

Technical Publications
Rev 9

RADPLUS 2100 X-Ray tube unit

Model number **2185226**

Model description **MX75TH.11**

Consisting of :

X-Ray tube

Model number **2208208**

Model description **MX75T.1**

&

X-Ray tube housing

Model number **2222709**

Model description **MX75H.1**



GE Medical Systems



X-Ray equipment is dangerous to both patient and operator unless measures of protection are strictly observed

Though this equipment is built to the highest standards of electrical and mechanical safety, the useful X-Ray beam becomes a source of danger in the hands of the unauthorized or unqualified operator. Excessive exposure to X-Ray Radiation causes damage to human tissue.

Therefore, adequate precautions must be taken to prevent unauthorized or unqualified persons from operating the equipment or exposing themselves or others to its radiation. Do not operate the tube excepted in accordance with Information included in present technical documentation.

Before operation, person qualified and authorized to operate this equipment should be familiar with the Recommendations of the International Commission on Radiological Protection, contained in Annals Number 26 of the ICRP, and with applicable national standards.

CHAPTER 0 - REGULATORY REQUIREMENTS

This equipment generates, uses, and can radiate radio frequency energy,. The equipment may cause radio frequency interference to other medical or non medical devices and radio communications. To provide reasonable protection against such interference, this product complies with emission limits for group 1 Class B Medical Devices as stated in EN 60601-1-2

However there is no guarantee that interference will not occur in a particular installation. If this equipment is found to cause interference (which may be determined by switching the equipment on and off), the user (or qualified service personnel) should attempt to correct the problem using on or more of the following measures :

- Reorientate or relocate the affected device(s)
- Increase the separating space between the equipment and the affected device
- Power the equipment from a source different from that of the affected device

Consult the point of purchase or the service representative for further suggestions.

The manufacturer is not responsible for any interference caused either by the use of the interconnect cables other than those recommended or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the users' authority to operate the equipment.

To comply with the regulations applicable to an electromagnetic interface for a Group 1 class A Medical device, all interconnect cables to peripheral devices must be shielded and properly grounded . Among other, to achieve correct electromagnetic compatibility, the braid of the stator power cable must be connected to the ground of the tube housing. Use of cables not properly shielded or grounded may result in the equipment causing radio frequency interference in violation of the European Union Medical Device directive and FCC regulations

This product complies with the regulatory requirements of the following :

- Council Directive 93/42/EEC concerning medical devices when it bears the following CE marking of conformity :

CE 0459

European registered place of business
GE Medical System Europe
Quality Assurance Manager
BP 34
F 78533 BUC CEDEX
France
Tel : + 33 1 30 70 40 40

- Green QSD Standard issued by MDA (Medical Device Agency, Department of Health, UK)
- Medical Device Good Manufacturing Practice Manual issued by FDA (Food and Drug Administration, Department of Health USA)
- International Electrotechnical Commission (IEC), Canadian Standards Association (CSA), and Underwriters Laboratories, Inc. (UL) Safety standards, when applicable.
- Japan standard MHW



CE marking on X-Ray tube assembly concerns only the X-ray tube assembly alone

This X-Ray tube assembly is intended to be used in a medical system which can be CE marked system or a non CE marked system.

Refer to accompanying document of the system for compatibility of the X-Ray tube assembly and for information concerning CE marking of the system.

To sum up, installing a CE marked X-Ray tube assembly in a non CE marked system does not make the whole system CE marked

Accompanying document of this product according to IEC 601-2-28/1993

*This document must be transmitted to the user and assembler of the X-Ray assembly.
Original languages of editing : English.*

Specifications to change without notices.

General Electric Medical Systems is ISO 9001 certified company

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REVISION HISTORY

REV	DATE	TYPE OF MODIFICATION
0	28 - Dec - 98	Initial release.
1	20 - Jan - 99	Update.
2	15 - Feb - 99	Update.
3	01 - Avr - 99	Update (LCIE remarks).
4	24-Jan-00	Updated (DDM 20025)
5	06 –Juil - 00	Updated (SPR BUCge54860)
6	21-Nov-00	Updated (SPRBUCge58551)
7	23-Avril-01	Updated (SPRBUCge63387)
8	19-Juillet-01	Updated (SPRBUCge99147)
9	10-October-01	Updated (SPRBUCge67548)

CHAPTER 1 - GENERAL

RADPLUS 2100 X-Ray TUBE ASSEMBLY

Model description MX 75 TH.11

18 kW (0,1 s) at 3400 RPM - 140 kJoules anode

Main features are :

- Large available anode input power on 0.8 mm IEC focus
- 140 kJ Rhenium Tungsten Molybdenum target achieving 600 W peak dissipation.
- one safety device : temperature switch (50°C).

