Datasheet of Sterilization with UV-C LED

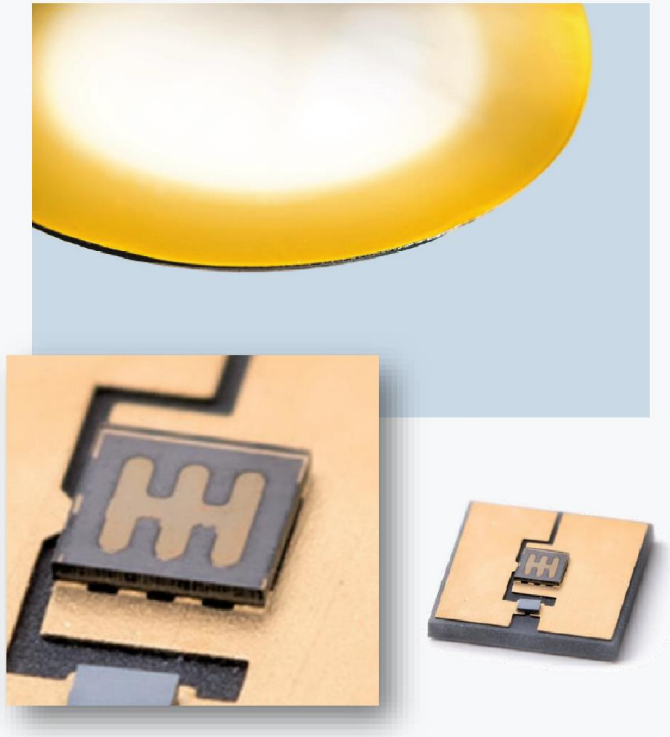
VTI

Výzkumný
Technologický
Institut s.r.o.

Our Unique Platform

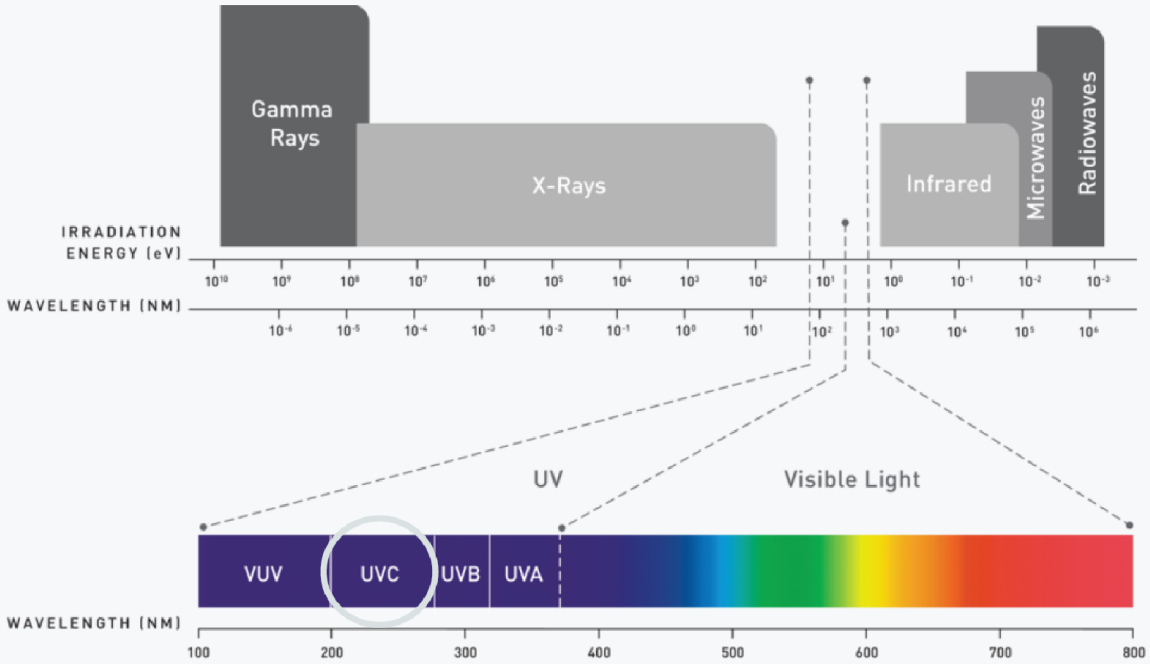
Our aluminum nitride-based UVC LEDs allow for more intense and reliable UVC output **at the key germicidal wavelengths** (260 nm – 275 nm).

