

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

Contents		Page
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 biodosimetry – 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 biodosimeter	53
8.6.5	Results of the biodosimetric 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

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