



UL 61010-2-012

STANDARD FOR SAFETY

Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-012: Particular Requirements for Climatic and Environmental Testing and Other Temperature Conditioning Equipment

UL Standard for Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-012: Particular Requirements for Climatic and Environmental Testing and Other Temperature Conditioning Equipment, UL 61010-2-012

Second Edition, Dated June 15, 2022

Summary of Topics

This revision of ANSI/UL 61010-2-012 dated November 2, 2023 adds requirements for refrigeration systems over 150 g of flammable refrigerant; [2DV](#) and [11.7.101.1DV](#)

UL 61010-2-012 is an Adoption of IEC 61010-2-012, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-012: Particular Requirements for Climatic and Environmental Testing and Other Temperature Conditioning Equipment (second edition, issued by IEC April 2019) as an IEC-based UL standard with US National Differences.

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The new requirements are substantially in accordance with Proposal(s) on this subject dated September 1, 2023.

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ANSI/UL 61010-2-012-2023

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UL 61010-2-012

**Standard for Safety Requirements for Electrical Equipment for
Measurement, Control, and Laboratory Use – Part 2-012: Particular
Requirements for Climatic and Environmental Testing and Other
Temperature Conditioning Equipment**

First Edition – February 20, 2017

Second Edition

June 15, 2022

This ANSI/UL Standard for Safety consists of the Second Edition including revisions through November 2, 2023.

The most recent designation of ANSI/UL 61010-2-012 as an American National Standard (ANSI) occurred on November 2, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

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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PREFACE

This UL Standard is based on IEC Publication 61010-2-012: second edition, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-012: Particular Requirements for Climatic and Environmental Testing and Other Temperature Conditioning Equipment. IEC publication 61010-2-012 is copyrighted by the IEC.

This edition has been issued to satisfy UL Standards policy.

This UL Standard 61010-2-012 Standard for Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 2-012: Particular Requirements for Climatic and Environmental Testing and Other Temperature Conditioning Equipment, is to be used in conjunction with the third edition of UL 61010-1. The requirements for control equipment are contained in this Part 2 Standard and UL 61010-1.

Requirements of this Part 2 Standard, where stated, amend the requirements of UL 61010-1.

Where a particular subclause of UL 61010-1 is not mentioned in UL 61010-2-012, the UL 61010-1 subclause applies.

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Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

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NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 61010-2-012, Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-012: Particular requirements for climatic and environmental testing and other temperature conditioning equipment, copyright 2019, are indicated by notations (differences) and are presented in bold text.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE – Part 2-012: Particular requirements for climatic and environmental testing and other temperature conditioning equipment

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

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International Standard IEC 61010-2-012 has been prepared by IEC technical committee 66: Safety of measuring, control and laboratory equipment.

It has the status of a group safety publication in accordance with IEC Guide 104.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) alignment with changes introduced by Amendment 1 of IEC 61010-1:2010;
- b) changes related to the use of small capitals for defined terms only;



c) clarifications for cooling tests in 4.4.2.10;

d) requirements for overtemperature protection in 10.101, including deletion of the second part of the sentence in item b), and the deletion of item c);

e) changes pertaining to the accurate employment of terms "temperature", "operating temperature", "working temperature", "application temperature", "room temperature" and "ambient temperature" in 3.5.104, 3.5.105, 4.3.1, 4.3.2, 5.4.2, 8.2.1, 8.2.2, 11.7.2.101.2, 11.7.2.101.3, 13.2.102, 14.102, 15.101, 15.102, 15.103, Introduction and many other locations. For the purpose of clarification, the definition of 3.5.114, CONTROLLED TEMPERATURE, is added.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
66/687/FDIS	66/688/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61010 series, published under the general title, *Safety requirements for electrical equipment for measurement, control, and laboratory use*, can be found on the IEC website.

IEC 61010-2-012 is to be used in conjunction with the latest edition of IEC 61010-1. It was established on the basis of the third edition (2010) and its Amendment 1 (2016), hereinafter referred to as Part 1.

This Part 2-012 supplements or modifies the corresponding clauses in IEC 61010-1 so as to convert that publication into the IEC standard: *Particular requirements for climatic and environmental testing and other temperature conditioning equipment*.

Where a particular subclause of Part 1 is not mentioned in this Part 2-012, that subclause applies as far as is reasonable. Where this Part 2-012 states "addition", "modification", "replacement", or "deletion", the relevant requirement, test specification, or note in Part 1 should be adapted accordingly.

In this standard:

1) the following print types are used:

- requirements and definitions: in roman type;
- NOTES: in smaller roman type;
- *conformity and tests: in italic type*;
- terms used throughout this standard which have been defined in Clause 3: SMALL ROMAN CAPITALS.

