INTERNATIONAL STANDARD

ISO 1071

Second edition
2003-07-01

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

Reference number
ISO 1071:2003(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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.

Contents

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.

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 [a]
FeC-1 [b]	lamellar graphite	E, R
FeC-2 [c]	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

[a] Symbols see 4.1.

[b] Covered electrode with core rod of cast iron.

[c] 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 % [abc]									
		C	Si	Mn	P	S	Fe	Ni[d]	Cu[e]	Remark	Sum of other elements
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.

Table 3 — Chemical composition of dissimilar rods, wire electrodes and of dissimilar all-weld metal of covered electrodes and of tubular cored electrodes

Symbol	Product form	Chemical composition in % [a b c d]									
		C	Si	Mn	P	S	Fe	Ni[e]	Cu[f]	Remark	Sum of other elements
Fe-1	E, S, T	2,0	1,5	0,5 to 1,5	0,04	0,04	Remainder	—	—	—	1,0
St	E, S, T	0,15	1,0	0,80	0,04	0,04	Remainder	—	0,35	—	0,35
Fe-2	E, T	0,2	1,5	0,3 to 1,5	0,04	0,04	Remainder	—	—	Nb + V: 5,0 to 10,0	1,0
Ni-CI	E	2,0	4,0	2,5	—	0,03	8,0	85 min	2,5	Al: 1,0	1,0
	S	1,0	0,75	2,5	—	0,03	4,0	90 min	4,0	—	1,0
Ni-CI-A	E	2,0	4,0	2,5	—	0,03	8,0	85 min	2,5	Al: 1,0 to 3,0	1,0
NiFe-1	E, S, T	2,0	4,0	2,5	0,03	0,03	Remainder	45 to 75	4,0	Al: 1,0	1,0
NiFe-2	E, S, T	2,0	4,0	1,0 to 5,0	0,03	0,03	Remainder	45 to 60	2,5	Al: 1,0 Carbide producing elements: 3,0	1,0
NiFe-CI	E	2,0	4,0	2,5	—	0,04	Remainder	40 to 60	2,5	Al: 1,0	1,0
NiFeT3-CI	T	2,0	1,0	3,0 to 5,0	—	0,03	Remainder	45 to 60	2,5	Al: 1,0	1,0
NiFe-CI-A	E	2,0	4,0	2,5	—	0,03	Remainder	45 to 60	2,5	Al: 1,0 to 3,0	1,0
NiFeMn-CI	E	2,0	1,0	10 to 14	—	0,03	Remainder	35 to 45	2,5	Al: 1,0	1,0
	S	0,50	1,0	10 to 14	—	0,03	Remainder	35 to 45	2,5	Al: 1,0	1,0
NiCu	E, S	1,7	1,0	2,5	—	0,04	5,0	50 to 75	Remainder	—	1,0
NiCu-A	E, S	0,35 to 0,55	0,75	2,3	—	0,025	3,0 to 6,0	50 to 60	35 to 45	—	1,0
NiCu-B	E, S	0,35 to 0,55	0,75	2,3	—	0,025	3,0 to 6,0	60 to 70	25 to 35	—	1,0
Z	E, S, T	Any other agreed composition									

a Single values are maximum percentages, unless otherwise noted.
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 shall 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 Certain bronze filler metals are not included in this table but can be used to braze weld cast iron very effectively. Colour match will not be the same as cast iron
e Nickel limit can include incidental cobalt.
f Copper limit can include incidental silver and copper coating.

4.5 Symbols for effective electrode efficiency and type of current (covered electrode)

The symbol in Table 4 indicates the effective electrode efficiency according to EN 22401 and the type of current.

Table 4 — Symbol for effective electrode efficiency and type of current

Symbol	Effective electrode efficiency %	Type of current [a]
1	≤ 105	Alternating and direct current
2	≤ 105	Direct current
3	>105 ≤ 125	Alternating and direct current
4	>105 ≤ 125	Direct current
5	>125 ≤ 160	Alternating and direct current
6	>125 ≤ 160	Direct current
7	> 160	Alternating and direct current
8	> 160	Direct current

[a] In order to demonstrate operability on alternating current tests shall be carried out with no load voltage not higher than 65 V.

5 Mechanical tests

The mechanical properties of the all-weld metal are not part of the classification.

NOTE 1 The mechanical properties and the microstructure of similar weld metal largely correspond with those of the parent metal. They mainly depend on e.g. preheating, thermal conditions during welding and cooling rate. The indication of compulsory mechanical properties is not possible.

NOTE 2 The tensile test is used to describe the mechanical properties of the dissimilar all-weld metal. It is performed with all-weld metal (as welded) according to EN 1597-1, type 3. Expected minimum values see Table B.1 in annex B.

6 Chemical analysis

The chemical analysis is performed on specimens of the rod/wire electrode respectively or on any suitable all-weld metal specimen (covered electrode and tubular cored electrode). In case of dispute specimens in accordance with EN ISO 6847 shall be used. Any analytical technique can be used, but in case of dispute reference shall be made to established published methods.

NOTE See bibliography.

