

STANDARD INFORMATION

This SUN establishes the Continuing Certification approach to Household and similar Electrical Appliances: Particular requirements for Motor-Compressors

Standard Number: UL 60335-2-34 / CSA C22.2 No. 60335-2-34

Standard Name: Household and Similar Electrical Appliances - Safety - Part 2-34: Particular Requirements for Motor-Compressors

Standard Edition and Issue Date: 6th / 2nd Edition Dated November 3, 2017

Date of Revision: November 3, 2017

Date of Previous Revision of Standard: March 22, 2013

EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

Effective Date: **No action is required for currently certified products to maintain certification.**

This SUN is being presented to assist users of the standard to appreciate the significance of the changes made to the standard that will apply should the product described be modified after March 31, 2019.

IMPACT, OVERVIEW, AND ACTION REQUIRED

Impact Statement:

- Existing certifications to UL 60335-2-34 / CSA C22.2 No. 60335-2-34 5th/1st edition will be allowed to continue to be certified after March 31, 2019, provided there are no changes to the design that require a certification decision or until a new/revised requirement in the Standard is determined as “Action Required” to require a file review in the future.
- New or revised products submitted for certification on or after March 31, 2019 will be required to be investigated to UL 60335-2-34 / CSA C22.2 No. 60335-2-34 6th/2nd

Overview of Changes: The following is the Sixth Edition of ANSI/UL 60335-2-34, the common CSA Group and UL (binational) standard that is an adoption of IEC 60335-2-34, Safety Standard for of Household and Similar Electrical Appliances – Safety – Part 2-34: Particular Requirements for Motor- Compressors (IEC 60335-2-34, Edition 5.2:2016.). 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 – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records.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.



STANDARD INFORMATION

CLAUSE	VERDICT	COMMENT
<p>Additions to existing requirements are <u>underlined</u> and deletions are shown lined-out below.</p>		
5	Info	General conditions for the tests
5.102		<u>With regard to 6.104, PROTECTIVE DEVICES other than the declared device under test shall be disabled during the tests of Annex AA and Clause 19. If multiple PROTECTIVE DEVICES are declared, each shall be tested independently.</u>
5.103		<u>For cascade systems comprising two or more motor-compressor circuits, each MOTOR-COMPRESSOR circuit is tested separately in the end product. IEC 60335-2-34 is not applicable for the system but each MOTOR-COMPRESSOR can be tested according to this standard.</u>
5.104DV		<u>DR Add the following clause to Clause 5 of the Part 1: Cheesecloth specified in this Standard shall be untreated cotton cloth 0,8 – 1,0 m (31 – 39 inches) wide and 28 – 30 m/kg (42 – 45 ft/lb). Tests involving cheesecloth shall be conducted in a room free of drafts.</u>
6	Info	Classification
6.101		<u>Motor-compressors without an incorporated or associated ELECTRONIC CIRCUIT are classified as being tested with Annex AA or without Annex AA.</u> <u>MOTOR-COMPRESSORS with an incorporated or associated ELECTRONIC CIRCUIT are classified as being tested with Annex AA.</u>
6.104		<u>The MOTOR-COMPRESSOR manufacturer shall declare the means of motor protection, THERMAL MOTOR PROTECTOR, impedance protection, PROTECTIVE ELECTRONIC CIRCUIT, or a combination of the above.</u>
6.105		<u>Motor-compressors using refrigerant R744 shall be classified as used in a TRANSCRITICAL REFRIGERATION SYSTEM or in a non-TRANSCRITICAL REFRIGERATION SYSTEM.</u>
7	Info	Marking and Instructions
7.1		Modification: The RATED POWER INPUT or RATED CURRENT need not be marked. Addition: <u>MOTOR-COMPRESSORS suitable for use with a flammable refrigerant shall be marked with symbol ISO 7010 W021.</u>
7.1DV.2		<u>DR Modification of Clause 7.1 of the Part 1 to add the following after the seventh <u>eighth</u> dashed item:</u> <u>– motor compressor locked rotor amperage (LRA) rating(s). If motor winding switching or alternate motor wiring options cause or allow different LRA, the</u>



highest resulting LRA shall be marked;
– manufacturing date or date code and location if the product is produced in more than one location.

If the motor compressor is thermally protected it shall be marked with:

- “Thermally Protected” if a THERMAL PROTECTOR is provided or is specified by the MOTOR-COMPRESSOR manufacturer; or
- “Thermally Protected System” if a protective system with all sensing elements and motor-current-interrupting means is provided or specified by the MOTORCOMPRESSOR manufacturer.

A motor-compressor subjected to the Optional Pressure Test in Annex 101.DVG shall be legibly and permanently marked with the maximum allowable or design pressure, psig (kPa) or Barg.

Addition:

New picture added:

7.6



Symbol ISO 7010 W021

Warning; Flammable materials

7.101 Refrigerants that can be used with the MOTOR-COMPRESSOR shall be listed in the instructions.
Compliance is checked by inspection.

13 Info **Leakage current and electric strength at operating temperature**

Addition:

In Table 4, add the following to table footnote a:

13.3

The test voltage for 600 V multi-phase appliances is that specified for a WORKING VOLTAGE > 250 V where U is taken as the RATED VOLTAGE.

16 Info **Leakage current and electric strength**

This clause of Part 1 is applicable except as follows.

Addition:

In Table 7, add the following to table footnote a:

16.3

The test voltage for 600 V multi-phase appliances is that specified for a WORKING VOLTAGE > 250 V where U is taken as the RATED VOLTAGE.

