

Founding – Technical conditions of delivery

Part 1: General

English version of DIN EN 1559-1

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Descriptors: Steel, iron, castings, technical delivery conditions.

Gießereiwesen – Technische Lieferbedingungen – Teil 1: Allgemeines

European Standard EN 1559-1 : 1997 has the status of a DIN Standard.**National foreword**

This standard has been prepared by CEN/TC 190.

The responsible German body involved in its preparation was the *Normenausschuß Gießereiwesen* (Foundry Practice Standards Committee), Technical Committee *Allgemeine Technische Lieferbedingungen*.**Amendments**

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ICS 77.180

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English version

**Founding - Technical conditions of delivery
Part 1: General**

Fonderie – Conditions techniques de
fourniture – Partie 1: Généralités

Gießereiwesen – Technische Liefer-
bedingungen – Teil 1: Allgemeines

This European Standard was approved by CEN on 1997-05-02.

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

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

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Contents

	Page		Page
Foreword	3	5 Designations	10
Introduction	4	6 Manufacture	10
1 Scope	4	6.1 Manufacturing process	10
2 Normative references	4	6.2 Welding operations	10
3 Definitions	6	7 Requirements	11
3.1 purchaser	6	7.1 General	11
3.2 manufacturer	6	7.2 Material	11
3.3 casting	6	7.3 Casting	12
3.4 as-cast casting	6	8 Testing and documents on material	
3.5 as-delivered casting	6	testing	13
3.6 initial sample	6	8.1 General	13
3.7 preliminary sample	6	8.2 Inspection and testing	14
3.8 relevant wall thickness	6	8.3 Test unit sampling	15
3.9 inspection	6	8.4 Samples	16
3.10 continuous inspection	7	8.5 Test methods	16
3.11 inspection representative	7	8.6 Invalidation of tests	16
3.12 test unit	7	8.7 Retests	17
3.13 sample casting	7	8.8 Sorting and reprocessing	17
3.14 sample	7	9 Marking	18
3.15 test piece	7	10 Packaging and surface protection	18
3.16 sequential testing	7	11 Complaints	18
4 Information to be supplied by the purchaser	8	Annex A (informative) Bibliography	19
4.1 Mandatory information	8	Annex B (normative) Mandatory and/or optional information checklist	20
4.2 Optional information	8		
4.3 Drawings, patterns and tools	9		
4.4 Information on the mass	9		
4.5 Preliminary sample	10		
4.6 Initial sample	10		

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 190 "Foundry technology", the secretariat of which is held by 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 December 1997, and conflicting national standards shall be withdrawn at the latest by December 1997.

Within its programme of work, Technical Committee CEN/TC 190 requested CEN/TC 190/WG 1.10 "Technical conditions of delivery" to prepare the following standard:

EN 1559-1

Founding – Technical conditions of delivery – Part 1: General

This standard is one of a series of European Standards for technical delivery conditions for castings. The other standards in this series are:

prEN 1559-2

Founding – Technical conditions of delivery – Part 2: Additional requirements for steel castings

EN 1559-3

Founding – Technical conditions of delivery – Part 3: Additional requirements for iron castings

prEN 1559-4

Founding – Technical conditions of delivery – Part 4: Additional requirements for aluminium alloy castings

EN 1559-5

Founding – Technical conditions of delivery – Part 5: Additional requirements for magnesium alloy castings

prEN 1559-6

Founding – Technical conditions of delivery – Part 6: Additional requirements for zinc alloy castings

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.

Introduction

This European Standard uses a system of identification for delivery conditions with the following structure:

- subclauses marked with a single dot (●) indicate that conditions shall be agreed at the time of enquiry and order;
- subclauses marked with two dots (●●) indicate that conditions can be agreed at the time of enquiry and order (optional);
- subclauses without dot marking are mandatory.

The purchaser specifies the requirements of the casting(s) to fulfill the intended use.

The manufacturer produces the casting(s) to the requirements stated.

It is recommended that full consultations between the manufacturer and the purchaser are made.

1 Scope

This part of EN 1559 specifies the general technical delivery conditions for castings made from cast metallic materials except copper alloy castings.

