



# Prodotti trafilati in barre: verso una nuova EN 10277

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Unsider  
Day Training  
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# La norma EN 10277 :2008

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# EN 10277: una breve storia

- A partire dal 1991, Unsider, su richiesta dei soci di Federacciai, diede vita ad un gruppo di lavoro che preparò una norma sui finiti a freddo in un tempo relativamente breve

UNI 10233 :1993 “Prodotti di acciaio in barre trafilati, pelati rullati e rettificati”

- 1 “Prescrizioni tecniche di fornitura e controllo”
  - 2 “Dimensioni e tolleranze dimensionali e geometriche”
  - 3 “Prescrizioni qualitative degli acciai non legati”
  - 4 “Prescrizioni qualitative degli acciai non legati per lavorazioni meccaniche ad alta velocità con asportazione di truciolo”
  - 5 “Prescrizioni qualitative degli acciai legati da costruzione meccanica”
  - 6 “Prescrizioni qualitative degli acciai inossidabili”
  - 7 “Prescrizioni qualitative degli acciai rapidi, per utensili, per molle e per cuscinetti” (mai portata a termine)
- Per l'epoca, questa norma era molto ben fatta (in particolare la parte dimensionale) e probabilmente migliore delle altre norme europee esistenti

# EN 10277: una breve storia

- Nel 1994 la EBA (European Bar Association) nominò un comitato di esperti con l'incarico di preparare una bozza di norma europea da presentare a ECISS per l'approvazione come norma europea.
- Attorno al tavolo c'erano i tecnici delle principali nazioni (D, F, UK, I), ciascuno con la propria norma nazionale da difendere
  - UNI 10233, DIN 1651 e 1652, BS 970-3...

# EN 10277: una breve storia

- I lavori, pur se in un gruppo ristretto, si rivelarono molto complessi per la forte determinazione di ciascuno nel difendere i principi delle singole norme nazionali
- Uno degli ostacoli maggiori fu la diatriba tra Italia e Germania per i prodotti piatti (caratteristiche e tolleranze)
- Una bozza di norma, con molte questioni irrisolte, arrivò alla discussione nell'ECISS TC 23 SC1 (oggi ECISS TC105), dove praticamente si ricominciò dall'inizio

# EN 10277: una breve storia

- La segreteria del TC23 decise che la norma doveva essere in 5 parti + una dimensionale (EN 10278)
  - per la valutazione dell'attività di un TC una norma in 5 parti valeva 5 norme...
- Dopo ulteriori lunghissime discussioni, la prima norma europea fu partorita nel 1999, con struttura uguale a quella attuale
  - EN 10277 luglio 1999
  - UNI EN 10277 luglio 2000 in italiano

# EN 10277: una breve storia

- La parte relativa alle barre inox trafilate fu lasciata a parte perché il TC23 SC1 si era dichiarato incompetente
  - l'Italia aveva la UNI 10233-6
  - non esisteva una norma europea sugli inox
- Su spinta dell'Italia l'argomento è stato poi inserito nella seconda revisione della EN 10088-3 :2005

# EN 10277: una breve storia

- La vera rivoluzione fu la tabella relativa alla qualità superficiale
- per la prima volta si metteva nero su bianco che ci possono essere imperfezioni superficiali (allora chiamate “difetti”) più profonde di un certo limite ma tollerabili, di cui l’acquirente doveva prendere conoscenza
- le precedenti norme nazionali, a tutti i livelli, dichiaravano che la superficie delle barre non dovesse avere alcun difetto oltre il limite di profondità specificato

**Table 1: Surface quality classes<sup>1)</sup>**

Condition	Class			
	1	2	3	4
Permissible defect depth	max. 0,3 mm for $d \leq 15$ mm; max. $0,02 \cdot d$ for $15 < d \leq 100$ mm	max. 0,3 mm for $d \leq 15$ mm; max. $0,02 \cdot d$ for $15 < d \leq 75$ mm; max. 1,5 mm for $d > 75$ mm	max. 0,2 mm for $d \leq 20$ mm; max. $0,01 \cdot d$ for $20 < d \leq 75$ mm; max. 0,75 mm for $d > 75$ mm	technically crack free by manufacture
Product form <sup>2)</sup>				
Rounds	+	+	+	+
Squares	+	+(for $d \leq 20$ mm) <sup>4)</sup>	-	-
Hexagons	+	+(for $d \leq 50$ mm) <sup>4)</sup>	-	-
Flats	+ <sup>3)</sup>	-	-	-

<sup>1)</sup> d = nominal diameter of bar and distance across flats of squares and hexagons.  
<sup>2)</sup> + indicates available in these classes, - indicates not available in these classes.  
<sup>3)</sup> Maximum defect depth refers to respective section (width or thickness).  
<sup>4)</sup> Crack detection with eddy current device not possible for  $d > 20$  mm or  $d > 50$  mm as indicated.

# EN 10277: una breve storia

- L'edizione 1999 fu revisionata e la seconda edizione fu pubblicata nel 2008
  - EN 10277 marzo 2008
  - UNI EN 10277 settembre 2008 in lingua inglese
- Su pressione italiana, alcune importanti modifiche sono state fatte per le caratteristiche dei prodotti trafilati

During the preparation of the first edition of this European Standard there were not enough statistical data available concerning mechanical properties of bright bar products. Since then it has been recognized that the proof strength values in the cold drawn condition were too high. In addition, cyclic stresses that occur during straightening can reduce the proof strength (Bauschinger's effect), which was not taken into account when drafting the first edition of this standard. In this second edition the proof strength values of non-alloy and alloy grades in condition +QT+C in parts 3 and 5 have been adjusted downwards compared to the first edition.

- Anche il contenuto del § 7.7 e la tabella 1 sulla qualità superficiale sono stati modificati

# EN 10277 :2008

- Norma in 5 parti valida solo per barre finite a freddo
  - UNI EN 10277 : Barre finite a freddo
    - Condizioni tecniche di fornitura
      - parte 1: Generalità
      - parte 2: Acciai per impieghi generali
      - parte 3: Acciai automatici
      - parte 4: Acciai da cementazione
      - parte 5: Acciai da bonifica

# EN 10277-1 :2008

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 10277-1**

March 2008

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ICS 77.140.60

Supersedes EN 10277-1:1999

English Version

**Bright steel products - Technical delivery conditions - Part 1:  
General**

Produits en acier transformés à froid - Conditions  
techniques de livraison - Partie 1: Généralités

Blankstahlerzeugnisse - Technische Lieferbedingungen -  
Teil 1: Allgemeines

# EN 10277 :2008 parte 1

## Scopo

- Scopo: la norma specifica le condizioni tecniche di fornitura per barre finite a freddo in condizioni trafilate, pelate-rullate o rettificate, in barre raddrizzate.

### 1 Scope

This part of EN 10277 specifies the general technical delivery conditions for bright steel bars in the drawn, turned or ground condition, in straight lengths and of the following steel types:

- a) steels for general engineering purposes as specified in EN 10277-2;
- b) free-cutting steels as specified in EN 10277-3;
- c) case hardening steels as specified in EN 10277-4;
- d) steels for quenching and tempering as specified in EN 10277-5.

It does not cover cold rolled products and cut lengths produced from strip or sheet by cutting.

In special cases variations in these technical delivery requirements or additions to them may form the subject of an agreement at the time of enquiry and order (see Annex B).

In addition to the specifications of this European Standard, the general technical delivery requirements of EN 10021 are applicable, unless otherwise specified.

