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

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 a new IEC-based UL standard, UL 61010-2-012 with US National Differences.

The new requirements are substantially in accordance with Proposal(s) on this subject dated February 11, 2022.

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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.

The most recent designation of ANSI/UL 61010-2-012 as an American National Standard (ANSI) occurred on June 15, 2022. 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 UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line 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.

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.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

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.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

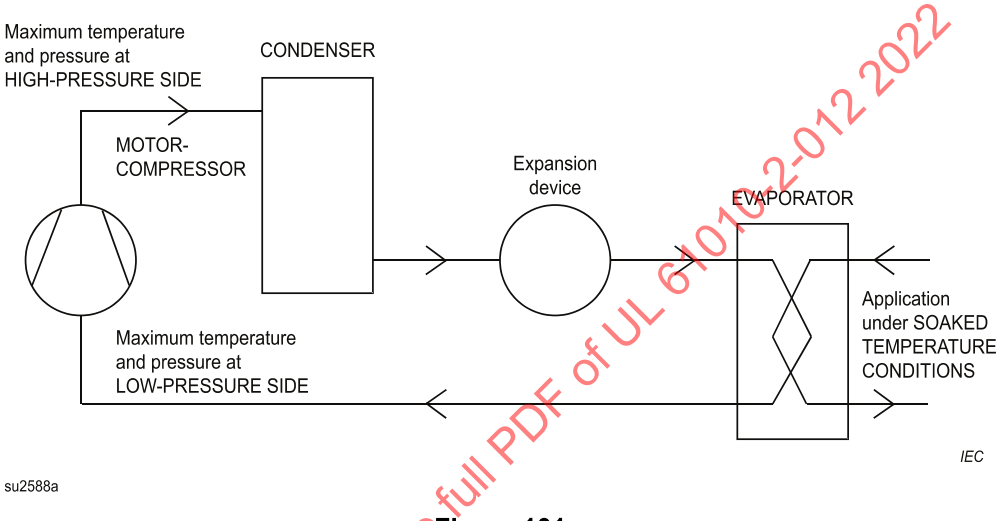

Figure 101

Schema of a REFRIGERATING SYSTEM incorporating a CONDENSER

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

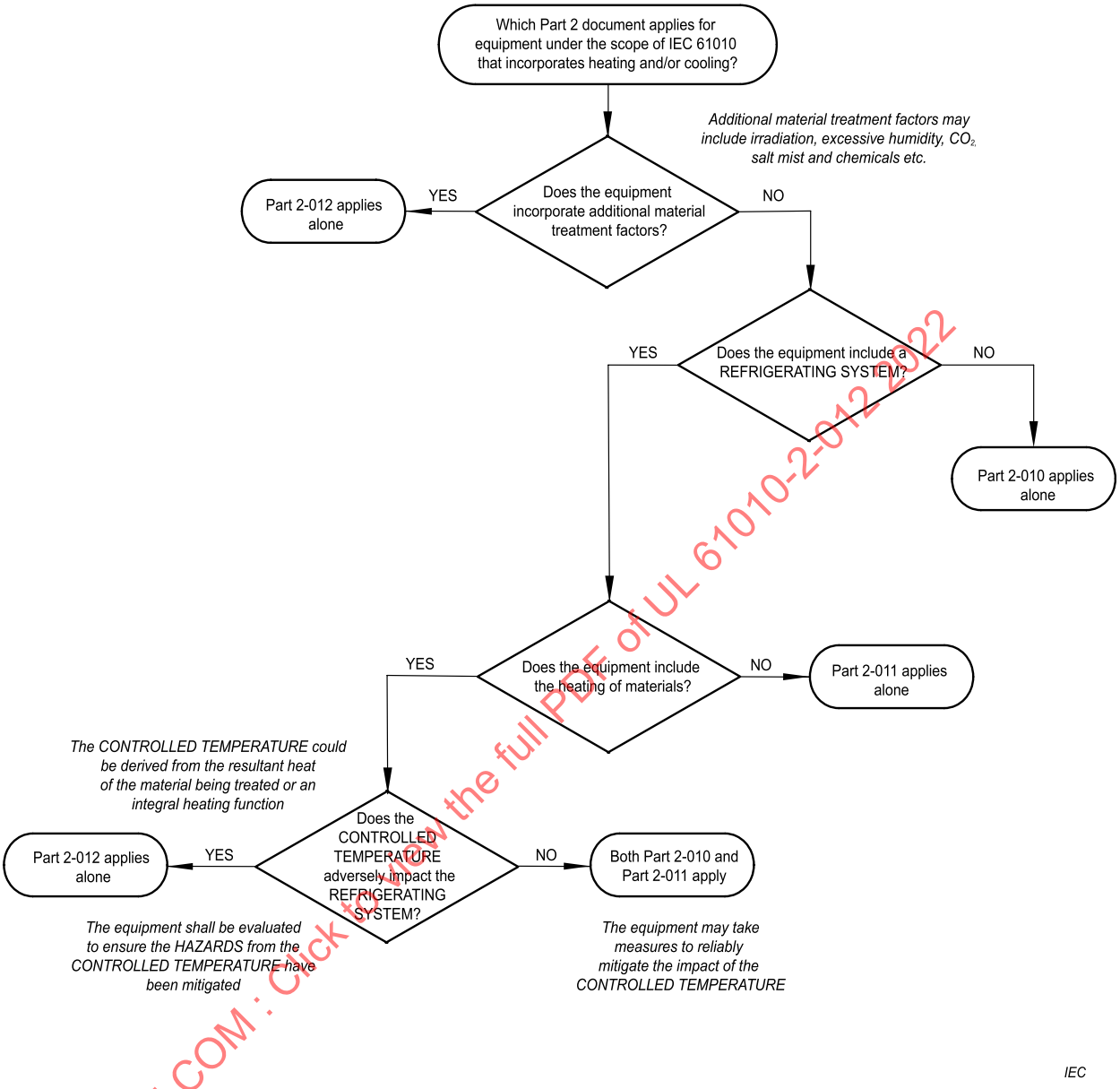

Figure 102

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)

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 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, 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

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 ±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 ±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 (±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.

4.4.2 Application of fault conditions

4.4.2.10 Cooling

Addition:

Add the following items and notes after item d):

aa) for an air-cooled CONDENSING UNIT, each CONDENSER fan shall be stalled one at a time unless a single fault could disable all CONDENSER fans simultaneously, or with the CONDENSER airflow restricted, whichever is the worst case, until maximum stabilized pressure is attained or until representative maximum temperatures are attained under cycling load. The temperatures and pressures shall be monitored at short intervals throughout the test to ensure that peak values are captured. This test is conducted at an ambient temperature of 25 °C ± 3 °C.

bb) for a water-cooled CONDENSING UNIT, the REFRIGERATING SYSTEM shall be operated with the condensing water shut off, or with the condensing water restricted, whichever is the worst case, until maximum stabilized pressure is attained or until representative maximum temperatures are attained under cycling load. The temperatures and pressures shall be monitored at short intervals throughout the test to ensure that peak values are captured. This test is conducted at an ambient temperature, and a water temperature of 25 °C ± 3 °C.

If a manual reset PRESSURE-LIMITING DEVICE is relied upon to limit the maximum and/or minimum pressure for the HIGH-PRESSURE SIDE or LOW-PRESSURE SIDE, then it shall be reset manually within 6 s of operation for 10 cycles.

NOTE 101 The running state of the MOTOR-COMPRESSOR is not relevant after the manual high PRESSURE-LIMITING DEVICE has operated.

If an automatic reset PRESSURE-LIMITING DEVICE is relied upon to limit the maximum and/or minimum pressure for the HIGH-PRESSURE SIDE or LOW-PRESSURE SIDE, then it shall be permitted to cycle automatically until it can be demonstrated that peak temperatures and pressures have been achieved.

NOTE 102 It is possible that a MOTOR-COMPRESSOR designed to be cooled by cycling of the REFRIGERANT would overheat enough to cause HAZARDS, if leakage of REFRIGERANT occurs and the PRESSURE-LIMITING DEVICE for LOW-PRESSURE SIDE is triggered repeatedly.

NOTE 103 The correct specification or appropriate setting of the pressure differential (hysteresis) of an automatic reset PRESSURE-LIMITING DEVICE is important for MOTOR-COMPRESSORS which require a longer STANDSTILL (off cycle) period.

If it can be demonstrated that a PRESSURE-LIMITING DEVICE will operate during the tests of MAXIMUM ALLOWABLE PRESSURE (PS), the manufacturer may elect to waive the test, but shall set the PS for the HIGH-PRESSURE SIDE of the MOTOR-COMPRESSOR to the RATING of the PRESSURE-LIMITING DEVICE.

For equipment with both air-cooled and water-cooled CONDENSERS, faults are applied one at a time only, unless the equipment is designed so that the OPERATOR can select to run either an air-cooled or a water-cooled CONDENSER (for example, some equipment is equipped with a water-cooled CONDENSER as an auxiliary for the air-cooled CONDENSER).

For a CASCADE SYSTEM, where an EVAPORATOR from the first stage REFRIGERATING SYSTEM acts as a CONDENSER to the second stage REFRIGERATING SYSTEM, the manufacturer may elect to run each CONDENSING UNIT individually under the tests of 4.4.2.10. In this case, disabling the first REFRIGERATING SYSTEM is considered to simulate the second stage CONDENSING UNIT running under the conditions of aa) and bb) above.

4.4.2.11 Heating devices

Addition:

Add the following paragraph after item b):

If a HAZARD could be caused by over-filling or under-filling with a liquid HEAT TRANSFER MEDIUM, the equipment shall be tested when empty, partially filled, or overfilled, whichever is least favourable. In case of doubt, the test shall be carried out in more than one condition. The HEAT TRANSFER MEDIUM used for the test shall be of a type specified for NORMAL USE.

Addition:

Add the following new subclauses:

4.4.2.101 MOTOR-COMPRESSOR

Housing and winding temperatures of MOTOR-COMPRESSORS that do not conform with IEC 60335-2-34 (including IEC 60335-2-34:2012, IEC 60335-2-34:2012/AMD1:2015 and IEC 60335-2-34:2012/AMD2:2016, Annex AA), shall be measured under the conditions of 19.101, 19.102 and 19.103 of IEC 60335-2-34:2012.

Housing and winding temperatures of MOTOR-COMPRESSORS conforming with IEC 60335-2-34 (including IEC 60335-2-34:2012, IEC 60335-2-34:2012/AMD1:2015 and IEC 60335-2-34:2012/AMD2:2016, Annex AA), are not measured.

4.4.2.102 Fluid leakage in the equipment

Internal leaks of fluids shall be simulated.

4.4.2.103 Solenoid valve and motorized valve

Equipment where the failure of a solenoid or motorized valve could cause a HAZARD shall be tested with the valve held in the worst likely failed state (including fully open, fully closed, anywhere in-between and changing state at the wrong time).

4.4.2.104 Failure of temperature control

The BATH TANK or other liquid vessel of the equipment shall be filled to its maximum level with the HEAT TRANSFER MEDIUM for NORMAL USE as specified by the manufacturer. The following faults shall then be applied, fault a) is applied on its own but if the conditions for c) are true then c) is applied immediately after b).

a) Uncontrolled heating – For equipment where there is an opening over the BATH TANK and where the boiling of the HEAT TRANSFER MEDIUM could cause a HAZARD, the temperature controllers shall be overridden so that the HEAT TRANSFER MEDIUM is kept boiling until any TEMPERATURE-LIMITING DEVICE for overtemperature protection is triggered, or boiling is terminated by the loss of the liquid.

b) Uncontrolled cooling – Temperature controllers shall be overridden to produce uncontrolled cooling until the HEAT TRANSFER MEDIUM becomes coagulated, solidified or frozen, or until there is no evidence of further increases in the kinematic viscosity of the HEAT TRANSFER MEDIUM, or operation of the MOTOR-COMPRESSOR is automatically terminated by a protective device.

c) Return to control – This test shall be applied to equipment incorporating an immersed or flow-through REFRIGERATING SYSTEM EVAPORATOR and/or a CIRCULATING PUMP and where the HEAT TRANSFER MEDIUM has become frozen, solidified or coagulated and the MOTOR-COMPRESSOR is still operational or could be made operational by resetting its protective device without the use of a TOOL. Under these conditions the MOTOR-COMPRESSOR's protective device shall be reset (if required) and the temperature control shall be reactivated with the CONTROLLED TEMPERATURE set to a value where the HEAT TRANSFER MEDIUM would be a liquid at its normal viscosity. The test terminates when all of the HEAT TRANSFER MEDIUM is at the specified CONTROLLED TEMPERATURE and normal viscosity.

4.4.2.105 HUMIDIFIER

HUMIDIFIERS that are not RATED to operate continuously shall be forced to operate continuously.

The container of an electrode-type HUMIDIFIER shall be filled with a saturated solution of sodium chloride in water, at a temperature of 20 °C ± 5 °C. The HUMIDIFIER shall be supplied at its RATED voltage.

NOTE The solution is saturated when no more salt can be dissolved in the water at a particular temperature.

If flexible tubing or hose is used for the steam or mist outlet, the test shall be performed with the tubing or hose unobstructed, partially blocked, and fully blocked.

If the equipment depends on a differential pressure between the inlet and outlet of the HUMIDIFIER to drive the steam or mist into the equipment, the HUMIDIFIER shall be operated with the equipment running at or cycling between its maximum and minimum CONTROLLED TEMPERATURES, whichever is least favourable.

In case of doubt, tests shall be carried out with more than one combination of conditions.

4.4.2.106 Speed controller

If a HAZARD could arise in case of a single fault of a speed controller, then such faults shall be applied, one at a time.

NOTE As examples, speed controllers are sometimes used to control MOVEMENT FREQUENCY in a SHAKER or COMBINED TEST CHAMBER, and to control pressure and flow rate of a CIRCULATING PUMP. Under a SINGLE FAULT CONDITION of the speed controller, a HAZARD might arise if the pressure developed by the pump exceeds the MAXIMUM ALLOWABLE PRESSURE of an APPLICATION SYSTEM, or if excessive MOVEMENT FREQUENCY of a SHAKER or COMBINED TEST CHAMBER results in loosening, tumbling, ejection, or destruction of the SPECIMEN.

4.4.3 Duration of tests

4.4.3.1 General

Replacement:

Replace the text with the following:

The equipment shall be operated until further change as a result of the applied fault is unlikely. Each test is normally limited to 1 h since a secondary fault arising from a SINGLE FAULT CONDITION will usually manifest itself within that time. If there is an indication that a HAZARD of electric shock, spread of fire or injury to persons can eventually occur, the test shall be continued until it is clear that stable conditions have been maintained for at least 1 h, unless one of these HAZARDS arises before then.

4.4.4 Conformity after application of fault conditions

4.4.4.1 General

Addition:

Add the following text below item c):

Conformity with the requirements for temperature protection of MOTOR-COMPRESSORS is checked as specified in 4.4.2.101.