19 Info **Abnormal operation**

19.11.2 For simulation of the fault conditions, a MOTOR-COMPRESSOR with its incorporated or associated ELECTRONIC CIRCUIT is connected to the substitute refrigeration circuit of Figure AA.1 and operated under the conditions given in Clause AA.5. The conditions applied shall be 5K lower than are the step prior to



	<p>that which caused the PROTECTIVE DEVICE to operate or the MOTOR-COMPRESSOR to stall during the tests of Clause AA.5.</p>
19.13	<p><u>If the MOTOR-COMPRESSOR is intended to use flammable refrigerants, and if during the tests of 19.11.2 and 19.11.3 any electrical component produced sparks or arcs, this shall be reported unless the component was an INTENTIONALLY WEAK PART or a NON-SELF-RESETTING PROTECTIVE DEVICE.</u></p> <p><u>MOTOR-COMPRESSORS are operated under the conditions of Clause AA.1. Any contactor or relay contact that operates under the conditions of Clause AA.1 is short-circuited.</u></p> <p><u>If a relay or contactor with more than one contact is used, all contacts are short-circuited at the same time.</u></p> <p><u>Any relay or contactor which operates only in order to ensure that the MOTOR-COMPRESSOR is energized for normal use and that does not otherwise operate in normal use is not short-circuited.</u></p>
19.14	<p><u>If more than one relay or contactor operates in Clause AA.1, each such relay or contactor is short-circuited in turn.</u></p> <p><u>For MOTOR-COMPRESSORS that use alternate start capacitors, the test shall be carried out using each alternate start capacitor in turn.</u></p> <p><u>The test is only performed on MOTOR-COMPRESSORS classified as being tested with Annex AA.</u></p> <p><u>NOTE 1 For MOTOR-COMPRESSORS not classified as being tested with Annex AA, this test will be performed on the final product.</u></p> <p><u>NOTE 2 If the MOTOR-COMPRESSOR has several modes of operation, the tests are carried out with the MOTOR-COMPRESSOR operating in each mode, if necessary.</u></p>
19.101DV	<p><u>DR Modification to Clause 19.101 to add the following:</u> <u>DR Add Clauses 19.101ADV.1 to 19.101ADV.5 to Clause 19.101 of the Part 2:</u></p>
19.101DV.1	<p><u>For MOTOR-COMPRESSORS with primary thermal protection, Clauses 19.101ADV.2 – 19.101ADV.4 shall be used. For MOTOR-COMPRESSORS with electronic protection, Clause 19.101ADV.5 shall be used.</u></p>
19.101ADV.5	<p><u>Motor-compressors intended to be controlled or protected by an electronic circuit shall be marked with MAXIMUM RATED CURRENT (MRC). This current shall be:</u></p> <ul style="list-style-type: none"><u>– The maximum current value as measured during Clause AA.4 testing; or</u><u>– The current rating of the motor-compressor controlling device if a PROTECTIVE ELECTRONIC CIRCUIT OR ELECTRONIC CIRCUIT is part of the controlling device.</u>
19.105DV	<p><u>D1 Modification by adding the following after the third paragraph:</u> <u>As an alternate test method, two of the MOTOR-COMPRESSOR windings shall be connected together to form a single line. A single-phase supply source rated at</u></p>



0,866 of the RATED VOLTAGE of the MOTOR-COMPRESSOR shall be applied to the single line (formed from the two windings) and the remaining line (from the remaining winding) so that maximum current flows in an unprotected winding of the MOTOR-COMPRESSOR.

22

Info

Construction

Replacement:

HOUSINGS shall withstand the pressure expected in normal use.
Compliance is checked by the following tests.

A HOUSING which is exposed to high side pressure, including those in a MOTOR-COMPRESSOR incorporating a bypass valve, shall be subjected to a pressure equal to:

- ~~for non transcritical~~ subcritical refrigeration systems a minimum of other than those using R-744, 3,5 times the saturated vapour pressure of the refrigerant at 70 °C, the test pressure being rounded up to the next 0,5 MPa (5 bar);
- for R-744 subcritical refrigeration systems, 3,5 times the saturated vapour pressure of the refrigerant at 27 °C, rounded up to the next 0,5 MPa (5 bar).

- for transcritical refrigeration systems, the highest of;
 - 3 times the DESIGN PRESSURE; or
 - the test pressure declared by the manufacturer; or
 - the test pressure specified in Table 101.

22.7

The test values for some refrigerants are given in Table 101. For refrigerants not mentioned, the saturated vapour pressure at the temperatures detailed is obtained from refrigerant vapour pressure curves supplied by the refrigerant manufacture.

In subcritical applications, a HOUSING which is exposed to low side pressure, including those in a MOTORCOMPRESSOR incorporating a bypass valve, shall be subjected to a test pressure equal to

- for subcritical applications, other than those using R-744, the higher of
 - 5 times the saturated vapour pressure of the refrigerant at 20 °C rounded up to the next 0,2 MPa (2 bar); or
 - 2,5 MPa (25 bar);

– for subcritical applications, using R-744, 5 times the saturated vapour pressure of the refrigerant at -6,5°C rounded up to the next 0,2 MPa (2 bar).

In TRANSCRITICAL REFRIGERATION SYSTEMS, a HOUSING which is exposed only to low side pressure shall be subjected to a test pressure that is equal to the highest of

- 5 times the DESIGN PRESSURE; or
-



- 5 times the saturated vapour pressure of the refrigerant at 20 °C rounded up to the next 0,2 MPa (2 bar); or
- 2,5 MPa (25 bar); or
- the test pressure specified in Table 102.

