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**Welding consumables — Covered  
electrodes, wires, rods and tubular cored  
electrodes for fusion welding of cast  
iron — Classification**

*Produits consommables pour le soudage — Électrodes enrobés, fils  
d'apport, baguettes et fils fourrés pour le soudage par fusion de la  
fonte — Classification*

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## Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 1071 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

This second edition cancels and replaces the first edition (ISO 1071:1983), which has been technically revised.

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## Foreword

This document (EN ISO 1071:2003) has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DS in collaboration with Technical Committee ISO/TC 44 "Welding and allied processes".

Annexes A, B and ZA are informative.

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of an identical text or by endorsement, at the latest by January 2004, and conflicting national standards shall be withdrawn at the latest by January 2004.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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## Introduction

This European Standard classifies welding consumables for fusion welding of various types of unalloyed cast irons, e.g.:

- grey cast irons with lamellar graphite according to EN 1561;
- malleable cast irons according to EN 1562;
- spheroidal graphite cast irons according to EN 1563;
- ductile iron pipes, fittings, accessories and their joints for water pipelines – Requirements and test methods according to EN 545;
- ductile iron pipes, fittings, accessories and their joints for gas pipelines – Requirements and test methods according to EN 969.

Applications for welding consumables classified to this standard:

- production welding, that means welding of cast materials during the process of production. In that way the quality of the casting shall be ensured according to the guaranteed properties and to the requirements of the application;
- repair welding of castings which are damaged during service;
- welding for construction purposes, where cast irons are joined to themselves or to other ferrous or non-ferrous metals.

Two different methods are used for the welding of cast irons:

- using a welding consumable which produces a weld metal similar to the parent metal. High preheating is required (typical temperature range 550 °C to 650 °C);
- using a welding consumable which produces a weld metal dissimilar to the parent metal. No or only low preheating is required.

This standard contains the different types of welding consumables because the chemical composition of welding rods and wire electrodes as well as the all-weld metal of the corresponding covered electrodes and tubular cored electrodes is similar.

Additionally to the welding consumables specified in this standard, consumables classified to other standards can be used (see annex A).

## 1 Scope

This European Standard specifies requirements for classification of covered electrodes for manual metal arc welding, wire electrodes for metal arc welding, tubular cored electrodes for metal arc welding with and without a gas shield, rods for TIG-welding and rods for oxyfuel gas welding of unalloyed cast irons. Classification is based on the chemical composition of wires and rods and on the all-weld metal deposit for tubular cored and covered electrodes.

## 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 (including amendments).

EN 439, *Welding consumables - Shielding gases for arc welding and cutting.*

EN 545, *Ductile iron pipes, fittings, accessories and their joints for water pipelines - Requirements and test methods.*

EN 969, *Ductile iron pipes, fittings accessories and their joints for gas pipelines - Requirements and test methods.*

EN 1561, *Founding - Grey cast irons.*

EN 1562, *Founding — Malleable cast irons.*

EN 1563, *Founding — Spheroidal graphite cast irons.*

EN 1564, *Founding — Austempered ductile cast irons.*

EN 22401, *Covered electrodes - Determination of the efficiency, metal recovery and deposition coefficient (ISO 2401:1972).*

EN ISO 6847, *Welding consumables - Deposition of a weld metal pad for chemical analysis (ISO 6847:2000).*

prEN ISO 544, *Welding consumables - Technical delivery conditions for welding filler metals - Type of product, dimensions, tolerances and markings (ISO/FDIS 544:2000).*

ISO 31-0:1992, *Quantities and units - Part 0: General principles.*

### 3 Classification

**3.1** A wire electrode and a rod are classified according to chemical composition in Tables 2 and 3. The classification is divided in three parts:

- a) the first part gives a symbol indicating the product to be identified;
- b) the second part indicates the type of alloy (C for cast iron);
- c) the third part gives a symbol indicating the chemical composition of the wire electrode or of the rod.

**3.2** A tubular cored electrode is classified according to the all-weld metal chemical composition produced with an appropriate shielding gas. The classification is divided into four parts:

- a) the first part gives a symbol indicating the product to be identified;
- b) the second part indicates the type of alloy (C for cast iron);
- c) the third part gives a symbol indicating the chemical composition of the all-weld metal;
- d) the fourth part gives a symbol indicating the shielding gas.

**3.3** Covered electrodes are classified according to the all-weld metal chemical composition. The classification is based on the electrode diameter 4 mm. The classification is divided into four parts:

- a) the first part gives a symbol indicating the product to be identified;
- b) the second part indicates the type of alloy (C for cast iron);
- c) the third part gives a symbol indicating the chemical composition of the all-weld metal;
- d) the fourth part gives a symbol indicating the effective electrode efficiency and the type of current.

**3.4** In order to facilitate the use of this standard, the classification of tubular cored and covered electrodes is split into two sections:

- a) compulsory section;

this section includes the symbols for the type of product, type of alloy, the chemical composition and the shielding gas, i.e. the symbols defined in 4.1, 4.2, 4.3 and 4.4.

