# Protective Vents

***FOR OUTDOOR LIGHTING ENCLOSURES***

- *Sustain original IP levels*
- *Retain brightness over time*
- *Reduce maintenance costs*

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## The Challenge: Preserve Lighting Performance Over Time

Bright, reliable lighting can dramatically enhance the enjoyment – and safety – of public and commercial spaces and transitways. People feel safer and more secure when the places they park and walk have bright, working luminaires. But over time, environmental factors can degrade the luminaire's original level of Ingress Protection (IP). This will allow damaging moisture and contaminants to enter the enclosure.

**The challenge for lighting manufacturers and their customers is: how to sustain luminaire protection, brightness and reliability over time, without escalating maintenance frequency and costs.**

### Prevent IP Drops to Keep Maintenance Costs Down

Failure to equalize pressures within the enclosure has been identified as a root cause of premature failure in outdoor luminaires. Unless relieved, these pressure differentials continue to stress seals. As seal performance degrades, so does the IP level. As IP diminishes from "as designed" levels, maintenance calls and costs can quickly exceed planned levels... and budgets.

### Enhance LED Savings and Acceptance

The popularity of LED technology for outdoor luminaires is driven by today's focus on energy savings, cost savings and environmental sustainability. If an LED luminaire fails prematurely, the costs of repair or replacement quickly offset any savings that may have been realized. GORE® Vents improve LED luminaire reliability, which also helps to increase acceptance of this emerging technology.

A Philips LED lighting enclosure, properly vented with a Screw-In Vent from Gore.

> **IEC 60529**
>
> *The effects of continuous exposure to weather and the environment are difficult to evaluate, and therefore the choice of material for the enclosure is as important as the actual IP designation. Attention should also be paid to any gaskets used for the higher IP ratings such that the water cannot readily be drawn past the seal. This is most likely to occur when a warm enclosure is suddenly cooled causing a pressure drop inside.*

Even rugged seals must be protected from repeated stress caused by pressure differentials. If seal performance is compromised, the original IP level will degrade over time in the field.

> **CIE 154**
>
> *Once the non-recoverable reductions by ageing or soiling have occurred they cannot be brought back to their original condition and replacement of the outer glazing or complete luminaire may be necessary. This is the case with luminaires if they are in, say, dusty or oily atmospheres. In such cases it is well worth considering at the design stage, the use of sealed luminaires of high IP ratings, e.g. IP6X.*

Of course, non-recoverable degradation occurs even in moderate climatic conditions. Weather changes cause wear that degrades luminaires over time. Designing for, and more importantly sustaining, an IP65 or higher level will extend the life of a luminaire in any environment.

# When IP Drops, Maintenance Costs Rise

## As Seals are Stressed, the IP Level Degrades

No matter how rugged the seal, its performance will degrade when it is repeatedly stressed by pressure differentials within the enclosure. As seal performance declines, the level of ingress protection degrades accordingly. Field performance no longer meets the "as designed" IP level.

## As Protection Degrades, so Does Luminaire Performance

With lower Ingress Protection, contaminants can more easily enter the housing. The results are predictable: Moisture that enters and is trapped can cause corrosion and electrical malfunctions; condensation can cloud lenses. Dust, dirt or particulates that enter will accumulate on lenses or reflectors, causing the greatest loss of light.

## As Performance Suffers, Maintenance Costs Escalate

**MF = LLMF * LMF * LSF**

| | | | |
|---|---|---|---|
| **M**aintenance **F**actor | **L**amp **L**umen **M**aintenance **F**actor | **L**uminaire **M**aintenance **F**actor | **L**amp **S**urvival **F**actor |

Source: CIE 154

Even routine maintenance is not easy or inexpensive when outdoor lighting is mounted at heights that require special equipment, and special safety considerations. However, if an IP drop compromises one or more aspects of luminaire performance, the frequency and costs of associated cleaning or component replacement will increase dramatically.

Architectural lighting from ConaTech incorporates a GORE® Screw-In Vent.

