ASSE LEC #2011-202x

PUBLIC REVIEW DRAFT

Product Performance Requirements for

Legionella Reduction and Treatment Devices

ASSE Board Approved: xxxx

ICS Code: 13 060 99

General Information

No product may be said to be ASSE approved unless the manufacturer has applied to the ASSE International, has had his product tested according to the applicable ASSE standards or listing evaluation criteria, and when the product has passed the test and complied with ASSE's product certification requirements and displays the ASSE Seal on the product.

Instructions for receiving the authorization to display the Seal are available from ASSE's International Office. Organizations wishing to adopt or list to any ASSE standard or listing evaluation criteria should print the ASSE number on the cover page first and in equal or larger type to that of the adopting or listing organization.

ASSE International
Mokena, Illinois

LEC 2011 Working Group

Tom Palkon – Chairman
IAPMO R&T
Chicago, IL

Kimberly Alexander
Special Pathogens Laboratory
Pittsburgh, PA

Raymond Knispel
Argonide
Sanford, FL

Christoph Lohr
IAPMO
Phoenix, AZ

George Lukasik, PhD
BCS Laboratories
Gainesville, FL

Rebecca Marino, PhD
Special Pathogens Laboratory
Pittsburgh, PA

Janet Stout, PhD
Special Pathogens Laboratory
Pittsburgh, PA

Muralidhara Sakhumalla PhD
IAPMO India
Bangalor, India

Yuly Vesga
Argonide
Sanford FL

Foreword

This foreword shall not be considered a part of the standard; however, it is offered to provide background information.

ASSE International Standards are developed in the interest of consumer safety. Legionnaires' disease is a pulmonary infection brought on by the aspiration or inhalation of aerosolized *Legionella* bacteria. While there are always various species of microorganisms in the public water supply, *Legionella* has gained attention in recent years due to the rising number of identified individuals who contracted Legionellosis (i.e., Legionnaires' Disease, Pontiac Fever). Risk management plans for a premise include the prevention of bacterial species proliferation in the water system and their aerosolization. Cooling towers, HVAC humidity controls, showers, evaporative (e.g., swamp) coolers, and other means of creating water vapor are fed by plumbing systems that can have a means of temperature control or water treatment. The bacteria typically proliferate when the water temperature is between 68-122 °F (20-50 °C). This standard defines the performance requirements for those plumbing devices in order to reduce the downstream risk due to *Legionella* bacteria.

Unlike this standard, most potable water treatment standards apply to devices that service cold water supplies rather than elevated temperatures.

Most water treatment products when installed become part of the plumbing system. Proper installation and care should be taken to ensure the integrity of the plumbing system remains in tack and compliant with plumbing codes.

Recognition is made of the time volunteered by members of the Working Group and of the support of the manufacturers who also participated in the meetings for this standard.

This standard does not imply ASSE International's endorsement of a product which conforms to these requirements.

Compliance with this standard does not imply acceptance by any code body.

It is recommended that these devices be installed consistent with local codes by qualified and trained professionals. It is recommended that these devices be maintained and serviced per the manufacturer's recommendation, and that filters are replaced at regular intervals per the manufacturer's instructions.

ASSE LEC 2011
Legionella Reduction and Treatment Devices

SECTION I

1.0 General

1.1 Application

Legionella reduction and treatment devices are designed to reduce the microorganisms in the genus *Legionella* (e.g., *Legionella pneumophila*) typically found in potable water systems. The devices reduce the number of the bacteria through inactivation and/or filtration. They can reduce or prevent the downstream bacterial colonization of a water system and thus ultimately the release of the bacteria into the product water. Devices are intended to be used at Point of Entry (POE) or Point-Of-Use (POU) in applications for hot or cold-water or both for drinking water, washing hands or showering.

1.2 Scope

1.2.1 Description

The device reduces the quantity of *Legionella* bacteria that exit the device. Major components may include a disinfecting chemical inlet, mixing chamber, thermal element, housing, filtration media, and ultraviolet (UV) light source. The performance requirements in this standard are for full systems and are not intended to apply to components (i.e., filters).

1.2.2 Size Range - Plumbed Devices

Include inlet sizes from NPS ¼ inch (DN 8) through NPS 1-½ inch (DN 40).

1.2.3 Flow Range

Device(s) may provide flow rates up to 100 GPM (375.815.1 L/min).

