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ISO 683-18

Third edition
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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

Reference number
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 17, *Steel*, Subcommittee SC 4, *Heat treatable and alloy steels*.

This third edition cancels and replaces the second edition (ISO 683-18:1996), which has been technically revised.

ISO 683 consists of the following parts, under the general title *Heat treatable, alloy steels and free-cutting steels*:

— *Part 1: Non-alloy steels for quenching and tempering*

— *Part 2: Alloy steels for quenching and tempering*

— *Part 3: Case-hardening steels*

— *Part 4: Free-cutting steels*

— *Part 5: Nitriding steels*

— *Part 14: Hot-rolled steels for quenched and tempered springs*

— *Part 15: Valve steels for internal combustion engines*

— *Part 17: Ball and roller bearing steels*

— *Part 18: Bright steel products*

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

Part 18:
Bright steel products

1 Scope

1.1 This part of ISO 683 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;

e) stainless steels.

1.2 In addition to this part of ISO 683, the general technical delivery requirements of ISO 404 are applicable.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 286-2, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 404, *Steel and steel products — General technical delivery requirements*

ISO 643, *Steels — Micrographic determination of the apparent grain size*

ISO 683-1, *Heat-treatable steels, alloy steels and free-cutting steels — Part 1: Non-alloy steels for quenching and tempering·*

ISO 683-2, *Heat-treatable steels, alloy steels and free-cutting steels — Part 2: Alloy steels for quenching and tempering*

ISO 683-3:—[1)], *Heat-treatable steels, alloy steels and free-cutting steels — Part 3: Case-hardening steels*

ISO 683-4, *Heat-treatable steels, alloy steels and free-cutting steels — Part 4: Free-cutting steels*

ISO 3887, *Steels — Determination of depth of decarburization*

1) To be published. (Revision of ISO 683-11:2012.)

ISO 4885, *Ferrous products — Heat treatments — Vocabulary*

ISO 4948-1, *Steels — Classification — Part 1: Classification of steels into unalloyed and alloy steels based on chemical composition*

ISO 4948-2, *Steels — Classification — Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics*

ISO/TS 4949, *Steel names based on letter symbols*

ISO 4967, *Steel — Determination of content of non-metallic inclusions — Micrographic method using standard diagrams*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 6929, *Steel products — Vocabulary*

ISO/TR 9769, *Steel and iron — Review of available methods of analysis*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

ISO 16143-2, *Stainless steels for general purposes — Part 2: Corrosion-resistant semi-finished products, bars, rods and sections*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 377, ISO 4885, ISO 4948-1, ISO 4948-2, ISO 6929, ISO 14284 and the following apply.

3.1
bright steel products
are drawn or peeled/turned bars with smoother surface quality and better dimensional accuracy in comparison with hot-rolled bars

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.

3.3
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.

3.4
ground products
drawn or peeled/turned round bars given an improved surface quality and dimensional accuracy by grinding or by grinding and polishing

3.5
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.

3.6
out-of round
difference between the smallest and largest dimension measured across the pairs of opposing points at a common cross-section

3.7
ruling section
that 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, at the position of its cross-section specified for taking the test pieces for the mechanical tests, will, when being cooled from austenitizing temperature, show the same cooling rate as the actual ruling section of the product concerned at its position for taking the test pieces.

4 Classification and designation

4.1 Classification

The classification of the relevant steel grades is allocated in accordance with ISO 4948-1 and ISO 4948-2. 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 given in the relevant tables are allocated in accordance with ISO/TS 4949.

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 3 and 16 to 18;

d) reference to this part of ISO 683, i.e ISO 683-18;

e) the designation of the steel grade and the delivery condition (see Tables 5 to 15);

f) standard designation for a test report 2.2 or, if required, any other type of inspection document in accordance with ISO 10474.

5.2 Options/Supplementary or special requirements

A number of options are specified in this part of ISO 683 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 part of ISO 683 (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 20 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 additionally requirement concerning the surface condition, i.e. ground surface +G or polished surface +PL for round bars (see 6.2.2 and Table 3);

k) surface quality class if another than the standard class is requested (see 7.8 and Table 4);

l) verification of the straightness (see 7.7, Table 19 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).

