

X-RAY TUBE ASSEMBLY

旋转阳极 X 射线管组件

RO 1750 ROT 360



TECHNICAL DATA

技术说明书

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本文档的英文版本为原始版本。

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ILLUSTRATIONS AND TECHNICAL DATA STATEMENT

All illustrations of the equipment in this Technical Data are examples only. Differences in detail can occur in your product because of the installed options, configurations and constant development progress of the product.

Reproduction of illustrations can cause loss of detail. Thus, illustrations in this Technical Data do not give an indication of the image quality.

All technical data are nominal or typical values unless specific tolerances are stated.

图表和技术说明书声明

本技术说明书中的所有设备图表仅为示例。

由于产品的安装选项、配置和持续的开发进展，您的产品可能会出现细节差异。

复制图表可能会导致细节丢失。因此，本技术说明书中的图表未给出图像质量的指示。

除非说明具体公差，否则技术说明书中的所有数据均为标称值或典型值。

Introduction/ 简介

The RO 1750 X-ray tube has an anode that turns during operation. The X-ray tube is assembled within the X-ray tube housing ROT 360. Both the X-ray tube and the X-ray tube housing are the X-ray tube assembly RO 1750 ROT 360.

The X-ray tube assembly was developed for applications in radiography.

The X-ray tube assembly is available only completely assembled. Only the manufacturer of the X-ray tube assembly is permitted to replace the X-ray tube!

RO 1750 X射线管具有在运行过程中旋转的阳极。该X射线管组件安装在X射线管外壳 ROT 360 中。X 射线管和 X 射线管外壳都是 X 射线管组件 RO 1750 ROT 360 的元件。

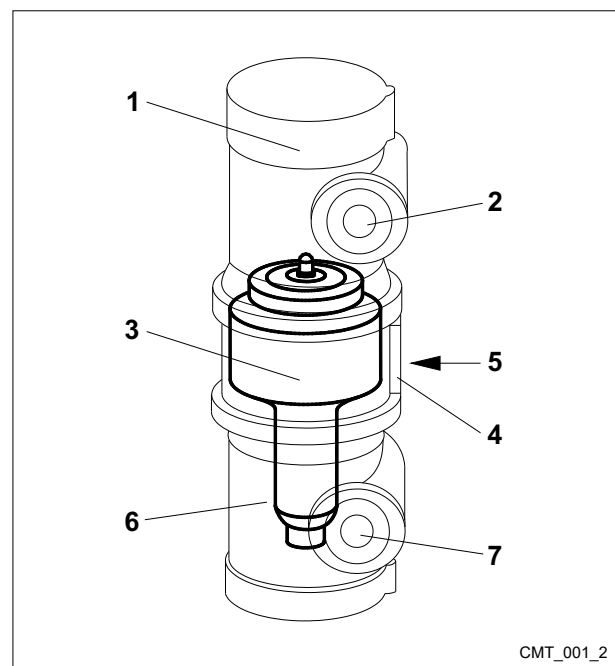
X 射线管组件经过严密开发，专门用于放射照相用途。

该 X 射线管组件仅提供组装完整的成品。仅允许 X 射线管组件的制造商更换 X 射线管！

Schematic overview of the X-ray tube assembly and the X-ray tube/ X 射线管组件和 X 射线管的概览图

X-ray tube assembly/ X 射线管组件

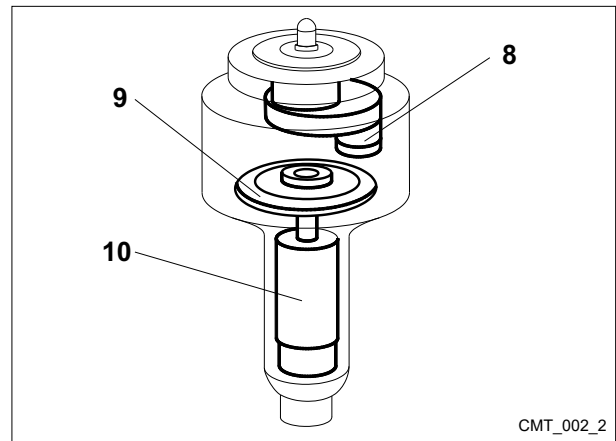
1. X-ray tube housing filled with insulation oil/ 装满绝缘油的 X 射线管外壳
2. High-voltage connection cathode side/ 高压接头，阴极侧
3. X-ray tube inclusive envelop/ X 射线管，包括包络
4. Connector plate for the collimator/ 准直器的连接器板
5. X-ray tube window with filter zone/ 带过滤区的 X 射线管窗口
6. Anode driving stator position
7. High-voltage connection anode side/ 高压接头，阳极侧



CMT_001
X-ray tube assembly/ X 射线管组件

X-ray tube/ X 射线管

- 8. Cathode/ 阴极
- 9. Anode disk/ 阳极盘
- 10. Rotor/ 转子



X-ray tube/ X 射线管

Identification numbers/ 识别号码Type numbers X-ray tube assembly/ X 射线管组件型号

RO 1750 ROT 360	9890 000 8611x
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Type numbers X-ray tube/ X 射线管型号

RO 1750	9890 000 8527x
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TECHNICAL DATA (ENGLISH)



Warning!

Safe operation of the X-ray tube assembly is only made sure when you use the X-ray tube assembly within the limits of its specification. This section "Technical Data" shows you the specification limits.

If you ignore the specification limits, there is the danger of coolant that flows out. The X-ray tube assembly becomes too hot. Component parts that are too hot can blow up as a result of an implosion or explosion.

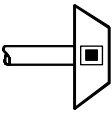
If you ignore the specification limits, the manufacturer of the X-ray tube assembly rejects the liability that refers to the use of the product.

The manufacturer rejects all guarantee claims!



**Read me,
understand me,
and obey me!**

Technical data

1	Anode material IEC 60601-2-28 Rhenium alloyed tungsten compound anode: RT / TZM	---		
2	Location of focal spots: Superimposed	---		
3	Nominal focal spot values width x length IEC 60336/2005 <i>For the determination of the nominal focal spot values special arrangements according to IEC 60336 may have been used.</i>	---	 0.6	 1.2
4	Filtration of X-ray tube IEC 60601-2-28:1993	0.62 mm Al/75 kV		
5	Nominal anode input power, based on 0.1 s IEC 60613 20 W equivalent anode input power 250 W equivalent anode input power	kW	 21 17	 60 50
6	Nominal radiographic anode input power IEC 60613	kW	 17	 50
7	Maximum anode heat content	kJ kHU	220 300	
8	Continuous anode input power IEC 60613/2010	W	63	
9	Maximum anode heat dissipation IEC 60613/1989 Not for continuous operation	W HU/min	1,300 105,300	
10	Anode angle IEC 60601-2-28	°	13	
11	Anode acceleration time <i>Depending on the rotor control unit.</i>	s	< 1.4	
12	Anode braking time <i>Depending on the rotor control unit.</i>	s	< 20.0	
13	Nominal anode rotational speed	RPM (Hz)	3,000 (50)	
14	Maximum filament current for exposure <i>Values are for adaptation. They depend on the generator control.</i>	A	 6.3	 6.75
15	Maximum filament voltage for exposure <i>Values are for adaptation. They depend on the generator control.</i>	V	 10.8	 14.4

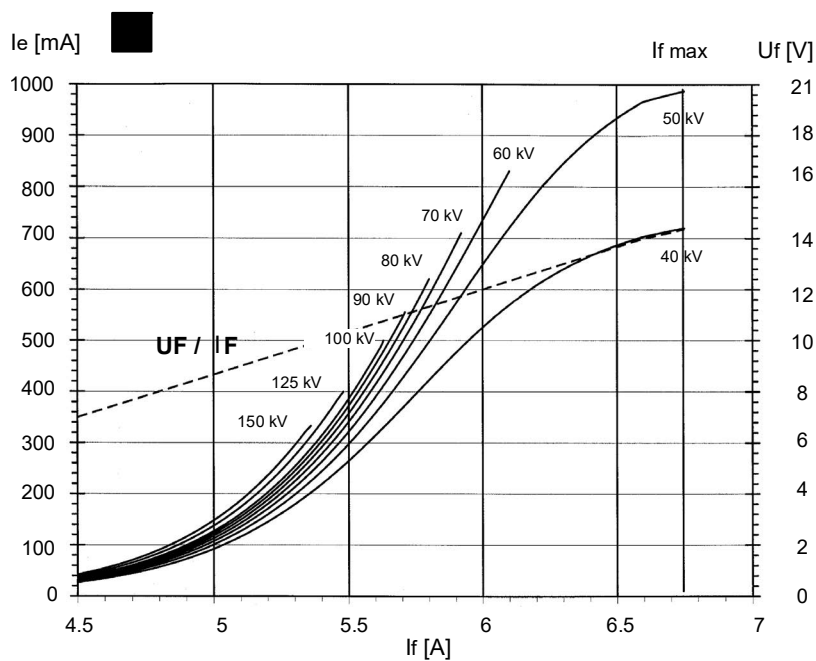
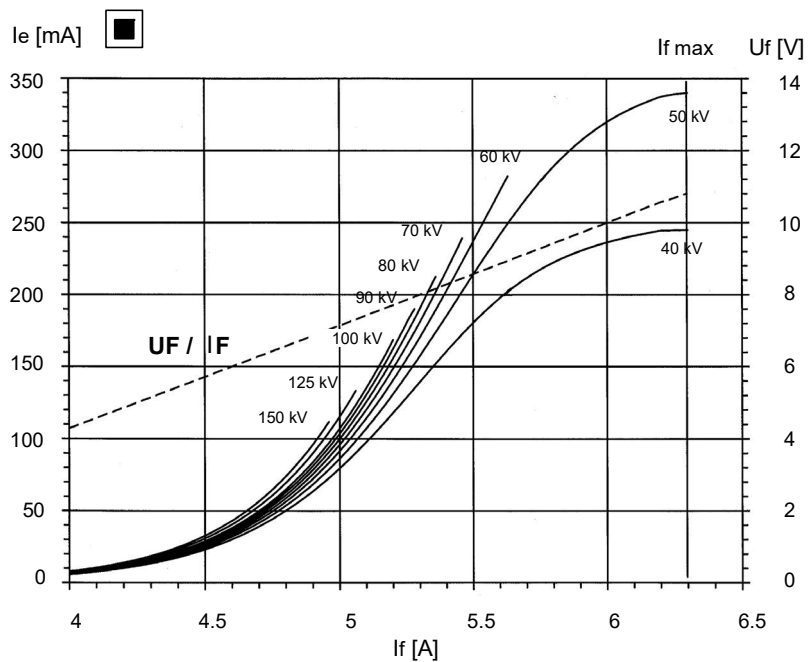
Technical data of
X-ray tube

TD-1

1	Nominal X-ray tube voltage IEC 60601-2-28	kV	150
2	Mode of operation	Continuous operation	
3	Nominal continuous input power IEC 60613/2010 (Maximum continuous heat dissipation IEC 60613/1989) Air convection cooling: $T_{amb.} \leq 25\text{ }^{\circ}\text{C}$	W	130
4	Maximum temperature of X-ray tube housing	$^{\circ}\text{C}$	+ 85
5	Overtemperature protection Closed during normal operation	Safety switch	Excess temperature switch/ Volume end switches
	Maximum nominal voltage	Vdc	24
	Maximum nominal current	mA	100
6	Maximum heat content $T_{amb.} \leq 25\text{ }^{\circ}\text{C}$	kJ kHU	1,260 1,700
7	Permanent Filtration IEC 60522/1999	2.5 mm Al/75 kV IEC 60522/1999	
8	Additional filtration IEC 60601-1-3	0 mm Al/75 kV / HVL 2.5 mm Al	
9	Total filtration IEC 60601-1-3	2.5 mm Al/75 kV	
10	Radiation leakage technique factors IEC 60601-1-3	kV / kW mAs/h	150 / 0.35 8,400
11	Maximum usable X-ray field in 100 cm source image distance (SID)	cm x cm	43 x 43
12	Distance: Focus <---> Reference plane of the X-ray window	mm	64.5 ± 0.5
13	Nominal weight of the X-ray tube assembly	kg	23
14	Maximum accelerations per minute (continuous operation)	2	
15	HV cable sockets	O3	
16	Stator data, coil Tolerance $\pm 10\%$	S1	19.0 Ω 68 mH
		S2	18.5 Ω 68 mH
		S3	23.3 Ω 115 mH
		S4	23.6 Ω 115 mH
17	Envelop voltage Envelop current IEC 60601-2-28:2017	V A	N/A N/A
18	Type of protection against electrical shock IEC 60601-1	Class I, ME equipment	
19	Ingress protection (IP) rating	IPX0	

Technical data of
X-ray tube assembly

20	Method of sterilization IEC 60601-1	Sterilization is not allowed	
21	Applied parts IEC 60601-1	No applied parts	
22	Use in presence of a flammable anesthetic mixture with air or oxygen rich environment or nitrous oxide IEC 60601-1	Not allowed	
23	Pollution degree classification IEC 60601-1	Poll. degree	2
24	Cooling method	Air convection cooling	
25	Ambient temperature in operation Minimum Maximum With reduced heat dissipation / input power.	°C	+ 10 + 40
26	Temperature limits for storage and transportation Minimum Maximum	°C	- 25 + 70
27	Ambient humidity in operation non-condensing Minimum Maximum	%	20 80
28	Humidity limits for storage and transportation Minimum Maximum	%	5 95
29	Ambient atmospheric pressure in operation IEC 60601-1 Minimum Maximum The minimum value corresponds to a height above the sea level of 3,000 m.	kPA	70 110
30	Ambient atmospheric pressure for storage and transportation IEC 60601-1 Minimum Maximum	kPA	70 110
31	Maximum shock on the product during storage and transportation	g	10
32	Maximum shock on the package during storage and transportation	g	25



