

## STANDARD INFORMATION

**Standard Number:** UL 749 / CSA C22.2 No 167  
**Standard Name:** Household Dishwashers  
**Standard Edition and Issue Date:** 10<sup>th</sup> / 7<sup>th</sup> Edition Dated March 16, 2017  
**Date of Revision:** March 16, 2017  
**Date of Previous Revision of Standard:** May 24, 2013

## EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

**Effective Date:** **September 16, 2020**

## IMPACT, OVERVIEW, AND ACTION REQUIRED

**Impact Statement:** A review of all Listing Reports is necessary to determine which products comply with new/revise requirements and which products will require re-evaluation. **NOTE:** Effective immediately, this revised standard will be exclusively used for evaluation of new products unless the Applicant requests in writing that current requirements be used along with their understanding that their listings will be withdrawn on Effective Date noted above, unless the product is found to comply with new/revise requirements.

**Overview of Changes:** New technology, harmonization, general updates, clarifications, and corrections. Specific details of new/revise requirements are found in table below.

**If the applicable requirements noted in the table are not described in your report(s), these requirements will need to be confirmed as met and added to your report(s) such as markings, instructions, test results, etc. (as required).**

### Client Action Required:

**Information** – To assist our Engineer with review of your Listing Reports, please submit technical information in response to the new/revise paragraphs noted in the attached or explain why these new/revise requirements do not apply to your product (s).

***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 – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records.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
		<i>Additions to the standard are <u>underlined</u>, deletions are <del>lined out</del>.</i>
15	Info	<b>Moisture resistance</b>
15.10		<b><i>New section added;</i></b>
		<b>Liquid leaking from an auxiliary reservoir</b>
15.10.1		An appliance that employs auxiliary reservoirs, such as a reservoir for cleaning agent or rinsing agent, shall show no evidence of wetting of electrical wire insulation after being conditioned as specified in Clause 15.10.4.
15.10.2		Clause 15.10.1 shall not apply to wiring within Class 2 circuits where the power available is limited to 15 watts.
15.10.3		<p>With the door of the appliance disassembled, a 3 mm (1/8 in) diameter hole shall be drilled in the reservoir in a location most likely to result in wetting of electrical wiring and such that the maximum amount of liquid will drain from the reservoir. One 3 mm (1/8 in) diameter vent hole shall also be drilled at the top of the reservoir and shall be located in a location high enough that it will not leak rinse agent as the door is cycled during conditioning. The door assembly shall be reassembled to meet the production intent configuration.</p> <p><b>Note: When identifying the hole location, consider a location(s) most likely to be the source of a leak (e.g., welds seams, seals, gates).</b></p>
15.10.4		<p>With the door in the horizontal position, the reservoir shall be filled with 100 mL (3.4 oz) of non-transparent rinse agent or to the maximum fill level of the reservoir; see Clause 5.6.1. The door shall be actuated a minimum of 20 times from fully open to fully closed at a rate of 3 seconds to close and 3 seconds to open, or until all liquid has drained from the reservoir. This sequence shall be repeated a minimum of 4 additional times until a volume of 400 mL (13.5 oz) has been allowed to leak from the reservoir.</p> <p>After conditioning as specified in Clause 15.10.4, an appliance shall be visually inspected for evidence of wetting of electrical wire insulation as follows. For the visual inspection, the door shall be orientated in its closed position.</p>
15.10.5		<p>a) An appliance that does not employ absorbent material within the door assembly, such as acoustic insulation, shall be immediately inspected after the conditioning; or</p> <p>b) An appliance that does employ absorbent material shall be inspected 24 hours (<math>\pm 1</math> hour) after the conditioning.</p> <p><b>Note: The 24 hours is intended to allow time for the rinse agent to absorb into the insulation.</b></p>



