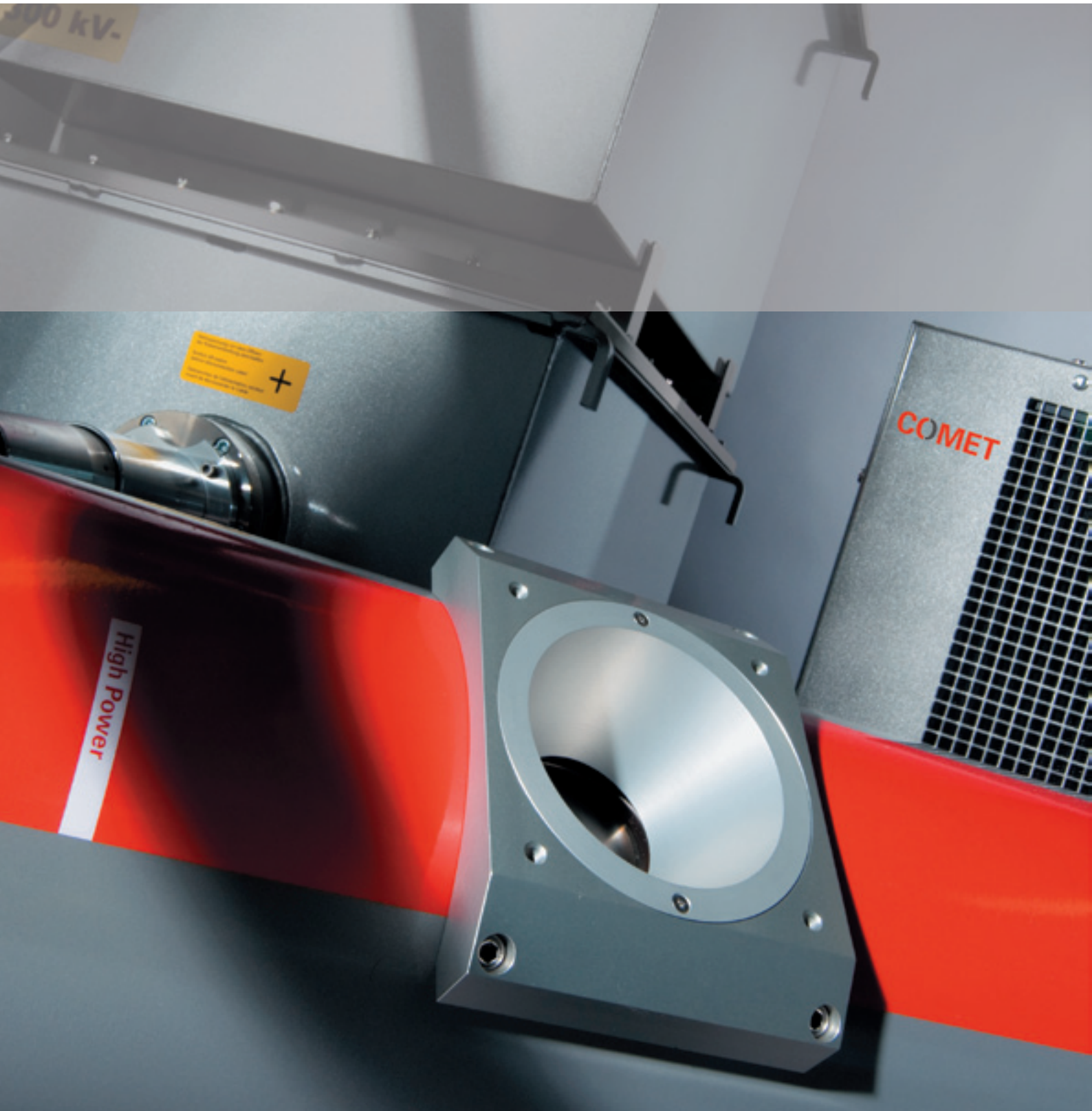


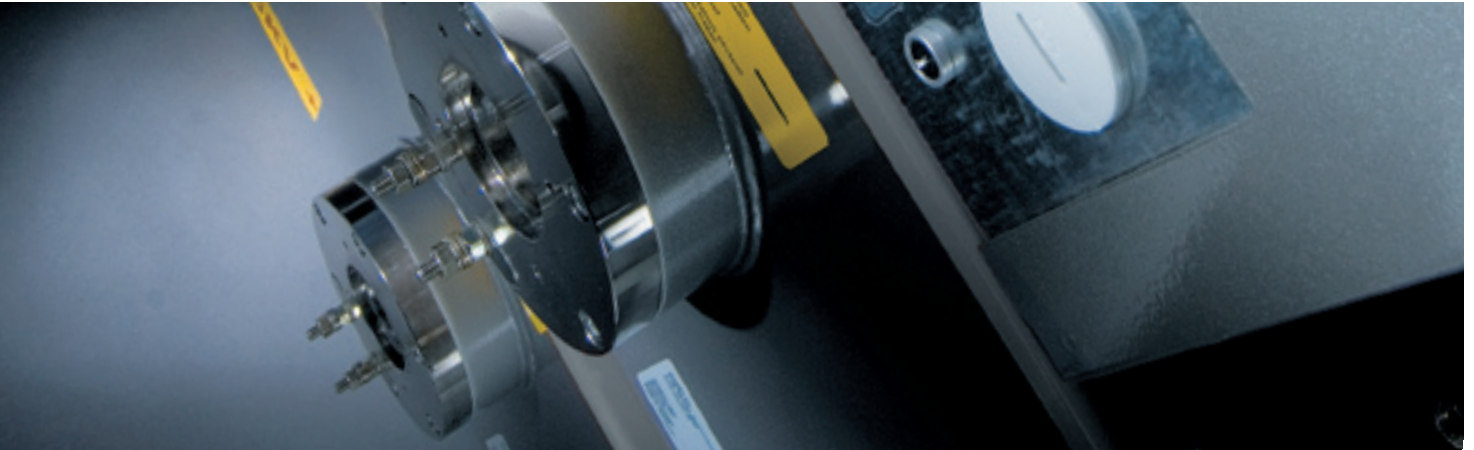
High Power Tubes

Industrial X-Ray

Overview







High Power HP Technology for X-Ray Tubes

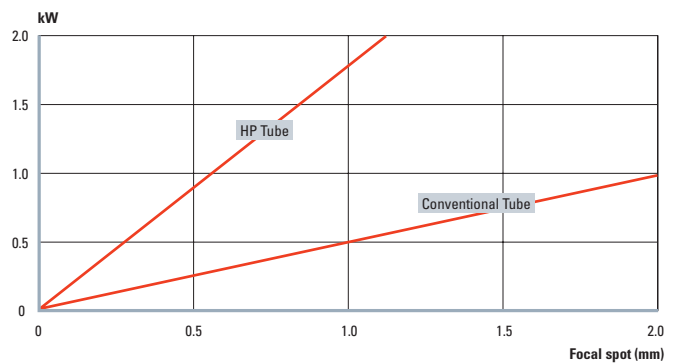
Since the invention of the X-Ray tube in 1895, the ratio between focal spot size and power has not improved significantly.