Legend

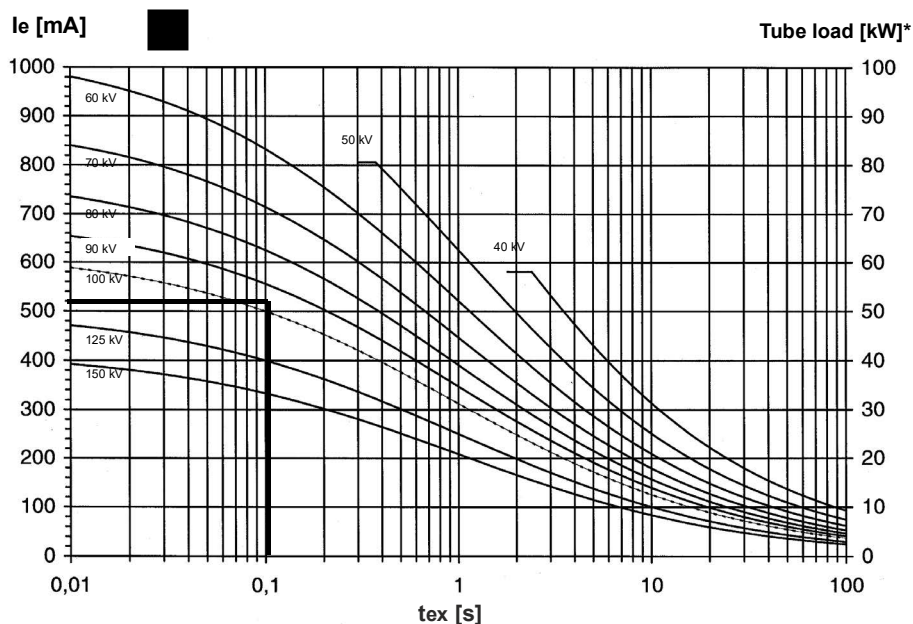
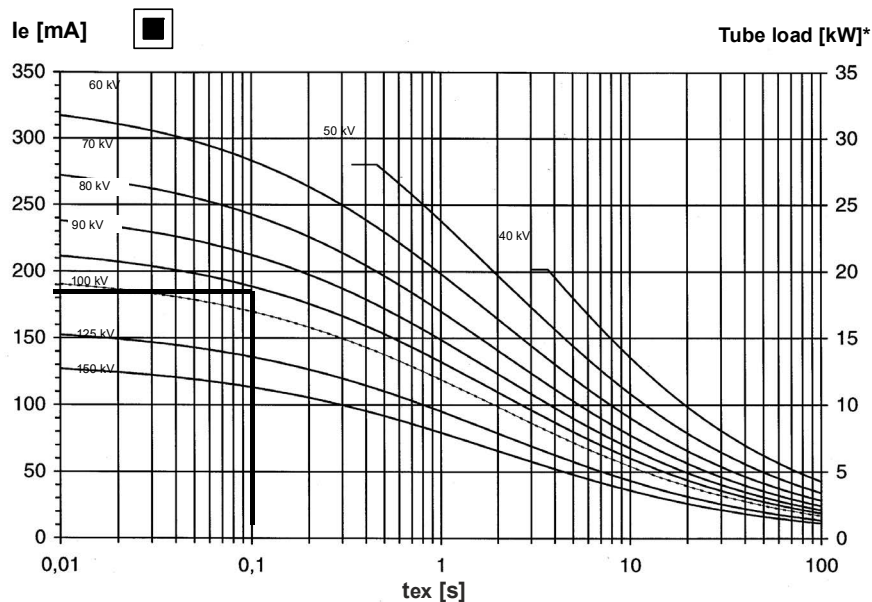
- I_e = Emission current
- U_f = Filament voltage
- I_f = Filament current
- $I_{f \max}$ = Maximum filament current
- U_f / I_f = Characteristic filament curve

Values are for adaptation. They depend on the generator control.

The emission and filament curves refer to IEC 60613.

CMT TD 042/043

Emission and filament curves



Legend

I_e = Emission current

t_{ex} = Exposure time

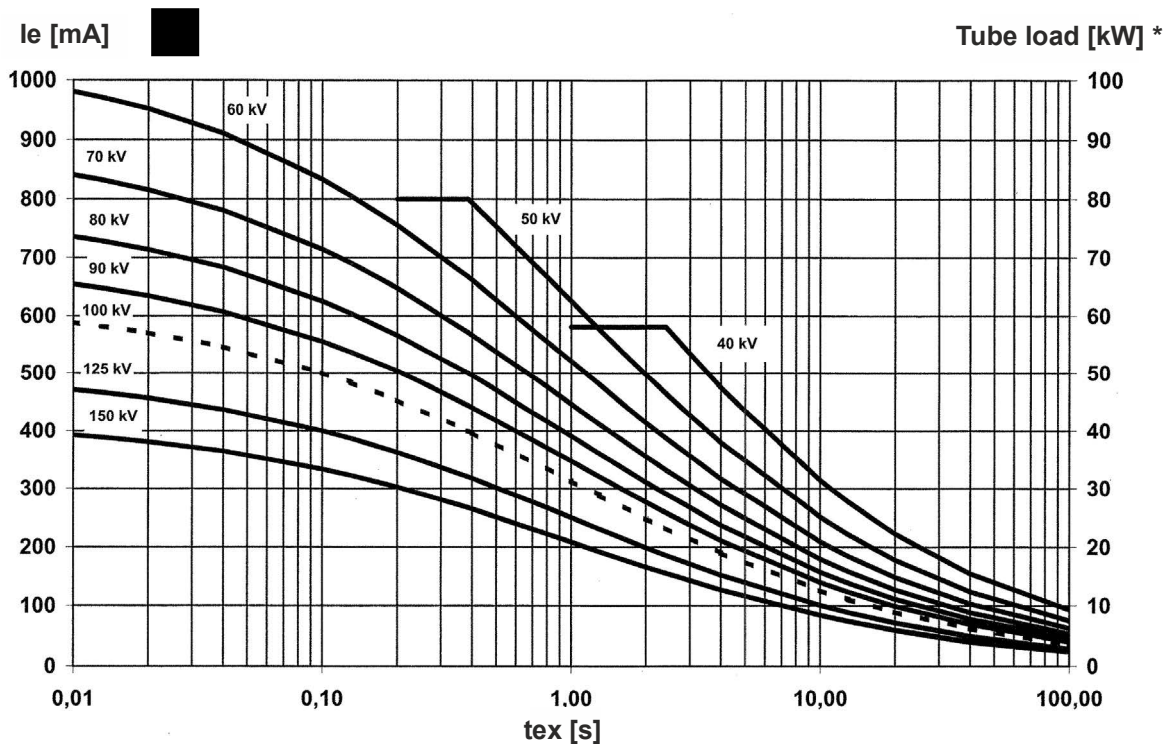
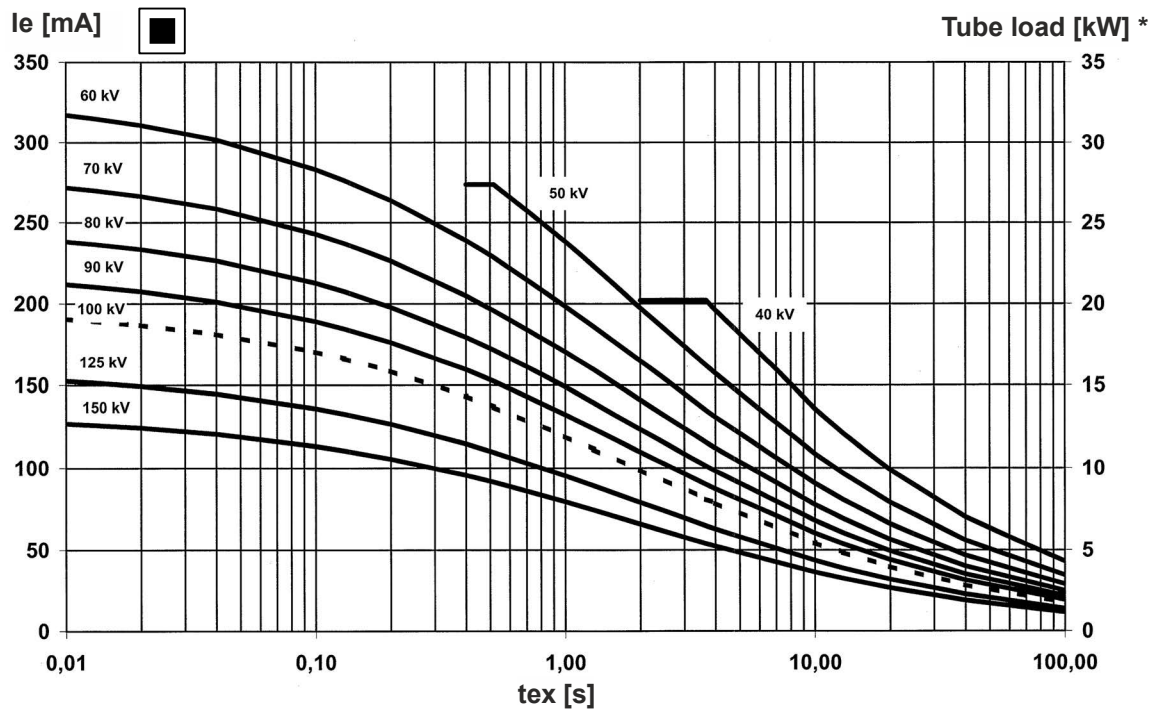
Based on 6-/12-pulse or DC and an equivalent anode input power of 250 W.

*) The tube load axes are for the 100 kV curves only.

The charts for single load rating refer to IEC 60613.

CMT TD 044/045

Charts for single load rating



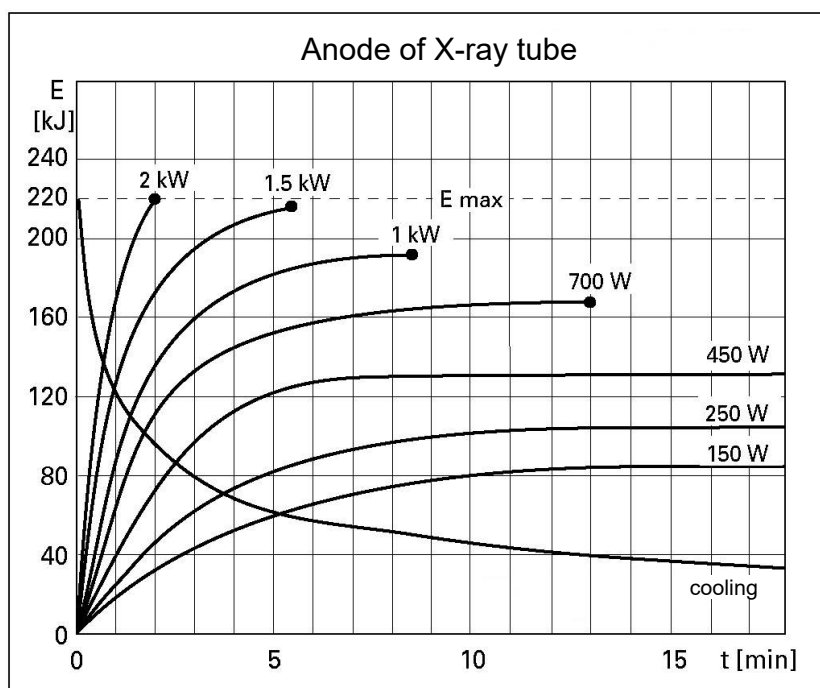
Based on a generator of the Velara family and an equivalent anode input power of 250 W.

*) The tube load axes are for the 100 kV curves only.

The charts for single load rating refer to IEC 60613.

CMT TD 046/047

Charts for single load rating



Ambient temperature $\leq 25\text{ }^{\circ}\text{C}$

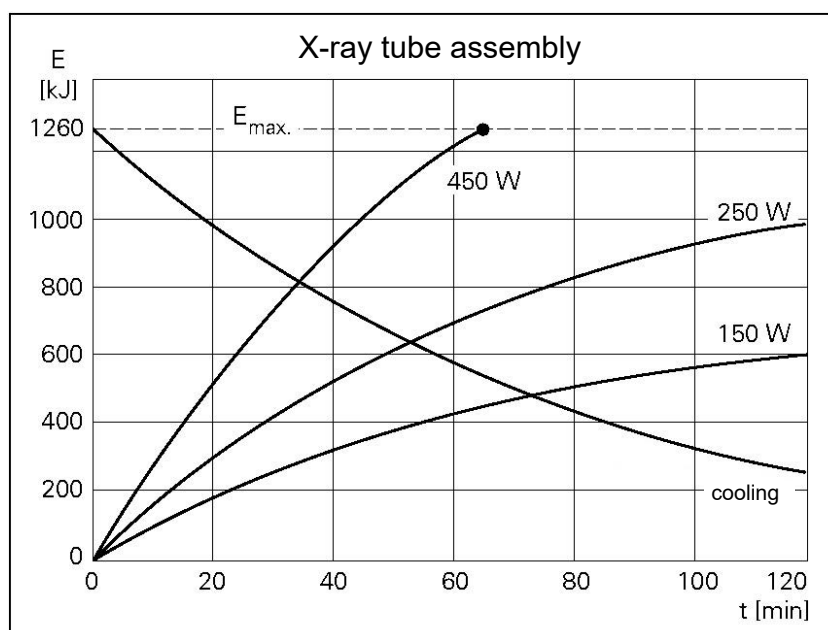
The heating and cooling curves refer to FDA 21 CFR 1020.30.

Legend

E [kJ] = Energy
t [min] = Time

CMT TD 048

Heating and cooling curves:
Anode of X-ray tube



Including heat content of the anode, heat dissipation of the stator and cathode supply at ambient temperature $\leq 25^{\circ}\text{C}$.

The heating and cooling curves refer to FDA 21 CFR 1020.30.

Legend

E [kJ] = Energy
t [min] = Time

CMT TD 049

Heating and cooling curves:
X-ray tube assembly

Focal spot: 0.6 Low speed rotation							
Duty factor [ms/s]	Total time of one cine run [s]						
	10	20	30	45	60	90	120
15	19	19	19	19	19	19	19
20	19	19	19	19	19	19	19
30	19	19	19	19	19	19	18
40	19	19	19	19	19	17	16
50	19	19	19	18	17	15	14
60	19	19	18	16	15	13	12
80	18	16	15	14	12	11	10
120	15	13	12	10	9	8	7
160	13	11	10	8	7	6	5
250	10	8	7	6	5	4	4

Focal spot: 1.2 Low speed rotation							
Duty factor [ms/s]	Total time of one cine run [s]						
	10	20	30	45	60	90	120
15	55	55	55	55	55	55	55
20	55	55	55	55	55	55	55
30	55	55	55	55	55	50	45
40	55	55	55	52	48	42	38
50	55	55	51	46	42	36	32
60	55	50	46	41	37	32	28
80	48	42	38	33	30	25	22
120	38	32	28	24	22	18	16
160	33	26	23	19	17	14	12
250	26	20	17	14	12	10	9

The tables give the maximum anode input power of each radiography in kW based on an equivalent anode power of 250 W.

