

INTERNATIONAL STANDARD

NORME INTERNATIONALE



GROUP SAFETY PUBLICATION
PUBLICATION GROUPEE DE SÉCURITÉ

**Safety requirements for electrical equipment for measurement, control, and laboratory use –
Part 2-011: Particular requirements for REFRIGERATING EQUIPMENT**

**Exigences de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire –
Partie 2-011: Exigences particulières pour APPAREILS DE REFRIGERATION**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



GROUP SAFETY PUBLICATION
PUBLICATION GROUPEE DE SÉCURITÉ

**Safety requirements for electrical equipment for measurement, control, and laboratory use –
Part 2-011: Particular requirements for REFRIGERATING EQUIPMENT**

**Exigences de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire –
Partie 2-011: Exigences particulières pour APPAREILS DE REFRIGERATION**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 19.080

ISBN 978-2-8322-6658-8

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	7
1 Scope and object.....	10
2 Normative references	11
3 Terms and definitions	11
4 Tests	13
5 Marking and documentation.....	16
6 Protection against electric shock	17
7 Protection against mechanical HAZARDS.....	19
8 Resistance to mechanical stresses	19
9 Protection against the spread of fire	19
10 Equipment temperature limits and resistance to heat.....	20
11 Protection against HAZARDS from fluids and solid foreign objects	21
12 Protection against radiation, including laser sources, and against sonic and ultrasonic pressure	32
13 Protection against liberated gases and substances, explosion and implosion	32
14 Components and subassemblies	32
15 Protection by interlocks	33
16 HAZARDS resulting from application.....	33
17 RISK assessment	33
Annexes	34
Annex G (informative) Leakage and rupture from fluids under pressure	35
Annex L (informative) Index of defined terms	36
Annex AA (normative) Non-sparking electrical device.....	37
Annex BB (informative) HAZARD associated with REFRIGERATING SYSTEMS and REFRIGERANTS	38
Annex CC (informative) Safety requirements for components and piping	40
Annex DD (informative) Equipment containing FLAMMABLE REFRIGERANTS – Information and marking requirements	45
Bibliography.....	49
Figure 101 – Schema of a REFRIGERATING SYSTEM incorporating a condenser.....	8
Figure 102 – Flow chart illustrating the selection process	9
Figure 103 – Scratching TOOL tip details	27
Table 1 – Symbols	17
Table 101 – Maximum temperatures for MOTOR-COMPRESSORS	20
Table 102 – Minimum temperature for determination of saturated vapor pressure of REFRIGERANT	22
Table 103 – REFRIGERANT flammability parameters	31
Table CC.1 – Parameters of pressure vessels according to EN 14276-1	40
Table CC.2 – Parameters of piping according to EN 14276-2.....	42

Table CC.3 – Component and piping requirements43
Table CC.4 – Minimum wall thickness for copper and steel tubing44
Table DD.1 – Quantity of Group A2/A3 REFRIGERANT per occupied space.....48

Currently in preview, click buy full version

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT
FOR MEASUREMENT, CONTROL, AND LABORATORY USE –****Part 2-011: Particular requirements for REFRIGERATING EQUIPMENT**

FOREWORD

- 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, accept 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 61010-2-011 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) introduction of new defined terms or modified terms to align with Part 2-012 and other source documents. Editorial changes to use small capitals only for defined terms. Note the difference of defined term ABNORMAL OPERATION (3.107) in 4.3.2.101 and abnormal operation in 11.7.104.3 and 11.7.104.5;

- c) clarifications for cooling tests in 4.4.2.10;
- d) changes pertaining to the accurate employment of the following terms: temperature, operating temperature, application temperature, CONTROLLED TEMPERATURE, room ambient and ambient temperature;
- e) use of defined term REFRIGERATING SYSTEM to replace cooling system;
- f) move text of 4.4.2.101 to 4.3.2.101, since the purpose of ABNORMAL OPERATION, as defined, is to simulate failure of the ambient conditions of 1.4.1 but not of the SINGLE FAULT CONDITION of the equipment;
- g) use of the term equipment to replace unit, apparatus, appliance, where applicable;
- h) in 5.1.2 dd) PS for high and low sides for each REFRIGERANT stage are required only under NORMAL CONDITION;
- i) use of defined term NORMAL CONDITION to replace normal operation;
- j) use of defined term OPERATOR to replace user.

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

CDV	Report on voting
66/676/CDV	66/683/RVC

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.

This Part 2-011 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 2-011 supplements or modifies the corresponding clauses in IEC 61010-1 so as to convert that publication into the IEC standard: *Particular requirements for REFRIGERATING EQUIPMENT*.

