

*SimpleSeal® and Sealed Enclosure Lighting for  
Today's ISO 3-9 Cleanroom and Containment Spaces*



## ***Kenall: The Industry Standard for Cleanroom & Containment Lighting***

As the global landscape continues to evolve, the availability of cleanrooms lags behind the demand. Critical industries such as pharmaceuticals, chip manufacturing, medical device development, food processing, chemical testing and research, advanced optical design, aerospace and automotive manufacturing, and life sciences are scrambling for safe, certified spaces that protect both personnel and the integrity of the products and processes they support.

Kenall's engineering expertise combines a deep knowledge of sealed enclosure manufacturing with an equally deep desire to innovate. Together with our production team, innovative ideas are brought to life. Our vertically integrated facility in the heartland of the U.S. includes robust testing labs to certify every product we manufacture, so when your sealed enclosure lighting arrives on the job site, there's no need for concern about its integrity or value.

Demanding environment? Stringent requirements? Trust Kenall to reliably protect people, products and processes in cleanroom and containment spaces.

### **Kenall lighting:**

- Appropriate for ISO 3-9 rated cleanrooms and biosafety labs rated BSL 1-4
- Maintains critical environmental barriers (UL/cUL, IP, and P442 rated)
- NSF2 certified
- Built for corrosive environments
- Rated for use with sensitive electronic devices (MIL-STD-461G)

*\* See individual product specifications for certification and listing details*

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# SimpleSeal® – Achieving Best Practices for a Variety of Cleanroom & Containment Spaces



*Pharmaceutical Compounding*



*Life Science Applications*



*Chemical Testing & Research*



*Food Packaging & Production*



*Sensitive Manufacturing Processes*



*Semiconductor Chip Production*



# What's New in Sealed Enclosure Products

## **NEW!** SimpleSeal® CSSGI



**COMING SOON! 1'x4'**

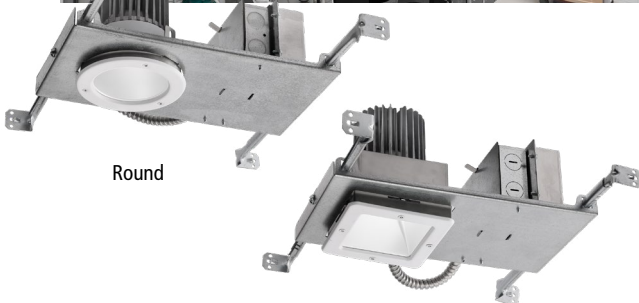
With the introduction of the SimpleSeal CSSGI, Kenall now offers a product suitable for ISO 5-8 rated spaces, ideal for a wide range of needs in cleanroom/clean space environments. Featuring an edge-lit light engine, the design allows for minimal intrusion into the plenum space (1.7" depth) without compromising uniform lighting across the surface of the lens.

The CSSGI is also available in a Buy American Act Compliant version. Designed with room side access, this luminaire is ideal for clean spaces including laboratories, food processing plants, pharmacies and pharmaceutical manufacturing, research centers and more.

### Performance certifications:

- ETL certified
- CCEA approved
- NSF rated
- Appropriate for ISO 5-8 rated spaces

## **NEW!** SimpleSeal® CDL4



Our new 4" downlight is available to fit the needs of cleanrooms, food and pharmaceutical processing areas, and more. This fixture includes options beyond the standard white LED, such as Native 630 nm Red and 590 nm Amber lamping options for narrow bandwidth, spectrally sensitive applications such as photo-sensitive manufacturing.

### Performance certifications:

- IP64/IP65 rated
- CCEA option
- Appropriate for ISO 5-8 rated spaces

**NEW!** SimpleSeal® Cleanslot CRS4

The SimpleSeal CleanSlot CRS4 Series is the industry's first NSF2 rated, recessed slot luminaire series appropriate for ISO 3-9 rated spaces. Designed with a slim footprint, the CleanSlot is ideal for use in BSL 1-2 labs and areas with lower footcandle requirements, such as gowning rooms, locker rooms, passageways, airlocks and packaging areas. A tunable white option is also available.

**Performance certifications:**

- IP65 rated
- Appropriate for ISO 3-9 rated spaces
- Available for use in BSL 1-2 labs
- NSF2 rated
- USP 797-800 compliant

**NEW!** SimpleSeal® NFCSEDI/NFCSESI

The SimpleSeal NFCSEDI & NFCSESI Series combine the best in non-ferrous construction and sealed performance to illuminate spaces where magnetically sensitive processes are performed. Your application will be safely and completely sealed from both the room and plenum sides. And work spaces will be comfortably lit without the debilitating glare commonly associated with lower quality, flat-panel lighting.

**Performance certifications:**

- IP65 rated
- NSF rated
- Appropriate for ISO 3, Class 100 rated spaces
- BSL 1-2
- Meets MIL STD 461G
- CCEA approved

# Sealed Lighting Basics





## Lighting that Protects Your Cleanroom...

Sealed enclosure lighting separates 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 lens, door, housing and ceiling interface.***

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

### Performance Requirements of Sealed Lighting

1. Recessed fixtures that do not leak due to a housing to ceiling interface
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 9 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 a complete, lasting seal

*See page 10 for full details*



#### Extended Flange Series

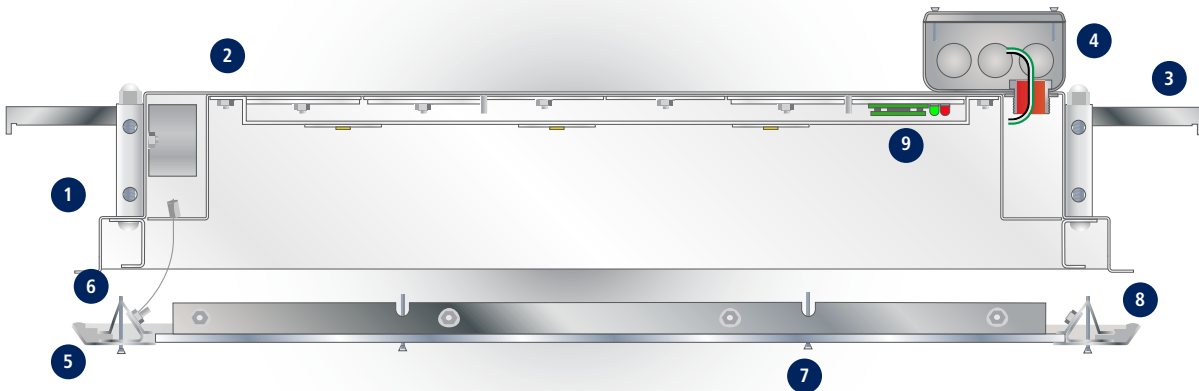
- Prevents leakage between the fixture and an imperfect ceiling via a one-piece doorframe that mates to a housing flange, creating a predictable sealed surface
- Comprised of a one-piece, seam-welded housing and a one-piece housing-to-doorframe gasket
- The doorframe uses a patented fulcrum repositioning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

*See page 11 for full details*

## Our Fully Sealed Luminaires Protect Your People & Processes from BOTH Sides

Some manufacturers provide luminaires that are only sealed from the room side. Kenall manufactures lighting that is *fully sealed from both the room side and the plenum*, to minimize the risk of contamination, extend the life of the fixtures, and make sure lighting is never a concern in process control or safety. With features such as non-porous gaskets, NSF2 certification for cleanability, triple-seal designs, and IP65 and 66 listings, Kenall luminaires reduce costly maintenance downtime and protect both the integrity of work and the well-being of those in the space.

### Overlapping Door Series



#### 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:

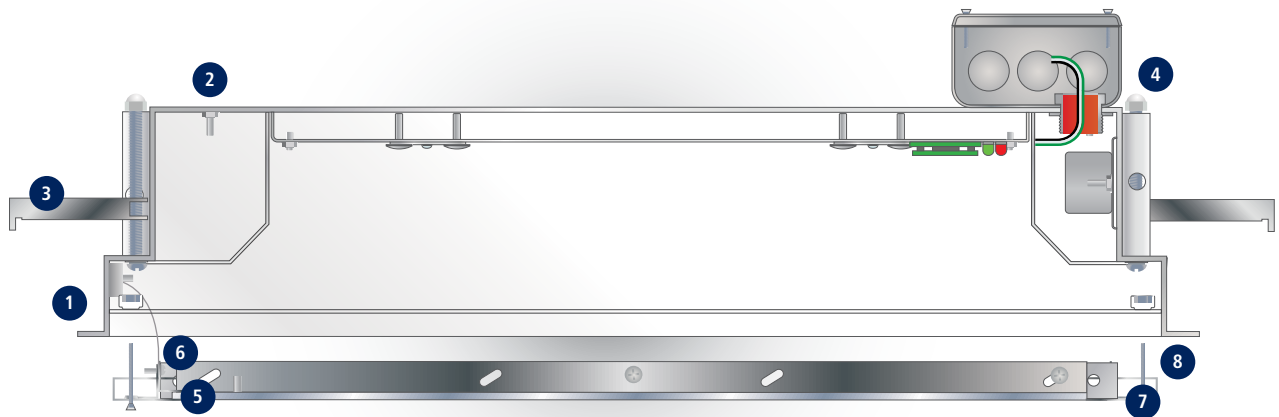
- Protected from moisture
- No interference from ambient temperatures
- Not reliant on line of sight
- California Title 24 compliant
- Tamper-resistant
- Energy efficient

## SimpleSeal™ Sealed Luminaires

### 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: defined and measured to the highest available standards and certified by an independent testing laboratory.