The test values for some refrigerants are given in Table 102. For refrigerants not mentioned, the saturated vapour pressure at the temperatures detailed is obtained from refrigerant vapour pressure curves supplied by the refrigerant manufacture.

For refrigerant blends, the saturated vapour pressure is taken as the pressure at the dew point temperature of 20 °C and 70 °C for low and high side respectively.

Addition:

Insulating materials used within the HOUSING shall be compatible with the refrigerant and oil used.

22.9

For the types of refrigerant and types of oil for which the MOTOR-COMPRESSOR is intended to be used, compliance of winding wire insulation shall be checked by the tests detailed in Annex BB or MOTORCOMPRESSORS that do not use oil by test 16 in IEC 60851-4 for resistance to refrigerants.

For test 16 in IEC 60851-4, the percentage of extractable matter shall not exceed 0,5 %. The breakdown voltage shall be at least 75 % of the minimum specified value.

For the types of refrigerant and types of oil for which the MOTOR-COMPRESSOR is intended to be used, compliance of tie cords and insulation materials other than winding wire insulation shall be checked by the tests detailed in Annex CC.

D1 Add the following clause to Clause 22 of the Part 1:

22.102DV

Motor-compressors intended to be used with A2 or A3 classified refrigerants shall be of a hermetically sealed design construction with a leakage rate of 3 grams per year or less.

The leakage rate shall be measured by filling the MOTOR-COMPRESSOR HOUSING with helium to a pressure of not less than one-third of the pressure applied during the testing conducted under Clause 22.7 or Annex 101.DVG. A mass spectrometer shall be used to determine the leakage rate.

24

Info

Components

24DV

DC Modification to replace Clause 24 of the Part 2 with the following: Except for 24.1.4, 24.1.4DV, 24.101, and 24.102DV, component requirements are replaced by the relevant component standards in Annex DVA. A component not complying with a Standard in Annex DVA shall be evaluated using the applicable component standard. If a standard does not exist for a component, then the component shall comply with requirements in this standard as far as they reasonably apply.



24.101	<p><u>In MOTOR-COMPRESSORS that employ flammable refrigerants, components that may arc or spark during NORMAL OPERATION of the end product shall comply with the requirements of IEC 60079-15, as modified by Annex DD, for group IIA gases or the refrigerant used. This requirement is not applicable to components within the HOUSING.</u></p>
29	<p>Info Clearances, creepage distances and solid insulation</p>
29.1	<p>Addition:</p> <p>Except as specified in 29.1.1 and 29.1.4, CLEARANCES less than those specified in Table 16 are not allowed for BASIC INSULATION and FUNCTIONAL INSULATION inside the HOUSING.</p> <p><u>For a RATED VOLTAGE > 300 V and ≤ 346 V the rated impulse voltage is for</u> <u>– overvoltage category I: 2 500 V;</u> <u>– overvoltage category II: 4 000 V;</u> <u>– overvoltage category III: 6 000 V.</u></p>
29.1.4	<p>Addition:</p> <p>CLEARANCES inside the HOUSING are reduced by 1,0 <u>0,5</u> mm for rated impulse voltages of 1-500 <u>2 500</u> V or more. Between winding wires and winding leads for motors or THERMAL MOTOR PROTECTORS, no minimum CLEARANCE is specified.</p>
29.3.4	<p>Addition:</p> <p><u>For a RATED VOLTAGE > 300 V and ≤ 346 V the minimum thickness for accessible parts of REINFORCED INSULATION consisting of a single layer is for</u> <u>– overvoltage category I: 0,6 mm;</u> <u>– overvoltage category II: 1,2 mm;</u> <u>– overvoltage category III: 1,5 mm.</u></p>
30	<p>Info Resistance to heat and fire</p>
30.102DV	<p><u>D1 Add Clauses 30.102DV.1 to 30.102DV.5 to the Part 1:</u></p>
30.102DV.1	<p><u>A starting relay of positive coefficient resistor (PTCR) type shall comply with testing as described in Clauses 30.102DV.2 – 30.102DV.5. As a result of the test, there shall be no charred or burned fibers of the cheesecloth. Smoke discoloration is acceptable. Thirty samples shall be tested.</u></p>
30.102DV.2	<p><u>The PTCR starting relay assembly shall be assembled to the motorcompressor, and the entire outer surface of the PTCR starting relay enclosure shall be covered by a single layer of cheesecloth. The cheesecloth panels shall be held in close contact with the external surfaces of the enclosure and adjacent surfaces of the compressor shell.</u></p>



