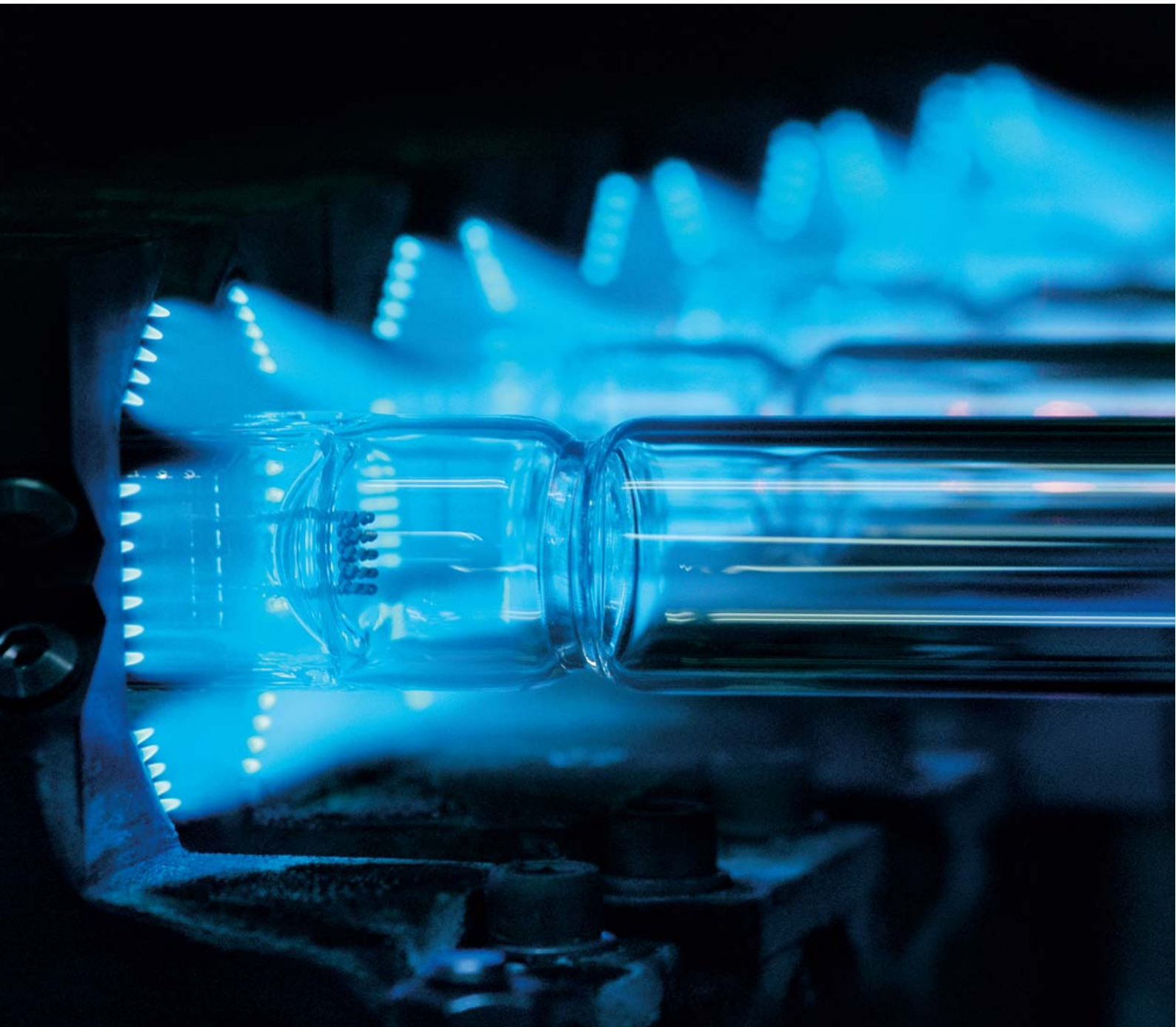


**Ultraviolet Lamps
for Disinfection and Oxidation**

Heraeus Noblelight

A Powerful Partner



Contents

High energy UV light purifies and disinfects water, air and surfaces, long term and reliably. The use of chemicals can be reduced or totally eliminated. All this makes UV disinfection and oxidation one of the most cost-effective and environmentally-friendly processes and one which is increasingly being used in innovative applications.

Heraeus offers

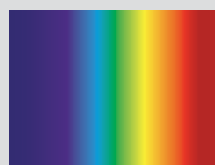
- High power longlife amalgam lamps
- Low pressure lamps
- Medium pressure lamps
- Immersion lamps
- BlueLight disinfection modules for surfaces
- BlueLight Excimer systems
- Lamps for photochemistry and laboratory reactors

Heraeus understands precisely the requirements of system builders and hence can offer lamps which meet these requirements for numerous applications, to improve the performance and efficiency of the equipment. Because: Every Heraeus UV lamp is matched exactly to the equipment and the process – and not vice versa. This saves energy, maintenance and operating costs and improves quality.

Have every confidence in the competence and responsibility of Heraeus personnel and their long years of experience, gained in a host of different applications. Make use of their modern Applications Centre and their accredited Measurement Laboratory.

Heraeus Noblelight – Decades of Experience

The origins of Heraeus Noblelight go back to the year 1899, when, within the Heraeus organisation, high purity quartz glass was first extracted from rock crystal. Shortly after the world's first industrial quartz lamp was developed – which paved the way for today's light source technology. Today, more than 10,600 people are employed by Heraeus worldwide. Heraeus Noblelight develops, manufactures and markets a wide range of infrared and ultraviolet lamps, which find application in all important sectors and areas of industry.



