

## STANDARD INFORMATION

**Standard:** UL 61010-2-011

**Standard ID:** Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 2-011: Particular Requirements for Refrigerating Equipment [UL 61010-2-011:2021 Ed.2+R:30Jan2025]

**Previous Standard ID:** Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 2-011: Particular Requirements for Refrigerating Equipment [UL 61010-2-011:2021 Ed.2+R:02Feb2024]

## EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

**Effective Date:** January 30, 2027

## IMPACT, OVERVIEW, AND ACTION REQUIRED

**Impact Statement:** Per our accreditation, Intertek is required to review reports against the standard revisions to confirm compliance. Once compliance is confirmed, the standard reference in the report is updated to show continued compliance to the technical requirements of the standard. Reports not updated to this version by the effective date above will be withdrawn.

This standard contains Functional Safety requirements.

**Overview of Changes:** Updates the requirements for Stirling Refrigeration Systems. Specific details of new/revised requirements are found in table below.

**Current Listings Not Active?** – *Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records. We will do this at no charge as long as Intertek is notified in writing prior to the review of your reports.*



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CLAUSE	VERDICT	COMMENT
		<i>Additions to existing requirements are <u>underlined</u> and deletions are shown <del>lined-out</del> below.</i>
1	Info	<b>Scope and object</b> <b>Equipment included in scope</b>  This Part 2 of IEC 61010 specifies particular safety requirements for the following types a) to c) of electrical equipment and their accessories, wherever they are intended to be used, whenever that equipment incorporates REFRIGERATING SYSTEMS as an integral part of, or separate from, the equipment and the equipment is in direct control of the REFRIGERATING SYSTEM.  1.1.1 Info This document details all the requirements when up to 150 g of FLAMMABLE REFRIGERANT are used per stage of a REFRIGERATING SYSTEM. Additional requirements beyond the current scope of this document apply if a REFRIGERANT charge of FLAMMABLE REFRIGERANT exceeds this amount.  <u>This document also details the requirements for STIRLING REFRIGERATION SYSTEMS.</u>
3	Info	<b>Terms and definitions</b> <b>MOTOR-COMPRESSOR</b>  A 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  <u>For the purposes of this standard, a Stirling engine is considered to be a motor-compressor.</u>
4	Info	<b>Tests</b>
4.4.2	Info	<b>Application of fault conditions</b>  For cooling not associated with the cooling of the REFRIGERATING SYSTEM:  a) air-holes with filters shall be closed; b) forced cooling by motor-driven fans shall be stopped; c) cooling by circulation of water or other coolant shall be stopped.  For cooling associated with the cooling of the REFRIGERATING SYSTEM:
4.4.2.10		



CLAUSE	VERDICT	COMMENT
		d) Condenser fan stall test – for an air-cooled REFRIGERATING SYSTEM
		Each condenser fan shall be stalled one at a time unless a single fault could disable all condenser fans simultaneously, or with the condenser airflow restricted, whichever is the worst case, until maximum stabilized pressure is attained or until representative maximum temperatures are attained under cycling load. The temperatures and pressures shall be monitored at short intervals throughout the test for the pressures to ensure that peak pressures are captured. This test is conducted at an ambient temperature of 25 °C ± 3 °C.
		<u>For STIRLING REFRIGERATION SYSTEMS, the gas pressure shall be monitored by a pressure gauge on the motor enclosure during the condenser fan stall test to determine maximum pressures. The maximum measured pressure shall not exceed 1/3 of the ultimate strength of the subject component as per the test of Clause 11.7.102.</u>
5	Info	<b>Marking and documentation</b>
		<b>Warning markings</b>
5.2		Warning markings or symbols for particular HAZARDS, which exist or develop only when performing installation or maintenance of the equipment, shall be marked and visible only when executing this particular maintenance. 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. Symbol 102 of Table 1 shall be placed on the nameplate of the equipment near the declaration of the REFRIGERANT type and charge information. It shall be visible after installation of the REFRIGERATING EQUIPMENT.
		<u>Equipment employing STIRLING REFRIGERATION SYSTEMS shall be provided with markings that indicate:</u>
		<u>WARNING: Refrigeration unit contains gas under high pressure. Do not tamper with or puncture the systems. Service by qualified persons only.</u>
		<b>New clause added;</b>
		<b>Additional instructions for equipment that uses STIRLING REFRIGERATION SYSTEMS</b>
5.4.103		Equipment employing STIRLING REFRIGERATION SYSTEMS the instructions shall include the substance of the following:
		WARNING: Refrigeration unit contains gas under high pressure. Do not tamper with or puncture the systems. Contact qualified service personnel before disposal.



