

## SECTION 2

### CHAPTER 1

# WIRE AND CABLE

## INTRODUCTION

1. In order to make installation, maintenance, and repair easier, runs of electric wire and cable in aircraft are broken at specified locations by junctions such as connectors, terminal blocks, busses, etc. Before assembly to these junctions, wires and cables must be cut to length, identified, stripped, and if required, tinned.

2. This chapter describes a variety of wire and cables suitable for use in aircraft.

## REFERENCE SPECIFICATIONS

3. The following specifications are applicable to aircraft wire and cable preparation:

MIL-C-17	Cable, Radio Frequency, Flexible and Semirigid, General Specification
MIL-C-5756	Cable and Wire Power, Electric, Portable
MIL-C-85485	Cable, Electric, Filter Line, Radio Frequency Absorptive
MIL-DTL-16878	Wire, Electrical, Insulated, General Specification
MIL-DTL-25038	Wire, Electrical, High Temperature and Fire Resistant Aircraft
MIL-DTL-8777	Wire, Electrical Silicone Insulated Copper, 600 Volts, 200°C
MIL-W-22759	Wire, Electric, Fluoropolymer Insulated, Copper or Copper Alloy
MIL-W-7072 (Cancelled)	Wire Electric, 600 Volts, Aluminium, Aircraft
NEMA WC 27500	Cable, Electrical, Shielded and Unshielded, Aerospace
SAE AS 81044	Wire, Electric, Crosslinked Polyalkene, Crosslinked Alkane-imide Polymer, or Polyarylene Insulated, Copper or Copper Alloy
MIL-DTL-81381	Wire, Electric, Polyimide Insulated, Copper and Copper Alloy

## DEFINITIONS

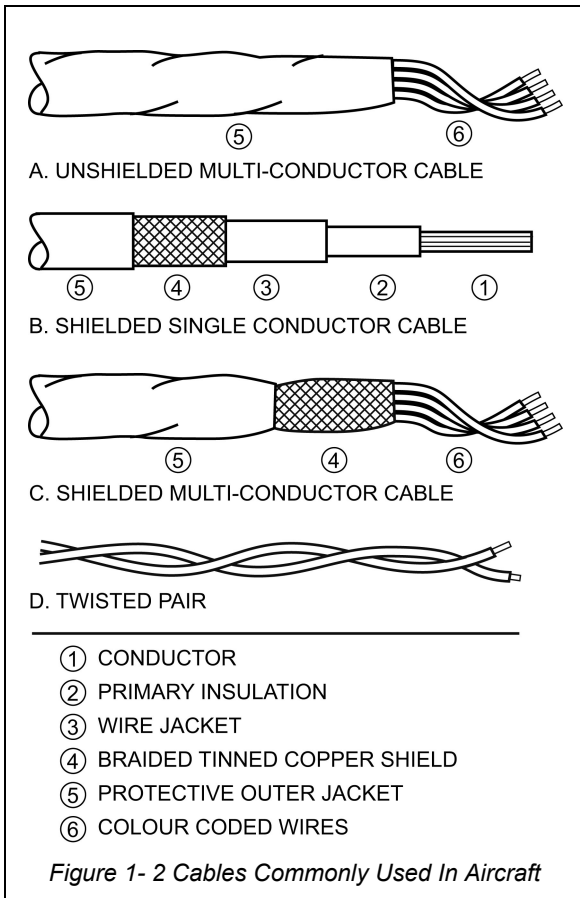
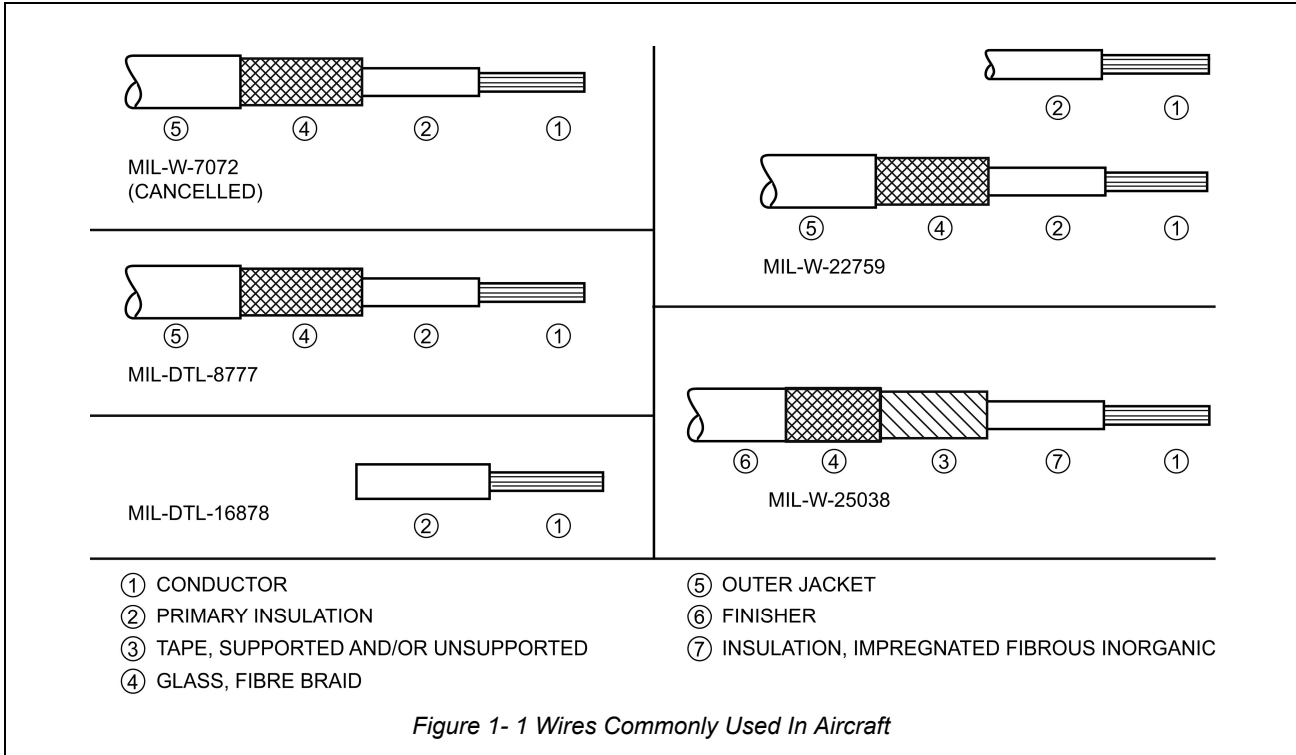
### Insulated Wire

4. For the purposes of electric and electronic installation in aircraft, an insulated wire consists of a metal conductor covered with a dielectric or insulating material (refer to Figure 1-1). Insulated wire is usually referred to as "wire" and will be so designated in this manual. Wires used in aircraft contain stranded conductors for flexibility. Insulations may consist of several materials and layers to provide dielectric insulation, thermal protection, abrasion resistance, moisture resistance, and fluid resistance. Wires commonly used in aircraft are described in Table 1-1. Insulations commonly used in aircraft are described in Table 1-2.