EXAMPLE 1

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 ISO 10474.

2 t round bars 20 h9 × stock 6000

steel grade ISO 683-18 - C45+C

Inspection document ISO 10474 - 2.2

EXAMPLE 2

3 t round bars with nominal diameter 80 mm, tolerance h8, stock length 6000 mm made of steel grade X5CrNi18–10 according to this standard in process route +2B, surface quality class 3, with surface condition +2G and a certificate 3.1 as specified in ISO 10474.

3 t round bars 80 h8 × stock 6000

steel grade ISO 683-18 - X5CrNi18–10+2B+2G

Inspection certificate ISO 10474 - 3.1

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.

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 or Table 2.

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.

6.2.2 Particular surface conditions

Table 3 shows the possible surface conditions and tolerance classes according to ISO 286-2 at delivery.

6.3 Traceability of the cast

Each product shall be traceable to the cast, see Clause 10.

7 Requirements

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 and 2.

7.1.2 Chemical composition

The chemical composition of the steels determined by the cast analysis, shall comply to ISO 630-2, ISO 683-1, ISO 683-2, ISO 683-3, ISO 683-4 and ISO 16143-2. The grades and the chemical composition of the steels are listed for information in Annex A for ISO 630-2, ISO 683-1, ISO 683-2, ISO 683-3, ISO 683-4 and ISO 16143-2.

Permissible deviations between the limiting values for cast analysis and the values for product analysis are given in the corresponding tables of ISO 630-2, ISO 683-1, ISO 683-2, ISO 683-3, ISO 683-4 and

ISO 16143-2. The product analysis shall be carried out when specified at the time of enquiry and order (see C.7).

If steels for case hardening or for quenching and tempering are ordered with hardenability requirements according to ISO 683-1, ISO 683-2 and 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 ISO 683-1, ISO 683-2 and 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 sulfur and other innocuous free-cutting element additions.

7.1.3 Mechanical properties

For steels ordered in one of the treatment condition in Tables 1 and 2, the requirements for mechanical properties specified in Tables 5 to 15 apply (except for stainless steel bars ordered in condition +2D for which the mechanical properties are to be found in ISO 16143-2). The mechanical property values given in Tables 5 to 15 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 ISO 683-1, ISO 683-2 for special steels and the narrowed hardenability values in ISO 683-3 for alloy special steels are for guidance purposes only.

For stainless steel bars which are intentionally cold work hardened in order to increase their 0,2-proof strength to a specific level, the mechanical properties at room temperature as specified in Table 15 apply. For these products, the mechanical properties are prime, with the condition a secondary property.

NOTE In this Tables 5 to 14, 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.5).

7.1.4 Hardenability

Unless otherwise agreed for alloy case-hardening steels, the hardenability requirements given in 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 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 ISO 683-1 or ISO 683-2 apply in addition to Table 1, columns 8 and 9.

NOTE In Tables 9 to 11, 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).

7.2 Machinability

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

Where improved machinablity is required the grades with a specified sulfur 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.

NOTE 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 ISO 643. Only for verification see C.3.

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 another regional standard: i.e. EN 10247 or JIS G 0555)

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

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).

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 ISO 3887.

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 3. If there is no agreement on the tolerance class the bright products are delivered with the standard tolerance class given in Table 3. The tolerance class and the corresponding tolerances are given in Table 16 for rounds, squares and hexagons and in Table 17 for drawn flats. Where specified by the purchaser at the time of enquiry and order the disposition tolerances specified in Table 16 shall be in accordance with C.5.

Unless otherwise agreed at the time of enquiry and order, the length and the tolerance on length shall be as specified in Table 18.

Maximum deviation from 'out of roundness' shall be not more than half the specified tolerance range in any case never above the upper limit of the tolerance.