## IP Drop Increases Maintenance Frequency...

Consider the example of 10,000 HID street lights, rated IP65, with a designed maintenance interval of 2.5 years. With a medium level of pollution, the Luminaire Maintenance Factor (LMF) is 0.88. To keep the same LMF when the field performance drops to IP54, the maintenance interval must be shortened to 1.5 years.

| Optical compartment IP Rating | Pollution Category | Exposure Time (years) | | | | |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| IP5X | High | 0.89 | 0.87 | 0.84 | 0.80 | 0.76 |
| | Medium | 0.90 | 0.88 | 0.86 | 0.84 | 0.82 |
| | Low | 0.92 | 0.91 | 0.90 | 0.89 | 0.88 |
| IP6X | High | 0.91 | 0.90 | 0.88 | 0.85 | 0.83 |
| | Medium | 0.92 | 0.91 | 0.89 | 0.88 | 0.87 |
| | Low | 0.93 | 0.92 | 0.91 | 0.90 | 0.90 |

Source of chart data: CIE 154

## ...Which Can Increase Costs by 60%

As shown below, the designed maintenance interval of 2.5 years requires maintaining 4.000 lights/year. When the IP drop shortens the interval to 1.5 years, 6.667 lights/year must be maintained. This increases maintenance costs by 60%!

| 10.000 luminaires, 0.88 LMF | Designed: IP65 | Field performance drops to IP54 |
|---|---|---|
| Maintenance interval | 2.5 years | 1.5 years |
| Luminaires to clean/ maintain | 4,000/year | 6,667/year |
| Maintenance cost per luminaire | $77.50 | $77.50 |
| Calculation | 4,000 x $77.50 | 6,667 x $77.50 |
| Total maintenance cost per year | $ 310,000.00 | $ 516,692.50 |
| **Result** | **Maintenance costs remain as planned/ budgeted.** | **IP drop causes 60% increase in maintenance costs.** |

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## The Smart Solution to Multiple Challenges

**Sustaining original IP ratings is the key to keeping maintenance intervals and costs at originally-planned levels. GORE® Protective Vents are unsurpassed at sustaining IP ratings over time.**

### Yesterday, Partial Protections

In the past, enclosures could be partially protected by various techniques such as:

**Desiccants**

- ⊕ Bind the relative humidity within the enclosure
- ⊖ Cannot equalize pressures

**Potting**

- ⊕ Encapsulates electronics against contaminants
- ⊖ Stresses electronics (due to a different thermal expansion coefficient of the potting, housing and PCB materials)
- ⊖ Prevents later maintenance or recycling
- ⊖ Requires labor-intensive chemical processes

**Tortuous paths**

- ⊕ Equalize pressures
- ⊖ Typically cannot achieve required high IP levels

### Today, A Comprehensive Solution

**GORE® Protective Vents** provide a comprehensive solution. They sustain today's required high IP ratings, as they:

&

- ⊕ Rapidly and continuously equalize pressure differentials
- ⊕ Effectively reduce condensation
- ⊕ Block ingress of dust, dirt and water

They provide important benefits in the field, because they:

- **Sustain enclosure integrity and IP ratings over time**
- **Preserve bright, reliable luminaire performance**
- **Minimize chances of premature component failure and associated replacement costs**
- **Keep maintenance intervals "as planned", avoiding escalating frequency and costs**

### WE-EF Street Lights: Highest LED Efficiency

WE-EF specializes in advanced optical systems and luminaires for street and area lighting. Their VFL500 series features a contoured acrylic cover (RFC®) that helps increase LED optical efficiency by 5 %. To counteract pressure differentials (caused by the contrast between heated up LEDs and cooler ambient air) WE-EF incorporates a GORE® Screw-In Vent in every VFL500 street light housing. The vent rapidly equalizes pressure differentials, which would otherwise deform the acrylic cover and compromise optical performance, as well as stress seals and reduce overall system longevity.

WE-EF relies on the GORE® Screw-In Vent PMF100391 to sustain the highest possible optical efficiency while effectively protecting seals and sensitive components within the housing.

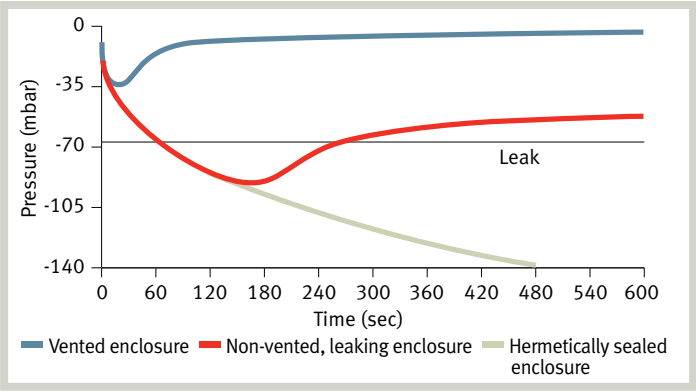
> *"We assure an IP66 rating and a service life of 60,000 hours. The Gore high-performance venting solution is instrumental in ensuring our products stand for long-lasting quality."*
>
> Thomas Müller, General Sales Manager, WE-EF

# How GORE® Vents Protect Enclosures

## GORE® Protective Vents Equalize Pressure

When the enclosure is exposed to environmental temperature changes, or temperature changes related to the light turning on and off, a pressure differential is created between the enclosure air volume and the environment. These pressure changes put extreme stress on the housing seals, over time causing them to fail and allow moisture and other contaminants to enter.