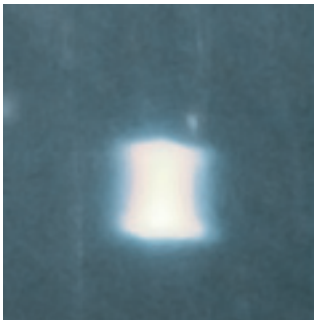
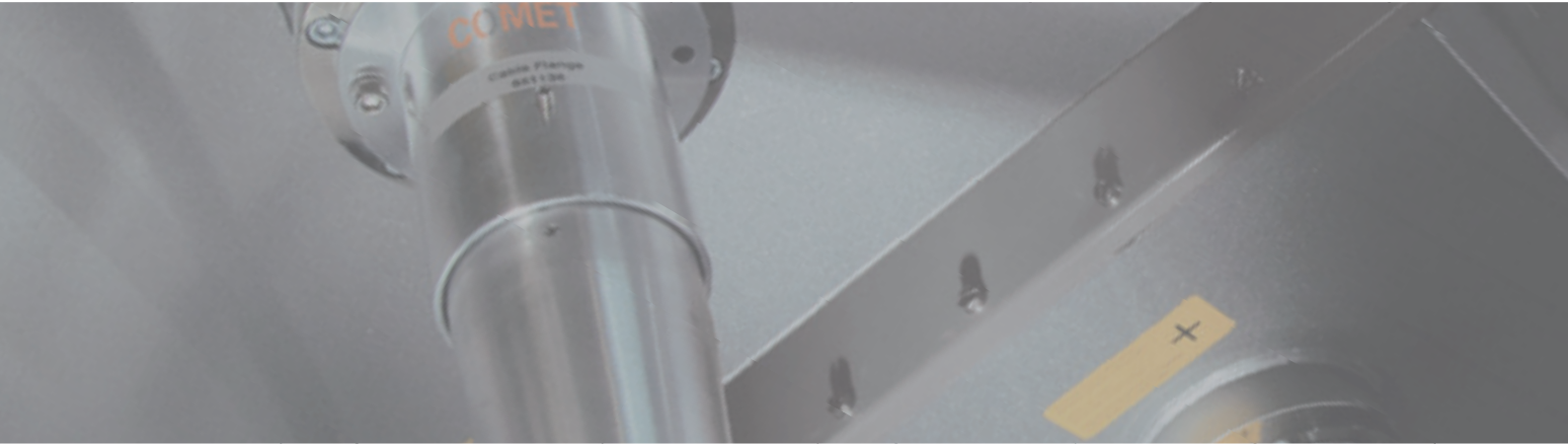
COMET AG has achieved a breakthrough in this historical relation with its new High Power (HP) technology. The HP family of X-Ray tubes has nearly doubled the power density of the conventional fixed-anode X-Ray tube.

