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# 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

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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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**JUNE 15, 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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## CONTENTS

<b>PREFACE .....</b>	<b>7</b>
<b>NATIONAL DIFFERENCES .....</b>	<b>9</b>
<b>FOREWORD .....</b>	<b>11</b>
<b>INTRODUCTION.....</b>	<b>15</b>
1 Scope and object .....	19
1.1.1 Equipment included in scope .....	19
1.1.2 Equipment excluded from scope .....	20
1.2 Object .....	20
1.2.1 Aspects included in scope .....	20
2 Normative references .....	20
3 Terms and definitions.....	20
3.1 Equipment and states of equipment .....	21
3.2 Parts and accessories.....	22
3.5 Safety terms.....	24
4 Tests .....	26
4.3 Reference test conditions.....	26
4.4.2 Application of fault conditions.....	29
4.4.3 Duration of tests .....	32
4.4.4 Conformity after application of fault conditions.....	32
5 Marking and documentation .....	32
5.1.3 MAINS supply.....	32
5.1.5 TERMINALS, connections and operating devices .....	34
5.1.101 Marking for equipment incorporating a REFRIGERANT CONDENSING UNIT .....	35
5.1.102 Marking for equipment incorporating MECHANICAL MOVEMENT .....	36
5.2 Warning markings.....	36
5.4.1 General.....	36
5.4.2 Equipment RATINGS .....	36
5.4.3 Equipment installation .....	37
5.4.4 Equipment operation .....	39
5.4.5 Equipment maintenance and service .....	40
5.4.101 Additional instructions for refrigerating equipment that use FLAMMABLE REFRIGERANT .....	42
5.4.102 Additional instructions for equipment intended for use with a FLAMMABLE LIQUID HEAT TRANSFER MEDIUM .....	43
6 Protection against electric shock .....	43
6.1.1 Requirements.....	43
6.3.1 Levels in NORMAL CONDITION.....	43
6.3.2 Levels in SINGLE FAULT CONDITION .....	44
6.7.2.2 Solid insulation .....	44
6.8.1 General.....	44
6.8.2 Humidity preconditioning .....	44
6.9.1 General.....	44
6.10.1 MAINS supply cords.....	45
7 Protection against mechanical HAZARDS .....	45
7.3.5.1 Gap limitations between moving parts – Access normally allowed .....	45
7.3.101 Warning markings for MECHANICAL MOVEMENT .....	46
7.4 Stability.....	46
7.5 Provisions for lifting and carrying .....	46
8 Resistance to mechanical stresses.....	47

8DV	Addition of Clauses 8DV.1 – 8DV.5 as follows:	47
8.1	General	48
8.2.1	Static test	48
8.2.2	Impact test	48
9	Protection against the spread of fire	49
9.5	Requirements for equipment containing or using FLAMMABLE LIQUIDS	49
10	Equipment temperature limits and resistance to heat	50
10.1	Surface temperature limits for protection against burns and frostbite	50
10.2	Temperatures of windings	51
10.4	Conduct of temperature tests	52
10.101	Overtemperature protection	53
10.102	Restarting after interruption of cooling and/or heating	54
11	Protection against HAZARDS from fluids and solid foreign objects	54
11.1	General	54
11.3	Spillage	55
11.4	Overflow and low level	55
11.7.1	Maximum pressure	59
11.7.2	Leakage and rupture at high pressure	60
11.7.3	Leakage from low-pressure parts	62
11.7.101	Additional requirements for REFRIGERATING SYSTEMS that use FLAMMABLE REFRIGERANT	62
11.7.102	Temperature test for storage and transport	69
11.7.103	Internal fluid leaks	70
12	Protection against radiation, including laser sources, and against sonic and ultrasonic pressure	70
12.1	General	70
12.2.1.3	Equipment not intended to emit radiation	71
12.3	Optical radiation	71
13	Protection against liberated gases and substances, explosion and implosion	71
13.1	Poisonous and injurious gases and substances	71
13.2.1	Components of the equipment and materials being treated	72
13.2.101	Implosion of low air pressure equipment	72
13.2.102	Explosion and implosion of lamps	72
13.101	Biohazardous substances	72
13.102	Warning requirements related to chemical HAZARD	73
14	Components and subassemblies	73
14.3	Overtemperature protection devices	74
14.101	Components and subassemblies for REFRIGERATING SYSTEMS	74
14.102	Flexible tubing and hose subjected to liquid pressure other than that of the REFRIGERANT	75
15	Protection by interlocks	75
15.1	General	75
15.101	Mechanism of door and/or lock for WALK-IN EQUIPMENT	75
15.102	Interlock between the CIRCULATING PUMP, agitator and heating, cooling, MECHANICAL MOVEMENT and/or operation of the APPLICATION SYSTEM	76
15.103	Interlock between CIRCULATING FAN, door or lid and heating, cooling and/or radiation, humidifying and MECHANICAL MOVEMENT	76
15.104	Interlock between salt spray and cover of salt spray corrosion TEST CHAMBER	77
16	HAZARDS resulting from application	77
16.1	REASONABLY FORESEEABLE MISUSE	77
16.101	Slip HAZARD	78
17	RISK assessment	78

