

**Heraeus**



**Light Sources for Optical and Analytical Instrumentation**



# Contents

Heraeus, the precious metals and technology group headquartered in Hanau, Germany, is a global, private company with over 155 years of tradition. Our businesses include precious metals, sensors, dental products, biomaterials, quartz glass and specialty lighting sources.

Heraeus Noblelight, a business segment of the Heraeus Group, counts itself among the market and technology leaders worldwide with the widest spectrum of specialty lamps from ultraviolet to infrared for industrial, scientific and medical applications. With locations in Germany, UK, China and USA, we manufacture lamps for the printing industry, industrial heating processes, laser pumping, water disinfection and oxidation as well as analytical instrumentation.

Developing high-quality analytical instrumentation requires light sources that match the performance of the instrument. Deuterium lamps, hollow cathode lamps and other specialty light sources from Heraeus' instrument-specific ranges are not only engineered for a long lifetime, which supports the lowest Cost-of-Ownership in your system, but also for the highest repeatable precision so users benefit from the most consistent and sensitive analysis.

For more information about Heraeus Noblelight's lamps for optical and analytical instrumentation please go to [www.heraeus-noblelight.com](http://www.heraeus-noblelight.com).



**Deuterium Lamps** 4



**Hollow Cathode Lamps (HCL)** 6



**Photoionisation Detector Lamps (PID)** 8



**Electrodeless Discharge Lamps (EDL)** 10

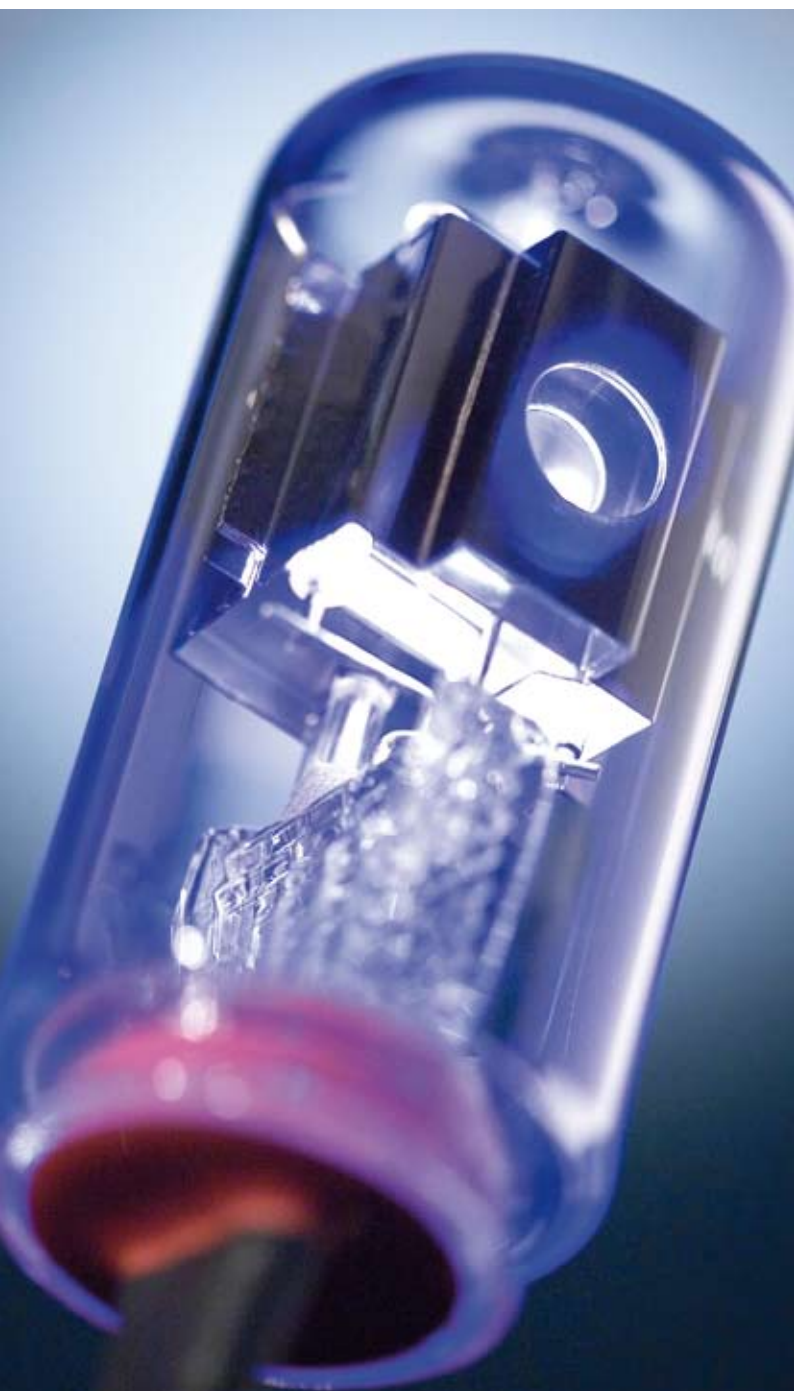


**Specialty Light Sources** 12



**Power Supplies** 14

# Deuterium Lamps



Deuterium lamps are light sources that utilise the discharge of excited deuterium gas ( $D_2$ ). They emit a continuum of UV light within the wavelength range 185–400 nm and discrete lines around this. Therefore they are widely used as an ultraviolet source in analytical equipment, such as UV-Vis spectrophotometers and High Performance Liquid Chromatography (HPLC) instruments.

Over the years, Heraeus has developed a lamp technology that meets the ever increasing demands of instrument manufacturers in terms of extremely low detection limits and sensitivity.

