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May 1985

# Technical delivery conditions for castings made from metallic materials

General conditions

DIN 1690 Part 1

Technische Lieferbedingungen für Gußstücke aus metallischen Werkstoffen; allgemeine Bedingungen

Supersedes August 1981 edition.

*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.*

The subclauses marked with a single dot (•) give specifications which are to be agreed upon at the time of ordering. The subclauses marked with two dots (••) give specifications which are optional and may be agreed upon at the time of ordering.

## 1 Field of application

These general technical delivery conditions apply to castings made from standard or non-standard cast metallic materials, unless other delivery conditions have been agreed at the time of ordering.

Additional delivery conditions specific to particular materials may be specified in other standards of the DIN 1690 series.

## 2 Concepts

### 2.1 Casting

A casting is a workpiece that has been shaped by the solidification of liquid metal in a mould.

### 2.2 Raw casting

A raw casting is a casting that has not been machined or has not yet been finish-machined.

### 2.3 Type sample

A type sample is a casting submitted to the customer for testing before approval is given for production.

### 2.4 Wall thickness to be considered

The wall thickness to be considered for the purposes of this standard is the wall thickness for which the agreed mechanical properties apply.

### 2.5 Welds

#### 2.5.1 Production weld

A production weld is a weld carried out by the manufacturer as part of the production process, the object of which is to ensure the agreed quality of the casting.

Note. Repair welds are to be distinguished from production welds; they are used to repair castings damaged after being produced.

#### 2.5.2 Fabrication weld

A fabrication weld is a weld by means of which a casting is joined to another workpiece to form one unit.

### 2.6 Heat treatment of ferrous materials

The technical terms and definitions given in DIN 17 014 Part 1 shall apply to the types of heat treatment of ferrous materials.

## 3 Ordering

### 3.1 Technical data

• The purchaser shall give clear information in the order, in particular on

- the number of castings to be supplied;
- the relevant drawings, standards, technical specifications, codes of practice, etc.;
- the supply of pattern equipment, core boxes, permanent moulds;
- the shape and sizes of castings, see subclause 3.1.1;
- the mass of the castings, see subclause 3.1.2;
- the requirements regarding the material, see subclause 3.1.3.

•• Where necessary, the order shall include other data essential for it to be carried out, such as

- requirements regarding the outer and inner condition of the castings;
- the wall thickness to be considered, see subclause 2.4;
- the type and extent of machining to be carried out by the manufacturer;
- the type and extent of special tests to be carried out by the manufacturer and the conditions applicable to such tests, see subclause 5.1;
- special measures to be taken or specifications to be observed for manufacture or testing of castings, particularly with regard to the testing of production welds, in cases where castings are partly or completely subject to special stress conditions;
- type of documents covering the tests performed, see subclause 5.2;
- type of packing, see clause 7;
- special requirements, where these are either not specified or not specified as binding in the standards covering materials specified in the order.

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**3.1.1 Information on shape and sizes**

3.1.1.1 • If the pattern equipment is to be manufactured by the manufacturer, this shall be specified in the order, and also the quality class as defined in DIN 1511.

The purchaser shall make available to the manufacturer a sufficient quantity of the necessary drawing(s), e.g. drawings of the raw casting and construction drawings. The numbers of the relevant drawings shall be specified in the order.

The surfaces to be machined and the starting surfaces for machining and for the dimensional check shall be specified in the drawings.

The drawings shall conform to standards and shall be prepared, taking into account the technical aspects regarding the mould, casting process, fettling, and testing. If modifications to the purchaser's drawings are necessary for these reasons, they shall be agreed between the manufacturer and the purchaser. It shall be stated whether the pattern draft (see DIN 1511) is to be added, subtracted or averaged.

For general tolerances and machining allowances for castings, DIN 1680 Part 1 and Part 2 shall apply.

For the various material groups, the accuracy grades for dimensional tolerances and machining allowances are specified in the following standards:

- for steel castings, in DIN 1683 Part 1;
- for malleable cast iron, in DIN 1684 Part 1;
- for spheroidal graphite cast iron, in DIN 1685 Part 1;
- for flake graphite cast iron, in DIN 1686 Part 1;
- for heavy metal castings, in DIN 1687 Part 1, Part 3 and Part 4;
- for light metal castings, in DIN 1688 Part 1, Part 3 and Part 4.

The accuracy grade shall be specified in the drawing.