5 Marking and documentation

This clause of Part 1 is applicable except as follows:

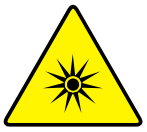
5.1.3 MAINS supply

Addition:

Add the following new symbols to Table 1:

Table 1

Symbols

Number	Symbol	Reference	Description
101		ISO 7010 - W010 (2011-05)	Warning; low temperature/freezing conditions, frostbite HAZARD
102		ISO 7010 - W021 (2011-05)	Warning; flammable material/FLAMMABLE LIQUID
103		ISO 7010 - W009 (2011-05)	Warning; biological HAZARD
104		ISO 7010 - W027 (2011-05)	Warning; optical radiation
105		ISO 7010 - W011 (2011-05)	Warning; slippery surface
106		ISO 7010 - W024 (2011-05)	Warning; crushing of hands

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5.1.5 TERMINALS, connections and operating devices

Addition:

Add the following new subclauses:

5.1.5.101 LIQUID CONNECTIONS for HEAT TRANSFER MEDIUM

LIQUID CONNECTIONS for HEAT TRANSFER MEDIUM shall be marked with graphical symbols or text to identify the outlet and inlet of the HEAT TRANSFER MEDIUM.

NOTE For refrigerating CIRCULATORS, symbols 107 through 109 can be used and, for refrigerating and heating CIRCULATORS, symbols 110 through 112 can be used (see Table AA.1).

Additionally, consideration may be given to mark the following:

a) if the outlet pressure of the liquid is greater than 0,03 MPa or 0,02 MPa with a maximum flow rate of more than 10 l/min, the maximum pressure in Pa, in association with symbol 108 or 111;

b) for a CIRCULATOR with a liquid suction pressure greater than 0,02 MPa, the maximum pressure in Pa preceded by a minus sign, in association with symbol 109 or 112;

c) for an enclosed CIRCULATOR intended for connection to a sealed APPLICATION SYSTEM, and if the LIQUID CONNECTIONS need to withstand pressure exceeding 0,03 MPa, the maximum pressure for each LIQUID CONNECTION, in association with symbols 108 and 109, or 111 and 112.

Symbols 107 to 112 are found in Table AA.1.

Where there is insufficient space near the LIQUID CONNECTIONS, symbol 14 of Table 1 may be used and explanations shall be given in the instructions provided with the equipment.

Conformity is checked by inspection.

5.1.5.102 LIQUID CONNECTION for filling of BATH TANKS with enclosed CIRCULATORS

Where the mis-setting of controls or valves associated with the LIQUID CONNECTION for filling a BATH TANK with an enclosed CIRCULATOR could cause a HAZARD, symbol 14 shall be placed close to the LIQUID CONNECTION and the instructions for use (see 5.4.4) shall clearly explain the necessary settings to ensure safety under different operating conditions.

Conformity is checked by inspection.

5.1.5.103 Other LIQUID CONNECTIONS and exhaust opening

LIQUID CONNECTIONS for filling, water supply, draining, overflowing and exhaust opening shall be marked as follows:

a) for equipment intended for manual filling of liquid, if the area of the opening for the BATH TANK or other liquid vessel is smaller than 80 cm^2 or it is not self-evident, a text marking or symbol 116 to indicate the location of the opening for filling;

b) for equipment intended for direct connection to the water supply, a text marking or symbol 113 for each LIQUID CONNECTION for water source, and optionally including, as applicable, auxiliary text to indicate the RATED pressure, flow rate, and maximum temperature of the water supply;

c) for equipment incorporating a water-cooled CONDENSING UNIT, or LIQUID CONNECTIONS for circulating water, a text marking or symbol 113 to identify the inlet, and a text marking or symbol 114 to identify the outlet, one or both of which also indicate the direction of liquid flow, and including as applicable, auxiliary text to indicate the RATED pressure, flow rate, and maximum temperature of the water supply;

d) for LIQUID CONNECTION for condensate, a text marking or symbol 115;

e) for LIQUID CONNECTION for draining, a text marking or symbol 117;

f) for LIQUID CONNECTION for overflowing, a text marking or symbol 118;

g) markings in association with a VENTILATOR include:

1) symbol 119 for the adjustment handle or shaft of the VENTILATOR,

2) symbol 120 for the fresh air inlet accompanied by, where necessary, the following text or its equivalent, "Fresh air inlet. Do not block.";

3) symbol 121 for the exhaust opening.

NOTE Symbols 113 to 121 can be found in Table AA.1.

Where there is insufficient space near the LIQUID CONNECTIONS and/or exhaust openings, symbol 14 of Table 1 may be used and additional explanation shall be included in the instructions.

Conformity is checked by inspection.

5.1.5.104 Equipotential TERMINALS

Each equipotential TERMINAL shall be marked with the symbol for equipotentiality of IEC 60417-5021 (2002-10). The marking shall not be marked on a screw, bolt, removable washer, or any other part that is removable when a connection is being made to conductors or wires.

Conformity is checked by inspection.

Addition:

Add the following new subclauses at the end of 5.1:

5.1.101 Marking for equipment incorporating a REFRIGERANT CONDENSING UNIT

For equipment incorporating a REFRIGERANT CONDENSING UNIT, the following information shall be marked:

a) the total mass of REFRIGERANT for each separate REFRIGERANT circuit;

b) for a single component REFRIGERANT, at least one of the following:

1) the chemical name,

2) the chemical formula,

3) the REFRIGERANT number;

c) for a blended REFRIGERANT, at least one of the following:

1) the chemical name and nominal proportion of each of its components,

2) the chemical formula and nominal proportion of each of its components,

3) the REFRIGERANT number and nominal proportion of each of its components,

4) the REFRIGERANT number of the REFRIGERANT blend;

NOTE 1 REFRIGERANT numbers are quoted in accordance with ISO 817 or other REFRIGERANT classification standard, for example ANSI/ASHRAE 34.

d) MAXIMUM ALLOWABLE PRESSURE (PS) under NORMAL CONDITION, HIGH-PRESSURE SIDE and LOW-PRESSURE SIDE for each REFRIGERANT stage.

NOTE 2 The collation of the test results that define PS is detailed in 11.7.1.

Conformity is checked by inspection.

5.1.102 Marking for equipment incorporating MECHANICAL MOVEMENT

For SHAKERS and COMBINED TEST CHAMBERS incorporating a function of MECHANICAL MOVEMENT, the maximum safe load of the SPECIMEN holder shall be marked.

Conformity is checked by inspection.

5.2 Warning markings

Addition:

Add the following text after item b):

Warning markings for particular HAZARDS which exist only when performing equipment maintenance shall be marked so that they are visible only when the particular maintenance is being performed. For example, the marking of the type of FLAMMABLE REFRIGERANT and of the flammable insulation blowing gas, shall be visible when gaining access to the MOTOR-COMPRESSORS, and, in the case of equipment with a remote REFRIGERANT CONDENSING UNIT, the pipe connections. The symbol 102 of Table 1 shall be at least 15 mm in height.

5.4.1 General

Replacement:

Replace item d) by the following:

d) the information specified in 5.4.2 to 5.4.6, 5.4.101 and 5.4.102;

5.4.2 Equipment RATINGS

Replacement:

Replace the first paragraph by the following text:

Where applicable the documentation shall include the following:

Addition:

Add the following items after f):

aa) the maximum and minimum CONTROLLED TEMPERATURES;

bb) the ACC RANGE and RATED cooling capacity for REFRIGERATING SYSTEM;

cc) RATED PRESSURE and flow rate for LIQUID CONNECTIONS between CIRCULATOR and an APPLICATION SYSTEM;

dd) the maximum additive relative humidity;

ee) the minimum air pressure;

ff) the maximum radiation strength;

gg) RATED PRESSURE, flow rate for connections to liquid and air supplies;

hh) maximum MOVEMENT FREQUENCY, MOVEMENT AMPLITUDE versus the mass of the load.

5.4.3 Equipment installation

Replacement:

Replace items a) to g) with the following:

a) assembly, location and mounting requirements. Space requirements, in particular the minimum distance to all the ventilating holes or grill, LIQUID CONNECTIONS and/or exhaust opening. Additional requirements for the rigidity and non-slip characteristics of the floor and/or laboratory bench. If a HAZARD could be caused by hot items falling from the equipment, for example when a door is opened, there shall be a warning that the equipment shall not be mounted on a surface of flammable material. Assembling the equipment away from overhead fire sensors, where opening of the door or lid or, exhausting of the fume is possible for NORMAL USE;

b) for equipment incorporating lockable swivel casters and/or levellers, the requirements to lock the casters and adjust the levellers;

c) ventilation requirements: if the operating of the equipment could lead to liberation of hazardous air or gas mixture, installation instructions shall warn of the need for an extraction system, and of additional TEMPERATURE-LIMITING DEVICES relating to safe temperatures for the materials, etc.;

d) requirements for liquid filling, draining or overflowing (see 10.1 b));

e) connection to the power source:

1) instructions for protective grounding;

2) for equipment intended for WET LOCATIONS (see 1.4.2) and in which HAZARDOUS LIVE parts may need to be ACCESSIBLE (see 6.1.2), warning symbol and statement that power socket with appropriate IP protection is used and whether external residual current circuit breaker (RCD) with RATED breaking capacity is necessary;

3) warning symbol and statement which are necessary when permanent connection to the supply source is essential;

4) for PERMANENTLY CONNECTED EQUIPMENT:

– supply wiring requirements;

– requirements for any external switch or circuit-breaker (see 6.11.3.1) and external overcurrent protection devices (see 9.6.2), and a recommendation that the switch or circuit-breaker be near the equipment;

f) requirements for special external services, for example, air and cooling liquid. Characteristics necessary for safety shall be specified, for example, maximum and minimum temperature, pressure, or flow of air or cooling liquid;

g) requirements for installation of and/or connection to vacuum pump, air compressor and/or steam source;

h) instructions relating to sound pressure level (see 12.5.1); the maximum sound power level produced by equipment which emits sound, if measurement is required by 12.5.1;

i) requirements for DRYING-OUT and/or STANDSTILL (see 5.4.3.101);

j) requirements for connecting a remote CONDENSING UNIT to the equipment, in particular, requirements for location, space, pipes, tubes, accessories (see 14.101), detailed specifications for REFRIGERANT (see 5.1.101), ventilation, water supply, and detailed procedures for connection and adjustment;

k) requirements for connecting a CIRCULATOR to the APPLICATION SYSTEM, in particular requirements for location, space, tubes, accessories (see 14.102), insulation, liquid HEAT TRANSFER MEDIUM, ventilation, water supply, and detailed procedures for connection and adjustment;

l) requirements for installing any functional lamp source, in particular recommended lamps and accessories, measures for protection against rupture of the lamp and its disposal, precautions for protection against HAZARDS of possible electric shock, hot surface, excessive optical and/or UV radiations, requirements for ventilation and water source, and detailed procedures for installation and adjustment;

m) requirements for connecting HUMIDIFIER or steam source to the equipment, in particular recommended type and specifications of the HUMIDIFIER, equivalent evaporation of the steam source, requirements for tubes, accessories, insulation, ventilation, water supply, and precautions for protection against HAZARDS of possible electric shock, hot surface, mechanical injury in association with the installation, and detailed procedures for installation and adjustment;

n) requirements for installation and adjustment for the MECHANICAL MOVEMENT.

Conformity is checked by inspection.

Addition:

Add the following new subclause:

5.4.3.101 DRYING-OUT and STANDSTILL

The instructions shall include a warning that the equipment cannot be assumed to meet all the safety requirements of this document during the DRYING-OUT and/or STANDSTILL.

Conformity is checked by inspection.

5.4.4 Equipment operation

Addition:

Add the following items after item j):

aa) requirements for the liquid HEAT TRANSFER MEDIUM and warning against HAZARDS related to improper use of the liquid;

– specifications of the liquid applicable to the equipment, in particular the CONTROLLED TEMPERATURE range, flammability, viscosity, FLASH POINT, FIRE POINT, AUTO IGNITION TEMPERATURE, specific gravity and specific heat capacity and their effect on applications (see 4.3.2.113);

– procedures and precautions for filling, draining and replacing (see 10.1 b));

– chemical HAZARD and instructions for disposal and emergency treatment;

– special requirements for HEAT TRANSFER MEDIA which change states during NORMAL USE, in particular the HEAT TRANSFER MEDIA in a salt BATH;

bb) instructions for how to calculate the cooling capacity and/or effective heating capacity for SPECIMENS and the APPLICATION SYSTEM;

NOTE 101 Cooling capacity is a measurement of the heat flow that a REFRIGERATING SYSTEM withdraws from the HEAT TRANSFER MEDIUM, as determined according to standard testing procedures, for example, DIN 12876-2.

NOTE 102 Effective heating capacity is a measurement of the heat flow that heating sources radiate to the HEAT TRANSFER MEDIUM.

cc) requirements for SPECIMEN loading, distributing and fixing within the working space for BATH, INCUBATOR or TEST CHAMBER or over the holder of MECHANICAL MOVEMENT;

dd) procedures to be followed to shut down the equipment safely and leave it in a safe state;

ee) warning against access to WALK-IN EQUIPMENT (see also Annex BB) for untrained personnel or children. Requirements for access to WALK-IN EQUIPMENT, in particular the use of personal protective equipment, presence of a second OPERATOR, unlocking mechanism and clearance of the door, and indicating device when the OPERATOR is inside the equipment;

ff) requirements for the ventilating device, access port (hatch) and LIQUID CONNECTIONS; warning against HAZARDS from high and low temperatures (see 10.1), liberated hazardous gas, liquid or solid (see 13.1);

gg) requirements for regular inspection and its intervals with regard to SPECIMEN fixing and potential HAZARDS during the shaking process;

hh) instructions for proper operation of and warning against HAZARDS from lamps and lamp systems, HUMIDIFIER or steam source and MECHANICAL MOVEMENT;

ii) instructions for use of personal protective equipment, protective measures or requirement for training.

Conformity is checked by inspection.

Addition:

Add the following new subclause:

5.4.4.101 Cleaning and decontamination

The instructions shall include conditions and intervals for cleaning and, where necessary, decontamination. The recognized generic names of recommended materials for cleaning and decontamination shall be given as well as an indication of any materials which could be likely to be used but which are incompatible with parts of the equipment or with material contained in it.

The instructions shall also state that the RESPONSIBLE BODY shall ensure that:

a) appropriate decontamination is carried out if a hazardous substance is spilt onto or into the equipment;

b) no decontamination or cleaning agents are used which could cause a HAZARD as a result of a reaction with parts of the equipment or with material contained in it;

c) the manufacturer or his agent is consulted if there is any doubt about the compatibility of decontamination or cleaning agents with parts of the equipment or with material contained in it.

If a manufacturer claims that an item can be decontaminated by steam sterilization, it shall be capable of withstanding steam sterilization under at least one of the time-temperature conditions given in Table 1.

Manufacturers should be aware of the internationally recognized "Laboratory Biosafety Manual", published by the World Health Organization in Geneva, which gives information on decontaminants, their use, dilutions, properties and potential applications. There are also national guidelines which cover these areas.

Cleaning and decontamination may be necessary as a safeguard when equipment intended for biological application and any accessories are maintained, repaired, or transferred. Manufacturers are required to provide a format for the RESPONSIBLE BODY to certify that such treatment has been carried out.