### Cable

5. The term "cable," as used in aircraft electrical installations (refer to Figure 1-2), includes the following:

- a. Two or more insulated conductors, contained in a common covering, or twisted together without a common covering (multi-conductor cable).
- a. One or more insulated conductors with an overall shield, or with an overall shield and a jacket over the shield (shielded cable).
- b. Two insulated conductors twisted together (twisted pair).
- c. A single insulated centre conductor with a metallic braided outer conductor (coaxial cable). The concentricity of centre and outer conductor is carefully controlled during manufacture to ensure that they are coaxial.



6. Cables commonly used in aircraft include the following:

- |               |   |
|---------------|---|
| MIL-C-17      | Cable, Radio Frequency, Flexible and Semirigid (Coaxial)  |
| MIL-C-5756    | Single or multiple conductor, rubber insulated conductor, rubber jacket.  |
| MIL-C-85485   | Cable, Electric, Filter Line, Radio Frequency Absorptive  |
| NEMA WC 27500 | Single or multiple conductor, using any wire listed in Table 1-1, shielded, with tin coated, silver-coated, or nickel-coated copper braid as appropriate and covered with appropriate jacket. |

## SELECTION OF AIRCRAFT ELECTRICAL WIRE AND CABLE

### General

7. Wire and cable is to be of a type suitable for the application. It is to be selected so that the maximum conductor temperature is not exceeded for any combination of electrical loading, ambient temperature and heating effects of bundles, conduits or other enclosures. Factors to be considered include voltage, current, ambient temperature, mechanical strength, abrasion qualities, flexibility and pressure/altitude requirements.

8. This AC limits the installation of specific wire type/gauge in aircraft to replacement of old type wire with a similar type and appropriate gauge as detailed in this chapter or applicable aircraft documentation.

#### NOTE

Installation of wire for modification, design or repair for devices used in aerospace applications, should conform to SAE AS 50881, Wiring Aerospace Vehicle.

9. A standard of wire is MIL-W-22759 and is suitable for general aircraft use. Annex C to this chapter details the method of determining the appropriate wire part number. If the part number is not identified:

- a. Variants of the original part number may be required ie colour, stranding or insulation type,
- b. Other Military Specification wire types should be investigated.

### Aluminium Wire

10. The use of aluminium wire for aircraft use is quite limited and whenever replacement of an installed wire is necessary, it may be advantageous to consider copper wire with similar electrical/physical characteristics. Currently there are no appropriate specifications detailing aluminium wire suitable for use in general aviation aircraft. Annex E to this chapter provides details of MIL-W-7072 that was cancelled in 1997. This information may be useful when determining a suitable replacement wire.

#### NOTE

Aluminium wire may be used on new aircraft designs and manufacturers information should be used to maintain this type of wire.

### Airframe Wire

11. Airframe wire is wire that is specifically designed for use as component interconnection wire in the airframe of aerospace vehicles. Airframe wire is usually classed as normal or medium weight and has two insulation coverings for protection against abrasions. This type of wire should be used where a secondary covering of insulation material is not required. The M22759/34 (tin plated, 150°C) and M22759/43 (silver plated, 200°C) wire is suitable for general airframe wire.

Table 1-1 Airframe Wire Used In Aircraft Electrical Installations

Applicable Specification	Title/Description
MIL-DTL-16878	Wire, Electrical, Insulated, General Specification For
MIL-DTL-25038	Wire, Electrical, High Temperature and Fire Resistant, Aircraft
MIL-DTL-81381	Wire, Electric, Polyimide-Insulated, Copper and Copper Alloy
MIL-DTL-8777	Wire, Electrical, Silicone-Insulated, Copper, 600V, 200°C
MIL-W-22759	Wire, Electric, Fluoropolymer Insulated, Copper or Copper Alloy
MIL-W-7072 (Cancelled)	Wire, Electric, 600 Volt, Aluminium, Aircraft, General Specification For
SAE-AS-81044A	Wire, Electric, Crosslinked Polyalkene, Crosslinked Alkane-imide, or Polyarylene Insulated, Copper or Copper Alloy

**NOTE**

Stranded conductor wire is used for flexibility. In low temperature wire (150°C), copper or copper alloy strands are tin plated to facilitate soldering. In wire rated at 200°C conductor temperature, silver plating is used to protect the copper from oxidation and to facilitate soldering. Wires for high temperatures (260°C) are nickel plated to prevent oxidation. Nickel plated wire is more difficult to solder, but satisfactory solder connections can be made with proper techniques. It is also more difficult to obtain low resistance crimp terminations on nickel plated wire.

**NOTE**

Hookup wire is not to be used in the airframe of aerospace vehicles where the wire or loom is not covered with a secondary insulation (ie PTFE conduit) for abrasion protection.

**Hookup Wire**

**12.** Hookup wire is designed for component interconnection inside a box or as an airframe wire only where there is a secondary insulation covering for abrasion protection. Hookup wire is usually classed as lightweight and has only one insulation covering. Hookup wire is normally of a smaller overall diameter than the equivalent gauge airframe wire. M22759/32 (tin plated, 150°C) and M22759/33 (silver plated, 200°C) wire is suitable for general hookup wire.

**Specifications**

**13.** Annexes to this chapter contain limited details of each Military Specification wire and cable suitable for aircraft use.

*Table 1–2 Common Aircraft Wire Insulations*

Type	Description
Asbestos	Asbestos is used to provide high temperature and flame resistance. No longer suitable for use due to health and safety issues.
ETFE – (Ethylene-tetrafluoroethylene)	ETFE is a fluoropolymer rated up to 260°C. It is widely used as aircraft wire insulation.
FEP-Fluorocarbon (Fluorinated ethylene propylene)	FEP is rated at 200°C, but will melt at higher temperatures. FEP has properties similar to TFE, but will melt at soldering temperatures.
Glass Braid	Widely used to provide thermal resistance and cut-through resistance. However, it may absorb moisture and its use is becoming less prevalent.
Polyamide (Nylon)	Widely used in low temperature wires as an outer insulation layer for abrasion resistance and fluid resistance.
Polyimide (Kapton)	This material has excellent thermal, abrasion, and cut-through resistance characteristics however due to its susceptibility to arc tracking it's use is discouraged in new installations.
PVC (Polyvinyl Chloride)	PVC is a common wire insulation and is fitted in older aircraft. It is no longer approved for use in manned aerospace applications. It may be used for replacement purposes however alternate insulations should be considered.
Silicone Rubber	Silicone rubber is rated at 200°C. It is highly flexible and self-extinguishing after flame except in vertical runs. The ash produced is non-conducting.
TFE-Fluorocarbon (polytetrafluoroethylene)	TFE or PTFE is widely used as a high-temperature insulation. It will not burn but will vaporise in flame. It will not melt at soldering temperatures. TFE is resistant to most fluids.
XLETFE – Crosslinked Ethylene-tetrafluoroethylene	XLETFE is ETFE that has been irradiated (crosslinked) to produce a tougher insulation.