1.2.4 Temperature Range

Inlet and outlet water temperature ranges from 33.0 °F (0.56 °C) up to 180 °F (82.2 °C).

1.2.5 Pressure Range

A maximum design pressure of 125.0 psi (827.4 kPa).

1.3 Reference Standards/Documents:

- APHA/AWWA/WEF, *Standard Methods for the Examination of Water and Wastewater, 23rd edition*
- ASHRAE 188-2018, *Legionellosis: Risk Management for Building Water Systems*
- ASME B1.20.1-2018, *Pipe Threads, General Purpose (Inch)*
- ASME B1.20.3-1976(R2018), *Dryseal Pipe Threads (Inch)*
- ASME B16.18-2021, *Cast Copper Alloy Solder Joint Pressure Fittings*

- ASME B16.22-2021, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*
- ASME B16.51-2018, *Copper and Copper Alloy Press-Connect Pressure Fittings*
- ASME A112.18.1-2018 / CSA B125.1-2018, *Plumbing Supply Fittings*
- ASSE 1061-2020, *Push-Fit Fittings*
- ASSE 1087-2018, *Commercial and Food Service Water Treatment Equipment Utilizing Drinking Water*
- ASTM F838-2020, *Standard Test Method for Determining Bacterial Retention of Membrane Filters Utilized for Liquid Filtration*
- *CDC Laboratory Guidance for Processing Environmental Samples*; https://www.cdc.gov/legionella/labs/procedures-manual.html
- ISO 11731:2017, *Water quality – Enumeration of* Legionella
- NSF/ANSI 42-2021, *Drinking Water Treatment Units - Aesthetic Effects*
- NSF/ANSI 53 – 2021, *Water Treatment Product – Health Effects*
- NSF/ANSI 55 – 2021, *Ultraviolet Microbiological Water Treatment Systems*
- NSF 61-2021, *Drinking Water System Components - Health Effects*
- NSF/ANSI 330 – 2021, *Glossary of drinking water treatment unit terminology*
- NSF 372-2022 – *Drinking Water System Components - Lead Content*
- NSF/ANSI/CAN 600-2021 – *Health Effects Evaluation and Criteria for Chemicals in Drinking Water*

SECTION II

2.0 Test Specimens

2.1 Sample Selection
Test plans and sample selections shall be as determined by the laboratory or certification body.

2.2 Testing
The test shall be performed so that all required challenges and procedures are conducted as specified in this standard.

2.3 Formulation
Complete formulation information on the materials used shall be reviewed to determine the following:

(a) Whether the material in contact with drinking water presents a health risk, and
(b) The material's potential for contributing contaminants to the drinking water.

2.4 Documentation
Assembly drawings, installation instructions, and other data, that is needed to enable a testing agency to determine compliance with this standard, shall accompany devices when submitted for examination and performance tests under this standard.

2.5 Rejection
Failure of one device at any sample point shall result in a rejection of that type, model, and size including any models that were intended to be bracketed.

SECTION III

3.0 Performance Requirements and Compliance Testing

3.1 System Structural Integrity

Residential water treatment devices shall comply with Section 5 of NSF/ANSI 42. Residential water treatment devices intended for hot water use shall be tested at 150° F ± 5° F (65 ° C ± 2.7° C) following NSF 42 protocol.

Commercial water treatment devices shall comply with Sections 3.6 through Section 3.9 of ASSE 1087. Showerheads with integral filters shall comply with Section 5.3.1.3, Pressure and temperature – Procedure with the outlet(s) blocked of ASME A112.18.1/CSA B125.1, *Plumbing supply fittings*.

3.2 *Legionella* Bacteria Reduction

3.2.1 Purpose

The purpose of this section is to measure the ability of the device to reduce the concentration of target microbial species when the means of reduction is a water purifier. *Legionella pneumophila* serogroup 1 (*L.p.*) is used as the challenge microorganism of choice. The culture may be obtained from American Type Culture Collection (ATCC). The culture reference number is ATCC 33152.