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CHAPTER 2 - XRAY TUBE MX75T.1

Section 1 - X-Ray Tube MX75T.1 specifications



MX75T.1

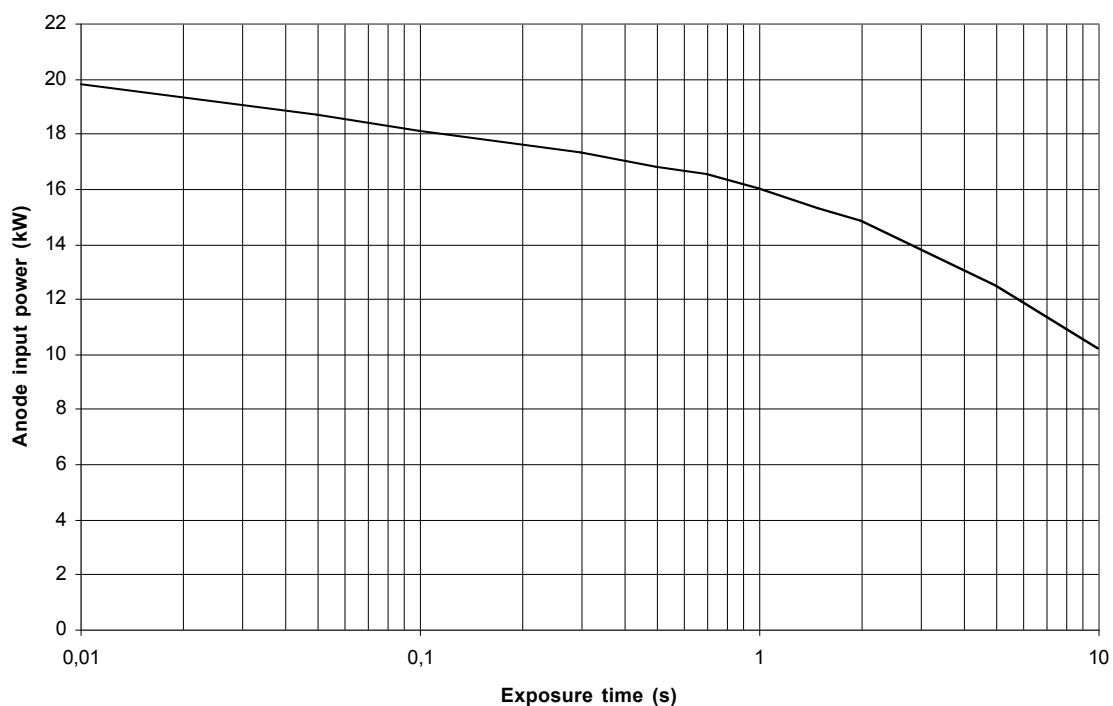
SUBJECT	Specifications	Reference standards (1)
Nominal focal spot values	0.8* mm	*IEC 336/1993
Nominal anode input power anode AT 20W steady state, 60 Hz, 3 phases 50 Hz, 3 phases	18.0 kW 16.4 kW	IEC 613/1989
Maximum anode heat content	140 000 Joules	IEC 613/1989
Anode heating and cooling curve	Chap.2, Sec.2, §2-4	IEC 613/1989
Target material	Tungsten/Molybdenum/ Rhenium	IEC 601-2-28/1993
Single load ratings	Chap.2, Sec.2, §2-1	IEC 613/1989
Target angle / reference axis	14°	IEC 601-2-28/1993
Nominal high voltage	125 kV	IEC 613/1989
Maximum anode rotation	3600 rpm	IEC 601-2-28/1993
Electron Emission curves	Chap.2, Sec.2, §2-3	IEC 613/1989
Disc diameter	73 mm	
Maximum current filament	5.3 Amps	IEC 613/1989

(1)Reference standard means that compliance with this standard is stated

Section 2 - Ratings/Charts

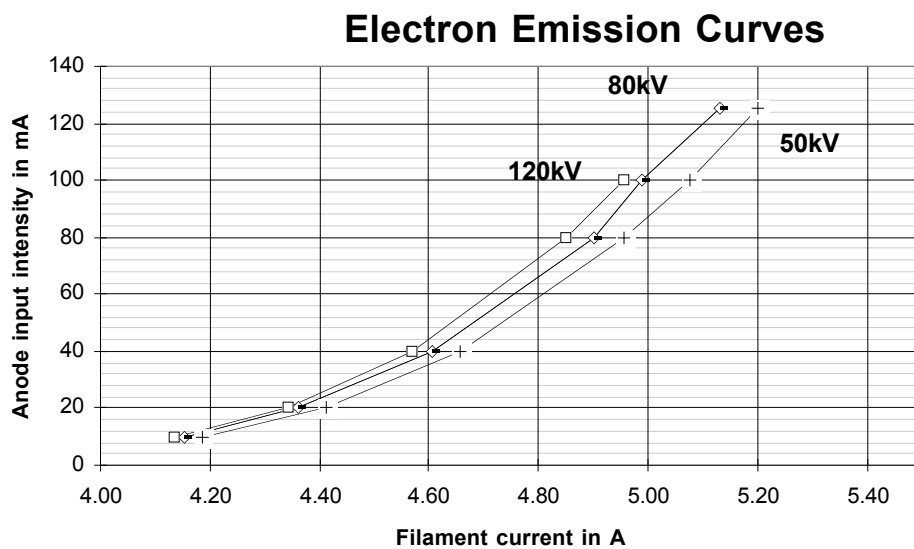
2-1 Single load ratings

Rating chart - Three phase
3400rpm/60 Hz (Anode at 20 W steady state)