- Fewer defects at shorter wavelengths: Higher disinfection capability
- Lower absorption in the UVC: Higher efficiency in the UVC
- Reduced etendue: Simpler, lower cost designs



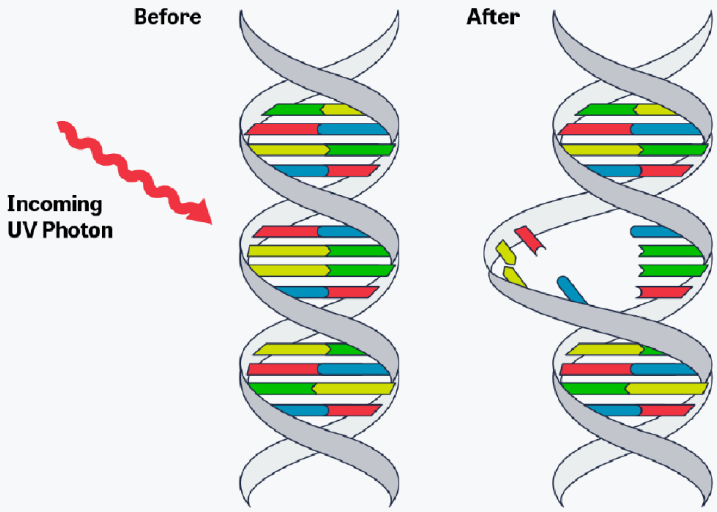
Unique and market leading UVC LED substrate platform

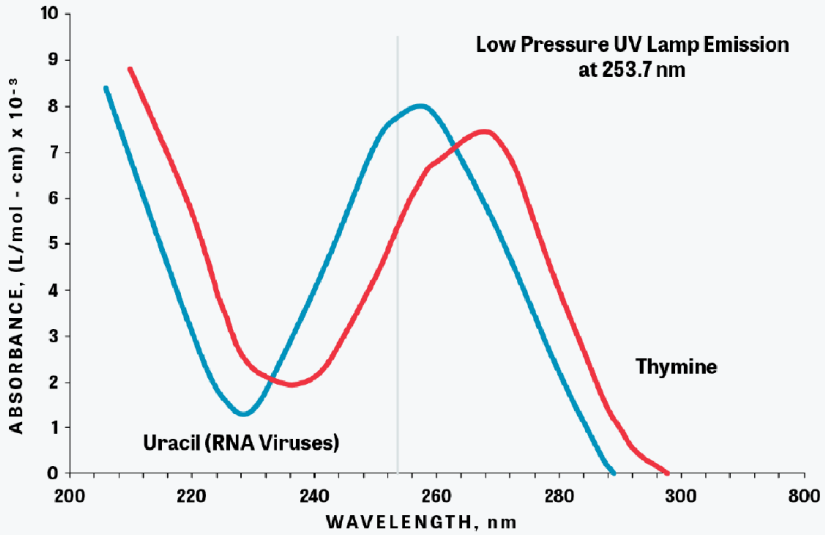
UVC Wavelength Range



How UVC disinfection works

- Nucleic acids strongly absorbs UVC wavelengths, with peak absorption around 265 nm
- In RNA-based microbes, uracil absorbs UVC light in place of thymine, with peak absorption around 260nm.
- With UVC irradiation, the DNA of pathogens is changed. Thus the pathogen cannot replicate anymore. → **INACTIVATION**





Why UVC for disinfection?