Ultraviolet Light 4



Longlife Amalgam Lamps 6



Low Pressure Lamps 8



Medium Pressure Lamps 10



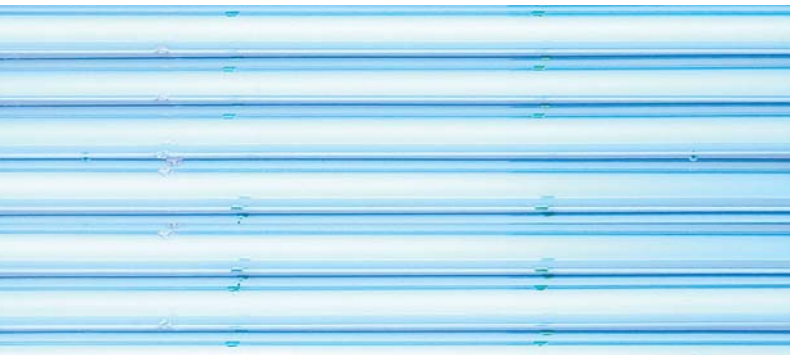
Operationally Ready Solutions for Special Applications 12



Practical Support, Measurement Laboratory and Applications Centre 14

Ultraviolet Light

Effective and Versatile



Ultraviolet light is very flexible in its application, for example in the treatment of water, air or surfaces. This type of disinfection reliably reduces pathogens and the germ count in water – and offers an economical and environmentally friendly alternative to chemical processes. There is no need for the addition of chemicals and there is no detrimental environmental impact as there are no chemical residuals.

Moreover, chlorine-resistant pathogens such as cryptosporidium can be killed with UV light. The benefit: resistance to UV light cannot be built up; the taste, smell or pH value of drinking water is not affected by UV radiation.

Sterilization by disinfection

UV disinfection is effective at wavelengths between 200 and 300 nm. Emitted UV radiation has a powerful bactericidal effect. It is absorbed by the DNA, breaks up its structure and kills living cells. Micro-organisms such as viruses, bacteria, yeasts and fungi are destroyed in seconds with UV radiation.

Low pressure and medium pressure lamps from Heraeus operate in this wavelength range: low pressure lamps emit radiation at a wavelength of 254 nm, while medium pressure lamps deliver a broad band spectrum over the complete range of 200–300 nm.



Purification through Oxidation

Radiation of wavelengths less than 200 nm generates ozone from oxygen in the air. At radiation of 254 nm, ozone is photolysed, such that oxygen radicals and excited oxygen result. In the next stage, harmful substances in water and air are mineralised into unharmed molecules.

Quartz glass Transmissivity Determines Effective Power

UV lamps from Heraeus are manufactured from high quality quartz glass: a material noted for its extremely high mechanical and thermal stability. In addition, quartz glass has a high transmissivity and is highly transparent to UV radiation.

Various types of quartz glass (natural, synthetic or doped) are used for the tubes of UV lamps. This allows controlling specifically the vacuum UV power (VUV) of low pressure lamps at 185 nm:

Ratio of 185 nm radiation output to electrical input power

Tube material	
Synthetic quartz glass	approx. 9%
Natural quartz glass	approx. 5%
Doped quartz glass	0%, Ozone-free

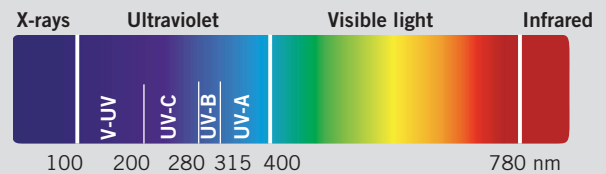


The Best Materials and Technologies

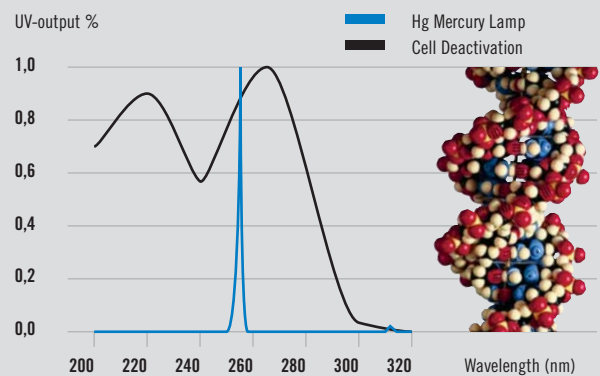
Heraeus Noblelight can call on the high quality quartz glass and precious metals of the Heraeus Group. This ensures the high quality of all Heraeus lamps and enables new developments to satisfy special requirements.

Custom-Built Lamps – Tailored To Your Application

Heraeus Noblelight is your UV specialist with the expertise and experience in all areas relating to disinfection and oxidation of water, air and surfaces: because every different application requires an individually-tailored UV treatment. Radiation spectrum, UV power, tube temperature, illuminated length and geometry are matched in a targeted fashion to the relevant application conditions. The matching of the UV lamp in the best possible way to the power supply equipment ensures the best performance of the total system.