3.2.2 Challenge Stock Suspension Preparation Procedure

The below is provided as guidance to prepare the Bacterial Challenge Stock Suspension. An alternate procedure for producing microbial challenge stock may be used if it yields homogenous and pure suspension containing >1.0 x 10^9 cfu/mL. The procedure below is based on ISO 11731 and ASTM F838 with the following exceptions:

***Note**: Specified ASTM F838 sections are indicated for easy reference.*

1. Change the challenge organism with *Legionella pneumophila* serogroup 1 (American Type Culture Collection # 33152), a species of *Legionella*.
2. Change the optimum growth temperature to 95 ± 3.6 °F (35 ± 2.0 °C).
3. Add Buffered Charcoal Yeast Extract (BCYE), Buffered Yeast Extract Broth (BYEB), and de-ionized (DI) water to ASTM F838 Section 8, Reagents and Materials. In addition to BCYE, BYEB and sterile DI water, the following are needed: BCYE without L-cysteine (negative growth control media) or Blood Agar Plates (BAP) and sterile Phosphate Buffered Saline (PBS).
4. Prepare stock culture by inoculating BCYE slant with no mineral oil overlay (per ASTM F838 section 9.2.1) or prepare stock culture from reference culture by inoculating BCYE agar plate and incubate for 4-6 days at 95 ± 3.6 °F (35 ± 2 °C) in humidified incubator while maintaining 2-5% carbon dioxide atmosphere. The resulting tube and/or plate will serve as the stock culture for studies and as the qualitative positive control for the culture. Maintain stock culture plates in a sealed container at 32 – 46°F (0-8 °C) for no longer than 30 days. Prepare new stock plate from reference culture following 30 days. Ensure Challenge Stock Suspension is made from single isolated colony from stock culture plate and/or tube.
5. Prepare Challenge Stock Suspension by either of the below:

a. BCYE Agar: Apply cells from a single stock culture colony to Buffered Charcoal Yeast Extract (BCYE) agar in petri dish and incubate at 95 ± 3.6 °F (35 ± 2 °C) in humidified incubator while maintaining 2-5% carbon dioxide atmosphere for up to 7 days. Following incubation, add 5-10 mL of sterile Phosphate Buffered Saline (PBS) or appropriate buffer to each plate and harvest microbial growth with a sterile spreader. Transfer required volume of suspended culture to a sterile centrifuge tube. Centrifuge at >4K x g for 10 minutes. Aspirate supernatant and suspend culture in sterile PBS up to the same volume as prior to centrifugation. Repeat centrifugation, aspirate, and suspend in adequate volume of sterile PBS. Use the purified Challenge Stock Suspension for study within 7 days of preparation.
b. BYEB Broth: Inoculate 10 mL of BYEB from a single stock culture colony and incubate shaking at optimal growth temperature for 48 hours per (ASTM F838 Section 9.3.1). Transfer 2 mL of BYEB culture to 1 L sterile de-ionized water to make the Challenge Stock Suspension and incubate for 24 hours per (ASTM F838 Section 9.3.2) or transfer required volume of BYEB culture to a sterile centrifuge tube. Centrifuge at a minimum of 4K x g for 10 minutes. Aspirate supernatant and suspend culture in sterile PBS; use same volume as the starting transferred culture volume. Repeat centrifugation, aspirate, and suspend in adequate volume of sterile PBS. Use the purified Challenge Stock Suspension for study within 7 days of preparation.

> ***Note:*** *Alternative methods for preparation of the Challenge Stock Suspension are acceptable given that they generate a viable culture that maintains a stable concentration prior to use in Challenge Water.*

6. Store purified challenge water at 39-46 °F (4-8 °C) for up to 7 days. Enumerate purified challenge culture by performing serial ten or one-hundred-fold dilutions in PBS or appropriate dilution buffer. Spread plate each dilution on BCYE agar plates or use other regulatory approved method for enumeration of viable *Legionella*. Incubate plates at 95 ± 3.6 °F (35 ± 2 °C) for 4-7 days in humidified incubator while maintaining 2-5% carbon dioxide atmosphere.
7. Verify purity and species identity of the challenge suspension. The results of culture will not be available until 4-7 days following plating. If results of purity and species identity are not indicative of *L. pneumophila* (*L.p.*), the challenge suspension preparation is invalid and shall be repeated.