The load data refer to IEC 60613.

Load data: Serial load rating for cine radiography

Focal spot: 0.6		Low speed rotation								Anode input power: 17 kW			
exp./s	Exposure time of individual radiograph [ms]												
	3	6	10	20	25	32	40	50	63	80	100	120	160
12	100	100	100	100	100	100	100	78	58	-	-	-	-
10	100	100	100	100	100	100	100	83	61	45	-	-	-
8	100	100	100	100	100	100	100	89	66	48	36	-	-
6	100	100	100	100	100	100	100	97	71	52	39	31	-
4	100	100	100	100	100	100	100	100	81	59	44	35	24
3	100	100	100	100	100	100	100	100	88	64	48	38	26
2	100	100	100	100	100	100	100	100	99	73	54	43	30
1	100	100	100	100	100	100	100	100	100	90	67	53	36

Focal spot: 0.6		Low speed rotation								Anode input power: 14 kW			
exp./s	Exposure time of individual radiograph [ms]												
	3	6	10	20	25	32	40	50	63	80	100	120	160
12	100	100	100	100	100	100	100	100	96	-	-	-	-
10	100	100	100	100	100	100	100	100	100	75	-	-	-
8	100	100	100	100	100	100	100	100	100	80	60	-	-
6	100	100	100	100	100	100	100	100	100	87	65	51	-
4	100	100	100	100	100	100	100	100	100	98	73	58	40
3	100	100	100	100	100	100	100	100	100	100	80	63	43
2	100	100	100	100	100	100	100	100	100	100	90	71	49
1	100	100	100	100	100	100	100	100	100	100	100	88	60

The tables give the max. number of exposures permissible per series.
The min. cooling time between subsequent series is 20 min.

The load data refer to IEC 60613.

Load data: Serial load rating

Focal spot: 1.2				Low speed rotation						Anode input power: 50 kW			
exp./s	Exposure time of individual radiograph [ms]												
	3	6	10	20	25	32	40	50	63	80	100	120	160
12	100	100	100	74	56	40	30	23	17	-	-	-	-
10	100	100	100	79	59	43	32	24	18	13	-	-	-
8	100	100	100	84	63	46	34	26	19	14	10	-	-
6	100	100	100	92	69	50	37	28	21	15	11	9	-
4	100	100	100	100	77	56	42	31	23	17	13	10	7
3	100	100	100	100	84	61	46	34	25	19	14	11	8
2	100	100	100	100	95	69	52	39	29	21	16	12	9
1	100	100	100	100	100	85	64	48	35	26	19	15	11

Focal spot: 1.2				Low speed rotation						Anode input power: 40 kW			
exp./s	Exposure time of individual radiograph [ms]												
	3	6	10	20	25	32	40	50	63	80	100	120	160
12	100	100	100	100	99	72	54	40	30	-	-	-	-
10	100	100	100	100	100	76	57	43	32	23	-	-	-
8	100	100	100	100	100	82	61	46	34	25	19	-	-
6	100	100	100	100	100	89	66	50	37	27	20	16	-
4	100	100	100	100	100	100	75	56	42	30	23	18	12
3	100	100	100	100	100	100	82	61	45	33	25	20	14
2	100	100	100	100	100	100	92	69	51	38	28	22	15
1	100	100	100	100	100	100	100	85	63	46	35	27	19

The tables give the max. number of exposures permissible per series.
The min. cooling time between subsequent series is 20 min.

The load data refer to IEC 60613.

Load data: Serial load rating

Focal spot: 0.6		Low speed rotation								
duty factor	Exposure time of individual radiograph [ms]									
	U/kV	40	50	60	70	80	90	100	125	150
75 (25 ms * 3 Hz)	P/kW	8,2	13,9	15,3	15,3	15,3	15,3	15,3	15,3	15,3
150 (10 ms * 15 Hz)	P/kW	8,2	13,9	14,8	14,8	14,8	14,8	14,8	14,8	14,8
300 (20 ms * 15 Hz)	P/kW	8,2	13,9	13,9	13,9	13,9	13,9	13,9	13,9	13,9
450 (150 ms * 3 Hz)	P/kW	8,2	13,1	13,1	13,1	13,1	13,1	13,1	13,1	13,1

Focal spot: 1.2		Low speed rotation								
duty factor	Exposure time of individual radiograph [ms]									
	U/kV	40	50	60	70	80	90	100	125	150
75 (25 ms * 3 Hz)	P/kW	24	41	48	48	48	48	48	48	48
150 (10 ms * 15 Hz)	P/kW	24	41	45	45	45	45	45	45	45
300 (20 ms * 15 Hz)	P/kW	24	39	39	39	39	39	39	39	39
450 (150 ms * 3 Hz)	P/kW	24	33	33	33	33	33	33	33	33

Based on a generator of the Velara family and an equivalent anode input power 250 W.

The run time is 5 s. The min. cooling time between subsequent series is 20 min.

The load data refer to IEC 60613.

Load data: Serial load rating

Long X-ray tube conditioning (LTC) / Seasoning procedure



Hazard of released radiation during the LTC.

- Obey the regulations for radiation protection.

If you do not obey this instruction, there is a risk of death or serious injury.

- Do the LTC for each new connected X-ray tube assembly.
- Obey the intervals between exposures.
- Use a watch to monitor the intervals.
- Do the LTC with the large focal spot only.

For operating breaks of more than 3 months, an exposure-series have to be made with the specified kV and mAs values as given in the table below.

The generator must be in READY state, i.e. the green LED on the desk must be lit. Pay attention that the READY state conditions are met.

Every exposure sequence must always be performed at the respective selected kV level without repeating the start-up procedure of the X-ray tube. The PREP button must remain to be pressed during the whole exposure sequence.

Long X-ray tube conditioning (LTC) /
Seasoning procedure

Conditioning procedure

1. Switch ON the system.
2. Select the large focal spot of the X-ray tube.
3. Select 2-button-technique "kV-mAs".
Choose kV-mAs-values at the system corresponding the first exposure sequence.
See table in Technical Data of the X-ray tube.

*) Given values depend on the generator. They may be slightly different.

4. Release exposures sequences. See table below.

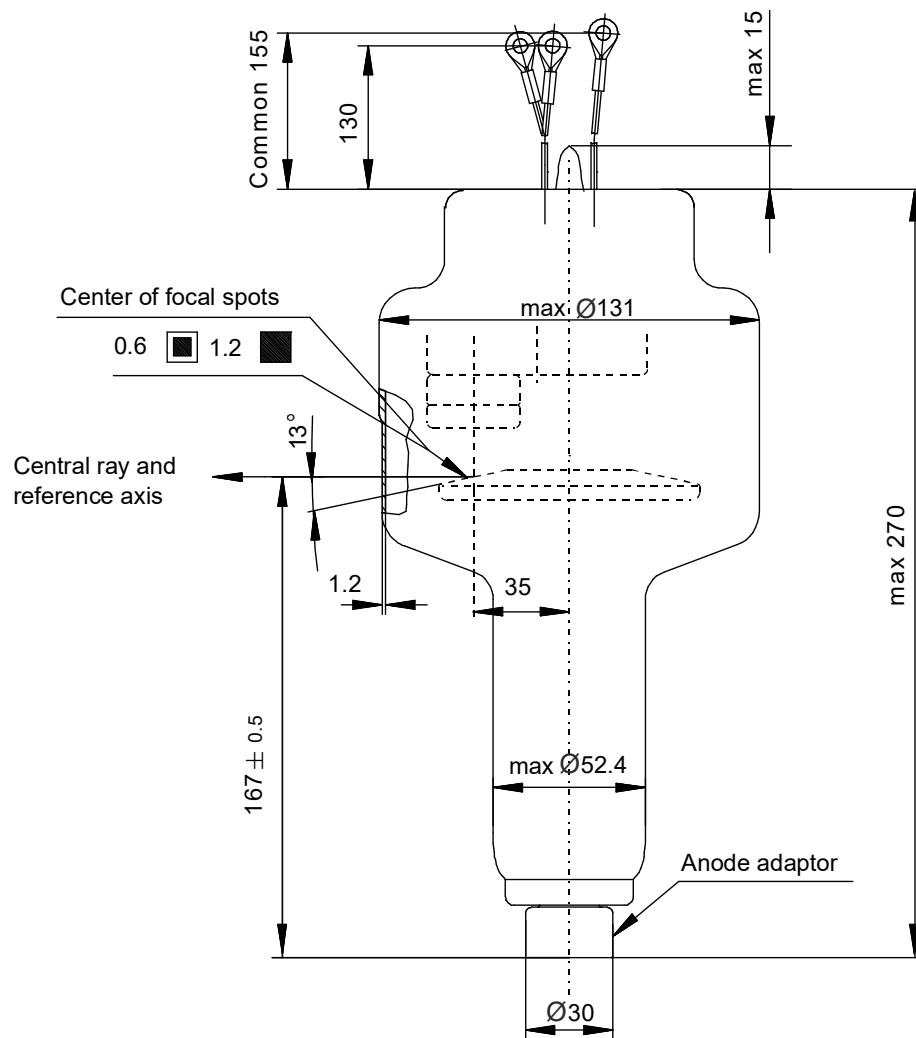
If electrical interferences occur during the conditioning procedure, obey the following steps:

- Continue the procedure after an interval of 5 minutes.
- Restart the procedure at a lower kV level.

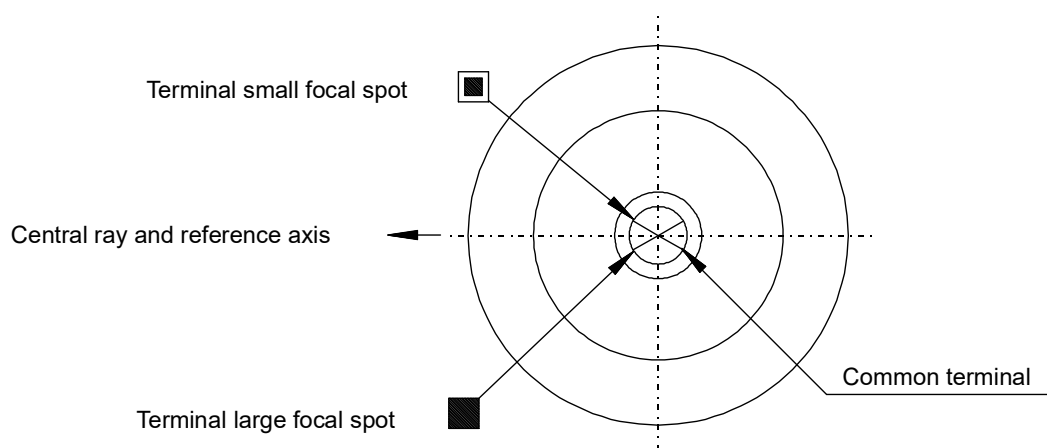
Exposure sequence	Number of exposures per sequence	X-ray tube voltage [kV] *	mAs product [mAs]	Break time between two exposures within the sequence [s]	Break time between two sequences [s]
1	5	81	125	1	
					30
2	3	102	125	1	
					30
3	2	117	125	1	
					60
4	2	141	125	1	
					≥ 120

