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Date: 01 April 2025

Origin: International

Latest date for receipt of comments: 23 April 2025

Project No. 2025/00829

Responsible committee: EPL/66 Safety of measuring, control and laboratory equipment

Interested committees:

Title: BS EN 61010-2-012 Ed.3.0 Draft 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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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

PROJECT NUMBER:

IEC 61010-2-012 ED3

DATE OF CIRCULATION:

2025-03-28

CLOSING DATE FOR COMMENTS:

2025-05-23

SUPERSEDES DOCUMENTS:

66/823/CD, 66/835/CC

IEC TC 66 : SAFETY OF MEASURING, CONTROL AND LABORATORY EQUIPMENT

SECRETARIAT:

United Kingdom

SECRETARY:

Ms Stephanie Lavy

OF INTEREST TO THE FOLLOWING COMMITTEES:

HORIZONTAL FUNCTION(S):

TC 66 Horizontal Group Safety

ASPECTS CONCERNED:

Safety

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TITLE:

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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CONTENTS

1		
2	CONTENTS	2
3	FOREWORD	12
4	INTRODUCTION	15
5	1. Scope and object	19
6	1.1.1 Equipment included in scope	19
7	1.1.2 Equipment excluded from scope	20
8	1.2 Object	20
9	1.2.1 Aspects included in scope	20
10	2. Normative references	21
11	3. Terms and definitions	22
12	3.1 Equipment and states of equipment	22
13	3.1.114	23
14	GROUP I EQUIPMENT	23
15	3.2 Parts and accessories	24
16	3.3 Quantities	30
17	3.5 Safety terms	30
18	4. Tests	32
19	4.3 Reference test conditions	33
20	4.3.1 Environmental conditions	33
21	4.3.2 State of equipment	33
22	4.3.2.1 General	33
23	4.3.2.101 Heat load	34
24	4.3.2.102 Humidity and steam	34
25	4.3.2.103 Lamp and lamp systems	34
26	4.3.2.104 MECHANICAL MOVEMENT	34
27	4.3.2.105 Spray generating systems	34
28	4.3.2.106 VENTILATORS	34
29	4.3.2.107 Pressures other than those of REFRIGERANT	34
30	4.3.2.108 REFRIGERANT pressure	34
31	4.3.2.109 Exhaust and condensate	35
32	4.3.2.110 Filling and draining systems	35
33	4.3.2.111 Circulating system	35
34	4.3.2.112 Gas HEAT TRANSFER MEDIUM	35
35	4.3.2.113 Properties of liquid HEAT TRANSFER MEDIUM	35
36	4.3.2.114 Refrigerating equipment intended to be used with other equipment inside	
37	the refrigerated compartment	35
38	4.4 Application of fault conditions	35
39	4.4.2.10 Cooling	35
40	4.4.2.11 Heating devices	36
41	4.4.2.101 MOTOR-COMPRESSOR	37
42	4.4.2.102 Fluid leakage in the equipment	37
43	4.4.2.103 Solenoid valve and motorized valve	37
44	4.4.2.104 Failure of temperature control	37
45	4.4.2.105 HUMIDIFIER	37
46	4.4.2.106 Speed controller	38
47	4.4.2.107 Simulate the failure of the controlled environment	

48	4.4.3Duration of tests	38
49	4.4.3.1General	38
50	4.4.4Conformity after application of fault conditions.....	38
51	4.4.4.1General	38
52	5. Marking and documentation	39
53	5.1.5TERMINALS, connections and operating devices.....	39
54	5.1.5.101LIQUID CONNECTIONS for HEAT TRANSFER MEDIUM	39
55	5.1.5.102LIQUID CONNECTION for filling of BATH TANKS with enclosed CIRCULATORS	39
56	5.1.5.103Other LIQUID CONNECTIONS and exhaust opening	39
57	5.1.5.104Equipotential TERMINALS.....	40
58	5.1.101Marking for equipment incorporating a REFRIGERANT CIRCUIT	40
59	5.1.102Symbols particular to heating and cooling equipment.....	41
60	5.2Warning markings.....	41
61	5.2.101Marking for GROUP I EQUIPMENT	41
62	5.2.102Marking for equipment incorporating MECHANICAL MOVEMENT	42
63	5.2.103Movable immersion CIRCULATOR.....	42
64	5.2.104Warning markings related to manual filling or draining	42
65	5.2.105Warning requirements related to chemical HAZARD	43
66	5.2.106Marking for hazardous radiation.....	43
67	5.4.1General	44
68	5.4.2Equipment RATINGS.....	45
69	5.4.3Equipment installation	45
70	5.4.3.101DRYING-OUT and STANDSTILL	47
71	5.4.4Equipment operation	47
72	5.4.4.101Cleaning and decontamination	48
73	5.4.5Equipment maintenance and service	49
74	5.4.101Additional instructions for equipment containing FLAMMABLE REFRIGERANT	50
75	5.4.102Additional instructions for EQUIPMENT TYPE E	53
76	5.4.103Additional instructions for equipment intended for use with refrigerated LN ₂	54
77	5.4.104Additional instructions for equipment intended for use with FLAMMABLE LIQUID	
78	HEAT TRANSFER MEDIA	54
79	5.4.105 Additional markings and instructions for equipment incorporating UV-C lamp	
80	systems	55
81	5.4.106Competence of personnel for equipment realization, installation,	
82	commissioning and maintenance.....	55
83	6. Protection against electric shock	56
84	6.1.1Requirements	56
85	6.3.1Levels in NORMAL CONDITION.....	56
86	6.3.2Levels in SINGLE FAULT CONDITION.....	56
87	6.7.2.2Solid insulation	56
88	6.7.2.2.101DRYING-OUT	57
89	6.8.1General	57
90	6.8.2Humidity preconditioning	57
91	6.9.1General	57
92	6.10.1MAINS supply cords.....	57
93	7. Protection against mechanical HAZARDS	58
94	7.3.5.1Gap limitations between moving parts – Access normally allowed.....	58
95	7.4Stability	58
96	7.4.101Movement during operation	58

97	7.4.102 Removable SPECIMEN holder for MECHANICAL MOVEMENT	59
98	7.5 Provisions for lifting and carrying	59
99	7.5.1 General	59
100	8. Resistance to mechanical stresses	59
101	8.1 General	59
102	8.2.1 Static test	60
103	8.2.2 Impact test	60
104	8.101 BATH TANK and liquid vessel of equipment intended for use with FLAMMABLE	
105	LIQUID HEAT TRANSFER MEDIA	61
106	8.102 Liquid connections for connecting to an APPLICATION SYSTEM, supply or	
107	draining	61
108	8.103 Flexible tubing and hose subjected to liquid pressure other than that of the	
109	REFRIGERANT	61
110	8.104 Loading capacity of shelves	62
111	8.105 Glass doors or windows	62
112	8.106 Structure requirements for the REFRIGERATING SYSTEM	63
113	8.106.1 The construction requirements	63
114	8.106.2 Protection against mechanical damage	64
115	8.106.3 Scratch test for ACCESSIBLE surfaces of REFRIGERANT CIRCUIT containing	
116	FLAMMABLE REFRIGERANT	64
117	8.106.4 Piping joints and fittings	65
118	8.106.5 HERMETICALLY SEALED JOINT	66
119	8.106.6 Field made joints	66
120	8.106.7 EQUIPMENT TYPE C2 including a separate section	66
121	8.106.8 ENHANCED TIGHTNESS REFRIGERATING SYSTEM	67
122	8.106.9 Limit of REFRIGERANT CHARGE for FLAMMABLE REFRIGERANT	68
123	8.106.10 Connections for CO ₂ charging or LN ₂ feeding	68
124	9. Protection against the spread of fire	68
125	9.2 Eliminating or reducing the sources of ignition within the equipment	68
126	9.2.101 Possible ignition sources	69
127	9.2.102 Arcs and sparks from electric components	69
128	9.2.103 Surface temperature limits exposed to leaked FLAMMABLE REFRIGERANT	71
129	9.5 Requirements for equipment containing or using FLAMMABLE LIQUIDS	73
130	9.5.101 Additional requirements for equipment containing FLAMMABLE	
131	REFRIGERANT	74
132	9.5.101.1 General	74
133	9.5.101.2 Inaccessible REFRIGERATING SYSTEM	74
134	9.5.101.3 ACCESSIBLE REFRIGERATING SYSTEMS	75
135	9.5.102 Internal fluid leaks	76
136	9.5.103 Sources and grade of release	76
137	9.5.103.1 General	76
138	9.5.103.2 Sources giving a continuous grade of release	76
139	9.5.103.3 Sources with NORMAL TIGHTNESS and giving a primary grade of release	76
140	9.5.103.5 Factors to be considered in assessment for sources and grade of release	78
141	9.5.104 Location for sensor of LEAK DETECTION SYSTEM	78
142	10. Equipment temperature limits and resistance to heat	79
143	10.1 Surface temperature limits for protection against burns	79
144	10.1 Surface temperature limits for protection against burns and frostbite	79
145	10.2 Temperatures of windings	80
146	10.4 Conduct of temperature tests	81

147	10.4.1General	81
148	10.101Overtemperature protection	82
149	10.102Restarting after interruption of cooling and/or heating	83
150	11. Protection against HAZARDS from fluids and solid foreign objects	83
151	11.1General	83
152	11.3Spillage	84
153	11.4Overflow	84
154	11.4Overflow and low level.....	84
155	11.4.101Salt mist, thawing, condensate and spray	86
156	11.4.102HAZARDS from liquids in relation to the SPECIMEN and APPLICATION SYSTEM	87
157	11.4.103HAZARDS from liquids in relation to the SHAKER.....	87
158	11.4.104Construction requirements related to manual filling or draining	87
159	11.7.1Maximum pressure	87
160	11.7.1.101 Determining the MAXIMUM ALLOWABLE PRESSURE (PS) in a REFRIGERATING	
161	SYSTEM.....	88
162	11.7.2Leakage and rupture at high pressure.....	90
163	11.7.2.101 Leakage and rupture of REFRIGERATING SYSTEMS	91
164	11.7.2.101.1General.....	91
165	11.7.2.101.2Pressure test	91
166	11.7.2.101.3Fatigue test.....	91
167	11.7.2.101.4 Tightness of equipment.....	92
168	11.7.2.102 Additional requirements for EQUIPMENT TYPE E	92
169	11.7.2.102.1 Requirements for EQUIPMENT TYPE E in a subcritical application	92
170	11.7.2.102.2 Requirements for EQUIPMENT TYPE E in a transcritical application.....	93
171	11.7.2.103Pressure test for storage and transport	94
172	11.7.2.103.1General.....	94
173	11.7.2.103.2 Test of charge-to-volume ratio	94
174	11.7.2.103.3 Test by pressure under the SOAKED TEMPERATURE CONDITION	94
175	11.7.2.103.4 Calculation by using the ideal gas law.....	95
176	11.7.2.103.5Test in a TEST CHAMBER.....	95
177	11.7.3Leakage from low-pressure parts.....	95
178	11.7.4Overpressure safety device	95
179	11.7.4.101PRESSURE-LIMITING DEVICE and discharge capacity for a PRESSURE-RELIEF	
180	DEVICE in EQUIPMENT TYPE E.....	95
181	12. Protection against radiation, including laser sources, and against sonic and	
182	ultrasonic pressure	96
183	12.1General	96
184	12.2.1.3Equipment not intended to emit radiation	96
185	12.3Optical radiation	96
186	12.3.101Construction requirements for UV-C radiation	97
187	12.3.102 UV-C irradiance test	97
188	13. Protection against liberated gases and substances, explosion and implosion	98
189	13.1Poisonous and injurious gases and substances	98
190	13.2.1Components	99
191	13.2.1Components of the equipment and materials being treated.....	99
192	13.2.101Implosion of low air pressure equipment	99
193	13.2.102Explosion and implosion of lamps	99
194	13.101Biohazardous substances	99
195	14. Components and subassemblies	100

196	14.3Overtemperature protection devices	100
197	14.101Components and subassemblies for REFRIGERATING SYSTEMS.....	101
198	14.102 Materials for REFRIGERATING SYSTEMS.....	101
199	14.102.1 Requirements for copper in REFRIGERANT CIRCUITS	101
200	14.102.2 Requirements for stainless steel	102
201	14.102.3 Minimum wall thickness for copper and steel tubes	102
202	14.103 SAFETY SHUT-OFF VALVES for FLAMMABLE REFRIGERANTS for the purposes of	
203	limiting the RELEASABLE CHARGE	102
204	15. Protection by interlocks	103
205	15.1General	104
206	15.101Mechanism of door and/or lock for WALK-IN EQUIPMENT	104
207	15.102 Interlock between the CIRCULATING PUMP, agitator and heating, cooling,	
208	MECHANICAL MOVEMENT and/or operation of the APPLICATION SYSTEM	104
209	15.103 Interlock between CIRCULATING FAN, door or lid and heating, cooling and/or	
210	radiation, humidifying and MECHANICAL MOVEMENT	105
211	15.104 Interlock between salt spray and cover of salt spray corrosion TEST CHAMBER	105
212	16. HAZARDS resulting from application	106
213	16.1REASONABLY FORESEEABLE MISUSE	106
214	16.101Slip HAZARD.....	106
215	17. RISK assessment	106
216	Annexes	107
217	Annex F (normative) ROUTINE TESTS.....	108
218	F.101ROUTINE TESTS for equipment incorporating a REFRIGERANT CIRCUIT.....	108
219	Annex K (normative) Insulation requirements not covered by 6.7	109
220	K.1.3Solid insulation for MAINS CIRCUITS.....	109
221	K.1.3.1General.....	109
222	Annex L (informative) Index of defined terms	110
223	Annex AA (informative) Useful symbols	113
224	Annex BB (informative) Protection of people who are inside WALK-IN EQUIPMENT	116
225	BB.1General.....	116
226	BB.2Emergency switch or signal	116
227	BB.3WALK-IN EQUIPMENT with a controlled atmosphere	116
228	Annex CC (informative) Safety requirements for components and piping.....	118
229	CC.1Overview	118
230	CC.2 Component and subassembly requirements for switches and controls used	
231	in REFRIGERATING SYSTEMS for North America	122
232	Annex DD (informative) Equipment containing FLAMMABLE REFRIGERANTS – Information	
233	and marking requirements	124
234	DD.1Marking, installation and operating instructions (SB6).....	124
235	DD.1.1Marking	124
236	DD.1.2OPERATOR markings.....	124
237	DD.1.3Service markings	124
238	DD.1.4Disposal	124
239	DD.1.5Exposed tubing.....	125
240	DD.1.6Accessing the REFRIGERANT CIRCUIT.....	125
241	DD.1.7Symbol for warning of flammable materials.....	125
242	DD.1.8Equipment containing a remote CONDENSING UNIT	125
243	DD.1.9Refrigerating equipment intended for laboratory use	125