30.102DV.3	<p><u>With the PTCR starting relay assembly at rated voltage, the voltage shall be increased in 50 V increments every 2 minutes until the starting relay changes from a low resistance state to the high resistance state. If the voltage at which this occurs:</u></p> <ul style="list-style-type: none"> <u>– Is less than three times the PTCR starting relay rated voltage, then the voltage shall be increased at the same rate until three times the starting relay rated voltage is reached. This voltage shall be held for not less than 6 minutes.</u> <u>– Equals or exceeds three times the PTCR starting relay rated voltage, then this voltage shall be held for not less than 6 minutes.</u> 	
30.102DV.4	<p><u>The voltage to the PTCR starting relay shall then be increased at the same rate until the PTCR opens or short circuits, or the PTCR enters a negative temperature coefficient (NTC) zone with a thermal runaway. When one of these conditions occurs, the voltage shall be maintained for an additional 2 minutes. No ignition of the cheesecloth shall occur during any part of this test.</u></p> <p><u>NOTE The PTCR change of state will occur when the voltage level exceeds the withstand voltage of the starting relay.</u></p>	
30.102DV.5	<p><u>The test shall be considered completed if the PTCR fractures and results in an open circuit without igniting the cheesecloth during this phase of the test. If a fractured PTCR does not result in an open circuit, it must comply with Clause 30.102DV.5.</u></p> <p><u>If the testing of Clause 30.102DV.3 and 30.102DV.4 does not result in an open circuit of the starting relay, then the starting relay shall be connected in series with a resistive load that allows the maximum continuous current to be applied through the starting relay when applying rated voltage. Rated voltage shall be applied until the circuit opens, until the cheesecloth burns, or for a minimum of 8 hours. If ignition of the cheesecloth occurs, the fire shall be extinguished as soon as possible. A self-resetting thermal motor-protector may operate during the test.</u></p> <p><u>NOTE The compressor windings are removed from the circuit and instead a resistive load is used to ensure the maximum continuous current value.</u></p>	
Annex AA	Info	Running overload tests for motor-compressors classified as tested with Annex AA
		<p>Unless otherwise stated, the tests in this annex are only applied if the MOTOR-COMPRESSOR is classified as being tested with Annex AA according to 6.101.</p>
AA.1		<p><u>Excluding starting current, the maximum value of the current averaged over any 5 min period is recorded. The interval between current measurements shall not exceed 30 s. The starting current is considered to be excluded if the first current measurement is made approximately 1 min after starting.</u></p>
AA.1DV		<p><u>D1 Addition of Clause AA.1DV.1 and Table AADV.1 as follows:</u></p>
AA.1DV.1		<p><u>If a compressor is not able to be tested to the conditions set forth in Tables AA.1 and AA.2, testing can be completed using the optional test conditions in Table AADV.1. A compressor tested to the optional test conditions shall be deemed to comply with Annex AA.</u></p>
Table		<i>New table added;</i>



AADV.1

Table AADV.1 – Optional test conditions

Test Conditions	Evaporation temperature °C	Condensation temperature °C	Motor-compressor ambient temperature °C	Return gas temperature °C
1	-25	+55	+43	+43
2	-25	+60	+43	+43
3	-15	+65	+43	+43
4	-0	+65	+43	+25
5	+15	+65	+43	+25
6	+30	+70	+43	+43

AA.2

The MOTOR-COMPRESSOR including the MOTOR-COMPRESSOR PROTECTION SYSTEM or MOTOR-COMPRESSOR CONTROL SYSTEM, if any, is connected to the substitute refrigeration circuit of Figure AA.1 and operated under the appropriate conditions given in Table AA.1 ~~the motor-compressor being supplied at 1,06 times the rated voltage. If the motor-compressor cooling capacity is variable it is adjusted to its maximum value. The test is continued until steady conditions are reached.~~ for tests 1 and 2. However, for R-744 refrigerant intended for use in a TRANSCRITICAL REFRIGERATION SYSTEM, for all tests the maximum operating discharge pressure is 12 MPa and the return gas temperature is +25 °C. The tests are continued until steady conditions are reached. If the MOTOR-COMPRESSOR cooling capacity is variable, the tests are carried out at maximum and minimum cooling conditions.

Table deleted;

Substitute refrigeration circuit conditions for operating under running overload Conditions

Application category	Evaporation temperature °C	Condensation temperature °C	Motor-compressor ambient temperature °C	Return gas temperature °C
Low back pressure	-15	+65	+43	+43
Medium back pressure	0	+65	+43	+25
High back pressure	+12	+65	+43	+25

Table AA.1

Table added;

Substitute refrigeration circuit conditions for operating under running overload Conditions



Test number	Applied voltage	Application category	Evaporation temperature °C	Condensation temperature °C	Motor-compressor ambient temperature °C	Return gas temperature °C
1	1,06 RATED VOLTAGE	Low back pressure – max. cooling	-15	+65	+43	+43
1	1,06 RATED VOLTAGE	Low back pressure – min. cooling	-15	+65	+43	+43
1	1,06 RATED VOLTAGE	Medium back pressure – max. cooling	0	+65	+43	+25
1	1,06 RATED VOLTAGE	Medium back pressure – min. cooling	0	+65	+43	+25
1	1,06 RATED VOLTAGE	High back pressure – max. cooling	+15	+65	+43	+25
1	1,06 RATED VOLTAGE	High back pressure – min. cooling	+15	+65	+43	+25
2	0,94 RATED VOLTAGE	Low back pressure – max. cooling	-15	+65	+43	+43
2	0,94 RATED VOLTAGE	Low back pressure – min. cooling	-15	+65	+43	+43
2	0,94 RATED VOLTAGE	Medium back pressure – max. cooling	0	+65	+43	+25
2	0,94 RATED VOLTAGE	Medium back pressure – min. cooling	0	+65	+43	+25
2	0,94 RATED VOLTAGE	High back pressure – max. cooling	+15	+65	+43	+25
2	0,94 RATED VOLTAGE	High back pressure – min. cooling	+15	+65	+43	+25
3	0,85 RATED VOLTAGE	Low back pressure – max. cooling	-15	+65	+43	+43
3	0,85 RATED VOLTAGE	Low back pressure – min. cooling	-15	+65	+43	+43
3	0,85 RATED VOLTAGE	Medium back pressure – max. cooling	0	+65	+43	+25
3	0,85 RATED VOLTAGE	Medium back pressure – min. cooling	0	+65	+43	+25
3	0,85 RATED VOLTAGE	High back pressure – max. cooling	+15	+65	+43	+25
3	0,85 RATED VOLTAGE	High back pressure – min. cooling	+15	+65	+43	+25

NOTE For R-744 refrigerant intended for use in a non-TRANSCRITICAL REFRIGERATION SYSTEM, for all tests the evaporation temperature is -15 °C, the condensation temperature is +20 °C, the MOTOR COMPRESSOR ambient temperature is +43 °C and the return gas temperature is +2 °C.

