SLOVENSKI STANDARD
SIST EN 10243-2:2000

01-november-2000

Utopno kovani jekleni izkovki - Mejni odstopki mer - 2. del: Izkovki, izdelani z nakrļ evanjem na horizontalnih kovaģkih strojih

Steel die forgings - Tolerances on dimensions - Part 2: Upset forging made on horizontal forging machines

Gesenkschmiedeteile - Maßtoleranzen - Teil 2: Warm hergestellt in Waagerecht-Stauchmaschinen

Pieces forgées par estampage en acier - Tolérances dimensionelles - Partie 2: Pieces exécutées a chaud sur machines horizontales a forger

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ICS:

77.140.85	Železni in jekleni kovani izdelki	Iron and steel forgings

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English version

Steel die forgings - Tolerances on dimensions - Part 2: Upset forging made on horizontal forging machines

Pièces forgées par estampage en acier - Tolérances dimensionnelles - Partie 2: Pièces exécutées à chaud sur machines horizontales à forger

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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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Content

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 28 "Steel forgings", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by March 2000, and conflicting national standards shall be withdrawn at the latest by March 2000.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

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.

1 Scope

1.1 This European Standard specifies the dimensional tolerances for steel upset forgings made on horizontal forging machines.

The second part of this European Standard applies to hot upset forgings, in the delivery condition, made in carbon and alloy steels. The tolerances specified apply to forgings not exceeding 250 kg in mass or 2 500 mm maximum dimension. Tolerances for heavier or layer forgings are subjected to negociation.

This European Standard does not apply to steel drop and press forgings (see prEN 10243-1).

1.2 For forgings produced in horizontal forging machines forging grade F tolerances only are provided. This tolerance grade provides an adequate standard of accuracy for the majority of applications and is capable of being complied with by commonly used forging equipment and production methods.

The tables showing dimensional tolerances are based on the R20 series of preferred numbers (see ISO 3).

The annex A gives for information some examples of application of these tolerances for different types of closed die forgings.

1.3 Any occasional instances may necessitate the use of tolerances wider than those indicated, e.g. specially complicated designs ; steels having particularly difficult forging characteristics. In such cases these standard tolerances can form only a basis on which to agree modifications appropriate to the particular circumstances.

1.4 This European Standard does not include ranges of special tolerances closer than grade F. Consideration of special tolerances whilst frequently encountered, are highly individual, and vary widely. They are best dealt with by consultation at the design stage and shall be agreed between the purchaser and the supplier. This approach will ensure that optimum use is made of the forging process in fulfilling the purchaser's special requirements at the lowest additional cost.

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 3	Preferred numbers - Series of preferred numbers
ISO 8015	Technical drawings - Fundamental tolerancing principle

3 Symbols

The symbols used along this European Standard are as follows :

l	=	length dimension ;
b	=	width dimension ;
h	=	height dimension ;
a	=	thickness dimension ;
d	=	diameter ;
r	=	radius ;
p	=	step dimension ;
u	=	height of burr ;
v	=	width of burr ;
t	=	theoretical length (of upset forgings) ;
e	=	special thickness across die line ;
m	=	mass (weight) ;
π	=	circle factor ;
ρ	=	density (specific gravity) ;
S	=	shape complexity factor (see 5.3) ;
M	=	category of steel (see 5.2) ;
x and y	=	shearing deformation.

4 Definitions

For the purposes of this European Standard and specially for classification, the following definitions apply :

4.1 upset portion of a forging : An upset, or group of upsets, produced without the direction of presentation of the bar stock to the heading tool having been reversed endwise (see figure 1).

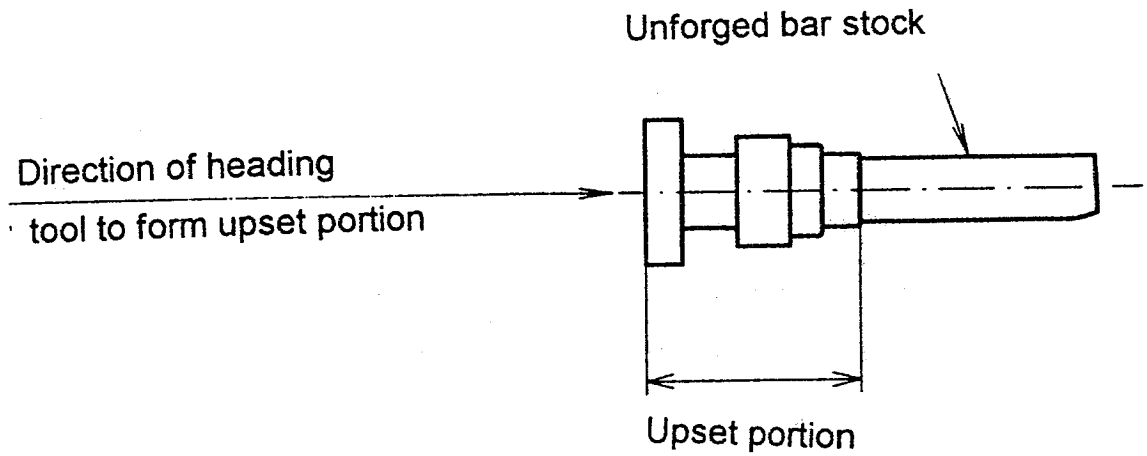

Figure 1 : An upset portion of a forging

4.2 double-ended upset forgings : Two separate upset portions which have been forged from opposite directions. In that case, the upset portion at each end shall be considered as an independent forging for the purpose of classification (see figure 2).