Table 101
Time-temperature conditions

Absolute pressure	Corresponding steam temperature		Minimum hold time
	Nominal	Range	
kPa	°C	°C	min
325	136,0	134 to 138	3
250	127,5	126 to 129	10
215	122,5	121 to 124	15
175	116,5	115 to 118	30
NOTE "Minimum hold time" means the time during which the containment is at steam temperature.			

Conformity is checked by inspection.

5.4.5 Equipment maintenance and service

Replacement:

Replace the text with the following:

Where continued safe operation is dependent on regular scheduled maintenance, inspection and/or testing of the equipment, the instructions to the RESPONSIBLE BODY shall detail the required maintenance, inspection and/or testing procedures, and provide information to assist the RESPONSIBLE BODY in determining a suitable maintenance schedule.

In particular the following details shall be included if applicable:

- Detailed specifications for the REFRIGERANT (see 5.1.101), HEAT TRANSFER MEDIUM, flexible tubing, hose, fittings, insulation materials, lamps, door gaskets which are specific to the equipment.

- Intervals, detailed procedures for checking the function of safety-related mechanisms of MECHANICAL MOVEMENT, specific consumable parts and accessories.

- Intervals, detailed procedures for inspecting the function of the TEMPERATURE-LIMITING DEVICE, LIQUID LEVEL CUT OUT, PRESSURE-LIMITING DEVICE and similar protective devices.

- Intervals and detailed procedures for cleaning of the piezo-electric transducer used in an ultrasonic HUMIDIFIER, RESISTANCE-HEATING DEVICE, water heat exchanger, and filters in the heat exchanging system.

- Statement that maintenance operations ACCESSIBLE by means of a TOOL shall be carried out only by trained personnel approved by the manufacturer.

- Where applicable, instructions shall specify procedures for the RESPONSIBLE BODY to check the effective operation of devices or systems for overtemperature protection, liquid level protection, high or low pressure protection, the unlocking or interlocking mechanism of a door or lid for escaping from within the WALK-IN EQUIPMENT (see Annex BB) which are necessary for safety, and shall state how often the checks need to be made.

If applicable, the manufacturer's documentation shall instruct against replacing detachable MAINS supply cords by inadequately RATED cords.

For equipment using replaceable batteries, the specific battery type shall be stated.

The instructions shall specify any parts which are required to be examined or supplied only by the manufacturer or his agent to ensure that safety is not compromised. Listing the manufacturer's part number is considered sufficient when the manufacturer does not wish to allow alternatives to be used.

The RATING and characteristics of replaceable fuses shall be stated.

Where special procedures are required to prepare equipment for periods of inactivity, storage or for decommissioning, these procedures shall be detailed in the instructions.

If the equipment is to be kept idle and/or stored under freezing ambient conditions, instructions for power disruption, liquid draining and DRYING-OUT shall be given.

Precaution statements and warnings against HAZARDS related to procedures for maintenance and inspection shall be given.

Instructions on the following subjects shall be provided for service personnel, as necessary to permit safe servicing and continued safety of the equipment after servicing if the equipment is suitable to be serviced:

a) RISKS, specific to the equipment, that can affect the service personnel;

b) protective measures for these RISKS;

c) verification of the safe state of the equipment after repair.

Instructions for service personnel need not be supplied to the RESPONSIBLE BODY, but should be made available to service personnel.

Conformity is checked by inspection.

Addition:

Add the following new subclauses:

5.4.101 Additional instructions for refrigerating equipment that use FLAMMABLE REFRIGERANT

For refrigerating equipment that us es FLAMMABLE REFRIGERANT, the instructions shall include sufficient information to ensure the safe handling, servicing and disposal of the equipment.

The instructions shall include the substance of the following warnings as necessary:

– WARNING: Ensure all ventilation openings are not obstructed;

– WARNING: Do not use mechanical devices or other means to accelerate the defrosting process, other than those recommended by the manufacturer;

– WARNING: Do not damage the refrigerant circuit;

– WARNING: Do not use electrical appliances within the equipment, other than those recommended by the manufacturer.

NOTE For the US, additional marking and informational requirements exist for refrigerating equipment which employs FLAMMABLE REFRIGERANTS. See Annex DD for detailed information.

For equipment which uses flammable gas for insulation blowing, the instructions shall include information regarding disposal of the equipment.

The instructions for equipment incorporating a remote REFRIGERANT CONDENSING UNIT that uses a FLAMMABLE REFRIGERANT shall include the substance of the following warning:

– WARNING: In order to reduce fire hazards, the installation of this equipment shall only be carried out by qualified personnel approved by the manufacturer.

The marking of the type of FLAMMABLE REFRIGERANT and of the flammable gas for insulation blowing shall be visible when gaining access to the MOTOR-COMPRESSORS, and, in the case of equipment with a remote REFRIGERANT CONDENSING UNIT, the pipe connections.

Symbol 102 of Table 1 shall be placed on the nameplate of the equipment near the declaration of the REFRIGERANT type and charge information. It shall be clearly visible after installation of the equipment.

Conformity is checked by inspection.

5.4.102 Additional instructions for equipment intended for use with a FLAMMABLE LIQUID HEAT TRANSFER MEDIUM

For BATHS, CIRCULATORS and shaking BATHS intended for use with a FLAMMABLE LIQUID HEAT TRANSFER MEDIUM, the instructions shall include sufficient information to ensure the safe handling, servicing and disposal of the equipment.

The instructions shall include the substance of the following warnings as necessary:

– WARNING: Ensure all ventilation openings are not obstructed;

– WARNING: No smoking! No flame! Do not use electrical parts which can produce spark when operating around the equipment and the application system;

– WARNING: Drain and recover the liquid when the equipment idles, if the liquid heat transfer medium is used with open bath tank and if it is highly volatile at ambient temperature.

A label carrying symbol 102 shall be provided with the equipment which can be used with a FLAMMABLE LIQUID HEAT TRANSFER MEDIUM along with instructions for the RESPONSIBLE BODY to affix the label visibly on the equipment if it is to be used with a FLAMMABLE LIQUID HEAT TRANSFER MEDIUM.

The instructions shall be provided with detailed information for procedures to reduce the RISK with regard to the use of a FLAMMABLE LIQUID HEAT TRANSFER MEDIUM, including how the adjustable TEMPERATURE-LIMITING DEVICE is adequately set so that the surface temperature in contact with the liquid is below the limit of 9.5 a).

Conformity is checked by inspection.

6 Protection against electric shock

This clause of Part 1 is applicable except as follows:

6.1.1 Requirements

Addition:

Add the following after the conformity statement:

If the installation instructions specify a STANDSTILL or DRYING-OUT (see 5.4.3.101), this is carried out before making the measurements set out in 6.3, 6.7.2.2 and 6.8. STANDSTILL or DRYING-OUT is followed by a rest period of 2 h, with the equipment de-energized, before the measurements are taken.

Measurements are made with the equipment at ambient temperature. If there is doubt whether the permissible limits could be exceeded at the least favourable combined operating conditions, the relevant measurements are repeated at these conditions and the higher values are used.

6.3.1 Levels in NORMAL CONDITION

Addition:

Add the following to item b) 1):

Levels for PERMANENTLY CONNECTED EQUIPMENT are 1,5 times these values.

6.3.2 Levels in SINGLE FAULT CONDITION

Addition:

Add the following to item b) 1):

Levels for PERMANENTLY CONNECTED EQUIPMENT are 1,5 times these values.

6.7.2.2 Solid insulation

Addition:

Add the following new subclause:

6.7.2.2.101 DRYING-OUT

If the performance requirements of the equipment cannot be achieved without the use of hygroscopic heater insulation, it is permissible for equipment to require a period of operation to dry out the insulation before meeting the requirements of 6.7.2.2, 6.3.1 and 6.8.2 provided that the OPERATOR is made aware of this (see 5.4.3.101).

Conformity is checked by performing the DRYING-OUT specified in the OPERATOR manual (see 5.4.3.101) before conducting the tests of 6.3.1 and 6.8.2.

6.8.1 General

Addition:

Add the following paragraph after the second paragraph:

If a DRYING-OUT is specified (see 6.7.2.2.101), this is carried out in accordance with the OPERATOR manual (see 5.4.3.101) before the tests of 6.8.3. DRYING-OUT is followed by a rest period of 2 h with the equipment de-energized. The tests are then performed and completed within 1 h at the end of the rest period.

6.8.2 Humidity preconditioning

Addition:

Add the following at the end of the last paragraph:

Equipment for which a DRYING-OUT is specified (see 5.4.3.101) shall not be subjected to humidity preconditioning.

6.9.1 General

Addition:

Add the following paragraph after the note:

Bare HAZARDOUS LIVE parts and insulated wiring and connections shall be so routed and arranged that the CLEARANCES and CREEPAGE DISTANCES are not reduced below acceptable values by:

1) liquids, vapours or impurities condensed, accumulated or leaking inside the equipment;

2) contact with hot or cold parts;

3) mechanical stress or abrasion by sharp edges.

6.10.1 MAINS supply cords

Replacement:

Replace the third and fourth paragraphs as follows:

If a cord is likely to come into contact with hot or cold external parts of the equipment, it shall be made of suitably temperature-resistant material or, alternatively, additional protection shall be provided to prevent the cord from coming into contact with the heated or cold surface.

If the cord is detachable, both the cord and the appliance inlet shall have adequate temperature RATINGS. The cord and the appliance inlet shall have a temperature RATING above the maximum temperatures measured under NORMAL CONDITION on any part of the appliance inlet itself.

The appliance coupler shall have a mechanism which prevents the cord of a lower temperature RATING from being inserted into the appliance inlet featuring a higher temperature RATING.

NOTE An appliance coupler in compliance with IEC 60320 (all parts), such as that with style C15 and C16, or C21 and C22 for hot conditions, or C15A and C16A for super hot conditions is an example of a required mechanism.

7 Protection against mechanical HAZARDS

This clause of Part 1 is applicable except as follows:

7.3.5.1 Gap limitations between moving parts – Access normally allowed

Addition:

Add the following paragraphs after the first paragraph:

If the width of the gap can decrease from a value larger than the minimum gap specified in Table 13 for that body part to a value smaller than the minimum gap in NORMAL CONDITION and SINGLE FAULT CONDITION, for example the door and/or locking device of TEST CHAMBERS or INCUBATORS, including WALK-IN EQUIPMENT (see Annex BB), the door or locking device shall be provided with a handle or shaft so that hand, wrist, fist and fingers are kept away from the moving gap during the operation of closing and/or locking the door. If twin doors are used, they may be so constructed that closing and/or locking of one door is possible only after the other door is closed, where the HAZARD of crushing is minimized.

Additional warning marking is necessary in proximity to the moving gap and where the locking device is located by using symbol 106 of Table 1.

Addition:

Add the following new subclause:

7.3.101 Warning markings for MECHANICAL MOVEMENT

The MECHANICAL MOVEMENT area in a SHAKER or COMBINED TEST CHAMBER shall be marked with symbol 14 of Table 1 or the applicable symbol 122 to 127 of Table AA.1.

The SPECIMEN holder of the MECHANICAL MOVEMENT shall be marked with symbol 14 of Table 1.

Conformity is checked by inspection.

7.4 Stability

Addition:

Add the following new subclauses:

7.4.101 Movement during operation

The equipment shall not change position during NORMAL USE.

Conformity is checked by inspection and test.

The equipment shall be operated according to the manufacturer's specifications, at the setting and load condition representing the worst case normal operating condition. Operating time is 10 min, or one operation cycle, whichever is shorter.

Movement shall be limited either by design, or by fastening to the mounting surface, or a combination of both, so that no part of the equipment moves outside a clearance envelope extending 5 mm, or less if stated by the manufacturer, in any direction from the outermost parts of the equipment in its original position.

During the tests the equipment shall remain in position. Any flexible tubing or other mechanical connection between the equipment and the APPLICATION SYSTEM shall withstand stress which could cause HAZARD.

For equipment intended for long-term continuous operation, the maximum excursion and test period is to be determined through the RISK assessment of Clause 17.

7.4.102 Removable SPECIMEN holder for MECHANICAL MOVEMENT

If a HAZARD, such as abnormal noise or mechanical injury from the imbalance or uncoupling of the SPECIMEN holder for MECHANICAL MOVEMENT during NORMAL USE could result during its removal or reengagement, the removable SPECIMEN holder shall be marked with an appropriate warning symbol in close proximity to the handles of the holder and an explanation shall be included in the documentation.

Conformity is checked by inspection.

7.5 Provisions for lifting and carrying

7.5.1 General

Addition:

Add the following text after the first paragraph:

Where the physical construction is such that parts which are not designed to be used as handles, grips, lifting devices or supporting parts could be mistaken as such, they shall:

a) have a strength identical to or higher than that required for normal lifting devices or supporting parts, or

b) have a warning marking (see 5.2) located adjacent to the relevant part(s), indicating that they shall not be used as handles, grips, lifting devices or supporting parts. Symbol 14 of Table 1 and additional explanations in the documentation are considered to meet the requirements.

Replacement:

Replace the conformity statement as follows:

Conformity is checked by inspection and as specified in 7.5.2 and 7.5.3.

8 Resistance to mechanical stresses

This clause of Part 1 is applicable except as follows:

8DV D1 ***Addition of Clauses 8DV.1 – 8DV.5 as follows:***

8DV.1 ***Refrigerant tubing on a refrigerator employing a flammable refrigerant shall be protected or enclosed to avoid mechanical damage and damage that could occur during moving of the product.***

8DV.1.1 ***Refrigerant tubing located within the confines of the cabinet and tubing that does not protrude from the compressor compartment are considered to be protected from mechanical damage.***

8DV.2 ***A static condenser coil mounted on the outside of a refrigerator is considered to be protected against mechanical damage if it complies with all of the following:***

– The return bends of the condenser are covered such that they cannot be grasped or handled during moving of the product. The return bends are considered to be adequately covered if they cannot be grasped with the jointed test finger (see Figure B.2) applied with a force of 20 N.

– The other edges of the condenser are covered or secured to prevent damage during moving of the product. They are considered adequately secured if they meet the pull force requirements of 8DV.5 without deformation of the tubing or loosening of the condenser from the refrigerator.

– All other tubing in the condenser is adequately protected by the fill wire. The tubing is considered adequately protected if any single tube cannot be grasped with the jointed test finger (see Figure B.2) applied with a force of 20 N.

8DV.3 ***A static evaporator coil mounted as shelving on the inside of a storage compartment is considered to be protected against mechanical damage if it complies with all of the following:***

– The shelf shall comply with clauses 8DV.5 and 7.5.3 with no permanent deformation or damage resulting in a refrigerant leak, kinked refrigerant tubing, or loosening of the tubing from the refrigerator.

– The tubing shall comply with the scratch test of 11.7.104.4.

8DV.4 ***All joints in a refrigeration system containing a FLAMMABLE REFRIGERANT shall be brazed or welded. Joining methods other than brazing or welding that have been evaluated with respect to corrosion resistance, mechanical stress, leak rates, and similar methods shall be considered to comply.***

8DV.5 ***A force is applied without jerks for 10 s in the most unfavourable direction to parts likely to be weak. The force is as follows:***

– if the shape of the part is such that the fingertips cannot easily slip off, 50 N;

– if the projection of the part that is gripped is less than 10 mm in the direction of removal, 30 N.

