

Ultraviolet Equipment

for water disinfection



ABOUT LIT

Founded in 1991, LIT is one of top three leading developers and manufacturers of UV systems for water, air and surface disinfection in the world.

LIT has production facilities in Germany and Russia. Local Sales and Service support is assured with subsidiary offices in the Netherlands, China, Hungary, Bulgaria, Turkey, Poland and Latvia.

The company has a strong focus on research in the field of UV applications for various industries.

The Research, Development and Design Engineering Departments are scientifically empowered by top-level experts including Professors and Doctors of Science.



Scientific & Production Centre, Erfurt, Germany



Scientific & Production Centre, Moscow, Russia

History

- 1991 LIT founded by a group of scientists.
- 1995 LIT's new generation amalgam UV lamp production launched.
- 1996 – Commissioning of Europe's largest UV disinfection plant for potable water disinfection (400,000 m³/day) and wastewater treatment plants (300,000 m³/day) in Tolyatti, Russia.
- 1998
- 2003 Launch of the project of UV systems for air and surface disinfection in social facilities (schools and hospitals) and subway.
- 2004 – The world's largest UV complex for water disinfection (9 UV plants with capacity from 0.3 up to 1.5 million m³/day each in St. Petersburg's water treatment plants, Russia).
- 2008
- 2005 The South Korean largest UV station for wastewater disinfection (Gumi – 330,000 m³/day).
- 2007 The world's largest UV station for wastewater disinfection – 1.3 million m³/day (Lyuberetskaya WWTP, Moscow, Russia).
- 2008 The EU's largest UV complex for water disinfection (Budapest, 600,000 m³/day).
- 2004 – Setting up subsidiaries and representative offices in the Netherlands, Hungary, Bulgaria, China and production centre in Germany.
- 2012
- 2012 – Commissioning of the world's largest UV plant for wastewater disinfection – 3.125 million m³/day (Kuryanovskaya WWTP, Moscow, Russia).
- 2013
- 2014 High-output amalgam 185 nm lamps production launched.
- 2015 Introduction of industrial UV treatment systems for air and gas emissions.

UV DISINFECTION TECHNOLOGY

Ultraviolet technology for water, air and surface disinfection is based on the germicidal effect of UV-C radiation.

UV radiation is electromagnetic radiation between x-rays and visible light. UV wavelengths range from 100 to 400 nanometers.

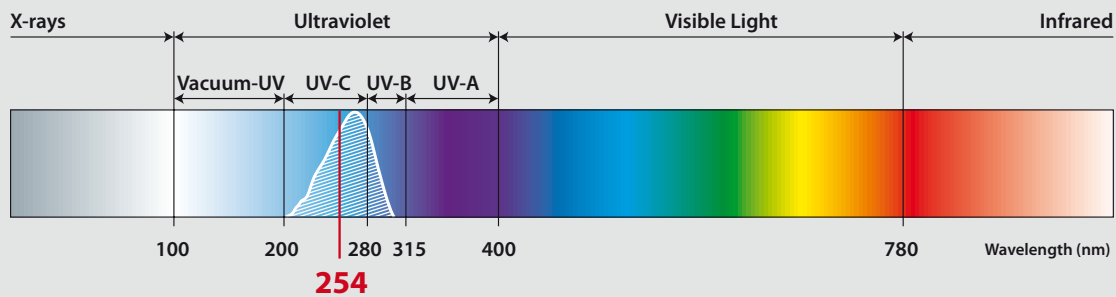
The UV wavelengths are divided in 4 groups, each with a different germicidal effect:

- ▶ UV-A – 315-400 nm;
- ▶ UV-B – 280-315 nm;
- ▶ UV-C – 200-280 nm;
- ▶ Vacuum UV – 100-200 nm.

Within the UV spectrum, UV-C range is considered the strongest UV radiation due to its high disinfection efficiency against bacteria and viruses.