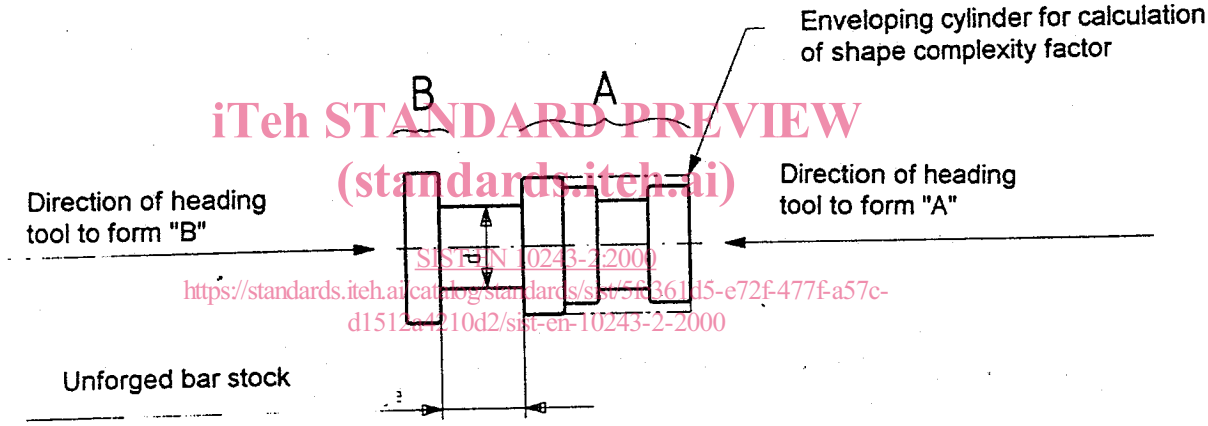

Figure 2 : A double-ended upset forging

EXCEPTION : If such a forging has either no unforged stock (see 4.3) retained or its length does not exceed its diameter, the tolerances shall be applied as if the forging had been produced as a single upset portion.

4.3 unforged stock : Any part of an upset forging which has been forged or formed prior to the upsetting operation (see figure 3).

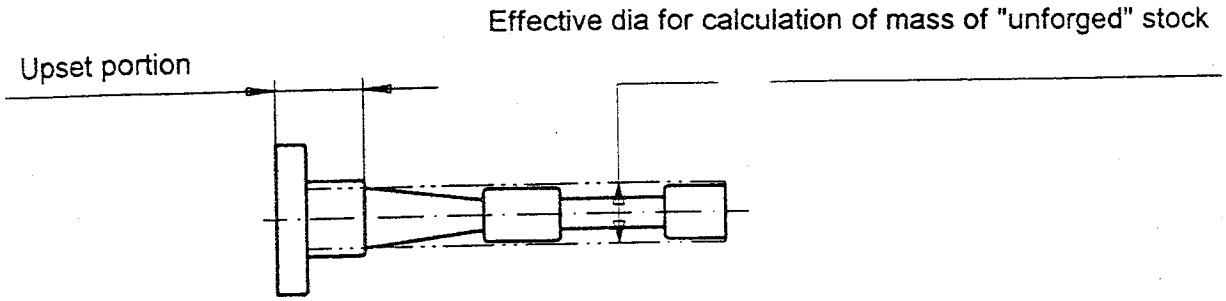

Figure 3 : "Unforged" stock

5 Information required in determining tolerances

To determine the tolerances applicable to a given upset forging in accordance with table 1 to 4, the following information is required in addition to the dimensions of the forging :

- mass of given upset portion(s) and mass of "unforged stock" (if any) (see 4.3 and 5.1) ;
- category of steel used ;
- shape complexity factor for a given upset portion of a forging.

5.1 Mass of upset portion

The mass of the upset portion is calculated.

5.2 Category of steel used

The type of steel symbol used takes account of the fact that steels of high carbon and high alloy content are more difficult to deform and cause higher die wear than do steels with lower carbon content and lower alloying elements.

The category of steel used is determined as being within one of the following :

- group M1 : Steel with carbon content not more than 0,65 % **and** total of specified alloying elements (Mn, Ni, Cr, Mo, V, W) not more than 5 % by mass ;

- group M2 : Steel with carbon content above 0,65 % **or** total of specified alloying elements (Mn, Ni, Cr, Mo, V, W) above 5 % by mass.

To determine the category in which a steel belongs the maximum permitted content of the elements in the steel specification shall be the values used.

5.3 Shape complexity factor

The shape complexity factor takes account of the fact that in forging thin sections and branched components, as compared to components having simple compact shapes, larger dimensional variations occur which are attributable to different rates of shrinkage, higher shaping forces and higher rates of die wear.