EN 10277 :2008 parte 1

# Come ordinare il prodotto

- Come tutte le norme di prodotto, la norma contiene capitoli che aiutano a fare richieste e ordini corretti e completi:
  - 5 Dati da fornire da parte del committente
    - 5.1 Dati obbligatori
    - 5.2 Opzioni
    - 5.3 Esempi di uno o più ordini

# EN 10277 :2008 parte 1

## Come ordinare il prodotto

### **5 Information to be supplied by the purchaser**

#### **5.1 Mandatory information**

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

- a) quantity (mass, number of bars) to be delivered;
- b) shape of the product (e.g. round, hexagon, square, flat);
- c) number of the dimensional standard (EN 10278);
- d) dimensions and tolerances on dimensions;
- e) reference to this European Standard including the number of the part (e.g. EN 10277-3);
- f) steel name or steel number (see 4.2);
- g) delivery condition (see 6.3);
- h) class of surface quality (see 7.7 and Table 1);

# EN 10277 :2008 parte 1

## Come ordinare il prodotto

### 5.2 Options

The following options may be supplied by the purchaser and as agreed with the manufacturer:

- a) reference testing for products used in the quenched and tempered condition (see B.1);
- b) any fine grain requirement and verification of fine grain size (see 7.4 and B.2);
- c) any requirement for the verification of non-metallic inclusions (see 7.5 and B.3);
- d) depth of decarburization (see 7.6 and B.4);
- e) additional requirements to the tolerances on shape according to EN 10278;
- f) temporary corrosion protection (see B.5);
- g) non-destructive testing (see 7.8 and B.6);
- h) product analysis (see 7.1.2 and B.7);
- i) special marking (see 9 and B.8);
- j) hardenability requirements for grades of EN 10277-4 and EN 10277-5 (see 7.1.1.2 and 7.3 of EN 10277-4 and EN 10277-5);
- k) type of inspection document in accordance with EN 10204 (see 8.1).

# EN 10277 :2008 parte 1

## Le finiture

- Sono previste le seguenti finiture:
  - Trafilato (+C)
  - Pelato-rullato (+SH)
  - Rettificato (+SL)

### 6.3.1 Finished condition

The steel product shall be delivered in one or a combination of the following finished conditions with or without heat treatment:

- a) drawn, symbol +C;
- b) turned, symbol +SH;
- c) ground, symbol +SL.

**EN 10277 :2008 parte 1**

# **La qualità superficiale**

- Poiché le discontinuità superficiali non possono essere completamente evitate durante la produzione, e poiché non si eliminano durante la trafilatura, occorre prendere accordi sulla qualità superficiale
- Sono previste 4 classi: salvo diversi accordi
  - i trafilati sono forniti in classe 1
  - i pelati rullati e i rettificati sono forniti in classe 3
  - la classe 4 si può ottenere di norma solo con asportazione
    - pelati-rullati o rettificati

# EN 10277 :2008 parte 1

## La qualità superficiale

**Table 1 — Surface quality classes**

Condition	Class			
	1	2	3	4
Permissible depth of discontinuities	max. 0,3 mm for $d \leq 15$ mm; max. $0,02 \cdot d$ for $15 < d \leq 100$ mm	max. 0,3 mm for $d \leq 15$ mm; max. $0,02 \cdot d$ for $15 < d \leq 75$ mm max. 1,5 mm for $d > 75$ mm	max. 0,2 mm for $d \leq 20$ mm; max. $0,01 \cdot d$ for $20 < d \leq 75$ mm; max. 0,75 mm for $d > 75$ mm	technically crack free by manufacture <sup>e</sup>
Maximum percentage of delivered weight with discontinuities in excess of specified level	4 %	1 %	1 %	0,2 %
Product form <sup>a</sup>				
Rounds	+	+	+	+
Squares	+	+ (for $d \leq 20$ mm) <sup>c</sup>	-	-
Hexagons	+	+ (for $d \leq 50$ mm) <sup>c</sup>	-	-
Flats	+ <sup>b</sup>	-	-	-
Special sections	+ <sup>d</sup>	-	-	-

## EN 10277 :2008 parte 1

# I documenti di controllo

- Un documento di controllo deve essere richiesto all'ordine
  - vedere § 5.2 Opzioni da richiedere all'ordinazione
- Può essere di tipo 2.2 e contiene
  - la conferma della conformità del materiale all'ordine
  - la composizione chimica di colata per gli elementi previsti dalla norma
- Può essere di tipo 3.1 o 3.2 e contiene
  - quanto previsto dal 2.2
  - i risultati di tutti i controlli e le prove richieste e concordate all'ordine
  - i numeri o le lettere che permettono di collegare il certificato, i campioni di prova e il prodotto

# EN 10277-2, -3, -4, -5 :2008

- Si riferiscono a diversi tipi di acciaio
- Comprendono tabelle per:
  - la composizioni chimica di colata
  - le caratteristiche meccaniche nelle più comuni condizioni di fornitura

# EN 10277-2, -3, -4, -5 :2008

## Bright steel products - Technical delivery conditions - Part 2: Steels for general engineering purposes

Produits en acier transformés à froid - Conditions  
techniques de livraison - Partie 2: Aciers d'usage général

Blankstahlerzeugnisse - Technische Lieferbedingungen -  
Teil 2: Stähle für allgemeine technische Verwendung

## Bright steel products - Technical delivery conditions - Part 3: Free-cutting steels

Produits en acier transformés à froid - Conditions  
techniques de livraison - Partie 3: Aciers de décolletage

Blankstahlerzeugnisse - Technische Lieferbedingungen -  
Teil 3: Automatenstähle

## Bright steel products - Technical delivery conditions - Part 4: Case hardening steels

Produits en acier transformés à froid - Conditions  
techniques de livraison - Partie 4: Aciers pour cémentation

Blankstahlerzeugnisse - Technische Lieferbedingungen -  
Teil 4: Einsatzstähle

English Version

## Bright steel products - Technical delivery conditions - Part 5: Steels for quenching and tempering

Produits en acier transformés à froid - Conditions  
techniques de livraison - Partie 5: Aciers pour trempe et  
revenu

Blankstahlerzeugnisse - Technische Lieferbedingungen -  
Teil 5: Vergütungsstähle

# EN 10277-2 :2008

- Acciai per impieghi generali
  - 4 acciai non legati per impieghi strutturali (da EN 10025-2)
  - 8 acciai al carbonio (da EN 10083-2)
- Caratteristiche meccaniche nelle condizioni:

• +SH	laminato + pelato-rullato	HBW, ( $R_m$ )
• +C	trafilato	$R_{p0,2}$ , $R_m$ , A

# EN 10277-3 :2008

- Acciai per lavorazioni meccaniche ad alta velocità  
(Acciai “automatici” – da EN 10087)

- 4 acciai non da trattamento termico (2 senza Pb, 2 con Pb)

- caratteristiche meccaniche nelle condizioni

+SH	laminato + pelato-rullato	R <sub>m</sub> , (HBW)
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+C	trafilato	R <sub>p0,2</sub> , R <sub>m</sub> , A
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- 3 acciai da cementazione (2 senza Pb, 1 con Pb)

- caratteristiche meccaniche nelle condizioni

+SH	laminato + pelato-rullato	R <sub>m</sub> , (HBW)
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+C	trafilato	R <sub>p0,2</sub> , R <sub>m</sub> , A
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- 10 acciai da bonifica (5 senza Pb, 5 con Pb)

- caratteristiche meccaniche nelle condizioni

+SH	laminato + pelato-rullato	R <sub>m</sub> , (HBW)
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+C	trafilato	R <sub>p0,2</sub> , R <sub>m</sub> , A
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+C +QT	trafilato + bonificato	R <sub>p0,2</sub> , R <sub>m</sub> , A
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+QT +C	bonificato + trafilato	R <sub>p0,2</sub> , R <sub>m</sub> , A
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# EN 10277-4 :2008

- Acciai da cementazione (da EN 10084)

- 3 acciai non legati (al carbonio)

- caratteristiche meccaniche nelle condizioni

+SH	laminato + pelato-rullato	HBW, $R_m$
+C	trafilato	$R_{p0,2}$ , $R_m$ , A
+A +SH	ricotto lavorabile + pelato-rullato	HBW
+A +C	ricotto lavorabile + trafilato	HBW

- 7 acciai legati

- caratteristiche meccaniche nelle condizioni:

+A +SH	ricotto lavorabile + pelato-rullato	HBW
+A +C	ricotto lavorabile + trafilato	HBW
+FP +SH	ricotto isothermico + pelato-rullato	HBW
+FP +C	ricotto isothermico + trafilato	HBW

# EN 10277-5 :2008

- Acciai da bonifica

- 10 acciai al carbonio (da EN 10083-2)

- caratteristiche meccaniche nelle condizioni

- +C           trafilato
- $R_{p0,2}, R_m, A$

- +SH          laminato + pelato-rullato
- HBW,  $R_m$

- +C +QT     trafilato + bonificato
- $R_{p0,2}, R_m, A$

- +QT +C     bonificato + trafilato
- $R_{p0,2}, R_m, A$

- 7 acciai legati (da EN 10083-3)

- caratteristiche meccaniche nelle condizioni

- +A +SH     ricotto lavorabile + pelato-rullato
- HBW

- +C +QT     trafilato + bonificato o

- +QT +SH   bonificato + pelato-rullato
- $R_{p0,2}, R_m, A$

- +QT +C     bonificato + trafilato
- $R_{p0,2}, R_m, A$

- +A +C       ricotto lavorabile + trafilato
- HBW

# La norma dimensionale EN 10278 :1999

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# EN 10278

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

EN 10278

October 1999

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ICS 77.140.60

English version

Dimensions and tolerances of bright steel products

Dimensions et tolérances des produits en acier transformé  
à froid

Maße und Grenzabmaße von Blankstahlerzeugnissen

# EN 10278

- Tolleranze per barre finite a freddo

- requisiti dimensionali per barre in acciaio

Diametro, ovalizzazione, rettilineità, lunghezza ecc.

