IEC 61010-2-012

Edition 1.0 2016-07

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

colour inside

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

## 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

## Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire –
## Partie 2-012: Exigences particulières pour les appareils d'essais climatiques et d'environnement, et autres appareils de conditionnement de température



IEC 61010-2-012:2016-07(en-fr)

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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

## FOREWORD

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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.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|---|---|
| 66/590/FDIS | 66/599/RVD |

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

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

A list of all parts of the IEC 61010 series, under the general title, *Safety requirements for electrical equipment for measurement, control, and laboratory use*, may 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) of IEC 61010-1

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, that subclause applies as far as is reasonable. where this part 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 publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication 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 document using a colour printer.**

# INTRODUCTION

This standard, in conjunction with Part 2-010 and Part 2-011, addresses the specific HAZARDS associated with the heating and cooling of materials by equipment and are segregated 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 cooling 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 whether the interaction between the two systems will generate additional or more severe HAZARDS than if the systems were evaluated separately (application 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 function, or 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 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 HIGH-PRESSURE SIDE under most unfavourable conditions may present a temperature HAZARD if the OPERATOR is exposed to or 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 application temperatures, namely, the SOAKED TEMPERATURE CONDITIONS, where the heat is being extracted from, 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 or electrical insulation is degraded. Whether this application 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.