The highest germicidal effect occurs at 205–280 nm and the maximum germicidal sensitivity of microorganisms at 265 nm.

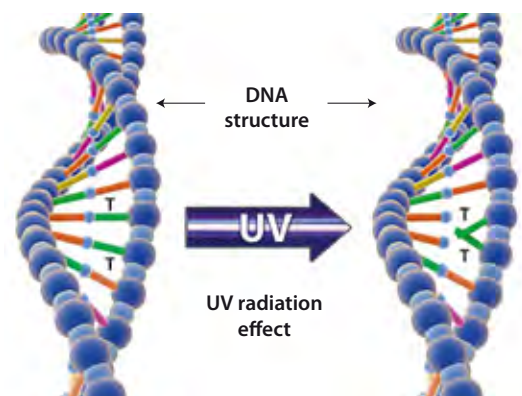
Ultraviolet in Electromagnetic Spectrum



Germicidal Effect of UV Irradiation

UV irradiation is a physical method of disinfection. The germicidal effect is based on photon absorption by DNA and RNA molecules. Photochemical reaction provokes dimerization of DNA and RNA bonds, which inhibits the ability of microorganisms to replicate. This process is known as inactivation of microorganisms.

UV disinfection technology can be applied for potable water supply and wastewater treatment as well as for air and surface disinfection applications.

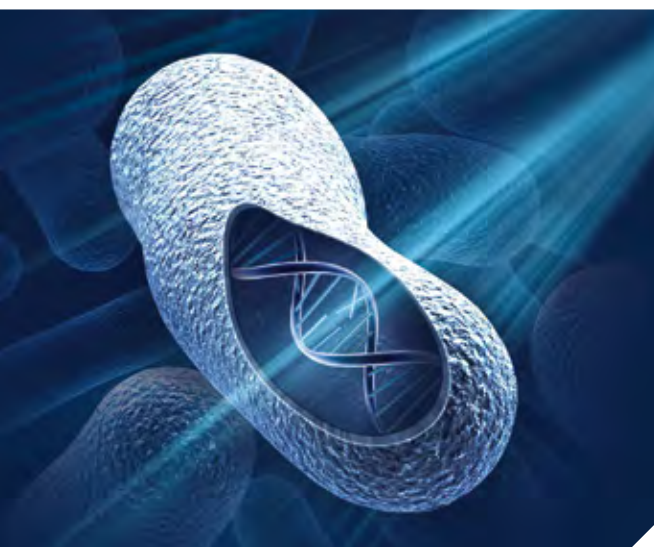


UV Irradiation Sources

Main industrial available sources of UV radiation are low pressure amalgam lamps and medium pressure mercury lamps. The amalgam lamps have higher efficiency ~40% in comparison to the medium pressure lamps with efficiency of only 9–12%.

UV systems equipped with amalgam lamp technology generally have a little larger physical footprint but they are significantly more energy efficient.

The design of UV system depends on the required UV dose, flow rate and physical and chemical parameters of media to be disinfected.



The Major Advantages of UV Technology:

- ▶ high disinfection efficiency against a wide range of microorganisms including chlorine resistant ones;
- ▶ environmentally safe, compared to chemical disinfection technologies; no by-products; no danger for overdosing;
- ▶ no impact on physical, chemical and organoleptic properties of water and air;
- ▶ disinfection process takes 1–10 sec; stream water is treated so there is no need in contact reservoirs;
- ▶ pH and water temperature do not affect UV disinfection process;
- ▶ low power consumption, capital and operational costs;
- ▶ UV systems are compact and easy to operate;
- ▶ no need for special operational safety precautions;
- ▶ UV disinfection process is easy to automate;
- ▶ no corrosion of process equipment.

APPLICATIONS

Potable Water

- ▶ ground water sources
- ▶ surface water sources
- ▶ local water systems

UV irradiation is widely used as a disinfection method to microbiologically safeguard the water supply systems.