The Benefit of the HP Innovation

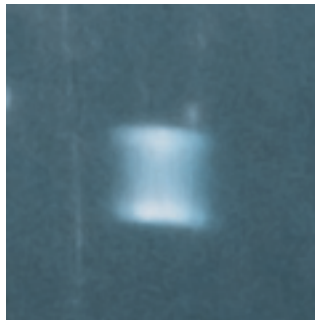
- Higher power with the same focal spot size. With higher power, shorter exposure times are possible. The result is higher throughput through the inspection process.
- Smaller focal spot at the same power. Previously, when striving for finer resolution, the customer had to sacrifice power (and thus throughput) to achieve a smaller focal spot. You must no longer suffer this compromise.
- Longer tube life. The lower Anode temperature results in less thermal stress and leads to a longer tube life.

Power/Focal Spot Ratio





1 mm focal spot of a conventional MXR-160/20. At 640 W (maximum power) the temperature reaches 1500 °C.



1 mm focal spot of the HP tube MXR-160HP/20, same focal spot size, same power, but with 900 °C, a significantly lower temperature. The power can be increased to 1000 W before the temperature reaches 1500 °C.

The Demanding Challenge to Increase the Power Density of an X-Ray Tube

X-Ray tubes operate in extreme conditions:

- Ultra high vacuum technology (10⁻⁹ mbar)
- Temperatures up to 1500 °C
- Rough environment
- Expectations to live more than 10 years

To make an X-Ray tube more efficient, one must go to work on the focal spot, the very small place where the electron beam strikes the heavy-metal target and produces X-Rays. The power dissipation by a standard X-Ray tube is approx 300 W/mm². With our revolutionary new construction of the anode we reach 600 W/mm². This success of COMET's development team was the result of the convergence of unconventional thinking, the use of the latest simulation techniques and more than 50 years of experience in the construction of X-Ray tubes.



What Are the Trends?

In the coming years, digital detectors will increasingly replace traditional X-Ray techniques such as film and image intensifiers. The consumer's demand for cost-effective products dictates that everything must be more efficient. Productivity must be increased. Cycle times must be shorter. With digital detectors, already flux-starved imaging chains will be at their limits just to produce adequate pictures.

The public's increasing demand for safer products will push manufacturers to find even smaller defects, thus increasing the need for high-resolution X-Ray inspection.

Our Response

To meet the challenges evoked by these trends, COMET invented the HP technology and thereby revolutionized the X-Ray industry.

Smaller focal spots with more power enable our customers to develop "best in class" solutions.

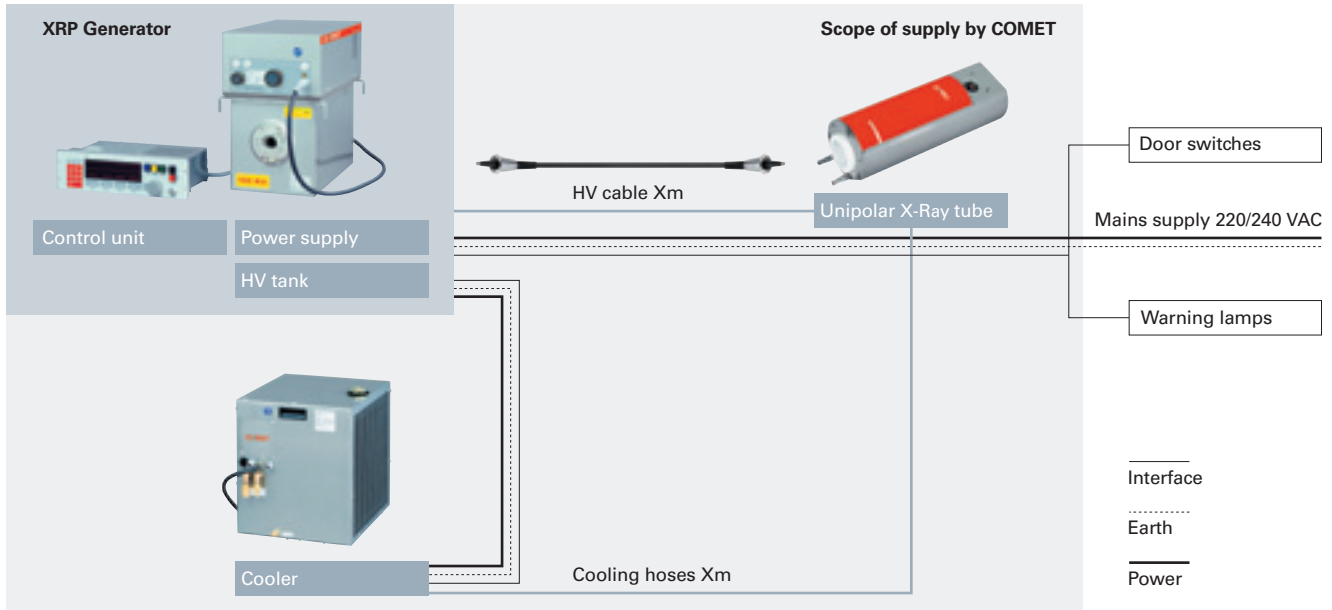
Today, COMET offers a broad portfolio of tubes based on HP technology in the range from 160 kV to 800 kV.

