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GROUP SAFETY PUBLICATION

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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.
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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.

This Redline version provides you with a quick and easy way to compare all the changes between this standard and its previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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, ~~in conjunction~~ along with Part 2-010 and Part 2-012, taken together, address~~es~~ the specific HAZARDS associated with the heating and cooling of materials by equipment ~~which are segregated~~ 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.

Guidance for the application of the correct 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 (~~application~~ 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~~s~~ from the combining of the heating and cooling function**s**, 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 ~~may~~ 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 ~~application~~ 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 ~~application~~ 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.

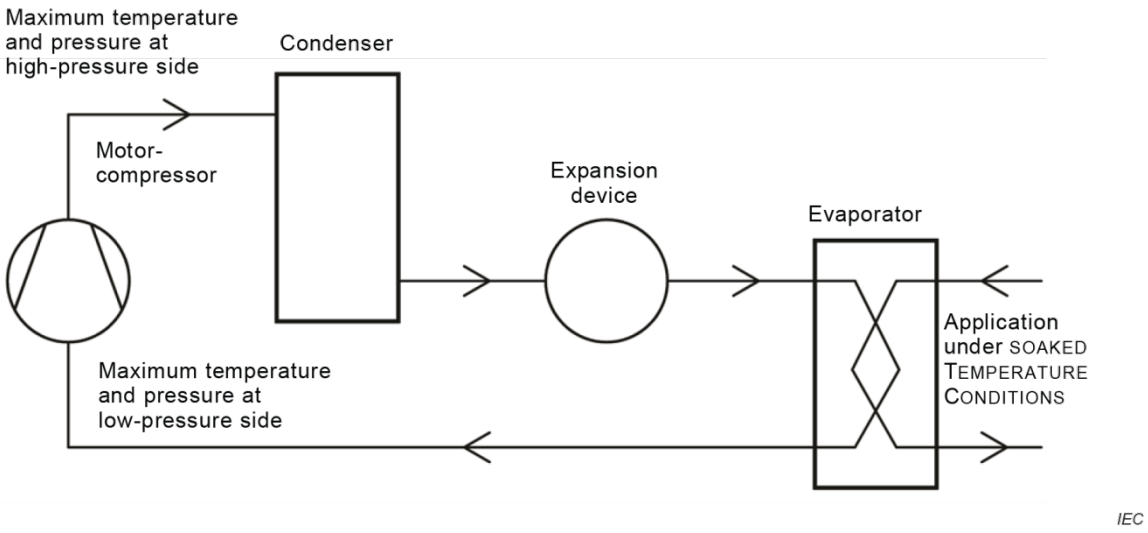

Figure 101 – Schema of a REFRIGERATING SYSTEM incorporating a condenser

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

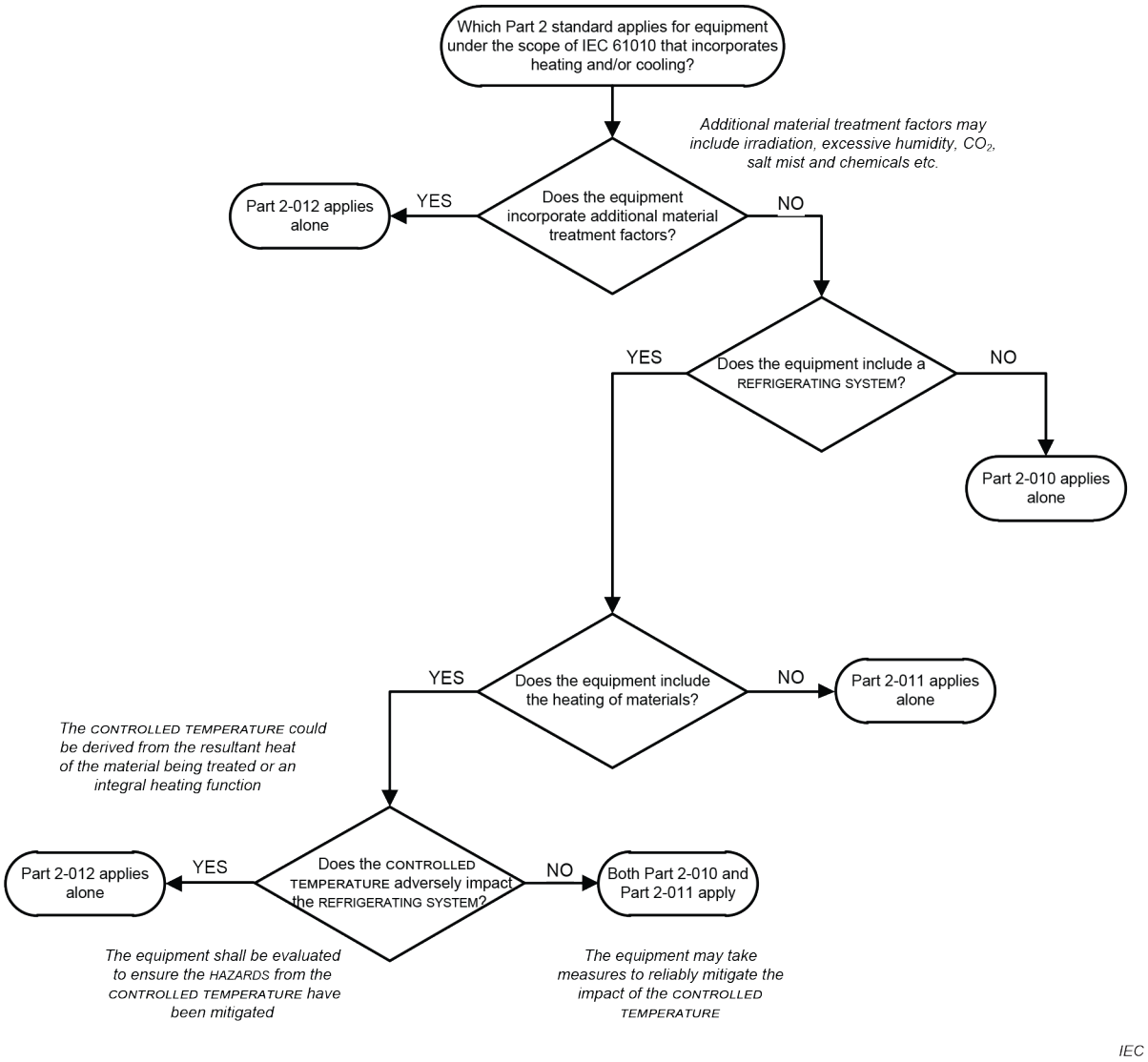

Figure 102 – Flow chart illustrating the selection process

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 ~~first~~ second paragraph by the following:

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

This Part 2 of IEC 61010 specifies 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 ~~whether~~ as an integral part of, or ~~remote to~~ 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~~, etc~~.

