# CODE DESIGNATIONS OF LOCALLY MANUFACTURED FLUXES AND FLUX + WIRE COMBINATIONS IN KEEPING WITH INTERNATIONAL STANDARDS

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The paper deals with the features of application of International Standards ISO 14171:2002 and ISO 14174:2004 for classification of welding fluxes. Code designations of local fluxes in keeping with the above standards are given, as well as identification of codes included into the designations, and recommendations on application of code designations of welding fluxes.

***Keywords:*** *arc welding, welding fluxes, International Standards ISO 14171:2002 and ISO 14174:2004, classification, code designations.*

Submerged-arc welding is the main technological process in manufacture of the most metal structures (pipes, bridges, oil and gas pipelines, ships, various structures). It is notable for a high level of mechanization and productivity, quality of welded joints, and is actually the only method for joining of elements of metal structures in welding of metal with a thickness of more than 12–15 mm.

The main factor for increasing competitiveness of welded metal structures is their high quality at a low cost. The cost of flux itself has a low influence on the cost of a metal structure. Despite this fact, the high quality of a metal structure and expenses for achieving it significantly depend on the welding flux i.e. its ability to provide the defect-free formation of the weld metal, pore and crack resistance of the latter, providing of high brittle fracture resistance of the weld, reduction of costs for repair of joints etc.

AN-60, AN60M, AN-348-A, AN-348-AM, AN-348-APM, AN-47, AN-47DP, OSTs-45, OSTs-45M, AN-43, AN-67B grades of fused fluxes used for welding of carbon unalloyed and low-alloyed steels, AN-8 flux for electroslag welding, and AN-20S, AN-20P, AN-26S, AN-26P fluxes for welding of stainless steels are widely applied in the CIS countries. Fluxes of the above grades are mainly produced by the two, most renown in Europe, Ukrainian manufacturers — OJSCs «Zaporozhie Plant of Welding Fluxes and Glass Products» and «Nikopol Ferroalloys Plant» (according to GOST 9087–81E [1], TU U 05416923.049–99 [2] and GOST R 52222 [3]). Joining of Ukraine to the World Trade Organization requires bringing of national standards and other regulatory technical documents in correspondence with international standards.

**Harmonization of national standards.** In this connection, there are two problems with the domestic welding fluxes. The first one is the absence of full information about consumer properties of fluxes in the national standards. Such information in accordance with International Standards ISO 14171:2002 and 14174:2004 should be included in codes giving the designations of fluxes. Code designations are indicated in labels, packages, in technical documents, in handbills and booklets etc. Designations for the new flux grades are to be given by their developers, and for the existing ones (according to GOST 9087–81E) — by a special organization having appropriate technical capabilities and specialists to conduct necessary tests and codifications.

The second problem lies in that even though fluxes meet the main technical requirements to the technology for manufacture of welded metal structures (strength of weld metals, their defect-free formation etc.), the national standards do not contain indicators of consumer properties of the fluxes (strength characteristics of welds, their brittle fracture resistance etc.). It is caused by the fact that, conceptually, the main standard, according to which domestic fluxes are manufactured, i.e. GOST 9087–81E [1] (as well as different specifications), is aimed at determination of requirements to the technology of manufacture of a flux, rather than to its consumer properties. For example, precise chemical composition of the flux, color of its grains, method for evaluation of the moisture content of the flux and other factors do not allow common flux customers (in particular, representatives of trade organizations, who in the most cases are not specialists in the field of development and application of fluxes) to effectively evaluate the possibility of using a certain grade of flux to solve their technological problems, as these indicators bear no information on mechanical properties of the weld metal or welded joint (yield strength and tensile strength, impact

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toughness etc.), while these indicators are the main criteria of for selection of flux. Hence, we will compare the main standards on welding fluxes in force in the international market.

