The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

# SURFACE VEHICLE DRAFT TECHNICAL REPORT

SAE J2222

ISSUED NOV93

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## COILED ELECTRICAL CABLE

***Foreword*—**This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

***1. Scope*—**This Draft Technical Report covers the minimum performance and endurance requirements for coiled electrical cables to connect a tractor and trailer and/or trailer to trailer.

The purpose of this Draft Technical Report is to give the technical community the opportunity to review, comment on, and use the Draft Technical Report prior to its final approval by SAE. This document shall have a life span of no more than three years from approval which may not be renewed.

This Draft Technical Report represents the current thinking of the sponsoring Technical Committee. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringements arising therefrom, is the sole responsibility of the user.

Comments on this Draft are welcome and should be submitted in writing to Secretary, Technical Standards Board, SAE Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

***2. References***

**2.1 Applicable Publications—**The following publications form a part of this Draft Technical Report to the extent specified herein. The latest revision of each SAE Document or version of material issued by other organizations shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J560—Electrical Connector for Truck-Trailer Jumper Cable
SAE J1067—Seven Conductor Cable

2.1.2 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 117—Standard for Salt Spray Testing





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## 3. *Definitions*

**3.1 Coiled Electrical Cable—**The coiled electrical cable consists of seven-conductor jacketed cable, described by SAE J1067, that has been formed into a cylindrical helix. The electrical connector specified in SAE J560 may terminate each end of the cable.

**3.2 Extended Length—**Extended length is the length to which the coiled section of the electrical cable can be stretched without exceeding the elastic limit. Extended length applies only to the coiled section of the cable; it excludes lead lengths (see 3.3).

**3.3 Lead Length—**Lead length refers to the straight, noncoiled cable section, including connector plug assembly, that terminates either end of a coiled electrical cable. Each lead length shall exceed 200 mm, as shown in Figure 1.

**3.4 Working Length—**Working length is the extended length of the coiled electrical cable, plus its two lead lengths.

**3.5 Sag—**Sag refers to the vertical drop measured from the horizontal centerline to the lowest coil outside diameter when cable is stretched to the extended length.

**3.6 Coil Flex Cycle—**A coil flex cycle is defined as stretching the coiled cable section to the extended length, and then allowing contraction to 150% of relaxed length.

**3.7 Relaxed Length—**Relaxed length is the length of the coiled electrical cable when lying on a smooth horizontal surface, under no external force except gravity, and having all of its coils coaxial. Relaxed length applies only to the coiled section of the cable: it excludes lead lengths.

**3.8 Type**

3.8.1 Type I Coiled Electrical Cable is designed for operating temperature extremes of –30 to +60 °C.

3.8.2 Type II Coiled Electrical Cable is designed for operating temperature extremes of –40 to +60 °C.

**3.9 Marking—**Parts conforming to this document shall be marked with the following information:

a. Manufacturer's name or symbol
b. Working length (including unit and "W.L")
c. "Type I" or "Type II"
d. "SAE J2222—" and year of manufacture

Other product or part number information may follow as part of the identification. The marking shall be permanent and endure for the life of the part.

