

# Operating Manual

## UVC Low Pressure Lamps

**Standard Low Pressure Lamps**  
**High Output Lamps**  
**Amalgam Lamps**



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## Imprint

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## Warning notes and symbols in the operating instructions

These operating instructions describe the UVC low pressure lamps, their installation, operation and capabilities. The safety and warning notices explain the safe, proper handling of the device.

You will find the symbols listed below next to all safety and warning instructions in these operating instructions where there is danger to life and limb. An additional signal word indicates the severity of a possible danger.

Observe these notes closely and be especially careful in these cases in order to prevent accidents.

**DANGER!** This signal word marks a danger with high risk or an immediately threatening danger. If it is not avoided, death or very severe injuries / damage to health will result. Damage to property is possible.

**WARNING!** This signal word marks a danger with medium risk or dangerous situation. If it is not avoided, death or very severe injuries / damage to health could result. Damage to property is possible.

**CAUTION!** This signal word marks a danger with low risk or marks a possible danger. If it is not avoided, slight injury / damage to health could be possible. Damage to property is possible.

## The symbols used in these operating instructions have the following meaning:



This symbol warns of a hazard.



This symbol warns of a hot surface.



This symbol warns of hazardous electrical voltage.

The two following symbols are used to address practices for optimal operation and/or prevention of damage to the equipment. This information is not related to hazardous situations. Additionally, the signal words **ATTENTION** and **NOTE!** are used.



### ATTENTION!

This symbol with signal word is found at those places in the operating instructions which must be observed so that damage or destruction of the equipment is prevented.



### NOTE!

This symbol is found next to notes, tips on operation and useful information.

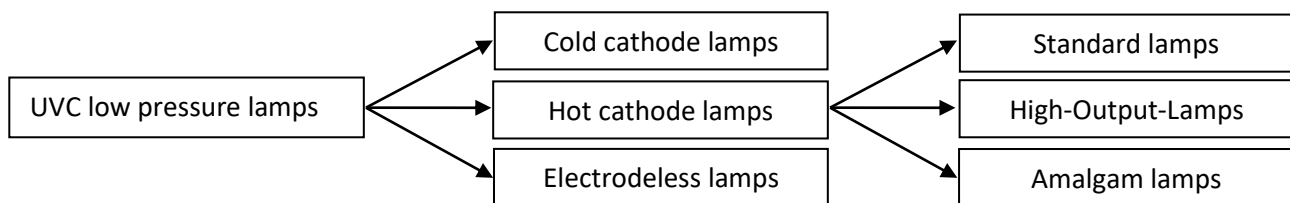
## 1. Function description of UVC low pressure lamps

### 1.1 UVC low pressure lamps

UVC low pressure lamps consist of a discharge tube made of quartz glass or UV transparent glass. The arc tube is filled with noble gas at a low pressure of some Millibar in addition with small amount of Mercury, free or bonded. While operation is formed a plasma emits UV radiation. The stimulation occurs normally by creating a current flow between electrodes at both ends of the lamp. Electrodeless lamps can be stimulated by microwaves or high frequency. Choosing different materials for the lamp tube the spectrum can be trimmed at the side of short wavelength. By variation of length, diameter and filling the low pressure lamps can be controlled regarding power and adapted to varying operating conditions. UV low pressure lamps are manufactured by default as linear or u-shaped lamps, but any shapes are possible in principle.

### 1.2 LP lamp types

LP lamps can be classified as follows:



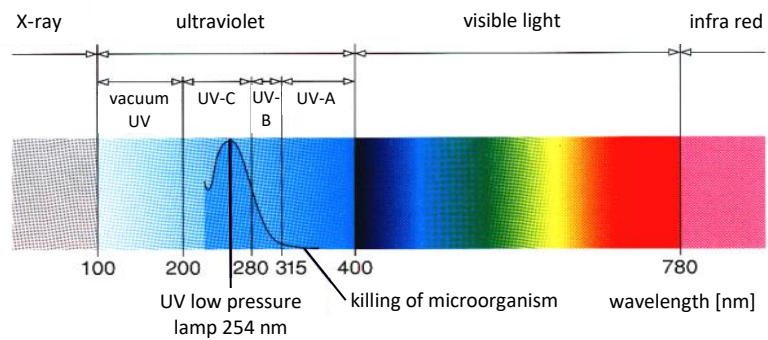
Except the cold cathode lamps, we are able to produce all types in our own fabrication including characteristic customization.

