



NSF INTERNATIONAL

# Protocol P442 –2015

Controlled Environment Light Fixtures

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# NSF Protocol P442

## Controlled Environment Light Fixtures

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# NSF Protocol P442

## Controlled Environment Light Fixtures

### 1 General

#### 1.1 Purpose

This protocol establishes minimum requirements for the design, construction, and performance of light fixtures (also known as luminaries, or complete lighting units) for use in controlled environments. These light fixtures are installed and used in environments in which cleanability, durability, and structural integrity (leak proof construction) are critical. They are designed to prevent the flow of air between the plenum space and the controlled environment; protect the luminaire interior from contaminants, particulates and moisture; and be easily cleanable.

#### 1.2 Scope

Controlled environment light fixtures (hereinafter referred to as “light fixtures”) may be used in a variety of different applications, including pharmaceutical processing, bio-tech research, biosafety labs, surgical suites, clean room manufacturing, food processing, horticulture, etc.

System components covered under NSF or NSF/ANSI standards or criteria shall also comply with the requirements contained in those other standards. This protocol shall in no way restrict new system designs, provided such designs meet the minimum specifications described herein.

#### 1.3 Alternate materials

While specific materials may be described in this protocol, light fixtures that incorporate alternate materials, design, or construction shall be acceptable when it is verified that the component(s) meet(s) the applicable requirements of the protocol based on its end use.

### 2 Definitions

Terms used in this Protocol that have a specific technical meaning are defined here.

**2.1 accessible:** Fabricated to be exposed for cleaning and visual inspection using simple tools.

**2.2 coating:** The result of a process where a material is deposited on and adhered to a substrate to create a new surface. The coating material does not alter the physical properties of the substrate.

**2.3 components:** All of the physical, mechanical, and electrical parts that comprise lighting fixtures.

**2.4 continuous run fixtures:** Fixtures mounted in a continuous row and are butted against each other. Fixtures require only one penetration in the ceiling for wiring in one of the fixtures. That one fixture shall feed the rest of the fixtures through wireways installed from one fixture to another.

**2.5 corrosion resistant:** Capable of maintaining original surface characteristics under prolonged contact with the intended end use environment and exposure to appropriate cleaning compounds and sanitizing solutions.

**2.6 disposable component:** A component that requires periodic replacement.

**2.7 easily cleanable:** Fabricated of materials, designed and constructed so soil and other debris anticipated in its end use environment are removed by normal (non-mechanical) cleaning methods.

**2.8 exposed:** Open to view from at least one angle.

**2.9 progressive surface:** Uninterrupted surface, devoid of both gaps and abrupt 90 degree returns.

**2.10 readily accessible:** Fabricated to be exposed for cleaning and visual inspection without using tools.

**2.11 removable:** Capable of being detached and taken away from the parent unit, and reattached to the parent unit with the use of simple tools.

**2.12 sealed:** Fabricated with no openings that will permit entry or leakage of air or water (leak-tight).

**2.13 simple tools:** Hand tools commonly available to maintenance and laboratory personnel, such as screwdrivers, pliers, open-end wrenches, and Allen wrenches.

**2.14 smooth:** A surface free of pits and inclusions, with cleanability equal to or exceeding No. 3 (100 grit) finish on stainless steel.

**2.15 acronyms used:** ANSI (American National Standards Institute); IEC (International Electrotechnical Commission); NSF International (formerly National Sanitation Foundation)

### 3 Normative References

The following documents contain provisions that, through reference in this text, constitute provisions of this protocol. At the time of publication, the indicated revisions were valid. All standards are subject to revision, and parties are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. These documents are copyrighted and available from their respective organizations.

- IEC 60529 *Degrees of Protection Provided by Enclosures (IP Code)*
- IEC 60598 *Luminaires*
- NSF/ANSI 2 – 2014 *Food Equipment*
- NSF/ANSI 49 – 2014 *Biosafety Cabinetry: Design, Construction, Performance, and Field Certification*

### 4 Materials

#### 4.1 General

The requirements contained in this section are intended to ensure that the materials used in the manufacture of light fixtures resist wear, penetration, or accumulation by particulates and contaminants (>0.1 micrometer); and the effects of foods, heat, cleaning compounds, sanitizers, and other substances that may contact the materials in their intended use environment(s).

#### 4.2 Conformance to NSF/ANSI Standard 2

Light fixtures shall comply with the materials requirements of section 5.4.4, Light Fixtures, NSF/ANSI



Standard 2 *Food Equipment – 2014*. Compliance is demonstrated by certification the standard by an ANSI-accredited third party certifier.

## 5 Design and construction

### 5.1 General

Light fixtures shall be designed and constructed to function properly and operate in a safe manner, prevent ingress of moisture and contamination, and be capable of being cleaned and decontaminated. Light fixtures shall produce a progressive surface with the ceiling. The normal environments in which these light fixtures are installed shall not adversely affect system components.

Light fixtures shall also be designed to eliminate any unnecessary grooves or indentations where contaminants can reside on the exterior (room) side of the fixture.

Exposed burrs and sharp edges (including, but not limited to, sheet metal screws) shall be eliminated from those surfaces that are subject to normal operation and/or maintenance (including those maintained with simple tools).

Fixture construction shall accommodate separate access to fixture for maintenance without breaching the continuous seal between the fixture trim and the ceiling. The doorframe shall seal to the trim using a gasket.