Where a particular subclause of Part 1 is not mentioned in this Part 2-011, that subclause applies as far as is reasonable. Where this Part 2-011 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 and additional list items are lettered 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 document using a colour printer.

INTRODUCTION

This Part 2-011, along with Part 2-010 and Part 2-012, 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 such as irradiation, excessive humidity, CO ₂ and mechanical movement.

Guidance for the application of the correct Part 2 standard (1)

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 of Figure 102 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?

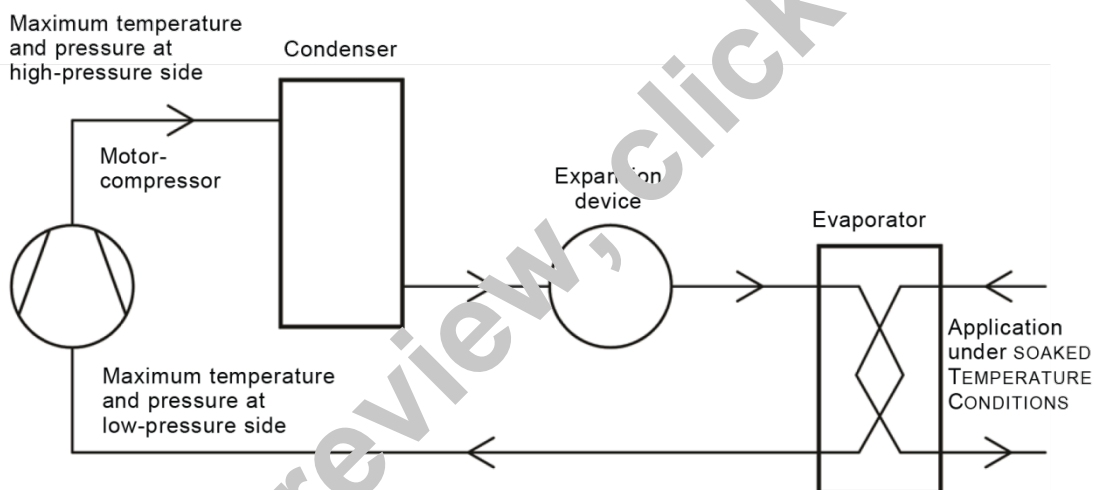
The typical HAZARDS for a REFRIGERATING SYSTEM (see Figure 101) consisting of a MOTOR-COMPRESSOR, a condenser, an expansion device and an evaporator include but are not limited to:

- The excess of temperature of the low-pressure side (return temperature) to the MOTOR-COMPRESSOR is higher than admissible. A MOTOR-COMPRESSOR incorporates a REFRIGERANT cooled motor and it should be established that the maximum temperatures of low-pressure side under least favourable condition do not exceed the insulation RATINGS within the motor.
- The excess of pressure of the low-pressure side at the inlet to the MOTOR-COMPRESSOR is higher than admissible. 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 excess of temperature of the high-pressure side to the condenser is higher than admissible. The temperatures of the high-pressure side under the most unfavourable

conditions can present a temperature HAZARD if the OPERATOR is exposed, or an electrical HAZARD if insulation is degraded.

- The excess of pressure of the high-pressure side to the condenser is higher than admissible. 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 correct safety margin for a pressure vessel.
- The maximum CONTROLLED TEMPERATURES where the heat is being extracted from, may impact the maximum temperature of the low-pressure side to the MOTOR-COMPRESSOR as well as present a temperature HAZARD if the OPERATOR is exposed, or an electrical HAZARD if 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.