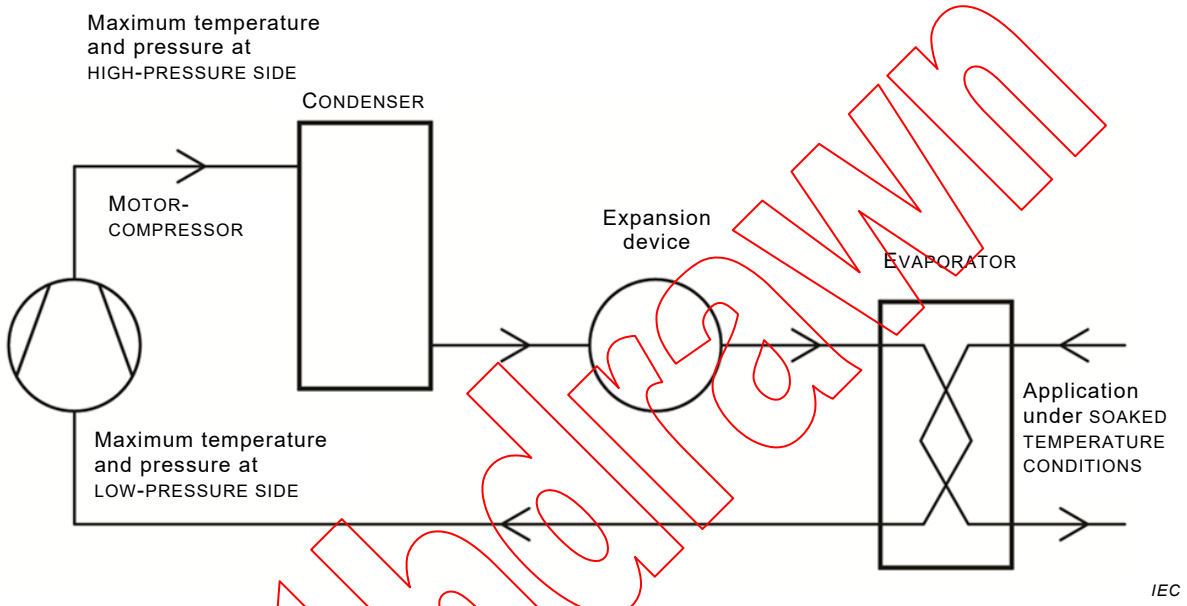


**Figure 101 – Schema of a REFRIGERATING SYSTEM incorporating a CONDENSER**

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

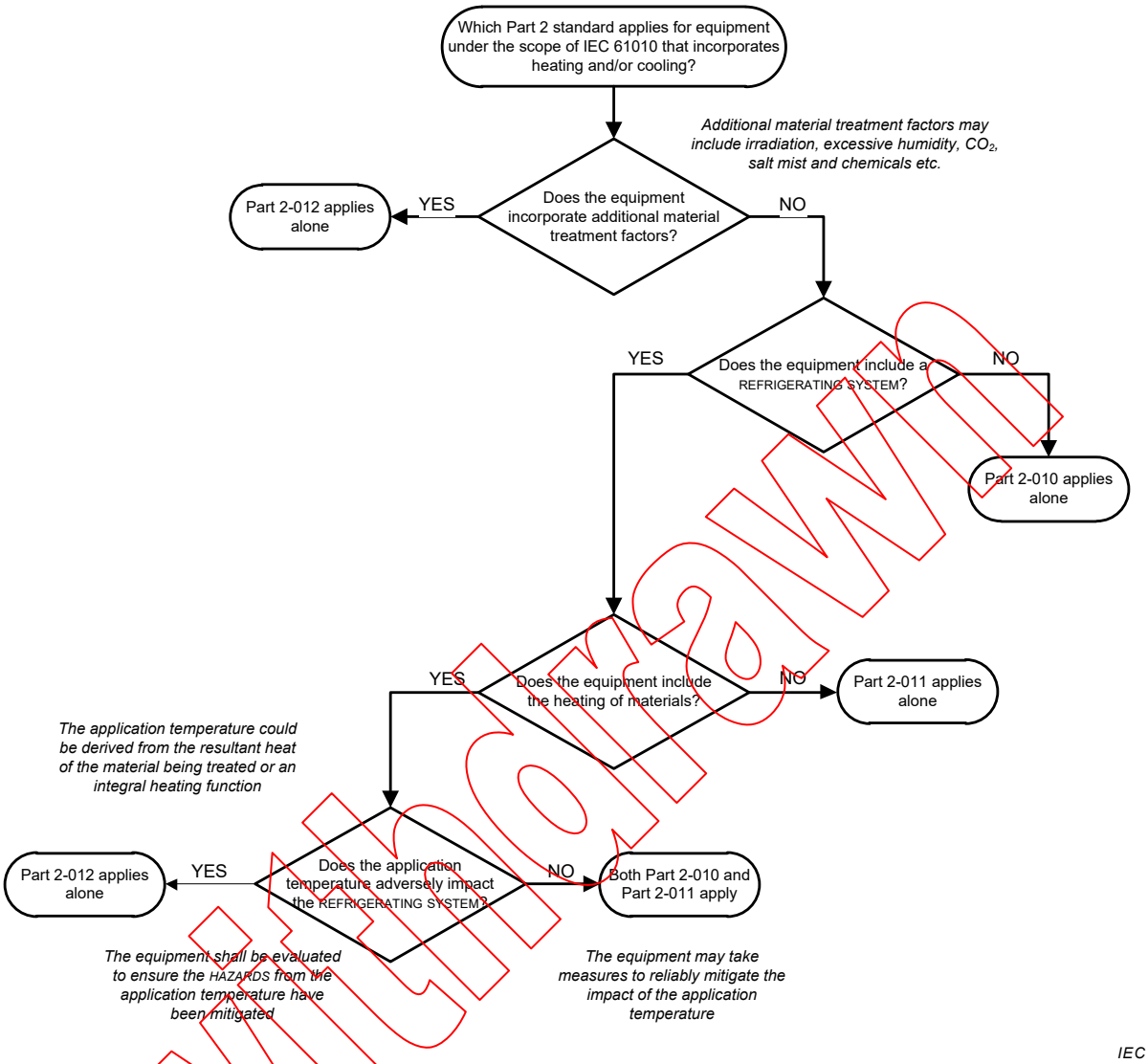


**Figure 102 – Flow chart illustrating the selection process**

# 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 first paragraph by the following:*

This group safety publication is primarily intended to be used as a product safety standard for the products mentioned in the scope, but shall also be used by technical committees in the preparation of their publications for products similar to those mentioned in the scope of this standard, in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51.

This Part 2 of IEC 61010 specifies safety requirements for electrical equipment and their accessories within the categories a) through c), wherever they are 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 cooling 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 that the cooling system in the application yield additional and/or more severe HAZARDS than those for the cooling system if operated at the maximum RATED ambient 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 may 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, recirculating coolers for extracting heat.

If 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, it should also meet the requirements of those other Part 2 standards. However, when the equipment incorporates only a REFRIGERATING SYSTEM or only a heating function or a combination of the two without introducing additional HAZARDS described in the above dashed paragraphs then the application of IEC 61010-2-011 or IEC 61010-2-010 or both, as applicable, shall be considered instead of this Part 2.