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10	Info	<b>Equipment temperature limits and resistance to heat</b>
10.4	Info	<b>Conduct of temperature tests</b> <p>Maximum temperature is determined by measuring the temperature rise under reference test conditions defined by 4.3.1 of this document. Linear extrapolation is not permitted. Unless a particular SINGLE FAULT CONDITION specifies otherwise, the manufacturer's instructions concerning ventilation, cooling liquid, limits for intermittent use, etc., are followed. Any cooling liquid shall be at the highest RATED temperature. Operating pressures shall be monitored and recorded during all the temperature runs for use in the evaluation of PS.</p> <p>Alternatively, temperature measurements are made at the least favourable ambient temperature within the RATED ambient temperature range of the equipment if this represents a less favourable condition. Measures are taken to eliminate errors caused by the method of achieving the test ambient temperature (e.g. suitable baffling or ENCLOSURE if the test is conducted in an environmental testing TEST CHAMBER and the forced air movements would cool the exterior of the equipment).</p>
10.4.1		<p>When measuring temperatures and pressures for REFRIGERATING EQUIPMENT the tests shall be started from a SOAKED TEMPERATURE CONDITION when all pressures have been fully equalized. Tests at the extremes of the input voltage (<math>\pm 10\%</math>) shall start under these voltage conditions and achieve a stable state but need not start from a soaked condition. Safety protective devices shall not operate during NORMAL CONDITION tests. At the termination of the test, the monitoring shall continue after the equipment is switched off until the pressures from each REFRIGERANT stage have equalized or clearly demonstrate that maximum values have been reached.</p> <p>During NORMAL CONDITION tests, protective devices other than self-resetting thermal motor-protectors for MOTOR-COMPRESSORS shall not operate. When steady conditions have been established, thermal motor-protectors for MOTOR-COMPRESSORS shall not operate.</p> <p><u>For STIRLING REFRIGERATION SYSTEMS, the mean pressure is to be measured.</u></p>
11	Info	<b>Protection against HAZARDS from fluids and solid foreign objects</b>
11.7	Info	<b>Fluid pressure and leakage</b>
		<b>Maximum pressure in a REFRIGERATING SYSTEM</b>
11.7.101		<p>The maximum pressure to which a part of the equipment can be subjected under NORMAL CONDITION or SINGLE FAULT CONDITION shall not exceed the RATED maximum working pressure for the part. The RATED maximum working pressure of a component is determined by either its RATING (if certified to the component requirements of 14.101) or by design if the parts can pass the tests of 11.7.102.</p>



