

Cleanroom and Containment LED Luminaires
Engineered to Protect People, Products and Processes

Sealed Enclosure
Product Selector
Guide

SE



Sealed Enclosure Luminaires: Protecting People, Products and Processes

Kenall draws on decades of industry experience to provide high-performance cleanroom and containment lighting. Kenall sealed luminaires specifically address three of the most critical cleanroom and containment lighting issues: contamination, spectral control (UV) and costly maintenance downtime.

These specialized luminaires are sealed to prevent the ingress of dirt, moisture and bacteria, and to protect the integrity of pressurized spaces. Superior spectral control is essential for a number of processes, such as the manufacture of photosensitive products or protecting the natural behavior of laboratory animals. Finally, sealed luminaires help facilities avoid costly downtime due to unscheduled maintenance by using properly designed LED and driver systems that provide extended L70 LED lifetime.

Whether your project requires luminaires that must meet stringent NSF2 standards, combat corrosive conditions, maintain critical environmental barriers (UL/cUL, IP65 / IP66, ISO, BSL and P442), or illuminate research areas without interfering with sensitive electronic devices (MIL-STD-461G), you can trust Kenall to reliably protect people, products and processes in cleanroom and containment applications.

Table of Contents

Sealed Enclosure Basics	3
Indigo-Clean™ Technology	4
Tunable White Technology	6
Narrow Spectrum Technology	7
Overlapping Door Luminaires	10
Hazardous Series	12
Plenum Access Series	14
Top Access Series	15
Inset Door Series	18
Environmental Series	20
Hazardous Series	22
Extended Flange Series	24
Linear & Specialty Luminaires	28
Wraparound Series	30
Downlight Series	31
Fluorescents	32
Exit Signs	33
Food Processing Products	34
Certifications	36
Warranties & ISO Classifications	37
Enclosure Ratings	38
Other Cleanroom Standards	40
Testing	44
Buy American Act	45
Product Index	46

We Understand Your Challenging Applications



Pharmaceutical



Research



Semiconductor



Biosafety and Containment



Vivariums



Cleanrooms



Laboratories



Anterooms

Sealed Enclosure Lighting Basics

A sealed enclosure separates its internal lighting components from the surrounding environment, protecting them from dirt, dust, moisture and other contaminants. It also protects the surrounding environment from outgassing, heat, arcing, air pressure leakage, electromagnetic Interference (EMI) and other conditions that could negatively affect process integrity or personal safety.

Kenall specifically designs these fixtures to maintain their seals in the dynamic pressure conditions found in today's cleanrooms. In order to resist penetration over time, resilient, chemically-resistant gaskets provide seals at the following interfaces: lens, door, housing and ceiling.

Kenall's easy-to-clean fixtures are Ingress Protection (IP) certified and have been tested for both positively and negatively pressurized environments to ensure protection against particulate contamination.

Performance Requirements of Sealed Lighting

1. A housing-to-ceiling interface for recessed fixtures that does not leak
2. A housing that does not leak
3. A doorframe that does not leak
4. A doorframe-to-housing interface that does not leak
5. When used in research environments, prevents EMI emissions from interfering with the performance of sensitive electronic equipment

Available Door Styles:



Overlapping Door Series

- For the most stringent cleanliness standards and cleaning protocols, including those that involve caustic chemicals and extreme abrasion
- One-piece, seam-welded, hole-free housing; one-piece doorframe and one-piece doorframe-to-housing gasket
- The doorframe's patented fulcrum repositioning bracket provides even, positive retention to the ceiling surface

See page 8 for full details



Inset Door Series

- Doorframe seals directly to housing, without involving a fixture flange or ceiling
- Can be inserted into a grid ceiling without opening the fixture
- One-piece, rigid doorframe with welded corners assures complete, lasting seal

See page 16 for full details



Extended Flange Series

- Prevents leakage between the fixture and an imperfect ceiling via a one-piece doorframe that mates to a housing flange, creating a predictable sealed surface
- Comprised of a one-piece, seam-welded housing and a one-piece housing-to-doorframe gasket
- The doorframe uses a patented fulcrum repositioning bracket for even, positive retention

See page 24 for full details

Add the Power of Disinfection to Your Cleanroom Lighting

Reduce the Risk of Bacterial Contamination

Kenall luminaires using Indigo-Clean Technology utilize a safe, new, state-of-the-art technology to kill harmful bacteria – and other organisms – in critical environments including cleanrooms. These revolutionary new LED luminaires combine white ambient light with 405nm Indigo light to provide on-demand disinfection and reduce the risk of contamination.

Kenall's sealed luminaires using Indigo-Clean Technology



- Kills Staph*, E. Coli, Salmonella and other organisms***
- Unlike UV disinfection devices, light is safe for occupants and requires no special technician or training***
- Provides a cleaner, safer environment, even in areas normal cleaning doesn't reach***

*per SGS#09S17036476 Other test reports available upon request.

On-Demand Disinfection Lighting for Cleanroom and Containment Applications



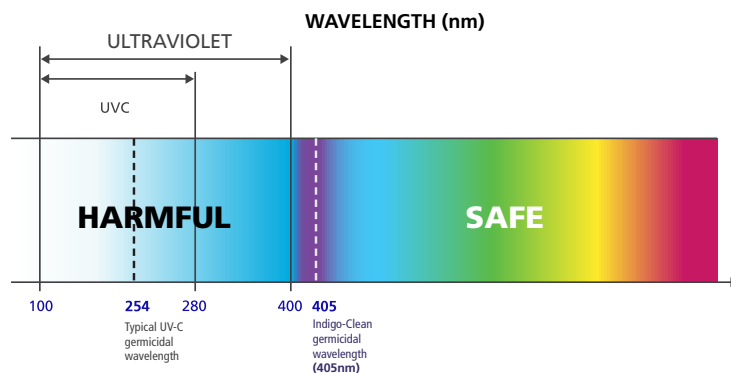
How Indigo-Clean™ Works

Help Prevent the Spread of Bacteria, and other organisms, with these Unique, Cost-Effective LED Luminaires

Kenall's SimpleSeal luminaires using Indigo-Clean technology combine white, ambient light with 405nm Indigo light to provide on-demand environmental disinfection with the flick of a switch.

- The 405nm light targets bacteria and produces intra-cellular Reactive Oxygen Species (ROS)
- Similar to bleach, these ROS kill the bacteria and prevent it from re-populating the space
- The 405nm emitted from Indigo-Clean Technology reflects off of walls and surfaces

Visible light spectrum showing the active element in Indigo-Clean



This icon indicates that the luminaire can be specified with the Indigo-Clean Technology option.

Learn more at kenall.com



Tune Your Lighting to Your Needs

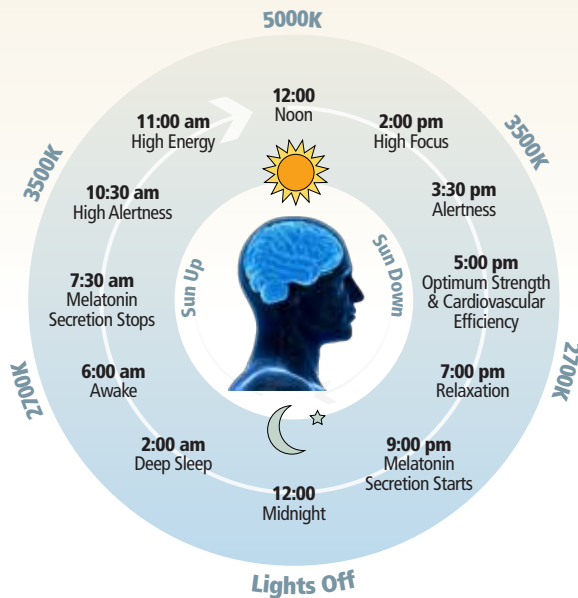
What Is Tunable White Technology?

Tunable white technology enables the user to independently control both color temperature and intensity of light within a given application. This provides the ability to change the color of light from warm to neutral to cool in appearance, over time, based on the needs of the occupant or the space.

The Primary Benefit of Tunable Lighting: Circadian Entrainment

Scientific studies have shown that when indoor light mimics the warm-to-cool cycle of natural daylight, people receive a number of benefits, including a more restful night's sleep and greater alertness during the day. This circadian entrainment is especially beneficial for those who do not have access to natural daylight, such as shift workers, office workers, hospital and nursing home patients, and correctional inmates.

Natural Light Simulation



Tunable White Lighting



Recreate Natural Daylight Patterns with Tunable White Light

Controls

The key to achieving the perfect balance of color and intensity is the use of appropriate controls. Kenall offers a choice of 0-10V Dimming, or Digital Addressable Lighting Interface (DALI) for more sophisticated capabilities. Both options provide the ability to interface with your choice of building automation systems. For your convenience, Kenall's tunable white products are compatible with a wide range of controls; from the simpler Pico® and EcoSystems® to the more sophisticated Fresco™, Grafic Eye® and Quantum® systems. Consult factory regarding specific controls compatibility.



Narrow Spectrum LED Lighting for Cleanrooms

Narrow spectrum is generated light energy, limited to targeted bandwidths, for the purpose of improving technical performance and/or visual acuity. When engineered into Kenall sealed luminaires, it provides consistent lighting for specific demands in research and cleanroom applications.



SimpleSeal™
570nm Amber
CSEDO, CSESO, CSETO, CSEDI, CSESI Series
Available in: 1'× 4', 2'× 2', 2'× 4'



SimpleSeal™
630nm Red
CSEDO, CSESO, CSETO, CSEDI, CSESI, CSEFL Series
Available in: 1'× 4', 2'× 2', 2'× 4'

Lighting that Preserves Photo-Sensitive Processes and Products

Life sciences and manufacturing applications use narrow spectrum amber light to avoid negative outcomes resulting from overexposure to the shorter wavelengths found in ordinary light.