For such state-of-the-art instruments Heraeus offers deuterium lamps with the highest stability, intensity and a long service life of more than 2,000 hours. To meet the requirements of your application and power supply, they are available with a variety of transmission windows, filament ratings, apertures and alignment configurations.

Heraeus engineers work closely with instrument manufacturers (OEMs) to optimise the lamp for the specific operating conditions within the instrument.

Through our approved worldwide dealer network, replacement deuterium lamps are available for the majority of existing HPLC instruments and spectrophotometers.

## Applications

- High Pressure Liquid Chromatography (HPLC + UHPLC)
- UV-Vis Spectrophotometry
- Atomic Absorption Spectroscopy (AAS)
- High Performance Capillary Electrophoresis (HPCE)
- Thin Layer Chromatography (TLC)
- Pollution Monitors
- Solar simulation ( $MgF_2$  window)
- Photoionising light source ( $MgF_2$  window)
- Film Thickness measurements
- Semiconductor inspection
- Fluorescence Spectrophotometry
- Removal of electrostatic charges from semiconductor wafers etc.



Long Nose Lamp      High Stability Lamp      High Intensity Lamp

### High Stability Long-Life Deuterium Lamps

Using the improved cathode technology, Heraeus long-life D2 lamps combine a guaranteed lifetime of 2,000 hours with unmatched output stability over their entire life. This sets them apart from many other long-life lamps on the market and makes them the ideal choice for high-end HPLC instruments.

### High Intensity Lamps

Heraeus high intensity deuterium lamps with the new “Enhanced Lifetime Performance (ELP)” technology maintain twice the residual intensity compared to standard D2 lamps at the end of life. The patent pending ELP coating protects D2 lamp bulbs against degradation caused by VUV radiation and reactive plasma components. It provides a particular advantage in the deep UV region between 160 to 230 nm for all Heraeus D2 lamps with a synthetic quartz envelope. The entire DO 600 series is available with the new ELP technology.

### See-Through Deuterium Lamps

See-through lamps offer a straight-line arrangement of a tungsten halogen lamp, deuterium lamp and optical system. Simplification and cost reduction of UV-Vis spectrophotometers can be achieved using this approach, for example, through the elimination of the moveable mirror.

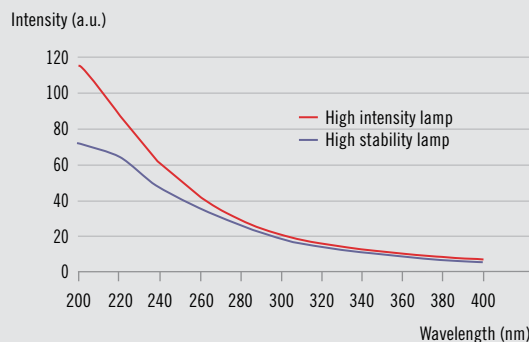
See-through lamps offer the same unmatched stability as the high stability types above and are available with the same diversity of heater voltages and aperture sizes.

