

UV

*Berson UV-technik*

for drinking water treatment

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*UV units for drinking water*



### Environmentally friendly

#### Berson UV units

- Lower operational costs
- CFD designed
- Bioassay validation (DVGW)
- Lowest number of components
- Smallest footprint
- Lowest headloss
- Highest medium pressure UV lamp life
- Automatic lamp wiping



Essen-Horst (Gelsenwasser), Germany  
4x DVGW-validated Berson InLine<sup>+</sup> 15000  
4240 m<sup>3</sup>/h



Paris, France  
5x Berson InLine 1500  
7500 m<sup>3</sup>/h

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*Best technology*

**Ultraviolet (UV) technology**

As invisible component of sunlight, UV has long been known as a natural source of disinfection. For over a century, scientists and researchers have built up a wealth of experience in the laboratory and in the field. UV is now a well established method of treating drinking water. It is very effective at inactivating pathogenic bacteria, spores, viruses and parasites such as E-coli O157:H7 and oocysts. In addition, UV does not generate harmful disinfection byproducts like TriHaloMethanes (THM), haloacetic acids and bromate.

**No Photorepair**

**Mechanism of UV inactivation**

The UV section of the electromagnetic spectrum is divided into three main wavelengths ranges, (UVC, UVB and UVA) which have different effects on DNA, RNA and other molecules, such as enzymes, within the cell.

DNA and RNA have their main absorption at 265 nanometres (nm). UV also causes photochemical reactions in proteins, enzymes and other molecules mainly between 240 and 280 nm.

Permanent inactivation with bersonMulti-Wave® lamps:

**'Photoreactivation' and 'dark-repair'**

Microorganisms contain enzymes that can repair UV-damaged DNA. Some of these enzymes need visible light to perform the repairs ('photoreactivation'), while others can do so without light ('dark repair').

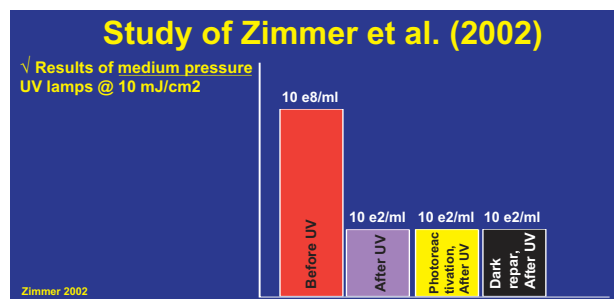
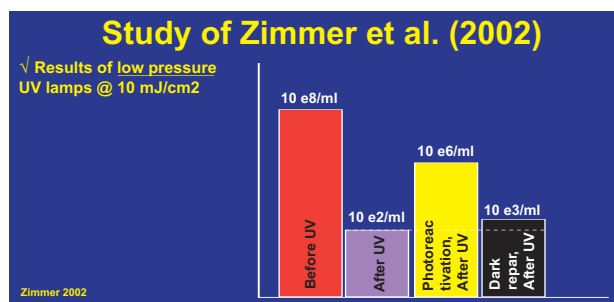
Photoreactivation is generally quicker than dark-repair, but both of these phenomena pose obvious problems for operators of UV disinfection plants.

**Permanent inactivation**

Research work by Oguma et al. (2002) has confirmed that bersonMultiWave® medium pressure lamps cause permanent irreversible inactivation of faecal bacteria such as E. coli. The results of their research suggests bersonMultiWave® lamps offer better protection against photoreactivation than low pressure lamps.

Zimmer et al. (2002) also reports permanent inactivation of pathogenic organisms like E. coli O157:H7 and various species of oocysts using medium pressure UV lamp technology.

