



# SLOVENSKI STANDARD

## SIST EN 10294-1:2005

01-december-2005

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Hollow bars for machining - Technical delivery conditions - Part 1: Non alloy and alloy steels

Stahlrohre für die spanende Bearbeitung (Drehteilrohre) - Technische Lieferbedingungen - Teil 1: Unlegierte und legierte Stähle

Barres creuses pour usinage - Conditions techniques de livraison - Partie 1 : Aciers non alliés et alliés

**Ta slovenski standard je istoveten z: EN 10294-1:2005**

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**ICS:**

77.140.75	Jeklene cevi in cevni profili za posebne namene	Steel pipes and tubes for specific use
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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 10294-1**

October 2005

ICS 77.140.75

English Version

## Hollow bars for machining - Technical delivery conditions - Part 1: Non alloy and alloy steels

Barres creuses pour usinage - Conditions techniques de  
livraison - Partie 1 : Aciers non alliés et alliés

Stahlrohre für die spanende Bearbeitung (Drehteilrohre) -  
Technische Lieferbedingungen - Teil 1: Unlegierte und  
legierte Stähle

This European Standard was approved by CEN on 29 August 2005.

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.

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 Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
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## EN 10294-1:2005 (E)

## Foreword

This European Standard (EN 10294-1:2005) has been prepared by Technical Committee ECISS/TC 29 “steel tubes and fittings for steel tubes”, the secretariat of which is held by UNI.

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 2006, and conflicting national standards shall be withdrawn at the latest by April 2006.

This European Standard differs from ISO 2938, *Hollow bars for machining*.

Another part of EN 10294 in course of preparation is:

— Part 2: *Stainless steels*.

Other European Standard series covering tubes for mechanical and general engineering purposes are:

— EN 10296, *Welded steel tubes for mechanical and general engineering purposes*,

— EN 10297, *Seamless steel tubes for mechanical and general engineering purposes*.

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

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## 1 Scope

This part of EN 10294 specifies the technical delivery conditions for seamless steel hollow bars intended for the manufacture of engineering components by machining.

Machinability requirements are defined and a list of hollow bar size codes is given with the related dimensions achievable after machining when centring on the outside diameter.

NOTE Dimensional requirements for other products, for example, applying when centring on the inside diameter may be agreed between purchaser and manufacturer at the time of enquiry and order (see Options 3 and 4).

## 2 Normative references

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

EN 10002-1, *Metallic materials – Tensile testing – Part 1: Method of test at ambient temperature.*

EN 10020:2000, *Definition and classification of grades of steel.*

EN 10021:1993, *General technical delivery requirements for steel and iron products.*

EN 10045-1, *Metallic materials – Charpy impact test – Part 1: Test method.*

EN 10052:1993, *Vocabulary of heat treatment terms for ferrous products.*

EN 10168, *Steel products – Inspection documents – List of information and description.*

EN 10204, *Metallic products – Types of inspection documents.*

EN 10266:2003, *Steel tubes, fittings and structural hollow sections – Symbols and definitions of terms for use in product standards.*

EN ISO 377, *Steel and steel products – Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997).*

EN ISO 2566-1, *Steel – Conversion of elongation values – Part 1: Carbon and low alloy steels (ISO 2566-1:1984).*

ISO 3685, *Tool-life testing with single-point turning tools.*

## 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 10020:2000, EN 10021:1993, EN 10052:1993 and EN 10266:2003 and the following apply.

### 3.1

#### **hollow bar**

circular long product made by a seamless tube manufacturing process or by drilling a bore into a rolled or forged bar

These products are characterized by special dimensions and material properties which confer machinability, suitability for heat treatment and surface condition suitable for final machining of the component

**EN 10294-1:2005 (E)****3.2****centering on outside diameter**

first chucking is made on the outside diameter and machining is performed on the outside surface and/or on the inside surface

**3.3****centering on the inside diameter**

first chucking is made on the inside diameter and machining is performed on the outside surface and/or on the inside surface

**3.4****normalizing forming**

rolling process in which the final deformation is carried out in a certain temperature range leading to a material condition equivalent to that obtained after normalizing so that the specified values of the mechanical properties are retained even after normalizing

NOTE When throughout this European Standard the term tube is used, it is synonymous to hollow bar.