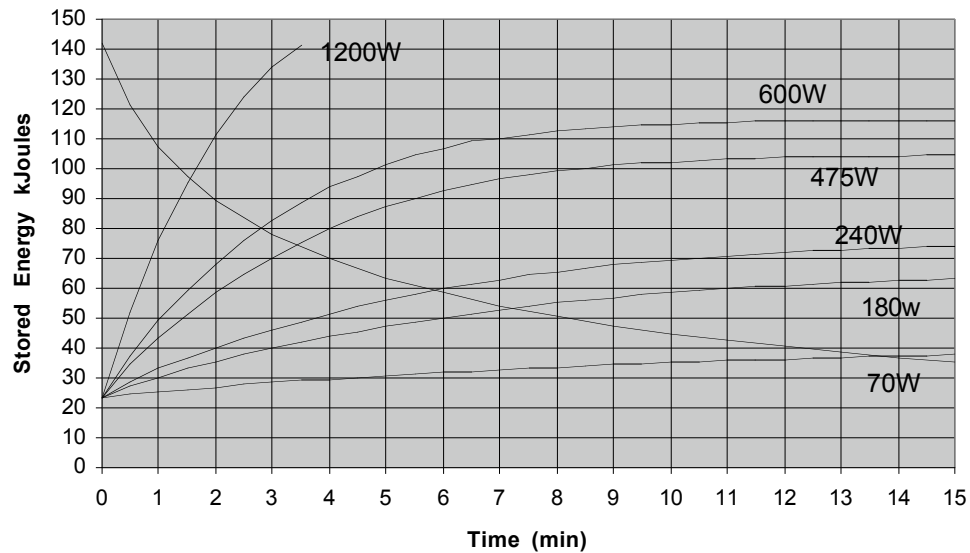
To accommodate power supply fluctuation and kV /mA accuracy use the tube at 90% or lower of the maximum permissible power.

2-2 Electron emission curves



Filament heating curve :

I (A)	V
2.00	0.33
2.30	0.69
2.60	0.95
2.90	1.22
3.20	1.50
3.50	1.80
3.80	2.13
4.10	2.47
4.40	2.84
4.70	3.23
5.00	3.64
5.31	4.09

2-3 Anode cooling and heating curves.**Anode heating and cooling curves**

- 1 - 100 % anode remaining capacity = single load exposure on cold anode
- 2 - 75 % anode remaining capacity = 60 W equivalent anode input power
- 3 - 55% anode remaining capacity = 180 W equivalent anode input power
- 4 - 30% anode remaining capacity = 475 W equivalent anode input power

CHAPTER 3 - X-RAY TUBE ASSEMBLY MX 75 TH11 SPECIFICATIONS

RADPLUS 2100 X-Ray tube assembly MX 75 TH.11



Section 1 - Description

1-1 Tube housing / Tube configuration

RADPLUS 2100 tube unit is MX75 TH11 tube unit assembly made of :
MX75 T.1 Rotating X-Ray tube and
MX75 H.1 X-Ray tube housing

1-2 Construction

The shock resistant housing is made of constructed aluminum lined with lead to minimize leakage radiation.

It is filled under vacuum with specially processed insulating oil.

Internal expansion chamber compensates for oil expansion at permissible temperature.

Port window is equipped with a lead precollimator.

Section 2 - XRay Tube Assembly MX75TH.11 specifications

2-1 MX75TH.11 Characteristics

SUBJECT	Specifications	Reference standards (1)
Maximum X-Ray tube assembly heat content	625 000 Joules	IEC 613/1989
XRTA heating and cooling curves		IEC 613/1989
Maximum continuous dissipation of XRTA	95 W at 25°C (ambient temperature)	IEC 613/1989
Maximum symetrical radiation field	43 * 43 cm at 1 m 17 *17 inch at 40 inches	IEC 806/1984
Target angle to specified reference axis	14°	IEC 601-2-28/1993
Nominal Focal spot value / reference axis	0.8	IEC 613
Nominal high voltage	125 kV	IEC 613/1989
High Voltage connection	Receptacle socket 3 connectors	IEC 526/1978
Loading factor for leakage radiation	125 kV - 0.76 mA	IEC 601-1-3/1994 IEC 601-2-28/1993
Classification	Class 1, type B(3)	IEC 601-1/1988
Temperature range for transportation and storage	- 9° +70°C 95 % non condensing humidity	IEC 601-1/1988
Quality Equivalent Filtration (2)	1.14 mm minimum of Al Equivalent at 70 kV	IEC 522/1999
Weight of XRTA, without cables	18.4 kg	
Tube mounting	End attachment on end-covers	

