



What Standards and Certifications Apply To Infrared (IR) Viewing Panes?

This question is frequently asked by clients as they begin to research the utility of infrared inspection windows for their specific application needs. There are many standards and certifications that can apply to infrared viewing panes so, this communication will help to identify and explain the most prominent ones.

Recognized Product Certifications:

UL 50V is specifically applied to infrared windows. It serves more as a classification than an actual standard for performance-of-build characteristics and states,

"Infrared viewports are a fixed aperture, consisting of one or more openings or a solid infrared transmitting media, surrounded by a mounting bezel or frame, that provide a means for the passage of infrared radiation. Infrared viewports are intended for factory installation in doors or walls of electrical enclosures for installation in ordinary (non-hazardous) locations to allow the use of IR scanners for monitoring temperatures of the enclosed equipment on which the viewport is installed, without compromising the integrity of the enclosure with respect to access to live parts."

This classification is applied to two different product categories: Infrared Windows and Infrared Ports. Infrared Windows provide a safety barrier that separates the thermographer from the target environment. In contrast, an Infrared Port is a hole and, when opened, it removes the barrier between the thermographer and the target thus increasing the risk of an accident. Knowing the difference between a Window and a Port is essential when determining the use of Personal Protective Equipment. UL Recognized or UL Listed marking on an infrared window indicates compliance with UL 50V but also with other relevant UL standards including UL1558 and UL746 discussed further below.



The **CE Mark** on a product or machine identifies it as complying with all the of safety requirements established by the European Union. The CE Mark is a mandatory conformity marking requirement for certain products sold within the European Economic Area and not a voluntary process. The CE marking is the manufacturer's declaration that they have researched the relevant standards, conducted the necessary tests and that the product meets the requirements of the applicable European Community directives specific to that product. It is a self-certification and no third party tests are involved. Companies that CE mark a product and are subsequently found not to have performed proper due diligence and testing can be subjected to fines. IEC Vibration and Humidity testing requirements may be relevant but, at present, there are NO specific CE standards for IR viewing windows so virtually any product can claim compliance and bear the CE mark. For this reason, it is recommended that the other standards be called out to ensure a robust product design is being deployed.

Other Certifications Relevant to Infrared Windows

UL 50E standard applies to enclosures for electrical equipment intended to be installed and used in non-hazardous locations as follows:

- a. Enclosures for indoor locations, Types 1, 2, 5, 12, 12K, and 13; and
- b. Enclosures for indoor or outdoor locations, Types 3, 3X, 3R, 3RX, 3S, 3SX, 4, 4X, 6, and 6P

This standard covers additional environmental construction and performance requirements for enclosures. This standard does not cover the requirements for protection of devices against conditions such as condensation, icing, corrosion, or contamination that may occur within the enclosure or that may enter via conduit or unsealed openings. Where an individual product standard contains requirements that are at variance with those of this standard, the requirements of the individual product standard take precedence.

UL 746C contains requirements that set the impact and flammability standards for polymeric materials used in electrical equipment up to 1500 volts. Any plastic or polymer, as a part of an infrared window, must pass flammability tests at room temperature, and must remain intact during an impact test performed at 0°C (32°F). It should be noted that of the fluoride-based crystal optics commonly used as IR window optics and capable of transmitting in the long wave portion of the infrared spectrum (8µm to 14µm), none are capable of passing the impact tests required in 746C. However, because they are classified as "glass" under the standard, they are not required to test for impact as long as they are thicker than 1.4mm.

Load and Impact Testing Standards

UL 1558 has requirement that cover metal-enclosed low-voltage power circuit breaker switchgear assemblies containing but not limited to such devices as low-voltage power circuit breakers, other interrupting devices, switches, control, instrumentation and metering, protective and regulating equipment. UL 1558 specifies static load (890 Newtons for 60 seconds) and impact testing (6.8 Joules via 0.54kg steel ball drop test) requirements for infrared windows utilized in these assemblies. UL1558 testing can be conducted with the window cover closed and passing criteria is that a ½" rod cannot pass through the window after testing. These requirements cover equipment intended for use in ordinary locations in accordance with the National Electrical Code. These requirements are intended to supplement and be used in conjunction with the



Standard for Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear, ANSI C37.20.1, and the Standard for Conformance Testing of Metal-Enclosed Low-Voltage AC Power Circuit Breaker Switchgear Assemblies, ANSI C37.51. These requirements cover equipment rated 1000 V ac or less nominal.

IEEE C37.20.2 Section a 3.6 (1999 edition) defined further Impact and Load Testing requirements for Viewing panes mounted in medium and high voltage equipment (600 volts to 38kv metal clad and 72kv station type gear) are required to withstand impact and load per IEEE C37.20.2 Section a.3.6. The standard specifically states that the viewing pane must withstand the impact and static load from both sides (inside/outside) and the viewing pane must not “crack, shatter or dislodge”. However, 2015 revision to the standard (adopted in 2016) loosened the tests requirements significantly. The standard now allows for static load (445N over 16 in² area or full window for 60 seconds) and impact (3.4 Joule via 2” diameter ball with mass 0.54kg) BUT from the outside ONLY and with the cover mounted. Again, the product must not “crack, shatter or dislodge”.