**GORE® Protective Vents equalize pressure by allowing air to pass through the membrane.**

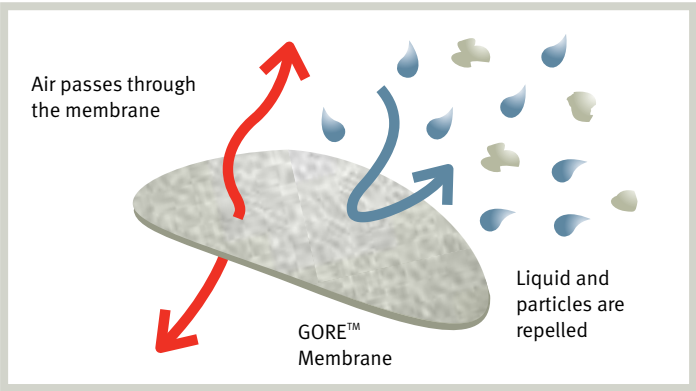



In non-vented housings, 70 mbar (1 psi) of pressure causes seals to leak after repeated temperature cycles. Vented housings equalize pressure and prevent seals from leaking.

## GORE® Protective Vents Prevent Contamination

A rapid change of temperature or altitude will cause pressure differentials between the enclosure and its environment. This leads to a vacuum forming within the enclosure. As the vacuum draws in contaminants, this will result in lower-performing lights, increased costs and dissatisfied customers.

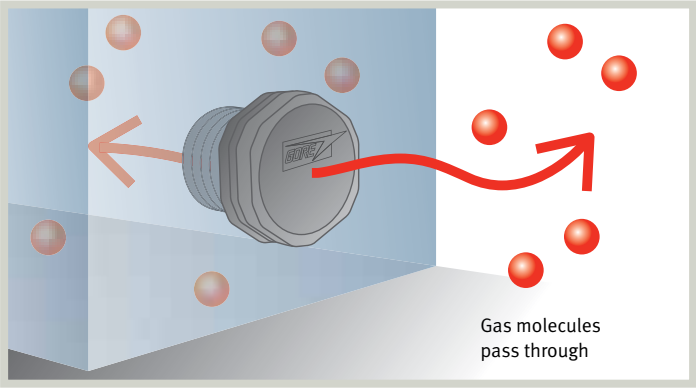
**GORE® Protective Vents provide a durable barrier against liquid, dust, dirt and other contaminants.**




## GORE® Protective Vents Reduce Condensation

Condensation can lead to corrosion that degrades illumination and fixture appearance, in turn shortening the life of the light. Independent research has shown that condensation is more damaging than rain because it remains on the surface. Condensation leads to corrosion that degrades the lens and electronic components.

**GORE® Protective Vents reduce condensation because water vapor molecules can pass through the membrane.**



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## Why Gore is the Better Alternative

**Gore, inventor of the ePTFE membrane, continues to lead the way in advancing venting technology. Gore offers significant advantages to manufacturers of outdoor lighting:**

### High Quality for Improved Reliability

- Our vents are lab-tested and field-proven to perform reliably in the most extreme environmental conditions.
- Our ePTFE membrane is insert-molded into our Screw-In and Snap-In vents, for a more secure, highly-protective design.
- Our standard and custom Adhesive Vents let you choose your preferred designs, sizes, membrane types and performance characteristics.
- Our vents provide the highest IP levels, up to IP69.
- More than 15 years' experience in outdoor lighting applications.
- Customers worldwide have installed more than 600 million GORE® Protective Vents.
- More than 8000 customers have relied on our global R&D and engineering support.