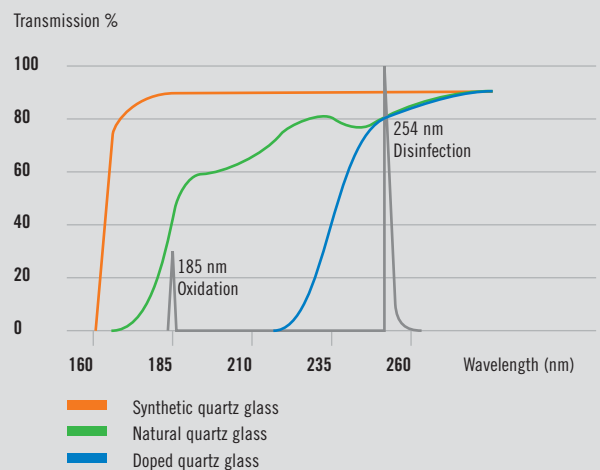


Effective spectrum and spectrum of a low pressure lamp



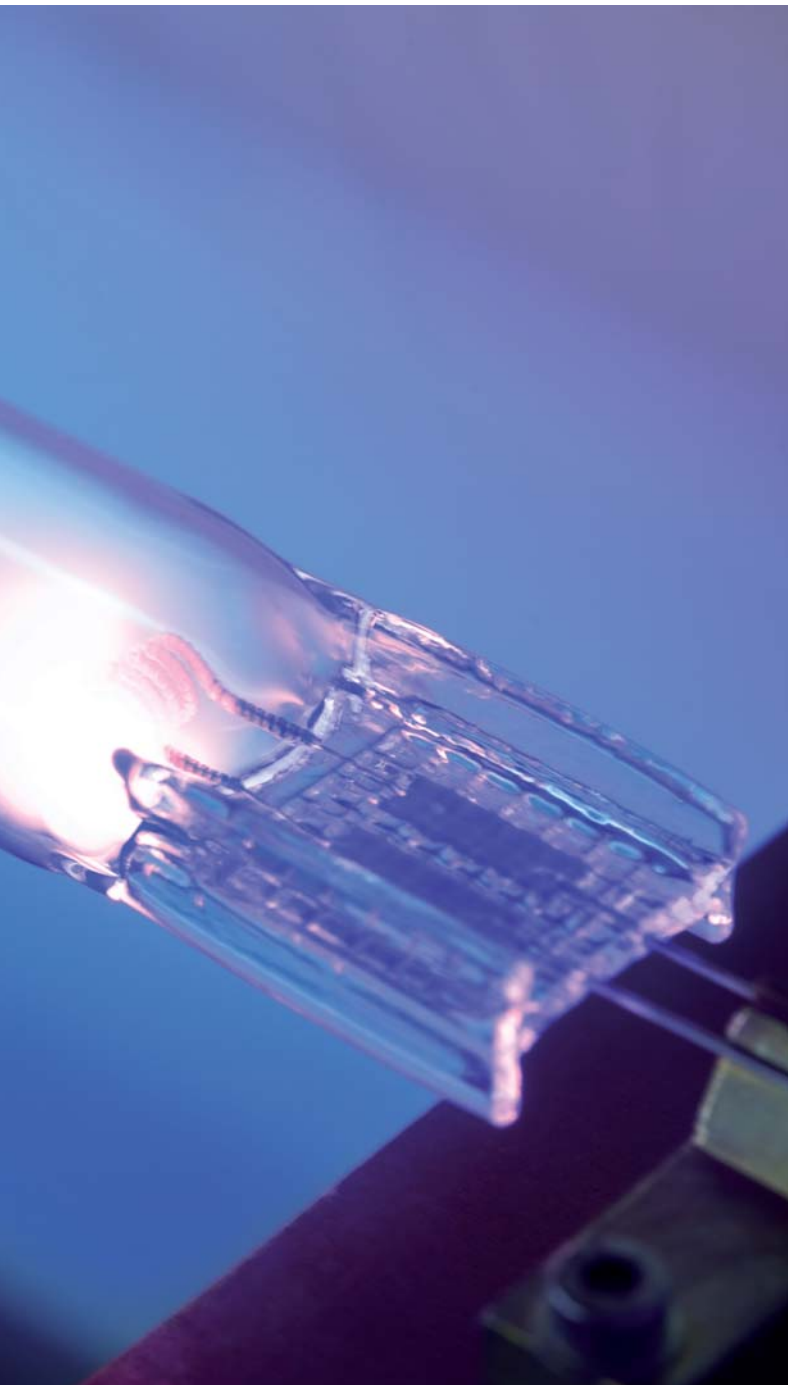
254nm spectrum of a low pressure lamp and the effective spectrum for killing bacteria (e-coli as DIN 1031 Part 10)

Transmissivity of quartz glass



Longlife Amalgam Lamps

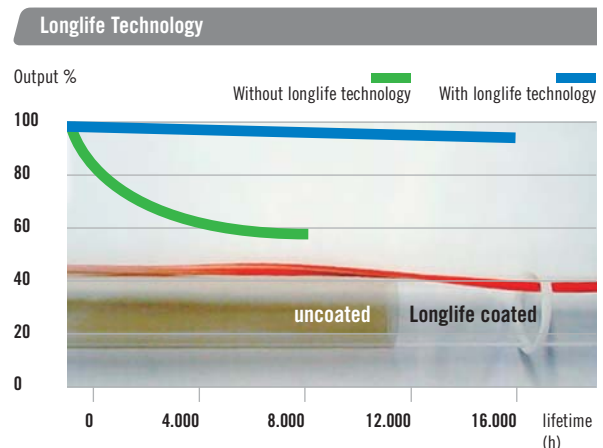
High Power Lamps With Twice The Operating Life



Longlife Amalgam lamps are extremely long life, high power, low pressure lamps. They deliver up to ten times the UV power density of classic mercury low pressure lamps and can be used even at high ambient temperatures of up to 90° Celsius. Moreover, amalgam lamps are insensitive to temperature fluctuations.