~~If~~ 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~~, it should also meet~~. 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, ~~it should meet~~ 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 ~~the application of~~ it is possible that IEC 61010-2-012 ~~should be considered~~ 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 CO_2) or a system that uses ammonia (NH_3) as the REFRIGERANT.

1.2 Object

1.2.1 Aspects included in scope

Replacement:

Replace the first paragraph by the following:

The object of this document is to ensure that the design and methods of construction of REFRIGERATING EQUIPMENT provide adequate protection for OPERATORS, bystanders, trained service personnel, and the surrounding area against the specific HAZARDS that relate to REFRIGERATING SYSTEMS.

Addition:

Add the following note after the existing note:

NOTE 101 A list of HAZARDS typically associated with REFRIGERATING SYSTEMS and REFRIGERANTS is included in Annex BB.

2 Normative references

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

Addition:

Add the following references to the list:

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

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/AMD2:2017

~~UL 471:2010, *Commercial Refrigerators and Freezers*~~

ISO 7010, *Graphical symbols - Safety colours and safety signs - Registered safety signs*

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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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 2-011: Particular requirements for REFRIGERATING EQUIPMENT

FOREWORD

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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;

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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 like irradiation, excessive humidity, CO_2 and mechanical movement.

Guidance for the application of the correct 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 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.