### Vacuum UV (VUV) Deuterium Lamps

VUV lamps are deuterium lamps with a MgF<sub>2</sub> window allowing the transmission of VUV radiation down to 115 nm. Heraeus offers lamps with 30 W and 200 W power consumption. The 200 W type is water-cooled and delivers a radiant flux 4–5 times higher than 30 W lamps. They are also available with flanges for mounting on a vacuum chamber.

| Lamp Type                 |                         |                         |              |                           |
|---------------------------|-------------------------|-------------------------|--------------|---------------------------|
| Feature                   | High Stability          | High Intensity          | VUV Lamps    | VUV Lamps<br>water-cooled |
| All purpose               | •                       | •                       | •            | •                         |
| See-Through               | •                       | •                       | –            | –                         |
| Lifetime                  | 2,000 h                 | 2,000 h                 | 1,000 h      | 1,000 h                   |
| Cathode                   | 2.0/2.5/3.0/<br>10-12 V | 2.0/2.5/3.0/<br>10-12 V | 10 V         | 6 V                       |
| Aperture size<br>diameter | 0.5/1.0 mm              | 0.5/1.0 mm              | 1.0 mm       | 1.0 mm                    |
| Noise                     | ≤ 0.005 % p-p           | ≤ 0.05 % p-p            | ≤ 0.05 % p-p | ≤ 0.05 % p-p              |
| Power                     | 30 Watt                 | 30 Watt                 | 30 Watt      | 200 Watt                  |

### Spectral Distribution of Deuterium Lamp



# Hollow Cathode Lamps



Hollow cathode lamps (HCL) are discharge lamps designed for use in Atomic Absorption (AA) instruments. They consist of a cathode made from the element of interest, an anode and an inert filler gas contained in a glass envelope.

Heraeus offers the widest selection of single- and multi-element coded/non-coded in low and high-current, 37 mm and 50 mm lamps in the industry. They are designed for optimum performance by combining:

- Good chemical sensitivity
- High spectral response
- Stable light output
- Low noise characteristics
- Long operating and shelf life

## Applications

- Atomic Absorption Spectroscopy
- Atomic Fluorescence Spectroscopy
- Multi wavelength laser tuning
- Laser output stabilisation (Optogalvanic effect)
- Multi component analysers
- Medical analysers

Heraeus hollow cathode lamps are available both for OEMs and as a replacement lamp by discerning users the world over. The range includes standard lamps and data-coded versions for PerkinElmer, Varian and ThermoFisher atomic absorption spectrometers. Lamps for use with Smith-Hieftje background correction can also be offered.

#### Single-Element Lamps

The Heraeus catalogue includes 70 single-element lamps in standard 37 mm (1½ inch) and 50 mm (2 inch) diameters to fit almost any AA instrument. All cathode materials are selected from the highest purity available – usually 99.99% or better – to ensure high spectral line intensity, stability and low noise with good analytical sensitivity. The window material is selected to achieve the optimum transmission of the primary spectral lines of the cathode element. Borosilicate glass is used for wavelengths over 350 nm, and high quality quartz for shorter wavelengths.

#### Multi-Element Lamps

Heraeus manufactures the largest range of multi-element lamps offering only those combinations which provide sufficient energy and an acceptable lifetime for each element with no spectral interference. Multi-element hollow cathode lamps are available with two to seven different element combinations. These are particularly useful for carrying out routine analysis on a number of different elements in the same sample, such as alloys.

#### See-Through Hollow Cathode Lamps

Heraeus also manufactures optogalvanic (See-through) hollow cathode lamps, designed to act as a frequency stable reference for high intensity tuneable monochromatic light sources, particularly lasers. Most of the cathode materials used in standard Heraeus hollow cathode lamps may be used in the “see through” design.



Hollow Cathode  
Lamp 37 mm

Hollow Cathode  
Lamp 37 mm

Hollow Cathode  
Lamp 50 mm



# Photoionisation Detector Lamps (PID)



Photoionisation detector lamps (PID) are most commonly used in gas chromatography (GC), trace gas monitoring and sample ionisation for mass spectrometry. The PID technique uses a lamp with known photon energies in the vacuum ultraviolet (VUV) region. The output from the lamp is used to photoionise gaseous molecules with ionisation potentials lower than the photon energy emitted. Typical photoionisation detectors measure volatile organic compounds (VOCs) and other gases in concentrations from the ppm to ppb level.

Heraeus offers a complete range of PID lamps with the highest quality in terms of intensity, spectral purity and long life. Both DC and RF excited lamps are available with a variety of gas fills and window materials.

Customers can also benefit from our design expertise, as the Heraeus Technical Team works with OEMs to design and build products to meet their specific dimensional and performance requirements.

