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Wrenches and sockets, bi-hexagonal — Technical specification

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ICS 49.030.99

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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This European Standard (EN 3709:2006) has been prepared by the European Association of Aerospace Manufacturers - Standardization (AECMA-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of AECMA, prior to its presentation to CEN.

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1 Scope

This standard specifies the requirements to be complied with by wrenches and double-hex sockets intended for aerospace products.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1174 (all parts), *Assembly tools for screws and nuts — Driving squares.*

ISO 4095, *Aerospace — Bihexagonal drives — Wrenching configuration — Metric series.*

EN 9133, *Aerospace series — Quality management systems — Qualification procedure for aerospace standard parts.*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1
lot
a lot is composed of wrenches or sockets of the same type, originating from the same material defined by the same standard

4 Requirements

4.1 Materials

The materials shall meet the required properties specified in the product standard.

4.2 Physical properties

4.2.1 Surface condition and appearance

The wrenches and sockets shall be free from pits, deposits, forging burrs, cracks, splits, flashes and other defects likely to modify their properties and endurance or to injure users.

The wrench handle shall allow an easy handling and its shape shall permit a correct guiding of the box end. The wrenches and the outer surface of the sockets shall have a polished, brushed or satin-finished appearance with a uniform bright or dull finish.

4.2.2 Surface coating

The surface treatment shall be as specified in the product standard.

4.2.3 Inner profile of teeth

The tooth quality shall allow an optimum efficiency of the bearing faces. The whole tooth (top, flank and bearing faces) shall be free from burrs and high metal.

4.3 Mechanical properties

The integrity and endurance of various types of wrenches are tried by torsional tests whose conditions are defined in Clause 5.

On completion of integrity and endurance tests, the wrenches and sockets shall not show the deteriorations and distortions defined below:

— The tooth shall not be rounded and shall comply with, the requirements specified in 4.2.3;

— The wrench or the socket shall be free from crack;

— The general surface condition shall comply with the requirements of 4.2.1;

— The distortion of the socket and wrench outer diameter shall not exceed 0,05 mm;

— The permanent distortion on the wrench handle shall not exceed 5;

— A Rockwell hardness test shall show values complying with the values specified in the product standard.

4.4 Dimensions and geometric tolerances

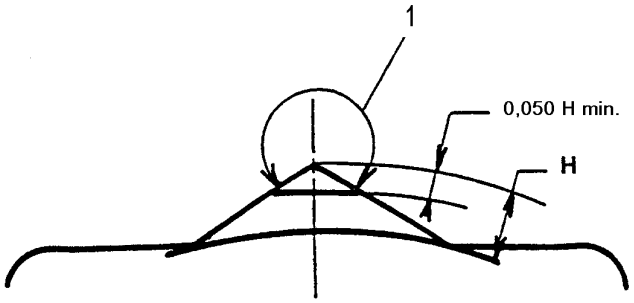
Dimensions and tolerances shall be as specified in the product standard.

5 Test methods

5.1 Test equipment

The wrenches are fitted on a hexagonal test mandrel [1)] whose nominal dimensions shall be equal to the dimensions of the corresponding wrench; machining tolerance h8, minimum hardness 55 HRC (See Figure 1). Dimensions and shapes to ISO 4095.

1) The mandrel is secured to a fixture or a calibrated torquemeter



$H = ½ \text{ nominal dim.} \left(\frac{1}{\cos 30°}\right) - \left(\frac{1}{\cos 15°}\right)$

H = 0,0597 hexagon nominal dim.

Key

1 The wrench teeth shall not seat on this part of the mandrel

Figure 1 — Test equipment

5.2 Test of wrenches

The wrenches shall be fully engaged on the mandrel. During the test, they shall be handled smoothly and without shaking movements.

The load is applied (as far as possible) on the wrench body normal to the centreline, continuously and progressively until a torsional torque corresponding to the tested wrench is obtained.

5.3 Test of socket

The insertion of the socket on the mandrel shall be equal to 0,55 IISM (where "S" is the nominal dimension across flat of the mandrel or of bolt considered) and shall be performed without induced resistance. The socket shall be manually extracted without the contribution of any external tooling. The socket is driven using a square mandrel with a minimum hardness of 55 HRC. The nominal dimension across flat of this mandrel shall be equal to the maximum dimension of the square drive corresponding to ISO 1174, tolerance h8.