244	DD.2 Installation and operating instructions.....	125
245	DD.2.1 Handling and moving	125
246	DD.2.2 Packaging markings	125
247	DD.2.3 Replacement components and servicing	126
248	DD.2.4 Installation instructions for equipment containing a remote CONDENSING UNIT	126
249	Annex EE (normative) Non-sparking "n" electrical device	127
250	11 Supplementary requirements for non-sparking luminaires	127
251	19 Supplementary requirements for sealed devices producing arcs, sparks or hot	
252	surfaces	127
253	19.1 Non-metallic materials	127
254	19.6 Type tests	127
255	20 Supplementary requirements for restricted-breathing ENCLOSURES protecting	
256	equipment producing arcs, sparks or hot surfaces	127
257	Annex FF (normative) Test method for determining gas concentration beyond the	
258	boundary of the equipment	128
259	FF.1 Arrangement	128
260	FF.2 Release conditions.....	128
261	Annex GG (informative) Classification of fluid group	133
262	GG.1 General.....	133
263	GG.2 HAZARD class pictograms	133
264	GG.3 HAZARD statement code for fluids commonly used in the GROUP I EQUIPMENT	134
265	GG.4 Meanings of the precautionary statement codes.....	135
266	Annex HH (normative) Competence of personnel for EQUIPMENT TYPE D	136
267	HH.1 General	136
268	HH.2 Lists of standards for personnel competence for REFRIGERATING SYSTEMS	136
269	HH.3 Competence of service personnel.....	137
270	HH.4 Information and training.....	137
271	Annex II (normative) Overload tests for refrigerating equipment incorporated with	
272	MOTOR-COMPRESSORS.....	140
273	II.1 General	140
274	II.2 Preparation operation.....	141
275	II.2.1 General	141
276	II.2.2 Under OPERATING CONDITION of maximum COOLING CAPACITY	141
277	II.2.3 Under variable OPERATING CONDITIONS of the REFRIGERATING SYSTEM	142
278	II.3 Overload tests	143
279	Annex JJ (normative) Winding wire insulation compatibility tests	145
280	Annex KK (informative) Transportation, marking and storage for equipment that	
281	containing FLAMMABLE REFRIGERANTS	146
282	KK.1 General.....	146
283	KK.2 Transport of equipment containing FLAMMABLE REFRIGERANTS.....	146
284	KK.3 Marking of equipment using markings	146
285	KK.4 Disposal of equipment using FLAMMABLE REFRIGERANTS	146
286	KK.5 Storage of equipment.....	146
287	KK.6 Storage of packed (unsold) equipment.....	146
288	Annex LL (normative) Requirements for installation, service, maintenance and repair,	
289	and decommissioning instructions of equipment using FLAMMABLE REFRIGERANTS.....	147
290	LL.1 General	147
291	LL.2 Symbols	148
292	LL.3 Information in instructions.....	148

293	LL.3.1 General	148
294	LL.3.2 Unventilated areas.....	151
295	LL.3.3 Qualification of workers	151
296	LL.4 Information on servicing	152
297	LL.4.1 General	152
298	LL.4.2 Checks to the area	152
299	LL.4.3 Work procedure	152
300	LL.4.4 General work area	152
301	LL.4.5 Checking for presence of REFRIGERANT	152
302	LL.4.6 Presence of fire extinguisher	152
303	LL.4.7 No ignition sources	152
304	LL.4.8 Ventilated area	152
305	LL.4.9 Checks to the refrigerating equipment	153
306	LL.4.10 Checks to electrical devices.....	153
307	LL.5 Sealed electrical components	153
308	LL.6 Cabling.....	153
309	LL.7 Detection of FLAMMABLE REFRIGERANTS	153
310	LL.8 REFRIGERANT removal and circuit evacuation	154
311	LL.9 Charging procedures	154
312	LL.10 Decommissioning	155
313	LL.11 Labeling	156
314	LL.12 Recovery	156
315	Annex MM (normative) Charge limits, ventilation requirements and requirements for	
316	secondary circuits for equipment using FLAMMABLE REFRIGERANTS.....	157
317	MM.1 Requirements for REFRIGERANT CHARGE limits.....	157
318	MM.1.1 General.....	157
319	MM.1.2 Determination of unventilated room area.....	158
320	MM.1.2.1 General.....	158
321	MM.1.2.2 Determination of unventilated room area for equipment using A2 and A3	
322	REFRIGERANT	158
323	MM.1.2.3 Determination of unventilated room area for equipment using A2L	
324	REFRIGERANT	159
325	MM.1.3 Opening conditions for connected rooms and natural ventilation for	
326	equipment using A2L REFRIGERANTS.....	160
327	MM.2 Requirements for charge limits in unventilated areas	160
328	MM.2.1 General.....	160
329	MM.2.2 FIXED EQUIPMENT using A2/A3 REFRIGERANTS with integral circulation airflow	161
330	MM.2.2.1 General.....	161
331	MM.2.2.2 Continuous circulation airflow	162
332	MM.2.2.3 Circulation airflow activated by a leak detection system	163
333	MM.2.3 FIXED EQUIPMENT using A2L REFRIGERANTS with integral circulation airflow	163
334	MM.2.3.1 General.....	163
335	MM.2.3.2 Continuous circulation airflow	164
336	MM.2.3.3 Circulation airflow activated by a leak detection system	164
337	MM.3 FACTORY SEALED SINGLE PACKAGE UNITS which are not FIXED EQUIPMENT with a	
338	MAXIMUM REFRIGERANT CHARGE of $2 \times m_1$	165
339	MM.3.1 Determination of REFRIGERANT CHARGE	165
340	MM.3.2 Mechanical requirements	165
341	MM.3.2.2 Drop test with packaging.....	166
342	MM.3.2.3 Drop test without packaging	166

343	MM.3.2.4 Test after installation	166
344	MM.3.3 Excessive vibration or resonance points of the REFRIGERATING SYSTEM and	
345	vibration test	167
346	MM.4 Requirements for charge limits in areas with mechanical ventilation within the	
347	equipment ENCLOSURE	167
348	MM.5.0 Requirements for charge limits in areas with mechanical ventilation for	
349	rooms complying with ISO 5149-3	169
350	MM.6 Allowable charge for ENHANCED TIGHTNESS REFRIGERATING SYSTEMS using A2	
351	or A3 REFRIGERANT	169
352	MM.6.1 General	169
353	MM.6.2 Requirement for ENHANCED TIGHTNESS equipment without integral circulation	
354	airflow	169
355	MM.6.3 Requirement for ENHANCED TIGHTNESS equipment with integral circulation	
356	airflow	170
357	MM.6.3.1 General	170
358	MM.6.3.2 Continuous circulation airflow	172
359	MM.6.3.3 Circulation airflow activated by a leak detection system	172
360	MM.7 Ventilated area requirements for equipments using A2L REFRIGERANTS	172
361	MM.7.1 General	172
362	MM.7.2 Natural ventilation to outdoors	172
363	MM.7.3 Mechanical ventilation requirements for rooms with equipments using A2L	
364	refrigerants	173
365	MM.7.3.1 Operation of mechanical ventilation system	173
366	MM.7.3.1.1 General	173
367	MM.7.3.1.2 Continuous operation of mechanical ventilation system	173
368	MM.7.3.1.3 Mechanical ventilation system activated by a leak detection system	173
369	MM.7.3.2 Required airflow	174
370	MM.7.3.3 Requirement for opening	174
371	MM.8 Charge limits for equipments using A2L REFRIGERANTS connected via an air	
372	duct system to one or more rooms	175
373	MM.8.1 General	175
374	MM.8.2 Continuous circulation airflow	176
375	MM.8.3 Circulation airflow activated by a leak detection system	176
376	MM.9 Allowable charge for ENHANCED TIGHTNESS REFRIGERATING SYSTEMS using A2L	
377	REFRIGERANT	176
378	MM.9.1 General	176
379	MM.9.2 Required measures for allowable REFRIGERANT CHARGE	176
380	MM.9.2.1 General	176
381	MM.9.2.2 Spaces except lowest underground floor of the building	177
382	MM.9.2.3 Lowest underground floor of the building	177
383	MM.9.3 MAXIMUM REFRIGERANT CHARGE	177
384	MM.9.3.1 MAXIMUM REFRIGERANT CHARGE limit A	177
385	MM.9.3.2 MAXIMUM REFRIGERANT CHARGE limit B	178
386	MM.9.4 Requirements for equipment with integral circulation airflow	178
387	MM.9.4.1 General	178
388	MM.9.4.2 Continuous circulation airflow	179
389	MM.9.4.3 Circulation airflow activated by a leak detection system	179
390	MM.10 Ventilation for ENHANCED TIGHTNESS REFRIGERATING SYSTEMS using A2L	
391	REFRIGERANTS	179
392	MM.10.1 General	179
393	MM.10.2 Natural ventilation	179

394	MM.10.3 Mechanical ventilation.....	181
395	MM.10.3.1 Operation of mechanical ventilation	181
396	MM.10.3.2 Required airflow.....	181
397	MM.10.3.3 Mechanical ventilation openings.....	181
398	MM.11 Safety shut-off valves for ENHANCED TIGHTNESS REFRIGERATING SYSTEMS	
399	using A2L REFRIGERANTS	181
400	MM.12 Safety alarms for ENHANCED TIGHTNESS REFRIGERATING SYSTEMS using A2L	
401	REFRIGERANTS	182
402	MM.12.1 General.....	182
403	MM.12.2 Safety alarm system warning	182
404	MM.12.2.1 General.....	182
405	MM.12.2.2 Safety alarm for general occupancy	182
406	MM.13 Requirements for REFRIGERATING SYSTEMS employing secondary heat	
407	exchangers	184
408	MM.14 Construction requirements for REFRIGERATING SYSTEMS considered to be	
409	intrinsically safe	185
410	Annex NN (normative) Methods for determining RELEASABLE CHARGE	189
411	NN.1 General	189
412	NN.2 Determination of RELEASABLE CHARGE by a simulated leak	189
413	NN.2.1 Test set-up	189
414	NN.2.2 Test method	190
415	NN.3 Determination of RELEASABLE CHARGE by a simulated leak for REFRIGERATING	
416	SYSTEMS complying with Clause MM.10.....	191
417	NN.3.1 General	191
418	NN.3.2 Test set-up	191
419	NN.3.3 Test method	191
420	NN.4 Determination of RELEASABLE CHARGE by calculation and test for	
421	REFRIGERATING SYSTEMS complying with Clause MM.10	192
422	NN.4.1 General	192
423	NN.4.2 REFRIGERANT release between detection and closing the SAFETY SHUT-OFF	
424	VALVES	193
425	NN.4.3 Determination of m_{r3}	193
426	NN.4.3.1 General	193
427	NN.4.3.2 Determine apparent density, $\rho_{\text{part},i}$, by measuring the pressure	193
428	NN.4.3.3 Determine apparent density, $\rho_{\text{part},i}$, by default values	194
429	NN.4.3.4 Determine apparent density, $\rho_{\text{part},i}$, by measuring the recovered	
430	REFRIGERANT amount from the unit or piping.....	194
431	NN.5 Time before the leak is detected, t_{r1}	195
432	NN.5.1 General	195
433	NN.5.2 Determination of t_{r1} by default time	195
434	NN.5.3 Determination of t_{r1} based on effective room concentration.....	195
435	NN.6 Test conditions for RELEASABLE CHARGE LIMITED SYSTEMS	196
436	Annex OO (normative) Leak simulation tests for FLAMMABLE REFRIGERANT	197
437	OO.1 General.....	197
438	OO.2 Test methods	197
439	OO.2.1 Leak simulation	197
440	OO.2.2 OPERATING CONDITION of equipment	198
441	OO.2.3 REFRIGERANT blends.....	198
442	OO.2.4 Measurement of leaked REFRIGERANT	199
443	OO.2.5 Criteria.....	200

444	Bibliography.....	201
445		
446	Figure 101 – Schema of a REFRIGERATING SYSTEM incorporating a CONDENSER	17
447	Figure 102 – Flow chart illustrating the selection process	18
448	Figure 103 – Details of scratching TOOL tip	65
449	Figure 104 – PS at HIGH PRESSURE SIDE and LOW PRESSURE SIDE	90
450	Figure FF.1 –Schematic illustration of the REFRIGERANT concentration sampling points	132
451	Figure MM.1 – Unventilated area	186
452	Figure MM.2 – Mechanical ventilated area	187
453	Figure MM.3 – Relevant heights h_{inst} , h_0 and h_{rel} for calculation of A_{min} and m_{max}	187
454	Figure MM.4 – Airflow direction.....	188
455		
456	Table 101 – Warning symbols	44
457	Table 102 – Time-temperature conditions	49
458	Table 103 – REFRIGERANT flammability parameters	72
459	Table 104 – Maximum temperatures for MOTOR-COMPRESSORS	81
460	Table 105 – Minimum temperature for determination of SATURATED VAPOUR PRESSURE	
461	of REFRIGERANT	89
462	Table 106 – UV-C spectral irradiance measurement location	98
463	Table 107 – Guidance for conformity assessment category for vessel volume of 100	
464	mL or less.....	101
465	Table AA.1 – Useful symbols	113
466	Table CC.1 – Parameters of pressure vessels according to EN 14276-1	119
467	Table CC.2 – Parameters of piping according to EN 14276-2.....	120
468	Table CC.3 – Components and piping requirements.....	121
469	Table CC.4 – North American component standards cross reference	122
470	Table CC.5 – Minimum wall thickness for copper and steel tubing	123
471	Table FF.1 – Relevant properties and mass flux for selected FLAMMABLE REFRIGERANTS	130
472	Table GG.1 GHS HAZARD class pictograms	133
473	Table GG.2 HAZARD statement code, fluid category, signal word and precautionary	
474	statements	134
475	Table GG.3 Precautionary statement codes and their meanings	135
476	Table HH.1 Lists of standards for personnel competence for REFRIGERATING SYSTEM.....	136
477	Table II.1 – Test of COOLING CAPACITY both under rated ambient conditions and test	
478	ambient conditions	142
479	Table II.2 – OPERATING CONDITIONS for overload tests of the MOTOR-COMPRESSORS.....	143
480	Table II.3 – Steps for increasing the load on the MOTOR-COMPRESSOR	144
481	Table LL.1 – Mandatory clauses in each instructions	147
482	Table MM.1 – Outline of Annex MM (normative).....	158
483	Table MM.2 – Circulation airflow	163
484	Table MM.3 – Equipment with packing	166
485	Table MM.4 – Equipment without packing	166
486	Table MM.5 – Refrigerant leak rate ($\dot{m}_{leak}$)	171
487	Table MM.6 – Minimum air velocity	183
488		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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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.