17	Info	<b>Abnormal Operation</b>
		<b><i>New section added;</i></b>
17.4		<b>Nichrome wire test</b>
17.4.1		<p>If specified by Clause 30.3.5(b), an electrical connection shall be tested as specified in Clauses 17.4.2 to 17.4.10. Each connection shall be evaluated using one connector sample. Multiple connections may be independently evaluated within the same appliance if they are located such as to not influence the outcome or evaluation of the test. As a result of the test, there shall be no evidence of ignition of the cheesecloth referenced in Clause 17.4.4 as indicated by broken threads of the cheesecloth. Browning of the cheesecloth is acceptable provided that all individual threads are unbroken.</p> <p><b>Note: Cheesecloth fibers may become brittle after exposed to heat. Care must be taken to prevent breakage of fibers during inspection. Fibers broken during inspection are not considered as a non-compliance.</b></p>
17.4.2		<p>The test shall be considered inconclusive and then repeated if there is evidence of either of the following:</p> <ul style="list-style-type: none"><li>a) A fracture or shorting of the nichrome wire prior to completion of the test; or</li><li>b) A shift in the position of the nichrome wire sufficient to alter the severity of the test.</li></ul>
17.4.3		<p>This test intentionally attempts to cause a fire. Appropriate safety precautions to prevent the spread of fire should be taken. The test location shall have sufficient fresh air to sustain the flame. This test shall be conducted at an elevation of less than 609.6 m (2,000 ft) above sea level.</p>



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The appliance shall be placed inside an enclosure constructed from painted plywood, cement board, or calcium silicate board with a minimum thickness of 9.5 mm (0.37 in). The enclosure shall consist of a bottom, a back, two sides, and a top. Each part of the enclosure shall be brought into the closest contact with the corresponding surface of the appliance as the configuration of the appliance permits. The following requirements shall apply:

- 17.4.4
- a) The top, two sides, and back inside surfaces of the test enclosure shall be completely covered by single-layer cheesecloth panels. A mechanical means, such as small pieces of metal foil adhesive tape, shall be used to secure the cheesecloth panels so there are no gaps between the panels. A single layer of cheesecloth slightly larger than the appliance bottom surface shall cover the supporting surface. A single layer of cheesecloth shall be draped from the top of the enclosure to the supporting surface and shall be secured to the sides such that it is held in close contact with the front of the appliance.
  - b) If agreeable to those concerned, portions of the appliance may be tested by placing cheesecloth only in the area of the anticipated breach.

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17.4.5

All labels that are applied by the manufacturer shall be applied to the intended surfaces of the test appliance. Printing on the labels is not required. The manufacturer shall place the wiring diagram in the test appliance as intended.

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17.4.6

The appliance shall be supported on a non-conductive surface. The appliance shall be de-energized during the test unless equipped with a protective control or device. The connection under evaluation shall be electrically isolated from the appliance circuitry during the test. If the appliance is energized during the test, a duplicate connection that is electrically isolated from live parts shall be evaluated. Thermocouples shall be placed around the part (but not in direct contact) such that when ignition occurs, an increase in temperature can be detected. When appropriate, windows made of glass, or other clear non-combustible material may be used in the product to allow viewing of the component being tested. Windows shall be sealed to prevent extraneous drafts or air leaks. Windows shall be located in areas not likely to be involved in or influence flame propagation. Video cameras may be employed to assist in verification of ignition. A constant current power supply shall be used and current shall be monitored for evidence of shorting or resistance wire breaks during testing.

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17.4.7

An appliance control or device employed to provide protection from risk of fire shall be evaluated as a protective control and may be used to de-energize the nichrome wire if found to actuate during the test.

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17.4.8

Nichrome wire [80% Nickel, 20% Chrome, 22 AWG, in accordance with ASTM 344] shall be applied to a connector or switching contact such that the adjacent non-metallic combustible materials will be ignited during the test.

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In the application of the nichrome wire to the part under test, the nichrome wire may be inserted into the part, or the wire may be externally wrapped around the part under test. The intent is to achieve complete combustion of the part under test and/or adjacent materials.

- 17.4.9
- a) When inserting the coil into the part under test, a single strand of nichrome wire with a minimum length of 100 mm (4.0 in) shall be formed into a coil with a diameter and length that approximates the connection under evaluation. The coil shall be inserted in place of the connection under evaluation. In the case of a multi-pin connector, a single terminal pin shall be removed from the connector such that the coil can be inserted in the worst case location (typically the lowest position). If the worst case position is not obvious, then multiple positions shall be evaluated.
  - b) When externally wrapping a connector or uninsulated terminal, use minimum 50 mm (2.0 in) of nichrome wire to achieve a minimum of three evenly spaced wraps along the length of the connector or uninsulated terminal.
  - c) Uninsulated terminals shall be wrapped with a non-flammable tape or sleeve prior to wrapping with nichrome wire to prevent shorting out portions of the nichrome wire.
  - d) In the case of switching devices, a coil of nichrome wire shall be placed inside the device in the position of the contacts and appropriately supported to prevent movement during the test. See Clause 30.3.6.