In addition, their unique coating ensures that they do not suffer the unwanted transmission loss of quartz glass associated with conventional UV lamps. The result is a virtually constant disinfection action over the total operating life of the lamp. And up to 90 percent of the UVC output power is delivered for up to 16,000 operating hours.

Thanks to their high power and long life, amalgam lamps offer great potential for savings in number of lamps, system components, energy consumption and servicing intervals – while significantly reducing the operating costs of disinfection systems. They save energy, generate only a small amount of heat and can be used as a cost-effective alternative to medium pressure lamps.



Graph of operating life of an uncoated amalgam lamp and a Heraeus amalgam lamp (254nm, 300 W) with Longlife coating.

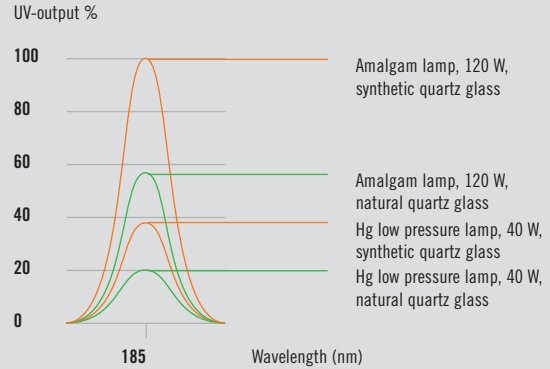
If the lamp tube is made of synthetic glass, VUV radiation is also emitted at a wavelength of 185 nm. This can be increased by a suitable combination of quartz material and lamp technology, so that, with the same lamp dimensions, the VUV output is five times that of a standard low pressure lamp.

Both Types of Lamps at a Glance

- Amalgam lamps up to with ten times the UV power (compared with conventional mercury low pressure lamps of the same length), higher operating temperatures (up to 90° C), a peak spectrum line of 254 nm, ozone-free.
- Amalgam lamps with a synthetic quartz glass tube, peak spectrum lines at 254 nm and 185 nm, ozone-generating.



Power comparisons between UV lamps

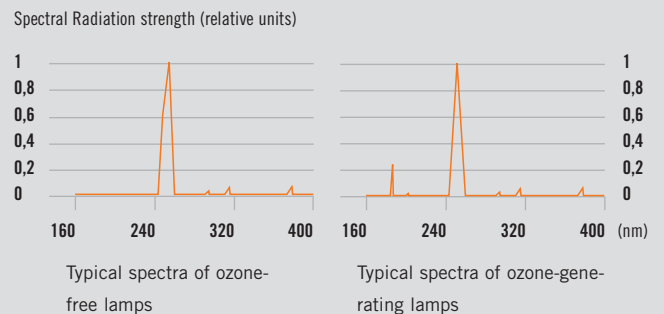


The UV power comparison relates to lamps with the same illuminated length of 800 mm and the same tube diameter of 15 mm

Amalgam Lamps:	Ozone-free	Ozone-generating
Spectrum: wavelength	254 nm	185 nm, 254 nm
Illuminated length	25–150 cm	25–150 cm
Electrical power	50–600 W	50–600 W
Typical UV efficiency at 254 nm	35 %	35 %
Typical efficiency at 185 nm, natural quartz glass	–	approx. 5 %
Typical efficiency at 185 nm, synthetic quartz glass	–	approx. 9 %
Specific UVC flux	0,5–4 W/cm	0,5–4 W/cm
Ambient application temperature	max. 90 °C	max. 90 °C
Operating life*	Up to 16,000 hours with a maximum fall-off of 10–20% UVC intensity	Up to 16,000 hours with a maximum off of 10–20% in UVC intensity

* Depending on the lamp power

Typical Spectra of Amalgam Lamps



Low Pressure Lamps



Classical low pressure UV lamps offer exceptional efficiency. 40% of the electrical power can be used for disinfection as UVC radiation at 254 nm. If synthetic quartz glass is used as the lamp material, UV radiation at 185 nm is also emitted for oxidation processes.

Low pressure UV lamps find particular application in the disinfection of water, air and surfaces in the food and beverage industry and also in waterworks, air conditioning and water sewage treatment plants.

Three types of lamps are available, in different lengths and with various pinches and connectors:

- Classic mercury low pressure lamps having high efficiency, peak spectrum lines at 254 nm and ozone-free.
- Classic mercury low pressure lamps of synthetic or natural quartz glass, peak spectrum lines at 254 and 185 nm, ozone-generating.
- U-shaped lamps, which supply high power in a compact design.