Additional technical delivery condition requirements which are specific to particular materials are specified in the following parts of this standard series:

- prEN 1559-2 for cast steel;
- EN 1559-3 for cast iron;
- prEN 1559-4 for cast aluminium;
- EN 1559-5 for cast magnesium;
- prEN 1559-6 for cast zinc.

This part of EN 1559 is not applicable to metallic castings for further reprocessing such as forging ingots and continuously cast billets and blooms.

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.

prEN 1559-2

Founding – Technical conditions of delivery – Part 2: Additional requirements for steel castings

EN 1559-3

Founding – Technical conditions of delivery – Part 3: Additional requirements for iron castings

prEN 1559-4

Founding – Technical conditions of delivery – Part 4: Additional requirements for aluminium alloy castings

EN 1559-5

Founding – Technical conditions of delivery – Part 5: Additional requirements for magnesium alloy castings

prEN 1559-6

Founding - Technical conditions of delivery - Part 6: Additional requirements for zinc alloy castings

- EN 1560**
Founding – Designation system for cast iron – Material symbols and material numbers
- EN 1754**
Magnesium and magnesium alloys – Magnesium and magnesium alloy anodes, ingots and castings – Designation system
- EN 1780-1**
Aluminium and aluminium alloys – Designation of unalloyed and alloyed aluminium ingots for remelting, master alloys and castings – Part 1: Numerical designation system
- EN 1780-2**
Aluminium and aluminium alloys – Designation of unalloyed and alloyed aluminium ingots for remelting, master alloys and castings – Part 2: Chemical symbol based designation system
- EN 10027-1**
Designation systems for steels – Part 1: Steel names, principal symbols
- EN 10027-2**
Designation systems for steels – Part 2: Numerical system
- EN 10204**
Metallic products – Types of inspection documents
- prEN 12844**
Zinc and zinc alloys – Castings - Specifications
- EN ISO 9001**
Quality systems – Model for quality assurance in design/development, production, installation and servicing (ISO 9001 : 1994)
- EN ISO 9002**
Quality systems – Model for quality assurance in production, installation and servicing (ISO 9002 : 1994)
- EN ISO 9003**
Quality systems – Model for quality assurance in final inspection and test (ISO 9003 : 1994)
- ISO 5459**
Technical drawings – Geometrical tolerancing – Datums and datum-systems for geometrical tolerances
- ISO 8062**
Castings – System of dimensional tolerances and machining allowances

NOTE: Informative references to documents used in the preparation of this standard, and cited at the appropriate places in the text, are listed in a bibliography, see annex A.

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 purchaser

Person or body who places an order.

3.2 manufacturer

Person or body who produces castings.

3.3 casting

Workpiece that has been shaped by solidification of a liquid metal or alloy in a mould.

3.4 as-cast casting

Casting that has not received any kind of finishing treatment after casting (beyond removal of casting appendages, such as gates, risers and flash and removal of residues of the moulding material where necessary).

3.5 as-delivered casting

Casting manufactured to the delivery requirements of the order.

3.6 initial sample

Casting, completely manufactured by means of the equipment and processes used for series production under the appropriate control conditions.

NOTE: The initial sample is to furnish the proof that the manufacturer is in the position to comply with the quality requirements (dimensions, material, function, etc.) requested by the purchaser.

3.7 preliminary sample

Casting which corresponds to a large degree to the "initial sample", but has either not or only partially been manufactured by means of the equipment and processes used for series production.

3.8 relevant wall thickness

Wall thickness for which the mechanical properties apply.

NOTE: Not always appropriate to all materials.

3.9 inspection

Activities such as measuring, examining, testing, gauging one or more characteristics of a product or service and comparing these with specified requirements to determine conformity.

3.10 continuous inspection

Any regular inspection of the characteristics and/or manufacturing parameters of a casting manufactured over a period of time, normally in large quantities and always to the same specification. This inspection is carried out according to an agreed procedure and may include agreed statistical methods.

3.11 inspection representative

One or more individuals who is/are either

- a) the inspector designated in the official regulations;
- b) the manufacturer's authorized representative, who is functionally independent of the production process, acting on behalf of the purchaser;
- c) the purchaser's authorized representative.

