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Welding consumables — Fluxes for submerged arc welding — Classification

Produits consommables pour le soudage — Flux pour le soudage à l'arc sous flux — Classification

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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 14174 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables*.

Introduction

This International Standard is based on the European Standard EN 760:1996.

Requests for official interpretations of any aspect of this standard should be directed to the Secretariat of ISO/TC 44/SC 3, via your national standards body, a complete listing of which can be found at www.iso.org.

Welding consumables — Fluxes for submerged arc welding — Classification

1 Scope

This International Standard applies to fluxes for the submerged arc welding of non alloy and fine grain steels, high strength steels, creep resisting steels, and stainless and heat resisting steels, nickel and nickel alloys for joining and overlay welding using wire electrodes and strip electrodes.

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.

ISO 3690, *Welding and allied processes — Determination of hydrogen content in ferritic steel arc weld metal*

3 Classification

Fluxes for submerged arc welding are granular, fusible products of mineral origin, which are manufactured by various methods. Fluxes influence the chemical composition and the mechanical properties of the weld metal. The current-carrying capacity of a flux depends on various welding conditions. This property of a flux is not covered by a symbol in this flux classification.

The classification of the fluxes is divided into six parts:

1) the first part gives a symbol indicating the product/process;

2) the second part gives a symbol indicating the method of manufacture (see 4.2);

3) the third part gives a symbol indicating the type of flux, characteristic chemical constituents (see Table 1);

4) the fourth part gives a symbol indicating the applications, flux class (see 4.4);

5) the fifth part gives a symbol indicating the type of current (see 4.5);

6) the sixth part gives a symbol indicating the hydrogen content of all-weld metal (see Table 2).

In order to promote the use of this International Standard, the classification is divided into two sections:

a) Compulsory section

This section includes the symbols for process, method of manufacture, characteristic chemical constituents (type of flux) and applications, i.e., the symbols defined in 4.1, 4.2, 4.3 and 4.4.

b) Optional section

This section includes the symbols for the type of current and diffusible hydrogen, i.e., the symbols defined in 4.5 and 4.6.

4 Symbols

4.1 Symbol for the product/process

The symbol for the flux used in submerged arc welding processes shall be the letter S.

4.2 Symbol for method of manufacture

The symbol below indicates the method of manufacture:

— F fused flux;

— A agglomerated flux;

— M mixed flux.

Fused fluxes are made by melting and granulating. Agglomerated fluxes are bound, granular mixtures of ground raw materials. Mixed fluxes comprise all fluxes which are mixed from two or more types of flux by the manufacturer.

For particle size requirements in marking, see Clause 5.

4.3 Symbol for type of flux, characteristic chemical constituents

The symbols in Table 1 indicate the type of flux in accordance with the characteristic chemical constituents.

Table 1 — Symbol for type of flux, characteristic chemical constituents [a, b, c]

Symbol	Characteristic chemical constituents	Limit of constituent %
MS Manganese-silicate	$MnO + SiO_2$ CaO	min. 50 max. 15
CS Calcium-silicate	$CaO + MgO + SiO_2$ $CaO + MgO$	min. 55 min. 15
CG [d] Calcium-magnesium	$CaO + MgO$ CO_2 Fe	max. 50 min. 2 max. 10
CB [d] Calcium-magnesium-basic	$CaO + MgO$ CO_2 Fe	40 to 80 min. 2 max. 10
CI [d] Calcium-magnesium-iron	$CaO + MgO$ CO_2 Fe	max. 50 min. 2 15 - 60
IB [d] Calcium-magnesium-iron-basic	$CaO + MgO$ CO_2 Fe	40 to 80 min. 2 15 - 60
ZS Zirconium-silicate	$ZrO_2 + SiO_2 + MnO$ ZrO_2	min. 45 min. 15
RS Rutile-silicate	$TiO_2 + SiO_2$ TiO_2	min. 50 min. 20
AR Aluminate-rutile	$Al_2O_3 + TiO_2$	min. 40
AB Aluminate-basic	$Al_2O_3 + CaO + MgO$ Al_2O_3 CaF_2	min. 40 min. 20 max. 22
AS Aluminate-silicate	$Al_2O_3 + SiO_2 + ZrO_2$ $CaF_2 + MgO$ ZrO_2	min. 40 min. 30 min. 5
AF Aluminate-fluoride-basic	$Al_2O_3 + CaF_2$	min. 70
FB Fluoride-basic	$CaO + MgO + CaF_2 + MnO$ SiO_2 CaF_2	min. 50 max. 20 min. 15
Z	Any other composition	

[a] A description of the characteristics of each of the types of flux is given in Annex A.