Classic low pressure lamps

	Ozone-free	Ozone-generating
Spectrum: wavelength	254 nm	185 nm, 254 nm
Illuminated length	10–150 cm	10–150 cm
Electrical power	5–80 W	5–80 W
Typical UV efficiency at 254 nm	40 %	40 %
Typical efficiency at 185 nm, natural quartz glass	–	approx. 5 %
Typical efficiency at 185 nm, synthetic quartz glass	–	approx. 9 %
Specific UVC flux	0,2–0,5 W/cm	0,2–0,5 W/cm
Ambient application temperature	max. 40 °C	max. 40 °C
Operating life	Up to 8,000 hours with a maximum fall-off of 50 % in UVC intensity	Up to 8,000 hours with a maximum fall-off of 50 % in UVC intensity

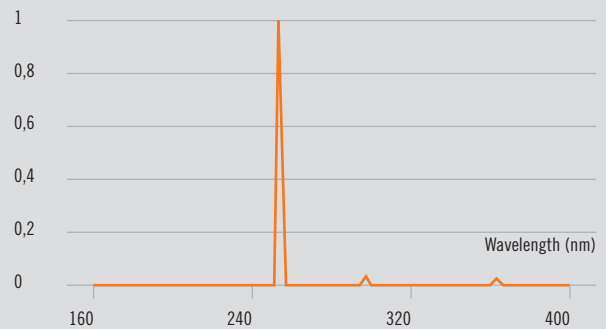
Other lengths can be supplied on request



Low pressure lamps can also be supplied as watertight UV immersion lamps, which can be quickly and easily installed as operationally ready systems for water disinfection.

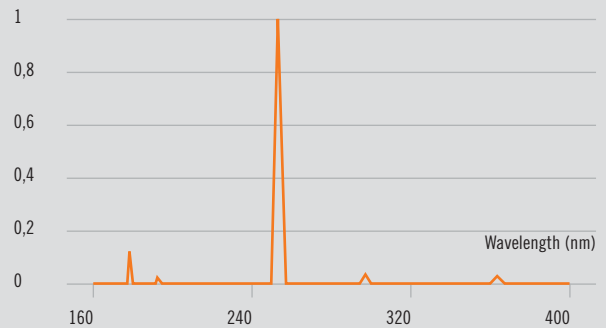
Ozone-free lamps

Spectral radiation strength (relative units)



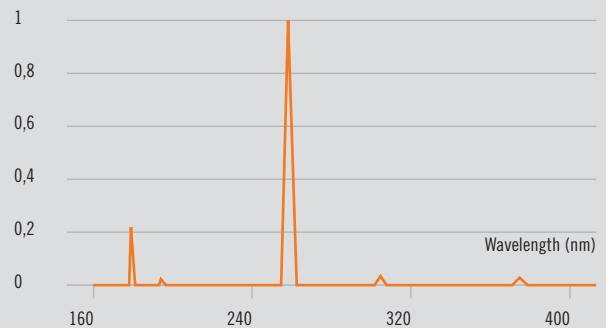
Ozone-generating lamps, natural quartz glass

Spectral radiation strength (relative units)

