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Welding consumables — Wire electrodes and weld deposits for gas shielded metal arc welding of non alloy and fine grain steels — Classification

Produits consommables pour le soudage — Fils-électrodes et métaux d'apport déposés en soudage à l'arc sous protection gazeuse des aciers non alliés et à grains fins — 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 14341 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables*.

This second edition cancels and replaces the first edition (ISO 14341:2002).

Requests for official interpretation of any aspect of this International Standard should be directed to the Secretariat of ISO/TC 44/SC 3 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

Introduction

This International Standard recognizes that there are two somewhat different approaches in the global market to classifying a given wire electrode, and allows for either or both to be used, to suit a particular market need. Application of either type of classification designation (or both where suitable) identifies a product as classified in accordance with this International Standard.

This International Standard provides a classification in order to designate wire electrodes in terms of their chemical composition and, where required, in terms of the yield strength, tensile strength and elongation of the all-weld metal. The ratio of yield strength to tensile strength of weld metal is generally higher than that of parent metal. Users should note that matching weld metal yield strength to parent metal yield strength does not necessarily ensure that the weld metal tensile strength matches that of the parent material. Therefore, where the application requires matching tensile strength, selection of the consumable should be made by reference to column 3 of Table 1A or 1B.

It should be noted that the mechanical properties of all-weld metal test specimens used to classify the electrodes vary from those obtained in production joints because of differences in welding procedures such as electrode size, width of weave, welding position and material composition.

Welding consumables — Wire electrodes and weld deposits for gas shielded metal arc welding of non alloy and fine grain steels — Classification

1 Scope

This International Standard specifies requirements for classification of wire electrodes and weld deposits in the as-welded condition and in the post-weld heat-treated condition for gas shielded metal arc welding of non alloy and fine grain steels with a minimum yield strength of up to 500 MPa or a minimum tensile strength of up to 570 MPa. One wire electrode can be tested and classified with different shielding gases.

This International Standard constitutes a combined specification providing classification utilizing a system based upon the yield strength and the average impact energy of 47 J of all-weld metal, or utilizing a system based upon the tensile strength and the average impact energy of 27 J of all-weld metal.

a) Clauses and tables which carry the suffix letter “A” are applicable only to wire electrodes classified to the system based upon the yield strength and the average impact energy of 47 J of all-weld metal in accordance with this International Standard.

b) Clauses and tables which carry the suffix letter “B” are applicable only to wire electrodes classified to the system based upon the tensile strength and the average impact energy of 27 J of all-weld metal in accordance with this International Standard.

c) Clauses and tables which have neither the suffix letter “A” nor the suffix letter “B” are applicable to all wire electrodes classified in accordance with this International Standard.

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 544, *Welding consumables — Technical delivery conditions for filler materials and fluxes — Type of product, dimensions, tolerances and markings*

ISO 13916, *Welding — Guidance on the measurement of preheating temperature, interpass temperature and preheat maintenance temperature*

ISO 14175:2008, *Welding consumables — Gases and gas mixtures for fusion welding and allied processes*

ISO 14344, *Welding consumables — Procurement of filler materials and fluxes*

ISO 15792-1:2000, *Welding consumables — Test methods — Part 1: Test methods for all-weld metal test specimens in steel, nickel and nickel alloys*

ISO 80000-1:2009, *Quantities and units — Part 1: General*

3 Classification

Classification designations are based upon two approaches to indicate the tensile properties and the impact properties of the all-weld metal obtained with a given electrode. The two designation approaches include additional designators for some other classification requirements, but not all, as will be clear from the following subclauses. In most cases, a given commercial product can be classified in both systems. Then either or both classification designations can be used for the product.

A wire electrode shall be classified according to its chemical composition as in Table 3A or Table 3B. A weld deposit shall be classified with additional symbols according to the mechanical properties of its all-weld metal, using a shielding gas from a specific group.