3.12 test unit

Number of pieces or the tonnage of castings to be accepted or rejected together, on the basis of the tests carried out on test pieces in accordance with the requirements of the relevant specification, material standard or order.

NOTE: This term is sometimes referred to as "inspection lot" or "test batch".

3.13 sample casting

Casting selected from a test unit for the purpose of obtaining test pieces.

3.14 sample

Sufficient quantity of material for the purpose of producing one or more test pieces. It can be separately cast, cast on or cut from the casting itself.

NOTE: In certain cases, the sample can be the sample casting itself.

3.15 test piece

Part of the sample, with specified dimensions, machined or unmachined, brought to a required condition for submission to a given test.

NOTE: In certain cases the test piece can be the sample itself.

3.16 sequential testing

Group or series of tests from which the average and individual results are used to demonstrate that the requirements of the order and/or product standard or material standard have been satisfied.

4 Information to be supplied by the purchaser

4.1 • Mandatory information (see also checklist in annex B)

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

- a) the number of castings to be supplied, the permissible deviations from this number, and the schedule of delivery;
- b) the specification of the cast material;

In the case of castings made of standardized cast material, the following shall be specified:

- the number of the relevant material standard;
 - the designation of the cast material either by symbol or by number;
- c) the relevant drawings, standards and technical specifications;
- d) the supply of pattern equipment, core boxes, permanent moulds;
- e) requirements regarding the outer and inner conditions of the castings.

4.2 •• Optional information (see also checklist in annex B)

When applicable, the enquiry and order shall include other requirements, such as

- a) the relevant wall thickness of the castings;
- b) the as-delivered condition, e.g. heat treatment, surface treatment;
- c) additional properties not specified in the material standard;
- d) the mass of the castings;
- e) the delivery of preliminary samples;
- f) the delivery of initial samples;
- g) the method and the extent (area and/or frequency) of non-destructive testing;
- h) the method and the extent (area and/or frequency) of machining to be carried out by the manufacturer;
- i) surface areas for further operations by the purchaser, such as local surface treatments, welding operations etc.;
- j) the type and the extent (area and/or frequency) of special tests to be carried out by the manufacturer and the conditions applicable to such tests;
- k) criteria for statistical sampling;
- l) 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;
- m) whether traceability is required;
- n) the type of documents covering the tests performed;
- o) the type of surface protection and packing for storage and transport arrangement;

- p) repairs and storage arrangements for patterns and tools;
- q) the formation of a test unit unless already defined by material specification;
- r) the agreement of production welding;
- s) any other special requirements, e.g. metallographic structure, corrosion resistance, machinability;
- t) the application of a quality assurance system given in EN ISO 9001, EN ISO 9002 or EN ISO 9003.

4.3 Drawings, patterns and tools

4.3.1 • The purchaser shall make available to the manufacturer the necessary drawing(s), e.g. drawing(s) of the as-cast casting and/or the finished machined casting. The identification of the relevant drawing(s) shall be specified in the enquiry and order.

Unless otherwise agreed, the drawing(s) shall conform to international or national drawing standards. If modifications to the purchaser's drawing(s) are necessary, they shall be agreed between the manufacturer and the purchaser.

Unless otherwise agreed the patterns and tools shall conform, where applicable, to the relevant European Standards.

NOTE: European Standards for patterns and tools are in course of preparation. It should be stated whether a tapered feature (see ISO 8062) is to be added, subtracted or averaged.

When applicable, the surfaces to be machined, the required machining allowances and datums (for datums see ISO 5459) for machining and for the dimensional check shall be specified on the drawing(s).

4.3.2 •• If the purchaser is making available to the manufacturer pattern equipment, tooling or permanent moulds, their identification shall be specified in the order. The surfaces of the casting to be machined shall be clearly identified and, when necessary, indicated on the drawing(s).

Unless otherwise required, the purchaser decides the shape, sizes and suitability for the purpose of the pattern equipment, tooling or permanent moulds, expendable patterns and inserts supplied.

