



SLOVENSKI STANDARD

SIST EN 586-3:2004

01-januar-2004

Aluminij in aluminijeve zlitine – Izkovki – 3. del: Odstopki mer in tolerance oblik

Aluminium and aluminium alloys - Forgings - Part 3: Tolerances on dimensions and form

Aluminium und Aluminiumlegierungen - Schmiedestücke - Teil 3: Grenzabmaße und Formtoleranzen

Aluminium et alliages d'aluminium - Pièces forgées - Partie 3: Tolerances sur dimensions et forme

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Ta slovenski standard je istoveten z: **EN 586-3:2001**

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ICS:

77.150.10 Alumijski izdelki Aluminium products

SIST EN 586-3:2004 **en**

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 586-3

October 2001

ICS 77.150.10

English version

**Aluminium and aluminium alloys - Forgings - Part 3: Tolerances
on dimensions and form**

Aluminium et alliages d'aluminium - Pièces forgées - Partie
3: Tolérances sur dimensions et forme

Aluminium und Aluminiumlegierungen - Schmiedestücke -
Teil 3: Grenzabmaße und Formtoleranzen

This European Standard was approved by CEN on 30 September 2001.

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 Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword.....	3
1 Scope	4
2 Normative references	4
3 Terms and definitions.....	5
4 Identification of symbols.....	6
5 General requirements.....	7
5.1 Technical conditions for inspection and delivery	7
5.2 Application of tolerances	7
5.3 Summarised references	7
5.4 Chemical composition.....	8
5.5 Alloy groups	8
6 Tolerances on dimensions and form	10
6.1 Die forgings	10
6.2 Hand forgings.....	25
Annex A (informative) Design guidelines for die and hand forgings.....	30
Bibliography	56

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[SIST EN 586-3:2004](https://standards.iteh.ai/catalog/standards/sist/51042979-d801-4a1a-b7ca-667a8cb277c4/sist-en-586-3-2004)

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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 April 2002, and conflicting national standards shall be withdrawn at the latest by April 2002.

Within its programme of work, Technical Committee CEN/TC 132 entrusted CEN/TC 132/WG3 "*Forgings and cast and wrought forging stock*" to prepare the following standard :

EN 586-3, *Aluminium and aluminium alloys - Forgings - Part 3 : Tolerances on dimensions and form'*

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

EN 586-1, *Aluminium and aluminium alloys - Forgings - Part 1 : Technical conditions for inspection and delivery*

EN 586-2, *Aluminium and aluminium alloys - Forgings - Part 2 : Mechanical properties and additional properties*

Annex A is informative.

This standard includes a Bibliography.

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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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

EN 586-3:2001 (E)**1 Scope**

This European Standard specifies the tolerances on dimensions and form of aluminium and aluminium alloy forgings for general engineering applications of usual design concepts which are formed hot.

It applies to :

— *die forgings without machining all over :*

shape dimensions $n_{\max} \leq 2\,000$ mm, die closure dimensions $t_{\max} \leq 600$ mm and projected area $A \leq 4\,000$ cm²;

— *die forgings with machining all over :*

shape dimensions $n_{\max} \leq 6\,000$ mm and projected area $A \leq 22\,000$ cm²;

— *hand forgings :*

profile dimensions $n_{\max} \leq 8\,000$ mm.

Tolerances on forgings outside the scope of this standard or of complex design can be mutually agreed between supplier and purchaser.

Design guidelines for die and hand forgings are given in annex A.

NOTE Some of the products mentioned in this European Standard may be the subject of patent or patent applications, and their listing herein is not to be construed in any way as the granting of a licence under such patent right.

CEN/TC 132 affirms it is its policy that in the case when a patentee refuses to grant licenses on standardized standards products under reasonable and non discriminatory conditions then this product should be removed from the corresponding standard.

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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 (including amendments).

EN 573-3, *Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 3 : Chemical composition.*

EN 573-4, *Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 4 : Form of products.*

EN 586-1, *Aluminium and aluminium alloys - Forgings - Part 1 : Technical conditions for inspection and delivery.*

EN 586-2, *Aluminium and aluminium alloys - Forgings - Part 2 : Mechanical properties and additional property requirements.*

EN 12258-1, *Aluminium and aluminium alloys - Terms and definitions - Part 1 : General terms.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 12258-1 and the following apply.