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 third edition cancels and replaces the second edition published in 2019. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

Introduction to include additional hazards applicable for heating and cooling equipment, other than those for a refrigerating system.

Extension of the scope to include refrigerating systems using R-744 (CO₂) both in subcritical and transcritical states as refrigerant, along with refrigerant equipment containing flammable refrigerant, from limited refrigerant

- charge of 150 g, up to 130×LFL for A2 and A3 refrigerant, 260×LFL for A2L refrigerant, and unlimited refrigerant charge based on intrinsic safe structure design and risk assessment;
- Addition of terms and definitions for equipment type b1 through equipment type c2, correspondence to different refrigerant charge limit, equipment type d without charge limit and equipment type e specific to refrigerant of R-744 (CO₂) in subcritical and transcritical state, and terms related to flammable refrigerants, CO₂ refrigerant, releasable charge and their requirements;
- State of equipment 4.3.2 to include requirements for refrigerating equipment intended to be used with other equipment inside the refrigerated compartment; Relocate test for simulation the failure of the controlled environment from 4.3.2 to 4.4.2.107.
- Remove added symbols related to the heating and cooling equipment from Table 1 to new Table 101 with addition of new symbols for ISO7000-2891 gas under pressure, IEC 60417-6415 minimum room floor area, and IEC 60417-6040, UV radiation;
- Addition for marking requirements for liquid connections, exhaust opening, flammable refrigerant and minimum room floor area, especially the introduction of GHS hazard statement codes and precautionary statement codes for group I fluids;
- Relocate marking requirements from CI 11 for mechanical movement, removable specimen holder, movable immersion circulator, manual filling and draining, and those from CI 13 for requirements related to chemical hazards to CI 5.1 (5.1.5.101 – 5.1.5.104, and 5.1.101, 5.1.102);
- 5.4.1 replace the general requirement for documents to include information related to the shipment so that UN number of equipment for refrigerating system can be specified;
- 5.4.3, 5.4.4 and 5.4.5 to include document requirements related to the GHS hazard statement codes and precautionary statement codes and more related to the use of flammable refrigerants and R-744.
- 5.4.101 additional instructions for equipment containing flammable refrigerant, 5.4.102 additional instructions for equipment using R-744, 5.4.103 additional instructions for equipment intended for use with refrigerated LN₂, 5.4.104 for equipment using flammable heat transfer medium, 5.4.105 for equipment integrated with UV-C-lamps and 5.4.106 for competence of personnel;
- 8.1 new addition of requirements for, bath tank and vessel (8.101), liquid connections (8.102), flexible tubing and hose (8.103), loading capacity of shelves (8.104), strength of glass windows or doors (8.105) and structure requirements for the refrigerating system, including, structure requirements, protection against mechanical damage, scratch tests, piping joints and fittings, hermetically sealed joints, field made joints, equipment type c2 including a separate section, enhanced tightness refrigerating system, limit of refrigerant charge and connections for CO₂ charging.
- 9.2.101 to include list and examples of possible ignition sources, arcs and sparks from electric components, and surface temperature limits exposed to leaked flammable refrigerant;
- 9.5.101 additional requirements for equipment containing flammable refrigerants removed from 11.7 to 9.5.101;
- 9.5.102 internal fluid leaks removed from 11.7 to 9.5.102;
- 9.5.103 flammable liquid heat transfer media and/or flammable refrigerants as release sources and example for grade of releases, factors to be considered in assessment for sources and grade of release;
- 9.5.104 to add location for sensor of leak detection system, for releasable charge;
- 11.1 general, to replace the first paragraph, so that single fault conditions are considered
- 11.7.1 maximum pressure for equipment with intrinsic safety or leak potential with or without limited by refrigerant charge. Relocate the determination of the PS to 11.7.1.101.
- 11.7.2 to delete the paragraph referring to EN378-2 and IEC 60335-2-89 and conformity statement;
- 11.7.2.101 rename the title for leakage and rupture of refrigerating systems, addition for tightness of the equipment
- 11.7.2.102 additional requirements for REFRIGERATING EQUIPMENT that use R-744 REFRIGERANT
- 11.7.2.103 pressure test for storage and transport;
- 11.7.4.101 pressure-limiting device and discharge capacity for pressure-relief device used in equipment type e;
- 12.3.101 to add construction requirements for UV-C radiation, 12.3.102 UV-C irradiance test.
- 14.101 for components and subassemblies for refrigerating systems;
- 14.102 materials for refrigerating system, including copper, stainless steel, thickness of copper and steel tubes;.
- Annex F, added for routine tests for equipment containing flammable refrigerants;
- Annex L, update the list for new terms;
- Table CC.4 to add component standards cross reference for USA and Canada
- Annex FF, added test method for determining gas concentration beyond the boundary of the equipment
- Annex GG added classification of fluid group
- Annex HH added competence of personnel for refrigerant equipment type d;
- Annex II added for overload tests for refrigerating equipment incorporated with motor-compressors;
- Annex JJ void;
- Annex KK added transportation, marking and storage for equipment that containing flammable refrigerants;

- 603 Annex LL added requirements for installation, service, maintenance and repair, and decommissioning instructions
604 of equipment using flammable refrigerants
- 605 Annex MM added charge limits, ventilation requirements and requirements for secondary circuits for equipment
606 using flammable refrigerants
- 607 Annex NN added methods for determining releasabl charge;
- 608 Annex OO remove leak simulations for flammable refrigerant from 11.7.
- 609 The text of this International Standard is based on the following documents:

FDIS	Report on voting
66/687/FDIS	66/688/RVD

- 610
611 Full information on the voting for the approval of this International Standard can be found in the report on voting
612 indicated in the above table.

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

- 614 A list of all parts of the IEC 61010 series, published under the general title, *Safety requirements for electrical*
615 *equipment for measurement, control, and laboratory use*, canbe found on the IEC website.

- 616 IEC 61010-2-012 is to be used in conjunction with the latest edition of IEC 61010-1. It was established on the basis
617 of the third edition (2010) and its Amendment 1 (2016), hereinafter referred to as Part 1.

- 618 This Part 2-012 supplements or modifies the corresponding clauses in IEC 61010-1 so as to convert that
619 publication into the IEC standard: *Particular requirements for climatic and environmental testing and other*
620 *temperature conditioning equipment*.

- 621 Where a particular subclause of Part 1 is not mentioned in this Part 2-012, that subclause applies as far as is
622 reasonable. Where this Part 2-012 states "addition", "modification", "replacement", or "deletion", the relevant
623 requirement, test specification, or note in Part 1 should be adapted accordingly.

- 624 In this standard:

- 625 1) the following print types are used:
- 626 – requirements and definitions: in roman type;
 - 627 – NOTES: in smaller roman type;
 - 628 – *conformity and tests: in italic type;*
 - 629 – terms used throughout this standard which have been defined in Clause 3: SMALL ROMAN CAPITALS.
- 630 2) subclauses, figures, tables and notes which are additional to those in Part 1 are numbered starting from 101.
631 Additional annexes are lettered starting from AA.

- 632 The committee has decided that the contents of this document will remain unchanged until the stability date
633 indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this
634 date, the document will be

- 635 ● reconfirmed,
- 636 ● withdrawn,
- 637 ● replaced by a revised edition, or
- 638 ● 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.

- Expansion of liquid REFRIGERANT in a closed space without the presence of vapour, caused by a rise in external temperature.
- 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, hot-gas bypassing, heat-pump reversing, low-speed and high-speed operation of the MOTOR-COMPRESSOR that may apply.
- The escape of REFRIGERANT causing, for example: asphyxiation, RISK of fire or explosion or freezing of skin, depending on the REFRIGERANT released.
- Thermal, chemical, mechanical stress of the EVAPORATOR imposed under extreme heating and cooling HEAT TRANSFER MEDIUM, including wide CONTROLLED TEMPERATURE range and fast temperature ramping, damp heat conditioning, as well as under vibrating or impact from MECHANICAL MOVEMENT.

What additional HAZARDS are applicable for a heating and cooling equipment?

- 1) from direct effect of extreme temperatures, resulting in, for example:
 - overheating or under heating of materials being treated or process being controlled.
 - burn or frost-bite by hot and cold surface, exhaust of air or leakage and spray of the liquid HEAT TRANSFER MEDIUM.
 - over-current of a motor stirrer or CIRCULATING PUMP under high viscosity or frozen condition, or leakage of water or brine after frost-heaving of the BATH TANK.
 - Degradation of material strength or insulation under temperature changing.
 - Electric shock or fire.
- 2) from direct effect of high pressures, resulting in, for example:
 - overpressure of a sealed CIRCULATOR, or a steam HUMIDIFIER.
 - pressure change of a TEST CHAMBER, especially fast ramping WALK-IN EQUIPMENT.
- 3) from direct effect of electric shock, resulted from, for example:
 - operation at WET LOCATION and under high humidity or condensing.
 - direct contact with accessible conductors of heating devices.
- 4) from direct effect of liquid, steam or fume, resulting in, for example:
 - overflow, spray or spillage of liquid HEAT TRANSFER MEDIUM under thermal expansion and contraction in an open BATH or sealed-CIRCULATOR during heating and cooling.
 - Leakage of liquid HEAT TRANSFER MEDIUM at shaft of a CIRCULATING PUMP, LIQUID CONNECTIONS when circulating.
 - Electric shock.
 - Fire or explosion.
 - Asphyxiation or slippery.
- 5) From direct effect of radiation or mechanical movement, resulting in, for example:
 - Overheating, hazardous radiation or strong optical radiation from functional light control of a growth or weathering TEST CHAMBER.
 - Injury or cutting, damage, hearing loss related to shaking, shocking, or impacting, or excessive noise in a SHAKER or a COMBINED TEST CHAMBER.

6) From direct effect of an application, resulting in, for example:

- Chemical or biological HAZARDS related to leakage, drainage or exhausted faeces, micro-particles, liquid or fumes as a result of incubation, breeding, growing, chemical or biological treatment etc in an INCUBATOR or biological and mould growth TEST CHAMBER.
- Chemical or biological HAZARDS as a result of imbalance or loose SPECIMEN related to shaking in a SHAKER.
- Rapture of an APPLICATION SYSTEM, for example a jacketed glass reactor connected to a CIRCULATOR.

Asphyxiation, slippery or crushing of hands in a WALK-IN EQUIPMENT. 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.

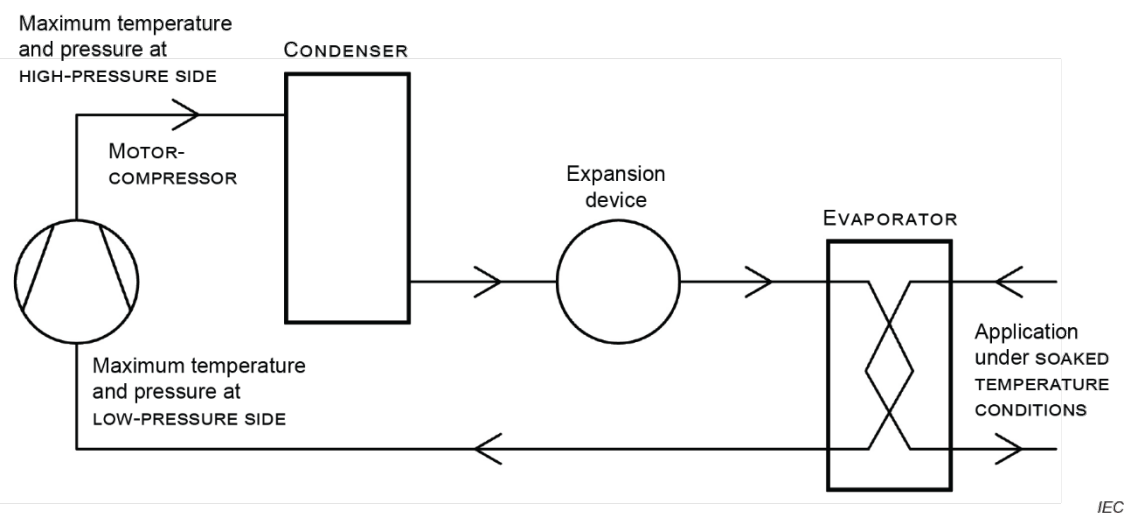
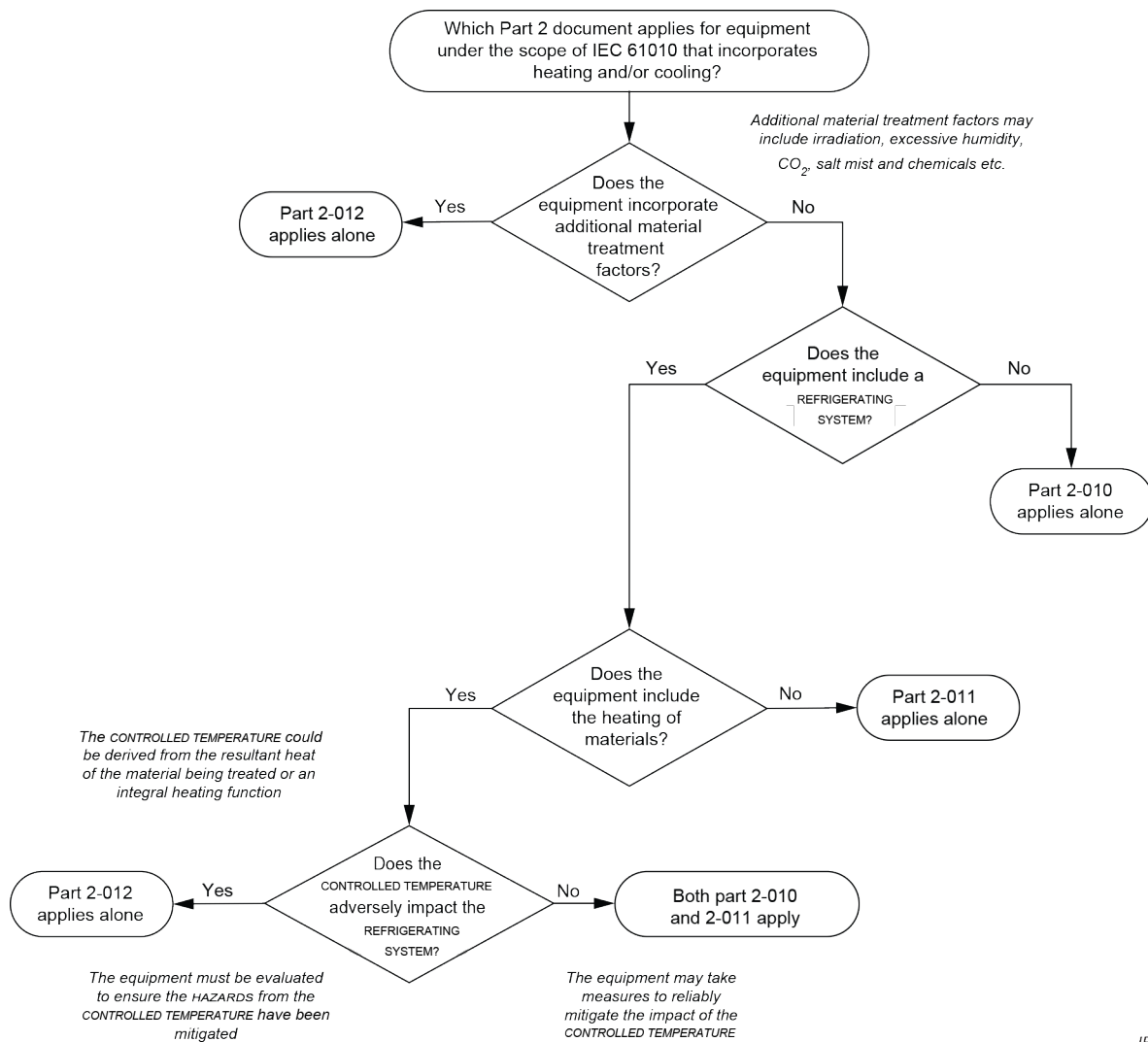


