

UDC 669.141.25 : 001.4 : 621.74.002.6
: 621.753.1 : 621.791.011 : 620.1

June 1985

	<p style="text-align: center;">Cast steels for general engineering purposes Technical delivery conditions</p>	<p style="text-align: center;">DIN 1681</p>
<p>Stahlguß für allgemeine Verwendungszwecke; technische Lieferbedingungen</p> <p><i>In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.</i></p> <p>See Explanatory notes for connection with International Standard ISO 3755 — 1976 published by the International Organization for Standardization (ISO).</p> <p>The subclauses marked with a single dot • give specifications which are to be agreed at the time of ordering.</p> <p>The subclauses marked with two dots •• give specifications which are optional and may be agreed upon at the time of ordering.</p> <p>1 Field of application</p> <p>1.1 This standard applies to the grades of cast steel listed in table 1 with specified minimum values for the mechanical properties at ambient temperature. The castings made from these steels are predominantly used at temperatures between -10 and $+300^{\circ}\text{C}$ (1), 2).</p> <p>1.2 See DIN 17 182 for cast steel grades with improved weldability and greater toughness for general engineering purposes.</p> <p>1.3 This standard does not apply to heat resisting ferritic cast steel (see DIN 17 245), cast steel with low temperature toughness (see <i>Stahl-Eisen-Werkstoffblatt</i> (Iron and steel materials sheet) 685) and cast steel for quenching and tempering (see <i>Stahl-Eisen-Werkstoffblätter</i> 510 and 515).</p> <p>1.4 Unless otherwise specified below, the general technical delivery conditions for steel castings specified in DIN 1690 Part 1 and DIN 1690 Part 2 shall apply in addition to the specifications of this standard.</p> <p>2 Concept</p> <p>The concept of "cast steel for general engineering purposes" covers cast carbon or low alloy steels, the classification of which into grades is essentially based on the mechanical properties at ambient temperature.</p> <p>3 Designation</p> <p>The symbols for the cast steel grades have been formed in accordance with subclause 2.1.1.1.2 of the Explanatory notes to <i>DIN-Normenheft</i> (DIN Standardization Booklet) 3, 1983 edition, the material numbers in accordance with DIN 17 007 Part 2.</p> <p>Example:</p> <p style="padding-left: 20px;">Cast steel identified by the symbol GS-38 or the material number 1.0420 shall be designated:</p> <p style="padding-left: 40px;">Cast steel DIN 1681 — GS-38</p> <p style="padding-left: 40px;">or Cast steel DIN 1681 — 1.0420</p>	<p style="text-align: right;">Supersedes June 1967 edition.</p> <p>4 Classification into grades</p> <p>The cast steel grades are essentially classified according to tensile strength and other mechanical properties (see table 1).</p> <p>5 Requirements</p> <p>5.1 •• As delivered condition (including heat treatment after welding)</p> <p>Before they are supplied, the steel castings shall be subjected to a heat treatment causing a structural transformation; in addition, any internal stresses present shall be reduced to a scale which does not impair the suitability of the casting. This means, amongst other things, that, unless otherwise agreed, welds shall be subjected to a heat treatment (as a rule, stress relieving).</p> <p>5.2 • Chemical composition</p> <p>The proportion of carbon by mass determined in the cast analysis, and also in the product analysis, at the points intended for fabrication welds shall not exceed 0,25 % for cast steel grades GS-38 and GS-45. The points concerned shall be indicated at the time of ordering.</p> <p>5.3 •• Mechanical properties</p> <p>The mechanical properties listed in table 1 shall apply to test pieces which have been taken from samples with thicknesses up to 100 mm for the cast steel grades</p> <p>1) If steel castings are intended for use as boiler components which are required to satisfy the <i>Technische Regeln für Dampfkessel (TRD)</i> (Technical rules for steam boilers) published by the <i>Deutscher Dampfkesselausschuß</i> (German Steam Boiler Committee), these rules shall additionally be observed.</p> <p>2) If steel castings are intended for use as pressure vessel components which are required to satisfy the rules published by the <i>Arbeitsgemeinschaft Druckbehälter</i> (Pressure Vessels Working Group), <i>AD-Merkblätter</i>, (AD Instruction sheets), <i>AD-Merkblatt W5</i> shall additionally be observed.</p>	<p style="text-align: center;">Continued on pages 2 and 3</p>

specified in this standard. Furthermore, the values of yield stress shall also apply to the casting itself if the wall thickness is not greater than 100 mm. If test pieces from the casting are tested in order to verify the yield stress, the requirements on the other properties listed in table 1 shall be agreed at the time of ordering, if necessary.

5.4 •• Magnetic properties

The values of the magnetic properties listed in table 1 shall apply by agreement, for test pieces taken from samples as described in subclause 5.3.

5.5 Weldability

Since the behaviour of a steel during and after welding depends not only on the material, but also on dimensions and form as well as fabrication and operating conditions of the component, it is possible to ensure an unconditional suitability of the cast steel grades for the various welding processes.

Given this reservation, cast steel grades GS-38, GS-45 and GS-52 are considered to be well suited to welding. No pre-heating is necessary for GS-38 cast steel, but this can be necessary for grades GS-45 and GS-52. GS-60 cast steel can be welded if special precautionary measures are taken.

5.6 Form and dimensions

The specification that 2 % can be assumed as a guide value for the mean shrinkage in the preparation of the patterns shall apply in addition to the specifications in DIN 1690 Part 1.

6 •• Testing

The following shall apply in addition to the specifications given in DIN 1690 Part 1 and DIN 1690 Part 2.

If magnetic induction is to be verified in acceptance inspection, the method of test to be used, the form of test piece and the scope of test programme shall be agreed at the time of ordering.