**4 Symbols**

In addition to (or deviating from) the symbols defined in EN 10266:2003 the following symbols apply:

$CS$	Cutting speed, in metres per minute
$D_e$	Maximum achievable outside diameter when centring on the outside diameter, in millimetres
$Di_e$	Minimum achievable inside diameter when centring on the outside diameter, in millimetres
$D_d$	Manufacturer's specific outside diameter of the delivered product, in millimetres
$T_d$	Manufacturer's specific wall thickness of the delivered product, in millimetres
$T_{0,3}$	Time to obtain a 0,3 mm tool wear, in minutes
$T_N$	Nominal wall thickness, calculated as the half difference between the maximum achievable outside diameter $D_e$ and the minimum achievable inside diameter $Di_e$ , in millimetres

**5 Classification and designation****5.1 Classification**

In accordance with the classification system in EN 10020, all steel grades except E590K2 are non-alloy quality steels; the steel grade E590K2 is a non-alloy special steel.

**5.2 Designation**

For tubes covered by this part of EN 10294 the steel designation consists of:

— number of this part of this European standard (EN 10294-1);

plus either:

— steel name in accordance with EN 10027-1;



or

— steel number in accordance with EN 10027-2.

The steel name is defined by:

- capital letter E for engineering purposes;
- indication of the specified minimum yield strength for thicknesses  $\leq 16$  mm, expressed in MPa.

## 6 Information to be supplied by the purchaser

### 6.1 Mandatory information

The following information shall be supplied by the purchaser at the time of enquiry and order:

- a) quantity (mass or total length or number);
- b) term "hollow bar";
- c) hollow bar size code;
- d) reference to this European Standard;
- e) steel grade (steel name or steel number);
- f) mechanical properties for tubes with wall thickness  $T_N$  greater than 50 mm.

### 6.2 Options

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A number of options are specified in this European Standard and these are listed below. In the event that the purchaser does not indicate a wish to implement any of these options at the time of enquiry and order, the hollow bars shall be supplied in accordance with the basic specification (see 6.1).

- 1) supply of machinability data to the purchaser (see 8.4);
- 2) special criteria for surface condition (see 8.5);
- 3) clean turned sizes when centring on the inside diameter(see 8.8.3);
- 4) exact lengths (see 8.8.4);
- 5) inspection document 3.2 (see 9.2.1);
- 6) temporary corrosion protection (see clause 13).

### 6.3 Example of an order

50 t of hollow bars in accordance with EN 10294-1, hollow bar size code 9065, made of steel grade E470:

50 t hollow bars – 9065 – EN 10294-1 – E470

## EN 10294-1:2005 (E)

**7 Manufacturing process****7.1 Steelmaking process**

The steels covered by this European Standard are characterized by their suitability for machining (see 8.4). The steelmaking process is left at the discretion of the manufacturer provided all requirements defined in clause 8 can be fulfilled with the material produced.

**7.2 Deoxidation process**

Steels shall be fully killed.

**7.3 Tube manufacture and delivery conditions**

The products shall be manufactured by a seamless process or by machining from round bars. At the discretion of the manufacturer the tubes may be hot finished or cold finished before any heat treatment in accordance with Table 1 is applied.

Cold finished products in grades E355 and E470 shall subsequently be either stress relieved or annealed or normalized. The method is left at the discretion of the manufacturer.

The delivery conditions are given in Table 1.

**Table 1 – Delivery condition**

Steel name	Delivery condition <sup>a</sup>
E355	No heat treatment required
E355J2	Normalized or normalizing-formed
E470	No heat treatment required
E420J2	Normalized or normalizing-formed
E590K2	Quenched + tempered
<sup>a</sup> See requirements for cold finished products in 7.3	

**8 Requirements****8.1 General**

The hollow bars, when supplied in a delivery condition according to 7.3 and inspected in accordance with clauses 9, 10 and 11, shall comply with the requirements of this part of EN 10294.

In addition, the general technical delivery conditions specified in EN 10021 shall apply.

**8.2 Chemical composition**

The cast analysis reported by the steel producer shall apply and conform to the requirements of Table 2.

In case of dispute the permissible deviations of a product analysis from the limits of cast analysis specified in Table 2 are given in table 3.

**NOTE** When welding products produced from hollow bars according to this European Standard, account should be taken of the fact that the behaviour of the steel during and after welding is dependent not only on the steel, but also on the material thickness and the conditions of preparing for and carrying out welding.

