

STANDARD INFORMATION

Standard Number: UL 61800-5-1

Standard Name: Standard for Adjustable Speed Electric Power Driven Systems - Part 5-1: Safety Requirements - Electrical, Thermal and Energy

Standard Edition and Issue Date: 1st Edition Dated June 8, 2012

Date of Revision: February 24, 2017

Date of Previous Revision of Standard: March 6, 2015

EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

Effective Date: **September 4, 2019**

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requests in writing that current requirements be used along with their understanding that their listings will be withdrawn on Effective Date noted above, unless the product is found to comply with new/revise requirements.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: Specific details of new/revise requirements are found in table below.

- Revision to Annex DVC for accessible secondary circuits.
- Revision to the conductor temperature limit during the Temperature Test, Table 15DV.
- Revision to the plenum rated drive requirements.
- Addition of Thermal Memory Retention Tests in Table 17DV.
- Elimination of 30 A ground fuse in Short Circuit Testing.
- Revision to input/output wiring for breakdown of components test - high fault currents specification.
- Revisions to Table 28DV - marking locations B and H, I, and J.
- Revision to the semiconductor fuse marking.

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 – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records.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
		Additions to existing requirements are <u>underlined</u> and deletions are shown lined out below.
		New clause added;
4.3.4.1DV		D2 Modification to add the following: Protection in case of direct contact according to 4.3.3 is not required if the circuit is an isolated secondary circuit investigated to Annex DVC and does not require protection against direct contact as indicated by Table DVC.1.
4.4.4	Info	Temperature limits
4.4.4DV	Info	D2 Modification to add the following:
4.4.4DV.3		PDS/CDM/BDM tested under the conditions described in 5.2.3.8 shall not attain a temperature at any point that will adversely affect any materials employed in the equipment, and shall not exceed the values specified in Table 15 <u>DV</u> and Table 16.
Table 15DV		Changes to table describing: Maximum measured temperatures for internal materials and components.
4.7DV	Info	D2 Addition:
4.7DV.1	Info	Plenum rated drives
		New clause added;
4.7DV.1.2		Drives with enclosures that are either whole or in part non-metallic and intended to be installed in air-handling spaces shall additionally comply with the requirements in the Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces, UL 2043.



4.7DV.1.3		<p>The requirements in 4.7DV.1.2 do not apply to the following:</p> <p>c) Miscellaneous small parts such as refrigerant line bushings or insulating bushings, resilient or vibration mounts, wire ties, clamps, labels, or drain line fittings having a total exposed surface area not exceeding 25 square inches (161.29 cm²);</p> <p>d) An adhesive that, when tested in combination with the specific insulating material, complies with the requirement.</p> <p>e) Molded or formed components (not liners) of polymeric materials in such quantities that their total exposed surface area within the compartment does not exceed 10 ft² (0,93 m²).</p>
<i>New clause added;</i>		
4.7DV.1.4		<p>Metallic enclosure surfaces, including those which are ventilated, are suitable for use in air handling ducts and plenums without further investigation.</p>
5.1.6	Info	Test overview
Table 17		Change to table describing Test overview
Table 17DV		Changes to table describing Test overview
5.2.2.2	Info	PWB short-circuit test (TYPE TEST)
5.2.2.2DV	Info	<i>D2 Modification to add the following:</i>
5.2.2.2DV.1		<p>The outer enclosure of the PDS and any exposed dead metal parts, normally intended to be earthed, are disconnected from earth and are to be connected through a 30-A fuse to the supply circuit pole least likely to arc to earth (usually the centre terminal for three-phase equipment). The 30-A fuse shall not open. <u>10 AWG solid copper wire 4 – 6 ft (1,22 – 1,83 m) long to the supply circuit pole least likely to arc to earth (usually the center terminal for three-phase equipment).</u></p>
5.2.2.3DV		<i>D2 Modification to add the following <u>replace 5.2.2.3 with the following:</u></i>
5.2.3.2.3	Info	Performing the voltage test
5.2.3.2.3DV		National Difference Deleted
<i>New clause added;</i>		
5.2.3.2.3DV.1		<p><i>DE Modification to correct:</i></p> <p>The test voltage in item (a) shall be according to Table 21, Table 22, or Table 23, column 2, corresponding to voltage of considered circuit under test.</p>
5.2.3.2.3DV.3		National Difference Deleted
5.2.3.2.3DV.4		National Difference Deleted