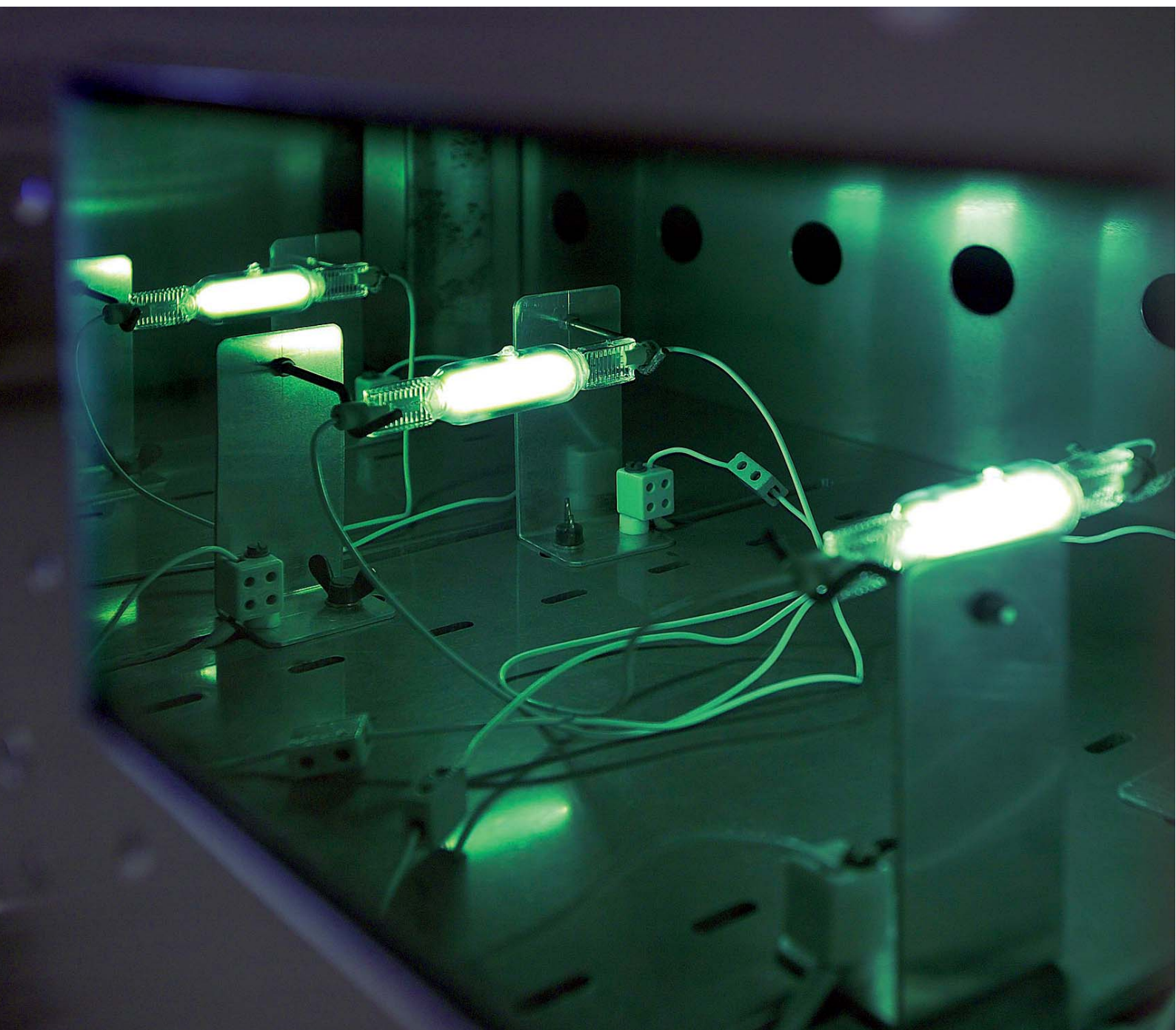


Ozone-generating lamps, synthetic quartz glass

Spectral radiation strength (relative units)



Medium Pressure Lamps



Medium pressure UV lamps have a broad and pronounced peak line spectrum in the ultraviolet and visible light spectral range. They are suitable for UV disinfection and UV oxidation – as well as photochemical processes.

Their high radiation flux allows very good disinfection within a compact design. Consequently, it is possible to build very compact disinfection plants even for handling large flow volumes.

In order to achieve even greater stability under high mechanical stress lamps are also available with a round fusing in the pinch.

Medium pressure lamps find particular application in municipal and industrial plants: wastewater disinfection, compact drinking water treatment plants, photochemistry and activated wet oxidation.

Medium Pressure lamps from Heraeus Noblelight

- DQ lamps: medium pressure UV lamps, with high radiation output in the UVC region and a strong disinfection action.
- QC lamps: medium pressure UV lamps with high UV power in a compact design, high disinfection and oxidation effect.
- The spectra for photochemical applications can be optimised by doping additions.

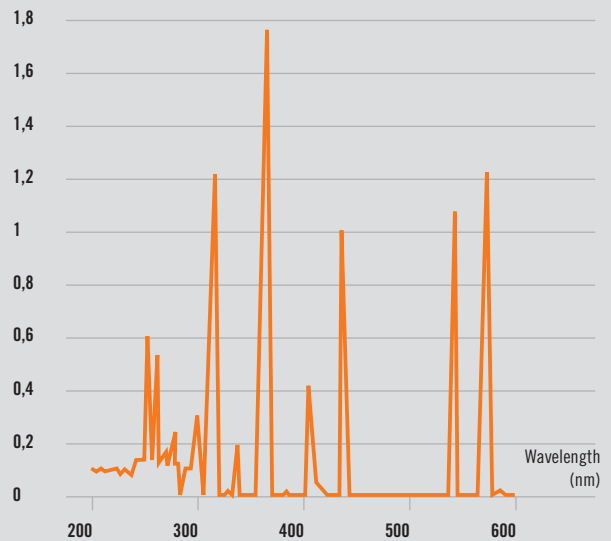


Technical Data – Medium Pressure Lamps

	DQ-Lamps	QC-Lamps
Particularly suitable for	Disinfection	Disinfection and Oxidation
Effective spectral range	200–300 nm	200–300 nm
Specific electrical power	80–120 W/cm	120–250 W/cm
Specific radiation flux UVC	12–18 W/cm	18–40 W/cm
Power range	0,4–10 kW	1–60 kW
Illuminated length dimensions	4–150 cm	7–200 cm
Tube diameter	15–28 mm	19–45 mm
Surface temperature	600–900 °C	800–900 °C
Typical operating life	1.500–5.000 h	1.500–5.000 h

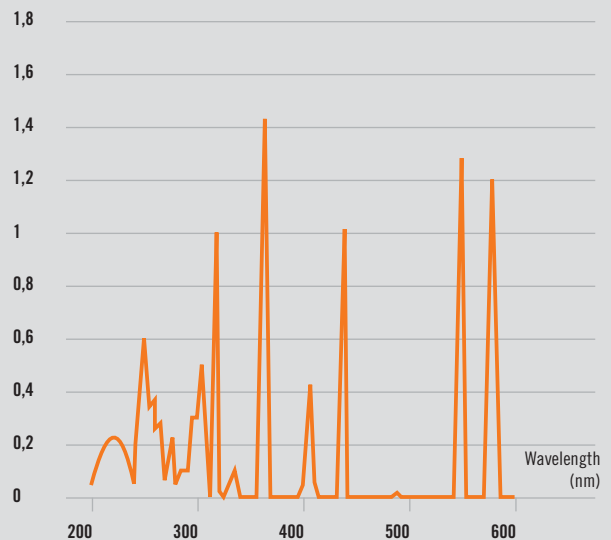
Typical Spectrum of DQ Lamps

Spectral radiation strength (relative units)



Typical Spectrum of QC Lamps

Spectral radiation strength (relative units)



Operationally Ready Solutions For Special Applications

BlueLight® UV Disinfection Systems



BlueLight®

BlueLight modules are operationally ready systems for the disinfection of surfaces. They consist of an air-cooled UV cassette, including electricity supply, and emit an intensive cold UV radiation, which is especially suitable for the disinfection of heat-sensitive packaging materials.

Disinfection using BlueLight UV radiation is an economical solution, requiring very low capital- and operating costs. Thanks to their compact design, they can be easily retrofitted in existing filling and closing machines. If higher UV dosage is required, several UV cassettes can be installed in parallel.

