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Founding – Low-alloyed ferritic spheroidal graphite cast irons for elevated temperature applications

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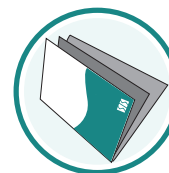
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EUROPEAN STANDARD

EN 16124

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2011

ICS 77.080.10

English Version

Founding - Low-alloyed ferritic spheroidal graphite cast irons for elevated temperature applications

Fonderie - Fontes ferritiques à graphite sphéroïdal faiblement alliées pour applications à haute température

Gießereiwesen - Niedriglegiertes ferritisches Gusseisen mit Kugelgraphit für Anwendungen bei höheren Temperaturen

This European Standard was approved by CEN on 15 October 2011.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Foreword

This document (EN 16124:2011) 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of an identical text or by endorsement, at the latest by May 2012, and conflicting national standards shall be withdrawn at the latest by May 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

Within its programme of work, Technical Committee CEN/TC 190 requested CEN/TC 190/WG 7 "Spheroidal graphite, silicon molybdenum and austempered ductile iron" to prepare EN 16124.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard classifies low-alloyed ferritic spheroidal graphite cast irons, principally used for their heat and oxidation resistance properties.

NOTE Ferritic spheroidal graphite cast irons alloyed with silicon and molybdenum is also known as SiMo cast irons.

Due to the ferritic structure and the silicon and molybdenum content, these cast irons allow producing castings which are resistant to distortion and oxidation at high temperatures.

Nine grades of low-alloyed ferritic spheroidal graphite cast iron are defined by their silicon and molybdenum content.

Typical applications for the first three grades are medium to heavy castings like turbine housings and compressor parts. The other six grades are mainly applied for exhaust manifolds and turbocharger parts in automotive applications.

The mechanical properties of the material can be evaluated on machined test pieces prepared from cast samples or samples cut from a casting.

Additional information on technical properties for low-alloyed ferritic spheroidal graphite cast iron is given in Annex B and Annex C.

1 Scope

This European Standard defines the grades and the corresponding requirements for low-alloyed ferritic spheroidal graphite cast irons for elevated temperature applications.

These requirements are specified in terms of

- chemical composition: as given for each of the grades,
- graphite form and matrix structure: spheroidal graphite in a predominantly ferritic matrix,
- mechanical properties measured on machined test pieces prepared from cast samples.

This European Standard does not cover technical delivery conditions for iron castings, see EN 1559-1 [1] and EN 1559-3 [2].

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10204, *Metallic products — Types of inspection documents*

EN ISO 945-1:2008, *Microstructure of cast irons — Part 1: Graphite classification by visual analysis (ISO 945-1:2008)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1)*

EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

low alloyed ferritic spheroidal graphite cast iron

cast iron material with carbon mainly present in the form of spheroidal graphite particles, alloyed with silicon in order to produce a predominantly ferritic matrix and alloyed with molybdenum to improve mechanical properties at elevated temperatures

3.2

graphite spheroidizing treatment

operation that brings the liquid iron into contact with a substance to produce graphite in the predominantly spheroidal (nodular) form during solidification

NOTE This operation is often followed by a second one called inoculation.

3.3

cast sample

quantity of material cast to represent the cast material, including separately cast sample, side by side cast sample and cast-on sample

3.4

separately cast sample

sample cast in a separate sand mould under representative manufacturing conditions and material grade

- 3.5**
side-by-side cast sample
sample cast in the mould alongside the casting, with a joint running system
- 3.6**
cast-on sample
sample attached directly to the casting
- 3.7**
relevant wall thickness
wall thickness representative of the casting, defined for the determination of the size of the cast samples to which the mechanical properties apply

4 Designation

The material shall be designated either by symbol or by number as given in Table 1.

NOTE The designation system is in accordance with EN 1560 [3].

In the case of samples cut from the casting, the letter C is added at the end of the designation by symbol.

5 Order information

The following information shall be supplied by the purchaser:

- a) the number of this European Standard;
- b) the designation of the material;
- c) the relevant wall thickness of the casting;
- d) any special requirements.

All requirements shall be agreed between the manufacturer and the purchaser by the time of acceptance of the order, e.g. technical delivery conditions according to EN 1559-1 and EN 1559-3.

6 Manufacture

Unless otherwise specified by the purchaser, the method of manufacture of low-alloyed ferritic spheroidal graphite cast irons and any heat treatment required to obtain the specified mechanical properties and microstructure shall be left to the discretion of the manufacturer.

The manufacturer shall ensure that the requirements defined in this European Standard are met for the material grade specified in the order.

All agreements between the manufacturer and the purchaser shall be made by the time of acceptance of the order.

7 Requirements

7.1 Chemical composition

The silicon and molybdenum content of low-alloyed ferritic spheroidal graphite cast iron grades shall be in accordance with Table 1.

Unless otherwise agreed, the content of other elements shall be left to the discretion of the manufacturer.

If the presence of any element specified in Table 1 is required to be outside the limits indicated, or if any other alloying elements are required, their contents shall be agreed between the manufacturer and the purchaser and specified in the order.

Table 1 — Chemical composition

| Material designation | | Silicon % (mass fraction) | Molybdenum % (mass fraction) |
|----------------------|--------|------------------------------|---------------------------------|
| Symbol | Number | | |
| EN-GJS-SiMo25-5 | 5.3111 | 2,3 to 2,7 | 0,4 to 0,6 |
| EN-GJS-SiMo30-7 | 5.3112 | 2,8 to 3,2 | 0,6 to 0,8 |
| EN-GJS-SiMo35-5 | 5.3113 | 3,3 to 3,7 | 0,4 to 0,6 |
| EN-GJS-SiMo40-6 | 5.3114 | 3,8 to 4,2 | 0,5 to 0,7 |
| EN-GJS-SiMo40-10 | 5.3115 | | 0,8 to 1,1 |
| EN-GJS-SiMo45-6 | 5.3116 | 4,3 to 4,7 | 0,5 to 0,7 |
| EN-GJS-SiMo45-10 | 5.3117 | | 0,8 to 1,1 |
| EN-GJS-SiMo50-6 | 5.3118 | 4,8 to 5,2 | 0,5 to 0,7 |
| EN-GJS-SiMo50-10 | 5.3119 | | 0,8 to 1,1 |

7.2 Microstructure

7.2.1 Graphite structure

The graphite structure shall be mainly of form V and VI in accordance with EN ISO 945-1. A more precise definition may be agreed upon by the time of acceptance of the order.

NOTE Annex E gives more information on nodularity.

7.2.2 Matrix structure

The matrix structure shall consist of minimum 85 % ferrite, the balance consisting of pearlite and carbides.

Carbides can be present to a maximum of 5 %.

Other limits may be agreed upon by the time of acceptance of the order.