### Limitations

**14. Insulation.** Except for existing installations, the use of polyvinyl chloride (PVC) insulated wire and cable for manned aerospace applications is prohibited.

**15. Kapton.** Due to the undesirable properties exhibited by polyimide (Kapton) insulated wiring, its use in aircraft should be avoided wherever practicable.

### Wire Temperature Ratings

**16.** Generally, aircraft electrical wire must be selected to perform continuously in a specified temperature range ie 150°C, 200°C, 260°C or fire resistant. Degradation will occur if the wire is subjected to continuous operation at elevated temperatures. Factors to be considered that will affect the temperature are:

- a. **Wire Gauge.** The wire should be of a gauge to ensure adequate current carrying capacity so that the voltage drops are acceptable.
- b. **Current Carrying Capacity.** The continuous duty current for each wire gauge is specified in Annex I to this chapter.
- c. **Bundle/Looms or Conduit.** Annex I to this chapter details current ratings for the following:
  - (1) wires positioned in free air, and
  - (2) wires in bundles, conduit or confined areas.

#### NOTE

The ratings listed in Annex I are based upon bundles of 33 or more wires. For further information on current ratings, refer to SAE AS 50881 or contact the publication sponsor.

- d. **Aluminium Wire.** The use of aluminium wire shall be restricted in applications and should not be:
  - (1) directly attached to engine mounted accessories or any area of severe vibration, or
- e. installed where frequent connection/disconnection is necessary.

f. **Aluminium Terminations.** Aluminium terminations should conform to SAE AS 70991. Refer to Section 2, Chapter 6 of this publication for details of aluminium terminals.

g. **Minimum Wire Size.** The minimum wire sizes are specified below unless authorised by specific aircraft publications.

(1) **Copper Wire.** SAE AS 50881 prohibits the use of wires smaller than 22 AWG for use in aircraft, helicopters and lighter than air vehicles. This restriction is due to maintenance difficulties, however many service aircraft have now been manufactured using 24 AWG and 26 AWG wire. When required, these wires should be repaired/replaced with similar gauge wires. Appropriate precautions should be taken to prevent failure caused by vibration and handling and wires should be adequately supported at each termination. For direct attachment to engine mounted accessories, wire size smaller than 18 AWG should not normally be used, however where 20 AWG wires are required they may be used, provided they are grouped, spot tied and clamped to the connector. If fewer than four 20 AWG wires are used with one connector, insulated tubing is to be used.

(2) **Aluminium Wire Size.** Aluminium wire is restricted to 8 AWG minimum. (Refer to para 10).

h. **Maximum Wire Size.** The maximum wire sizes should be as listed below, unless specifically authorised by the applicable aircraft documentation.

(1) Copper wire - 2 AWG.

(2) Aluminium wire - 0 AWG.

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**Annexes:**

- |    |   |    |  |
|----|---|----|--|
| A. | MIL-DTL-16878 Wire, Electrical, Insulated, General Specification  | F. | NEMA WC 27500 Standard For Aerospace and Industrial Electrical Cable   |
| B. | SAE-AS-81044 Wire, Electrical, Crosslinked Polyalkene, Crosslinked Alkane-imide Polymer or Polyarylene Insulated Copper or Copper Alloy | G. | MIL-DTL-81381 Wire, Electric, Polyimide-Insulated, Copper              |
| C. | MIL-W-22759 Wire, Electric Fluoropolymer Insulated Copper or Copper Alloy   | H. | MIL-C-85485 Cable, Electric, Filter Line, Radio Frequency Absorptive   |
| D. | MIL-DTL-25038 Wire, Electrical, High Temperature, Fire Resistant and Flight Critical, General Specification                             | I. | Current Ratings of Wire and Maximum Allowable Nicked or Broken Strands |
| E. | MIL-W-7072 Wire, Electric, 600 Volt, Aluminium, Aircraft, General Specification   | J. | Wire Gauge Comparison  |

## MIL-DTL-16878 WIRE, ELECTRICAL, INSULATED, GENERAL SPECIFICATION

### Scope

1. This specification covers unshielded wire for hook-up and lead wiring of electrical and electronic components and equipment. The temperature rating of wire under this specification ranges from -65°C to 260°C, with potential rating from 250Vrms to 5000Vrms.

### Specification Sheets

2. Specification Sheets are as follows:

*Table 1-A-1 Specification Sheets*

Description	MIL-W-16878D	MIL-W-16878E	MIL-W-16878F	MIL-DTL-16878G
600 Volt, 105°C, PVC	TYPE B	M16878/1 M16878/17	M16878/1 M16878/17	M16878/1 M16878/17
1000 Volt, 105°C, PVC	TYPE C	M16878/2 M16878/18	M16878/2 M16878/18	M16878/2 M16878/18
3000 Volt, 105°C, PVC	TYPE D	M16878/3 M16878/19	M16878/3 M16878/19	M16878/3 M16878/19
600 Volt, 200°C/260°C, PTFE	TYPE E	M16878/4 M16878/21 M16878/25 M16878/26	M16878/4 M16878/21 M16878/25 M16878/26	NEMA HP 3 NEMA HP 3 NEMA HP 3 NEMA HP 3
1000 Volt, 200°C/260°C, PTFE	TYPE EE	M16878/5 M16878/22 M16878/27 M16878/28 M16878/34 M16878/35	M16878/5 M16878/22 M16878/27 M16878/28 M16878/34 M16878/35	NEMA HP 3 NEMA HP 3 NEMA HP 3 NEMA HP 3 NEMA HP 3 NEMA HP 3
250 Volt, 200°C/260°C, PTFE	TYPE ET	M16878/6 M16878/20 M16878/23 M16878/24	M16878/6 M16878/20 M16878/23 M16878/24	NEMA HP 3 NEMA HP 3 NEMA HP 3 NEMA HP 3
600 Volt, Silicone Rubber	TYPE F	M16878/7 M16878/29	M16878/7 M16878/29	M16878/7 M16878/29
1000 Volt, Silicone Rubber	TYPE FF	M16878/8 M16878/30 M16878/31 M16878/32	M16878/8 M16878/30 M16878/31 M16878/32	M16878/8 M16878/30 M16878/31 M16878/32
PE, 75°C	TYPE J	M16878/10 M16878/33	M16878/10 M16878/33	M16878/10 M16878/33
FEP, 600 Volt, 200°C	TYPE K	M16878/11	M16878/11	NEMA HP 4
FEP, 1000 Volt, 200°C	TYPE KK	M16878/12	M16878/12	NEMA HP 4
FEP, 250 Volt, 200°C	TYPE KT	M16878/13	M16878/13	NEMA HP 4
XLPE, 600 Volt, 125°C	---	M16878/14	M16878/14	M16878/14
XLPE, 1000 Volt, 125°C	---	M16878/15	M16878/15	M16878/15
XLPE, 3000 Volt, 125°C	---	M16878/16	M16878/16	M16878/16
XLPO, 600 Volt, 105°C	---	---	M16878/36	M16878/36