2) subclauses, figures, tables and notes which are additional to those in Part 1 are numbered starting from 101. Additional annexes are lettered starting from AA.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this standard using a colour printer.

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INTRODUCTION

This Part 2-012, along with Part 2-010 and Part 2-011, taken together, address the specific HAZARDS associated with the heating and cooling of materials by equipment and are organized as follows:

IEC 61010-2-010	Specifically addresses the HAZARDS associated with equipment incorporating heating systems.
IEC 61010-2-011	Specifically addresses the HAZARDS associated with equipment incorporating REFRIGERATING SYSTEMS.
IEC 61010-2-012	Specifically addresses the HAZARDS associated with equipment incorporating both heating and REFRIGERATING SYSTEMS that interact with each other such that the combined heating and REFRIGERATING SYSTEM yield additional or more severe HAZARDS for the two systems than if treated separately. It also addresses the HAZARDS associated with the treatment of materials by other factors like irradiation, excessive humidity, CO ₂ and MECHANICAL MOVEMENT, etc.

Guidance for the application of the appropriate Part 2 standard(s)

When the equipment includes only a material heating system, and no REFRIGERATING SYSTEM or other environmental factors apply, then Part 2-010 applies without needing Part 2-011 or Part 2-012. Similarly, when the equipment includes only a REFRIGERATING SYSTEM, and no material heating system or other environmental factors apply, then Part 2-011 applies without needing Part 2-010 or Part 2-012. However, when the equipment incorporates both a material heating system, and a REFRIGERATING SYSTEM or the materials being treated in the intended application introduce significant heat into the REFRIGERATING SYSTEM, a determination should be made as to whether the interaction between the two systems will generate additional or more severe HAZARDS than if the systems were evaluated separately (CONTROLLED TEMPERATURE, see flow chart for selection process). If the interaction of the heating and cooling functions yields no additional or more severe HAZARDS, then both Part 2-010 and Part 2-011 apply for their respective functions. Conversely, if additional or more severe HAZARDS result from the combining of the heating and cooling functions, or if the equipment incorporates additional material treatment factors, then Part 2-012 applies, but not Part 2-010 or Part 2-011.

What HAZARDS are applicable for a REFRIGERATING SYSTEM?

The typical HAZARDS for a REFRIGERATING SYSTEM (see [Figure 101](#)) consisting of a MOTOR-COMPRESSOR, a CONDENSER, an expansion device and an EVAPORATOR include but are not limited to:

- The maximum temperature of LOW-PRESSURE SIDE (return temperature) to the MOTOR-COMPRESSOR. A MOTOR-COMPRESSOR incorporates a REFRIGERANT cooled motor and it should be established that the maximum temperatures of the LOW-PRESSURE SIDE under least favourable condition do not exceed the insulation RATINGS within the motor.
- The maximum pressure of LOW-PRESSURE SIDE at the inlet to the MOTOR-COMPRESSOR. The housing of the MOTOR-COMPRESSOR is exposed to this pressure and so the design RATING of the MOTOR-COMPRESSOR housing should accommodate the worst-case pressures whilst providing the correct safety margin for a pressure vessel.
- The maximum temperature of HIGH-PRESSURE SIDE to the CONDENSER. The temperatures of the HIGH-PRESSURE SIDE under most unfavourable conditions may present a temperature HAZARD if the OPERATOR is exposed to them or if the electrical insulation is degraded.
- The maximum pressure of HIGH-PRESSURE SIDE at the outlet to the MOTOR-COMPRESSOR. The REFRIGERANT components downstream of the MOTOR-COMPRESSOR up to the expansion device are exposed to this pressure and so the design RATING of these components should accommodate the worst-case pressures whilst providing the appropriate safety margin for a pressure vessel.
- The maximum CONTROLLED TEMPERATURES, namely, the SOAKED TEMPERATURE CONDITIONS, from which the heat is being extracted, may impact the maximum temperature of LOW-PRESSURE SIDE to the MOTOR-

COMPRESSOR as well as present a temperature HAZARD if the OPERATOR is exposed to them or if the electrical insulation is degraded. Whether this CONTROLLED TEMPERATURE is derived from an integral heating function of the device or from the heat dissipated from the material being cooled, the impact under worst case conditions should be evaluated.

– The current draw of the equipment should be established when including the worst-case running conditions of the REFRIGERATING SYSTEM including any defrost cycles that may apply.

The worst-case conditions should be determined for the equipment and will include both the least favourable NORMAL USE conditions as well as the most unfavourable testing results under SINGLE FAULT CONDITIONS.

