

SLOVENSKI STANDARD

SIST EN 1669:1998

01-april-1998

Aluminij in aluminijeve zlitine - Metode preskušanja - Preskus ušesenja pločevine in trakov

Aluminium and aluminium alloys - Test methods - Earing test for sheet and strip

Aluminium und Aluminiumlegierungen - Prüfverfahren - Zipfelprüfung an Blechen und Bändern

Aluminium et alliages d'aluminium - Méthodes d'essai - Mesure de l'indice de cornes a l'emboutissage pour les tôles et les bandes

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ICS:

77.150.10

Aluminijski izdelki

Aluminium products

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en

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EUROPEAN STANDARD

EN 1669

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September 1996

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Descriptors: aluminium, aluminium alloys, metal plates, steel strips, tests, cupping, determination, height

English version

Aluminium and aluminium alloys - Test methods - Earing test for sheet and strip

Aluminium et alliages d'aluminium - Méthodes
d'essai - Mesure de l'indice de cornes à
l'emboutissage pour les tôles et les bandes

Aluminium und Aluminiumlegierungen -
Prüfverfahren - Zipfelprüfung an Blechen und
Bändern

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This European Standard was approved by CEN on 1996-08-29. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

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

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

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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 March 1997, and conflicting national standards shall be withdrawn at the latest by March 1997.

Within its programme of work, Technical Committee CEN/TC 132 entrusted CEN/TC 132/WG 7 "Sheet, strip and plate" to prepare the following standard :

EN 1669	Aluminium and aluminium alloys - Test methods - Earing test for sheet and strip
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According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This standard specifies the method for determining the ear height of sheet and strip of nominal thicknesses from 0,08 mm to 6 mm after deep drawing.

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.

ISO 468	Surface roughness - Parameters, their values and general rules for specifying requirements.
ISO 6507 - 1	Metallic materials - Hardness test - Vickers test - Part 1 : HV 5 to HV 100.

3 Symbols and designations

The symbols and designations used in the earing test are specified in figures 1 and 2 and in table 1.