[b] Carbonates such as $CaCO_3$, $MgCO_3$ in agglomerated flux are converted to CaO, MgO and the constituent shall be the ratio of the remaining amount exclusive of CO_2 content in the flux (see Clause 8).

[c] E.g., all of metallic Si and Si-compound is converted to SiO_2, and all of metallic Mn and Mn-compound is converted to MnO to determine the numerical value (see Clause 8).

[d] The amount of constituent in the agglomerated flux shall be the ratio of remaining amount exclusive of Fe content in the flux (see Clause 8).

4.4 Symbol for applications, flux class

4.4.1 Flux class 1

These are fluxes for submerged arc welding of non alloy and fine grain steels, high strength steels and creep resisting steels. In general, the fluxes do not contain alloying elements, other than Mn and Si, thus the weld metal analysis is predominantly influenced by the composition of the wire electrode and metallurgical reactions. The fluxes are suitable for both joint welding and surfacing. In the case of joint welding, most of them can be applied for both multi-run and single-run and/or two-run technique.

In the flux designation, the digit 1 indicates class 1.

4.4.2 Flux class 2

These are fluxes for joint and overlay welding of stainless and heat-resisting steels and/or nickel and nickel-based alloys, and unalloyed fluxes for hard facing [1)].

In the flux designation, the digit 2 indicates class 2.

4.4.3 Flux class 3

These are fluxes mainly for overlay welding purposes yielding a wear-resisting weld metal by transfer of alloying elements from the flux, such as C, Cr or Mo.

In the flux designation, the digit 3 indicates class 3.

4.4.4 Flux class 4

These are fluxes applicable both to flux classed 1 and classed 2[1)].

In the flux designation, the digit 4 indicates class 4.

4.5 Symbol for type of current

The symbol below indicates the type of current (a.c. or d.c.) for which the flux is suitable:

— d.c. is the symbol for direct current;

— a.c. is the symbol for alternating current.

Suitability for use on a.c. generally also implies suitability for d.c.

4.6 Symbol for hydrogen content in deposited metal

The symbols in Table 2 indicate the hydrogen content determined in deposited metal in accordance with the method described in ISO 3690.

Other methods of collection and measurement of the diffusible hydrogen can be used for testing provided they possess equal reproducibility with, and are calibrated against, the method described in ISO 3690.

In case of dispute, the method described in ISO 3690 shall be used.

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1) Not all fluxes suitable for use with stainless steel filler metal are also suitable for nickel and nickel-based alloy filler metal.

Table 2 — Symbol for hydrogen content in deposited metal

Symbol	Hydrogen content ml/100 g deposited metal max.
H5	5
H10	10
H15	15

When the letter H is included in the classification, the manufacturer shall state in his literature whether the maximum hydrogen level achieved is 15 ml, 10 ml or 5 ml per 100 g of deposited metal, and what restrictions need to be placed on the conditions of storage and on current, arc voltage, electrode extension and polarity to remain within this limit.

If a low hydrogen weld metal is necessary in view of the parent materials to be welded, the flux manufacturer should be consulted for details of the redrying conditions specific to the flux.

A usual redrying condition for fused flux can be 2 h at (250 ± 50) °C or 2 h at (350 ± 50) °C for an agglomerated flux.

4.7 Metallurgical behaviour

The metallurgical behaviour of the flux shall be indicated in the manufacturer's literature or data sheets.

The metallurgical behaviour of a flux is characterized by the pick-up and/or burn-out of alloying elements. Pick-up or burn-out is the difference between the chemical composition of the all-weld metal deposit and the composition of the original electrode. It is described in general terms in the notes on flux types in Annex A.

5 Particle size range

The particle category is not a part of the flux designation but shall be used for information in the marking of packaging units.

The particle size range shall be measured by a suitable technique. The size range to be stated on the packaging shall be the range of particle diameters that includes 70 % of the flux. Particle sizes shall be expressed to the nearest 0,1 mm, e.g. a particle size range of 0,2 mm to 1,6 mm.

6 Technical delivery conditions

The flux shall be granular and so constituted that it can be conveyed freely by the flux feed system. The particle size distribution shall be uniform and consistent in the different packaging units. The fluxes are obtainable in different granulations.

The fluxes shall be supplied packaged. Subject to proper transportation and storage, the packaging shall be sufficiently robust to provide the contents with a high standard of protection against damage.

7 Marking

The packaging shall be clearly marked with the following details:

a) trade name;