The manufacturer of the casting shall check on the basis of physical examination that the pattern etc. are useable and complete.

The purchaser may require the manufacturer to either fully inspect the equipment supplied or to satisfy himself that the sufficient machining allowances for his manufacturing work and any subsequent machining are available.

4.3.3 • For general tolerances and machining allowances for castings, ISO 8062 shall apply unless otherwise specified by the purchaser.

The casting tolerance grade and, where applicable, the required machining allowance grade shall be specified on the drawing or in the order.

4.4 •• Information on the mass

If there is a tolerance on the mass for castings, agreement shall be made by 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 an initial sample with sizes within the size tolerances. When the mass is calculated from the drawing, then any modifications to the mould and/or the casting process and all machining allowances shall be taken into account.

4.5 ●● Preliminary sample

The supply of preliminary samples may be agreed.

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

If the agreed tolerances are exceeded on the preliminary sample, and if the purchaser gives his approval for such deviations, the new limit values shall be agreed.

The terms of approval shall be previously agreed and described in a contractual document.

4.6 ●● Initial sample

The supply of initial samples may be agreed.

If the agreed limit values or tolerances are exceeded on the initial sample, and if the purchaser gives his approval for such deviations, the new limit values or tolerances shall be agreed.

The terms of approval shall be previously agreed and described in a contractual document.

5 Designations

Designations of cast materials shall be in accordance with the following European Standards where applicable:

- a) Cast steel: EN 10027-1 and EN 10027-2;
- b) Cast iron: EN 1560;
- c) Cast magnesium: EN 1754;
- d) Cast aluminium: EN 1780-1 and EN 1780-2;
- e) Cast zinc: prEN 12844.

6 Manufacture

6.1 ●● Manufacturing process

The manufacturing process shall be left to the discretion of the manufacturer unless otherwise agreed by the time of ordering or otherwise specified in the product standard.

NOTE: The manufacturing process covers all operations up to the delivery of the casting(s).

If requested in the order, the melting and moulding processes shall be indicated to the purchaser for information.

6.2 Welding operations

6.2.1 General

The terms and definitions contained in the relevant European Standards for welding shall apply.

Production welding includes finishing welding and joint welding.

6.2.2 ●● Production welding

6.2.2.1 ●● According to the weldability of the material, the geometry of the weld and the shape and the purpose of the casting three options are available for production welding.

Unless the option of choice is laid down in any relevant product standard and/or delivery standards, then the parties shall agree on one or more of the options below:

- a) the manufacturer may undertake production welding without reference back to the purchaser;
- b) the manufacturer shall inform the purchaser that production welding has been undertaken;
- c) the manufacturer shall obtain the purchaser's agreement prior to undertake production welding.

The order may require an approved procedure and/or a technical welding sheet and/or suitably qualified welders.

6.2.2.2 ●● 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 relevant properties of the weld metal and the heat-affected zone, are sufficient to correspond to the requirements of the parent material.

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

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 similar to parent material.

6.2.2.3 ●● If a casting is locally 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 by the time of ordering with regard to production welds and their inspection.

6.2.2.4 ●● Documentation for production welded areas may be agreed.

6.2.2.5 ●● If necessary, after production welding the casting shall be subjected to heat treatment. For this purpose, the specifications given in the material standards shall be observed.

7 Requirements

7.1 General

Requirements related to materials or to castings shall be considered separately.

7.2 Material

7.2.1 Chemical composition

If not otherwise specified in the enquiry and order the requirements of the relevant material standard shall apply with regard to the chemical composition of the cast material.

If not otherwise specified in the enquiry and order the data on the chemical composition of the cast material shall relate to the liquid metal, i.e. ladle analysis.

If neither the relevant material standards nor the order or enquiry include any data on the chemical composition of the cast material, e.g. in cases where the material is specified by mechanical properties only, the choice of a suitable chemical composition shall be left to the manufacturer.

7.2.2 Mechanical properties

If not otherwise specified in the enquiry and order the requirements of the relevant material standard shall apply with regard to the properties of the material.

7.2.3 •• Other properties

Other material properties may be specified, such as corrosion resistance, creep resistance, structure, specific physical properties.