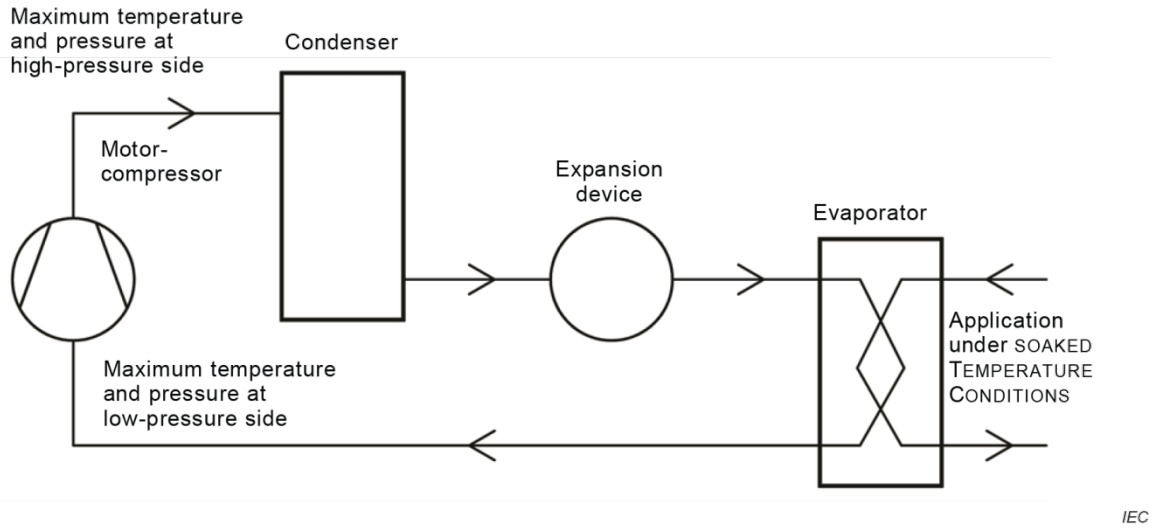

Figure 101 – Schema of a REFRIGERATING SYSTEM incorporating a condenser

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

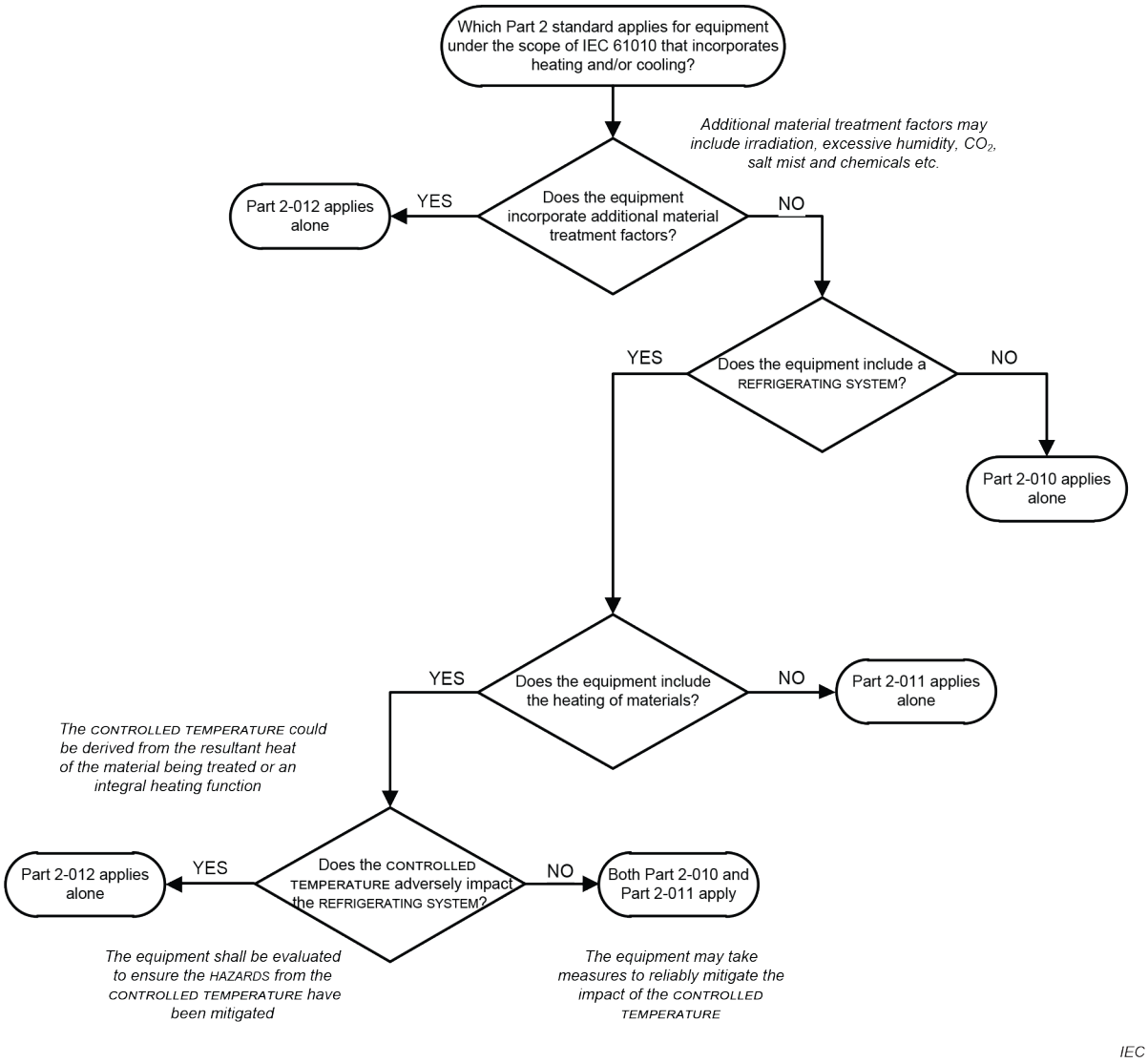

Figure 102 – Flow chart illustrating the selection process

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 CO_2) or a system that uses ammonia (NH_3) as the REFRIGERANT.

1.2 Object

1.2.1 Aspects included in scope

Replacement:

Replace the first paragraph by the following:

The object of this document is to ensure that the design and methods of construction of REFRIGERATING EQUIPMENT provide adequate protection for OPERATORS, bystanders, trained service personnel, and the surrounding area against the specific HAZARDS that relate to REFRIGERATING SYSTEMS.

Addition:

Add the following note after the existing note:

NOTE 101 A list of HAZARDS typically associated with REFRIGERATING SYSTEMS and REFRIGERANTS is included in Annex BB.

2 Normative references

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

Addition:

Add the following references to the list:

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

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/AMD2:2017

ISO 7010, *Graphical symbols ‑ Safety colours and safety signs ‑ Registered safety signs*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

_____

EXIGENCES DE SÉCURITÉ POUR APPAREILS ÉLECTRIQUES DE MESURAGE, DE RÉGULATION ET DE LABORATOIRE –

Partie 2-011: Exigences particulières pour APPAREILS DE REFRIGERATION

AVANT-PROPOS

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La Norme internationale IEC 61010-2-011 a été établie par le comité d'études 66 de l'IEC: Sécurité des appareils de mesure, de commande et de laboratoire.

Elle a le statut d'une publication groupée de sécurité conformément au Guide IEC 104.