In accordance with the said standards, a manufacturer, putting a tag (label) on a product, evidences that the latter meets requirements of a corresponding standard specifying properties of the given product. Complete information on these properties, as a rule, is contained in the accompanying documents. At the same time, the information (or its main part), which is indicated on the labels or in short advertisements, should be concise and clear for a consumer. Therefore, it is formed in accordance with special standards.

The following main international standards are used for welding fluxes:

ISO 14171:2002. Welding consumables — Wire electrodes and wire-flux combinations for submerged arc welding of non alloy and fine grain steels — Classification;

ISO 14174:2004. Welding consumables — Fluxes for submerged arc welding — Classification;

ISO 544:2003. Welding consumables — Technical delivery conditions for welding filler metals — Type of product, dimensions, tolerances and marking;

ISO 14344:2002. Welding and allied processes — Flux and gas shielded electrical welding processes — Procurement guidelines for consumables;

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

ISO 15792-2:2000. Welding consumables — Test methods. Pt 2: Preparation of single-run and two-run technique test specimens in steel;

ISO 3690:2000. Welding and allied processes — Determination of hydrogen content in ferritic steel arc weld metal.

It should be noted that harmonized international standards do not automatically cancel regional, intergovernmental and national standards, including GOST 9087–81E. For example, in addition to international standards, European standards EN 760 and EN 756 are in effect in the European market of welding fluxes, and German standards DIN 32522 and DIN 8557 are in effect in the German market. Main principles of the international standards are implemented in national production through development of similar national standards on their basis.

American standards [4, 5] are widely applied by flux manufacturers, in addition to the above international standards. They are differ from the international standards (including ISO 14171:2002 and ISO 14174:2004) in that they do not contain information on physical-chemical properties of fluxes, and have differences in welding technologies during testing. However, like in ISO 14171:2002, the results of tests of the flux + wire combinations are applied for the classification purposes. According to the American system of classification, fluxes have no designation except for a trade mark. All the flux grades have a mandatory designation of the flux + wire combinations, which, like in ISO 14171:2002, contains the main data on consumer properties of a flux in the coded form: for welding of which materials the flux is designed, what level of mechanical properties of the weld metal this flux in combination with specific welding wires provides under standard conditions, etc. These characteristics are basic in evaluation of fitness of fluxes for purpose in accordance with the international standards. This approach provides the customer with a possibility to compare technical characteristics and select an optimal welding variant using code designations of fluxes. From this point of view, domestic marking of fluxes, for example AN-60 grade, gives no information to a customer who knows nothing about this flux. It only indicates that this flux was developed by the Academy of Sciences of Ukraine (AN) and gives the development number (60). At the same time, even a short designation of this flux according to ISO 14174:2004 (SF 1 MS) indicates that this product is a welding (S) fused (F) flux for welding of carbon and low-alloyed steels (1), and is of the manganese-silicate type (MS).

Given the above-said, to determine codes and give corresponding designations to fluxes, we carried out tests of welding-technological properties of domestic fluxes of the most common grades in accordance with the requirements of ISO 14174:2004 and ISO 14171:2002.

Welding and tests of mechanical properties of the welded joints were carried out in certified laboratories of the E.O. Paton Electric Welding Institute and branch RPE «Conversion Technologies» of the Ukrainian Research Institute of Shipbuilding Technology.

Only the most widely used welding wires of the Sv-08A, Sv-08GA (GOST 2246–70) and Sv-08G1NMA (TU U 14-16-130–97) grades of the domestic production, and 4.0 mm diameter wires of the S1 and S2 grades from the known European manufacturers, i.e. «Multimet» (Poland), 5.0 mm diameter wire S2 from the «Boehler» (Austria), and 5.0 mm diameter wire S1 from the OERLIKON (Germany) were utilized in study. Welding and testing of joints were carried out in accordance with the requirements of standards ISO 14171:2002, ISO 15792-1:2000 and ISO 15792-2:2000.

The codes of properties were determined, and code designations were given to tested combinations based on the investigations results for combinations of fluxes and welding wires in accordance with the requirements of standard ISO 14171:2002 (Table 1).