## Applications

- Gas Chromatography (GC)
- Mass Spectrometry (MS)
- Field monitoring of air and soil
- Emergency first response
- Jar headspace screening
- Leak detection
- Personnel safety in confined spaces



PID, RF excited  
6 mm and 12 mm  
diameter



PID, DC excited  
20 mm diameter

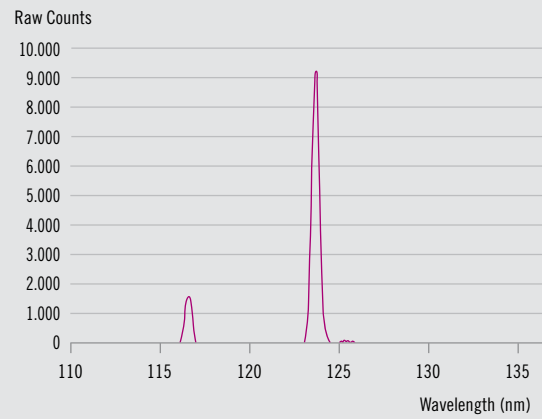


PID, DC excited  
35 mm diameter

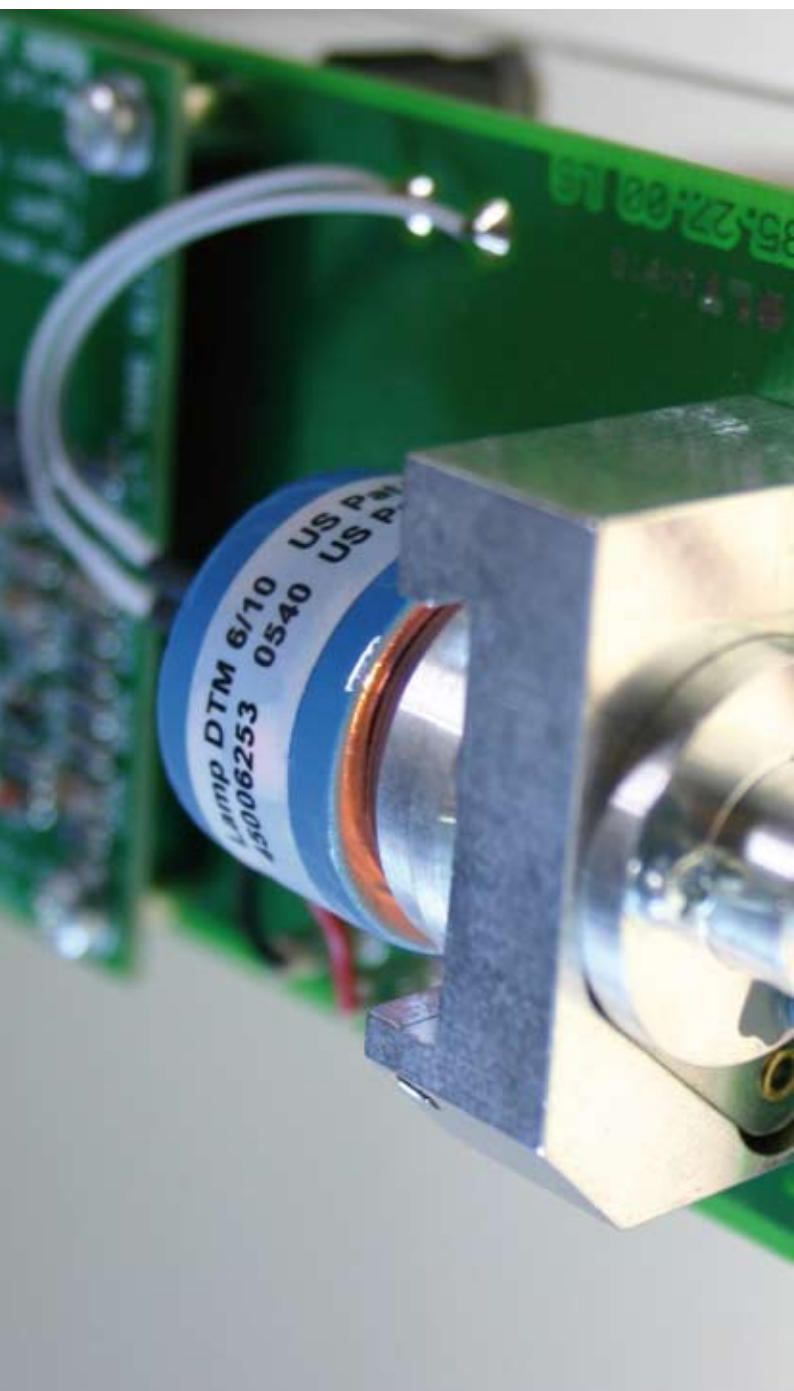
#### PID photon energies and window materials

| Gas fill                    | Photon energy (eV) | Wavelength (nm) | Window material                            | Detectable compounds (amongst others) |
|-----------------------------|--------------------|-----------------|--|---------------------------------------|
| Xenon                       | 9.6/8.4            | 129/147         | MgF <sub>2</sub>                           | Butene, Benzene, Toluene              |
| Xenon                       | 8.4                | 147             | Sapphire (Al <sub>2</sub> O <sub>3</sub> ) | Aniline, Styrene                      |
| Krypton                     | 10.6/10.0          | 117/124         | MgF <sub>2</sub>                           | Ethylene, n-Octane                    |
| Deuterium (D <sub>2</sub> ) | 10.2               | 122             | MgF <sub>2</sub>                           | Vinyl Bromide                         |
| Argon                       | 11.7               | 105             | LiF  | Methanol, Chloroform, Freon           |