- Scopo: la norma specifica i requisiti tecnici di fornitura per le barre finite a freddo, in condizioni trafilate o pelate-rullate, utilizzate per impieghi meccanici, per esempio per pezzi lavorati di utensile.

Le barre finite a freddo sono suddivise nei seguenti tipi di acciaio:

- a) acciai non legati per impieghi generali
- b) acciai non legati automatici
- c) acciai da cementazione non legati e legati
- d) acciai da bonifica non legati e legati
- e) acciai inossidabili

# Le principali norme di base

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# Le norme di base EN

- UNI EN 10025 :2005 “Prodotti laminati di acciaio strutturale”
  - parte 1: Condizioni tecniche generali di fornitura
  - parte 2: Condizioni tecniche di fornitura per acciai strutturali non legati
- UNI EN 10083 :2006 “Acciai da bonifica”
  - parte 1: Condizioni tecniche generali di fornitura
  - parte 2: Condizioni tecniche di fornitura per acciai non legati
  - parte 3: Condizioni tecniche di fornitura per acciai legati
- UNI EN 10084 :2008 “Acciai da cementazione”
- UNI EN 10087 :2000 “Acciai per lavorazioni meccaniche ad alta velocità – Condizioni tecniche di fornitura per i prodotti semilavorati, le barre laminate a caldo e le vergelle” (Acciai automatici)

# Le norme di base EN

- UNI EN 10088 :2014 Acciai inossidabili
  - parte 1: Lista degli acciai inossidabili
  - parte 3: Condizioni tecniche di fornitura per prodotti semilavorati, barre, vergelle, fili, profili e prodotti finiti a freddo in acciaio resistente alla corrosione per uso generale
  - (parte 5): Condizioni tecniche di fornitura per barre, vergelle, fili, profili e prodotti finiti a freddo in acciaio resistente alla corrosione per utilizzo nelle costruzioni

# Le norme di base ISO

- ISO 683 Heat-treatable steels, alloy steels and free-cutting steels
  - part 1 :2016 “Non-alloy steels for quenching and tempering”
  - part 2 :2016 “Alloy steels for quenching and tempering”
  - part 3 :2016 “Case-hardening steels”
  - part 4 :2016 “Free-cutting steels”
- ISO 15510 Stainless steel . Chemical composition
- ISO 16143-2 :2014 Stainless steels for general purposes
  - part 2: Corrosion-resistant semi-finished products, bars, rods and sections
- ISO 630-2 :2011 Structural steels
  - part 2: Technical delivery conditions for structural steels for general purposes

# Il futuro delle norme per barre

- Le norme ISO relative ai laminati sostituiranno le corrispondenti norme EN
  - In genere, in conformità ai recenti accordi e tendenze ECISS e ISO, ove possibile le nuove norme ISO sostituiranno le corrispondenti EN
  - La sostituzione non avverrà per le norme relative agli acciai inossidabili perché esistono troppe divergenze tra le EN e le ISO, a partire dalla composizione chimica
  - Inoltre, molti acciai inossidabili sono elencati in regolamenti cogenti delle varie nazioni europee (contatto con alimenti, recipienti in pressione ecc.) e non possono essere sostituiti da acciai simili
  - Le EN 10088-1, -2, -3 continueranno la loro vita naturale
    - non saranno sostituite da ISO 15510, ISO 16143-1, -2, -3
  - Anche le EN 10025 sono armonizzate e contengono acciai di direttive europee (CPR) e non saranno sostituite dalle ISO 630



Dear Madam or Sir,

meanwhile the enquiry procedures for acceptance of the above mentioned ISO-standards as European standards are open and we hope for positive votes and a publication of these standards at the end of this year.

Although for ISO 683-1 to -4 only a yes/no vote is possible due to the 1:1 takeover of the ISO standards we have to decide and to deal about the comments on prEN 10277. Therefore we would like to invite you to the next meeting ECISS/TC 105 which will take place on

**Thursday, 8 June 2017 at 11:00 a.m. meeting room 3  
at Stahl-Zentrum, Sohnstraße 65 in 40237 Düsseldorf**

As a reminder we would like to explain the current procedure and if you have any questions concerning the ISO standards or concerning the procedures, please do not hesitate to contact me. We have started in 2009 with the revision of the ISO-standards on steels for quenching and tempering and steels for case hardening, which were published in 2012. At that time Finland made a proposal to take over the ISO standards as EN ISO standards. Main reasons were that there were hardly enough experts on the European level for revising the corresponding European standards and that the technical level of the ISO standards were equal to the European ones. Then we faced two problems: 1) European manufacturer requested more steel grades for the standard for case hardening steels and 2) only a simultaneous adoption of the standards for free-cutting steels and bright steels could guarantee a takeover without problems due to the dependency of bright steel products from the other standards. The corresponding standards were published 2014 and only after a further minor revision we thought that the ISO-standards published in 2016 were ready for European acceptance. Therefore at the second half of 2016 we have asked for the corresponding new European projects, which were accepted. Now we hope for a successful vote on the enquiry procedures.

# Il futuro delle norme di base

Norma EN	Norma ISO	acciai	sostituzione	situazione
EN 10083-2	ISO 683-1 :2016	laminati non legati da bonifica	si	prEN ISO 683-1 chiusura indagine 11/05/2017 2 voti italiani su 26 aventi diritto
EN 10083-3	ISO 683-2:2016	laminati legati da bonifica	si	prEN ISO 683-2 chiusura indagine 11/05/2017 2 voti italiani su 26 aventi diritto
EN 10084	ISO 683-3 :2016	laminati da cementazione	si	prEN ISO 683-3 chiusura indagine 11/05/2017 2 voti italiani su 26 aventi diritto
EN 10087	ISO 683-4 :2016	laminati automatici	si	prEN ISO 683-4 chiusura indagine 11/05/2017 2 voti italiani su 26 aventi diritto
EN 10088-1	ISO 15510	elenco acciai inossidabili	no	
EN 10088-3	ISO 16143-2 :2014	acciai inossidabili prodotti lunghi (caldo + freddo)	no	
EN 10025-2	ISO 630-2	Laminati strutturali	no	

# La norma ISO 683-18 :2014

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# ISO 683- 18:2014

INTERNATIONAL  
STANDARD

ISO  
683-18

Third edition  
2014-09-15

- ... una corposa norma di 71 pagine per barre in acciaio finite a freddo

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**Heat-treatable steels, alloy steels and  
free-cutting steels —**

Part 18:  
**Bright steel products**

*Aciers pour traitement thermique, aciers alliés et aciers pour  
décolletage —*

*Partie 18: Produits en aciers transformés à froid*

# ISO 683-18 :2014

- Acciai da trattamento termico, acciai legati e acciai automatici
- Parte 18: prodotti finiti a freddo
  - Scopo: la norma elenca i requisiti tecnici di fornitura per le barre finite a freddo, in condizioni trafilate o pelate-rullate, utilizzate per impieghi meccanici, per esempio per pezzi lavorati di utensile.