Uses for narrow-spectrum amber include:

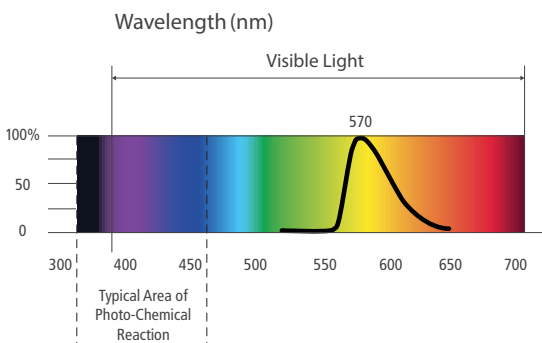
- Semiconductor manufacturing and nanotechnology research
- Preventing damage to light-sensitive ingredients in pharmaceuticals during manufacture
- Increasing cell viability at in-vitro fertilization clinics
- Reducing the possibility of damage to DNA during stem cell transplants

Lighting that Supports the Natural Circadian Rhythms of Laboratory Animals in Research Environments

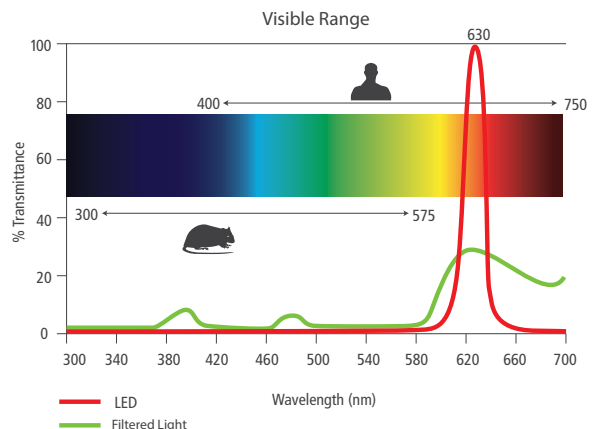
Studies indicate that the timing and duration of light and dark cycles (called a photoperiod) influences the body weight and food intake of laboratory animals, and can shift circadian rhythms, affecting blood pressure, heart rate and activity. Since red light is invisible to rodents (and some other research animals), it is used to prevent photoperiod disruption.

Historically, fixtures would use a red-filtered lamp sleeve. Over time, the filter degraded and passed visible light, compromising the vivarium's effectiveness. Kenall's red LEDs are made with AlInGaP die chemistry, which offers pure, consistent, controllable red light that does not degrade even when light output drops.

Visible light spectrum showing the active element in SimpleSeal Amber Series



Visible light spectrum showing the active element in SimpleSeal Red Series



Sealed Enclosure Luminaires



SimpleSeal™ Overlapping Door Series

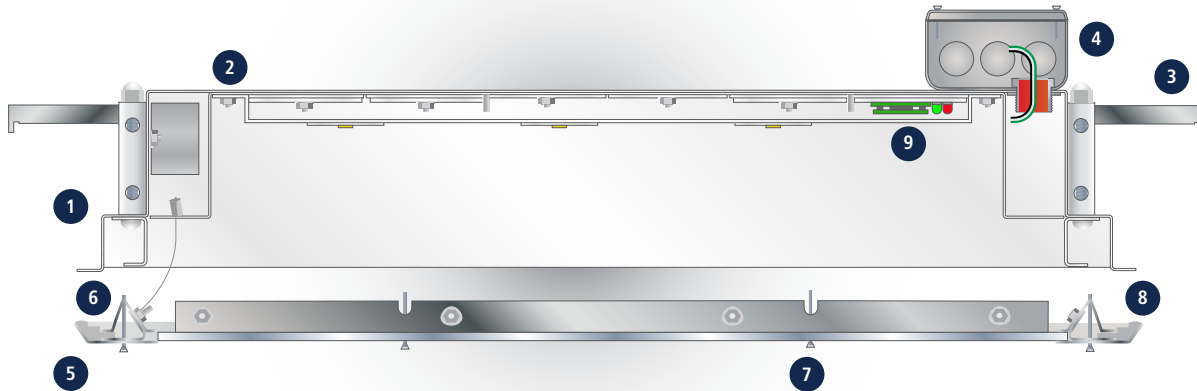
Highest Performance Seal and Optimal Cleanability



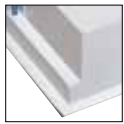
Project: Lab Corp
Location: Redmond, WA
Specifier: JPC Architects

Industry-Leading Patented Design Protects Your Space

Loaded with features, including the highest performance seal available, these luminaires are the preferred choice for your most challenging cleanroom and containment applications.



One-Piece Housing



- 1. TIG Welded Construction**
Eliminates inherent weakness of lapped and spot-welded construction. Available in cold-rolled steel, painted aluminum or stainless steel (304 or 316).



- 2. Compression Set PEM Studs**
Subassemblies and electrical components can be secured to housing without compromising its air-tight integrity.



- 3. Sealed Swing-Out Arms**
Recessed flange housing can be installed in ceilings more quickly and securely.



- 4. Optional, Hermetically Sealed Wireway**
Maintains seal integrity from plenum; eliminates need for caulk.

One-Piece Doorframe



- 5. Frame with 60° Beveled Edge**
Assures protection against harsh cleaning protocols. 60° beveled edge is easier to clean than a standard 90° return.



- 6. Patented Fulcrum Repositioning Bracket**
Reverse doorframe bowing to assure consistent contact with ceiling surface. Doorframe and gasket mate to ceiling structure, eliminating the need for caulk.



- 7. Flush Mounted Fasteners**
Stainless steel fasteners with Teflon® washers ensure air-tight integrity of the fixture, providing ease of cleanability.

One-Piece Doorframe Gasket



- 8. Extruded Closed Cell Gasket**
Customized shape with continuous skin. No open cell pockets to collect particulates as in die-cut strip gaskets.

- Vulcanized Corners
Sealed at corner to prevent leakage.
- Mechanically Secured to Doorframe
Precise secure and permanent positioning of gasket.

Sensor Options



- 9. Optional embedded motion sensor available in select luminaires**

Embedded Occupancy Sensor Benefits:

- Protected from moisture
- No interference from ambient temperatures
- Not reliant on line of sight
- California Title 24 compliant
- Abuse-resistant

Built to Prevent Leakage & Withstand Stringent Cleaning Requirements

CSE_O luminaires are the first in the industry to be certified NSF P442, which requires a test for pressure decay resistance in which the fixture is stressed, with both positive and negative pressure, and checked to ensure no leaks are present.

The CSEDO2424 is a sealed, high-output luminaire that is engineered for high-ceilinged applications, such as pharmaceutical manufacturing and food processing.



CSE_O Overlapping Series

- Industry's first NSF P442 certified luminaire
- Delivered lumen range: 5,057 – 24,761 lm
- Input power: 49 – 196W
- Efficacy: 102 – 138 lm/W
- CCT: 3500K, 4000K, 5000K; 82 or 90 CRI
- Indigo-Clean Technology and Tunable White options available
- Embedded motion sensor option
- Available in 570nm amber and 630nm red for scientific applications
- Universal housing accommodates either flange or grid applications

Nominal sizes: 1' × 4', 2' × 2', 2' × 4'; corner unit 7.75" × 50"
 Installation Types: Surface; recessed ceiling mount, grid or flange; corner-mount
 Lamp Types: LED, T5, T8



The above-referenced luminaires may bear these certifications and options. See individual product spec sheets for current listings.

NEW CSEDO2424 Overlapping Series

- Delivered lumen range: 24,000 – 36,000 lm
- Input power: 211 – 333W
- Efficacy: up to 123 lm/W
- CCT: 4000K, 5000K; 70 CRI minimum
- Easily replaces HID for high ceiling applications
- Multiple optical choices for distribution and glare control
- Universal housing accommodates either flange or grid applications

Nominal size: 2' × 2'
 Installation Types: Recessed ceiling mount: grid or flange
 Lamp Type: LED



www.kenall.com | P: 800-4-Kenall | F: 262-891-9701 | 10200 55th Street Kenosha, Wisconsin 53144

This product complies with the Buy American Act: manufactured in the United States with more than 50% of the component cost of US origin. It may be covered by patents found at www.kenall.com/patents. Content of specification sheets is subject to change; please consult www.kenall.com for current product details.

Understanding Hazardous Locations – And Why the Right Lighting is Critical

A hazardous location is designated by the presence of a specific concentration of fuel in an environment where electric service is also available. The number of hazardous locations in the US numbers in the hundreds of thousands and includes places we visit or drive by every day, such as retail gas stations; grain elevators; food processors; distilleries; chemical plants; refineries; paint and surface coating application and storage areas; and power generation and waste treatment plants.



Flammable gases

Most flammable gases have an ignitable range of concentration above or below which the fuel may not ignite. (Note: a concentration of fuel above the specified range is still considered a hazard, since it is possible to reduce the concentration until it returns to within the ignitable range.)

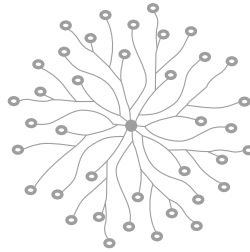
The Texas City, Texas BP Refinery explosion in 2005 was caused by an accidental gasoline spill that vaporized: the resulting cloud was ignited by a running vehicle parked nearby.

Examples of other flammable gases include: acetylene, propane, butane, ammonia, methane, hydrogen, and ethylene.

T-Code Ratings

Hazardous listed fixtures are also defined by their T-code rating. A T-code is determined by the temperature of the fixture's hottest surfaces. The T-codes range from a very hot T1 at 450°C down to a cool T6 at 80°C. Since fuels will auto-ignite when exposed to high temperatures, it's important to specify fixtures with cool T-codes, well below the specific fuel's autoignition temperature.

See page 43 for more information.



Dust / Fibers and Flyings

Combustible dusts can either form an explosive cloud when mixed with air, or accumulate on the surfaces of electrical components, causing them to overheat.

According to a 2014 New York Times editorial, combustible dust explosions killed 29 people and injured 161 between 2008 and 2012. Incidents included a series of sugar dust explosions in Georgia in 2008 and three combustible dust accidents in 2011 at the Hoeganaes metal powder plant in Gallatin, Tennessee.

