International Standard

ISO 6934-5

Second edition
2024-08

Steel for the prestressing of concrete —

Part 5: Hot-rolled steel bars with or without subsequent processing

Acier pour armatures de précontrainte —

Partie 5: Barres en acier laminées à chaud avec ou sans transformation ultérieure

Reference number
ISO 6934-5:2024(en)

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Published in Switzerland

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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 document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 16, *Steels for the reinforcement and prestressing of concrete*.

This second edition cancels and replaces the first edition (ISO 6934-5:1991), which has been technically revised.

The main changes are as follows:

— the normative references, steel grade and test method have been revised;

— Table 1 have been split to Table 1 and Table 2;

— retest requirements have been added (see Clause 9).

A list of all parts in the ISO 6934 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Steel for the prestressing of concrete —

Part 5:
Hot-rolled steel bars with or without subsequent processing

1 Scope

This document specifies requirements for round high tensile strength steel bars for the prestressing of concrete. The surface can be plain or threaded.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 6934-1, *Steel for the prestressing of concrete — Part 1: General requirements*

ISO 15630-3, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 3: Prestressing steel*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6934-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Conditions of manufacture

4.1 Steel

The bars shall be manufactured from steel in accordance with ISO 6934-1.

The steel shall be hot rolled into bars and, if required, subsequently processed to give the specified mechanical properties.

The nominal diameter of the bars shall be in the range of 15 mm to 75 mm. Recommended nominal diameters, *d*, are given in Table 1.

By agreement between the manufacturer and purchaser, threaded bars for which the nominal diameters are other than those shown in Table 1 may be used.

Longitudinal cracks which do not impair the specified properties of the bar shall not be considered as defects.

Table 1 — Dimensions, mass per unit length and permissible deviations

Nominal diameter d mm	Nominal cross-sectional area S_n mm^2	Mass per unit length	
		Reference kg/m	Permissible deviation %
15	177	1,44	+6/-2
17	227	1,84	
(17,5) 18	255	1,95	
20	314	2,55	
23	415	3,38	
25	491,0	4,10	
26	531	4,31	
26,5	552	4,48	
32	804	6,53	
36	1 018	8,27	
40	1 257	10,21	
47	1 735	14,10	
50	1 964	15,95	+6/-5
57	2 552	20,73	
60	2 827	23,36	
63,5	3 167	26,50	
65	3 318	26,96	
70	3 848	31,80	
75	4 418	35,89	
NOTE 1 The nominal cross -sectional area is for information only. NOTE 2 If agreed between the purchaser and manufacturer, different mass per length can be applied.			

4.2 Welds

There shall be no welds or other joints in the bar supplied to the purchaser.

4.3 Threaded ends

Where the bars have threaded ends, the threads shall be cold rolled to a profile agreed upon by the purchaser and manufacturer.