Le barre finite a freddo sono suddivise nei seguenti tipi di acciaio:

- a) acciai non legati per impieghi generali
- b) acciai non legati automatici
- c) acciai da cementazione non legati e legati
- d) acciai da bonifica non legati e legati
- e) acciai inossidabili

# ISO 683-18 :2014

## Condizioni di trattamento e requisiti

### Per acciai non inossidabili

Table 1 — Combinations of usual treatment conditions at delivery and requirements for non-stainless steels

1	2	3	4	5	6	7	8	9
Treatment condition at delivery	Symbol	Chemical composition  All steels	Mechanical properties					
			General engineering steels	Free cutting steels	Non-alloy case-hardening steels	Alloy case-hardening steels	Non-alloy steels for quenching and tempering	Alloy steels for quenching and tempering
2	As-rolled and peeled/turned <sup>a</sup>	+SH	See <a href="#">Table 5</a>	See <a href="#">Table 6, 7</a>	See <a href="#">Table 8</a>	–	See <a href="#">Table 10<sup>d</sup></a>	–
3	Cold drawn <sup>b</sup>	+C	See <a href="#">Table 5<sup>c</sup></a>	See <a href="#">Table 6, 7</a>	See <a href="#">Table 8</a>	–	See <a href="#">Table 10<sup>d</sup></a>	–
4	Soft annealed and peeled/turned	+A+SH	–	–	See <a href="#">Table 8</a>	See <a href="#">Table 9</a>	–	See <a href="#">Table 11<sup>d</sup></a>
5	Soft annealed and cold drawn	+A+C	–	–	See <a href="#">Table 8</a>	See <a href="#">Table 9</a>	–	See <a href="#">Table 11<sup>d</sup></a>
6	Treated to ferrite-pearlite structure and hardness range and peeled/turned	+FP+SH	–	–	–	See <a href="#">Table 9</a>	–	–
7	Treated to ferrite-pearlite structure and hardness range and cold drawn	+FP+C	–	–	–	See <a href="#">Table 9</a>	–	–
8	Quenched and tempered and peeled or cold drawn and quenched and tempered	+QT+SH +C+QT	– <sup>c</sup>	See <a href="#">Table 7</a>	–	–	See <a href="#">Table 10</a>	See <a href="#">Table 11</a>
9	Quenched+tempered and cold drawn	+QT+C	–	See <a href="#">Table 7</a>	–	–	See <a href="#">Table 10</a>	See <a href="#">Table 11</a>
10	Other heat-treatment conditions, for example, stress relieved (+SR), normalized (+N) and the mechanical properties, may be agreed at the time of enquiry and order.  The condition “annealed to achieve a spheroidization of the carbides” as required for cold heading and cold extrusion is covered in ISO 4954.	Chemical composition according to ISO 630-2, ISO 683-1, ISO 683-2, ISO 683-4, and ISO 683-3, for information see <a href="#">Tables A.1 to A.4</a>	To be agreed					

<sup>a</sup> Peeling is in general possible for diameters of 16 mm and over.

<sup>b</sup> For rounds with diameters over 80 mm, it is more usual to apply peeling/turning instead of drawing.

<sup>c</sup> If these steels should be drawn and quenched and tempered, values for this treatment could be found at the comparable special steel grades in [Table 10](#).

<sup>d</sup> The mechanical properties specified in [Table 10](#), respectively [Table 11](#), for the condition +C+QT must be achievable after appropriate heat treatment if so agreed in the order (for reference test pieces see [C.2](#)).

## Condizioni di trattamento e requisiti

Table 2 — Types of process routes, surface finish and requirements for stainless steels<sup>a</sup>

	1	2	3	4	5	6	7
1		Type of process route	Symbol <sup>b</sup>	Surface finish <sup>b</sup>	Note	Chemical composition	Mechanical properties
2	Cold processed	Heat treated <sup>c</sup> , mechanically or chemically descaled or rough machined, cold processed <sup>d</sup> ,	+2H	Smooth and matt or bright. Substantially smoother than finishes 1E, 1D or 1X. Not free of surface imperfections.	On products formed by cold drawing without subsequent heat treatment, the tensile strength is substantially increased, particularly in austenitic materials, depending on the degree of forming. The surface hardness may be higher than the centre hardness.	See ISO 16143-2, for information see <a href="#">Table A.5</a>	See <a href="#">Tables 12, 13, 14, 15</a>
3		Finish +2H, heat treated <sup>c</sup> , pickled	+2D	Smooth and matt or bright. Smoother than finishes 1E or 1D. Not free of surface imperfections.	This finish allows the restoration of the mechanical properties after cold processing. Products with good ductility (cold heading) and specific magnetic properties.		See ISO 16143-2
4		Heat treated <sup>c</sup> , mechanically or chemically descaled or rough machined, cold processed <sup>d</sup> , mechanically smoothed <sup>e</sup>	+2B	Smoother, uniform and bright. Brighter than finishes 1E, 1D or 1X. Free of surface defects	Products used in their present condition or intended for better finishing. In products formed by cold drawing without subsequent heat treatment, the tensile strength is substantially increased, particularly in austenitic materials, depending on the degree of cold processing. The surface hardness may be higher than the centre hardness. Pre-finish for close ISO-tolerances.		See <a href="#">Tables 12, 13, 14</a>
5	Cold processed with special finishing process	Finishes +2H, +2D or +2B, centreless ground, mechanically smoothed (optional) <sup>f</sup>	+2G	Smooth, uniform and bright. Free of surface defects	Finish for close ISO-tolerances (see <a href="#">Table 3</a> ). Unless otherwise agreed the surface roughness shall be $R_a \leq 1,2$ .		See finishes +2H, +2D and +2B
6		Finishes +2H, +2D or +2B, polished	+2P	Smoother and brighter than finish +2G. Free of surface defects.	Finish for close ISO-tolerances (see <a href="#">Table 3</a> ). Surface roughness can be specified at the time of enquiry and order.		See finishes +2H, +2D and +2B

Per acciai  
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ISO 683-18 :2014

# Qualità superficiale

Table 4 — Surface quality classes

Condition	Class			
	1	2	3	4
Permissible depth of discontinuities	max. 0,3 mm for $t \leq 15$ mm; max. $0,02t$ for $15 < t \leq 100$ mm	max. 0,3 mm for $t \leq 15$ mm; max. $0,02t$ for $15 < t \leq 75$ mm max. 1,5 mm for $t > 75$ mm	max. 0,2 mm for $t \leq 20$ mm; max. $0,01t$ for $20 < t \leq 75$ mm; max. 0,75 mm for $t > 75$ mm	technically crack free by manufacture <sup>e</sup>
Maximum percentage of delivered weight with discontinuities in excess of specified level	4 %	1 %	1 %	0,2 %
Product form <sup>a</sup>				
Rounds	+	+	+	+
Squares	+	+ (for $t \leq 20$ mm) <sup>c</sup>	-	-
Hexagons	+	+ (for $t \leq 50$ mm) <sup>c</sup>	-	-
Flats	+ <sup>b</sup>	-	-	-
Special sections	+ <sup>d</sup>	-	-	-

Qualità superficiale corrispondente a quella della EN 10277-1 :2008

# ISO 683-18 :2014

## Requisiti dimensionali

- La norma comprende requisiti dimensionali per tutti i prodotti in funzione del tipo di finitura
  - Tolleranze su diametro, ovalizzazione, lunghezza, rettilineità ecc.

**Table 3 — Surface condition and tolerance class at delivery**

	1	2	3	4	5	6	7	8
1	Surface condition at delivery	Symbol	Tolerance class to ISO 286-2 <sup>a</sup>					
			Rounds	Squares	Hexagons	Drawn flats	Special sections	Notes
2	Cold Drawn or heat-treated and cold drawn	+C +2H	h10 (h9 to h12) see <a href="#">Table 16</a>	h11 for $d \leq 80$ mm, h12 for $d > 80$ mm (h11 or h12); see <a href="#">Table 16</a>		h11, h12, see <a href="#">Table 17</a>	– <sup>b</sup>	See <a href="#">Table 1</a> , lines 3,5,7,9 and <a href="#">Table 2</a> line 2
3	Cold drawn, heat treated	+C+QT (+C+N) (+C+SR) (+C+A) +2D	h11 see <a href="#">Table 16</a>	–	–	–	–	Finish for good ductility see <a href="#">Table 1</a> , line 8 and <a href="#">Table 2</a> line 3
4	Peeled/turned	+SH +2B	h10 (h9 to h12) see <a href="#">Table 16</a>	–	–	–	–	See <a href="#">Table 1</a> , lines 2,4,6 and <a href="#">Table 2</a> , line 4
5	Ground	+G +2G	h9 (h6 to h12) see <a href="#">Table 16</a>	–	–	–	–	Obtained e.g. from conditions <a href="#">Table 1</a> , lines 2 to 7 and 9 and see <a href="#">Table 2</a> line 5
6	Polished	+PL +2P	h9 (h6 to h12) see <a href="#">Table 16</a>	–	–	–	–	Obtained e.g. from conditions <a href="#">Table 1</a> , lines 2 to 7 and 9 and see <a href="#">Table 2</a> line 6