Modern reliable water treatment processes imply the use of multi barrier treatment and disinfection of water. It combines UV radiation as a main disinfection stage with a residual disinfection effect by chemical agents for sanitary safety of facilities and distribution pipes.



Wastewater

- ▶ municipal wastewater
- ▶ industrial wastewater
- ▶ storm wastewater

Wastewater is a major source of microbiological contamination of the environment. UV disinfection for wastewater treatment completely eliminates the need for chlorination and, as a result, excludes expensive safety measures and dechlorination. UV disinfection provides microbiological safety of wastewater discharge into water bodies without negative ecological impact.

Wastewater disinfection becomes more significant due to the increasing water shortage and need for reuse of treated wastewater.



Swimming Pools and Water Parks

Combination of UV disinfection and chlorination are mainly used for water disinfection in swimming pools and recreational water parks. UV disinfection of swimming pools significantly reduces the amount of free residual chlorine in pool basins, which has a beneficial effect on organoleptic water quality and reduces the formation of chloramines.

UV disinfection ensures high germicidal effect against chlorine-resistant microorganisms.



Recycling Water

UV disinfection is used in industrial processes where water is recirculated. For example cooling circuits, fire extinguishing, washing processes, water based heat exchangers, etc.

The number of UV installations in the power industry is continuously growing. The UV disinfection in this industry is mainly used for operational purposes and infrastructure.



Industry

UV disinfection is applied in almost any production process which uses water as raw material or supplementary element.

The disinfection standards applied in such industries like pharmaceutical, food & beverage and microelectronic are much more stringent compared to potable water standards.



Aquaculture

UV disinfection is increasingly used for fresh and sea water disinfection in aquaculture plants. Unlike chlorination and ozonation, UV disinfection is not hazardous for the aquatic life; it prevents diseases and creates favorable conditions for aquaculture growth and reproduction.



Agriculture and City Parks

Treated wastewater is actively reused for irrigation in agriculture and urban parks. UV disinfection is now considered as almost the single option for environmentally safe, economical and most hygienic water reuse methodology.



UV SYSTEMS FOR WATER DISINFECTION

LIT offers a wide range of UV disinfection systems for natural, industrial, waste- and other water applications with capacities depending on the project specific water quality, the required disinfection level and the operational conditions.

LIT offers four groups of UV disinfection systems for a wide range of capacities, different water qualities and various application:

- ▶ DUV
- ▶ DUV Pro
- ▶ MLP
- ▶ MLV



Certificates

A wide range of LIT equipment is certified according to international standards:

- ▶ ÖVGW (Austria)
- ▶ DVGW (Germany)
- ▶ USEPA (USA)

UV Transmittance

UV transmittance (water transparency index for UV-C rays) determines the size of the required UV system and thus the energy costs for the UV disinfection. The lower UV transmittance, the more UV equipment and the more energy is required to achieve the same germicidal effect.

UV equipment is divided into series: A, B, E, F, G, K, N depending on the quality of treated water and UV transmittance range.

The UV equipment of each series is optimized for a specific range of UV transmittance (τ) to provide higher efficiency and minimize head losses over the UV system.

The LIT UV equipment automation and controls are based on state-of-the-art microprocessor systems of renowned brands like VIPA, SIEMENS, Schneider Electric. LIT UV systems are equipped with UV intensity sensors manufactured by LIT or third party. Validated UV intensity sensors are manufactured by renowned global manufacturers.

All LIT UV equipment (except for ultra-small systems) has a dose pacing system, to optimize the power consumption. LIT applies effective chemical cleaning and/or automatic mechanical cleaning systems for various equipment types; cleaning requirements depend on operational conditions and client's request.

Distribution of the UV intensity field in the UV reactor, hydraulic optimization and flow equalization determine the disinfection efficiency and operational stability of UV disinfection systems. The equipment design of LIT UV units integrates all the above design parameters and operational conditions for different water volumes and water types.

For specific project and operational conditions, LIT's specialists select the required UV equipment and optimize the configuration for a reliable and cost-effective solution.