7 Retests

If the results of any test fail to meet the requirement, that test shall be repeated twice. The results of both retests shall meet the requirement. Specimens for retest may be taken from the original test assembly or from a new test assembly using parent metals of the same type, welding consumables from the same production lot and the same welding procedure as used for the first test assembly. For chemical analysis, retest need be only for those specific elements that failed to meet the test requirement.

If the results of one or both retests fail to meet the requirement, the material under test shall be considered as not meeting the requirements of this specification for that classification.

In the event that, during preparation or after completion of any test, it is clearly determined that prescribed or proper procedures were not followed in preparing the weld test assembly or test specimen(s) or in conducting the test, the test shall be considered invalid, without regard to whether the test was actually completed or whether the test results met, or failed to meet, the requirement. That test shall be repeated, following proper prescribed procedures. In this case, the requirement for doubling the number of test specimens does not apply.

8 Technical delivery conditions

The technical delivery conditions shall meet the requirements in prEN ISO 544. The requirements for the cast rod and for the covered electrode with cast core rod shall be defined separately.

9 Designation

The designation of the consumables shall follow the principle given in the examples below:

EXAMPLE 1 A cast rod for oxy-fuel gas welding (R) with a chemical composition within the limits for the alloy symbol FeC-1 of Table 2 is designated:

Cast rod ISO 1071 – R C FeC-1

EXAMPLE 2 A wire electrode for gas shielded metal arc welding (S) with a chemical composition within the limits for the alloy symbol NiFe-2 of Table 3 is designated:

Wire electrode ISO 1071 – S C NiFe-2

EXAMPLE 3 A tubular cored electrode for gas shielded metal arc welding (T) deposits an all-weld metal with a chemical composition within the limits for the alloy symbol NiFe-1 of Table 3. The electrode was tested under mixed gas (M). The designation will be:

Tubular cored electrode ISO 1071 – T C NiFe-1 M

EXAMPLE 4 A tubular cored electrode for metal arc welding (T) deposits an all-weld metal with a chemical composition within the limits for the alloy symbol FeC-2 of Table 2. The electrode was tested without a shielding gas (N). The designation will be:

Tubular cored electrode ISO 1071 – T C FeC-2 N

EXAMPLE 5 A covered electrode for manual metal arc welding (E) deposits all-weld metal with a chemical composition within the limits for the alloy symbol NiFe-1 of Table 3. The electrode can be used with alternating current or direct current and has an effective electrode efficiency of 120 % (3). The designation will be:

Covered electrode ISO 1071 – E C NiFe-1 3

Annex A
(informative)

Description of the consumable

A.1 General

In the following each consumable for unalloyed cast irons is described and examples for the intended applications of the different alloy types are given.

A.2 Similar weld metal

A.2.1 FeC-1

Consumables of this alloy type are used as cast welding rods and as covered electrodes with cast core rods of grey cast iron with lamellar graphite. The rods for oxy-fuel gas welding may be bare or thin covered with flux. The covering of the electrodes is basic-graphitic. The all-weld metal consists of grey cast iron with lamellar graphite.

Preferred application: welding of grey cast irons.

A.2.2 FeC-2

Consumables of this alloy type are used as basic-graphitic covered electrodes and as self-shielded tubular cored electrodes. The core rod and the tube respectively consist of unalloyed steel. The consumables produce a weld metal of grey cast iron with lamellar graphite.

Preferred application: welding of grey cast irons.

A.2.3 FeC-3

Consumables of this alloy type are used as basic-graphitic covered electrodes and as self-shielded tubular cored electrodes. The core rod consists of the alternative of grey cast iron or of unalloyed steel. The consumables produce a weld metal of grey cast iron with lamellar graphite.

Preferred application: welding of grey cast irons.

A.2.4 FeC-4

Consumables of this type are cast welding rods used for oxy-fuel gas welding of grey cast iron with lamellar graphite. This rod will melt before the cast grey iron and will flow very well. A separate iron oxide flux may be needed to obtain sound weld metal. Properly made welds match the properties of low strength grey iron in the 150 to 250 MPa range including colour of grey cast iron. Such welds are generally machinable unless iron phosphides have formed due to insufficient dilution of the weld rod with enough base metal.

A.2.5 FeC-5

Consumables of this low-alloy type are cast iron welding rods used for oxy-fuel gas welding of medium strength grey cast iron. Properly made welds with these rods develop higher strength than those of the FeC-4 type and are suitable for grey cast iron in the range of 250 to 300 MPa. The deposit generally remains more machinable since iron phosphides do not form even in undiluted weld metal.

A.2.6 FeC-GP1

Consumables of this low-alloy type are cast iron welding rods used for oxy-fuel gas welding of spheroidal graphite cast irons and grey irons. Properly made, most of the graphite in the weld deposit is spheroidal unless the welder's technique has oxidised the Mg and Ce additions from the filler rod. The deposit has improved ductility as compared to deposits made with FeC-4 and FeC-5 type rods and improves even more with post weld heat treatment. Matching strength to nodular iron of 400 MPa tensile strength is possible.