Immediately after the tests of Clause AA.2, ~~the following tests are conducted~~ the MOTOR-COMPRESSOR including the MOTOR-COMPRESSOR PROTECTION SYSTEM or MOTOR-COMPRESSOR CONTROL SYSTEM, if any, is operated under the appropriate conditions given in Table AA.1 for test 3 so as to cause the MOTOR-COMPRESSOR PROTECTION SYSTEM to operate or to reach steady conditions with the MOTOR-COMPRESSOR in the stalled or running condition.

AA.3

~~The motor compressor is operated under the conditions of clause AA.2, but with the supply voltage reduced to 0,85 times the rated voltage, until the motor compressor protection system operates or steady conditions are reached.~~

During test 3, if the MOTOR-COMPRESSOR PROTECTION SYSTEM does not operate, the voltage is reduced in steps of 4 % ± 1 % of the RATED VOLTAGE, at a rate of approximately 2 V/min, until steady conditions are reached at each step. This procedure is continued until one of the following conditions occurs:

- the MOTOR-COMPRESSOR protection system operates;
- the MOTOR-COMPRESSOR stalls and steady conditions are reached.
- ~~- the motor compressor continues to run regardless of further voltage reductions and steady conditions are reached.~~

AA.4

The MOTOR-COMPRESSOR including the MOTOR-COMPRESSOR PROTECTION SYSTEM and MOTOR-COMPRESSOR CONTROL SYSTEM, if any, is connected to the substitute refrigeration circuit of Figure AA.1 and operated until steady conditions are reached at: under the appropriate conditions given in Table AA.2. However, for R-744 refrigerant intended for use in a TRANSCRITICAL REFRIGERATION SYSTEM, for all tests the operating discharge pressure is 12 MPa and for test 4 the



return gas temperature is +25 °C. The tests are continued until steady conditions are reached.

- a) ~~The appropriate conditions given in Table AADV.2 for each of tests 1, 2, 3, and 4; or~~
 - b) ~~Conditions other than those specified in Table AADV.2, if agreeable to all parties. Testing at such conditions shall be conducted at the designated maximum and minimum load pressure conditions and with maximum and minimum motor-compressor cooling loads.~~
-



New table added;

**Substitute refrigeration circuit conditions for operating under maximum load
Conditions**

Table AA.2

Test number	Applied voltage	Back pressure application category	Evaporation temperature °C	Condensation temperature °C	Motor-compressor ambient temperature °C	Return gas temperature °C
4	RATED VOLTAGE	Low back pressure – max. load – max. cooling	-15	+65	+43	+43
5	RATED VOLTAGE	Low back pressure – min. load – max. cooling	-35	+49	+43	+25
4	RATED VOLTAGE	Medium back pressure – max. load – max. cooling	0	+65	+43	+25
5	RATED VOLTAGE	Medium back pressure – min. load – max. cooling	-20	+55	+43	+25
4	RATED VOLTAGE	High back pressure – max. load – max. cooling	+15	+65	+43	+25
5	RATED VOLTAGE	High back pressure – min. load – max. cooling	-5	+55	+43	+25

New table added;

Table AA.3 – Steps for increasing the load on the motor-compressor

AA.5

STEPS	PROCEDURE
1a	For other than R-744 TRANSCRITICAL REFRIGERATION SYSTEMS, increase the condensing temperature to 70 °C.
1b	For R-744 TRANSCRITICAL REFRIGERATION SYSTEMS, increase the discharge pressure in steps of approximately 0,05 MPa up to a discharge pressure of 13 MPa.
2	Increase the evaporating temperature in steps of approximately 5 K for a – LBP application category: up to 0°C – MBP application category: up to +10°C – HBP application category: up to +20°C
3	Increase the input voltage to the inverter in steps of approximately 6 % of the input voltage to the inverter at RATED VOLTAGE, up to 1,12 times the input voltage to the inverter at RATED VOLTAGE.
4	Starting from RATED VOLTAGE, decrease the input voltage to the inverter in steps of approximately 5 % of the input voltage to the inverter at RATED VOLTAGE.

New annex added;

