

What UV resistance is required for outdoor equipment cases?

Outdoor equipment cases are often exposed to harsh weather conditions, with UV radiation being one of the most insidious enemies. UV resistance is a crucial property for cases that are used outdoors for long periods of time, such as in defence and security applications. This protection prevents material degradation, discolouration and weakening of structural integrity. In this article, we answer the most important questions about UV resistance for outdoor equipment cases, so you know exactly what protection you need for your specific application.

What is UV resistance in outdoor equipment cases?

UV resistance in outdoor equipment cases refers to the ability of the materials used to resist the harmful effects of ultraviolet radiation from the sun. This property is important because UV radiation can break down the molecular structure of polymers (plastics), leading to weakening, embrittlement, discolouration and ultimately failure of the material.

When sunlight hits a case, it is mainly the UV-A (315-400 nm) and UV-B (280-315 nm) rays that cause damage. These rays have enough energy to break chemical bonds in polymers, which weakens the material. This process, also known as photodegradation, is cumulative – the damage builds up with each exposure.

This is **particularly relevant** for outdoor equipment cases, as they often protect valuable or sensitive equipment that must function under all conditions. Examples include measuring equipment, communication systems, or specialised tools used by professionals in the field. A case that is UV-resistant ensures that its protective properties are retained, even after prolonged exposure to sunlight.

The level of UV resistance is determined by the base material type, added UV stabilisers and the thickness of the material. Manufacturers can increase UV resistance by adding special additives that absorb or scatter UV radiation before it can damage the polymer chains.

What UV protection classes are there for outdoor cases?

For outdoor cases, there are various classification systems that indicate UV resistance, although there is no universally standardised 'UV class' as there is with IP ratings for water and dust resistance. UV resistance is usually determined by standardised test methods that measure resistance to ageing caused by UV radiation.

The most commonly used test methods are:

- **ASTM G154** – This standard test accelerates weathering by means of UV lamps and condensation cycles. It simulates months or years of outdoor exposure in just a few weeks.
- **ISO 4892** – This international standard specifies methods for exposing specimens to artificial weathering under controlled conditions.
- **SAE J2527** – A standard specific to automotive materials, but also relevant to outdoor cases that must withstand similar conditions.

The results of these tests are often expressed in terms of:

- **Weathering resistance** – How long the material retains its properties under UV exposure, often expressed in hours of test exposure.

- **Colour fastness** – The extent to which the material retains its original colour, measured on a grey scale or with Delta-E values.
- **Retention of mechanical properties** – The percentage retention of tensile strength, impact strength or other mechanical properties after UV exposure.

Although not directly a UV classification, the IP rating (Ingress Protection) indirectly plays a role in UV resistance. A case with a high IP rating such as IP67 or IP68 often has better seals that not only keep out water and dust, but are also more resistant to environmental factors including UV radiation.

For military applications, MIL-STD-810 is often used, which includes tests for solar radiation (method 505.6). This test evaluates the effects of solar radiation on materials and is particularly relevant for defence applications where equipment must function under extreme conditions.

How does UV radiation affect different case materials?

UV radiation has varying effects on different materials used for outdoor equipment cases. Here is an analysis of how different materials react to prolonged UV exposure:

Plastics

- **ABS (Acrylonitrile Butadiene Styrene):** Without UV stabilisers, ABS is susceptible to UV degradation, leading to yellowing, embrittlement and surface cracking. UV additives significantly improve its resistance.
- **Polycarbonate:** Naturally has reasonable UV resistance but yellows after prolonged exposure. UV-stabilised polycarbonate retains its transparency and mechanical properties for much longer.
- **Polypropylene (PP):** Very susceptible to UV degradation without protection. With UV stabilisers, it is suitable for long-term outdoor use.
- **Polyethylene (PE):** Similar to PP, but often slightly less sensitive to UV damage. Still requires UV stabilisers for outdoor applications.
- **Rotationally moulded plastic:** Often used for robust cases, can be highly UV-resistant when the right additives are added during the manufacturing process.