If there are any departures from the standard machining allowances, these shall be agreed between the manufacturer and the purchaser.

If nothing has been agreed at the time of ordering, the manufacturer shall specify the accuracy grade according to the moulding and casting process used and the shape of the castings.

Machining allowances shall be such that the machined surfaces are clean after machining.

3.1.1.2 •• If the purchaser is making available to the manufacturer pattern equipment or permanent moulds for the castings to be supplied, their numbers shall be specified in the order. The pattern equipment shall conform to DIN 1511. The quality class shall be specified. The surfaces to be machined shall be clearly indicated by the lettering on the pattern equipment or permanent moulds and, where drawings are available, indicated also on the drawings.

The manufacturer shall check

- what machining allowances are necessary for his manufacturing work, and
- whether the pattern, on the basis of visual examination, is usable and complete.

The purchaser is responsible for the shape, sizes and serviceability of the pattern equipment or permanent moulds supplied, unless he has at the time of ordering the castings expressly instructed the manufacturer to reinspect them.

If the castings are to be manufactured in small numbers, the purchaser is recommended to require inspection of the shape and dimensions of the pattern equipment or permanent moulds supplied by him, by the manufacturer.

3.1.1.3 Parts to be cast in and lost patterns, supplied by the purchaser, shall conform to the required dimensions and be in a satisfactory condition.

**3.1.2 Information on the mass**

•• For castings produced in lost moulds, agreement shall be made at the time of ordering as to whether the mass of a casting shall be the same as the mass calculated from the drawing or the mass of a pilot casting accurate to size. In the first case, any modifications to the mould or the casting process and all machining allowances shall be taken into account.

**3.1.3 Information on material**

The choice of the cast material is at the discretion of the purchaser.

The suitability of the cast material with regard to the casting process and the proposed casting shall be checked by the manufacturer.

• In the case of castings from standard cast materials, the following shall be specified:

- the number of the relevant material standard;
- the symbol and/or material number of the cast material;

•• and if necessary,

- the wall thickness of the castings to be considered;
- the as delivered condition;
- the technological values that the manufacturer is required to conform to.

• If castings are to be made from non-standard cast materials or if the wall thickness to be considered exceeds the characteristic values for the mechanical properties specified in the material standard, the requirements regarding the material shall be agreed at the time of ordering.

**3.2 •• Type sample (initial sample)**

The supply of type samples may be agreed.

If the agreed limit values are exceeded on the type sample, the purchaser shall notify the manufacturer of this. If the purchaser gives his approval for such deviations, new limit values shall be agreed.

If type samples are to be used only for checking dimensions and deviate from the agreed material properties, this shall be agreed between the manufacturer and the purchaser.

## 4 Requirements

The specifications agreed at the time of ordering shall apply as the requirements for the casting.

**4.1 Manufacture**

**4.1.1 Manufacturing process**

Unless otherwise agreed, the choice of the adequate method of carrying out the individual stages of the manufacturing process, such as

melting of the cast material,
manufacture of the mould,
casting,
heat treatment,
fettling and machining
is at the manufacturer's discretion.

#### 4.1.2 Production welds

Production welds are permitted, unless otherwise agreed at the time of ordering. Production welds solely for improving the appearance are not permitted.

4.1.2.1 With due regard to the material and the shape of the casting, production welds shall be made in such a manner that the values obtained for the mechanical and technological properties of the weld metal and the heat affected zone, conform to the requirements specified for the parent metal.

●● Agreements may be made regarding the filler metals used. Otherwise, the manufacturer shall decide, where applicable, in accordance with the recommendations of the standard covering the material.

The areas where production welds are to be made shall be prepared and inspected so as to ensure a satisfactory weld. No plugs or similar devices shall be used when carrying out the welding work unless agreements to the contrary have been made with the purchaser. If filler pieces are inserted in the case of large weld areas, these shall be of the same type of material; good fusion of the root shall be ensured.

4.1.2.2 ●● If a casting is partly or completely subject to exceptional stresses and if these require special measures or compliance with special specifications during manufacture or testing of the casting, agreements may be made with the manufacturer at the time of ordering with regard to production welds and their inspection.

4.1.2.3 ●● Documentation for large welded areas may be agreed.

For the purposes of this standard, a large welded area is any area prepared for welding, the depth of which exceeds 40 % of the wall thickness.