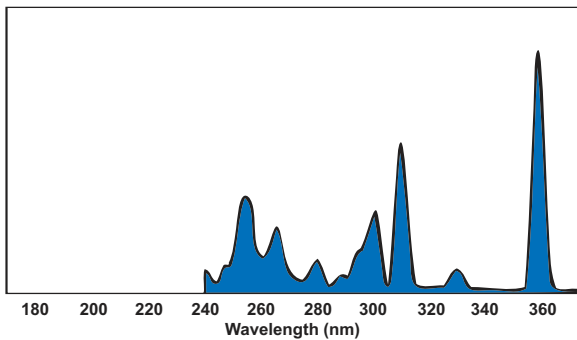
If there is any chance that UV-treated drinking water will be exposed to visible light, even for short periods of time, it is best to use the high output bersonMulti-Wave® medium pressure UV lamps rather than low pressure lamps.



### Lamp technologies

#### Medium pressure UV lamps

Medium pressure lamps emit a broad spectrum of UV light between 185 and 400 nm.



For drinking water applications, wavelengths below 240 nm can be filtered out to prevent the formation of nitrites (acc. to DVGW W294 part 1/2/3).

Medium pressure lamps emit high intensity UV light due to their high power input.

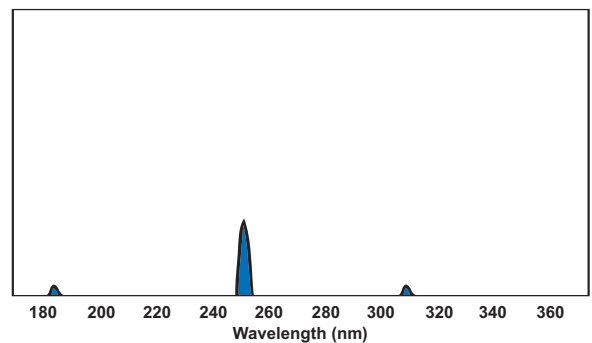
Main properties of medium pressure lamps:

- multiple effects on microorganisms
- small number of lamps required (therefore easier to install wipers, lower headloss and therefore lower consumption of pumping energy)
- adjustable UV-output in various energy levels per lamp (optional stepless adjustable)
- low amount of mercury per UV system
- stable UV output at varying water temperatures

Medium pressure UV lamps are effective against microorganisms' DNA, RNA, enzymes and other molecules. There is only a very limited chance of microbial recovery either by photoreactivation or dark repair.

#### Low pressure UV lamps

Low pressure UV lamps emit single wavelength peaks at 185, 254 and 313 nm. Compared to medium pressure lamps, low pressure lamps have limited effects on microorganisms.



Low pressure UV lamps are only effective against microorganisms' DNA, not other molecules involved in the life processes. A higher incidence of microbial recovery from low pressure UV damage has been shown in certain pathogenic microorganisms such as *E. coli* O157:H7 and oocysts.

Low pressure lamp technology is mainly used for specialised industrial applications with relatively small flows of high quality water.



Bergen, Norway

4x DVGW-validated Berson InLine 15000<sup>+</sup>  
1665 m<sup>3</sup>/h

*Smallest footprint*

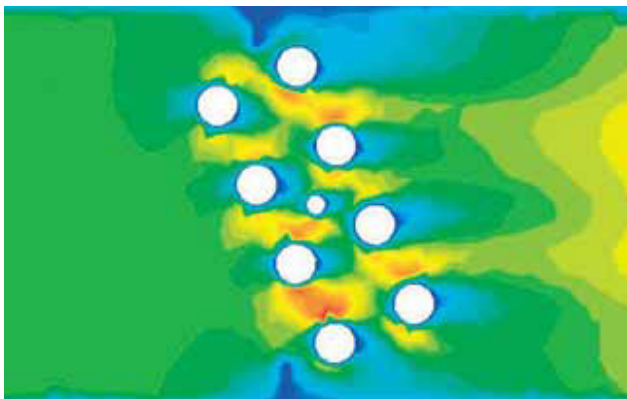
**Computational Fluid Dynamics (CFD)**

CFD is a computer generated prediction of the flow- and other characteristics inside a UV chamber.

