# AEROSPACE STANDARD

| AS4536™ | REV. D |
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Superseding AS4536C

# Safety Cable Kit Procurement Specification and Requirement for Use

RATIONALE

Revise tolerance for the 0.022 diameter cable from 0.006 to 0.004 (see 3.3.1.1 and Table 1), update references, add specification references for ferrules, correct typographical errors in Tables 4 and 5, general editorial revisions.

## 1. SCOPE

### 1.1 Purpose

This procurement specification covers aerospace quality safety cable kits consisting of safety cables and ferrules made from the same corrosion and heat resistant steels and a nickel base alloy of the type identified under the Unified Numbering System as follows:

a. UNS S30400 - Corrosion resistant steel (AMS5697, AMS5560)

b. UNS S32100 - Corrosion and heat resistant steel (AMS5689, AMS5570)

c. UNS N06600 - Nickel base alloy (AMS5687, AMS5580)

d. UNS N06625 - Nickel alloy, corrosion resistant (AMS5666, AMS5581)

The requirements for installation practices are also specified.

### 1.2 Field of Application

For use in aerospace systems for securing fasteners and other utility parts which may have the potential of coming loose during operation.

## 2. REFERENCES

### 2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.



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**SAE WEB ADDRESS:**

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.

AMS5560 Steel, Corrosion Resistant, Seamless Tubing, 19Cr - 10Ni (304), Solution Heat Treated

AMS5570 Steel, Corrosion and Heat-Resistant, Seamless Tubing, 18Cr - 11Ni - 0.40Ti (321), Solution Heat Treated

AMS5580 Nickel Alloy, Corrosion and Heat-Resistant, Seamless Tubing, 74Ni - 15.5Cr - 8.0Fe, Annealed

AMS5581 Nickel Alloy, Corrosion and Heat-Resistant, Seamless or Welded Tubing, 62Ni - 21.5Cr - 9.0Mo - 3.7Cb (Nb), Annealed

AMS5666 Nickel Alloy, Corrosion and Heat-Resistant, Bars, Forgings, Extrusions, and Rings, 62Ni - 21.5Cr - 9.0Mo - 3.65 Cb (Nb), Annealed

AMS5687 Nickel Alloy, Corrosion and Heat-Resistant, Wire, 74Ni - 15.5Cr - 8.0Fe, Annealed

AMS5689 Steel, Corrosion and Heat Resistant, Wire, 18Cr - 10.5Ni - 0.40Ti (321), Solution Heat Treated

AMS5697 Steel, Corrosion-Resistant, Wire, 19Cr - 9.5Ni (304), Solution Heat Treated

AS567 Safety Cable, Safety Wire, Key Washers, and Cotter Pins for Propulsion Systems, General Practices for Use of

AS3509 Cable, Safety, Kit, Nickel Alloy, UNS N06600

AS3510 Cable, Safety, Kit, Corrosion and Heat Resistant Steel, UNS S32100

AS3511 Cable, Safety, Kit, Corrosion Resistant Steel, UNS S30400

AS3618 Cable, Safety, Ferrule, Elongated, Corrosion and Heat Resistant Steel, UNS S32100

AS3619 Cable, Safety, Ferrule, Elongated and Kits, Nickel Alloy, UNS N06600

AS3655 Cable, Safety, Nickel Alloy, Corrosion Resistant (UNS N06625)

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 D3951 Packaging, Commercial

ASTM E4 Standard Practices for Force Verification of Testing Machines

ASTM E8/E8M Standard Test Methods for Tension Testing of Metallic Materials

2.2 Definitions

STRAND: A group of wires helically wound around a core wire in a left-hand direction or a right-hand direction.

CABLE: A group of strands helically twisted together in a right-hand direction without a core.

DEFECTIVE: A defective is a unit of product which contains one or more defects.

DIAMETER: The diameter of wire strand and cable is the diameter of the circumscribing circle, or across diametrically opposite wires.

FERRULE/END FITTING: Metal sleeve used for crimping onto the cable to maintain tension in the cable.

LAY: The helical form taken by the wires in the strand and by the strands in the cable is characterized as the lay (or twist) of the wires in a strand, or strands in a cable, respectively. In a right-hand lay, the wires of the strand are the same direction as the thread on a right-hand screw, and a left-hand lay the strands or wires lay in the opposite direction.

LENGTH OF LAY (OR PITCH): The distance parallel to the axis of the strand, in which a wire makes one complete turn about the axis.

PING: Ping is an audible sound given off as a result of an individual wire breaking in the wire strand.

PRODUCTION INSPECTION LOT: Shall be all finished parts of the same part number, made from a single heat of alloy, heat treated at the same time to the same specified condition, produced as one continuous run, and submitted for vendor's inspection at the same time.

PULL-OFF LOAD: The force required to pull the cable out of either the ferrule or cable end fitting.

SAFETY CABLE: An inseparable assembly consisting of a length of cable and an end fitting affixed to one end of the cable.