- UVC cannot be overdosed
- **No by-products or toxins**
- Does not require storage or disposal of hazardous material
- Requires minimal space for equipment and contact chamber
- **Does not affect the smell, taste or minerals in the water**

UVC light is the most efficient, safe, and documented way to disinfect

Why UVC LED technology?

Advantages over Hg lamp

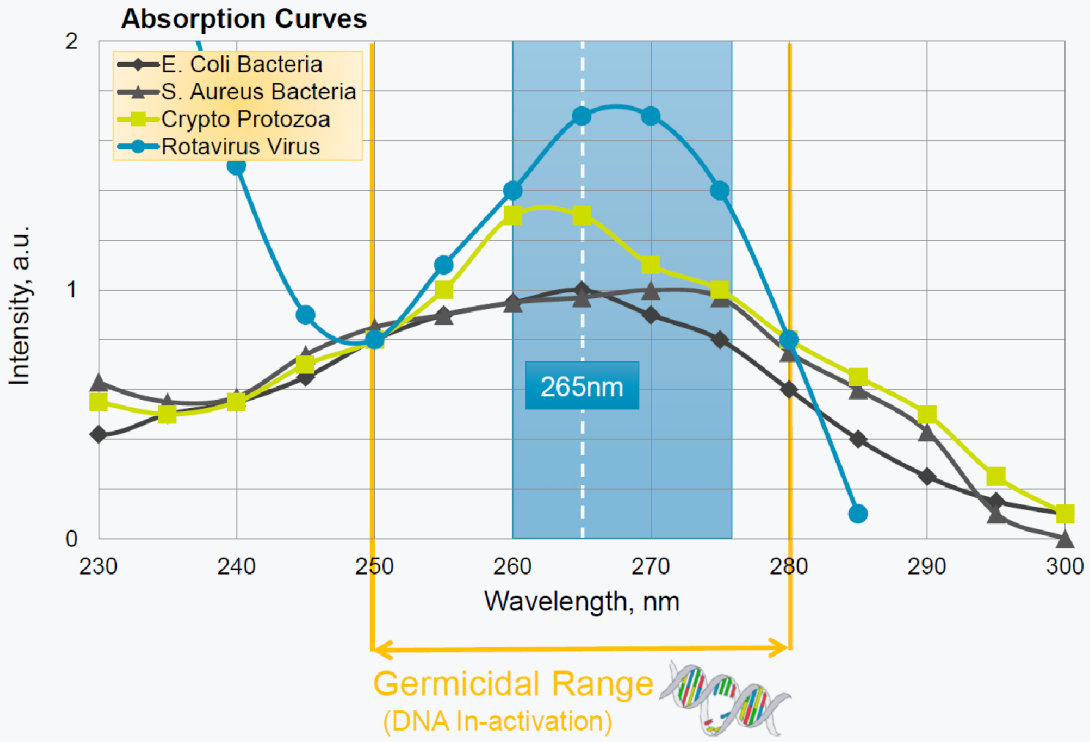
- Maintenance free
  - No need for qualified personnel to handle disposal of Hg lamps
  - **No catastrophic failure**, therefore maintenance planning made easier
- Instant on
  - Ability to switch at will, no impact on lifetime
  - No recirculation: **1st glass disinfected**
- Heat extracted from backside
  - Water not heated up, no taste/smell

MERCURY LAMP

UVC LED	Benefit in disinfection
Instant on/off	On-demand disinfection without wasted energy
Directional emission	Targeted disinfection with simple designs and no front-side heat
Compact package	Maximum design flexibility
Eco-friendly construction	Easy disposal without harmful mercury

UVC LED offer higher reliability and lower maintenance than existing technology

WHY VTI UV-C LEDs ?



Light at 265 nm provides the most efficient disinfection performance.