5.2.3.6DV.1.1.3	<p>The branch-circuit protective devices shall be selected in accordance with 5.2.3.6DV.1.4 5.2.3.6DV.4.1, with the following modifications:</p> <p>a) The branch-circuit protective devices shall be either inverse time circuit breakers or non-semiconductor fuses.</p> <p>b) The current rating of the protective device is permitted to be greater than the values specified in 5.2.3.6.2DV.4.1.6 (a),(b) and 5.2.3.6.2DV.4.1.8 (a),(b). The maximum size of the branch circuit protective device shall not exceed the ampere rating calculated from the following formula: $\text{Amperes} = [9,6 \times (\text{maximum wire size})] - [2,2 \times (\text{minimum motor FLA})]$ <i>in which:</i> <i>Maximum wire size is the ampacity from Table 4.3.8.8.2DV.1 of the largest conductor size for which the device terminals have been evaluated; and</i> <i>Minimum motor FLA is the smallest rated FLA (or equivalent FLA from horsepower rating per Table DVE.1) marked on the device.</i></p>
5.2.3.6.2DV.2	Info D2 Modification to add the following:
5.2.3.6.2DV.2.1	Info Earthing
5.2.3.6.2DV.2.1.1	<p>The drive shall be connected to earth by means of a wire sized as noted in 5.2.3.6.2DV.2.1.2 4.3.5.4DV.1, and in accordance with one of the following:</p> <p>a) The earthing wire shall be connected between the enclosure and earth, with the main input earth connection removed; or</p> <p>b) The earthing wire shall be connected between the enclosure and the main input power terminal judged least at risk of arcing to earth, with the main input earth connection removed. For 3-phase drives, the main input power terminal judged least at risk of arcing to earth is the L2 terminal.</p>
5.2.3.6.2DV.2.1.2	National Difference Deleted
5.2.3.6.2DV.2.1.3	National Difference Deleted
5.2.3.6.2DV.5	<p><i>New section added;</i></p> <p>D2 Modification to add the following:</p>
5.2.3.6.2DV.5.1	Input/output wiring connection
5.2.3.6.2DV.5.1.1	<p>Each drive is to be tested with 4 ft (1.2 m) of wire, or less, attached to each input and output terminal. The input/output test wiring is not prohibited from exceeding 4 ft (1.2 m) in length when the wiring is in the test circuit during its calibration.</p>
5.2.3.6.2DV.5.1.2	<p>The wire size of the input and output wiring shall be in accordance with Table 4.3.8.8.2DV.1 with the required ampacity of the wiring being based on the marked wire temperature rating (either 60°C or 75°C) and each of the following:</p> <p>a) The main input power wiring shall be sized for 125 percent of the rated fullload output motor current;</p> <p>b) All other input wiring shall be sized for 100 percent of the maximum intended full-load current;</p>



		<p>c) The main output power wiring shall be sized for 125 percent of the rated fullload current or shall be sized for 125 percent of the full-load output motor current specified in Table DVE.1 or DVE.2, based on the rated horsepower rating; and</p> <p>d) All other output wiring shall be sized for 100 percent of the maximum intended full-load current.</p>
5.2.3.6.2DV.5.1.3		The type of wire insulation shall be T or TW for 60°C wiring and shall be THW or THWN for 75°C wiring.
5.2.3.6.2DV.5.1.4		For drives rated more than 200 hp (150 kW), the main input/output power connections shall be in accordance with 5.2.3.6.2DV.1.1 – 5.2.3.6.2DV.1.3, or may be made with bus bars equivalent in cross-sectional area to the required wiring. The bus bars are to be in the test circuit during its calibration.
5.2.3.6.2DV.5.1.5		Input and output wiring may then be routed through 10 – 12 in (250 – 305 mm) lengths of conduit installed on the enclosure. If conduit is not used then the wire shall be routed through a bushing appropriate for the size of the conductors.
5.2.3.6.2DV.5.1.6		The ends of the conduit, the bushing opening, or the openings around the bus bars are to be plugged with surgical cotton.
5.2.3.6.2.1	Info	Supply voltage and current
5.2.3.6.2.1DV.2.4		A drive series with an assigned short circuit rating higher than the standard fault current test value shown in Table 5.2.3.6.2.1DV.1 shall comply with the breakdown of components test requirements of this clause at the Standard Fault Current and the maximum assigned Short Circuit rating <u>Breakdown of Components Test – High Fault Currents, 5.2.3.6.2.1DV.5.</u>
5.2.3.6.2.1DV.5.5		<p>The requirements for conducting the high fault current short circuit test shall be in accordance with 5.2.3.6.2 except for the following differences:</p> <p>a) For drives rated over 10 000 A, the branch circuit short circuit protection fuses shall be limited to high-interrupting capacity, current limiting types such as Class CC, CF, G, J, L, R, T, etc.</p> <p>b) For drives rated 50 hp (37 kW) or less and tested at 10 000 A, the branch circuit short circuit protection fuses are able to be Class H or K.</p> <p>c) A drive that is intended to be used with Class RK1 or RK5 fuses shall be tested with fuses having I2t and Ip characteristics for Class RK5 fuses. All references to Class R fuses are intended to mean fuses with energy let-through (I2t) characteristics of Class RK5 fuses.</p> <p>d) Instead of the 30 A nontime delay ground fuse, the enclosure of the drive shall be connected through a solid conductor without a fuse to one of the main input power terminals by a 10 AWG (2,59 mm) copper wire 4 – 6 ft (1,22 – 1,83 m) long.</p> <p>e) <u>d)</u> For noncombination controllers, the circuit breaker to be used is to be from commercially available units of the molded-case type having the same characteristics with respect to opening time and without current-limiting features.</p>



Ⓕ) e) For circuit breakers with current limiters provided as part of the controller, the current limiter shall have a peak let-through current and a clearing I^2t not less than the maximum value established for the current limiter intended to be used with the controller being tested, when tested on a single-phase circuit.