> ***Note:*** *Incubation conditions for Legionella may vary based on specific strain requirements and enumeration method. The incubation conditions used may be adjusted throughout the study as per the requirements of the method used or the individual strain requirements.*

3.2.3 Identification and Acceptance of Challenge Stock Suspension

1. *L. pneumophila* (*L.p.*) will grow on BCYE agar and will not grow on BCYE agar without Cysteine or BAP. Verify species identity by plating on both media. If growth is observed on BCYE agar without Cystine, discard challenge stock solution and start production of new stock. *L.p.* colonies on BCYE agar are gray-white, convex, complete, and shiny with a blue, pink, or purple iridescence. *L.p.* colonies are from microscopic to pinpoint size at 2-3 days and 2-3 mm in diameter after 5-7 days incubation. Compare resulting colonies to colonies on stock plate (qualitative positive control). Colonies must match in appearance and growth

characteristics. If all or some of resulting colonies do not match in appearance, discard stock appropriately and start production of new stock.

2. Latex agglutination can be used for further identification as well as Direct Fluorescent Antibody (DFA) staining, MALDI-ToF, nucleic acid sequencing or hybridization, PCR, biochemical assay, or other available validated method.
3. The calculated concentration of microbial challenge stock shall be >1.0 x 10^9 cfu/mL.

3.2.4 General Water Conditions

Challenge water is general water plus *Legionella pneumophila* (*L.p.*) ATCC 33152 at a final diluted concentration of >1.0 x 10^7 cfu/mL of challenge water. The parameters for the general water as below:

Note: *A filtered municipal water supply is typically adequate to achieve the below requirements.*

(a) pH: 7.5 ± 0.5
(b) Turbidity: <1 NTU
(c) Total Dissolved Solids (TDS): 150-500 mg/L
(d) Hardness: <200 mg/L
(e) Total Organic Carbon (TOC): 0.5-5.0 mg/L
(f) Total Chlorine: <0.04 mg/L
(g) Heterotrophic Plate Count (HPC) of 10-10,000 cfu/mL
Measure and report. Adjustment is not necessary. The naturally present HPC in dechlorinated water is within the specified range, and therefore the concentration would not need to be adjusted. If absolutely needed, adjustment may be conducted by dilution with membrane filtered water or addition of *E. coli* bacteria.
(h) The temperature for hot water applications shall be 90-100 °F (32.2 – 37.8 °C) and for shower filters shall be 100-105 °F (37.8 – 40.6 °C).

Note: *Temperatures in excess of 100° F (37.8 °*C*) reduces viability of lab strains of* Legionella*.*

(i) The temperature for cold water applications shall be 68 -77 °F (20-25 °C).
(j) The initial dynamic inlet pressure used for testing shall be ± 5% of the manufacturer's recommended working pressure, or 60 ± 3 psi (414 ± 21 kPa), whichever is greater. Flowing pressure shall not be less than 15 psi (103 kPa), or greater than 80 psi (552 kPa). Pressure shall not be adjusted through test progression. Units shall be tested at the flow rate achieved at the initial dynamic inlet pressure.
(k) Pressure is not a requirement for non-plumbed devices and non-filtration-based water treatment units (UV, Ozone, Heat, etc.).

3.2.5 Test Unit Challenge and Microbial Reduction Demonstration Procedure

1. Assemble the test apparatus in accordance with Figure 2. Figure 2 is provided as an example. Deviation from Figure 2 is permitted to allow for testing of appropriate treatment technologies.

Note: *Laboratory and staff shall have several barriers in place to minimize and contain the aerosolization of test water. Stringent containment protocols shall be in place to prevent infection.*

2. Testing shall be conducted to 100% of the manufacturer's recommended service capacity (volume) at the manufacturer's service flow rating. If a rated service capacity is not

provided, testing shall be conducted for the minimum 14-day test period. If flow rate is decreased by 75% prior to achieving recommended service capacity, the test shall be stopped, and a final challenge shall be conducted. If the device passes at the point of 75% flow reduction, and the test capacity has reached at least 50%, the rated capacity of the device shall be the capacity achieved at the point of 75% flow reduction.

3. Test to run a minimum of 14 days including stagnation, laboratory to adjust the cycle length and running hours of duration per day. Cycle duration maximum of 50-on/50-off minimal of 10-on/90-off; exception is for shower filters as they need to be on for minimum of 10 minutes continuously. Water treatment devices such as UV may be run at a cycle and duration per day comparable to NSF 55 or as to simulate use by consumer.

