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# 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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**Descriptors** : iron and steel products, steels, high yield strength steels, hot rolled products, chemical composition, mechanical properties, materials specifications, delivery conditions.

Price based on 3 pages

## 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.

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Belgium  
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# High yield strength flat steel products — Part 3 : Products supplied in the heat-treated (quenched + tempered) condition

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## 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/mm<sup>2</sup> for thicknesses less than or equal to 50 mm and 400 to 670 N/mm<sup>2</sup> for thicknesses between 50 and 70 mm.

## 3 Reference

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

## 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 :  Ni < 2 %            Ti < 0,20 % <sup>1)</sup> N < 0,020 % Cr < 2 %            Nb < 0,060 % <sup>1)</sup> B < 0,005 % Cu < 1,5 %        V < 0,10 % <sup>1)2)</sup> Mo < 1 %            Zr < 0,15 % <sup>1)</sup>  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 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	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	
	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	
	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	
	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 <sup>1)</sup>
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 <sup>2</sup> 1)		$R_m$ N/mm <sup>2</sup> 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/mm<sup>2</sup> = 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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