# La nuova prEN 10277

## comparata con la EN 10277 :2008

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**prEN 10277**

**EN 10277 :2008**

**EN 10278 :2008**

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**DRAFT**  
**prEN 10277**

February 2017

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ICS 77.140.60

Will supersede EN 10277-1:2008, EN 10277-2:2008,  
EN 10277-3:2008, EN 10277-4:2008,  
EN 10277-5:2008

English Version

## Bright steel products - Technical delivery conditions

Produits en acier transformés à froid - Conditions  
techniques de livraison

Blankstahlerzeugnisse - Technische Lieferbedingungen

# 1 Scope

This European Standard specifies the technical delivery requirements for bright steel bars in the drawn or peeled/turned condition and they are intended for mechanical purposes, for example for machine parts. The bright bars are subdivided into the following steel types:

- a) non-alloy general engineering steels;
- b) non-alloy free-cutting steels;
- c) non-alloy and alloy case-hardening steels;
- d) non-alloy and alloy steels for quenching and tempering.

Bright steel products of stainless steels are to be found in EN 10088-3.



In addition to this standard, the general technical delivery requirements of EN 10021 are applicable.

## 1 Scope

This part of EN 10277 specifies the general technical delivery conditions for bright steel bars in the drawn, turned or ground condition, in straight lengths and of the following steel types:

- a) steels for general engineering purposes as specified in EN 10277-2;
- b) free-cutting steels as specified in EN 10277-3;
- c) case hardening steels as specified in EN 10277-4;
- d) steels for quenching and tempering as specified in EN 10277-5.

It does not cover cold rolled products and cut lengths produced from strip or sheet by cutting.

In special cases variations in these technical delivery requirements or additions to them may form the subject of an agreement at the time of enquiry and order (see Annex B).

In addition to the specifications of this European Standard, the general technical delivery requirements of EN 10021 are applicable, unless otherwise specified.

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 10020, EN 10027-1, EN 10027-2, EN 10052, EN 10079, EN ISO 377, EN ISO 14284 and the following apply.

#### 3.1

##### **bright steel products**



drawn or peeled/turned bars with smoother surface quality and better dimensional accuracy in comparison with hot-rolled bars

### 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 10021:2006, EN ISO 377:1997, EN ISO 14284:2002 and the following apply.

#### 3.1

##### **non-alloy and alloy steel; quality and special steel**

see the terms and definitions in EN 10020:2000

#### 3.2

##### **steel products**

steel products are defined according to their shape and dimensions in EN 10079. In particular the following definitions are reproduced

## 3.2

### **drawn products**

products of various cross-sectional shapes obtained, after descaling, by cold drawing of hot-rolled bars or rod, on a drawing bench (cold deformation without removing material)

Note 1 to entry: This operation gives the product special features with respect to shape, dimensional accuracy and surface finish. Products in lengths are delivered straightened, products of small cross-section may also be supplied in coils.



### 3.2.1

#### **drawn products** (3.4.5.1, EN 10079:2007)

products of various cross section shapes obtained, after descaling, by drawing of hot rolled bars or rod on a draw bench (cold deformation without removing material)

**NOTE** This operation gives the product special features with respect to shape, dimensional accuracy and surface finish. In addition, the process causes cold working of the product, which can be eliminated by subsequent heat treatment. Products in lengths are delivered straightened regardless of size.

### 3.3

#### **peeled/turned products**

steel bars of circular cross-section having the same features of drawn products concerning shape, dimensional accuracy and bright surface finish but without work hardening

Note 1 to entry: They are produced by peeling on a peeling machine usually followed by straightening and by polishing. The removal of metal by peeling is carried out in such a way that the bright product is generally free from surface defects and decarburization coming from the hot-rolling process.

### 3.2.2

#### **turned products** (3.4.5.2, EN 10079:2007)

round bars produced by turning on a lathe where the product can be further processed by straightening and polishing

NOTE 1 This operation gives the bar special features with respect to shape, dimensional accuracy and surface finish. The removal of metal is carried out in such a way that the bright product is generally free from rolling defects and surface decarburization.

NOTE 2 For technical reasons some bars ordered as hot rolled products may be delivered roughly turned (peeled), nevertheless such products are treated as hot rolled products and not as bright products.

### 3.4

#### **ground products**

drawn or peeled/turned round bars given an improved surface quality and dimensional accuracy by grinding or by grinding and polishing

### 3.2.3

#### **ground products** (3.4.5.3, EN 10079:2007)

drawn or turned round bars given an improved surface quality and dimensional accuracy by grinding or grinding and polishing

### 3.5

#### **thickness**

nominal dimension of the product

Note 1 to entry: That means:

- a) the diameter in the case of rounds;
- b) the lateral length in the case of squares;
- c) the width over flats in the case of hexagons;
- d) the shorter lateral length in the case of flats (rectangular bars) and wide-flats.

For special sections, 'thickness' has to be defined at the time of enquiry and order.

### 3.7

#### **ruling section**

section for which the specified mechanical properties shall apply

Note 1 to entry: Independent of the actual shape and dimensions of the cross-section of the product, the size of its ruling section is always given by a diameter. This corresponds to the diameter of an “equivalent round bar”. That is a round bar which will show the same cooling rate as the actual ruling section of the product concerned at its position for taking the test pieces, when being cooled from austenitizing temperature.

### 3.4

#### **ruling section for heat treatment**

ruling section for heat treatment of a product is the section for which the mechanical properties have been specified (see Annex A).

Whatever the actual shape and dimensions of the cross section of the product, the size of its ruling section is expressed as a diameter. This corresponds to the diameter of an “equivalent round bar” which, at the position of its cross section specified for taking test pieces for mechanical tests, will, when being cooled from the austenitising temperature, show the same cooling rate as the actual ruling section of the product concerned at its position for taking test pieces

**NOTE** The term “ruling section” should not be confused with the term “equivalent diameter” as defined in EN 10052.

## **4 Classification and designation**

### **4.1 Classification**

The classification of the relevant steel grades is allocated in accordance with EN 10020. The general engineering and the free cutting steels are quality steels. The steels for case hardening, for quenching and tempering and the stainless steels are special steels.

### **4.2 Designation**

For the steel grades covered by this document, the steel names and numbers given in the relevant tables are allocated in accordance with EN 10027-1 and EN 10027-2.

## **4 Classification and designation**

### **4.1 Classification**

The classification of the relevant steel grades according to EN 10020 is indicated in EN 10277-2 to EN 10277-5.

### **4.2 Designation**

#### **4.2.1 Steel names**

For the steel grades covered by this European Standard, the steel names as given in the relevant tables of EN 10277-2 to EN 10277-5 are assigned in accordance with EN 10027-1.

#### **4.2.2 Steel numbers**

For the steel grades covered by this European Standard, the steel numbers as given in the relevant tables of EN 10277-2 to EN 10277-5 are allocated in accordance with EN 10027-2.

## 5 Information to be supplied by the purchaser

### 5.1 Mandatory information

The manufacturer shall obtain the following information from the purchaser at the time of enquiry and order.

- a) quantity (mass, number of bars) to be delivered;
- b) shape of the product (e.g. round, hexagon, square, flat);
- c) the dimensions and tolerances of the product, see 7.7 and Tables 2 and 11 to 13;
- d) reference to this European Standard, i.e. EN 10277;
- e) the designation of the steel grade and the delivery condition (see Tables 4 to 10);
- f) standard designation for a test report 2.2 or, if required, any other type of inspection document in accordance with EN 10204.

## 5 Information to be supplied by the purchaser

### 5.1 Mandatory information

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

- a) quantity (mass, number of bars) to be delivered;
- b) shape of the product (e.g. round, hexagon, square, flat);
- c) number of the dimensional standard (EN 10278);
- d) dimensions and tolerances on dimensions;
- e) reference to this European Standard including the number of the part (e.g. EN 10277-3);
- f) steel name or steel number (see 4.2);
- g) delivery condition (see 6.3);
- h) class of surface quality (see 7.7 and Table 1);



## 5.2 Options/Supplementary or special requirements

A number of options are specified in this European standard and listed below. If the purchaser does not indicate the wish to implement any of these options, the products will be supplied in accordance with the basic specifications of this standard (see 5.1).