The shape complexity factor (S) of a forging is the ratio of the mass[1]) of the forging to the mass of the enveloping shape necessary to accommodate the maximum dimensions of the forging.

$$S = \frac{m_{forging}}{m_{enveloping\ shape}}$$

The enveloping shape of a circular forging is the circumscribing cylinder the mass of which calculated from the formula (see figure 4) :

$$m_{enveloping\ shape} = \frac{\pi \times d^2}{4} \times h \times \rho$$

where :

d = diameter ;

ρ = density (7,85 g/cm^3) ;

h = height, or length of cylinder.

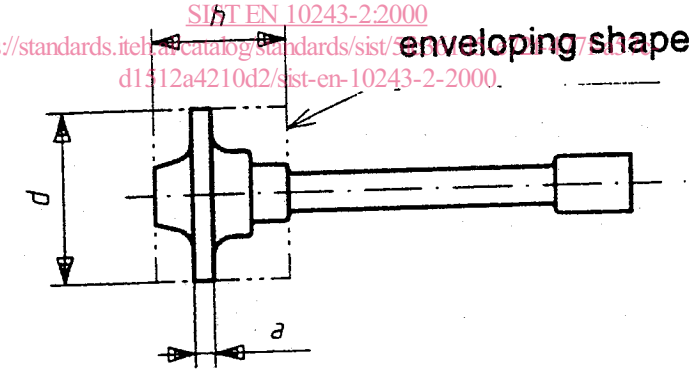

Figure 4 : Determining shape complexity factor

The resulting shape complexity factor is determined as falling within one of the following categories :

S4 : Up to and including 0,16 ;

S3 : Above 0,16 up to and including 0,32 ;

S2 : Above 0,32 up to and including 0,63 ;

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[1] If desired, the shape complexity factor may be calculated as the ratio of the volume of the forging to the volume of the enveloping shape.

S1 : Above 0,63 up to and including 1.

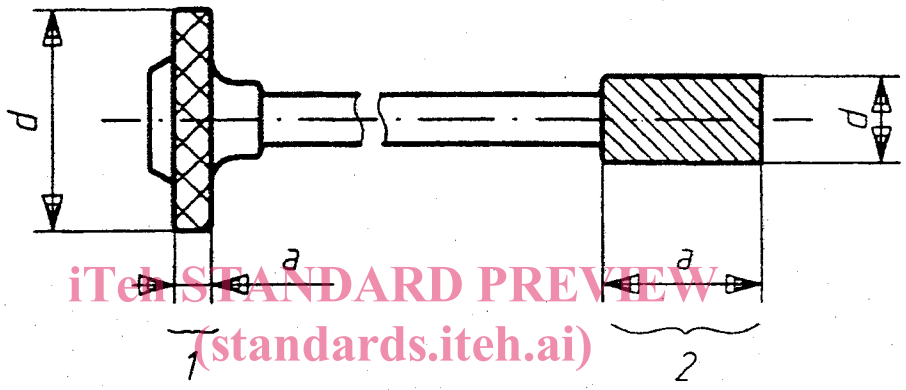
EXCEPTIONS : In determining the shape complexity factor for an upset portion there are exceptions to the above procedure when one of the following conditions applies :

1) *a/d* up to and including 0,20 ;

2) *a/d* greater than 2.

Where *d* is the greatest diameter of an upset portion, and *a* is the corresponding dimension of thickness or length crossing the die line between header die and grip dies.

In cases 1) and 2) the factor S4 is used and the mass is that of the cylinder *d* x *a* even if this is not the entire upset portion (see figure 5).



Case 1 Case 2

Figure 5 : Exception in determining shape complexity factor

When applying $a/d \leq 0,2$, mass of upset should be considered as mass of flange only (*a* x *d* dia).

If $a/d \leq 0,2$, use factor S4.

This special procedure is not applied if larger tolerances will result from use of the normal procedure as shown in 5.3, taking into account the whole of the upset portion (see figure 4).

6 Categories of tolerances

6.1 Scope of categories

The tolerances are related to the different kind of dimensions. They are classified into four groups accordingly each of them is displayed in the table.

6.1.1 First group of tolerances (table 1)

Tolerances for :

- diameter ;

- step ;

- length ;
- mismatch and eccentricity ;
- local deviations from original bar stock diameter ;
- residual flash/trimmed flat ;
- internal dimensions including diameters of holes.

6.1.2 Second group of tolerances (table 2)

Tolerances for :

- thickness.

6.1.3 Third group of tolerances (table 3)

Tolerances for :

- straightness and flatness ;
- centre-to-centre.

6.1.4 Other categories of tolerances

Tolerances for :

- fillet and edge radii (table 4) ;
- die line fins and trimming burrs (table 4) ;
- surface ;
- draft angle surfaces.
- eccentricity for deep holes ;
- deformation of sheared ends (table 4).

6.2 Definition of categories

6.2.1 First group of tolerances (table 1)

6.2.1.1 Diameter tolerances

Tolerances for dimensions of external diameter on all upset portions of a forging (i. e. excluding unforged stock) are taken from table 1. For external dimensions the tolerance dispersions are as shown in the table 1.