A.2.7 FeC-GF and FeC-GP2

Consumables of this alloy type are used as basic-graphitic covered electrodes and as self-shielded tubular cored electrodes. The core rod and the tube respectively consist of unalloyed steel. The consumables produce a weld metal of cast iron with spheroidal graphite. Depending on thermal conditions and chemical composition the type FeC-GF has a mainly ferritic microstructure and the type FeC-GP2 mainly a pearlitic microstructure.

Preferred application: welding of cast irons with spheroidal graphite and neutral tempered malleable cast irons.

A.3 Dissimilar weld metal

A.3.1 Fe-1

Consumables of this alloy type are used as covered electrodes. They have a special covering and they are suitable for one-layer surfacing on corroded or scaled cast irons, to get a good fusion with the parent metal. This type of electrode is not suited for filler layers because of the risk of hardening.

Basic covered electrodes according to EN 499, wire electrodes according to EN 440 and tubular cored electrodes according to EN 758 can be used for welding of malleable cast iron with a ferritic surface area. Consumables producing a weld metal of low strength should be preferred.

A.3.2 St

Consumables of this alloy type are covered non alloy steel electrodes, the covering of which has a very low melting temperature, as well as solid wires and rods or tubular electrodes. They are primarily used for repair of small pits and cracks in cast iron. The weld deposit, due to carbon pickup from the cast iron, tends to become largely martensite and is machinable only by grinding.

A.3.3 Fe-2

Consumables of this alloy type are used as covered electrodes and as tubular cored electrodes. The core rod and the tube respectively consist of unalloyed steel. The covering and the core respectively contain carbide-producing elements. By welding of cast iron the microstructure of the first layer will be ferritic with much carbide. As carbon combines with the carbide-producing elements too much hardening by formation of martensite is avoided.

Preferred application: surfacing of grey and nodular cast irons and malleable cast irons. Buffer layers on aged cast irons will produce a good fusion to the parent metal.

A.3.4 Ni-Cl

Consumables of this alloy type are used as covered electrodes, wire electrodes, wires and rods. They deposit a high nickel alloy containing some graphite. Single pass weld deposits on cast iron are more ductile and machinable than deposits from nickel-iron electrodes and rods, but are less resistant to hot cracking due to high phosphorus in the cast iron.

A.3.5 Ni-Cl-A

Filler metals of this composition are largely interchangeable with those of the Ni-Cl composition. The Ni-Cl-A composition contains more aluminium, which enhances welding characteristics. However, the additional aluminium also enters solution in the weld metal and tends to reduce ductility.

A.3.6 NiFe-1

Consumables of this alloy type are used as covered electrodes, wire electrodes and tubular cored electrodes. The strength of the all-weld metal is higher than that of the Ni-Cl-type.

Wire electrodes of type NiFe-1 only are suited for single pass welds, for buffer layers and for such multiple pass welds with sufficient dilution with the parent metal.

A.3.7 NiFe-2

Consumables of this alloy type are used as covered electrodes, wire electrodes and tubular cored electrodes.

Preferred application: multiple pass welding of spheroidal graphite cast irons and neutral tempered (black) malleable cast irons.

A.3.8 NiFe-Cl

Consumables of this alloy type are used as covered electrodes. The nickel-iron alloy they deposit is more crack resistant in high phosphorus cast irons than the higher nickel deposits. Single pass weld deposits can be machined with difficulty, but multi-pass welds are readily machinable.

A.3.9 NiFeT3-Cl

Consumables of this alloy type are used as tubular cored electrodes with or without gas shielding. The nickel-iron alloy they deposit is more crack resistant in high phosphorus cast irons than the higher nickel deposits. Single pass weld deposits can be machined with difficulty, but multi-pass welds are readily machinable.

A.3.10 NiFe-Cl-A

The higher aluminium of covered electrodes of this composition makes the deposits more resistant to porosity, at some sacrifice in ductility, as compared to NiFe-Cl compositions.

A.3.11 NiFeMn-Cl

Consumables of this alloy type are used as covered electrodes, wire electrodes, wires and rods. The nickel-iron-manganese weld deposit is ductile and provides higher strength than the nickel-iron deposits. A primary use is for repair and joining of higher strength spheroidal graphite cast irons.

A.3.12 NiCu

Consumables of this alloy type are used as covered electrodes. Wires and rods S Ni 4060 (S NiCu30Mn3Ti) according to prEN ISO 18274 also are suitable.

Preferred application: filler passes of multiple pass welds of great cross-sections of grey cast irons, of spheroidal graphite cast irons and neutral tempered (black) malleable cast irons. Good fusion to the parent metal, when welding aged cast irons.

A.3.13 NiCu-A and NiCu-B

Consumables of these alloy types are used as covered electrodes, solid wires and rods. Properly used, they produce shallow penetration and provide a ductile and machinable deposit.

A.3.14 Z

Filler metals identified by the symbol "Z" do not match any composition given in Table 2 or Table 3 of this standard. Taken together, the symbols "C Z" identify a filler metal of unspecified composition as being intended for welding cast iron, without any indication of filler metal composition. The user of such filler metals should be aware that two filler metals, each identified by the symbols "C Z", may be quite different from one another in composition and/or in welding characteristics.