### Inset Door Series



#### 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

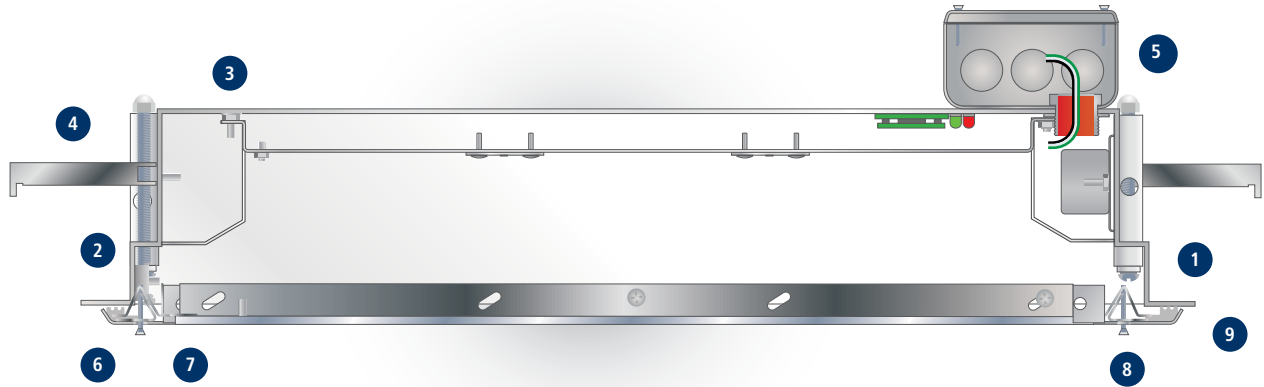
#### Embedded Occupancy Sensor Benefits:

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

## Creates a Secure Seal in Imperfect Ceilings

These easy-to-clean fixtures are IP65 rated and meet 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.

### Extended Flange Series



#### One-Piece Housing



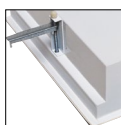
1. Extended flange provides consistent, level, smooth surface for a positive doorframe seal.



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.

# *Kenall Lighting Technologies Improving Safety & Well Being*



# Proprietary KORE Technology™ Eliminates Striping & Glare

## The Problem:

Cleanrooms and containment areas contain a wide variety of hard, glossy surfaces: windows, walls, floors, doors, monitors and equipment. As light from traditional fixtures reflects off these surfaces, it creates veiling reflections that cause eye strain, migraines, and disability glare; interfering with worker safety, productivity and comfort.

*Luminance (or luminous) contrast is the amount of light reflected from one surface or component, compared to the amount of light reflected from the background or surrounding surfaces.*

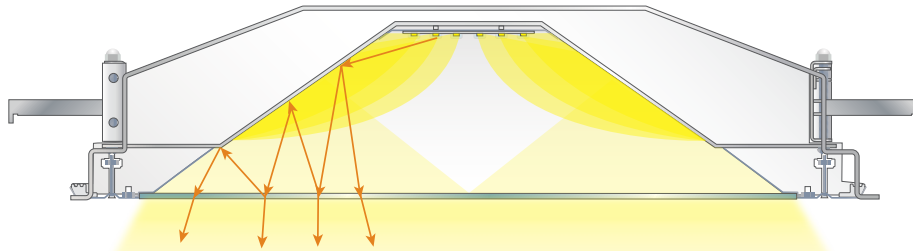
## The Solution

To prevent glare and, as a result, distracting reflections in this highly precise environment, cleanroom lighting should have a lens luminous contrast ratio of <math><2.5:1</math>. This can be accomplished by reducing the luminous contrast of the LED lens. Distributing the flux across the full aperture hides the LEDs as well as their reflections on glossy surfaces.

Select Kenall luminaires now employ patented KORE Technology creating a low luminous contrast of 1.5:1.

**KORE™**  
TECHNOLOGY

KORE Technology provides the required lumens from the lowest possible surface brightness (luminance), resulting in a uniformly lit lens at every power level. The final result is that the glare-creating maximum luminance (brightness) is now greatly reduced, while the minimum luminance is increased.



KORE Technology's trapezoidal reflector and optics work together to evenly distribute radiant flux across the lens, creating a **highly efficient 1.5:1 lens uniformity**

## So how does KORE Technology work?

- Kenall engineers combined optics, special reflectors, and a unique lens to create uniform lens luminance. The key is in the combination of these three components.
- Collimating optics capture nearly all the light and create narrow beams aimed at the reflectors. The reflectors are made with an ultra-reflective coating that diffuses the narrow beams, sending them to the lens.
- After its first reflection, light will either exit through the special, highly-receptive lens or reflect back onto the UR coating, where it is recycled with minimal loss.

Learn More



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A majority of products in this guide are able to comply with the latest domestic preference legislation, such as the Buy American Act (BAA), Trade Agreement Act (TAA), Build America, Buy America Act (BABA), and others. They may be covered by patents found at [www.kenall.com/patents](http://www.kenall.com/patents). Content of specification sheets is subject to change; please consult [www.kenall.com](http://www.kenall.com) for current product details.

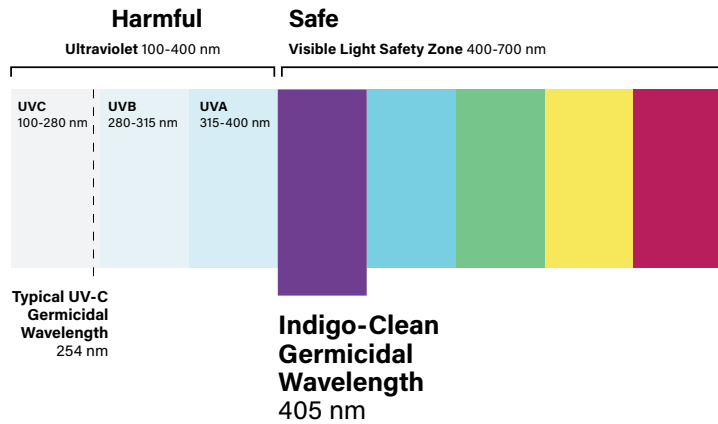
A brand of **legrand**

# *Indigo-Clean & Indigo-Clean Technology*

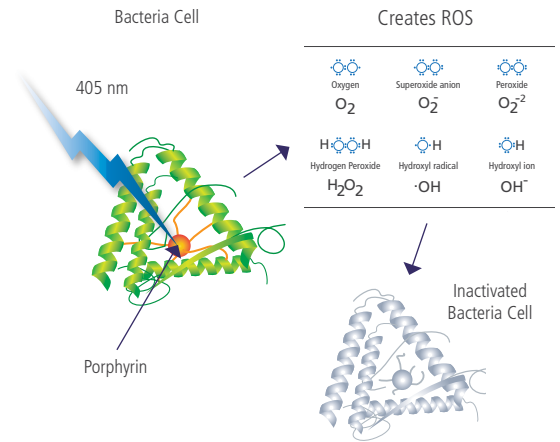


# Indigo-Clean is **Not UV**: Here's How It Works

- 405 nm wavelength of light emitted from Indigo-Clean luminaires reflects off walls and surfaces, penetrating harmful micro-organisms
- 405 nm light targets and excites naturally occurring molecules within the bacteria (porphyrins) to produce intra-cellular Reactive Oxygen Species (ROS).
- These ROS create an oxidative environment within the organism, inactivating it and preventing it from repopulating the space.



## Inactivation of pathogens via visible light absorption



# What Does It Kill?

VIRUSES	ESKAPE PATHOGENS	OTHER ORGANISMS
<ul style="list-style-type: none"> <li>• SARS-CoV-2</li> <li>• Influenza-A</li> </ul>	<ul style="list-style-type: none"> <li>• Enterococcus faecalis</li> <li>• Staphylococcal Aureus (incl. MRSA)</li> <li>• Klebsiella pneumoniae</li> <li>• Acinetobacter baumannii</li> <li>• Pseudomonas aeruginosa</li> <li>• Enterobacter species</li> </ul>	<ul style="list-style-type: none"> <li>• <i>C. diff</i>*</li> <li>• VRE</li> <li>• Aspergillus niger</li> <li>• E.coli</li> <li>• Salmonella enteritidis</li> </ul>

\* Indigo-Clean EX only



[Learn More](#)



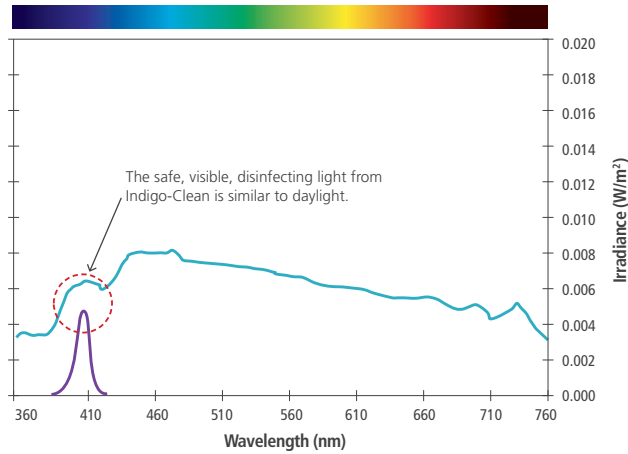
# Indigo-Clean Visible Light Disinfection

## Continuous Whole-room Disinfection Technology

### Visible Light Disinfection

With every new occupant, unknown pathogens may enter your cleanroom, setting the stage for contamination. But Indigo-Clean, an environmental disinfection technology, uses visible light to safely, automatically and continuously kill harmful pathogens in the air and on surfaces.