3.1

die forgings without machining all over

parts entering service use whilst still retaining forged surfaces

3.2

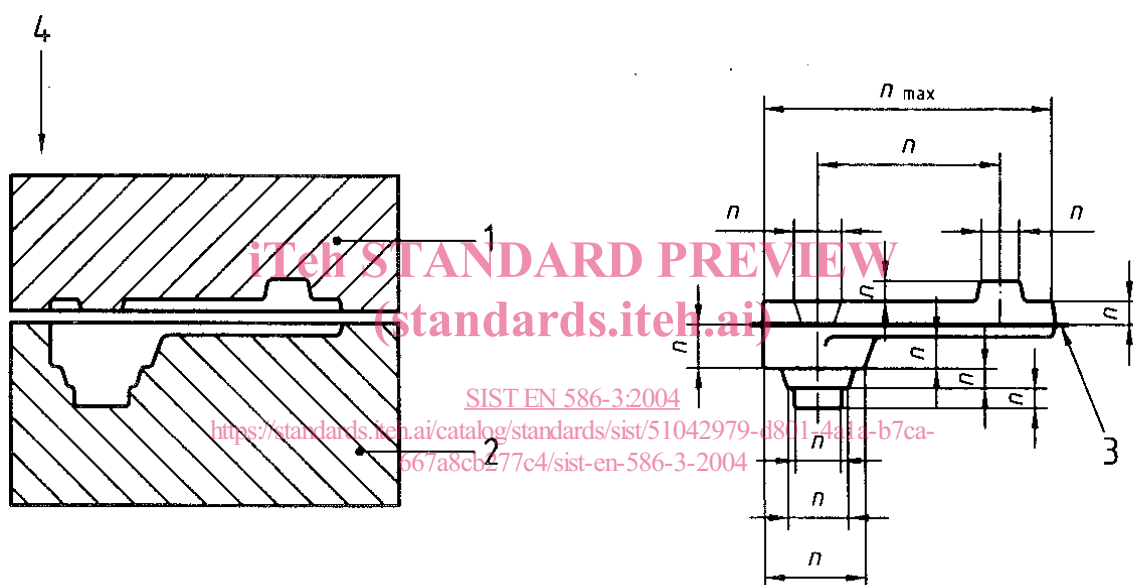
die forgings with machining all over

parts entering service use after removal of all forged surfaces by machining

3.3

shape dimensions

dimensions associated with the shape length, width and height dimensions, including diameters and distances between centre axes, situated within the shape impression on the parts of the die set, designated n , see Figure1



Key

- 1 Upper die
- 2 Lower die
- 3 Parting line
- 4 Direction of forging

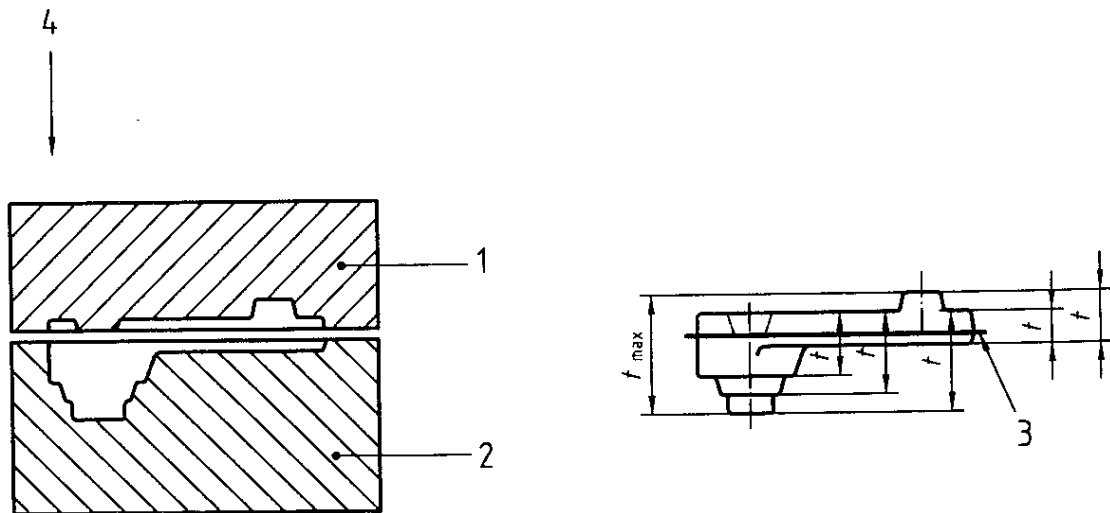
Figure 1 - Shape dimensions n (die forgings)