UVC LEDs at 265nm reduce uncertainty from production tolerances and ensure consistent germicidal performance

Improved disinfection performances and reliability with UVC LED technology (centered at 265nm)

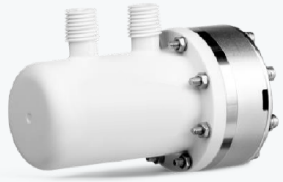
List of microbes with corresponding absorption correction factors at different UV wavelengths

Wavelength	Adenovirus	Bacillus Pumilis Spores	EMC	Bacillus Subtilis Spore	Cryptosporidium parvum	E. Coli	MS2 Coliphage	FD	FX-174	Poloma	Qbeta coliphage	Salmonella typhimurium	Staphylococcus Aureus	T1 Coliphage	T2 Coliphage	T7 Coliphage	VSW	Vaccinia
250	0.60	1.02	0.95	0.85	0.83	0.81	0.84	0.89	0.89	0.97	0.82	0.73	0.96	0.68	0.99	0.82	0.83	0.83
254	1.00	1.00	1.07	1.00	1.02	1.02	1.01	1.00	1.00	1.00	1.02	1.00	1.00	1.02	1.00	1.02	1.00	1.02
260	1.53	1.39	1.19	1.19	1.26	1.26	1.22	1.13	1.17	1.23	1.24	1.13	1.04	1.26	1.12	1.31	1.12	1.21
265	1.70	1.65	1.22	1.41	1.26	1.35	1.22	1.19	1.24	1.42	1.24	1.08	1.05	1.20	1.24	1.49	1.07	1.22
270	1.64	1.30	1.10	1.57	1.14	1.27	1.10	1.19	1.19	1.42	1.10	1.03	1.02	1.02	1.26	1.49	0.91	1.00
275	1.44	1.10	0.90	1.31	1.02	1.04	0.95	1.09	1.09	1.19	0.91	0.90	0.94	0.95	1.17	1.25	0.72	0.71
280	1.17	0.95	0.74	0.90	0.88	0.71	0.78	0.88	0.98	0.81	0.72	0.72	0.81	0.95	0.98	0.92	0.59	0.53
285	0.91	0.75	0.59	0.55	0.70	0.36	0.58	0.62	0.70	0.54	0.54	0.53	0.65	0.60	0.71	0.65	0.45	0.42
290	0.65	0.49	0.41	0.30	0.49	0.10	0.36	0.35	0.37	0.35	0.38	0.35	0.44	0.23	0.42	0.46	0.27	0.29

Source: IUVA News, Vol 19, No. 2

- Maximum absorption for microbes is between 260 nm and 270 nm
- LEDs are specified within tolerances, typically +/- 5nm
  - Wavelength affects germicidal efficiency, therefore products should be designed around highest rated specification (i.e. lowest germicidal efficiency).
  - UVC LEDs at 265nm provide consistent, dependable performance, reducing uncertainty throughout the product lifetime.

Why VTI reactor products?



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Reliability

- Control of all components, from LED to reactor
- 100% LED testing
- LEDs rated at higher reliabilities (B10)
- LEDs emitting at 265nm, best wavelength for both germicidal performances and control of uncertainty due to tolerances
- Production capability
- Only 36ml internal volume (27 re-disinfected on each dispense)

Validated performances

- **5+ LRV E.Coli at 2L/min** (3+ LRV after 36'000L)
- **4+ LRV pseudomonas at 2L/min**
- Third party tested (SGS, Linden Lab at UColorado, several watercooler manufacturers) on several pathogens and at different operating conditions, flow rates, and orientations.