Sequence of exposures for long X-ray tube conditioning

Long X-ray tube conditioning (LTC) /
Seasoning procedure

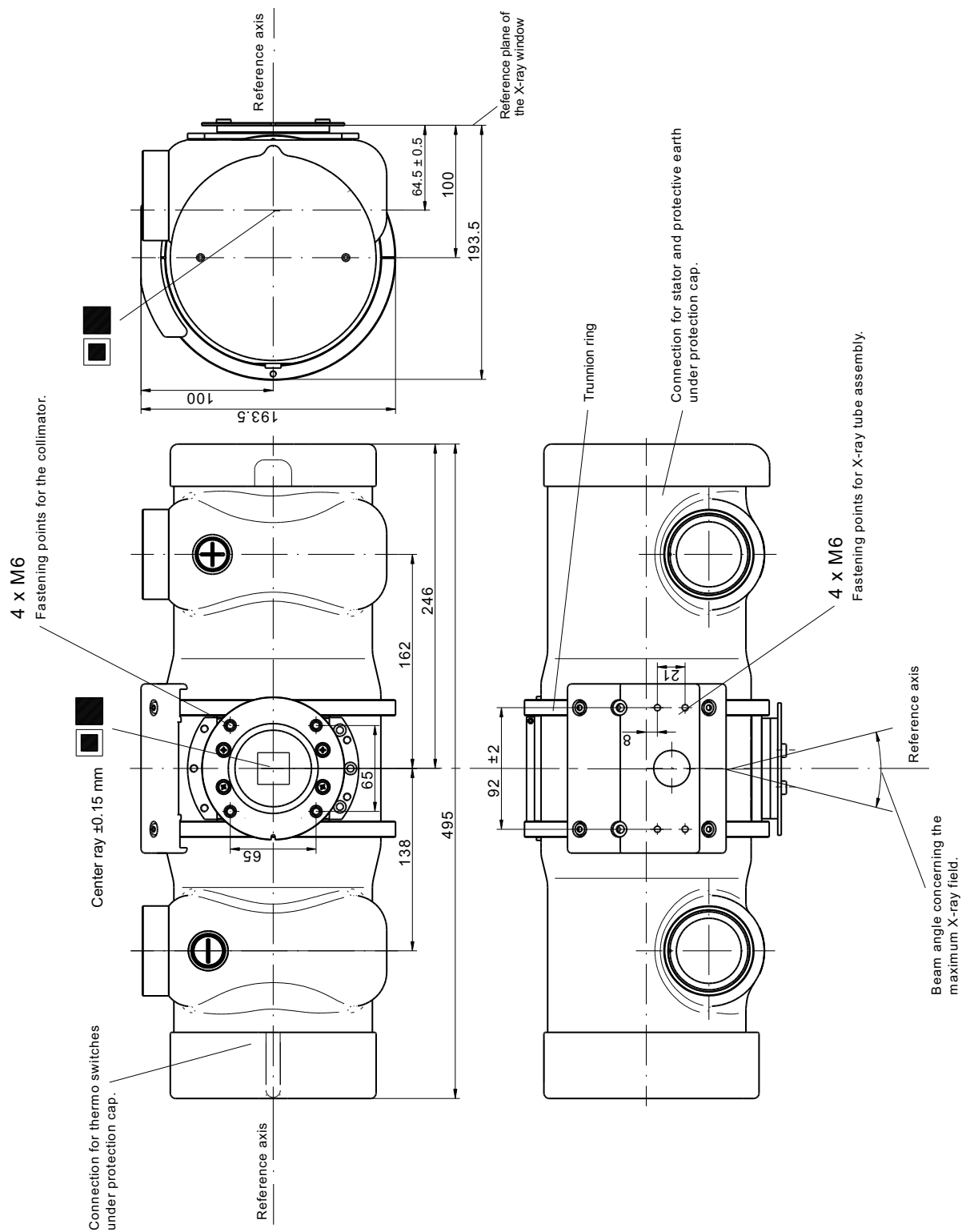


View spots position



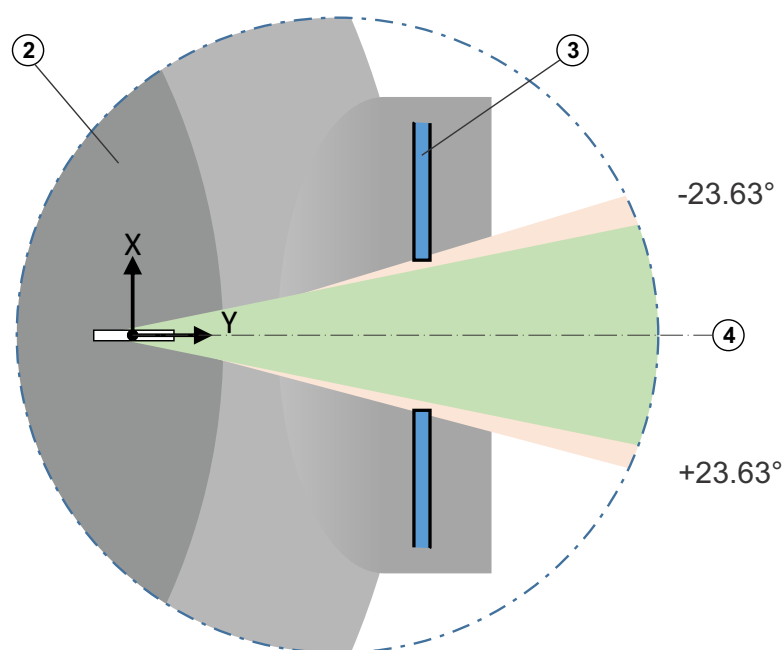
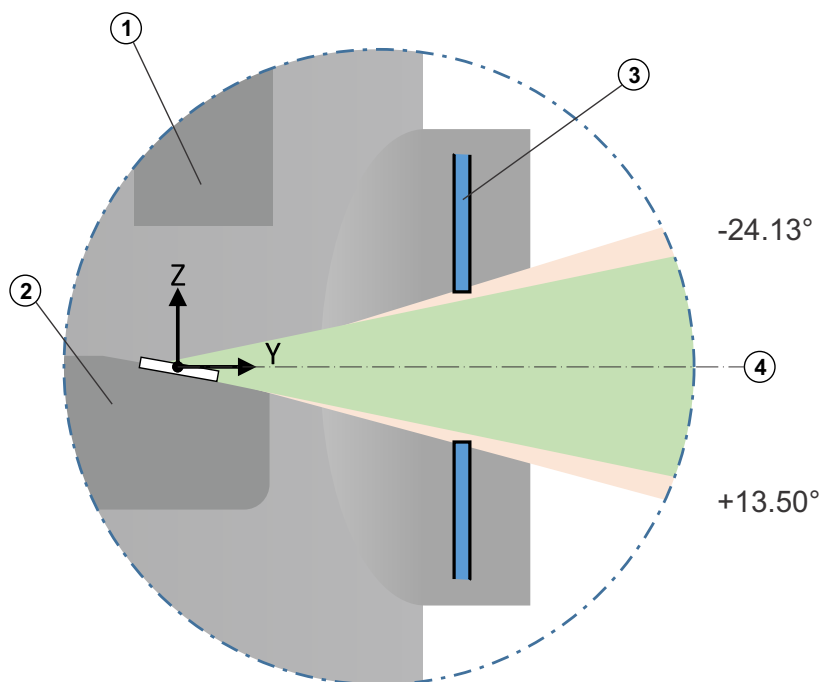
CMT TD 057

Mechanical dimensions of X-ray tube



CMT TD 073

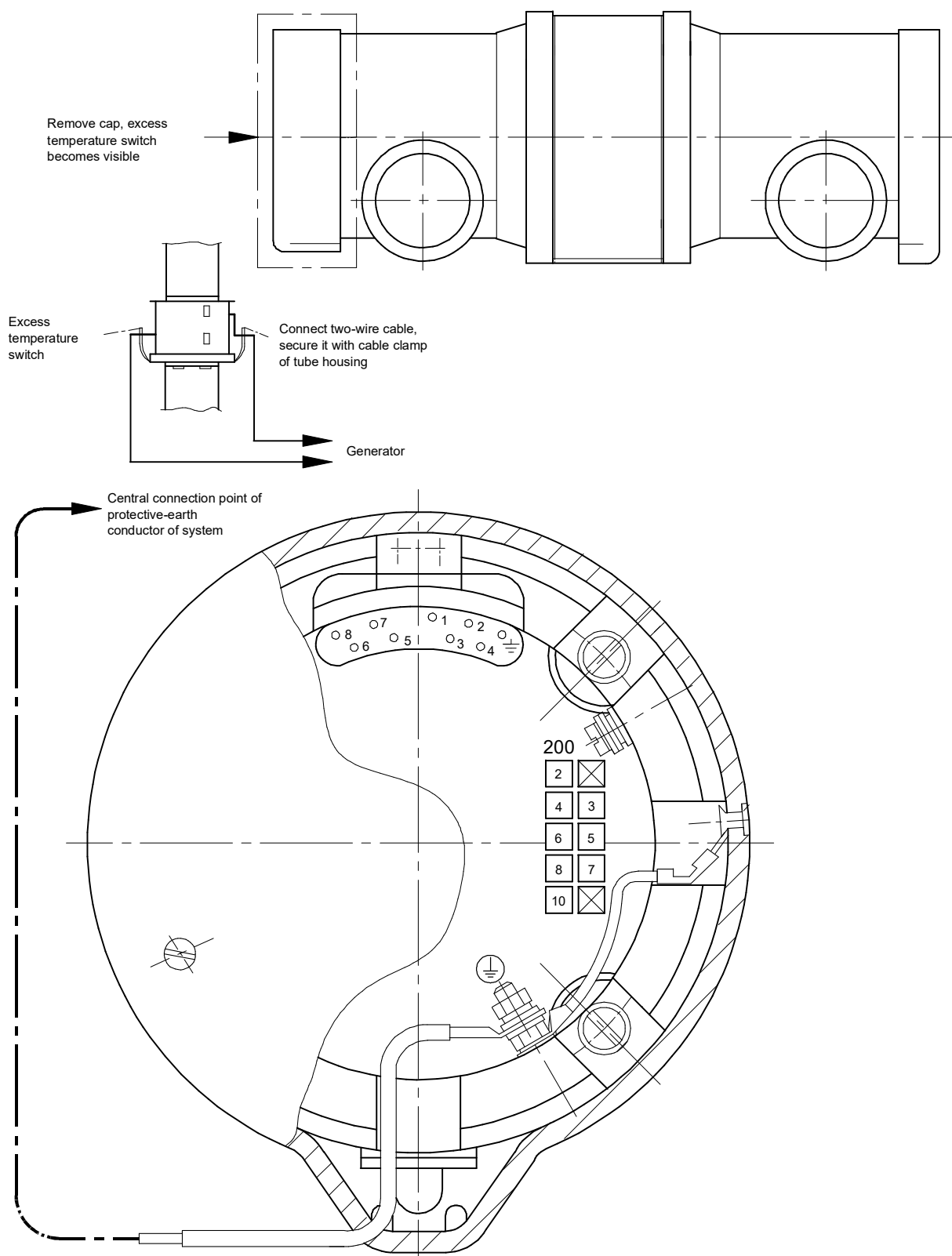
Mechanical dimensions of X-ray tube assembly



Item	Designation
1	Cathode
2	Anode
3	X-ray window
4	Reference axis

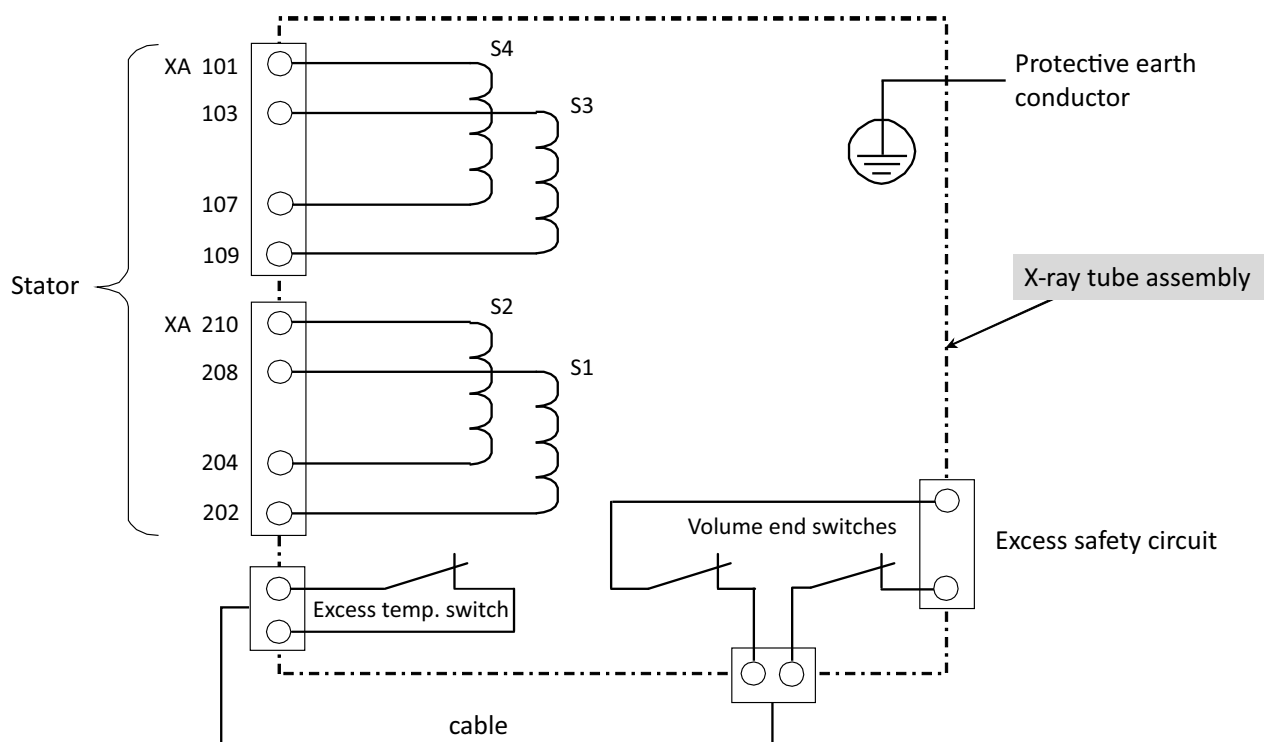
CMT TD 915 / 916

Maximum fan beam angle for beam limitation



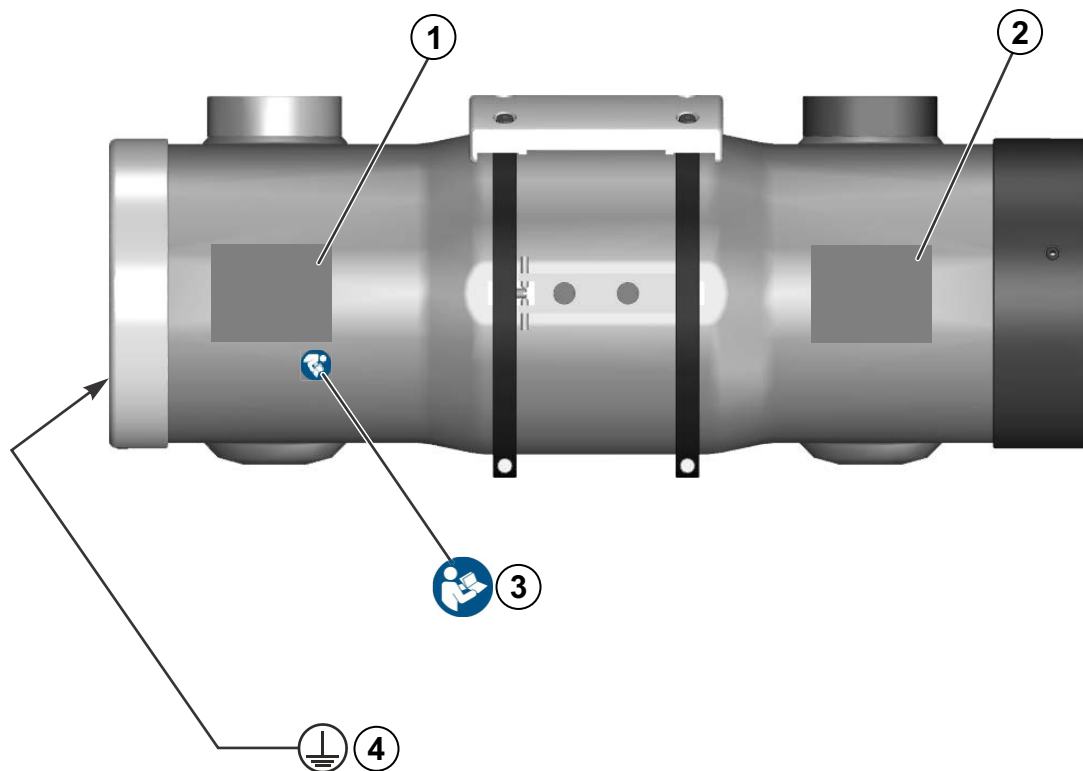
CMT TD 072

Electrical connections



CMT TD 925

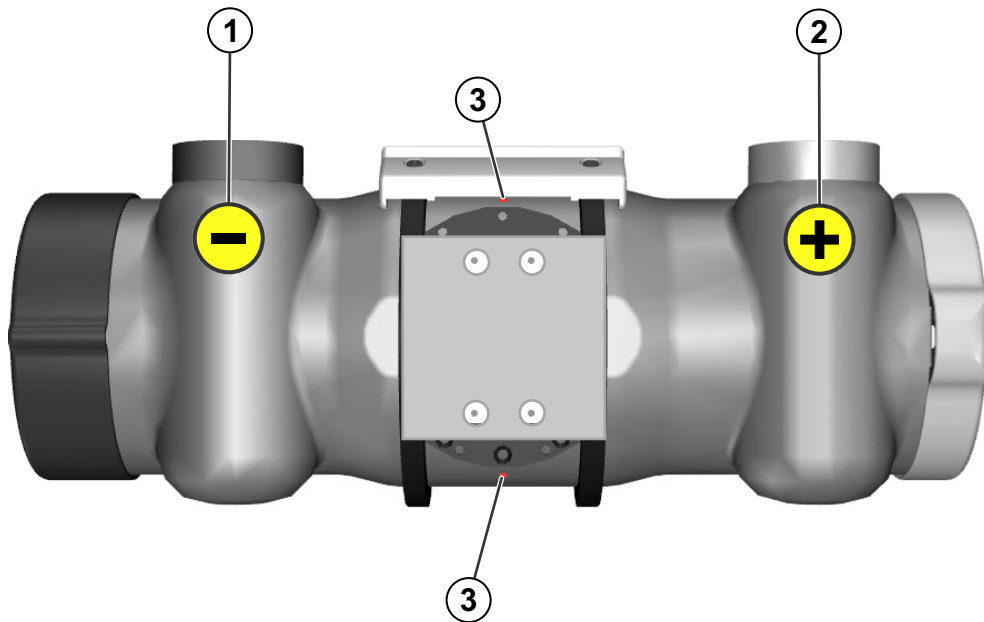
Electrical connections



Item	Designation
1	Identification label
2	Conformity label for China
3	Safety label: Read the accompanying documents.
4	Safety label: Protective earth terminal, below the end cover