- b) optional section;

this section includes the symbol for the effective electrode efficiency and type of current and the welding positions for which the consumable is suitable, i.e. the symbols defined in 4.5.

The full designation (see clause 9) shall be used on packages and in the manufacturer's literature and data sheets.

### 4 Symbols and requirements

#### 4.1 Symbols for the product form

The symbol for the covered electrode shall be the letter E.

The symbol for the solid wire and rod shall be the letter S and the symbol for the tubular cored wire shall be T.

The symbol for the cast rod shall be R.



## 4.2 Symbol for the type of alloy

The symbol C as the second symbol shall be used to indicate the welding of cast iron as the main application.

## 4.3 Symbol for the chemical composition

### 4.3.1 General

The symbols in Tables 2 and 3 indicate the chemical composition of rods and wire electrodes as well as the chemical composition of the all-weld metal of covered electrodes and tubular cored electrodes in accordance with clause 6.

A distinction has to be made between similar and dissimilar consumable according to the chemical composition of the weld metal.

### 4.3.2 Consumables producing similar weld metal

The consumables of this group are classified according to the alloy type in Table 1. The symbols in Table 2 indicate the chemical composition of similar rods and similar all-weld metal of covered electrodes and tubular cored electrodes. The description of each consumable and examples for application are given in annex A.

**Table 1 — Welding consumables producing weld metal similar to parent metal**

Symbol	Microstructure	Product form <sup>a</sup>
FeC-1 <sup>b</sup>	lamellar graphite	E, R
FeC-2 <sup>c</sup>	lamellar graphite	E, T
FeC-3	lamellar graphite	E, T
FeC-4	lamellar graphite	R
FeC-5	lamellar graphite	R
FeC-GF	ferritic microstructure, spheroidal graphite	E, T
FeC-GP1	pearlitic microstructure, spheroidal graphite	R
FeC-GP2	pearlitic microstructure, spheroidal graphite	E, T
<sup>a</sup> Symbols see 4.1. <sup>b</sup> Covered electrode with core rod of cast iron. <sup>c</sup> Covered electrode with core rod of unalloyed steel.		

**Table 2 — Chemical composition of similar rod and of similar all-weld metal of covered electrode and tubular cored electrode**

Symbol	Product form	Chemical composition % <sup>abc</sup>										Sum of other elements
		C	Si	Mn	P	S	Fe	Ni <sup>d</sup>	Cu <sup>e</sup>	Remark		
FeC-1	E, R	3,0 to 3,6	2,0 to 3,5	0,8	0,5	0,1	Remainder	–	–	–	Al: 3,0	1,0
FeC-2	E, T	3,0 to 3,6	2,0 to 3,5	0,8	0,5	0,1	Remainder	–	–	–	Al: 3,0	1,0
FeC-3	E, T	2,5 to 5,0	2,5 to 9,5	1,0	0,20	0,04	Remainder	–	–	–	–	1,0
FeC-4	R	3,2 to 3,5	2,7 to 3,0	0,60 to 0,75	0,50 to 0,75	0,10	Remainder	–	–	–	–	1,0
FeC-5	R	3,2 to 3,5	2,0 to 2,5	0,50 to 0,70	0,20 to 0,40	0,10	Remainder	1,2 to 1,6	–	–	Mo: 0,25 to 0,45	1,0
FeC-GF	E, T	3,0 to 4,0	2,0 to 3,7	0,6	0,05	0,015	Remainder	1,5	–	–	Mg: 0,02 to 0,10 Ce: 0,20	1,0
FeC-GP1	R	3,2 to 4,0	3,2 to 3,8	0,10 to 0,40	0,05	0,015	Remainder	0,50	–	–	Mg: 0,04 to 0,10 Ce: 0,20	1,0
FeC-GP2	E, T	2,5 to 3,5	1,5 to 3,0	1,0	0,05	0,015	Remainder	2,5	1,0	–	Mg: 0,02 to 0,10 Ce: 0,20	1,0
Z	R, E, T	Any other agreed composition										

a Single values are maximum percentages.

b The results shall be rounded to the same number of significant figures as in the specified value using the rules in accordance with annex B, Rule A of ISO 31-0:1992.

c The weld metal, core metal or filler metal, as specified should be analysed for specific elements for which values are shown in this table. If the presence of other elements is indicated, in the course of this work, the amount of those elements shall be determined to ensure that their total does not exceed the limit specified for "Sum of other elements" in the last column of the table.

d Nickel limit can include incidental cobalt.

e Copper limit can include incidental silver.

#### 4.3.3 Consumables producing dissimilar weld metal

The consumables of this group are classified according to the chemical composition of the wire electrode or of the all-weld metal of the covered electrode and of the tubular cored electrode (see Table 3). The description of each consumable and examples for application are given in annex A.

#### 4.4 Symbol for shielding gas ( tubular cored electrode)

The symbol M for mixed gases as described in EN 439 shall be used when the classification is performed with shielding gas EN 439-M2, but without helium.

Tubular cored electrodes used with carbon dioxide shielding gas EN 439-C1 are designated C. Tubular cored electrodes used without a gas shield are designated N.

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