SAFETY CABLE ASSEMBLY: An assembly consisting of a ferrule affixed to the safety cable.

TERMINATION POINT: The point at which the cable end fitting or ferrule attach to the cable.

WIRE: Each individual cylindrical element is designated as a wire.

## 3. TECHNICAL REQUIREMENTS

### 3.1 Material

Material requirements for cable, end fitting, and ferrule shall be as specified on the part standards.

### 3.2 Design

3.2.1 Finished safety cable shall conform to AS3509, AS3510, AS3511, or AS3655.

3.2.2 Corresponding finished safety cable ferrules shall conform to AS3509, AS3510, AS3511, AS3618, AS3619, or AS3655.

### 3.3 Construction

3.3.1 Wire Properties

Tensile strength of wire and wire sizes shall be such that the cable will be capable of meeting the requirements of this specification.

3.3.1.1 Preforming of Wires

The individual wires comprising a strand shall be shaped into the exact helical position they will have in the finished strand or cable, so that if the strand or cable is cut, the measured diameter of the cable at the cut ends shall not increase by more than 0.004 inch (0.10 mm) for nominal cable diameter 0.022 inch (0.56 mm), shall not increase by more than 0.006 inch (0.15 mm) for nominal cable diameter 0.032 inch (0.81 mm), shall not increase more than 0.008 inch (0.20 mm) for nominal cable diameter 0.040 inch (1.02 mm), and shall not increase by more than 0.009 inch (0.23 mm) for nominal cable diameter 0.062 inch (1.57 mm).

3.3.1.2 Splicing and Joining

There shall be no wire splices in the finished strand or cable.

3.3.2 Type of Construction

3.3.2.1 0.022 inch (0.56 mm) diameter safety cable shall be 1 x 7 construction.

3.3.2.1.1 Strand 1 x 7

The 0.022 inch (0.56 mm) nominal diameter cable shall be a strand of wires having 1 x 7 construction, consisting of a lay of six wires laid around a center core wire in a left-hand, or right hand direction. The length of lay shall be not more than 0.25 inch (6.35 mm) nor less than 0.20 inch (0.51 mm).

3.3.2.2 0.032 inch (0.81 mm) diameter safety cable shall be 3 x 7 construction.

3.3.2.2.1 Cable 3 x 7

The 0.032 inch (0.81 mm) nominal diameter cable shall consist of three strands of seven wires each, laid together without a core. Each strand shall consist of a layer of six wires laid around a center core wire in a left-hand direction. The three strands shall be laid together in a right-hand direction. The length of the lay of the six outer wires in each strand shall not exceed 70% of the lay of the finished cable. The length of lay of the finished cable shall be not more than 0.25 inch (6.35 mm) nor less than 0.18 inch (4.57 mm).

3.3.2.3 0.040 inch (1.02 mm) diameter safety cable shall be 7 x 7 construction.

3.3.2.3.1 Cable 7 x 7

The 0.040 inch (1.02 mm) nominal diameter cable shall consist of six outer strands of seven wires each laid around a core of seven wires. The six outer strands shall consist of six wires laid around a center wire in a left-hand direction. The core strand shall consist of six wires laid around a center wire in a right-hand direction. The six outer strands shall be laid around a core in a right-hand direction. The length of lay of the outside six wires in each of the six outside strands, and the outside six wires of the core strand shall not exceed 60% of the length of lay of the finished cable. The length of lay of the finished cable shall be not more than 0.37 inch (9.40 mm) not less than 0.24 inch (6.10 mm).

3.3.2.4 0.062 inch (1.57 mm) diameter safety cable shall be 7 x 19 construction.

3.3.2.4.1 Cable 7 x 19

The 0.062 inch (1.57 mm) nominal diameter cable shall consist of six outer strands of 19 wires each laid around a strand core of 19 wires. The six outer strands shall each consist of a layer of six wires laid around a center wire in a left-hand direction and a layer of 12 wires laid over the seven-wire strand in a left-hand direction. The strand core shall consist of a layer of six wires laid around a center wire in a right-hand direction. The six outer strands shall be laid around the core in a right-hand direction. The length of lay of the inside layer of six wires in each of the six outer strands and the one strand core shall not exceed 60% of the outside layer of 12 wires in each strand. The length of lay of the outside layer of 12 wires in each of the six outside strands and the strand core shall not exceed 50% of the lay of the finished cable. The length of lay of the finished cable shall be not more than 0.54 inch (13.72 mm), not less than 0.40 inch (10.16 mm).

3.3.3 Safety Cable

3.3.3.1 The 0.022 inch (0.56 mm) nominal diameter safety cable comprises the following:

a. One strand of wires, 1 x 7 construction as in 3.3.2.1.1.

b. Fitting end, as specified on part drawing, crimped onto strand at one end.

c. Free end of strand is fused by brazing or welding.

d. Ferrule, as specified on part drawing, to be crimped onto the free end of the strand at installation.