Categories of combustible/explosive dusts:

1. Agricultural products such as egg whites, powdered milk, starches, sugars and wood flour
2. Agricultural dusts including many grains (dust and flour), coffee, cotton, grass and spices
3. Carbonaceous dusts such as coal, charcoal, petroleum coke, cork and cellulose
4. Chemical dusts including methyl-cellulose, lactose and sulfur
5. Metal dusts including aluminum, magnesium and zinc
6. Numerous types of plastics including melamine and several types of vinyl



Preventing Ignition

There are two ways that fuel is ignited: when a fuel is in its explosive range and exposed to both air and an ignition source (sparks or an open flame), or when it reaches its Auto Ignition Temperature (AIT). The AIT is the temperature at which a fuel will, if heated, ignite and burn without the addition of a spark or flame.

Authorities use factors such as AIT to determine the required maximum operating temperatures of heat generating devices, such as luminaires and equipment motors. These devices must be designed to contain all sparks or flames generated during normal or abnormal conditions, and must not exceed the maximum operating temperature required for this environment.

Kenall manufactures Hazardous Location fixtures under the SimpleSeal™ family: for a more in-depth look at Hazardous Location lighting, please download our whitepaper, "A Guide to Hazardous Location Classifications and Device Types", available at kenall.com.

SimpleSeal Luminaires: Keeping Their Cool in Hazardous Locations

The SimpleSeal HSEDO and HSESO Series are high-output, sealed, IP-rated, overlapping door LED luminaires that are rated for use in the most common hazardous locations, where gases and liquid fuels are stored and/or used. Cool-running, low voltage LEDs paired with chemically-resistant gaskets provide a high level of safety, reliability and long service life in industrial spaces.



HSEDO Recessed Series

- Delivered lumen range: 5,057 – 24,761 lm
- Input power: 49 – 196W
- Efficacy: 132 – 138 lm/W
- CCT: 3500K, 4000K, 5000K; 82 CRI
- Suitable for hazardous locations rated Class 1, Division 2
- T-code rating: T-6 for cool operation
- Groups A through D for use with a wide variety of fuels
- Integral emergency battery pack available
- All models suitable for ambient temperatures up to 40°C (104°F)

Nominal sizes: 1'×4', 2'×2', 2'×4'
 Installation Types: Recessed ceiling mount, grid or flange
 Lamp Type: LED

HSESO Surface Series

- Delivered lumen range: 6,150 – 20,418 lm
- Input power: 59 – 184W
- Efficacy: 104 – 110 lm/W
- CCT: 3500K, 4000K, 5000K; 82 CRI
- Suitable for Hazardous locations rated Class 1, Division 2
- Groups A through D for use with a wide variety of fuels
- T-code rating: T-5 or T-6 for cool operation
- Integral emergency battery pack available
- Select models suitable for ambient temperatures up to 40°C (104°F)

Nominal sizes: 1'×4', 2'×2', 2'×4'
 Installation Type: Surface mount
 Lamp Types: LED, T8



www.kenall.com | P: 800-4-Kenall | F: 262-891-9701 | 10200 55th Street Kenosha, Wisconsin 53144

This product complies with the Buy American Act: manufactured in the United States with more than 50% of the component cost of US origin. It may be covered by patents found at www.kenall.com/patents. Content of specification sheets is subject to change; please consult www.kenall.com for current product details.

SimpleSeal CSEPO Series: Designed to Provide Easy Plenum Access

The SimpleSeal Plenum Access (CSEPO Series) creates a doorway into your ceiling, allowing service personnel access wherever a luminaire is installed. It simplifies ceiling layout, prevents the disruption caused by removing a fixture, and permits a quick return to the function of your cleanroom.



CSEPO Plenum Access Series

- Delivered lumen range: 5,777–11,903 lm
- Input power: 47–99W
- Efficacy: 109–136 lm/W
- CCT: 3500K, 4000K, 5000K; 82 CRI
- Service the plenum space without disturbing electrical components
- Access opening reinforced with 18-gauge steel frame, preventing damage during use

Nominal size: 2' x 4'
 Installation types: Recessed ceiling mount, grid or flange
 Lamp type: LED



Large removable panel allows a man-sized opening for maximizing serviceability



POWER SYSTEMS



SimpleSeal CSETO Series: Created to Provide Top Access, Protecting Sensitive Processes

The SimpleSeal Top Access (CSETO Series) is sealed to prevent dust and particulates from entering the cleanroom, even when the luminaire is being serviced. Service personnel need never bring equipment or parts into your cleanroom, protecting your sensitive processes. This series uses the SimpleSeal overlapping door system to provide IP66 certified dust and water resistance.



Easy access to electrical components using rotary latches and a full length piano hinge

CSETO Top Access Series*

- Delivered lumen range: 5,876 – 25,427 lm
- Input power: 50 – 198W
- Efficacy: 114 – 143 lm/W
- CCT: 3500K, 4000K, 5000K; 82 or 90 CRI
- Durable construction: 600 lb-load tested, resists damage from unintended foot traffic
- Easily wired through top of fixture
- Mounting frame provided to simplify secure installation
- Provides service to all electronics without entering the cleanroom
- Available in 570nm amber and 630nm red LED for scientific applications

* Not intended for walking traffic

Nominal sizes: | 1' x 4', 2' x 2', 2' x 4'
Installation Types: | Recessed ceiling mount, grid or flange

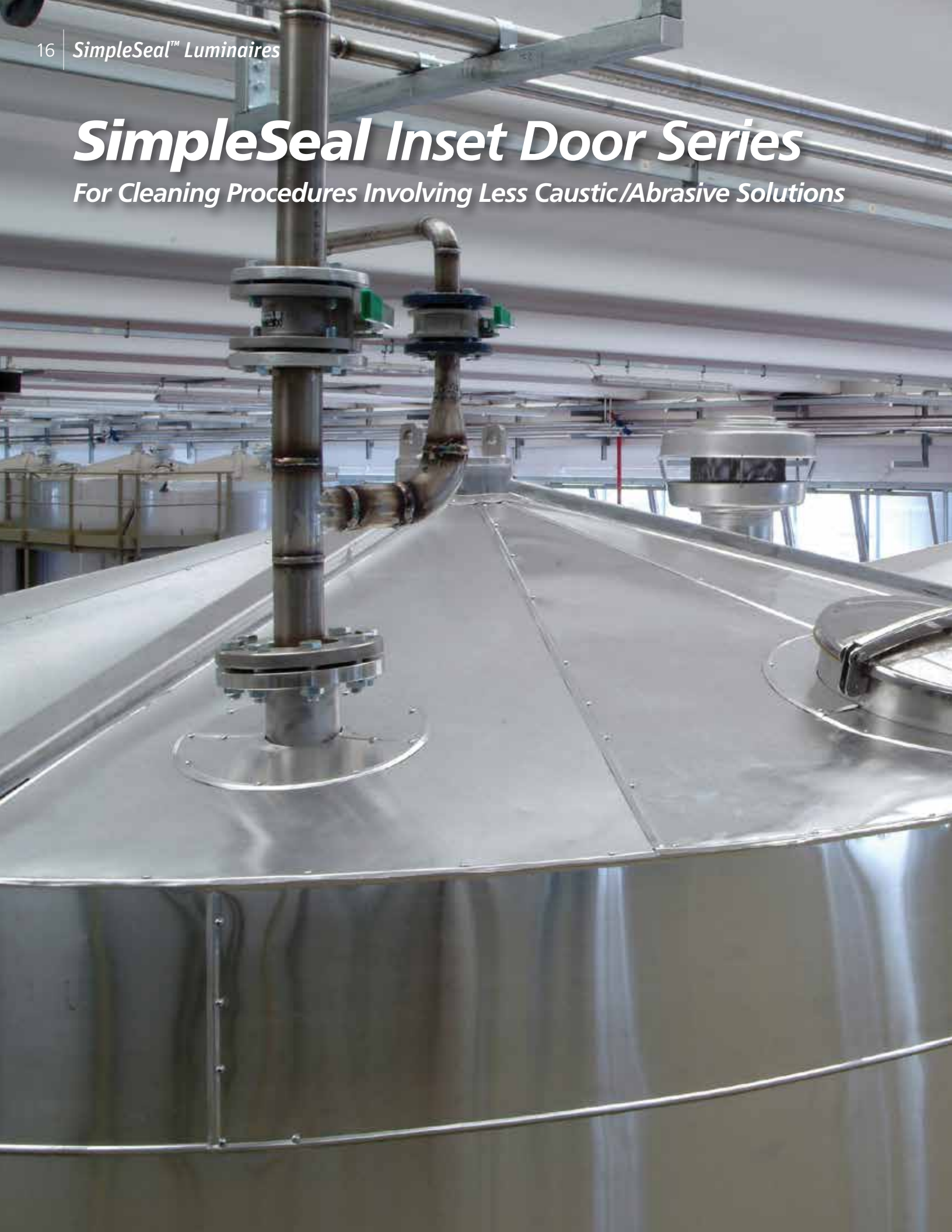


POWER SYSTEMS



SimpleSeal Inset Door Series

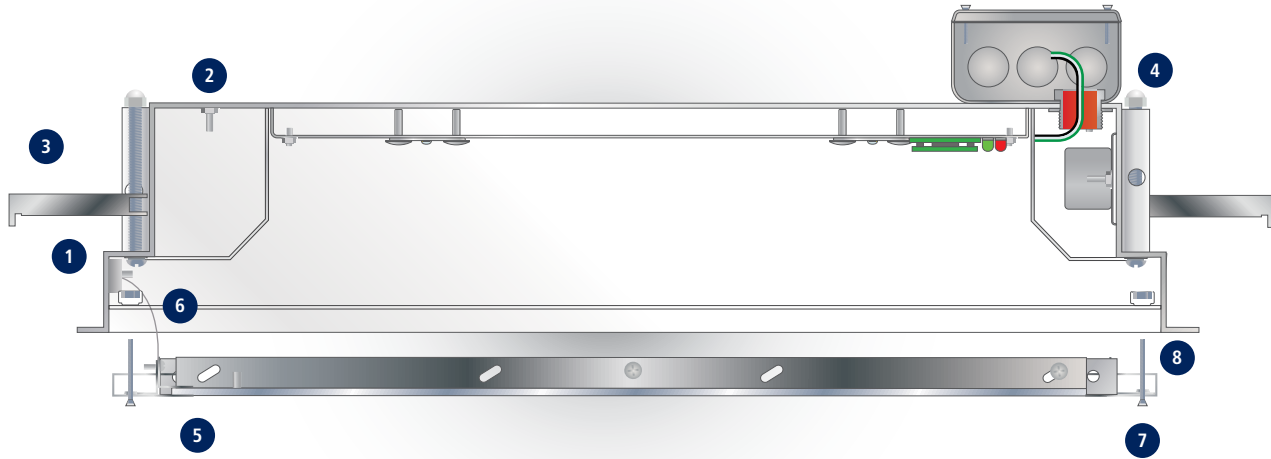
For Cleaning Procedures Involving Less Caustic/Abrasive Solutions