About the Business Unit Industrial X-Ray

COMET Industrial X-Ray is an experienced supplier of components and modules for industrial X-Ray applications and is proud of its reputation as the preferred engineering partner in terms of innovation potential, know how, flexibility and speed. Our product range features X-Ray tubes and sources with small focal spot resolution ($< 1 \mu\text{m}$) up to 6 kW in output for more power demanding requirements: from the smallest footprint for use in portable units to 800 kV fixed gantry systems that are suitable for cargo screening.

Unipolar X-Ray Source

Diagram of a Unipolar X-Ray Source XRS and its environment.



“One Stop Shop” for Industrial X-Ray Sources: COMET’s XRS Modules

COMET is pleased to offer all of the necessary components for a customized X-Ray Source: The new XRS modules each contain a COMET X-Ray tube, high voltage generator with cables and coolers designed for easy

integration that will optimize system performance. All XRS modules are factory prepared and tested for hassle free installation and operation.

This novel solution demonstrates COMET’s continuous commitment and investment in delivering real added value to our worldwide customer base.

High Power Tubes – Configuration Information (examples)

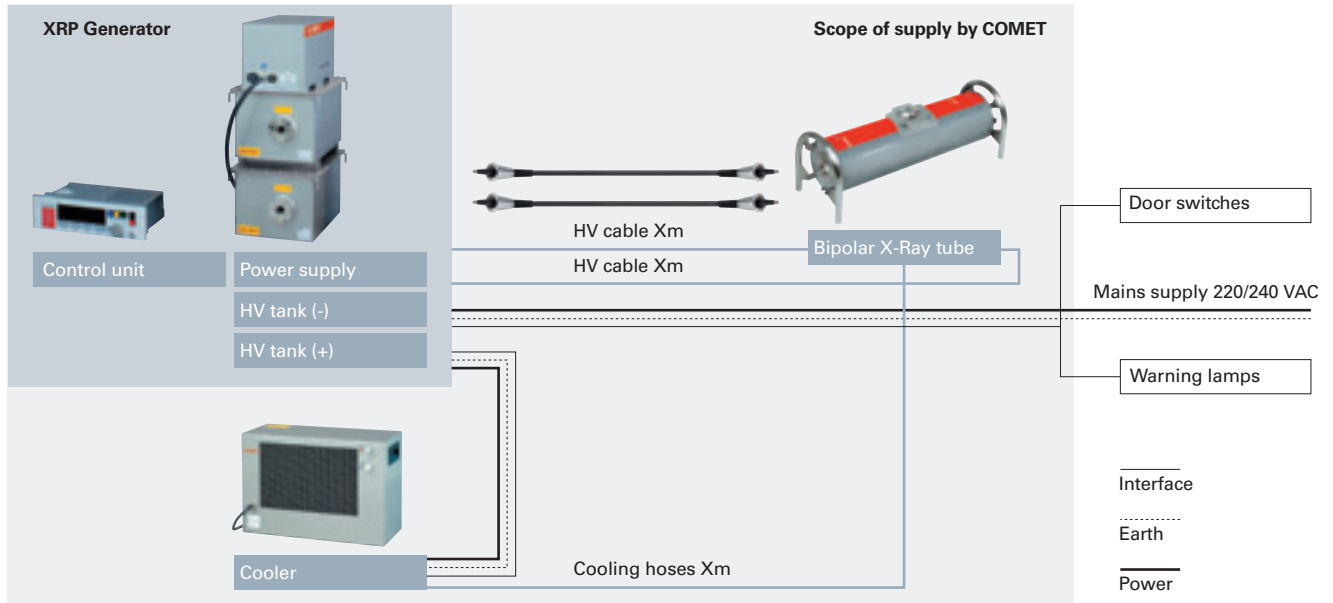
Overview of tubes and fitting module components; high voltage generator, high voltage cable and cooler.

