SAE International™

SURFACE VEHICLE STANDARD

SAE J2501

REV. AUG2007

Issued 2001-03
Revised 2007-08

Superseding J2501 MAR2001

Round, Screened and Unscreened, 60 V and 600 V Multi-Core Sheathed Cables

RATIONALE

The changes to this document reflect the latest review and format changes as per the SAE document standard guidelines. Definitions were updated and Figure 4 was revised to include all conductor sizes less than 6 mm^2.

FOREWORD

The SAE Standard is functionally equivalent to ISO 14572.

TABLE OF CONTENTS

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

1. SCOPE

This standard specifies basic and high performance test methods and requirements for round, screened and unscreened, multi-core sheathed cables intended for use in road vehicle applications.

The unscreened, single-core cables shall be in accordance with ISO 6722, SAE J1127, SAE J1128, SAE J1654, SAE J1678, or SAE J2183. Other cores may be used, but in these cases, the construction and tests required to ensure functionality of these cores shall be agreed between customer and supplier. See ISO 6722 for temperature classes. ISO 6722 will be needed to perform some of the tests in this standard.

2. REFERENCES

2.1 Applicable Publications

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

2.1.1 SAE Publications

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

SAE EA-1128 Wire Color Charts

SAE J1127 Low Voltage Battery Cable

SAE J1128 Low Voltage Primary Cable

SAE J1654 High Voltage Primary Cable

SAE J1678 Low Voltage Ultra Thin Wall Primary Cable

SAE J2183 60 V and 600 V Single-Core Cables

SAE Dictionary of Materials and Testing

2.1.2 ASTM Publications

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

ASTM B 33 Standard Specification for Tinned Soft or Annealed Copper Wire

ASTM B 193 Standard Test Method for Resistivity of Electrical Conductor Materials

ASTM B 263 Method for Determination of Cross-Sectional Area of Standard Conductors

ASTM B 298 Standard Specification for Silver-Coated Soft or Annealed Copper Wire

ASTM B 354 Definitions of Terms Relating to Uninsulated Metallic Electrical Conductors

ASTM B 355 Standard Specification for Nickel-Coated Soft or Annealed Copper Wire

ASTM B 452 Standard Specification for Copper-Clad Steel Wire for Electronic Application

ASTM D 471 Standard Test Method for Rubber Property—Effect of Liquids

ASTM E 145 Standard Specification for Gravity-Convection and Forced-Ventilation Ovens

ASTM F 1251 Standard Terminology Relating to Polymeric Biomaterials in Medical and Surgical Device

2.1.3 ISO Publications

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 6722 Road vehicles—60 V and 600 V single-core cables—Test methods, dimensions and requirements

ISO 14572 Road vehicles—Round, screened and unscreened, 60 V and 600 V multi-core sheathed cables—Basic and high performance test methods and requirements

ISO 16553 Road vehicles—Data cables—Test methods and requirements

2.1.4 IEC Publications

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

IEC 216-4-1 Guide for the determination of thermal endurance properties of electrical insulating materials—Part 4: Ageing ovens—Section 1: Single-chamber ovens

IEC 811-1-1 Common test methods for insulating and sheathing materials of electric cables—Part 1: Methods for general application—Section 1: Measurement of thicknesses and overall dimensions—Tests for determining the mechanical properties

IEC 811-2-1 Common test methods for insulating and sheathing materials of electric cables—Part 2: Methods specific to elastomeric compounds—Section 1: Ozone resistance test—Hot set test—Mineral oil immersion test

IEC, Electricity, Electronics and Telecommunications, Multilingual Dictionary

2.2 Related Publications

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

2.2.1 SAE Publication

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

SAE J156 Fusible Links

2.2.2 ASTM Publications

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

ASTM B 1 Standard Specification for Hard-Drawn Copper Wire

ASTM B 3 Standard Specification for Soft or Annealed Copper Wire

ASTM B 8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM B 174 Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors

ASTM B 787 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation

3. DEFINITIONS

3.1 60 Volt (V) Cable

Cable intended for use in road vehicle applications where the nominal system voltage ≤ 60 V DC (25 V AC). AC tests are performed at 60 Hz. Applications at higher frequencies may require additional testing.

3.2 600 Volt (V) Cable

Cable intended for use in road vehicle applications where the nominal system voltage is > 60 V DC (25 V AC) to ≤ 600 V DC (600 V AC). AC tests are performed at 60 Hz. Applications at higher frequencies may require additional testing.

3.3 3000 h Temperature Class Rating

Letter designation (class) based on the maximum test temperature (rating) at which a primary cable successfully passes the minimum requirements of 3000 h of heat aging.

3.4 Additional Mass (ref. “Resistance to Abrasion” test)

Mass which is applied to the support rod. The combination of the forces exerted by the additional mass and the 0.63 N exerted by the remaining apparatus (bracket, support rod, and pivoting arm) is applied to the cable.

3.5 Basic Performance (Cable)

Requirements for general automotive applications.

3.6 Cable

See primary cable.

3.7 Cable Family

Group with multiple conductor sizes having the same conductor strand coating, insulation formulation, and wall thickness type.

3.8 Coated Wire

Wire comprised of a given metal covered with a relatively thin application of a different metal. (ASTM B 354)

3.9 Conductor

Wire or combination of wires not insulated from one another, suitable for carrying an electrical current. (ASTM B 354)

3.10 Conductor Size

See SAE conductor size.

3.11 Core

One of the components in an assembly. A component may be an uninsulated conductor, an insulated conductor, a twisted pair, a shielded assembly, a coaxial cable, or any finished cable (see Conductor).