It is used to predict and understand flow patterns, headloss, velocities, pressures, particle distribution and UV dose.

As all UV systems are different in terms of flow, chamber design, geometry, fluid kinetics and process piping, CFD modelling is needed to predict the required performance of a UV drinking water unit.

CFD modelling, combined with microbial biosimetric validation tests such as DVGW W294 part 1/2/3, optimises the design of UV chambers.



Berson UV's extensive field experience provides concrete proof of the accuracy of its CFD prediction modelling.

Berson UV combines CFD with biosimetric tests

90% fewer lamps, ballasts, sleeves and rings

**Controls**

The controls of the bersonInLine<sup>+</sup>DW use the highest quality components from established suppliers.

Berson UV uses highly reliable long-life 'constant wattage transformers' made from steel and copper wires.

The distance between the UV units and the control panels can be as much as 100 metres.

Berson UV's enhanced UVtronic<sup>+</sup> device can be used to control the bersonInLine<sup>+</sup>DW and its connection with an external PLC.



### Options and standards

#### UVtronic<sup>+</sup> control

The new UVtronic<sup>+</sup> is an intelligent, flexible and adjustable control device which ensures required microbial performance. It continuously interprets all process parameters and reacts immediately to any changes by selecting the optimal program to run the UV systems. It communicates via MODBUS/PROFIBUS protocols to SCADA systems and guarantees minimal operational costs in all possible situations.

#### UV sensor

The sensors on Berson UV's systems are very reliable, providing accuracy and a long life between factory calibrations. They are important components, ensuring better control and assessment of disinfection performance. Certified UV sensors are standard on all DVGW approved systems.

#### Cleaning

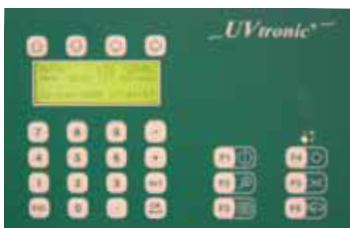
Berson UV's cleaning mechanism prevents fouling of the quartz sleeves and the UV monitor's optics. The company offers both manual or motor-driven wiping mechanisms, the choice depending on the quality of the water to be treated. UV-resistant, long-life O-rings are used to remove tough deposits without the use of chemicals.

#### ECtronic<sup>+</sup> control

The new ECtronic<sup>+</sup> is a very reliable control device which ensures optimal operation of the UV systems. ECtronic<sup>+</sup> indicates the most important condition parameters, such as relevant input and output signals.

#### Energy control

Enhanced energy control technology makes it possible to adjust power input based on UV dose, calculated or indicated either by the UVtronic<sup>+</sup> or ECtronic control devices. Depending on UV output, the energy is adjusted either manually or automatically to the correct value needed to provide the required UV dose with the lowest energy input.



Berson, for small and large drinking water plants

*Berson UV units*



bersonInLine® series



bersonInLine<sup>+</sup>DW series



Berson ProLine<sup>+</sup> series

Properties	bersonInLine®	bersonInLine <sup>+</sup> DW	Berson ProLine <sup>+</sup>
bersonMultiWave® lamp	•	•	-
Low-pressure Amalgam lamp	-	-	•
Manual wiper	◦	◦	◦
Automatic Wiper	◦	◦	◦
UltraWipe	◦	-	-
Calibrated UV sensor	•	•	◦
Temperature control	•	•	◦
Energy control	•	•	-
Modular lamp switch	-	-	-
'in-line'-construction	•	•	-
BSP connection	-	-	◦
Flange connection	•	•	◦
ECtronic/ECtronic <sup>+</sup>	•/-	-/•	-
UVtronic/UVtronic <sup>+</sup>	•/-	-/•	-
Access hatch	◦	-	-
DVGW(Önorm)-certified	•	•	-

• standard      ◦ optional      - not available      DW = drinking water

The best choice for your installation

### Drinking water sites



Thousands of drinking water sites use Berson UV



Berson, masters in UV