lamp type	characteristics
cold cathode lamps	specific electric power approx. 0.2 W per cm light length low wattages up to approx. 40 W
Standard LP lamps	specific electric power approx. 0.5 W per cm light length wattages 4 – 100 W, lamp currents typically 170 – 425 mA optimal lamp tube temperatures approx. 40 – 50 °C
High-Output (HO) lamps	specific electric power approx. 1.0 W per cm light length wattages 20 – 200 W, lamp currents typically 650 – 800 mA optimal lamp tube temperature approx. 40 - 50°C at least punctual
Amalgam lamps	specific electric power approx. 1.5..3,0 W per cm light length wattages 40 – 800 W, lamp currents typically 1,5 – 8 A optimal lamp tube temperature approx. 90 – 120 °C
electrodeless lamps	wattage, filling an design in arrangement

The current technological feasibilities allow the manufacturing of UVC low pressure lamps with diameters of 10 – 36 mm und a length of approx. 105 mm – 2000 mm. Special forms according to drawing are possible.

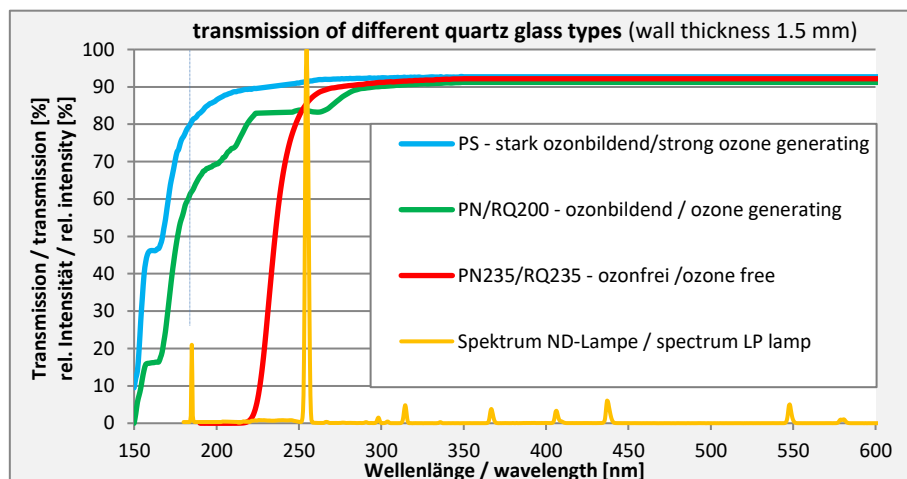
## 1.3 Information on UV radiation

UV radiation is per definition (for human eyes) the invisible radiation below the optical spectrum of visible light. The common classification defines wavelength between 400 - 315 nm as UVA. This radiation is responsible e.g. for browning of skin. Radiation in the range 315 - 280 nm is called UVB. This range causes sunburn and is present in the surrounding natural radiation from the sun up to approx. 300 nm. Shorter wavelengths will be absorbed by the earth's atmosphere. The range 280 - 200 nm is defined as UVC range. Radiation in that range can be used for disinfection because of the destructive effect of the very high energy radiation. Even shorter wavelengths form ozone by dissociation of oxygen and is called vacuum UV radiation. Unhindered propagation is possible only in an inert atmosphere (e.g. nitrogen) or in vacuum. At 100 nm the VUV range passes into the X-rays. At this point the optical range of the spectrum ends. Shorter wavelengths can penetrate material.



## 1.4 Spectrum of UVC low pressure lamps

UVC low pressure lamps emit most of their radiant power at a wavelength of 253.7 nm. A second important emission line can be found at 184.9 nm. Their power is approx. 20 % related to the power of the 254 nm line. Scattered there are some more small lines up to the visible blue range which explains the bluish shine of such lamps.



### ATTENTION!



While UVC low pressure lamps are visually a moderate brightness, much of what will be emitted is in the dangerous UVC range!

## 1.5 Transmission of lamp quartz

By using a selection of different materials for the lamp tube it can be determined if the UVC low pressure lamps are ozone generating or not. Three quartz glass type are available for our production (see graphic in chapter 1.4):

**PN235 / RQ235:** ozone free, 185 nm line will be suppressed

**PN / RQ200:** ozone generating, 185 nm line is able to pass through with slight loss

**PS:** strong ozone generating, best possible transmission of 185 nm, maximal ozone production

## 1.6 Operation of UVC low pressure lamps

UVC low pressure lamps must be operated with an appropriate ballast.