Where specified at the time of enquiry and order and in cases of dispute, an agreed number of bars shall be evaluated for straightness in accordance with the method specified in Annex D and the tolerances specified in Table 19 shall apply.

Non-round bars (i.e. square, hexagon and flat) in widths ≤ 150 mm may have an undefined profile within a distance of 0,2 mm of the hypothetical edge, flats in widths > 150 mm within a distance of 0,5 mm, unless otherwise agreed. For widths > 150 mm, the corner profile may be undefined within a distance of 0,5 mm of the hypothetical edge, unless sharp corners have specifically been ordered.

7.8 Surface quality

Bright products shall have a smooth, scale free surface. Bright products in the final heat treated condition shall be free from loose surface scale; their surface might be discoloured or darker. For hexagons, squares, flats and profiles with special cross-sections, one cannot achieve – for manufacturing reasons – the same quality of surface finish as for round cross-sections.

Since surface discontinuities (cracks, overlapping, scale, isolated pores, pits, grooves, etc.) cannot be completely avoided during manufacturing (hot and cold forming, heat treatments, handling and storage) and since they are retained when drawing, agreements shall be made regarding surface quality. The surface quality of the products shall be one of the classes according to Table 4. Cold drawn bars and ground/polished bars (+C, +C+QT, +C+G, +C+PL, +2H, +2D, +2H+2G, +2H+2P) are delivered in class 1, while peeled/turned bars as well as ground/polished bars produced from peeled/turned bars (+SH, +SH+G, +SH+PL, +2B, +2B+2G, +2B+2P) are delivered in class 3. Different classes may be agreed at the time of enquiry and order.

For flats, squares in sizes greater than 20 mm and hexagons in sizes greater than 50 mm, the maximum possible depth of surface discontinuities shall be agreed at the time of enquiry and order.

NOTE Where automatic testing of the surface is applied, 50 mm of each end of the bar is not normally covered.

Surface defects cannot be eliminated without removal of material. Products in the 'technically crack free by manufacture' condition are only available in the peeled/turned and/or ground conditions.

8 Inspection

8.1 Testing procedures and types of documents

8.1.1 Products complying with this part of ISO 683 shall be ordered and delivered with one of the inspection documents specified in ISO 10474. The type of document shall be agreed upon at the time of enquiry and order. If the order does not contain any specification of this type, a test report 2.2 shall be issued.

8.1.2 If, in accordance with the agreements made at the time of enquiry and order, a test report 2.2 is to be provided, this shall cover the following information:

a) confirmation that the material complies with the requirements of the order;

b) results of the cast analysis for all elements specified in Tables A.1 to A.5 for the steel grade concerned.

8.1.3 If in accordance with the agreements in the order an inspection certificate 3.1 or 3.2 to ISO 10474 is to be provided, the specific inspections and tests described in 8.3 and 9 shall be carried out and the results shall be confirmed in the inspection certificate.

In addition the inspection certificate shall cover:

a) confirmation that the material complies with the requirements of the order;

b) results of the cast analysis for all elements specified in Table A.1 to A.5 for the steel grade concerned;

c) the result of all inspections and tests ordered by supplementary requirements (see Annex C),

d) the symbol letters or numbers relating the inspection certificate, test pieces and products to each other.

8.2 Frequency of testing

The amount of testing, the sampling conditions and the test methods to be applied for the verification of the requirements shall be in accordance with the prescriptions of Table 20.

8.3 Specific inspection and testing

8.3.1 Verification of the hardenability, hardness and mechanical properties

For steels ordered in one of the treatment condition in Table 1 or Table 2, the hardness requirements or mechanical properties, shall, with the following exception, be verified. The requirements given in Table 1, footnote d (mechanical properties of reference test pieces), is only to be verified if supplementary requirement specified in C.2 is ordered.

For steels being ordered with the symbol +H, +HH or +HL in the designation, unless otherwise agreed, only the hardenability requirements according to ISO 683-1, ISO 683-2 and ISO 683-3 are to be verified.

8.3.2 Visual and dimensional inspection

A sufficient number of products are to be inspected to ensure the compliance with the specification.