- a) Reference testing for products used in the quenched and tempered condition (for steels for quenching and tempering only, see Table 1, footnote d and C.2);
- b) any fine grain requirement and verification of fine grain size (see 7.3 and C.3);
- c) non-destructive testing (see 7.5 and C.4);
- d) the disposition of tolerances in accordance with 7.7 and C.5;
- e) end conditions may be specified at the time of enquiry and order in accordance with C.6;
- f) product analysis (see 7.1.2, Table 15 and C.7);
- g) for a minimum reduction ratio or minimum thickness deformation (see 6.1 and C.8)
- h) temporary corrosion protection (see 6.2.1 and C.9);
- i) any requirement to special marking (see Clauses 10 and C.10)
- j) any additional requirement concerning the surface condition, i.e. ground surface +G or polished surface +PL for round bars (see 6.2.2 and Table 2);
- k) surface quality class if another than the standard class is requested (see 7.8 and Table 3);
- l) verification of the straightness (see 7.7, Table 14 and Annex D);
- m) any requirement to the hardenability (+H, +HH, +HL), for special steels only (see 7.1.4);
- n) any requirement regarding the permissible depth of decarburization (see 7.6);
- o) impact test at a temperature lower than room temperature (see 9.2.2).

## 5.2 Options

The following options may be supplied by the purchaser and as agreed with the manufacturer:

- a) reference testing for products used in the quenched and tempered condition (see B.1);
- b) any fine grain requirement and verification of fine grain size (see 7.4 and B.2);
- c) any requirement for the verification of non-metallic inclusions (see 7.5 and B.3);
- d) depth of decarburization (see 7.6 and B.4);
- e) additional requirements to the tolerances on shape according to EN 10278;
- f) temporary corrosion protection (see B.5);
- g) non-destructive testing (see 7.8 and B.6);
- h) product analysis (see 7.1.2 and B.7);
- i) special marking (see 9 and B.8);
- j) hardenability requirements for grades of EN 10277-4 and EN 10277-5 (see 7.1.1.2 and 7.3 of EN 10277-4 and EN 10277-5);
- k) type of inspection document in accordance with EN 10204 (see 8.1).

## 5.3 Ordering examples

### EXAMPLE

2 t round bars with nominal diameter 20 mm, tolerance h9, stock length 6000 mm made of steel grade C45 according to this standard in delivery condition +C, surface quality class 1 and a test report 2.2 as specified in EN 10204.

**2 t round bars 20 h9 × stock 6000**

**steel grade EN 10277 —+C C45**

**Inspection document EN 10204 — 2.2**

### EXAMPLE

2 t round bars with nominal diameter 20 mm, tolerance h9, stock length 6000 mm according to EN 10278 made of steel grade 38SMn28 (1.0760) according to EN 10277-3 in the delivery condition +C, surface quality class 3 and a test report 2.2 as specified in EN 10204.

2t round bars EN 10278 - 20 h9 x stock 6000  
EN 10277-3-38SMn28+C - class 3  
EN 10204 – 2.2

or

2t round bars EN 10278 - 20 h9 x stock 6000  
EN 10277-3-1.0760+C - class 3  
EN 10204 – 2.2

## **6 Manufacturing process**

### **6.1 General**

The manufacturing process of the steel and of the products is with the restrictions given by the requirements in 6.2 and 6.3 left to the discretion of the manufacturer.

For minimum reduction ratio or minimum thickness deformation ratio of rolled and forged products, see C.8.

### **C.8 Reduction ratio and deformation ratio**

If the central soundness of the hot-rolled or forged products is important, the purchaser must be aware that a minimum reduction ratio (referred to the cross-section) for long products, or a minimum thickness deformation ratio (referred to the thickness) for flat products is necessary. In this case a minimum reduction ratio or a minimum thickness deformation ratio of, for example, 4:1 may be agreed at the time of enquiry and order.

## **6 Manufacturing process**

### **6.1 Steel making process**

The steelmaking process shall be at the manufacturer's discretion.

### **6.2 Manufacture of the product**

The manufacturing process route of the steel product shall be at the manufacturer's discretion.



## 6.2 Treatment and surface condition at delivery

### 6.2.1 Treatment condition

The treatment and heat-treatment condition (if any) at the time of delivery must comply with the condition agreed in the order and shall be one of the conditions indicated in Table 1.

Bright steel products in cold drawn or peeled/turned condition are coated with a light film of grease from processing, for bright steel products in a finally heat treated condition the manufacturer chooses the rust protection after heat treatment.

The usual light application of ordinary grease or oil does not afford positive protection against rusting, particularly in the presence of condensation water. The use of a selected rust inhibitor or a special type of packing shall, if required, be agreed at the time of enquiry and order, see C.9.

## C.9 Temporary corrosion protection

A protective medium shall be applied by the manufacturer to give temporary and adequate protection during transport and storage. Where a special protective medium is required it shall be agreed at the time of enquiry and order.

## 6.3 Delivery conditions

### 6.3.1 Finished condition

The steel product shall be delivered in one or a combination of the following finished conditions with or without heat treatment:

- a) drawn, symbol +C;
- b) turned, symbol +SH;
- c) ground, symbol +SL.

# prEN 10277 feb.2017

## **7.1 Chemical composition, mechanical properties and hardenability**

### **7.1.1 General**

Combination of usual treatment conditions at the time of delivery and requirements concerning chemical composition and mechanical properties are shown in Tables 1.

**Table 1 — Combinations of usual treatment conditions at delivery and requirements**



	1	2	3	4	5	6	7	8	9
1	Treatment condition at delivery	Symbol	Chemical composition  All steels	Mechanical properties					
				General engineering steels	Free cutting steels	Non-alloy case-hardening steels	Alloy case-hardening steels	Non-alloy steels for quenching and tempering	Alloy steels for quenching and tempering
2	As-rolled and peeled/turned <sup>a</sup>	+SH	Chemical composition according to EN 10025-2, EN ISO 683-1, EN ISO 683-2, EN ISO 683-3, and EN ISO 683-4, for information see Tables A.1 to A.4	See Table 4	See Table 5,6	See Table 7	–	See Table 9d	–
3	Cold drawn <sup>b</sup>	+C		See Table 4c	See Table 5, 6	See Table 7	–	See Table 9d	–
4	Soft annealed and peeled/turned	+A+SH		–	–	See Table 7	See Table 8	–	See Table 10d
5	Soft annealed and cold drawn	+A+C		–	–	See Table 7	See Table 8	–	See Table 10d
6	Treated to ferrite-pearlite structure and hardness range and peeled/turned	+FP+SH		–	–	–	See Table 8	–	–
7	Treated to ferrite-pearlite structure and hardness range and cold drawn	+FP+C		–	–	–	See Table 8	–	–
8	Quenched and tempered and peeled or cold drawn and quenched and tempered	+QT+SH +C+QT		–c	See Table 6	–	–	See Table 9	See Table 10
9	Quenched+tempered and cold drawn	+QT+C		–	See Table 6	–	–	See Table 9	See Table 10

10	Other heat-treatment conditions, for example, stress relieved (+SR), normalized (+N) and the mechanical properties, may be agreed at the time of enquiry and order.  The condition “annealed to achieve a spheroidization of the carbides” as required for cold heading and cold extrusion is covered in EN 10263.		To be agreed						
----	--	--	--------------	--	--	--	--	--	--

<sup>a</sup> Peeling is in general possible for diameters of 16 mm and over.

<sup>b</sup> For rounds with diameters over 80 mm, it is more usual to apply peeling/turning instead of drawing

<sup>c</sup> If these steels should be drawn and quenched and tempered, values for this treatment could be found at the comparable special steel grades in Table 9.

<sup>d</sup> The mechanical properties specified in Table 9, respectively Table 10, for the condition +C+QT must be achievable after appropriate heat treatment if so agreed in the order (for reference test pieces see C.2).

## 6.2.2 Particular surface conditions



Table 2 shows the possible surface conditions and tolerance classes according to ISO 286-2 at delivery.

