

# DIN 19294-1:2020-08 (E)

## Devices for the disinfection of water using ultraviolet radiation - Part 1: Devices equipped with UV low pressure lamps - Requirements and testing

---

<b>Contents</b>		<b>Page</b>
Foreword .....		5
1	Scope .....	6
2	Normative references .....	6
3	Terms and definitions .....	7
4	Requirements for UV devices with UV low pressure lamps .....	10
4.1	General .....	10
4.2	Requirements for the UV device .....	10
4.2.1	Irradiation chamber .....	10
4.2.2	Sensor position .....	11
4.2.3	Device control and monitoring .....	12
4.2.4	Operation with controlled lamp power .....	13
4.2.5	Operating instructions .....	14
4.3	Requirements for device components .....	15
4.3.1	General .....	15
4.3.2	UV lamps .....	15
4.3.3	Lamp control gears .....	17
4.3.4	Lamp sleeves .....	18
4.3.5	Duty radiometers .....	19
4.3.6	Sensor attachment system .....	22
5	Test documents .....	24
5.1	General .....	24
5.2	Irradiation chamber .....	24
5.3	Device controller .....	25
5.4	UV lamps .....	25
5.5	Lamp control gears .....	26
5.6	Lamp sleeves .....	27
5.7	Duty radiometers .....	27
5.8	Sensor attachment system .....	28
5.9	Spare parts .....	29
5.10	Operating instructions .....	29
6	Requirements for the test set-up .....	29
6.1	Test rig .....	29
6.2	Testing at the operating location .....	31
6.3	Requirements for the test equipment .....	31
6.3.1	Test water .....	31
6.3.2	Transmittance-reducing substance .....	31
6.3.3	Water for producing the test water .....	31
6.3.4	Transmittance measurement .....	32
6.4	Measurement technology for the test set-up .....	32
6.4.1	UV-VIS spectrophotometer .....	32
6.4.2	Requirements for ultra pure water for calibrating the photometer .....	32
6.4.3	Flow rate measurement .....	32
6.4.4	Pressure measurement (optional) .....	32
6.4.5	Temperature measurement .....	33
6.4.6	Power consumption of the UV device .....	33

6.4.7	Power consumption of the lamps and lamp control gears during characterization .....	33
6.4.8	Irradiance measurement .....	34
6.5	Biodosimeter .....	34
6.5.1	General .....	34
6.5.2	UV inactivation curves .....	34
6.5.3	Inactivation procedure .....	34
7	Test procedure .....	38
7.1	General .....	38
7.2	Technical testing .....	39
7.2.1	Manufacturer's documents .....	39
7.2.2	Irradiation chamber .....	39
7.2.3	UV lamp test .....	40
7.2.4	Lamp control gear test .....	41
7.2.5	Lamp sleeve test .....	42
7.2.6	Lamp ranking and determination of the deviation from the mean value .....	43
7.2.7	Sensor attachment system test .....	44
7.2.8	Duty radiometers .....	44
7.3	Biodosimetric testing .....	46
7.3.1	General .....	46
7.3.2	Set-up and installation of the UV device .....	46
7.3.3	Recording of the correlation between the irradiance and the UV transmittance of the water .....	47
7.3.4	Determination of the test points (flow rate, minimum irradiance, UV transmittance) .....	47
7.3.5	Procedure .....	48
7.3.6	Consistency of the test conditions .....	48
7.3.7	General data recording using measurement technology during the procedure .....	49
7.4	Assessment of biosimetry – determination of the operation range .....	49
7.4.1	General .....	49
7.4.2	Calculation of the permissible operation range .....	49
7.4.3	Calculation of the operation range with just one test point .....	51
8	Structure and content of the test report .....	51
8.1	General .....	51
8.2	Specification of the UV device .....	51
8.3	UV device test set-up .....	51
8.4	Performance of the tests .....	52
8.5	Test equipment used .....	52
8.5.1	Measuring devices .....	52
8.5.2	Biodosimeter .....	52
8.5.3	Chemical-bacteriological investigation of the test water .....	52
8.6	Results of the tests .....	52
8.6.1	Results of the technical tests .....	52
8.6.2	Results of the general measurement technology .....	53
8.6.3	Correlation between irradiance and UV transmittance .....	53
8.6.4	Confirmation test of the UV sensitivity of the biosimetry .....	53
8.6.5	Results of the biosimetric investigations .....	53
8.6.6	Specification of the permissible operation and suitability range .....	54
8.7	Additional data/annex .....	55
Annex A (normative)	Measurement of the radiant power of mercury low pressure lamps in the UV- C spectral range .....	56
A.1	General .....	56
A.2	Prerequisites for reproducible and comparable measurements .....	57
A.2.1	Climatic conditions during the measurement .....	57
A.2.2	Measuring devices .....	57
A.2.3	Alignment of the sensor onto the lamp .....	57
A.2.4	Reflections and dark measurements .....	57
A.2.5	Radiation source .....	57

<b>Annex B (informative) Method for producing spores of <i>Bacillus subtilis</i> for use as a biosimulator (example) .....</b>	<b>58</b>
<b>B.1 General .....</b>	<b>58</b>
<b>B.2 Sporulation nutrient solution modified in accordance with Schaffer .....</b>	<b>58</b>
<b>Annex C (normative) Measurement uncertainties .....</b>	<b>60</b>
<b>Annex D (normative) Laboratory irradiation apparatus for reproducible UV irradiation in the laboratory .....</b>	<b>61</b>
<b>Annex E (normative) Test chamber for the characterization of UV lamps .....</b>	<b>64</b>
<b>Annex F (informative) Conversion table SSK -- UVT-10 -- UVT-100 .....</b>	<b>68</b>
<b>Annex G (informative) Conversion table UVT-100 -- UVT-50 -- UVT-10 -- SSK .....</b>	<b>71</b>
<b>Bibliography .....</b>	<b>73</b>