#### Spectral distribution of a Krypton PID Lamp



# Electrodeless Discharge Lamps (EDL)



A high frequency electromagnetic field creates the discharge in an EDL. This removes the need for electrodes, which results in the following advantages over conventional UV lamps:

- Extended lamp life
- Elimination of reactions between gas fill and metal electrodes

Heraeus is able to offer the following types of EDLs:

- FiberLight miniature UV-Vis light source
- Excimer lamp
- NO<sub>x</sub> lamp

## **FiberLight Miniature UV-Vis Light Source**

FiberLight is a UV-Vis light source developed by Heraeus especially for mobile and compact spectroscopy applications. It is a ready-to-use module consisting of an RF driven deuterium lamp combined with a tungsten lamp, mounted on a PCB with a fiber optic connector. The standard spectral emission covers the entire range from 200–1100 nm (optional 185–1100 nm). Its compact dimensions and ease of operation open up new possibilities for instrument designers. FiberLight is a complete unit requiring only a 12 Vdc/0.6 Adc input. The deuterium/tungsten lamps and the integrated shutter can be controlled separately by TTL signals.

FiberLight is available in different versions: standard or extended wavelength range and either focused (with an optical fibre connection) or quasi-parallel light output. Different PCB layouts to fit any compact instrument design can be built to your specific dimensional requirements.

## **Applications**

- UV-Vis Spectroscopy
- Water quality monitoring
- Waste water analysis
- Process control
- Marine chemistry
- Stand-alone light source
- Calibration



#### FiberLight features

- Small size
- Low power consumption (6 W)
- Low heat output
- Instant ignition allowing the possibility of cyclic operation
- Extended service life of up to 3 years
- Battery operation for portable instruments

#### FiberLight Replacement Lamps

The lamps can be replaced by users at the end of life and are available with quartz windows for 200–1100 nm and with Suprasil windows for 185–1100 nm. Depending on the gas fill, lamps can be either a continuum source (deuterium) or a line source filled with noble gases or mercury. Continuous operation lifetime is 1,000 hours.

#### Excimer Lamp

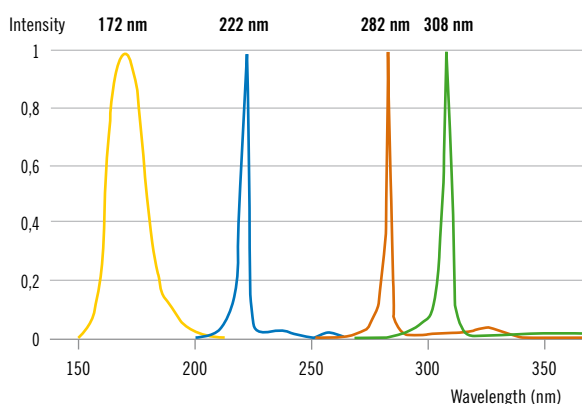
Excimer lamps are mercury-free UV lamps that emit monochromatic UV radiation. The narrow band, single spectral line and the capability to choose specific wavelengths-, make them ideal for use in specific applications. In addition they are power-efficient and there is no unwanted heating effect, as excimer EDLs produce no infrared radiation. Excimer is an abbreviation of “excited dimer”. This is essentially a pair of atoms with one excited atom, which are normally not bonded in the ground state ( $Xe + Xe^* = Xe_2^*$  Excimer). Today, there are several different excimer combinations, which can produce UV radiation in the wavelength range between 120–380 nm. The specific wavelengths available are: 172 nm, 222 nm, 282 nm and 308 nm.

For small format applications, Heraeus offers an excimer lamp with 222 nm output and power consumption of 10 W, with dimensions 50 mm length and 17 mm diameter.

