusing magnet]

(1) All equipment incorporating this focusing magnet must be equipped with safety mechanisms as described below. (2) All equipment incorporating this focusing magnet and their operations manual must include the warning indications described below to ensure safe operation of the focusing magnet. (3) To ensure safe operation of this focusing magnet, observe the precautions described below. (4) For any questionable points, consult with TETD before operating this focusing magnet.

Danger	
 (High Voltage)	High voltage is supplied to the electrical connector of this focusing magnet. (1) The main body shell of this focusing magnet is used as the return circuit (ground). (2) Place a cover or cage around the high-voltage section to prevent it from being touched. (3) Before replacing or performing maintenance work on the focusing magnet, be sure to turn OFF the power switch and discharge all residual charge by touching each electrode of the focusing magnet with a ground rod. At least two workers are required for replacement or maintenance work to ensure safety. (A person who has received training in cardiopulmonary resuscitation is desirable.)

Warning	
 (X-ray Radiation)	The Focusing magnet does not generate X-ray. An electron tube which is used with the focusing magnet generates X-rays at tube voltage of more than 10 kV. X-ray generation increases as the voltage and current are increased. (1) Perform thorough evaluation for X-ray leakage for the equipment used in combination with this focusing magnet. Add shielding appropriate for the installation and operating conditions as required. Checks for X-ray generation must be performed both when microwave is outputted and when it is not outputted. (2) If an X-ray shield has already mounted, do not remove or modify it. Since the amount of X-ray generation may change over time, perform X-ray checks periodically.
 (Magnetic Field)	About 0.30-tesla intense magnetic field is used for this focusing magnet. (1) Persons with cardiac pacemakers must not engage in the handling, operation, or maintenance of this focusing magnet. (2) The magnetic field of the electromagnet has been precisely adjusted. Do not allow any permanent magnets or magnetic objects to come near the focusing magnet. They will be attracted by the magnetic field, possibly resulting in personal injury or damage to the focusing magnet. (3) Do not place magnetic cards, floppy disks, etc. near the focusing magnet.

CAUTION	
(Handling)	Only qualified engineers or persons who have received the specialized training listed below are permitted to handle this focusing magnet. The types of specialized training required are as follows: (1) Slinging work (2) Crane operation (3) Electrical device work Read the Operating Instructions carefully and fully understand the contents before handling the focusing magnet.
(Weight)	Be careful when handling this focusing magnet because it is very heavy (Approx. 450kg). (1) Be extremely careful to ensure safety when lifting, moving, or installing this focusing magnet. (2) Be careful not to subject this focusing magnet to excessive vibration or shock because it is a precision device. (3) Use the standard packing box of TETD to carry or store the focusing magnet.
(Temperature)	The body shell of this focusing magnet becomes high temperature. Surface temperature of body shell: Approx. 60 degrees centigrade (room temperature of 20 degrees centigrade) (1) Do not touch the focusing magnet while it is operated and before it is cooled down sufficiently when it is shut down. High temperature may possibly cause a burn. (2) When disconnect the coolant connectors, make sure that temperature of the coolant water is cooled down sufficiently.
(Caution)	Note the following when handling damaged or used focusing magnets: (1) When handling a focusing magnet that has fractured, wear protective gloves, protective glasses, etc. because the ceramic or metal fragments are sharp and very dangerous. (2) Dispose the scrapped products according to the requirement of local regulation. If you have any questions, please contact to our local sales representatives for further information. (3) The main materials used in this focusing magnet are as follows: Copper, stainless steel, iron, lead. Note that no radioisotopes or beryllia porcelain are used. (4) Lead is used for the X-ray shield of this focusing magnet. Do not abrade or melt the lead because lead powder or vapor is harmful if it comes into contact with the skin or is ingested. For lead disposal, consult with a specialized disposal personnel.
(Caution)	Before operating this focusing magnet, confirm that the cooling unit operates properly. (1) Excessive temperatures due to interruption of cooling air or water may result in damage to the magnet, smoking, or a fire. (2) It is recommended that various sensors such as an airflow sensor, a water flow sensor, a pressure sensor, a thermometer, and/or a smoke sensor be provided to protect the magnet.

 (Caution)	Perform periodic inspection. (1) When the focusing magnet is not used during a long period, remove the coolant water by using high-pressured air and dry the coolant system thoroughly to prevent the freezing of the coolant water. A little coolant remaining in the cooling pipe causes corrosion of the cupper. Before storage of the focusing magnet, remove the coolant and dry the coolant pipe completely. (2) During storage of the focusing magnet, cover the upper and lower flanges to prevent the inside of focusing magnet from pollution by dust or humidity.

OPERATING HAZARDS

Read the following instruction and take necessary precautions to prevent personnel from hazards. Safe operating conditions are the responsibility of the equipment designers and the users of such tubes.

(1) High voltage

This focusing magnet operates with high voltage. So that, power supplies for the solenoid coils must be shut down when it is necessary to touch the electrical connectors for the focusing magnet and power supplies.

(2) Maintenance and Storage

Maintenance

In case of shutting down operation of the focusing magnet during a comparably long period, prevent the coolant water from freezing. When coolant freezing is anticipated, remove the coolant from the focusing magnet and dry the coolant pipe thoroughly.

Storage

For storage of the focusing magnet, store the product in the formal packing case or put it in a stand for storage. Remove the coolant in the focusing magnet and dry the coolant pipe completely before storage. A little coolant remaining in the cooling pipe causes corrosion of the cupper.

Transportation

Use the formal package and cushion for transportation of the focusing magnet.

History of Revision

Date	Page	Revised Contents	Revised Reason

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