Figure 101 – Schema of a REFRIGERATING SYSTEM incorporating a CONDENSER

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748 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

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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, and when containing or intended for use with hazardous fluids, whether flammable or under high pressure, such that additional and/or more severe HAZARDS resulted than those for non-hazardous fluids.
- 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 damp heat, 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.

This document details the requirements for equipment when containing or intended for use with

- a) non-flammable REFRIGERANTS of no charge limit including R-744 (CO₂), in either subcritical and transcritical state, and
- b) FLAMMABLE REFRIGERANT where a single rupture of the REFRIGERANT CIRCUIT may result in a REFRIGERANT release to an OCCUPIED SPACE, with limited MAXIMUM REFRIGERANT CHARGE m_c up to
 - m_1 (equivalent to $4 \times LFL$, R290, 150 g),
 - $2 \times m_1$ for non-FIXED EQUIPMENT,
 - m_2 (equivalent to $26 \times LFL$) and
 - m_3 (equivalent to $130 \times LFL$) and

c) FLAMMABLE REFRIGERANT where a single rupture of the REFRIGERANT CIRCUIT does not result in a REFRIGERANT release to an OCCUPIED SPACE, for example, in case of a liquid to liquid heat pumps, liquid to gas heat pumps, and cooling and/or heating BATHS and CIRCULATORS, MAXIMUM REFRIGERANT CHARGE up to m_3 may apply and no MINIMUM ROOM AREA is required, and

d) FLAMMABLE REFRIGERANT where the construction and ROUTINE TEST are such that a REFRIGERANT leak under NORMAL USE and SINGLE FAULT CONDITIONS is not considered likely possible, therefore, the equipment can be assumed to be intrinsically safe without limited by REFRIGERANT CHARGE and room size. Supplemental requirements may apply based on the RISK mitigation approach and the FLAMMABLE REFRIGERANT employed in each REFRIGERANT CIRCUIT.

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.

NOTE 102 National and regional laws and regulations may apply, Examples include but are not limited to Pressure Equipment Directive PED 2014/68/EU, Boiler and Pressure Vessel Code, BPVC of ASME, USA, etc.

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 103 Term number 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 (IEC 61010-2-040);
- cc) the evaluation of safety devices or components for pressure equipment;
- dd) equipment or components exceeding the limits in Table CC.1 or Table CC.2 as additional requirements apply and national or international legislation may set additional requirements.

1.2 Object

1.2.1 Aspects included in scope

Addition:

Add the following items after item g):

- aa) biohazards(see 13.101);

839 bb) hazardous chemical substances(see13.102).

840 *Addition:*

841 *Add the following note after the existing note:*

842 NOTE 101 A list of HAZARDS typically associated with climatic and environmental testing and other temperature
843 conditioning equipment is included in Introduction.

844 NOTE 102 For EU, the sealed system components may be considered pressure vessels or piping in accordance
845 with the PRESSURE EQUIPMENT DIRECTIVE (PED) 2014/68/EU. This document addresses equipment which is
846 PED category $\leq$ I and so excluded from the scope of the PED according to Article 4 (3). Refer to Annex CC for
847 guidance on the applicable pressure category for vessels (Table CC.1) or piping (Table CC.2).

848 For the equipment or the components, which are classified higher than category I and operated at this
849 classification level, will have to follow additional requirements (such as EN 378-2, alternative standards are not
850 excluded). These additional requirements are not covered by this document. However, the basic method applied in
851 this document is according to the method for complying with such additional requirements.

852 2. Normative references

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

854 *Addition:*

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

857 IEC 60079-7:2015/AMD1:2017, *Explosive atmospheres – Part 7: Equipment protection by*
858 *increased safety "e"*

859 IEC 60079-20-1, *Explosive atmospheres – Part 20-1: Material characteristics for gas and*
860 *vapour classification – Test methods and data*

861 IEC 60079-29-1, *Explosive atmospheres – Part 29-1: Gas detectors – Performance*
862 *requirements of detectors for flammable gases*

863 IEC 60335-2-34:2024, *Household and similar electrical appliances – Safety – Part 2-34:*
864 *Particular requirements for motor-compressors*

865 IEC 60335-2-40:2022, *Household and similar electrical appliances – Safety – Part 2-40:*
866 *Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers*

867 IEC 60730-1:2007, ed3.2, *Automatic electrical controls for household and similar use – Part 1:*
868 *General requirements*

869 IEC 60730-2-6, *Automatic electrical controls – Part 2-6: Particular requirements for automatic*
870 *pressure sensing controls including mechanical requirements*

871 IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

872 ISO 817:2014/AMD1:2017, *Refrigerants – Designation and safety classification*

873 ISO 4126-2:2018, *Safety devices for protection against excessive pressure – Bursting disc*
874 *safety devices*

875 ISO 5149-1:2014/AMD1:2015, *Refrigerating systems and heat pumps – Safety and*
876 *environmental requirements – Part 1: Definitions, classification and selection criteria*

877 ISO 7010, *Graphical symbols– Safety colours and safety signs – Registered safety*
878 *signs*(available at <https://www.iso.org/obp>)

879 UL 1998 Ed.3:2013, *Standard for Software in Programmable Components*

880 **3. Terms and definitions**

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

882 **3.1 Equipment and states of equipment**

883 *Addition:*

884 *Add the following new terms and definitions:*

885 **3.1.101**

886 **BATH**

887 complete device intended for application of CONTROLLED TEMPERATURES to SPECIMENS by
888 immersion in a temperature-controlled liquid HEAT TRANSFER MEDIUM

889 **3.1.102**

890 **CIRCULATOR**

891 equipment intended for application of CONTROLLED TEMPERATURES to an APPLICATION SYSTEM
892 by external circulating of a temperature-controlled liquid HEAT TRANSFER MEDIUM

893 **3.1.103**

894 **TEST CHAMBER**

895 ENCLOSURE or space in some part of which specified conditions can be achieved, in particular,
896 temperature, humidity, irradiation, low air pressure, mould growth and salt spray

897 **3.1.104**

898 **COMBINED TEST CHAMBER**

899 special TEST CHAMBER combined with the function of MECHANICAL MOVEMENT, for example, for
900 vibration, shock, impact, and similar dynamic tests

901 **3.1.105**

902 **INCUBATOR**

903 special TEST CHAMBER, primarily for incubation of microorganisms and tissue culture

904 **3.1.106**

905 **SHAKER**

906 equipment to disperse or dissolve one substance in another by MECHANICAL MOVEMENT without
907 the use of blades or stirrers that might destroy the structure of the substance, in particular,
908 shaking BATH and shaking INCUBATOR

909 **3.1.107**

910 **WALK-IN EQUIPMENT**

911 TEST CHAMBER or INCUBATOR, the door of which allows the OPERATOR to enter and remain
912 inside the equipment even with the door closed

913 **3.1.108**

914 **EQUIPMENT TYPE B1**

915 Type of REFRIGERANT equipment where a single rupture of the REFRIGERANT CIRCUIT may result
916 in a REFRIGERANT release to an OCCUPIED SPACE, that the MAXIMUM REFRIGERANT CHARGE of
917 FLAMMABLE REFRIGERANT is limited up to m_1 in each REFRIGERANT CIRCUIT.

918 NOTE to entry: Annex MM provides quantity for m_1 and detailed requirements for charge limits and ventilation.

3.1.109**EQUIPMENT TYPE B2**

Type of REFRIGERANT equipment, which is non-FIXED EQUIPMENT, where a single rupture of the REFRIGERANT CIRCUIT may result in a REFRIGERANT release to an OCCUPIED SPACE, and that the MAXIMUM REFRIGERANT CHARGE of FLAMMABLE REFRIGERANT is limited up to $2 \times m_1$ in each REFRIGERANT CIRCUIT.

NOTE to entry: Annex MM provides quantity for m_1 and detailed requirements for charge limits and ventilation.

3.1.110**EQUIPMENT TYPE C1**

Type of REFRIGERANT equipment where a single rupture of the REFRIGERANT CIRCUIT may result in a REFRIGERANT release to an OCCUPIED SPACE, that the MAXIMUM REFRIGERANT CHARGE of FLAMMABLE REFRIGERANT is limited up to m_2 in each REFRIGERANT CIRCUIT.

NOTE to entry: Annex MM provides quantity for m_2 and detailed requirements for charge limits and ventilation.

3.1.111**EQUIPMENT TYPE C2**

Type of REFRIGERANT equipment where a single rupture of the REFRIGERANT CIRCUIT may result in a REFRIGERANT release to an OCCUPIED SPACE, that the MAXIMUM REFRIGERANT CHARGE of FLAMMABLE REFRIGERANT is limited up to m_3 in each REFRIGERANT CIRCUIT.

NOTE to entry: Annex MM provides quantity for m_3 and detailed requirements for charge limits and ventilation.

3.1.112**EQUIPMENT TYPE D**

Type of REFRIGERANT equipment where the construction and ROUTINE TEST are such that a leak of FLAMMABLE REFRIGERANT under SINGLE FAULT CONDITIONS is not considered possible during its expected life provided all preventative maintenance is sustained. Therefore, there is no limit to the REFRIGERANT CHARGE of REFRIGERANT employed.

3.1.113**EQUIPMENT TYPE E**

Type of REFRIGERANT equipment that contains CO₂ REFRIGERANT (R744) in both subcritical and transcritical states

3.1.114**GROUP I EQUIPMENT**

equipment containing or intended for using with group I fluids.

Note 1 to entry: Group I fluids are dangerous fluids with at least one of the HAZARD statements as defined in Annex GG.

Note 2 to entry: Group I fluids also include substances and mixtures contained or intended for use with the equipment whose maximum permissible temperature is above the FLASH POINT of the fluid.

3.1.115**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

3.1.116**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

3.1.117**OPERATING CONDITION**

function and state of the equipment is in at a specific time during normal operation

NOTE to entry: Examples include STANDSTILL, cooling, heating, defrosting, humidity conditioning and light exposure.

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****REFRIGERANT CIRCUIT**

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: IEC 60335-2-89:2019, 3.6.104]

3.2.103**CASCADE SYSTEM**

REFRIGERATING SYSTEM consisting of two or more independent REFRIGERANT 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 gasketed joints (semi-hermetic MOTOR-COMPRESSOR). A TERMINAL box, a TERMINAL box cover, and other electrical components or an electronic control system may be included.

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".]