Table 1. Mechanical and magnetic properties of cast steel (see subclauses 5.3 and 5.4)

Grade		Yield stress 1)	Tensile strength	Elongation after fracture ($L_0 = 5 d_0$)	Reduction of area after fracture 2)	Impact energy (ISO V-notch test pieces) ≤ 30 mm > 30 mm (mean value 3))		Magnetic induction 4) at a field intensity of		
Symbol	Material number	N/mm ² min.	N/mm ² min.	% min.	% min.	J min.		25 A/cm T	50 A/cm T	100 A/cm T
GS-38	1.0420	200	380	25	40	35	35	1,45	1,60	1,75
GS-45	1.0446	230	450	22	31	27	27	1,40	1,55	1,70
GS-52	1.0552	260	520	18	25	27	22	1,35	1,55	1,70
GS-60	1.0558	300	600	15	21	27	20	1,30	1,50	1,65

1) The 0,2 % proof stress shall apply if there is no marked yield stress.

2) The values are not relevant for acceptance.

3) Determined from three individual values in each case.

4) ●● These values shall apply only by agreement (see subclause 5.4).

Standards and other documents referred to

- DIN 1690 Part 1 Technical delivery conditions for castings made from metallic materials; general conditions
DIN 1690 Part 2 Technical delivery conditions for castings made from metallic materials; steel castings; classification into quality levels on the basis of non-destructive testing
DIN 17 007 Part 2 Material numbers; system of principal group 1: steel
DIN 17 182 Cast steel grades with improved weldability and greater toughness for general engineering purposes
DIN 17 245 Heat resisting ferritic cast steel; technical delivery conditions

Stahl-Eisen-Werkstoffblatt 510 3)

Vergütungsstahlguß für Gußstücke mit Wanddicken bis 100 mm (Cast steel for quenching and tempering for castings with wall thicknesses up to 100 mm)

Stahl-Eisen-Werkstoffblatt 515 3)

Vergütungsstahlguß für Gußstücke mit Wanddicken über 100 mm (Cast steel for quenching and tempering for castings with wall thicknesses exceeding 100 mm)

Stahl-Eisen-Werkstoffblatt 685 3)

Kaltzäher Stahlguß (Cast steel with low temperature toughness)

DIN-Normenheft 3 – 1983

Kurznamen und Werkstoffnummern der Eisenwerkstoffe in DIN-Normen und Stahl-Eisen-Werkstoffblättern (Symbol and material numbers of ferrous materials specified in DIN Standards and Iron and steel materials sheets)

AD-Merkblatt W54) Stahlguß (Cast steels)**Previous editions**

DIN 1681: 04.25, 07.29, 03.42xx, 06.67

Amendments

The following amendments have been made in comparison with the June 1967 edition:

- a) Specifications of a general nature have been deleted. The requirements of DIN 1690 Part 1 and DIN 1690 Part 2 now apply.
- b) Cast steel grades with no minimum requirements on the impact energy and grade GS-62.3 cast steel have been dropped. The suffix .3 to the symbols for the grades of cast steel has thereby become superfluous.
- c) The minimum values of yield stress of castings with wall thicknesses not exceeding 100 mm now also apply to the casting itself.
- d) The minimum values of impact energy are to be verified on the basis of ISO V-notch test pieces.
- e) The bending behaviour need no longer be verified in a bend test.

Explanatory notes

Revision of DIN 1681, June 1967 edition, became necessary in order to bring it up to the state of the art. The aim of the revision was to achieve broad harmonization with ISO 3755 – 1976, cast steels for general engineering purposes, without abandoning the experience gained in Germany regarding the relationship between yield stress and tensile strength. The cast steel grades covered by this standard have the same minimum values of yield stress, elongation after fracture and reduction of area after fracture as the corresponding cast steel grades in the proposed revised edition of ISO 3755 – 1976 (at present document ISO/TC 17/SC 11/WG 5 N5). However, there are differences in the specifications relating to the tensile strength and the impact energy. It should be noted that the specifications in the ISO proposal apply only for a 28 mm test block. Whilst the ISO proposal requires compliance with, optionally, either the requirement on the minimum reduction of area after fracture or of the minimum impact energy, DIN 1681 specifies that both requirements be fulfilled at the same time. In addition, the ISO proposal specifies four grades of cast steel for which, for the purposes of improved weldability, additional requirements on the chemical composition apply with identical requirements on the mechanical properties. Cast steel grades with improved weldability (and greater toughness) for general engineering purposes are standardized in Germany in DIN 17 182.

Since, at the time of the publication of this standard, it was not clear whether the symbols in ISO 3755 – 1976 would in future only cover the minimum yield stress, or as before, the minimum tensile strength in addition to the minimum yield stress, and it was wished to avoid unnecessary amendment of drawings etc., the symbols for the cast steel grades covered in this standard only show one tenth of the value of the minimum tensile strength (in N/mm²) as in the June 1967 edition.

It should be noted that this standard now only specifies grades with requirements on the minimum impact energy. The suffix .3 has been dropped in order to keep the symbols as short as possible. This cannot become the source of difficulties since, for example, the current grade GS-38 covers the previous grades GS-38 (without) and GS-38.3 (with requirements on the impact energy).

After the general technical delivery conditions for castings (DIN 1690 Part 1 and DIN 1690 Part 2) had been published, it became possible to delete most of its general specifications from this standard, meaning that this standard can only be applied in conjunction with DIN 1690 Part 1 and DIN 1690 Part 2 in future.

International Patent Classification

C 22 C 1/04

C 21 D 1/00

3) Obtainable from: *Verlag Stahleisen mbH*, Postfach 82 29, D-4000 Düsseldorf 1.

4) Obtainable from: *Beuth Verlag GmbH*, Burggrafenstraße 4–10, D-1000 Berlin 30.