BRITISH STANDARD

BS EN
1301-2 : 1997

# Aluminium and aluminium alloys — Drawn wire

## Part 2. Mechanical properties

The European Standard EN 1301-2 : 1997 has the status of a British Standard

ICS 77.150.10

# National foreword

This British Standard is the English language version of EN 1301-2 : 1997. Together with Parts 1 and 3 of BS EN 1301, it supersedes BS 1475 : 1972.

The UK participation in its preparation was entrusted to Technical Committee NFE/35/5, Wrought aluminium and aluminium alloys, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

**Cross-references**

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled 'International Standards Correspondence Index', or by using the 'Find' facility of the BSI Standards Electronic Catalogue.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

**Summary of pages**

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 8, an inside back cover and a back cover.

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EUROPEAN STANDARD

NORME EUROPÉENNE

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# EN 1301-2

July 1997

ICS 77.150.10

Descriptors: Aluminium, aluminium alloys, wires, drawn products, extruded products, designation, mechanical properties

English version

# Aluminium and aluminium alloys — Drawn wire — Part 2: Mechanical properties

Aluminium et alliages d'aluminium — Fil étiré — Partie 2 : Caractéristiques mécaniques

Aluminium und Aluminiumlegierungen Gezogene Drähte — Teil 2 : Mechanische Eigenschaften



**CEN**

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

**Central Secretariat: rue de Stassart 36, B-1050 Brussels**



Ref. No. 1301-2 : 1997 E

## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 132, Aluminium and aluminium alloys, the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 1998, and conflicting national standards shall be withdrawn at the latest by January 1998.

Within its programme of work, Technical Committee CEN/TC 132 entrusted CEN/TC 132/WG 4, Wires and drawing stock to prepare the following standard:

EN 1301-2 *Aluminium and aluminium alloys — Drawn wire — Part 2 : Mechanical properties*

This standard is a part of a set of three standards. The other standards deal with:

EN 1301-1 *Aluminium and aluminium alloys — Drawn wire — Part 1 : Technical conditions for inspection and delivery*

EN 1301-3 *Aluminium and aluminium alloys — Drawn wire — Part 3 : Tolerances on dimensions*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## Contents

## 1 Scope

This Part of EN 1301 specifies the mechanical properties of aluminium and aluminium alloy drawn wire for general engineering applications, including rivet manufacture (except aeronautical rivets).

It applies to drawn wires, except for electrical or welding purposes.

It does not apply to drawing stock.

The designation of aluminium and aluminium alloys, their chemical composition and the temper designations used in this standard are in accordance with EN 573-3 and EN 515 respectively.

These aluminium and aluminium alloys correspond to the alloys produced in large quantities in Europe (class A as defined in 573-4).

## 2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

| | |
|---|---|
| EN 515 | *Aluminium and aluminium alloys — Wrought products — Temper designations* |
| EN 573-3 | *Aluminium and aluminium alloys — Chemical composition and forms of wrought products — Part 3: Chemical composition* |
| EN 573-4 | *Aluminium and aluminium alloys — Chemical composition and forms of wrought products — Part 4: Forms of products* |
| EN 10002-1 | *Metallic materials — Tensile testing — Part 1: Method of test (at ambient temperature)* |
| EN 1301-1 | *Aluminium and aluminium alloys — Drawn wire — Part 1: Technical conditions for inspection and delivery* |

## 3 Tensile test

The conditions for the sampling shall be in accordance with EN 1301-1.

The testing conditions specified in EN 10002-1 shall apply together with the following additional conditions:

– the full section test pieces shall be used;

– the elongation shall be measured on a reference length of 100 mm.

Tensile strength shall conform to tables 1 to 6.

NOTE. Typical values for proof stress and elongation are given for information only.

Tensile strength values shall be rounded in accordance with annex A.

For rivet wire in non heat-treatable alloys delivered in H13 temper, the mechanical properties shall be determined in the temper of delivery.