CMT TD 648_1

Labeling of X-ray tube assembly



Item	Designation
1	Cathode label
2	Anode label
3	Punch marks that show the position of the focal spot

CMT TD 648_2

Labeling of X-ray tube assembly

技术说明书（中文）

(Chinese Version)



警告！

仅当按照 X 射线管组件的规格限制进行使用时，才能保证 X 射线管组件的安全操作。本部分“技术说明书”为您提供了规格限制。

如果忽略规格限制，则可能会导致冷却液流出。X 射线管组件会过热。元件过热可能爆炸并引发内爆/爆炸。

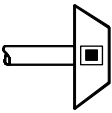
如果您忽略规格限制，X 射线管组件的制造商将拒绝承担与使用该产品相关的责任。

制造商将拒绝所有保修请求。



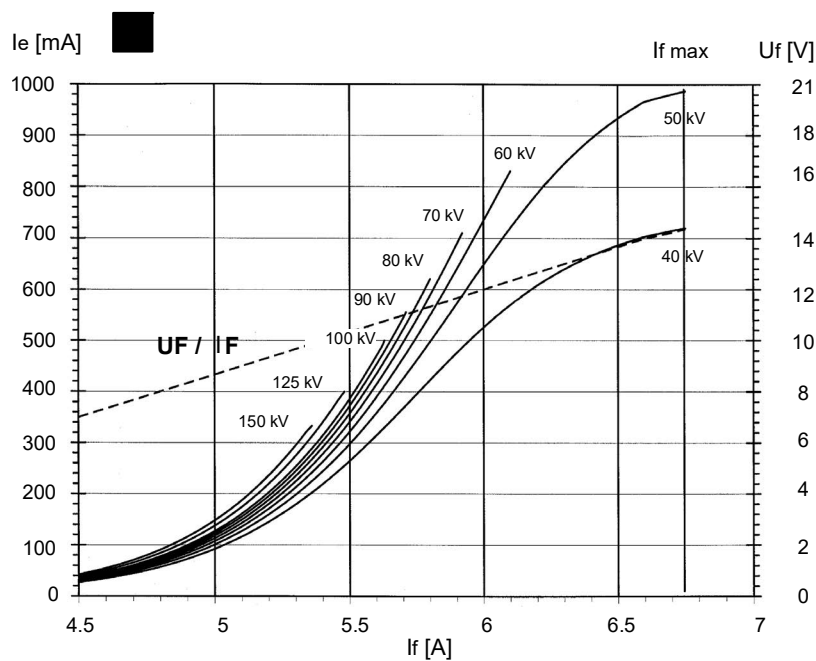
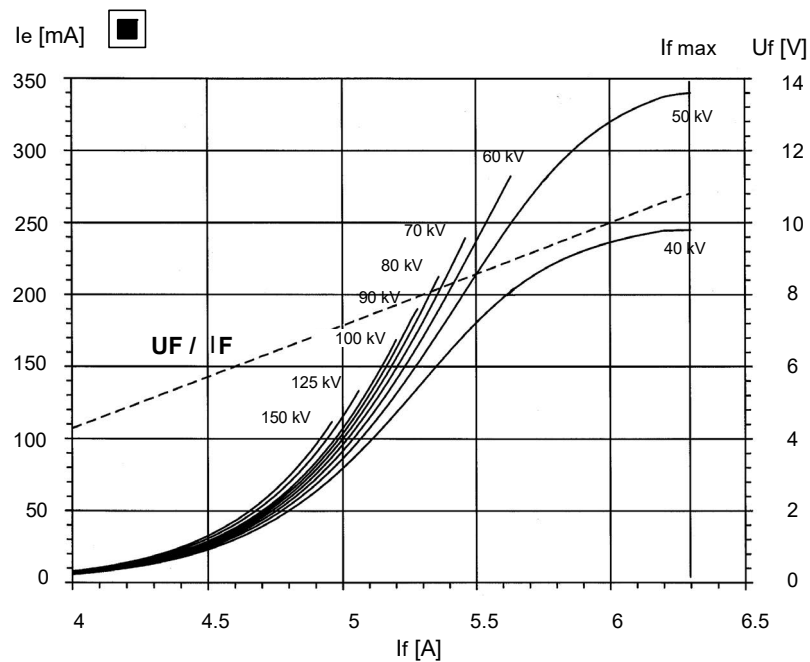
务必阅读、理解并遵守！

技术说明书

1	阳极材料 IEC 60601-2-28 钨铍合金阳极: RT/TZM	---		
2	焦点位置: 叠加	---		
3	标称焦点值 宽 x 长 IEC 60336/2005 标称焦点值是根据 IEC 60336 规定的特殊方法确定的。	---	 0.6	 1.2
4	X 射线管的滤过 IEC 60601-2-28:1993	0.62 mm Al/75 kV		
5	标称阳极输入功率, 基于 0.1 秒 IEC 60613 20 W 等效阳极输入功率 250 W 等效阳极输入功率	kW	 21 17	 60 50
6	标称摄影阳极输入功率 IEC 60613	kW	 17	 50
7	最大阳极热容量	kJ kHU	220 300	
8	连续阳极输入功率 IEC 60613/2010	W	63	
9	最大阳极热耗散 IEC 60613/1989 不适用于连续操作	W HU/min	1,300 105,300	
10	阳极靶角 IEC 60601-2-28	°	13	
11	阳极加速时间 取决于转子控制装置。	s	< 1.4	
12	阳极制动时间 取决于转子控制装置。	s	< 20.0	
13	标称阳极旋转速度	RPM (Hz)	3,000 (50)	
14	曝光时的最大灯丝电流 数值可作调整。其取决于发生器控件。	A	 6.3	 6.75
15	曝光时的最大灯丝电压 数值可作调整。其取决于发生器控件。	V	 10.8	 14.4

1	标称 X 射线管电压 IEC 60601-2-28	kV	150
2	运行模式	连续运行	
3	标称连续输入功率 IEC 60613/2010 (最大连续散热速率 IEC 60613/1989) 空气对流冷却: $T_{amb.} \leq 25\text{ °C}$	W	130
4	X 射线管外壳的最高温度	°C	+ 85
5	过温保护 正常工作期间关闭	安全开关	过温保护开关 / 容积停止开关
	最大标称电压 最大标称电流	Vdc mA	24 100
6	最大热容量 $T_{amb.} \leq 25\text{ °C}$ 热量单位 (HU) 的计算基于平均校正因子。根据所应用的发生器，它们可能略有不同。	kJ kHU	1,260 1,700
7	固有滤过 IEC 60522/1999	2.5 mm Al/75 kV IEC 60522/1999	
8	附加滤过 IEC 60601-1-3	0 mm Al/75 kV / HVL 2.5 mm Al	
9	总滤过 IEC 60601-1-3	2.5 mm Al/75 kV	
10	辐射泄漏技术系数 IEC 60601-1-3	kV/kW mAs/h	150/0.35 8,400
11	100 cm 源像距 (SID) 中可以使用的最大 X 射线照射野	cm x cm	43 x 43
12	距离: 焦点 <---> X 射线窗口的基准平面	mm	64.5 ± 0.5
13	X 射线管组件的标称重量	kg	23
14	每分钟最大加速度 (连续操作)	2	
15	高压电缆插座	O3	
16	定子数据, 线圈 公差 ± 10%	S1	19.0 Ω 68 mH
		S2	18.5 Ω 68 mH
		S3	23.3 Ω 115 mH
		S4	23.6 Ω 115 mH
17	包络电压 包络电流 IEC 60601-2-28:2017	V A	N/A N/A
18	电击防护类型 IEC 60601-1	I 类, ME 设备	
19	防护 (IP) 等级	IPX0	

20	灭菌方法 IEC 60601-1	不允许灭菌	
21	外加部件 IEC 60601-1	无外加部件	
22	在存在易燃麻醉气体以及空气、一氧化二氮或富含氧气的混合气体环境中使用 IEC 60601-1	不允许	
23	污染等级分类 IEC 60601-1	污染等级	2
24	冷却方法	空气对流冷却	
25	操作中的环境温度 具有较低的散热率 / 输入功率。	最小值 最大值 °C	+ 10 + 40
26	存储和运输的温度限制	最小值 最大值 °C	- 25 + 70
27	操作中的环境湿度 无冷凝	最小值 最大值 %	20 80
28	存储和运输的湿度限制	最小值 最大值 %	5 95
29	操作中的环境大气压力 IEC 60601-1 最小值对应海拔 3,000 米以上的高度。	最小值 最大值 kPa	70 110
30	存储和运输的环境大气压力 IEC 60601-1	最小值 最大值 kPa	70 110
31	产品在储存和运输中所能承受的最大冲击力	g	10
32	包装在储存和运输中所能承受的最大冲击	g	25



图例

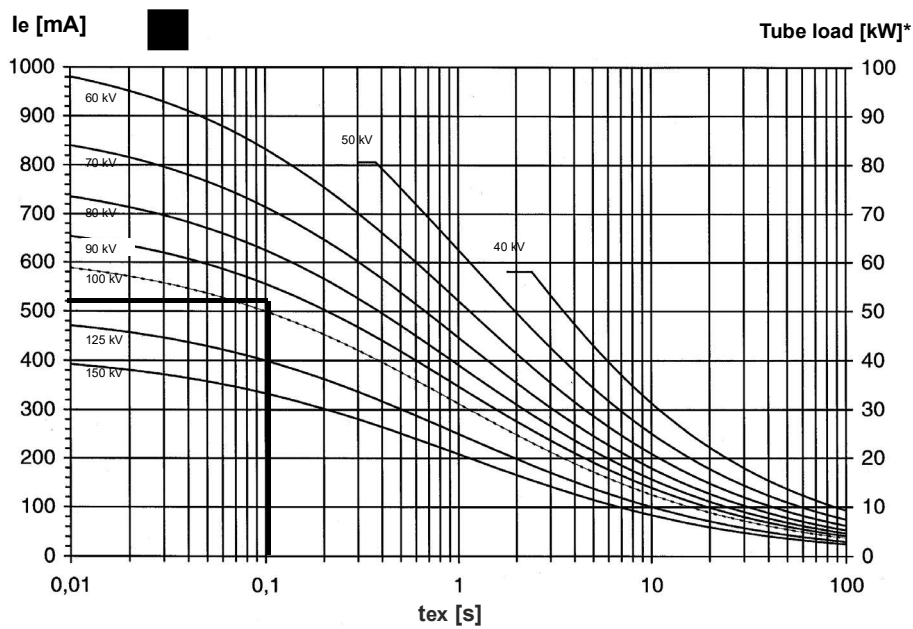
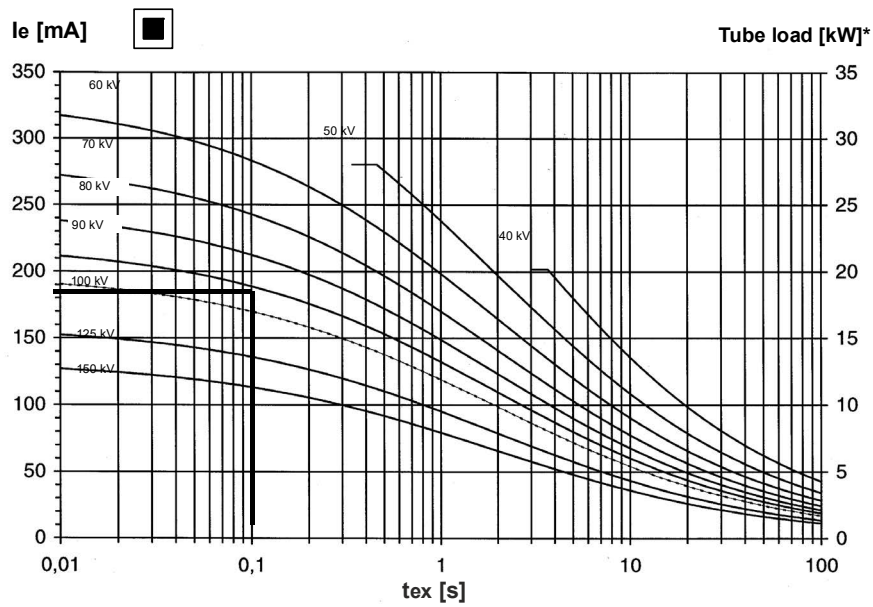
- I_e = 发射电流
- U_f = 灯丝电压
- I_f = 灯丝电流
- $I_{f \max}$ = 最大灯丝电流
- U_f / I_f = 灯丝特性曲线