Support

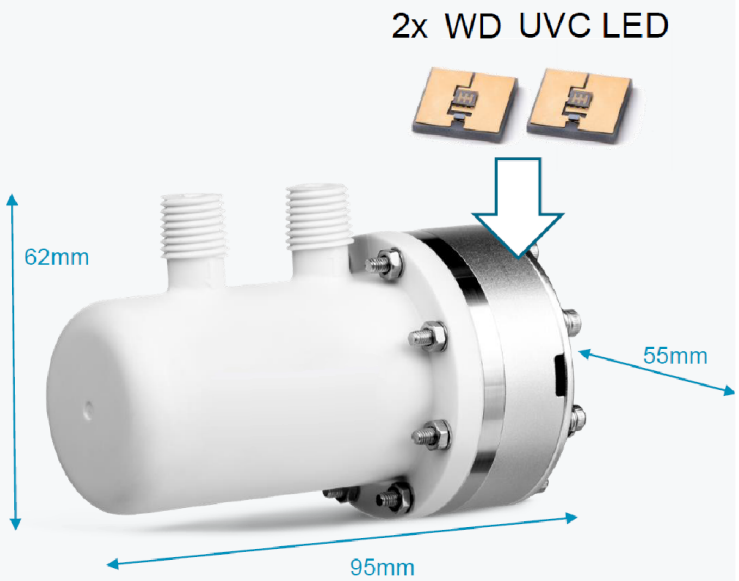
- Testing protocol
- Testing kit, including manual switch and AE

VTI reactors offer reliable, controlled and documented disinfection performances

VTI water reactor (WR) specifications

- High Capacity, On Demand UVC Purification Ready for Integration

Specification	Rating
Flow Rate	.5 to 3 LPM (30 to 180 LPH)
Water T	5-45 deg C
UV Transmittance (265nm)	> 95%
Size	95mm X 62mm X 55mm
Power Input	24V DC
Power consumption (LED on)	8W
Power consumption (Standby)	0.08W



Rapid path to market with existing or upcoming products

VTI water reactor (WR) Performance

Flow rate	0.5 liters per minute	2 liters per minute
Beginning-of-life (0 hours)	> than newest NSF-Class B equivalent*	> 4 LRV (99.99%) pseudomonas****
at 36.000 liters	> 5 LRV (99.999%) E.coli***	> 3 LRV (99.9%) E.coli**
After 36.000 liters	Smaller than 5 LRV (99.999%) E.coli but only slowly decreasing (no catastrophic failure)	Smaller than 3 LRV (99.9%) E.coli but only slowly decreasing (no catastrophic failure)

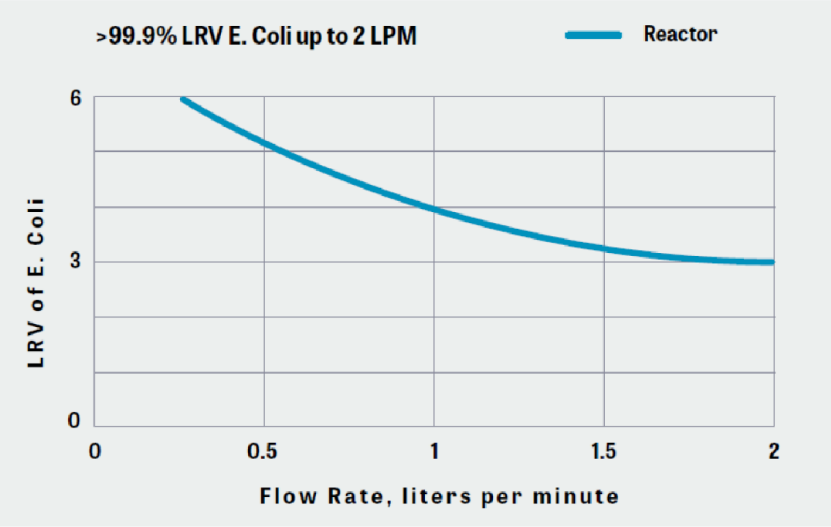
* third party Qbeta test (exact pathogen type from newest NSF 55 regulation)