   Note: *Cycles are intended to be modified so stagnation can be run over a weekend.*

4. Two production units shall be conditioned per the manufacturer's instructions prior to the start of the test using the described Challenge Water (Sections 3.2.2 through 3.2.4) without the microorganism.
5. Conditioning water samples shall be collected for each test unit after conditioning prior to challenge with test organism. Neutralization of active agent in effluent samples shall be performed if units contain an active agent. Samples are analyzed for the challenge organisms and shall not demonstrate presence of challenge microorganisms.

   Note: *The active agent information is gathered during formulation review.*

6. In-line units shall be maintained under pressure during no flow conditions. Solenoid valves that are appropriately matched to the required flow rate shall be placed following the units. Terminal devices (i.e., mounted at the end of shower and faucets) do not need to be maintained under pressure. The cycling of the solenoids shall be programed and controlled electronically.
7. Calibrated flow meters and totalizers shall be used to record flow rate and cumulative volume passed through each unit. Water temperature shall be adjusted for cold or hot water applications per the manufacturer's use instructions. For hot water applications, the water shall be heated to appropriate temperature prior to introduction into the units. Sampling ports prior to and following units are used to collect influent and effluent samples, respectively. Microbial suspension shall be injected into influent water during flow to achieve a concentration of $> 1 \times 10^7$ cfu/mL at the required sampling points. The thorough homogenization, dilution of challenge suspension, adjustment of challenge suspension injection rate, and adequate inline mixing following injection of challenge solution are paramount to achieving the required influent concentrations. Alternately, a dedicated reservoir containing sufficient volume of Challenge Water at the desired *Legionella* concentration may be used as the supply during challenge events. Between sampling points, background levels of microbial Heterotrophic Plate Count (HPC) shall be 10 – 10,000 cfu/mL.
8. Challenge Water is introduced into the unit's influent at the beginning of the "on flow" period. A minimum of 10-unit void volumes of the Challenge Water shall pass through the units prior to sampling the effluent. Neutralization of effluent samples is required if the unit contains an active agent. A minimum of 1 Liter (.3 gallons) sample volume shall be collected in a sterile container (with neutralizer if applicable) for *L.p.* analysis. HPC analysis may be conducted on the collected sample or a separate sample may be collected in a sterile container for HPC analysis. Active agent samples shall be collected in a separate and

appropriate container. Active agent samples shall be stabilized appropriately. Active agent samples may be stored appropriately and analyzed simultaneously following the final sample collection at end of study.

9. Samples for microbial analysis shall be analyzed within 6 hours of collection (see Table 1 for sample schedule). This process shall be repeated for each sampling timepoint. Sufficient volume shall be collected at each sampling point so that each influent and effluent sample is analyzed for *L.p.* in triplicate. Analysis volume shall be adjusted to allow the demonstration of the required percent reduction based on *L.p.* concentration in Challenge Water (influent).

   Note: *The method(s) used to enumerate recovery of organisms must be dynamic enough to accurately quantify a range of recovered organism concentrations. Multiple methods can be used to enumerate the same sample to cover this range. Depending on volume of original sample needed for each method, effluent volume collected may need to increase.*

10. Perform microbial challenge sampling at start-up and every 25% of the systems rated capacity. Analysis shall be performed by approved methods (ISO, CDC, and/or Standard Methods). Continue water passage using required cycling and repeat challenge at 25%, 50%, 75%, and 100% of the system's capacity. A total of 5 challenge events are conducted per test unit.
11. The two stagnation samples shall occur at 40-49% rated capacity, and again between 90-99% of rated capacity. Stagnation samples shall be collected after a minimum of 48-hour rest with no flow through the test units. Stagnation samples shall be collected from the first water draw through the device after the stagnation period.

Table 1: Sampling and Challenge Schedule for Microbial Reduction Demonstration

Sampling Timepoint[1]	**Test Water Type**	***L.p.* Challenge Inoculation**	**Sampling and Analysis**			
			Active Agent Residual[2]	*Influent Background[3]*	*HPC*	*L.p.*
Start (Day 1)	Challenge	x	x	x	x	x
Run device with General test water including background bacteria						
25% (Day 4)	Challenge	x	x		x	x
Run device with General test water including background bacteria						
49% (Day 7) Following 48-hour Stagnation #1	General		x	x	x	x
50% (Day 7)	Challenge	x	x		x	x
Run device with General test water including background bacteria						
75% (Day 11)	Challenge	x	x		x	x
Run device with General test water including background bacteria						
99% (Day 14) Following 48 hours stagnation #2	General		x	x	x	x
100% (Day 14)	Challenge	x	x		x	x

