



UL 3650

STANDARD FOR

**Product-level Climate Risk Assessment
and Adaptation Management – General
Sustainability Requirements and
Practices**

Standard for Product-level Climate Risk Assessment and Adaptation Management – General Sustainability Requirements and Practices, UL 3650

First Edition, Dated May 13, 2025

Summary of Topics

This is the First Edition of UL 3650, Standard for Product-level Climate Risk Assessment and Adaptation Management – General Sustainability Requirements and Practices dated May 13, 2025.

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Management – General Sustainability Requirements and Practices**

First Edition

May 13, 2025

This UL Standard for Safety consists of the First Edition.

Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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INTRODUCTION

1 General

1.1 As severe weather events such as hurricanes, extreme heat, flooding, and droughts increase globally, manufacturers must understand how their products will perform in various climate scenarios to properly assess vulnerabilities and build long-term product resilience. This Standard collates a number of internationally recognized standards on enterprise-wide climate risk assessments and applies key principles to the assessment of climate risks and vulnerabilities at the product-level.

1.2 To effectively carry out a climate risk and resilience assessment, manufacturers need a structured framework that enables them to evaluate the performance of their products under the stress of adverse climate conditions. The Standard provides a structured approach to model extreme climate scenario and offers guidelines for interpreting the results. The Standard incorporates best practices from established climate risk assessments with product-specific considerations, and provides adaptation plans to help increase the resiliency of products to climate risks.

1.3 The Standard provides a general framework for product manufacturers to assess vulnerabilities of defined electrification products to the impacts from climate change and helps stakeholders understand climate scenarios of greatest risk to product failure. It also provides requirements to develop climate adaptation measures. In addition to general requirements, this Standard provides guidance for product manufacturers within the electrification products industry. The requirements included herein may benefit other stakeholders that are impacted by the resiliency of products against climate change such as product installers and customers.

1.4 Manufacturers who assert that their products are climate-resistant must substantiate these claims through product-specific climate risk assessments. This will help demonstrate resilience under projected environmental conditions, build credibility, and align with industry standards for sustainability and risk mitigation.

2 Scope

2.1 This Standard provides a general framework for evaluating and reporting on climate resilience and risk assessment that can be applied across several product categories to identify, assess, evaluate, and manage product vulnerabilities to climate impacts. Climate impacts in this document fall into two categories:

- a) Acute impacts from extreme weather events and natural disasters; and
- b) Long-term chronic impacts of change in climate patterns.

2.2 Additionally, the Standard addresses how to account for regional trends and variations, performance and design threshold with climatic loads, projected future intensity and frequency of extreme weather events, and actions to prevent, mitigate, or limit damage while enhancing a product's climate resiliency.

2.3 This Standard includes detailed requirements on the following:

- a) Section [5](#), Evaluation and Assessment Criteria
- b) Section [6](#), Preparing a Product Level Climate Risk Assessment
- c) Section [7](#), Assessing Climate Risks at the Product Level
- d) Section [8](#), Addressing Climate Risks at the Product Level

e) Section 9, Monitoring, Reporting, and Verification (MRV)

2.4 This Standard does not cover climate risks associated with the product's production process and supply chain (e.g., resource availability, transportation, or manufacturing disruptions due to climate impacts).

3 Referenced Publications

3.1 Any undated reference to a code or standard appearing in the requirements of this Standard shall be interpreted as referring to the latest edition of that code or standard.

3.2 The following publications are referenced in this Standard:

ASHRAE 169, *Climatic Data for Building Design Standards*

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*

ASTM D570, *Standard Test Method for Water Absorption of Plastics*

ASTM D610, *Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces*

ASTM D638, *Standard Test Method for Tensile Properties of Plastics*

ASTM D1654, *Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments*

ASTM D2247, *Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity*

ASTM D4329, *Standard Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastics*

ASTM D5229/D5229M, *Standard Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials*

ASTM D7032, *Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite and Plastic Lumber Deck Boards, Stair Treads, Guards, and Handrails*

ASTM D7334, *Standard Practice for Surface Wettability of Coatings, Substrates and Pigments by Advancing Contact Angle Measurement*