Metals and composites

- **Aluminium:** Excellent natural UV resistance. Forms a protective oxide layer that protects the material from further degradation. This makes aluminium boxes **ideal for applications** where equipment is exposed to sunlight for long periods of time.
- **Composite materials:** UV resistance varies greatly depending on the resins and fibres used. Epoxy-based composites are generally more resistant to UV radiation than polyester-based variants.

Coatings and protective layers

Many cases are provided with special coatings that offer extra UV protection:

- **UV-resistant paints:** These contain UV absorbers that protect the underlying materials.
- **Powder coatings:** Offer excellent UV protection and are highly durable.
- **Anodisation** (for aluminium): Strengthens the natural oxide layer and can be coloured without reducing UV resistance.

The choice of material is crucial for applications where UV resistance is important. For high-quality equipment used in demanding outdoor environments, such as defence applications, it is wise to choose materials with proven UV resistance or cases specifically designed for extreme conditions.

When is high UV resistance crucial for equipment cases?

Not every application requires the same degree of UV resistance. However, there are specific circumstances in which high UV resistance is not only desirable but essential:

Geographical locations with intense solar radiation

The intensity of UV radiation varies greatly depending on geographical location:

- **Equatorial and desert areas:** Areas close to the equator or in desert climates receive much more direct and intense solar radiation. Equipment cases used here must have the highest UV resistance.
- **High altitude areas:** At high altitudes, the atmosphere is thinner, resulting in less filtering of UV radiation. For every 1,000 metres of elevation, UV intensity increases by approximately 10-12%.
- **Snow and ice areas:** Snow and ice can reflect up to 80% of UV radiation, leading to almost double the exposure.

Prolonged exposure

The duration of exposure is just as important as the intensity:

- **Permanent outdoor installations:** Equipment cases that are continuously exposed to the outdoors, such as for measuring equipment or surveillance systems, require the highest level of UV resistance.
- **Seasonal use:** Even if equipment is only used outdoors during certain seasons, cumulative exposure over several years can be significant.
- **Expeditions and fieldwork:** Long-term missions in remote areas, where equipment remains outdoors for weeks or months, require cases that retain their protective properties.

Critical applications

Some applications are so important that even minimal degradation due to UV radiation is unacceptable:

- **Medical equipment:** Outdoor medical equipment must remain reliable under all conditions.
- **Rescue equipment:** Emergency equipment must always be ready for use, regardless of how long it has been stored.
- **Military applications:** Defence equipment is often used in extreme environments where reliability is of vital importance. Cases must maintain their structural integrity to protect their valuable and sensitive contents.
- **Critical communication systems:** Equipment used for essential communication must remain protected, even after years of outdoor exposure.

Protection of light-sensitive content

Some equipment is itself sensitive to UV radiation:

- **Optical equipment:** Lenses, filters, and other optical components can degrade due to UV exposure.
- **Electronic displays:** LCD and other display technologies can fade or discolour due to UV radiation.
- **Certain chemicals and reagents:** Some substances used in the field are light-sensitive and require UV-protective storage.

For these applications, it is important not only that the case itself is UV-resistant, but also that it effectively blocks UV radiation to protect the contents.

Conclusion

The right UV resistance for outdoor equipment cases depends on several factors: geographical location, duration of use, criticality of the application and the sensitivity of the equipment itself. For applications in extreme environments, such as defence or emergency services, high UV resistance is not a luxury but a necessity.

When choosing a case, it is important to consider not only the initial specifications, but also how these performance characteristics are maintained after prolonged exposure to sunlight. Materials such as UV-stabilised plastics and aluminium, combined with high-quality seals and coatings, offer the best protection against the insidious effects of UV radiation.

At Faes, we understand that reliable equipment starts with safe transport and storage. Our customised packaging is designed to protect fragile and valuable equipment from all external influences, including UV radiation. Whether it's robust aluminium boxes, UV-resistant plastic cases or custom-made flight cases, we ensure that your equipment arrives at its destination safe, intact and ready for use – regardless of the conditions.