Ingress Protection Standards

IP

Standards:
IEC 60598 FOR LUMINAIRES VS. IEC 60529 FOR ENCLOSURES

Why do two ingress protection standards appear on luminaire specifications, what are the differences in these two standards, and should lighting professionals care?

Two IEC standards exist regarding enclosure ingress protection. This white paper will discuss why there are two standards; which standard is more robust; and which standard is more applicable for luminaires and, as such, should be accepted on fixture schedules.

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IEC 60598 VS. IEC 60529

Luminaire Ingress Protection Ratings

IP Dust Rating

IEC 60529 (Enclosure Standard)

***Section 13.4** Dust test for first characteristic numerals 5 and 6.*

The object of the test is to draw into the enclosure, by means of depression, a volume of air 80 times the volume of the sample enclosure tested without exceeding the extraction rate of 60 volumes per hour. In no event shall the depression exceed 2 kPa.

IEC 60598 (Luminaire Standard)

9.2.1

Dust-proof luminaires (first characteristic IP numeral 5) shall be tested in a dust chamber in which talcum powder is maintained in suspension by an air current. The chamber shall contain 2 kg of powder for every cubic metre of its volume. The talcum powder used shall be able to pass through a square-meshed sieve whose nominal wire diameter is 50 µm and whose nominal free distance between wires is 75 µm. It shall not have been used for more than 20 tests. The test shall proceed as follows:

a) The luminaire is suspended outside the dust chamber and operated at rated supply voltage until operating temperature is achieved.

b) The luminaire, whilst still operating, is placed with the minimum disturbance in the dust chamber.

c) The door of the dust chamber is closed.

d) The fan/blower causing the talcum powder to be in suspension is switched on.

e) After 1 min the luminaire is switched off and allowed to cool for 3 h whilst the talcum powder remains in suspension.

Dust Test Conclusions:

IEC 60529 calls for the luminaire to have no more than 2 kilopascals (kPa) applied to the inside of the enclosure, in other words, a vacuum, which is a condition that will draw gaskets together or assist in their ability to seal.

IEC 60598 calls for the luminaire to be thermally stabilized, shut off and allowed to cool for three hours while under test. This condition calls for the luminaire to be under pressure pushing the gaskets and seals to open up, and does not assist in the seal, but, in fact, will distress the gaskets on the luminaire causing them to have a higher potential for leaking during the three hour cooling period. Some have incorrectly asserted that a vacuum condition is more stringent because it will attempt to "draw particles into the luminaire." However, this assertion is incorrect since a vacuum (as previously described) will actually *assist* in the luminaire's ability to seal.

Additionally, the pressure can be significantly higher when using the 60598 standard over the 60529 requirement of 2 kPa in vacuum. For example, a Kenall 2'× 4' cleanroom luminaire with an LED light engine of 200 watts will create 7 kPa of pressure. Imagine the amount of pressure exerted on a 2'× 2' luminaire with 150-200 watts of input power, which is frequently seen on cleanroom lighting specifications.

IP Water Rating

Both 60598 and 60529 have the same requirements for water pressure and throughput for both the X5 and X6 water tests. However, IEC 60529 does not require the luminaire to be illuminated and brought up to temperature stability before executing the exam, whereas, the IEC 60598 test requires the fixture to be thermally stable and de-energized immediately before executing the exam. Unlike the dust portion of exams, the 60529 standard does *not* require any pressure to be applied to the seams.

Water test conclusions:

As witnessed with the dust portion of the luminaire examinations, *the IEC 60598 water test is significantly more stringent than the water test from IEC 60529* since the fixture is heated up, creating positive pressure on the seals and gaskets of the luminaire. Therefore, passing the 60598 is more stringent and time consuming, since thermal stabilization can take as much as three hours of soak time. During the water test, the 60529 standard does *not* require negative or positive pressure to be applied to the luminaire under test, making the exam significantly easier to pass.