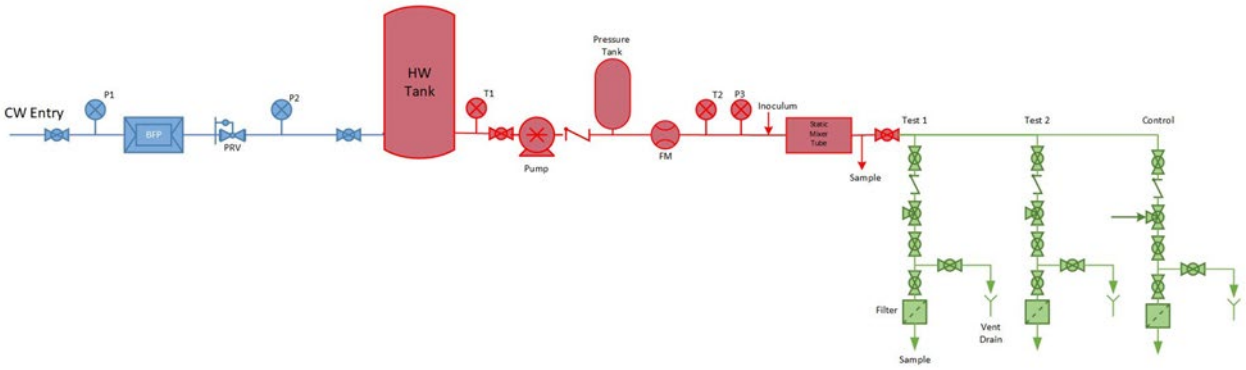
[1] Percent of estimated capacity or number of calendar days required for test completion.

[2] Active agent levels shall not exceed US EPA Federal Drinking Water standards or NSF/ANSI/CAN 600.

[3] Shall be 10-10,000 cfu/mL of the HPC.

3.2.6 Criteria

1. Systems for drinking water shall demonstrate at least 99.9999% reduction (6-$\log_{10}$ reduction) of challenge bacteria species at every test point.
2. Alternately, systems not intended for drinking water (e.g., shower water) shall be certified to the manufacturer's specific percent reduction claim, or 3-$\log_{10}$, whichever is greater. The units shall continuously demonstrate a percent reduction that is equal to or higher than the one specified by the manufacturer.
3. Challenge microorganism following stagnation periods shall be calculated as the geometric mean of the influent concentration used in previous challenge points. Challenge microorganism following stagnation periods shall be less than 6-$\log_{10}$.



Note: *Laboratory may vary from this example provided all test parameters are met.*

Figure 2 (Example of Test System)

3.3 Warning Indicator – Optional

3.3.1 Purpose

The purpose of this section is to determine the ability of the device to alert the user or facility manager of the operability of the device.

3.3.2 Procedure

Follow the performance indication device verification test procedure in Section 6.1.4 of NSF/ANSI 55.

3.3.3 Criteria

See Section 6.1.4.3.1 of NSF/ANSI 55.

SECTION IV

4.0 Detailed Requirements

4.1 Materials and Hardware

Residential systems intended to treat water for drinking shall comply with Section 4 (Materials) of NSF/ANSI 42.

Commercial POU systems intended to treat water for drinking shall comply with Section 4.1 (Materials) of ASSE 1087.

Devices where the water is intended for human consumption shall comply with NSF 372 and NSF 61 as applicable.

4.2 Documentation

4.2.1 Drawings

Assembly drawings, schematics, supply void volume, and other data, which is helpful to the installer, and needed by the testing agency to determine compliance, shall accompany the product when submitted for examination and testing under this standard.

4.2.2 Installation Instructions

Instructions for installation, maintenance and testing shall be packaged with the device or clearly made available online.