5.4 Test performance

The endurance torques specified in Table 1 and Table 2 shall be applied in both directions 1 000 times. Cadence 60 by minute maximum.

An integrity torque of 1,5 times the endurance torque shall be applied every 250th time.

In the case of wrenches each end shall be tested.

Table 1 — Test torques for flat, offset and modified offset double-hex box wrenches

Dimension across flat	Integrity torque Nm	Endurance torque Nm
6	30	20
7	40	27
8	51	34
9	75	50
10	105	70
11	132	88
12	165	110
14	248	155
17	440	235
19	630	315
22	800	400

Table 2 — Test torque for socket wrenches

Dimension across flat	CODE		
	063	100	125
	Endurance and integrity torques Nm	Endurance and integrity torques Nm	Endurance and integrity torques Nm
5	15 / 23	–	–
6	20 / 29	–	–
7	27 / 40	27 / 40	–
8	34 / 51	34 / 51	–
9	50 / 75	50 / 75	–
10	–	77 / 115	77 / 115
11	–	93 / 140	93 / 140
12	–	133 / 200	133 / 200
13	–	186 / 280	186 / 280
14	–	–	240 / 360
15	–	–	300 / 450
16	–	–	360 / 540
17	–	–	400 / 600
18	–	–	433 / 650
19	–	–	453 / 680
20	–	–	453 / 680
21	–	–	453 / 680
22	–	–	453 / 680

6 Qualification and acceptance requirements

6.1 Qualification

6.1.1 Purpose

Purpose of qualification tests is to ensure that, the wrench and/or socket design and manufacturing conditions allow the wrenches or sockets to comply with the requirements of this standard.

6.1.2 Qualification procedure

EN 9133: Requirement for ISO 9000:2000 not applicable.

6.1.3 Conditions

Qualification inspection and tests specified in this document, shall be carried out on each type and size combination for wrenches and on each socket size and drive size according to Table 3 and Table 4.

All or part of these tests may also be performed for production acceptance, when a reinforced inspection seems to be necessary.

6.2 Acceptance

Acceptance tests shall be performed on wrenches or sockets randomly sampled from different manufacturing lots according to Table 5 and Table 6.

7 Marking, labelling and packaging

7.1 Marking

The marking shall be as specified in the product standard.

7.2 Packaging

All wrenches and sockets shall be packed by manufacturers option.

Table 3 — Summary of test qualification and production acceptance

Type of test	Qualification		Production acceptance	
	Clause	Sample size	Clause	Sample size
Dimensions and geometrical tolerances	4-4	5	4-4	Table 5
Mechanical properties	4-3	4	–	–
Surface condition and appearance	4-2-1	5	4-2-1	Table 5
Surface coating	4-2-2	2	–	–
Inner profile of teeth	4-2-3	2	4-2-3	Table 5
Test methods	5	5	5	Table 6
Marking	7-1	5	–	–

Table 4 — Qualification testing for each dimensions samples

Type of test	Clause	1	2	3	4	5
Dimension and geometrical tolerances	4-4	X	X	X	X	X
Mechanical properties	4-3	X	–	X	X	X
Surface condition and appearance	4-2-1	X	X	X	X	X
Surface coating	4-2-2	–	X	–	X	–
Inner profile of teeth	4-2-3	–	–	X	X	–
Test methods	5	X	X	X	X	X
Marking	7-1	X	X	X	X	X

Table 5 — Sampling plan for visual inspections and dimensional characteristics

Batch size	Sample size	Acceptance number (Ac) and limiting quality (LQ) in accordance with the acceptable quality level (AQL)	
		AQL 2,5 %	
		Ac	LQ_{10} %
Up to 20	3	–	–
21 to 50	5	0	90
51 to 90	8	0	90
91 to 150	10	1	90
Above 151	12	2	80

Table 6 — Sampling plans for the inspection of torque tests

Batch size	Sample size	
	Destructive test	
	Wrench	Socket
Up to 20	0	0
21 to 40	0	0
41 to 81	1	1
81 to 120	1	1
Above 121	2	2

NOTE The wrench or socket to be subjected to destructive tests may be those on which non destructive tests have been performed.

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