IEC 60598 (Luminaire) vs. IEC 60529 (Enclosure) *Buyers Beware…*

Overall Conclusions:

IEC 60598 was created for luminaire testing and it is clear that IEC 60529 is a *less stringent standard*, and should never be considered an equivalent to IEC 60598. Advantages to the luminaire manufacturer in utilizing the IEC 60529 standard are as follows:

- Luminaires are not bound by the normal, maximum-watt density limitations of IEC 60598 since the light engine is not installed into the luminaire. This allows a manufacturer to have the product listed a single time without any heat-generating components installed. This means that larger engines can be installed at any time *without requiring retesting and relisting*.
- The IEC 60529 protocol provides a less stringent dust test, creating only a small negative pressure that assists in the product seal. Conversely, IEC 60598 applies force on the gaskets with positive pressure, creating a condition more likely to cause a leak. The 60598 exam lasts for three hours: any leak created by the positive pressure will turn into a vacuum when the fixture cools, and dust particles will immediately enter the luminaire.
- IEC 60529 allows the enclosure to be tested *without* any heat generating components, thereby making the water test component of an IP rating under such conditions *far less robust*. In the past, many luminaires have been designed with breathers in place to overcome the disabling effect of excessive heat created in the enclosure.

While a product listed according to the IEC 60529 standard is not equivalent to IEC 60598, is there some type of correlation that exists? For example, is a product listed to IP66 utilizing the 60529 standard equivalent to IP55 utilizing the 60598 standard? After significant testing, Kenall has deduced that such correlations do *not* exist. (See appendix A).

The International Electro-technical Commission created a special luminaire standard (See appendix B) because they understand the harsh effects a large heat generating source has upon an enclosure's ability to seal. Therefore, the IEC 60529 standard is *not* an equivalent to the IEC 60598 standard and should *not* be accepted in its place.

Appendix A

Kenall Lighting produces many fixtures that require different water testing requirements from sprinkler and rain tests, to IP×4, IP×5, IP×6, and the 2012 ANSI standard for water testing, C136.27. Many times, Kenall's products require both the C136.27 listing as well as IP×6. As a result, testing was conducted to verify if one test could be replaced with the other.

Kenall's ISO 17025 accredited compliance laboratory is one of the most advanced luminaire water testing facilities in the world; the lab can test to the IEC 60598 dust and water standards, but the facility also boasts the only known ANSI C136.27 2012 water testing laboratory. The IPx6 exam calls for 300 liters of water to be sprayed on the luminaire over a three minute period with a single jet of water at a very high pressure (100 liters/minute). However, each luminaire seam is really only tested for a very short period of time with the IP×6 test since the unit under test must be rotated over a duration of three minutes. Therefore, it's not only conceivable, but *likely* that an individual seam will only be exposed to 30 seconds of hose time.

In contrast to the IP×6 exams—300 liters of water in three minutes—the ANSI C136.27 water test calls for 5,451 liters of water to be sprayed over a period of 30 minutes; 15 minutes on, and 15 minutes off (understanding the importance of positive pressure inside the luminaire). The test nozzles' coverage is wide enough to douse all of the luminaires' seams continuously for the entire 30 minute exam.

This begs the question; would it be possible to complete only one of the tests and not the other in order to expedite product testing and validation? Kenall's testing conclusively proved that the answer is **"No"**. While units have passed both the IP×6 test and the ANSI test, many other units passed the IP×6 test but went on to fail the ANSI water test. Never did a test unit fail the IP×6 test and go on to pass the ANSI water test, establishing the *ANSI test as the more stringent of the two exams*. Furthermore, it concludes that the IP×6 water test provides *no* insight into the luminaire's ability to pass the ANSI C136.27 test, but rather each fixture requiring both listings must be examined under *both* conditions.

Appendix B

The IEC created two standards: *only one—60598—is for the sole purpose of testing luminaires.*

IEC 60598 is a *luminaire standard* intended to quantify general lighting specifications. Per the standard:

Part 1 of International Standard IEC 60598 specifies general requirements for luminaires, incorporating electric light sources for operation from supply voltages up to 1000 V. The requirements and related testing covered by this standard *include all of the following:* classification, marking, mechanical construction and electrical construction.

On the other hand, **IEC 60529 is an *enclosure standard*** that addresses the following:

The standard describes a system for classifying the degrees of protection provided by the enclosures of electrical equipment. While this system is suitable for use with most types of electrical equipment, it should *not* be assumed that all degrees listed *are applicable to each component of the equipment*.