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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Aircraft — Nickel-chromium and nickel-aluminium thermocouple extension cables —

Part 2 : Terminations — General requirements and tests

Aéronefs — Câbles de compensation de couples thermoélectriques en nickel-chrome et en nickel-aluminium —

Partie 2 : Raccordements — Exigences générales et essais

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Foreword

ISO (the International Organization for Standardization) 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 organizations, 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 standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Aircraft — Nickel-chromium and nickel-aluminium thermocouple extension cables —

Part 2 :
Terminations — General requirements and tests

0 Introduction

This International Standard on nickel-chromium and nickel-aluminium thermocouple extension cables for use in aircraft comprises the following four parts :

Part 1 : Conductors — General requirements and tests.

Part 2 : Terminations — General requirements and tests.

Part 3 : Crimp-type ring terminal ends — Dimensions.

Part 4 : Crimp-type butt connectors — Dimensions.

1 Scope and field of application

This part of ISO 8056 specifies the design requirements and tests for the crimping of non-insulated terminations, of nickel-chromium or nickel-aluminium alloy, to the standard flexible conductors of nickel-chromium or nickel-aluminium thermocouple extension cables, respectively, in such a manner that the thermoelectric integrity and constancy of resistance of a thermocouple circuit are contained within specified limits.

Although the metallic materials used in the crimped joint will be the same for all groups, the limiting temperature of use of the crimped joint is defined by the insulation of the cable and will fall within one of the following groups : 105 °C, 150 °C, 200 °C and 260 °C.

2 Reference

ISO 1966, *Crimped joints for aircraft electrical cables.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 crimped joint : A permanent connection formed by crimping a terminal end or in-line splice of an appropriate thermocouple material, for example nickel-chromium or nickel-aluminium, to its matching conductor.

3.2 terminal end : A connecting device, of an appropriate thermocouple material, with a barrel accommodating the conductor of a thermocouple extension cable, with or without additional provision to accommodate the insulation of the cable. A permanent joint between conductor and terminal is made, and the cable insulation may be secured, by using a crimping tool.

3.3 termination : A terminal end or in-line splice.

3.4 crimping : The physical compression or deformation of a conductor barrel round a conductor to make a mechanical and electrical connection.

3.5 insulation support : That part of a terminal barrel into which the insulation of the cable is inserted and that, by re-forming, supports the insulation.

3.6 crimping tool : A manually operated or power-operated mechanical device for crimping and, where required, re-forming the insulation support.

3.7 positioner : A locator, turret or other device serving to locate and control the position of the crimp on the barrel of the terminal.

3.8 flash : Material of the barrel of a terminal or in-line splice extruded between the edges of the dies in a crimping tool during the crimping operation.

4 Design requirements

4.1 Terminal ends, in-line splices and crimping tools

4.1.1 Terminal ends and in-line splices shall comply with the requirements of the relevant national or International Standard. Strip or bar material used for the manufacture of terminations shall be nickel-chromium or nickel-aluminium alloy having thermoelectric properties against a platinum standard or a nickel-chromium or nickel-aluminium sub-standard. Tools shall be capable of crimping to the requirements of this International Standard.

4.1.2 Terminal ends and in-line splices shall be designed to give a contact resistance compatible with the appropriate matched conductor to which it is crimped.

4.1.3 The design of the terminal end or in-line splice shall make it possible to check whether the cable conductor has been adequately inserted in the completed crimped joint to be checked.

4.1.4 The manufacturer shall make the following information available :

a) terminal ends or in-line splices : limiting dimensions, material specifications, hardness and thermoelectric properties, and the size and types of cable for which they are suitable;

b) associated crimping tools : limiting dimensions, die references and, when applicable, the tool settings, locators, positioners or turrets appropriate to the various combinations of conductors and terminations;

c) an identification code to distinguish nickel-chromium from nickel-aluminium terminations;

d) the proposed method of gauging of the crimping tool.

