

STANDARD INFORMATION

Standard: UL 61800-5-1

Standard ID: Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements - Electrical, Thermal and Energy [UL 61800-5-1:2012 Ed.1+R:28Oct2020]

Previous Standard ID: Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements - Electrical, Thermal and Energy [UL 61800-5-1:2012 Ed.1+R:20Jun2018]

EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

Effective Date: **October 28, 2023**

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 Reports not updated to this version by the effective date above will be withdrawn.

Overview of Changes:

- BDM/CDM/PDS Supplied by Photovoltaic (PV) Modules
- Update to Lithium Battery Requirements
- Heat Cycling Test for Spring-loaded Bus Bar Joints

Specific details of new/revise 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 – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records.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
1	Info	Scope
		<i>New clause added;</i>
1DV.1.4		The scope includes BDM/CDM/PDS intended for connection to photovoltaic (PV) modules with output voltages not exceeding 1.5 kV DC.
4	Info	Protection against electric shock, thermal, and energy hazards
4.3	Info	Protection against electric shock
4.3.6	Info	Insulation
4.3.6.2	Info	Insulation to the surroundings
4.3.6.2.1	Info	General
		<i>New clause added;</i>
4.3.6.2.1DV.3		For BDM/CDM/PDS intended to receive power partially or fully from photovoltaic (PV) modules and panels, the system voltage of Table 7 shall be the larger of the mains voltage or the PV open-circuit line to ground voltage at the PV power input of the BCM/CDM/PDS.
4.3.8	Info	Wiring and connections
4.3.8.4	Info	Splices and connections
		<i>New clause added;</i>
4.3.8.4DV.3		Bus bars using spring-loaded joints for connection shall be subjected to the heat cycling test of 5.2.3.8DV.3. A spring-loaded joint shall be considered to be one in which the clamping force is developed by the deflection of a spring member in the assembly of the joint or developed by the elasticity of a metal clamp or clip in the assembly of the joint. For the purpose of this requirement, a dished washer shall not be considered to exert spring loading and would not be required to be evaluated using the heat cycling test.
4.16DV1		<i>New section added;</i> BDM/CDM/PDS supplied by photovoltaic (PV) modules
4.16DV.1.1		BDM/CDM/PDS intended to receive power from photovoltaic (PV) modules and panels
4.16DV.1.2		Photovoltaic modules or panels used with BDM/CDM/PDS shall comply with UL 1703. If the photovoltaic modules or panels are not provided with the BDM/CDM/PDS, the installation instructions shall specify that PV modules and panels shall comply with UL 1703. See 6.3.6.8DV.2.
4.16DV.1.3		A power converter stage used with the BDM/CDM/PDS which receives power from PV modules or panels and converts it for use by the BDM/CDM/PDS shall comply with UL 1741.



CLAUSE	VERDICT	COMMENT
5	Info	Test requirements
5.2	Info	Test specifications
5.2.3	Info	Electrical tests
5.2.3.6	Info	Short-circuit test and Breakdown of components test (TYPE TESTS)
5.2.3.6.2	Info	Test configuration
5.2.3.6.2.1	Info	Supply voltage and current
5.2.3.6.2.1 DV.2.6		<i>New section added;</i> BDM/CDM/PDS supplied by photovoltaic (PV) modules
5.2.3.6.2.1 DV.2.6.1		A BDM/CDM/PDS which receives power from PV modules or panels shall be tested by connecting the equipment to a power source that is representative of a PV power system with regard to maximum power voltage and current levels. Tests involving an input for connection to a PV source shall use a source which complies with one of the following: a) When the BDM/CDM/PDS requires the use of a source having specific V/I characteristics (such as PV modules provided with integrated electronics), the test shall be conducted with the source intended for use with the input, or with a source with V/I characteristics as close as practicable to the intended source. b) If the BDM/CDM/PDS is required to be used with PV modules which are provided with the product, or is marked only for use with specific models of PV modules where the V/I characteristic curves are known, the test source shall be a PV simulator which can provide: 1) A minimum open circuit voltage greater than or equal to the PV module rated operating voltage multiplied by 1.5. 2) A minimum available short circuit current greater than or equal to the PV module nameplate short circuit current (Isc) multiplied by 1.5. c) If the BDM/CDM/PDS is rated for general use with PV modules which comply with NEC cl. 690.8 and 690.9, the test source shall be a PV input source (PV array or PV simulator) which can provide: 1) A minimum open circuit voltage greater than or equal to the products' rated input operating voltage multiplied by 1.25. 2) A minimum available short circuit current greater than or equal to the products' rated input short circuit current multiplied by 1.25.
5.2.3.6.2.1 DV.2.6.2		
5.2.3.6.2.1 DV.2.6.3		If an input is rated for use with multiple source types, the source with the most severe characteristic shall be used to characterize the test source.
5.2.3.6.2.1 DV.2.6.4		During testing using a PV simulator, Voc, Isc, and the other controllable quantities such as Irradiance, Vmp, Imp and FF (fill factor) shall be set at levels which cause the product to operate at a V/I input level which provides the required voltage and current for the test being conducted, however Voc and Isc shall be set no higher than the products' maximum rated open circuit voltage and short circuit respectively.