Ingress Protection

The Ingress Protection rating system is a classification system showing the degrees of protection from solid objects like dust or liquids coming in contact within the enclosure. The IP rating of an IR window should be the same or higher than the equipment into which it will be installed and ties directly to the UL50E ratings.

Vibration Testing

IEC 60068-2-6:2007 test provides a standard procedure to determine the ability of components, equipment and other articles to withstand specified severities of sinusoidal vibration. If an item is to be tested in an unpackaged form that is without its packaging. The purpose of this test is to determine any mechanical weakness and/or degradation in the specified performance of specimens and to use this information, in conjunction with the relevant specification, to decide upon the acceptability of the specimens. In some cases, the test method may also be used to demonstrate the mechanical robustness of specimens and/or to study their dynamic behavior. Infrared windows that will be installed in areas with high physical equipment vibration should be tested to this standard.

Humidity Testing

IEC 60068-2-3:2012 test provides a method for determining the ability of components or equipment to withstand transportation, storage and use under conditions of high humidity. The object of this standard is to investigate the effect of high humidity at constant temperature without condensation on a specimen over a prescribed period. It is applicable to small equipment or components as well as large equipment and can be applied to both heat-dissipating and non-heat- dissipating specimens. Infrared windows that will be installed in areas of high humidity should be tested to this standard. Crystal infrared windows are known to experience transmission degradation in the presence of even moderate levels of humidity.

Canadian Standards Association (CSA)

The CSA is a membership organization serving industry, educational institutions, and government in the field of standardization, including the standardization of building components, materials, and testing. CSA - C22.2 No.14-10 Meets and exceeds equivalent UL50V Certification Standards. However, C22.2 No. 14-10 also includes an impact test requirement with the covers removed. As such, Crystal based windows cannot pass this standard. The CSA registered mark shows that a product has been independently tested and certified to meet recognized standards for safety or performance.

Lloyd's of London Register

Lloyd's Register provides independent, 3rd-party approval certificates attesting to a product's conformity with specific standards or specifications. It also verifies the manufacturer's production quality system through a combination of design reviews and type testing. There is growing international awareness of the importance of third-party certifications such as those offered by Lloyd's.

American Bureau of Shipping

ABS Rules form the basis for assessing the design and construction of new vessels and the integrity of existing vessels and marine structures. The intended service location and environmental ratings for a component are verified by engineers confirming the validity of the testing performed on a component before the design assessment certification process in marine and offshore electrical equipment is completed.

Arc Resistance

An arc rating can only be given to a completed assembly and not to a single component within that assembly. Electrical cabinet designs and dimensions are infinite and we therefore we cannot assume equivalency of the test results from one cabinet design to another design unless they are identical in every way. This is the reason why components can never carry a generic arc rating and must be subjected to industry standard tests to confirm that they conform to the minimum required level of mechanical strength and environmental properties for the electrical cabinets and assemblies which they are going to be fitted into. There are three standards most commonly referenced when discussing Arc Resistant ratings.

For International based Metalclad equipment designs, IEC 62271-200 specifies requirements for prefabricated metal enclosed switchgear and control gear for alternating current of rated voltages above 1 kV and up to and including 52 kV for indoor and outdoor installation, and for service frequencies up to and including 60 Hz. Enclosures may include fixed and removable components and may be filled with fluid (liquid or gas) to provide insulation. Test involves a bolted fault at 6KV, 31.5kA for 60 cycles and typically results in pressures exceeding 18 bar and temperatures >1500C. Flags mounted 12" in front of switchgear must not ignite and window covers must remain intact after test.

For International Arc Resistant equipment designs, IEC 60298 Appendix A testing (63kA, 15kV for 30 cycles at 60Hz). Similarly, for North America based Arc Resistant equipment designs, IEEE C37.20.7 Type 2B tests (63kA, 15kV for 30 cycles at 60Hz) is usually applicable. These tests must be completed by the OEM with the IR window

products installed in the OEM equipment to validate the windows can be offered as an option without downgrading the overall equipment rating. ANSI/IEEE C37.20.7 further defines switchgear arc resistance in two basic categories:

ANSI type 1: Arc resistance from the front of gear only

ANSI type 2: Arc resistance provided from the front, sides and rear

A suffix may be added to either of these two types to further define the type of protection provided:

- a. Basic design
- b. Arc resistance is maintained even while opening designated low voltage compartments
- c. Arc resistance is maintained even when opening designated adjacent compartments
- d. Special designation that supplements the Type 1 designation, but identifies additional arc resistance in certain structures

Conclusion

Infrared viewing panes may have many certifications depending on the specific application or global location where they will be used. The most common certifications are UL Recognized or UL Listed, CSA recognized and Lloyd's of London. Partner with your inspection window manufacturer to determine the best solution for your specific application.