**Table 2 — Surface condition and tolerance class at delivery**

	1	2	3	4	5	6	7	8
1	Surface condition at delivery	Symbol	Tolerance class to ISO 286-2 <sup>a</sup>					
			Rounds	Squares	Hexagons	Drawn flats	Special sections	Notes
2	Cold drawn or heat-treated and cold drawn	+C	h10 (h9 to h12) see Table 11	h11 for $d \leq 80$ mm, h12 for $d > 80$ mm (h11 or h12); see Table 11		h11, h12, see Table 12	_b	See Table 1, lines 3,5,7,9
3	Cold drawn, heat treated	+C+QT (+C+N) (+C+SR) (+C+A)	h11 see Table 11	–	–	–	–	Finish for good ductility see Table 1, line 8
4	Peeled/turned	+SH	h10 (h9 to h12) see Table 11	–	–	–	–	See Table 1, lines 2,4,6
5	Ground	+G	h9 (h6 to h12) see Table 11	–	–	–	–	Obtained e.g. from conditions Table 1, lines 2 to 7 and 9
6	Polished	+PL	h9 (h6 to h12) see Table 11	–	–	–	–	Obtained e.g. from conditions Table 1, lines 2 to 7 and 9

<sup>a</sup> Standard tolerance classes unless otherwise specified. In brackets: other possible tolerance classes according to ISO 286-2 if required at the time of enquiry and order.

<sup>b</sup> To be agreed at the time of enquiry and order.

### 7.1.2 Chemical composition

The chemical composition of the steels determined by the cast analysis, shall comply to EN 10025-2, EN ISO 683-1, EN ISO 683-2, EN ISO 683-3 and EN ISO 683-4. The grades and the chemical composition of the steels are listed for information in Annex A for EN 10025-2, EN ISO 683-1, EN ISO 683-2, EN ISO 683-3 and EN ISO 683-4.

If steels for case hardening or for quenching and tempering are ordered with hardenability requirements according to EN ISO 683-1, EN ISO 683-2 and EN ISO 683-3, such hardenability requirements shall be considered as the governing criteria for acceptance. In such cases, the cast analysis may deviate by the values given in EN ISO 683-1, EN ISO 683-2 and EN ISO 683-3, Table 3, footnote b.

**WARNING** Due to hazardous effects to health and environmental problems of Pb, it is recommended to use instead steels only with sulphur and other innocuous free-cutting element additions.

## 7.1 Chemical composition

### 7.1.1 Cast analysis

**7.1.1.1** The chemical composition determined by cast analysis shall be as specified in Table 1 of EN 10277-2 to EN 10277-5.

**7.1.1.2** In cases where steels for case hardening (see EN 10277-4) or for quenching and tempering (see EN 10277-5) are ordered with hardenability requirements, such hardenability requirements shall be considered as the governing criterion for acceptance.

In such cases a deviation of the cast analysis with respect to the values indicated in Table 1 of EN 10277-4 and EN 10277-5 is admissible taking into account footnote b of those tables.

### 7.1.3 Mechanical properties

For steels ordered in one of the treatment conditions in Tables 1 and 2, the requirements for mechanical properties specified in Tables 4 to 10 apply. The mechanical property values given in Tables 4 to 10 apply to test pieces which have been taken and prepared in accordance with Figure 1.

In this case, the normal and narrowed hardenability values given in EN ISO 683-1, EN ISO 683-2 for special steels and the narrowed hardenability values in EN ISO 683-3 for alloy special steels are for guidance purposes only.

NOTE In Tables 4 to 10, grades alloyed with further elements for better machinability are not explicitly mentioned, but the mechanical properties are also valid for them (see Tables A.1 to A.4).

## 7.2 Mechanical properties

The mechanical properties of products covered by this European Standard shall meet the specifications stated in 7.2 of EN 10277-2 to EN 10277-5.

### **7.1.4 Hardenability**

Unless otherwise agreed for alloy case-hardening steels, the hardenability requirements given in EN ISO 683-3, Table 5 apply. If agreed at the time of enquiry and order, alloy case-hardening steels with restricted hardenability scatterbands given in EN ISO 683-3, Table 6 shall be supplied and these values apply in addition to Table 1, columns 6 and 7.

If special steels for quenching and tempering are ordered by using the designations to normal or to narrowed hardenability scatterbands, the values of hardenability given in EN ISO 683-1 or EN ISO 683-2 apply in addition to Table 1, columns 8 and 9.

NOTE In Tables 8 to 10, grades alloyed with further elements for better machinability are not explicitly mentioned, but the mechanical properties are also valid for them (see Tables A.3 and A.4).

## **7.3 Hardenability**

Where steels are ordered with hardenability requirements, the requirements of EN 10084 shall apply.

## **7.3 Hardenability**

Where steels are ordered with hardenability requirements, the requirements of EN 10083-2 shall apply for non alloyed steels and EN 10083-3 shall apply for alloyed steels.

## 7.2 Machinability

All non-stainless steels are machinable in the conditions 'soft annealed' (+A) and treated to ferrite/pearlite structure (+FP).

Where improved machinability is required the grades with a specified sulphur or lead range should be ordered and/or with a specific treatment to improve machinability (see also footnote b in Tables A.1, A.3 and A.4).

Free-cutting steels with low carbon content have their best machinability in the cold drawn condition.

NOTE Non-leaded steels with comparable chemical composition generally have identical mechanical properties but often lower machinability than leaded steels.

### **7.3 Grain size**

Unless otherwise agreed at the time of enquiry and order the grain size of the general engineering, free-cutting steels, the non-alloy steels for quenching and tempering and the stainless steels shall be left to the discretion of the manufacturer. If a fine grain structure is required for non-alloy steels for quenching and tempering or for case-hardening or quenched and tempered free-cutting steels, Annex C, Option C.3 shall be ordered.

If direct hardening treatment is used for free-cutting case-hardening steels, a fine grain structure should be ordered.

The case-hardening and the alloy steels for quenching and tempering shall have a fine grain structure with an austenite grain size of 5 or finer, when tested in accordance with EN ISO 643. Only for verification see C.3.

### **7.4 Grain size**

Unless otherwise specified by the purchaser at the time of enquiry and order, the grain size of the steel shall be at the discretion of the manufacturer, except for case hardening steels according to EN 10277-4 and for alloy steels for quenching and tempering according to EN 10277-5. Case hardening steels according to EN 10277-4 and alloy steels for quenching and tempering according to EN 10277-5 shall be supplied with fine grain, unless otherwise agreed at the time of enquiry and order.

Where specified by the purchaser at the time of enquiry and order, verification of fine grain size shall be in accordance with B.2.

## **7.4 Non-metallic inclusions**

### **7.4.1 Microscopic inclusions**

The special steels shall have a certain degree of cleanness, however, verification of the non-metallic inclusion content requires a special agreement. If there is such an agreement at the time of enquiry and order the microscopically non-metallic inclusion content shall be determined to an agreed procedure and within agreed limits (see ISO 4967 or EN 10247).

For grades with specified minimum sulphur content, the agreement should only concern the oxides.

## **7.5 Non-metallic inclusions**

### **7.5.1 Microscopic inclusions**

Where specified by the purchaser at the time of enquiry and order, microscopic non-metallic inclusions of case hardening steels and of steels for quenching and tempering (see EN 10277-4 and EN 10277-5) shall be verified in accordance with B.3.1.

### **7.4.2 Macroscopic inclusions**

This requirement is applicable for the verification of the macroscopic inclusions in special steels. If verification is agreed then the method and acceptance limits shall be agreed at the time of enquiry and order.

### **7.5 Internal soundness**

Where appropriate, requirements relating to the internal soundness of the products shall be agreed at the time of enquiry and order (see C.4).

## **C.4 Non-destructive tests**

The products shall be NDT tested under conditions and according to an acceptance standard agreed at the time of enquiry and order (see also EN ISO 683-1, EN ISO 683-2, EN ISO 683-3).

### **7.5.2 Macroscopic inclusions**

Freedom of macroscopic inclusions cannot be insured in any steel. If agreed at the time of enquiry and order macroscopic inclusions of case hardening steels and of steels for quenching and tempering (see EN 10277-4 and EN 10277-5) shall to be verified in accordance with B.3.2

### **7.8 Internal soundness**

Requirements for internal soundness may be agreed upon at the time of enquiry and order, e.g. on the basis of non-destructive tests (see B.6).