The pull force is applied by a suitable means, such as a suction cup, so that the test results are not affected. While the force is being applied, the test finger of Figure B.2 is inserted in any aperture or joint with a force of 10 N. The finger is then slid sideways with a force of 10 N but is not twisted or used as a lever.

8.1 General

Replacement:

Replace the text of item 3) by the following:

3) except for FIXED EQUIPMENT, for equipment with a mass over 100 kg, or for equipment whose size and weight make unintentional movement unlikely and which is not moved in NORMAL USE.

8.2.1 Static test

Replacement:

Replace the second paragraph by the following:

An ENCLOSURE which is non-metallic or has glass as part of its construction is operated until a steady-state condition is reached at the least favourable of the following conditions:

a) at maximum or minimum ambient temperature; or

b) at extended maximum or minimum ambient temperature; or

c) over the maximum or minimum CONTROLLED TEMPERATURE; or

d) cycled between the maximum and minimum CONTROLLED TEMPERATURE range; or

e) with all the lamps on and at maximum power input for radiation.

The equipment is disconnected from the supply source before the test is performed.

8.2.2 Impact test

Replacement:

Replace the first paragraph after the Note by the following:

An ENCLOSURE which is non-metallic or has glass as part of its construction is operated until a steady-state condition is reached at the least favourable of the following conditions:

a) at maximum or minimum ambient temperature; or

b) at extended maximum or minimum ambient temperature; or

c) over the maximum or minimum CONTROLLED TEMPERATURE; or

d) cycled between the maximum and minimum CONTROLLED TEMPERATURE range; or

e) with all the lamps on and at maximum power input for radiation.

The equipment is disconnected from the supply source and then tested within 10 min.

9 Protection against the spread of fire

This clause of Part 1 is applicable except as follows:

9.5 Requirements for equipment containing or using FLAMMABLE LIQUIDS

Addition:

Add the following text after the first paragraph:

This subclause 9.5 applies to FLAMMABLE LIQUIDS other than FLAMMABLE REFRIGERANTS. The requirements for FLAMMABLE REFRIGERANTS are covered in 5.4.101 and 11.7.101.

Replacement:

Replace item a) and Note 1 by the following:

a) The equipment shall be so constructed that it complies with items 1), 2) and 3) as follows:

1) In NORMAL CONDITION and SINGLE FAULT CONDITION, the surface temperature of the FLAMMABLE LIQUID shall not exceed the FLASH POINT of the liquid being exposed to the air.

2) In NORMAL CONDITION and SINGLE FAULT CONDITION, the surface temperature of any RESISTANCE-HEATING DEVICE at the surface of the FLAMMABLE LIQUID and in contact with air shall not exceed (t − 25) °C, where t is the FIRE POINT of the liquid.

3) For equipment where an OPERATOR setting could expose a FLAMMABLE LIQUID to a condition where the temperatures in a) 1) or 2) could be exceeded in the case of a SINGLE FAULT CONDITION during REASONABLY FORESEEABLE MISUSE, additional measures shall be provided to protect the OPERATOR from this HAZARD.

– For example, a LIQUID LEVEL CUT OUT that disables the RESISTANCE-HEATING DEVICE before the temperature requirements of a) 1) or 2) are exceeded is considered to comply with this requirement.

– Consideration should be given to any scenario that can expose any permitted FLAMMABLE LIQUID to a temperature that could exceed t_a – 100 °C, where t_a is the AUTO IGNITION TEMPERATURE.

– The use of a FLAMMABLE LIQUID not approved by the manufacturer for use in the equipment is not considered as an OPERATOR setting and is therefore beyond the evaluation of Clause 16.

NOTE 101 Guidance on what is considered REASONABLY FORESEEABLE MISUSE is provided in 16.1.

It is not sufficient to limit the surface temperature of the FLAMMABLE LIQUID and parts in contact with the surface solely by the temperature control system. Overtemperature protection meeting the requirements of 10.101 achieved by an independent, adjustable TEMPERATURE-LIMITING DEVICE shall be used.

NOTE 102 The surface temperature of a RESISTANCE-HEATING DEVICE used to heat a liquid can be considerably higher than the temperature of the liquid.

NOTE 103 Additional instructions for equipment intended for use with a FLAMMABLE LIQUID HEAT TRANSFER MEDIUM are detailed in 5.4.102.

Addition:

Add the following note after item c):

NOTE 104 Where FLAMMABLE LIQUID is present in the equipment, symbol 102 can be used as a warning marking.

Replacement:

Replace the first paragraph of the conformity statement by the following:

Conformity is checked by inspection, including nameplate, documentation and function of the equipment and, if necessary, by the tests and measurements of temperature as specified in 10.4 and 10.101.

10 Equipment temperature limits and resistance to heat

This clause of Part 1 is applicable except as follows:

10.1 Surface temperature limits for protection against burns

Replacement:

Replace the title by the following:

10.1 Surface temperature limits for protection against burns and frostbite

Replace the third paragraph by the following:

If easily touched heated surfaces are necessary for functional reasons, whether because they are intended to deliver heat or they are hot because of proximity to heating parts, they are permitted to exceed the values of Table 19 in NORMAL CONDITION and to exceed 105 °C in SINGLE FAULT CONDITION, provided that they are recognizable as such by appearance or function or are marked with symbol 13 of Table 1 (see 5.2). Equipment heated by its environment to temperature values exceeding the values in Table 19 in NORMAL CONDITION and 105 °C in SINGLE FAULT CONDITION need not be marked with symbol 13.

NOTE The limit for the maximum surface temperature of the housing of the discharge pipe in proximity to the MOTOR-COMPRESSOR conforming to IEC 60335-2-34 (including IEC 60335-2-34:2012, IEC 60335-2-34:2012/AMD1:2015 and IEC 60335-2-34:2012/AMD2:2016, Annex AA) is 150 °C when tested at 43 °C ambient.

If the minimum temperature of the easily touched cold surfaces exceeds the value of −30 °C, the cold surface shall be marked with symbol 101 of Table 1 1 to warn the OPERATOR of the HAZARD of frostbite (see 5.2). Equipment cooled by its environment to temperature values lower than −30 °C need not be marked with symbol 101.

Additionally, where the liquid temperature could be higher than +60 °C or lower than −30 °C, or where the temperature of air or gas mixture could be higher than +70 °C or lower than −40 °C, consideration should be given to mark the following to warn against possible burn and/or frostbite HAZARDS:

a) for movable immersion CIRCULATOR during movement for NORMAL USE, the surface of the equipment in close proximity to the wetted parts may be marked with symbol 13 and/or symbol 101.

b) LIQUID CONNECTIONS for circulating, draining or overflowing of the HEAT TRANSFER MEDIUM may be marked with symbol 13 and/or symbol 101, and/or with the maximum and/or minimum CONTROLLED TEMPERATURES of the equipment in association with symbols 108, 111, 117 or 118.

c) The exhaust opening may be marked with symbol 13 and/or symbol 101 and/or, the maximum and/or minimum CONTROLLED TEMPERATURES of the equipment in association with symbol 121.

d) If an enclosed CIRCULATOR is intended for a hydraulically sealed APPLICATION SYSTEM, the LIQUID CONNECTION for filling the BATH TANK or the exhaust of a PRESSURE-RELIEF DEVICE may be marked with symbol 13 and/or symbol 101 and/or the maximum and/or minimum CONTROLLED TEMPERATURES of the equipment in association with symbol 116.

Addition:

Add the following paragraph after the fourth paragraph:

For TEST CHAMBERS, INCUBATORS, and similar equipment with heating functions for high temperatures, there shall be an indication of the "ON" condition on each side of the equipment which has a door in it or has any other opening intended for loading of the SPECIMEN.

Replacement:

Replace the conformity statement with the following:

Conformity is checked by inspection and by measurement as specified in 10.4, and by inspection of barriers to check that protection against accidentally touching surfaces exceeding temperatures above the values of Table 19 is appropriate, and that they cannot be removed without the aid of a TOOL.

10.2 Temperatures of windings

Addition:

Add the following text and table after Table 20:

Conformity for MOTOR-COMPRESSORS is checked by measurement as specified in 10.4, in NORMAL CONDITION and in the applicable SINGLE FAULT CONDITIONS of 4.4.2.10, 4.4.2.101 and also in any other SINGLE FAULT CONDITIONS that could cause a HAZARD as a result of excessive temperature or pressure. The temperature limits for MOTOR-COMPRESSORS are defined in Table 102. The pressures are recorded for use in accordance with 11.7.2.

Table 102
Maximum temperatures for MOTOR-COMPRESSORS

Part of the MOTOR-COMPRESSOR	Temperature (°C)
Windings with	
– synthetic insulation	140
– cellulosic insulation or the like	130
Housing	150

10.4 Conduct of temperature tests

10.4.1 General

Replacement:

Replace the text with the following:

Maximum temperature is determined by measuring the temperature rise under reference test conditions defined by 4.3.1 of this document. Linear extrapolation is not permitted. Unless a particular SINGLE FAULT CONDITION specifies otherwise, the NORMAL USE of the equipment as defined in 4.3.2 of this document and the manufacturer's instructions concerning ventilation, cooling liquid, limits for intermittent use, etc., are followed. Any cooling liquid shall be at the highest RATED temperature. Operating pressures shall be monitored and recorded during all the temperature tests for use in the evaluation of the PS.

Alternatively, temperature measurements are made at the least favourable ambient temperature within the RATED ambient temperature range of the equipment if this represents a less favourable condition. Measures are taken to eliminate errors caused by the method of achieving the test ambient temperature (e.g. suitable baffling or ENCLOSURE if the test is conducted in an environmental testing TEST CHAMBER and the forced air movements would cool the exterior of the equipment).

When measuring temperatures and pressures for REFRIGERATING SYSTEMS, the tests shall be started from a SOAKED TEMPERATURE CONDITION when all pressures have been fully equalized. Tests at the extremes of the input voltage (±10 %) shall start under these voltage conditions and achieve a stable state but need not start from a SOAKED TEMPERATURE CONDITION. At the termination of the test, the monitoring shall continue after the equipment is switched off until the pressures from each REFRIGERANT stage have equalized or clearly demonstrate that maximum values have been reached.

During the test, protective devices other than self-resetting thermal motor-protectors for MOTOR-COMPRESSORS shall not operate. When steady conditions have been established, thermal motor-protectors for MOTOR-COMPRESSORS shall not operate.

Unless thermocouples are embedded in the windings of the MOTOR-COMPRESSOR, winding temperatures shall be taken using the change of resistance method in accordance with Annex E of IEC 60950-1:2005, and should be recorded at initial conditions and at steady-state. All other temperature and pressure measurements shall be taken continuously and the maximum temperatures and pressures recorded.

For MOTOR-COMPRESSORS conforming with IEC 60335-2-34 (including IEC 60335-2-34:2012, IEC 60335-2-34:2012/AMD1:2015 and IEC 60335-2-34:2012/AMD2:2016, Annex AA), the temperatures of the following parts are not measured:

– MOTOR-COMPRESSOR housing;

– MOTOR-COMPRESSOR windings and other accessories, such as parts for protection, start-up, and any other parts that are tested with MOTOR-COMPRESSORS in accordance with IEC 60335-2-34 (including IEC 60335-2-34:2012, IEC 60335-2-34:2012/AMD1:2015 and IEC 60335-2-34:2012/AMD2:2016, Annex AA).

For MOTOR-COMPRESSORS not conforming with IEC 60335-2-34 (including IEC 60335-2-34:2012, IEC 60335-2-34:2012/AMD1:2015 and IEC 60335-2-34:2012/AMD2:2016, Annex AA), the temperatures of the following parts shall not exceed the limits as specified in Table 102:

– MOTOR-COMPRESSOR housing;

– MOTOR-COMPRESSOR windings.

Addition:

Add the following new subclauses:

10.101 Overtemperature protection

When a single fault in the equipment could lead to a HAZARD from overheating of the equipment or material being processed, a non-self-resetting TEMPERATURE-LIMITING DEVICE or system meeting the requirements of 14.3 shall de-energize the RESISTANCE-HEATING DEVICE and any other parts which could cause a HAZARD.

If an insufficient quantity of liquid HEAT TRANSFER MEDIUM could cause a HAZARD, a self-resetting or non-self-resetting LIQUID LEVEL CUT OUT shall de-energize the RESISTANCE-HEATING DEVICE and any other parts which could cause a HAZARD. When the temperature of a surface in direct contact with the FLAMMABLE LIQUID HEAT TRANSFER MEDIUM exceeds t_a – 100 °C, where t_a = AUTO IGNITION TEMPERATURE, the LIQUID LEVEL CUT OUT shall operate before this surface can be exposed to air.

If a HAZARD could result from an incorrect immersion depth, movable immersion CIRCULATORS, when combined with either an open BATH TANK or a refrigerating BATH resulting in a BATH or CIRCULATOR, shall be marked with the maximum and minimum depth of immersion. These markings may be horizontal lines if additional explanation is included in the documentation.

For equipment designed to contain FLAMMABLE LIQUIDS, either for treatment or for heat-transfer, TEMPERATURE-LIMITING DEVICES or systems shall ensure, when set as directed in the manufacturer's instructions, that the temperature of the liquid shall not exceed the value as specified in 9.5 a) in NORMAL USE or SINGLE FAULT CONDITION.

The equipment as a whole, or the relevant parts, shall be de-energized by one of the following methods:

a) For single-phase equipment, the proposed circuit and physical construction shall be examined to identify possible single faults. The TEMPERATURE-LIMITING DEVICE shall be placed in the pole of the supply that provides the better protection from single faults that could defeat the overtemperature protection in the event of a subsequent failure of the temperature control system. A device which isolates both phase and neutral conductors at the same time can provide double fault protection (depending on application) and should be considered if the residual RISK is unacceptable.

Conformity is checked by inspection of the circuit diagram, the data sheet for the TEMPERATURE-LIMITING DEVICE, and the method in which it is installed in the equipment, and, if necessary, by the tests specified in 14.3.

b) For polyphase equipment, either by one single device or a system disconnecting all phases.

Consideration shall be given to the following:

– In equipment designed for the cooling and/or heating of materials, HAZARDS can arise from the overheating of materials being processed or overheating of the liquid HEAT TRANSFER MEDIUM as well as from the overheating of parts of the equipment itself. For this reason a higher level of safety may need to be provided in case of a SINGLE FAULT CONDITION in the equipment.

– In some cases, a fall in the CONTROLLED TEMPERATURE of a heated medium (for example liquid in a BATH or air in an oven or heating cabinet) could cause a HAZARD. If this could occur as a result of the operation of a TEMPERATURE-LIMITING DEVICE, an additional independent system may be used to prevent the CONTROLLED TEMPERATURE from falling to a hazardous level.

NOTE NORMAL USE (which is use in accordance with the manufacturer's instructions) includes the correct setting of any adjustable TEMPERATURE-LIMITING DEVICE. If the OPERATOR is instructed to change the set point of the TEMPERATURE-LIMITING DEVICE (including providing the TOOL if required) then the incorrect setting of the TEMPERATURE-LIMITING DEVICE can be considered REASONABLY FORESEEABLE MISUSE. Refer to 16.1 for additional guidance.