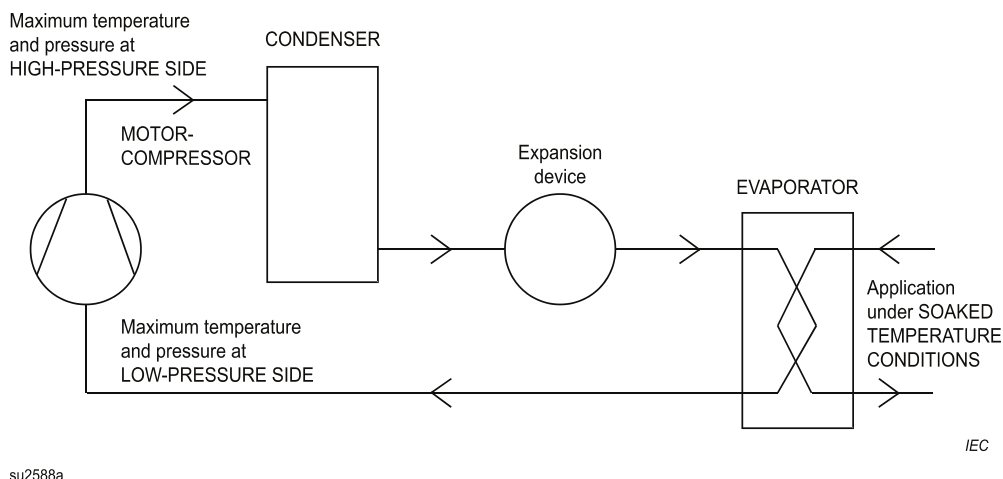
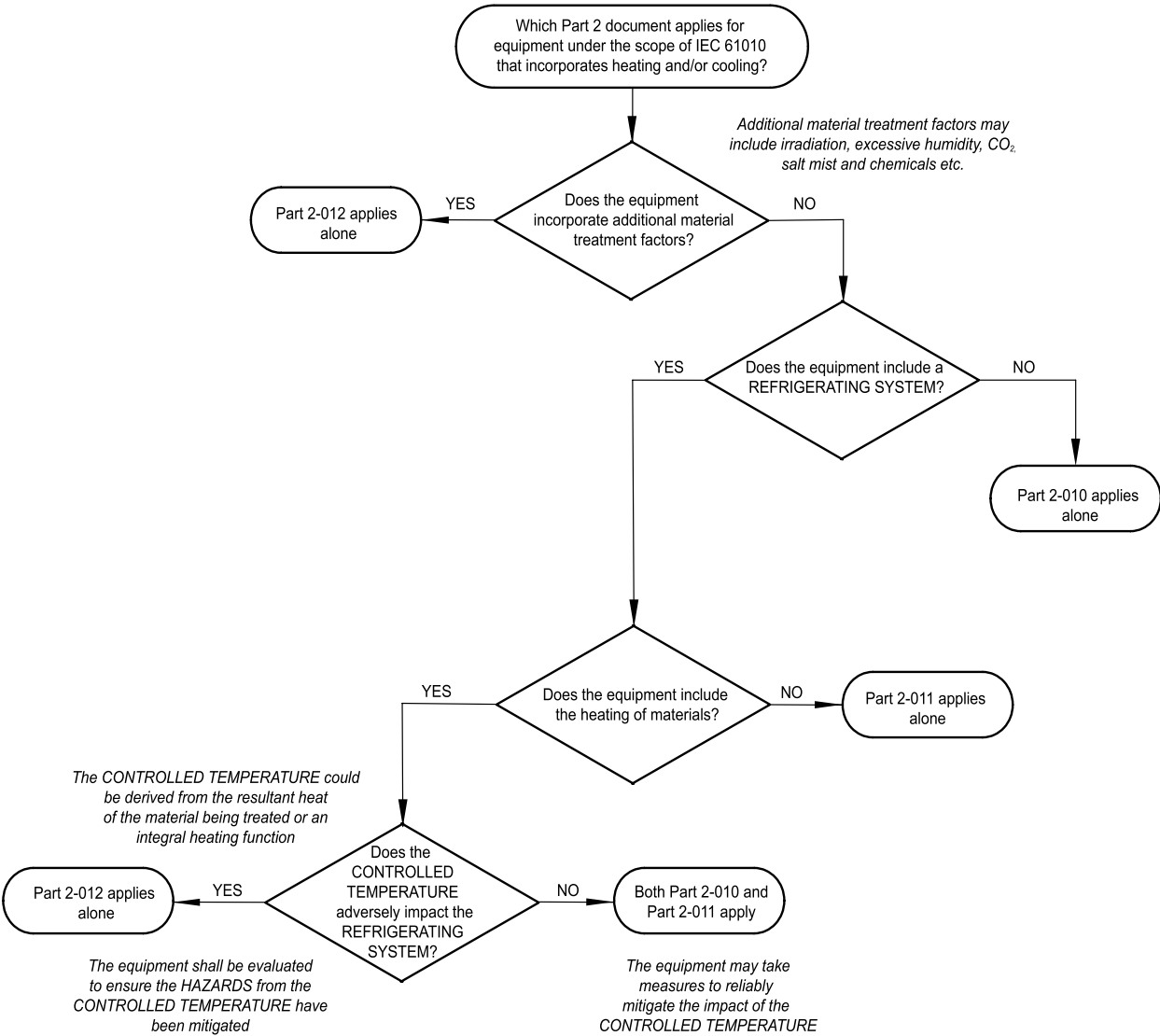