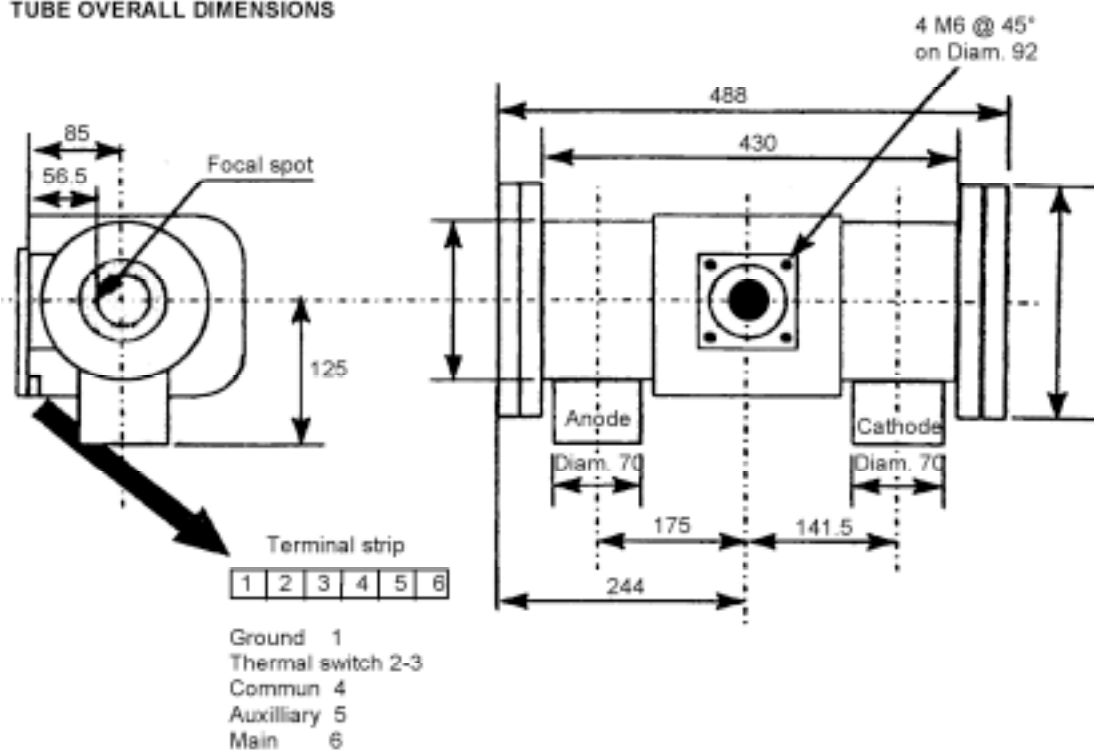
(1) Reference standard means that compliance with this standard is stated

(2) Determined according theoretical method of calculating from Birch and Marshall

(3) Equipement providing a particular degree of protection against electric shock, particularly regarding :
 - Allowable leakage current
 - Reliability of the protective earth connection (if present)

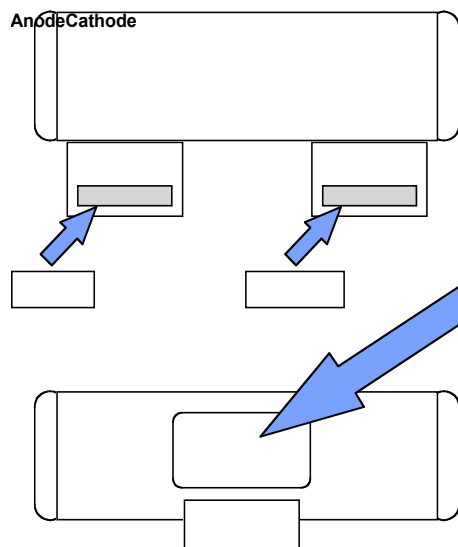
2-2 Housing outline drawing

TUBE OVERALL DIMENSIONS



2-3 Marking

The X-ray tube assembly carries marking required by IEC 601-2-28 in the form shown here below.



 APPAREIL DE TYPE B TYPE B EQUIPMENT		
GE Medical Systems 283 RUE DE LA MINIERE BP 34 78533 BUC CEDEX-FRANCE		MODEL NUMBER 2185226
COMPLIES WITH DHS RADIATION PERFORMANCE STANDARDS 21 CFR SUBCHAPTER J  0450  LR 80463 C		TYPE 02851P
MANUFACTURED LOCATION HOUSING S.N. NOM. VOLTAGE INSERT S.N. NOM. VOLTAGE HOUSING ASSY NOM. VOLTAGE MIN. FILTRATION FOCAL SPOTS		H 2222709 125kV 2208208 125 kV 2185226 125kV 1,14 mm A1 0,8 mm

2-4 Electrical characteristics

2-4-1 General

MX75H.1 is a bipolar tube housing.