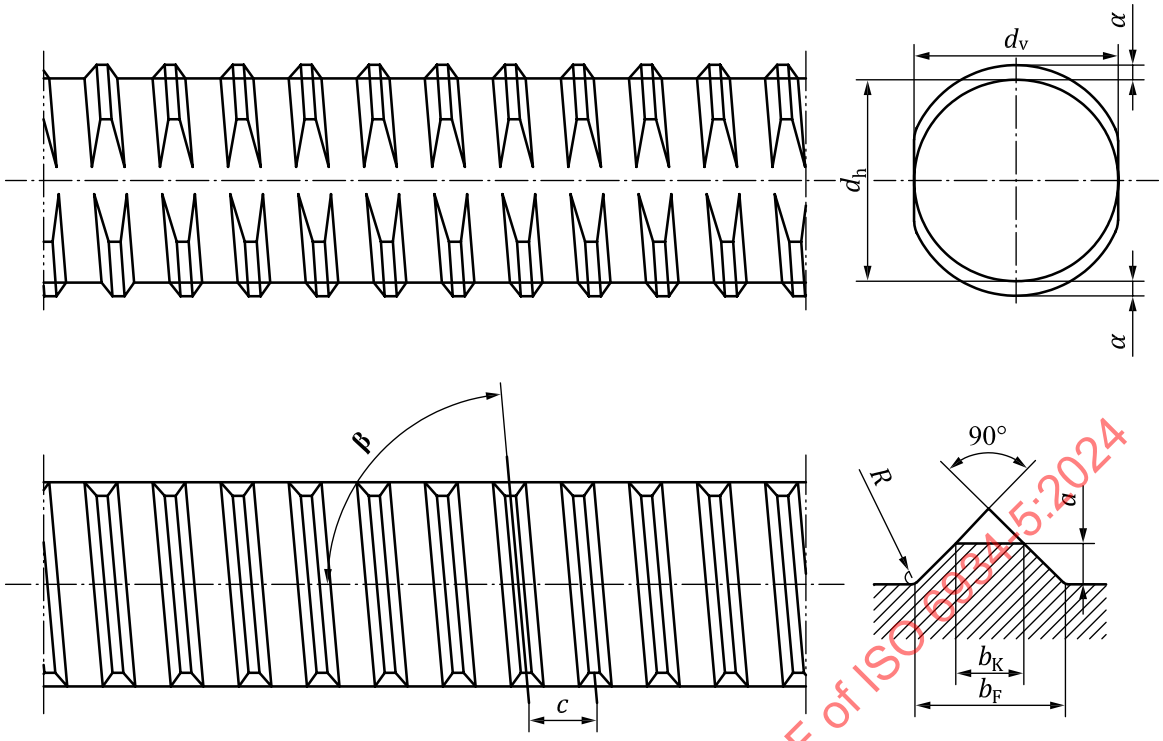
5 Surface configuration

The surface configuration may be either plain or threaded. A typical figure of threaded bars has been given in Figure 1.

The declared thread parameters should not be outside the thresholds shown in the following Table 2.

Table 2 — Ranges for the thread parameters

Core diameter		Rib height	Rib spacing	Rib inclination	Rib top width	Rib bottom width
d_h	d_v	a	c	β	b_k	b_F
0,95d-1,02d	0,92d-1,02d	0,025d-0,10d	0,30d-0,60d	75°-85°	0,05d-0,20d	0,10d-0,50d



Key

a	rib hight
c	rib spacing
β	rib inclination
b_K	rib top width
b_F	rib bottom width
d_h	horizontal core diameter
d_v	vertical core diameter
R	radius of the transition

Figure 1 — Typical threaded bars

Threaded bars shall have two or more rows of transverse threads equally distributed around the perimeter with a substantially uniform spacing shall be between 0,6d to1,0d, where d is the nominal diameter. Figure 1 shows an example with two rows.

The minimum value for the specific projected rib area, A_r, shall be 0,048 for all diameters and is calculated using Formula (1):

$$A_r = \frac{k \times a_r \times \sin\beta}{\pi \times d_{nomi} \times c} \quad (1)$$

where

k is the number of rib rows;

a_r is the area of the longitudinal section of one rib;

β is the rib inclination relative to the axis of the bar;

d_{nomi} is the nominal diameter of the bar;

c is the rib spacing.

6 Properties

6.1 Total elongation at maximum force

The characteristic percentage total elongation at maximum force, A_{gt}, shall be not less than 3,5 %.

6.2 Tensile properties

Steel grades, nominal tensile strength and nominal 0,2 % proof strength are given in Table 3. No single test result shall be less than 95 % of the characteristic value specified in Table 3.

Table 3 — Tensile properties

Steel grade	Tensile strength N/mm²	0,2 % proof strength[a] N/mm²
Y980	980	785
Y1030	1 030	835
Y1035	1 035	835
Y1050	1 050	950
Y1080	1 080	930
Y1180	1 180	930
Y1230	1 230	1 080

[a] The proof strength is for information only.

6.3 Bendability

If agreed between the purchaser and manufacturer, the bars shall withstand a bend test according to ISO 15630-3 without fractures or cracks visible to the unaided eye. The mandrel diameter and angle of bend is subject to agreement between the purchaser and manufacturer.

6.4 Relaxation

The relaxation at 1 000 h at an initial force of 70 % of the characteristic maximum force specified in Table 1 shall be not more than 4,0 % for all bars.

The characteristic maximum force specified is the product of nominal tensile strength and nominal cross-sectional area.

If requested by the purchaser, the relaxation at 60 % and 80 % of the characteristic maximum force specified in Table 2 shall be provided. The maximum relaxation values shall then be 1,5 % and 6,0 %, respectively.

The test shall be carried out according to ISO 15630-3.

6.5 Fatigue

If agreed between the purchaser and manufacturer, the bars shall withstand, without failure, 2×10^6 cycles of stress fluctuating down from a maximum stress of 70 % of the nominal tensile strength. The stress range shall be 245 N/mm² for plain bars, and 195 N/mm² for threaded bars. Further requirements for fatigue performance may be as given in Table 4.

The test shall be carried out according to ISO 15630-3.