- 1006 **3.2.106**
1007 **CONDENSING UNIT**
1008 specific refrigerating subassembly combination for a given REFRIGERANT, consisting of one or
1009 more MOTOR-COMPRESSORS, CONDENSERS or GAS COOLERS, liquid receivers (when required)
1010 and the regularly furnished accessories
- 1011 **3.2.107**
1012 **EVAPORATOR**
1013 heat exchanger in which liquid REFRIGERANT is vaporized by absorption of heat
- 1014 [SOURCE: IEC 60335-2-40:2018, 3.110, modified – "refrigerant liquid" has been replaced by
1015 "liquid refrigerant".]
- 1016 **3.2.108**
1017 **HIGH-PRESSURE SIDE**
1018 part of a REFRIGERATING SYSTEM operating approximately at the CONDENSER pressure
- 1019 [SOURCE: ISO 5149-1:2014, 3.1.7]
- 1020 **3.2.109**
1021 **LOW-PRESSURE SIDE**
1022 part of a REFRIGERATING SYSTEM operating approximately at the EVAPORATOR pressure
- 1023 [SOURCE: ISO 5149-1:2014, 3.1.8]
- 1024 **3.2.110**
1025 **CIRCULATING PUMP**
1026 pressure and/or suction pump transporting the liquid HEAT TRANSFER MEDIUM in a BATH or
1027 CIRCULATOR
- 1028 **3.2.111**
1029 **CIRCULATING FAN**
1030 propeller fan or centrifugal impeller designed to circulate the air in a TEST CHAMBER or an
1031 INCUBATOR with or without any air duct
- 1032 **3.2.112**
1033 **HUMIDIFIER**
1034 electric device that generates a water mist or steam and releases it into a room, greenhouse
1035 or other ENCLOSURE
- 1036 **3.2.113**
1037 **BATH TANK**
1038 open or enclosed vessel containing the HEAT TRANSFER MEDIUM, in a BATH or CIRCULATOR
- 1039 **3.2.114**
1040 **LIQUID CONNECTION**
1041 pipe fitting through which liquid is expelled from or discharged into a vessel or a heat
1042 exchanger
- 1043 **3.2.115**
1044 **VENTILATOR**
1045 device for replacing air inside a TEST CHAMBER or an INCUBATOR with outside air
- 1046 **3.2.116**
1047 **TEMPERATURE-LIMITING DEVICE**
1048 temperature-actuated device that is designed to prevent unsafe temperatures

1049 [SOURCE: EN 378-1:2008, 3.6.5]

1050 **3.2.117**

1051 **LIQUID LEVEL CUT OUT**

1052 **LLCO**

1053 liquid level-actuated device designed to prevent unsafe liquid levels

1054 [SOURCE: EN 378-1:2008, 3.6.12]

1055 **3.2.118**

1056 **PRESSURE-LIMITING DEVICE**

1057 pressure-actuated device (for example, a high-pressure switch) which is designed to stop the
1058 operation of the pressure-imposing element and may also operate an alarm

1059 NOTE to entry: For this part of the document, the category of a PRESSURE-LIMITING DEVICE, which is used for the
1060 protection of equipment subject to high pressure, can be generally determined to category IV.

1061 **3.2.119**

1062 **PRESSURE-RELIEF DEVICE**

1063 valve or disc designed to relieve excessive pressure automatically

1064 [SOURCE: ISO 5149-1:2014, 3.6.7, modified – "pressure relief valve or bursting disc device"
1065 has been replaced with "valve or disc" in the definition.]

1066 **3.2.120**

1067 **FLAMMABLE LIQUID**

1068 liquid capable of producing a flammable gas or vapour which, when mixed with air in certain
1069 proportions, will form an EXPLOSIVE GAS ATMOSPHERE under any foreseeable OPERATING
1070 CONDITIONS

1071 **3.2.121**

1072 **HEAT TRANSFER MEDIUM**

1073 medium used to transfer heat to the material being processed

1074 NOTE to entry: For this part of the document, a liquid heat transfer medium is classified as liquid, i.e. liquid having
1075 a vapour pressure at the maximum allowable temperature of 0.5 bar or less.

1076 **3.2.122**

1077 **REFRIGERANT**

1078 fluid used for heat transfer in a REFRIGERATING SYSTEM, which absorbs heat at a low
1079 temperature and a low pressure of the fluid and rejects heat at a higher temperature and a
1080 higher pressure of the fluid, usually involving changes of state of the fluid

1081 NOTE to entry: For this part of the document, a REFRIGERANT, including CO₂ and LN₂ is classified as gas, i.e. gas,
1082 liquefied gas, gas dissolved under pressure or any liquid whose vapour pressure at the maximum allowable
1083 temperature is greater than 0.5 bar.

1084 [SOURCE: ISO 817:2014, 3.1.35, modified – the term "phase" has been replaced with "state"
1085 in the definition.]

1086 **3.2.123**

1087 **FLAMMABLE REFRIGERANT**

1088 REFRIGERANT with a flammability classification of group A2L, A2 or A3 in accordance with
1089 ISO 817, or HAZARD statement codes of H220, H221 in accordance with GHS Classification

1090 NOTE 1 to entry: For REFRIGERANT blends which have more than one flammability classification, either the most
1091 unfavourable classification is taken for the purpose of this definition or the blend itself is evaluated for flammability
1092 in accordance with ISO 817.

1093 NOTE 2 to entry: GHS, an abbreviation for the Globally Harmonized System of Classification and Labelling of
1094 Chemicals. Refer to Annex GG for more information.

1095 3.2.124**1096 SPECIMEN**

1097 any material, substance, or product designated to be processed, for example, in a BATH, TEST
1098 CHAMBER or an INCUBATOR

1099 3.2.125**1100 APPLICATION SYSTEM**

1101 system or device intended to work with a CIRCULATOR to carry out a functional purpose

1102 3.2.126**1103 GAS COOLER**

1104 heat exchanger in which, after compression, the REFRIGERANT is cooled down, by transferring
1105 heat to an external cooling medium, without changing state

1106 NOTE to entry: A gas cooler is normally used in TRANSCRITICAL REFRIGERATING SYSTEMS.

1107 [SOURCE: IEC 60335-2-89:2019, 3.6.103]

1108 3.2.127**1109 TRANSCRITICAL REFRIGERATING SYSTEM**

1110 REFRIGERATING SYSTEM where the pressure in the HIGH-PRESSURE SIDE is above the pressure
1111 where the vapour and liquid stated of the REFRIGERANT can coexist in thermodynamic
1112 equilibrium

1113 3.2.128**1114 FLASH GAS BYPASS VALVE**

1115 enables gas from the FLASH GAS TANK to be removed for compression with carbon dioxide (R-
1116 744) TRANSCRITICAL REFRIGERATING SYSTEMS.

1117 3.2.129**1118 FLASH GAS TANK**

1119 provided to separate the vapour and supply liquid to EVAPORATORS for expansion in carbon
1120 dioxide (R-744) TRANSCRITICAL REFRIGERATING SYSTEMS, and once cooled in the GAS COOLER,
1121 REFRIGERANT is throttled to the subcritical region and enters this device.

1122 3.2.130**1123 INTERMEDIATE PRESSURE STAGE**

1124 this applies to carbon dioxide (R-744) TRANSCRITICAL REFRIGERATING SYSTEMS, lays between
1125 the HIGH-PRESSURE SIDE and LOW-PRESSURE SIDE stages and is regulated by a FLASH GAS
1126 BYPASS VALVE. This stage may include a FLASH GAS TANK and GAS COOLER.

1127 3.2.131**1128 PRESSURE REGULATING RELIEF VALVE**

1129 similar to a PRESSURE RELIEF VALVE except specifically intended for use with REFRIGERATING
1130 SYSTEMS utilizing carbon dioxide (R-744) as the REFRIGERANT in a secondary loop or CASCADE
1131 SYSTEM.

1132 NOTE 1 to entry The pressure relief setting of this valve is always lower than the relief setting of a PRESSURE
1133 RELIEF DEVICE. This valve may open and re-close many times during the life of the system.

1134 3.2.132**1135 CRITICAL POINT**

1136 point in a REFRIGERANT CIRCUIT where FLAMMABLE REFRIGERANT may leak

1137 NOTE 1 to entry: The following are not considered to be CRITICAL POINTS:

- 1138 – pipes with a bended radius, measured along the centre line, of no less than 2,5 times the external pipe
1139 diameter;
- 1140 – welded telescopic joints of the MOTOR-COMPRESSOR;

- 1141 – welding of the pipes through the MOTOR-COMPRESSOR housing;
- 1142 – welding of hermetic glass to metal seals (fusite);
- 1143 – schraeder valve with double gaskets and/or seals.

1144 NOTE 2 to entry: CRITICAL POINTS can include parts under stress or vibration.

1145 [SOURCE: IEC 60335-2-89:2019, 3.6.108, modified]

1146 **3.2.133**

1147 **HERMETICALLY SEALED SYSTEM**

1148 REFRIGERATING SYSTEM in which all REFRIGERANT-containing parts are sealed by welding,
1149 brazing or a similar permanent connection

1150 [SOURCE: IEC 60335-2-89:2019, 3.6.107]

1151

1152 **3.2.134**

1153 **HERMETICALLY-SEALED JOINT**

1154 joint that are made tight by welding, brazing or a similar permanent connection.

1155 [SOURCE: ISO 14903:2017, 3.7]

1156 **3.2.135**

1157 **HERMETICALLY-SEALED COMPONENT**

1158 component that are made tight by welding, brazing or a similar permanent connection.

1159 [SOURCE: ISO 14903:2017, 3.8]

1160 **3.2.136**

1161 **TYPE APPROVED COMPONENT**

1162 component for which examination is performed on one or more samples of this component in
1163 accordance with a recognized standard for type approval.

1164 **3.2.137**

1165 **WELDED JOINT**

1166 joint obtained by the joining of metal parts in the plastic or molten state.

1167 [SOURCE: EN 378-1: 2016, 3.5.3]

1168 **3.2.138**

1169 **BRAZED JOINT**

1170 joint obtained by the joining of metal parts with alloys which melt at temperatures in general
1171 higher than 450 °C but less than the melting temperatures of the joined parts.

1172 [SOURCE: EN 378-1: 2016, 3.5.4]

1173 **3.2.139**

1174 **SOLDERED JOINT**

1175 joint obtained by the joining of metal parts with metallic mixtures or alloys which melt at
1176 temperatures in general less than 450 °C

1177 [SOURCE: EN 378-1: 2016, 3.5.5]

1178 **3.2.140**

1179 **NORMAL TIGHTNESS**

1180 absence of leakage when any of the tightness tests or tightness monitoring appropriate for the
1181 application does not reveal any hazardous leaks during NORMAL USE.

1182 [SOURCE: EN 1127-1:2019, 3.1, change made for normal operation to normal use]

1183 **3.2.141**

1184 **ENHANCED TIGHTNESS**

1185 absence of leakage when due to the design and measures of maintenance any of the
1186 tightness tests or tightness monitoring appropriate for the application does not reveal any
1187 hazardous leaks during NORMAL USE and under SINGLE FAULT CONDITION.

1188 **3.2.142**

1189 **ENHANCED TIGHTNESS REFRIGERATING SYSTEM**

1190 REFRIGERATING SYSTEM in which the heat exchanger in OCCUPIED SPACE are designed and
1191 fabricated to ensure a high level of confidence that hazardous REFRIGERANT leak will not occur
1192 under NORMAL CONDITION and SINGLE FAULT CONDITION

1193 **3.2.143**

1194 **SERVICE PORT**

1195 **means to access the REFRIGERANT in a REFRIGERATING SYSTEM for the purpose of charging or**
1196 **servicing the system, typically a valve, tube extension or entry location**

1197 [SOURCE: IEC 60335-2-40: 2022, 3.125]

1198 **3.2.144**

1199 **FACTORY SEALED SINGLE PACKAGE UNIT**

1200 **factory assembly of components of REFRIGERATING SYSTEM fixed on a common mounting to**
1201 **form a discrete unit in which all REFRIGERATING SYSTEM parts have been sealed tight by**
1202 **welding, brazing or a similar permanent connection during the manufacturing process**

1203 [SOURCE: IEC 60335-2-40: 2022, 3.126]

1204 **3.2.145**

1205 **UV-C LAMP**

1206 **source made to produce ultraviolet radiation in the range of 100 nm to 280 nm wavelengths**

1207 **Note 1 to entry: There are several types of such lamps used for photobiological, photochemical and biomedical**
1208 **purposes.**

1209 [SOURCE: IEC 60335-2-40: 2022, 3.150]

1210 **3.2.146**

1211 **RELEASABLE CHARGE LIMITED SYSTEM**

1212 **REFRIGERATING SYSTEM in which the RELEASABLE CHARGE is limited by design measures**

1213 **NOTE 1 to entry: Example, Systems relying on closing SAFETY SHUT-OFF VALVES when the MOTOR-COMPRESSOR is**
1214 **STANDSTILL are examples of RELEASABLE CHARGE LIMITED SYSTEMS not relying on LEAK DETECTION SYSTEMS.**

1215 **NOTE 2 to entry: Example, Systems relying on measuring temperature, pressure, ultrasonic leak detection, or other**
1216 **working parameters to detect a leak are examples of RELEASABLE CHARGE LIMITED SYSTEMS not relying on REFRIGERANT**
1217 **detection systems.**

1218 [SOURCE: IEC 60335-2-40: 2022, 3.158]

1219 **3.2.147**

1220 **SAFETY SHUT-OFF VALVE**

1221 **valve for the purpose of limiting the amount of RELEASABLE CHARGE**

1222 [SOURCE: IEC 60335-2-40: 2022, 3.159]

3.2.148**LEAK DETECTION SYSTEM****sensing system which responds to REFRIGERANT leaking from a REFRIGERATING SYSTEM**

NOTE 1 to entry: A LEAK DETECTION SYSTEM can include gas sensing, ultrasonic or other such methods demonstrated to be sufficiently effective.

NOTE 2 to entry: A REFRIGERANT detection system is an example of a LEAK DETECTION SYSTEM.

NOTE 3 to entry: Annex PP of IEC 60335-2-40:2022 provides test procedures for confirmation of a LEAK DETECTION SYSTEM for FLAMMABLE REFRIGERANTS.

NOTE 4 to entry: Annex LL of IEC 60335-2-40:2022 provides requirements for REFRIGERANT detection system for use in equipment containing containing FLAMMABLE REFRIGERANTS.

3.3 Quantities*Addition:**Add the following new terms and definitions:***3.3.101****REFRIGERANT CHARGE** m_c **mass of REFRIGERANT within a single REFRIGERANT CIRCUIT****3.3.102****MAXIMUM REFRIGERANT CHARGE** m_{max} **limit of REFRIGERANT CHARGE within a single REFRIGERANT CIRCUIT as result from a calculation for room area or similar**

NOTE to entry: Annex MM provides quantity for m_{max} and detailed requirements for charge limits and ventilation.

3.3.103**RELEASABLE CHARGE** m_{rl} **part of REFRIGERANT CHARGE that can be released into the OCCUPIED SPACE from a REFRIGERATING SYSTEM in the event of a leak**

NOTE 1 to entry: Any part of the REFRIGERANT CHARGE that leaks to the outdoor is excluded from the RELEASABLE CHARGE.

[SOURCE: IEC 60335-2-40:2022, 3-156, modified]

3.3.104**MINIMUM ROOM AREA** A_{min} **limit of room area as result from a calculation in which equipment containing specific quantity of FLAMMABLE REFRIGERANT CHARGE allowed to be installed.**

NOTE to entry: Annex MM provides formulae for A_{min} based on REFRIGERANT CHARGE m_c and ventilation.