Maximum tube voltage, between pole is 125 kV peak value, on rectified or constant voltage generator balanced relative to ground

2-4-2 Electrical connection

High Voltage connection

The high voltage connects to two identical American (U.S. Federal) Standard type receptacles on the housing. Installing or removing the high voltage cables requires a special wrench.

The accessible parts of the X-Ray tube assembly body and flexible conductive housing of high voltage cables shall be connected to the conductive enclosure or the high voltage generator.

The HV receptacles are designed to operate with isolation grease before the male connector is plugged in.

Low voltage connections

Stator supply.

Stator winding nominal values :

Main winding resistance	:	20 ohms
Auxiliary winding resistance	:	50 ohms
Main winding inductance	:	60 mH
Auxiliary winding inductance	:	90mH

Recommended phase capacitors on auxiliary winding :

50/60 Hz operation : 30 to 40 μ F

60 Hz stator supply :

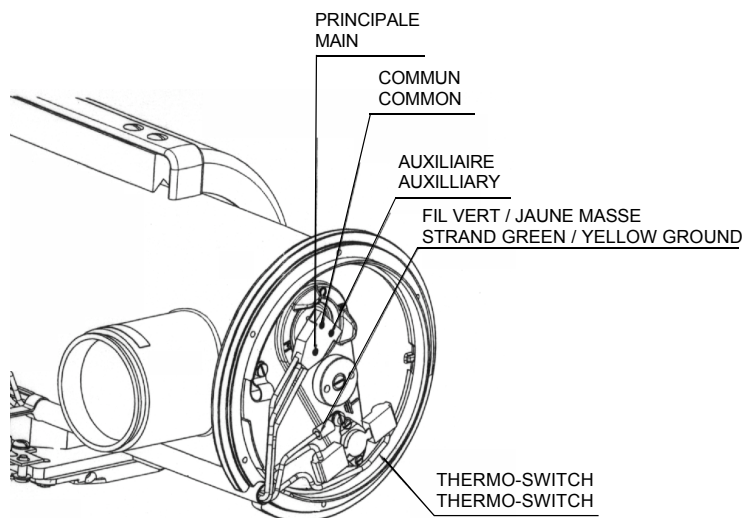
Voltage (V rms)			Current (A)			Stator power (W)	Acceleration time (s)
M - C	A - C	M - A	M	A	C		
47	50.9	64.7	1.2	0.5	1.3	59	Run
107.3	116.2	150.8	3	1.3	3.3	314	1.5

Stator diagram



Thermoswitch supply

Thermoswitch can be used at a 250 V max. voltage



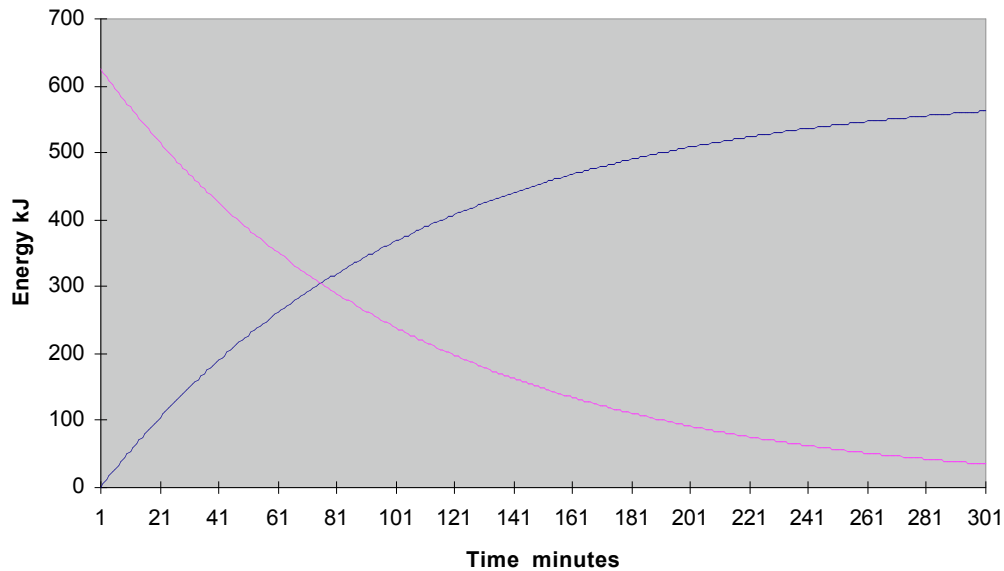
Main winding	:	black
Auxilliary winding	:	green
Common winding	:	white
Thermoswitch	:	red
Thermoswitch	:	blue
Ground	:	green/yellow

2-5 Thermal characteristics and temperature safety devices

Thermal safety :

Whatever the tube position is, the tube skin temperature will not exceed 60°C
A thermoswitch opens the power circuit when its temperature reaches 50°C.

