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Cast carbon steels for general engineering purposes

Aciers au carbone moulés pour construction mécanique d'usage général



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ISO 3755:1991(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 3755 was prepared by Technical Committee ISO/TC 17, *Steel*, Sub-Committee SC 11, *Steel castings*.

This second edition cancels and replaces the first edition (ISO 3755:1976), of which it constitutes a technical revision.

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Cast carbon steels for general engineering purposes

1 Scope

1.1 This International Standard specifies requirements for eight grades of heat-treated cast carbon steels for general engineering purposes. Four of the grades have a restricted chemical composition to ensure uniform weldability.

1.2 In cases where castings are produced by welding together component parts, this International Standard does not cover the welding process or the properties of the weldment.

1.3 These grades are intended to be used at ambient temperature. However, properties at other temperatures may be agreed upon by using the supplementary requirements in 9.4.1 or 9.4.4 of ISO 4990:1986.

2 Normative reference

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

ISO 4990:1986, *Steel castings — General technical delivery requirements*.

3 General delivery conditions

Materials furnished according to this International Standard shall conform to the applicable requirements of ISO 4990, including the supplementary requirements that are indicated in the enquiry and purchase order.

4 Heat treatment

The type of heat-treatment is left to the discretion of the manufacturer unless specifically agreed upon at the time of ordering.

5 Chemical requirements

The steel shall conform to the chemical composition requirements given in table 1.

6 Mechanical properties

Steel used for castings shall conform to the mechanical property requirements given in table 2.

Either reduction of area or impact strength shall be determined and shall conform to the requirements given for the grade in table 2. The choice of test will be at the discretion of the manufacturer, unless it is specified by the purchaser at the time of ordering.

7 Supplementary requirements

The following supplementary requirements shall only apply when specified in the enquiry and purchase order and when agreed upon by the manufacturer and purchaser.

A list of standardized supplementary requirements for use at the option of the purchaser is included in ISO 4990. Those which are usually considered suitable for use with this International Standard are given below with their appropriate subclause numbers in ISO 4990:1986. Others, whether or not in ISO 4990, may be used with this International Standard upon agreement between the manufacturer and the purchaser.

9.1.1 Steelmaking Process

9.1.2 Reporting of the steelmaking process

9.1.3 Agreed manufacturing procedure

9.1.4 Dividing up the cast

- 9.1.5 Weight of test lots
- 9.1.6 Mass and tolerance on mass
- 9.2.1 Certificates
- 9.2.2 Test reports shall provide the required traceability of the castings they represent
- 9.3 Chemical analysis for residual elements
- 9.4.1 Proof stress at 0,2 % at elevated temperature
- 9.4.2 Brinell hardness test (specific to certain products)
- 9.4.3 Brinell hardness test
- 9.4.4 Impact test at low temperatures
- 9.5 The homogeneity of the test lot shall be verified by hardness test carried out on 5 % of the castings (or at five castings) per test lot
- 9.6 Test blocks
- 9.7.1 Type of heat treatment
- 9.7.2 Details of the treatment
- 9.7.3 Quenched and tempered castings
- 9.8.1 Prior agreement relating to major repair welds
- 9.8.2 Weld maps (Sketches)
- 9.9.1 Liquid penetrant inspection
- 9.9.2 Magnetic particle inspection
- 9.9.3 Radiographic examination
- 9.9.4 Ultrasonic inspection
- 9.9.5 Surface roughness
- 9.9.6 Examination of weld preparation and repair welds
- 9.10.2 Magnetic tests
- 9.10.3 Pressure-tightness

Table 1 — Chemical composition requirements of cast steel grades

Steel grade	Chemical composition [% (m/m)] ¹⁾ (maxima)									
	C ²⁾	Mn	Si	P	S	Ni ³⁾	Cr ³⁾	Cu ³⁾	Mo ³⁾	V ³⁾
200-400	—	—	—	0,035	0,035	—	—	—	—	—
200-400W	0,25	1,00	0,60	0,035	0,035	0,40	0,35	0,40	0,15	0,05
230-450	—	—	—	0,035	0,035	—	—	—	—	—
230-450W	0,25	1,20	0,60	0,035	0,035	0,40	0,35	0,40	0,15	0,05
270-480	—	—	—	0,035	0,035	—	—	—	—	—
270-480W	0,25	1,20	0,60	0,035	0,035	0,40	0,35	0,40	0,15	0,05
340-550	—	—	—	0,035	0,035	—	—	—	—	—
340-550W	0,25	1,50	0,60	0,035	0,035	0,40	0,35	0,40	0,15	0,05

1) The choice of chemical composition in the non-weldable grades shall be left to the discretion of the manufacturer.

2) For each 0,01 % reduction of carbon below 0,25 %, an increase of 0,04 % manganese above the maximum specified will be permitted, to a maximum of 1,20 % for grade 200-400W and to 1,40 % for grade 270-480W.

3) Maximum content of residual elements, the sum of which shall not exceed 1,00 %.

Table 2 — Mechanical properties at ambient temperatures on 28 mm thick test blocks

Steel grade	Upper yield stress ¹⁾	Tensile strength	Elongation	By choice according to the order	
	$R_{e, \min}$ MPa ³⁾	R_m MPa	$A_{\min}$ %	Reduction of area ²⁾ $Z_{\min}$ %	Impact strength ²⁾ $KV_{\min}$ J
200-400	200	400-550	25	40	30
200-400W ⁴⁾	200	400-550	25	40	45
230-450	230	450-600	22	31	25
230-450W ⁴⁾	230	450-600	22	31	45
270-480 ⁵⁾	270	480-630	18	25	22
270-480W ^{4), 5)}	270	480-630	18	25	22
340-550 ⁵⁾	340	550-700	15	21	20
340-550W ^{4), 6)}	340	550-700	15	21	20

NOTES

1) The required mechanical properties are obtained from 28 mm thick standard test blocks, cast either separately from, or attached to, the casting they represent. The test values so exhibited therefore represent the quality of steel from which the castings were poured; they do not necessarily represent the properties of the casting themselves, which may be affected by solidification conditions and rate of cooling during heat treatment, which in turn are influenced by casting thickness, size and shape. If the thickness of the casting is considerably greater than 28 mm, the application of the supplementary requirement in 9.6 of ISO 4990:1986 should be taken into consideration.

2) The ambient temperature was taken as $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$

1) If measurable the upper yield stress, otherwise the 0.2 % proof stress.

2) See clause 6.

3) $1\text{ MPa} = 1\text{ N/mm}^2$.

4) The W-grades restrict the chemical composition and may be ordered to ensure uniform weldability.

5) For grades 270-480 and 270W-480W, the casting will have an R_e of 260 MPa and an R_m of 500 MPa-650 MPa, in sections from 28 mm up to 40 mm.

6) For grades 340-550 and 340W-550W, the casting will have an R_e of 300 MPa and an R_m of 570 MPa-720 MPa, in sections from 28 mm up to 40 mm.

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