#### Comparison of Indigo-Clean with Daylight



**Indigo-Clean™ Source**

— D<sub>55</sub> Daylight Spectrum CCT=6500K — Indigo-Clean™

#### Safety Testing

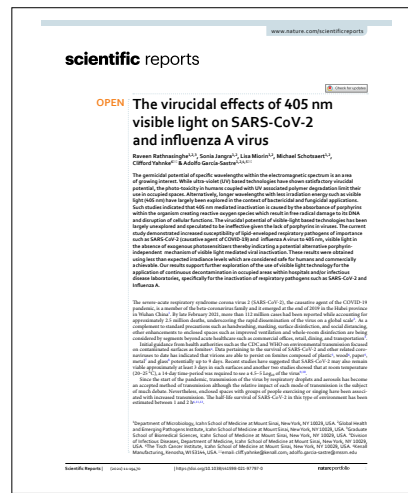
Indigo-Clean has been evaluated against existing visible light safety standards.

Standard	Testing Method	Results
IEC 62471/62778 <sup>1,2</sup>	Independent 3rd Party Laboratory	Pass (Exempt)
ACGIH <sup>3</sup>	Self-Assessment	Pass
ICNIRP <sup>4,5</sup>	Self-Assessment	Pass

- 1: International Electrotechnical Commission – Photobiological safety of lamps and lamp systems, 2006
- 2: International Electrotechnical Commission – Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires, 2014
- 3: American Conference of Governmental Industrial Hygienists – Threshold Limit Values (TLVs) & Biological Exposure Indices Signature Publications, Cincinnati, 2007
- 4: International Commission on Non-Ionizing Radiation Protection – Guidelines on limits of exposure to optical radiation from 0.38 to 3.9 mm. Health Physics 73; 539-555; 1997
- 5: International Commission on Non-Ionizing Radiation Protection – Guidelines on limits of exposure to ultraviolet radiation of wavelengths between 180 nm and 400 nm (incoherent radiation) Health Physics 87, 171-186; 2004



Read the Article



Read the Article



# Three Categories of Indigo-Clean: Which Should I Choose?

	Dual-Mode Indigo-Clean EX	Dual-Mode Indigo-Clean technology	Single-Mode Indigo-Clean technology	Controlled	SARS-CoV-2 & Influenza-A Claim
<b>LED Source</b>					
Blended White + Indigo only light Highest irradiance; Kills C. diff	<b>X</b>			<b>Y</b>	<b>99%</b>
Blended White + Indigo only light		<b>X</b>		<b>Y</b>	<b>94%</b>
Blended White: White + Indigo mix			<b>X</b>	<b>N</b>	Kills 90%+ of SARS-CoV-2 & Influenza-A in less than 2 hours in the upper air



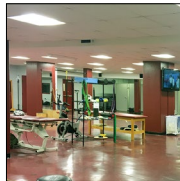
**Dual-mode Indigo-Clean EX** is a Continuous Environmental Disinfection System that employs

*high-power* blended—white + 405 nm indigo—light, and full 405 nm indigo light via a lighting control system to disinfect the space. This dual-mode system delivers blended white light when the room is occupied, and full 405 nm indigo light when it is not.

Both modes **contain NO UV and are safe for room occupants.**

Recommended for use in Critical Care Areas:

- Cleanrooms
- Gowning areas



**Dual-mode Indigo-Clean Technology** is a Continuous Environmental Disinfection System that employs

*mid-power* blended—white + 405 nm indigo—light, and full 405 nm indigo light via a lighting control system to disinfect the space. This dual-mode system delivers blended white light when the room is occupied, and full 405 nm indigo light when it is not.

Both modes **contain NO UV and are safe for room occupants.**

Recommended for 12 hrs White/12 hrs Indigo Operation:

- Conference Rooms
- General Office
- Locker Rooms
- Public Restrooms
- Soiled Workrooms



**Single-mode Indigo-Clean Technology** is a Continuous Environmental Disinfection System that employs

*blended—white + 405 nm visible light—exclusively, to disinfect the space. When the light is on, disinfection is active. 24/7 use is recommended for optimal disinfection.*

Single-mode contains **NO UV and is safe for room occupants.**

Recommended for Use in Areas in Operation 24/7:

- Staff lounges
- Waiting rooms
- Lunch/break rooms
- Pharmacies
- Kitchens
- Corridors
- Isolation rooms



# **BIOS SkyBlue™ Circadian Lighting Fixtures** from Kenall Protect Health & Promote Wellness


[Learn More](#)


## **Wellness Lighting Made Easy**

Kenall now offers many of its best-selling luminaires with BIOS SkyBlue technology. A NASA spinoff, BIOS lighting promotes health and wellness using brilliant, high-quality architectural white light. It is the first circadian light to align with the key blue-sky signals (490 nm) our minds and bodies need to encourage daytime alertness and promote a better night's sleep.

With a peak energy emission of 490 nm, BIOS SkyBlue offers the highest melanopic/photopic ratio—the percent of light going through the eye for circadian entrainment—at standard color temperatures (3500K, 4000K). This comfortable, energy efficient illumination brings what's outside, inside, allowing you to work more productively, sleep more soundly, and live healthier.

## **Choose from three modes based on your environment:**

1. *Biological Static*
2. *Biological Dynamic*
3. *Biological Tunable*

## **Benefits:**

- *Industry leading melanopic/photopic (m/p) ratios (3500K, 4000K)*
- *Most effective source to achieve WELL™ Building Standard Light Features: L02, L03, L04 and L07.*
- *Brilliant color quality for visual comfort (CRI 80+ and R9>90)*
- *Simple single- and 2-channel lighting control options; controls agnostic*



# Kenall's Tunable White Technology

## Tailor Lighting to Staff Needs

Kenall's tunable white lighting technology enables users to independently 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. In addition, Kenall's combination of white color tuning and warm dimming creates flexibility in adjusting the ambiance of the space, while providing excellent value and controls compatibility.

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 building automation systems, including Pico®, EcoSystems® and Fresco™. Consult factory regarding specific controls compatibility.

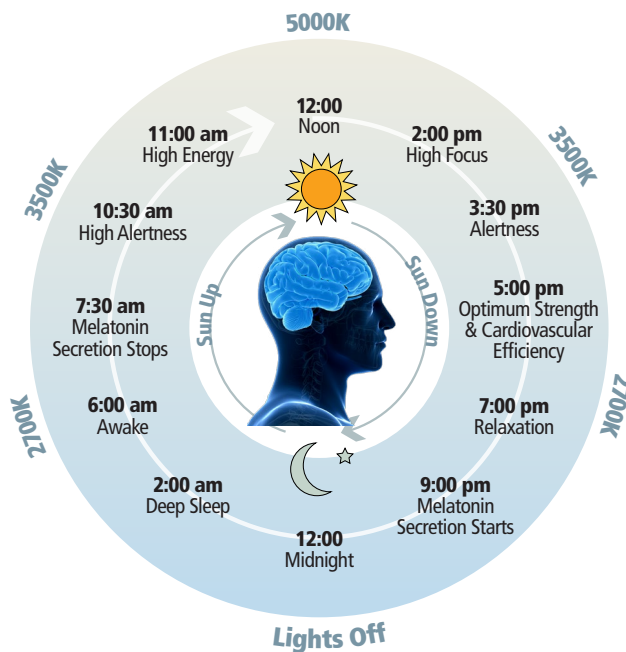
### Benefits to staff:

- Maintains circadian rhythm in areas without natural light
- Helps workers stay alert
- Integrates simply with existing controls



[Learn More](#)

### Natural Light Simulation



# Narrow Spectrum LED

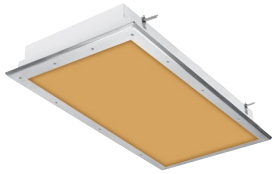
*Technology for Specialized Cleanroom Applications*

[Learn More](#)



## Improve Procedural & Research Outcomes with Specific LED Wavelengths

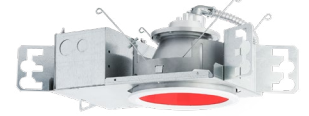
Kenall has utilized the applied science of color to develop high-quality, sealed, narrow-spectrum luminaires for specialized applications. Rather than employing color filters or color mixing, Kenall engineers have utilized specific wavelengths of the visible light spectrum to tailor the best delivery of light for your unique scientific applications.



### Amber Series

Choose 570 nm Phosphor-Converted (PC) amber LED light for enhanced performance and long life, or wildlife-friendly native amber.