Construction that Supports Reliable Performance in Cleanroom Environments

The Inset Door series is comprised of a one-piece, seam welded and hole-free housing, a doorframe in either aluminum, cold-rolled or stainless steel, and a housing-to-doorframe gasket. This clean design provides excellent performance that has been defined and measured to the highest available standards, and certified by an independent testing laboratory.



One-Piece Housing



1. TIG Welded Construction eliminates inherent weakness of lapped and spot-welded construction. Available in cold-rolled steel, painted aluminum or stainless steel (304 or 316).



2. Compression Set PEM Studs Subassemblies and electrical components can be secured to housing without compromising its air-tight integrity.



3. Sealed Swing-Out Arms Recessed flange housing can be installed in ceilings more quickly and securely.



4. Optional Hermetically Sealed Wireway Maintains seal integrity from plenum.

Doorframe



5. Available in cold-rolled steel, aluminum or brushed 304 stainless steel.



6. Doorframe secured by retractable aircraft cables and stainless steel fasteners.



7. Flush Mounted Fasteners Captive stainless steel fasteners with Teflon washers ensure air-tight integrity of the fixture and provide ease of cleanability.

Doorframe Gasket



8. Extruded Closed Silicone Cell Gasket Customized shape with continuous skin. No open cell pockets to collect particulates as in die-strip gaskets.

Sensor Options



9. Optional embedded motion sensor available in select luminaires

Embedded Occupancy Sensor Benefits:

- Protected from moisture
- No interference from ambient temperatures
- Not reliant on line of sight
- California Title 24 compliant
- Abuse-resistant

Ample Options Add More Functionality to Cleanrooms & Labs

The SimpleSeal CSE_I Inset Door Series maintains its reliable seal while not involving the T-bar or fixture flange, making it ideal for applications where cleaning protocols do not require caustic chemicals or extreme abrasion.



CSE_I Inset Door Series

- Delivered lumen range: 5,403 – 23,427 lm
- Input power: 105 – 131W
- Efficacy: 98 – 138 lm/W
- CCT: 3500K, 4000K, 5000K; 82 CRI
- Universal grid-flange mounting provides field installation flexibility
- Available in 570nm amber and 630nm red LED for scientific applications
- Indigo-Clean Technology and Tunable White options available
- Embedded motion sensor option

Nominal sizes: 1'×4', 2'×2', 2'×4'; CSECI 8"×48"
 Installation Types: Surface; recessed ceiling mount, grid or flange; corner-mount
 Lamp Types: LED, T5, T8



*The above-referenced luminaires may bear these certifications and options.
 See individual product spec sheets for current listings.*



www.kenall.com | P: 800-4-Kenall | F: 262-891-9701 | 10200 55th Street Kenosha, Wisconsin 53144

This product complies with the Buy American Act: manufactured in the United States with more than 50% of the component cost of US origin. It may be covered by patents found at www.kenall.com/patents. Content of specification sheets is subject to change; please consult www.kenall.com for current product details.

Facilitating Maintenance in Less Critical Cleanroom Areas

The Environmental ESE Series is comprised of a one-piece, seam-welded and hole-free housing, a doorframe and a housing-to-doorframe gasket. It is designed to the highest standards and certified by an independent testing laboratory. The series has a piano hinge door that facilitates fixture maintenance in less critical areas within the facility, such as packaging and staging areas. It can also be used in other common areas, such as corridors or stairwells, and extends beyond the cleanroom into industrial, school or transportation applications where corrosion resistance and cleanability are valued.

**ESE Environmental Series**

- Delivered lumen range: 5,160 – 12,120 lm
- Input power: 49 – 98W
- Efficacy: 105 – 131 lm/W
- CCT: 3500K, 4000K, 5000K; 82 or 90 CRI
- Corrosion resistant aluminum or stainless steel piano hinges
- Universal grid-flange mounting provides field installation flexibility

Nominal sizes: | 1'× 4', 2'× 2', 2'× 4'; ESECI 8"× 48"
 Installation Types: | Surface; recessed ceiling mount, grid or flange; corner-mount
 Lamp Types: | LED, T5, T8



POWER SYSTEMS

Ideal for General Illumination Areas

The CSEA Series offers aesthetically pleasing and comfortable illumination in research and small scale cleanrooms. The low brightness of the direct/indirect recessed optical system delivers the acuity and contrast required for technical work, while opening up the area and removing sharp random transitions in surface brightness, making the workspace more naturally pleasant.



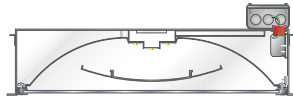
CSEA Ambient Series

- CCT: 3000K, 4000K, 5000K; 82 or 90 CRI
- One-piece, seam-welded housing in cold-rolled steel, painted aluminum, or stainless steel
- Acrylic ingress-barrier lens

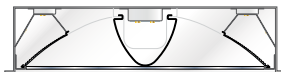
Architectural Styles



CSEA1 center acrylic diffuser



CSEA31 Combination perforated basket and acrylic lens



CSEA41 Combination center and dual side lenses

Nominal sizes: 1'×4', 2'×2', 2'×4'
 Installation Types: Surface; recessed ceiling mount, grid or flange; corner-mount
 Lamp Types: T5, T8



The above-referenced luminaires may bear these certifications and options. See individual product spec sheets for current offerings.



22 SimpleSeal™ Inset Hazardous Series

Hazardous Location Luminaires that Protect Your Space and Budget

The HSE_I series is designed to safely illuminate areas with flammable gases, liquids or dusts. The construction and electrical components are carefully selected to reduce the hazard of ignition by removing, containing or arresting ignition sources and sealing out the environmental fuel, while operating well below the AIT. Though not intended for areas of continuous or frequent hazard, the Class I or II, Division 2 listings* provide assurance that the luminaire will operate safely in these adverse conditions.

*Class II, Div2 and Class III listings are only available in select fluorescent models. See below for details.



HSE_I Inset Door Series

- Hazardous Location Listings include Class I, Division 2; Groups A, B, C, D
- HSEFI also includes Class II, Division 2; Groups F and G
- T-code Rating: T6
- One-piece inset doorframe secured to housing with aircraft cables
- Hole-free, one-piece, cold rolled steel housing
- Closed cell, extruded silicone gasket seals doorframe to housing

Nominal sizes: 1' x 4', 2' x 2', 2' x 4'; HSECI 8" x 48"
Installation Types: Surface; recessed ceiling mount, grid or flange; corner-mount
Lamp Types: T5, T8



The above-referenced luminaires may bear these certifications and options.
See individual product spec sheets for current offerings.



www.kenall.com | P: 800-4-Kenall | F: 262-891-9701 | 10200 55th Street Kenosha, Wisconsin 53144

This product complies with the Buy American Act: manufactured in the United States with more than 50% of the component cost of US origin. It may be covered by patents found at www.kenall.com/patents. Content of specification sheets is subject to change; please consult www.kenall.com for current product details.



SOFT GELATIN ENCAPSULATION M/C



P
P
OFF
R
EMER

SimpleSeal Extended Flange Series

Designed to Seal to Imperfect Ceilings

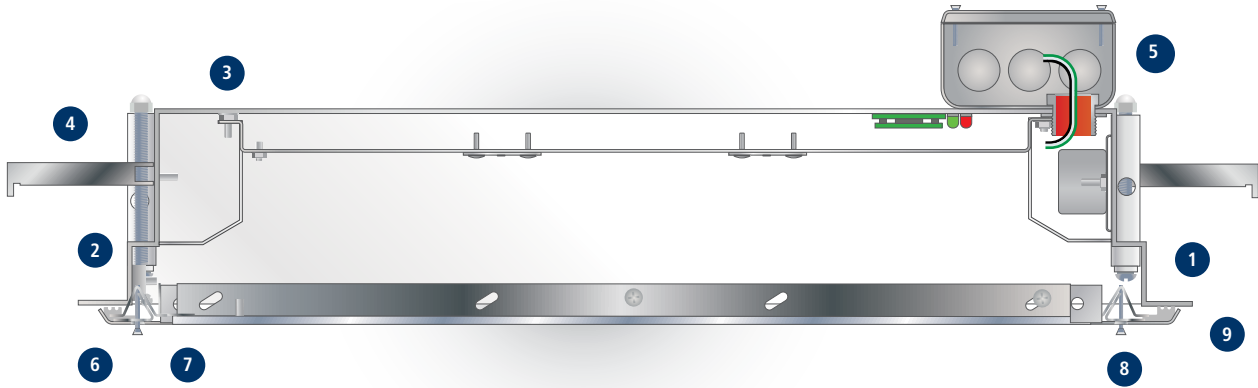




Project: Boston University Laboratory
Location: Boston, Massachusetts
Specifier: Payette Architects

Creates a Secure Seal in Imperfect Ceilings

These easy-to-clean fixtures meet IP65 and pressurized room standards, ensuring the integrity of pressurized plenums and protection against particulate contamination. The doorframe uses a patented fulcrum repositioning bracket for even, positive retention to the ceiling surface.



