
International Standard



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

Aciers — Classification — Partie 2 : Classification des aciers alliés et aciers non alliés en fonction des principales classes de qualité et des caractéristiques principales de propriété ou d'application

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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 4948/2 was developed by Technical Committee ISO/TC 17, *Steel*, and was circulated to the member bodies in June 1980.

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

Australia	Hungary	Poland
Austria	India	Romania
Belgium	Iran	South Africa, Rep. of
Bulgaria	Ireland	Spain
Canada	Italy	Sweden
Chile	Japan	Turkey
China	Korea, Dem. P. Rep. of	United Kingdom
Czechoslovakia	Korea, Rep. of	USA
Egypt, Arab Rep. of	Mexico	USSR
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No member body expressed disapproval of the document.

Steels — Classification —

Part 2 : Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics

1 Scope and field of application

This part of ISO 4948 lays down a classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics.

Part 1 lays down the classification of steels into unalloyed and alloy steels based on chemical composition.

2 References

ISO 630, *Structural steels.*

ISO/R 683/1, *Heat-treated steels, alloy steels and free-cutting steels — Part 1 : Quenched and tempered unalloyed steels.*¹⁾

ISO/R 683/3, *Heat-treated steels, alloy steels and free-cutting steels — Part 3 : Wrought quenched and tempered unalloyed steels with controlled sulphur content.*¹⁾

ISO/R 683/5, *Heat-treated steels, alloy steels and free-cutting steels — Part 5 : Wrought quenched and tempered manganese steels.*¹⁾

ISO/R 683/9, *Heat-treated steels, alloy steels and free-cutting steels — Part 9 : Wrought free-cutting steels.*¹⁾

ISO/R 683/11, *Heat-treated steels, alloy steels and free-cutting steels — Part 11 : Wrought case hardening steels.*¹⁾

ISO 683/12, *Heat-treated steels, alloy steels and free-cutting steels — Part 12 : Flame and induction hardening steels.*

ISO 683/14, *Heat-treated steels, alloy steels and free-cutting steels — Part 14 : Steels for hot-formed and heat-treated springs.*

ISO 683/18, *Heat-treated steels, alloy steels and free-cutting steels — Part 18 : Wrought unalloyed steels in the normalized, or normalized and cold-drawn, or hot-rolled and cold-drawn condition.*

ISO 1052, *Steels for general engineering purposes.*²⁾

ISO/R 1111/1, *Cold-reduced tinplate and cold-reduced black-plate — Part 1 : Sheet.*¹⁾

ISO 1111/2, *Cold-reduced tinplate and cold-reduced black-plate — Part 2 : Coil for subsequent cutting into sheet.*

ISO 2604, *Steel products for pressure purposes —*
Part 1 : Forgings.
Part 2 : Wrought seamless tubes.
Part 3 : Electric resistance and induction-welded tubes.
Part 4 : Plates.
Part 6 : Submerged arc longitudinally or spirally welded steel tubes.

ISO 3183, *Oil and natural gas industries — Steel line pipe.*

ISO 3573, *Hot-rolled carbon steel sheet of commercial and drawing qualities.*

ISO 3574, *Cold-reduced carbon steel sheet of commercial and drawing qualities.*

ISO 3575, *Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock-forming and drawing qualities.*

ISO 3755, *Cast steels for general engineering purposes.*

ISO 3845, *Oil and natural gas industries — High-test steel line pipe.*³⁾

ISO 4948/1, *Steels — Classification — Part 1 : Classification of steels into unalloyed and alloy steels based on chemical composition.*³⁾

ISO 4950/2, *High yield strength flat steel products — Part 2 : Products supplied in the normalized or controlled rolled condition.*

ISO 4951, *High yield strength steel sections.*

ISO 4954, *Steel for cold heading and cold extruding.*

ISO 4957, *Tool steels.*

1) Under revision.

2) At present at the stage of draft. (Revision of ISO/R 1052-1969.)

3) At present at the stage of draft.

ISO 4995, *Hot-rolled steel sheet of structural quality.*

ISO 4996, *Hot-rolled steel sheet of high yield stress structural quality.*

ISO 4997, *Cold-reduced steel sheet of structural quality.*

ISO 5002, *Hot-rolled and cold-reduced electrolytic zinc coated carbon steel sheet of commercial and drawing qualities.¹⁾*

ISO 5003, *Flat bottom railway rails and special rail sections for switches and crossings of non-treated steel — Technical delivery requirements.*

3 Definitions

For definition of the terms "unalloyed steel" and "alloy steel", see ISO 4948/1.

4 Main classes of unalloyed steels

4.1 The main classes of unalloyed steels are given in table 1. The individual main classes are characterized by

- a) the main quality class (see 4.2), and
- b) the main characteristic (see 4.3)

of the steel.

4.2 Main quality classes

4.2.1 Subdivision

Unalloyed steels are subdivided into the following main quality classes :

- base steel (see 4.2.2);
- unalloyed quality steel (see 4.2.3);
- unalloyed special steel (see 4.2.4).

4.2.2 Base²⁾ steel

4.2.2.1 General description

The term "base steel" applies to all steels for which no quality requirement, which would necessitate special care during steel production, is specified.

1) At present at the stage of draft.

2) Other terms used until now are regular steels, commercial or merchant steel.