Cette deuxième édition annule et remplace la première édition parue en 2016. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) alignement sur les modifications apportées par l'Amendement 1 de l'IEC 61010-1:2010;

b) introduction de nouveaux termes et définitions ou modification de termes pour s'aligner sur la Partie 2-012 et d'autres documents de base. Modifications rédactionnelles permettant d'utiliser les petites majuscules uniquement pour les termes définis. Noter la différence entre "FONCTIONNEMENT ANORMAL" (3.107) utilisé en 4.3.2.101 et "fonctionnement anormal" en 11.7.104.3 et 11.7.104.5;

c) clarifications relatives aux essais de refroidissement en 4.4.2.10;

d) modifications relatives à l'emploi précis des termes suivants: "température", "température de fonctionnement", "température d'application", "TEMPERATURE REGULEE", "température du local" et "température ambiante";

e) utilisation du terme défini "SYSTEME FRIGORIFIQUE" pour remplacer "système de refroidissement";

f) déplacement du texte de 4.4.2.101 à 4.3.2.101, en ce sens que le FONCTIONNEMENT ANORMAL tel que défini consiste à simuler une défaillance des conditions ambiantes au 1.4.1, mais pas une CONDITION DE PREMIER DEFAUT de l'appareil;

g) utilisation du terme "appareil" ("equipment" en anglais) pour remplacer le terme "unité", le cas échéant;

h) les PRESSIONS MAXIMALES ADMISSIBLES (PS) de 5.1.2 dd) des côtés haute et basse pression pour chaque étage du FLUIDE FRIGORIGENE sont exigées uniquement en CONDITION NORMALE;

i) utilisation du terme défini "CONDITION NORMALE" pour remplacer "fonctionnement normal";

j) utilisation du terme défini "OPERATEUR" pour remplacer "utilisateur".

Le texte de cette Norme internationale est issu des documents suivants:

CDV	Rapport de vote
66/676/CDV	66/683/RVC

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 61010, publiées sous le titre général *Exigences de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire*, peut être consultée sur le site web de l'IEC.