- Provides visual acuity for detailed tasks without the damaging effects of white light to light-sensitive products and processes; used to increase cell viability at in-vitro fertilization clinics
- Reduces possible damage to delicate DNA during stem-cell transplant procedures
- Protects light-sensitive ingredients used in pharmaceutical compounding
- 4" downlight also available in 570 nm native amber



### Red Series

630 nm red LED light provides consistent, controllable red light, supporting the naturally occurring circadian rhythm of laboratory animals in research environments

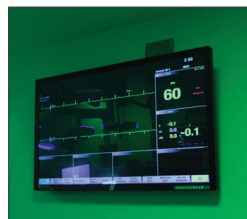
- Offers pure, consistent and controllable red light intensity over time.
- Does not degrade in purity, even when light output has degraded



### Green Series

530 nm green LED light enhances the visibility of monitors during surgical procedures, and reduces eye strain

- Diffused high-efficiency lens for reduced glare
- Symmetric and asymmetric optical distributions
- Dual-function white and green LED sources provide individually-dimmable illumination
- Also available in green only



Green LED Light



White LED Light

*530 nm "green" LED light significantly reduces monitor glare allowing the medical staff to see clearly without adjusting the lights.*

# *ISO 3 Lighting Fixtures*





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## SimpleSeal™ Sealed Luminaires

Luminaires Suitable for ISO 3/4 Spaces— Built for the Most Stringent Cleanroom Standards

### Cleanrooms Classifications

The uses for cleanrooms are varied and growing — dozens of industries utilize them, including (but NOT limited to) aerospace, automotive, biotech, cell & gene therapy, environmental testing, lithium battery production, medical devices, nanotechnology, pharmaceuticals, plastics and solar technology.

Cleanrooms are classified by either governments (previously, United States Federal Standard 209E, and currently European Union GMP and British BS5295), or a non-government entity such as the United States Pharmacopeial Convention (USP) or the International Organization for Standardization (ISO).

#### US FED STD 209E

US FED STD (federal standards) 209E cleanroom class numbers correspond with the amount of .5-plus micrometer-sized particles per cubic foot of air contained in the room. Larger numbers indicate a higher number of particles allowed in the air.

#### ISO 14644-1

International Organization for Standardization (ISO) standards arrange cleanrooms on a scale from one to eight, with one being the most stringent, and also the most rare. Most cleanrooms are rated ISO 3-8.

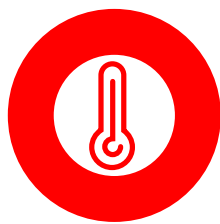
#### EMP EU & BS 5295

EMP EU standards are used in the European Union; BS 5295 are British cleanroom standards. These two standards measure contaminants by the cubic meter, rather than the cubic foot.

In addition to the above standards, your clean room may require additional certification, depending on your application and industry

ISO Class	*Maximum Particles/m <sup>3</sup>						Particles/ ft <sup>3</sup>	Fed. Std. 209 Equivalent
	≥0.1µm	≥0.2µm	≥0.3µm	≥0.5µm	≥1µm	≥5µm	≥0.5µm	
ISO 1	10	2.37	1.02	0.35	0.0083	0.00029		
ISO 2	100	23.7	10.2	3.5	0.83	0.029		
ISO 3	1,000	237	102	35	8.3	0.29	1	Class 1
ISO 4	10,000	2,370	1,020	352	83	2.9	10	Class 10
ISO 5	100,000	23,700	10,200	3,520	832	29	100	Class 100
ISO 6	(1.0 × 10 <sup>6</sup> )	237,000	102,000	35,200	8,320	293	1,000	Class 1,000
ISO 7	(1.0 × 10 <sup>7</sup> )	2.37 × 10 <sup>6</sup>	1,002,000	352,000	83,200	2,930	10,000	Class 10,000
ISO 8	(1.0 × 10 <sup>8</sup> )	2.37 × 10 <sup>7</sup>	1.02 × 10 <sup>7</sup>	3,520,000	832,000	29,300	100,000	Class 100,000
ISO 9	(1.0 × 10 <sup>9</sup> )	2.37 × 10 <sup>8</sup>	1.02 × 10 <sup>8</sup>	35,200,000	8,320,000	293,000		

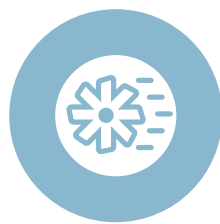
### Cleanrooms Control:



TEMPERATURE



HUMIDITY



AIRFLOW



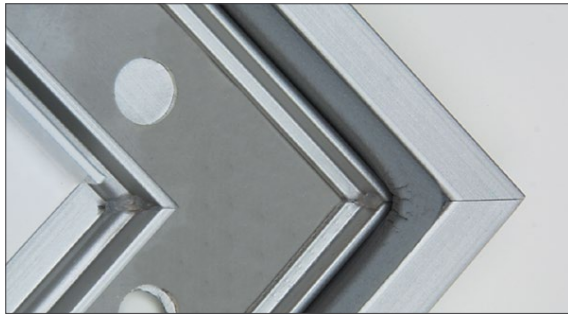
FILTRATION



PRESSURE

## Cleanroom Best Practices, and how SimpleSeal® Helps You Meet Them

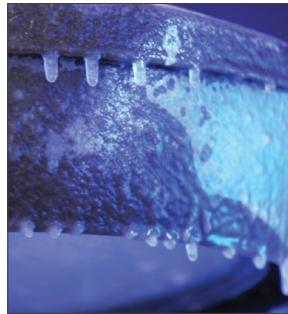
Because only a few ISO 1-2 cleanrooms exist in the world, we will focus on the more common ISO 3 and 4 cleanrooms. ISO 3 and 4 standards are extremely strict and are required for industries such as nanotechnology and semiconductor manufacturing. Per ANSI/IES, **one of the most appropriate luminaire choices for these environments is an overlapping door style.** Kenall's overlapping door luminaires feature nitrile gaskets, which are the highest performance seals available on the market.



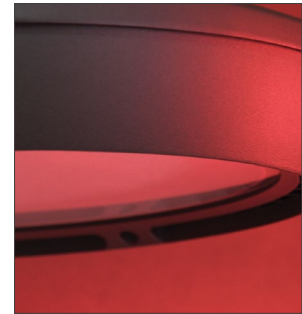
Because of the limited space found in cleanroom ceilings, **luminaires must also be highly efficacious and available in smaller sizes.** Kenall's ISO 3 rated luminaires are available in several size configurations, starting at just 12" wide. The SimpleSeal CSERO features **KORE technology™**, which eliminates striping and glare on monitors and reflective surfaces, while still producing the required lumen output. KORE Technology creates a more comfortable environment for workers and helps protect the integrity of the work being done. (see page 13 for more information on this patented technology).



Additionally, **all cleanroom surfaces must be smooth and cleanable.** SimpleSeal luminaires are manufactured from a single sheet of 24-gauge (optional 20-gauge) cold rolled steel, and are also hole-free and seam-welded. They are then finished with a white TGIC polyester powder coat, which is salt spray tested to 1,000 hours.



Cold Weather Testing



High Temperature Testing

*Note: Excessively high temperatures (over 104 degrees F/30C) can affect some LED lighting performance. If you are specifying lighting for these environments, we recommend contacting your Kenall regional sales manager to discuss the specific needs of your installation.*

**SimpleSeal® CleanSlot™ Series**



**CRS4 Series**

- Delivered lumen range: 500 – 1200 lms/ft
- Input Power: 4 – 12 W/ft
- Efficacy: 79 – 128 lm/W
- CCT: 3000K, 3500K, 4000K; 80 or 90 CRI
- Symmetric and 15° asymmetric distribution options
- Tunable white and BIOS options
- Installation type: grid or flange

Nominal Size: | 4"× 2', 3', 4', 6' & 8'  
 Installation Types: | Recessed ceiling mount  
 Lamp Type: | LED



**SimpleSeal® Inset Door Series**



**CSEDI Series**

- Delivered lumen range: 5,069 – 22,804 lm
- Input power: 149 – 196W
- Efficacy: 102 – 143 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- Universal grid-flange mounting provides field installation flexibility
- Available in [570 nm amber](#) and [630 nm red](#) LED for scientific applications
- Indigo-Clean Technology, BIOS and Tunable White options available
- Embedded motion sensor option

Nominal sizes: | 1'×4', 2'×2', 2'×4'; CSECI 8"×48"  
 Installation Types: | Recessed ceiling mount, grid or flange;  
 Lamp Types: | LED



SimpleSeal® Overlapping Door Series



CSEDO Series

- Delivered lumen range: 4,906 – 24,103 lm
- Input power: 46 – 196W
- Efficacy: 99 – 152 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- High output, high CRI for accurate color rendition & lighting performance
- Diffused, high efficiency lens for reduced glare
- Available in [570 nm amber](#) & [630 nm red](#) for scientific applications
- Indigo-Clean Technology, BIOS and Tunable White options available

Nominal size: | 1' x 4', 2' x 2', 2' x 4'  
 Installation Types: | Recessed ceiling mount: grid or flange  
 Lamp Type: | LED



SimpleSeal® Inset Door Series Plenum Access



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

CSEPO Series

- Delivered lumen range: 5,604 – 11,903 lm
- Input power: 47 – 99W
- Efficacy: 109 – 136 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- Service the plenum space without disturbing electrical components
- Access opening reinforced with 20-gauge steel frame, preventing damage during use

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



**SimpleSeal® Inset Door Using Kore Technology™**



**CSERI Series**

- Features patented Kenall Optical Radiance Engine (KORE) technology
- Lumen range: 1,795 – 19,529 lm
- Input power: 18 – 133W
- Efficacy: 100 – 147 lm/W
- CCT: 3000K, 3500K, 4000K 5000K; 80 or 90 CRI
- Universal installation into grid or flange (drywall) ceiling applications.
- Improves visual performance provides industry leading efficacy
- Distribution suppresses central hot spots
- Evenly illuminated diffuser reduces surface brightness

Nominal Size: 1'x4', 2'x2', 2'x4'  
 Installation Type: Recessed ceiling mount; grid or flange  
 Lamp Type: LED