3.4

die closure dimensions

dimensions dissociated with the shape dimensions which cross the die parting line, measured perpendicular to the predominant mating surface, designated t , see Figure2

EN 586-3:2001 (E)

**Key**

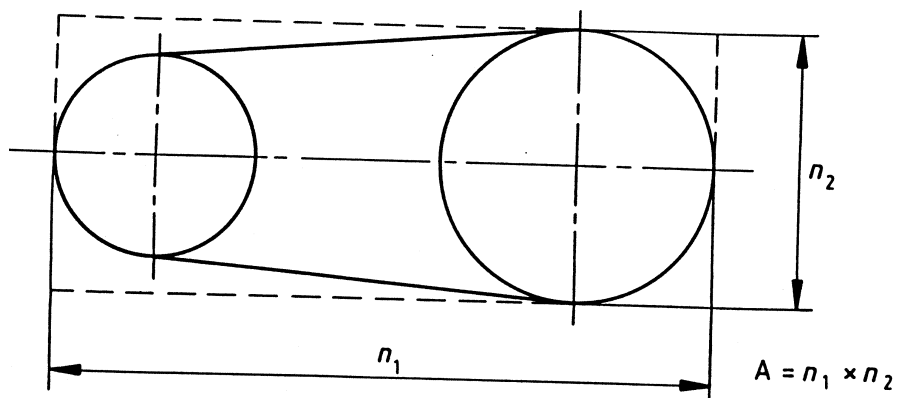
- 1 Upper die
- 2 Lower die
- 3 Parting line
- 4 Direction of forging

Figure 2 - Die closure dimensions t (die forgings)**3.5****projected area**

area of the part viewed in the direction of forging, designated A , conventionally taken as :

- the area of a circle when the projection is a circle ;
- the area of a circumscribing rectangle in all other cases, see Figure3.

NOTE Projected area is expressed in square centimetres.

**Key**

- 1 Parting line
- 2 Direction of forging

Figure 3 - Calculation of projected area A (die forgings)**4 Identification of symbols**

The following symbols have been adopted for use in this standard :

n is shape dimension

n_{\max}	is maximum shape dimension
t	is thickness and/or die closure dimension
t_{\max}	is maximum thickness/maximum die closure dimension
A	is projected area in square centimetres
m	is mismatch (offset)
x	is fin height
y	is fin width
f	is flatness (plus/minus tolerance)
s	is flatness or straightness (plus only tolerance)
p	is profile tolerance (hand forgings)
c	is constant thickness tolerance (hand forgings)
h	is height of rib, flange or bead
d	is diameter of indentations
F	is flash type
R	is rounding/radius
β	is inboard draft angle
D_t	is die closure tolerance
M_t	is mismatch tolerance

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5 General requirements

5.1 Technical conditions for inspection and delivery

Technical conditions for inspection and delivery of forgings are specified in EN 586-1.

5.2 Application of tolerances

The dimensional tolerances specified on drawings shall, in principle, conform to those laid down in this standard. If no dimensional tolerances are specified on drawings, those given in this standard shall apply. In such cases it is recommended that a suitable reference to this standard be made on drawings. If the purchaser requires tolerances on individual dimensions tighter than those laid down in this standard, these shall be agreed with the supplier.

5.3 Summarised references

A summary of references to the applicable subclauses and tables covering the different types of characteristics together with the basis on which tolerances are calculated is given in Table 1.