*Table 1-A-1 Specification Sheets (continued)*

Description	MIL-W-16878D	MIL-W-16878E	MIL-W-16878F	MIL-DTL-16878G
EPDM, 600 Volt, 125°C	---	---	M16878/37	M16878/37
EPDM, 5000 Volt, 125°C	---	---	M16878/38	M16878/38
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)				
NEMA HP 3 -	Electrical and Electronic PTFE Insulated High Temperature Hook-Up Wire; Types ET (250 Volts), E (600 Volts) and EE (1000 Volts)			
NEMA HP 4 -	Electrical and Electronic FEP Insulated High Temperature Hook-Up Wire; Types KT (250 Volts), K (600 Volts) and KK (1000 Volts).			

**Part Number**

3. Part numbers under this specification are coded as in the following example:

*Table 1-A-2 Part Number Coding*

M16878/3	B	C	B	903
Specification Sheet (para 2)	Conductor Material (para 4)	Conductor Size (para 5)	Conductor Stranding (para 6)	Insulation Colour Code (para 7)

**Conductor Material**

4. Conductor Material is designated by a single letter as follows:

- B** – Coated Copper
- C** – Coated Copper-Clad Steel
- D** – Coated High Strength Copper Alloy

**Conductor Size**

5. The conductor American Wire Gauge (AWG) size is designated by a single letter as follows:

*Table 1-A-3 Conductor Size*

AWG	Letter	AWG	Letter
32	A	10	M
30	B	8	N
28	C	6	P
26	D	4	R
24	E	2	S
22	F	1	T
20	G	0	U
18	H	00	W
16	J	000	Y
14	K	0000	Z
12	L		



**Conductor Stranding**

6. The number of strands making up the conductor is designated by a single letter as follows:

*Table 1-A-4 Conductor Stranding*

Number of Strands	Letter	Number of Strands	Letter
1	A	133	L
7	B	259	M
10	C	427	M
16	D	665	P
19	E	817	R
26	F	1045	S
37	G	1330	T
41	H	1672	V
65	J	2109	W
105	K		

**Insulation Colour Code**

7. The insulation colour code is in accordance with the identification coding of MIL-STD-681 and may be one, two, or three digits depending on the number of stripes or bands. The first number is the colour of the insulation; the second number is the colour of the first stripe or band; and the third number is the colour of the second stripe or band. The colours and their corresponding numbers are as follows:

*Table 1-A-5 Colour Code*

Colour	Number Designator	Colour	Number Designator
Black	0	Green	5
Brown	1	Blue	6
Red	2	Violet (Purple)	7
Orange	3	Grey (Slate)	8
Yellow	4	White	9

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## SAE-AS-81044 WIRE, ELECTRICAL, CROSSLINKED POLYALKENE, CROSSLINKED ALKANE-IMIDE POLYMER OR POLYARYLENE INSULATED COPPER OR COPPER ALLOY

### Scope

1. This specification covers single conductor electric wires made as specified in the applicable specification sheet with tin-coated, silver-coated or nickel-coated copper or copper alloy conductors insulated with crosslinked polyalkene, crosslinked alkane-imide polymer or polyarylene. The crosslinked polyalkene, crosslinked alkane-imide polymer or polyarylene may be used alone or in conjunction with other materials as detailed in the specification sheet.

### Specification Sheets

2. Specification Sheets are as follows:

*Table 1-B-1 Specification Sheets*

Specification No	Title
SAE-AS-81044/5	Wire, Electric, Crosslinked Polyalkene Insulated, Silver-coated Copper, Normal Weight, 600 Volt, 150°C.
SAE-AS-81044/6	Wire, Electric, Crosslinked Polyalkene Insulated, Tin-coated Copper, Normal Weight, 600 Volt, 150°C.
SAE-AS-81044/7	Wire, Electric, Crosslinked Polyalkene Insulated, Silver-coated Copper, High Strength Copper Alloy, Normal Weight, 600 Volt, 150°C.
SAE-AS-81044/8	Wire, Electric, Crosslinked Polyalkene Insulated, Silver-coated Copper, Medium Weight, 600 Volt, 150°C.
SAE-AS-81044/9	Wire, Electric, Crosslinked Polyalkene Insulated, Tin-coated Copper, Medium Weight, 600 Volt, 150°C.
SAE-AS-81044/11	Wire, Electric, Crosslinked Polyalkene Insulated, Silver-coated Copper, Light Weight, 600 Volt, 150°C.
SAE-AS-81044/12	Wire, Electric, Crosslinked Polyalkene Insulated, Tin-coated Copper, Light Weight, 600 Volt, 150°C.

### Part Number

3. Part numbers under this specification are coded as in the following example:

*Table 1-B-2 Part Number Coding*

<b>M81044/5</b>	<b>- 22</b>	<b>- 9</b>
Specification Sheet (para 2)	Conductor Size (AWG)	Insulation Colour Code (para 4)

**Colour Chart**

4. The colour coding is as follows:

*Table 1-B-3 Colour Code*

<b>Colour</b>	<b>Number Designator</b>	<b>Colour</b>	<b>Number Designator</b>
Black	0	Green	5
Brown	1	Blue	6
Red	2	Violet (Purple)	7
Orange	3	Grey (Slate)	8
Yellow	4	White	9

## MIL-W-22759 WIRE, ELECTRIC FLUOROPOLYMER-INSULATED COPPER OR COPPER ALLOY

### Scope

1. This specification covers fluoropolymer-insulated single conductor electric wires made with tin coated, silver coated or nickel-coated conductors of copper or copper alloy as specified in the applicable specification sheet. The fluoropolymer insulation of these wires may be polytetrafluoroethylene (TFE), fluorinated ethylene propylene (FEP), polyvinylidene fluoride (PVF<sup>2</sup>), ethylene-tetrafluoroethylene copolymer (ETFE), or other fluoropolymer resin. The fluoropolymer may be used alone or in combination with other insulation materials.