Table 2 – Chemical composition (cast analysis) <sup>a</sup> in % by mass

Steel grade		C		Si		Mn		P max	S		Cr max	Mo max	Ni max	Al		Cu max	N Max	Nb <sup>b</sup> max	Ti <sup>b</sup> max	V <sup>c</sup>	
Name	Number	min	max	min	max	min	max		min	max				min	max					min	max
E355 <sup>d</sup>	1.0580	-	0,22	-	0,55	-	1,60	0,030	0,015	0,050	-	-	-	-	-	-	-	-	-	-	-
E355J2	1.0592	-	0,22	-	0,55	-	1,60	0,030	0,015	0,050	0,30	0,08	0,30	0,010	0,060	0,30	0,020	0,05	0,05	-	0,10
E420J2	1.0599	0,16	0,22	0,10	0,50	1,30	1,70	0,030	0,015	0,050	0,30	0,08	0,40	0,010	-	0,30	0,020	0,07	0,05	0,08	0,15
E470	1.0536	0,16	0,22	0,10	0,50	1,30	1,70	0,030	0,015	0,050	-	-	-	0,010	-	-	0,020	0,07	-	0,08	0,15
E590K2	1.0644	0,16	0,22	0,10	0,50	1,30	1,70	0,030	0,015	0,050	0,30	0,08	0,40	0,010	-	0,30	0,020	0,07	0,05	0,08	0,15

- <sup>a</sup> Elements not included in this table shall not be intentionally added to the steel without the agreement of the purchaser, except for elements which may be added for finishing the cast. All appropriate measures shall be taken to prevent the addition of undesirable elements from scrap or other materials used in the steelmaking process.
- <sup>b</sup> The content of these elements need not to be reported unless intentionally added to the cast.
- <sup>c</sup> V may be replaced by Nb or Ti percent for percent provided that the V content shall be at least 0,05 % and the sum V + Nb + Ti is ≤ 0,21 %.
- <sup>d</sup> Additions of Nb, V or Ti are permitted and left at the discretion of the manufacturer. The content of these elements shall be reported

**Table 3 – Permissible deviations of the product analysis from specified limits on cast analysis given in Table 2**

Element	Limiting value for the cast analysis according to Table 2	Permissible deviation of the product analysis
C	≤ 0,22	± 0,02
Si	≤ 0,55	± 0,05
Mn	≤ 1,70	- 0,05 / + 0,10
P	≤ 0,030	+ 0,005
S	≤ 0,050	- 0,003/+ 0,005
Cr	≤ 0,30	+ 0,05
Ni	≤ 0,40	+ 0,05
Mo	≤ 0,08	+ 0,02
Cu	≤ 0,30	+ 0,05
N	≤ 0,020	+ 0,002
Al	≤ 0,060	± 0,005
Nb	≤ 0,07	+ 0,01
V	≤ 0,15	± 0,02
Ti	≤ 0,05	+ 0,01

### 8.3 Mechanical properties

The mechanical properties of the tubes shall conform to the requirements of Table 4.

**Table 4 – Mechanical properties <sup>a</sup>**

Steel grade		Upper yield strength ReH min MPa For $T_N$ in mm				Tensile strength Rm min Mpa For $T_N$ in mm				Elongation in the longitudinal direction	Minimum average absorbed energy KV, in. J at a test temperature of - 20 °C
Name	Number	$T_N \leq 16$	16 < $T_N \leq 25$	25 < $T_N \leq 40$	40 < $T_N \leq 50$	$T_N \leq 16$	16 < $T_N \leq 25$	25 < $T_N \leq 40$	40 < $T_N \leq 50$	A min %	
E355	1,0580	355	345	335	335	490	490	470	470	18	-
E355J2	1,0592	355	345	335	335	490	490	470	470	20	27
E420J2	1,0599	420	400	380	380	600	560	530	530	19	27
E470	1,0536	470	460	430	430	650	620	600	550	17	-
E590K2	1,0644	590	540	480	480	700	650	570	570	16	40

<sup>a</sup> At the discretion of the manufacturer the elongation may also be determined in the transverse direction. In this case the minimum values to be achieved shall be those for the longitudinal direction minus 2 points.

For nominal wall thicknesses  $T_N$  greater than 50 mm, the mechanical properties shall be agreed between the manufacturer and the purchaser.