Table 1 – Summarised references

Characteristic	Subclause	Base	Table reference
Die forgings	6.1		
Die forgings without machining all over	6.1.2		
Shape dimensions	6.1.2.2	n	Table 3, Table 4
Die closure dimensions	6.1.2.4	t_{\max} and A	Table 5
Die forgings with machining all over	6.1.3		
Shape dimensions	6.1.3.2	n	Table 6
Die closure dimensions	6.1.3.4	n_{\max} and A	Table 7
Mismatch (offset)	6.1.4		
Die forgings without machining all over	6.1.4.2	n_{\max}	Table 8
Die forgings with machining all over	6.1.4.3	n_{\max}	Table 9
Flash and fin projections	6.1.5	n_{\max}	Table 10, Table 11
Roundings and transitions	6.1.6	R nominal	
Ejector marks	6.1.7	A	Table 12
Flatness and straightness	6.1.8	n_{\max}	Table 13
Angles	6.1.9	n_1	Table 14
Hand forgings	6.2		
Profile dimensions	6.2.2	n_{\max} and t_{\max}	Table 15
Flatness and straightness	6.2.3	n_{\max}	Table 16

5.4 Chemical composition

The chemical composition limits of the alloys shall be as specified in EN 573-3.

5.5 Alloy groups

For the purposes of this European Standard alloys are divided into two groups dependent on their shaping capability. The division into Group I and Group II of these alloys is specified in Table 2.

The division into Class A and Class B alloys shall be as specified in EN 573-4. Class A covers aluminium and aluminium alloys produced in large volume as forgings for which mechanical properties are specified in EN 586-2. Class B covers aluminium and aluminium alloys produced in limited volume as forgings for which mechanical properties are not specified.

Table 2 - Alloy Groups

Alloy Group I (forge with ease)		Alloy Group II (difficult to forge)	
Alloy designation	Class	Alloy designation	Class
EN AW-1050A [Al 99,5]	B	EN AW-2011 [Al Cu6BiPb]	B
		EN AW-2014 [Al Cu4SiMg]	A
EN AW-6005A [Al SiMg (A)]	B	EN AW-2017A [Al Cu4MgSi(A)]	B
		EN AW-2618A [Al Cu2Mg1,5Ni]	B
EN AW-6060 [Al MgSi]	B	EN AW-2219 [Al Cu6Mn]	B
		EN AW-2024 [Al Cu4Mg1]	A
EN AW-6061 [Al Mg1SiCu]	B	EN AW-2031 [Al Cu2,5NiMg]	B
		EN AW-4032 [Al Si12,5MgCuNi]	B
EN AW-6082 [Al Si1MgMn]	A	EN AW-5454 [Al Mg3Mn]	B
		EN AW-5754 [Al Mg3]	A
		EN AW-5019 [Al Mg5]	B
		EN AW-5083 [Al Mg4,5Mn0, 7]	A
		EN AW-7010 [Al Zn6MgCu]	B
		EN AW-7012 [Al Zn6Mg2Cu]	B
		EN AW-7020 [Al Zn4,5Mg1]	B
		EN AW-7075 [Al Zn5,5MgCu]	A

Other alloys shall be grouped as follows :

Alloy Group I

- unalloyed aluminium ;
- alloys Al Mn ;
- alloys Al Mg with a maximum of 2,8 % Mg ;
- alloys Al MgSi ;

Alloy Group II :

- alloys Al Mg with more than 2,8% Mg ;
- alloys Al CuMg ;
- alloys Al ZnMg.

EN 586-3:2001 (E)

6 Tolerances on dimensions and form

6.1 Die forgings

6.1.1 General

Dimensional variations are influenced by the fabrication accuracy of the dies, tool wear, shrinkage and the unavoidable deviations caused during the shaping process as well as during heat treatment.