Table AA.3

Winding wire insulation compatibility tests

Annex BB



BB.1	<p><u>Testing of winding wire insulation shall be conducted on two sets of six representative samples as follows:</u></p> <p>a) <u>Film-coated winding wire shall be prepared in accordance with 4.4.1 of IEC 60851-5:2008 except that samples for the refrigerant and oil exposure shall not have the loop at the end removed until after the refrigerant and oil exposure.</u></p> <p>b) <u>Other winding wires shall be straight lengths of wire.</u></p>
BB.1DV	<p><u>D1 Add the following:</u></p>
BB.1DV.1	<p><u>If motor-compressors are not used, either two or six (at the manufacturer's option) motorettes or coillettes or samples as shown in Annex BB shall be prepared for this test.</u></p>
BB.1DV.2	<p><u>For winding wires over 600 volts refer to IEEE 1776.</u></p>
BB.2	<p><u>The size of the test samples shall be the smallest nominal wire size (diameter) intended for use on the MOTOR-COMPRESSOR.</u></p>
BB.3	<p><u>One set of six samples shall be maintained in the as-received condition (no exposure to refrigerant and oil). Another set of six samples shall be prepared for the refrigerant and oil exposure testing.</u></p>
BB.4	<p><u>The six as-received samples of winding wire shall be subjected to the electric strength test of 16.3 except that the applied voltage shall be 125 % of the maximum WORKING VOLTAGE of the MOTOR-COMPRESSOR, but not less than 500 V. The test voltage is applied between the conductors of the wires. The winding wire tested shall withstand the application of the test voltage specified without breakdown.</u></p>
BB.5	<p><u>The set of six samples prepared for the refrigerant and oil exposure testing shall be placed in test vessel(s) and each test vessel shall be provided with a pressure relief device. Each test vessel shall then be sealed, evacuated to 100 µm of mercury or less and heated to not less than 150 °C for at least 1 h.</u></p> <p><u>NOTE A safety control other than a pressure relief device can be used if it serves the purpose of preventing excessive pressure build-up within a test vessel.</u></p>
BB.6	<p><u>The oil shall be added within each test vessel so that all samples will remain partially immersed in the refrigerant-oil-mixture throughout the duration of the test, including during the no heat period.</u></p>
BB.7	<p><u>Each test vessel shall then be re-sealed, evacuated and heated in accordance with Clause BB.5.</u></p>
BB.8	<p><u>Each test vessel shall then be charged with the refrigerant vapour in a manner which does not permit air to be introduced into the test vessel. The pressure of the refrigerant vapour shall be any convenient pressure between 1,0 MPa and 2,4 MPa for any refrigerant other than transcritical R-744, which shall be at a pressure of not less than 7,3 MPa.</u></p>



BB.9 The test samples shall be tested as detailed in Table BB.1. The time of heating shall be divided into five equal heating periods. Each heating period is followed by a period without heating. The period without heating shall be at a temperature of approximately 25 °C for 48 h.

D2 Modification by adding the following note:

BB.9DV NOTE 1DV: To shorten the test time and at the manufacturer's option, the minimum 48-hour cool-down period between each heat exposure may be omitted.

BB.10 The time temperature heating cycle used for the test is selected by the manufacturer.

Temperature heating cycles

Table BB.1	Heating temperature	Total heating time	Heating period
	°C	h	H
	140	1 440	288
	145	1 080	216
	150	720	144
	155	540	108
	160	360	72
	175	240	48

BB.11 Immediately after being exposed to the refrigerant and oil, the winding wire samples shall be subjected to the electric strength test of 16.3 except that the applied voltage shall be not less than 100 % of the maximum WORKING VOLTAGE of the MOTOR-COMPRESSOR for which the winding wire is intended to be used. The test voltage is applied between the conductors of the wires. The winding wire tested shall withstand the application of the test voltage specified without breakdown.

D2 Add the following figure:

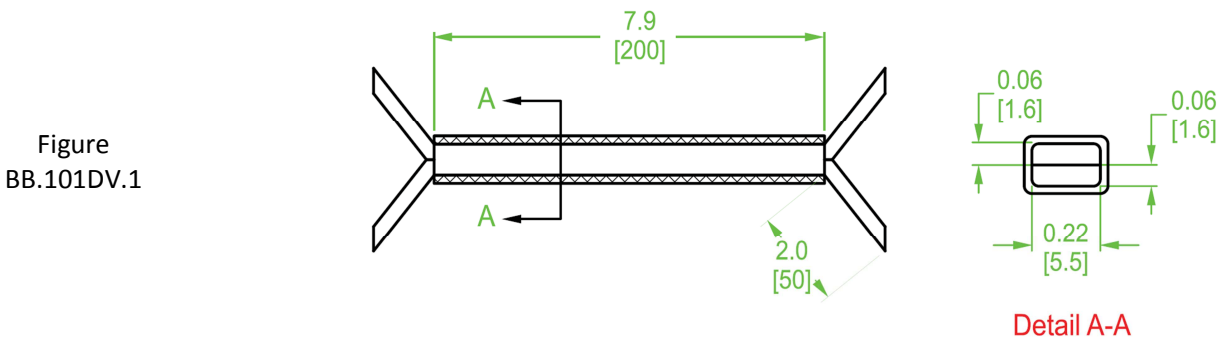


Figure BB.101DV.1 – Illustration of turn to turn test specimen

Figure BB.101DV.2 D2 Add the following figure:

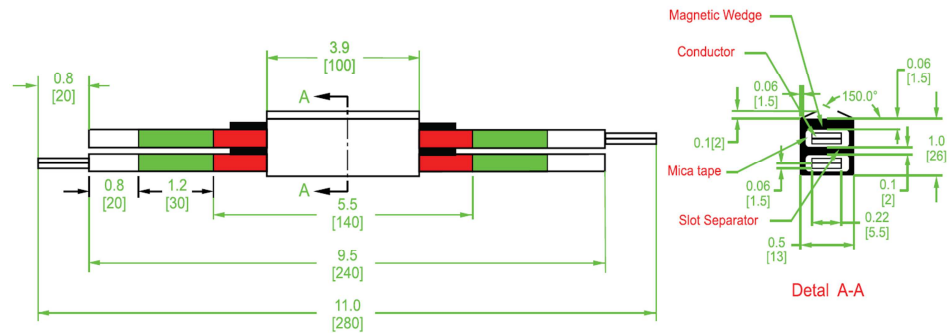


Figure BB.101DV.2 – Illustration of Formette test specimen

New annex added;

Annex CC

Tie cords and insulation compatibility tests

Testing of tie cords, insulating system materials or parts shall be conducted on two sets of six representative samples as follows:

- CC.1
- a) Tie cords shall be at least 500 mm long and of the minimum nominal thickness intended for use on the MOTOR-COMPRESSOR.
 - b) Insulating system materials shall be of an amount approximately proportional to their use in the system. They shall be of the minimum nominal thickness intended for use on the MOTOR-COMPRESSOR and having an overall size so the test in Clause CC.3 can be conducted without flashover.
 - c) Parts such as an internal motor terminal assembly or lead connection block shall be the actual type and size as intended for use in the MOTOR-COMPRESSOR.