ASTM E8/E8M, *Standard Test Methods for Tension Testing of Metallic Materials*

ASTM E2921, *Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes, Standards, and Rating Systems*

ASTM G154, *Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials*

ASTM G155, *Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials*

GR-63 CORE, *Seismic Server Cabinet*

International Code Council – The International Building Code (ICC IBC)

IEC 60068-2, *Environmental testing – Part 2: Tests – ALL PARTS*

IEC 60529, *Degrees of Protection Provided by Enclosures (IP Code)*

IEEE 693, *Recommended Practice for Seismic Design of Substations*

IEEE 1547, *Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces*

IEEE 2030, *Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System (EPS), End-Use Applications, and Loads*

Intergovernmental Panel on Climate Change (IPCC) Coupled Model Intercomparison Project (CMIP6) Representative Concentration Pathway (RCP8.5)

Intergovernmental Panel on Climate Change (IPCC) Coupled Model Intercomparison Project (CMIP6) Shared Socioeconomic Pathway (SSP5)

ISO 527, *Plastics – Determination of tensile properties*

ISO 4354, *Wind actions on structures*

ISO 9001, *International standard for quality management systems (QMS)*

ISO 12944-2, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 2: Classification of environments*

ISO 14044, *Environmental management – Life cycle assessment – Requirements and guidelines*

ISO 14091, *Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO/IEC 18004, *Information technology – Automatic identification and data capture techniques – QR code bar code symbology specification*

ISO 31000, *Risk Management – Guidelines*

MEASNET, *Evaluation of site-specific wind conditions*

Recommendations of the Task Force on Climate-related Financial Disclosures

UL 50E, *Enclosures for Electrical Equipment, Environmental Considerations*

UL 464, *Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories*

UL 489, *Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures*

UL 525, *Flame Arresters*

UL 746A, *Polymeric Materials – Short Term Property Evaluations*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 810B, *DC Power Capacitors*

UL 1564, *Industrial Battery Chargers*

UL 1638, *Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories*

UL 1642, *Lithium Batteries*

UL 1741, *Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources*

UL 1778, *Uninterruptible Power Systems*

UL 1973, *Batteries for Use in Stationary and Motive Auxiliary Power Applications*

UL 1989, *Valve Regulated or Vented Batteries with Aqueous Electrolytes*

UL 2075, *Gas and Vapor Detectors and Sensors*

UL 3141, *Outline of Investigation for Power Control Systems*

UL 3703, *Solar Trackers*

UL 4703, *Photovoltaic Wire*

UL 9540A, *Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems*

UL 60730-1, *Automatic Electrical Controls – Part 1: General Requirements*

ULC 526, *Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories*

ULC 601, *Shop Fabricated Steel Aboveground Tanks for Flammable and Combustible Liquids*

ULC 602, *Aboveground Steel Tanks for the Storage of Combustible Liquids Intended To Be Used as Heating and/or Generator Fuels*

ULC 603.1, *External Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids*

3.3 See Annex [E](#) for a listing of supplemental standards.

4 Glossary

4.1 For the purpose of this Standard the following definitions apply.

4.2 ADAPTIVE CAPACITY – The ability to adjust and respond to potential harm through prevention and detection mechanisms that allow for effective response and recovery to environmental changes and disturbances.

4.3 ACUTE RISK – Acute risks refer to those that are event-driven, including increased severity of extreme weather events, such as cyclones, hurricanes, or floods.

NOTE: Reprinted from Recommendations of the Task Force on Climate-related Financial Disclosures

4.4 CHRONIC RISK – Chronic physical risks refer to longer-term shifts in climate patterns (e.g., sustained higher temperatures) that can cause sea level rise or chronic heat waves.