3A Classification by yield strength and 47 J impact energy

The classification is divided into five parts:

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

2) the second part gives a symbol indicating the strength and elongation of the all-weld metal (see Table 1A);

3) the third part gives a symbol indicating the impact properties of the all-weld metal (see Table 2);

4) the fourth part gives a symbol indicating the shielding gas used (see 4.4);

5) the fifth part gives a symbol indicating the chemical composition of the wire electrode used (see Table 3A).

3B Classification by tensile strength and 27 J impact energy

The classification is divided into five parts:

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

2) the second part gives a symbol indicating the strength and elongation of the all-weld metal in either the as-welded or post-weld heat-treated condition (see Table 1B);

3) the third part gives a symbol indicating the impact properties of the all-weld metal in the same condition as specified for the tensile strength (see Table 2). The letter U after this symbol indicates that the deposit meets an average optional requirement of 47 J at the designated Charpy test temperature;

4) the fourth part gives a symbol indicating the shielding gas used (see 4.4);

5) the fifth part gives a symbol indicating the chemical composition of the wire electrode used (see Table 3B).

4 Symbols and requirements

4.1 Symbol for product/process

The symbol for a weld deposit produced by gas shielded metal arc welding shall be the letter G placed at the beginning of the designation.

The symbol for a wire electrode for use in gas shielded metal arc welding shall be the letter G placed at the beginning of the wire electrode designation.

4.2 Symbol for strength and elongation of all-weld metal

4.2A Classification by yield strength and 47 J impact energy

The symbols in Table 1A indicate the yield strength, tensile strength, and elongation of the all-weld metal in the as-welded condition determined in accordance with Clause 5.

Table 1A — Symbols for strength and elongation of all-weld metal

Symbol	Minimum yield strength [a] MPa	Tensile strength MPa	Minimum elongation [b] %
35	355	440 to 570	22
38	380	470 to 600	20
42	420	500 to 640	20
46	460	530 to 680	20
50	500	560 to 720	18

[a] For yield strength, the lower yield strength (R_{eL}) is used when yielding occurs, otherwise the 0,2 % proof strength ($R_{p0,2}$) is used.

[b] Gauge length is equal to five times the test specimen diameter.

4.2B Classification by tensile strength and 27 J impact energy

The symbols in Table 1B indicate the yield strength, tensile strength, and elongation of the all-weld metal in the as-welded condition or in the post-weld heat-treated condition determined in accordance with Clause 5.

Table 1B — Symbols for strength and elongation of all-weld metal

Symbol [a]	Minimum yield strength [b] MPa	Tensile strength MPa	Minimum elongation [c] %
43X	330	430 to 600	20
49X	390	490 to 670	18
55X	460	550 to 740	17
57X	490	570 to 770	17

[a] X is A or P, where A indicates testing in the as-welded condition and P indicates testing in the post-weld heat-treated condition.

[b] For yield strength, the lower yield strength (R_{eL}) is used when yielding occurs, otherwise the 0,2 % proof strength ($R_{p0,2}$) is used.

[c] Gauge length is equal to five times the test specimen diameter.

4.3 Symbol for impact properties of all-weld metal

4.3A Classification by yield strength and 47 J impact energy

The symbols in Table 2 indicate the temperature at which an impact energy of 47 J is achieved under the conditions given in Clause 5.

Three test specimens shall be tested. Only one individual value may be lower than 47 J but not lower than 32 J.

4.3B Classification by tensile strength and 27 J impact energy

The symbols in Table 2 indicate the temperature at which an impact energy of 27 J is achieved under the conditions given in Clause 5.

Five test specimens shall be tested. The lowest and highest values obtained shall be disregarded. Two of the three remaining values shall be greater than the specified 27 J level, one of the three may be lower but shall not be less than 20 J. The average of the three remaining values shall be at least 27 J.

The addition of the optional symbol U, immediately after the symbol for condition of heat treatment, indicates that the supplemental requirement of 47 J impact energy at the normal 27 J impact test temperature has also been satisfied. For the 47 J impact requirement, the number of specimens tested and values obtained shall meet the requirement of 4.3A.