Figure 101

Schema of a REFRIGERATING SYSTEM incorporating a CONDENSER

The selection process is illustrated in the following flow chart (see [Figure 102](#)).



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Figure 102
Flow chart illustrating the selection process

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SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – Part 2-012: Particular requirements for climatic and environmental testing and other temperature conditioning equipment

1 Scope and object

This clause of Part 1 is applicable except as follows:

1.1.1 Equipment included in scope

Replacement:

Replace the second paragraph by the following:

This part of IEC 61010 specifies safety requirements for electrical equipment and its accessories within the categories a) through c), wherever it is intended to be used, whenever that equipment incorporates one or more of the following characteristics:

- A REFRIGERATING SYSTEM that is acted on or impacted by an integral heating function such that the combined heating and REFRIGERATING SYSTEM generates additional and/or more severe HAZARDS than those for the two systems if treated separately.
- The materials being treated in the intended application introduce significant heat into the REFRIGERATING SYSTEM, so that the REFRIGERATING SYSTEM in the application yields additional and/or more severe HAZARDS than those for the REFRIGERATING SYSTEM if operated at the maximum RATED ambient temperature alone.
- An irradiation function for the materials being treated presenting additional HAZARDS.
- A function to expose the materials being treated to excessive humidity, carbon dioxide, salt mist, or other substances which can result in additional HAZARDS.
- A function of MECHANICAL MOVEMENT presenting additional HAZARDS.
- Provision for an OPERATOR to walk in to the operating area to load or unload the materials being treated.

Addition:

Add the following text after the last paragraph:

NOTE 101 Examples of such equipment include environmental testing and plant growth TEST CHAMBERS, refrigerating CIRCULATORS which incorporate heating, and recirculating coolers for extracting heat.

It is possible that all or part of the equipment falls within the scope of one or more other Part 2 standards of IEC 61010 as well as within the scope of this standard. In that case, the requirements of those other Part 2 standards also apply. This document is intended for application when one or more of the additional HAZARDS described in the above dashed listed items are introduced. However, when the equipment incorporates only a REFRIGERATING SYSTEM or only a heating function or a combination of the two without

introducing the additional HAZARDS described in the above list, then IEC 61010-2-011 or IEC 61010-2-010 or both, as appropriate, apply instead of this Part 2-012.

See further information in the flow chart ([Figure 102](#)) for selection process and guidance in the Introduction.

NOTE 102 Subclause [3.1.107](#) and Annex [BB](#) provide the definition and requirements for the protection of people who are inside WALK-IN EQUIPMENT.

1.1.2 Equipment excluded from scope

Addition:

Add the following items after item j):

- aa) equipment for the heating, cooling, and ventilation of laboratories;
- bb) sterilizing equipment.

1.2 Object

1.2.1 Aspects included in scope

Addition:

Add the following items after item g):

- aa) biohazards (see [13.101](#));
- bb) hazardous chemical substances (see [13.102](#)).

2 Normative references

This clause of Part 1 is applicable, except as follows:

Addition:

IEC 60079-15:2010, *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*

IEC 60079-20-1, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

IEC 60335-2-34:2012, *Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor-compressors*

IEC 60335-2-34:2012/AMD1:2015

IEC 60335-2-34:2012/AMD2:2016

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs* (available at <https://www.iso.org/obp>)

2DV DR Modification of Clause 2 of the Part 2 to add the following normative references:

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

UL 60335-2-89, Household and Similar Electrical Appliances – Safety – Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor

3 Terms and definitions

This clause of Part 1 is applicable except as follows:

3.1 Equipment and states of equipment

Addition:

Add the following new terms and definitions:

3.1.101**BATH**

complete device intended for application of CONTROLLED TEMPERATURES to SPECIMENS by immersion in a temperature-controlled liquid HEAT TRANSFER MEDIUM