数值可作调整。其取决于发生器控件。

灯丝发射曲线参考 IEC 60613。

CMT TD 042/043

灯丝发射曲线



基于 6-12 脉冲或直流以及 250 W 的等效阳极输入功率。

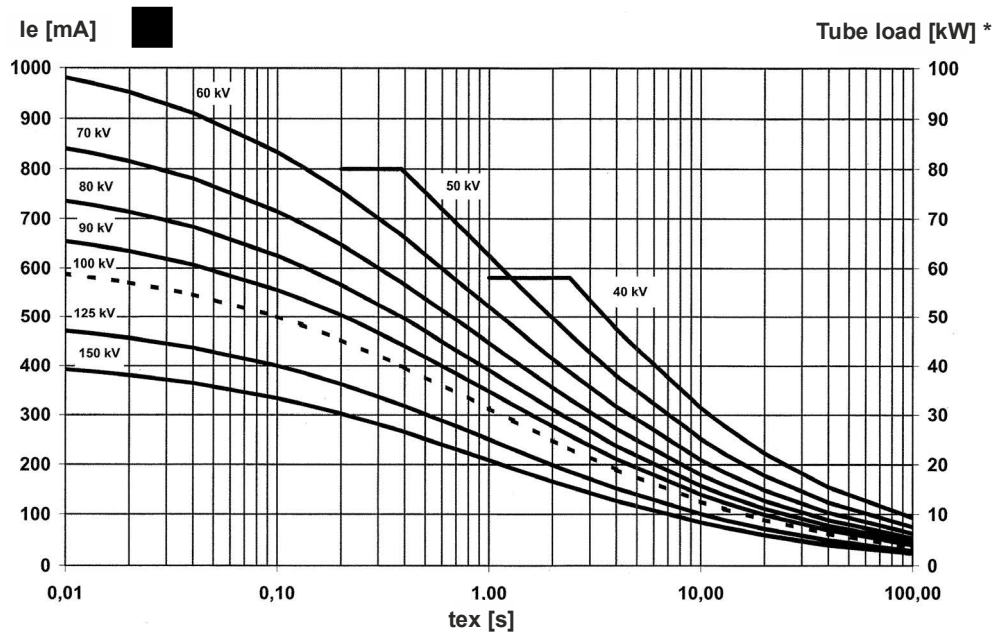
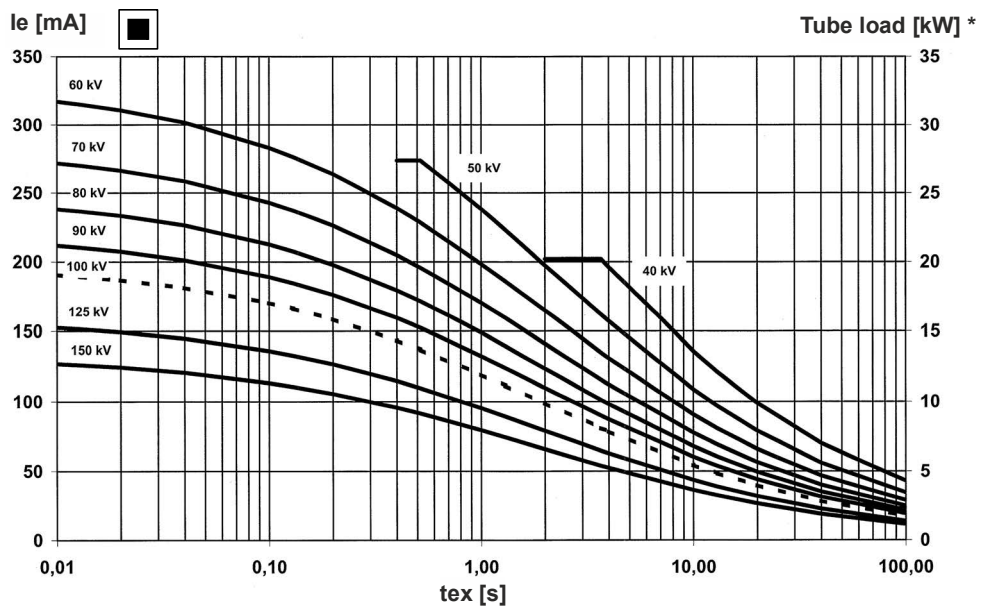
*) 球管负载 [kW] 轴仅适用于 100 kV 曲线。

单次额定负载图表参考 IEC 60613。

Designation English	名称 (中文)
I_e = Emission current	I_e = 发射电流
t_{ex} = Exposure time	t_{ex} = 曝光时间
Tube load [kW]	球管负载 [kW]

CMT TD 044/045

单次额定负载图表



基于 Velara 系列发生器以及高速旋转时 250 W 的等效阳极输入功率。

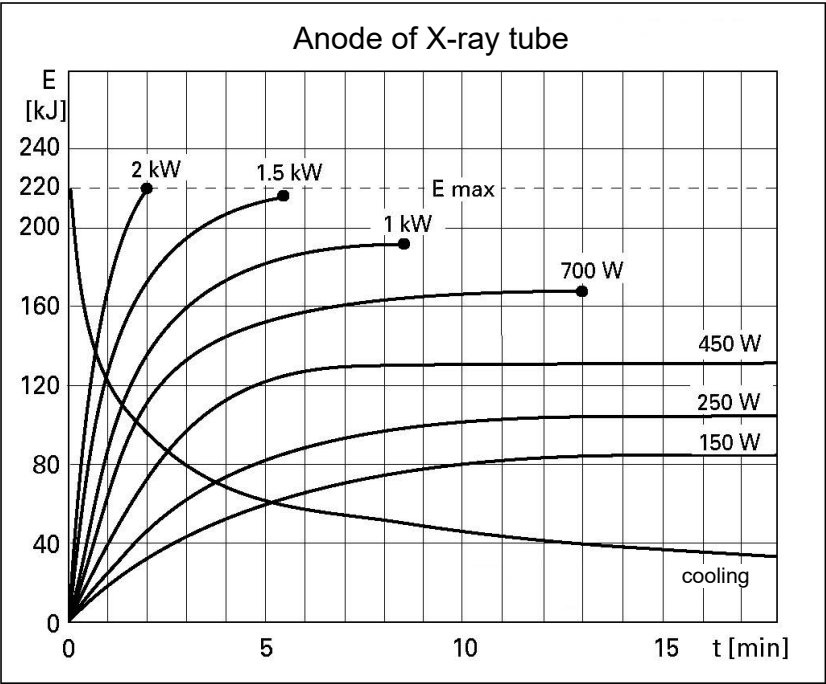
*) 球管负载 [kW] 轴仅适用于 100 kV 曲线。

单次额定负载图表参考 IEC 60613。

Designation English	名称 (中文)
I_e = Emission current	I_e = 发射电流
t_{ex} = Exposure time	t_{ex} = 曝光时间
Tube load [kW]	球管负载 [kW]

CMT TD 046/047

单次额定负载图表



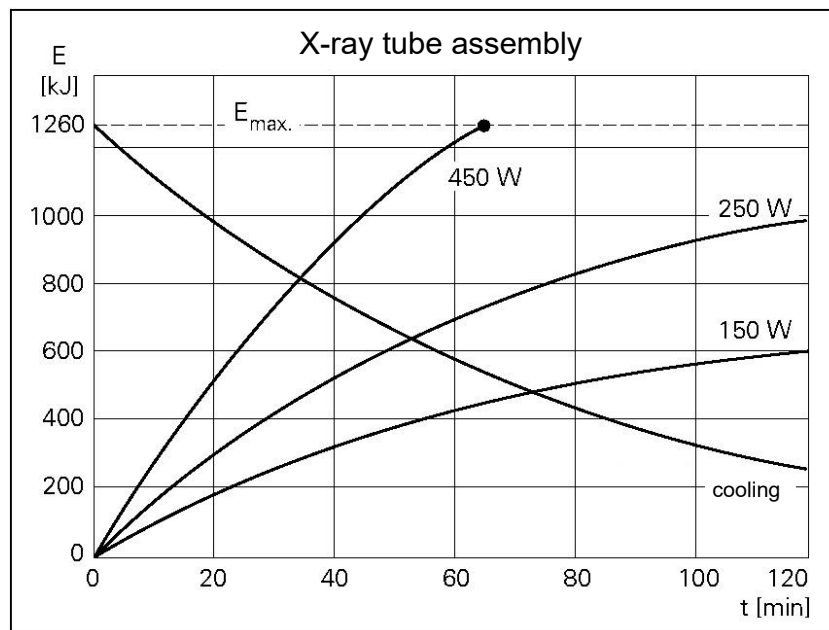
环境温度 $\leq 25^{\circ}\text{C}$

加热与冷却曲线参考 FDA 21 CFR 1020.30。

Designation English	名称（中文）
E [kJ] = Energy	E [kJ] = 能量
t [min] = Time	t [min] = 时间
Anode of X-ray tube	X 射线管阳极
cooling	冷却

CMT TD 048

加热与冷却曲线：
X 射线管阳极



包括环境温度 $\leq 25^{\circ}\text{C}$ 时阳极的热容量、定子和阴极电源的散热情况

加热与冷却曲线参考 FDA 21 CFR 1020.30。

Designation English	名称 (中文)
E [kJ] = Energy	E [kJ] = 能量
t [min] = Time	t [min] = 时间
X-ray tube assembly	X 射线管组件
cooling	冷却

CMT TD 049

加热与冷却曲线：
X 射线管组件

焦点： 0.6							低速旋转
占空系数 [ms/s]	一次电影摄影的总时间 [秒]						
	10	20	30	45	60	90	120
15	19	19	19	19	19	19	19
20	19	19	19	19	19	19	19
30	19	19	19	19	19	19	18
40	19	19	19	19	19	17	16
50	19	19	19	18	17	15	14
60	19	19	18	16	15	13	12
80	18	16	15	14	12	11	10
120	15	13	12	10	9	8	7
160	13	11	10	8	7	6	5
250	10	8	7	6	5	4	4

焦点： 1.2							低速旋转
占空系数 [ms/s]	一次电影摄影的总时间 [秒]						
	10	20	30	45	60	90	120
15	55	55	55	55	55	55	55
20	55	55	55	55	55	55	55
30	55	55	55	55	55	50	45
40	55	55	55	52	48	42	38
50	55	55	51	46	42	36	32
60	55	50	46	41	37	32	28
80	48	42	38	33	30	25	22
120	38	32	28	24	22	18	16
160	33	26	23	19	17	14	12
250	26	20	17	14	12	10	9

表格基于 250 W 的等效阳极功率列出了每次放射照相的最大阳极输入功率，单位为 kW。

负载数据请参考 IEC 60613。

负载数据：电影摄影的系列额定负载

焦点: 0.6		低速旋转									阳极输入功率: 17 kW			
每秒曝光次数	单次放射照相的曝光时间 [ms]													
	3	6	10	20	25	32	40	50	63	80	100	120	160	
	12	100	100	100	100	100	100	100	78	58	-	-	-	-
	10	100	100	100	100	100	100	100	83	61	45	-	-	-
	8	100	100	100	100	100	100	100	89	66	48	36	-	-
	6	100	100	100	100	100	100	100	97	71	52	39	31	-
	4	100	100	100	100	100	100	100	100	81	59	44	35	24
	3	100	100	100	100	100	100	100	100	88	64	48	38	26
	2	100	100	100	100	100	100	100	100	99	73	54	43	30
	1	100	100	100	100	100	100	100	100	100	90	67	53	36

焦点: 0.6		低速旋转									阳极输入功率: 14 kW			
每秒曝光次数	单次放射照相的曝光时间 [ms]													
	3	6	10	20	25	32	40	50	63	80	100	120	160	
	12	100	100	100	100	100	100	100	96	-	-	-	-	
	10	100	100	100	100	100	100	100	100	75	-	-	-	
	8	100	100	100	100	100	100	100	100	80	60	-	-	
	6	100	100	100	100	100	100	100	100	87	65	51	-	
	4	100	100	100	100	100	100	100	100	98	73	58	40	
	3	100	100	100	100	100	100	100	100	100	80	63	43	
	2	100	100	100	100	100	100	100	100	100	90	71	49	
	1	100	100	100	100	100	100	100	100	100	100	88	60	

表格列出了每个系列所允许的最大曝光次数。
 后续系列之间的最短冷却时间为 20 分钟。
 负载数据请参考 IEC 60613。

负载数据: 系列额定负载

焦点：1.2		低速旋转									阳极输入功率：50 kW			
每秒曝光次数	单次放射照相的曝光时间 [ms]													
	3	6	10	20	25	32	40	50	63	80	100	120	160	
	12	100	100	100	74	56	40	30	23	17	-	-	-	-
	10	100	100	100	79	59	43	32	24	18	13	-	-	-
	8	100	100	100	84	63	46	34	26	19	14	10	-	-
	6	100	100	100	92	69	50	37	28	21	15	11	9	-
	4	100	100	100	100	77	56	42	31	23	17	13	10	7
	3	100	100	100	100	84	61	46	34	25	19	14	11	8
	2	100	100	100	100	95	69	52	39	29	21	16	12	9
	1	100	100	100	100	100	85	64	48	35	26	19	15	11

焦点: 1.2		低速旋转										阳极输入功率: 40 kW		
每秒曝光次数	单次放射照相的曝光时间 [ms]													
	3	6	10	20	25	32	40	50	63	80	100	120	160	
	12	100	100	100	100	99	72	54	40	30	-	-	-	-
	10	100	100	100	100	100	76	57	43	32	23	-	-	-
	8	100	100	100	100	100	82	61	46	34	25	19	-	-
	6	100	100	100	100	100	89	66	50	37	27	20	16	-
	4	100	100	100	100	100	100	75	56	42	30	23	18	12
	3	100	100	100	100	100	100	82	61	45	33	25	20	14
	2	100	100	100	100	100	100	92	69	51	38	28	22	15
	1	100	100	100	100	100	100	100	85	63	46	35	27	19

