INTERNATIONAL STANDARD



Second edition 1995-08-15

AMENDMENT 1 2003-12-01

High yield strength flat steel products —

Part 3: **Products supplied in the heat-treated** (quenched + tempered) condition

AMENDMENT 1

Produits plats en acier à haute limite d'élasticité — Partie 3: Produits livrés à l'état traité (trempé + revenu) AMENDEMENT 1



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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

Amendment 1 to ISO 4950-3:1995 was prepared by Technical Committee ISO/TC 17, Steel, Subcommittee SC 3, Steels for structural purposes.

Introduction

It appeared during the systematic review, that strip and coils should be deleted from the scope of this International Standard because they are relevant to ISO/TC 17/SC 12, consequently ISO/TC 17/SC 3 decided to prepare an amendment to correct this International Standard accordingly.

High yield strength flat steel products —

Part 3:

Products supplied in the heat-treated (quenched + tempered) condition

AMENDMENT 1

Cover page and page 1, title

Modify the title of ISO 4950-3:1995 as follows:

"High yield strength steel plates and wide flats — Part 1: Plates and wide flats supplied in the heat-treated (quenched + tempered) condition"

Page 1, Clause 1

1st paragraph, 3rd line, replace "... flat steel products ..." by "... steel plates and wide flats ...".

2nd paragraph, replace the text with the following:

"It is applicable to steel plates hot-rolled on reversing mills and to hot-rolled wide flats having a width equal to or greater than 600 mm, in the thickness range 3 mm to 70 mm, in steel which, after quenching and tempering, has a minimum specified yield strength of 460 N/mm² to 690 N/mm² for thicknesses up to and including 50 mm and 440 N/mm² to 670 N/mm² for thicknesses between 50 mm and 70 mm."

ISO 4950-3:1995/Amd.1:2003(E)

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INTERNATIONAL STANDARD

ISO 4950-3

Second edition 1995-08-15

High yield strength flat steel products —

Part 3:

Products supplied in the heat-treated (quenched + tempered) condition

Produits plats en acier à haute limite d'élasticité Part 3: Produits livrés à l'état traité (trempé + revenu)



Reference number ISO 4950-2:1995(E) ISO 4950-3:1995(E)

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 4950-3 was prepared by Technical Committee ISO/TC 17, *Steel,* Subcommittee SC 3, *Steels for structural purposes.*

This second edition cancels and replaces the first edition (ISO 4950-3: 1981), which has been technically revised.

ISO 4950 consists of the following parts, under the general title *High yield strength flat steel products*:

- Part 1: General requirements
- Part 2: Products supplied in the normalized or controlled rolled condition
- Part 3: Products supplied in the heat-treated (quenched + tempered) condition

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High yield strength flat steel products —

Part 3:

Products supplied in the heat-treated (quenched + tempered) condition

1 Scope

This part of ISO 4950 specifies the chemical composition and the mechanical properties of high yield strength flat steel products supplied in the quenched and tempered condition. For the method of manufacture, acceptance conditions and marking of these products, see ISO 4950-1.

It is applicable to hot-rolled plates and wide flats having a width greater than or equal to 600 mm, in the thickness range 3 mm to 70 mm, in steel which, after quenching and tempering, has a minimum specified yield strength of 460 N/mm² to 690 N/mm² for thicknesses less than or equal to 50 mm, and 440 N/mm² to 670 N/mm² for thicknesses between 50 mm and 70 mm.

This part of ISO 4950 does not apply to products covered by other standards, such as plates for pressure vessels (see ISO 9328-4).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 4950. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 4950 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4950-1:1995, High yield strength flat steel products — Part 1: General requirements.

ISO 9328-4:1991, Steel plates and strip for pressure purposes — Technical delivery conditions — Part 4: Weldable fine grain steels with high proof stress supplied in the normalized or quenched and tempered condition.

3 Manufacture

3.1 Deoxidation process

All steels shall come from fully killed casts with added elements that are capable of producing a fine grain.

3.2 Delivery condition

The products shall be delivered in the heat-treated condition, i.e. they have undergone a quenching and then a tempering treatment. On request, the purchaser shall be informed of the heat treatment applied by the producer; if, in the course of subsequent manufacture, a heat treatment is to be carried out by the purchaser, he may find out from the producer the appropriate conditions for this heat treatment.

4 General requirements

4.1 Chemical composition

4.1.1 Ladle analysis

Table 1 gives the chemical composition limits for the ladle analysis.