EXAMPLE— XYZ Corporation
12 Ft. W.L.
Type I
SAE J2222-1992

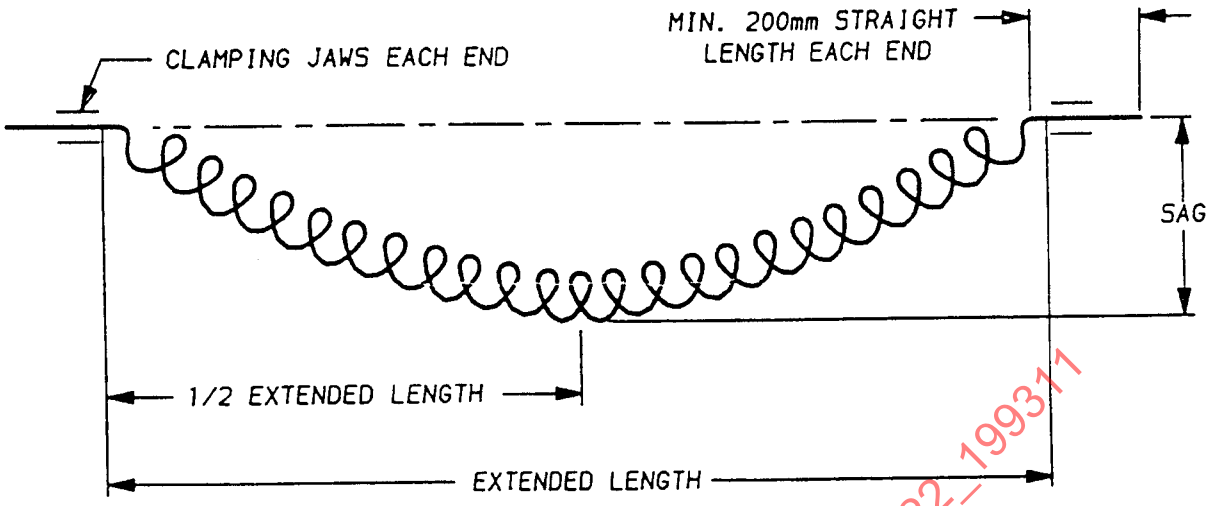


FIGURE 1—SAG MEASUREMENT



## *4. Test Procedure*

### 4.1 Test Sequence

4.1.1 All tests shall be executed in the order specified herein.

4.1.2 The same physical sample of a cable is to be used in each successive test, with only the following exception: a new sample may be tested for environmental resistance (6.3).

### 4.2 Test Equipment and Instrumentation

4.2.1 POWER SUPPLY—The power supply shall comply with the following specifications:

*4.2.1.1* *Output Current*—Capable of supplying the continuous and in-rush currents of the test load.

*4.2.1.2* *Regulation*—The output voltage at the supply shall not deviate more than 2% with changes in static load from zero to maximum (not including in-rush current), and means shall be provided to compensate for static input line variations.

*4.2.1.3* *Ripple Voltage*—Maximum 300 mV peak-to-peak.

4.2.2 VOLTMETER—0 to 30 V maximum full scale deflection, accuracy ± 1/2%. (A digital meter having at least a 3-1/2 digit readout with an accuracy of ± 1% plus 1 digit is recommended for millivolt readings.)

4.2.3 AMMETER—Accuracy ±1%.

4.2.4 HIPOT—Capable of detecting leakage currents of 0.5 mA at 500 V AC.

## 4.3 Electrical

4.3.1 Individual conductors shall meet SAE J1067 wire sizes and color identification.

*4.3.1.1* Measure mV drop at 10.0 A ± 0.10 A across each conductor and calculate the resistance based on the measurements. It is recommended that the individual conductor ends be stripped approximately 30 mm to perform this test.

*4.3.1.2* Adjust Hipot for 0.5 mA current detection. Apply 500 V AC with the Hipot between the red conductor and the other six conductors for 1 min. Stretch the coil to the extended length once during this 1 min test. Repeat test six times for blue, brown, green, yellow, black, and white conductor.

## 4.4 Mechanical

4.4.1 FORCE TO EXTEND—TYPE I CABLE

*4.4.1.1* Stretch the coiled electrical cable from the relaxed to the extended length and hold for 60 s ± 6 s, then let it return to its natural position.

*4.4.1.2* Place the coiled electrical cable in a low-temperature chamber (–30 °C ± 2 °C) for 4 h. Then measure the force to stretch the cable to the extended length within 10 s after removing it from the chamber.

*4.4.1.3* Let the coiled electrical cable from test 3.4.1.2 return to its natural position at 20 °C ± 5 °C ambient temperature for 2 h.

*4.4.1.4* Place the coiled electrical cable in a low-temperature chamber (–40 °C ± 2 °C) for 4 h. Then stretch it to the extended length within 10 s after removing it from the chamber.