**SimpleSeal® Overlapping Door Using Kore Technology™**



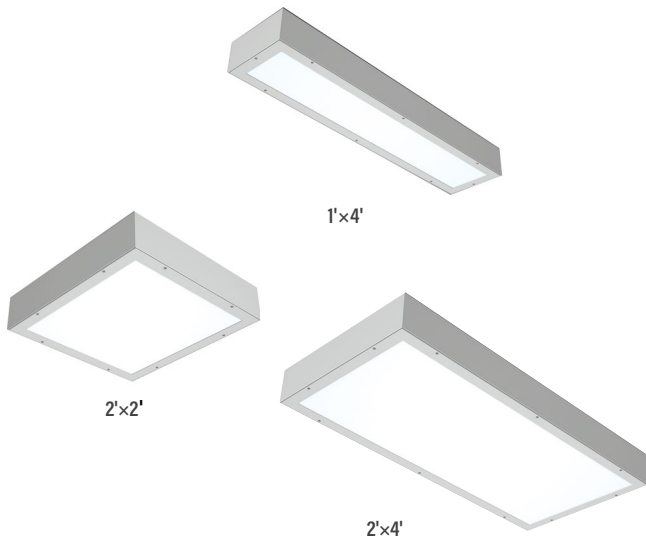
**CSERO Series**

- Features patented Kenall Optical Radiance Engine technology
- Input watts: 18 – 137W
- Lumen range: 1,801 – 19,228 lm
- Lumens per watt: up to 152 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 or 90 CRI

Nominal sizes: 1'x4', 2'x2', 2'x4'  
 Installation Type: Universal installation into 1.0" grid or flange (drywall) ceilings  
 Lamp Type: LED



SimpleSeal® Surface Mount - Inset Door



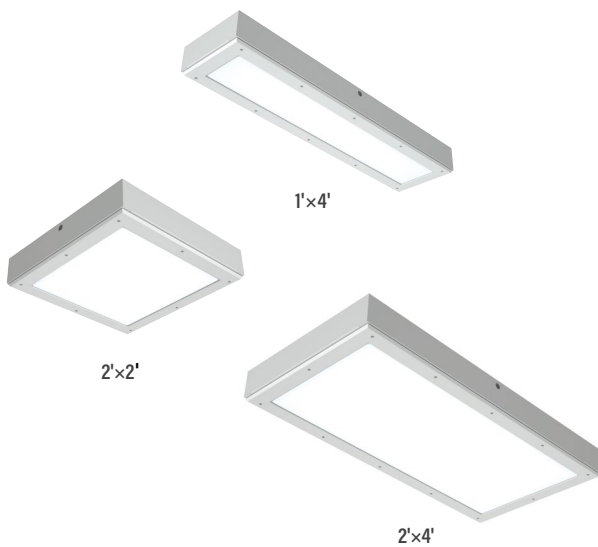
CSESI Series

- Lumen range: 5,241 – 22,804 lm
- Input power: 49 – 196W
- Efficacy: 102 – 144 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- One piece inset door
- Closed cell extruded silicone gasket seals doorframe to housing

Nominal Size: | 1'x4', 2'x2', 2'x4'  
 Installation Type: | Surface ceiling mount  
 Lamp Type: | LED



SimpleSeal® Surface Mount



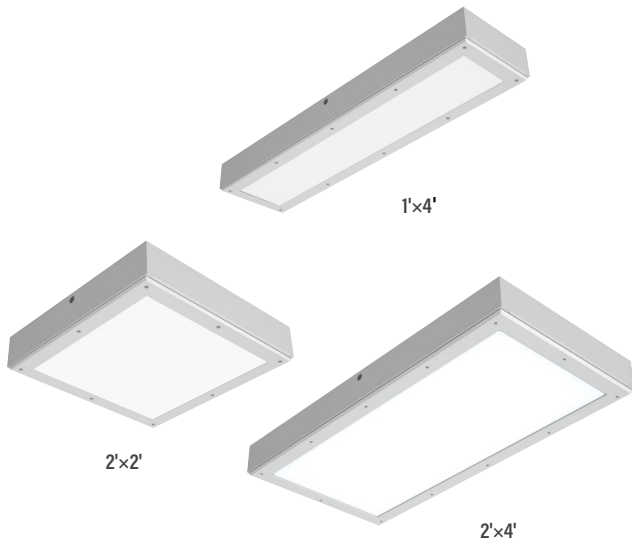
CSESL Series

- Delivered lumen range: 4,906 – 12,470 lms/ft
- Input Power: 46 – 97W
- Efficacy: 100 – 152 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- One-piece closed cell extruded nitrile gasket seals doorframe to housing
- Extruded aluminum, one-piece doorframe with 60° beveled edge for cleanability

Nominal Size: | 1'x4', 2'x2', 2'x4'  
 Installation Types: | Surface ceiling mount  
 Lamp Type: | LED



**SimpleSeal® Surface Mount – Overlapping Door**



**CSESO Series**

- Lumen range: 4,906 – 24,103 lm
- Input power: 46 – 196W
- Efficacy: 99 – 152 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- One-piece doorframe ensures air-tight integrity of luminaire
- Available in [630 nm red](#) for scientific applications
- Optional Food Zone/Non-Contact listing ideal for food processing

Nominal Size: | 1'x4', 2'x2', 2'x4'  
 Installation Types: | Surface ceiling mount  
 Lamp Type: | LED



**SimpleSeal® Top Access**



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

**CSETO 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 [570 nm amber](#) and [630 nm red](#) LED for scientific applications

\*Not intended for walking traffic

Nominal sizes: | 1'x4', 2'x2', 2'x4'  
 Installation Types: | Recessed ceiling mount, grid or flange



SimpleSeal® - Tear Drop



CTD Series

- Lumen range: 5,789 – 11,962 lm
- Input power: 53 – 106W
- Efficacy: 110 – 117 lm/W
- CCT: 3500K, 4000K, 5000K; 80 CRI
- Optical system reduces glare & improves visibility
- Low profile for modern design aesthetic

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



EnviroSeal™ Wraparound Series



FES Series

- Delivered lumen range: 4,410 – 10,325 lm
- Input power: 49 – 98W
- Efficacy: 90 – 111 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- Corrosion resistant, 20-gauge cold-rolled steel
- UV-stabilized, polycarbonate lens
- T-code Rating: T-3A to T-6 (see individual spec sheets for details)

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



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
- Tamper-resistant

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

# *ISO 5 Rated Lighting Fixtures*



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## SimpleSeal® Luminaires Suitable for ISO 5-8 Spaces

### ISO 5 cleanrooms – Control, with more Expansive Lighting Options

ISO 5-8 cleanrooms are common and are utilized extensively throughout the pharmaceutical, medical device, agriculture, and chemical industries, as well as high-demand emerging industries, such as lithium battery, solar energy and medical marijuana manufacturing.

The best practices for lighting ISO 3/4 rated cleanrooms also apply to those spaces rated ISO 5-8, however, options for luminaires and exits are now more expansive, and may include inset door, grid, and flange style fixtures.

An ISO 5-8 cleanroom must have less than 3,520 particles larger than 0.5 microns per cubic meter, and 250-300 air changes per hour. Also, maintaining an ISO 5-8 cleanroom will require multiple airlocks, and lighting for those airlocks need to be sealed.

While some manufacturers may recommend Ingress Protection ratings as low as IP45, Kenall luminaires appropriate for ISO 5-8 rated spaces are all IP65 rated to withstand dirt, dust and chemical cleaners, while also helping preserve positive and negative air pressure within the cleanroom.

#### 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 length 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 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

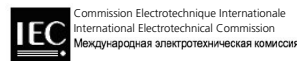
**IP65**

##### 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.

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# 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 environments 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

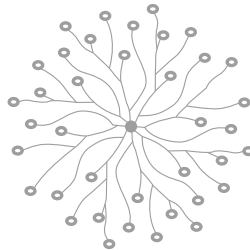
Most flammable gases have an ignitable range of concentration above or below which the fuel may not ignite. (Note: a concentration of fuel above the specified range is still considered a hazard, since it is possible to reduce the concentration until it returns to within the ignitable range.)

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 auto ignition temperature.



## 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.

Combustible dust explosions can result in significant loss of life: a series of sugar dust explosions at Imperial Sugar in Port Wentworth, Georgia killed 14 people and injured 42 others.