7.3 Casting

7.3.1 Chemical composition

When a chemical analysis is required to be carried out on a casting the permissible deviations shall conform to those given in the material standard or to those which have been agreed between the purchaser and the manufacturer. When applicable, the sampling position shall be agreed between the purchaser and the manufacturer.

7.3.2 •• Mechanical properties

In cases where particular properties, e.g. yield stress, tensile strength, hardness, apply to certain areas of the casting or to the complete casting, these properties shall be agreed by the time of the order. If applicable, the position, the shape of the sample and the sampling conditions shall be agreed between the purchaser and the manufacturer.

7.3.3 Non-destructive testing

7.3.3.1 • Requirements regarding the outer and/or inner conditions shall be agreed. They shall specify:

- the method of non-destructive testing to be used;
- the extent (area and/or frequency) of testing;
- the acceptance criteria.

In those areas where non-destructive testing has been agreed, the required surface condition shall be ensured by the use of an appropriate process.

References to discontinuities shall be expressed in terms of dimension, quantity and location.

7.3.3.2 Where minor surface defects do not impair the application or if the surface of the casting corresponds to that of the initial sample, they need not be removed.

NOTE: Examples of minor surface defects include small areas of sand or slag, small cold laps, small scabs, small shrink-holes, groups of small pores, residues of the moulding material, uneven areas, flash.

7.3.3.3 Unacceptable external and internal discontinuities may be recovered by methods specified in parts 2 to 5 of this standard. A conforming procedure may be agreed between the purchaser and the manufacturer. In the case of as-cast castings, it is recommended that the purchaser discusses with the manufacturer the choice of any non-destructive testing and criteria to determine the acceptability of a subsequently machined surface. Unless specifically agreed, discontinuities revealed on the machined surface are not to be regarded as a non-conformity.

7.3.3.4 ●● If required, the surface condition including burrs and parting line flash shall be agreed upon.

NOTE: Examples of acceptable surfaces include surface comparators or another casting used as a reference comparator, etc.

7.3.4 Condition of the casting

7.3.4.1 General

The shape and sizes of the castings shall conform to the requirements of the order and shall be given in the form of drawings, models or templates.

● The enquiry and order shall detail the dimensional tolerances and the machining allowances to be specified, preferably in accordance with ISO 8062.

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

7.3.4.2 ●● Fettling and finishing

Unless otherwise agreed by the time of ordering, the castings shall be supplied fettled, but unmachined. Gates and feeders shall be removed. Residues of moulding and foreign material and scale shall be removed from accessible surfaces.

7.3.5 ●● Mass of the casting

If applicable, the mass and its tolerance shall be agreed by the time of ordering.

7.3.6 ●● Additional requirements regarding the condition of the casting

Additional requirements regarding the condition of the casting, e.g. pressure or leak tightness to particular media, at specified pressures and temperatures, or the microstructure, shall be specified by the time of ordering.

8 Testing and documents on material testing

8.1 General

8.1.1 The manufacturer shall take the necessary measures to ensure compliance with the agreed requirements. The testing shall be carried out by competent persons.

8.1.2 ●● The purchaser may agree with the manufacturer suitable measures and levels of quality inspection, whether the inspectors have to be qualified and/or certificated, the requisite level of this certification and the extent of the documentation of test results.

8.1.3 The terms and definitions contained in EN 10204 shall apply.

NOTE: For the purposes of this standard the terms product/produit/Produkt mean casting/pièce moulée/Gußstück and the terms producer/producteur/Hersteller mean manufacturer/fabricant/Hersteller.

8.2 Inspection and testing

8.2.1 • Types of inspection and testing

When ordering, the purchaser shall state which type of document, if any, is required (see EN 10204), thereby indicating the required type of inspection and testing: non-specific, specific or continuous.

8.2.2 •• Non-specific inspection and testing

The purchaser may require, that on the basis of non-specific inspection and testing a certificate of compliance with the order (2.1 according to EN 10204) or a test report (2.2 according to EN 10204) is to be furnished by the manufacturer. When the purchaser requires a test report he shall indicate for which casting characteristics test results shall be given in this document.