One-Piece Housing



1. Extended flange provides consistent, level, smooth surface for a positive doorframe seal.



2. TIG Welded Construction Eliminates inherent weakness of lapped and spot-welded construction. Available in cold-rolled steel, painted aluminum or stainless steel (304 or 316).



3. Compression Set PEM Studs Subassemblies and electrical components can be secured to housing without compromising its air-tight integrity.



4. Sealed Swing-Out Arms Recessed flange housing can be installed in ceilings more quickly and securely.



5. Optional Hermetically Sealed Wireway Maintains seal integrity from plenum and eliminates need for caulk.

One-Piece Doorframe



6. Frame with 60° Beveled Edge Assures protection against harsh cleaning protocols. 60° beveled edge is easier to clean than a standard 90° return.



7. Patented Fulcrum Repositioning Bracket Doorframe mates consistently to housing flange for uniform seal.



8. Flush Mounted Fasteners Stainless steel fasteners with Teflon® washers ensure air-tight integrity of the fixture and provides ease of cleanability.

One-Piece Doorframe Gasket



9. Extruded Closed Cell Gasket Customized shape with continuous skin. No open cell pockets to collect particulates as in die-strip gaskets. Sealed, vulcanized corners prevent leakage.

- Vulcanized Corners Sealed at corner to prevent leakage.
- Mechanically Secured to Doorframe Precise secure and permanent positioning of gasket.

Detailed Design Prevents Leaks, Stands Up to Extreme Cleaning

The Extended Flange Series prevents leakage via a doorframe that mates to a housing flange of similar material, creating a predictable, sealed surface. The Extended Flange Series is designed for applications with the highest cleanliness standards, and cleaning protocols that might involve caustic chemicals or extreme abrasion.



CSEFL Series

- Delivered lumen range: 5,057 – 12,810 lm
- Input power: 49 – 97W
- Efficacy: 105 – 131 lm/W
- CCT: 3500K, 4000K, 5000K; 82 or 90 CRI
- Suitable for Class 100 (ISO 5) environments
- Available in 630nm red LED for scientific applications

Nominal sizes: 1'×4', 2'×2', 2'×4'
 Installation Types: Recessed ceiling mount, flange
 Lamp Types: LED, T5, T8



www.kenall.com | P: 800-4-Kenall | F: 262-891-9701 | 10200 55th Street Kenosha, Wisconsin 53144

This product complies with the Buy American Act: manufactured in the United States with more than 50% of the component cost of US origin. It may be covered by patents found at www.kenall.com/patents. Content of specification sheets is subject to change; please consult www.kenall.com for current product details.

Linear and Specialty Luminaires

Designed for Environmental Performance in a Variety of Applications





The Peace of Mind® You Need in Critical Environments

The HES and FES Series are part of a family of ceiling and wall-mounted wraparound luminaires that include models specifically designed for hazardous locations (HES Series) and food processing (FES Series). The HES is classified for use in NEC Class I, Division 2, Groups A, B, C and D areas and the FES Series is NSF2 Splash Zone listed. Additionally, the series is available with an optional IP65 listing. The impact-resistant, DR acrylic or polycarbonate lensing contributes to the EnviroSeal's industry-leading durability – in fact, EnviroSeal luminaires specified with polycarbonate lenses are backed by Kenall's exclusive Peace of Mind Guarantee®.



Sensor Options (FES only)



Optional embedded motion sensor available in select luminaires

Embedded Occupancy Sensor Benefits:

- Protected from moisture
- No interference from ambient temperatures
- Not reliant on line of sight
- California Title 24 compliant
- Abuse-resistant

HES and FES Series

- Delivered lumen range: 4,751 – 10,325 lm
- Input power: 49 – 98W
- Efficacy: 96 – 110 lm/W
- CCT: 3500K, 4000K, 5000K; 82 CRI
- Corrosion resistant cold-rolled steel or stainless steel housing
- UV-stabilized, polycarbonate lens
- HES is Hazardous listed Class I, Division 2; Groups A, B, C D
- T-code Rating: T-3A to T-6 (see individual spec sheets for details)

Nominal sizes: 3", 5", 8" and 12" widths; 2', 3', 4', 6' and 8' lengths
 Installation Types: Surface ceiling or wall mount; optional pendant mount
 Lamp Types: LED, T5, T8



The above-referenced luminaires may bear these certifications and options. See individual product spec sheets for current listings.



Sealed Downlights that Stand Up to Your Demanding Applications

Avoid the headache of downlights that don't live up to your demanding applications. Kenall's 6" SimpleSeal CDL Series flush lens downlights are designed to stay tightly sealed and perform efficiently for years in a variety of environments, including areas where damp and wet location listings just aren't enough. And Ingress Protection is an integral part of the design — so there are no surprise upcharges.



CDL Series

- Delivered lumen range: 794–5,305 lm
- Input power: 15–62W
- Efficacy: 53–86 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 80 or 90 CRI
- Tunable white option
- Die-cast aluminum heatsink protects LEDs and provides long life

Nominal sizes:	6" diameter aperture
Installation Types:	Recessed
Lamp Types:	LED



www.kenall.com | P: 800-4-Kenall | F: 262-891-9701 | 10200 55th Street Kenosha, Wisconsin 53144

This product complies with the Buy American Act: manufactured in the United States with more than 50% of the component cost of US origin. It may be covered by patents found at www.kenall.com/patents. Content of specification sheets is subject to change; please consult www.kenall.com for current product details.

SimpleSeal Fluorescent Lighting Provides Efficiency, Value

Intended for cleanrooms where ceilings are fully covered with HEPA filters and there is no room for a recessed troffer, the CSESTD provides the profile that maintains unidirectional airflow and light. The unique doorframe and gasket system of the CSEFBO can accommodate variations in ceiling surface better than many other fixtures, while also maintaining a reliable seal.



CSESTD Linear Series

- Designed for continuous rows
- Independent lab-tested to Fed-Std 209E/Class 100 (ISO5) cleanrooms
- Internally-ribbed clear or opal acrylic lens
- 20-gauge cold-rolled steel construction standard, option for type 304 stainless, type 316 stainless or aluminum housing

Nominal Sizes: 2" wide; 2', 3', 4' and 8' lengths
 Installation Type: Surface ceiling mount



CSEFBO Overlapping Door Series

- One-piece doorframe provides air-tight integrity of luminaire
- UL certified IP65 per IEC 60598
- Extended doorframe gasket is the only contact to ceiling

Nominal Sizes: 1' x 4', 2' x 4'
 Installation Type: Flange



Sealed Exit Signs Provide Unparalleled Safety & Performance

Kenall's sealed exit signs resist leakage and surface contamination more effectively than any other exit sign on the market.



SimpleSeal™ CMEXR



CMEXR Series

- Single-faced, recessed wall mount
- Indirect red or green LED
- Internal battery backup system
- Cold temperature options
- High impact polycarbonate lens



Millenium™ METSU/METDU

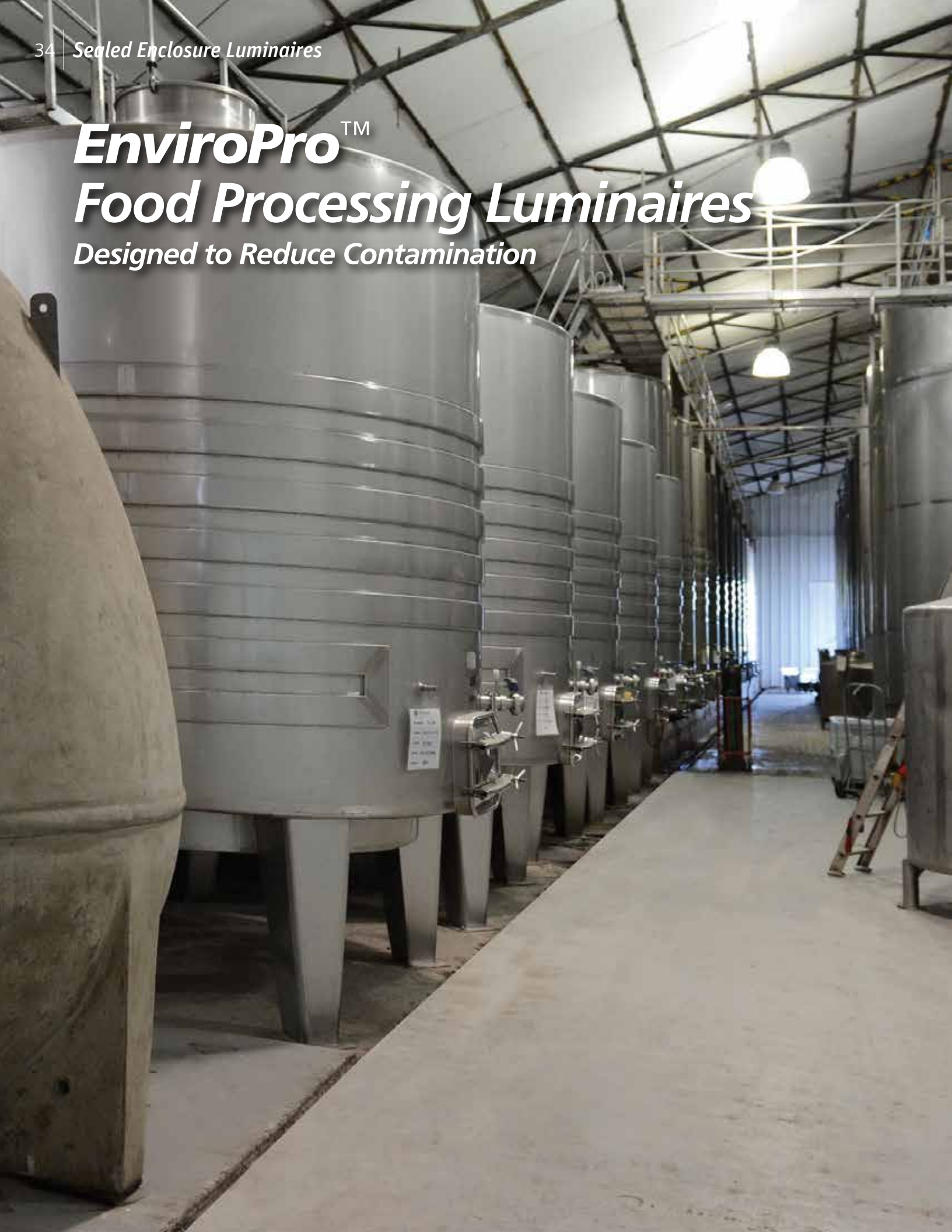


METSU/METDU Series

- Surface-mount end – wall or ceiling
- Indirect red or green LED
- Single or double face signage
- Internal battery backup system
- Cold temperature options
- High-impact polycarbonate lens



EnviroPro™ ***Food Processing Luminaires*** ***Designed to Reduce Contamination***



Complementary Products Designed for Food Processing Environments



EPLB Series

The award-winning EnviroPro Low Bay has a traditional appearance that incorporates Kenall's high-performance optics. Pair it with TekLink™ controls for even greater energy savings.