Code designations of domestic welding fluxes in accordance with the requirements of International Standard ISO 14174:2004 are given in Table 2. These fluxes manufactured in accordance with GOST 9087-

**Table 1.** Code designations of combinations of domestic welding fluxes with wires of local and import production in accordance with requirements of International Standard ISO 14171:2002

| Flux + wire combination | Designations acc. to ISO 14171:2002 |
|---|---|
| **Yield strength of base metal and 47 J impact energy of welded joint metal (TWO-run technique, section A)** | |
| AN-60 + S1 | ISO 14171-A-S 3T 0 MS S1 |
| AN-348-A + S1 | ISO 14171-A-S 5T 2 MS S1 |
| OSTs-45M + S1 | ISO 14171-A-S 5T 2 MS S1 |
| AN-47 + S2 | ISO 14171-A-S 5T 2 CS S2 |
| AN-47DP + S2 | ISO 14171-A-S 5T 2 CS S2 |
| AN-43 + S2 | ISO 14171-A-S 3T 4 AR S2 |
| AN-67B + S2 | ISO 14171-A-S 3T 4 AR S2 |
| **Tensile strength and 27 and 47 J impact energy of welded joint metal (TWO-run technique, section B)** | |
| AN-60 + Sv-08A | ISO 14171-B-S49S 2 MS SU11 |
| AN-60 + SV-08A | ISO 14171-B-S49S 0U MS SU11 |
| AN-348-A + SV-08A | ISO 14171-B-S49S 2 MS SU11 |
| AN-348-A + Sv-08A | ISO 14171-B-S43S 0U MS SU11 |
| OSTs-45M + Sv-08A | ISO 14171-B-S49S 2 MS SU11 |
| OSTs-45M + Sv-08A | ISO 14171-B-S43S 0U MS SU11 |
| AN-43 + Sv-08GA | ISO 14171-B-S57S 5 AR SU11 |
| AN-43 + Sv-08GA | ISO 14171-B-S57S 4U AR SU11 |
| AN-47 + Sv-08GA | ISO 14171-B-S57S 5 CS SU11 |
| An-47 + Sv-08GA | ISO 14171-B-S57S 3U CS SU11 |
| AN-67B + Sv-08G1NMA | ISO 14171-B-S57S 7 AR SUN2M3 |
| AN-67B + Sv-08G1NMA | ISO 14171-B-S57S 6U AR SUN2M3 |
| **Yield strength of pure (deposited) weld metal and 47 J impact energy (Multi-run technique, section A)** | |
| AN-60 + S1 | ISO 14171-A-S35 2 MS S1 |
| AN-60 + S2 | ISO 14171-A-S42 0 MS S2 |
| AN-348-A + S1 | ISO 14171-A-S38 0 MS S1 |
| AN-348-AM + S1 | ISO 14171-A-S38 0 MS S1 |
| OSTs-45M + S1 | ISO 14171-A-S35 0 MS S1 |
| AN-47 + S2 | ISO 14171-A-S42 2 CS S2 |
| AN-47DP + S2 | ISO 14171-A-S50 2 CS S2 |
| AN-47DP + S3Ni1Mo | ISO 14171-A-S50 2 CS S3Ni1Mo |
| **Tensile strength of pure (deposited) weld metal and 27 and 47 J impact energy (Multi-run technique, section B)** | |
| AN-60 + Sv-08A | ISO 14171-B-S49A 2 MS SU11<br>ISO 14171-B-S49A 0U MS SU11<br>ISO 14171-B-S49S 2 MS SU11<br>ISO 14171-B-S49S 0U MS SU11 |
| AN-348-A + Sv-08A | ISO 14171-B-S49A 2 MS SU11<br>ISO 14171-B-S49A 0U MS SU11<br>ISO 14171-B-S49S 2 MS SU11<br>ISO 14171-B-S49S 0U MS SU11 |
| OSTs-45M + Sv-08A | ISO 14171-B-S49A 2 MS SU11<br>ISO 14171-B-S49A 0U MS SU11<br>ISO 14171-B-S49S 2 MS SU11<br>ISO 14171-B-S49S 0U MS SU11 |