8.2.3 •• Specific inspection and testing

When the purchaser specifies that compliance with the requirements of the order is to be verified by specific inspection and testing, the enquiry and order shall cover:

- the type of document required in accordance with EN 10204: specific test report 2.3 or inspection certificate 3.1.A or 3.1.B or 3.1.C or inspection report 3.2;

and if not specified in the product or material standard:

- the test unit and the number of samples per test unit;
- the conditions for sampling and for the preparation of the samples and test pieces;
- the identification of test units, if any;
- the test methods;

and in the case of inspection certificates and inspection reports to be signed by external inspectors,

- the address of the inspection body.

8.2.4 •• Continuous inspection

In special cases the specific inspection of a casting can be replaced, by agreement, by continuous inspection of its characteristics and/or manufacturing, carried out by the manufacturer. The characteristics to be verified and their values, the frequency of the inspection and testing, and, if necessary, the required documents shall be agreed by the time of ordering. This agreement shall, where necessary, also define the right of the purchaser to verify this inspection.

8.2.5 •• Place of specific inspection and testing

If the necessary facilities are not available at the manufacturer's works, the specific inspection and testing shall be carried out at another place agreed between the two parties, or at an establishment accredited by a recognized organization, preferably in the country of manufacture. In this latter case, the castings shall not be delivered before receipt of the test results by the manufacturer.

8.2.6 Submission for specific inspection and testing to the inspection representative

The inspection representative shall be informed, by the manufacturer or his authorized representative, of the date of availability of part or all of the consignment for specific inspection and testing. Reference shall be made to the order. The submission note referring to the order or to the available parts of the order shall be delivered to the inspection representative not later than the beginning of the inspection/testing procedure.

The manufacturer and the inspection representative shall agree the time and date of the inspection and testing in order to avoid interference with the normal operation of the works.

If the external inspection representative does not attend on the agreed date, and, in order not to disturb the manufacturing process the inspection representative authorized by the manufacturer may carry out on agreement with the purchaser the acceptance operations himself and provide the purchaser, or his representative, with the inspection document, unless this was expressly forbidden.

8.2.7 Rights and duties of the inspection representative

In order to carry out the agreed inspection and testing, the inspection representative shall have free access, at any appropriate time, to the places where the castings to be tested/inspected are manufactured and stored. He may select the sample castings from the test unit from which the samples are to be taken in conformity with the specifications. He shall have the right to be present during the selection of samples, preparation (machining and treatment) of test pieces and of witnessing the tests. He shall observe all the instructions in force in the manufacturer's works and particularly the safety rules. The manufacturer can reserve the right to have him accompanied by a representative of the works. The testing/inspection procedures shall be carried out so that disturbance of the normal run of production is minimized.

8.3 Test unit sampling

8.3.1 •• Formation of test units

Different criteria designated by the following letters taken separately or together shall be used for defining the test unit, which can be formed by:

- S a single casting;
- A castings of the same alloy;
- D castings defined by the same drawing;
- M castings from a single melt which has undergone the same treatment;
- H castings which have undergone the same heat treatment;
- P castings obtained from charges of similar composition and poured during a given production period (shift, day, week, etc.);
- T a tonnage (mass) of castings;
- Q a quantity (number) of castings of the same material and similar shape.

NOTE: For example, a test unit can be formed by castings of the same alloy A, defined by the same drawing D, from a single melt M and from the same heat treatment charge H, in which case it is designated ADMH.

8.3.2 •• Size of test units

The size of test units shall be specified in the order.

8.3.3 ●● Inspection frequency

The inspection frequency shall be agreed either according to the details in the material standard, product standard, or in the purchaser's specification.

8.4 Samples

8.4.1 If required, samples shall be produced as specified in the appropriate material standard or agreed by the time of ordering. These can be

- separately cast,
- cast on, or
- cut from the casting.

If appropriate, 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 relevant wall thickness specified in the material standard.

8.4.2 If the drawing or the material standard or the order does not specify the type and position of the samples, that shall be at the discretion of the manufacturer.