Insulated wire leads shall be used to supply power to the nichrome wire and shall be supported and strain-relieved to prevent the nichrome wire from shifting during testing.

**Note: With reference to (a) and (d), the preferred method of wrapping a coil is wrapping nichrome wire around the threads of a 6-18 AWG wood screw with a nominal root diameter of 2.4 mm (0.094 in) and a thread per 25.4 mm (1 in) count of 18.**

**Note: The preferred method of wrapping a coil is wrapping nichrome wire around the threads of a #6-18 wood screw with a root diameter of 0.094 inch and a thread per inch count of 18.**

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17.4.10		The nichrome wire shall be energized such that current in the circuit is immediately increased to 11 amperes, and held constant for the duration of the test. If no ignition is detected within 20 minutes, the current shall be removed from the nichrome wire. If ignition is detected, the current shall be held constant until burning of the non-metallic combustible material ceases naturally or there is ignition of the cheesecloth. If ignition of the cheesecloth occurs, the fire shall be extinguished as soon as possible. If the nichrome wire fractures prematurely, the test shall be repeated.
22	Info	<b>Components</b>
22.5	Info	<b>Heating elements</b>
22.5.2		HEATING ELEMENTS shall be supported in a substantial and reliable manner, and provided with means of reducing the likelihood of mechanical damage and contact with outside objects. <u>Heating elements shall be supported by a means which allows thermal expansion during operation to occur without restriction.</u>
		<b><i>New clause added;</i></b>
22.5.3		An appliance that employs a heating element with a metallic tubular sheath that is in direct contact with water and detergent shall employ the following:  a) A heating element with a sheath material composed of a metal alloy with a minimum of 20 percent nickel;  b) A sheath material in accordance with Clause 22.5.4; or  c) A device as specified in Clause 22.11.8.  <b>Note: This requirement does not apply to flow-through heater applications where the sheath is not in direct contact with water.</b>
		<b><i>New clause added;</i></b>
22.5.4		The sheath material of a heater assembly shall be subjected to a stress corrosion cracking comparison test in accordance with ASTM G36 and supported using a u-bend fixture in accordance with ASTM G30. The proposed material shall be compared to a baseline material fabricated from a metal alloy composed of 20% nickel, 60% iron, and 20% chromium. Coupons of identical wall thickness, length, and width shall be fabricated for the test. Testing shall be done sequentially such that the alloy comparison is done under the same conditions. As a result of the test, using a statistically relevant sample size, the proposed material shall not crack statistically sooner than the baseline material.
		<b><i>New section added;</i></b>
22.11.8		Leakage current detection devices

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22.11.8.1		A leakage current detection device provided in accordance with Clause 20.2.3 shall check leakage current to the outer metal sheath of the heating assembly at least one time per wash cycle. The trip current rating for the device shall be 100 mA or less.
22.11.8.2		The minimum test parameters for the evaluation of a leakage current detection device to CAN/CSA-E60730 and UL 60730 shall be as specified in Table 5.
29	Info	<b>Resistance to corrosion</b>
		<i><b>New section added;</b></i>
29.4		<b>Metallic coating thickness test</b>
29.4.1		The solution to be used for this test is to be made from distilled water containing 200 grams per liter of chemically pure chromic acid, CrO <sub>3</sub> and 50 grams per liter of chemically pure concentrated sulfuric acid, H <sub>2</sub> SO <sub>4</sub> . The latter is equivalent to 27 milliliters per liter of chemically pure concentrated sulfuric acid, specific gravity 1.84 containing 96 percent of H <sub>2</sub> SO <sub>4</sub> .
29.4.2		The test solution is to be contained in a glass vessel, such as a separatory funnel, with the outlet equipped with a stopcock and a capillary tube of 0.64 mm (0.025 inch) inside bore and 140 mm (5.5 inches) long. The lower end of the capillary tube is to be tapered to form a tip; each drop from which is to be 0.05 milliliter. To preserve an effectively constant level, a small glass tube is to be inserted in the tip of the funnel through a rubber stopper and its position adjusted so that the rate of dropping is 100 ±5 drops per minute when the stopcock is open. An additional stopcock may be used in place of the glass tube to control the rate of dropping.
29.4.3		The sample and the test solution are to be kept in the test room long enough to acquire the temperature of the room, which is to be noted and recorded. The test is to be conducted at a room temperature of 21.1 to 32.2°C (70 to 90°F).
29.4.4		Each sample is to be thoroughly cleaned before testing. All grease, lacquer, paint, and other nonmetallic coatings are to be removed completely by means of an acceptable solvent. Samples then are to be thoroughly rinsed in water and dried with clean cheesecloth. Care should be exercised to avoid contact of the cleaned surface with the hands or any foreign material.
29.4.5		The sample to be tested is to be supported 17.8-25.4 mm (0.7-1 inch) below the orifice so that the drops of solution strike the point to be tested and run off quickly. The surface to be tested is to be inclined 45 degrees from horizontal.
29.4.6		After cleaning, the sample to be tested is to be placed under the orifice. The stopcock is to be open and the time, in seconds, is to be measured with a stopwatch until the dripping solution dissolves off the protective metallic coating and exposes the base metal. The initial appearance of the base metal is recognizable by the change in color at that point.