TEMPERATURE-LIMITING DEVICES necessary for safety shall be separate from any temperature controller. This applies not only to the temperature sensing means but also to all disconnecting devices in the circuits to be de-energized. Whether operated by temperature, pressure, liquid level, airflow or other means, they shall meet the requirements of 14.3.

Adjustable TEMPERATURE-LIMITING DEVICES and system shall be adjustable only with the aid of a TOOL or similar means that prevents unintended adjustment.

Conformity is checked by inspection and during the fault tests specified in 4.4.2.10, 4.4.2.11 and as applicable, the tests in 4.4.2.101 to 4.4.2.106.

10.102 Restarting after interruption of cooling and/or heating

According to applications, a HAZARD could arise either by re-starting or by not re-starting after interruption of the cooling and/or heating as result of the termination of the circulating or agitating in a BATH or CIRCULATOR and in an oven or TEST CHAMBER. Equipment shall be incorporated with the appropriate means to re-start or not re-start, and instructions shall specify whether the equipment will re-start or not re-start, both in the case of MAINS interruption and in the case of a SINGLE FAULT CONDITION.

NOTE In some cases, it can be appropriate for an audible or visible signal to warn that an interruption has occurred.

Conformity is checked by inspection and test.

11 Protection against HAZARDS from fluids and solid foreign objects

This clause of Part 1 is applicable except as follows:

11.1 General

Addition:

Add the following paragraph and Note 101 after the conformity statement:

Equipment intended to be connected to the water supply shall be constructed to prevent backsiphonage of non-potable water into the water supply.

NOTE 101 IEC 61770 gives requirements for preventing backsiphonage of non-potable water into the water supply and tests.

Conformity is checked by inspection.

11.3 Spillage

Addition:

Add the following text after the conformity statement:

The construction of a draining valve, nozzle and any other similar device shall be designed to prevent them from being opened or pulled out unintentionally.

Conformity is checked by inspection.

11.4 Overflow

Replacement:

Replace the title and text of 11.4 with the following:

11.4 Overflow and low level

Liquid overflowing from any container in the equipment which can be overfilled or overflowed, whether by the OPERATOR or for functional reasons as part of equipment operation, shall not cause a HAZARD during NORMAL USE or in SINGLE FAULT CONDITION, for example, as a result of the wetting of insulation or of internal uninsulated parts that are HAZARDOUS LIVE.

Equipment likely to be moved while a vessel is full of liquid shall be protected against liquid surging out of the vessel.

Equipment containing liquid, whether as the HEAT TRANSFER MEDIUM or as a result of treatment, experiencing expansion and contraction, evaporation, spray, rain or dripping when being heated, cooled, atomized, irrigated or condensed shall be provided with means to protect against any HAZARD associated with the overflow or low level during NORMAL USE or in SINGLE FAULT CONDITION.

Conformity is checked by inspection and by carrying out each of the following treatments and tests, if applicable. Immediately after the treatment, the CLEARANCE and solid insulation shall pass the voltage tests of 6.8 (without humidity preconditioning) applicable to the type of insulation (see 6.7), and ACCESSIBLE parts shall not exceed the limits of 6.3.1 for NORMAL USE and 6.3.2 under SINGLE FAULT CONDITION.

For BATHS, CIRCULATORS and similar equipment incorporating a liquid vessel, operate the equipment as follows:

Fill the BATH TANK or any other liquid vessel of the equipment to its maximum level with water unless otherwise specified, following the instructions of the manufacturer.

a) Spillage from overflow

> *The filling is continued for an additional amount equal to 20 % of the vessel capacity, but not less than 0,25 l, or for 1 min after the first evidence of overflow. Where no spillage occurs due to the function of the LIQUID CONNECTION for overflow that prevents such spillage, the filling is continued for a further amount equal to 30 % of the vessel capacity, or for 5 min following the overflow through the LIQUID CONNECTION.*
>
> *The LIQUID CONNECTION for overflow, if so equipped, shall be connected and fitted as instructed in the manual. If not specified by the manufacturer, use a filling rate of 10 l/min.*

Take the value resulting from the least favourable situation. There shall be no wetting of conductive live parts.

For a remotely controlled automatic refill system, a RISK assessment shall be carried out according to Clause 17.

b) Splash from low level

Drain the BATH TANK or any other liquid vessel of the equipment to its minimum level or just prior to the evidence of the triggering of the low LIQUID LEVEL CUT OUT, if so equipped, while keeping the equipment running and the functional assembly relying on appropriate liquid level operating, for example, by ensuring that the CIRCULATING PUMP and HUMIDIFIER are working.

There shall be no wetting of conductive live parts.

c) Spillage from expansion and contraction

Use the HEAT TRANSFER MEDIUM with the widest CONTROLLED TEMPERATURE range and highest coefficient of expansion applicable for the equipment as instructed by the manufacturer.

Set the CONTROLLED TEMPERATURE of the equipment at ambient and keep the CIRCULATING PUMP running until the CONTROLLED TEMPERATURE is stabilized, and:

1) set the CONTROLLED TEMPERATURE of the equipment to its minimum, then to its maximum applicable for the same liquid, and finally to ambient. Change the setting only if the CONTROLLED TEMPERATURE is stabilized at its setting or there is no evidence of further significant changing. Refill the BATH TANK if necessary with the same liquid to its maximum level for NORMAL USE prior to subsequent tests;

2) set the CONTROLLED TEMPERATURE of the equipment to its maximum, then to its minimum, and finally to ambient. Change the setting only if the CONTROLLED TEMPERATURE is stabilized at its setting or there is no evidence of further significant changing. Refill the BATH TANK if necessary with the same liquid to its maximum level for NORMAL USE prior to subsequent tests;

3) program the setting for the CONTROLLED TEMPERATURES of the equipment to its maximum, minimum and time for the change that maximum difference of the CONTROLLED TEMPERATURE changing is possible. Run the program with two repetitions or until no evidence of a more unfavourable situation is expected.

d) Surging from movement

Remove the plug from the power supply, and operate the equipment as follows:

1) For equipment with castors, or provided with accessory trolleys specified by the manufacturer:

– The equipment is moved in the forward direction on a smooth and solid surface at a speed of 0,5 m/s ± 0,1 m/s for 2 m, and then with one of the castors against a solid vertical plane obstacle. The obstacle shall have a rectangular cross section with a height of 10 mm ± 0,5 mm and a width of at least 80 mm with a radius of 2 mm ± 0,1 mm at the top edges. Unless the direction of movement is mechanically restricted or explicitly specified by the manufacturer, the longest side of the equipment should be aligned with the direction of travel.

– Equipment intended to be moved when the fluid-containing vessel is emptied shall be filled to 50 % of the maximum level.

– Operate the equipment with the obstacle against different castors, and repeat each test three times.

Take the value resulting from the least favourable situation. There shall be no wetting of conductive live parts, or if a HAZARD could result, no wetting of the OPERATOR's grips or handles.

A BATH TANK or any other liquid vessel incapable of sealed operation is left open. Equipment with fully enclosed fluid containing vessels is exempted from this test.

2) For equipment with lifting devices:

– equipment up to 18 kg, including liquid, is subjected to a cycling 10° tilt-test across the short side of the equipment, or

– equipment over 18 kg, including liquid, is subjected to a cycling 5° tilt-test across the long side of the equipment.

In either case, the equipment is subjected to 3 tilt-test cycles, where one cycle consists of the positions flat, tilted left, flat, tilted right, cycled within 10 s.

There shall be no wetting of conductive live parts, and if a HAZARD could result, no spillage outside the equipment or wetting of the OPERATOR's grips or handles.

A BATH TANK or any other liquid vessel incapable of sealed operation is left open. Equipment with fully enclosed fluid containing vessels is exempted from this test.

e) Spillage from condensate and simulated spraying, irrigating or raining

For equipment incorporating a drip pan, operate the equipment as follows:

Block the outlet of the drip pan. Fill the pan with water carefully to the brim without splashing. The drip pan is then subjected to a continuous overflow, the rate of which is adjusted to approximately 17 cm^3/s, or to its maximum RATING specified by the manufacturer. Apply an airflow of 1 m^3/s if the overflow is influenced by the airflow of the cooling of CIRCULATING FAN(S). The test is continued for a period of 30 min, or until water drains from the equipment.

Equipment incorporating a defrosting device is subjected to a complete cycle of defrosting under the least favourable conditions.

Equipment incorporating a spraying, irrigating or raining device is subjected to a complete cycle of spraying, irrigating or raining under the most unfavourable conditions.

Addition:

Add the following new subclauses:

11.4.101 Salt mist, thawing, condensate and spray

Where a HAZARD could result by direct exposure to the spray, the saturated compressed-air for salt-solution atomizing of the salt-spray-corrosion TEST CHAMBER shall be designed to be interlocked by the mechanism of the cover, so that it stops automatically or so that it will not start with the cover opened.

It is permissible for the interlock detailed above to be overridden where necessary for operation or maintenance and when spray is desired with the cover opened, only where activation of the spray is

controlled by a device that needs to be continuously held in the active state by the OPERATOR and the following warning symbol and statement is placed on the equipment:

Hazardous chemicals, use protective respirator, face mask, coverall s or gloves!

Conformity is checked by inspection and evaluation of the interlock according to Clause 15 if relied upon to mitigate the RISK.

The refrigerating subassembly and piping, where necessary for safety, shall be properly insulated and protected against occurrence of condensate or accumulation of frost for NORMAL USE. Salt mist, thawing, condensing and spraying water shall be collected and discharged, ensuring that no leakage, spillage or overflow occurs.

Conformity is checked by inspection. In case of doubt, the CLEARANCES and solid insulation shall pass the voltage tests of 6.8 (without humidity preconditioning) applicable to the type of insulation (see 6.7) and ACCESSIBLE parts shall not exceed the limits of 6.3.1.

11.4.102 HAZARDS from liquids in relation to the SPECIMEN and APPLICATION SYSTEM

Fixing devices, tube racks or insulated vessels, and flexible tubing and clamps, if necessary for safety, shall be provided with the equipment to fix the SPECIMENS or for connection to the APPLICATION SYSTEM to protect them from coming into contact with the HEAT TRANSFER MEDIUM.

Where a HAZARD could be caused by excessive torque or pressure applied to a high-viscosity liquid HEAT TRANSFER MEDIUM or to a pressure-sensitive APPLICATION SYSTEM, for example through rupture of a jacketed glass reactor, a CIRCULATOR with a discharge pressure exceeding 0,08 MPa shall be incorporated with pressure-indicating and adjusting devices. A safety device can be integrated to interrupt the CIRCULATING PUMP and initiate an alarm signal if the torque or pressure rises above a pre-set value.

According to the applications, a HAZARD could arise either by re-starting or by not re-starting after interruption of the circulation of the liquid. Equipment shall be incorporated with the appropriate means to re-start or not re-start, and instructions shall specify whether equipment will re-start or not re-start, both in the case of MAINS or mechanical interruption and in the case of a SINGLE FAULT CONDITION.

Conformity is checked by inspection and in case of doubt by measurement of pressure.

11.4.103 HAZARDS from liquids in relation to the SHAKER

Safety devices or means shall be provided with the SHAKER to protect against HAZARDS from splash and/or spillage of the liquids, accumulation of released volatile or hazardous substances, or condensation of the volatile substances. The safety device shall be independent of the controllers for MECHANICAL MOVEMENT and/or the temperature, humidity.

Conformity is checked by inspection.

11.4.104 Construction and warning markings related to manual filling or draining

Equipment incorporating a BATH TANK or other liquid container intended for manual filling or incorporating a reservoir for collecting condensate that requires manual draining, if the liquid level is not visible in construction or location, shall be equipped with a clearly visible liquid level indicator. Alternatively, if the liquid level indicator cannot be made available, a warning marking shall be applied and clearly visible in close proximity to the LIQUID CONNECTION for filling or draining. Additional explanations including instructions for operation and maintenance requirements for the warning marking shall be included in the documentation.

Conformity is checked by inspection.

11.4.105 Movable immersion CIRCULATOR

If HAZARDS could arise from liquid penetration or spillage when the movable immersion CIRCULATOR is removed from the BATH TANK and placed horizontally or upside down or during movement for NORMAL USE, it shall be marked with symbol 12 or symbol 14 of Table 1 to warn of electric or liquid HAZARD.

Conformity is checked by inspection.

11.4.106 Removable SPECIMEN holder for MECHANICAL MOVEMENT

If a HAZARD, such as spillage or overflow of the liquid, could result during the removal or reinsertion, the removable SPECIMEN holder for MECHANICAL MOVEMENT shall be marked with an appropriate warning symbol and text in close proximity to the handles of the holder, and an explanation shall be included in the documentation.

Conformity is checked by inspection or by operation in accordance with instructions.

11.7.1 Maximum pressure

Addition:

Add the following after the conformity statement:

The maximum pressure to which a part of the REFRIGERATING SYSTEM can be subjected under NORMAL CONDITION or SINGLE FAULT CONDITION shall not exceed the RATED MAXIMUM ALLOWABLE PRESSURE for the part. The RATED MAXIMUM ALLOWABLE PRESSURE of a component is determined either by its RATING if certified to the component requirements of 14.101 or by its design if the parts can pass the tests of 11.7.2.

The MAXIMUM ALLOWABLE PRESSURE (PS) of REFRIGERATING SYSTEMS shall be determined by test or by applying the saturated REFRIGERANT pressures at the minimum specified temperatures given in Table 103. When saturated REFRIGERANT pressures are used to define the PS, the manufacturer is exempted from the requirement to record the pressures during tests for NORMAL USE and under SINGLE FAULT CONDITIONS. If the start-to-discharge pressure of a PRESSURE RELIEF DEVICE or the set pressure of a ruptured member used in the REFRIGERATING SYSTEM is less than the SATURATED-VAPOUR PRESSURE in Table 103, it can be used to limit the PS for that system. The value of the PS when determined by test shall be considered to be the highest of the following:

a) the maximum pressure developed during the temperature test as defined in 10.4;

b) the maximum pressure developed during the abnormal test to simulate the failure of the controlled environment in accordance with 4.3.2.114, if applicable;

c) the maximum pressure developed during the test in SINGLE FAULT CONDITION for cooling as specified in 4.4.2.10;

d) the maximum pressure developed during the temperature test for transportation and storage as defined in 11.7.102.

NOTE 101 For a single REFRIGERATING SYSTEM, the pressure can be separated into two sections, the HIGH-PRESSURE SIDE and LOW-PRESSURE SIDE of each MOTOR-COMPRESSOR; the PS value can be different for each HIGH-PRESSURE SIDE and LOW-PRESSURE SIDE.

NOTE 102 It is possible that equipment meeting the requirements of 11.7 will not be accepted as conforming to national requirements relating to high pressures. There are notes applied to the relevant requirements which detail the modification of these requirements in order to be accepted as evidence of conformity with national regulations in the USA, in Canada, and in some other countries.