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

8.4.4 Unless otherwise specified cast-on samples shall only be separated after their identification and, if any, heat treatment.

8.4.5 Separately cast samples and those that have to be separated to allow machining, shall be identified. They shall, in case of heat treatment, be heat treated together with the test unit, unless otherwise specified in the relevant material standard.

8.5 Test methods

If applicable, tests shall be carried out, and the results presented, in accordance with the corresponding European Standard. When no such European Standard exists other test methods may be used which then shall be agreed by the time of ordering.

NOTE: Annex A (see [1] to [10]) contains a list of some of the European Standards on testing and analysis.

8.6 Invalidation of tests

The requirements given in the relevant material standard shall apply.

If not otherwise specified in the relevant material standard, test results which are due to improper sampling and/or preparation of test pieces or tests carried out improperly shall be considered invalid.

Test results shall be disregarded where non-conforming results arise from defects found on one (or more) test piece(s) (improper structure, fracture outside the gauge marks of the tensile test piece etc.) after the test has been carried out.

8.7 Retests

8.7.1 General

If not otherwise specified in the material standard, specific technical delivery condition standard or product standard, the following applies:

When one or more tests have given unsatisfactory or non-conforming results, the manufacturer may either withdraw the test unit concerned or retest in accordance with the procedures described in 8.7.2 and 8.7.3.

8.7.2 Individual values (Non-sequential tests)

When the unsatisfactory or non-conforming result comes from tests for which no average, but only individual values are specified (e.g. tensile test, bend test, etc.), the following shall be carried out:

a) the test unit is a single piece

Two new tests of the same type as the one giving an unsatisfactory or non-conforming result shall be carried out. Both new tests shall give satisfactory or conforming results. If not, the casting shall be rejected or reprocessed.

b) the test unit is more than one piece

Unless otherwise agreed, the manufacturer may, at his discretion, retain or not retain in the test unit the sample casting from which the unsatisfactory or non-conforming test results have been obtained.

1) If the sample casting is withdrawn from the test unit, the inspection representative shall designate, within the same test unit, two other sample castings of his choice. One more test of the same type shall then be carried out on test pieces from each of these sample castings, under the same conditions as for the first tests; both new tests shall give satisfactory or conforming results.

2) If the sample casting is retained in the test unit, the procedure is as indicated in 1), but one of the new test pieces shall be taken from the sample casting retained in the test unit; both new tests shall give satisfactory or conforming results.

8.7.3 Sequential tests

Retests of sequential tests, e.g. impact test, shall be carried out in accordance with prEN 1559-2, EN 1559-3, prEN 1559-4, EN 1559-5 or prEN 1559-6 and/or the relevant material standard.

8.8 Sorting and reprocessing

The manufacturer shall have the right to carry out sorting and/or reprocessing (e.g. heat treatment, machining, etc.) of non-conforming castings, either before or after the retests, and to submit these castings as a new test unit in accordance with 8.3.

The manufacturer shall inform the inspection representative about the method of sorting and/or reprocessing used.

9 Marking

At delivery, the manufacturer shall have marked either the castings or the consignment with his identification and, additionally, in accordance with the product standard and/or with the agreement by the time of ordering with,

•• if required:

- traceability reference;
- designation of the alloy;
- other marking requested by the purchaser.

10 Packaging and surface protection

Packaging and/or surface protection, if any, for the transport or storage of castings shall be at the discretion of the manufacturer unless a specific agreement has been made by the time of acceptance of the order.

11 Complaints

In case of any complaint, the manufacturer shall be able to examine the validity of the complaint within a reasonable time.

Complaints may only be made against defective castings when the defects impair further processing and use to a more than negligible extent. This applies, unless otherwise agreed by the time of ordering.

Annex A (informative)

Bibliography

In the preparation of this European Standard, use was made of a number of documents for reference purposes. These informative references are cited at the appropriate places in the text and the publications are listed hereafter.

