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Aircraft — Hand-or power-activated crimping tools and accessories —

Part 1:
General requirements

Aéronefs — Outils de sertissage manuels ou mécaniques et accessoires —

Partie 1: Exigences générales

ICS 49.060

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Foreword

ISO (the International Organisation for Standardisation) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organisations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardisation.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11373-1 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*

ISO 11373 is published in the following parts:

ISO 11373-1, Technical specification

ISO 11373-2, List of product standards

ISO 11373-3, Type 1 tools - Product standard

ISO 11373-4, Type 2 tools - Product standard

ISO 11373-5, Type 3 tools - Product standard

ISO 11373-6, Accessories - Product standard

Introduction

This specification has been derived from MIL-DTL-22520G.

Throughout this International Standard, the minimum essential criteria are identified by the use of the key word “shall”. Recommended criteria are identified by the use of the key word “should”, and while not mandatory are considered to be of primary importance in providing serviceable, economical and practical connectors. Deviation from the recommended criteria should occur only after careful consideration, extensive testing and thorough service evaluation have shown alternative methods to be satisfactory.

Specific requirements of relevance to, and applicable only to, the military forces of a single nation e.g. USA, should be ignored in the context of this International Standard.

Descriptors: Connectors, electrical, contacts, dies, end caps, ferrules, gauges, inspection, positioners, splices, terminals, turret, cable, electrical

Aircraft — Hand-or power-activated crimping tools and accessories —

Part 1:
General requirements

1 Scope

1.1 Scope

This specification covers the general requirements for crimping tools, accessories and inspection gauges used for connecting removable contacts (such as; signal, power, coaxial, shielded, thermocouple, and filter pin contacts) coaxial connectors, shielded connectors, ferrules, terminals, end caps and splices to cable conductors for use in electrical connectors, terminal junction systems, and other electrical or electronic components. It shall apply to civil as well as military aircraft.

1.2 Classification

Crimping tools covered by this specification are of the following types:

- Type I - Tools that produce an indent termination ;

- Type II - Tools that produce a formed termination ;

- Type III - Tools that produce a compression termination.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 11373-2, *Aircraft — Crimping tools and accessories, hand or power activated — Part 2 : List of product standards*

ISO/TR 224:1998, *Aircraft — Declaration of design and performance for aircraft equipment — Standard form*

QQ-W-343, *Wire, electrical, copper (Uninsulated)* [1)]

MIL-T-7928, *Terminals, lug splices, conductor, crimp style, copper, General specification for* [1)]

MIL-W-22759, *Wire, electric, fluoropolymer-insulated, copper or copper alloy* [1)]

MIL-W-81044, *Wire, electric, crosslinked polyalkene, crosslinked alkane iImide polymer, or polyarlene insulated, copper or copper alloy* [1)]

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1) available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

ISO 2635, *Aircraft - Conductors for general purpose aircraft electrical cables and aerospace applications - Dimensions and characteristics*.

MIL-S-81824, *Splice, electric, permanent, crimp style, copper, insulated, environment resistant* [1)]

MIL-W-16878, *Wire, electrical, insulated, General specification for* [1)]

MIL-STD-202, *Test methods for electronic and electrical component parts* [1)]

ASTM-B16, *Rod, brass, bar, and shapes for use in screw machines (Metric)* [4)]

ASTM-B133, *Copper, rod, bar, and shapes (Metric)* [4)]

ASTM-B272, *Copper flat products with finished (rolled or drawn) edges (flat wire and strip)* [4)]

ASQC-Z1.4, *Procedures, sampling and tables for inspection by attributes* [5)]

SAE-AIR1351, *Aerospace electrical & electronic wiring, devices and accessories, manufacturers' identification of* [6)]

3 Requirements

3.1 Product standard

The individual item requirements shall be as specified herein and in accordance with the applicable product standard (see ISO 11373-2). In the event of any conflict between the requirements of this specification and the product standard, the latter shall govern.

3.2 Qualification

3.2.1 Tools furnished under this specification shall be products that are certified by the manufacturer as meeting this specification and the associated product standard. Evidence of qualification shall be provided in the form of a declaration of design and performance in the format specified in ISO/TR 224:1998.

3.2.1 Part numbers shall not be applied to a product, except for qualification test samples (see 4.3), until qualification and acceptance testing has been completed and certified.

3.3 Materials

3.3.1 General

Materials shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the tools to meet the performance and interface requirements of this specification and the applicable product standard. Acceptance or approval of any constituent material shall not be construed as a guarantee of the acceptance of the finished product.

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2) available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392.)

3) available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

4) available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, Pa. 19428-2950.)

5) available from the American Society For Quality Control P.O. Box 3005, 611 E. Wisconsin Avenue, Milwaukee, Wisconsin 53201-4606).