### ATTENTION!



There is no claim for replacement in case of damages by incorrect operation or inappropriate ballasts. The operation instruction must be understood and observed. Please contact us in case of doubts or questions.

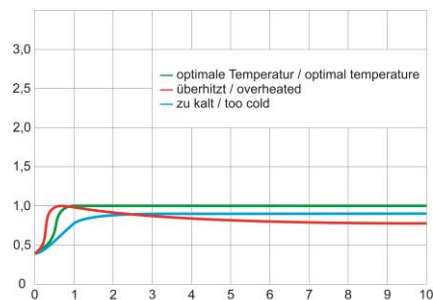
### Start behavior of UVC low pressure lamps

The start behavior of UVC low pressure lamps depends on temperature, geometry (length / diameter) and preheating. The longer the length and the shorter the diameter the higher the necessary ignition voltage will be. Even higher ignition voltages are necessary for a cold start of UVC low pressure lamps without preheating. That's why generally we recommend preheating the filaments. This saves both the lamps and electronic ballasts. A re-ignition of warm lamps is unproblematic.

### Behavior of UVC low pressure lamps while in operation

After starting the flowing current warms up the lamp and the contained Mercury will be distributed in the discharge. The different lamp types take different times to reach their optimal operation temperature and hence the optimal Mercury vapor pressure for low pressure gas discharge. Not until then will the lamps emit uniform UV radiation.

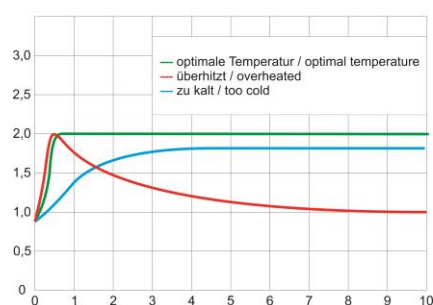
The following charts shows the start up behavior of UV low pressure lamps, as an example.



#### Temperature behavior of standard low pressure lamps

Hg is present uncombined in the lamp. Hence UV radiation is present directly after the start (depending on temperature).

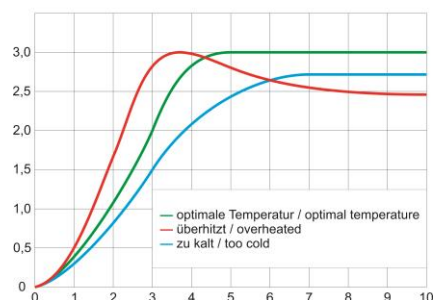
- short start up period to reach the operation temperature
- optimal lamp tube temperature at 42 °C (40-50 °C)
- small ambient temperature range for optimal operation
- operation heavily dependent on ambient temperature/cooling
- overheating causes loss of UV power/UV efficiency



#### Temperature behavior of HO lamps

Hg is present uncombined in the lamp. Hence UV radiation is present directly after the start (depending on temperature).

- very short start up period to reach the operation temperature
- optimal lamp tube temperature at 42 °C (40-50 °C)
- very small ambient temperature range for optimal operation
- operation very strong dependent on ambient temperature/cooling
- overheating cause heavy loss of UV power/UV efficiency



#### Temperature behavior of Amalgam lamps

Hg is present combined as an Amalgam in the lamp. Hence UV radiation is not present direct after the start (temperature depending).

- start up period lasting some minutes to reach the operation temperature
- optimal Amalgam / lamp tube temperature at 90 – 120 °C
- wide ambient temperature range for optimal operation
- operation slightly dependent on ambient temperature/cooling
- overheating causes loss of UV power and can damage the lamps

Legend to chart at page 7:

**Green graph:**

- optimal operation temperature
- lamp cooling correct

- ambient condition of the lamp ideal
- diameter of the submersion tube correct
- water /air temperature in a proper range

**Red graph:**

- operation temperature will be exceeded
- cooling of the lamp too low

- ambient condition of the lamp too warm
- diameter of the submersion tube too big
- water /air temperature too high

**Blue graph:**

- operation temperature will be not reached
- cooling of the lamp too much

- ambient condition of the lamp too cold
- diameter of the submersion tube too small
- water /air temperature too low

**Switching of UVC low pressure lamps**

Every switching process slightly wears the electrodes of the UVC low pressure lamps. The highest levels of erosion are caused by a conventional supply with choke/starter/ignitor and by electronic ballasts with instant start. The best solution is an electronic ballast with preheating which is properly adjusted to the used lamp.