4.1.2.4 After production welding, if necessary, the casting shall be subjected to heat treatment. For this purpose, the specifications given in the material standards shall be observed.

Production welds shall generally be ground smooth.

#### 4.1.3 Fabrication welds

●● For fabrication welds, the specifications given in subclause 4.1.2 shall apply as appropriate and, where necessary, additional requirements regarding the quality of the weld shall be agreed at the time of ordering.

### 4.2 Chemical composition

The specifications given in the appropriate material standard or those in the order shall apply with regard to the chemical composition of the cast material.

Unless expressly agreed otherwise, the data on the chemical composition of the cast materials relate to the cast analysis.

In cases of dispute, the results of the product analysis and the relevant requirements shall be taken as the basis.

If neither the relevant material standards nor the order include any data on the chemical composition of the cast materials, the choice of a suitable chemical composition shall be left to the manufacturer.

### 4.3 Properties of the material

The specifications given in the relevant material standard or those in the order shall apply with regard to the properties of the material.

If the order does not specify the wall thickness of the castings to be considered and the sampling method, the requirements relating to the material properties specified for the samples in the material standard for the standard case shall apply.

●● In cases where particular properties, e.g. yield stress, tensile strength, hardness, are to apply to certain areas of the casting or to the complete casting, these properties shall be agreed at the time of ordering.

### 4.4 General condition of the casting

4.4.1 ●● Unless otherwise agreed at the time of ordering, the castings shall be supplied fettled and unmachined. Gates and feeders shall be removed. Residues of the mould material and scale shall be removed from accessible surfaces.

Where non-destructive testing has been agreed, the necessary surface condition shall be ensured by the use of a suitable fettling process.

4.4.2 Where minor surface defects, e.g. small areas of sand or slag, small cold laps, small scabs, small shrinkholes, groups of small pores, residues of the mould, uneven areas, burr do not constitute a justification for complaints in accordance with clause 8 or if the surface of the casting corresponds to that of the type sample, they need not be removed. Otherwise, such surface defects shall be removed by fettling, provided this does not result in the wall thickness going below the minimum.

4.4.3 Unallowable external and internal defects shall, where applicable, be removed by the method described in subclause 4.1.2.

### 4.5 ●● Special condition of the casting

Special requirements regarding the condition of the casting, e.g. leak tightness to particular media, at specified pressures and temperatures, shall be agreed at the time of ordering.

### 4.6 Shape and sizes

Shape and sizes of the castings shall conform to the agreements made, taking into account the tolerances, pattern drafts and machining allowances, for example to the standards on general tolerances and machining allowances, as listed in subclause 3.1.1.

●● If it is required that manufacture be approved on the basis of type samples, this shall be agreed at the time of ordering.

### 4.7 Mass

●● If agreements have been made on the mass of castings produced in lost moulds (see subclause 3.1.2) and

unless otherwise agreed, the tolerances on mass specified in subclauses 4.7.1 and 4.7.2 shall apply.

4.7.1 Castings exceeding the specified mass by more than 15% shall be regarded as not conforming to the standard.

4.7.2 Castings made on the basis of the same drawing and with the same pattern equipment shall not exceed the mass of an accurate-to-size casting in accordance with subclause 3.1.1 by more than

5% in the case of a machine-finished casting;

7% in the case of a single casting from a pattern;

10% in the case of a single casting from a template or skeleton pattern.

The mass of an accurate-to-size casting can be taken, in the case of machine-finished castings, as the average mass of the first five castings.

The mass of very small castings (of less than 200 g) may deviate by up to 10% from the specified value.

## 5 Testing and documents on materials testing

### 5.1 General

The manufacturer shall take the necessary measures to ensure that the agreed requirements are complied with, e.g. by monitoring the manufacturing conditions and/or by inspection of cast samples or castings.

When producing large numbers of castings it is impossible to avoid some faulty castings. Depending on the use of the castings, it is not always necessary or economic to remove faulty castings from a delivery or a batch.

●● The customer may agree with the manufacturer suitable measures of quality assurance, relating to test methods and the scope of testing.

### 5.2 Documents on materials testing

5.2.1 ●● If a statement of compliance with the order or a test report as specified in DIN 50049 is to be issued on the basis of internal control and tests carried out by the manufacturer, this shall be agreed at the time of ordering.