2-6 Casing cooling and heating curves.



Heating and cooling curves are for horizontal mounting of tube assembly in 25°C ambient temperature. the heating curves take into account all power dissipated in the tube housing : anode, stator (run is : 60W), and filament heating (20W).

Section 3 - Patient, user, assembler and installer safety



Never disconnect the thermal switch !

Always operate the tube with the safety device connected !

3-1 Radiation protection

X-Ray radiation leakage

MX75TH.11 X-Ray tube complies with IEC 601-1-3/1994 EC 601-2-28/1993 specified radiation leakage factors : 125 kV - 0.76 mA.

Beam limiting device :

The MX75TH.11 X-ray tube assembly must not be used as an X-ray source assembly. It will be equipped with the beam limiting device reference 46-270615P2 that satisfies the conformity of the prescriptions of CEI 601.1.3.

The Quality equivalent filtration of the XRay Tube assembly is not less than 1.14 mm Al.

The Quality equivalent filtration of the beam limiting device is not less than 2.0 mm Al

So the Quality equivalent filtration of XRay equipment is not less than 3.14 mm Al and complies to the chap.29.201.5 (IEC 601-1-3).

3-2 Electrical protection :



The accessible parts of the X-Ray tube assembly body and flexible conductive housing of high voltage cables shall be connected to the conductive enclosure of the high voltage generator.

Section 4 - Installation and maintenance instructions :

4-1 Installation instructions :

Do not operate the tube except in accordance with Information included in present technical documentation, especially « Patient, user, assembler and installer safety » Chap.2, Sec.3.

When installing the tube on the system or during a preventive maintenance call, check that exposure is disabled when the safety thermal switch is disconnected.

Before applying the first charge, refer to the documentation and to the tube rating charts .

Take into account following into account in determining operating factors

- Electrical characteristics
 - High voltage rating and wave form
 - High voltage exposure time
 - Filament heating current rating
 - Anode rotation speed
 - Stator voltage supply
- Thermal characteristics
 - Heat storage capacity
 - Anode heating and cooling curves
 - Cooling and heating curves for tube housing, also taking
 - into account auxiliary power (stator, filament)
 - Tube rating charts

The over voltage value which may be produced by the HV generator should not exceed the maximum acceptable voltage for tube and housing.

For longer life of the rotating anode tube and satisfactory results it is essential that calibration or re-calibration of the HV generator be correct. If not, make a new calibration. Any way, To accommodate power supply fluctuation and kV/mA accuracy use the tube at 90% or lower of the maximum permissible power.

Warm up

The first exposure of the day, or following two or more hours shutdown, must be made at a MEDIUM power level rather than voltages or current near maximum ratings. A medium exposure will test the system for normal function with a minimum risk of damaging the tube or transformer in the event of a component failure. The following technique may be used due regard to radiation protection of all personnel

4 exposures, 30 s apart
Large focal spot
80 kV Peak - 100 mA - 1 second

4-2 Preventive maintenance instructions:

Check the following during a preventive maintenance call :

- No oil leak
- Correct operation of rotation
- Correct grounding connection
- Good condition of HV receptacles - Change grease if required
- Clean external parts only with clean dry clothes

These operations should be done by a qualified operator only

Section 5 - Environmental health & safety (EHS) information

The MX75TH.11 X-ray tube assembly contains potentially dangerous materials but does not present any danger as long as it is neither opened nor disassembled.



DO NOT DISCARD THE X-RAY TUBE ASSEMBLY AMONG INDUSTRIAL WASTE OR DOMESTIC GARBAGE.



A DAMAGED X-RAY TUBE ASSEMBLY SHOULD NOT BE DISPATCHED THROUGH THE NATIONAL POSTAL SERVICE.

Your local GEMS field service will advise you on the suitable means of disposal.

The tube assembly to be discarded should be forwarded to the GEMS Service network, and it will be disposed off in a GEMS recycling center.

Dangerous materials

The X-ray tube assembly contains the following potentially dangerous materials :

Lead : Lead salts are toxic and their ingestion may cause serious problems. The working of lead is subject to regulations.

Oil : Univolt 54 mineral oil is not toxic, but the prevailing environmental regulations should be observed for its disposal or recuperation. For example, it is forbidden to dispose of this oil in the waste water or sewage system or in the natural environment.

Precautions

Take all the necessary precautions for the personnel handling the recovery or destruction of X-ray tube assemblies, and in particular against the risks due to lead, or vacuum tube implosion.

These personnel must be informed of the danger involved and of the necessity to observe the safety procedures.