For rivet wire in heat-treatable alloys delivered in H13 temper, the mechanical properties shall be determined:

– in the delivered temper H13;

– and also in tempers:

a) T42 for EN AW-2017A, EN AW-2117 and EN AW-2024 alloys;

b) T62 for EN AW-2014A, EN AW-6061 and EN AW-6082 and EN AW-7075 alloys.

In these cases the mechanical properties limits are those given for the corresponding T4 and T6 tempers.

**Table 1. Series 1 000 (Al)**

| Material designation | Temper | Diameter $d$ up to and including | $R_m$ | | $R_{p0,2}$[1] | Elongation[1] $A_{100\ mm}$ |
|---|---|---|---|---|---|---|
| | | | MPa | | MPa | % |
| | | mm | min. | max. | typical | typical |
| EN AW-1098 [Al 99,98] | O | 20 | — | 70 | — | 25 |
| | H14 | 18 | 85 | — | 80 | 3 |
| | H18 | 10 | 115 | — | 110 | 2 |
| EN AW-1080A [Al 99,8 (A)] | O | 20 | — | 80 | — | 35 |
| | H14 | 18 | 90 | — | 85 | 5 |
| | H18 | 10 | 120 | — | 115 | 3 |
| EN AW-1070A [Al 99,7] | O | 20 | — | 85 | — | 35 |
| | H14 | 18 | 95 | — | 90 | 5 |
| | H18 | 10 | 125 | — | 120 | 3 |
| EN AW-1050A [Al 99,5] | O | 20 | — | 95 | — | 35 |
| | H14 | 18 | 100 | — | 95 | 5 |
| | H16 | 15 | 120 | — | 115 | 3 |
| | H18 | 10 | 140 | — | 135 | 3 |

[1] These typical proof stress and elongation values quoted are for information only and will be influenced by the wire diameter and, particularly for the H1X tempers, the method of drawing.

**Table 2. Series 2 000 (Al Cu)**

| Material designation | Temper | Diameter $d$ up to and including | $R_m$ | | $R_{p0,2}$[1] | Elongation[1] $A_{100\ mm}$ |
|---|---|---|---|---|---|---|
| | | | MPa | | MPa | % |
| | | mm | min. | max. | typical | typical |
| EN AW-2011 [Al Cu6BiPb] | T3 | 18 | 310 | | 295 | 6 |
| | T8 | 18 | 370 | — | 310 | 4 |
| EN AW-2014A [Al Cu4SiMg(A)] | H13[2] | 18 | 210 | 300 | 190 | 5 |
| | T4 | 18 | 380 | — | 255 | 18 |
| | T6 | 18 | 440 | — | 415 | 9 |
| EN AW-2017A [Al Cu4MgSi(A)] | H13[2] | 18 | 210 | 300 | 190 | 5 |
| | T4 | 18 | 380 | — | 255 | 18 |
| EN AW-2117 [Al Cu2,5Mg] | H13[2] | 18 | 170 | 240 | 110 | 5 |
| | T4 | 18 | 260 | — | 160 | 20 |
| EN AW-2024 [Al Cu4Mg1] | H13[2] | 18 | 230 | 300 | 200 | 5 |
| | T4 | 18 | 420 | — | 315 | 18 |

[1] These typical proof stress and elongation values quoted are for information only and will be influenced by the wire diameter and, particularly for the H1X tempers, the method of drawing.

[2] Mechanical properties shall be also tested in T42 temper (EN AW-2017A, EN AW-2117 and EN AW-2024 alloys) or T62 temper (EN AW-2014A alloy), and those given for T4 or T6 temper as above shall apply.

**Table 3. Series 3 000 (Al Mn)**

| Material designation | Temper | Diameter $d$ up to and including | $R_m$ | | $R_{p0,2}$ [1)] | Elongation [1)] $A_{100\ mm}$ |
|---|---|---|---|---|---|---|
| | | | MPa | | MPa | % |
| | | mm | min. | max. | typical | typical |
| EN AW-3003 [Al Mn1Cu] | O | 20 | — | 130 | 60 | 35 |
| | H14 | 18 | 135 | 180 | 120 | 5 |
| | H18 | 10 | 180 | — | 175 | 3 |
| EN AW-3103 [Al Mn1] | O | 20 | — | 130 | 60 | 35 |
| | H14 | 18 | 135 | 180 | 120 | 5 |
| | H18 | 10 | 170 | — | 165 | 3 |

[1)] These typical proof stress and elongation values quoted are information only and will be influenced by the wire diameter and, particularly for the H1X tempers, the method of drawing.