5.2.2 ●● For tests carried out on the consignment, a manufacturer's test certificate or an inspection certificate may be agreed. This applies in particular to non-destructive testing, for which additional agreements shall be made on the nature of the documents to cover the test results.

In general, the tests shall be carried out by the manufacturer's inspectors, or, by special agreement, by inspection representatives of the purchaser.

### 5.3 Tests on the castings supplied

#### 5.3.1 General

In general, the castings shall be tested at the manufacturer's works. For this purpose, the tests to be carried out and the requirements to be complied with shall be in accordance with the relevant material standard and/or shall be agreed at the time of ordering.

Unless substantial reasons exist for testing each individual casting, castings shall be assembled in batches and subjected to random testing.

#### 5.3.2 Scope of test programme

5.3.2.1 ● The number of test pieces shall be based on whether castings are being tested individually or by batches. Which of these two alternatives is to be selected shall be agreed at the time of ordering.

5.3.2.1.1 If testing by batches is agreed, one of the following types of batch shall be selected:

a) material batch,
castings from the same cast having undergone the same heat treatment;

b) cast batch,
castings from the same cast having undergone similar heat treatment;

c) heat treatment batch,
castings from different casts of the same grade of material having undergone the same heat treatment;

d) consignment batch,
castings from different casts of the same grade of material having undergone similar heat treatment, by number or mass.

5.3.2.1.2 ●● If statistical sampling inspection has been agreed, the principles of sampling inspection as specified in DIN 40080 for inspection by attributes and in ISO 3951 – 1981 for inspection by variables[1]) shall be observed.

For the preparation of sampling charts the following may be agreed:

a) the acceptable quality level (AQL) and the limiting quality;

b) the sampling system and the acceptable quality level or

c) the sampling system and the inspection level.

5.3.2.2 ●● If checking of the chemical composition on the casting has been agreed at the time of ordering, the scope of testing shall also be agreed at the same time.

5.3.2.3 Unless otherwise agreed, for the tensile test, for individual testing, each casting shall be tested and, for testing by batches, one test piece shall be taken from each batch.

5.3.2.4 The scope of testing for the impact test shall be the same as for the tensile test described in subclause 5.3.2.3. One tensile test piece however corresponds to a set of three impact test pieces.

5.3.2.5 ●● Agreements shall also be reached if necessary on the method of non-destructive testing, on the locations on the casting to be tested and (in the case of series production) on the number of castings to be tested.

5.3.2.6 ●● The scope of testing for all other tests including checking of dimensions and mass and the test for leak tightness, shall, where necessary, be agreed in the order.

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[1]) See also *DGQ* Publication No. 16-43 *Stichprobenpläne für quantitative Merkmale (Variablenstichprobenpläne)* (Sampling charts for quantitative characteristics (charts for inspection by variables)).

### 5.3.3 Samples for destructive testing

5.3.3.1 •• The required test pieces can be taken from samples, which are either:

- cast-on,
- separately cast or
- taken from the casting,

as specified in the appropriate material standard or agreed at the time of ordering.

The thickness of the samples shall be the same as the wall thickness of the casting to be considered, but not greater than the maximum wall thickness specified in the material standard.

5.3.3.2 •• If the material standard or the order does not specify the type and location of the samples, these shall be cast in the form of cast-on bars close to the casting. If casting-on is not possible or is not desirable, agreement shall be made at the time of ordering as to whether separately cast samples shall be produced or whether the samples shall be taken from the casting.

5.3.3.3 The number and size of the samples depend on the specified number of test pieces for the agreed tests including those for retesting.

5.3.3.4 Cast-on samples in general may only be separated after stamping and (if necessary) after the heat treatment to be considered for achieving the mechanical properties. Any departure from this specification shall be the subject of particular agreement.

5.3.3.5 Separately cast samples and those that have to be separated to allow machining, shall be stamped. They shall, if necessary, be heat treated together with the casting.

### 5.3.4 Test methods

5.3.4.1 The chemical composition shall normally be determined spectrometrically; in cases of dispute, the methods specified by the Chemists' Committee of the *Verein Deutscher Eisenhüttenleute*[2] (Society of German Ferrous Metallurgy Engineers) or the *Gesellschaft Deutscher Metallhütten- und Bergleute*[3] (Association of German Metallurgists and Miners) shall be used.

5.3.4.2 The tensile test shall be carried out as specified in DIN 50 145, using if possible the short proportional bar specified in DIN 50 125, unless other specifications are given in the material standards.