La présente Partie 2-011 doit être utilisée conjointement avec la dernière édition de l'IEC 61010-1. Elle a été établie sur la base de la troisième édition (2010) et son Amendement 1 (2016), ci-après dénommée la Partie 1.

La présente Partie 2-011 complète ou modifie les articles correspondants de l'IEC 61010-1 de façon à transformer cette publication en norme IEC: *Exigences particulières pour APPAREILS DE REFRIGERATION.*

Lorsqu'un paragraphe particulier de la Partie 1 n'est pas mentionné dans la présente Partie 2-011, ce paragraphe est applicable pour autant qu'il soit raisonnable. Lorsque la présente Partie 2-011 spécifie "addition", "modification", "remplacement" ou "suppression", il convient d'adapter en conséquence l'exigence, la modalité d'essai ou la note correspondante de la Partie 1.

Dans la présente norme:

1) les caractères d'imprimerie suivants sont utilisés:
   - exigences et définitions: caractères romains;
   - NOTES: petits caractères romains;

– *conformité et essais: caractères italiques*;

– termes définis à l'Article 3 et utilisés dans toute cette norme: PETITES CAPITALES ROMAINES.

2) les paragraphes, figures, tableaux et notes complémentaires à ceux de la Partie 1 sont numérotés à partir de 101. Les annexes complémentaires sont désignées à partir de AA et les listes de termes additionnels à partir de aa).

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

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INTRODUCTION

La présente Partie 2-011, ainsi que la Partie 2-010 et la Partie 2-012 pris ensemble, couvrent les DANGERS spécifiques associés à l'échauffement et au refroidissement des matières par des appareils, et sont organisés comme suit:

l'IEC 61010-2-010	Couvre spécifiquement les DANGERS associés aux appareils comportant des systèmes de chauffage.
l'IEC 61010-2-011	Couvre spécifiquement les DANGERS associés aux appareils comportant des SYSTEMES FRIGORIFIQUES.
l'IEC 61010-2-012	Couvre spécifiquement les DANGERS associés aux appareils comportant à la fois des systèmes de chauffage et des SYSTEMES FRIGORIFIQUES qui interagissent entre eux de sorte que les SYSTEMES de chauffage et FRIGORIFIQUES combinés génèrent des DANGERS supplémentaires ou plus graves pour les deux systèmes que s'ils sont traités séparément. Elle couvre également les DANGERS associés au traitement des matières par d'autres facteurs tels que l'exposition aux rayonnements, une humidité excessive, la présence de CO_2 et un mouvement mécanique.

Recommandations pour l'application de la ou des parties 2 appropriées

Lorsque l'appareil comprend uniquement un système d'échauffement des matières, et aucun SYSTEME FRIGORIFIQUE, ou lorsque d'autres facteurs d'environnement s'appliquent, la Partie 2-010 s'applique alors sans que la Partie 2-011 ou la Partie 2-012 ne s'avère nécessaire. De façon analogue, lorsque l'appareil comprend uniquement un SYSTEME FRIGORIFIQUE et aucun système d'échauffement des matières, ou lorsque d'autres facteurs d'environnement s'appliquent, la Partie 2-011 s'applique sans que la Partie 2-010 ou la Partie 2-012 ne s'avère nécessaire. Toutefois, lorsque l'appareil comporte à la fois un système d'échauffement des matières et un SYSTEME FRIGORIFIQUE ou lorsque les matières traitées dans l'application prévue génèrent une chaleur importante dans le SYSTEME FRIGORIFIQUE, il convient de déterminer si l'interaction entre les deux systèmes engendre des DANGERS supplémentaires ou plus graves que si les systèmes étaient évalués séparément (TEMPERATURE REGULEE, voir l'organigramme de la Figure 102 pour le processus de sélection). Lorsque l'interaction des fonctions de chauffage et de refroidissement n'engendre aucun DANGER supplémentaire ou plus grave, les deux Parties 2-010 et 2-011 s'appliquent alors pour leurs fonctions respectives. Inversement, si des DANGERS supplémentaires ou plus graves proviennent de la combinaison des fonctions de chauffage et de refroidissement, ou lorsque l'appareil inclut des facteurs supplémentaires de traitement des matières, la Partie 2-012 s'applique alors, contrairement aux Parties 2-010 et 2-011.

Quels DANGERS sont applicables dans le cas d'un SYSTEME FRIGORIFIQUE?