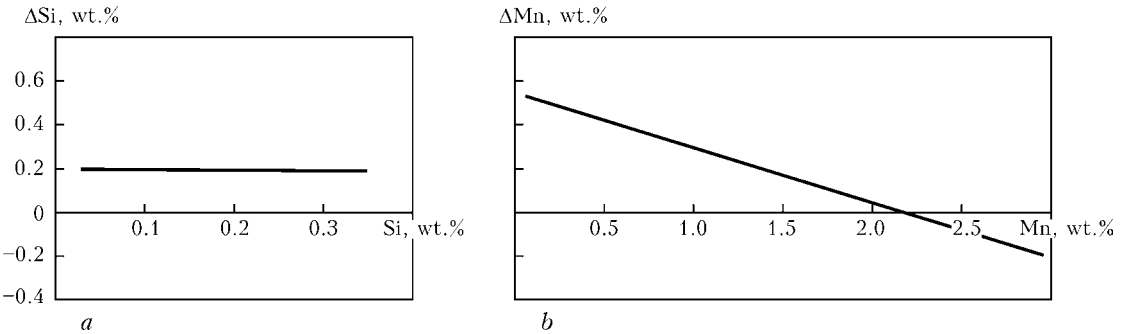
**Table 2.** Code designations of domestic welding fluxes in accordance with requirements of International Standards ISO 14174:2004 and DSTU ISO 14174:2009

| Flux grade | Full designation | Concise designation |
|---|---|---|
| AN-60<br>AN-60M | Welding flux ISO 14174-S F MS 1 AC H10<br>Welding Flux DSTU ISO 14174 S F MS 1 AC H10 | Welding flux ISO 14174-S F MS 1<br>Welding flux DSTU ISO 14174-S F MS 1 |
| AN-348-A<br>AN-348-AM<br>AN-348AP<br>AN-348APM | Welding flux ISO 14174-S F MS 1 AC H10<br>Welding flux DSTU ISO 14174-S F MS 1 AC H10 | Welding flux ISO 14174-S F MS 1<br>Welding flux DSTU ISO 14174-S F MS 1 |
| AN-47<br>AN-47DP | Welding flux ISO 14174-S F CS 1 AC H10<br>Welding flux DSTU ISO 14174-S F CS 1 AC H10 | Welding flux ISO 14174-S F CS 1<br>Welding flux DSTU ISO 14174-S F CS 1 |
| OSTs-45M<br>OSTs-45 | Welding flux ISO 14174-S F MS 1 AC H10<br>Welding flux DSTU ISO 14174-S MS 1 AC H0 | Welding flux ISO 14174-S F MS 1<br>Welding flux DSTU ISO 14174-S F MS 1 |
| AN-43 | Welding flux ISO 14174-S F AB 1 AD H5<br>Welding flux DSTU ISO 14174-S F MS 1 AB 1 AD H5 | Welding flux ISO 14174-S F AB 1<br>Welding flux DSTU ISO 14174-S F MS 1 |
| AN-67B | Welding flux ISO 14174-S F AR 1 AC H5<br>Welding flux DSTU ISO 14174-S F MS 1 AR 1 AC H5 | Welding flux ISO 14174-S F AR 1<br>Welding flux DSTU ISO 14174-S F MS 1 |
| AN-8 | Welding flux ISO 14174-S F MS 1 AC H10<br>Welding flux DSTU ISO 14174-S F MS 1 AC H10 | Welding flux ISO 14174-S F MS 1<br>Welding flux DSTU ISO 14174-S F MS 1 |
| AN-20S<br>AN-20P | Welding flux ISO 14174-S F AB 2 AD H10<br>Welding flux DSTU ISO 14174-S F AB 2 AD H10 | Welding flux ISO 14174-S F AB 2<br>Welding flux DSTU ISO 14174-S F AB 2 |
| AN-26S<br>AN-26P | Welding flux ISO 14174-S F AB 2 AC H5<br>Welding flux DSTU ISO 14174-S F AB 2 AC H5 | Welding flux ISO 14174-S F AB 2<br>Welding flux DSTU ISO 14174-S F AB 2 |