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29.4.7		Each sample of a test lot is to be subjected to the test at three or more points, excluding cut, stenciled, and treaded surfaces, on the inside surface, and at the equal number of points on the outside surface, at points where the metallic coating may be expected to be the thinnest. On enclosures made from precoated sheets, the external corners that are subjected to the greatest deformation may have thin coatings.
29.4.8		To calculate the thickness of the coating being tested, the thickness factor appropriate for the temperature at which the test was conducted is to be selected from Table 9 and multiplied by the time, in seconds, required to initially expose base metal as determined in Clause 29.4.6.
30	Info	<b>Resistance to heat, fire and cracking – polymeric materials</b>
30.3	Info	<b>Flammability</b>
30.3.2		<p>A flammability classification of HB used for the outer enclosure material is acceptable if:</p> <p>a) a metal or polymeric material classified 5VA, 5VB, or V-0 is used as a sub-enclosure that houses all insulated or uninsulated live parts that involve a risk of fire, <del>or and</del></p> <p><del>b) the outer ENCLOSURE complies with the flammability requirements in Clauses 30.3.3 – 30.3.9 live parts are adequately housed within the sub-enclosure where accessibility shall be determined by application of the probe as shown in Figure 2.</del></p>
30.3.5		<p><b><i>New clause added;</i></b></p> <p>All electrical connections where the total circuit load is greater than 60 W during normal operation shall:</p> <p>a) comply with Clauses 30.3.8, 30.3.9, and 30.3.10; or</p> <p>b) be evaluated as specified in Clause 17.4.</p> <p><b>Note: A risk of fire is considered to exist at any two points in a circuit where a power of more than 15 watts can be delivered into an external resistor connected between the two points within 5 seconds. To deliver 15 watts at a connector, the circuit must have a nominal load of 60 watts or more. This is based on the maximum power transfer theorem that shows an electrical connection can only dissipate 1/4 of the power of the load when the resistance of the connection is equal to the resistance of the load.</b></p>

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With reference to Clause 30.3.5, components such as wire, tubing, sleeving, or tape that are located within 3 mm of an electrical connection as shown in Figure 11 shall have a flammability classification as follows:

30.3.8

- a) VW-1 for wire evaluated in accordance with ~~Test Methods for Electrical Wires and Cables, CSA C22.2 No. 0.3, and Reference Standard for Electrical Wires, Cables, and Flexible Cords, UL 1581 and FT1~~ and FT1 for wire evaluated in accordance with CSA C22.2 No. 2556.
- b) VW-1 for tubing and sleeving evaluated in accordance with Extruded Insulating Tubing, CAN/CSA-C22.2 No. 198.1, and Extruded Insulating Tubing, UL 224 or Coated Electrical Sleeving, UL 1441; or
- c) Evaluated in accordance with PVC Insulating Tape, CSA C22.2 No. 197, and Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape, UL 510, for flame-retardant insulating tape.

