

International Standard



4950/3

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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 — Partie 3 : Produits livrés à l'état traité (trempé + revenu)

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4950/3 was developed by Technical Committee ISO/TC 17, *Steel*, and was circulated to the member bodies in October 1979.

It has been approved by the member bodies of the following countries :

Australia	Germany, F.R.	Poland
Austria	India	Romania
Bulgaria	Italy	South Africa, Rep. of
Canada	Japan	Switzerland
China	Korea, Dem. P. Rep. of	Turkey
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Finland	Netherlands	USA
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The member bodies of the following countries expressed disapproval of the document on technical grounds :

Belgium
Sweden

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.

2 Field of application

This part of ISO 4950 is applicable to hot-rolled plates and wide flats having a width greater than or equal to 600 mm, in the thickness range of 3 to 70 mm, in steel which, after quenching and tempering, has a minimum guaranteed yield strength of 420 to 690 N/mm² for thicknesses less than or equal to 50 mm and 400 to 670 N/mm² for thicknesses between 50 and 70 mm.

3 Reference

ISO 4950/1, *High yield strength flat steel products — Part 1 : General requirements*.¹⁾

4 Manufacture

4.1 De-oxidation process

All steels shall come from fully killed casts which also have additives capable of producing a fine grain.

4.2 Delivery condition

The products are 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.

5 General requirements

5.1 Chemical composition

5.1.1 Ladle analysis

Table 1 gives the composition limits for the ladle analysis.

¹⁾ At present at the stage of draft.

Table 1 — Chemical composition

Grade	Quality	C % max.	Mn %	Si %	P % max.	S % max.	Other elements
E 420	DD	0,20	0,7 to 1,7	≤ 0,55	0,035	0,035	Depending on thicknesses and manufacturing conditions, the manufacturer may find it necessary to add one or several alloying elements within the limits defined below :
	E	0,20	0,7 to 1,7	≤ 0,55	0,030	0,030	
E 460	DD	0,20	0,7 to 1,7	≤ 0,55	0,035	0,035	Ni ≤ 2 % Ti ≤ 0,20 % ¹⁾ N ≤ 0,020 % Cr ≤ 2 % Nb ≤ 0,060 % ¹⁾ B ≤ 0,005 % Cu ≤ 1,5 % V ≤ 0,10 % ¹⁾²⁾ Mo ≤ 1 % Zr ≤ 0,15 % ¹⁾
	E	0,20	0,7 to 1,7	≤ 0,55	0,030	0,030	
E 500	DD	0,20	0,7 to 1,7	≤ 0,55	0,035	0,035	The manufacturer shall state the type of steel supplied and also the range of alloying elements present in this steel.
	E	0,20	0,7 to 1,7	≤ 0,55	0,030	0,030	
E 550	DD	0,20	≤ 1,7	0,10 to 0,80	0,035	0,035	1) At least one of these grain-refining elements should be present or aluminium should be added. In all cases, the minimum content should be 0,015 %. 2) When there is no stress-relieving treatment, a maximum content of 0,20 % is permitted.
	E	0,20	≤ 1,7	0,10 to 0,80	0,030	0,030	
E 620	DD	0,20	≤ 1,7	0,10 to 0,80	0,035	0,035	
	E	0,20	≤ 1,7	0,10 to 0,80	0,030	0,030	
E 690	DD	0,20	≤ 1,7	0,10 to 0,80	0,035	0,035	
	E	0,20	≤ 1,7	0,10 to 0,80	0,030	0,030	

5.1.2 Product analysis

Product analysis may be requested 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.

Table 2 — Permissible deviations for the product analysis relative to the specified ladle analysis

Element	Specified limits	Permissible deviations ¹⁾
C	≤ 0,20	+ 0,03
Mn	0,70 to 1,70	± 0,10
Si	0,10 to 0,80	+ 0,05
P	≤ 0,035	+ 0,005
S	> 0,035	+ 0,005
Cr	≤ 2	+ 0,05
Ni	≤ 2	+ 0,05
Mo	≤ 1	+ 0,05
Cu	≤ 0,50	+ 0,05
	> 0,50 to 1,5	+ 0,07
Nb	0,015 to 0,060	± 0,005
V	0,015 to 0,20	+ 0,02 - 0,01
Ti	0,015 to 0,20	+ 0,02 - 0,01
Zr	0,015 to 0,15	+ 0,02
B	≤ 0,005	+ 0,0005

1) The deviations apply either above or below the specified limits of the range, but not simultaneously.

When maxima only are specified, the deviations are positive only.

5.2 Mechanical properties

Table 3 specifies the guaranteed mechanical properties in the quenched and tempered condition determined on test pieces prepared in accordance with the requirements of clause 6.2 of ISO 4950/1, except with regard to the axis of tensile test pieces which is, in all cases, perpendicular to the direction of rolling.

Table 3 — Mechanical properties ($e < 70$ mm)

Grade	Quality	Specified yield strength ($R_{p0,2}$) N/mm ² 1)		R_m N/mm ² 1)	A min. on $L_0 = 5,65\sqrt{S_0}$ 2) %	KV J 3)	
		$e < 50$	$50 < e < 70$			-20 °C	-50 °C
E 420	DD	420	400	530 to 680	18	40	
	E	420	400	530 to 680	18		27
E 460	DD	460	440	570 to 720	17	40	
	E	460	440	570 to 720	17		27
E 500	DD	500	480	610 to 770	16	40	
	E	500	480	610 to 770	16		27
E 550	DD	550	530	670 to 830	16	40	
	E	550	530	670 to 830	16		27
E 620	DD	620	600	720 to 890	15	40	
	E	620	600	720 to 890	15		27
E 690	DD	690	670	770 to 940	14	40	
	E	690	670	770 to 940	14		27

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 should be used.

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

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