Les DANGERS typiques dans le cas d'un SYSTEME FRIGORIFIQUE (voir Figure 101) comprenant un MOTOCOMPRESSEUR, un condenseur, un détendeur et un évaporateur incluent entre autres:

– L'excès de température côté basse pression (température de retour) en direction du MOTOCOMPRESSEUR est supérieur au niveau admissible. Un MOTOCOMPRESSEUR comporte un moteur refroidi par FLUIDE FRIGORIGENE, et il convient d'établir que les températures maximales du côté basse pression dans les conditions les moins favorables ne dépassent pas les CARACTERISTIQUES ASSIGNEES d'isolation du moteur.

– L'excès de pression côté basse pression au niveau de l'admission du MOTOCOMPRESSEUR est supérieur au niveau admissible. L'enveloppe du MOTOCOMPRESSEUR est exposée à cette pression et il convient d'adapter ses CARACTERISTIQUES ASSIGNEES de conception aux

pressions les plus défavorables tout en assurant la marge de sécurité correcte pour un récipient sous pression.

– L'excès de température côté haute pression en direction du condenseur est supérieur au niveau admissible. Les températures côté haute pression dans les conditions les plus défavorables peuvent présenter un DANGER lié à la température en cas d'exposition de l'OPERATEUR ou de détérioration de l'isolation électrique provoquant un DANGER électrique.
– L'excès de pression côté haute pression en direction du condenseur est supérieur au niveau admissible. Les composants FRIGORIGENES en aval du MOTOCOMPRESSEUR jusqu'au niveau du détendeur sont exposés à cette pression et il convient d'adapter leurs CARACTERISTIQUES ASSIGNEES de conception aux pressions les plus défavorables tout en assurant la marge de sécurité correcte pour un récipient sous pression.
– Les TEMPERATURES maximales REGULEES, desquelles la chaleur est extraite, peuvent affecter la température maximale côté basse pression en direction du MOTOCOMPRESSEUR, ainsi que présenter un DANGER lié à la température en cas d'exposition de l'OPERATEUR ou de détérioration de l'isolation électrique provoquant un DANGER électrique. Que cette TEMPERATURE REGULEE soit issue d'une fonction de chauffage intégrée du dispositif ou de la chaleur dissipée de la matière refroidie, il convient d'évaluer l'effet dans les conditions les plus défavorables.
– Il convient d'établir l'appel de courant de l'appareil lorsque les conditions de fonctionnement les plus défavorables du SYSTEME FRIGORIFIQUE sont prises en compte, y compris les cycles de dégivrage éventuels qui peuvent s'appliquer.

Il convient de déterminer les conditions les plus défavorables pour les appareils qui comprennent à la fois les conditions d'UTILISATION NORMALE les moins favorables, et les résultats d'essai les plus défavorables dans des CONDITIONS DE PREMIER DEFAUT.

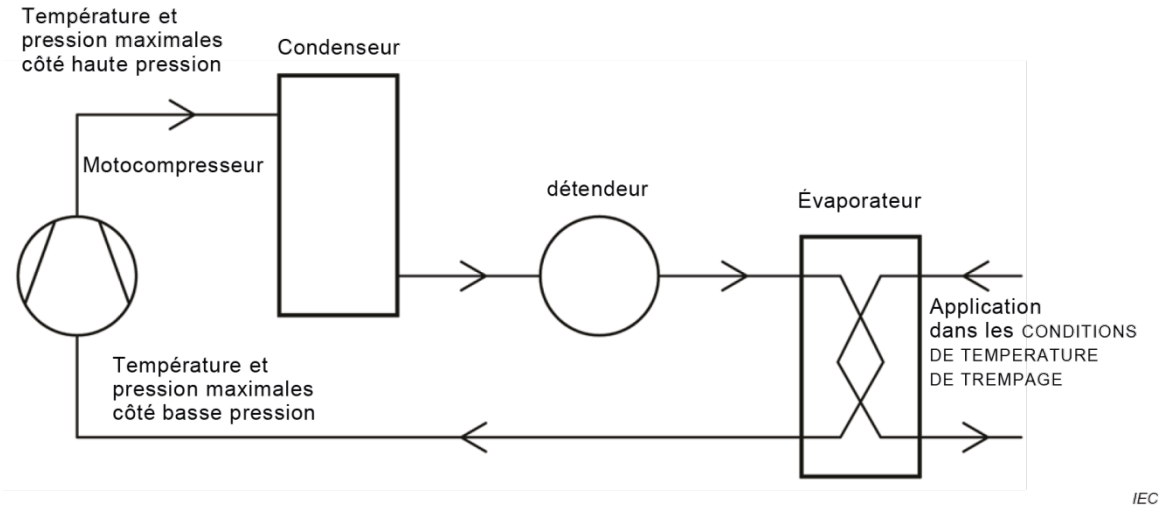

Figure 101 – Schéma d'un SYSTEME FRIGORIFIQUE comprenant un condenseur

Le processus de sélection est illustré dans l'organigramme suivant (voir Figure 102).