See further information in the flow chart for selection process and guidance in the INTRODUCTION.

NOTE 102 Subclause 3.1.107 and Annex BB provides definition and requirements for protection of people who are inside WALK-IN EQUIPMENT.

### 1.1.2 Equipment excluded from scope

*Addition:*

*Add the following two new 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 two new items to the list:*

aa) biohazards (see 13.101);

bb) hazardous chemical substances (see13.102).

## 2 Normative references

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

*Additions:*

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

IEC 60079-20, *Explosive Atmospheres – Part 20: Material characteristics for gas and vapour classification*

IEC 60335-2-24:2010, *Household and similar electrical appliances – Safety – Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice makers*
IEC 60335-2-24:2010/AMD1:2012

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 62471, *Photobiological safety of lamps and lamp systems*

IEC TR 62471-2, *Photobiological safety of lamps and lamp systems – Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety*

ISO 7010:2011,*Graphical symbols – Safety colours and safety signs – Registered safety signs*

## 3 Terms and definitions

This clause of Part 1 is applicable except as follows:

## 3.1 Equipment and states of equipment

*Addition:*

*Additional 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 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 function of MECHANICAL MOVEMENT, for example, for vibrating, shocking, impacting 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 a 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 standard

**3.1.109**
**STANDSTILL**
period to wait or a procedure to be carried before operation to return the equipment to NORMAL CONDITION if it has been transported or moved or shaken or tilted or inverted and which could cause the equipment to fail to meet all the safety requirements of this standard

## 3.2 Parts and accessories

*Addition:*

*Additional definitions:*

**3.2.101**
**RESISTANCE-HEATING DEVICE**
part of a 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: 1993, 1.3.47]

**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 bepermanently sealed, such as by welding or brazing (hermetic MOTOR-COMPRESSOR), or may be sealed by gasketted 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/AMD1:2015, 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: 1993, 1.3.11]

**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

[SOURCE: ISO 5149: 1993, 1.3.12, modified – "machine" has been replaced by "subassembly"]

**3.2.107**
**EVAPORATOR**
heat-exchanger in which liquid REFRIGERANT is vaporized by absorption of heat

[SOURCE: IEC 60335-2-40: 2009, 3.110]

**3.2.108**
**HIGH-PRESSURE SIDE**
part of a REFRIGERATING SYSTEM operating at approximately the CONDENSER pressure

[SOURCE: ISO 5149: 1993, 1.3.24]

**3.2.109**
**LOW-PRESSURE SIDE**
part of a REFRIGERATING SYSTEM operating at approximately the EVAPORATOR pressure

[SOURCE: ISO 5149: 1993, 1.3.30]

**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 impellor 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 by outside air

**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 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: 1993, 1.3.40]

**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 5149: 1993, 1.3.45]

**3.2.123**
**FLAMMABLE REFRIGERANT**
REFRIGERANT with a flammability classification of group 2 or 3 in accordance with ISO 5149

[SOURCE: IEC 60335-2-24:2010/AMD1:2012, 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:*

*Additional definitions:*

**3.5.101**
**SATURATED-VAPOUR PRESSURE (OF REFRIGERANT)**
vapour pressure (of REFRIGERANT) 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**
working 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 ±2,0°C of maximum ambient of 1.4.1 for NORMAL USE, storage or transport, and the operating temperature of the EUT equals to ±2,0°C of the maximum ACC RANGE with the MOTOR-COMPRESSOR running or, the maximum RATED operating temperature with the MOTOR-COMPRESSOR off

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

**3.5.111**
**MECHANICAL MOVEMENT**
general description for the 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

## 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 operating 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

aa) an ambient temperature of 40 °C, or the maximum RATED operating ambient temperature if higher;

bb) the temperature of water supply being the maximum as specified by the manufacturer (see 5.4.3);

cc) a relative humidity not exceeding the limits of 1.4.1 d), or the maximum RATED operating relative humidity at the maximum RATED operating temperature, if higher;

If, as permitted by note 2 of 1.4.1, a REFRIGERATING SYSTEM has an operating temperature RATING below 40 °C, the NORMAL CONDITION tests shall be performed in an environment that matches the maximum RATED operating temperature, and then repeated at an environmental temperature of 40 °C. See 4.4.2.106.