3.1.102**CIRCULATOR**

equipment intended for application of CONTROLLED TEMPERATURES to an APPLICATION SYSTEM by external circulating of a temperature-controlled liquid HEAT TRANSFER MEDIUM

3.1.103**TEST CHAMBER**

ENCLOSURE or space in some part of which specified conditions can be achieved, in particular, temperature, humidity, irradiation, low air pressure, mould growth and salt spray

3.1.104**COMBINED TEST CHAMBER**

special TEST CHAMBER combined with the function of MECHANICAL MOVEMENT, for example, for vibration, shock, impact, and similar dynamic tests

3.1.105**INCUBATOR**

special TEST CHAMBER, primarily for incubation of microorganisms and tissue culture

3.1.106**SHAKER**

equipment to disperse or dissolve one substance in another by MECHANICAL MOVEMENT without the use of blades or stirrers that might destroy the structure of the substance, in particular, shaking BATH and shaking INCUBATOR

3.1.107**WALK-IN EQUIPMENT**

TEST CHAMBER or INCUBATOR, the door of which allows the OPERATOR to enter and remain inside the equipment even with the door closed

3.1.108

DRYING-OUT

period to wait or procedure to be carried out before operation to return the equipment to NORMAL CONDITION if it has been transported or stored in humid conditions, or moved from a cold environment to a much warmer one where condensation could occur, and could cause the equipment to then fail to meet all the safety requirements of this document

3.1.109

STANDSTILL

period to wait or procedure to be carried out before operation to return the equipment to NORMAL CONDITION if it has been transported, moved, shaken, tilted or inverted and which could cause the equipment to then fail to meet all the safety requirements of this document

3.2 Parts and accessories

Addition:

Add the following new terms and definitions:

3.2.101

RESISTANCE-HEATING DEVICE

part of resistance-heating equipment, comprising one or more heating resistors, typically composed of metallic conductors or an electrically conductive compound suitably insulated and protected

[SOURCE: IEC 60050-426:2008, 426-08-08, modified – "resistance-heating unit" has been replaced with "resistance-heating equipment".]

3.2.102

REFRIGERATING SYSTEM

combination of interconnected REFRIGERANT-containing parts constituting one closed REFRIGERANT circuit in which the REFRIGERANT is circulated for the purpose of extracting and rejecting heat

[SOURCE: ISO 5149-1:2014, 3.1.9, modified – the term "(heat pump)" has been deleted from the term and the words "(i.e. cooling and heating)" have been deleted from the definition and the note.]

3.2.103

CASCADE SYSTEM

REFRIGERATING SYSTEM consisting of two or more independent refrigeration circuits where the CONDENSER of one system rejects heat directly to the EVAPORATOR of another

[SOURCE: EN 378-1:2008, 3.1.12, modified – "REFRIGERATING SYSTEM consisting of" has been included.]

3.2.104

MOTOR-COMPRESSOR

refrigerating subassembly consisting of the mechanical mechanism of the compressor and the motor, both of which are enclosed in the same sealed housing, with no external shaft seals, and with the motor operating in a REFRIGERANT atmosphere with or without oil

Note 1 to entry: The housing may be permanently sealed, such as by welding or brazing (hermetic MOTOR-COMPRESSOR), or may be sealed by gasketed joints (semi-hermetic MOTOR-COMPRESSOR). A TERMINAL box, a TERMINAL boxcover, and other electrical components or an electronic control system may be included.

[SOURCE: IEC 60335-2-34:2012, 3.101, modified – "appliance" has been replaced by "refrigerating subassembly".]

3.2.105

CONDENSER

heat exchanger in which vaporized REFRIGERANT is liquified by removal of heat

[SOURCE: ISO 5149-1:2014, 3.4.4, modified – "refrigerant vapour" has been replaced by "vaporized REFRIGERANT".]

3.2.106

CONDENSING UNIT

specific refrigerating subassembly combination for a given REFRIGERANT, consisting of one or more MOTOR-COMPRESSORS, CONDENSERS, liquid receivers (when required) and the regularly furnished accessories

3.2.107

EVAPORATOR

heat exchanger in which liquid REFRIGERANT is vaporized by absorption of heat

[SOURCE: IEC 60335-2-40:2018, 3.110, modified – "refrigerant liquid" has been replaced by "liquid refrigerant".]

