



SURFACE VEHICLE STANDARD

J1678™**JUN2023**

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Superseding J1678 FEB2020

(R) Low Voltage Ultra-Thin Wall Primary Cable

RATIONALE

SAE J1678 has been revised to: (1) remove the reference to an ignition coil in 3.14 and redefine use as an insulated small conductor for signal, low current or power applications, (2) clarify cable types in Figure 1 as “not all types are commercially available,” (3) add a cross-linking test as shown in Figure 2 and 6.17, (4) reformat Figure 5, (5) insert Figure 13 to clarify the temperature and humidity cycles and transition zones, (5) remove Figure C1 from the document, (6) all figures, appendix, and equation references were reviewed and added as required in the text.

SAE J1678 has been reaffirmed to comply with the SAE Five-Year Review policy.

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Documents



Sharing Hub

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1. SCOPE

This standard covers ultra-thin wall low voltage primary cable intended for use at a nominal system voltage of 60 VDC (60 VAC rms) or less in surface vehicle electrical systems. The tests are intended to qualify cables for normal applications with limited exposure to fluids and physical abuse. This standard covers SAE conductor sizes which usually differ from ISO conductor sizes.

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 EA-1128 Wire Color Charts

SAE J311 Fluid for Passenger Car Type Automatic Transmissions

Dictionary of Materials and Testing

2.1.2 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 B33 Standard Specification for Tinned Soft or Annealed Copper Wire

ASTM B193 Standard Test Method for Resistivity of Electrical Conductor Materials

ASTM B263 Method for Determination of Cross-Sectional Area of Standard Conductors

ASTM B298 Standard Specification for Silver-Coated Soft or Annealed Copper Wire

ASTM B354 Definitions of Terms Relating to Uninsulated metallic Electrical Conductors

ASTM B355 Standard Specification for Nickel-Coated Soft or Annealed Copper Wire

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

ASTM D833 Standard Terminology Relating to Plastics

ASTM D5374 Standard Test Methods for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation

ASTM D5423 Standard Specification for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation

2.1.3 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

60811-2-1 Common Test Methods for Insulating and Sheathing Materials of Electrical 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 SAE Technical Report.

2.2.1 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 J156	Fusible Links
SAE J1127	Low Voltage Battery Cable
SAE J1128	Low Voltage Primary Cable
SAE J1654	Unshielded High Voltage Primary Cable
SAE J1673	High Voltage Automotive Wiring Assembly Design
SAE J2183	60 V and 600 V Single-Core Cables
SAE J2501	Round, Screened and Unscreened, 60 V and 600 V Multi-Core Sheathed Cables
SAE J2840	High Voltage Shielded and Jacketed Cable

2.2.2 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 B1	Standard Specification for Hard-Drawn Copper Wire
ASTM B3	Standard Specification for Soft or Annealed Copper Wire
ASTM B8	Concentric-Lay-Stranded Copper conductors, Hard, Medium-Hard, or Soft
ASTM B174	Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors
ASTM B263	Method for Determination of Cross-Sectional Area of Standard Conductors
ASTM B452	Standard Specification for Copper-Clad Steel Wire for Electronic Application
ASTM B787	19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation

2.2.3 ISO Publications

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

ISO 6722-1 Road Vehicles - 60 V and 600 V Single Core Cables - Test Methods, Dimensions and Requirements

ISO 14572 Road Vehicles - Round, Unscreened, 60 V and 600 V Multicore Sheathed Cables - Basic and High Performance Test Methods and Requirements

3. DEFINITIONS

3.1 3000 HOUR TEMPERATURE CLASS RATING (TCR)

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

3.2 ADDITIONAL MASS

The 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. (See resistance to sandpaper abrasion test.)

3.3 COATED WIRE

Wire comprised of a given metal covered with a relatively thin application of a different metal. (ASTM B354.)

3.4 CABLE

See primary cable.

3.5 CABLE FAMILY

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

3.6 CONDUCTOR

A wire or combination of wires not insulated from one another, suitable for carrying an electrical current. (ASTM B354.)

3.7 CONDUCTOR SIZE

See SAE conductor size.

3.8 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.

3.9 FLUID COMPATIBILITY

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

3.10 LOW VOLTAGE (LOW TENSION)

Usually considered to be ≤ 60 VDC (25 VAC).

3.11 MINIMUM WALL (THICKNESS)

The lowest allowable insulation thickness at any point.

3.12 NOMINAL

A suitable approximate value used to designate or identify a component.

3.13 PLASTICS

A material that contains as an essential ingredient one or more organic polymeric substances of large molecular weight, is solid in its finished state, and, at some stage in its manufacture or processing into finished articles, can be shaped by flow. (ASTM D833.)