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***New clause added;***

With reference to Clause 30.3.5, polymeric materials located within 3 mm of an electrical connection as shown in Figure 11 shall have a flammability classification as follows:

30.3.9

- a) A minimum V-0 or VTM-0, in accordance with Evaluation of Properties of Polymeric Materials, CAN/CSA-C22.2 No. 0.17, and Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94;
  - b) A minimum SC-0 or SCTC-0, in accordance with Evaluation of Properties of Polymeric Materials, CAN/CSA-C22.2 No. 0.17, and Tests for Flammability of Small Polymeric Component Materials, UL 1694; or
  - c) A minimum glow wire ignition temperature (GWIT) of 775°C according to IEC 60695-2-13; or
  - d) Withstands glow-wire test (GWT) according to IEC 60695-2-11 with a minimum test severity of 750°C and during the test flames persists for no longer than 2 seconds.
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***New clause added;***

With reference to Clause 30.3.5, all non-metallic combustible materials located within the envelope of a vertical cylinder having a diameter of 20 mm (0.787 in) and a height of 50 mm (2 in), placed above the center of the connection zone and on top of the non-metallic parts that are supporting current-carrying electrical connections as shown in Figure 12, shall have a flammability classification as follows:

30.3.10

- a) A minimum of V-0 or VTM-0 or HF-1, in accordance with CAN/CSA-C22.2 No. 0.17, and UL 94, and IEC Test Flames 60695-11-10; or
- b) A minimum of SC-0 or SCTC-0, in accordance with CAN/CSA-C22.2 No. 0.17, and UL 1694; or
- c) A minimum VW-1 and FT1 for wire, tubing, sleeving and tape in accordance with Clause 30.3.8.

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***New clause added;***

With reference to Clause 30.3.10 and Figure 12, the flame cylinder shall be placed above the center of each connection zone and on top of any non-metallic parts that are supporting current-carrying connections, as shown in Examples 1-3 of Figure 12. In the case of uninsulated connections, the flame cylinder shall be placed above the center of each connection zone and directly on top of current-carrying conductors, as shown in Examples 4-6 of Figure 12. The flame cylinder shall project through all metallic and non-metallic material. If "C" is intended to act as a barrier to "D", or if the flame cylinder extends beyond the outer enclosure of the appliance, then the adequacy of the barrier shall be demonstrated by testing as described in the Nichrome Wire Ignition Test, Clause 17.4.

30.3.11

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Table 5

***New table added;***

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**Table 5**  
**Leakage current detection device correlation table**  
 (See Clauses 22.11.8.2 and SD5.2.1)

Information	OPERATING CONTROL Requirement
<u>FMEA</u>	<u>Conduct a failure-mode and effect analysis (FMEA) to identify components the failure of which may result in a risk of fire or electric shock.</u>
<u>Declared Trip Current and Response Time</u>	<u>100 mA maximum</u> <u>10 seconds maximum</u> <u>Deviation and Drift: + 0 %</u>
<u>Operating Ambient Action</u>	<u>Determined via Heating Test, Clause 12, of the appliance Type 2 (2.B.D. 2.Y)</u>
<u>Endurance and Thermal Cycling Test</u>	<u>Manual reset<sup>1</sup> or non-resettable device</u> <u>3,000 cycles for manual, non-self-resetting devices</u> <u>100,000 cycles for relay contacts also operating during the normal operating cycle of the dishwasher</u>
<u>Overvoltage Category</u>	<u>Overvoltage Category II</u>
<u>Pollution Degree</u>	<u>See Clause 28.4</u>
<u>ENCLOSURE Flammability</u>	<u>Minimum V-1, except as indicated in Clause 30.3</u>
<u>EMC Immunity</u>	<u>Tested as an Operating, Type 2 control (Table H11DV)</u>
<u>CONTROL CLASS</u>	<u>Class B</u>
<sup>1</sup> A control requiring removal of power to the appliance in order to reset the control is considered to be a manual reset device.	

**New table added;**

**Table 9**  
**Thickness of coating factors**  
 (See Clause 29.4.8.)

Temperature		Thickness factors, 0.0003 mm (0.00001 inches) per second	
°C	°F	Cadmium platings	Zinc platings
21.1	(70)	1.331	0.980
21.7	(71)	1.340	0.990
22.2	(72)	1.352	1.000
22.8	(73)	1.362	1.010
23.3	(74)	1.372	1.015
23.9	(75)	1.383	1.025
24.4	(76)	1.395	1.033
25.0	(77)	1.405	1.042
25.6	(78)	1.416	1.050
26.1	(79)	1.427	1.060
26.7	(80)	1.438	1.070
27.2	(81)	1.450	1.080
27.8	(82)	1.460	1.085
28.3	(83)	1.470	1.095
28.9	(84)	1.480	1.100
29.4	(85)	1.490	1.110
30.0	(86)	1.501	1.120
30.6	(87)	1.513	1.130
31.1	(88)	1.524	1.141
31.7	(89)	1.534	1.150
32.2	(90)	1.546	1.160

Table 9

**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.**