This test is performed to stress the insulation material at a temperature 10 °C lower than the lowest operating temperature, prior to the visual and Hipot tests.

4.4.2 FORCE TO EXTEND—TYPE II CABLE

*4.4.2.1* Stretch the coiled electrical cable from the relaxed to the extended length and hold for 60 s ± 6 s, then let it return to its natural position.

*4.4.2.2* Place the coiled electrical cable in a low-temperature chamber (–40 °C ± 2 °C) for 4 h. Then measure the force to stretch the cable to the extended length within 10 s after removing it from the chamber.

*4.4.2.3* Let the coiled electrical cable from test 4.4.2.2 return to its natural position at 20 °C ± 5 °C ambient temperature for 2 h.

*4.4.2.4* Place the coiled electrical cable in a low-temperature chamber (–50 °C ± 2 °C) for 4 h. Then stretch it to the extended length within 10 s after removing it from the chamber.

This test is performed to stress the insulation material at a temperature 10 °C lower than the lowest operating temperature, prior to the visual and Hipot tests.

4.4.3 SAG RESISTANCE

*4.4.3.1* Stretch the coiled electrical cable horizontally and hold for 16 h ± 1 h to the extended length in a high-temperature chamber (60 °C ± 2 °C). If equipment size limitations exist, this test may be performed by first stretching one-half of the coiled section for 16 h, then the other half for 16 h.

*4.4.3.2* Immediately after removing the cable from the chamber, reduce stretch to one-half of the extended length.

*4.4.3.3* After 60 min ± 3 min at 20 °C ± 5 °C ambient temperature, measure sag while cord is stretched to one-half of the extended length (see Figure 1).

4.4.4 FLEX CYCLE

*4.4.4.1* Subject coiled electrical cable to 200 000 flex cycles at 20 °C ± 5 °C ambient temperature. One flex cycle is described as follows:

4.4.4.1.1 Start with the coiled section at 150% of relaxed length, ± 50 mm; then stretch the cable to the extended length ± 50 mm.

4.4.4.1.2 Actuation rate shall be 2.0 to 4.0 s stretch, 0.5 to 1.5 s dwell at extended length, 2.0 to 4.0 s contraction to 150% of relaxed length, and 0.5 to 1.5 s dwell at this length.

*4.4.4.2* Repeat 4.3.1.1 and 4.3.1.2 upon completion of the 200 000 cycle test.

**4.5 Environmental Resistance**

4.5.1 The coiled cable shall be tested for environmental resistance in accordance with the test procedures that are pertinent to externally mounted cable, as outlined in SAE J1067.

These tests include exposure to salt spray, ultraviolet, ozone, and abrasion, as well as common fuels, oils, and cleaning substances.

***5. Performance Requirements***

**5.1 Electrical**

5.1.1 Coiled electrical cable shall pass test requirement 4.4 without exceeding a 5% resistance increase when measured per 4.3.1.1.

**5.2 Dielectric (Hipot)**

5.2.1 Coiled electrical cable shall pass 4.4.1.1 through 4.4.1.4 for Type I, or 4.4.2.1 through 4.4.2.4 for Type II, extension tests without cracking of the jacket or individual wire insulators. Check for cracks by visually inspecting jacket and end sections of wire insulators.

5.2.2 Coiled electrical cable shall pass 4.3.1.2 Hipot test after the force to extend tests, Type I cable, 4.3.1; Type II cable, 4.4.2 has been performed.

5.2.3 Coiled electrical cable shall pass 4.3.1.2 Hipot test after flex cycle test 4.4.4 has been performed.

**5.3 Extension Force**

5.3.1 Coiled electrical cable shall not exceed 157 N extension force during test outlined in 4.4.1.2 for Type I coiled electrical cable, or 4.4.2.2 for Type II coiled electrical cable.

**5.4 Sag Resistance—**The coiled electrical cable shall not exceed a sag of 20% of the extended length if tested in accordance with4.4.3 (see Figure 1).