

Valve steels and alloys for internal combustion engines

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British Standard

ICS 77.140.10

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National foreword

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Summary of pages

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English version

Valve steels and alloys for internal combustion engines

Aciers et alliages pour soupapes de moteurs à
combustion interne

Ventilstähle und -legierungen für
Verbrennungskraftmaschinen

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

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Foreword

This European Standard has been prepared by ECISS/TC 23/SC 1, Stainless steels, the secretariat of which is held by the Normenausschuß Eise und Stahl (FES) of DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 1998, and conflicting national standards shall be withdrawn at the latest by August 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

1.1 This European Standard applies to the grades of wrought high-alloy materials listed in Table 1. These valve materials are used for intake and exhaust valves in reciprocating internal combustion engines.

It is applicable to bars, wire, rod and forgings and for the surface finishes listed in note 3 of **6.3**.

1.2 This European Standard does not apply to alloys resistant to wear and corrosion which are used to protect valve seat surfaces.

1.3 In addition to the specifications of this European Standard, the general technical delivery requirements of EN 10021 are applicable, unless otherwise specified.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test (at ambient temperature)* (including Addendum AC1:1990).

EN 10002-5, *Metallic materials — Tensile testing — Part 5: Method of test at elevated temperature*.

EN 10003-1, *Metallic materials — Hardness test — Brinell — Part 1: Test method*.

EN 10020, *Definition and classification of grades of steel*.

EN 10021, *General technical delivery requirements for steel and iron products*.

EN 10027-1, *Designation systems for steel — Part 1: Steel names, principal symbols*.

EN 10027-2, *Designation systems for steel — Part 2: Numerical system*.

EN 10052, *Vocabulary of heat treatment terms for ferrous products*.

EN 10079, *Definition of steel products*.

EN 10109-1, *Metallic materials — Hardness test — Part 1: Rockwell methods (scales A, B, C, D, E, F, G, H, K) and methods N and T (scales 15N, 30N, 45N, 15T, 30T, 45T)*.

EN 10204, *Metallic products — Types of inspection documents* (includes amendment A1:1995).

EN 10221, *Surface quality classes for hot-rolled bars and rods — Technical delivery conditions*.

EN ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*.

prEN 10278, *Dimensions and tolerances of bright steel products*.

EURONORM 17¹⁾, *Rod in general purpose non-alloy steel for cold drawing; dimensions and tolerances*.

EURONORM 60¹⁾, *Hot rolled round bars for general purposes*.

EURONORM 103¹⁾, *Microscopic determination of the ferritic or austenitic grain size of steels*.

CR 10261, *ECISS/IC 11 — Iron and steel — Review of available methods of chemical analysis*.

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*.

3 Definitions

For the purpose of this European Standard the following definition applies, in addition to the definitions in EN 10020, EN 10021, EN 10052, EN 10079, EN ISO 377 and ISO 14284.

3.1 valve materials

steels and non-ferrous metal alloys which exhibit, to varying degrees, resistance to:

- heat;
- thermal cycling;
- corrosion;
- oxidation;
- fatigue loading;
- impact;
- adhesive and abrasive wear

valve materials are therefore used for the manufacture of intake and exhaust valves in reciprocating internal combustion engines

4 Classification and designation

4.1 Classification

4.1.1 All steel grades are, according to EN 10020, classified as alloyed special steels.

4.1.2 Valve materials are divided into two categories based upon structure, which is itself determined by the general chemical composition:

- martensitic steels which are primarily used for intake valves and the stem portion of exhaust valves;
- austenitic alloys, which are primarily used for exhaust valves.

¹⁾ It may be agreed at the time of ordering, until this EURONORM has been adopted as a European Standard, that either this EURONORM or a corresponding national standard should be applied.

4.2 Designation

4.2.1 Names

For the steel grades covered by this European Standard, the steel names as given in the relevant tables are assigned in accordance with EN 10027-1.

NOTE Explanation of the names used for alloys:
The preceding chemical symbols indicate the main alloy elements and the figure immediately following indicates the average content of these alloys subsequently followed by the other added alloy elements in short designation.

4.2.2 Numbers

For the steel grades covered by this European Standard, the steel numbers as given in the relevant tables are allocated in accordance with EN 10027-2.

NOTE Explanation of the numbers used for alloys:
The structure is set out according to EN 10027-2 with the number 2 for the material group number. This material group comprises chemically resistant and high temperature or heat resistant nickel and cobalt alloys.

5 Information to be supplied by the purchaser

5.1 Mandatory information

The following information shall be supplied by the purchaser at the time of enquiry and order:

- a) the quantity to be delivered;
- b) the designation of the product form (e.g. “bar”);
- c) the number of the dimensional standard (e.g. EURONORM 60);
- d) the dimensions and tolerances on dimensions and shape;
- e) reference to this European Standard (EN 10090);
- f) name or number of the steel or alloy grade (see Table 1);
- g) the heat treatment condition on delivery (see 6.3);
- h) all other necessary details including the intended method of processing (hot extrusion or upsetting with electric resistance heating);
- i) if required, the type of inspection document in accordance with EN 10204 (see 8.1).

EXAMPLE

10 t round bars of 30 mm diameter, dimensional tolerances as specified in EURONORM 60, of a steel grade according to EN 10090 with the name X45CrSi9-3 and the number 1.4718, in the soft annealed condition (+A), intended for hot extrusion, inspection document 3.1.B as specified in EN 10204:

10 t rounds EURONORM 60–30 steel EN 10090 – X45CrSi9-3 +A, for hot extrusion EN 10204-3.1.B

or

10 t rounds EURONORM 60–30 steel
EN 10090 – 1.4718 +A, for hot extrusion
EN 10204-3.1.B

5.2 Supplementary information

The following supplementary information may be supplied by the purchaser and agreed with the manufacturer:

- a) product analysis (see 7.1.3);
- b) verification of mechanical properties in the reference heat treatment condition (see A.2.4);
- c) limitations on non-metallic inclusions (see 7.3.1);
- d) surface quality class for hot-rolled round bars and rods (see 7.3.5);
- e) other tests (see 8.2.2);
- f) special marking (see 9.1).

6 Manufacturing process

6.1 Melting process

6.1.1 Unless otherwise agreed in the order, the type of melting process (see 6.1.2) is left to the discretion of the manufacturer.

6.1.2 The non-ferrous metal alloys NiFe25Cr20NbTi and NiCr20TiAl are usually produced by remelting processes.

6.2 Manufacture of the product

The manufacturing process route of the product shall be at the manufacturer's discretion.

6.3 Heat treatment condition and surface finish at the time of delivery

The heat treatment condition and surface finish of the products at the time of delivery shall be agreed when ordering.

NOTE 1 Valve materials intended for subsequent processing by metal forming are normally ordered in one of the heat treatment conditions indicated in Table 3.

NOTE 2 When they have become finished components, the materials are used, depending on their chemical composition, in the quenched and tempered or precipitation-hardened condition (see Tables A.1 and A.5).

NOTE 3 Valve materials are mainly supplied in bar form, with one of the following surface finishes:

- turned and polished;
- turned and ground;
- ground;
- ground and polished;
- turned and ground, then polished;
- as rolled.

7 Requirements

7.1 Chemical composition

7.1.1 The chemical composition of the materials, as given by the cast analysis, shall conform to the specifications in Table 1.

7.1.2 Slight deviations from the specified limits may be permitted by the purchaser, if the characteristics in use are only affected to a negligible extent.