Table 103
Minimum temperature for the determination of SATURATED-VAPOUR PRESSURE of the REFRIGERANT

Ambient conditions	**≤ 43 °C**	**≤ 55 °C**
HIGH-PRESSURE SIDE with air-cooled CONDENSER	63 °C	67 °C
HIGH-PRESSURE SIDE with water-cooled CONDENSER	Maximum leaving water temperature + 8 °C	
HIGH-PRESSURE SIDE with evaporative CONDENSER in a CASCADE SYSTEM	43 °C	55 °C
LOW-PRESSURE SIDE with heat exchanger exposed to the outdoor ambient temperature	43 °C	55 °C
LOW-PRESSURE SIDE with heat exchanger exposed to the indoor ambient temperature	38 °C	38 °C
NOTE 1 For the HIGH-PRESSURE SIDE, the specified temperatures are considered the maximum which will occur during operation. These temperatures are higher than those during the off cycle of THE MOTOR-COMPRESSOR. For the LOW-PRESSURE SIDE and/or intermediate pressure side, it is sufficient to base the calculation of pressure on the expected temperature during the off cycle of the MOTOR-COMPRESSOR. These temperatures are minimum temperatures and thus determine that the system will not be designed for a MAXIMUM ALLOWABLE PRESSURE lower than the REFRIGERANT SATURATED-VAPOUR PRESSURE corresponding to these minimum temperatures. NOTE 2 The use of specified temperatures does not always result in REFRIGERANT SATURATED-VAPOUR PRESSURE within the system, for example a limited-charge REFRIGERATING SYSTEM or a system working at or above critical temperature, CO_2 in particular. NOTE 3 For zeotropic blends, the MAXIMUM ALLOWABLE PRESSURE (PS) is the pressure at the bubble point.		

Conformity is checked by inspection of the RATINGS of the parts and, if necessary, by measuring the pressures.

11.7.2 Leakage and rupture at high pressure

Addition:

Add the following new subclauses:

11.7.2.101 Leakage and rupture of REFRIGERATING SYSTEMS

11.7.2.101.1 General

REFRIGERANT-containing parts of a REFRIGERATING SYSTEM shall not cause a HAZARD through rupture or leakage. The specific requirements for REFRIGERATING SYSTEMS using FLAMMABLE REFRIGERANT or FLAMMABLE REFRIGERANT blends are addressed in 11.7.101.

For components subject to the pressure at the HIGH-PRESSURE SIDE or LOW-PRESSURE SIDE of the REFRIGERATING SYSTEM, the structural strength of the fluid-containing parts shall comply with three times the PS as defined in 11.7.1 for the HIGH-PRESSURE SIDE or LOW-PRESSURE SIDE.

Conformity is checked by inspection of the RATINGS of the components exposed to this pressure and, if a HAZARD could arise, by the pressure test in 11.7.2.101.2 and 11.7.2.101.3. Components that are certified to the component requirements in 14.101 and are used within their RATINGS (component pressure RATING ≥ PS) are deemed to comply with this requirement without test.

NOTE 1 For evidence of conformity with national regulations in the USA, in Canada, and in some other countries, the structural strength of components is identical but the design RATING of the component is different based on the safety margin required in the

national regulations. For example, in the USA, the design RATING for a component complying with the ASME boiler code is 1/5 of the structural strength of the component.

NOTE 2 In conjunction with NOTE 1, the minimum structural strength RATING of REFRIGERANT-containing components in the USA and Canada is 5 times the PS measured during normal pressure tests and 3 times the PS measured during abnormal pressure tests, where PS is derived from tests in 10.4 for the HIGH-PRESSURE SIDE or LOW-PRESSURE SIDE and the test in 4.4.2.10 for the HIGH-PRESSURE SIDE only. Note the fact of these certification differences during selection of certified components from North America based on the testing conducted in this document.

11.7.2.101.2 Pressure test

The pressure of the component or assembly (equipment under test (EUT)) is raised gradually, by air or non-hazardous gas or via a hydrostatic pressure test, to the specified test value and is held at that value for 1 min. If the continuously CONTROLLED TEMPERATURE for the EUT is less than or equal to 125 °C for copper or aluminium, or 200 °C for steel, the test temperature of the EUT during this test shall be at least 20 °C. If the continuously CONTROLLED TEMPERATURE for the EUT exceeds 125 °C for copper or aluminium, or 200 °C for steel, the test temperature of the EUT during this test shall be at least 150 °C for copper or aluminium and 260 °C for steel. For other materials or higher CONTROLLED TEMPERATURES, the effects of temperature on the material fatigue characteristics shall be evaluated.

The EUT is considered to comply with the requirements of 11.7.2.101 if it can withstand the pressure test without rupture. If the EUT does not comply, then an alternative method to demonstrate compliance is to subject the EUT to the test in 11.7.2.101.3.

11.7.102.2DV.1 D1 *Addition of the following at the end of the first paragraph:*

The test value shall be determined as the higher of the following 3:

5 times the pressure under normal use [see 11.7.1 a)]

3 times the pressure under transportation [see 11.7.1 d)]

3 times the pressure under single fault condition [see 11.7.1 b) and c)]

11.7.2.101.3 Fatigue test

If the continuously CONTROLLED TEMPERATURE of the EUT exceeds 125 °C for copper or aluminium, or 200 °C for steel, the fatigue test temperature of the parts or assemblies that are at these CONTROLLED TEMPERATURES, shall be at least 10 K above the continuously CONTROLLED TEMPERATURE. The static test pressure shall be increased by the ratio of the allowable stress of the material at ambient temperature to that at the highest continuously CONTROLLED TEMPERATURE. For other materials, the effects of the CONTROLLED TEMPERATURE on the fatigue characteristics shall be evaluated to determine the test conditions.

Three test samples shall be filled with fluid, and shall be connected to a pressure-driving source. The pressure shall be raised and lowered between the upper and lower cyclic values at a rate specified by the manufacturer for a total number of 250 000 cycles. The entire specified pressure excursion shall occur during each cycle.

The following test pressures shall be applied:

For safety purposes, it is suggested that a non-compressible fluid be used.

– For components at the LOW-PRESSURE SIDE, the PS for the LOW-PRESSURE SIDE shall be applied for the first cycle. For components at the HIGH-PRESSURE SIDE, the PS for the HIGH-PRESSURE SIDE shall be applied for the first cycle.

The pressure for the test cycles shall be as follows:

– The upper pressure value shall not be less than 0,7 times the PS and the lower pressure value shall not be greater than 0,7 times the PS. The upper pressure shall be 0,9 times the PS, for water-cooled condensers.

– For the final test cycle, the test pressure shall be increased to 1,4 times the PS (2 × 0,7 × PS). The pressure shall be 1,8 times the PS (2 × 0,9 × PS), for water-cooled CONDENSERS.

The component shall not rupture, burst or leak during this test.

A strength pressure test at 2 times the PS is to be performed on three samples other than the samples used for the fatigue test.

The component shall not rupture, burst or leak during this test.

11.7.3 Leakage from low-pressure parts

Addition:

Add the following text after the conformity statement:

For REFRIGERATING SYSTEMS, the requirements of 11.7.2 address the low -pressure leakage evaluation.

Addition:

Add the following new subclauses:

11.7.101 Additional requirements for REFRIGERATING SYSTEMS that use FLAMMABLE REFRIGERANT

11.7.101.1 General

This document addresses the requirements for REFRIGERATING SYSTEMS which use FLAMMABLE REFRIGERANT when the amount of REFRIGERANT is limited to a maximum of 150 g in each separate REFRIGERANT circuit. For equipment that uses a REFRIGERANT charge of FLAMMABLE REFRIGERANT that exceeds this amount, additional requirements shall apply.

NOTE ISO 5149-1 or EN 378 (all parts) are standards that address the requirements for REFRIGERATING SYSTEMs that utilize more than 150 g of FLAMMABLE REFRIGERANT and can be used to identify what the additional requirements can be.

11.7.101.2 Protected REFRIGERATING SYSTEM

Equipment with a protected REFRIGERATING SYSTEM is that:

– without any part of the REFRIGERATING SYSTEM inside an OPERATOR access compartment;

– where any part of the REFRIGERATING SYSTEM which is located inside an OPERATOR access compartment is constructed so that the REFRIGERANT is contained within an ENCLOSURE with at least two layers of metallic materials separating the REFRIGERANT from the OPERATOR access compartment, each layer having

a thickness of at least 0,1 mm. The ENCLOSURE has no joints other than the bonded seams of the EVAPORATOR where the bonded seam has a width of at least 6 mm;

– where any part of the REFRIGERATING SYSTEM which is located inside an OPERATOR access compartment has the REFRIGERANT contained in an ENCLOSURE which itself is contained within a separate protective ENCLOSURE. If leakage from the containing ENCLOSURE occurs, the leaked REFRIGERANT is contained within the protective ENCLOSURE and the REFRIGERATING SYSTEM will not function as in NORMAL USE. The protective ENCLOSURE shall also withstand the test of 11.7.2.101. No critical point in the protective ENCLOSURE shall be located within the OPERATOR access compartment.

Separate compartments with a common air circuit are considered to be a single compartment.

Equipment with a protected REFRIGERATING SYSTEM and which uses FLAMMABLE REFRIGERANT shall be so constructed as to avoid any fire or explosion HAZARD in the event of leakage of the REFRIGERANT from the REFRIGERATING SYSTEM.

Separate components such as thermostats which contain less than 0,5 g of FLAMMABLE REFRIGERANT are not considered to cause a fire or explosion HAZARD in the event of a leakage from the component itself.

For equipment with a protected REFRIGERATING SYSTEM, no additional requirements apply to electrical components located inside OPERATOR access compartments.

Equipment with a protected REFRIGERATING SYSTEM which, when tested, is found not to comply with the requirements specified for a protected REFRIGERATING SYSTEM, may be considered as having an unprotected REFRIGERATING SYSTEM if it is tested in accordance with 11.7.101.5 and found to comply with the requirement for an unprotected REFRIGERATING SYSTEM.

Compliance is checked by inspection and by the tests of 11.7.101.3 and 11.7.101.4.

11.7.101.3 Leakage test for FLAMMABLE REFRIGERANT

Critical points are only considered to be the interconnecting joints between parts of the REFRIGERANT circuit, including the gasket of a semi-hermetic MOTOR-COMPRESSOR. Welded telescopic joints of the MOTOR-COMPRESSOR, the welding of the pipes through the compressor housing and the welding of the fusite are not considered critical points.

To find the most critical point of the REFRIGERATING SYSTEM, it can be necessary to perform more than one test.

The method for simulating a leakage is to inject the REFRIGERANT vapour through a capillary tube at the critical point. The capillary tube shall have a bore of 0,7 mm ± 0,05 mm and a length between 2 m and 3 m.

Care should be taken that the installation of the capillary tube does not unduly influence the results of the test and that foreign material does not enter the capillary tube during insulation or assembly for the test. The capillary tube may need to be positioned before the equipment is insulated.

During this test the equipment is tested with doors and lids closed, and is switched off or operated under NORMAL CONDITION at RATED voltage, whichever gives the more unfavourable result.

During a test in which the equipment is operated, gas injection is started at the same time as the equipment is first switched on.

The quantity of REFRIGERANT of the type indicated by the manufacturer to be injected is equal to 80 % of the nominal charge of the REFRIGERANT ±1,5 g or the maximum that can be injected in 1 h, whichever is the smaller.

The quantity injected is taken from the vapour side of a gas bottle which shall contain enough liquid REFRIGERANT to ensure that, at the end of the test, there is still liquid REFRIGERANT left in the bottle.

If a REFRIGERANT blend can fractionate, the test is performed using the fraction that has the smallest value of the LOWER EXPLOSIVE LIMIT.

The gas bottle is kept at a temperature of:

a) 32 °C ± 2 °C for leakage simulation on the LOW-PRESSURE SIDE;

b) 70 °C ± 2 °C for leakage simulation on the HIGH-PRESSURE SIDE.

The quantity of gas injected should preferably be measured by weighing the bottle.

The concentration of leaked REFRIGERANT is measured at least every 30 s from the beginning of the test and for at least 1 h after injection of the gas has stopped, inside and outside OPERATOR ACCESSIBLE areas, as close as possible to the electrical components which, during NORMAL USE or abnormal operation, produce sparks or arcs.

The concentration is not measured close to:

– non-self-resetting protective devices necessary for compliance with single fault testing under 4.4 even if they produce arcs or sparks during operation;

– intentionally weak parts that become permanently open-circuited during the single fault testing under 4.4 even if they produce arcs or sparks during operation;

– an electrical device that has been tested and found to comply with at least the requirements in Annex EE.

The instrument used for monitoring gas concentrations (such as those which use infrared sensing techniques) should have a fast response, typically 2 s to 3 s and not unduly influence the result of the test.

If gas chromatography is to be used, the gas sampling in the confined areas should occur at a rate not exceeding 2 ml every 30 s.

Other instruments are not precluded from being used provided that they do not unduly influence the results.

The measured value shall not exceed 75 % of the LOWER EXPLOSIVE LIMIT of the REFRIGERANT as specified in Table 104, and shall not exceed 50 % of the LOWER EXPLOSIVE LIMIT of the REFRIGERANT as specified in Table 104 for a period exceeding 5 min.

Substitution of an inert gas for leak test purposes is permitted if it can be demonstrated that the molecular mass of an inert gas matches that of the FLAMMABLE REFRIGERANT in question.

11.7.101.4 Scratch test for protected REFRIGERATING SYSTEMS

All ACCESSIBLE surfaces of protected REFRIGERATING SYSTEMS, including ACCESSIBLE surfaces in intimate contact with the protected REFRIGERATING SYSTEMS, are scratched using the TOOL, the tip of which is shown in Figure 103.

The TOOL is applied using the following parameters:

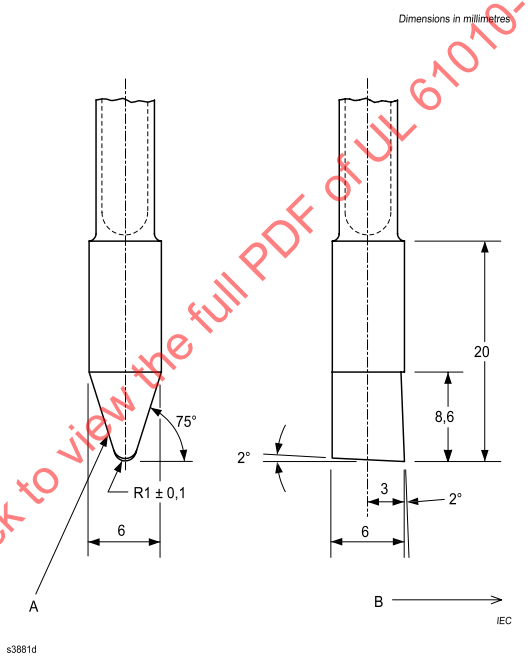
– force at right angles to the surface to be tested	*35 N ± 3 N;*
force parallel to the surface to be tested	*not exceeding 250 N.*

The TOOL is drawn across the surface to be tested at a rate of approximately 1 mm/s.

The surface to be tested is scratched at three different positions in a direction at right angles to the axis of the channel and at three different positions on the channel in a direction parallel to it. In the latter case, the length of the scratch shall be approximately 50 mm.

The scratches shall not cross each other.