TUBE

Type	Ordering No.	Ordering No. with 90° housing	Nominal tube voltage	Continuous rating	Focal spot acc. EN 12543	Terminal type
MXR-75HP/20	915376.51	–	75 kV	1000W	d=1.0mm	CA11
MXR-160HP/11	915370.51	–	160 kV	800W/1800W	d=0.4 mm/d=1.0 mm	R24
MXR-160HP/FB	915359.51	–	160 kV	1000 W	d=1.0 mm	R24
MXR-160HP/20	915357.51	–	160 kV	1000W/1000W	d=1.0 mm/d=1.0 mm	R24
MXR-225HP/11	915371.51	–	225 kV	800 W /1800 W	d=0.4 mm/d=1.0 mm	R24
MXR-320HP/11	915368.51	–	320 kV	800W/1800W	d=0.4 mm/d=1.0 mm	R24
MXR-451HP/11	915369.51	–	450 kV	700W/1500W	d=0.4 mm/d=1.0 mm	R28
MXC-451HP/11	915705.51	–	450 kV	700W/1500W	d=0.4 mm/d=1.0 mm	R28
MXR-600HP/11	915378.51	–	600 kV	700W/1500W	d=0.4 mm/d=1.0 mm	R30

Bipolar X-Ray Source

Diagram of a Bipolar X-Ray Source XRS and its environment.



GENERATOR		HIGH VOLTAGE CABLE	COOLER	
Type	Ordering No.	Type/Xm	Type	Ordering No.
XRP-75/1000/1	20032831	L3/75-CA11-CA11-Xm	XRC-1001-WA	20033773
XRP-160/2250/2	10008863	N3/160-R24SL-R24SL-Xm	XRC-3001-WA	10008640
XRP-160/4500/2	10006465		XRC-3001-WW	10008641
XRP-160/4500/2	10006465	N3/160-R24SL-R24SL-Xm	XRC-3001-WA	10008641
XRP-160/2250/2	10008863	N3/160-R24SL-R24SL-Xm	XRC-3001-WA	10008640
XRP-225/2250/2	10008864	P3/250-R24SL-R28SL-Xm	XRC-3001-WA	10008640
			XRC-3001-WW	10008641
XRP-320/4500/2	10006467	N3/160-R24SL-R24SL-Xm	XRC-4501-OW	10008643
			XRC-4501-OA	10008642
XRP-450/4500/2	10006468	P3/250-R28SL-R28SL-Xm	XRC-4501-OW	10008643
			XRC-4501-OA	10008642
XRP-450/4500/2	10006468	P3/250-R28SL-R28SL-Xm	XRC-4501-OW	10008643
			XRC-4501-OA	10008642
XRP-600/4500/2	20039607	F3/300-R30-R30-5m	XRC-4501-OA	10008642



MXR-75HP/20

Ordering No.	915377.51
Ordering No. with 90° housing	–
Nominal tube voltage	75kV
Continuous rating	1000W
Focal spot acc. EN 12543	d = 1mm
Former focal spot disgn.	–
Filament current, max.	3.7 A
Filament voltage, typical	2.8 V
Inherent filtration	0.8 mm Be
Target material	W
Target angle	20°
Radiation coverage	40° x 40°
Leakage radiation, max.	1.5 mSv/h
Cooling medium	Water
Cooling medium flow, min	4 l/min
Anode temperature, max.	–
Temperature at inlet, max.	40 °C
Weight	2.1 kg
Terminal type	CA11
Mounting flange	10001711
Locking device	940303



MXR-160HP/11

Ordering No.	915370.51
Ordering No. with 90° housing	–
Nominal tube voltage	160 kV
Continuous rating	800 W / 1800 W
Focal spot acc. EN 12543	d = 0.4 mm* / d = 1.0 mm
Former focal spot disgn.	–
Filament current, max.	4.1 A / 4.1 A
Filament voltage, typical	2.9 V / 7.3 V
Inherent filtration	0.8 mm Be
Target material	W
Target angle	11°
Radiation coverage	40° x 30°
Leakage radiation, max.	2.5 mSv/h
Cooling medium	Water
Cooling medium flow, min	4 l/min
Anode temperature, max.	–
Temperature at inlet, max.	35 °C
Weight	8 kg
Terminal type	R24
Mounting flange	10001756
Locking device	941002

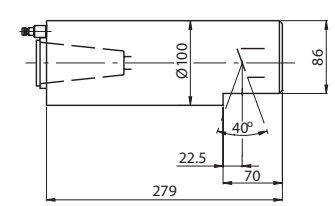
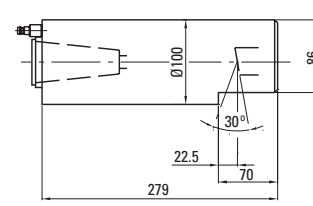
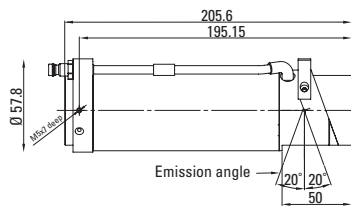
*Threshold: 30 %