NOTE: Reprinted from Recommendations of the Task Force on Climate-related Financial Disclosures

4.5 CLIMATE – The long-term average of weather patterns, typically measured over a period of 30 years or more. It includes various atmospheric conditions such as temperature, humidity, precipitation, wind, and atmospheric pressure, observed over extended periods.¹

4.6 CLIMATE ADAPTATION – The process of adjusting to current or expected effects of climate change. This involves making changes to social, economic, and environmental practices to reduce harm and take advantage of infrastructural improvements, policy changes, and behavioural shifts to enhance resilience against climate impacts.²

4.7 CLIMATE CHANGE – The Long-term alterations in the average weather patterns that define Earth's local, regional, and global climates. These changes are primarily driven by human activities, especially the burning of fossil fuels, which increases levels of greenhouse gases like carbon dioxide in the atmosphere. This leads to global warming and range of other effects ranging from rising sea levels, more frequent and severe weather events, and shifts in ecosystems and wildlife populations.¹

4.8 CLIMATE IMPACT – Effects that changes in climate have on natural and human systems. These impacts can be direct, such as increased temperatures and sea level rise, and also indirect, affecting ecosystems, human health, agriculture, and infrastructure.¹

4.9 CONSUMER – Individual and institutional purchaser of the product.

4.10 CONSEQUENCES – Outcome of an event affecting objectives.

NOTE: Reprinted from ISO 31000

4.11 DURABILITY – Ability to perform as required, under given conditions of use and maintenance, until the end of useful life.

NOTE: Reprinted from IEC 60050 / IEV ref 192-01-21

4.12 END OF LIFE (EOL) – Life cycle stage of a product starting when removed from its intended use stage.

4.13 ENVIRONMENTAL IMPACT – Change to the environment, whether adverse or beneficial, wholly or partly resulting from environmental aspects.

NOTE: Reprinted from IEC 60050 / IEV ref 904-01-03

4.14 EXPANDABLE MATERIALS – Materials that are designed to increase in volume when subjected to certain conditions, such as heat, pressure, or chemical reactions. These materials include plastics such as expanded polystyrene (EPS), expanded polyethylene (EPE), and expanded metals.

4.15 EXPERT – Person who can judge the work assigned and recognize possible hazards on the basis of professional training, knowledge, experience and knowledge of the relevant equipment.

NOTE: Reprinted from IEC, IEC ref 851-11-10

4.16 EXTREME WEATHER EVENTS – Severe or unseasonal weather conditions that deviate significantly from average weather patterns and are typically at the extremes of historical weather data. Extreme weather events are characterized by their intensity and potential to cause significant impacts on human health, infrastructure, and ecosystems such as heat and cold waves, tornadoes, hurricanes and typhoons, as well as heavy rain and flooding.³

4.17 EXPOSURE – The presence of people, ecosystems, environmental functions, infrastructure, and other assets that could be adversely affected by climate-related hazards.

4.18 HAZARD – A potential source of harm, injury or damage to the health of people, to property, or to the environment.

4.19 HAZARDOUS WASTE – Waste which, due to its nature, physical, chemical or infectious properties, is potentially hazardous to human health and/or the environment during use, handling, storage or transportation, including any material which may require special handling, disposal or recycling techniques to eliminate or reduce the hazard.

NOTE: Reprinted from ISO 24161, Waste collection and transportation management - Vocabulary

4.20 IMPACT – Effect on natural and human systems.

NOTE: Reprinted from ISO 14091

4.21 LIFE CYCLE – The stages and activities spanning the life of the system from the definition of its requirements to the termination of its use covering its conception, development, operation, maintenance support and disposal.

NOTE: Reprinted from ISO 15288 and IEC 61508

4.22 LIFETIME – Duration or total time span of a product, focusing on the length of time from the beginning to the end of its existence.

4.23 LIKELIHOOD – The chance or probability that an event will occur.

4.24 MANUFACTURER – An organization, situated at a stated location or locations, that carries out or controls such stages in the manufacture, assessment, handling and storage of a product that enables it to accept responsibility for continued compliance of the product with relevant requirements and undertakes all obligations in that connection.

NOTE 1: For the purpose of the standard, 'Manufacturer' refers to the organization responsible for the manufacturing of the final products covered in the scope of this standard.

NOTE 2: Reprinted from ISO/IEC 80079-34

4.25 PHYSICAL RISK – Refers to the potential for damage or loss resulting from climate-related hazards and can be event driven (acute) or longer-term shifts (chronic).

NOTE: Reprinted from Recommendations of the Task Force on Climate-related Financial Disclosures

4.26 PRODUCT – Item that is made or created by a person or machine.

4.27 PRODUCTION – Process or method for the manufacture of products.