- Delivered lumen range: 1,375–24,005 lm
- Input power: 22–210W
- Efficacy: 48–118 lm/W
- Embedded motion sensor option

Nominal Size: 12", 16" and 22" diameter
 Installation Types: Ceiling mount, pendant or loop hanger
 Lamp Type: LED



EPMP Series

The EnviroPro EPMP Series is designed specifically for insulated metal panel (IMP) ceilings: it is an IP-rated, sealed LED high-output, top-serviceable luminaire that can reduce your ceiling cutout by 40%, protecting the ceiling's structural integrity.

- Lumen range: 20,506 – 36,948 lm
- Input power: 211, 333W
- Efficacy: 88 – 123 lm/W
- Designed for 4-or-6-inch thick insulated ceilings
- Remote heat extraction reduces cooling costs
- Resistant to accidental foot traffic to 600 lbs.
- Integral emergency battery pack available

Nominal Size: 16" x 20"
 Installation Type: IMP ceilings
 Lamp Type: LED



EPC Series

Designed for zones that require low-to-medium mounting heights and high-CRI lighting, such as inspection areas. FDA/USDA compliant and NSF Food Zone/Non-contact certified.

- One-piece, high-impact, extruded acrylic lens featuring a high efficiency optical system
- Two point mounting; surface or suspended installation

Nominal Size: 6.5" diameter, 2', 4' and 8' lengths
 Installation Type: Ceiling or suspended mount
 Lamp Type: Fluorescent



EnviroPro EPDL Series

This downlight, designed specifically for food processing applications, features either flush or regressed lens construction and stainless steel or aluminum trim.

- Delivered lumen range: 880 – 5,543 lm
- Input power: 15 – 62W
- Efficacy: 59–90 lm/W
- CCT: 3000K, 4000K, 5000K; 80 or 90 CRI
- 1% dimming via 0-10V, DALI or EcoSystem® control

Nominal size: 6" dia.
 Installation type: Recessed
 Lamp type: LED



Download the Food Processing Luminaires brochure at www.kenall.com



Listings, Certifications, Warranties

Fixtures designed for use in cleanroom and containment settings must satisfy a large number of demanding lighting and environmental requirements. Listings applicable to these requirements are shown below. Please refer to the www.kenall.com to determine product specific listings.



UL/CUL Listed—The UL symbol signifies that Underwriter's Laboratory (UL) has determined that a manufacturer has demonstrated the ability to produce a product complying with UL's requirements with respect to specific risk, performance under specific conditions, compliance with regulatory codes and specified standards, or any other conditions as determined by UL.



CCEA Approved—The City of Chicago Environmental Air (CCEA) rating ensures that the luminaire is inherently airtight. Wiring and/or branch circuit terminations are sealed off and gasketed from the plenum air space. This listing ensures that the luminaire is sealed to limit air flow from the room side to the plenum.



ICT—Indicates white, ambient Kenall luminaires using Indigo-Clean Technology, which kills harmful bacteria, including Staph, such as MRSA.



Tunable White — Tunable white technology enables the user to independently control both color temperature and intensity of light within a given application. This provides the ability to change the color of light from warm to neutral to cool in appearance, over time, based on the needs of the occupant or the space.



ETL—A product bearing the ETL Listed mark is determined to have met the minimum requirements of prescribed product safety standards as certified by a Nationally Recognized Testing Laboratory (NRTL). The mark also indicates that the manufacturer's production site conforms to a range of compliance measures and is subject to periodic follow-up inspections to verify continued conformance.



UL 924—UL 924 is UL's Standard for Safety of Emergency Lighting and Power Equipment. UL 924 listed electrical exit signs are tested and given a visibility rating of at least 100 feet, requiring them to be legible from a 100 foot viewing distance in total darkness. The battery backup is tested by UL and must provide at least 90 minutes of emergency operation. Letters must be red or green and at least 6" height with a 3/4" letter stroke.



ISO 3 — Suitable for ISO 3, Class 1 Rated Rooms (FED-STD209E). Measures the number of particles equal to or greater than 0.5 mm in one cubic foot of air. The measurement must not exceed specified particle limits in order for the space to be considered a controlled 'clean room' environment.



BSL BioSafety Level (BSL-x) classifies the relative danger from biohazardous material to the surrounding people and environment. There are four biosafety levels (BSL1 – BSL4), with the highest number representing the greatest risk. Luminaires in each class are designed to provide the protections necessary for containing the risks associated with that level. See the chart on page 39 for more information.



ISO 5 — Suitable for ISO 5, Class 100 Rated Rooms (FED-STD209E). Measures the number of particles equal to or greater than 0.5 mm in one cubic foot of air. The measurement must not exceed specified particle limits in order for the space to be considered a controlled 'clean room' environment.



HAZ —The National Electric Code (NEC) identifies and classifies potentially hazardous materials and conditions. Kenall's hazardous rated products are approved for use in Class 1, Division 2, Groups A, B, C, and D. Basic requirements for Class I Division 2 electrical equipment is no arcing or sparking parts be present, or if present, be in an explosion-proof enclosure.



IP64—UL Certified IP64 per IEC 60598 ensures that the enclosure is dust-tight and protected against splashing water without any harmful effects.



NFPA101—This National Fire Protection Agency (NFPA) Life Safety Code pertains to egress facilities. The code establishes minimum criteria for the design of egress facilities so as to allow prompt escape of occupants from buildings or, where desirable, into safe areas within buildings.



FN Option — FN refers to Food Zone/Non-Food Contact. Fixtures are located in food preparation and handling areas but do not come in contact with food under normal conditions. All fixtures in this category have a higher level of construction: housing painted with paint that meets U.S. Code of Federal Regulations; fasteners constructed with stainless-steel and removable without tools; and FDA-approved Food Grade polycarbonate material outer exposed lensing.



IP65— UL Certified IP65 per IEC 60598 ensures that the enclosure is dust-tight and protected against jet streams of water from any direction without any harmful effects.



DesignLights Consortium — The DesignLights Consortium is an organization that certifies the accuracy and completeness of fixture performance data, which then allows building owners to qualify for certain utility and government rebates.



IP66 —UL Certified IP66 per IEC 60598 ensures that the enclosure is dust tight and protected against water projected in powerful jets without any harmful effects.



NSF2—An NSF2 Listing denotes that the luminaire has been evaluated for corrosion resistance, cleanability and the ability of exposed material to withstand normal wear. This supports infection control standards as it indicates that the luminaire is easy to sanitize.



MIL STD 461G — Military Standards testing measurements cover both radiated and conducted electromagnetic emissions in addition to maximum allowable amounts of emitted energy based on both frequency range and field strength. Luminaires meeting MIL STD 461G pose the lowest possible likelihood of causing EMI-related issues.



P442 NSF P442— This protocol is a series of minimum requirements for the design, construction, performance and certifications of luminaires for cleanrooms. It requires ingress protection IEC 60529/60598 (IP-65) and NSF-2 Food Equipment certifications and a performance test for pressure decay resistance in which the sealed fixture is stressed with positive and negative pressure and checked to ensure that no leaks are present.



K230—The K230 performance standard determines a fixture's ability to restrict the passage or penetration of contaminants when subjected to a prescribed pressure level in either positively or negatively pressurized environments.

Warranties

On behalf of our valued customers, Kenall promises to stand behind our luminaires. Our commitment to excellence enables us to offer a variety of product warranties, including the Kenall exclusive Peace of Mind Guarantee and 5-year LED warranty. For more detailed, product specific warranty information, please visit our website at www.kenall.com.



Peace of Mind Guarantee

Kenall's High Abuse luminaires are designed and built to take exceptional physical punishment. When installed according to our instructions, Kenall will repair or replace any unit rendered inoperable due to physical abuse for the normal service life of the fixture.



POWER SYSTEMS

LED 5-year Warranty

Kenall offers a 5-year limited power system warranty on select LED products. For complete warranty information, please visit us on the web at www.kenall.com.

Classification of Air Cleanliness - ISO 14644-1

These standards are used to classify cleanroom environments and then specify components. The new standard was developed to make a more comprehensive cleanroom rating that is measured in metric units and covers a wider range of particulate size and particle count. The highest rated cleanrooms are designated by the lowest numerical values. For example, an ISO-3 cleanroom is cleaner than an ISO-5, and would require higher quality luminaires.

The chart below summarizes ISO 14644-1 and cross references definitions to Federal Standard 209E, which was discontinued in 2001. Kenall carefully evaluates a luminaire's ability to meet cleanliness protocols in the various classes of cleanrooms and measures the ability to seal out, and not produce, airborne particulates as small as 0.1 micrometer. The luminaires are then rated to cleanliness standards using the definitions of ISO 14644-1, and are labeled accordingly.