3.12 Data Cable

Cable used to transmit electrical digital signals to allow electronic devices to communicate with each other.

3.13 Decimals

Decimal points are shown as "." instead of "," commonly used in ISO standards.

3.14 Fluid Compatibility

Ability of a cable to resist the effects of various fluids found in surface vehicles.

3.15 High Performance (Cable)

Meeting all basic requirements plus enhanced mechanical and/or environmental performance (as defined by the customer).

3.16 Low Voltage

Usually considered to be 60 V DC (25 V AC).

3.17 Minimum Wall (Thickness)

Lowest allowable insulation thickness at any point.

3.18 Nominal

Suitable approximate value used to designate or identify a component.

3.19 Plastic

Any of numerous polymeric materials that are usually thermoplastic or thermosetting, of high molecular weight and that can be molded, cast, extruded, drawn, laminated, or otherwise fabricated into objects, powders, beads, films, filaments, fibers, or other shapes. (ASTM F 1251)

3.20 Primary Cable

Single or multi-stranded, single conductor, insulated cable used to carry electric current, by attachment to the low voltage side of an ignition coil in surface vehicles.

3.21 Resistance to Ozone

Ability of a material to withstand the deteriorating effect of ozone (surface cracking). SAE, Dictionary of Materials and Testing.

3.22 SAE Conductor Size

System that indicates the cross sectional area of the conductor. The Metric SAE Conductor Size is the approximate area of the conductor. The English SAE Conductor Size number indicates that the area of the conductor approximates the area of the American Wire Gauge for the equivalent size.

3.23 Screen

Conductive material intended to reduce the penetration and/or radiation of a varying electromagnetic field into an assigned region.

3.24 Separator

Thin layer used as a barrier to prevent mutually detrimental effects between different components of a cable such as between the conductor and insulation or between the insulation and the sheath. (IEC, Electricity, Electronics and Telecommunications, Multilingual Dictionary)

3.25 Strip Force

Peak axial force required to overcome the adhesion between the conductor and the insulation.

3.26 Strand

See wire.

3.27 TCR

See “3000 h Temperature Class Rating”.

3.28 Thermoplastic

Plastic capable of being softened by heating and hardened by cooling through a temperature range characteristic of the plastic and, in the softened state, capable of being repeatedly shaped by flow into articles by molding, extrusion or forming. (IEC, Electricity, Electronics and Telecommunications, Multilingual Dictionary)

3.29 Thermoset

Plastic which, when cured by heat or other means, changes into a substantially infusible and insoluble product.

NOTE: Thermosets are often called thermosetting before curing and thermoset after cure. (IEC, Electricity, Electronics and Telecommunications, Multilingual Dictionary)

3.30 Unscreened

Absence of a screen.

3.31 Wire (Strand)

Rod or filament of drawn or rolled metal whose length is great in comparison with the major axis of its cross section. (ASTM B 354)

4. GENERAL REQUIREMENTS

4.1 Rating of Cables

4.1.1 Voltage Rating

The voltage rating is established by the rating of the cores. 60 V and 600 V cores shall not be mixed in the same multi-core cable.

4.1.2 Temperature Class Rating

The “Temperature class rating” is established by the rating(s) of the cores and sheath. The rating of the cable shall be equal to the lowest rating of the individual cores and sheath.

4.2 600 Volt Cables

See ISO 14572.

4.3 Cables

4.3.1 See the applicable standard, i.e. ISO 6722, ISO 14572, SAE J1127, SAE J1128, SAE J1654, SAE J1678, or SAE J2183.

4.3.2 The cables shall be submitted to the tests as specified in FIGURE 1.

4.4 General Test Conditions

See ISO 14572.

4.5 Ovens

See ISO 6722. The ovens shall meet the requirements of IEC 216-4-1.

4.6 Visual Appearance

On visual examination, the sheath shall be smooth, even and free from surface imperfections such as lumps, voids, particles, or other imperfections.

Clause	Test Description	See ISO	Certification Initial	Certification Periodic[1]	If Required[2] Initial	If Required[2] Periodic[1]
5	**Dimensions**					
5.1	Outside Cable Diameter and Ovality	14572	X	X		
5.2	Thickness of the Sheath	14572	X	X		
5.3	Visual Appearance	14572	X	X		
6	**Electrical Characteristics**					
6.1	Continuity	14572	X	X		
6.2	Withstand Voltage	14572	Note 3	Note 3		
6.3	Screening Effectiveness	14572			X	X
7	**Mechanical Characteristics**					
7.1	Adhesion of the Sheath	14572	X	X		
7.2	Cyclic Bending	14572			X	X
8	**Low Temperature Characteristics**					
8.1	Winding	14572	X	X		
9	**Resistance to Abrasion**	14572	X	X		
10	**Heat Aging**					
10.1	Short Term Aging 240 h	14572	X	X		
10.2	Long Term Aging, 3000 h	14572	X			
11	**Resistance to Chemicals**					
11.1	Fluid Compatibility of the Sheath	14572	X	X		
11.2	Resistance to Ozone	14572			X	
11.3	Temperature and Humidity Cycling	14572			X	X
12	**Resistance to Flame Propagation**	14572	X	X		

NOTE 1: The frequency of periodic testing shall be established by agreement between customer and supplier.
NOTE 2: The usage of "if required" tests shall be established by agreement between customer and supplier.
NOTE 3: Some cables are rated at 60 V and others at 600 V. See clause 3 for details.

FIGURE 1 - TESTS
REF. 4.2