81:2004, TU U 05416923-049–99 and GOST R 52222 were designated on the basis of the results of tests carried out according to the requirements of International Standard ISO 14174:2004. The information, which is contained in technical documents for manufacture of fluxes (GOST 9087–81E, TU U 05416923.049–99 and GOST R 52222 etc.) and relates to application, methods of manufacture and chemical composition of the fluxes, as well as the results of special tests conducted to determine applicability of the fluxes to AC and/or DC welding, data on the content of diffusible hydrogen, metallurgical characteristic and current load was used to make a decision. Designations of the above fluxes according to draft DSTU ISO 14174:2009, introduction of which in Ukraine as a national standard is planned for 2010, are also given.

**Some peculiarities of application of international standards.** Analysis of international standards relating to fluxes shows that they contain no data, which are included in intergovernmental and national standards acting in Ukraine, as well as in specifications. In fact, the latter regulate the technology for manufacture of fluxes — their chemical composition, color etc. These data are classified information (know-how) of foreign manufacturers. Therefore, from a point of view of a foreign consumer, GOST 9087–81E and different Ukrainian specifications are internal normative documents of enterprises, from which no information can be obtained, for example, on a level of strength of a welded joint provided by this flux in combination with welding wires of these or other grades, as well as on that under which conditions this flux should be used.

As noted above, implementation of international standards does not cancel any currently acting national norms. However, it imposes some requirements to the product delivery conditions. These requirements are specified in ISO 14344:2002, which sets a list and scope of mandatory tests for welding consumables. The latter are determined by the customer when concluding a delivery contract. The results of these tests are by all means included into the quality certificate or an accompanying document that replaces it.




Dependence of increment (burnout) of silicon (*a*) and manganese (*b*) in weld metal on their content in welding wire [6]

**Table 3.** Designations of metallurgical characteristics of domestic fluxes

| Flux grade | ISO 14174:2004 | EN 760:1996 |
|---|---|---|
| AN-60 | ISO 14174-S F MS 1 AC H10 | F MS 1 68 AC 14 SM HP10 3-40 |
| AN-60M | ISO 14174-S F MS 1 AC H10 | F MS 1 68 AC 14 SM HP10 2-16 |
| AN-348-A | ISO 14174-S F MS 1 AC H10 | F MS 1 78 AC 12 HP10 2-28 |
| AN-348-AM | ISO 14174-S F MS 1 AC H10 | F MS 1 78 AC 12 HP10 2-16 |
| AN-47 | ISO 14174-S F CS 1 AC H10 | F CS 1 66 AC 12 HP10 3-25 |
| OSTs-45 | ISO 14174-S F MS 1 AC H10 | F MS 1 78 AC 14 HP10 2-25 |
| OSTs-45M | ISO 14174-S F MS 1 AC H10 | F MS 1 78 AC 14 HP10 2-16 |
| AN-43 | ISO 14174-S F AB 1 AD H5 | F AB 1 54 AD 8 HP5 2-25 |
| AN-67B | ISO 14174-S F AR 1 AC H5 | F AR 1 54 AC 14 HP5 2-25 |
| AN-8 | ISO 14174-S F MS 1 AC H10 | F MS 1 78 AC 12 HP10 2-28 |
| AN-20S | ISO 14174-S F AB 2 AD H10 | F AB 2 65AD 9 HP10 2-28 |
| AN-20P | ISO 14174-S F AB 2 AD H10 | F AB 2 65AD 9 HP10 3-40 |
| AN-26S | ISO 14174-S F AB 2 AC H5 | F AB 2 65 AC 10 HP5 2-25 |
| AN-26P | ISO 14174-S F AB 2 AC H5 | F AB 2 65 AC 10 HP5 2-28 |