## Annexes

**Annex K (normative) Insulation requirements not covered by 6.7**

K.1.3 Solid insulation for MAINS CIRCUITS ..... 80  
 K.1.3.1 General ..... 80

**Annex L (informative) Index of defined terms**

**Annex AA (informative) Useful symbols**

**Annex BB (informative) Protection of people who are inside WALK-IN EQUIPMENT**

BB.1 General..... 87  
 BB.2 Emergency switch or signal ..... 87  
 BB.3 WALK-IN EQUIPMENT with a controlled atmosphere ..... 87

**Annex CC (informative) Safety requirements for components and piping**

CC.1 Overview ..... 89  
 CC.2 Component and subassembly requirements for switches and controls used in REFRIGERATING SYSTEMS for North America ..... 92

**Annex DD (informative) Equipment containing FLAMMABLE REFRIGERANTS – information and marking requirements**

Annex DDDV Modification: Replace (informative) with (normative) in the header ..... 93  
 DD.1 Marking, installation and operating instructions (SB6)..... 93  
     DD.1.1 Marking..... 93  
     DD.1.2 OPERATOR markings ..... 93  
     DD.1.3 Service markings ..... 93  
     DD.1.4 Disposal ..... 93  
     DD.1.5 Exposed tubing..... 93  
     DD.1.6 Accessing the REFRIGERANT circuit..... 94  
     DD.1.7 Symbol for warning of flammable materials ..... 94  
     DD.1.8 Equipment containing a remote CONDENSING UNIT ..... 94  
     DD.1.9 Refrigerating equipment intended for laboratory use ..... 94  
 DD.2 Installation and operating instructions ..... 94  
     DD.2.1 Handling and moving ..... 94  
     DD.2.2 Packaging markings..... 94  
     DD.2.3 Replacement components and servicing..... 95  
     DD.2.4 Installation instructions for equipment containing a remote CONDENSING UNIT ..... 95

**Annex EE (normative) Non-sparking “n” electrical device**

ANNEX EEDV Modification: Replace in the entire Annex IEC 60079-15:2010 with UL 60079-15:2013 ..... 96  
 11 Supplementary requirements for non-sparking luminaires..... 96  
 19 Supplementary requirements for sealed devices producing arcs, sparks or hot surfaces ..... 96  
     19.1 Non-metallic materials..... 96  
     19.6 Type tests ..... 96  
 20 Supplementary requirements for restricted-breathing enclosures protecting equipment producing arcs, sparks or hot surfaces ..... 96

## Bibliography

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## PREFACE

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

This edition has been issued to satisfy UL Standards policy.

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

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

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

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

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## NATIONAL DIFFERENCES

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

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

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

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

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

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

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

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

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

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

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## FOREWORD

### INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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

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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.

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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 <sub>2</sub> and MECHANICAL MOVEMENT, etc.

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

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

### What HAZARDS are applicable for a REFRIGERATING SYSTEM?

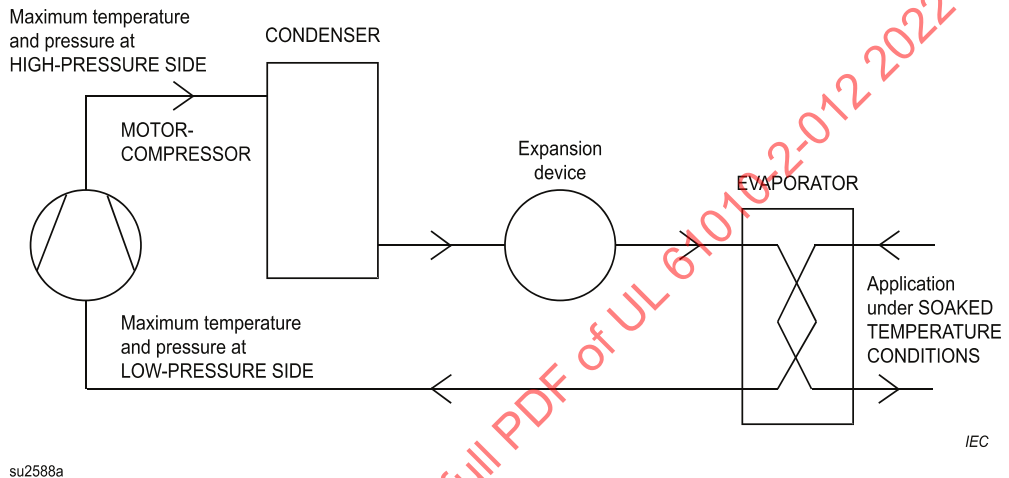
The typical HAZARDS for a REFRIGERATING SYSTEM (see [Figure 101](#)) consisting of a MOTOR-COMPRESSOR, a CONDENSER, an expansion device and an EVAPORATOR include but are not limited to:

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

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

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

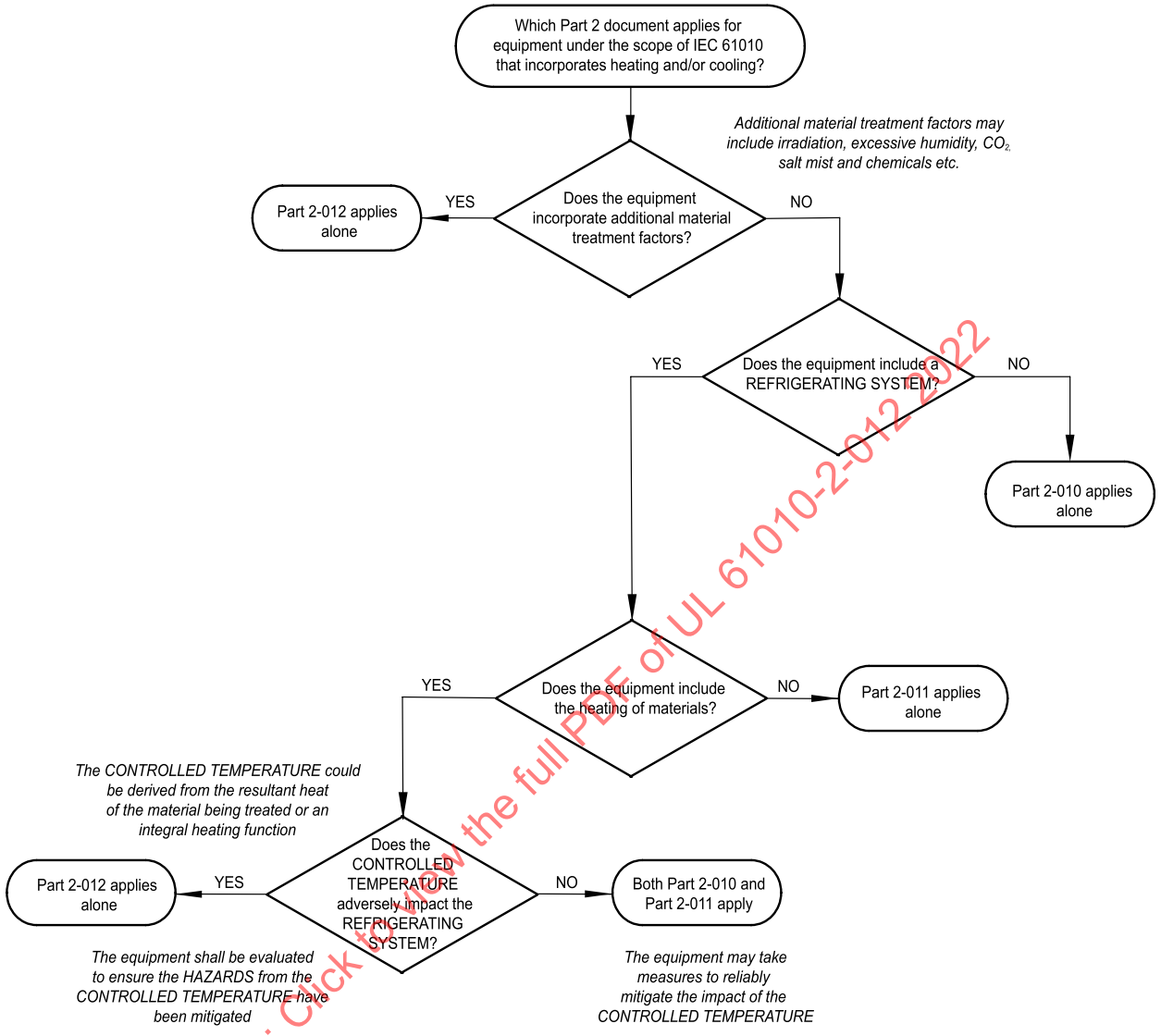
The worst-case conditions should be determined for the equipment and will include both the least favourable NORMAL USE conditions as well as the most unfavourable testing results under SINGLE FAULT CONDITIONS.



**Figure 101**

**Schema of a REFRIGERATING SYSTEM incorporating a CONDENSER**

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



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