### Specification Sheets

2. Specification Sheets are as follows:

*Table 1-C-1 Specification Sheets*

Specification No	Title
MIL-W-22759/1	Wire, Electric, Fluoropolymer-insulated, TFE and TFE Coated Glass, Silver Coated Copper Conductor, 600 Volt, 200°C.
MIL-W-22759/2	Wire, Electric, Fluoropolymer-insulated, TFE and TFE-Coated Glass, Nickel Coated Copper Conductor, 600 Volt, 260°C.
MIL-W-22759/5	Wire, Electric, Fluoropolymer-insulated, Abrasion Resistant, Extruded TFE, Silver Coated Copper Conductor, 600 Volt, 200°C.
MIL-W-22759/7	Wire, Electric, Fluoropolymer-insulated, Abrasion Resistant, Extruded TFE, Medium Weight, Silver Coated Copper Conductor, 600 Volt, 200°C.
MIL-W-22759/8	Wire, Electric, Fluoropolymer-insulated, Abrasion Resistant, Extruded TFE, Medium Weight, Nickel Coated Copper Conductor, 600 Volt, 260°C.
MIL-W-22759/11	Wire, Electric, Fluoropolymer-insulated, Extruded TFE, Silver Coated Copper Conductor, 600 Volt, 200°C.
MIL-W-22759/12	Wire, Electric, Fluoropolymer-insulated, Extruded TFE, Nickel Coated Copper Conductor, 600 Volt, 260°C.
MIL-W-22759/16	Wire, Electric, Fluoropolymer-insulated, Extruded TFE, Medium Weight, Tin Coated Copper Conductor, 600 Volt, 150°C.
MIL-W-22759/22	Wire, Electric, Fluoropolymer-insulated, Extruded TFE, Silver Coated, High Strength, Copper Alloy Conductor, 600 Volt, 200°C.
MIL-W-22759/32	Wire, Electric, Fluoropolymer-insulated, Cross-Linked Modified ETFE, Light Weight, Tin Coated Copper Conductor, 600 Volt, 150°C.
MIL-W-22759/33	Wire, Electric, Fluoropolymer-insulated, Cross-Linked Modified ETFE, Light Weight, Silver Coated, High Strength, Copper Alloy Conductor, 600 Volt, 200°C.
MIL-W-22759/34	Wire, Electric, Fluoropolymer-insulated, Cross-Linked Modified ETFE, Normal Weight, Tin Coated Copper Conductor, 600 Volt, 150°C.
MIL-W-22759/41	Wire, Electric, Fluoropolymer-insulated, Cross-Linked Modified ETFE, Normal Weight, Nickel Coated Copper Conductor, 600 Volt, 200°C.
MIL-W-22759/43	Wire, Electric, Fluoropolymer-insulated, Cross-Linked Modified ETFE, Normal Weight, Silver-Coated Copper Conductor, 600 Volt, 200°C.

**Part Number**

3. Part numbers under this specification are coded as in the following example:

*Table 1-C-2 Part Number Coding*

<b>M22759/1</b>	<b>- 22</b>	<b>- 9</b>
Specification Sheet (para 2)	Wire Size (AWG)	Insulation Colour Code (para 4)

**Colour Chart**

4. The colour coding is as follows:

*Table 1-C-3 Colour Code*

<b>Colour</b>	<b>Number Designator</b>	<b>Colour</b>	<b>Number Designator</b>
Black	0	Green	5
Brown	1	Blue	6
Red	2	Violet (Purple)	7
Orange	3	Grey (Slate)	8
Yellow	4	White	9

## MIL-DTL-25038 WIRE, ELECTRICAL, HIGH TEMPERATURE, FIRE RESISTANT AND FLIGHT CRITICAL, GENERAL SPECIFICATION

### Scope

1. This specification covers insulated single wire for electrical use in flight critical circuits and under short-time emergency conditions involving exposure to flames with temperatures up to 1,093°C (2,000°F). The wire covered by this specification is predominantly used in the engine compartment of aerospace vehicles.

#### WARNING

This wire may contain asbestos.

2. The use of asbestos products in wire insulation designed for high temperature areas is no longer considered appropriate due to the well documented health problems attributed to this material. Asbestos materials are **NOT** to be used in aircraft electrical systems except under circumstances detailed in the following warning.

#### WARNING

The introduction of new products and equipment containing asbestos into the environment is not permitted except where it can be demonstrated clearly that no suitable alternative is available and that the use of the product will not create a risk to health.

#### NOTE

Asbestos has been not been permitted in the manufacture of this wire since 1993 however as it may be impossible to determine the manufacture date of wire fitted to aircraft or held in stock, all wire of this type which has no manufacture date, should be treated as containing asbestos.

3. Where asbestos materials are identified or suspected in aircraft electrical systems, Environmental Health personnel should be contacted to provide advice on appropriate handling procedures. Authorised engineering personnel should then determine the feasibility of replacing the asbestos products with suitable non-asbestos alternatives or, where no alternatives are available, introducing appropriate risk management procedures.

### Specification Sheets

4. Specification Sheets are as follows:

Table 1-D-1 Specification Sheets

Specification No	Title
MIL-DTL-25038/1	Wire, Electrical, High Temperature, Fire Resistant and Flight Critical, Normal Weight, 260°C, 600 Volt. <b>Wire sizes 22 through 12 are inactive for new design. For new design use MIL-W-25038/3.</b>
MIL-DTL-25038/3	Wire, Electrical, High Temperature, Fire Resistant and Flight Critical, Light Weight, Small Diameter, 260°C, 600 Volt.

**Part Number**

5. Part numbers under this specification are coded as in the following example:

*Table 1-D-2 Part Number Coding*

<b>M25038/3</b>	<b>- 22</b>	<b>- 9</b>
Specification Sheet (para 2)	Wire Size (AWG)	Insulation Colour Code (para 4)
Note: For M25038/3, add 'H' to the part number for heavier wall construction.		

**Colour Chart**

6. The colour coding is as follows:

*Table 1-D-3 Colour Code*

<b>Colour</b>	<b>Number Designator</b>	<b>Colour</b>	<b>Number Designator</b>
Black	0	Green	5
Brown	1	Blue	6
Red	2	Violet (Purple)	7
Orange	3	Grey (Slate)	8
Yellow	4	White	9



# MIL-W-7072 WIRE, ELECTRIC, 600 VOLT, ALUMINIUM, AIRCRAFT, GENERAL SPECIFICATION

**(CANCELLED)**

## Scope

1. This specification covers 600 volt insulated single aluminium conductors capable of continuous operation at a maximum conductor temperature of 105°C (221°F). This wire is suitable for use in aircraft using any combination of electrical loading and ambient temperatures providing that the maximum conductor temperature is not exceeded.

**NOTE**

This specification and specification sheet were cancelled without replacement in May 1997 and September 1996 respectively. The details below are retained for information purposes only and may be useful when selecting replacement copper wire.