### Cost Savings for You and for Your Customers

- Our broad product portfolio allows fast, easy product selection and sampling.
- Standard parts are easy to integrate into production, with minimal capital investment.
- Independent tests certify GORE® Vents meet the most demanding industrial standards, to minimize your testing time and costs.
- 100% airflow and optical inspection at Gore reduces your costs for incoming inspection and quality assurance.
- Sustaining original IP ratings over time keeps field maintenance and replacement costs at originally-planned levels.

Gore worked with two of China's top outdoor lighting manufacturers to provide a venting solution for the World Expo in Shanghai. Although not visible to spectators, GORE® Protective Vents helped to ensure the reliable performance of lighting structures throughout the Expo.

The GORE® Metal Vent PMF100444 is the best solution for the BEKA Stadialux XP because of its high airflow and more rugged design.

# A Broad Portfolio of Venting Products...

**GORE® Protective Vents come in a variety of product forms, including screw-in vents, snap-in vents and adhesive vents. Customized venting solutions can also be designed to meet your application requirements.**

## Screw-In Vents

- Mechanically robust: durable molded-plastic body protects the membrane (IP69).
- Easy installation (with or without counter-nut) for automated or manual processes.
- Designed for longer life: temperature- and UV-resistant, and hydrolytically stable.

## Snap-In Vents

- Fast, easy installation allows for semi-automated or high-volume automated production.
- Mechanically robust: durable molded-plastic body protects the membrane (IP69k).
- Designed for longer life: temperature- and UV-resistant, and hydrolytically stable.

## Adhesive Vents

- Flexible, low profile: easy to install in small spaces; protects design aesthetics.
- Versatile adhesive: bonds securely to smooth and rough enclosure surfaces (testing recommended).
- Standard as well as customized vents are available.

# ...To Meet All Your Venting Challenges

**Our portfolio of GORE® Protective Vents holds the solution to protect and preserve a wide range of lighting applications and components.**

## Applications

- Street Lights
- Architectural Lights / Floodlights
- Strip Lights / Spotlights
- Marine Lights
- Flashlights
- LED Displays
- Traffic Lights
- Tunnel Lights
- High Bay Lights

## Components

- LED Modules
- Power Supplies
- Drivers
- Ballasts & Transformers
- Sensors

Choose from a variety of vent shapes, sizes and forms that are easy to integrate into your lighting enclosures.

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## About W. L. Gore & Associates

Gore is a technology-driven company focused on discovery and product innovation. Well known for waterproof, breathable GORE-TEX® fabric, the company's portfolio includes everything from high-performance fabrics and implantable medical devices to industrial manufacturing components and aerospace electronics. Gore products have remained at the forefront of creative solutions because they are engineered specifically for challenging applications requiring durable performance where other products fail.

For almost thirty years, Gore has delivered venting solutions for a variety of applications working in rugged environments throughout the world — applications for heavy-duty equipment and the automotive industry; electronic housings for the solar, lighting, security and telecommunication market; mobile electronic devices; and chemical and agricultural packaging. Engineered with the latest materials and technology, Gore's vents are backed by years of research and testing to help extend product life and enhance reliable performance — all to ensure that these venting products can meet the challenging environments and application demands of today's technology.

Headquartered in the United States, Gore employs approximately 10,000 associates in 30 countries worldwide. In Europe, Gore started its first business operations only a few years after the Enterprise's founding in 1958.

**Learn more at gore.com/protectivevents.**

### Please Contact Gore to Learn About the Right Gore® Protective Vent for your Unique Application

### International Contacts

| | | | |
|---|---|---|---|
| Australia | +61 2 9473 6800 | Mexico | +52 81 8288 1281 |
| Benelux | +49 89 4612 2211 | Scandinavia | +46 31 706 7800 |
| China | +86 21 5172 8299 | Singapore | +65 6733 2882 |
| France | +33 1 5695 6565 | South America | +55 11 5502 7800 |
| Germany | +49 89 4612 2211 | Spain | +34 93 480 6900 |
| India | +91 22 6768 7000 | Taiwan | +886 2 2173 7799 |
| Italy | +39 045 6209 240 | United Kingdom | +44 1506 460123 |
| Japan | +81 3 6746 2572 | USA | +1 410 506 7812 |
| Korea | +82 2 393 3411 | | |

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**W. L. Gore & Associates, Inc.**
401 Airport Road • Elkton, MD 21921 • USA
Phone: +1 410 506 7812 (USA) • Toll-free: +1 800 523 4673 (USA)
Fax: +1 410 506 8749 • Email: protectivevents@wlgore.com

**gore.com/protectivevents**

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