6) available from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.)

3.3.2 Finish

Aluminium parts shall be anodized in accordance with an anodizing process that meets the performance requirements specified in clause 3.5 of this specification. All other metal parts shall be made of corrosion-resistant material or protected to meet the performance requirements of this specification. Colour shall be as specified on the applicable product standard. Cadmium plating shall not be used.

3.3.3 Dissimilar metals

When dissimilar metals are employed in intimate contact with each other, protection against electrolytic corrosion shall be provided.

3.4 Design and construction

3.4.1 General

Tools and accessories shall be in accordance with the applicable product standard.

3.4.2 Crimping operation

3.4.2.1 Type I tools

When the tool is in the fully opened position, the contacts shall pass freely between the indenters, both before and after being crimped. All indenters shall be designed to travel with equal and simultaneous movement. The motion and dimensional configuration shall be specified in the applicable product standard. The tool design shall provide for positive closed positioning for the indenters. The indenter closure selector shall have a positive detent at each setting. The tool shall be designed such that they can meet specified closure with or without positioners or turrets installed. All positioners and turrets shall provide positive location of cable barrels for crimping for specified contacts.

3.4.2.2 Type II tools.

3.4.2.2.1 The crimping operation shall be accomplished by the closure of a set of dies with the specified configuration (see 3.1). The movement of the opposing crimp dies shall be perpendicular or radial to the mating die face, and the fully closed position shall be as specified on the applicable product standard.

3.4.2.2.2 Locator. When required (see 3.1), a locating device shall be incorporated on the crimping dies or crimping tools for positioning the item to be crimped in the proper location prior to the initiation of the crimp cycle.

3.4.2.3 Type III tools

Operation of the tool shall be in accordance with the individual product standard.

3.4.3 Tool malfunction

3.4.3.1 All tools shall be provided with a return mechanism and a full cycling mechanism that shall not jam or malfunction if operated with or without a contact or connector, and with or without a positioner, turret, or die. Any tool operation within the scope of this specification shall neither create a jammed mechanism nor impair the function of the tool. Metal particles from operation of the tool or the crimping operation shall not accumulate within the tool where they would contribute to or cause any malfunction of the tool mechanism.

3.4.3.2 Full cycle mechanism. The full cycle mechanism shall be tamper-proof so that it cannot be disengaged prior to or during the crimp cycle.

3.4.4 Removal of crimped parts

The crimped assembly shall be removed from the tool without impediment upon completion of the crimping operation

3.4.5 Calibration

Tool calibration adjustments shall be accessible only when the tool is disassembled. These adjustments shall be made only by the manufacturer or by an approved calibration laboratory.

3.4.6 Gauges

3.4.6.1 Inspection gauges. The required "GO" and 'NO-GO' gauges shall be made available by the tool manufacturer for performing the qualification and conformance inspection gauging tests specified herein. These gauges shall conform to the gauging limits specified on the applicable tool product standard.

3.4.6.2 In-service gauges. The gauges to be supplied for maintenance use shall be in accordance with the gauge product standard specified on the applicable tool product standard.

3.5 Performance

3.5.1 General

Tools shall meet the test requirements of this specification.

a) Type I tools. Type I tools shall crimp cable barrels and other electrical connector contacts to cables as specified in the applicable component specification.

b) Type II tools. Type II tools shall crimp terminal splices, end caps, shielded or coaxial contacts, coaxial connectors, ferrules and other connecting devices to wires or cables as specified in the applicable product standard.

c) Type III tools. Type III tools shall meet the requirements as specified in the applicable product standard.

3.5.2 Gauging

Tools shall meet the gauging limits specified in the applicable product standard when tested in accordance with 4.7.1.

3.5.3 Humidity (steady state)

There shall be no damage to basic tools, turrets, positioners, or dies to impair operation when tested in accordance with 4.7.2.

3.5.4 Handle indenter and die return operation (full cycle)

The return mechanism shall compel the handles, indenters, and dies to automatically return to the fully open position when tested in accordance with 4.7.3. This requirement shall apply regardless of the plane or position of the tool, with or without a wired assembly located in the tool.

3.5.5 Ratcheting mechanism

3.5.5.1 Type I tools

The ratchet shall hold above the 'NO-GO' limit of the applicable product standard when tested in accordance with 4.7.4.1.

3.5.5.2 Type II tools

When tested in accordance with 4.7.4.2, the opposing die faces shall meet and the dies shall fully close before the ratchet releases. The force required to release the ratchet mechanism shall be not less than 133,45 N and shall be not more than 222,4 N.

3.5.5.3 Type III tools

Type III tool operation shall be in accordance with the applicable product standard.