### Categories of combustible/explosive dusts include:

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 provides 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® Shallow Plenum**



**COMING SOON! 1'x4'**

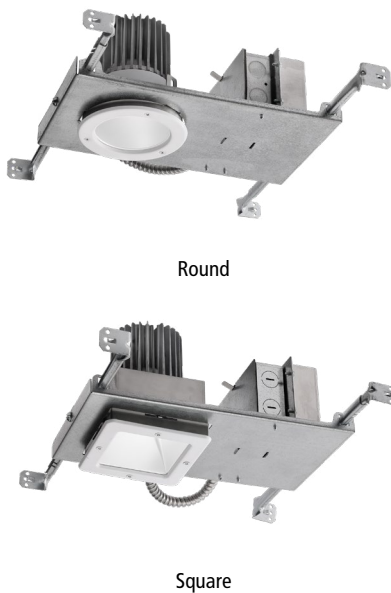
**CSSGI Series**

- Delivered lumen range: 2197–8,639 lm
- Input power: 23 – 69W
- Efficacy: 97–132 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K, 80 or 90 CRI
- Edge-lit LED light engine for minimal luminaire intrusion into the plenum space (1.7" depth)
- Anodized extruded aluminum inset door construction allows for room-side servicing

Nominal sizes: | 2' x 2', 2' x 4'  
 Installation Types: | Recessed  
 Lamp Types: | LED



**SimpleSeal® Sealed Downlight**



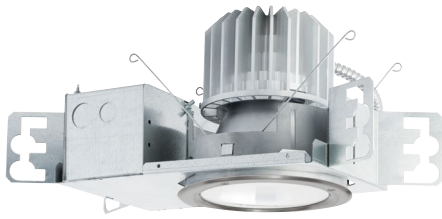
**CDL4**

- Delivered lumen range: 830–2,500 lm
- Input power: 13 – 27W
- Efficacy: 59 – 97 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K, 80 or 90 CRI
- Flush trim, round or square aperture available
- Available in [Native 630 nm Red](#) and [590 nm Amber](#) for scientific applications

Nominal sizes: | 4" diameter aperture  
 Installation Types: | Recessed  
 Lamp Types: | LED



SimpleSeal® Sealed Downlight



CDL6 Series

- Delivered lumen range: 772–4,746 lm
- Input power: 12–51W
- Efficacy: 59–104 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 80 or 90 CRI
- Available in [Native 630 nm Red and 590 nm Amber](#) for scientific applications
- Die-cast aluminum heatsink protects LEDs and provides long life

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



SimpleSeal® Exit Sign



CMEXR Series

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

Nominal sizes: 16"×14.5"×5/8"  
 Installation Types: Surface ceiling or wall mount; optional pendant mount  
 Lamp Types: LED



**SimpleSeal® Architectural**



**CSEAI Ambient Series**

- CCT: 3000K, 3500K, 4000K, 5000K; 82 or 90 CRI
- Center diffuser provides indirect ambient lighting
- Clear, impact-resistant outer lens sealed to doorframe

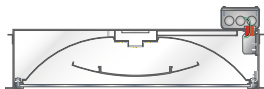
Nominal sizes: | 1'×4', 2'×2', 2'×4'  
 Installation Types: | Surface; recessed ceiling mount, grid or flange  
 Lamp Types: | LED



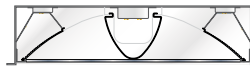
**Architectural Styles**



CSEAI center acrylic diffuser



CSEAI3I Combination perforated basket and acrylic lens



CSEAI4I Combination center and dual side lenses

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

**SimpleSeal® Counter-mount Overlapping Door Series**



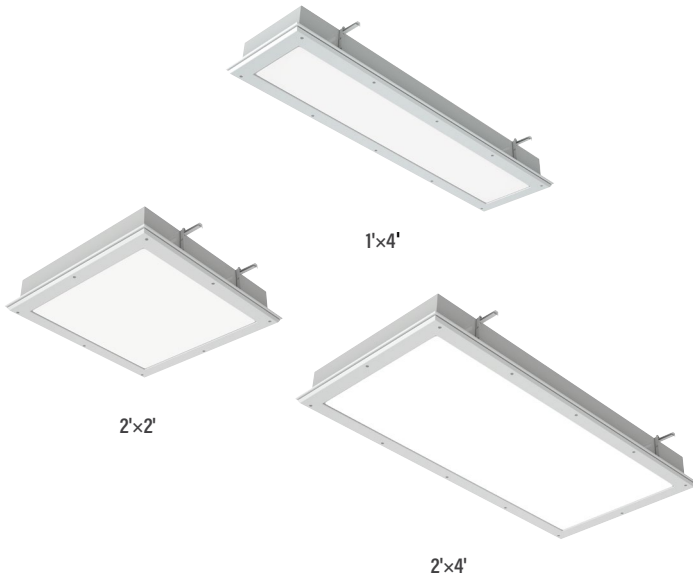
**CSECO Series**

- Lumen range: 4,108 – 9,706 lm
- Input power: 46 – 98W
- Efficacy: 76 – 115 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 or 90 CRI
- High-output, high-CRI LED lamp sources for accurate color rendition & lighting performance
- One-piece overlapping doorframe with closed-cell silicone gasket provides air-tight integrity to luminaire

Nominal sizes: | 8"×50"  
 Installation Types: | Surface; recessed ceiling mount, grid or flange  
 Lamp Types: | LED



SimpleSeal® Extended Flange Series



CSEFL Series

- Delivered lumen range: 4,906–12,470 lm
- Input power: 49–97W
- Efficacy: 100–152 lm/W
- CCT: 300K, 3500K, 4000K, 5000K; 82 CRI
- Suitable for Class 100 (ISO 5) environments
- Available in [630 nm red LED](#) for scientific applications
- Indigo-Clean Technology option available

Nominal sizes: | 1'x4', 2'x2', 2'x4'  
 Installation Types: | Recessed ceiling mount, flange  
 Lamp Types: | LED



# *Sealed Enclosures – Hazardous Locations*



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**SimpleSeal® Overlapping Door Series**



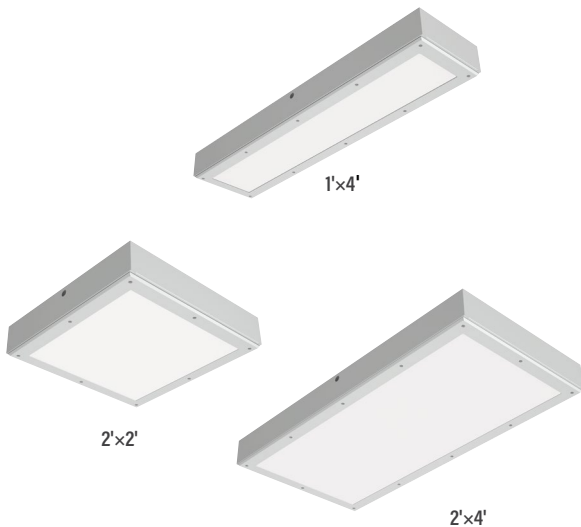
**HSEDO Recessed Series**

- Delivered lumen range: 5,057–24,761 lm
- Input power: 49 –196W
- Efficacy: 102–138 lm/W
- CCT: 3500K, 4000K, 5000K; 82 CRI
- Suitable for hazardous locations rated Class 1, Div 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 option
- All models suitable for ambient temperatures up to 40°C (104°F)

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



**SimpleSeal® Inset Door Series**



**HSESO Series**

- Lumen range: 5,424–21,235 lm
- Input power: 59–184W
- Efficacy: 89–121 lm/W
- One-piece overlapping doorframe secured to housing with aircraft cables
- 20-gauge, hole-free one-piece cold rolled steel housing
- Closed cell extruded silicone gasket seals doorframe to housing
- Haz Location Listing: Class I, Div 2, Grps A, B, C, D

Nominal Size: | 1'x4', 2'x2', 2'x4'  
 Installation Type: | Surface ceiling mount  
 Lamp Type: | LED





# *Sealed Enclosure - Luminaires Suitable for BSL 1-4 Rated Spaces*



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## SimpleSeal™ Biosafety Luminaires

### Luminaires for Biosafety Labs

Biosafety laboratories (BSLs) are specifically designed for the handling and study of infectious agents, toxins and other biological hazards in clinical, research or educational environments. Much like the standards for cleanrooms, biosafety standards must be followed to the letter to protect the health of workers and the integrity of the work being done. Several of Kenall's SimpleSeal luminaires are rated for use in Biosafety labs.

#### 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 specify 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, designating they are appropriate for the space.

#### 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 specification sheet.

	U.S. Biosafety Levels	Examples of Pathogens Handled
<b>BSL -1</b>	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
<b>BSL-2</b>	Containment required: used in work with human disease agents that pose a moderate health hazard.	Hepatitis A & B, some types of salmonella and listeria
<b>BSL-3</b>	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
<b>BSL-4</b>	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



**SimpleSeal® Inset Door Series**



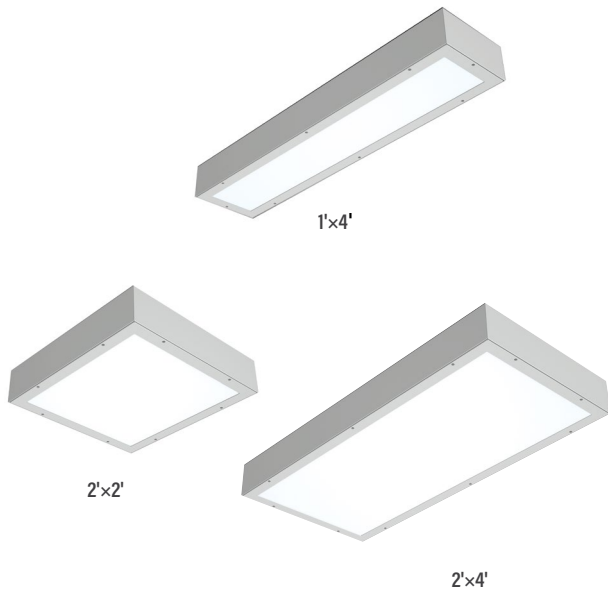
**CSEDI Series**

- Delivered lumen range: 5,069 – 22,804 lm
- Input power: 149 – 196W
- Efficacy: 102 – 143 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- Universal grid-flange mounting provides field installation flexibility
- Available in [570 nm amber](#) and [630 nm red](#) LED for scientific applications
- Indigo-Clean Technology, BIOS and Tunable White options available
- Embedded motion sensor option

Nominal sizes: | 1'x4', 2'x2', 2'x4'; CSECI 8"×48"  
 Installation Types: | Recessed ceiling mount, grid or flange;  
 Lamp Types: | LED