**Table 4. Series 5 000 (Al Mg)**

| Material designation | Temper | Diameter $d$ up to and including | $R_m$ | | $R_{p0,2}$ [1)] | Elongation [1)] $A_{100\ mm}$ |
|---|---|---|---|---|---|---|
| | | | MPa | | MPa | % |
| | | mm | min. | max. | typical | typical |
| EN AW-5051A [Al Mg2(B)] | O | 20 | — | 195 | 85 | 15 |
| | H12 | 18 | 170 | 220 | 155 | 6 |
| | H14 | 18 | 195 | 245 | 200 | 4 |
| | H18 | 10 | 245 | — | 200 | 3 |
| EN AW-5251 [Al Mg2] | O | 20 | — | 215 | 95 | 15 |
| | H14 | 18 | 215 | 265 | 220 | 4 |
| | H18 | 10 | 265 | — | 270 | 3 |
| EN AW-5052 [Al Mg2,5] | O | 20 | — | 225 | 100 | 15 |
| | H14 | 18 | 225 | 275 | 225 | 4 |
| | H18 | 10 | 275 | — | 275 | 3 |
| | H32 | 18 | 190 | 240 | 145 | 11 |
| | H34 | 15 | 215 | 265 | 195 | 8 |
| | H38 | 10 | 260 | — | 245 | 5 |
| EN AW-5154A [Al Mg3,5(A)] | O | 20 | — | 275 | 125 | 16 |
| | H14 | 18 | 280 | 330 | 270 | 3 |
| | H18 | 10 | 330 | — | 320 | 2 |
| | H32 | 18 | 235 | 285 | 170 | 11 |
| | H34 | 15 | 265 | 315 | 230 | 8 |
| | H36 | 10 | 290 | 340 | 250 | 6 |
| | H38 | 10 | 310 | — | 280 | 4 |

**Table 4. Series 5 000 (Al Mg)** *(continued)*

| Material designation | Temper | Diameter $d$ up to an including | $R_m$ | | $R_{p0,2}$ [1)] | Elongation [1)] $A_{100\ mm}$ |
|---|---|---|---|---|---|---|
| | | | MPa | | MPa | % |
| | | mm | min. | max. | typical | typical |
| EN AW-5754 [Al Mg3] | O | 20 | — | 250 | 110 | 16 |
| | H12 | 18 | 230 | 280 | 200 | 6 |
| | H14 | 18 | 255 | 305 | 250 | 3 |
| | H18 | 10 | 305 | — | 300 | 2 |
| | H32 | 18 | 220 | 270 | 160 | 11 |
| | H34 | 15 | 245 | 295 | 210 | 8 |
| | H38 | 10 | 290 | — | 260 | 4 |
| EN AW-5019 [Al Mg5] | O | 20 | — | 320 | 150 | 17 |
| | H12 | 18 | 295 | 355 | 255 | 6 |
| | H14 | 18 | 325 | 385 | 315 | 3 |
| | H18 | 18 | 370 | — | 360 | 2 |
| | H32 | 18 | 280 | 340 | 205 | 11 |
| | H34 | 15 | 310 | 370 | 265 | 8 |
| | H38 | 10 | 360 | — | 320 | 4 |

[1)] These typical proof stress and elongation values quoted are information only and will be strongly influenced by the wire diameter and, particularly for the H1X tempers, the method of drawing.