3.2.108

HIGH-PRESSURE SIDE

part of a REFRIGERATING SYSTEM operating approximately at the CONDENSER pressure

[SOURCE: ISO 5149-1:2014, 3.1.7]

3.2.109

LOW-PRESSURE SIDE

part of a REFRIGERATING SYSTEM operating approximately at the EVAPORATOR pressure

[SOURCE: ISO 5149-1:2014, 3.1.8]

3.2.110

CIRCULATING PUMP

pressure and/or suction pump transporting the liquid HEAT TRANSFER MEDIUM in a BATH or CIRCULATOR

3.2.111

CIRCULATING FAN

propeller fan or centrifugal impeller designed to circulate the air in a TEST CHAMBER or an INCUBATOR with or without any air duct

3.2.112

HUMIDIFIER

electric device that generates a water mist or steam and releases it into a room, greenhouse or other ENCLOSURE

3.2.113

BATH TANK

open or enclosed vessel containing the HEAT TRANSFER MEDIUM, in a BATH or CIRCULATOR

3.2.114

LIQUID CONNECTION

pipe fitting through which liquid is expelled from or discharged into a vessel or a heat exchanger

3.2.115

VENTILATOR

device for replacing air inside a TEST CHAMBER or an INCUBATOR with outside air

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3.2.116

TEMPERATURE-LIMITING DEVICE

temperature-actuated device that is designed to prevent unsafe temperatures

[SOURCE: EN 378-1:2008, 3.6.5]

3.2.117

LIQUID LEVEL CUT OUT

liquid level-actuated device designed to prevent unsafe liquid levels

[SOURCE: EN 378-1:2008, 3.6.12]

3.2.118

PRESSURE-LIMITING DEVICE

pressure-actuated device (for example, a high-pressure switch) which is designed to stop the operation of the pressure-imposing element and may also operate an alarm

3.2.119

PRESSURE-RELIEF DEVICE

valve or disc designed to relieve excessive pressure automatically

[SOURCE: ISO 5149-1:2014, 3.6.7, modified – "pressure relief valve or bursting disc device" has been replaced with "valve or disc" in the definition.]

3.2.120

FLAMMABLE LIQUID

liquid capable of producing a flammable gas or vapour which, when mixed with air in certain proportions, will form an EXPLOSIVE GAS ATMOSPHERE under any foreseeable operating conditions

3.2.121

HEAT TRANSFER MEDIUM

medium used to transfer heat to the material being processed

3.2.122

REFRIGERANT

fluid used for heat transfer in a REFRIGERATING SYSTEM, which absorbs heat at a low temperature and a low pressure of the fluid and rejects heat at a higher temperature and a higher pressure of the fluid, usually involving changes of state of the fluid

[SOURCE: ISO 817:2014, 3.1.35, modified – the term "phase" has been replaced with "state" in the definition.]

3.2.123

FLAMMABLE REFRIGERANT

REFRIGERANT with a flammability classification of A2L, A2 or A3 in accordance with ISO 817

[SOURCE: IEC 60335-2-24:2010 and IEC 60335-2-24:2010/AMD2:2017, 3.109]

3.2.124

SPECIMEN

any material, substance, or product designated to be processed, for example, in a BATH, TEST CHAMBER or an INCUBATOR

3.2.125

APPLICATION SYSTEM

system or device intended to work with a CIRCULATOR to carry out a functional purpose

3.5 Safety terms

Addition:

Add the following new terms and definitions:

3.5.101

SATURATED-VAPOUR PRESSURE

of REFRIGERANT vapour pressure at which the liquid and vapour can exist in equilibrium at a given temperature

3.5.102

MAXIMUM ALLOWABLE PRESSURE

PS

maximum pressure for which the equipment is designed, as specified by the manufacturer

Note 1 to entry: This note applies to the French language only.

[SOURCE: EN 378-1:2008, 3.3.2]

3.5.103

RATED PRESSURE

MAXIMUM ALLOWABLE PRESSURE for pressure components of equipment with regard to their ability to withstand pressures as specified by the manufacturer

3.5.104

ACTIVE COOLING CONTROL RANGE

ACC RANGE

CONTROLLED TEMPERATURE range that is achieved by an active REFRIGERATING SYSTEM

Note 1 to entry: This note applies to the French language only.

3.5.105

FLASH POINT

lowest liquid temperature at which, under certain standardized conditions, a liquid gives off vapours in quantity such as to be capable of forming an ignitable vapour/air mixture

Note 1 to entry: At the FLASH POINT, the vapour may cease to burn when the ignition source is removed.

[SOURCE: IEC 60050-426:2008, 426-02-14]

3.5.106

FIRE POINT

lowest temperature at which a substance ignites and continues to burn for at least 5 s after a small flame has been applied to its surface under standardized conditions

3.5.107

AUTO IGNITION TEMPERATURE

lowest temperature at which a substance will spontaneously ignite in a normal atmosphere without an external ignition source, such as a flame or spark

Note 1 to entry: Once ignited, the substance will continue to burn until it is either completely consumed or the temperature of the remainder of the substance is reduced to or below its FIRE POINT.