3) Annealing (for example stress-relieving treatment, softening, annealing or normalizing) is not to be considered as heat treatment.

4.2.2.2 Definition

Base steels are steels which simultaneously meet the following four conditions :

- a) The steel is unalloyed.
- b) No heat treatment³⁾ is specified.
- c) The characteristics, if specified in product standards or specifications, are as follows :

Minimum tensile strength : $\leq 690 \text{ N/mm}^2$

Minimum yield strength : $\leq 360 \text{ N/mm}^2$

Minimum elongation on ($L_0 = 5 d_0$) : $\leq 26 \%$

Minimum diameter of bending mandrel : $\geq 1 \times$ thickness of test piece

Minimum energy absorbed at 20 °C (on ISO V-notch test piece taken longitudinally) : $\leq 27 \text{ J}$

Maximum Rockwell hardness HRB : ≥ 60

Maximum carbon content : $\geq 0,10 \%$

Maximum phosphorus content : $\geq 0,050 \%$

Maximum sulphur content : $\geq 0,050 \%$

Maximum nitrogen content : $\geq 0,007 \%$

NOTE — The indicated mechanical characteristics correspond to the range of thicknesses from 3 to 16 mm and apply to test pieces taken in the longitudinal or transverse direction in accordance with the requirements of the relevant standard or specification.

- d) No other quality requirement is specified.

4.2.3 Unalloyed quality steel

4.2.3.1 General description

The term "unalloyed quality steel", applies to those unalloyed steels which require special care during production (for example by grain size control, decrease of sulphur and phosphorus content, improvement of surface finish or increased production control, etc.) to achieve, in comparison with base steels, special quality characteristics such as improved resistance against brittle fracture, improved cold-forming properties, etc.

However, requirements concerning careful production of these steels are less stringent than those for classical unalloyed special steels, i.e. steels with controlled hardenability.

4.2.3.2 Definition

Unalloyed quality steels are those unalloyed steels which are covered neither by the definition given in 4.2.2 for base steels nor by that given in 4.2.4 for unalloyed special steels.

4.2.3.3 Examples

See table 1, column Q.

4.2.4 Unalloyed special steel

4.2.4.1 General description

The term "unalloyed special steel" applies to those steels the production of which requires special care comparable in extent with the care necessary for the production of the classical special steels, i.e. unalloyed steels with controlled (special) hardenability requirements.

In view of their special manufacturing conditions, special steels are generally cleaner — especially from the point of view of inclusions — than quality steels.

4.2.4.2 Definition

The following unalloyed steels are special steels.

a) All unalloyed steels (including unalloyed free-cutting steels and tool steels) destined for heat treatment for which specific requirements for at least one of the following characteristics are to be observed :

- 1) Requirements concerning the impact properties in the quenched and tempered or simulated case-hardened condition.
- 2) Requirements concerning the hardening depth or surface hardness after hardening or hardening and tempering.
- 3) Requirements concerning limitation of surface discontinuities.
- 4) Requirements concerning limitation of the non-metallic inclusion content and/or the internal homogeneity.

b) All unalloyed steels **not** destined for heat treatment for which at least one of the following requirements is to be observed :

- 1) Requirements concerning limitation of the non-metallic inclusion content and/or the internal homogeneity, for example plates resistant to lamellar tearing.

2) The maximum phosphorus and/or sulphur content is limited as follows :

- for ladle analysis : $\leq 0,020$ %
- for product analysis : $\leq 0,025$ %

Examples : Certain steels for welding wire, steel for wire for tyres.

3) The contents of the following residual elements are simultaneously restricted as follows :

- Cu max., cast $\leq 0,10$ %
- Co max., cast $\leq 0,05$ %
- V max., cast $\leq 0,05$ %

4) The requirements for the surface quality are more stringent than those specified in ISO 4954 for cold-heading and cold-extruding steels.

Examples : Certain cold-forging, cold-drawing and plating qualities.

c) Steels with a specified electrical conductivity ≥ 9 S/m or with specified magnetic properties, excepting magnetic sheet and strip for which only the maximum magnetic losses and the minimum magnetic induction, and not, for example, the permeability, is specified.

4.3 Main characteristics

4.3.1 For the purpose of this International Standard, main characteristics are considered to be those characteristics which are applied with a certain priority, for example in designation systems or for classification of steels.

4.3.2 For unalloyed steels, the classification according to main characteristics used in table 1 is as follows :

- a) Unalloyed steels with R_e max., R_m max., or HB max. (or maximum diameter of bending mandrel, etc.) as the main characteristic. (Example : Soft sheet for cold forming)
- b) Unalloyed steels with R_e min. or R_m min. as the main characteristic. (Examples : Structural steels including steels for ships, pipelines, pressure purposes and unalloyed steels with improved weather resistance)
- c) Unalloyed steels with the carbon content as the main characteristic, with the exception of the steels indicated under d) and e). (Examples : Steels for wire rod, steel for quenching and tempering, etc.)
- d) Unalloyed free cutting steels (% S min., cast $\geq 0,070$ % and/or additions of Pb, Bi, Te, Se or P)
- e) Unalloyed tool steels
- f) Unalloyed steels with particular specifications for magnetic or electrical properties (Examples : Magnetic sheet and strip, steel with permeability requirements for transmitters, telephone wire, etc.)
- g) Other unalloyed steels.