5.3.4.3 The impact test shall be carried out as specified in DIN 50 115 on ISO V-notch test pieces. The test result shall normally be taken as the mean of three test pieces. The use of DVM test pieces is only permitted if a provision is made for this in the material standard or if it has been agreed at the time of ordering.

5.3.4.4 The Brinell hardness test shall be carried out as specified in DIN 50 351.

5.3.4.5 If an internal pressure test has been agreed for testing leak tightness, this shall be carried out as specified in DIN 50 104.

• The pressurizing medium, pressure level, duration of pressure stressing and test temperature shall be agreed at the time of ordering.

Appropriate specifications shall be agreed for carrying out other tests for leak tightness.

5.3.4.6 • All other test methods, if not specified in the material standards, shall be agreed at the time of ordering.

### 5.3.5 Invalidation of tests

A test shall be considered invalid if its results are unsatisfactory for the following reasons:

- defective manufacture of a test piece (workpiece defect, machining defect) but not defects in the material;
- deficiency in testing (mounting of the test piece, test procedure, testing machine).

The above applies irrespective of whether the defect is detected during or after the test. In all such cases, the test must be repeated.

### 5.3.6 Retests

For each valid test, the result of which does not conform to the requirements, retests shall be carried out as specified in subclauses 5.3.6.1 and 5.3.6.2.

5.3.6.1 For each test, the result of which did not conform to the requirements, two retests shall be carried out, the results of which shall comply with the requirements.

In cases in which a series of similar tests has had to be carried out, e.g. in the impact test, the term "test" or "test piece" shall be understood to mean the complete series of tests or test pieces.

5.3.6.2 The test pieces for the retests shall be taken from the test unit from which the unsatisfactory test pieces were taken.

If the test unit consists of several castings and if, in cases where test pieces are taken from cast-on samples or from the casting itself, the unsatisfactory results are attributable to a particular casting of the test unit, the manufacturer has the choice of withdrawing the casting concerned or of retaining it in the test unit.

If the manufacturer retains the casting, for which an unsatisfactory result was obtained, in the test unit, then one of the two retests shall be carried out on the casting concerned or its cast-on sample and the other on another casting in the test unit.

Apart from this, with regard to sampling, preparation and testing of test pieces, the specifications given in the relevant material standard shall apply for retests, unless otherwise agreed at the time of ordering.

## 5.4 Sorting, retreatment and repair

The manufacturer may repair defects on rejected castings or batches of castings in some suitable manner and resubmit the castings.

The method used for removal of defects shall be agreed with the purchaser.

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[2], [3] See "Standards and other documents referred to" clause.

## 6 Identification and marking

6.1 If an inspection certificate or marking has been agreed at the time of ordering, the castings shall be market as follows:

a) with the manufacturer's mark;

b) with symbols indicating the date or period of manufacture or the cast number;

c) if acceptance inspection has been carried out, with the inspector's mark and with letters or numbers relating the test documents and the test results listed in them to the test units and, where applicable, to the castings.

●● Apart from this, marking with the pattern number, part number or drawing number and with the material number or material designation complying with DIN Standards may be agreed.

6.2 In cases where no agreements have been made, the manufacturer may apply a marking of his own choice.

6.3 The marking shall be applied in an easily legible form (e.g. by casting-on, stamping, embossing with a steel punch or some similar method) in such a manner as not to impair the use of the casting.

●● The purchaser should express his wishes on this matter if any at the time of ordering.

6.4 ●● In cases where small castings are supplied in containers, the marking referred to in subclause 6.1 may be applied to the container or to a tie-on label carefully attached to the container, unless otherwise specified in the agreements made at the time of ordering.

## 7 Packing and surface protection

The manufacturer may supply the castings without any packing and without any surface protection or with packing and/or with surface protection, if nothing is specified in the order.

●● The packing and the surface protection of the castings for storage and transport shall conform to the agreements made at the time of ordering.

If castings are to be subjected to acceptance inspection, the surface protection and/or packing shall only be applied after such inspection.

## 8 Complaints

Under current law, warranty claims may only be raised against defective products if the defects impair their processing and use to a more than negligible extent. This shall apply unless otherwise agreed at the time of ordering.

It is normal and practical for the purchaser to give the supplier the opportunity to judge whether the complaints are justified, if possible by submitting the casting objected to or samples of the castings supplied.