表格列出了每个系列所允许的最大曝光次数。
 后续系列之间的最短冷却时间为 20 分钟。
 负载数据请参考 IEC 60613。

负载数据：系列额定负载

焦点: 0.6										低速旋转
占空系数	单次放射照相的曝光时间 [ms]									
	U/kV	40	50	60	70	80	90	100	125	150
75 (25 ms * 3 Hz)	P/kW	8,2	13,9	15,3	15,3	15,3	15,3	15,3	15,3	15,3
150 (10 ms * 15 Hz)	P/kW	8,2	13,9	14,8	14,8	14,8	14,8	14,8	14,8	14,8
300 (20 ms * 15 Hz)	P/kW	8,2	13,9	13,9	13,9	13,9	13,9	13,9	13,9	13,9
450 (150 ms * 3 Hz)	P/kW	8,2	13,1	13,1	13,1	13,1	13,1	13,1	13,1	13,1

焦点: 1.2										低速旋转
占空系数	单次放射照相的曝光时间 [ms]									
	U/kV	40	50	60	70	80	90	100	125	150
75 (25 ms * 3 Hz)	P/kW	24	41	48	48	48	48	48	48	48
150 (10 ms * 15 Hz)	P/kW	24	41	45	45	45	45	45	45	45
300 (20 ms * 15 Hz)	P/kW	24	39	39	39	39	39	39	39	39
450 (150 ms * 3 Hz)	P/kW	24	33	33	33	33	33	33	33	33

基于 Velara 系列发生器以及 250 W 的等效阳极输入功率。
运行时间为 5 秒。后续系列之间的最短冷却时间为 20 分钟。

负载数据请参考 IEC 60613。

负载数据：系列额定负载

X 射线管长调节 / 重新格式化程序



LTC 期间释放辐射会出现危险。

- 遵守辐射防护法规。

若不按照本说明操作，则可能会导致死亡或严重伤害。

- 对每个新连接的 X 射线管组件执行 LTC。
- 遵守两次曝光之间的间隔时间。
- 使用手表监视时间间隔。
- 仅使用大焦点执行 LTC。

如果运行间隔时间超过 3 个月，则必须使用下表中给出的指定 kV 和 mAs 值完成暴露系列。

发生器必须处于“准备就绪”状态，即，桌面上的绿色 LED 必须亮起。请注意，要满足“准备就绪”状态条件。

每个曝光序列必须始终在各自的选定 kV 级别执行，无需重复执行 X 射线管的启动程序。在整个曝光序列期间，必须保持按下“PREP”按钮。

调节过程

- 1. 打开系统。
- 2. 选择 X 射线管的大焦点。
- 3. 选择双按钮技术 “kV-mAs”。
在系统中选择与第一个曝光序列相对应的 kV-mAs 值。
请参见 X 射线管技术说明书中的表。

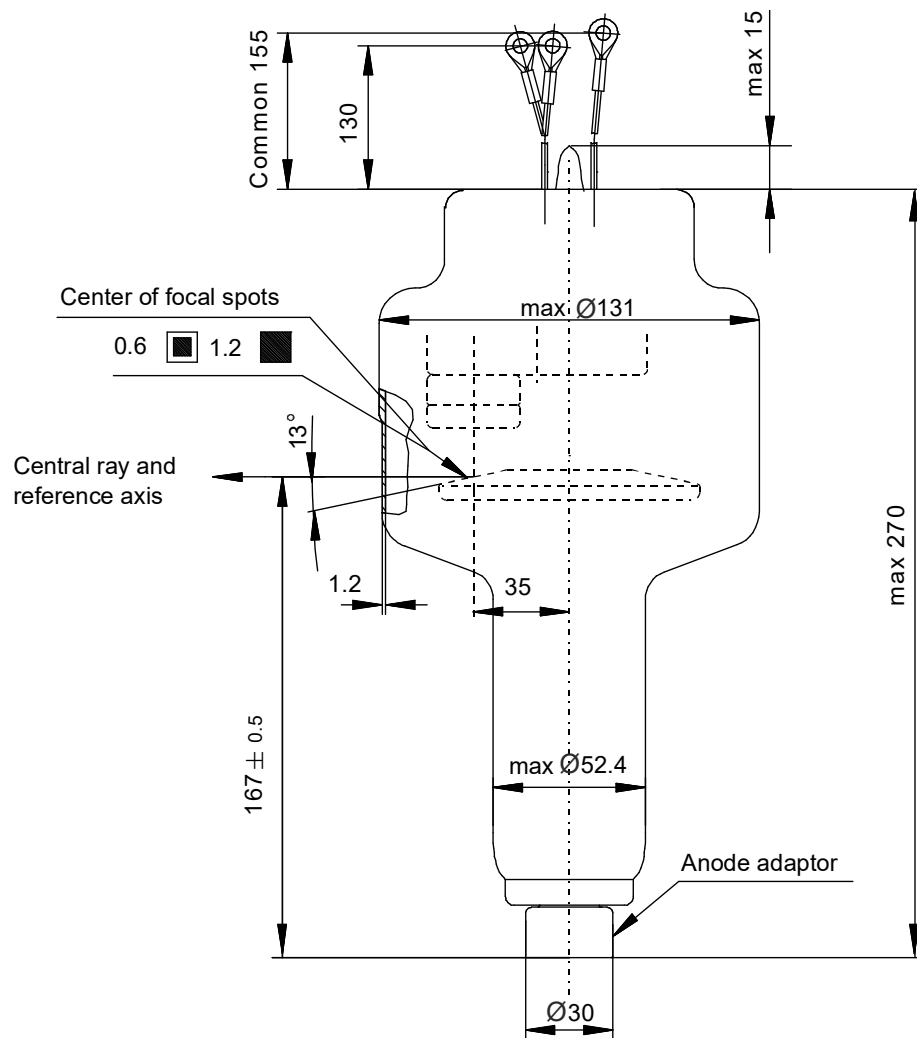
*) 给出的数值取决于发生器。它们可能略有不同。
- 4. 释放曝光序列。参见下表。

如果在调节过程中发生电气干扰，请遵循以下步骤：

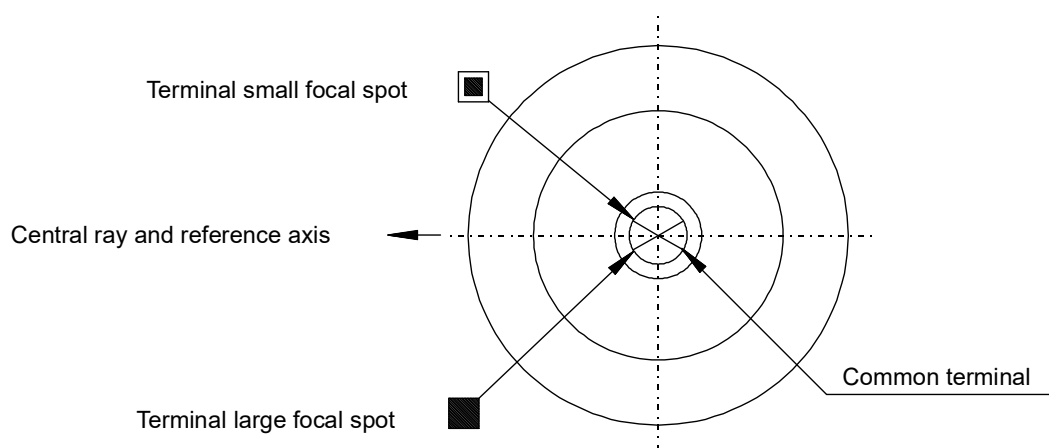
- 间隔 5 分钟后，继续执行该程序。
- 在较低的 kV 级别重新启动该程序。

曝光 顺序	每序列曝光 数	X 射线管 电压 [kV] *	电流时间 积 [mAs]	序列中两次曝 光之间的间隔 时间 [s]	两个序列之 间的间隔时 间 [s]
1	5	81	125	1	
					30
2	3	102	125	1	
					30
3	2	117	125	1	
					60
4	2	141	125	1	
					≥ 120

X射线管长调节曝光系列



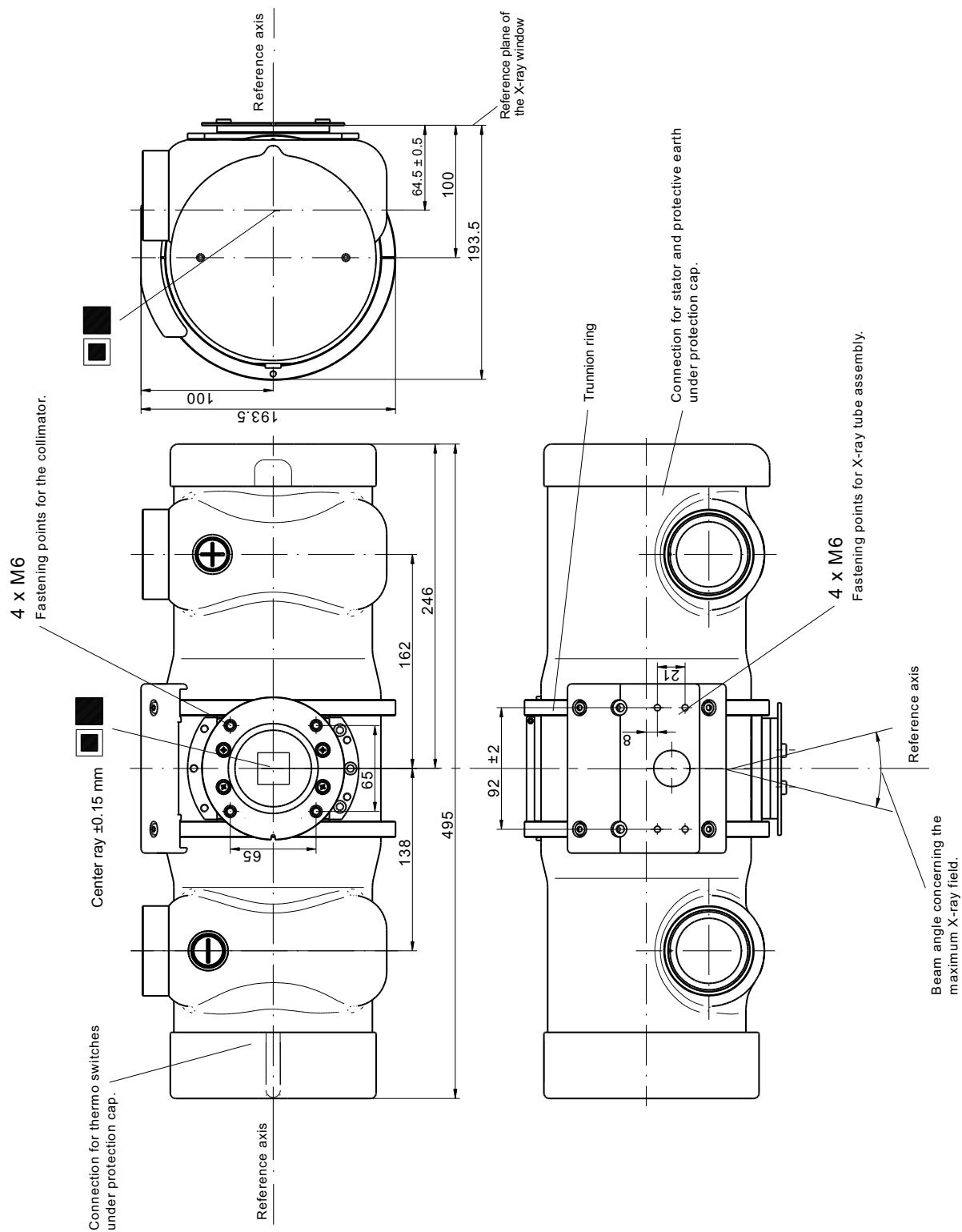
View spots position



CMT TD 057

X 射线管的机械尺寸

Designation English	名称（中文）
Common 155	公共端 155
Center of focal spots	焦点中心
Central ray and reference axis	中心射线和参考轴线
Anode adapter	阳极适配器
View spots position	视点位置
Terminal small focal spot	小焦点端子
Terminal large focal spot	大焦点端子
Common terminal	公共端

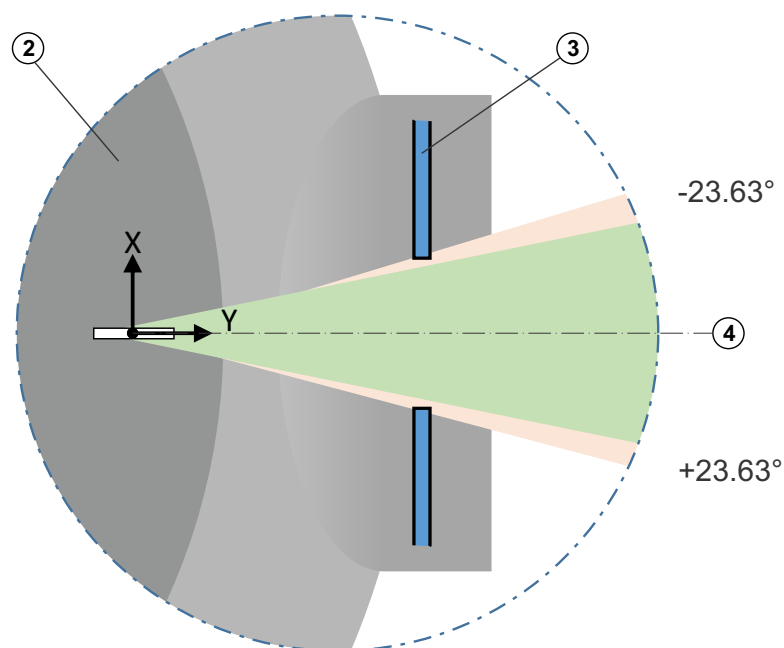
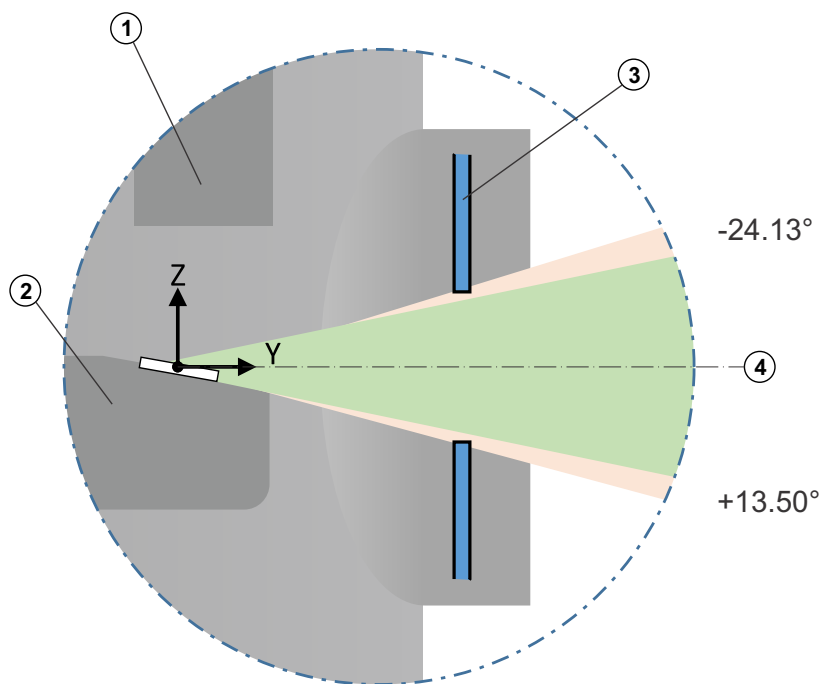