#### Applications

- Chemistry
- Petroleum industry
- Biology
- Medicine

#### Spectrum Excimer Lamps



#### NOx Lamp

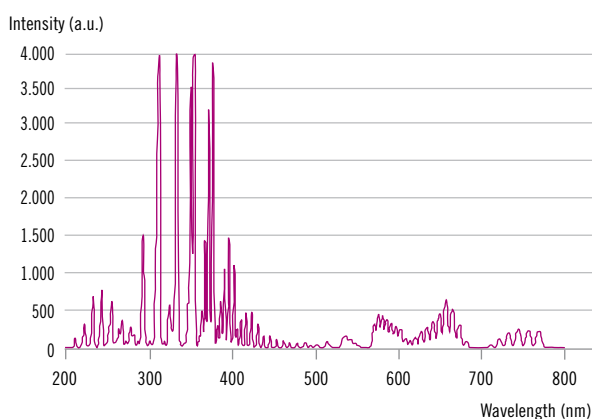
An EDL lamp with a NO (nitrogen, oxygen) gas fill that emits a spectrum in the wavelength range between 200 nm to 600 nm. Spectral lines in the 200 nm region can be used for the detection of NO and NO<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub> and others.

Heraeus has many years of experience in making such UV light sources and is pleased to collaborate with OEMs working in the fields of environmental protection and process gas control.

#### Applications

- Combustion chemistry
- Exhaust monitoring

#### Spectrum NOx Lamp



# Specialty Light Sources



## **Tungsten Halogen Lamps**

Tungsten halogen lamps (TH) generate a continuous spectrum between 350–3000 nm. The output in the visible range of the spectrum ensures that TH lamps are highly suitable for use in analytical instrumentation. Used in conjunction with deuterium lamps, they provide the wide spectral range required by UV-Vis spectrophotometers. Alone, they are suitable light sources for simple Visible spectrophotometers used in analytical and medical markets.

Heraeus TH lamps are designed specifically for use in analytical applications; special quartz envelopes enable high transmission below 380 nm and the position of the tungsten filament is closely controlled through alignment and potting processes. The lamps offer high colour temperature and luminous efficacy, superior maintenance and long life.

Heraeus TH lamps are filled with a halogen gas mixture specific to its final application and range from 5 W–200 W, with typical lifetimes of more than 3,000 hours-, dependant on the operating conditions. Lamps can be designed and built according to OEMs specific requirements, such as colour temperature, voltage, wattage and mechanical tolerances.

## **Applications**

- Analytical and Medical instrumentation



Sodium Lamp



Mercury Lamp



Mercury Lamp

### Line Sources

The range includes:

#### Mercury Vapour Lamp

For applications that require single or multiple line spectra, Heraeus offers low pressure and high pressure mercury lamps with a 253.7 nm line and high pressure mercury lamps with spectral lines between 250–580 nm, and from 2 W–125 W.

#### Applications

- Photochemical processes
- Fluorimetry
- Mercury analysers
- Fixed wavelength detectors
- UV aging

#### Black Light Blue Lamp

Heraeus manufactures the phosphor-coated TW6W black light blue fluorescent lamp that emits ultra violet radiation in the 300–400 nm range. The lamp is fitted with an E27 screw base and can be orientated in any direction. It can be operated directly from mains voltage (220–240 Vac).

#### Applications

- Forensic science
- Excitation luminescence to reveal markers in bank notes, stamps, dark room paints, papers and textiles

#### Germicidal Lamp

Heraeus manufactures the TUV6WE germicidal lamp, a low pressure mercury vapour device emitting UV radiation primarily at 254 nm. The lamp is fitted with an E27 screw base and can be operated directly on mains voltage (220–240 Vac).

#### Applications

- Sterilization of small volumes where compact size and direct mains operation are an advantage

### Spectral Calibration Line sources

Heraeus offers a series of six electrodeless gas discharge lamps that provide well over 100 discrete wavelengths in the range 178–843 nm. Their low temperature, low pressure operation provides highly stable output spectra at wavelengths that are physical constants for the particular element employed.

#### Application

- Wavelength calibration references

#### Other line sources

Heraeus manufactures a range of sources that each emit a number of monochromatic lines of known wavelength. The lamps contain a discharge tube filled with very pure gas, metallic vapour or a combination of the two. Two types of lamps are available:

- Mercury lamp
- Sodium lamp

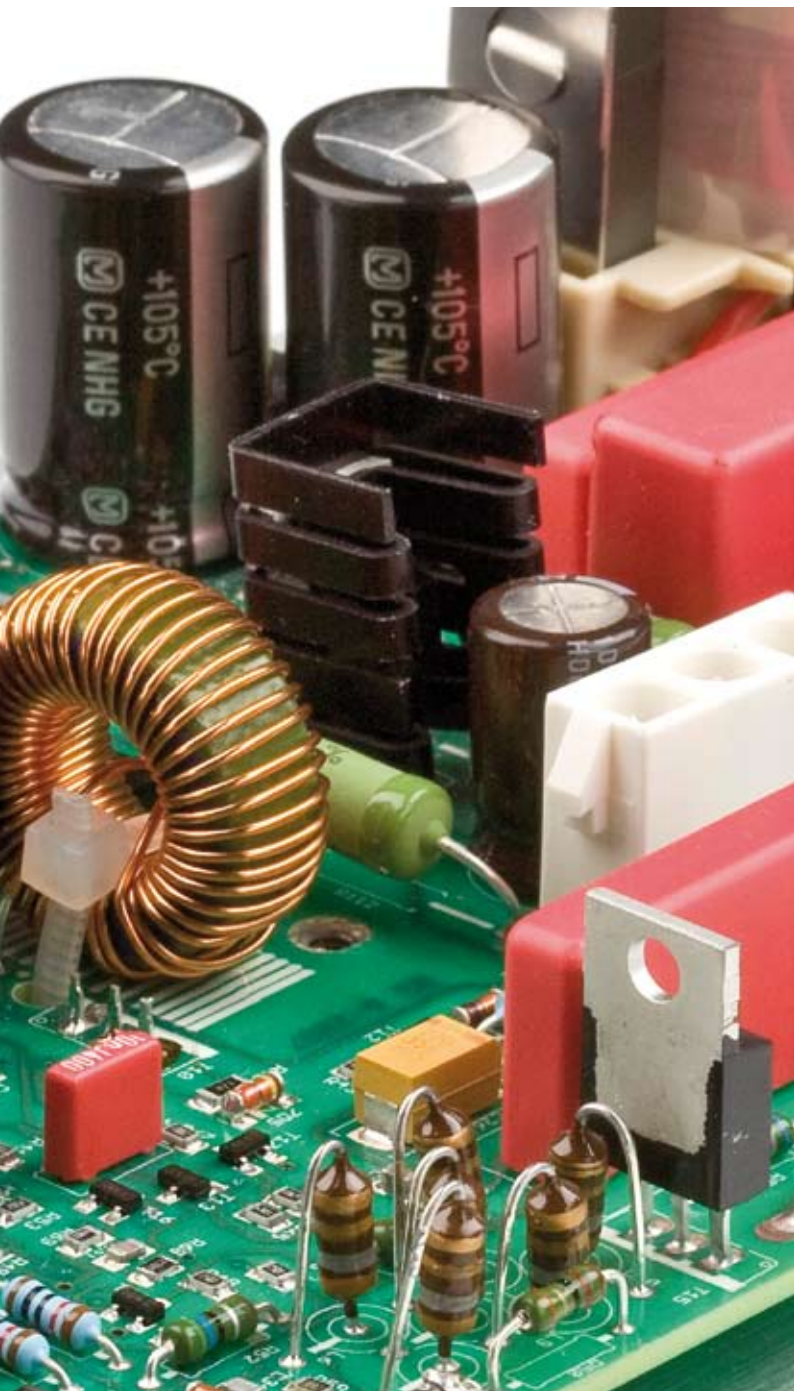
All the lamps have identical electrical and geometrical characteristics including the light centre position-, and E27 screw base.

#### Application

- Calibration source in biological and chemical research
- Interferometry
- Polarimetry
- Refractometry
- Spectroscopy



# Power Supplies



Modern deuterium lamps meet strict requirements with regard to noise, long term stability and operating life. Power supplies should in no way limit or reduce the performance of the lamp.

Consequently, Heraeus offers its own power supplies, which have been specifically developed based on our technical expertise in deuterium lamps. Heraeus uses a large number of its own power supplies while testing new lamps, and field operation is guaranteed as a result.

Heraeus power supplies distinguish themselves by the stability of their electrical parameters and excellent ignition circuitry, which protect the lamps, improve the operating life and ensure reliable starting. As a consequence OEMs can save the cost of developing their own power supplies and benefit from the experience of the lamp manufacturer that is dedicated to ensuring the optimum performance of deuterium lamps. Both bench top laboratory and OEM versions are available.