## Standards and other documents referred to

| | |
|---|---|
| DIN 1511 | Pattern equipment for foundries; production and quality |
| DIN 1680 Part 1 | Raw castings; general tolerances and machining allowances; general |
| DIN 1680 Part 2 | Raw castings; general tolerance system |
| DIN 1683 Part 1 | Raw castings made from cast steel; general tolerances, machining allowances |
| DIN 1684 Part 1 | Raw castings made from malleable cast iron; general tolerances, machining allowances |
| DIN 1685 Part 1 | Raw castings made from spheroidal graphite cast iron; general tolerances, machining allowances |
| DIN 1686 Part 1 | Raw castings made from flake graphite cast iron; general tolerances, machining allowances |
| DIN 1687 Part 1 | Raw castings made from heavy metal alloys; sand casting; general tolerances, machining allowances |
| DIN 1687 Part 3 | Raw castings made from heavy metal alloys; gravity die casting; general tolerances, machining allowances |
| DIN 1687 Part 4 | Raw castings made from heavy metal alloys; general tolerances, pressure die casting |
| DIN 1688 Part 1 | Raw castings made from light metal alloys; sand casting; general tolerances, machining allowances |
| DIN 1688 Part 3 | Raw castings made from light metal alloys; gravity die casting; general tolerances, machining allowances |
| DIN 1688 Part 4 | Raw castings made from light metal alloys; general tolerances, pressure die casting |
| DIN 17 014 Part 1 | Heat treatment of ferrous materials; technical terms and definitions |
| DIN 40 080 | Sampling procedures and tables for inspection by attributes |
| DIN 50 049 | Documents on materials testing |
| DIN 50 104 | Internal pressure test on hollow products; leak tightness test up to a defined internal pressure; general specifications |
| DIN 50 115 | Testing of metallic materials; impact test |
| DIN 50 125 | Testing of metallic materials; tensile test pieces; guidelines for their preparation |
| DIN 50 145 | Testing of metallic materials; tensile test |
| DIN 50 351 | Testing of metallic materials; Brinell hardness testing |
| ISO 3951 – 1981 | Sampling procedures and charts for inspection by variables for percent defective |

*Handbuch für das Eisenhüttenlaboratorium*[4] (Handbook for the ferrous metallurgy laboratory);
volume 2: *Die Untersuchung der metallischen Stoffe* (Investigation of metallic materials); Düsseldorf 1966;
volume 5: (supplementary volume): A 4.1 – *Aufstellung empfohlener Schiedsverfahren* (List of recommended arbitration procedures);
B – *Probenahmeverfahren* (Sampling procedures);
C – *Analysenverfahren* (Methods of analysis);
most recent edition in each case.

*Analyse der Metalle*[5] (Analysis of metals);
volume I *Schiedsanalysen* (Arbitration analyses);
volume III *Probenahme* (Sampling);
supplementary volume to volumes I *Schiedsanalysen* and II *Betriebsanalysen*

*DGQ* 16-43[6] *Stichprobenpläne für quantitative Merkmale (Variablenstichprobenpläne) nach ISO 3951*

## Previous editions

DIN 1693: 09.61; DIN 1693 Part 14: 10.73; DIN 1690 Part 1: 08.81

## Amendments

The following amendments have been made in comparison with the August 1981 edition:

a) A system of marking clauses with "•" or "••" to draw attention to the possibility of making special agreements has been introduced.
b) The "additional information" to be provided at the time of ordering has been transferred from subclause 3.2 to subclause 3.1.
c) For castings with lost moulds, data on the mass and the tolerance on mass have been included, see subclauses 3.1.2 and 4.7.
d) The specifications given in subclause 4.1.2 on production welds have been supplemented.
e) Subclause 5.3 dealing with tests on the castings supplied (formerly dealing with acceptance inspection) has been completely revised, e.g. as regards scope of testing, batching, test methods.
f) Clause 8 "Complaints" has been worded on the basis of agreements between DIN and the Federal Cartel Office.
g) The text has been editorially revised.

## International Patent Classification

B 22 D 29/00

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[4] Obtainable from: *Verlag Stahleisen mbH*, Postfach 82 29, D-4000 Düsseldorf 1.
[5] Obtainable from: *Springer-Verlag*, Berlin – Heidelberg – New York.
[6] Obtainable from: *Beuth Verlag GmbH*, Postfach 11 45, D-1000 Berlin 30.