The disinfection action of the BlueLight modules has been certified by the Fraunhofer Institute for Process Engineering and Packaging.



BlueLight Cassette Models

	Number of UV lamps	Window size	Cassette dimensions
NG 5036	2	365 mm x 107 mm	111 mm x 150 mm x 530 mm
NG 6062	2	615 mm x 107 mm	111 mm x 150 mm x 780 mm
NG 7087	2	865 mm x 107 mm	111 mm x 150 mm x 1030 mm
NG 8062.30	8	615 mm x 298 mm	155 mm x 360 mm x 780 mm
NG 10087.38	10	865 mm x 372 mm	171 mm x 434 mm x 1030 mm



Laboratory Reactors

Active environmental protection is an important subject in the chemical industry. UV oxidation is a really important process for destroying organic compounds virtually without residuals. A process which can be easily analysed and optimised in steps in the UV laboratory reactor. Heraeus offers two UV reactors using medium pressure lamps of different power classes. Further possible photochemical applications are: chlorination, vitamin-D-production, photonitrosiation, photoximisation, photo polymerisation.

Excimer Lamps and Modules

BlueLight Excimer Lamps

Excimer systems are mercury-free UV lamps, which deliver UV radiation with a monochromatic characteristic. The narrow band UV radiation in a single spectral line and the capability to choose specific wavelengths allow photo processes to be highly focused and broaden specific application of UV emitters. Moreover, no heat is generated as Excimer UV lamps produce no infrared radiation. Consequently, Excimer lamps find particular application in specific industrial processes and in chemistry, biology and medicine.

High Power Excimer Module with Water Cooling

BlueLight high power Excimer systems with various peak spectral lines can be supplied so that specific systems can be provided to meet specific applications:

BlueLight 172 nm, BlueLight 222 nm,
BlueLight 282 nm, BlueLight 308 nm.

BlueLight High Power Excimer Modules Consist Of:

- BlueLight Irradiation Cassette
- Excimer UV lamp
- BlueLight Power Supply
- BlueLight Cooling Unit

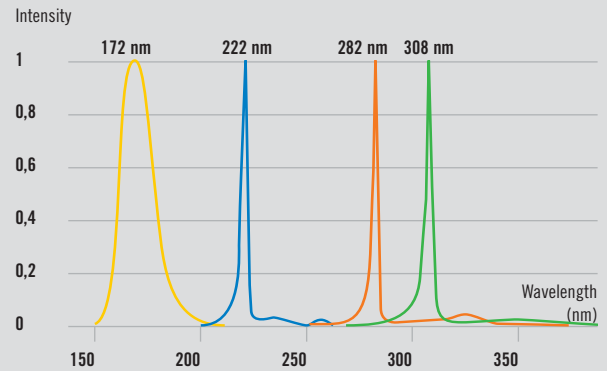
Features

- Can be supplied in 50 Hz and 60 Hz versions
- Irradiation lengths of 30 cm or 60 cm.
- Electrical Power:
 - 172 nm: 450 W (30 cm), 900 W (60 cm)
 - 222 nm / 282 nm / 308 nm: 1.5 kW (30 cm), 3 kW (60 cm)

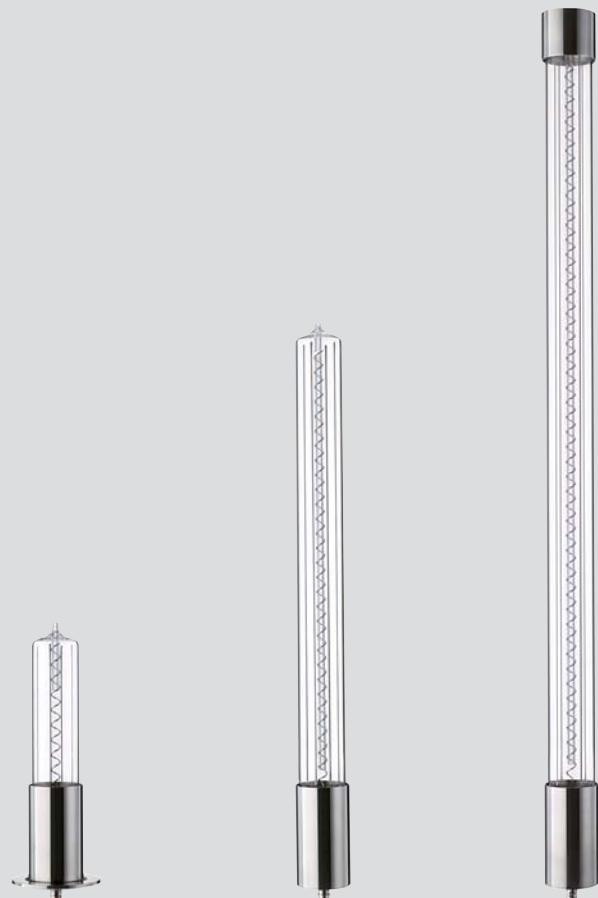
BlueLight Compact Excimer Module

The BlueLight Compact is a versatile and operationally ready Excimer module. It consists of a lamp and the corresponding power supply unit. The BlueLight Compact is available in three different sizes and power classes of 20, 50 and 100 watts. The system operates with air cooling and there is no need for forced cooling. This compact solution operates at a wavelength of 172nm. Particularly suitable for: surface cleaning in semiconductors and LCDs in production.