CLAUSE	VERDICT	COMMENT
5.2.3.6.2.1 DV.2.6.5		During the temperature rise test, the PV source shall be set to operate at the operating point which creates the highest PV output voltage and the operating point which creates the highest DC current prior to a protective device or circuit operating. The recorded temperatures shall be the highest of those between the highest voltage and highest current operating points.
5.2.3.6.2.1 DV.2.6.6		If the equipment is designed to utilize multiple types of sources which can be connected simultaneously, then all sources which may be connected simultaneously shall be utilized during the test, and a test source shall be provided in accordance with the above description if a PV type, or with 5.2.3.6.2.1DV.2.1 or 5.2.3.6.2.1DV.2.2 as appropriate.
5.2.3.6.2.1 DV.2.6.7		The circuit capability for all of the tests shall be verified in accordance with the Calibration of Short Circuit Test Circuit, 5.2.3.6.2.1DV.3. The equipment shall be marked in accordance with 6.3.6.8DV.2.
5.2.3.8	Info	Temperature rise test (TYPE TEST)
5.2.3.8DV.3.1		<i>New section added;</i>
		Heat Cycling Test
5.2.3.8 DV.3.1.1		Spring-loaded bus bar joints as described in 4.3.8.4DV.3 shall be subjected to a heat cycling test.
5.2.3.8 DV.3.1.2		For the heat cycling test, the rated bus bar current shall vary in cycles in the manner described in 5.2.3.8DV.3.2.1 and 5.2.3.8DV.3.2.2. Results shall comply with the limitations on increase in temperature rise specified in 5.2.3.8DV.3.2.2.
5.2.3.8 DV.3.1.3		The spring-loaded joints shall be conditioned by being assembled and disassembled 5 times prior to final assembly for the test.
5.2.3.8 DV.3.2		Heat Cycling Test arrangement
5.2.3.8 DV.3.2.1		The temperature rises on the contacts of the spring-loaded bus bar joint shall be determined while the equipment is carrying the specified current continuously. After temperatures have become constant under these conditions, the current shall be stopped, and the equipment shall be allowed to cool to room temperature.
5.2.3.8 DV.3.2.2		The equipment shall then be subjected to two successive sets of cycling of the current. Each set shall consist of 42 complete cycles. During each cycle the current shall be on for 2 hours and off for 2 hours; or if, during the initial heating mentioned in Clause 5.2.3.8DV.3.2.2, average temperatures on the spring-loaded bus bar joint at the end of 2 hours are more than 5°C lower than the average final temperatures during continuous operation, the current shall remain on for 3 hours in each cycle. Stable maximum temperatures shall be observed again after the 42nd cycle and also after the 84th cycle. The final temperatures shall not be more than 5°C higher than those observed initially, nor shall the final temperatures be more than 5°C higher than those observed at the conclusion of the 42nd cycle.



CLAUSE	VERDICT	COMMENT
6	Info	Information and marking requirements
6.3	Info	Information for INSTALLATION and commissioning
6.3.6	Info	Connections
6.3.6.8	Info	Special requirements
6.3.6.8DV.2		<i>New section added;</i>
		Instructions pertaining to connection to photovoltaic (PV) modules
6.3.6.8DV.2.1		Adjustable speed POWER DRIVE SYSTEMS, or their elements intended to receive power partially or fully from photovoltaic modules or panels shall specify that the photovoltaic modules or panels used shall comply with UL 1703. Products that require the use of specific PV module sources shall specify the manufacturer and model of the modules or panels. The instructions shall provide the maximum open circuit voltage and short circuit current rating of each input which is intended for use with a PV source.
6.3.6.8DV.2.2		A BDM/CDM/PDS's ratings shall not directly utilize or reference UL 1703 PV module nameplate ratings. The standard PV module abbreviations "Isc" and "Voc" shall not be used to state ratings for a drive intended for use with PV.
6.3.6.8DV.2.3		The installation instructions for the equipment shall indicate that wiring between PV modules, PV panels or PV arrays and the equipment input shall be in compliance with NEC article 690. If the PV modules, panels, or arrays are not included with the BDM/CDM/PDS, the installation instructions shall specify that the BDM/CDM/PDS be used only with PV panels in compliance with UL 1703.
Annex DVC	Info	Isolated Secondary Circuits and Circuits Supplied by Battery
DVC.3	Info	Circuits supplied by a battery
		<i>New section added;</i>
		Lithium cells and batteries
DVC.3.1A		This section applies to rechargeable lithium (typically lithium ion) and non-rechargeable lithium (typically lithium metal) batteries supplying power to any primary or secondary circuit. A circuit supplied by a lithium cell or battery shall comply with the primary circuit requirements in this standard or with the requirements for Secondary Circuits of this Annex. See standard for details.