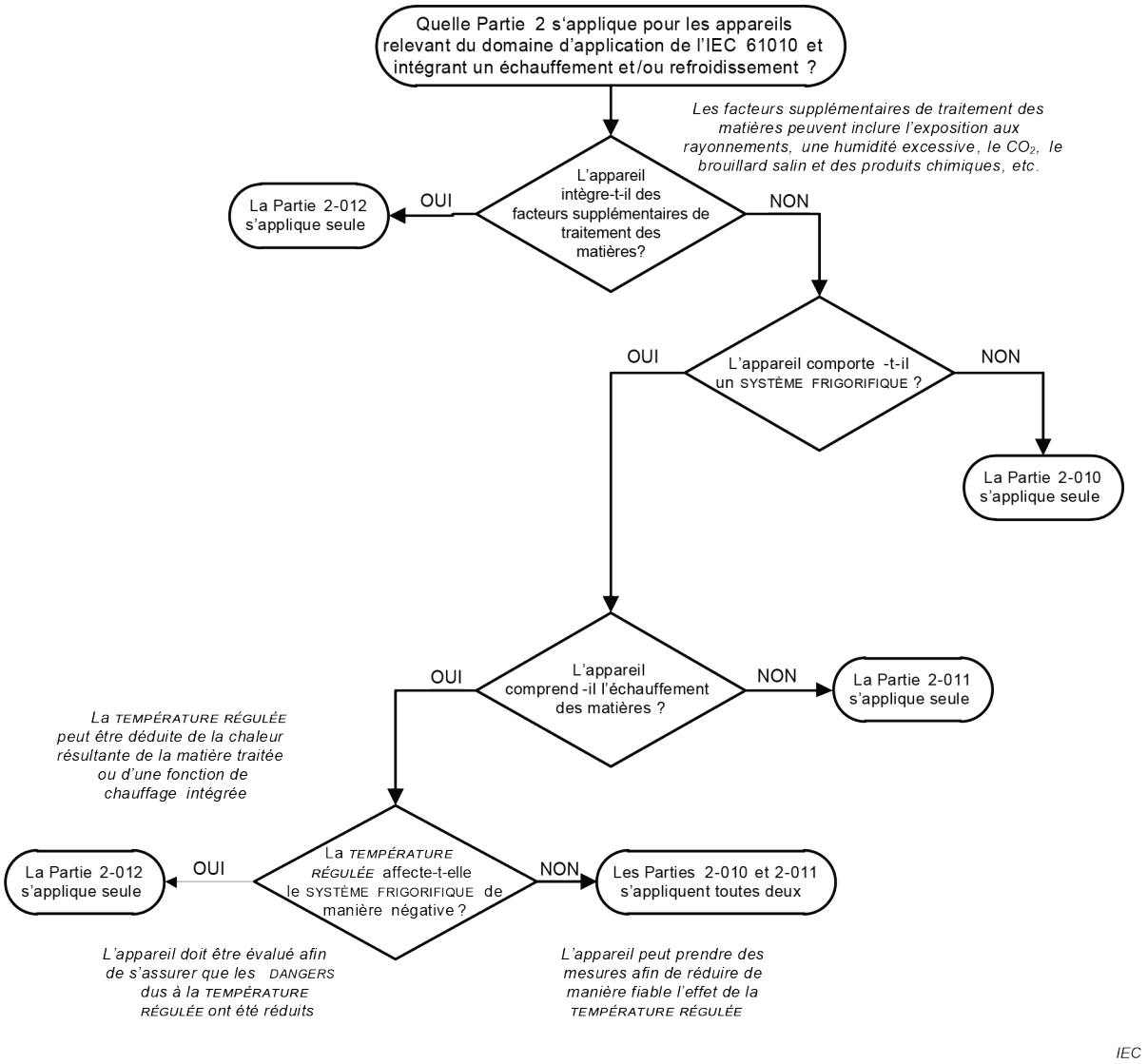

Figure 102 – Organigramme illustrant le processus de sélection

EXIGENCES DE SÉCURITÉ POUR APPAREILS ÉLECTRIQUES DE MESURAGE, DE RÉGULATION ET DE LABORATOIRE –

Partie 2-011: Exigences particulières pour APPAREILS DE REFRIGERATION

1 Domaine d'application et objet

L'article de la Partie 1 est applicable, à l'exception de ce qui suit:

1.1.1 Appareils inclus dans le domaine d'application

Remplacement:

Remplacer le deuxième alinéa par le suivant:

La présente Partie 2 de l'IEC 61010 spécifie les exigences de sécurité particulières pour les types a) à c) suivants d'appareils électriques et leurs accessoires, quel que soit l'endroit dans lequel ils sont destinés à être utilisés, lorsque ces appareils comportent des SYSTEMES FRIGORIFIQUES, que ces derniers fassent partie intégrante des appareils ou qu'ils soient séparés des appareils, et que les appareils sont sous la commande directe du SYSTEME FRIGORIFIQUE.

Le présent document décrit de manière détaillée toutes les exigences correspondant à l'utilisation d'une quantité de FLUIDE FRIGORIGENE INFLAMMABLE allant jusqu'à 150 g par étage d'un SYSTEME FRIGORIFIQUE. Lorsqu'une charge de FLUIDE FRIGORIGENE INFLAMMABLE dépasse cette quantité, des exigences supplémentaires hors du domaine d'application du présent document s'appliquent.

Addition:

Ajouter le texte suivant après le dernier alinéa:

NOTE 101 Les exemples D'APPAREILS DE REFRIGERATION incluent, entre autres, les appareils de laboratoire tels que les réfrigérateurs de laboratoire, les congélateurs, les vitrines réfrigérées.

Il est possible qu'une ou toutes les parties de l'appareil relèvent du domaine d'application d'une ou plusieurs autres Parties 2 de l'IEC 61010, ainsi que du domaine d'application de la présente norme. Dans ce cas, les exigences de ces autres Parties 2 s'appliquent également. En particulier, si l'appareil est prévu pour être utilisé comme centrifugeuse, les exigences de l'IEC 61010-2-020 s'appliquent. Toutefois, lorsque l'appareil comprend un système frigorifique et une fonction de chauffage dont la combinaison des deux introduit des DANGERS supplémentaires ou plus graves que lorsque le traitement est réalisé séparément, alors il est possible que l'IEC 61010-2-012 soit applicable à la place de la présente Partie 2-011.

Voir d'autres informations dans l'organigramme (Figure 102) pour le processus de sélection et les recommandations dans l'Introduction.

1.1.2 Appareils exclus du domaine d'application

Addition:

Ajouter le nouveau point suivant après le point j):

ou appareil incorporant

aa) un SYSTEME DE REFRIGERATION transcritique (système utilisant du CO_2) ou système utilisant de l'ammoniaque (NH_3) comme FLUIDE FRIGORIGENE.

1.2 Objet

1.2.1 Aspects inclus dans le domaine d'application

Remplacement:

Remplacer le premier alinéa par le suivant:

L'objet du présent document est d'assurer que la conception et les méthodes de construction des APPAREILS DE REFRIGERATION fournissent une protection adéquate aux OPERATEURS, aux spectateurs, au personnel de service formé, ainsi qu'à la zone périphérique contre les DANGERS spécifiques relatifs aux SYSTEMES FRIGORIFIQUES.

Addition:

Ajouter la note suivante après la note existante:

NOTE 101 Une liste des DANGERS typiquement associés aux SYSTEMES FRIGORIFIQUES et aux FLUIDES FRIGORIGENES est incluse dans l'Annexe BB.

2 Références normatives

L'article de la Partie 1 est applicable, à l'exception de ce qui suit:

Addition:

Ajouter à la liste les références suivantes:

IEC 60079-15:2010, *Atmosphères explosives – Partie 15: Protection du matériel par mode de protection "n"*

IEC 60335-2-34:2012, *Appareils électrodomestiques et analogues – Sécurité – Partie 2-34: Exigences particulières pour les motocompresseurs*
IEC 60335-2-34:2012/AMD1:2015
IEC 60335-2-34:2012/AMD2:2017

ISO 7010*, Symboles graphiques — Couleurs de sécurité et signaux de sécurité — Signaux de sécurité enregistrés*