3.5.108

LOWER EXPLOSIVE LIMIT**LEL**

concentration of flammable gas or vapour in air, below which an EXPLOSIVE GAS ATMOSPHERE WILL NOT BE FORMED

Note 1 to entry: This note applies to the French language only.

[SOURCE: IEC 60050-426:2008, 426-02-09]

3.5.109

EXPLOSIVE GAS ATMOSPHERE

mixture with air, under atmospheric conditions, of flammable substances in the form of gas or vapour which, after ignition, permits self sustaining flame propagation

[SOURCE: IEC 60050-426:2008, 426-01-07]

3.5.110

SOAKED TEMPERATURE CONDITION

temperature conditions when the ambient temperature of the equipment under test (EUT) equals to $\pm 2,0$ °C of maximum ambient of 1.4.1 for NORMAL USE, storage or transport, and the CONTROLLED TEMPERATURE of the EUT equals to $\pm 2,0$ °C of the maximum ACC RANGE with the MOTOR-COMPRESSOR running or, the maximum RATED CONTROLLED TEMPERATURE with the MOTOR-COMPRESSOR off

Note 1 to entry: This note applies to the French language only.

3.5.111

MECHANICAL MOVEMENT

motion of materials being processed, for example in a SHAKER or COMBINED TEST CHAMBER

3.5.112

MOVEMENT FREQUENCY

number of complete cycles of MECHANICAL MOVEMENT

3.5.113

MOVEMENT AMPLITUDE

maximum radius, distance, or angle of the MECHANICAL MOVEMENT

3.5.114

CONTROLLED TEMPERATURE

temperature where the EVAPORATOR is located and to which the LOW-PRESSURE SIDE of the equipment is exposed, as a result of heat transfer either by active heating or from the APPLICATION SYSTEM or SPECIMEN

Note 1 to entry: For a heat pump system, where a four-way valve is used to shift between heat and cool, the function of CONDENSER and EVAPORATOR is exchanged.

4 Tests

This clause of Part 1 is applicable except as follows:

4.3 Reference test conditions

4.3.1 Environmental conditions

Addition:

Add the following text after item d):

Since the temperatures, pressures and current draw for a REFRIGERATING SYSTEM are significantly impacted by ambient temperatures in a non-linear way, linear extrapolation of test data is not possible. Therefore, tests to establish the temperatures, pressures, and current draw for a REFRIGERATING SYSTEM shall be conducted under the following environmental conditions:

- 1) an ambient temperature of 40 °C, or the maximum RATED ambient temperature, if higher;
- 2) the temperature of water supply is the maximum as specified by the manufacturer (see [5.4.3](#));
- 3) a relative humidity not exceeding the limits of 1.4.1 d), or the maximum RATED relative humidity at the maximum RATED ambient temperature, if higher.

If, as permitted by Note 2 of 1.4.1, a REFRIGERATING SYSTEM has an ambient temperature RATING below 40 °C, the NORMAL CONDITION tests shall be performed in an environment that matches the maximum RATED ambient temperature, and then repeated at an ambient temperature of 40 °C. See [4.3.2.114](#).

4.3.2 State of equipment

4.3.2.1 General

Replacement:

Replace the first paragraph and note by the following:

Unless otherwise specified, each test shall be carried out on the equipment assembled for NORMAL USE, and under the least favourable combination of the conditions given in 4.3.2.2 to 4.3.2.13 and [4.3.2.101](#) to [4.3.2.114](#) if applicable.

When measuring temperatures, pressures, and current draws of equipment incorporating a REFRIGERATING SYSTEM, the tests shall be started from a SOAKED TEMPERATURE CONDITION when all pressures have fully equalized. Tests at the extremes of the input voltage ($\pm 10\%$) shall start under these voltage conditions and achieve a stable state but need not start from a SOAKED TEMPERATURE CONDITION.

In case of doubt, a test may have to be made with more than one combination of conditions, for example, when the equipment is operated at or cycled in between its maximum and minimum CONTROLLED TEMPERATURES or operated in combination with excessive humidity, low air pressure, radiation, or conditions of precipitation.

Addition:

Add the following new subclauses:

4.3.2.101 Heat load

Where the equipment or materials being processed require either the provision or extraction of heat, the equipment under test (EUT) shall be loaded with a heat source/sink within the manufacturer's specified conditions of use (including maximum RATED and none).

NOTE DIN 12876 (all parts) provides procedures for determining cooling capacity and efficient heating capacity of the equipment.