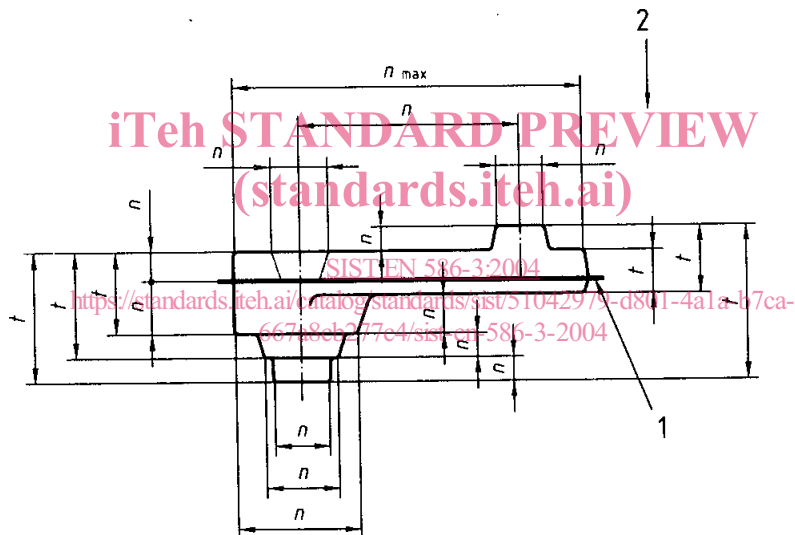
The different forging applications necessitate different dimensional tolerance levels for die forgings with and without machining all over. Likewise, tolerances applied to shape dimensions n are different to those applied to die closure dimensions t .

When specifying dimensions, due consideration shall be given to the accumulation of tolerances, see A.1.13, A.1.14 and Figure 5.

6.1.2 Forgings without machining all over

6.1.2.1 General

Shape dimensions n and die closure dimensions t for die forgings without machining all over are shown in Figure 4.



Key

- 1 Parting line
- 2 Direction of forging

Figure 4 - Shape dimensions n and die closure dimensions t for die forgings without machining all over

6.1.2.2 Shape dimensions

The tolerances on shape dimensions n for forgings of a size which fits within a sphere of 120 mm diameter shall be as specified in Table 3 and for a size greater than that which fits within a sphere of 120 mm diameter shall be as specified in Table 4.

If the purchaser requires a given dimension to be governed by a wholly plus or a wholly minus tolerance the tolerance range stated in Tables 3 and 4 shall apply.

EXAMPLE According to Table 3 the tolerance for the nominal dimension of 8 mm is $\pm 0,25$ mm. If the dimension is to be governed by a wholly plus or a wholly minus tolerance this would apply as $^{+0,5}_0$ mm or $^0_{-0,5}$ mm respectively.

Table 3 - Tolerances on shape dimensions for forgings without machining all over which fit within a sphere of 120 mm diameter

Dimensions in millimetres

Nominal dimension n		Tolerances on dimension n
Over	Up to and including	
-	6	$\pm 0,2$
6	10	$\pm 0,25$
10	18	$\pm 0,3$
18	30	$\pm 0,35$
30	50	$\pm 0,4$
50	80	$\pm 0,55$
80	120	$\pm 0,7$

Table 4 - Tolerances on shape dimensions for forgings without machining all over of a size greater than that which fits within a sphere of 120 mm diameter

Dimensions in millimetres

Nominal dimension n		Tolerances on dimension n
Over	Up to and including	
	50	$\pm 0,5$
50	80	$\pm 0,65$
80	120	$\pm 0,8$
120	180	$\pm 0,9$
180	250	$\pm 1,0$
250	315	$\pm 1,2$
315	400	$\pm 1,3$
400	500	$\pm 1,5$
500	630	$\pm 1,7$
630	800	$\pm 2,0$
800	1 000	$\pm 2,3$
1 000	2 000	$\pm 2,5$

6.1.2.3 Application of tolerances to forgings without machining all over having one plain die half

The tolerances given in Tables 3 and 4 shall apply also to forgings without machining all over produced from a recessed bottom die in conjunction with a plain top die.

EN 586-3:2001 (E)**6.1.2.4 Die closure dimensions**

The tolerances on die closure, dimensions t , shall be as specified in Table 5.