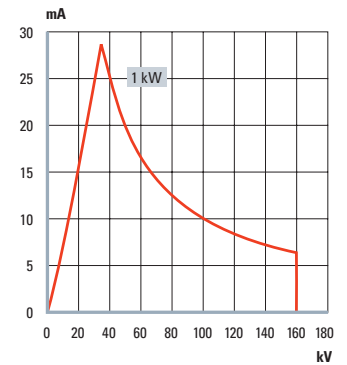
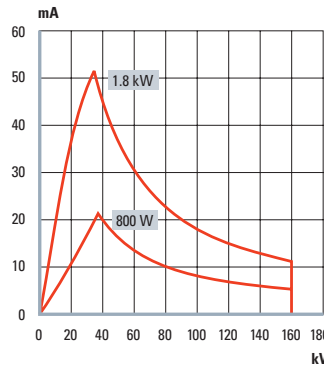
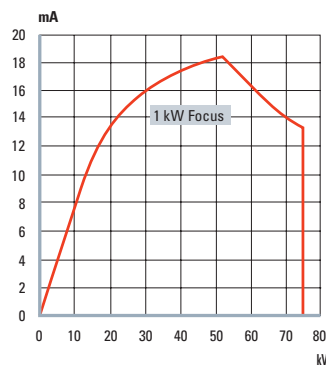
MXR-160HP/20

Ordering No.	915357.51
Ordering No. with 90° housing	–
Nominal tube voltage	160 kV
Continuous rating	1000 W / 1000 W
Focal spot acc. EN 12543	d = 1.0 mm / d = 1.0 mm
Former focal spot disgn.	0.4 / 0.4
Filament current, max.	4.1 A / 4.1 A
Filament voltage, typical	4.2 V / 4.2 V
Inherent filtration	0.8 mm Be
Target material	W
Target angle	20°
Radiation coverage	40°
Leakage radiation, max.	2.5 mSv/h
Cooling medium	Water
Cooling medium flow, min	4 l/min
Anode temperature, max.	–
Temperature at inlet, max.	35 °C
Weight	8 kg
Terminal type	R24
Mounting flange	10001756
Locking device	941002

Outline drawing



Tube diagram





MXR-160HP/FB

915359.51
–
160 kV
1000 W
d = 1.0 mm
–
4.1 A
3.0 V
0.8 mm Be
W
20°
60° x 25°
2.5 mSv/h
Water
4 l/min
–
35°C
8 kg
R24
10001756
941002



MXR-225HP/11

915371.51
–
225 kV
800 W / 1800 W
d = 0.4 mm* / d = 1.0 mm
–
4.1 A / 4.1 A
2.9 V / 7.3 V
0.8 mm Be
W
11°
40° x 30°
5 mSv/h
Water
4 l/min
–
35°C
11 kg
R24
10001756
941002

*Threshold: 30 %



MXR-320HP/11

915368.51
–
320 kV
800 W / 1800 W
d = 0.4 mm* / d = 1.0 mm
–
4.1 A / 4.6 A
2.3 V / 6.8 V
3 mm Be
W
11°
40° x 30°
5 mSv/h
Oil
14 l/min
–
50°C
40 kg
R24
10001711
–

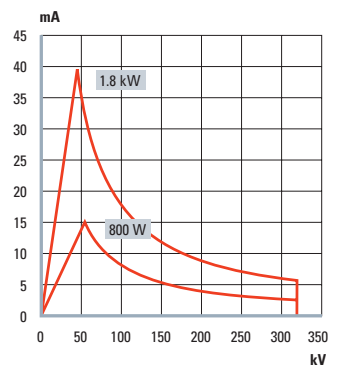
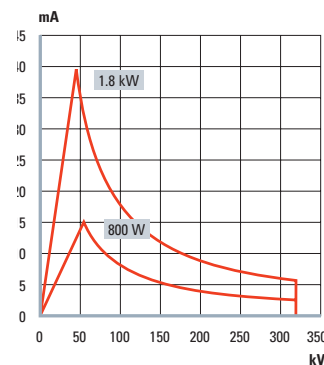
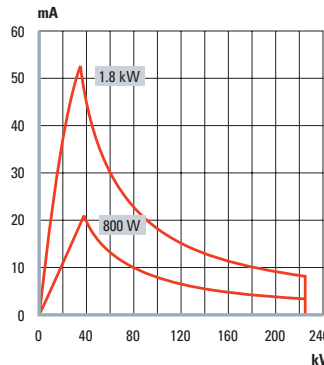
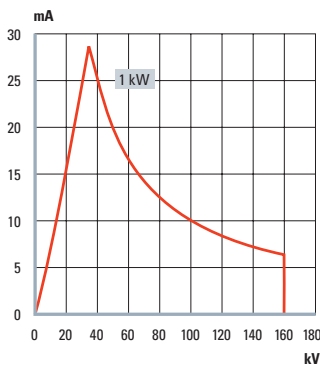
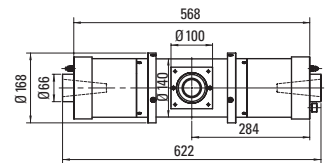
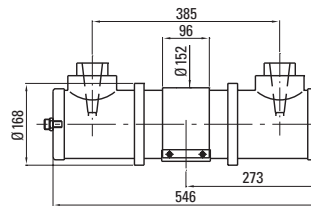
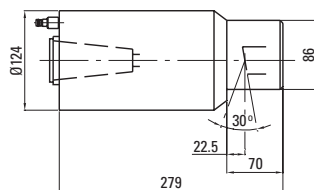
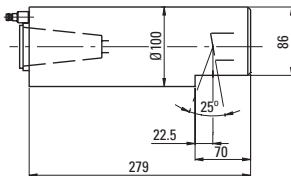
*Threshold: 25 %