## Specification Sheet

2. Specification Sheet is as follows:

*Table 1-E-1 Specification Sheet*

Specification No	Title
MS25191	Wire, Electric, 600 Volt, Aluminium, Aircraft

## Part Number

3. Part numbers under this specification are coded as in the following example:

*Table 1-E-2 Part Number Coding*

<b>M25191</b>	<b>- 01</b>	<b>B</b>
Specification Sheet (para 2)	Wire Size (para 4)	Insulation Material (para 5)

**Wire Size**

4. The conductor size is indicated as follows:

*Table 1-E-3 Wire Size*

Number	Wire Size (AWG)
8	8
6	6
4	4
2	2
1	1
01	0
02	00
03	000
04	0000

**Insulation Material**

5. **B** – Primary insulation is Polyvinyl Chloride (PVC) with a secondary insulation of Glass Fibre braid impregnated with Nylon finisher. Outer layer is Nylon Fiber Braid impregnated with Nylon finisher.

## NEMA WC 27500 STANDARD FOR AEROSPACE AND INDUSTRIAL ELECTRICAL CABLE

### Scope

1. This standard contains requirements for finished cables. The component wires are covered by other referenced standards. These cables are intended for signal and low voltage power applications with defined environment or temperature conditions found in commercial aircraft and high performance vehicles.

### Classification

1. The cable shall be constructed as follows:

*Table 1-F-1 Classification*

Type	Description
Unjacketed	2 to 15 colour coded wires, spirally laid without an overall outer jacket.
Jacketed	2 to 15 colour coded wires, spirally laid with an overall outer jacket.
Shielded	A single wire or 2 to 15 colour coded wires spirally laid, with one or two overall shields.
Shielded and Jacketed	A single wire or 2 to 15 colour coded wires spirally laid, with one or two shields and one or two jackets.

### Cable Designation

2. Cable shall be identified by a combination of digits and letters (not exceeding 16) in accordance with the following example.

*Table 1-F-2 Cable Part Number Breakdown*

M27500	-	22	SD	3	T	23
Identification Number	Identification method of cable wire (See Note)	Wire Size (AWG)	Basic wire Specification (Table 1-F-3)	Numbers of Wires	Shield (Table 1-F-4)	Jacket (Table 1-F-5)
Note: Refer to NEMA WC 27500.						

Table 1-F-3 Basic Wire Specification

Symbol	Wire Specification
TE	MIL-W-22759/16
JF	MIL-DTL-25038/3
MH	MIL-W-81044/9
MV	MIL-DTL-81381/10
SB	MIL-W-22759/32
SD	MIL-W-22759/34
SP	MIL-W-22759/43
Note: Refer to NEMA WC 27500	

Table 1-F-4 Shield Identification

Symbol	Shield Material
U	No Shield
T	Tin Coated Copper, 150°C (single shield)
S	Silver Coated Copper, 200°C (single shield)
N	Nickel Coated Copper, 260°C (single shield)
V	Tin Coated Copper, 150°C (double shield)
W	Silver Coated Copper, 200°C (double shield)
Y	Nickel Coated Copper, 260°C (double shield)
Note: Refer to NEMA WC 2750.	

Table 1-F-5 Jacket Identification

Symbol	Jacket Material
00	No Jacket
02	Extruded Clear Nylon, 105°C (single jacket)
05	Extruded Clear FEP, 200°C (single jacket)
06	Extruded White PTFE, 260°C (single jacket)
23	White, Crosslinked, Extruded ETFE, 200°C (single jacket)
52	Extruded Clear Nylon, 105°C (double jacket)
55	Extruded Clear FEP, 200°C (double jacket)
56	Extruded White PTFE, 260°C (double jacket)
Note: Refer to NEMA WC 2750.	

**Identification of Cable Wire**

3. The insulation color of wires used within the cable shall be as detailed in Table 1-F-6 or Table 1-F-7. Table 1-F-6 details the color coding of wires, ie. White wire with a colored stripe, which is the current preferred method, and would normally be used when installing a new cable into an aircraft during modification etc. Table 1-F-7 details the optional color coding of wires, ie. Solid color wires, which is the method used to identify cable wires currently fitted too many aircraft and should be used when repairing or replacing these existing cables.

Table 1-F-6 Preferred Cable Identification Method

No of Wires in Cable	Identification Colors for Respective Wires in Cable														
	Wire Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	White														
2	White	Blue													
3	White	Blue	Orange												
4	White	Blue	Orange	Green											
5	White	Blue	Orange	Green	Red										
6	White	Blue	Orange	Green	Red	Black									
7	White	Blue	Orange	Green	Red	Black	Yellow								
8	White	Blue	Orange	Green	Red	Black	Yellow	Violet							
9	White	Blue	Orange	Green	Red	Black	Yellow	Violet	Gray						
10	White	Blue	Orange	Green	Red	Black	Yellow	Violet	Gray	Brown					
11	White	Blue	Orange	Green	Red	Black	Yellow	Violet	Gray	Brown	Blue/Blue				
12	White	Blue	Orange	Green	Red	Black	Yellow	Violet	Gray	Brown	Blue/Blue	Orange/Orange			
13	White	Blue	Orange	Green	Red	Black	Yellow	Violet	Gray	Brown	Blue/Blue	Orange/Orange	Green/Green		
14	White	Blue	Orange	Green	Red	Black	Yellow	Violet	Gray	Brown	Blue/Blue	Orange/Orange	Green/Green	Red/Red	
15	White	Blue	Orange	Green	Red	Black	Yellow	Violet	Gray	Brown	Blue/Blue	Orange/Orange	Green/Green	Red/Red	Black/Black

Note: For cables with 2 to 10 conductors, the wire insulation shall be white with a single colored spiral stripe.  
For cables with more than 10 conductors, the wire insulation for conductors 11 to 15 shall be white with double spiral stripes.  
(Blue/Blue indicates a white base wire with double blue stripes).

Table 1-F-7 Optional Cable Identification Method

No of Wires in Cable	Identification Colors for Respective Wires in Cable														
	Wire Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	White														
2	Red	Blue													
3	Red	Blue	Yellow												
4	Red	Blue	Yellow	Green											
5	Red	Blue	Yellow	Green	White										
6	Red	Blue	Yellow	Green	White	Black									
7	Red	Blue	Yellow	Green	White	Black	Brown								
8	Red	Blue	Yellow	Green	White	Black	Brown	Orange							
9	Red	Blue	Yellow	Green	White	Black	Brown	Orange	Violet						
10	Red	Blue	Yellow	Green	White	Black	Brown	Orange	Violet	Gray					
11	Red	Blue	Yellow	Green	White	Black	Brown	Orange	Violet	Gray	Red/ White				
12	Red	Blue	Yellow	Green	White	Black	Brown	Orange	Violet	Gray	Red/ White	Blue/ White			
13	Red	Blue	Yellow	Green	White	Black	Brown	Orange	Violet	Gray	Red/ White	Blue/ White	Yellow/ White		
14	Red	Blue	Yellow	Green	White	Black	Brown	Orange	Violet	Gray	Red/ White	Blue/ White	Yellow/ White	Green/ White	
15	Red	Blue	Yellow	Green	White	Black	Brown	Orange	Violet	Gray	Red/ White	Blue/ White	Yellow/ White	Green/ White	Black/ White

Note: For cables with 1 to 10 conductors, the wire insulation shall be a solid color.  
For cables with more than 10 conductors, the wire insulation for conductors 11 to 15 shall be a solid color with a stripe.  
(Red/White – solid red insulation with a white stripe).