Dimensional inspection shall be carried out as follows:

a) for round bars: not less than 150 mm from the end of the bar;

b) for round bars cut to length: not less than 10 mm from the end of the bar;

c) for shapes other than round: not less than 25 mm from the end of the bar.

9 Test methods

9.1 Chemical analysis

The choice of a suitable physical or chemical analytical method for the analysis shall be at the discretion of the manufacturer. In cases of dispute, the method for product analysis used shall be agreed taking into account the relevant existing International Standards.

NOTE The list of available International Standards on chemical analysis is given in ISO/TR 9769.

9.2 Mechanical tests

9.2.1 Tensile test

The tensile test shall be carried out in accordance with ISO 6892-1.

For the specified yield strength in the tables on mechanical properties in this standard, the upper yield strength (R_{eH}) shall be determined.

If a yield phenomenon is not present, the 0,2 % proof strength ($R_{p0,2}$) shall be determined.

9.2.2 Impact test

The Charpy-V-notch (CVN) impact test shall be carried out in accordance with ISO 148-1. For cold drawn bars (+C, +C+G, +C+PL, +2H, +2H+2G. +2H+2P), requirements on impact tests can normally not be fulfilled, impact tests can only be performed if mentioned in the tables for mechanical properties.

At the time of enquiry and order additional requirements concerning the impact energy and the verification at temperatures other than room temperature (0 °C, –20 °C and –40 °C) can be agreed.

The average values of a set of three test pieces shall be equal to or greater than the specified value. One individual value may be below the specified value, provided that it is not less than 70 % of that value.

If these conditions are not satisfied the sample product is rejected and retests may be carried out on the remainder of the test unit.

9.3 Hardness and hardenability tests

9.3.1 Hardness in treatment conditions +A and +FP

For products in treatment conditions +SH (hot-rolled and peeled/turned), +A+SH (soft annealed and peeled/turned), +A+C (soft annealed and cold drawn, +FP +SH (treated to ferrite-pearlite structure and peeled/turned) and +FP+C (treated to ferrite-pearlite structure and cold drawn), the hardness tests shall be carried out in accordance with ISO 6506-1.

9.3.2 Verification of hardenability

For verification of hardenability, see ISO 683-1, ISO 683-2 and ISO 683-3.

9.4 Verification of dimensions

The out-of-roundness test has to be carried out by the two-point measuring method. Other methods have to be agreed at the time of enquiry and order.

9.5 Retests

Retests for steels for quenching and tempering and criteria should be as specified in ISO 404.

10 Marking

The manufacturer shall mark the products or the bundles or boxes containing the products in a suitable way, so that the identification of the cast, the steel type and the origin of the delivery is possible (see C.10).

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

	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[a]	+SH	Chemical composition according to ISO 630-2, ISO 683-1, ISO 683-2, ISO 683-4, and ISO 683-3, for information see Tables A.1 to A.4	See Table 5	See Table 6, 7	See Table 8	–	See Table 10[d]	–
3	Cold drawn[b]	+C		See Table 5[c]	See Table 6, 7	See Table 8	–	See Table 10[d]	–
4	Soft annealed and peeled/turned	+A+SH		–	–	See Table 8	See Table 9	–	See Table 11[d]
5	Soft annealed and cold drawn	+A+C		–	–	See Table 8	See Table 9	–	See Table 11[d]
6	Treated to ferrite-pearlite structure and hardness range and peeled/turned	+FP+SH		–	–	–	See Table 9	–	–
7	Treated to ferrite-pearlite structure and hardness range and cold drawn	+FP+C		–	–	–	See Table 9	–	–
8	Quenched and tempered and peeled or cold drawn and quenched and tempered	+QT+SH +C+QT		–[c]	See Table 7	–	–	See Table 10	See Table 11
9	Quenched+tempered and cold drawn	+QT+C		–	See Table 7	–	–	See Table 10	See Table 11
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.			To be agreed					

a Peeling is in general possible for diameters of 16 mm and over.

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

c 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.

d 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).