The appropriate parts of the REFRIGERATING SYSTEM shall withstand the test of 11.7.2.101 with the test pressure reduced by 50 %.



Key

A Hard-soldered carbide tip K10

B Direction of movement

Figure 103

Scratching TOOL tip details

11.7.101.5 Unprotected REFRIGERATING SYSTEMS

Equipment with an unprotected REFRIGERATING SYSTEM is that where at least one part of the REFRIGERATING SYSTEM is placed inside an OPERATOR ACCESSIBLE compartment or that which does not comply with 11.7.101.2.

For equipment with an unprotected REFRIGERATING SYSTEM and which uses a FLAMMABLE REFRIGERANT, any electrical component located inside the OPERATOR ACCESSIBLE compartment, which during NORMAL

CONDITION or SINGLE FAULT CONDITION produces arcs or sparks, and luminaries, shall be tested and found at a minimum to comply with the requirements of Annex EE for group IIA gases or for the REFRIGERANT used.

This requirement does not apply to:

– non-self-resetting protective devices necessary for compliance with 4.4; nor to

– intentionally weak parts that become permanently open -circuited during the tests of 4.4, even if they produce arcs or sparks during operation.

REFRIGERANT leakage into OPERATOR ACCESSIBLE compartments shall not result in an EXPLOSIVE GAS ATMOSPHERE outside the OPERATOR ACCESSIBLE compartments in areas where electrical components that produce arcs and sparks during NORMAL USE or abnormal operation, or luminaries, are mounted, when doors or lids remain closed or when opening or closing doors or lids, unless these components have been tested and found at a minimum to comply with Annex EE for group IIA gases or for the REFRIGERANT used.

This requirement does not apply to:

– non-self-resetting protective devices necessary for compliance with 4.4; nor to

– intentionally weak parts that become permanently open -circuited during the tests of 4.4, even if they produce arcs or sparks during operation.

Separate components such as thermostats which contain less than 0,5 g of flammable gas are not considered to cause a fire or explosion HAZARD in the event of a leakage from the component itself.

Other types of protection for electrical devices for potentially EXPLOSIVE GAS ATMOSPHERES covered by IEC 60079 (all parts) are also acceptable.

Changing of a lamp is not considered a potential explosion HAZARD, because the door or lid is open during this operation.

Compliance is checked by inspection, by the appropriate tests of IEC 60079-15:2010 and by the following test.

The tests contained in Annex EE may be carried out using the stoichiometric concentration of the REFRIGERANT used. However, a device which has been independently tested and found to comply with Annex EE using the gas specified for group IIA need not be tested.

Irrespective of the requirements given in IEC 60079-15:2010, Clause 5, surface temperature limits are specified in 11.7.101.7.

The test is performed in a draught-free location with the equipment switched off or operated under conditions of NORMAL USE at RATED voltage, whichever gives the more unfavourable result.

During a test in which the equipment is operated, gas injection is started at the same time as the equipment is first switched on.

The test is performed twice and is repeated a third time if one of the first tests gives more than 40 % of the LOWER EXPLOSIVE LIMIT.

Through an appropriate orifice, 80 % of the nominal REFRIGERANT charge ±1,5 g, in the vapour state, is injected into an OPERATOR ACCESSIBLE compartment in a time not exceeding 10 min. The orifice is then closed. The injection shall be as close as possible to the centre of the back wall of the compartment at a

distance from the top of the compartment approximately equal to one-third of the height of the compartment. Thirty minutes after the injection is completed, the door or lid is opened at a uniform rate in a time between 2 s and 4 s, to an angle of 90° or to the maximum possible, whichever is less.

For equipment having more than one door or lid, the most unfavourable sequence or combination of opening the lids or doors is used.

For equipment fitted with fan motors, the test is performed with the most unfavourable combination of motor operation.

The concentration of leaked REFRIGERANT is measured every 30 s from the beginning of the test, at positions as close as possible to the electrical components. However, it is not measured at the locations of:

– non-self-resetting protective devices necessary for compliance with 4.4; nor at

– intentionally weak parts that become permanently open-circuited during the tests of 4.4, even if they produce arcs or sparks during operation.

The concentration values are recorded until they tend to go down.

The measured value shall not exceed 75 % of the LOWER EXPLOSIVE LIMIT of the REFRIGERANT as specified in Table 104, and shall not exceed 50 % of the LOWER EXPLOSIVE LIMIT of the REFRIGERANT as specified in Table 104 for a period exceeding 5 min.

The above test is repeated, except that the door or lid is subjected to an open/close sequence at a uniform rate in a time of between 2 s and 4 s, the door or lid being opened to an angle of 90° or to the maximum possible, whichever is less, and closed during the sequence.

11.7.101.6 Stagnation of leaked FLAMMABLE REFRIGERANT

Equipment which uses FLAMMABLE REFRIGERANT shall be constructed so that leaked REFRIGERANT will not stagnate and thus cause a fire or explosion HAZARD in areas outside the OPERATOR ACCESSIBLE compartment where components producing arcs or sparks or luminaires are mounted.

This requirement does not apply to areas where:

– non-self-resetting protective devices necessary for compliance with 4.4; or

– intentionally weak parts that become permanently open-circuited during the test of 4.4

are mounted, even if they produce arcs and sparks during operation.

Separate components such as thermostats that contain less than 0,5 g of flammable gas are not considered to cause a fire or explosion HAZARD in the event of a leakage of the component itself.

Compliance is checked by the following test, unless luminaires and components that produce arcs and sparks during NORMAL USE and which are mounted in the areas under consideration, have been tested and found to comply at a minimum with the requirements in Annex EE for group IIA gases or for the REFRIGERANT used.

Irrespective of the requirements given in IEC 60079-15:2010, Clause 5, the surface temperature limits are specified in 11.7.101.7.

Other types of protection for electrical devices for potentially EXPLOSIVE GAS ATMOSPHERES covered by IEC 60079 (all parts) are also acceptable.

The test is performed in a draught-free location with the appliance switched off or operated under NORMAL USE at RATED voltage, whichever gives the more unfavourable result when an ignition source is present.

During a test in which the equipment is operated, gas injection is started at the same time as the equipment is first switched on.

A quantity equal to 50 % of the REFRIGERANT charge ±1,5 g is injected into the considered area.

Injection is to be at a constant rate over a period of 1 h and is to be at the point of closest approach of:

– pipe-work joints in external parts of the refrigerating circuit,

– the gaskets of semi-hermetic MOTOR-COMPRESSORS,

to the electrical component under consideration. Any direct injection shall be avoided.

Welded telescopic joints of the MOTOR-COMPRESSOR, the welding of the pipes through the compressor housing and the welding of the fusite are not considered to be pipework joints.

The concentration of leaked REFRIGERANT as close as possible to the electrical component is measured continuously from the beginning of the test until it starts to decrease.

The measured value shall not exceed 75 % of the LOWER EXPLOSIVE LIMIT of the REFRIGERANT as specified in Table 104, and shall not exceed 50 % of the LOWER EXPLOSIVE LIMIT of the REFRIGERANT as specified in Table 104 for a period exceeding 5 min.

11.7.101.7 Surface temperature limits

Temperatures on surfaces that can be exposed to leakage of FLAMMABLE REFRIGERANT shall not exceed the AUTO IGNITION TEMPERATURE of the REFRIGERANT as specified in Table 104, reduced by 100 K.

Compliance is checked by measuring the appropriate surface temperatures during the tests specified in 4.4 and Clause 10.

Temperatures of

– non-self-resetting protective devices that operate during the tests specified in 4.4; or

– intentionally weak parts that become permanently open-circuited during the tests specified in 4.4

are not measured during those tests specified in 4.4 that cause these devices to operate.

Table 104
REFRIGERANT flammability parameters

REFRIGERANT number	REFRIGERANT name	REFRIGERANT formula	REFRIGERANT AUTO IGNITION TEMPERATURE [a,c] °C	REFRIGERANT LOWER EXPLOSIVE LIMIT [b,c,d,e] % V/V
R50	Methane	CH_4	645	4,9
R170	Ethane	CH_3CH_3	515	3,1
R290	Propane	$CH_3CH_2CH_3$	470	1,7
R600	n-Butane	$CH_3CH_2CH_2CH_3$	365	1,5
R600a	Isobutane	$CH(CH_3)_3$	460	1,8
R1150	Ethene	$CH_2=CH_2$	425	3,1
R1270	Propylene	$CH_2=CHCH_3$	455	2,3

[a] Values for other FLAMMABLE REFRIGERANTS shall be obtained from IEC 60079-20-1.
[b] Values for other FLAMMABLE REFRIGERANTS shall be obtained from IEC 60079-20-1 and ISO 5149-1.
[c] IEC 60079-20-1 is the reference standard. ISO 5149-1 may be used if the required data is not contained in IEC 60079-20-1.
[d] Concentration of REFRIGERANT in dry air.
[e] In some standards, the term "flammability limit" is used for "LOWER EXPLOSIVE LIMIT".

11.7.102 Temperature test for storage and transport

11.7.102.1 General

Pressures developed from SOAKED TEMPERATURE CONDITIONS resulting from the temperatures the REFRIGERATING SYSTEM is exposed to during storage and/or transport shall not cause a HAZARD.

These pressures are used as one input for determining the PS (11.7.1) and are derived by the test below or from the REFRIGERANT SATURATED-VAPOUR PRESSURES at a storage and/or transport ambient temperature of 55 °C for NORMAL CONDITION or 70 °C for storage and/or transport under tropical conditions.

For pressures in parts protected by a PRESSURE-RELIEF DEVICE, the test pressure shall not exceed 0,9 times the setting of that device during storage and/or transport.

For refrigerating equipment that uses FLAMMABLE REFRIGERANT, the storage and/or transport ambient temperature shall be 70 °C.

Conformity is checked by inspection of the RATINGS of the components exposed to this pressure and, if a HAZARD could arise, by the tests of 11.7.2.

If there is any doubt as to the SATURATED-VAPOUR PRESSURE of the REFRIGERANT in use, then the test pressure shall be derived by one of the following test methods: 11.7.102.2 or 11.7.102.3, or the calculation of 11.7.102.4.

11.7.102.2 Test of charge-to-volume ratio

The steps for the test of charge-to-volume ratio are as follows:

a) calculate the total volume of the REFRIGERATING SYSTEM in question;

b) calculate the charge-to-volume ratio for the design charge;

c) take a charging cylinder of known volume and charge it to give the same volume-to-mass ratio as the system to be simulated;

d) place the cylinder with a pressure gauge or transducer in a controlled ambient environment defined by the storage and/or transport ambient temperature and allow the cylinder to soak;

e) record the maximum pressure and use this value as the test pressure for the REFRIGERATING SYSTEM.

11.7.102.3 Test by pressure under the SOAKED TEMPERATURE CONDITION

The steps for test by pressure under the SOAKED TEMPERATURE CONDITION are as follows:

a) measure the pressure of the REFRIGERATING SYSTEM under the SOAKED TEMPERATURE CONDITION;

b) use an evacuated cylinder and heat it up to the SOAKED TEMPERATURE CONDITION;

c) charge the cylinder with the same REFRIGERANT used in the REFRIGERATING SYSTEM under the SOAKED TEMPERATURE CONDITION until it has the same pressure as the REFRIGERATING SYSTEM in the SOAKED TEMPERATURE CONDITION;

d) place the cylinder with a pressure gauge or transducer in a controlled ambient environment defined by the storage and/or transport ambient temperature and allow the cylinder to soak;

e) record the maximum pressure and use this value as the test pressure for the REFRIGERATING SYSTEM.

11.7.102.4 Calculation by using the ideal gas law

FLAMMABLE REFRIGERANTS are assumed to be ideal gases. Calculate the pressure at transport and storage conditions by using the ideal gas law, based on the pressure and temperature in the SOAKED TEMPERATURE CONDITION.

11.7.103 Internal fluid leaks

Where, in a SINGLE FAULT CONDITION, fluid can leak within the equipment, this shall not cause a HAZARD.

Fluid-containing parts meeting the construction requirements of IEC 60079-15:2010 can be assumed not to leak. Other fluid-containing parts and seals shall be assumed to leak.

In particular, leaked FLAMMABLE LIQUID shall not come into contact with any ignition sources. Equipment containing no spark-generating parts (see Annex EE) and where no surface temperature exceeds t_a − 100 K (see 9.5 a) and 11.7.101.7), where t_a is the AUTO IGNITION TEMPERATURE of the liquid, is considered to meet this requirement.

Conformity is checked by inspection, by performing the tests of 4.4.2.102 and 10.4.

12 Protection against radiation, including laser sources, and against sonic and ultrasonic pressure

This clause of Part 1 is applicable except as follows:

12.1 General

Replacement:

Replace the text with the following:

The equipment shall provide protection against the effects of internally generated optical, ultraviolet, ionizing and microwave radiation as well as laser sources, and sonic and ultrasonic pressure.

Conformity tests are carried out if the equipment is likely to cause such HAZARDS.

12.2.1.3 Equipment not intended to emit radiation

Addition:

Add the following paragraph and Note 101 after the conformity statement:

The equipment intended for application to radioactive substances, for example chemicals in a jacketed reactor, or a plant, seed or insect treated with radioactive chemicals, shall be isolated to provide protection against transmission of ionizing radiation, and the operation of the equipment shall be strictly supervised to follow the rules and regulations for radiation laboratories to reduce the amount of ionizing radiation to an acceptable level (see also 5.4.4.101). The RESPONSIBLE BODY or the OPERATOR shall apply the symbol 17 of Table 1 with the signature of the OPERATOR. The symbol shall at the minimum be in close proximity to where the SPECIMEN is kept and easily visible for NORMAL USE.

NOTE 101 Examples of such equipment include the BATH, CIRCULATOR and climatic TEST CHAMBER for biological applications, etc.

Conformity is checked by inspection.

12.3 Optical radiation

Addition:

Add the following text after the first paragraph:

Where the exposure to hazardous radiation is inevitable for functional reasons, the equipment shall incorporate protective measures to limit exposure to a safe level. Equipment incorporating a lamp and lamp systems that can produce hazardous effects shall be marked with symbol 104 to warn of optical radiation, with symbol 13 to warn of a burn HAZARD, or with symbol 14 to warning of other HAZARDS, as applicable.

13 Protection against liberated gases and substances, explosion and implosion

This clause of Part 1 is applicable except as follows:

13.1 Poisonous and injurious gases and substances

Addition:

Add a new sentence at the end of the first paragraph:

For example, the high temperature decomposition products of the oil HEAT TRANSFER MEDIUM.

13.2.1 Components

Replacement:

Replace the title and text in 13.2.1 with the following:

13.2.1 Components of the equipment and materials being treated

If components liable to explode are not provided with a PRESSURE-RELIEF DEVICE, or if the equipment is intended to treat materials in such a way that explosion or implosion can occur, protection for the OPERATOR shall be incorporated with the equipment (see 7.7) or otherwise personal protective measures shall be included in the OPERATOR instructions. PRESSURE-RELIEF DEVICES shall be located so that a discharge will not cause HAZARD to the OPERATOR. The construction shall be such that the PRESSURE-RELIEF DEVICE cannot be obstructed.