Class	Maximum particles/m ³ a						FED STD 209E equivalent
	≥0.1 μm	≥0.2 μm	≥0.3 μm	≥0.5 μm	≥1 μm	≥5 μm	
ISO 1	10b						
ISO 2	100	24b	10b				
ISO 3	1,000	237	102	35b			Class 1
ISO 4	10,000	2,370	1,020	352	83		Class 10
ISO 5	100,000	23,700	10,200	3,520	832		Class 100
ISO 6	1,000,000	237,000	102,000	35,200	8,320	293	Class 1,000
ISO 7				352,000	83,200	2,930	Class 10,000
ISO 8				3,520,000	832,000	29,300	Class 100,000
ISO 9				35,200,000	8,320,000	293,000	Room air

SimpleSeal luminaires are suitable for use in facilities governed by this standard. For information regarding specific listings and certifications, consult the product spec sheet.



Enclosure Ratings Overview**What are IEC Standards?**

IEC Standards are international standards that many European countries adopt as their national standard. North America has traditionally adopted UL standards as the source for standards. U.S. product manufacturers designed their products to IEC standards initially for sale overseas but are finding them increasingly useful here in North America.

Limitations of Wet & Hosedown Ratings – UL Standards

The fixture standard UL1598 uses tests that simulate falling rain or a sprinkler to achieve a wet location listing. NEMA 4 testing uses a 1-inch diameter nozzle from a fire hose, delivering 65 gallons per minute. Industrial cleanroom applications are not represented by either of these water resistance tests: the ingress protection tests of IEC 60598 more closely match the needs of industrial and research applications.

Benefits of Ingress Protection Ratings IEC standards

The IP water rating of “5” (IP_5), described in IEC Standard 60598, provides an intermediate step between the rain rating and the NEMA 4 rating. It also provides an internationally accepted standard that can be used to evaluate fixtures or any other electrical equipment, and the test can be performed by an independent third party testing agency for verification. Underwriters Laboratories investigates products and tests to the IEC standard.

Dust-tight Protection

An additional test criterion that can be applied to fixtures is the ability to exclude solid matter. The IP solid rating of “6” (IP6_) means the fixture will be dust tight. The specified test requires that the fixture be placed in a circulating talc atmosphere for 3 hours. The particle size of the talc is a range of one to 75 microns and the fixture is placed under negative pressure in an attempt to draw the talc into the fixture. No talc shall be found inside the fixture after this test.

The Importance of Recognized Standards & Independent Testing

Other lighting manufacturers that claim a hosedown rating other than NEMA or IP are not testing to recognized standards and cannot have the tests confirmed or audited by an independent outside testing agency.

Beware of statements such as “Tested to 75psi at 1 inch.”

No reference is made to the volume of water that is leaving the nozzle and impacting the product. In fact, high nozzle pressures typically have low water volumes because the nozzle is restricting the flow of water causing the pressure in the hose to increase, minimizing the amount of water leaving the nozzle.

Regardless of the hose pressure, any water volume less than 3.3 gal/minute is less severe than the IP_5 test. The most relevant characteristics are the diameter of the nozzle and the flow rate of the water. The following chart shows the test characteristics for various Standards.

IP Standards Characteristics					
Rating	Standard	Nozzle Dia	Flow Rate	Distance	Duration
IP_5	IEC 60598	0.2 inches	3.3 gal/min	8-10 ft	15 min
IP_6	IEC 60598	0.5 inches	25 gal/min	8-10 ft	3 min
NEMA4	NEMA 250	1.0 inches	65 gal/min	10-12 ft	5 min
Marine	UL 595	1.0 inches	115 gal/min	10 ft	5 min

NEMA Enclosure Types

In non-hazardous locations, the specific enclosure types, their applications, and the environmental conditions they are designed to protect against, when completely and properly installed, are as follows:

Type 4X enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the

equipment inside the enclosure against ingress of solid foreign objects (windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); that provides an additional level of protection against corrosion; and that will be undamaged by the external formation of ice on the enclosure.



IP

EXPLANATION OF “INGRESS PROTECTION” IP NUMBERS

for Degrees of Protection for Sealed Luminaires

Example:

IP65**DEGREES OF PROTECTION INDICATED BY THE FIRST CHARACTERISTIC NUMERAL**

Numeral	Short Description	Brief details of objects which will be “excluded” from the enclosure
0	Non-protected	No special protection
1	Protected against solid objects greater than 50 mm	A large surface of the body, such as a hand (but no protection against deliberate access). Solid objects exceeding 50 mm in diameter.
2	Protected against solid objects greater than 12 mm	Fingers or similar objects not exceeding 80 mm in diameter. Solid objects exceeding 12 mm in diameter.
3	Protected against solid objects greater than 2.5 mm	Tools, wires, etc., of diameter or thickness greater than 2.5 mm. Solid objects exceeding 2.5 mm in diameter.
4	Protected against solid objects greater than 1.0 mm	Wires or strips of thickness greater than 1.0 mm. Solid objects exceeding 1.0 mm in diameter.
5	Dust-protected	Ingress of dust is not totally prevented but dust does not enter in sufficient quantity to interfere with satisfactory operation of the equipment.
6	Dust-tight	No ingress of dust

IP65**DEGREES OF PROTECTION INDICATED BY THE SECOND CHARACTERISTIC NUMERAL**

Numeral	Short Description	Brief details of objects which will be “excluded” from the enclosure
0	Non-protected	No special protection
1	Protected against dripping water	Dripping water (vertically falling drops) shall have no harmful effect.
2	Protected against dripping water when tilted up to 15°	Vertically dripping water shall have no harmful effect when tilted up to 15° when the enclosure is tilted at any angle up to 15° from its normal position.
3	Protected against spraying water	Water falling as a spray at an angle up to 60° from the vertical shall have no harmful effect.
4	Protected against splashing water	Water splashed against the enclosure from any direction shall have no harmful effect.
5	Protected against water jets	Water projected by a nozzle against the enclosure from any direction shall have no harmful effects.
6	Protected against heavy seas	Water from heavy seas or water projected in powerful jets shall not enter the enclosure in harmful quantities.
7	Protected against the effects of immersion	Ingress of water in a harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time.
8	Protected against submersion	The equipment is suitable for continuous submersion in water under conditions which shall be specified by the manufacturer.

NOTE – Normally, this will mean that the equipment is hermetically sealed. However with certain types of equipment it can mean that water can enter but only in such a manner that it produces no harmful effects.

NOTE: The author thanks the International Electrotechnical Commission (IEC) for permission to reproduce definitions for IP65 from its International Standard IEC 60598. All such extracts are copyright of IEC, Geneva, Switzerland. All rights reserved. Further information on the IEC is available from www.iec.ch. IEC has no responsibility for the placement and context in which the extracts and contents are reproduced by the author; nor is IEC in any way responsible for the other content or accuracy therein.



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная электротехническая комиссия

NSF P442 and K230 – Testing Standards for Cleanroom Fixtures

Kenall has spent decades perfecting sealed enclosure lighting: prior to protocols created by NSF International, we developed our own rigorous pressure-testing protocol, called K230, to ensure that the SimpleSeal™ luminaires were built to prevent both the ingress and egress of moisture, dust, fungus, bacteria and other contaminants that might put processes and people at risk.

In 2017, NSF introduced a protocol very similar to K230, called NSF P442. It requires that a sealed fixture be stressed with positive and negative pressure, and acceptance is granted only after it is proven that no leaks are present. They must also prevent the flow of air between the plenum space and the controlled environment, be protected from contaminants, particulates and moisture, and be easily cleanable. This protocol is very difficult to achieve, but proves that a luminaire ready for use in the most challenging environments, including pharmaceutical and semiconductor manufacturing, bio-tech research, biosafety labs, clean rooms, and surgical suites.

P442 requires:

- IP65 or greater (performed by an independent Nationally Recognized Testing Laboratory [NRTL])
- NSF 2 certification (performed by an independent NRTL)
- Progressive doorframe (not 90 degrees) cleanable surface with no crevices
- IP65 or greater (performed by an independent Nationally Recognized Testing Laboratory [NRTL])
- NSF 2 certification (performed by an independent NRTL)
- Progressive doorframe (not 90 degrees) cleanable surface with no crevices

Kenall is the first manufacturer to be certified to the P442 standard, affirming that Kenall's design and materials are the preeminent choice for even the most stringent clean environments.

**Electromagnetic Interference Testing & Military Standard 461G****Where is EMI a Concern?**

Electromagnetic Interference (EMI) has long been a critical concern in scientific and healthcare facilities where it can cause the malfunction of life support and monitoring systems, surgical devices, and other electrically sensitive medical and scientific equipment. In recent years, concern over EMI has become widespread due to its potential impact on communications, security systems, manufacturing equipment, and a variety of sensitive electronic devices.

Limitations of Required EMI Standards

Unlike the European Community, the United States has no comprehensive standard for lighting-based EMI. Because high-frequency drivers operate within radio, television and other established communications bandwidths, the Federal Communications Commission (FCC) issues standards for Electromagnetic Compatibility (EMC) between certain devices as well as maximum radiated electromagnetic emissions levels for some equipment, including drivers. FCC listings do not, however, provide a standard for complete luminaires. Further, the FCC does not issue standards for conducted emissions. The Food & Drug Administration (FDA) issues EMC standards for certain medical devices operating outside the FCC's jurisdiction, but these standards typically do not apply to light fixtures.

Military Standard 461G

The most comprehensive, widely recognized and acknowledged domestic EMI standard is Military Standard (MIL STD) 461G, a mandatory standard for military hospitals and other EMI-sensitive military facilities and a voluntary standard for public and private facilities applications. MIL STD testing measurements cover both radiated and conducted emissions in addition to maximum allowable amounts of emitted energy based on both frequency range and field strength.