Therefore, after Ukraine joined WTO, the situation is as follows. If the customer requires to deliver flux AN-60 according to GOST 9087–81E, the supplier should manufacture and deliver the flux in compliance with this regulatory document, but if it is necessary to deliver this flux according to ISO 14344:2002, the supplier manufactures it in compliance with GOST 9087–81E, since it is this standard that determines the technology for manufacture of the given flux, carries out welding tests (if the customer requests this) in accordance with the requirements of ISO 14171:2002, ISO 15792-1:2000 and ISO 15792-2:2000, and draws up documents (quality certificate etc.) in compliance with ISO 14344:2002. It should be noted that this standard contains only guidelines for delivery of welding consumables, while GOST 9087-81:2002 contains requirements to physical-chemical characteristics of the products and their manufacture technology. Therefore, both standards supplement each other. So, GOST 9087–81E will act for some time as

**Table 4.** Designations of fluxes for welding of carbon and low-alloy steels

| Flux grade (Flux) (ISO 14174:2004) | Welding wire (Wire electrodes) (ISO 14171:2002) | Classification (Classification ISO 14171:2002) | |
|---|---|---|---|
| | | Probe of pure (deposited) weld metal (Multi-run technique) | Welded joint (TWO-run technique) |
| AN-60<br>AN-60M<br>S F MS 1 AC H10 | S1 | A-S35 2 MS S1 | A-S 3T 0 MS S1 |
| | S2 | A-S42 0 MS S2 | – |
| | S1 (Sv-08A) | B-S49A 2 MS SU11<br>B-S49A 0U MS SU11 | B-S49S 2 MS SU11<br>B-S49S 0U MS SU11 |
| AN-348-A<br>AN-348-AM<br>S F MS 1 AC H10 | S1 | A-S38 0 MS S1 | A-S 5T 2 MS S1 |
| | S1 (Sv-08A) | B-S49A 2 MS SU11<br>B-S49A 0U MS SU11 | B-S49S 2 MS SU11<br>B-S49S 0U MS SU11 |
| AN-47<br>S F CS 1 AC H10 | S2 | A-S42 2 CS S2 | A-S 5T 2 CS S2 |
| | SU11 (Sv-08GA) | – | B-S57S 5 CS SU11 |
| OSTs-45M<br>S F MS 1 AC H10 | S1 | A-S35 0 MS S1 | A-S 5T 2 MS S1 |
| | S1 (Sv-08A) | B-S49A 2 MS SU11<br>B-S49A 0U MS SU11 | B-S49S 2 MS SU11<br>B-S49S 0U MS SU11 |
| AN-67B<br>S F AR 1 AC H5 | S2 | A-S 50 4 AR S2 | A-S 3T 4 AR S2 |
| | SUN2M3<br>(Sv-08G1NMA) | B-S57A 7 AR SUN2M3<br>B-S57A 6U AR SUN2M3 | B-S57S 7 AR SUN2M3<br>B-S57S 6U AR SUN2M3 |
| AN-43<br>S F AB 1 AD H5 | S2 | A-S 50 4 AR S2 | A-S 3T 4 AR S2 |
| | SU11 (Sv-08GA) | B-S57A 5 AR SU11<br>B-S57A 4U AR SU11 | B-S57A 5 AR SU11<br>B-S57A 4U AR SU11 |

**Designation of combination of flux AN-60 + wire S1 according to standard ISO 14171:2002 (testing of pure (deposited) weld metal for determination of yield strength and 47 J impact energy (Multi-run technique, section A)**

ISO 14171 – A – S 35 2 MS S1

- S1 — Welding wire of S1 grade
- MS — Flux of manganese-silicate type
- 2 — Impact energy is not less than 47 J at −20 °C test temperature of pure (deposited) weld metal
- 35 — Yield strength of pure (deposited) weld metal is not less than 355 N/mm²
- S — Flux + wire combination designed for arc welding
- A — Classification was carried out according to section A (minimal yield strength of pure (deposited) weld metal and 47 J impact energy)
- ISO 14171 — Standard according to which classification was carried out