GROUPS OF LIT EQUIPMENT

DUV

Closed vessel (pressurized) systems with longitudinal lamp orientation.

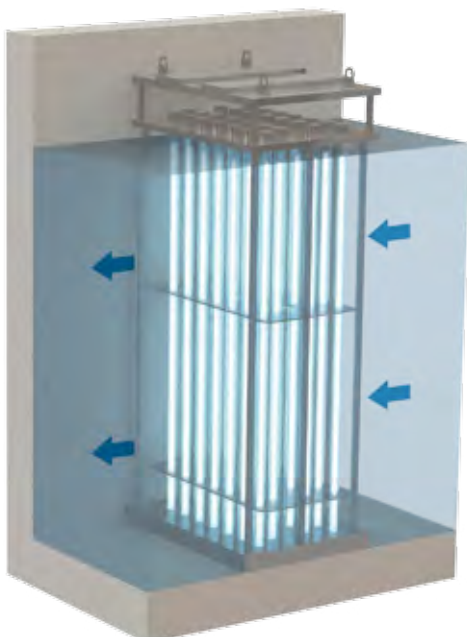
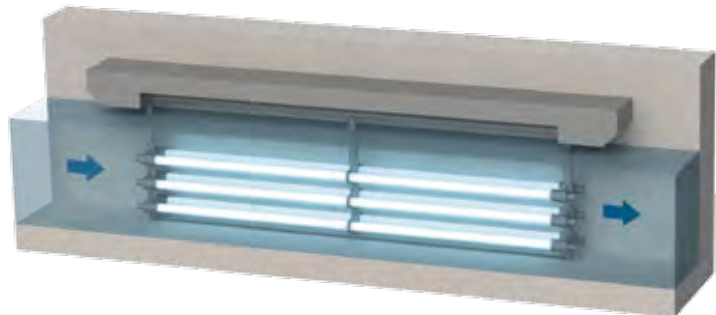


DUV Pro

Closed vessel (pressurized) systems with cross-flow lamp orientation.

MLP

Open channel systems with longitudinal lamp orientation.



MLV

Open channel systems with cross-flow lamp orientation.

DUV GROUP

DUV Group includes 5 series of closed vessel systems with various capacities and specific ranges of UV transmittance (τ).

DUV/A Series

for water with UV transmittance of $\tau \geq 85\%$

DUV/E Series

for water with UV transmittance of $75\% \leq \tau \leq 95\%$

DUV/B Series

for water with UV transmittance of $60\% \leq \tau \leq 80\%$

DUV/K Series

for water with UV transmittance of $30\% \leq \tau \leq 65\%$

DUV/N Series

standard UV units, with low and medium capacity and for UV transmittance of $50\% \leq \tau \leq 90\%$

DUV Group E, B, K, N series systems are available with three inlet/outlet flange orientations – L (default), Z or U – and for operating pressure up to 10 bar (up to 20 bar available on request).

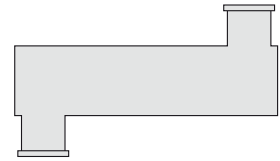
UV systems can be installed in a vertical or horizontal position.

The equipment of DUV/A Series is produced only in L-orientation for operating pressure up to 10 bar (up to 20 bar available on request).

DUV Group systems have the option to be equipped with fully automatic mechanical and/or chemical cleaning systems on client's requirements.

DUV Flange Orientations

Z



U



L



UV Equipment with Low and Medium Capacities

Standard equipment with low and medium capacities in DUV Group (1–500 m³/h) is developed and produced for two ranges of UV transmittances: A Series ($\tau \geq 85\%$) and N Series ($90\% \geq \tau \geq 50\%$). Both series use traditional (mercury) low-pressure lamps (15–75 W) and short amalgam lamps (95–500 W). Thanks to their compact size, the units require a small service area and therefore find their application in small rooms.