**SimpleSeal® Surface Mount - Inset Door**



**CSESI Series**

- Lumen range: 5,241–22,804 lm
- Input power: 49–196W
- Efficacy: 102–144 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- One piece inset door
- Closed cell extruded silicone gasket seals doorframe to housing

Nominal Size: | 1'x4', 2'x2', 2'x4'  
 Installation Type: | Surface ceiling mount  
 Lamp Type: | LED



SimpleSeal® Inset Door - EMI - Sensitive Cleanrooms



NFCSEDI Series

- Delivered lumen range: 4,160 – 15,535 lm
- Input power: 48 – 121W
- Efficacy: 86 – 128 lm/W
- CCT: 3000K, 3500K, 4000K; 80 & 90 CRI
- Non-ferrous construction & remote power supplies provide safe operation with EMI-sensitive equipment
- Symmetric, optical distribution with uniform lens appearance
- One-piece sealed housing; smooth exterior doorframe & lens for simplified cleaning
- High-output, high CRI LED lamp sources

Nominal sizes: 1'x4', 2'x2', 2'x4'  
 Installation Types: Universal recessed installation into grid or flange (drywall) ceilings  
 Lamp Types: LED



SimpleSeal® - Surface Mount - EMI - Sensitive Cleanrooms



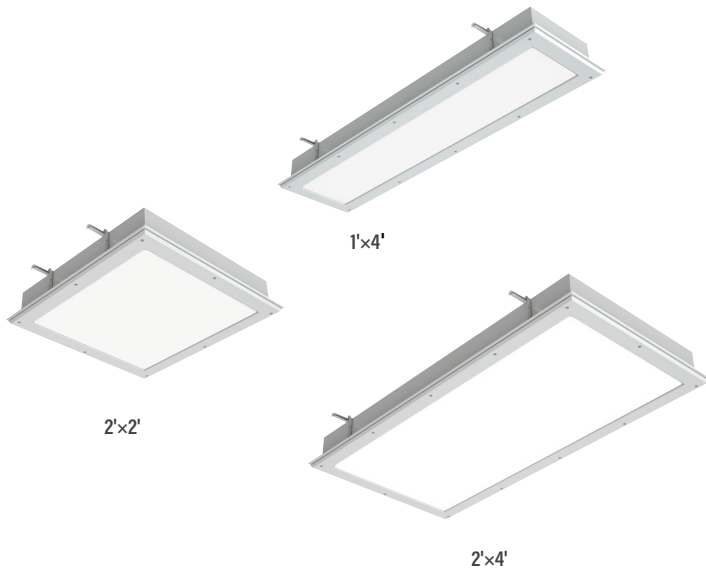
NFCSESI Series

- Delivered lumen range: 6,077 – 15,535 lm
- Input power: 60, 121W
- Efficacy: 96 – 129 lm/W
- CCT: 3000K, 3500K, 4000K; 80 & 90 CRI
- Non-ferrous construction & remote power supplies provide safe operation with EMI-sensitive equipment
- Symmetric, optical distribution with uniform lens appearance
- One-piece sealed housing; smooth exterior doorframe & lens for simplified cleaning
- High-output, high CRI LED lamp sources

Nominal sizes: 2'x2', 2'x4'  
 Installation Types: Surface ceiling mount  
 Lamp Types: LED



**SimpleSeal® Extended Flange Series**



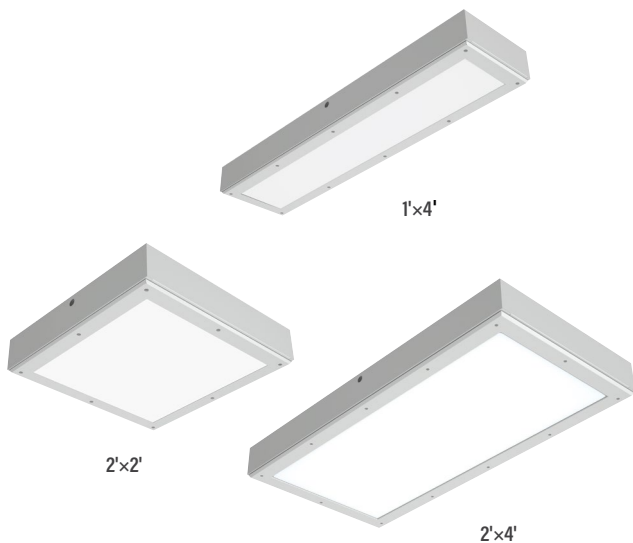
**CSEFL Series**

- Delivered lumen range: 4,906 – 12,470 lm
- Input power: 49 – 97W
- Efficacy: 100 – 152 lm/W
- CCT: 300K, 3500K, 4000K, 5000K; 82 CRI
- Suitable for Class 100 (ISO 5) environments
- Available in [630 nm red](#) LED for scientific applications
- Indigo-Clean Technology option available

Nominal sizes: | 1'x4', 2'x2', 2'x4'  
 Installation Types: | Recessed ceiling mount, flange  
 Lamp Types: | LED



**SimpleSeal® Surface Mount - Overlapping Door**



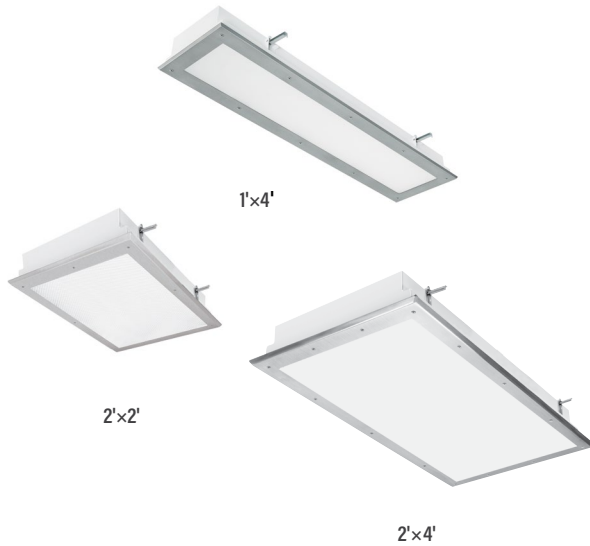
**CSESO Series**

- Lumen range: 4,906 - 24,103 lm
- Input power: 46 - 196W
- Efficacy: 95 - 152 lm/W
- One-piece doorframe provides air-tight integrity of luminaire
- Optional Food Zone/Non-Contact listing ideal for food processing applications
- Available in [630 nm red](#) for scientific applications
- For Hazardous applications please refer to the HSESO series

Nominal Size: | 1'x4', 2'x2', 2'x4'  
 Installation Type: | Surface mount; ceiling  
 Lamp Type: | LED



SimpleSeal® Overlapping Door Series



CSEDO Series

- Delivered lumen range: 4,906 – 24,103 lm
- Input power: 46 – 196W
- Efficacy: 99 – 152 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- High output, high CRI for accurate color rendition & lighting performance
- Diffused, high efficiency lens for reduced glare
- Available in [570 nm amber](#) & [630 nm red](#) for scientific applications
- Indigo-Clean Technology, BIOS and Tunable White options available

Nominal size: | 1' x 4', 2' x 2', 2' x 4'  
 Installation Types: | Recessed ceiling mount: grid or flange  
 Lamp Type: | LED



*Lighting Options for Innovation, BioTech & LifeScience Hubs*



In addition to lighting for extremely stringent environments, Kenall also manufactures sealed luminaires and sealed, illuminated signage appropriate for a wide variety of other uses, from food processing plants to innovation, life sciences, and biotech hubs.

Also included in this section is the SimpleSeal luminaire recommended for use in areas containing High Efficiency Particulates Air (HEPA) filters. HEPA filters trap airborne particles, including bacteria, fungi and dust, while allowing gases to flow through.

SimpleSeal® Architectural



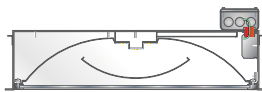
CSEAI Ambient Series

- CCT: 3000K, 3500K, 4000K, 5000K; 82 or 90 CRI
- Center diffuser provides indirect ambient lighting
- Clear, impact-resistant outer lens sealed to doorframe

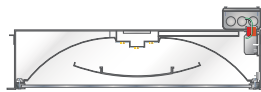
Nominal sizes: | 1'x4', 2'x2', 2'x4'  
 Installation Types: | Surface; recessed ceiling mount, grid or flange  
 Lamp Types: | LED



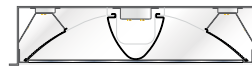
Architectural Styles



CSEAI center acrylic diffuser



CSEA3I Combination perforated basket and acrylic lens



CSEA4I Combination center and dual side lenses

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

EnviroSeal™ Linear



ES Series

- Delivered lumen range: 2,205 – 10,325 lm
- Input power: 25 – 98W
- Efficacy: 88 – 110 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 or 90 CRI
- Cold rolled steel or stainless steel housing for corrosion resistance
- UV-stabilized polycarbonate lens
- IP65 option available
- Ligature resistant construction

Nominal sizes: | 3", 5", 8" and 12" widths; 4' and 8' lengths  
 Installation Types: | Surface ceiling mount  
 Lamp Types: | LED