IEC

Figure 101 – Schema of a REFRIGERATING SYSTEM incorporating a condenser

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

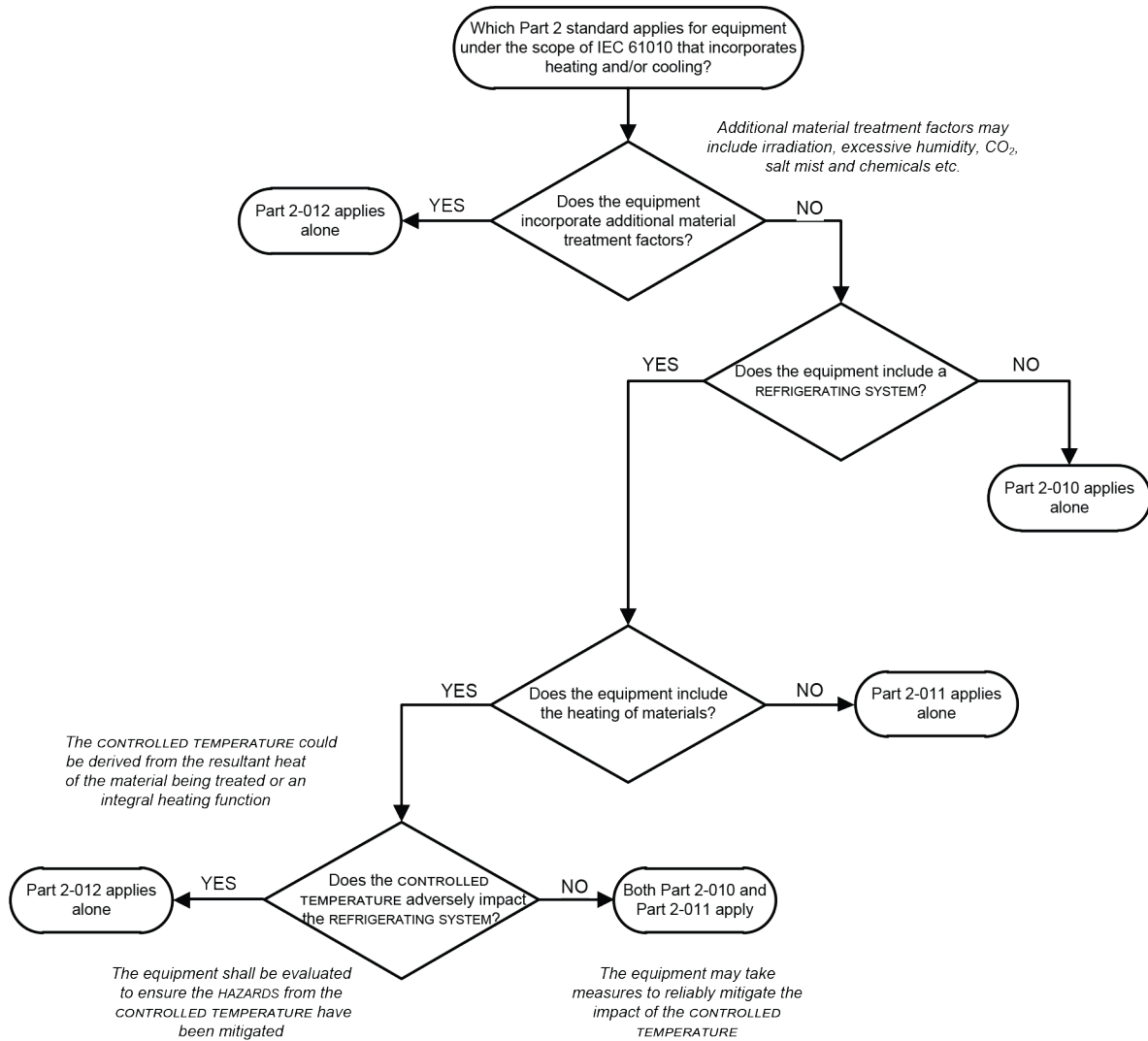


Figure 102 – Flow chart illustrating the selection process

SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE –

Part 2-011: Particular requirements for REFRIGERATING 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 2 of IEC 61010 specifies particular safety requirements for the following types a) to c) of electrical equipment and their accessories, wherever they are intended to be used, whenever that equipment incorporates REFRIGERATING SYSTEMS as an integral part of, or separate from, the equipment and the equipment is in direct control of the REFRIGERATING SYSTEM.

This document details all the requirements when up to 150 g of FLAMMABLE REFRIGERANT are used per stage of a REFRIGERATING SYSTEM. Additional requirements beyond the current scope of this document apply if a REFRIGERANT charge of FLAMMABLE REFRIGERANT exceeds this amount.

Addition:

Add the following text after the last paragraph:

NOTE 101 Examples for REFRIGERATING EQUIPMENT include, but are not limited to, laboratory equipment such as laboratory refrigerators, freezers, refrigerated display cabinets.

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 will also apply. In particular, if equipment is intended to be used as a centrifuge, the requirements of IEC 61010-2-020 apply. However, when the equipment incorporates a refrigerating system and a heating function where the combination of the two introduces additional or more severe HAZARDS than if treated separately, then it is possible that IEC 61010-2-012 is applicable instead of this Part 2-011.

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

1.1.2 Equipment excluded from scope

Addition:

Add the following new item after item j):

or equipment incorporating:

aa) a transcritical REFRIGERANT SYSTEM (system that uses CO₂) or a system that uses ammonia (NH₃) as the REFRIGERANT.