**Dimming of UVC low pressure lamps**

UVC low pressure lamps are dimmable in principle. The possible dimming level depends on the ambient conditions and has to be tested. A lamp specific value must not be undercut. By dimming an optimal operation level can be adjusted in case of overheating.

**Control of UVC low pressure lamps**

UVC low pressure lamps can be monitored by checking the operation parameters or by measurement of the UV radiation. The operation only can be checked easily by using the potential free contacts of the electronic ballasts. Alternatively the lamp current can be monitored. By measurement of the UV output a statement can be made if the lamps runs optimally and if the UV output is depreciated by ageing.

**NOTE!**

uv-technik international also offers UV sensors as well as monitors. Our sales staff would be pleased to help you in this regard.

## 2. Safety instructions

### 2.1 General information

A sound knowledge of all basic safety regulations is essential to ensure safe and fault-free operation of the UVC low lamps.

This operating manual contains all important safety regulations to ensure safe operation of the lamps. In particular the safety instructions, must be observed by all persons working with the lamps.

In addition, all relevant rules and accident prevention regulations relating to the operation site must be observed. In regular intervals, the operator will check that all personnel are observing the safety regulations.

## 2.2 Appropriate use

The operator may only operate the UV lamps as stipulated by the operating instructions in this manual and must follow the relevant rules for accident avoidance. UV low pressure lamps must be always supplied with an appropriate ballast.

### ATTENTION!



uv-technik international is not liable for damages resulting from inappropriate use of the UV lamps. Also all claims for replacement expires in case of damages by using an appropriate ballast.

## 2.3 Staff obligation

Before commencing work, all persons entrusted with work to be performed on the UV lamps undertake the following:

- to observe the safety at work and accident prevention regulations
- to read the chapter on safety and the warnings printed in this manual and to observe them at all times while using the equipment

## 2.4 Hazards from handling the equipment

The UV lamps have been manufactured in accordance with the very latest state-of-the-art technology and the recognized rules of safety technology.

**The equipment may only be used under the following conditions:**

- it is used for the purpose for which it was constructed
- in a condition in which the equipment complies with all safety technology requirements



### **Danger! – HAZARDOUS ELECTRICAL VOLTAGE!**

### **Attention: Danger of death**

Switch off the main switch and the main contractor before working on the lamps or their ballasts, e.g. during lamp replacement, to avoid danger of electric shock.



### **WARNING! – UV RADIATION!**

### **Attention: Health risk**

UV rays, direct or indirect, are a danger of health! Switch off the lamps before working on them. If not possible eyes and skin must be protected with appropriate aids against inadmissible high radiation doses.



### **WARNING! – OZONE!**

### **Attention: Health risk**

UV lamps can form ozone in operation. Ozone is a poisonous gas which is heavier than air. Ozone is a danger of health! Inadmissible high ozone concentrations must be avoided. Ventilate if the situation arises.



### **WARNING! – DANGER OF CUTS!**

### **Attention: Health risk**

UV lamps can break. Wear appropriate gloves while assembling to avoid cuts or lacerations from broken lamps.



### **WARNING! – MERCURY!**

### **Attention: Health risk**

UV lamps contains Mercury which will be released if a lamp breaks. Mercury is a danger to

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health for humans and animals alike. Remove contamination immediately and ventilate adequately.

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**WARNING! – HOT SURFACE!****Attention: Health risk**

UV lamps become hot during operation. To avoid burns the lamps have to have enough time to cool down after switching off, e.g. in case of replacement.