3.5.6 High compression force

Type I and type II tools shall conform to the gauging requirement of 3.5.2, after being subjected to a 667,2 N compression force in accordance with 4.7.5. High compression force, if required, for type III shall be in accordance with the applicable product standard.

3.5.7 Compression force

The force required to complete the cycle of the tool shall not exceed the value specified on the applicable product standard when tested in accordance with 4.7.6.

3.5.8 Deformation of crimped connection

3.5.8.1 Type I tools

The out-of-roundness of the crimped cable barrel shall be not greater than the specified maximum diameter of the barrel by more than 0,05 mm for sizes smaller than size 20 or by more than 0,15 mm for size 20 and larger cable barrels when measured as specified in 4.7.7. 1.

3.5.8.2 Type II tools

The crimped connection shall be symmetrical to ensure that the component shall function as required when examined as specified in 4.7.7.2.

3.5.8.3 Type III tools

Deformation requirements shall be in accordance with applicable product standard, if applicable.

3.5.9 Cracking of crimped connection

There shall not be any cracks penetrating the plating (or insulation, if applicable) and exposing the basis metal as a result of crimping, when tested as specified in 4.7.8.

3.5.10 Concentricity (straightness)

3.5.10.1 Type I tools

The position of the outside diameter of the contact after being crimped shall be not greater than 0,305 mm (relative to measured contact diameter) of the OD as manufactured for sizes 12 and 16 contacts and 0,0279 mm (relative to measured contact diameter) for size 20 and smaller contacts, when measured as specified in 4.7.9.1. This includes the 0,13 mm permitted during contact manufacturing. This test shall be waived for stamped and formed contacts or contacts whose configuration does not allow testing with measuring equipment (see figure 3).

3.5.10.2 Type II tools

The crimped cable assembly shall be straight to ensure that the component shall function as required when examined as specified in 4.7.9.2.

3.5.10.3 Typed III tools

Requirements for straightness shall be in accordance with the applicable product standard.

3.5.11 Voltage drop

3.5.11.1 Type I tools

The voltage drop across the crimped joint shall be not greater than the value specified in table 1 when tested as specified in 4.7.10.1.

3.5.11.2 Type II tools

The voltage drop shall meet the requirements of the specification to which the crimped item is qualified. If the component specification does not specify the voltage drop, the values specified in table m shall apply when tested as specified in 4.7.10.2.

3.5.11.3 Type III tools

Voltage drop shall be in accordance with the applicable product standard.

3.5.12 Tensile strength

When tested in accordance with 4.7.11, the cable shall not break at, or pull out of, the crimped joint. The connection shall not break or become distorted to the extent that it is unfit for further use before the minimum tensile strength is reached as specified in tables 2 and 3.

3.5.13 Dielectric strength for Type II tools

When applicable (see 3.1), the insulation on terminals, splices, ferrules and end caps shall show no evidence of damage, arcing, or breakdown, when tested in accordance with 4.7.12.

3.5.14 Low temperature crimp

There shall be no binding of the tool handles, indenters, dies, or crimped wired assemblies when tested as specified in 4.7.13. The wired assemblies shall then meet the requirements of 3.5.11 and 3.5.12.

3.5.15 Shock

Crimping tools, turrets. positioners, or dies shall not be damaged as a result of the shock test of 4.7.14.

Table 1 — Voltage drop for type I tools (AWG wire only)

Cable size range test current (A)		Maximum voltage drop	
		Silver-or tin-plated copper cable (mV)	Nickel-plated copper cable (mV)
000	225,0	6,0	N/A
00	185,0	8,0	N/A
0	150,0	3,0	N/A
2	N/A	N/A	N/A
4	80,0	4,0	N/A
6	60,0	4,5	N/A
8	46,0	5,0	N/A
10	33,0	4,0	N/A
12	23,0	3,0	14,0
14	17,0	3,5	13,5
16	13,0	3,5	16,0
20	7,5	4,0	15,5
22	5,0	4,0	22,5
24	3,0	4,0	15,5
26	2,0	4,0	17,0
28	1,5	5,0	18,5
30	1,0	6,0	21,0
32	0,5	8,0	19,0

Table 1A — Voltage drop for type I tools (IWG wire only)

Cable size range test current (A)		Maximum voltage drop	
		Silver-or tin-plated copper cable (mV)	Nickel-plated copper cable (mV)
I10	33,0	4.0	TBD
I12	23,0	3.0	14.0
I14	17,0	3.5	13.5
I16	13,0	3.5	16.0
I20	7,5	4.0	15.5
I22	5,0	4.0	22.5
I24	3,0	4.0	15.5
I26	2,0	4.0	17.0
I28	1,5	5.0	18.5