In order to assure proper design and optimize energy costs for UV disinfection, the recommendations for UV equipment selection with capacity of more than 200 m³/h are given by LIT on client's request, with the exception of the DUV/N series.

UV Equipment with Medium and High Capacities

LIT DUV Series provide an unique wide product line of longitudinal UV systems with medium and large capacities (up to 3,500 m³/h) utilizing powerful amalgam lamps of 300–900 W.

This equipment has been developed for four different UV transmittance ranges in order to provide maximum energy efficiency and reliable UV disinfection with significant flow rates for specific water qualities.

DUV/N Series

DUV/N series consists of standard pressurized UV equipment with low and medium capacities.

DUV/N equipment is designed for disinfection of natural, industrial and wastewater with UV transmittances of $50\% \geq \tau \geq 90\%$ at a wave length of 254 nm.

All standard UV systems are equipped with UV sensors and designed for operating pressure 10 bar.



DUV PRO GROUP

For large-scale UV systems LIT offers closed vessel cross-flow UV systems with a capacity from 500 to 10,000 m³/h.

DUV Pro systems are equipped with powerful amalgam lamps (500–900 W) for various water qualities. The systems have various inlet and outlet configuration options, allowing to design a disinfection system of any capacity with minimum head losses. When necessary the UV equipment can be integrated into an existing water treatment facility with minimum cost.

Within the DUV Pro Group there are three series of closed vessels (pressurized) equipment.

DUV Pro/K Series

UV equipment for water with UV transmittance of $30\% \leq \tau \leq 65\%$

DUV Pro/B Series

UV equipment for water with UV transmittance of $60\% \leq \tau \leq 80\%$

DUV Pro/E Series

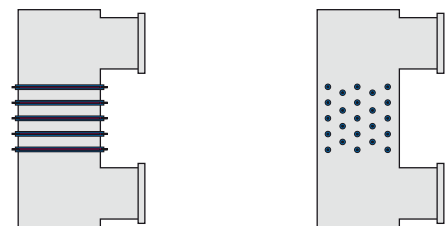
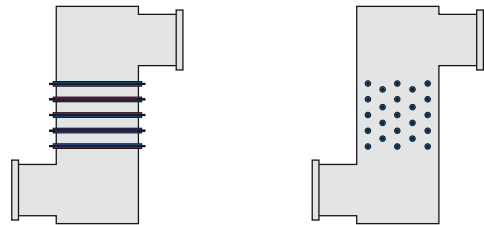
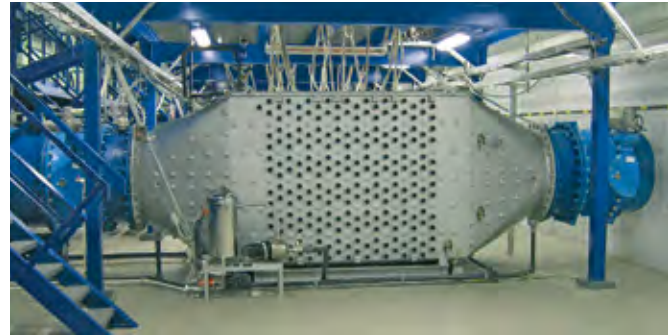
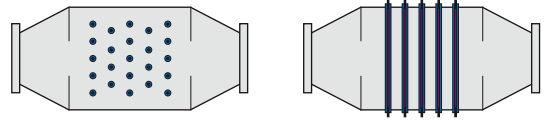
UV equipment for water with UV transmittance of $\tau \geq 75\%$

All series of DUV Pro Group equipment are produced for operating pressure up to 10 bar (up to 16 bar available on request).

DUV Pro Group UV Systems are available in six modifications.

To assure proper system design and to optimize energy costs for the UV disinfection application, LIT provides design recommendations and equipment selection on customers request in accordance with the project design input parameters.

DUV Pro Modifications





MLP AND MLV GROUPS

For wastewater disinfection LIT offers two types of open channel systems equipped with powerful amalgam lamps (300–900 W).