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## 2.5 Warranty and liability

The General sales and delivery conditions of uv-technik international apply. The operator will have received these terms, at the latest upon signing the contract. uv-technik international is not liable for any damage to persons or property arising from any one or more of the following:

- inappropriate use of the UV lamps
- incorrect assembly, commissioning and operation
- operation of UV system with a faulty and/or non functioning safety and protection device
- non observance of the instructions given in the user's manual with reference to the safety, transport, storage, assembly, commissioning, operation and servicing of the device
- unauthorized repair or alterations to the construction of the UV lamps
- repairs which are carried out incorrectly
- catastrophes, the action of foreign bodies or acts of God
- damages or losses originated from the use or a defect of the UV lamps

## 2.6 Organizational measures

All safety devices on the equipment must be tested for correct functioning regularly, prior to carrying out work and at each shift change. Look for external signs of damage.

## 2.7 Informal safety measures

In addition to this user manual, the generally and locally applicable accident prevention and environmental protection regulations must be made available and observed.

### Danger due to electricity

**DANGER! – HAZARDOUS ELECTRICAL VOLTAGE!**

There is a danger caused by direct or indirect contact with electricity!

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The electrical components of the UV lamps must be inspected regularly.

#### Before commencing work:

- check all equipment components for external signs of damage
- check that all electric cables are in perfect condition

Loose connections must be tightened and damaged wiring replaced immediately.

## 2.8 Service, maintenance, remedying faults

In case of disturbances during operation of the UV lamps, the chapter 'Faults' offers information on the causes of the fault and possible remedial action.

In the event of faults occurring which cannot be remedied by any of the procedures listed, please contact our customer service department.

No changes may be made to the UV lamps, no fittings may be added, or conversions carried out without obtaining the prior permission of uv-technik international.

In the event of claims under the warranty, for our repair and spare parts service, please contact:

E-Mail: [info@uv-technik.co.uk](mailto:info@uv-technik.co.uk)



### **WARNING!**

No repairs or changes to the UV lamps other than those described in this manual may be carried out.

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## 3. Transport, delivery, storage

Please note the delivery conditions, which will be communicated to you in the offer. Deliveries are ex works. Transport insurance can be arranged on request. UVC low-pressure lamps are delivered in suitable transport packaging. Any damage found must be documented immediately and reported to uv-technik international without delay.



### **NOTE!**

It is advisable to keep the packaging material in case the UV lamps need to be shipped or transported elsewhere. Please dispose of the packaging material in an environmentally friendly manner if you no longer need to use it.

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UVC low-pressure lamps can be stored almost indefinitely in a dry and non-corrosive environment. We recommend storage conditions of -10...+75°C at 5...80% humidity. If oxide deposits have formed on the connection contacts during storage, these must be removed before commissioning. In order to be able to utilise the 2-year limited warranty at the end of the operating time of the lamps, the storage time should be calculated to be correspondingly short.

## 4. Ordering data for equipment

Order UV low pressure lamps from:

E-Mail: [info@uv-technik.co.uk](mailto:info@uv-technik.co.uk)

To allow clear assignment on all orders the article number and name of the UV lamp must be specified. If unknown our sales staff would be pleased to help you to find out the correct lamp and explanation of differences in detail.

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**NOTE!**

Nearly all of our special lamps will be produced according to the order. Occasionally longer lead times may occur (e.g. if upstream suppliers are not able to deliver or in case of unforeseen events). Hence please calculate your order with a sufficient safety stock, especially for systems in which downtimes are unacceptable. uv-technik international is not liable for damages or losses caused by such delivery delays. In such cases we recommend blanket orders, so that replacement lamps are held on stock. In this regard we refer also to our sales and delivery conditions.

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## 5. Repair

The repair of UV lamps is, with a few exceptions, not possible. In doubt, please contact us.

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**ATTENTION!**

We accept no warranty for damages to the UV lamps caused by non-observance of the operation instructions. No repairs or changes to the UV lamps other than those described in this manual may be carried out. In case of claims appropriate evidence must prove the observance of the required operation conditions.

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For repair or claim the UV lamps normally have to be shipped to us. Please contact us in advance to agree the cheapest delivery. Please keep the following disclosures ready:

- lamp type, article number, delivery note number, customer number
  - operation hours, switching cycles (prove in an appropriate manner)
  - used ballast
  - operation conditions (air or water application, submersion tube diameter  $\varnothing$ , temperatures, etc.)
  - dimensions and weight of the consignment
- 

**ATTENTION!**

Please note that cash on delivery will be not accepted.

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For the complaints process an operation number is assigned either in advance or after receipt. After inspection of the UV lamps in our lab you will get an acknowledgment. We will contact you if consultation is necessary. Inquiries are possible at any time if you tell us the above mentioned operation number.