3.14 PRIMARY CABLE

An insulated small conductor (24 to 8 gauge), used for signal, low current, or power applications.

Examples include standard wiring harness applications such as body, instrument panel, engine, front end modules, and doors. The cable is not limited to these applications and may be used wherever signal, low current, or power circuits are required.

3.15 RESISTANCE TO OZONE

The ability of a material to withstand the deteriorating effect of ozone (surface cracking). (Dictionary of Materials and Testing.)

3.16 SAE CONDUCTOR SIZE

A system that indicates the cross sectional area of the conductor. The SAE conductor size is the approximate area of the conductor.

3.17 SEPARATOR

A 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.)

3.18 STRIP FORCE

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

3.19 STRAND

One of the wires of any stranded conductor. (ASTM B354.)

3.20 TCR

Temperature class rating.

3.21 THERMOPLASTIC

A 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.)

3.22 THERMOSET

A 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.)

3.23 WIRE (STRAND)

A rod or filament of drawn or rolled metal whose length is great in comparison with the major axis of its cross section. (ASTM B354.)

4. GENERAL

4.1 Cable Types

See Figure 1.

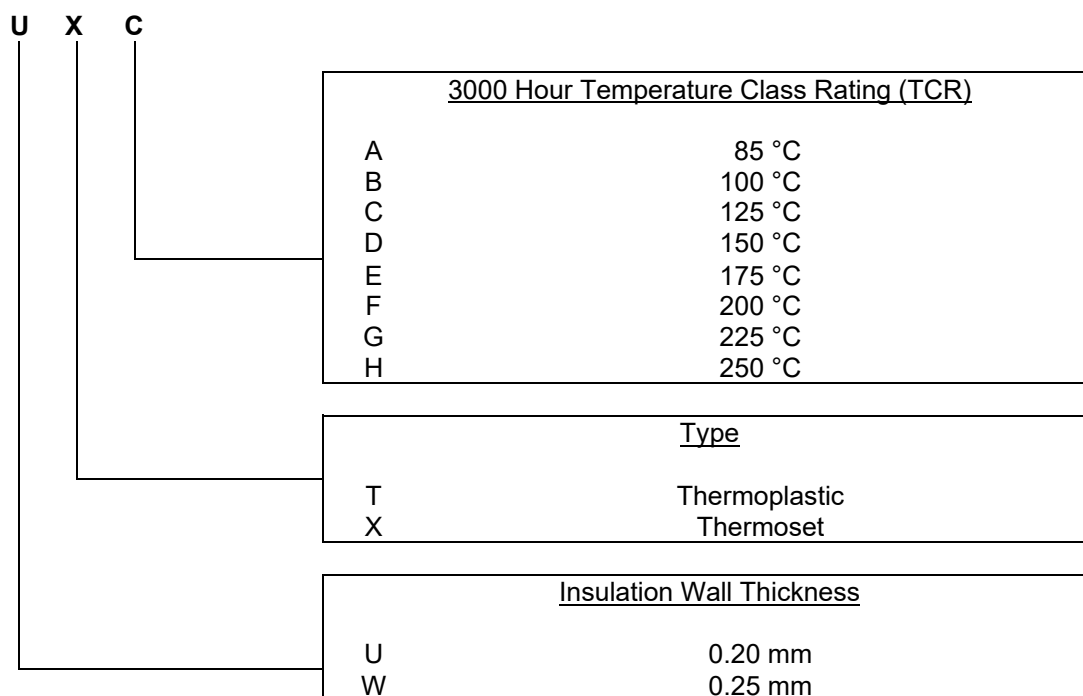


Figure 1 - Cable types

In this example, UXC, the cable, has an insulation wall thickness of 0.20 mm, thermoset, with a 3000 hour temperature class rating of 125 °C. Not all combinations of letter designations are commercially available.

4.2 General Test Conditions

Test samples for all tests except 6.3 shall be preconditioned for at least 16 hours at a room temperature of 23 °C ± 3 °C. Unless otherwise specified, all tests shall be conducted at this same temperature.

All specimens shall pass. In the case where the test result is based on an average, the average shall meet the requirement.

4.3 Ovens

Unless otherwise specified, when an oven is required, it shall be a hot air oven in accordance with ASTM D5374 and D5423 Type I. The air contained in the oven shall be completely changed at least eight times, but not more than 20 times per hour, at the specified temperature.

4.4 Tolerances

Unless otherwise specified, all values are considered to be approximate. Temperature tolerances are <125 °C = ±2 °C and ≥125 °C = ±3 °C, except where otherwise specified.