Section 6 - Tube unit catalog number :

New tube	: D2651 P
Replacement tube	: D2652 P

Section 7 - Warranty :

The published Company warranty in effect on date of shipment shall apply. Right reserved to make changes.

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CHAPTER 4 - RENEWAL PARTS**ABBREVIATIONS**

ITEM NO.
-
- 6

Not illustrated.
item No. 6 not illustrated.

FRU
1
2
N

Field Replaceable Unit.
Critical.
Not critical.
Not available.

REP
Y

Repairable.

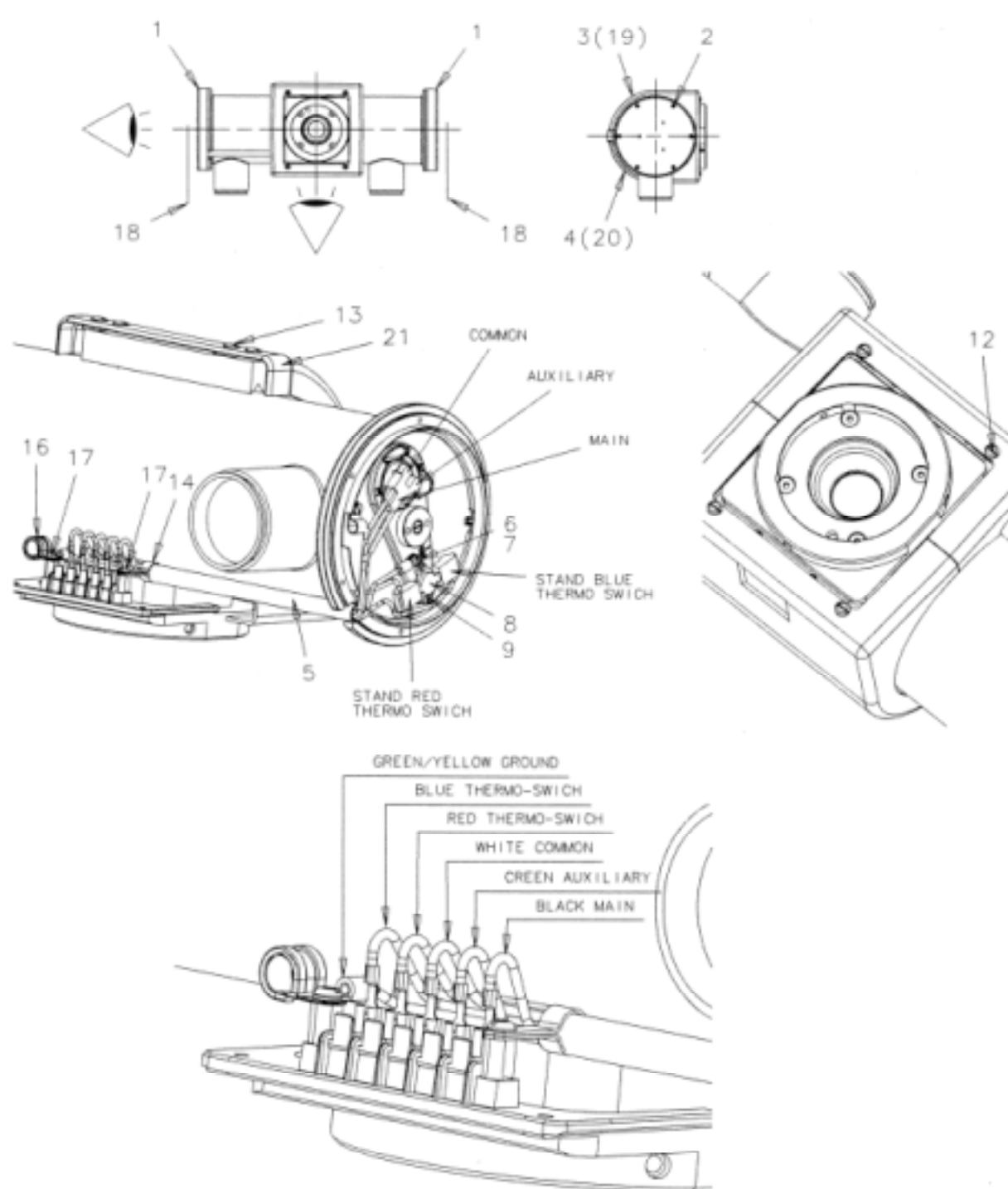
QTY

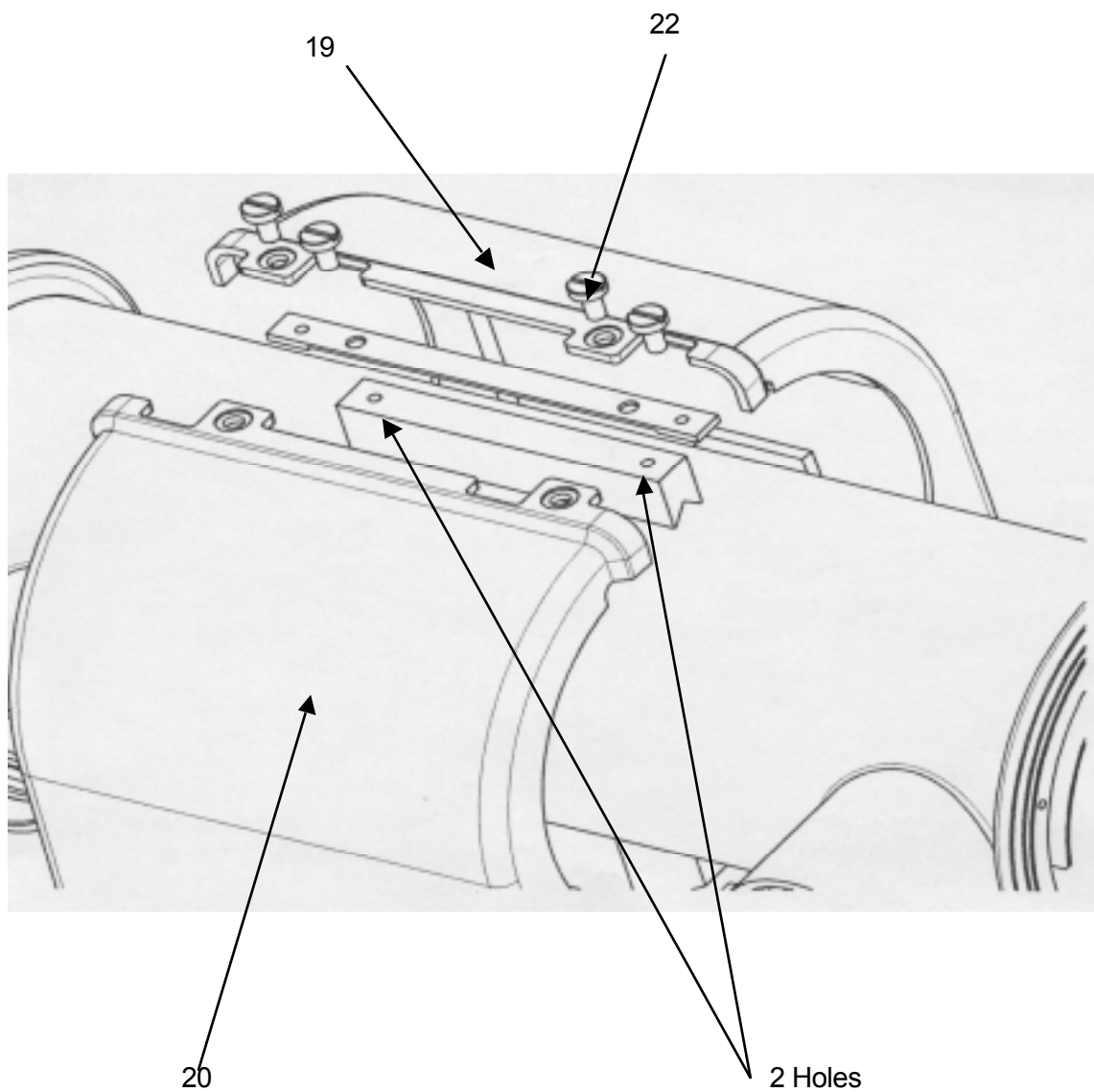
Previously listed for assembly.

APP

Applies to.
Viewing direction.

ITEM No	PART No	FRU	REP	DESCRIPTION	QTY
1	2220823	2		END COVER	1
2	99059812	N		SCREW M4X20/14	12
3	2238275	1		FRONT COVER (configuration 2)	1
4	2238276	1		BACK COVER (configuration 2)	1
5	2224340	N		CABLE MX75TH,11	1
6	99059598	N		SCREW M4X8 STAINLESS	1
7	99132746	N		WASHER M4 STAINLESS	1
8	2225869	1		THERMO-SWITCH	1
9	99051913	N		SCREW M3X5/5 STAINLESS	2
12	99131426	N		SCREW LARGE HEAD M5X12/12 STEEL	4
13	2247043	N		SCREW BULGE HEAD M6	4
14	2240275	N		CLAMP	1
16	46-208718P4	N		SUPPORT	1
17	46-170015P14	N		SCREW 8-32X3/8	2
18	2241328	2		LABEL END COVER	2
19	2237623	1		FRONT COVER (configuration1)	1
20	2237775	1		BACK COVER (configuration 1)	1
21	2238277	1		SEAM COVER (configuration2)	1
22	46-208560P30	N		SCREW BINGDING HEAD 10-32X1/2	8



RADPLUS 2100 X-Ray tube assembly MX75TH.11**Configuration 1 with front and back cover rework**

RADPLUS 2100 X-Ray tube assembly MX75TH.11**Configuration 2 with front and back cover**