CC.2

One set of six samples shall be maintained in the as-received condition (no exposure to refrigerant and oil). Another set of six samples shall be prepared for the refrigerant and oil exposure testing.

CC.3

The six as-received samples of insulating materials or parts shall be subjected to the electric strength test of 16.3 except that the applied voltage shall be not less than 125 % of the maximum WORKING VOLTAGE of the circuit for which the materials are intended, but not less than 500 V.

If the parts to be tested are:

- CC.4
- a) insulating materials other than tubing or leads, the test electrodes shall be opposing cylindrical rods, sized 5 mm diameter with edges rounded to a 1 mm radius;
 - b) tubing, the test electrodes shall be a copper conductor and spherical metal shot. The copper conductor shall be of a size approximately equal to the tubing internal diameter and then inserted into the tubing. The tubing and conductor shall be bent 180° over a mandrel having a diameter of not more than 10 mm. The metal shot shall be sized 2 mm to 3 mm diameter. The tubing and conductor shall be inserted into the metal shot such that the test voltage is applied between the conductor within the tubing and the metal shot;
 - c) leads, the tests electrodes shall be the wire within the lead and metal foil 50 mm long, wrapped around the lead and centred on the lead length. The test voltage shall be applied between the wire within the lead and the metal foil.



CC.5	<u>The insulation or parts tested shall withstand the application of the test voltage specified without breakdown.</u>
CC.6	<u>The six as-received sample tie cords shall be subjected to a breaking test as follows:</u> <u>a) Tie cord breaking strength shall be determined by using constant rate of specimen extension tensile testing machine. Clamping jaws, such as of the drum or capstan type to prevent slippage or breakage of the tie cord, shall be used. The distance between the contact points of the jaws shall be adjusted to 250 mm ±10 mm.</u> <u>b) Tie cord samples shall be installed and aligned in the test machine jaws. The movable jaw shall be operated at a speed of 300 mm/min ±10 mm/min. If a sample breaks within 10 mm of the jaw contact point, the results shall be disregarded and another sample tested.</u>
CC.7	<u>The average tie cord breaking strength shall be recorded.</u>
CC.8	<u>The set of six samples prepared for the refrigerant and oil exposure testing shall be placed in test vessel(s) and each test vessel shall be provided with a pressure relief device. Each test vessel shall then be sealed, evacuated to 100 µm of mercury or less and heated to not less than 150 °C for at least 1 h.</u>
CC.9	<u>The oil shall be added within each test vessel so that all samples will remain partially immersed in the refrigerant-oil-mixture throughout the duration of the test, including during the no heat period.</u>
CC.10	<u>Each test vessel shall then be re-sealed, evacuated and heated in accordance with Clause CC.8.</u>
CC.11	<u>Each test vessel shall then be charged with the refrigerant vapour in a manner which does not permit air to be introduced into the test vessel. The pressure of the refrigerant vapour shall be any convenient pressure between 1,0 MPa and 2,4 MPa for any refrigerant other than transcritical R-744, which shall be at a pressure of not less than 7,3 MPa.</u>
CC.12	<u>The test samples shall be tested as detailed in Table CC.1. The time of heating shall be divided into five equal heating periods. Each heating period is followed by a period without heating. The period without heating shall be at a temperature of approximately 25 °C for 48 h.</u>
CC.13	<u>The time temperature heating cycle used for the test is selected by the manufacturer.</u>



Time temperature heating cycles

Table CC.1

Heating temperature	Total heating time	Heating period
°C	h	H
140	1 440	288
145	1 080	216
150	720	144
155	540	108
160	360	72
175	240	48

CC.14

Immediately after being exposed to the refrigerant and oil:
 a) Tie cord samples shall be subjected to the breaking strength test in accordance with Clause CC.6. Not less than five of the six tie cord samples exposed to refrigerant and oil shall have a breaking strength of at least 80 % of the average as-received tie cord breaking strength.
 b) Other insulation samples shall be subjected to the strength test of 16.3 except that the applied voltage shall be not less than 100 % of the maximum WORKING VOLTAGE of the circuit for which the materials are intended. The insulation or parts tested shall withstand the application of the test voltage specified without breakdown.

Annex DD

New annex added;

Non-sparking “n” electrical apparatus

16

General supplementary requirements for equipment producing arcs, sparks or hot surfaces
Clause 16 is applicable.

17

Supplementary requirements for enclosed-break devices and non-incendive components producing arcs, sparks or hot surfaces
Clause 17 is applicable.

18

Supplementary requirements for hermetically sealed devices producing arcs, sparks or hot surfaces
Clause 18 is applicable.

19

Supplementary requirements for sealed devices producing arcs, sparks or hot surfaces
Clause 19 is applicable.

20

Supplementary requirements for restricted-breathing enclosures protecting apparatus producing arcs, sparks or hot surfaces
Clause 20 is applicable.