4.2 Crimped joints

4.2.1 Preparation

Cable ends shall be stripped of insulation in accordance with the manufacturer's recommendation, care being taken not to sever or damage any strands. All insulation shall be removed from the stripped portion of the conductor. After being stripped, the end of the conductor shall be left clean and square. Should the lay of the strands be disturbed, it may be readjusted by twisting slightly. The conductor shall be free from contamination immediately prior to assembly with the termination.

4.2.2 Form

4.2.2.1 Terminal ends and in-line splices shall include a barrel designed so that it will enclose and support the outside of the cable insulation. If the support barrel is deformed during the crimping operation to form an insulation support, the action of the tool shall achieve the conductor crimp and the insulation support in one operation.

4.2.2.2 The joint shall be formed by a tool that will

a) correctly locate and control the position of the crimp on the barrel;

b) not release the termination until the conductor crimp has been correctly formed;

c) apply the appropriate mark (where code marking is used), in accordance with 4.2.5, to indicate the die or tool that has been used;

d) not fracture the terminal end or cause any rough or sharp edges or flash.

4.2.2.3 Tools shall be marked with the manufacturer's name and serial number.

4.2.2.4 The gauging method shall be stated on the approved drawings and provision made for the use of test gauges or test bars.

4.2.3 Dimensions

The overall dimensions of the completed joints shall comply with the requirements of the relevant specification.

4.2.4 Strength

The mechanical strength of the completed joints shall fulfil the test requirements specified in clause 5.

4.2.5 Marking

The completed joint should, preferably, be marked to identify the size of crimping tool or die used. The marking code, if used, shall be stated on the approved drawings. Such marking shall be applied during the formation of the crimp and may be embossed or indented.

5 Tests

5.1 General requirements

Tests shall be made to prove compliance with all the requirements of this International Standard. The following three kinds of tests are specified :

— type tests (see 5.2);

— production control tests by manufacturer (see 5.3);

— user's control tests (see 5.4).

NOTE — The type of cable with which a termination is to be used and the tool with which the joint is to be made should be declared in applications for type approval.

5.2 Type tests

5.2.1 Test conditions, test sequence and specimens

5.2.1.1 Test conditions

Unless otherwise specified, all tests shall be performed at a temperature of 20 ± 5 °C at an air pressure of 1 060 mbar max. and at a relative humidity not greater than 75 %. All joints used in the type tests should be stored under these conditions for a period of 48 h before testing.

5.2.1.2 Test sequence and number of specimens

The observation and tests in 5.2.2 to 5.2.4 shall be applied to each and every combination of type size and material of termination barrel, crimped to the appropriate size of conductor of the corresponding material by each type of tool and each size of die, indentor or positioner for which approval is sought.

NOTE — When a particular tool, die or positioner is designed to accommodate a range of crimping barrels, tests need to be made only on the largest and smallest sizes of barrel. If a crimp barrel is designed to accommodate a range of conductor sizes, tests need only be made on the largest and smallest conductor sizes.

Tests shall be made in the order shown in table 1 on sixteen specimens. (A specimen is defined as a length of cable with a similar termination at each end.)

The cables shall be 150 ± 1,5 mm long, measured before crimping between the points where the conductors enter the respective conductor crimping barrels. Specimens shall be numbered on an area not subjected to the crimping operation.

Table 1 — Test sequence and number of specimens for test

Test	Test specimens
Inspection (see 5.2.2)	Nos. 1 to 16
Tensile (as formed) (see 5.2.3.2)	Nos. 1 to 8
Tensile (after thermal shock) (see 5.2.3.3)	Nos. 9 to 16

5.2.2 Inspection

5.2.2.1 The terminal ends or in-line splices and the tools shall be inspected for compliance with the approved drawings. It shall be checked that the cables have been released to the appropriate specification and that stripping has been satisfactorily carried out.

5.2.2.2 Dies or positioners used in forming the crimped joints shall be inspected to ensure that they comply with the approved drawings.

5.2.2.3 All crimped joints shall be visually inspected for the following :

a) correct combination of terminal end or in-line splice and cable conductor in respect of material, size and code identification;

b) correct die mark, where applicable;

c) correctness of form and location of crimp;

d) freedom from fracture, rough or sharp edges, and flash;

e) adequate insertion of all conductor strands in the barrel;

f) absence of damage to the conductor or insulation.