** full SGS Test report available

*** **VTI** refers to E. coli (ATTC 8739), one of the strongest E. coli versions.

**** third party test available

Performance vs. flow rate after 36.000 liters consumption



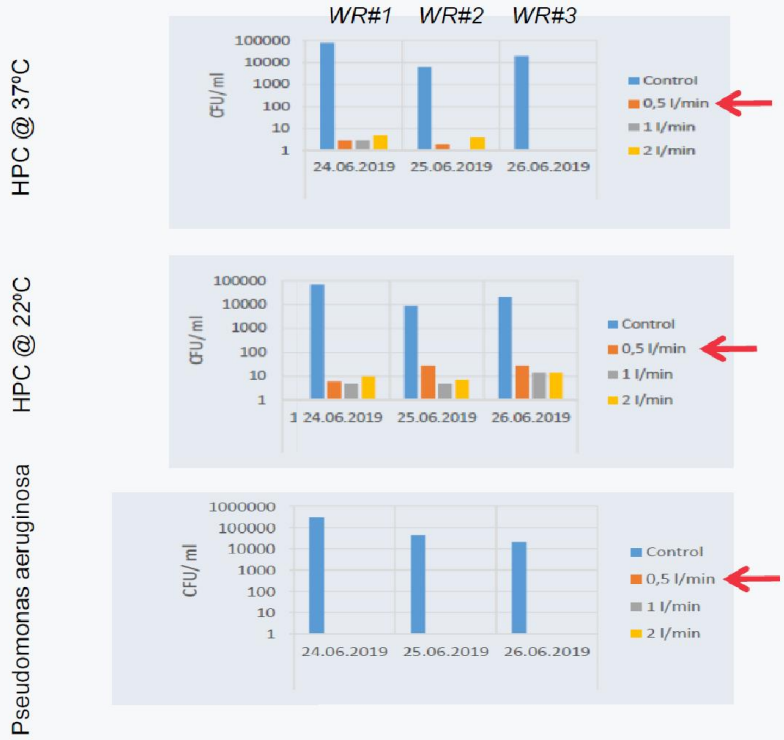
Superior reliability over Lifetime: B value B1

➢99% of devices perform better than our specifications

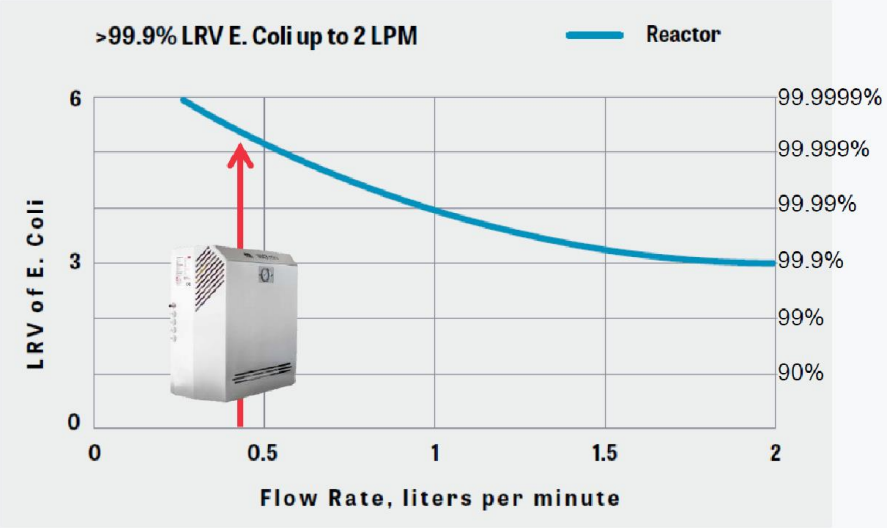
VTI provides reliable performance through in-house control of UVC LED production

VTI WR expectable performances within AQ3 mini

VTI WR test results
from a EU leading watercooler distributer:



Performance vs. flow rate **after 36.000 liters** consumption



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