Ⓕ) f) A Class CC, CF, G, J, L, R, or T fuse, or motor short-circuit protector shall have a peak let-through current and clearing I^2t not less than the maximum value established for the fuse (see the UL 248 series of standards for fuses), or motor short-circuit protector rating that is intended to be used with the controller being tested, when tested on a single-phase circuit. For a fuse with I_p and I^2t limits established for several different short-circuit current levels, the test fuse is to have at least the maximum values of the current corresponding to the marked short-circuit-withstand current of the controller.

Ⓕ) g) A test limiter is not prohibited from being used in place of the fuses specified in items a), b), c), and f) above.

5.2.3.6.3.2DV		D2 National Difference Deleted
5.2.3.6.6DV.1		D2 National Difference Deleted
Table 28DV	Info	D2 Modification to replace Table 28 with the following:
Table 28DV		Describes changes to Marking locations requirements
6.3.3	Info	Environment
6.3.3DV.2		The optional markings, “Suitable for Installation in a Compartment Handling Conditioned Air” or “Suitable for Use in Other Environmental Air Space in Accordance with Section 300.22 (C) of the National Electrical Code” shall only be marked on power conversion equipment that has been evaluated in accordance with requirements for plenum rated drives.
6.3.7	Info	Overcurrent or short-circuit protection



D2 Modification to add the following:

A drive protected by fuses (either semiconductor or non-semiconductor types), circuit breakers (either inverse-time or instantaneous trip types), or Type E combination motor controllers, sized in accordance with 5.2.3.6.2DV.4.1.6, 5.2.3.6.2DV.4.1.9, 5.2.3.6.2DV.4.1.7, 5.2.3.6.2DV.4.1.8, 5.2.3.6.2DV.4.1.11, 5.2.3.6.2DV.4.1.12, or 5.2.3.6.2DV.4.1.14 shall be marked as noted below:

6.3.7DV.1

- a) For non-semiconductor fuse types, the marking shall include the Class – when other than Class H or K5 – and the voltage and current or voltage and percent of the full-load motor output current rating.
- b) For semiconductor fuse types, the marking shall include the fuse manufacturer and fuse model number (no fuse rating marking is required). This marking shall also state that the drive controller and overcurrent protection device must be integrated within the same overall assembly;
- e) For instantaneous trip circuit breaker types, the marking shall include the breaker manufacturer and breaker model number (no breaker rating marking is required). This marking shall also state that the drive controller and overcurrent protection device must be integrated within the same overall assembly; or
- f) For Type E combination motor controllers, the marking shall include the motor controller manufacturer, model number, rated voltage and rated HP.

Annex DVA		(normative) Changes Normative References and Component Standards
Table DVC.1		Changes in table describing Secondary circuits, differences in evaluation
DVC.1.4	Info	Class 2 circuits
DVC.1.4.1		A Class 2 circuit shall be supplied by an isolating source that complies with the requirements in the Standard for Class 2 Power Units, UL 1310, or <u>the requirements in the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1, and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.</u>
DVC.2.4	Info	Limiting impedance test
DVC.2.4.1	Info	Limiting impedance abnormal test



DVC.2.4.1.3

Single component fault conditions of a circuit component of a limiting impedance include:

- a) For a resistor, capacitor, or diode, or similar two-terminal solid state device the device terminals shall be open-circuited or short-circuited;
 - b) For a discrete solid-state device having more than two terminals, such as a transistor, SCR, triac, or similar device, any combination of terminals taken two at a time shall be open-or shortcircuited.
 - c) For an integrated circuit device, the following combinations of terminals shall be tested:
 - 1) Each pair of adjacent terminals shorted;
 - 2) Each input terminal shorted to ground terminal;
 - 3) Each output terminal shorted to ground terminal;
 - 4) Each input terminal shorted to each power supply;
 - 5) Each output terminal shorted to each power supply;
 - 6) Each terminal open-circuited.
 - d) A single resistor serving as a limiting impedance is not required to be evaluated under single component fault conditions.
 - e) A single capacitor serving as a limiting impedance that complies with the requirements in the Standard for ~~Capacitors and Suppressors for Radio and Television Type Appliances, UL 1414~~ Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains, UL 60384-14, is not required to be evaluated under single component fault conditions.
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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.