5.2.3 Tensile test

5.2.3.1 Each specimen shall be tested in a suitable tensile testing machine in which an axial pull is applied between the terminations and in which the jaws separate at a steady rate of between 25 and 50 mm/min.

The specimen shall be tested to destruction (i.e. failure at one end) as specified in 5.2.3.2 or 5.2.3.3; the load at failure shall be not less than the minimum for the size of conductor shown in table 2.

5.2.3.2 Specimens Nos. 1 to 8 shall be tested as formed, after conditioning as specified in 5.2.1.1.

5.2.3.3 Specimens Nos. 9 to 16 shall be tested after the following conditioning procedure — specimens shall be transferred immediately from one condition to the next in the sequence :

a) store in an oven at 260 ± 5 °C for not less than 2 h;

b) immerse in iced water and leave for not less than 1 h;

c) transfer to the oven and store at 260 ± 5 °C for not less than 2 h;

d) immerse in iced water and leave for not less than 1 h;

e) transfer to the oven and store at 260 ± 5 °C for not less than 2 h;

f) immerse in iced water and leave for not less than 18 h;

g) transfer to the oven and store at 260 ± 5 °C for not less than 2 h;

h) immerse in iced water and leave for not less than 1 h;

i) transfer to the oven and store at 260 ± 5 °C for not less than 2 h;

j) immerse in iced water and leave for not less than 1 h;

k) allow to regain room temperature and condition as specified in 5.2.1.1.

Damage to the insulation of the cable resulting from exposure to 260 °C shall be disregarded in cables intended for use at a maximum conductor temperature of less than 260 °C.

5.2.4 Insulation support tests

Terminal ends that incorporate an insulation support shall meet the relevant requirement specified in ISO 1966.

5.3 Production control tests (by original equipment manufacturers)

5.3.1 Terminal ends and in-line splices

Samples of each type and size of terminal end or in-line splice to be supplied shall be inspected for compliance with the requirements of 4.1 and with the approved drawings, as agreed with the approving authority.

5.3.2 Tools and dies

All tools and dies to be supplied shall be inspected for compliance with the requirements of 4.2.2.2 and 4.2.2.3 and with the approved drawings.

5.4 Users' control tests

5.4.1 Routine inspection of crimped joints

Every crimped joint shall be visually inspected in accordance with the requirements of 5.2.2.3.

5.4.2 Quality control tests

5.4.2.1 Tools and dies shall be inspected to verify that they comply with the requirements of 4.2.2.2 and 4.2.2.3 and with gauging in accordance with the tool manufacturer's recommendations when any tool or die is used for the first time and subsequently

a) at intervals of 3 months, or at intervals of 1 000 crimps[1] per tool, whichever is the shorter; or

b) when the tool is withdrawn from stores if the tool is stored without use for more than 3 months; or

c) as otherwise agreed with the inspecting authority.

5.4.2.2 Tensile tests in accordance with 5.2.3 shall be carried out on no fewer than four specimens of each and every combination of crimped barrel, conductor, tool, die, indentor or positioner as required by 5.2.1.2.

5.4.2.3 If any specimen fails to fulfil the requirements of these tests, the cause of failure shall be investigated.

Table 2 — Pull-off loads for nickel-chromium and nickel-aluminium terminations crimped to the corresponding conductors

Conductor					Minimum pull-off load for	
Code number	Nominal cross-sectional area mm²	Approximate gauge AWG[1]	Number of strands	Diameter of strands mm	Ni-Cr terminations N	Ni-Ai terminations N
004	0,4	22	19	0,15	130	105
006	0,6	20	19	0,2	225	180
010	1	18	19	0,25	325	260
012	1,2	16	19	0,3	465	370
020	2	14	37	0,25	580	460
030	3	12	37	0,32	940	750
050	5	10	61	0,32	1 280	1 015

1) American Wire Gauge

1) By agreement with the inspecting authority, the interval between inspection may be progressively lengthened to a maximum of 10 000 crimps per tool in the light of experience.

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