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**

1266 3.5.102**1267 MAXIMUM ALLOWABLE PRESSURE****1268 PS**

1269 maximum pressure for which the equipment is designed, as specified by the manufacturer

1270 NOTE to entry: This note applies to the French language only.

1271 [SOURCE: EN 378-1:2008, 3.3.2]

1272 3.5.103**1273 RATED PRESSURE**

1274 MAXIMUM ALLOWABLE PRESSURE for pressure components of equipment with regard to their
1275 ability to withstand pressures as specified by the manufacturer

1276 3.5.104**1277 ACTIVE COOLING CONTROL RANGE****1278 ACC RANGE**

1279 CONTROLLED TEMPERATURE range that is achieved by an active REFRIGERATING SYSTEM

1280 NOTE to entry: This note applies to the French language only.

1281 3.5.105**1282 FLASH POINT**

1283 lowest liquid temperature at which, under certain standardized conditions, a liquid gives off
1284 vapours in quantity such as to be capable of forming an ignitable vapour/air mixture

1285 NOTE to entry: At the FLASH POINT, the vapour may cease to burn when the ignition source is removed.

1286 [SOURCE: IEC 60050-426:2008, 426-02-14]

1287 3.5.106**1288 FIRE POINT**

1289 lowest temperature at which a substance ignites and continues to burn for at least 5 s after a
1290 small flame has been applied to its surface under standardized conditions

1291 3.5.107**1292 AUTO IGNITION TEMPERATURE**

1293 lowest temperature at which a substance will spontaneously ignite in a normal atmosphere
1294 without an external ignition source, such as a flame or spark

1295 NOTE to entry: Once ignited, the substance will continue to burn until it is either completely consumed or the
1296 temperature of the remainder of the substance is reduced to or below its FIRE POINT.

1297 3.5.108**1298 LOWER EXPLOSIVE LIMIT / LOWER FLAMMABILITY LIMIT****1299 LEL / LFL**

1300 concentration of flammable gas or vapour in air, below which an EXPLOSIVE GAS ATMOSPHERE
1301 will not be formed

1302 NOTE to entry: This note applies to the French language only.

1303 [SOURCE: IEC 60050-426:2008, 426-02-09]

1304 3.5.109**1305 EXPLOSIVE GAS ATMOSPHERE**

1306 mixture with air, under atmospheric conditions, of flammable substances in the form of gas or
1307 vapour which, after ignition, permits self sustaining flame propagation

1308 [SOURCE: IEC 60050-426:2008, 426-01-07]

1309 **3.5.110**1310 **SOAKED TEMPERATURE CONDITION**

1311 temperature conditions when the ambient temperature of the equipment under test (EUT)
 1312 equals to $\pm 2,0$ °C of maximum ambient of 1.4.1 for NORMAL USE, storage or transport, and the
 1313 CONTROLLED TEMPERATURE of the EUT equals to $\pm 2,0$ °C of the maximum ACC RANGE with the
 1314 MOTOR-COMPRESSOR running or, the maximum RATED CONTROLLED TEMPERATURE with the
 1315 MOTOR-COMPRESSOR off

1316 NOTE 1 to entry: This note applies to the French language only;

1317 NOTE 2 to entry: If ACC range is not specified by the instructions, take the maximum RATED CONTROLLED TEMPERA-
 1318 TURE as maximum ACC RANGE.

1319 **3.5.111**1320 **MECHANICAL MOVEMENT**

1321 motion of materials being processed, for example in a SHAKER or COMBINED TEST CHAMBER

1322 **3.5.112**1323 **MOVEMENT FREQUENCY**

1324 number of complete cycles of MECHANICAL MOVEMENT

1325 **3.5.113**1326 **MOVEMENT AMPLITUDE**

1327 maximum radius, distance, or angle of the MECHANICAL MOVEMENT

1328 **3.5.114**1329 **CONTROLLED TEMPERATURE**

1330 temperature where the EVAPORATOR is located and to which the LOW-PRESSURE SIDE of the
 1331 equipment is exposed, as a result of heat transfer either by active heating or from the
 1332 APPLICATION SYSTEM or SPECIMEN

1333 NOTE to entry: For a heat pump system, where a four-way valve is used to shift between heat and cool, the
 1334 function of CONDENSER and EVAPORATOR is exchanged.

1335 **3.5.115**1336 **QUALIFIED PERSON**

1337 person having the appropriate technical training and experience necessary to be aware of
 1338 HAZARDS to which he or she is exposed in performing a task and of measures necessary to
 1339 minimize the danger to themselves or other persons.

1340 [SOURCE: IEC 60335-2-89:2019, 3.8.102]

1341 **3.5.116**1342 **OCCUPIED SPACE**

1343 the installation location of equipment where leakage FLAMMABLE REFRIGERANT may enter and,
 1344 area of which is used to determine compliance with MINIMUM ROOM AREA, A_{min}

1345 **3.5.117**1346 **COOLING CAPACITY**

1347 measurement of the heat flow that a REFRIGERATING SYSTEM withdraws from the HEAT
 1348 TRANSFER MEDIUM, in kW, as determined according to standard testing procedures

1349 NOTE to entry For example, testing procedures to DIN 12876-3 and DIN 12876-2 for BATHS and CIRCULATORS.

1350 **4. Tests**

1351 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 specified by 1.4.1, the equipment is permitted to be tested at these restricted NORMAL CONDITIONS without activation of safety devices, for example,

- 1) ambient temperatures above 5 °C to below 40 °C,
 - 2) MAINS supply voltage fluctuations less than ± 10 % of the nominal voltage,
- and then the tests are repeated at more unfavourable environmental conditions of 1.4.1 and/or 1.4.2 allowing operation of safety devices if any.

See 4.4.2.107 for simulation of the failure of the controlled environment.

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 4.4.2.114 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 % or less as restricted by 4.3.1) 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 damp heat, 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 1 DIN 12876 (all parts) provides procedures for determining COOLING CAPACITY and efficient heating capacity of the equipment.

NOTE 2 See Annex II for overload tests for refrigerating equipment incorporated with MOTOR-COMPRESSORS

NOTE 3 Heat load from tests of 4.3.2.102 through 4.3.2.106 and, operation of 4.3.2.111 and 4.3.2.114 needs to be considered.

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 1 An example is a Xenon arc lamp used in a weather durability TEST CHAMBER.

NOTE 2 Safety aspects of exposure to strong visual light, UV-A and/or UV-C need to be evaluated.

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 the 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:

- 1433 – MOTOR-COMPRESSOR running throughout;
- 1434 – MOTOR-COMPRESSOR started during test;
- 1435 – outside its ACC RANGE with the MOTOR-COMPRESSOR off and the equipment set to
- 1436 apply the maximum CONTROLLED TEMPERATURE allowed by the controls or interlocks.

1437 **4.3.2.109 Exhaust and condensate**

1438 The least favourable conditions which result in production of exhaust, vapours and/or
1439 condensates shall be created (including maximum and cycled).

1440 NOTE The TERMINALS of a RESISTANT-HEATING DEVICE exposed to ambient condition are easily condensed after the
1441 HEAT TRANSFER MEDIUM has been cooled to below ambient temperature for some time.

1442 **4.3.2.110 Filling and draining systems**

1443 Filling and draining systems shall be operated within the manufacturer's specified conditions
1444 of use (including maximum, minimum and intermediate).

1445 **4.3.2.111 Circulating system**

1446 CIRCULATING PUMP(s), agitator(s) or CIRCULATING FAN(s) shall be operated within the
1447 manufacturer's specified conditions of use (including maximum and off).

1448 **4.3.2.112 Gas HEAT TRANSFER MEDIUM**

1449 The equipment shall be operated with the gas HEAT TRANSFER MEDIUM, whether it is air or
1450 other designated gases, at the percentage of content and pressure within the manufacturer's
1451 specified conditions of use (including maximum, minimum and none).

1452 **4.3.2.113 Properties of liquid HEAT TRANSFER MEDIUM**

1453 For equipment with a wide CONTROLLED TEMPERATURE range, the effect of contraction,
1454 expansion, evaporating, condensing, oxidizing, boiling and freezing of the liquid and its
1455 allowable CONTROLLED TEMPERATURE range should be considered. HEAT TRANSFER MEDIA which
1456 change states during NORMAL USE shall be simulated to generate state change both from solid
1457 to liquid and vice versa.

1458 **4.3.2.114 Refrigerating equipment intended to be used with other equipment inside the** 1459 **refrigerated compartment**

1460 EQUIPMENT TYPE B1 through EQUIPMENT TYPE C2, where potential REFRIGERANT leak can occur,
1461 according to the instructions, intended to be used with other electrical equipment inside a
1462 refrigerated storage compartment, are evaluated with such equipment in operation as they
1463 would be in NORMAL USE.

1464 **4.4.2 Application of fault conditions**

1465 **4.4.2.10 Cooling**

1466 *Addition:*

1467 *Add the following items and notes after item d):*

- 1468 aa) for an air-cooled CONDENSING UNIT, each CONDENSER fan shall be stalled one at a time
1469 unless a single fault could disable all CONDENSER fans simultaneously, or with the
1470 CONDENSER airflow restricted, whichever is the worst case, until maximum stabilized
1471 pressure is attained or until representative maximum temperatures are attained under
1472 cycling load. The temperatures and pressures shall be monitored at short intervals
1473 throughout the test to ensure that peak values are captured. This test is conducted at
1474 an ambient temperature of 40 °C ± 3 °C.

1475 bb) for a water-cooled CONDENSING UNIT, the REFRIGERATING SYSTEM shall be operated with
1476 the condensing water shut off, or with the condensing water restricted, whichever is the
1477 worst case, until maximum stabilized pressure is attained or until representative
1478 maximum temperatures are attained under cycling load. The temperatures and
1479 pressures shall be monitored at short intervals throughout the test to ensure that peak
1480 values are captured. This test is conducted at an ambient temperature, and a water
1481 temperature of $40\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.

1482 If a manual reset PRESSURE-LIMITING DEVICE is relied upon to limit the maximum and/or
1483 minimum pressure for the HIGH-PRESSURE SIDE or LOW-PRESSURE SIDE, then it shall be reset
1484 manually within 6 s of operation for 10 cycles.

1485 NOTE 101 The running state of the MOTOR-COMPRESSOR is not relevant after the manual high PRESSURE-LIMITING
1486 DEVICE has operated.

1487 If an automatic reset PRESSURE-LIMITING DEVICE is relied upon to limit the maximum and/or
1488 minimum pressure for the HIGH-PRESSURE SIDE or LOW-PRESSURE SIDE, then it shall be
1489 permitted to cycle automatically until it can be demonstrated that peak temperatures and
1490 pressures have been achieved.

1491 NOTE 102 It is possible that a MOTOR-COMPRESSOR designed to be cooled by cycling of the REFRIGERANT would
1492 overheat enough to cause HAZARDS, if leakage of REFRIGERANT occurs and the PRESSURE-LIMITING DEVICE for
1493 LOW-PRESSURE SIDE is triggered repeatedly.

1494 NOTE 103 The correct specification or appropriate setting of the pressure differential (hysteresis) of an automatic
1495 reset PRESSURE-LIMITING DEVICE is important for MOTOR-COMPRESSORS which require a longer standstill (off cycle)
1496 period.

1497 If it can be demonstrated that a PRESSURE-LIMITING DEVICE will operate during the tests of
1498 MAXIMUM ALLOWABLE PRESSURE (PS), the manufacturer may elect to waive the test, but shall
1499 set the PS for the HIGH-PRESSURE SIDE of the MOTOR-COMPRESSOR to the RATING of the
1500 PRESSURE-LIMITING DEVICE.

1501 For equipment with both air-cooled and water-cooled CONDENSERS, faults are applied one at a
1502 time only, unless the equipment is designed so that the OPERATOR can select to run either an
1503 air-cooled or a water-cooled CONDENSER (for example, some equipment is equipped with a
1504 water-cooled CONDENSER as an auxiliary for the air-cooled CONDENSER).

1505 For a CASCADE SYSTEM, where an EVAPORATOR from the first stage REFRIGERATING SYSTEM acts
1506 as a CONDENSER to the second stage REFRIGERATING SYSTEM, the manufacturer may elect to
1507 run each CONDENSING UNIT individually under the tests of 4.4.2.10. In this case, disabling the
1508 first REFRIGERATING SYSTEM is considered to simulate the second stage CONDENSING UNIT
1509 running under the conditions of aa) and bb) above.

1510 **4.4.2.11 Heating devices**

1511 *Addition:*

1512 *Add the following paragraph after item b):*

1513 If a HAZARD could be caused by over-filling or under-filling with a liquid HEAT TRANSFER MEDIUM,
1514 the equipment shall be tested when empty, partially filled, or overfilled, whichever is the least
1515 favourable. In case of doubt, the test shall be carried out in more than one condition. The
1516 HEAT TRANSFER MEDIUM used for the test shall be of a type specified for NORMAL USE.

1517 *Addition:*

1518 *Add the following new subclauses:*

4.4.2.101 MOTOR-COMPRESSOR

Housing and winding temperatures of MOTOR-COMPRESSORS that do not conform with IEC 60335-2-34:2024 (including Annex AA), shall be measured under the conditions of 19.101, 19.102 and 19.103 of IEC 60335-2-34:2024(including Annex AA).

Housing and winding temperatures of MOTOR-COMPRESSORS conforming with IEC 60335-2-34:2024 (including, Annex AA), are not measured.

4.4.2.102 Fluid leakage in the equipment

Internal leaks of fluids shall be simulated.

NOTE 9.5.102 provides details for how to simulate internal leaks of the REFRIGERANT CIRCUIT using FLAMMABLE REFRIGERANT.

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 over temperature 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 re-activated 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.

1564 If flexible tubing or hose is used for the steam or mist outlet, the test shall be performed with
1565 the tubing or hose unobstructed, partially blocked, and fully blocked.

1566 If the equipment depends on a differential pressure between the inlet and outlet of the
1567 HUMIDIFIER to drive the steam or mist into the equipment, the HUMIDIFIER shall be operated with
1568 the equipment running at or cycling between its maximum and minimum CONTROLLED
1569 TEMPERATURES, whichever is the least favourable.