### 5.2 Conformance to NSF/ANSI Standard 2

Light fixtures shall comply with the design and construction requirements of section 5.4.4, Light Fixtures, NSF/ANSI Standard 2 *Food Equipment – 2014*. Compliance is demonstrated by certification to the standard by an ANSI-accredited third party certifier.

## 6 Requirements for performance

### 6.1 General

For qualification by the testing organization, lighting fixtures shall meet the pressure testing performance requirements described in 6.2 through 6.3. All removable components within the lighting fixture that are offered as optional equipment by the manufacturer shall be in place during pressure testing.

### 6.2 Pressure decay tests

The periphery and penetrations of the light fixture shall be leak tight when tested by the pressure decay tests in 6.2.1.

#### 6.2.1 Pressure decay test methods

##### 6.2.1.1 Purpose

These tests determine whether welds, gaskets, penetrations, and seals are free of leaks. Two pressure decay tests shall be conducted. One pressurizes the light fixture with and evaluates for leakage from the light fixture to the environment. The other creates negative pressure within the light fixtures and

evaluates for leakage from the environment into the light fixture.

#### 6.2.1.2 Apparatus

- manometer, pressure gauge, or pressure transducer system with a minimum range of 0.2 in w.g. (0-500 Pa) and accurate to  $\pm 0.02$  in w.g. (5 Pa);
- liquid leak detector;
- plastic or rubber hosing;
- source of pressurized air; and
- source of vacuum.

#### 6.2.1.3 Method (pressure decay – leakage from light fixture to room environment)

- a) Prepare the light fixture as a sealed system.
- b) Remove any obstructions, where necessary, to expose the outer hull of the fixture.
- c) Attach a manometer, pressure gauge, or pressure transducer system to the outer hull of the light fixture with plastic or rubber hosing to indicate the interior pressure. A viable penetration point may need to be installed.
- d) Pressurize the light fixture with a regulated air pressure source to a reading of 2 in w.g. (500 Pa)  $\pm 10\%$ , turn off the pressurizing air, and wait 5 minutes.
- e) Repeat step d as need until air pressure has stabilized. Turn off the pressuring air and wait 30 min.
- f) Measure the pressure after 30 min. A change in pressure within 10% of the original value is allowable.

#### 6.2.1.4 Method (pressure decay – leakage from room environment into light fixture)

- a) Prepare the light fixture as a sealed system.
- b) Remove any obstructions, where necessary, to expose the outer hull of the fixture.
- c) Attach a manometer, pressure gauge, or pressure transducer system to the outer hull of the light fixture with plastic or rubber hosing to indicate the interior pressure. A viable penetration point may need to be installed.
- d) Pressurize the light fixture with a regulated vacuum source to a reading of -2 in w.g. (500 Pa)  $\pm 10\%$ , turn off the vacuum, and wait 5 minutes.
- e) Repeat step d as needed until air pressure has stabilized. Turn off the vacuum and wait 30 min.
- f) Measure the pressure after 30 min. A change in pressure within 10% of the original value is allowable.

### 6.2.1.5 Acceptance

The light fixture shall hold 2 in w.g. (500 Pa) +/- 10% for 30 min when tested in accordance with section 6.2.1.3 and -2 in w.g. (500 kPa) +/- 10% for 30 min when tested in accordance with section 6.2.1.4.

### 6.3 IP rating

The light fixture shall have an International protection (IP) rating of IP65 or higher when tested in accordance with the current version of IEC 60529. The scope of IEC 60529 focuses on the protection of persons against access to hazardous parts within the enclosure, along with protection of the equipment within the enclosure against both ingress of solid foreign objects and harmful effects due to the ingress of water. Within the context of NSF Protocol P442, the IP rating is an indication of leak tight construction of a light fixture, protecting against both the ingress and the egress of solids and liquids. An IP65 rating indicates that the light fixture was determined to be dust-tight and prevented the ingress of jetted water under controlled test conditions.

### 6.4 IP rating acceptance criteria

A light fixture's IP rating shall be demonstrated by test data generated by a Nationally Recognized Test Laboratory (NRTL).

## 7 Requirements for manufacturer's specifications

The requirements in this section pertain to the manufacturer's specifications for proper installation and operation of the equipment. These specifications are necessary to ensure the light fixture is installed and used as intended. For other parameters, there are no restrictions on the values the manufacturer specifies.

### 7.1 Data plate

A permanent plate or label shall be affixed in a readily accessible location on each device, and shall contain, at a minimum, the following information:

- model number;
- name of the manufacturer; and
- a statement noting that the system conforms to NSF Protocol P442 for Controlled Environment Light Fixtures.

Where applicable and appropriate, the model number of the replacement components shall also be included.

### 7.2 Marking

Equipment certified according to this Protocol shall bear the following mark:



NSF Protocol P442  
Controlled Environment Light Fixture

### 7.3 Installation, operation, and maintenance instructions

The manufacturer shall provide written instructions for the operation and maintenance of the lighting fixture. The instructions shall include the following information:

- name, address, and telephone number of the manufacturer;
- model number;
- operation and maintenance requirements (including user responsibilities and service requirements);
- statement noting that the light fixture conforms to NSF Protocol P442 for Controlled Environment Light Fixtures; and
- electrical requirements.

Where applicable and appropriate, the following information shall also be included:

- sources of supply for replacement components; and
- model numbers of replacement