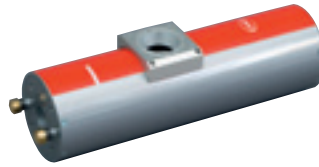


MXR-320HP/11AX

915368.58
–
320 kV
800 W / 1800 W
d = 0.4 mm* / d = 1.0 mm
–
4.1 A / 4.6 A
2.3 V / 6.8 V
3 mm Be
W
11°
40° x 30°
5 mSv/h
Oil
14 l/min
–
50°C
40 kg
R24
10001711
940303

*Threshold: 25 %





MXR-451HP/11

MXC-451HP/11

MXR-600HP/11

Ordering No.	915369.51
Ordering No. with 90° housing	–
Nominal tube voltage	450 kV
Continuous rating	700 W / 1500 W
Focal spot acc. EN 12543	d = 0.4 mm* / d = 1.0 mm
Former focal spot design.	–
Filament current, max.	4.1 A / 4.6 A
Filament voltage, typical	2.3 V / 6.8 V
Inherent filtration	3 mm + 2 mm Be
Target material	W
Target angle	11°
Radiation coverage	40° x 30°
Leakage radiation, max.	5 mSv/h
Cooling medium	Oil
Cooling medium flow, min.	14 l/min
Anode temperature, max.	–
Temperature at inlet, max.	50°C
Weight	95 kg
Terminal type	R28

Ordering No.	915369.51
Ordering No. with 90° housing	–
Nominal tube voltage	450 kV
Continuous rating	700 W / 1500W
Focal spot acc. EN 12543	d=0.4 mm*/ d=1.0 mm
Former focal spot design.	–
Filament current, max.	4.1 A / 4.6A
Filament voltage, typical	2.3V / 6.8V
Inherent filtration	3 mm + 2 mm Be
Target material	W
Target angle	11°
Radiation coverage	40°x 30°
Leakage radiation, max.	5 mSv/h
Cooling medium	Oil
Cooling medium flow, min.	14l/min
Anode temperature, max.	–
Temperature at inlet, max.	50°C
Weight	45 kg
Terminal type	R28

Ordering No.	915378.51
Ordering No. with 90° housing	–
Nominal tube voltage	600 kV
Continuous rating	700 W / 1500W
Focal spot acc. EN 12543	d=0.4 mm*/ d=1.0 mm
Former focal spot design.	–
Filament current, max.	4.1 A / 4.6A
Filament voltage, typical	2.3V / 6.8V
Inherent filtration	3 mm + 2 mm Be
Target material	W
Target angle	11°
Radiation coverage	40° x 30°
Leakage radiation, max.	10 mSv/h
Cooling medium	Oil
Cooling medium flow, min.	14l/min
Anode temperature, max.	–
Temperature at inlet, max.	50°C
Weight	ca. 145 kg
Terminal type	R30

Mounting flange	10001710
Locking device	–

Mounting flange	20032631
Locking device	–

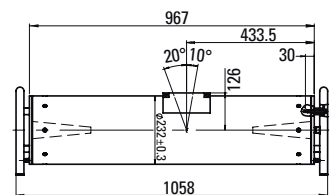
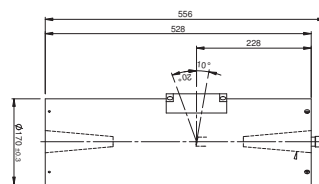
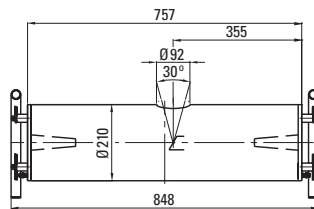
Mounting flange	20038982
Locking device	–