4.3.2.102 Humidity and steam

Where equipment generates humidity or is intended for connection to a steam supply, it shall be set to generate or be supplied with them within the manufacturer's specified conditions of use (including maximum RATED and none).

4.3.2.103 Lamp and lamp systems

Illumination that provides part of the primary function (whether it be integral or an accessory), shall be installed and operated within the manufacturer's specified conditions of use (including maximum, off and cycled).

NOTE An example is a Xenon arc lamp used in a weather durability TEST CHAMBER.

4.3.2.104 MECHANICAL MOVEMENT

Equipment with a function of MECHANICAL MOVEMENT (for materials or HEAT TRANSFER MEDIUM) shall be set to expose the equipment and any materials being processed to the worst conditions (including maximum, off and cycled).

4.3.2.105 Spray generating systems

Spray generating systems of equipment shall be operated within the manufacturer's specified conditions of use (including maximum, off and cycled).

4.3.2.106 VENTILATORS

VENTILATORS shall be operated within the manufacturer's specified conditions of use (including maximum, off and cycled).

4.3.2.107 Pressures other than those of REFRIGERANT

Where equipment generates or uses pressures other than local atmospheric it shall be set to generate, or be supplied with pressure(s) within the manufacturer's specified conditions of use (including maximum RATED and none).

4.3.2.108 REFRIGERANT pressure

Where a heating system (or HEAT TRANSFER MEDIUM) can apply a CONTROLLED TEMPERATURE to the REFRIGERATING SYSTEM which is outside its ACC RANGE, the equipment shall be set to apply the maximum CONTROLLED TEMPERATURE allowed by the controls or interlocks with the MOTOR-COMPRESSOR off or maximum ACC RANGE with the MOTOR-COMPRESSOR on, whichever is least favourable.

Where a heating system (or HEAT TRANSFER MEDIUM) can apply a CONTROLLED TEMPERATURE to the REFRIGERATING SYSTEM which could affect the pressure in the system, the most unfavourable condition for pressure shall be established including:

- MOTOR-COMPRESSOR running throughout;
- MOTOR-COMPRESSOR started during test;
- outside its ACC RANGE with the MOTOR-COMPRESSOR off and the equipment set to apply the maximum CONTROLLED TEMPERATURE allowed by the controls or interlocks.

4.3.2.109 Exhaust and condensate

The least favourable conditions which result in production of exhaust, vapours and/or condensates shall be created (including maximum and cycled).

NOTE The TERMINALS of a RESISTANT-HEATING DEVICE exposed to ambient condition are easily condensed after the HEAT TRANSFER MEDIUM has been cooled to below ambient temperature for some time.

4.3.2.110 Filling and draining systems

Filling and draining systems shall be operated within the manufacturer's specified conditions of use (including maximum, minimum and intermediate).

4.3.2.111 Circulating system

CIRCULATING PUMP(s), agitator(s) or CIRCULATING FAN(s) shall be operated within the manufacturer's specified conditions of use (including maximum and off).

4.3.2.112 Gas HEAT TRANSFER MEDIUM

The equipment shall be operated with the gas HEAT TRANSFER MEDIUM, whether it is air or other designated gases, at the percentage of content and pressure within the manufacturer's specified conditions of use (including maximum, minimum and none).

4.3.2.113 Properties of liquid HEAT TRANSFER MEDIUM

For equipment with a wide CONTROLLED TEMPERATURE range, the effect of contraction, expansion, evaporating, condensing, oxidizing, boiling and freezing of the liquid and its allowable CONTROLLED TEMPERATURE range should be considered. HEAT TRANSFER MEDIA which change states during NORMAL USE shall be simulated to generate state change both from solid to liquid and vice versa.

4.3.2.114 Abnormal test to simulate the failure of the controlled environment

For REFRIGERATING SYSTEMS intended to operate in an ambient environment that is more restricted than that specified in 1.4.1, this additional abnormal test shall be applied to simulate the failure of the controlled environment in which the equipment is located.

Having determined the least favourable test conditions for the temperature and pressure tests under [10.4.1](#), the equipment is operated under these conditions until a steady state has been achieved. The test environment conditions are then increased to the levels set out in 1.4.1 (40 °C, 50 % RH) and the equipment is allowed to stabilize before the maximum temperatures and pressures are recorded. Protective devices shall not be bypassed or disabled. If the equipment does not reach steady state due to the operation of protective devices, then the maximum values recorded for this test shall be either:

- a) the maximum temperatures and pressures at the point of operation of non-resettable or manually resettable devices, which do not need to be reset during this test; or
- b) the maximum temperatures and pressures achieved after continued cycling of automatically resetting protective devices, which shall be allowed to cycle until it is clear that successive cycles will not develop higher maximum values.