MLP Group

UV modules with longitudinal lamp orientation

MLV Group

UV modules with cross-flow lamp orientation

These two types of UV equipment allow:

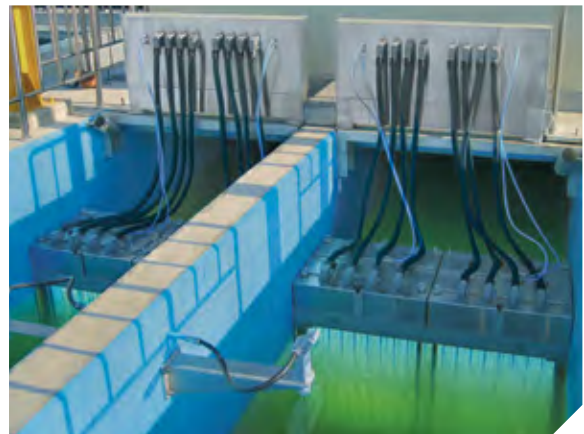
- ▶ for an existing WWTP – to fit UV equipment in any existing channel system;
- ▶ for a new WWTP design – to assure a compact footprint and minimize civil construction costs.

MLP and MLV Groups have two series of UV equipment for water of different quality: G ($\tau \geq 50\%$), F ($\tau \leq 50\%$). All MLP and MLV Group systems are equipped with fully automatic mechanical cleaning systems.

To assure proper system design and to optimize energy costs for the disinfection application, LIT provides design recommendations and equipment selection on customers request in accordance with the project design input parameters.