The bases for establishing such tolerances shall be the largest overall dimension in the direction of forging t_{\max} and the projected area A .

All other dimensions t in the direction of forging shall carry the same tolerance as t_{\max} .

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Table 5 - Tolerances on die closure dimensions for forgings without machining all over

Nominal closure dimension t_{\max} (mm)		Projected area A in square centimetres (cm ²)								
		Up to 25	Over 25 to 50	Over 50 to 100	Over 100 to 200	Over 200 to 400	Over 400 to 800	Over 800 to 1 200	Over 1 200 to 2 000	Over 2 000 to 4 000
Over	Up to and including	Tolerances for die closure dimensions t (mm)								
	3	+ 0,3 - 0,15	-	-	-	-	-	-	-	-
3	6	+ 0,35 - 0,2	+ 0,35 - 0,3	+ 0,45 - 0,3	+ 0,7 - 0,5	-	-	-	-	-
6	10	+ 0,35 - 0,3	+ 0,5 - 0,3	+ 0,5 - 0,35	+ 0,8 - 0,5	+ 1,0 - 0,6	+ 1,1 - 0,7	-	-	-
10	18	+ 0,45 - 0,3	+ 0,5 - 0,35	+ 0,6 - 0,45	+ 0,9 - 0,6	+ 1,1 - 0,7	+ 1,2 - 0,8	+ 1,3 - 0,8	+ 1,4 - 0,9	+ 1,5 - 1,0
18	30	+ 0,5 - 0,35	+ 0,6 - 0,45	+ 0,7 - 0,45	+ 1,0 - 0,7	+ 1,2 - 0,8	+ 1,3 - 0,9	+ 1,4 - 0,9	+ 1,6 - 1,0	+ 1,6 - 1,1
30	50	+ 0,5 - 0,45	+ 0,7 - 0,45	+ 0,8 - 0,5	+ 1,1 - 0,8	+ 1,3 - 0,9	+ 1,4 - 1,0	+ 1,5 - 1,0	+ 1,7 - 1,1	+ 1,7 - 1,2
50	80	+ 0,7 - 0,45	+ 0,8 - 0,5	+ 0,85 - 0,6	+ 1,3 - 0,9	+ 1,4 - 1,0	+ 1,6 - 1,0	+ 1,7 - 1,1	+ 1,8 - 1,2	+ 1,9 - 1,2
80	120	+ 0,8 - 0,6	+ 0,9 - 0,6	+ 1,0 - 0,85	+ 1,4 - 1,0	+ 1,6 - 1,0	+ 1,7 - 1,2	+ 1,8 - 1,2	+ 1,9 - 1,3	+ 2,0 - 1,4
120	180	+ 1,3 - 0,9	+ 1,4 - 1,0	+ 1,5 - 1,0	+ 1,6 - 1,1	+ 1,7 - 1,2	+ 1,9 - 1,2	+ 1,9 - 1,3	+ 2,1 - 1,4	+ 2,2 - 1,4
180	250	+ 1,6 - 1,0	+ 1,6 - 1,1	+ 1,7 - 1,2	+ 1,8 - 1,2	+ 1,9 - 1,3	+ 2,0 - 1,3	+ 2,1 - 1,4	+ 2,2 - 1,4	+ 2,3 - 1,5
250	315	-	+ 1,9 - 1,2	+ 1,9 - 1,3	+ 2,0 - 1,3	+ 2,0 - 1,4	+ 2,2 - 1,4	+ 2,2 - 1,5	+ 2,3 - 1,5	+ 2,3 - 1,6
315	400	-	-	+ 2,0 - 1,4	+ 2,1 - 1,4	+ 2,2 - 1,4	+ 2,2 - 1,5	+ 2,3 - 1,5	+ 2,3 - 1,6	+ 2,4 - 1,6
400	500	-	-	-	-	-	+ 2,3 - 1,6	+ 2,4 - 1,6	+ 2,5 - 1,6	+ 2,5 - 1,6
500	600	-	-	-	-	-	-	+ 2,5 - 1,6	+ 2,5 - 1,7	+ 2,5 - 1,7