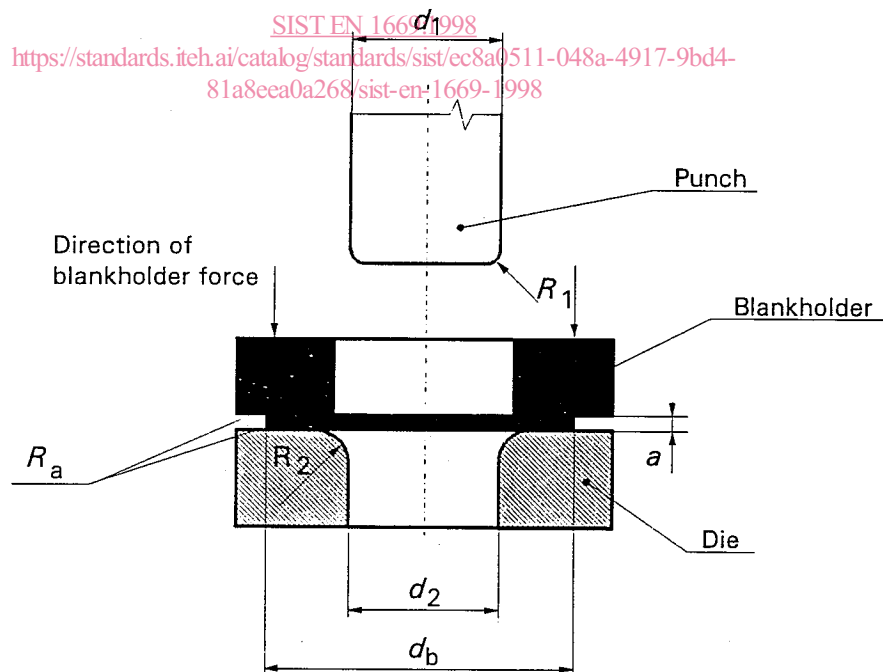


Figure 1 : Schematic of the testing equipment

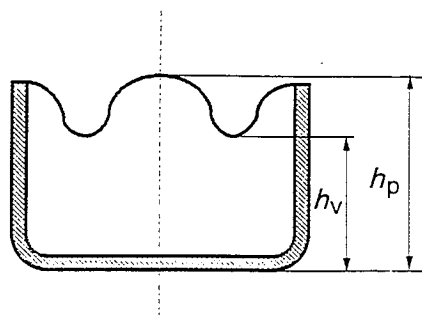


Figure 2 : Schematic section of the cup

Table 1 : Symbols and designations

Symbol	Designation	Unit
a	Thickness of the test piece	mm
d_1	Diameter of the punch	mm
R_1	Corner radius of the punch	mm
d_2	Inside diameter of the die	mm
R_2	Inside corner radius of the die	mm
d_b	Diameter of the circular blank	mm
h_p	Distance between outside bottom of cup to any ear peak	mm
\bar{h}_p	Mean value of h_p	mm
h_{pxx}	Distance between outside bottom of cup to any ear peak at xx° to the rolling direction	mm
$\overline{h_{pxx}}$	Mean value of h_{pxx}	mm
h_v	Distance between outside bottom of cup to any ear valley	mm
\bar{h}_v	Mean value of h_v	mm
h_{vxx}	Distance between outside bottom of cup to any ear valley at xx° to the rolling direction	mm
$\overline{h_{vxx}}$	Mean value of h_{vxx}	mm
\bar{h}	Mean cup height	mm
h_e	Mean height of ear	mm
Z	Mean height of ear expressed in percentage	%
h_{exx}	Mean height of ear at xx° to the rolling direction	mm
S_{xx}	Mean height of ear at xx° to the rolling direction expressed in percentage	%
R_a	Surface roughness parameter : arithmetical mean deviation of the profile	μm

4 Principle

Drawing of cylindrical cups from circular blanks taken from metallic sheet and strip and evaluation of the height of any earing produced by this process.

5 Testing equipment

5.1 The arrangement for the test equipment is given in figure 1. The punch shall be capable of moving along the axial centerline of the die, blankholder and circular blank. The equipment shall be such that ironing of ears due to the blankholder force and/or due to the insufficient clearance between the punch and die is avoided and so that the cup can be removed without damaging the ears.

5.2 The machine shall be capable of controlling the speed of drawing and the blankholder force.

5.3 The machine shall be equipped with a device for locating the circular blank concentrically with the axial line of the machine.

NOTE : The device for concentrically locating the blank is not required if the circular blank is produced as a part of the cup forming process.

5.4 The combinations of the punch and die diameters shall be chosen, in relation to the nominal sheet thickness, such that the clearance between punch and die (i.e. $\frac{d_2 - d_1}{2}$; see figure 1) is at least 1,15 times the nominal sheet thickness and not more than 1,8 times the nominal sheet thickness.

Recommended sets of punch and dies to be used in relation to sheet thickness are given in annex A.

5.5 The corner radius of the punch, R_1 , shall be 5,0 mm \pm 0,05 mm for the 33 mm diameter punch and 7,0 mm \pm 0,05 mm for the 50 mm diameter punch.

5.6 The die, the blankholder and the punch shall be sufficiently rigid not to deform appreciably during the test. The Vickers hardness of working surfaces of the die, the blankholder and the punch shall be at least 750 HV 30 (measurement according to ISO 6507-1). The surfaces of the die and the blankholder which contact the test piece shall have a roughness value R_a (measurement according to ISO 468) not exceeding :

- 0,1 μm for thicknesses up to 0,45 mm ;
- 0,5 μm for thicknesses over 0,45 mm up to 1,25 mm ;
- 1,0 μm for thicknesses over 1,25 mm.

6 Test piece

6.1 Circular blanks are used as test pieces. The drawing ratio, i.e. the ratio of blank diameter to punch diameter, shall be as large as possible without the risk of tearing at the bottom of the cup.

The recommended blank diameters are :

- $d_b = 60 \text{ mm}$ or 64 mm when $d_1 = 33 \text{ mm}$;
- $d_b = 90 \text{ mm}$ when $d_1 = 50 \text{ mm}$.

For a test series or comparative tests the same drawing ratio shall be maintained in all cases.

6.2 The test piece shall be free of burrs on the edges which would interfere with the test.

7 Procedure

7.1 In general, the test shall be carried out at ambient temperature within the limits of 10°C to 35°C . In case of dispute, a temperature range of $23^\circ\text{C} \pm 5^\circ\text{C}$ should be agreed upon between purchaser and supplier.

7.2 Select the appropriate punch and die in accordance with 5.4 and A.2.

7.3 Before testing coat the two faces of the test piece lightly and uniformly with an appropriate lubricant (tallow is frequently used).

NOTE : Test results depend on the type and quantity of lubricant used. In case of dispute, lubrication conditions should be discussed between purchaser and supplier.

7.4 Locate the circular blank concentrically between the blankholder and the die. Apply the blankholding force that is just sufficient to prevent wrinkling of the flange (see 5.1).

NOTE : If it is not known what blankholder force is required to achieve this, it should be found by trial. The values in table 2 are provided for guidance for the first attempt.

Table 2 : Typical blankholder force

Diameter of punch mm	Blankholder force (N)	
	Soft temper	Strain-hardened
33	1 000	4 000
50	2 000	8 000

7.5 Bring the punch into contact with the test piece and form the cup without a flange.