In case the complaint is justified, you will get a full replacement within the first 1000 operation hours of the UV lamps. For higher operation hours we grant pro rata replacement based on the lamp lifetime. Details regarding our warranty conditions can be read at [www.uv-technik.co.uk](http://www.uv-technik.co.uk).

Damaged, faulty or spent UVC low pressure lamps at end of lifetime must be disposed according to the applicable national rules for hazardous waste.

## 6. Faults

### 6.1 General information

If a fault occurs on the UVC low pressure lamps which can not be remedied by the following instructions, contact the customer service department of uv-technik international.

E-Mail: [info@uv-technik.co.uk](mailto:info@uv-technik.co.uk)

Additionally we refer to the installation instructions of the ballasts. The display of the ballasts can be very helpful for troubleshooting.

### 6.2 Disturbance and remedying

The following fault list informs about possible disturbances during the operation of UV lamps, their causes and remedying measures.

fault	fault description, possible cause	measures
ignition problem	<ul style="list-style-type: none"> <li>- connection fault/loose connection</li> <li>- drop of ignition voltage over the cable too high respectively lamp too cold</li> <li>- production fault (e.g. untight lamp)</li> </ul>	check cabling reduce cable length, increase cross-section note manual of the electronic ballast check lamp with lamp tester LT1
UV power too low	<ul style="list-style-type: none"> <li>- lamp temperature not optimal</li> <li>- impure lamp/sensor/protecting tube/reflector</li> <li>- sensor aged or faulty</li> <li>- bad water transmission</li> <li>- lamp aged</li> </ul>	water /air temperature too cold/too warm clean all system parts send in sensor for examination check transmission with gauge TMX01 replace lamp
failure	<ul style="list-style-type: none"> <li>- malfunction of lamp, ballast, sensor</li> </ul>	determine failure cause replace/repair faulty part
changes at lamp tube	<ul style="list-style-type: none"> <li>- blackening in the filament region</li> <li>- recrystallization in the lamp quartz</li> </ul>	consult us lamp was too hot or touched with bare hands
glass breakage	<ul style="list-style-type: none"> <li>- transport damage</li> <li>- improper handling</li> </ul>	<b>immediate</b> information to us replace lamp
other faults		consult us

## 7. Installation instructions for UVC low pressure lamps



### ATTENTION!

Installation, electrical connection, maintenance and care of UVC low pressure lamps must be carried out from qualified specialists.

These operating instructions, the information in the data sheets on the UVC low pressure lamps, and the applicable legal rules for health and electrical safety must be observed. UV lamps have to be supplied with a suitable ballast according to the information on the data sheet. Beside the given lamp current and a suitable pre heating current the switching frequency must be observed. UV Technik lamps have to be supplied with the suitable ballast from our assortment. If devices of other manufacturers are used, approval is required, otherwise the warranty expires.

Besides the electrical safety the EMC problem also needs to pay attention. Especially the high frequency emissions of lamp and cable have to be considered in the design and installation of UV systems. Therefore lamp cables should be kept as short as possible and installed preferably separated from other components

and their cabling. To avoid disturbances lamp cables must never be laid parallel to supply cables of the ballasts. The same applies to control, signal or sensor cables since they carry usually small voltages or currents. If needed system-side measures have to be taken for compliance with the standards.

### 7.1 Cabling of UVC low pressure lamps

Every UV lamp must be connected with a separate cable. Cable cross-section, length and capacity must be adapted to the lamp current and the ballast used. Connections in the lamp cable should be avoided if possible. If inevitable, the used plugs must be dimensioned not only in accordance with lamp current and voltage, but also according to the ignition voltage of the UV lamps and the present operation conditions. Usually plugs with sufficient contact distances are suitable, possibly encapsulated to avoid soiling of the clearance and creepage distances.

Any damage of the cable has to be avoided. Cable passages in housings must be isolated sufficiently. The same is valid if cables are routed over edges. Cable inlets and kink protections have to be used and the bending radius has to be noted. The cable specification must comply with the ambient conditions. Possibly special cables must be used (e.g. radial water protected, oil resistant, flame retardant). If the cables are exposed to UV radiation or ozone, they must be isolated with Teflon (PTFE) or glass fiber. All other materials are not sufficiently stable and must be protected appropriately.