CMT TD 073

X 射线管组件的机械尺寸

Designation English	名称（中文）
Connection for the thermo switches under protection cap	保护盖下热开关的连接
Center ray ± 0.15 mm	中心射线 ± 0.15 mm
Fastening points for collimator	准直器的固定点
Reference axis	参考轴线
Trunnion ring	耳轴环
Reference plane of the X-ray window	X 射线窗口的基准平面
Connection for the stator and protective earth under protection cap	保护盖下定子和保护接地的连接
Fastening points for X-ray tube assembly	X 射线管组件的固定点
Beam angle concerning the maximum X-ray field	最大 X 射线照射野的射束角度

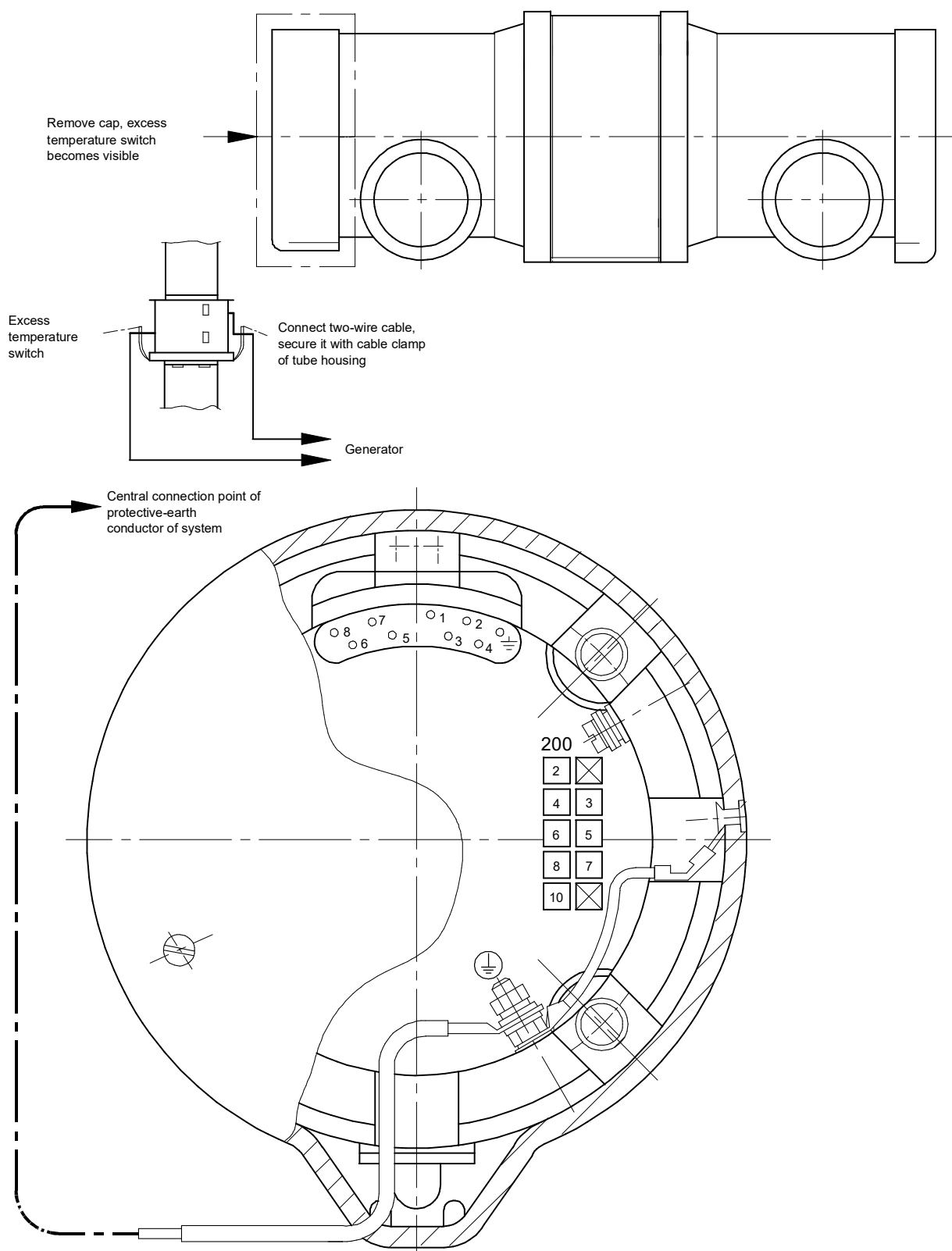
X 射线管组件的机械尺寸



项目	名称
1	阴极
2	阳极
3	X 射线窗口
4	参考轴线

CMT TD 915/916

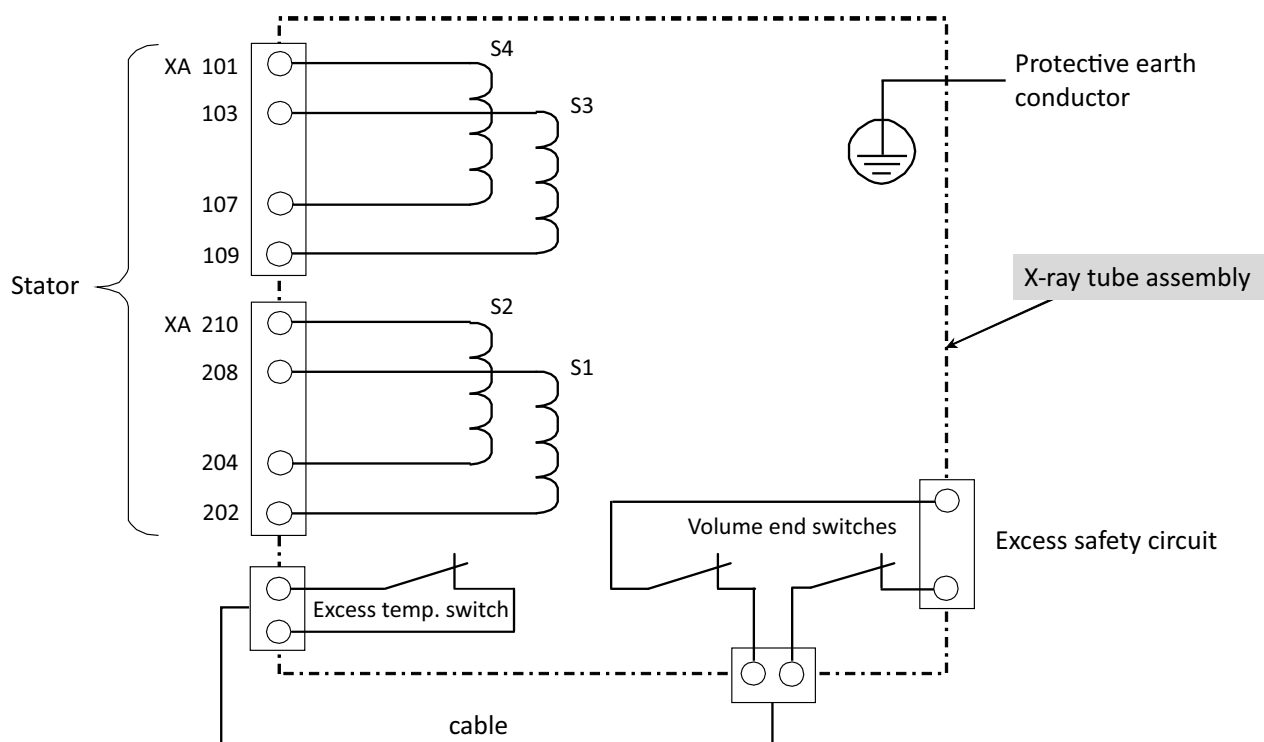
射束界限的最大扇形射束角度



CMT TD 072

电气连接

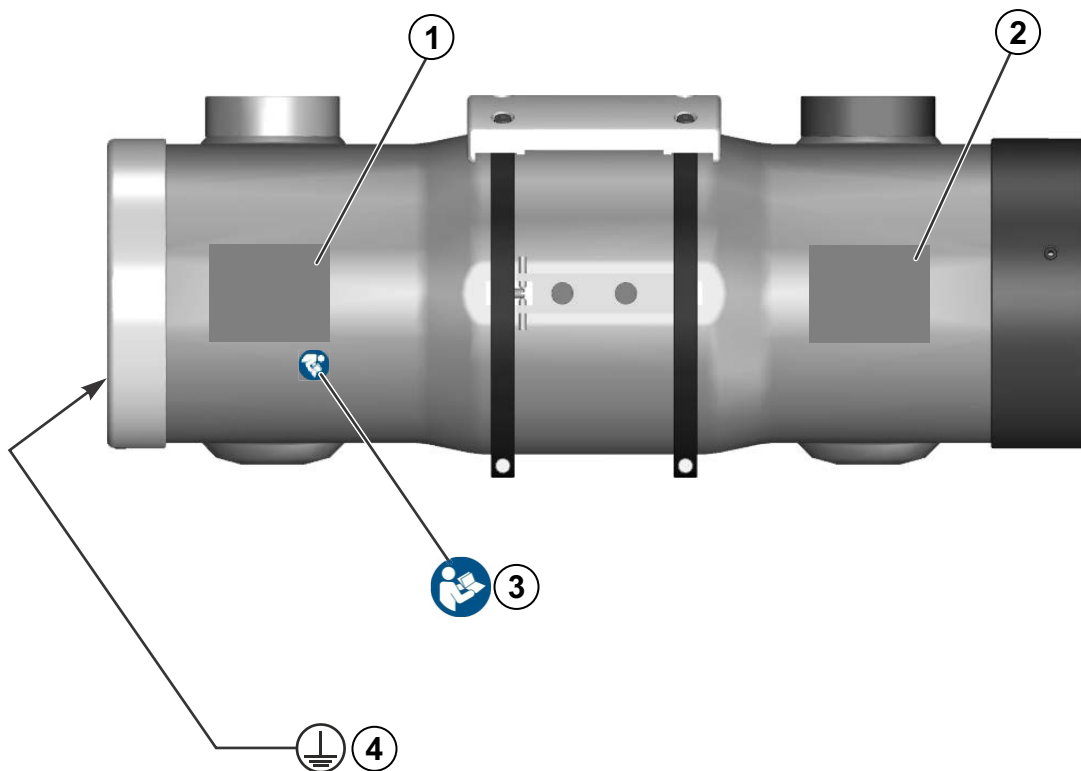
Designation English	名称（中文）
Remove cap, excess temperature switch becomes visible	取下保护盖，可看到过温保护开关
Excess temperature switch	过温保护开关
Connect two-wire cable, secure it with cable clamp of tube housing	连接双芯电缆，用射线管外壳的电缆夹固定
Generator	发生器
Central connection point of protective-earth conductor of system	系统保护接地导体的中心连接点



Designation English	名称 (中文)
Stator	定子
cable	电缆
Excess safety circuit	额外的安全电路
X-ray tube assembly	X 射线管组件
Protective earth conductor	保护接地导体
Excess temp. switch	过温保护开关
Volume end switches	容积停止开关

CMT TD 925

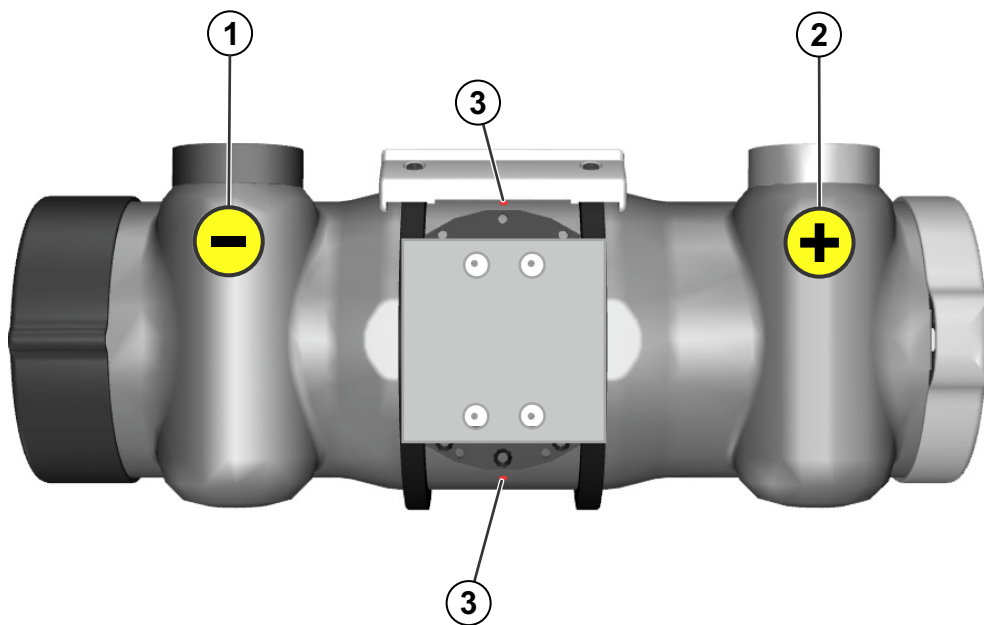
电气连接



项目	名称
1	识别标签
2	适用于中国的合规性标签
3	安全标签：请阅读随机文件。
4	安全标签：保护接地端子。在端盖下

CMT TD 648_1

X 射线管组件的标签



项目	名称
1	阴极标签
2	阳极标签
3	表示焦点位置的冲孔标记

CMT TD 648_2

X 射线管组件的标签