



SURFACE VEHICLE STANDARD

J2030™

JUN2025

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Heavy-Duty Electrical Connector Performance Standard

RATIONALE

The nominal charging voltage for a 48-V system is 56 V, which is within the 60-V range. A change from 50 V to 60 V in the scope does not affect anything in the rest of the document because the only electrical tests are 6.22 Current Test and 6.25 Current Cycling Test, neither of which calls out a voltage. This change in Scope from 50 V to 60 V is to harmonize with other SAE documents that include 48-V electrical systems and reference 60 V or less.

NOTICE

Some test procedures are potentially dangerous. SAE Technical Reports do not purport to address all of the safety problems, if any, associated with their use. It is the responsibility of the user of an SAE Technical Report to establish and employ appropriate safety practices. Tests should only be conducted by individuals who have been properly trained in the test procedure and who are aware of any hazards which might be present. Appropriate safety and health precautions must be employed when conducting any test.

1. SCOPE

This SAE Standard encompasses connectors between two cables or between a cable and an electrical component and focuses on the connectors external to the electrical component. This document provides environmental test requirements and acceptance criteria for the application of connectors for direct current electrical systems of 60 V or less in the majority of heavy-duty applications typically used in off-highway machinery. Severe applications can require higher test levels or field-testing on the intended application.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J163 Low Tension Wiring and Cable Terminals and Splice Clips

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Full document details: SAE J2030_202506

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Documents



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SAE J726 Air Cleaner Test Code

SAE J1455 Recommended Environmental Practices for Electronic Equipment Design in Heavy-Duty Vehicle Applications

SAE J1614 Wiring Distribution Systems for Off-Road, Self-Propelled Work Machines

2.1.2 ASABE Publications

Available from the American Society of Agricultural and Biological Engineers, 2950 Niles Road, St. Joseph, MI 49085-9659, Tel: 269-429-0030, www.asabe.org.

ASAE EP455 Environmental Considerations in Development of Mobile Agricultural Electrical/Electronic Components

2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D471 Standard Test Method for Rubber Property - Effect of Liquids

ASTM G154 Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

ASTM G155 Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials

2.1.4 ECIA Publications

Available from Electronic Components Industry Association, 13873 Park Center Road, Suite 315, Herndon, VA 20171, Tel: 571-323-0294, www.ecianow.org.

EIA-364-23 Low-Signal Level Contact Resistance

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 API Publications

Available from API, 200 Massachusetts Avenue NW, Suite 1100, Washington, DC 20001-5571, Tel: 202-682-8000, www.api.org.

API 1560 Lubricant Service Designation for Automotive Manual Transmissions and Axles

2.2.2 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO 8092 Road Vehicles - Connections for On-Board Electrical Harnesses

3. DEFINITIONS

3.1 CABLE

Insulated stranded electrical conductor used to establish a single current path.

3.2 CONNECTOR

A coupling device, which provides an electrical junction, a mechanical junction, or both, between two cables or between one or more cables and an electrical component. Connectors can also provide for mechanical stability and geometric arrangement.

3.3 POWER CIRCUIT

A system using two or more cables where current flows from the source to one or more electronic/electrical devices and back again to the source. The electrical energy is supplied at high levels of current and typical system voltage (system battery voltage).

3.4 SEALED

A system that creates a nonleaking union between mechanical elements when submerged in a water solution as defined in the tests within this document.

3.5 SIGNAL LEVEL CIRCUIT

A circuit in which open circuit voltage is typically less than 5 V and current is typically less than 0.05 A. Circuits of this energy level typically are not able to break through oxides, sulfides, or other contaminants, which can build up on the contact surfaces and prevent continuity.

3.6 TERMINAL

An electrically conductive device attached to a cable to facilitate connection to an electrical component, cable, or termination.

3.7 WIRING

Collectively, the cables, harnesses, connectors, terminations, and supporting components used in the electrical wiring distribution system.

4. SAMPLE PREPARATION

Samples shall be made on the connector manufacturer's recommended tooling and checked for conformance to the connector manufacturer's standards.

4.1 Assembly

All connector cavities shall be wired with the manufacturer's minimum approved cable outside diameter size except for test groups "A" and "D," which shall be wired with the manufacturer's maximum approved conductor size in lengths sufficient to accommodate testing. Cable diameter shall be checked and be within the connector's manufacturing specification. Crimp characteristics (i.e., height, width, etc.) shall be checked. To prevent capillary action on sealed connectors, all loose wire ends and test points (i.e., millivolt test connection) shall be sealed with alcohol-based RTV silicone or equivalent.

5. TEST SEQUENCE

For qualification testing, test samples shall be subjected to the tests in the order shown in Table 1 with a quantity of six for each group. The tests are to be carried out in the numerical sequence as described in each group's column. It is permissible to use separate sample sets for Low Voltage Resistance and Insulation Resistance when both are required in the same test sequence. For those sequences requiring both Low Voltage Resistance and Insulation Resistance, two groups of six may be tested, one group going through the test sequence including Insulation Resistance without Low Voltage Resistance and the second group going through the test sequence including Low Voltage Resistance without Insulation Resistance.

Group A emphasizes mechanical, fluid, and thermal performance for sealed signal connectors

Group B emphasizes mechanical and thermal performance for signal connectors

Group C emphasizes thermal performance for all connectors

Group D emphasizes mechanical performance for all connectors

Group E emphasizes mechanical, fluid, and thermal performance for sealed power connectors

Group F emphasizes mechanical and thermal performance for power connectors

Table 1 - Test sequences

Test Description	Test Para	Group A Sequence Sealed Signal Connector Test	Group B Sequence Signal Connector Test	Group C Sequence Connector Test	Group D Sequence Connector Test	Group E Sequence Sealed Power Connector Test	Group F Sequence Power Connector Test
Examination of Product	6.1	1	1	1	1	1	1
Low-Voltage Resistance	6.2	2,14,15	2,11,16				
Insulation Resistance	6.3	3,6,8,17,19	3,14	2		2,5,7,15,18	2,13
Connection Resistance	6.4	4	4	3		3,20	3,15
Pressure Washing	6.5	5				4	
Maintenance Aging	6.6				2		
Temperature Life	6.7		5	4			4
Ultraviolet Effects	6.8				3		
Mating Forces	6.9		6		4		5
Un-mating Forces	6.10		7		5		6
Durability	6.11		8		6		7
Salt Fog	6.12	7				6	
Thermal Shock	6.13	9	9	5		8	8
Fluid Immersion	6.14	10				9	
Vibration	6.15	12	10			11	9
Shock	6.16	13	12			12	10
Drop Test	6.17	15		6		13	
Terminal Retention in Connector	6.18				7		
Water Immersion	6.19	16				14	
Connector Retention	6.20			7	8		
Mismating	6.21				9		
Current Test	6.22					16	11
Dust Test	6.23		15				16
Temperature/Humidity	6.24	18	13			17	12
Current Cycling	6.25					19	14
Terminal Crimp Strength	6.26				10		
Visual Examination	6.27	11,20	17	8	11	10,21	17

5.1 Test Groups A, B, C, and D are for sealed signal level connectors.

5.2 Test Groups C, D, E, and F are for sealed power level connectors.

5.3 Test Groups B, C, and D are for unsealed signal level connectors.