### 7.2 Place of installation

UV low pressure lamps must be installed and operated only in a dry, chemically and biologically inactive environment. Installation in vibrating parts of the system is not allowed. Hints regarding the mounting position have to be observed. The arrangement of the UV lamps has to be done so that a proper cooling is ensured. When used in water treatment systems the lamps have to be protected with submersion tubes. The same is valid for wet environment or ambient condition which can harm the lamps.



#### NOTE!

uv-technik international offers submersion tubes as well as submersion tube systems which facilitate the installation of our UVC low pressure lamps. Our sales staff will be pleased to advise you in this regard.

### 7.3 Handling of UVC low pressure lamps, maintenance, storage

For the optimal effectiveness of UV systems a professional maintenance is essential. Depending on the operating conditions a periodical cleaning of the UV lamps and other system components like submersion tubes, sensors, sensor ports or reflectors must be taken place.



#### ATTENTION!

Do not touch UVC low pressure lamps with bare hands. Skin oils and sweat are aggressive against the quartz glass of the lamps and cause re-crystallizations (clouding). Inadvertently touched lamps must be cleaned with an appropriate solvent. We recommend high purity alcohol (Ethanol) for cleaning. Methylated spirits is not suitable since denaturing additives leave residues. Wet cleaning or even an immersing of the lamps into water is not allowed. It is advisable to wear gloves. These gloves should be protect also against cuts. Note in the installation that the lamps are not tilted during insertion.

The storage of the UVC low pressure lamps has to be done in a dry and non corrosive environment. Otherwise oxide layers can be formed at the terminals and the low hygroscopic potting cement could absorb moisture. A long storage can slightly degrade the ignition ability.



#### NOTE!

To avoid problems during commissioning/installation, we recommend a short ignition test or possibly a practice run prior to delivery.

UVC low pressure lamps do not age during storage. Especially there is not any loss of UV power. To take advantage of the limited warranty of 2 years at the end of the lifetime of the lamps, the storage time should be calculated accordingly. The lifetime of the lamps can be found in the data sheets.

## NOTE!



uv-technik international offers for a simple test of UVC low pressure lamps a battery supplied lamp tester LT1. Using that small and handy unit a quick test of the lamps can be carried out and a passage test of its filaments. We recommend this unit to all service associates.

## 7.4 Health protection at work with UVC low pressure lamps

Health protection mainly affects protection against the radiation of the lamp and the thereby generated ozone. Moreover a cut protection has to be considered when working with glass parts.

## NOTE!



When using UV lamps the official application recommendations and the health and safety regulations have to be observed. Rules can be found in publications of the World Health Organization WHO and the International Radiation Protection Association IRPA as well as their implementation into national rules.

## ATTENTION!



Devices with UV lamps have to be constructed in a way so that no radiation can leak out, even by reflection. The allowed limits according to occupational safety must be not exceeded. Opening the UV units by mistake must be prevented. If applicable the opening should be possible by qualified personnel with (special) tools. Alternatively the UV lamps have to be switched off if an operator stays in the radiation area. Ensure there is an emergency off-switch or security lock and mark UV units with warning stickers.

## ATTENTION!



When working in an area with radiation eyes must be protected with suitable glasses. Moreover long clothing and gloves are recommended to protect the skin. As far as possible the UV radiation can be blocked, e.g. with a pane of glass or acrylic glass. Both materials stop the especially dangerous short wavelength below 300 nm.

## ATTENTION!



Devices with ozone generating UV lamps have to be constructed in a way so that no UV radiation and no ozone can leak out. Measures have to be taken to comply with the legal requirements for occupational safety. Please consider in the planning of systems that ozone is heavier than air. In case of a failure of the ventilation the UV lamps must be switched off. Please ventilate sufficiently in case of accidental leaking of ozone. Ozone is detectable by smell at very low concentrations. On the other hand it anesthetizes the odor receptors after a short time and so an accidentally too long exposure time to the gas could be possible. Ozone is toxic at higher concentrations and can harm the mucous membranes. Concentrations of 1 to 2 ppm during some hours can cause headache, chest pain as well as dryness and irritation of the upper respiratory tract. Regarding the exhaust air treatment of professional kitchens we refer to the DIN 18869-7.

*In addition to the known technical contexts, all given instructions of this document are based on our experiences. We take no guarantee of completeness and correctness.*