Annex 101.DVA

Info

Accelerated Aging Tests – Gaskets



101.DVA.5	<p><u>At least three samples of neoprene, rubber, or polyvinyl chloride materials shall be used for each of the following tests:</u></p> <ul style="list-style-type: none">a) <u>Recovery</u>b) <u>Before Elongation</u>c) <u>After Elongation</u>d) <u>Before Tensile Strength</u>e) <u>After Tensile Strength</u>
101DVA.6	<p><u>neoprene, rubber or polyvinyl chloride gasket material shall be considered as complying if the average results for all samples comply with the physical properties to which they were subjected as specified in Table 101.DVA.1.</u></p>
Annex 101.DVI	<p><i>New annex added;</i></p> <p><u>Requirements for motor-compressors rated over 600 volts to 15 000 volts</u></p>
Annex 101.DVI	<p><u>D1 Add a new Annex 101.DVI as follows:</u></p>
101.DVI.1	<p><u>Scope</u></p>
101.DVI.1.1	<p><u>This Annex provides information for evaluation of motor-compressors rated greater than 600 volts up to 15 000 volts.</u></p>
101.DVI.2	<p><u>Components</u></p>
101.DVI.2.1	<p><u>Motor overload protective devices and thermal protective devices rated over 600 volts shall comply with CSA C22.2 No. 253 and UL 347.</u></p>
101.DVI.3	<p><u>Clearances, creepage distances and solid insulation</u></p>
101.DVI.3.1	<p><u>Motor-compressors rated greater than 601 volts up to 15 000 volts shall have the minimum clearances and creepage distances, specified in Table 101.DVI.1.</u></p>



Creepage and Clearance for High Voltage Circuits

Table
DVI.3.1

Voltage range, V	Minimum spacing			
	Through air		Over surface	
	mm	In	mm	in
601 - 750	9,5	3/8	12,5	1/2
751 - 1 000	10	3/8	13,0	1/2
1 001 - 2 000	19	3/4	34	1-3/8
2 001 - 3 000	25	1	50	2
3 001 - 5 000 ^a	63	2-1/2	75	3
3 001 - 5 000 ^b	82	3-1/4	100	4
5 001 - 7 200 ^a	75	3	88	3-1/2
5 001 - 7 200 ^b	100	4	127	5
7 201 - 13 800 ^a	127	5	127	5
7 201 - 13 800 ^b	134	5-1/4	134	5-1/4
13 801 - 14 400 ^a	165	6-1/2	165	6-1/2
13 801 - 14 400 ^b	230	9	230	9
Voltage range, V	Minimum spacing			
	Through air		Over surface	
	mm	in	mm	in
14 401 - 15 000 ^a	190	7-1/2	190	7-1/2
14 401 - 15 000 ^b	270	10-1/2	270	10-1/2
^a Between uninsulated live parts and grounded non-current-carrying metal parts.				
^b Between uninsulated live parts of opposite polarity.				

Annex
101.DVJ

New annex added;

Annex
101.DVJ

Hydrostatic strength testing of internal motor protective devices

101.DVJ.1

D1 Add a new Annex 101.DVJ as follows:

101.DVJ.1.1

Scope

This test applies to any motor PROTECTIVE DEVICE located within the MOTORCOMPRESSOR HOUSING.

101.DVJ.2

Hydrostatic strength testing of internal motor protective devices

A motor PROTECTIVE DEVICE located within the MOTOR-COMPRESSOR HOUSING shall be subjected to the test specified below. Following this test, the PROTECTIVE DEVICE shall not be structurally damaged. In addition, the maximum allowable operating (opening) and reset (closing) temperature:

a) Deviation shall not exceed 8 K of the test value between the two PROTECTIVE DEVICE samples, and

b) Drift shall not exceed 5 % of the test value of the specific PROTECTIVE DEVICE sample.

If the operating and reset temperatures of a PROTECTIVE DEVICE have not been declared, one sample PROTECTIVE DEVICE shall be mounted within an air oven having a forced air circulation velocity of not less than 0,51 m/s and designed to nullify the effects of radiation. The oven temperature shall be measured at a



location immediately adjacent to the PROTECTIVE DEVICE. Operating and reset temperature shall be indicated by a continuity-indicating circuit that does not influence operation of the PROTECTIVE DEVICE.

Temperatures of all PROTECTIVE DEVICE parts shall be maintained at equilibrium. The oven temperature shall then be increased at a rate of not greater than 0,5 K per minute until the PROTECTIVE DEVICE operates. Oven equilibrium conditions shall then be reestablished. The oven temperature shall then be decreased at a rate of not greater than 0,5 K per minute until the PROTECTIVE DEVICE resets. The test shall be repeated on the same sample PROTECTIVE DEVICE.

The test shall then be conducted using a second sample PROTECTIVE DEVICE.

NOTE If the operating and reset temperatures of a PROTECTIVE DEVICE have been declared, then determining the operating and reset temperatures prior to the pressure test is not required.

The two samples of the PROTECTIVE DEVICE shall then be placed within a container completely filled with an incompressible, inert fluid to exclude all air, and connected to a hydraulic pump system.

The container pressure shall be raised gradually and maintained for 1 minute at a pressure of not less than 120 % of the maximum pressure developed during the heat transfer medium failure test on the end-use product.

The air oven temperature test as specified above shall then be conducted on each sample PROTECTIVE DEVICE following the pressure test.

CUSTOMERS PLEASE NOTE: This Table and column “Verdict” can be used in determining how your current or future production is or will be in compliance with new/revised requirements.