1570 In case of doubt, tests shall be carried out with more than one combination of conditions.

1571 **4.4.2.106 Speed controller**

1572 If a HAZARD could arise in case of a single fault of a speed controller, then such faults shall be
1573 applied, one at a time.

1574 NOTE As examples, speed controllers are sometimes used to control MOVEMENT FREQUENCY in a SHAKER or
1575 COMBINED TEST CHAMBER, and to control pressure and flow rate of a CIRCULATING PUMP. Under a SINGLE FAULT
1576 CONDITION of the speed controller, a HAZARD might arise if the pressure developed by the pump exceeds the
1577 MAXIMUM ALLOWABLE PRESSURE of an APPLICATION SYSTEM, or if excessive MOVEMENT FREQUENCY of a SHAKER or
1578 COMBINED TEST CHAMBER results in loosening, tumbling, ejection, or destruction of the SPECIMEN.

1579 **4.4.2.107 Simulate the failure of the controlled environment**

1580 For REFRIGERATING SYSTEMS intended to operate in an ambient environment that is more
1581 restricted than that specified in 1.4.1, this additional test shall be applied to simulate the
1582 failure of the controlled environment in which the equipment is located.

1583 Having determined the least favourable test conditions for the temperature and pressure tests
1584 under 10.4.1 and 4.3.1, the equipment is operated under these conditions until a steady state
1585 has been achieved. The test environment conditions are then increased to the levels set out
1586 in 1.4.1 (40 °C, 50 % RH) and the equipment is allowed to stabilize before the maximum
1587 temperatures and pressures are recorded. Protective devices shall not be bypassed or
1588 disabled. If the equipment does not reach steady state due to the operation of protective
1589 devices, then the maximum values recorded for this test shall be either:

- 1590 a) the maximum temperatures and pressures at the point of operation of non-resettable or
1591 manually resettable devices, which do not need to be reset during this test; or
- 1592 b) the maximum temperatures and pressures achieved after continued cycling of
1593 automatically resetting protective devices, which shall be allowed to cycle until it is clear
1594 that successive cycles will not develop higher maximum values.

1595 **4.4.3 Duration of tests**

1596 **4.4.3.1 General**

1597 *Replacement:*

1598 *Replace the text with the following:*

1599 The equipment shall be operated until further change as a result of the applied fault is
1600 unlikely. Each test is normally limited to 1 h since a secondary fault arising from a SINGLE
1601 FAULT CONDITION will usually manifest itself within that time. If there is an indication that a
1602 HAZARD of electric shock, spread of fire or injury to persons can eventually occur, the test shall
1603 be continued until it is clear that stable conditions have been maintained for at least 1 h,
1604 unless one of these HAZARDS arises before then.

1605 **4.4.4 Conformity after application of fault conditions**

1606 **4.4.4.1 General**

1607 *Addition:*

1608 *Add the following text below item c):*

1609 *Conformity with the requirements for temperature protection of MOTOR-COMPRESSORS is*
1610 *checked as specified in 4.4.2.101.*

1611 **5. Marking and documentation**

1612 This clause of Part 1 is applicable except as follows:

1613 **5.1.5 TERMINALS, connections and operating devices**

1614 *Addition:*

1615 *Add the following new subclauses:*

1616 **5.1.5.101 LIQUID CONNECTIONS for HEAT TRANSFER MEDIUM**

1617 LIQUID CONNECTIONS for HEAT TRANSFER MEDIUM shall be marked with graphical symbols or text
1618 to identify the outlet and inlet of the HEAT TRANSFER MEDIUM.

1619 NOTE For refrigerating CIRCULATORS, symbols 110 through 112 can be used and, for refrigerating and heating
1620 CIRCULATORS, symbols 113 through 115 can be used (see Table AA.1).

1621 Additionally, consideration may be given to mark the following:

- 1622 a) if the outlet pressure of the liquid is greater than 0,03 MPa or 0,02 MPa with a maximum
1623 flow rate of more than 10 l/min, the maximum pressure in Pa, in association with
1624 symbol 111 or 114;
- 1625 b) for a CIRCULATOR with a liquid suction pressure greater than 0,02 MPa, the maximum
1626 pressure in Pa preceded by a minus sign, in association with symbol 112 or 115;
- 1627 c) for an enclosed CIRCULATOR intended for connection to a sealed APPLICATION SYSTEM, and
1628 if the LIQUID CONNECTIONS need to withstand pressure exceeding 0,03 MPa, the maximum
1629 pressure for each LIQUID CONNECTION, in association with symbols 111 and 112, or 114
1630 and 115.

1631 Symbols 110 to 115 are found in Table AA.1.

1632 Where there is insufficient space near the LIQUID CONNECTIONS, symbol 14 of Table 1 may be
1633 used and explanations shall be given in the instructions provided with the equipment.

1634 *Conformity is checked by inspection.*

1635 **5.1.5.102 LIQUID CONNECTION for filling of BATH TANKS with enclosed CIRCULATORS**

1636 Where the mis-setting of controls or valves associated with the LIQUID CONNECTION for filling a
1637 BATH TANK with an enclosed CIRCULATOR could cause a HAZARD, symbol 14 shall be placed
1638 close to the LIQUID CONNECTION and the instructions for use (see 5.4.4) shall clearly explain
1639 the necessary settings to ensure safety under different OPERATING CONDITIONS.

1640 *Conformity is checked by inspection.*

1641 **5.1.5.103 Other LIQUID CONNECTIONS and exhaust opening**

1642 LIQUID CONNECTIONS for filling, water supply, draining, overflowing and exhaust opening shall
1643 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 cm² or it is not self-evident, a text marking or symbol 119 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 116 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 116 to identify the inlet, and a text marking or symbol 117 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 118;
- e) for LIQUID CONNECTION for draining, a text marking or symbol 120;
- f) for LIQUID CONNECTION for overflowing, a text marking or symbol 121;
- g) markings in association with a VENTILATOR include:
 - 1) symbol 122 for the adjustment handle or shaft of the VENTILATOR,
 - 2) symbol 123 for the fresh air inlet accompanied by, where necessary, the following text or its equivalent, "Fresh air inlet. Do not block.";
 - 3) symbol 124 for the exhaust opening.

NOTE Symbols 116 to 124 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 CIRCUIT

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

- a) the designation of the REFRIGERANT equipment type, EQUIPMENT TYPE B1, EQUIPMENT TYPE B2, EQUIPMENT TYPE C1, EQUIPMENT TYPE C2, EQUIPMENT TYPE D or EQUIPMENT TYPE E,
- b) the total REFRIGERANT CHARGE for each separate REFRIGERANT CIRCUIT;
- c) for a single component REFRIGERANT, at least one of the following:
 - 1) the chemical name,
 - 2) the chemical formula,
 - 3) the REFRIGERANT number;
- d) 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.

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

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

5.1.102 Symbols particular to heating and cooling equipment

Table 101 is provided with additional symbols, particular to heating and cooling equipment, for warning against HAZARDS related to low temperature, flammable material, biological substance, optical radiation, slippery surface, crushing of hands, gas under pressure and requirement for MINIMUM ROOM AREA.

Other useful symbols for marking on equipment and operating instructions are available in Annex AA.

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 101 shall be at least 15 mm in height.

Addition:

Add the following new subclauses and Table 101 at the end of 5.2:

5.2.101 Marking for GROUP I EQUIPMENT

For equipment intended for use with FLAMMABLE LIQUID HEAT TRANSFER MEDIA, HAZARD statement code H224, H225, H226, H227 (Table GG.2) and symbol 102 (Table 101) may be marked as applicable.

For equipment intended for use with gas under pressure, example as CO₂ incubator, HAZARD statement code H280 (Table GG.2), and symbol 107 (Table 101) may be marked as applicable.

For equipment intended for use with refrigerated LN₂ in a fast ramping or deep cooling TEST CHAMBER, HAZARD statement code H281 (Table GG.2), and symbol 107 (Table 101) may be marked as applicable.

For EQUIPMENT TYPE B1 through EQUIPMENT TYPE D containing FLAMMABLE REFRIGERANTS, HAZARD statement code H220 or H221 (Table GG.2), and symbol 102 (Table 101) shall be marked as applicable

For EQUIPMENT TYPE E, containing R-744 (CO₂) in a subcritical or transcritical state, HAZARD statement code H281 (Table GG.2), and symbol 107 (Table 101) should be marked as applicable.

1730 In case of mixture of different hazardous fluids, more than one HAZARD may present with the
1731 equipment, then a list of HAZARD statements shall be declared and symbols should be used as
1732 applicable;

1733 Based on the temperature range of the equipment and the related HAZARDS and unless
1734 otherwise specified, the equipment should be marked with symbol 13 of Table 1 against burn
1735 HAZARD and symbol 101 of Table 101 against frost-bite HAZARD.

1736 For H220, H221 Category 1A and 1B, H224 and H225, warning text starting with signal word
1737 *Danger* and those corresponding to their precautionary statement codes (Table GG.3) may be
1738 accompanied with symbol 102 (Table 101), for H221 Category 2, H226 and H227, warning
1739 text starting with signal word *Warning* and those corresponding to their precautionary
1740 statement codes (Table GG.3) may be accompanied with symbol 102 (Table 101).

1741 For H280 and H281, warning text starting with signal word *Warning* and those corresponding
1742 to their precautionary statement codes (Table GG.3) may be accompanied with symbol 107.

1743 NOTE: The HAZARD statement codes (Table GG.2), precautionary statement codes (Table GG.3) including
1744 meanings, and their intended use can be found in the safety data sheet (SDS) of the REFRIGERANTS or chemicals.
1745 Refer to Annex GG for more information.

1746 *Conformity is checked by inspection of the SDS for the REFRIGERANT contained in, or*
1747 *REFRIGERANT and chemicals intended for use with the equipment including their intended use*
1748 *and HAZARD statements.*

1749 **5.2.102 Marking for equipment incorporating MECHANICAL MOVEMENT**

1750 For SHAKERS and COMBINED TEST CHAMBERS incorporating a function of MECHANICAL MOVEMENT,
1751 the maximum safe load of the SPECIMEN holder shall be marked.

1752 The MECHANICAL MOVEMENT area shall be marked with symbol 14 of Table 1 or the applicable
1753 symbol 123 to 128 of Table AA.1.

1754 The SPECIMEN holder of the MECHANICAL MOVEMENT shall be marked with If a HAZARD, such as
1755 spillage or overflow of the liquid, could result during the removal or re-insertion, the
1756 removable SPECIMEN holder for MECHANICAL MOVEMENT shall be marked with symbol 14 of
1757 Table 1, or other appropriate warning symbol and text in close proximity to the handles of the
1758 holder, and an explanation shall be included in the documentation.

1759 *Conformity is checked by inspection.*

1760 **5.2.103 Movable immersion CIRCULATOR**

1761 If HAZARDS could arise from liquid penetration or spillage when the movable immersion
1762 CIRCULATOR is removed from the BATH TANK and placed horizontally or upside down or during
1763 movement for NORMAL USE, it shall be marked with symbol 12 or symbol 14 of Table 1 to warn
1764 against electric or liquid HAZARD, or symbol 13 of Table 1 or symbol 101 of Table 101 to warn
1765 against hot or frost-bite HAZARD.

1766 *Conformity is checked by inspection.*

1767 **5.2.104 Warning markings related to manual filling or draining**

1768 Equipment incorporating a BATH TANK or other liquid container intended for manual filling or
1769 incorporating a reservoir for collecting condensate that requires manual draining, if the liquid
1770 level indicator cannot be made available as specified in 11.4.104, a warning marking shall be
1771 applied and clearly visible in close proximity to the LIQUID CONNECTION for filling or draining.
1772 Additional explanations including instructions for operation and maintenance requirements for
1773 the warning marking shall be included in the documentation.

1774 Draining of BATH TANK for liquid HEAT TRANSFER MEDIA shall be warned of burn HAZARD and/or
1775 frost-bite HAZARD applicable to the CONTROLLED TEMPERATURE range, by use of Symbol 13
1776 and/or Symbol 101.

1777 *Conformity is checked by inspection.*

1778 **5.2.105 Warning requirements related to chemical HAZARD**

1779 Equipment intended for chemical applications, such as BATHS, CIRCULATORS, SHAKERS, climatic
1780 TEST CHAMBERS and salt spray corrosion TEST CHAMBERS, and which could present chemical
1781 HAZARDS to the OPERATOR and the environment, shall be marked with a symbol or text suitable
1782 to the chemical HAZARD. The symbol shall be in close proximity to where the SPECIMEN is kept
1783 and easily visible during NORMAL USE. Where applicable, the symbol or text shall also be
1784 attached to glassware such as flasks for shaking or immersion applications, APPLICATION
1785 SYSTEMS such as jacketed reactors containing hazardous chemicals, or LIQUID CONNECTIONS
1786 and exhaust openings where liberating of chemical contaminants can occur during NORMAL
1787 USE.

1788 See also 5.4.3 c) for details of instructions relating to ventilation requirements.

1789 NOTE Examples of chemical HAZARDS presented by these types of equipment are salt mist, salt solutions,
1790 SPECIMENS treated with salt spray, pest insects, microorganisms or plants treated with pesticides, radioactive
1791 substances and chemical mixtures.

1792 Symbol 102 of Table 101 is used for warnings pertaining to flammable materials. Symbols for
1793 other chemical HAZARDS may be selected from ISO 7010, as follows:

- 1794 a) for explosive materials, W002:2011-05
- 1795 b) for radioactive materials, W003:2011-05
- 1796 c) for toxic materials, W016:2011-05
- 1797 d) for corrosive materials, W023:2011-05
- 1798 e) for oxidizing substances, W028:2011-05
- 1799 f) for other chemical HAZARDS, other appropriate symbols from ISO 7010.

1800 If there is no appropriate symbol for the particular chemical HAZARD, symbol 14 of Table 1
1801 shall be used and additional explanations of the chemical HAZARD shall be included in the
1802 documentation.

1803 *Conformity is checked by inspection.*

1804 **5.2.106 Marking for hazardous radiation**

1805 Where the exposure to hazardous radiation is inevitable for functional reasons, the equipment
1806 shall incorporate protective measures to limit exposure to a safe level. Equipment
1807 incorporating a visual lamp and lamp systems, or UV-A and UV-C for ultra-violet radiation that
1808 can produce hazardous effects shall be marked with symbol 104 to warn of optical radiation,
1809 symbol 13 to warn of a burn HAZARD, symbol 109 to warn of UV HAZARD, and with symbol 14 to
1810 warn of other HAZARDS, as applicable.