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Chemical composition [% (m/m)]											
Grade	Quality	C max.	Mn	Si	P max.	S max.	Other elements				
E 460	DD E	0,20 0,20	0,7 to 1,7 0,7 to 1,7	≤ 0,55 ≤ 0,55	0,035 0,030	0,035 0,030	Depending on thicknesses and manufac- turing conditions, the manufacturer may find it necessary to add one or several alloying element(s) within the limits				
E 550	DD E	0,20 0,20	≤ 1,7 ≤ 1,7	0,10 to 0,80 0,10 to 0,80	0,035 0,030	0,035 0,030	defined below: Ni ≤ 2 Ti $\leq 0,20^{11}$ N $\leq 0,020$ Cr ≤ 2 Nb $\leq 0,060^{11}$ B(total) $\leq 0,005$ Cu $\leq 1,5$ V $\leq 0,10^{11}$ 2 Ma ≤ 1 Tr $\leq 0,15^{11}$				
E 690	DD E	0,20 0,20	≤ 1,7 ≤ 1,7	0,10 to 0,80 0,10 to 0,80	0,035 0,030	0,035 0,030	The manufacturer shall state the type of steel supplied and also the range of alloying elements present in this steel.				
1) At least one of these grain-refining elements shall be present or aluminium shall be added. In this case, the minimum total aluminium											

Table 1 — Chemical composition (ladle analysis)

content shall be 0,020 % (m/m).

2) When there is no stress-relieving treatment, a maximum content of 0,20 % (m/m) is permitted.

All elements other than those mentioned in table 1 and added intentionally shall be indicated to the purchaser.

analysis relative to the specified ladle analysis Values in percentage by mass

Table 2 — Permissible deviations for the product

4.1.2 Product analysis

A product analysis may be required by the purchaser; in this case, it shall be specified when ordering.

Table 2 gives the permitted deviations for the product analysis relative to the values for ladle analysis given in table 1.

4.2 Mechanical properties

The steels in the quenched and tempered condition, shall comply with the mechanical properties specified in table 3, when they are determined on test pieces prepared in accordance with the requirements of 5.3 of ISO 4950-1:1995, except with regard to the axis of tensile test pieces which is, in all cases, perpendicular to the direction of rolling.

Element	Specified limits	Permissible deviation ¹⁾				
С	≤ 0,20	+ 0,20				
Mn	≤ 1,70	± 0,10				
Si	≤ 0,80	+ 0,05 - 0,02				
Р	≤ 0,035	+ 0,005				
S	≤ 0,035	+ 0,005				
Cr	≤ 2	+ 0,05				
Ni	≤ 2	+ 0,05				
Мо	≤ 1	+ 0,05				
Cu	≤ 0,50 > 0,50	+ 0,05 + 0,07				
Nb	≤ 0,060	+ 0,005				
V	≤ 0,20	+ 0,02				
Ti	≤ 0,20	+ 0,02				
Zr	≤ 0,15	+ 0,02				
В	≤ 0,005	+ 0,000 5				
N	≤ 0,020	+ 0,002				
AI	≥ 0,020	- 0,005				
1) The deviations apply either above or below the specified limits of the range, but not simultaneously.						

Grade	Quality	Specified yield strength $R_{ m eH} (R_{ m p0,2})$ min. N/mm ^{2 1)}		R _m N/m m² ¹⁾	A ²⁾ min. %	<i>KV</i> ³⁾ min. Ј	
		<i>e</i> ≤ 50	50 < <i>e</i> ≤ 70			– 20 °C	– 50 °C
E 460	DD E	460 460	440 440	570 to 720 570 to 720	17 17	39	27
E 550	DD E	550 550	530 530	650 to 830 650 to 830	16 16	39	27
E 690	DD E	690 690	670 670	770 to 940 770 to 940	14 14	39	27

Table 3 — Mechanical properties ($e \le 70$ mm)

R_{eH}: upper yield stress;

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R_{p0,2}: 0,2 % proof stress;

R_m: tensile strength;

A: percentage elongation after fracture on original gauge length $L_0 = 5,65\sqrt{S_0}$ (where S_0 is the original cross-sectional area);

KV: impact strength of ISO V-notch test pieces;

e: thickness of test piece, in millimetres.

1) 1 N/mm² = 1 MPa

2) The use of a test piece 200 mm long, elongation being measured on a gauge length of 50 mm across the fracture, is permitted. However, in cases of dispute, only those results obtained on a proportional test piece shall be used.

3) Average of three tests; no individual result shall be less than 70 % of the specified minimum average value.

ISO 4950-3:1995(E)

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Descriptors: iron and steel products, structural steels, heat treatable steels, high yield strength steels, hot-rolled products, metal plates, wide flats, specifications, mechanical properties, chemical composition, grades (quality), delivery condition.

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