**SimpleSeal® Environmental Inset Door**



**ESEDI**

- Delivered lumen range: 5,069 – 22,804 lm
- Input power: 46 – 196W
- Efficacy: 102 – 144 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- High-output, high-CRI LED lamp sources for accurate color rendition & lighting performance
- Diffused high-efficiency lens for reduced glare
- Closed cell extruded silicone gasket seals doorframe to housing
- Continuous piano hinge

Nominal sizes: | 1'x4', 2'x2', 2'x4'  
 Installation Types: | Recessed ceiling mount; grid or flange  
 Lamp Types: | LED



**SimpleSeal® High Abuse Extended Flange Series**



**HASEDI**

- Delivered lumen range: 4,480 - 22,539 lm
- Input power: 45 - 196W
- Efficacy: 90 - 137 lm/W
- CCT: 3000K, 3500K, 4000K, 5000K; 82 CRI
- High-output lamp sources for accurate color rendition & lighting performance
- Diffused high-efficiency lens for reduced glare
- One-piece inset doorframe, secured to housing with continuous piano hinge & Torx® fasteners
- Indigo-Clean Technology option available

Nominal sizes: | 1'x4', 2'x2', 2'x4'; CSECI 8"×48"  
 Installation Types: | Universal installation into grid or flange (drywall) ceilings  
 Lamp Types: | LED



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

SimpleSeal® Exit Sign



CMEXR Series

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

Nominal sizes: 16"×14.5"× 5/8"  
Installation Types: Surface ceiling or wall mount; optional pendant mount  
Lamp Types: LED



### 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 limited product warranty. For more detailed, product specific warranty information, please visit our website at [www.kenall.com](http://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.

**LED 5-year Warranty**  
 This warranty covers select Kenall LED products for a period of 5 years from the date of manufacture. For complete warranty information, please visit us on the web at [www.kenall.com](http://www.kenall.com).

### Sample Ordering Information

Example: CSEDO-24-67L-40K8-DIM1-DV-2F-4H-SYM

#### ORDERING INFORMATION

Model	Size	Lamp Power	Lamp Color	Driver	Voltage	Doorframe	Housing	Optics	Options	
								<b>SYM</b>		
<b>CSEDO</b>										
<b>Size</b>		<b>Lamp Power</b>		<b>Driver Type</b>					<b>Options</b>	
14	1'x4'	<b>1'x4'</b>		<b>DIM1</b>	0-10V Dimming to 1%				<b>LEL†</b> 10W Emergency Battery Pack	
22	2'x2'	<b>45L</b>	45 Watt LED	<b>DIM01</b>	0-10V Dimming to 0.1% (n/a with 347 Voltage)				<b>20KV</b> 20KV/KA Surge Protection per IEEE/ANSI C62.41.2 Cat. A	
24	2'x4'	<b>67L</b>	67 Watt LED						<b>AMF▲</b> Antimicrobial Finish	
		<b>90L</b>	90 Watt LED						<b>FN**</b> Food Zone/Non-Contact	
		<b>2'x2'</b>		<b>Voltage</b>					<b>TS</b> Stainless Steel Doorframe Thumb Screws	
		<b>45LD</b>	45 Watt Dual-Row LED	<b>DV</b>	120-277VAC, 50/60Hz				<b>FS</b> Fuse & Holder	
		<b>67L</b>	67 Watt LED	<b>120</b>	120VAC				<b>HJ</b> Sealed Wireway	
		<b>90L</b>	90 Watt LED	<b>277</b>	277VAC				<b>MS</b> Motion Sensor (n/a with 347 Voltage Option)	
		<b>2'x4'</b>		<b>347</b>	347VAC				<b>RF◆</b> Radio Frequency Filter	
		<b>45LD</b>	45 Watt Dual-Row LED	<b>Doorframe Options</b>						
		<b>67L</b>	67 Watt LED	<b>5F</b>	20-Ga Type 304 SS (STD)				<b>RM◆</b> Continuous Row Mounting	
		<b>90L</b>	90 Watt LED	<b>2F</b>	20-Ga CRS				<b>2C</b> Two Circuit Wiring (1'x4'-45L single circuit operation will yield uneven lens luminance)	
		<b>135L</b>	135 Watt LED	<b>XF</b>	20-Ga Type 316 SS				<b>P442‡</b> Optional NSF Protocol P442 Certified	
		<b>180L</b>	180 Watt LED	<b>PAF</b>	.063" Painted Fabricated Aluminum				<b>Accessories</b>	
		<b>Lamp Color</b>		<b>Housing Options</b>						
		<b>30K8</b>	3000K / 82 CRI min.	<b>4H</b>	24-Ga CRS (STD)				<b>IF◆◆</b> Install Frame	
		<b>35K8</b>	3500K / 82 CRI min.	<b>2H</b>	20-Ga CRS				* Add .375" to ceiling cut out dimensions	
		<b>40K8</b>	4000K / 82 CRI min.	<b>5H</b>	20-Ga Type 304 SS				• Voltage specific selection required	
		<b>50K8</b>	5000K / 82 CRI min.	<b>XH</b>	20-Ga Type 316 SS				** Lensing consists of FDA approved Food Zone clear polycarbonate outer lens and diffused acrylic inner lens	
				<b>PAH</b>	.050" Painted Aluminum				† n/a with 180L lamp option or 347V input; voltage-specific selection required and height of fixture is 5.875" when specified with 135L lamp option; 0°C/32°F min. operating environment.	
				<b>Optics</b>						▲ Applied only to exposed painted surfaces of luminaire (not available on stainless steel doorframes)
				<b>SYM</b>	Symmetric, Diffused DR Acrylic				‡ P442 only available on CSEDO24	
									◆ Only available when installed in drywall ceilings (flange mount)	



## Listings & Certifications

Fixtures designed for use in cleanrooms and clean spaces must satisfy a large number of demanding lighting and environmental requirements. Listings applicable to the cleanroom luminaires featured in this product selector guide are shown below. Please refer to the products within each section of this guide to determine specific listings, or visit us on the web at [www.kenall.com](http://www.kenall.com)

- UL US** 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.
- ETL US** 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.
- IP64** IP64—UL Certified IP64 per IEC 60598 ensures that the enclosure is dust-tight and protected against splashing water without any harmful effects.
- IP65** 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.
- IP66** 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.
- IK10** IK10 RATED - Impact protection (IK) ratings indicate the ability of an enclosure to protect its contents from external impacts, per IEC IEC 60068-2-75:1997-08. The IK10 ratings range from IK00, or no protection, up to IK10, a maximum of 20 joules of impact protection, or the equivalent of a 5kg mass dropped from 40 cm above the impacted surface.
- NSF** 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.
- CCEA** 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.
- UL 924** 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.
- NFPA 101** 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.
- DLC** 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.
- MIL STD 461G** 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.
- ICT** ICT—Indicates white, ambient Kenall luminaires using Indigo-Clean Technology, which kills harmful bacteria, including Staph, such as MRSA.
- ISO 3** 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.
- ISO 5** 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.
- FN** 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.
- 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.
- TW** 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.
- BSL 1-2** 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.
- BSL 1-4**
- HAZ** 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.
- K230** 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.
- LR** Ligature Resistant — Based on standards of new construction, and also applicable to substantial renovations, select Kenall fixtures bearing this mark have been reviewed by mental health professionals for ligature-resistance and other safety criteria to earn a [Patient Safety Standard Guidelines](#) listing.



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.



**Buy American Act Compliant**

When you see this symbol, it indicates the product is able to comply with the latest domestic preference legislation, such as the Buy American Act (BAA), Trade Agreement Act (TAA), Build America, Buy America Act (BABA), and others.

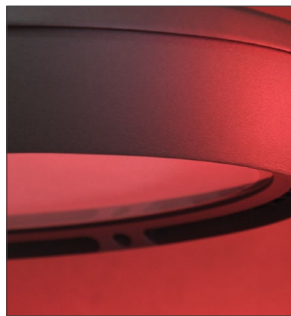
**State-of-the-art, certified testing facility**

Kenall is equipped with a state-of-the-art certified safety laboratory, providing comprehensive in-house testing capabilities:

**Thermal Testing**



Cold Weather Testing

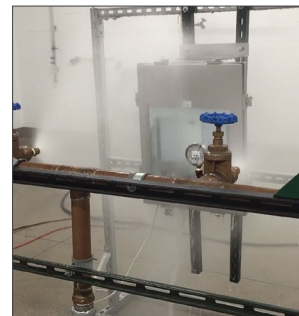


High Temperature Testing

**Ingress Testing**

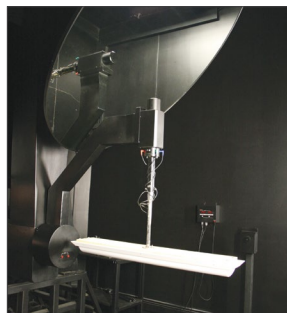


Solids and Particulates Testing



Water Ingress Testing

**Photometrics Testing**



Luminous Intensity Distribution Testing



## Kenall Market Segments

Kenall offers luminaires designed according to industry best practices and certified performance standards in each of the market segments we serve. From high abuse fixtures with an exclusive 'Peace of Mind' Guarantee® against breakage and healthcare fixtures sealed for infection control, to sealed enclosure fixtures that comply with stringent military standards for RFI/EMI and food processing fixtures that carry mission critical NSF, NEMA and IP ratings, our fixtures are designed with your specific needs in mind.



CORRECTIONAL



EDUCATION



HEALTHCARE



BEHAVIORAL HEALTH



CLEANROOM



INDUSTRIAL FOOD



TUNNEL & TRANSPORTATION



PARKING & SITE





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