1811 For additional warning requirements, refer to the following:

1812 Clause 5.4.101, warning requirements for EQUIPMENT TYPE B1 through EQUIPMENT TYPE C2.

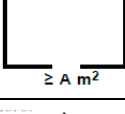
1813 Clause 5.4.102, warning requirements for EQUIPMENT TYPE E.

1814 Clause 5.4.103, warning requirements for equipment intended for use with refrigerated LN₂.

1815 Clause 5.4.104, warning requirements for equipment intended for use with FLAMMABLE LIQUID
1816 HEAT TRANSFER MEDIA.

1817 Clause 5.4.105, additional markings and instructions for equipment incorporating UV-C LAMP
1818 systems.

1819 **Table 101 – Warning 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
107		ISO 7000-2891 (2018-03)	Warning, gas cylinder under pressure
108		IEC 60417-6415 (2019-03)	Warning, minimum room floor area
109		IEC 60417-6040 (2019-03)	Ultraviolet radiation, instructional safeguard

1820 **5.4.1 General**

1821 *Replacement:*

1822 *Replace the first paragraph by the following:*

1823 The following documentation necessary for safety purposes, as needed by the OPERATOR, the
1824 RESPONSIBLE BODY or carrier of the equipment as applicable, shall be provided with the equipment.
1825 Safety documentation for service personnel authorized by the manufacturer shall be made available to
1826 such personnel, and safety documentation for the transportation of REFRIGERANT equipment shall be
1827 available to the carrier at the time of shipment:

1828 *Replace item d) by the following:*

1829 d) the information specified in 5.4.2 to 5.4.6, 5.4.101 to 5.4.105;

1830 *Addition:*

1831 *Add a new item after item h):*

1832 aa) in case the manufacturer is not the only shipper of the equipment, a written statement of
1833 the applicable UN number for the equipment shall be given in the technical document,
1834 along with shipping mark of the package.

1835 – UN 2857 refrigerating equipment containing non-flammable, non-toxic gases;

1836 – UN 3358 refrigerating equipment containing flammable, non-toxic, liquefied gases.

1837 NOTE 101 The shipper may check the individual requirements for each carrier prior to the shipment.

1838 NOTE 102 Transportation by land (ADR), by sea (IMDG) or by air (IATA-DGR) may have individual rules that apply.

1839 **5.4.2 Equipment RATINGS**

1840 *Replacement:*

1841 *Replace the first paragraph by the following text:*

1842 Where applicable the documentation shall include the following:

1843 *Addition:*

1844 *Add the following items after f) as applicable:*

1845 aa) the maximum and minimum CONTROLLED TEMPERATURES;

1846 bb) the ACC RANGE and RATED COOLING CAPACITY, PS for HIGH PRESSURE SIDE and LOW
1847 PRESSURE SIDE, for REFRIGERATING SYSTEM;

1848 cc) RATED PRESSURE and flow rate for LIQUID CONNECTIONS between CIRCULATOR and an
1849 APPLICATION SYSTEM;

1850 dd) the maximum additive relative humidity;

1851 ee) the maximum air pressure;

1852 ff) the maximum radiation strength either in visual, UV-A, or UV-C wavelength, in particular
1853 ratings in watts and voltage of a UV-C lamp system;

1854 gg) RATED PRESSURE, flow rate for connections to liquid and air supplies;

1855 hh) maximum MOVEMENT FREQUENCY, MOVEMENT AMPLITUDE versus the mass of the load.

1856 **5.4.3 Equipment installation**

1857 *Replacement:*

1858 *Replace items a) to g) with the following:*

1859 a) assembly, location and mounting requirements. Space requirements, in particular the
1860 minimum distance to all the ventilating holes or grid, LIQUID CONNECTIONS and/or exhaust
1861 opening. Additional requirements for the rigidity and non-slip characteristics of the floor
1862 and/or laboratory bench. If a HAZARD could be caused by hot items falling from the
1863 equipment, for example when a door is opened, there shall be a warning that the
1864 equipment shall not be mounted on a surface of flammable material. Assembling the
1865 equipment away from overhead fire sensors, where opening of the door or lid or,
1866 exhausting of the fume is possible for NORMAL USE;

1867 b) for equipment incorporating lockable swivel casters and/or levellers, the requirements to
1868 lock the casters and adjust the levellers;

1869 c) ventilation requirements: if the operating of the equipment could lead to liberation of
1870 hazardous air or gas mixture, installation instructions shall warn of the need for an

- 1871 extraction system, and of additional TEMPERATURE-LIMITING DEVICES relating to safe
1872 temperatures for the materials, etc.;
- 1873 d) requirements for liquid filling, draining or overflowing (see 10.1 b));
- 1874 e) connection to the power source:
- 1875 1) instructions for protective grounding;
- 1876 2) for equipment intended for WET LOCATIONS (see 1.4.2) and in which HAZARDOUS LIVE
1877 parts may need to be ACCESSIBLE (see 6.1.2), warning symbol and statement that
1878 power socket with appropriate IP protection is used and whether external residual
1879 current circuit breaker (RCD) with RATED breaking capacity is necessary;
- 1880 3) warning symbol and statement which are necessary when permanent connection to the
1881 supply source is essential;
- 1882 4) for PERMANENTLY CONNECTED EQUIPMENT:
- 1883 – supply wiring requirements;
- 1884 – requirements for any external switch or circuit-breaker (see 6.11.3.1) and external
1885 overcurrent protection devices (see 9.6.2), and a recommendation that the switch
1886 or circuit-breaker be near the equipment;
- 1887 f) requirements for special external services, for example, air and cooling liquid.
1888 Characteristics necessary for safety shall be specified, for example, maximum and
1889 minimum temperature, pressure, or flow of air or cooling liquid;
- 1890 g) requirements for installation of and/or connection to vacuum pump, air compressor and/or
1891 steam source;
- 1892 h) instructions relating to sound pressure level (see 12.5.1); the maximum sound power level
1893 produced by equipment which emits sound, if measurement is required by 12.5.1;
- 1894 i) requirements for DRYING-OUT and/or STANDSTILL (see 5.4.3.101);
- 1895 j) requirements for connecting a remote CONDENSING UNIT to the equipment, in particular,
1896 requirements for location, space, pipes, tubes, accessories (see 14.101), detailed
1897 specifications for REFRIGERANT (see 5.1.101), ventilation, water supply, and detailed
1898 procedures for connection and adjustment;
- 1899 k) requirements for connecting a CIRCULATOR to the APPLICATION SYSTEM, in particular
1900 requirements for location, space, tubes, accessories (see 14.102), insulation, liquid HEAT
1901 TRANSFER MEDIUM, ventilation, water supply, and detailed procedures for connection and
1902 adjustment;
- 1903 l) requirements for installing any functional lamp source, in particular recommended lamps
1904 and accessories, measures for protection against rupture of the lamp and its disposal,
1905 precautions for protection against HAZARDS of possible electric shock, hot surface,
1906 excessive optical and/or UV radiations, requirements for ventilation and water source, and
1907 detailed procedures for installation and adjustment;
- 1908 m) requirements for connecting HUMIDIFIER or steam source to the equipment, in particular
1909 recommended type and specifications of the HUMIDIFIER, equivalent evaporation of the
1910 steam source, requirements for tubes, accessories, insulation, ventilation, water supply,
1911 and precautions for protection against HAZARDS of possible electric shock, hot surface,
1912 mechanical injury in association with the installation, and detailed procedures for
1913 installation and adjustment; requirements for installation and adjustment for the
1914 MECHANICAL MOVEMENT;
- 1915 n) meanings for GHS HAZARD statement codes (Table GG.2) and precautionary statement
1916 codes (Table GG.3), in case handling and processing of hazardous fluids are concerned
1917 during installation.
- 1918 o) statement that installation and commissioning of GROUP I EQUIPMENT shall be carried out
1919 only by QUALIFIED PERSON approved by the manufacturer.
- 1920 p) indication of which parts of the equipment are suitable for outdoor installation, if applicable.
- 1921 q) instructions on charging of REFRIGERANTS when addition of REFRIGERANT CHARGE is
1922 required by the manufacturer for completing the REFRIGERATING SYSTEM.

- 1923 r) when the symbol 108 is used, a warning that the equipment shall be installed, operated
1924 and stored in a space with a floor area not less than the MINIMUM ROOM AREA.

1925 NOTE 1 More information for installation of refrigerating equipment containing FLAMMABLE REFRIGERANTS is
1926 available in CEN/TS 17606:2021. Refer to Annex GG for information related to GHS HAZARD statement codes
1927 (Table GG.2) and precautionary statement codes (Table GG.3).

1928 NOTE 2 National laws and regulations can take precedence.

1929 NOTE 3 Refer to Annex KK for information for transportation, marking and storage for equipment that containing
1930 FLAMMABLE REFRIGERANTS

1931 NOTE 4 Refer to Annex LL for requirements for installation, service, maintenance and repair, and decommissioning
1932 instructions of equipment using FLAMMABLE REFRIGERANTS

1933 *Conformity is checked by inspection.*

1934 *Addition:*

1935 *Add the following new subclause:*

1936 **5.4.3.101 DRYING-OUT and STANDSTILL**

1937 When required by 6.7.2.2.101, the instructions shall include a warning that the equipment
1938 cannot be assumed to meet all the safety requirements of this document during the DRYING-
1939 OUT and/or STANDSTILL.

1940 *Conformity is checked by inspection.*

1941 **5.4.4 Equipment operation**

1942 *Addition:*

1943 *Add the following items and notes after item j):*

1944 aa) requirements for the liquid HEAT TRANSFER MEDIUM and warning against HAZARDS related
1945 to improper use of the liquid;

1946 – specifications of the liquid applicable to the equipment, in particular the
1947 CONTROLLED TEMPERATURE range, flammability, viscosity, FLASH POINT, FIRE POINT,
1948 AUTO IGNITION TEMPERATURE, specific gravity and specific heat capacity and their
1949 effect on applications (see 4.3.2.113);

1950 – procedures and precautions for filling, draining and replacing(see 10.1 b));

1951 – chemical HAZARD and instructions for disposal and emergency treatment;

1952 – special requirements for HEAT TRANSFER MEDIA which change states during NORMAL
1953 USE, in particular the HEAT TRANSFER MEDIA in a salt BATH;

1954 – meanings for GHS HAZARD statement code (Table GG.2) and precautionary
1955 statement codes (Table GG.3), for FLAMMABLE LIQUID HEAT TRANSFER MEDIA as
1956 applicable;

1957 NOTE 101 Refer to Annex GG for more information related to GHS HAZARD statement codes (Table GG.2)
1958 and precautionary statement codes (Table GG.3).

1959 bb) instructions for how to calculate the COOLING CAPACITY and/or effective heating capacity
1960 for SPECIMENS and the APPLICATION SYSTEM;

1961 NOTE 102 Effective heating capacity is a measurement of the heat flow that heating sources radiate to the
1962 HEAT TRANSFER MEDIUM.

1963 cc) requirements for SPECIMEN loading, distributing and fixing within the working space for
1964 BATH, INCUBATOR or TEST CHAMBER or over the holder of MECHANICAL MOVEMENT;

- 1965 dd) information regarding the uniform and maximum loading of each type of shelf; warning
1966 against storage or conditioning of explosive substances such as aerosol cans with a
1967 flammable propellant within the cabinet;
- 1968 dd) procedures to be followed to shut down the equipment safely and leave it in a safe state;
- 1969 ee) warning against access to WALK-IN EQUIPMENT (see also Annex BB) for untrained
1970 personnel or children. Requirements for access to WALK-IN EQUIPMENT, in particular the
1971 use of personal protective equipment, presence of a second OPERATOR, unlocking
1972 mechanism and clearance of the door, and indicating device when the OPERATOR is
1973 inside the equipment;
- 1974 ff) requirements for the ventilating device, access port (hatch) and LIQUID CONNECTIONS;
1975 warning against HAZARDS from high and low temperatures (see 10.1), liberated
1976 hazardous gas, liquid or solid (see 13.1);
- 1977 gg) requirements for regular inspection and its intervals with regard to SPECIMEN fixing and
1978 potential HAZARDS during the shaking process;
- 1979 hh) instructions for proper operation of and warning against HAZARDS from lamps and lamp
1980 systems, HUMIDIFIER or steam source and MECHANICAL MOVEMENT;
- 1981 ii) instructions for use of personal protective equipment, protective measures or
1982 requirement for training;
- 1983 jj) statement that access and operation of GROUP I EQUIPMENT shall be accepted only by
1984 QUALIFIED PERSON approved by the RESPONSIBLE BODY.

1985 NOTE 103 More information for operations of refrigerating equipment containing FLAMMABLE REFRIGERANTS
1986 is available in CEN/TS 17607:2021.

1987 NOTE 104 National laws and regulations can take precedence.

1988 *Conformity is checked by inspection.*

1989 *Addition:*

1990 *Add the following new subclause:*

1991 **5.4.4.101 Cleaning and decontamination**

1992 The instructions shall include conditions and intervals for cleaning and, where necessary,
1993 decontamination. The recognized generic names of recommended materials for cleaning and
1994 decontamination shall be given as well as an indication of any materials which could be likely
1995 to be used but which are incompatible with parts of the equipment or with material contained
1996 in it.

1997 The instructions shall also state that the RESPONSIBLE BODY shall ensure that:

- 1998 a) appropriate decontamination is carried out if a hazardous substance is spilt onto or into
1999 the equipment;
- 2000 b) no decontamination or cleaning agents are used which could cause a HAZARD as a result
2001 of a reaction with parts of the equipment or with material contained in it;
- 2002 c) the manufacturer or his agent is consulted if there is any doubt about the compatibility of
2003 decontamination or cleaning agents with parts of the equipment or with material contained
2004 in it.

2005 If a manufacturer claims that an item can be decontaminated by steam sterilization, it shall be
2006 capable of withstanding steam sterilization under at least one of the time-temperature
2007 conditions given in Table 102.

2008 Manufacturers should be aware of the internationally recognized "Laboratory Biosafety
2009 Manual", published by the World Health Organization in Geneva, which gives information on
2010 decontaminants, their use, dilutions, properties and potential applications. There are also
2011 national guidelines which cover these areas.