* Threshold: 25 %

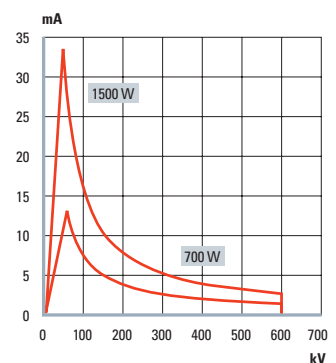
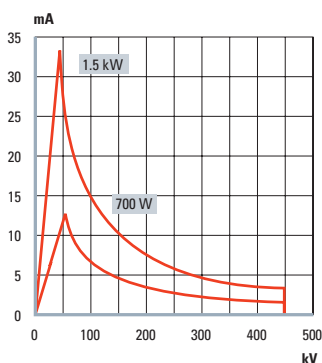
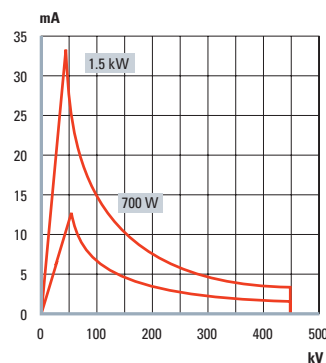
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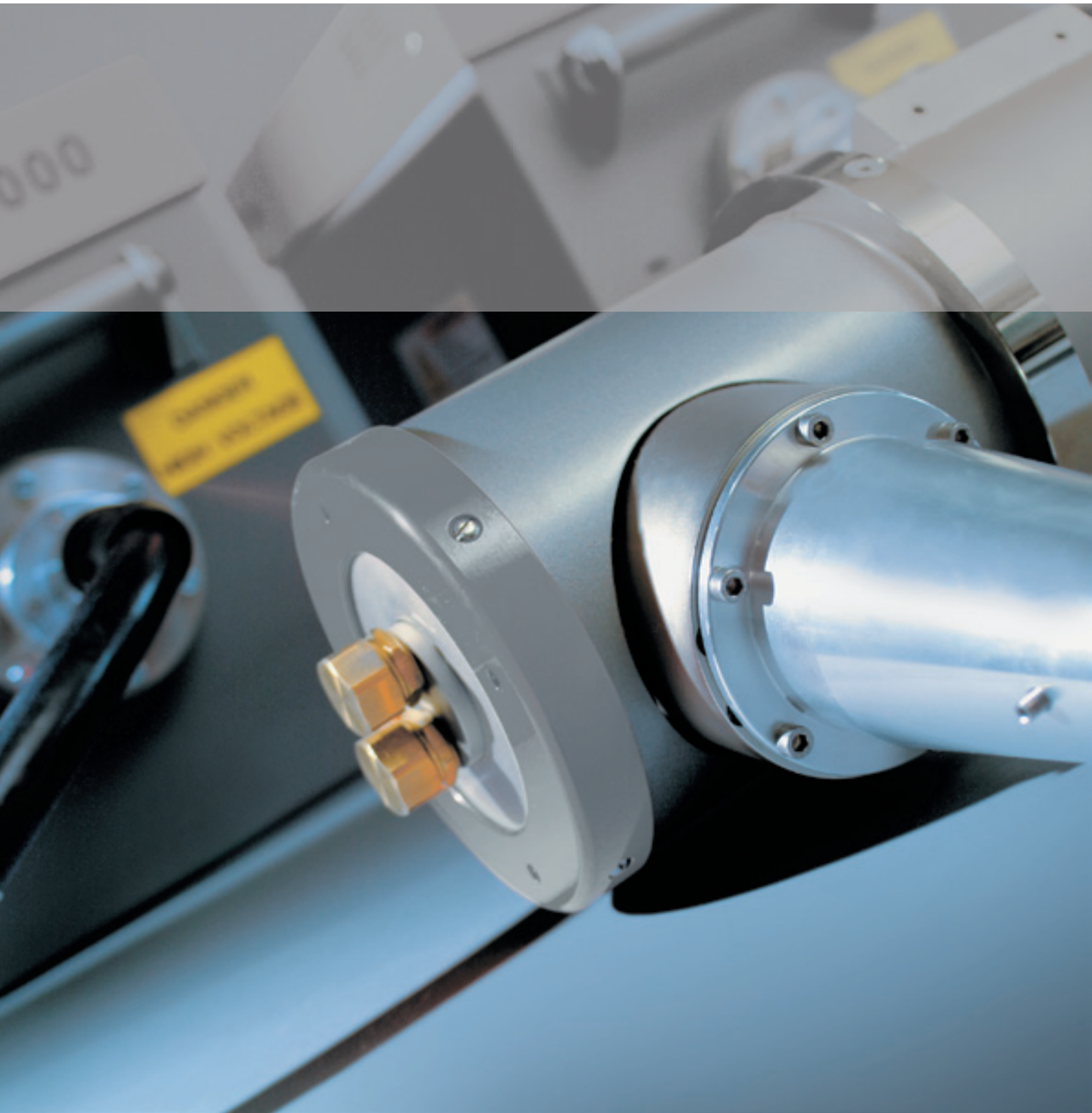
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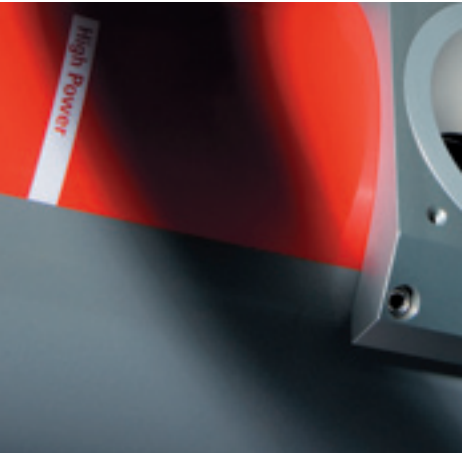
Outline drawing



Tube diagram







12/2010

COMET

Technology with Passion

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