## MIL-DTL-81381 WIRE, ELECTRIC, POLYIMIDE INSULATED, COPPER OR COPPER ALLOY (KAPTON)

### Scope

1. This specification covers polyimide-insulated single conductor electric wires made with silver coated or nickel coated conductors of copper or copper alloy, as specified in the applicable specification sheet. The polyimide insulation may be used alone or in combination with other insulation materials.

### Specification Sheets

2. Specification Sheets are as follows:

*Table 1-G-1 Specification Sheets*

Specification No	Title
MIL-DTL-81381/7	Wire, Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Silver Coated Copper, 600 Volt, 200°C. Nominal 5.8 Mil Wall.
MIL-DTL-81381/8	Wire, Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Nickel Coated Copper, 600 Volt, 200°C. Nominal 5.8 Mil Wall.
MIL-DTL-81381/9	Wire, Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Silver Coated High Strength Copper Conductor, 600 Volt, 200°C. Nominal 5.8 Mil Wall.
MIL-DTL-81381/10	Wire, Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Nickel Coated High Strength Copper Conductor, 600 Volt, 200°C. Nominal 5.8 Mil Wall.
MIL-DTL-81381/11	Wire, Electric, Fluorocarbon/Polyimide Insulated, Medium Weight, Silver Coated Copper Conductor, 600 Volt, 200°C. Nominal 8.4 or 15.4 Mil Wall.
MIL-DTL-81381/12	Wire, Electric, Fluorocarbon/Polyimide Insulated, Medium Weight, Nickel Coated Copper Conductor, 600 Volt, 200°C. Nominal 8.4 or 15.4 Mil Wall.
MIL-DTL-81381/13	Wire, Electric, Fluorocarbon/Polyimide Insulated, Medium Weight, Silver Coated High Strength Copper Alloy Conductor, 600 Volt, 200°C. Nominal 8.2 or 8.4 Mil Wall.
MIL-DTL-81381/14	Wire, Electric, Fluorocarbon/Polyimide Insulated, Medium Weight, Nickel Coated High Strength Copper Alloy Conductor, 600 Volt, 200°C, Nominal 8.2 or 8.4 Mil Wall.
MIL-DTL-81381/17	Wire, Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Silver Coated Copper Conductor. 600 Volt, 200°C. Nominal 4.6 Mil Wall.
MIL-DTL-81381/18	Wire, Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Nickel Coated Copper Conductor, 600 Volt, 200°C. Nominal 4.6 Mil Wall.
MIL-DTL-81381/19	Wire, Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Silver Coated, High Strength Copper Alloy Conductor, 600 Volt, 200°C. Nominal 4.6 Mil Wall.
MIL-DTL-81381/20	Wire, Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Nickel Coated, High Strength Copper Alloy Conductor, 600 Volt, 200°C. Nominal 4.6 Mil Wall.
MIL-DTL-81381/21	Wire, Electric, Fluorocarbon/Polyimide Insulated, Light Weight, Tin Coated Copper Conductor, 600 Volt, 150°C. Nominal 5.8 Mil Wall.
MIL-DTL-81381/22	Wire, Electric, Fluorocarbon/Polyimide Insulated, Medium Weight, Tin Coated Copper Conductor, 600 Volt, 150°C. Nominal 8.4 or 15.4 Mil Wall.

**NOTE**

Polyimide based wiring insulation (commonly known by the Du Pont trade name KAPTON) exhibits a property known as flashover or arc tracking. For this phenomenon to occur, damaged insulation, a conductive path to ground and sufficient voltage and source current capability to sustain arcing are required. When these conditions exist, an arc is produced which converts the insulation to a conductive carbon residue. Additionally, Polyimide insulation is prone to radial cracking which results from hydrolytic degradation in humid environments, and also a property known as memory effect where, after installation, the wire tends to regain its original manufactured lay (ie coiled on a spool). For these reasons, the use of polyimide-insulated wiring in aircraft should be avoided. (Refer to Table 1-G-4 for alternate wires).

**Part Number**

3. Part numbers under this specification are coded as in the following example:

*Table 1-G-2 Part Number Coding*

<b>M81381/7</b>	<b>22</b>	<b>9</b>
Specification Sheet (para 2)	Wire Size (AWG)	Insulation Colour Code (para 4)

**Colour Chart**

4. The colour coding is as follows:

*Table 1-G-3 Colour Code*

Colour	Number Designator	Colour	Number Designator
Black	0	Green	5
Brown	1	Blue	6
Red	2	Violet (Purple)	7
Orange	3	Grey (Slate)	8
Yellow	4	White	9



**Cross Reference of Kapton to Non-Kapton Insulated Wires**

5. When selecting a replacement wire, consideration must be given to the specific application and end use. Table 1-G-4, below, provides a direct equivalent for a Kapton wire, however this wire may not be the most appropriate or cost effective option in all applications.

*Table 1-G-4. Equivalent Non-Kapton Insulated Wires*

<b>KAPTON</b>	<b>NON-KAPTON</b>
M81381/7	M22759/44
M81381/8	M22759/45
M81381/9	M22759/33
M81381/10	M22759/46
M81381/11	M22759/43
M81381/12	M22759/41
M81381/13	M22759/35
M81381/14	M22759/42
M81381/17	M22759/44
M81381/18	M22759/45
M81381/19	M22759/33
M81381/20	M22759/46
M81381/21	M22759/32
M81381/22	M22759/34

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## MIL-C-85485 CABLE, ELECTRIC, FILTER LINE, RADIO FREQUENCY ABSORPTIVE

### Scope

1. This specification covers the requirements for radio frequency absorptive component wires and finished cables that function electrically as distributed low-pass filters.

### Specification Sheets

2. Specification Sheets are as follows:

*Table 1-H-1 Specification Sheets*

Specification No	Title
MIL-C-85485/5	Cable, Electric, Filter Line, Component Wire, Tin-Coated Copper Conductor, Radio Frequency Absorptive, 150°C, 600 Volt.
MIL-C-85485/6	Cable, Electric, Filter Line, Component Wire, Silver-Coated High Strength Copper Alloy Conductor, Radio Frequency Absorptive, 150°C, 600 Volt.
MIL-C-85485/7	Cable, Electric, Filter Line, Unshielded, Unjacketed, Multiple-Component, Radio Frequency Absorptive, 150°C, 600 Volt.
MIL-C-85485/8	Cable, Electric, Filter Line, Shielded, Jacketed, Radio Frequency Absorptive, 150°C, 600 Volt.
MIL-C-85485/9	Cable, Electric, Filter Line, Component Wire, Tin-Coated Copper Conductor, Radio Frequency Absorptive, 150°C, 600 Volt.
MIL-C-85485/10	Cable, Electric, Filter Line, Component Wire, Silver-Coated High Strength Copper Alloy Conductor, Radio Frequency Absorptive, 150°C, 600 Volt.
MIL-C-85485/11	Cable, Electric, Filter Line, Unshielded, Unjacketed, Multiple-Component, Radio Frequency Absorptive, 150°C, 600 Volt.
MIL-C-85485/12	Cable, Electric, Filter Line, Shielded, Jacketed, Radio Frequency Absorptive, 150°C, 600 Volt.