## **B.6 Non-destructive testing**

Products shall be non-destructively tested in accordance with a method and to acceptance criteria as agreed at the time of enquiry and order.

## **7.6 Decarburization**

For non-stainless steels for quenching and tempering, requirements relating to the permissible depth of decarburization may be agreed at the time of enquiry and order.

The depth of decarburization shall be determined in accordance with the micrographic method specified in EN ISO 3887.

## **7.6 Decarburization**

Where specified by the purchaser at the time of enquiry and order, for steels for quenching and tempering of EN 10277-5, the permissible depth of decarburization and the method of determination shall be in accordance with B.4.

## 7.7 Shape, dimensions and tolerances

The tolerance class on thickness (and width for flats) shall comply with the requirements agreed at the time of enquiry and order and shall be in accordance with Table 2. If there is no agreement on the tolerance class the bright products are delivered with the standard tolerance class given in Table 2. The tolerance class and the corresponding tolerances are given in Table 11 for rounds, squares and hexagons and in Table 12 for drawn flats. Where specified by the purchaser at the time of enquiry and order the disposition tolerances specified in Table 11 shall be in accordance with C.5.

**Table 11 — Tolerance classes for rounds, squares and hexagons**

Nominal thickness mm	Tolerance class to ISO 286-2 <sup>a</sup>						
	h6	h7	h8	h9	h10	h11	h12
$1 < t \leq 3$	0,006	0,010	0,014	0,025	0,040	0,060	0,100
$3 < t \leq 6$	0,008	0,012	0,018	0,030	0,048	0,075	0,120
$6 < t \leq 10$	0,009	0,015	0,022	0,036	0,058	0,090	0,150
$10 < t \leq 18$	0,011	0,018	0,027	0,043	0,070	0,110	0,180
$18 < t \leq 30$	0,013	0,021	0,033	0,052	0,084	0,130	0,210
$30 < t \leq 50$	0,016	0,025	0,039	0,062	0,100	0,160	0,250
$50 < t \leq 80$	0,019	0,030	0,046	0,074	0,120	0,190	0,300
$80 < t \leq 120$	0,022	0,035	0,054	0,087	0,140	0,220	0,350
$120 < t \leq 180$	0,025	0,040	0,063	0,100	0,160	0,250	0,400
$180 < t \leq 250$	0,029	0,046	0,072	0,115	0,185	0,290	0,460

<sup>a</sup> The above deviation values are negatively disposed about the nominal dimension. For example, a 20 mm nominal diameter having a tolerance class h9 is 20 mm + 0, - 0,052 mm or 19,948/20,000 mm.

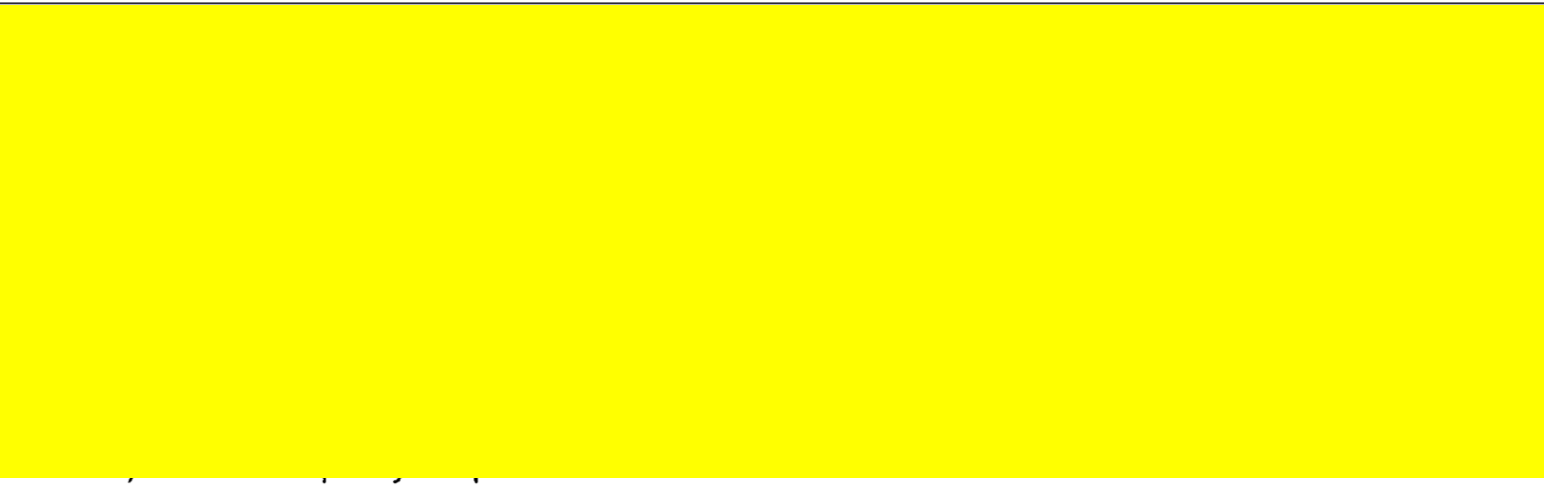


## C.5 Disposition of tolerances



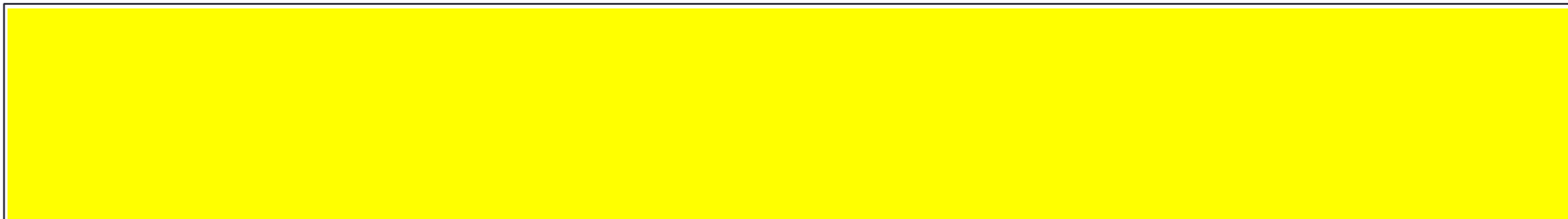
The disposition of tolerances about the nominal dimension of the product other than specified in 7.7 shall be one of the following as specified by the purchaser at the time of enquiry and order:

- a) values all positive, i.e. + and lower tolerances all zero, i.e. -0
- b) values equally disposed about the nominal dimension.



## C.6 Condition of bar ends

The ends of the product shall be as specified by the purchaser at the time of enquiry and order, e.g.: chamfering, facing.



**Table 12 — Tolerances for drawn flats**

Width mm	Deviation		ISO 286-2 Class
	mm	mm	
$w \leq 18$	-	-	h11
$18 < w \leq 30$	+ 0	-0,13	h11
$30 < w \leq 50$	+ 0	-0,16	h11
$50 < w \leq 80$	+ 0	-0,19	h11
$80 < w \leq 100$	+ 0	-0,22	h11
$100 < w \leq 150$	+ 0,50	-0,50	
$150 < w \leq 200$	+ 1,00	-1,00	
$200 < w \leq 300$	+ 2,00	-2,00	
$300 < w \leq 400$	+ 2,50	-2,50	
$400 < w \leq 500$	+ 1 %	- 1 %	
Thickness mm	Deviation <sup>a</sup>		
	mm	mm	
$3 < t \leq 6$	+ 0	-0,075	h11
$6 < t \leq 10$	+ 0	-0,090	h11
$10 < t \leq 18$	+ 0	-0,11	h11
$18 < t \leq 30$	+ 0	-0,13	h11
$30 < t \leq 50$	+ 0	-0,16	h11
$50 < t \leq 60$	+ 0	-0,19	h11
$60 < t \leq 80$	+ 0	-0,30	h12
$80 < t \leq 120$	+ 0	-0,35	h12
$120 < t \leq 140$	+ 0	-0,40	h12
<sup>a</sup> The tolerances in this table apply to low carbon ( $C \leq 0,20 \%$ ) and low carbon free cutting steels only. For all other steels, deviation increases to 150 % of the mentioned tolerance class.			