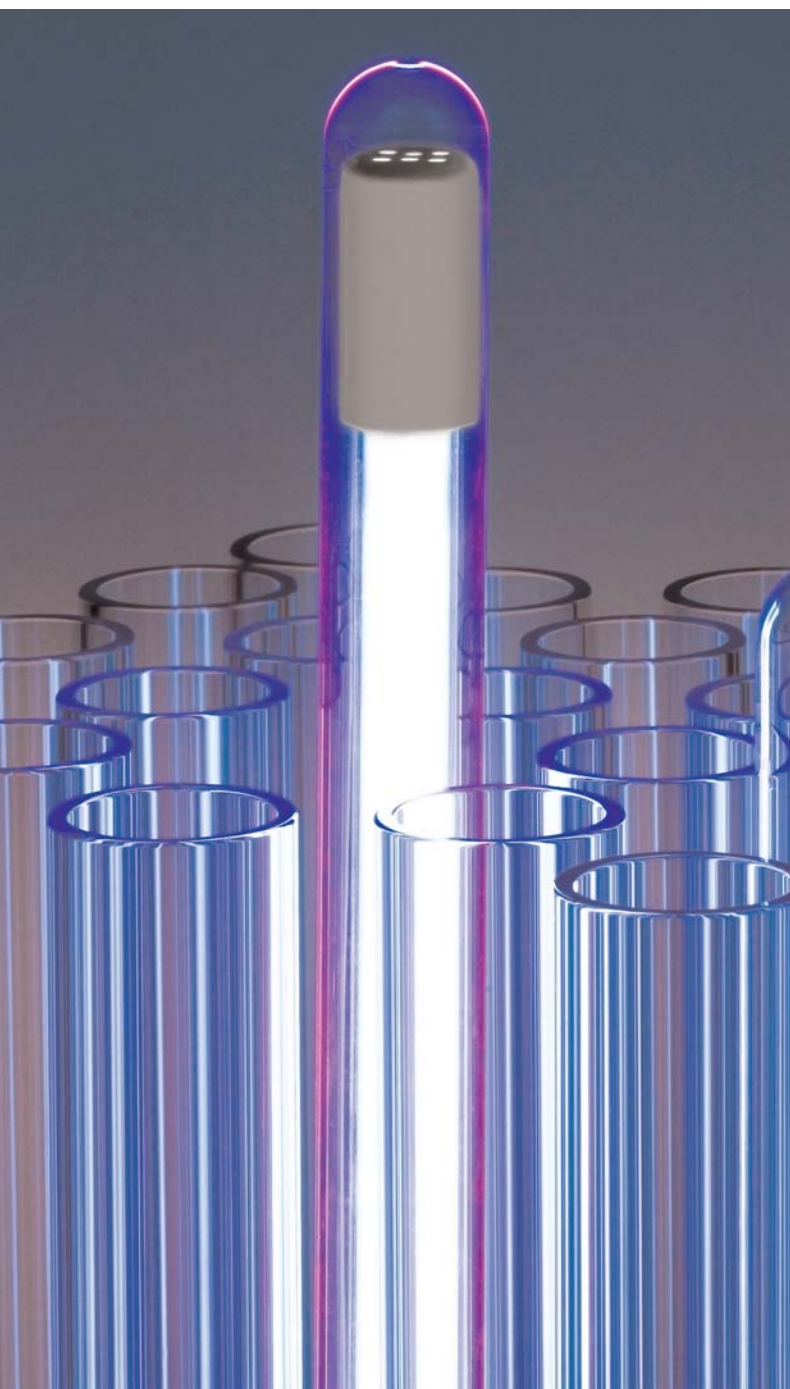
Different BlueLight Excimer Systems



Heraeus offers two Excimer versions: high power Excimer systems with water cooling and compact systems with air cooling.



Practical Support Accessories



Quartz Glass Protection Tubes

Protection tubes can be used for electric isolation in water and for thermal insulation. The use of protection tubes permits easy cleaning of UV lamps. Heraeus offers protection tubes for all lamps and provides advice on their selection. For example, ozone-generating lamps should be fitted only in protection tubes of synthetic quartz glass, so that the 185 nm radiation can be efficiently transmitted through the tube wall. It is also important that there is only a small spacing between lamp and tube. 185 nm radiation is absorbed by air, so that a large spacing between tube and lamp leads to loss in intensity.

Installation Accessories

Clamping and holding springs ensure that lamps are held firmly and elastically. Heraeus will be pleased to provide advice on suitable holders.

Individual Electrical Connectors

Various pinch designs for electrical connection and matched lamp lengths permit the manufacture of custom-built lamps.

Suitable electronic supply units, starters and chokes are available as accessories.



Measurement Laboratory Applications Centre

Measurement Laboratory

Heraeus operates an independent measurement laboratory, which is one of the most modern and best-equipped in the lamp industry. It is accredited and authorised as a test laboratory, in line with DIN EN ISO/EC 17025:2000, to carry out measurements on lamps and equipment in the wavelength range 200–1,700 nm. The measurement laboratory finds application in lamp- and product development. It is also used to support quality management, for example to regularly check all products for radiation properties and operating life.

In addition, customer-specific measurements can be professionally carried out on light sources, optical components or complete instruments – either in our laboratory in Hanau or on-site at your factory.

UV Applications Centre

Heraeus offers you the possibility to explore practical answers to important questions relating to your own products:

- Can my process be optimised and improved with UV light?
- How will my material behave?
- Which lamps are best suited to my process?
- How should these be designed?

Take advantage of our offer to use our facilities and improve your process!