**Table 5. Series 6 000 (Al Mg Si)**

| Material designation | Temper | Diameter $d$ | $R_m$ | | $R_{p0,2}$ [1)] | Elongation [1)] $A_{100\ mm}$ |
|---|---|---|---|---|---|---|
| | | | MPa | | MPa | % |
| | | mm | min. | max. | typical | typical |
| EN AW-6060 [Al MgSi] | T39 [3)] | ≥ 6 | 220 | — | — | — |
| | T39 [3)] | < 6 | 270 | — | — | — |
| | T4 | ≤ 20 | 140 | — | 90 | 13 |
| | T6 | ≤ 20 | 210 | — | 160 | — |
| | T89 [3)] | < 6 | 260 | — | — | — |
| EN AW-6061 [Al Mg1SiCu] | H13 [2)] | ≤ 18 | 150 | 210 | 120 | 4 |
| | T39 [3)] | ≥ 6 | 260 | — | — | — |
| | T39 [3)] | < 6 | 310 | — | — | — |
| | T4 | ≤ 20 | 205 | — | 135 | 13 |
| | T6 | ≤ 20 | 290 | — | 260 | 10 |
| | T89 [3)] | < 6 | 300 | — | — | — |
| EN AW-6063 [Al Mg0,7Si] | T39 [3)] | ≥ 6 | 230 | — | — | — |
| | T39 [3)] | < 6 | 280 | — | — | — |
| | T4 | ≤ 20 | 150 | — | 100 | 13 |
| | T6 | ≤ 20 | 220 | — | 190 | 10 |
| | T89 [3)] | < 6 | 270 | — | — | — |

**Table 5. Series 6 000 (Al Mg Si)** *(continued)*

| Material designation | Temper | Diameter $d$ mm | $R_m$ MPa min. | $R_m$ MPa max. | $R_{p0,2}$[1] MPa typical | Elongation[1] $A_{100\ mm}$ % typical |
|---|---|---|---|---|---|---|
| EN AW-6082 [Al Si1MgMn] | H13[2] | ≤ 18 | 165 | 225 | 130 | 4 |
| | T39[3] | ≥ 6 | 310 | — | — | — |
| | T39[3] | < 6 | 360 | — | — | — |
| | T4 | ≤ 20 | 205 | — | 135 | 13 |
| | T6 | ≤ 20 | 300 | | 270 | 10 |
| | T89[3] | < 6 | 340 | — | — | — |

[1] These typical proof stress and elongation values quoted are for information only and will be influenced by the wire diameter and, particularly for the H13 temper, the method of drawing.

[2] Mechanical characteristics shall be tested also in T62 temper, and those given for T6 temper as above shall apply.

[3] For these tempers the mechanical characteristics are very dependent on the amount of cold work and, for T89 temper, on the ageing conditions. It is recommended that these characteristics should be agreed between supplier and purchaser. Consequently, typical values of $R_{p0,2}$ and elongation are not given.

**Table 6. Series 7 000 (Al Zn)**

| Material designation | Temper | Diameter $d$ up to and including mm | $R_m$ MPa min. | $R_m$ MPa max. | $R_{p0,2}$[1] MPa typical | Elongation[1] $A_{100\ mm}$ % typical |
|---|---|---|---|---|---|---|
| EN AW-7075 [Al Zn5,5MgCu] | O | 20 | — | 275 | 110 | 13 |
| | H13[2] | 18 | 230 | 310 | 230 | 2,5 |
| | T6 | 20 | 510 | — | 485 | 10 |

[1] These typical proof stress and elongation values quoted are for information only and will be influenced by the wire diameter and, particularly for the H13 temper, the method of drawing.

[2] Mechanical properties shall also be tested in T62 temper, and those given for T6 temper as above apply.

## Annex A (normative)

## Rules for rounding

In recording test results, the number representing the results of a test to determine a given property shall be expressed to the same number of decimal places as the corresponding number in this standard, except for elongation values which shall be recorded with one more decimal place.

The following rounding rules shall be used for determination of compliance with this standard:

a) when the figure immediately after the last figure to be retained is less than 5, the last figure to be retained remains unchanged;

b) when the figure immediately after the last figure to be retained is greater than 5, or equal to 5 and followed by at least one figure other than zero, the last figure to be retained is increased by one;

c) when the figure immediately after the last figure to be retained is equal to 5 and followed by zeros only, the last figure to be retained remains unchanged if even and is increased by one if odd.

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