Russia, 1 350 000 m³/day



South Korea, 120 800 m³/day



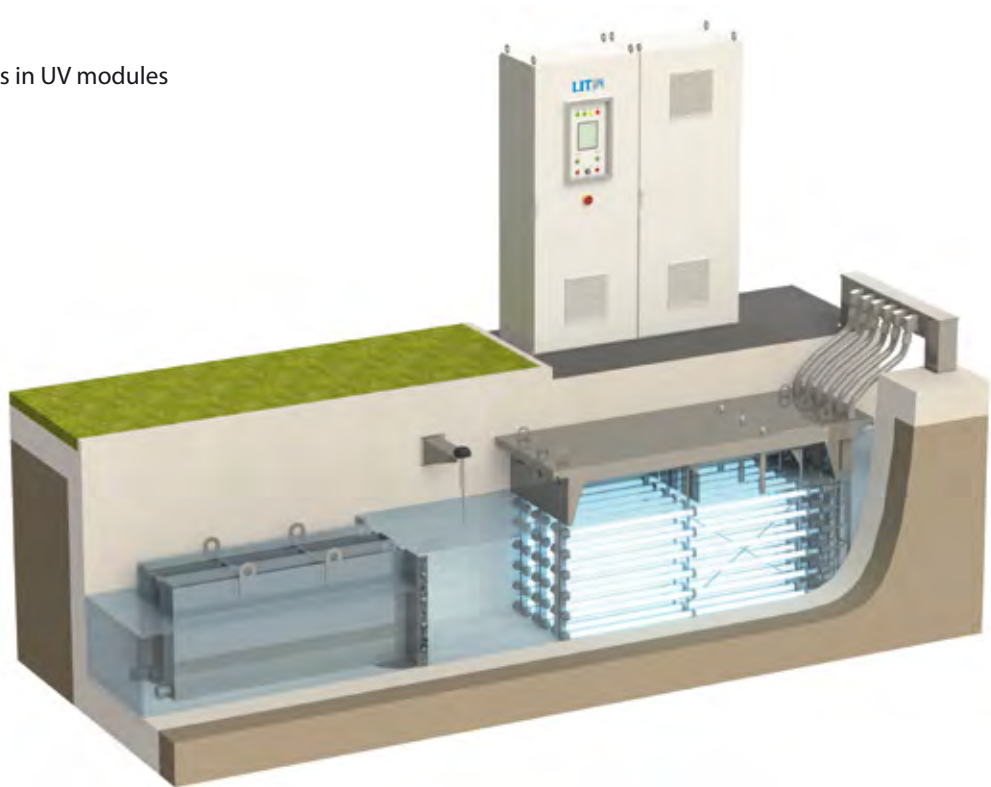
Hungary, 24 000 m³/day



France, 8 400 m³/day

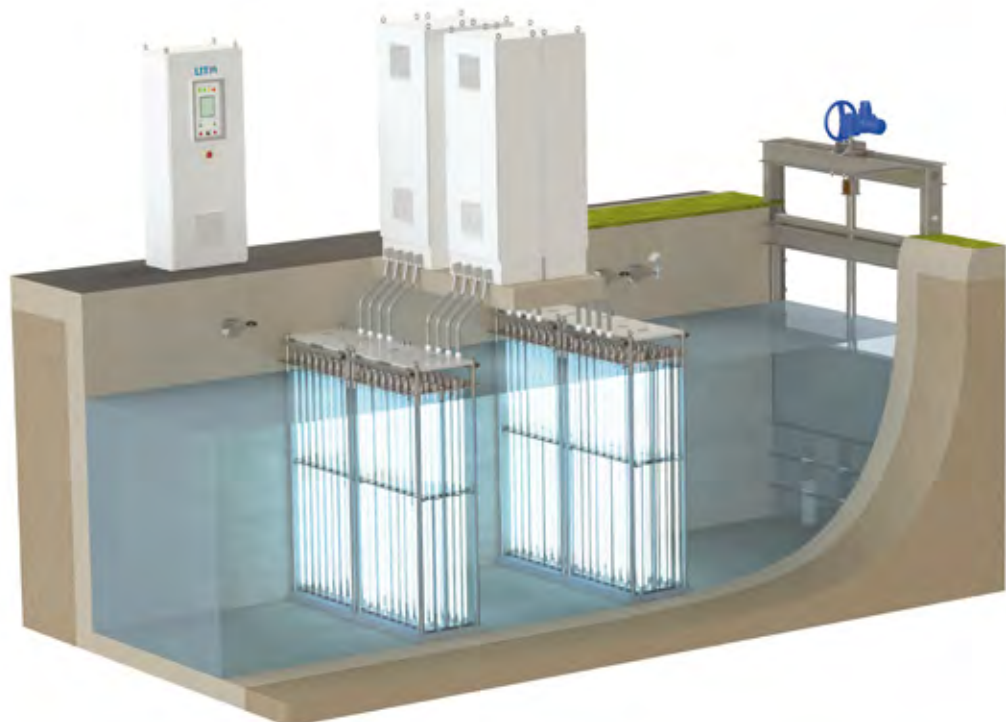
MLP GROUP

The number of lamps in UV modules ranges from 4 to 18.



MLV GROUP

Vertical UV modules (from 24 to 36 lamps in each module) enable LIT to produce ultra large-scale disinfection systems of 1 million m³/day and higher capacity at existing municipal WWTPs in large cities.

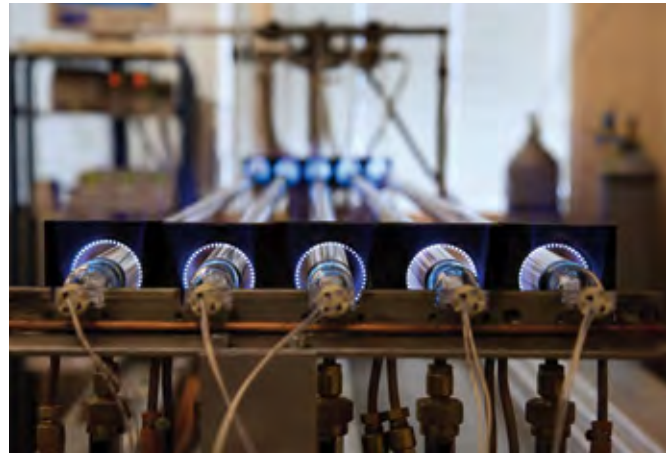


UV LAMPS

The basis of any UV system for water, air and surface disinfection is the UV source (lamp). UV lamp parameters – power consumption, efficiency, dimensions, lamp life, price – determine technical and economic properties and abilities of the specific UV unit.