Addition:

Add the following new subclauses:

13.2.101 Implosion of low air pressure equipment

A low air pressure TEST CHAMBER or vacuum oven shall be incorporated with protection for the OPERATOR and the surroundings against the effects of implosion.

Conformity is checked by inspection of the equipment and of the design information and, in case of doubt, by provoking an implosion.

13.2.102 Explosion and implosion of lamps

The lamps or lamp systems shall be incorporated and constructed to provide protection against explosion and implosion, whether for normal operation or for maintenance, under mechanical and thermal stresses resulting from shaking, vibrating, thermal shocking over the CONTROLLED TEMPERATURE range, or unexpected contact with a cold liquid.

Lamps liable to explode or implode when vibrated, shaken, heated, cooled or thermal shocked over the CONTROLLED TEMPERATURE range and, where a HAZARD could arise when ruptured, shall be protected with an explosion-proof transparent shield which is ACCESSIBLE only with the aid of a TOOL. If glass is used, it shall not be in contact with the surface of the lamps and it shall be subjected to the tests of 8.2, and meet the pass criteria of 8.1 of this document.

Conformity is checked by inspection.

Addition:

Add the following new subclauses:

13.101 Biohazardous substances

Equipment that can be potentially infectious, whether from the SPECIMEN itself or as a result of treatment with biohazardous agents or formulations, shall be prominently marked with symbol 103 of Table 1. At a minimum, the symbol shall be in close proximity to where the SPECIMEN or biohazardous substance is kept and easily visible during NORMAL USE.

Symbol 103 shall be placed near any biohazardous area ACCESSIBLE during OPERATOR maintenance and visible only during this maintenance.

Where applicable, symbol 103 shall also be attached to disposal bags or containers for biologically hazardous materials removed from the equipment, and to any LIQUID CONNECTIONS or exhaust openings where the liberation of biohazardous substances can occur during NORMAL USE.

Equipment that can be hazardous due to the use of hazardous substances shall be marked with an appropriate international symbol, or (if none is available) symbol 14 of Table 1.

See also 5.4.3 c) for details of instructions relating to ventilation requirements.

NOTE Local, national or regional regulations concerning the collection or discharge of biohazardous material can apply.

Conformity is checked by inspection.

13.102 Warning requirements related to chemical HAZARD

Equipment intended for chemical applications, such as BATHS, CIRCULATORS, SHAKERS, climatic TEST CHAMBERS and salt spray corrosion TEST CHAMBERS, and which could present chemical HAZARDS to the OPERATOR and the environment, shall be marked with a symbol or text suitable to the chemical HAZARD. The symbol shall be in close proximity to where the SPECIMEN is kept and easily visible during NORMAL USE. Where applicable, the symbol or text shall also be attached to glassware such as flasks for shaking or immersion applications, APPLICATION SYSTEMS such as jacketed reactors containing hazardous chemicals, or LIQUID CONNECTIONS and exhaust openings where liberating of chemical contaminants can occur during NORMAL USE.

See also 5.4.3 c) for details of instructions relating to ventilation requirements.

NOTE Examples of chemical HAZARDS presented by these types of equipment are salt mist, salt solutions, SPECIMENS treated with salt spray, pest insects, microorganisms or plants treated with pesticides, radioactive substances and chemical mixtures.

Symbol 102 of Table 1 is used for warnings pertaining to flammable materials. Symbols for other chemical HAZARDS may be selected from ISO 7010, as follows:

a) for explosive materials, W002:2011-05

b) for radioactive materials, W003:2011-05

c) for toxic materials, W016:2011-05

d) for corrosive materials, W023:2011-05

e) for oxidizing substances, W028:2011-05

f) for other chemical HAZARDS, other appropriate symbols from ISO 7010.

If there is no appropriate symbol for the particular chemical HAZARD, symbol 14 of Table 1 shall be used and additional explanations of the chemical HAZARD shall be included in the documentation.

Conformity is checked by inspection.

14 Components and subassemblies

This clause of Part 1 is applicable except as follows:

14.3 Overtemperature protection devices

Replacement:

Replace the text by the following:

TEMPERATURE-LIMITING DEVICES and systems for overtemperature protection designed to operate in SINGLE FAULT CONDITION shall meet all of the following requirements:

a) be constructed and tested to ensure reliable function. Devices of the capillary type shall be so designed that the protection is kept complete in the event of leakage from the capillary tube;

b) be RATED to interrupt the maximum voltage and current of the circuit in which they are employed;

c) do not operate in NORMAL USE.

LIQUID LEVEL CUT OUTS used to protect against overtemperature shall meet the same requirements as TEMPERATURE-LIMITING DEVICES and systems.

Conformity is checked by studying the operating principle of the device or system or by fracturing the capillary tube and by performing adequate reliability tests with the equipment operated in SINGLE FAULT CONDITION. Ensure that the capillary tube is not obstructed when it is being fractured.

The number of operations is as follows:

1) non-resetting devices are caused to operate once;

2) non-self-resetting devices and systems, except thermal fuses, are reset after each operation and thus caused to operate 10 times;

3) self-resetting devices are caused to operate 200 times.

NOTE Forced cooling and resting periods can be introduced to prevent damage to the equipment.

During the test, resetting devices shall operate each time the SINGLE FAULT CONDITION is applied and non-resetting devices shall operate once to provide the expected protection. After the test, the resetting devices shall show no sign of damage which could prevent their operation in a further SINGLE FAULT CONDITION.

Addition:

Add the following new subclauses:

14.101 Components and subassemblies for REFRIGERATING SYSTEMS

Components and piping that are part of the REFRIGERATING SYSTEM shall comply with the related standards or requirements as indicated in Annex CC or be evaluated according to the pressure RATING requirements of this document (see 11.7.2).

Conformity is checked by inspection or as specified in 11.7.2, as applicable.

14.102 Flexible tubing and hose subjected to liquid pressure other than that of the REFRIGERANT

Flexible tubing and hose subjected to the RATED PRESSURE of the equipment shall be of sufficient mechanical strength.

The construction and materials of the flexible tubing and hose, including fittings and thermal insulation for subassemblies if any, shall withstand mechanical, chemical and thermal stresses encountered for NORMAL USE.

Conformity is checked by the following tests and, in case of doubt, by tests repeated at RATED PRESSURE and temperature:

The high pressure flexible tubing and hose for liquid circulating shall be subjected to a static pressure test of four times the RATED PRESSURE at ambient temperature and under the maximum CONTROLLED TEMPERATURE range of the intended application, whereby the test pressure shall be reached between 15 s and 30 s after starting at zero pressure.

NOTE The PRESSURE-RELIEF DEVICE and/or alternative sensing devices can be rendered inoperative in this test.

The flexible tubing and hose used for water supply, if any, shall be subjected to a static pressure test of two times the maximum inlet pressure for 5 min at ambient temperature.

During the test there shall be no leakage or rupture.

15 Protection by interlocks

This clause of Part 1 is applicable except as follows:

15.1 General

Replacement:

Replace the text with the following:

Interlocks used to protect OPERATORS from HAZARDS shall prevent an OPERATOR from being exposed to the HAZARD before the HAZARD is removed and shall meet the requirements of 15.2, 15.3 and 15.101 to 15.104 as applicable.

Conformity is checked by inspection and by performing all the relevant tests of this document.

Addition:

Add the following new subclauses:

15.101 Mechanism of door and/or lock for WALK-IN EQUIPMENT

It shall be possible to escape from the WALK-IN EQUIPMENT at all times.

The door for WALK-IN EQUIPMENT shall be so designed and constructed that its opening is possible both from the outside and from within the equipment, with the priority assigned to the unlocking and opening from within the equipment.

NOTE 1 A separate door or exit independent of the main entrance which is locked and opened from outside the equipment, when ACCESSIBLE only from within the equipment and when open to the outside, is considered to meet this requirement.

NOTE 2 Additional requirements for WALK-IN EQUIPMENT can apply in accordance with Annex BB.

When the door is closed and/or locked from within the equipment, there shall be an illuminated indication in proximity to the controller outside the equipment, which reads: "equipment in operation, OPERATOR inside the room!" The indication shall be interlocked to one or more of the following settings ACCESSIBLE from outside:

1) the maximum CONTROLLED TEMPERATURE not exceeding: +40 °C

2) the minimum CONTROLLED TEMPERATURE not exceeding: −30 °C

3) start the VENTILATOR or any other similar devices;

4) disable the initiation of vacuum pump or any evacuating system;

5) limit the number of lamps or the light emitting intensity in accordance with 12.3 and/or warn the OPERATOR of the HAZARD and the necessity for protective eyewear if hazardous optical radiation exists.

Conformity is checked by inspection of the documentation and in accordance with 15.2 and 15.3.

15.102 Interlock between the CIRCULATING PUMP, agitator and heating, cooling, MECHANICAL MOVEMENT and/or operation of the APPLICATION SYSTEM

The RESISTANCE-HEATING DEVICE and/or MOTOR-COMPRESSOR of the BATH and CIRCULATOR shall be interlocked with the CIRCULATING PUMP, agitator and, where applicable, the APPLICATION SYSTEM, if HAZARDS could arise due to one or more of the following:

– the CONTROLLED TEMPERATURE of the equipment deviates from its setting to some extent, resulting in overheating or deep cooling of the SPECIMEN or APPLICATION SYSTEM;

– localized overheating or deep cooling of the liquid HEAT TRANSFER MEDIUM occurs as a result of the termination of the CIRCULATING PUMP or agitator;

– obstruction or leakage of the external liquid circulating occurs between the equipment and the APPLICATION SYSTEM.

Depending on the related HAZARD, the RESISTANCE-HEATING DEVICE or the MOTOR-COMPRESSOR, or both, shall be de-energized if the CIRCULATING PUMP and/or agitator is interrupted and if the CONTROLLED TEMPERATURE deviates from its setting to some extent, and the operation of the APPLICATION SYSTEM shall be controlled to prevent the developing of the HAZARD.

NOTE Whether the RESISTANCE-HEATING DEVICE or the MOTOR-COMPRESSOR alone, or both, are de-energized depends on the related HAZARD. It is advantageous to provide the equipment with means such that either or both of these could be interlocked and available to the OPERATOR with additional instructions for the configuration of the function.

Conformity is checked by inspection and by operating the interlocks as specified in the documentation and in accordance with 15.2 and 15.3.

15.103 Interlock between CIRCULATING FAN, door or lid and heating, cooling and/or radiation, humidifying and MECHANICAL MOVEMENT

The RESISTANCE-HEATING DEVICE and/or MOTOR-COMPRESSOR and, where applicable, the radiation, humidifying, MECHANICAL MOVEMENT, shall be interlocked with the CIRCULATING FAN if HAZARDS could arise due to one or more of the following:

– the CONTROLLED TEMPERATURE of the equipment deviates from its setting to some extent, resulting in overheating or deep cooling of the SPECIMEN;

– where the RESISTANCE-HEATING DEVICE and/or EVAPORATOR are located, localized overheating and/or deep cooling occur(s) resulting from the termination of the CIRCULATING FAN;

– with the door or lid open, continuous heating and/or cooling, and humidifying can occur if the settings deviate from the ambient temperature and humidity;

– with the door or lid open, the OPERATOR or the surroundings can be exposed to excessive optical radiation or any other hazardous radiation;

– with the door or lid open, the OPERATOR can be exposed to mechanical HAZARD if MECHANICAL MOVEMENT continues.

Depending on the related HAZARD, the RESISTANCE-HEATING DEVICE or the MOTOR-COMPRESSOR, or both, shall be de-energized if the CIRCULATING FAN is interrupted and if the CONTROLLED TEMPERATURE deviates from its setting to some extent. The CIRCULATING FAN shall be switched off while or some time after the door or lid is opened, while the HUMIDIFIER, lamp or lamp systems (see 12.3) and MECHANICAL MOVEMENT shall be terminated or reduced to a safe level with the door or lid opened.

NOTE Whether the RESISTANCE-HEATING DEVICE or the MOTOR-COMPRESSOR alone or both are de-energized depends on the related HAZARD. It is advantageous to provide the equipment with means that either or both of them could be interlocked and available to the OPERATOR with additional instructions for the configuration of the function.

Conformity is checked by inspection and by operating the interlocks as specified in the documentation and, in accordance with 15.2 and 15.3.

15.104 Interlock between salt spray and cover of salt spray corrosion TEST CHAMBER

The mechanism of the cover for the salt spray corrosion TEST CHAMBER shall meet the requirements specified in 11.4.101 of this document. The activation of the saturated compressed-air for salt solution atomizing shall be interlocked by the mechanism of the cover.

Conformity is checked by inspection and by operating the interlocks as specified in the documentation and in accordance with 15.2 and 15.3.

16 HAZARDS resulting from application

This clause of Part 1 is applicable except as follows.

16.1 REASONABLY FORESEEABLE MISUSE

Replacement:

Replace the text as follows:

The equipment shall comply with the requirements of this document during NORMAL USE, including mistakes, lapses, slips or use of an equipment or system in a way not intended by the manufacturer, but which can result from readily predictable human behaviour. Such acts to consider would include well-meant optimization or readily available shortcuts.

No HAZARD shall arise in NORMAL USE or SINGLE FAULT CONDITION, through readily available adjustments, knobs, or other software-based or hardware-based controls are set in a way not intended, or not described in the instructions.

Reckless use, unqualified use or use outside the specifications set by the manufacturer is not considered as part of this document. Similarly, intended acts or intended omissions of an act by the OPERATOR of the equipment as a result of conduct that is beyond any reasonable means of RISK control by the manufacturer are similarly excluded from the scope of this document.

Other possible cases of REASONABLY FORESEEABLE MISUSE that are not addressed by specific requirements in this document shall be addressed by the RISK assessment (see Clause 17).

Addition:

Add the following new subclause:

16.101 Slip HAZARD

For WALK-IN EQUIPMENT (see Annex BB), where the ground or floor can be slippery when wet or icy, the equipment shall be designed and constructed in such a way as to minimize the RISK of slipping. Where a slip HAZARD remains, appropriate means including personal protective measures which enable the OPERATOR to maintain their stability and safety shall be provided (for example handholds that are fixed relative to the OPERATOR) and the equipment shall be permanently marked with symbol 105 of Table 1, warning of slippery surface and against the HAZARD of falling. The symbol shall be placed on the door or on the inside wall of the equipment, where it is clearly visible for the OPERATOR during NORMAL USE.

Conformity is checked by inspection.

17 RISK assessment

This clause of Part 1 is applicable.

Annexes

The annexes of Part 1 are applicable except as follows:

Annex K
(normative)

Insulation requirements not covered by 6.7

K.1.3 Solid insulation for MAINS CIRCUITS

K.1.3.1 General

Addition:

Add the following paragraph after Note 1:

If the performance of the equipment requires the use of a hygroscopic insulated RESISTANCE-HEATING DEVICE, it is permissible for equipment to require a period of operation to dry out the insulation before meeting the requirements of 6.3.1 and 6.8.3, provided that the OPERATOR is made aware of this (see 5.4.3.101).

Addition:

Add the following paragraph after the conformity statement:

If a DRYING-OUT is specified, conformity is checked by performing the DRYING-OUT specified in the OPERATOR manual (see 5.4.3.101) before conducting the tests of a) and b) above.