The MIL-STD-461G testing procedures and requirements appropriate to light fixtures are found under Navy and Air Force Limits for Electronic Devices, with the specific testing information for conducted emissions outlined in CE 102-1 and for radiated emissions in RE 102-4. While both are designed to emulate worst case operating conditions, both the test procedures and the standards themselves are logical and reasonable. Because MIL-STD-461G standards are harder to meet than either the FCC or European Community standards, luminaires meeting them pose the lowest possible likelihood of causing EMI-related problems

Hazardous Location Rating: Listings and T-Ratings

The National Electric Code (NEC) identifies and classifies potentially hazardous materials and conditions. The identified and classified materials may or may not be hazardous in their own right, but can, under certain conditions, violently explode. Types of hazardous materials and conditions are organized by Class (I, II and III); Divisions (1 and 2); and Groups (A, B, C, D, E, F, and G). If the hazardous material is a flammable gas, vapor, or liquid, it is a Class 1 material. Ignitable concentrations of hazardous materials present in the air under abnormal conditions (i.e. spillage or storage rupture) are classified Division 2.

Class I materials are further broken down into Groups which define the volatility of the material. Within Class I there are Group A, B, C, and D gases. The basic requirement for Class I, Division 2 electrical equipment is that no arcing or sparking parts be present, or if present, be in an explosion-proof enclosure. In addition, the temperature of any heat producing component must be lower than the ignition temperature of the hazardous material present in the area. Any electrical equipment having components operating at temperatures of 85°C (185°F) or above must be marked with the operating temperature.

Kenall's SimpleSeal™ line of hazardous rated products are approved for use in Class I, Division 2, Groups A,B,C, and D. Consult the charts below for product specific temperature ratings.

Thermal Performance Data – NEC T-Codes for Class I, Division 2 Atmospheres

Surface Mount			
Model	Lamp Type	T-Code Rating	Max. Ambient Temp.
HSES014	50LxxK	T6	40°C
HSES014	70LxxK	T5	40°C
HSES014	83LxxK	T6	25°C
HSES022	50LxxK	T6	40°C
HSES022	100LxxK	T5	40°C
HSES022	120LxxK	T6	25°C
HSES024	60LxxK	T6	40°C
HSES024	120LxxK	T5	40°C
HSES024	166LxxK	T6	25°C

Recessed Mount			
Model	Lamp Type	T-Code Rating	Max. Ambient Temp.
HSEDO14	45LxxK	T6	40°C
HSEDO14	67LxxK	T6	40°C
HSEDO14	90LxxK	T6	40°C
HSEDO22	45LxxK	T6	40°C
HSEDO22	67LxxK	T6	40°C
HSEDO22	90LxxK	T6	40°C
HSEDO24	45LxxK	T6	40°C
HSEDO24	67LxxK	T6	40°C
HSEDO24	90LxxK	T6	40°C
HSEDO24	135LxxK	T6	40°C
HSEDO24	180LxxK	T6	40°C



Other Standards that May Apply to Cleanroom Lighting**Current Good Manufacturing Practices (CGMPs)**

These regulations are enforced by the United States Food and Drug Administration (FDA) and provide for systems that assure proper design, monitoring, and control of manufacturing processes and facilities. Adherence to CGMP assures the identity, strength, quality, and purity of drug products by requiring that manufacturers of medications adequately control manufacturing operations. This formal system of controls helps prevent errors, contamination, deviations and failures, and assures that drug products meet quality standards.

EU GMP

This standard describes the minimum production process standards that a pharmaceutical manufacturer must meet, including requirements for rooms and equipment. Any manufacturer of medicines intended for the EU market, no matter where in the world it is located, must comply with GMP. Air cleanliness standards are listed below, as well as a comparison to ISO-14644-1 guidelines.

EU GMP Class	At Rest		In Operation	
	Max. permitted Number of Particles / m3 (equal or above)			
	0,5 µm	5,0 µm	0,5 µm	5,0 µm
A	3.520	20	3.520	20
B	3.520	29	352.000	2.900
C	352.000	2.900	3.520.000	29.000
D	3.520.000	29.000	not defined	not defined

Comparison of the Cleanroom Classification according to ISO 14644-1 and the EU GMP Guideline

ISO 14644-1	EG-GMP non operational	EG-GMP operational
ISO 1-5	A / B	A
ISO 7	C	B
ISO 8	D	C

USP 797 and USP 800

The United States Pharmacopeial Convention and National Formulary (USP) is a publication that sets enforceable and recommended industry standards for the manufacture of over-the-counter and prescription pharmaceuticals.

USP 797 outlines the requirements for the environmental monitoring of sterile compounding areas: USP 800 builds on earlier regulations by focusing on hazardous drugs and occupational safety. Both of these standards, along with others numbered 998 or below and published by USP, are enforced by agencies including state pharmacy boards and the FDA.

Biosafety Levels:

A biosafety level is a set of biocontainment precautions required to isolate dangerous biological agents in an enclosed laboratory facility. The levels of containment range from the lowest biosafety level 1 (BSL-1) to the highest at level 4 (BSL-4). In the United States, the Centers for Disease Control and Prevention (CDC) have specified these levels. In the European Union, the same biosafety levels are defined in a directive. In Canada the four levels are known as Containment Levels. Look for the BSL rating on our cleanroom fixtures.

Canadian Biosafety Standard (CBS)

The CBS is used by the Public Health Agency of Canada and the Canadian Food Inspection Agency to verify the ongoing compliance of regulated facilities, animal pathogen import permit applications, and, where applicable, the facility certification (and recertification) of containment zones.

The CBS sets out the physical containment, operational practice, and performance and verification testing requirements for the safe handling or storing of human and terrestrial animal pathogens and toxins. There are four containment levels (CL) ranging from a basic lab (CL1) to the highest level of containment (CL4).

SimpleSeal luminaires are suitable for use in facilities governed by these standards. For information regarding specific listings and certifications, consult the product spec sheet.

	U.S. Biosafety Levels	Examples of Pathogens Handled
BSL -1	No containment: suitable for agents that do not cause disease in healthy humans. Most high school and some college laboratories fall into this category.	Non-pathogenic E. coli, vaccine-strain influenza virus
BSL-2	Containment required: used in work with human disease agents that pose a moderate health hazard.	Hepatitis A & B, some types of salmonella and listeria
BSL-3	High containment required: used with indigenous or exotic agents, microbes that could cause serious or potentially deadly disease, and can be transmitted via aerosol.	West Nile virus, the bacteria that cause Tuberculosis and Yellow Fever
BSL-4	These max containment facilities are rare: they work with exotic, highly dangerous microbes, that are frequently fatal and do not have treatment or vaccines.	Ebola virus, Marburg virus



Kenall Sophistication in Testing

All Kenall luminaires are designed, engineered and manufactured to meet designated performance requirements based on rigorous testing criteria. Whether testing for ingress protection, photometric performance or effective thermal management, Kenall is equipped with a state-of-the-art certified safety laboratory, providing the following testing capabilities:

- Certified for safety testing by Underwriters Laboratory and Intertek Laboratories for Incandescent, Fluorescent and HID Luminaires (UL 1598), LED luminaires (UL 8750) Hazardous Locations (UL 844 and Class I Div II), and Emergency Lighting (UL 924).
- Ingress Protection testing (Dust and Water chambers)
- MIL-STD-461G- Conducted electromagnetic interference (EMI)
- Highly Accelerated Stress Screening (-50°C to 150°C Environmental Chamber)
- 25°C and 40°C thermal testing rooms
- ISO/IEC 17025 accredited photometric laboratory—including a Type C goniophotometer and 2-meter integrating sphere with spectroradiometer—providing credentials for the Department of Energy's Lighting Facts® listings and DesignLights Consortium® approvals.



Integrating Sphere Testing

The integrating sphere is used to measure the total light output of a lamp. It is a high reflectance, highly diffuse spherical chamber, which has been specifically designed to provide an overview of the color properties of the luminaire.

Output of the integrating sphere includes the following measurements:

- Total luminous flux
- Spectral power distribution
- Chromaticity coordinates
- Color Rendering Index (CRI)
- Correlated Color Temperature (CCT)



Goniophotometer Testing

According to ANSI/IESNA RP-16-05, a goniophotometer measures the directional light distribution characteristics of a luminaire. The only goniophotometer recognized and approved under IES standards is a Type C.

The goal of a Type C goniophotometer is to measure the luminous intensity of the luminaire from specific angles. Its output includes the following:

- Luminous intensity distribution
- Total luminous flux
- Zonal lumen sums
- Spatial uniformity of color
- An IES file

Once testing is complete and the IES file is received, lighting application software can be used to predict the photometric performance of a luminaire in a particular installation.



Kenall's luminaires are expertly designed in our state-of-the-art, vertically integrated, static-controlled manufacturing facility in Wisconsin. This enables us to provide tight control over the entire development process from fixture design and engineering to full-fledged metal fabrication, paint, assembly and shipping. We also take great care in sourcing only the highest-quality components to assure optimal product performance.

Our products comply with the Buy American Act: manufactured in the United States with more than 50% of the component cost of US origin.




Buy American Act Compliant



www.kenall.com | P: 800-4-Kenall | F: 262-891-9701 | 10200 55th Street Kenosha, Wisconsin 53144

This product complies with the Buy American Act: manufactured in the United States with more than 50% of the component cost of US origin. It may be covered by patents found at www.kenall.com/patents. Content of specification sheets is subject to change; please consult www.kenall.com for current product details.

SimpleSeal Overlapping Door Series	Series	Page
	CSE_O	11
	CSEDO2424	11
	HSEDO	13
	HSESO	13
	CSEPO	14
	CSETO	15

SimpleSeal Inset Door Series	Series	Page
	CSE_I	19
	ESE	20
	CSEA	21
	HSE_I	22

SimpleSeal Extended Flange Door Series	Series	Page
	CSEFL	27

Product Index, Alphabetical by Section

Specialty and Linear Luminaires	Series	Page
	HES/FES	30
	CDL	31
	CSESTD	32
	CSEFBO	32
	CMEXR	33
	METSU/METDU	33

Complementary Products Designed for Food Processing Environments	Series	Page
	EPLB	35
	EPMP	35
	EPC	35
	EPDL	35