PSD 184



PSD 185



PSD 186

#### Technical data for power supplies

| Type                                      | PSD 184                                 | PSD 185                                 | PSD 186                                     |
|---|---|---|---|
|   | OEM version                             | OEM version                             | Bench top version                           |
| Input voltage                             | 85-264 Vac                              | 24 Vdc                                  | 85-264 Vac                                  |
| Anode voltage                             | 55-115 Vdc                              | 55-110 Vdc                              | 55-115 Vdc                                  |
| Anode current                             | 300 mAdc<br>fixed                       | 300 mAdc<br>fixed                       | 300 mAdc fixed and<br>100-400 mA adjustable |
| Anode current stability                   | $\leq 5 \times 10^{-6}$ p-p<br>(300 mA) | $\leq 5 \times 10^{-6}$ p-p<br>(300 mA) | $\leq 5 \times 10^{-6}$ p-p<br>(300 mA)     |
| Strike voltage                            | 600 V                                   | 600 V                                   | 600 V                                       |
| Heater voltage<br>(warm-up/<br>operation) | 2.5/0 V or<br>2.5/1 V                   | See below                               | 2; 2.5; 3; 6;<br>9; 10; 12 V                |

#### Heater voltage PSD 185

| Type            | Warm-up (Vdc) | Operation (Vdc) |
|-----------------|---------------|-----------------|
| PSD 185 (2 V)   | 2.0           | 0               |
|                 | 2.0           | 1.0             |
| PSD 185 (2.5 V) | 2.5           | 0               |
|                 | 2.5           | 1.0             |
| PSD 185 (3 V)   | 3.0           | 0               |
|                 | 3.0           | 1.0             |
| PSD 185 (10 V)  | 10            | 6               |
| PSD 185 (12 V)  | 12            | 0               |
|                 | 12            | 3               |
| PSD 185 (15 V)  | 15            | 0               |





The Optics and Analytics division of Heraeus Noblelight (business segment specialty lighting sources) develops and manufactures lamps and power supplies for a broad spectrum of analytical applications. Using our advanced capabilities, we have developed lamp technologies that combine maximum stability with long operating life. At  $2 \times 10^{-5}$  AU, the noise characteristics of our deuterium lamps are significantly better than conventional ones.

Our new ELP (Enhanced Lifetime Performance) technology guarantees twice the intensity of conventional deuterium lamps at the end of lamp life. This means that the results of your analysis will be more consistent and will benefit from a higher degree of confidence in chemical detection. Profit from the acknowledged Heraeus quality.

The patented miniature deuterium lamp, FiberLight, is ideal for small, portable, battery-powered instruments designed for in-field and on-line analysis. At only 6 W, it has the lowest power consumption in the world and is the only deuterium lamp with instant-on and no reduction in life from multiple ignitions.

The advantage to you: lower Cost-of-Ownership through more analyses per battery set and no unproductive down-time. Comprehensive testing of all our light sources ensures they meet specifications, for example in terms of intensity, ignition voltage and life-time. This gives you total functional security and reliability for your analysis. Uniquely positioned with the widest range of specialist analytical lamps, Heraeus can supply high quality lamps for all leading instrument brands.

For example, our hollow cathode lamps include more than 70 single- and 120 multi-element lamps in low- and high-current 37 mm and 50 mm versions.

Our worldwide sales and dealer network ensures that lamps are easily available with quick delivery. Benefit from Heraeus – reduce your Cost-of-Ownership, extend your service intervals and simplify your supply-chain.

Germany

**Heraeus Noblelight GmbH**

Heraeusstraße 12-14

D-63450 Hanau

Phone +49 (6181) 35 5085

Fax +49 (6181) 35 7970

[hng-analyticallamps@heraeus.com](mailto:hng-analyticallamps@heraeus.com)

[www.heraeus-noblelight.com](http://www.heraeus-noblelight.com)

USA

**Heraeus Noblelight LLC**

2150 Northmont Parkway, Suite L

Duluth, GA 30096

Phone +1 (770) 418 0707

Fax +1 (770) 418 0688

[analytics-usa@heraeus.com](mailto:analytics-usa@heraeus.com)

[www.heraeus-noblelight.com](http://www.heraeus-noblelight.com)

United Kingdom

**Heraeus Noblelight Analytics Ltd.**

Nuffield Close

Cambridge CB4 1SS

Phone +44 (1223) 424100

Fax +44 (1223) 426338

[hna-analytics@heraeus.com](mailto:hna-analytics@heraeus.com)

[www.heraeus-noblelight.com](http://www.heraeus-noblelight.com)

PR China

**Heraeus Noblelight (Shenyang) Co., Ltd.**

4F, 11th Building, No. 99 Tianzhou Rd.

Shanghai, 200233

Phone +86 (21) 5445 2255

Fax +86 (21) 5445 2410

[info.hns@heraeus.com](mailto:info.hns@heraeus.com)

[www.heraeus-noblelight.cn](http://www.heraeus-noblelight.cn)