### Part Number

3. Part numbers under this specification are coded as in the following example:

*Table 1-H-2 Component Wire*

<b>M85485</b>	<b>/5</b>	<b>- 22</b>	<b>- 7L</b>
Basic Specification	Specification Sheet	Wire Size	Color Code

*Table 1-H-3 Finished Cable*

<b>M85485</b>	<b>/8</b>	<b>- 22</b>	<b>U</b>	<b>3</b>	<b>A</b>
Basic Specification	Specification Sheet (para 2)	Wire Size (AWG)	Construction (Tables 1-H-4 & 1-H-5)	Number of Component Wires	Color Code Designator (Table 1-H-6)

*Table 1-H-4 Shielded, Jacketed Cable Construction*

<b>Letter Code</b>	<b>Conductor Type</b>	<b>Shield Type</b>
T	Tin Coated Copper	Tin Coated Copper
S	Silver Coated Copper	Silver Coated Copper
N	Nickel Coated Copper	Nickel Coated Copper
M	Silver Coated High Strength Copper Alloy	Silver Coated High Strength Copper Alloy
P	Nickel Coated High Strength Copper Alloy	Nickel Coated High Strength Copper Alloy
U	Silver Coated High Strength Copper Alloy	Tin Coated Copper
V	Silver Coated High Strength Copper Alloy	Silver Coated Copper
W	Nickel Coated High Strength Copper Alloy	Nickel Coated Copper
Note: Refer to MIL-C-85485 or publication sponsor for full details.		

*Table 1-H-5 Unshielded, Unjacketed Cable Construction*

<b>Letter Code</b>	<b>Conductor Type</b>
T	Tin Coated Copper
S	Silver Coated Copper
N	Nickel Coated Copper
M	Silver Coated High Strength Copper Alloy
P	Nickel Coated High Strength Copper Alloy
Note: Refer to MIL-C-85485 or publication sponsor for full details.	

**Colour Chart**

4. The color of the first component wire shall be light violet, designated by 7L. Any additional component wires shall be light violet with a colored stripe as per Table 1-H-6.

*Table 1-H-6 Cable Colour Designation*

<b>Component Wire Number</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Wire Insulation Base Color</b>	Light Violet	Light Violet	Light Violet	Light Violet	Light Violet	Light Violet	Light Violet
<b>Stripe Color</b>	N/A	Blue	Orange	Green	Red	Black	Yellow
Note: Refer to MIL-C-85485 or publication sponsor for full details.							

## CURRENT RATINGS OF WIRE AND MAXIMUM ALLOWABLE NICKED OR BROKEN STRANDS

*Table 1-I-1 Current Rating Of Wires In Amps (SAE AS 50881)*

Conductor Material	Wire Size	Wires in Bundles, Groups or Harnesses (Note 1)			Wire in Free Air & Ambient 70°C (Note 2)		
		Wire Temp Rating			Wire Temp Rating		
		105°C	150°C	200°C	105°C	150°C	200°C
Copper or Copper Alloy	22	3	5	6	9	12.5	16
	20	4	7	9	11	17	21
	18	6	9	12	15	22.5	28
	16	7	11	14	17	26	33
	14	10	14	18	23	35	44
	12	13	19	25	31	47	60
	10	17	26	32	41	62	78
	8	38	57	71	64	90	125
	6	50	76	97	82	125	
	4	68	103	133	110	170	
	2	95	141	179	155		
	1	113	166	210	185		
	1/0	128	192	243	210		
	2/0	147	222	285	240		
3/0	172	262	335	276			
4/0	204	310	395	340			
Aluminium	8	30	45				
	6	40	61				
	4	54	82				
	2	76	113				
	1	90	133				
	1/0	102	153				
	2/0	117	178				
	3/0	138	209				
4/0	163	248					
Notes:							
1	Rating for 70°C ambient, 33 or more wires in harness with no more than 20% harness current capacity being used at operating altitude of 60,000 ft.						
2	Rating of wires in FREE air at ambient temperature of 70°C.						

**AC 21-99 Aircraft Wiring and Bonding**  
**Annex I to Sect 2 Chap 1**

*Table 1-1-2 Maximum Allowable Nicked Or Broken Strands (SAE AS 50881)*

<b>Conductor Material</b>	<b>Number of Strands per Conductor</b>	<b>Total Allowable Nicked and Broken Strands</b>
Copper or Copper Alloy	19	2 nicked, none broken
	37	4 nicked, none broken
	Above 37	6 nicked or broken
Aluminium	All numbers of strands	None nicked or broken

## WIRE GAUGE COMPARISON

*Table 1-J-1 Wire Gauge Comparison*

Wire Gauge Number	American Wire Gauge (AWG)		Standard Wire Gauge (UK) (SWG)	
	Conductor Diameter (Inches) [Note 1]	Conductor Area (Circular Mils) [Note 2]	Conductor Diameter (Inches) [Note 1]	Area (Circular Mils) [Note 2]
26	0.020	304	0.018	289
24	0.025	475	0.022	419
22	0.031	754	0.028	661
20	0.039	1216	0.041	1156
18	0.049	1900	0.051	1825
16	0.055	2426	0.060	2645
14	0.069	3831	0.072	3553
12	0.089	5874	0.090	5781
10	0.113	9354	0.113	9120
8	0.173	16983	0.173	17683
6	0.217	26818	0.192	26316
4	0.274	42614	0.268	42642
2	0.340	65500	0.338	67516
0	0.425	104500	0.421	103050
00	0.475	133000	0.477	131479

**Notes:**

- 1 Wire diameters and areas are listed for the equivalent wire gauge number. The actual diameter and area of the conductor in an aircraft wire will vary due to the stranding and plating used. Refer to the appropriate military specification or the publication sponsor for exact dimensions.
- 2 A circular mil is the cross-sectional area of a circular conductor having a diameter of 1 mil (0.001 inch). The circular mil area (CMA) of a conductor is calculated by squaring the diameter (in mils) of the circular conductor. Thus, a wire having a diameter of 4 mils (0.004 inch) has a CMA of 4<sup>2</sup>, or 16 circular mils. If the conductor is stranded, the CMA for the conductor is calculated by multiplying the CMA of the strand by the number of strands.
- 3 Details of terminal lugs and splices and associated tooling are contained in Section 2, Chapter 6.

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