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		<p>The MAXIMUM ALLOWABLE PRESSURE (PS) shall be determined by test or by applying the saturated REFRIGERANT pressures at the minimum specified temperatures given in Table 102. In case of doubt, testing shall be performed. If the start-to-discharge pressure of a pressure relief valve or the set pressure of a rupture member used in the sealed system is less than the saturated vapour pressure derived from Table 102, it can be used to limit PS for that system. When saturated REFRIGERANT pressures are used to define PS, the manufacturer is exempted from recording the pressures during the normal and abnormal tests. The value of PS, when determined by test, shall be considered to be the highest of the following:</p> <p>a) the maximum pressure developed during the temperature runs as defined by 10.4.1;</p> <p>b) the maximum pressure developed during the cooling failure SINGLE FAULT CONDITION test defined by 4.4.2.10 d) or 4.4.2.10 e);</p> <p>c) the maximum pressure developed during the test of 4.3.2.101 if applicable;</p> <p>d) the maximum pressure developed during the test of 11.7.104.8.</p> <p><u>e) The thermosiphon pressure in the case of STIRLING REFRIGERATING SYSTEMS, shall be subjected to measurement of the maximum pressure developed in the refrigerating systems under the condition of standstill.</u></p> <p><u>For STIRLING REFRIGERATION SYSTEMS, the gas pressure shall be monitored by a pressure gauge on the motor enclosure where applicable.</u></p>
11.7.102	Info	<b>Leakage and rupture at high pressure</b>
		<b>Pressure test</b>
11.7.102.2		<p>The pressure of the component or assembly (equipment under test (EUT)) is raised, by air or non-hazardous gas or via a hydrostatic pressure test, gradually to the specified test value and is held at that value for 1 min. If the continuous CONTROLLED TEMPERATURE for the EUT is less than or equal to 125 °C for copper or aluminium, or 200 °C for steel, the test temperature of the EUT during this test shall be at least 20 °C. If the continuous CONTROLLED TEMPERATURE for the EUT exceeds 125 °C for copper or aluminium, or 200 °C for steel, the test temperature of the EUT during this test shall be at least 150 °C for copper or aluminium and 260 °C for steel. For other materials or higher temperatures, the effects of temperature on the material fatigue characteristics shall be evaluated.</p> <p>The test value shall be determined as the higher of the following 3:</p> <ul style="list-style-type: none"><li>5 times the pressure under normal use [see 11.7.101 a)]</li><li>3 times the pressure under transportation [see 11.7.101 d)]</li><li>3 times the pressure under single fault condition [see 11.7.101 b) and c)]</li></ul> <p><u>For STIRLING REFRIGERATION SYSTEMS, the maximum pressure shall be 3</u></p>



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		<p><u>times the mean pressure measured during the test of Clause 10.4.</u></p> <p><u>For Stirling engine systems, using refrigerants classified as A1 in accordance with the Standard for the Designation and Safety Classification of Refrigerants, ASHRAE 34 in amounts less than 100 g (3.53 oz), leakage is permitted provided that the test pressure can be maintained for 1 minute.</u></p> <p><u>The component shall not rupture at the required strength test pressure even though leakage has been detected.</u></p> <p>The EUT is considered to have complied with the requirements of this test if it withstands the pressure test without rupture. If the EUT does not comply, then an alternate method to demonstrate compliance is to subject the EUT to the fatigue test detailed below.</p>
11.7.102.3		<p><b>Fatigue test</b></p> <p>If the continuous CONTROLLED TEMPERATURE of the EUT exceeds 125 °C for copper or aluminium, or 200 °C for steel, the fatigue test temperature of the parts or assemblies that are at these temperatures, shall be at least 10 K above the continuous CONTROLLED TEMPERATURE. Static test pressure shall be increased by the ratio of the allowable stress of the material at ambient temperature to that at the highest continuous CONTROLLED TEMPERATURE. For other materials, the effects of temperature on the fatigue characteristics shall be evaluated to determine the test conditions.</p> <p>Three test samples shall be filled with fluid and shall be connected to a pressure-driving source. The pressure shall be raised and lowered between the upper and lower cyclic values at a rate specified by the manufacturer for a total number of 250 000 cycles. The entire specified pressure excursion shall occur during each cycle.</p> <p>The following test pressures shall be applied:</p> <p>For safety purposes, it is suggested that a non-compressible fluid be used.</p> <ul style="list-style-type: none"><li>– For components at the low-pressure side, the PS for the low-pressure side shall be applied for the first cycle. For components at the high-pressure side, the PS for the high-pressure side shall be applied for the first cycle.</li></ul> <p>The pressure for the test cycles shall be as follows:</p> <ul style="list-style-type: none"><li>– The upper pressure value shall not be less than 0,7 times the PS and the lower pressure value shall not be greater than 0,2 times the PS.</li><li>– For the final test cycle, the test pressure shall be increased to 1,4 times the PS (2 times 0,7 times the PS).</li></ul> <p>The component shall not rupture, burst or leak during this test.</p>



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		<p>A strength pressure test at 2 times the PS is to be performed on three samples, other than the samples used for the fatigue test.</p> <p>The component shall not rupture, burst or leak during this test.</p> <p><u>STIRLING REFRIGERATION SYSTEMS are excluded from this option when a leak is detected in pressure testing.</u></p>