When an all-weld metal has been classified for a certain temperature, it automatically covers any higher temperature listed in Table 2.

Table 2 — Symbol for impact properties of all-weld metal

Symbol	Temperature for minimum average impact energy of 47 J [ab] or 27 J [b] °C
Z	No requirement
A [a] or Y [b]	+ 20
0	0
2	– 20
3	– 30
4	– 40
5	– 50
6	– 60
7	– 70
8	– 80
9	– 90
10	– 100

[a] See 4.3A.

[b] See 4.3B.

4.4 Symbol for shielding gas

The symbols for shielding gases shall be in accordance with ISO 14175:2008, for example:

— The symbol M12, for mixed gases, shall be used when the classification has been performed with shielding gas ISO 14175-M12, but without helium;

— The symbol M13 shall be used when the classification has been performed with shielding gas ISO 14175-M13;

— The symbol M20, for mixed gases, shall be used when the classification has been performed with shielding gas ISO 14175-M20, but without helium;

— The symbol M21, for mixed gases, shall be used when the classification has been performed with shielding gas ISO 14175-M21, but without helium;

— The symbol C1 shall be used when the classification has been performed with shielding gas ISO 14175-C1, carbon dioxide;

— The symbol Z is used for an unspecified shielding gas.

4.5 Symbol for chemical composition of wire electrodes

The symbol in Table 3A or Table 3B indicates the chemical composition of the wire electrode and includes an indication of characteristic alloying elements.

Table 3A — Symbol for chemical composition
(Classification by yield strength and 47 J impact energy)

Symbol	Chemical composition, % (by mass) [a]											
	C	Si	Mn	P	S	Ni	Cr	Mo	V	Cu	Al	Ti + Zr
2Si	0,06 to 0,14	0,50 to 0,80	0,90 to 1,30	0,025	0,025	0,15	0,15	0,15	0,03	0,35	0,02	0,15
3Si1	0,06 to 0,14	0,70 to 1,00	1,30 to 1,60	0,025	0,025	0,15	0,15	0,15	0,03	0,35	0,02	0,15
3Si2	0,06 to 0,14	1,00 to 1,30	1,30 to 1,60	0,025	0,025	0,15	0,15	0,15	0,03	0,35	0,02	0,15
4Si1	0,06 to 0,14	0,80 to 1,20	1,60 to 1,90	0,025	0,025	0,15	0,15	0,15	0,03	0,35	0,02	0,15
2Ti	0,04 to 0,14	0,40 to 0,80	0,90 to 1,40	0,025	0,025	0,15	0,15	0,15	0,03	0,35	0,05 to 0,20	0,05 to 0,25
2Al	0,08 to 0,14	0,30 to 0,50	0,90 to 1,30	0,025	0,025	0,15	0,15	0,15	0,03	0,35	0,35 to 0,75	0,15
3Ni1	0,06 to 0,14	0,50 to 0,90	1,00 to 1,60	0,020	0,020	0,80 to 1,50	0,15	0,15	0,03	0,35	0,02	0,15
2Ni2	0,06 to 0,14	0,40 to 0,80	0,80 to 1,40	0,020	0,020	2,10 to 2,70	0,15	0,15	0,03	0,35	0,02	0,15
2Mo	0,08 to 0,12	0,30 to 0,70	0,90 to 1,30	0,020	0,020	0,15	0,15	0,40 to 0,60	0,03	0,35	0,02	0,15
4Mo	0,06 to 0,14	0,50 to 0,80	1,70 to 2,10	0,025	0,025	0,15	0,15	0,40 to 0,60	0,03	0,35	0,02	0,15
Z [b]	Any other agreed composition											

[a] Single values shown in the table are maximum values.

[b] Consumables for which the chemical composition is not listed in this table shall be symbolized similarly and prefixed by the letter Z. The chemical composition ranges are not specified and therefore two electrodes with the same Z classification may not be interchangeable.