4.2.3 Literature

The device's literature shall state:

- Company name and contact information.
- Model number.
- The minimum rated flow rate in gallons per minute (L/min) at 45 psi (310 kPa) and maximum rated flow rate at 80 psi (552 kPa).
- General operation and maintenance requirements including, but not limited to, suggested frequency of filter and/or consumables replacement or service to the device, user responsibility, and parts and service availability.
- The rated capacity or rated service life in gallons (L). [The UV service life in hours or days].
- Flow rate.
- Rated pressures and temperatures.
- Minimum and maximum operating pressure.
- Pressure drop throughout the system.
- Statement noting the device and installation shall comply with applicable state and local regulations.
- A statement of the percent or log reduction of *Legionella*.
- For filtration systems, the statement: "This device is not intended to be operated without the integral filter."
- Filter conditioning instructions, if applicable.
- The percent reduction of the contaminant or that it meets this standard.

4.2.4 Replacement Components

The packaging or literature of components, specifically for replacement purposes, shall include the following information:

- Model number or name of component.
- Model number of device(s) in which the component is to be used.
- Rated capacity/rated service life in gallons (liters).
- Operating or exchange steps.

4.3 Markings

Each device shall be marked with:

- Manufacturer/company name.
- Model number.
- Maximum rated temperature.
- Maximum rated pressure.
- Rated capacity or service life.
- Statement that the system conforms to ASSE LEC 2011.
- With a (specify per section 3.2.6) log reduction.

4.4 Connections

Pipe threads and other connections shall conform to the applicable standards as follows:

- Tapered pipe threads shall comply with ASME B1.20.1.
- Dry seal pipe threads shall comply with ASME B1.20.3.
- Compression assemblies shall be compatible with SAE J 512.
- Soldered connections shall comply with ASME B16.18 or ASME B16.22.
- Push fit connections shall comply with ASSE 1061.
- Press connections shall comply with ASME B16.51.

SECTION V

5.0 Definitions

Definitions in the standard shall take precedence over any other publication. Definitions not shown are found in the Plumbing Dictionary (sixth edition) published by ASSE International, or NSF 330.

Active Agent

Additive used to prevent or retard the growth of organisms in the system.

Challenge Water

Water used during the contaminant test characterized by certain parameters. It is meant to test the capability of the device to reduce contaminants.

Effluent Water

Water that is flowing out of the device.

Filter Housing
The enclosure that houses the filter media, material, or assembly in the configuration required for a device to perform its function.

Filter Media
The aggregate substance that removes a pre-defined set of mixed chemicals, particles, etc. within the potable water stream flowing past it.

Fitting (as repeated from the Plumbing Dictionary)
Any device designed to control or guide the flow of water into a fixture.

General Water
Water used during the non-contaminant test characterized by certain parameters.

Influent Water
Water that is flowing into the device.

Service Capacity
Maximum rated volume for filters or rated flow rate for ultraviolet systems per the manufacturer's specification sheet.

Stagnation Sample
Sample collected immediately following a period in which no flow has occurred through the device for 48 hours or greater at ambient temperature.

Void Volume –
Total water-holding volume with the media and internal wetted components in place as determined by measuring the volume of water required to completely fill a dry system.

SECTION VI – Informative

Legionella species are able to grow at temperatures between 20-50 °C (68-122 °F). Below 20 °C (68 °F), *Legionella* will survive but are generally dormant. Temperatures above 50 °C (122 °F) can kill *Legionella* depending on the contact time. At 55 °C (131 °F), *L. pneumophila* will die in 5-6 hours. At 60 °C (140 °F), *L. pneumophila* will die in about 33 minutes, however, at 66 °C (151 °F), *L. pneumophila* die in less than 2 minutes (Sanden et al.). For sanitization of whole systems, it is recommended they should be heated to 60-70 °C (140 – 158 °F) for 30 min. (Allegra et. al.)

Temperature	**Time**	**State**
<20 °C (68 °F)	Indefinite	Dormant
20-50 °C (68-122 °F)	Indefinite	Growth range
50-55 °C (122-131 °F)	>6 hours	Disinfecting depending on time
55 °C (131 °F)	5-6 hours	Disinfecting
60 °C (140 °F)	33 min	Disinfecting
66 °C (151 °F)	<2 min	Disinfecting

References

Allegra, S., et al. “Longitudinal Evaluation of the Efficacy of Heat Treatment Procedures Against *Legionella* spp. in Hospital Water Systems by Using a Flow Cytometric Assay.” Applied and Environmental Microbiology, vol. 77, no. 4, 2010, pp. 1268–1275.

Sanden, G.N., et al. “Viability of *Legionella pneumophila* in chlorine-free water at elevated temperatures.” Current Microbiology, vol. 18, 1989, pp. 61-65.