- [1] EN 1369
Founding – Magnetic particle inspection
- [2] EN 1370
Founding – Surface roughness inspection by visual tactile comparators
- [3] prEN 1371-1
Founding – Liquid penetrant inspection – Part 1: Sand, gravity die and low pressure die castings
- [4] prEN 1371-2
Founding – Liquid penetrant inspection – Part 2: Investment castings
- [5] EN 10002-1
Metallic materials – Tensile testing – Part 1: Method of testing (at ambient temperature)
- [6] EN 10003-1
Metallic materials – Brinell hardness test – Part 1: Test method
- [7] EN 10045-1
Metallic materials – Charpy impact test – Part 1: Test method
- [8] prEN 12680-1
Founding – Ultrasonic inspection – Part 1: Steel castings
- [9] prEN 12680-2
Founding – Ultrasonic inspection – Part 2: Spheroidal graphite cast iron castings
- [10] prEN 12681
Founding – Radiographic inspection

Annex B (normative)

Mandatory and/or optional information checklist

This annex B gives a checklist for quick information about different points that shall or may be agreed by the time of acceptance of the order (marked by x, table B.1). It relates to the relevant clauses or subclauses of this standard.

Table B.1: Checklist

Clause, subclause	Title	Agreement		Remarks
		shall be specified ●	may be specified ●●	
4 Information to be supplied by the purchaser				
4.1	Mandatory information Number of castings a) Cast material and material standard b) Specifications c) Patterns d) Outer and inner conditions e)	x x x x x	 x	 see 4.3.1 see 4.3.2 see 7.3.3.1
4.2	Optional information		x	
4.3	Drawings, patterns and tools Taper, surface to machine, machining allowance (4.3.1) Pattern supplied (4.3.2) Machining allowance out of standard (4.3.3)	x x	 x	 see also 7.3.4.1
4.4	Information on the mass		x	see also 7.3.5
4.5	Preliminary sample		x	
4.6	Initial sample		x	
6 Manufacture				
6.1	Manufacturing process		x	
6.2	Welding operations Production welding (6.2.2.1) Welding procedure agreement (6.2.2.2) Areas where welding is permitted (6.2.2.2) Exceptional stress (6.2.2.3) Documentation of welded areas (6.2.2.4) Heat treatment after welding (6.2.2.5)		 x x x x x x	
7 Requirements				
7.2.1	Chemical composition of the material			specified in material standard
7.2.2	Mechanical properties of the material			specified in material standard
7.2.3	Other properties of the material		x	
(continued)				

Table B.1: (concluded)

Clause, subclause	Title	Agreement		Remarks
		shall be specified ●	may be specified ●●	
7.3.1	Chemical composition of the casting – Sampling position	x		
7.3.2	Mechanical properties of the casting	x		
7.3.3	Non-destructive testing¹⁾ Outer and/or inner conditions (7.3.3.1) Minor surface defects (7.3.3.2) Repair methods (7.3.3.3) Surface condition (7.3.3.4)	x x	 x	see text
7.3.4	Condition of the casting Dimensional tolerances and machining allowances (7.3.4.1) Preliminary sample agreement (7.3.4.1) Fettling and finishing (7.3.4.2)	x 	 x x	
7.3.5	Mass of the casting		x	
7.3.6	Additional requirements		x	
8 Testing and documents on material testing				
8.1	General Levels of quality inspection (8.1.2) Qualification/certification of inspectors (8.1.2)		x x	
8.2	Inspection and testing Types (8.2.1) Non-specific inspection (8.2.2) Specific inspection (8.2.3) Continuous inspection (8.2.4) Place of specific inspection (8.2.5) Submission for specific inspection (8.2.6) Rights and duties of the inspection representative (8.2.7)	x 	 x x x x	see text see text
8.3	Test unit sampling Formation of test units (8.3.1) Size of test units (8.3.2) Inspection frequency (8.3.3)		x x x	
8.4	Samples Types (8.4.1) Position (8.4.2) Number and size (8.4.3) Identification (8.4.5)		 x	see text see text see text
8.5	Test methods			see text
8.6	Invalidation of tests			see text
8.7	Retests			see text
8.8	Sorting and reprocessing			see text
9	Marking		x	
¹⁾ If not applicable, the purchaser shall inform the manufacturer that no non-destructive testing is required.				