Due to the efficient energy conversion, LIT focuses on the new generation of low pressure amalgam UV lamps as the most reliable UV source for UV disinfection systems available today (other lamp types may be applied for specific projects).

LIT uses a wide range of lamps produced in house and by world's leading manufactures (Philips Lighting, LSI/Lighttech) with power consumption from 15 W to 1 kW, efficiency of ~ 40% and lamp life up to 16,000 hr. This unique application expertise in UV lamp technology allows LIT to produce energy efficient UV systems of any capacity and provide customers with reliable, high-quality UV sources in many applications worldwide.



Ballast

A modern ballast provides long lamp life time (12,000–16,000 hours) and almost does not limit the number of on/off cycles. Dimmable ballasts are used to reduce energy costs as they allow to adjust the lamp power from 50% to 100%, following the operational water quality fluctuations and flow rate. Such dose pacing provides the required UV dose with minimum energy costs and prolongs the lamp life.



UV EQUIPMENT OPTIONS

Cleaning Systems

The LIT UV systems can be optionally equipped with chemical cleaning and/or fully automatic mechanical cleaning systems.

Both cleaning methods constantly assure the required level of UV intensity. The clients' operational requirements, the project specific water quality parameters, and operational conditions determine the use of chemical cleaning and/or automatic mechanical cleaning systems.

Chemical Cleaning System

Chemical cleaning system is based on weak solution of edible acids. UV system's components and reactor's inner walls are cleaned simultaneously.

Automatic Mechanical Cleaning System

The applied fully automatic mechanical cleaning system effectively removes various types of fouling from the quartz sleeves surface and provide consistent operation of the UV equipment. Pneumatic and electrical drives ensure high reliability of the UV system as a whole.



Dose Pacing System

LIT systems can be equipped with dose pacing system to adjust lamp intensity for different water quality parameters and flow rates, this optimizes energy consumption.

Control System

A PLC control system maintains the UV dose in the UV reactor and monitors lamp status and elapsed operating time. The operator interface indicates all operational parameters. A UV system is easy to integrate into the plant SCADA system of a water treatment plant using various industrial interfaces.



LIT UV INSTALLATIONS



Russia, 3 125 000 m³/day



Russia, 1 584 000 m³/day



China, 70 000 m³/day



Brunei, 58 200 m³/day



Hungary, 48 000 m³/day



LIT UV Elektro

Erfurt, Germany
Tel.: +49 3643 48999 0
Email: germany@lit-uv.com

LIT UV Europe

Eindhoven, the Netherlands
Tel.: +31 402 240 730
Email: info@lit-uv.com

LIT Moscow

Moscow, Russia
Tel.: +7 495 733 9526
Email: lit@lit-uv.com

LIT Duna

Budapest, Hungary
Tel.: +36 1 239 5268
Email: hungary@lit-uv.com

LIT Bulgaria

Sofia, Bulgaria
Tel.: +359 887 036 330
Email: bulgaria@lit-uv.com

LIT Baltics

Riga, Latvia
Tel.: +371 278 714 18
Email: baltics@lit-uv.com

LIT Poland

Lodz, Poland
Tel.: +48 603 304 366
Email: poland@lit-uv.com

LIT Asia

Beijing, China
Tel.: +86 139 111 639 97
Email: asia@lit-uv.com

LIT Turkey

Istanbul, Turkey
Tel.: +90 212 945 0 269
Email: turkey@lit-uv.com

www.lit-uv.com