**Designation of combination of flux AN-60 + wire Sv-08A according to standard ISO 14171:2002 (testing of welded joint for determination of tensile strength and 27 J impact energy (TWO-run technique, section B)**

ISO 14171 – B – S49A 2 MS SU11
ISO 14171 – B – S49S 0U MS SU11

- SU11 — Designation of welding wire Sv-08A according to classification of standard ISO 14171:2002 (Table 4)
- MS — Flux of manganese-silicate type
- 0U — Letter U indicates that impact energy of not below 47 J was achieved in testing of welded joint at 0 °C (0)
- 2 — Figure 2 indicates that impact energy of not below 27 J was achieved in testing of pure weld metal at temperature −20 °C
- S49 — Figure 49 indicates that tensile strength was more than 490 N/mm² in testing of pure weld metal (A) or welded joint (S)
- S — Flux + wire combination for arc welding
- B — Tests were carried out according to section B
- ISO 14171 — Standard according to which classification was carried out

**Designation of flux AN-60 according to standard ISO 14174:2004 Welding flux ISO 14174-S MS 1 AC H10**

Welding flux ISO 14171 – S F MS 1 AC H10

- H10 — Flux provides not more than 10 cm³ content of diffusible hydrogen in 100 g of deposited metal
- AC — Flux is suitable for alternating and direct current welding
- 1 — Flux is designed for welding of carbon unalloyed and low-alloy steels
- MS — Flux of manganese-silicate type
- F — Fused flux
- S — Flux for welding
- ISO 14171 — Standard according to which classification was carried out

an intergovernmental standard for customers from the CIS countries, and further on will become a standard of enterprise.

**Some explanations to standards ISO 14171:2002 and ISO 14174:2004.** *Metallurgical characteristic*. Standard ISO 14174:2002 contains a statement about metallurgical characteristic of a flux, although it indicates that this characteristic is not included in the flux designation, but is only mentioned in technical documentation (not saying in what document). Also, this standard does not mention a regulatory document, according to which this characteristic is determined.

The metallurgical characteristic shows an influence of chemical composition of a flux on transfer of primarily silicon and manganese into the weld metal — increments $\Delta$Si and $\Delta$Mn, which are determined as a difference between the content of an element in the deposited metal, obtained according to ISO 15792-1:2000, and in the welding wire.

Sometimes the metallurgical characteristic of flux is given in advertisement materials [6] in form of diagrams of the dependence of increase in alloying elements on their content in the flux (Figure). European standard EN 760:1996 is used more often. In it an appropriate number is given to a specific range of values of increase in alloying elements, by using which the metallurgical characteristic is evaluated. However, in tests a disagreement is observed in obtained results. This is explained by the fact that a number of factors, which are difficult to take into account, for example, maintaining the precise welding conditions or chemical composition of metal, influence the transfer of alloying elements into the weld metal. Therefore, for comparative assessment of domestic fluxes by the codes with allowance for the metallurgical characteristic, we recommend to use a comparative table, which is made based on the statistical data, using European standard EN 760:1996 (Table 3).

*Current load*. Current load is a maximal current for welding with one electrode, at which the flux melt boils and loses its ability to form the weld. This characteristic is not included into the flux designations in existing standard ISO 14174:2004. However, this drawback was eliminated in a new edition of this standard ISO 14174:2008 by using flux designations according to EN 760:1996 (figure after code AC or AD multiplied 100 times shows current load value).

*Grain size*. The last three figures in designations according to EN 760:1996 point to a grain size (minimum/maximum). The code of this characteristic is not included into the flux designations of existing standard ISO 14174:2002. However, its new edition requires that the grain size be indicated on a packing and in technical documents.

*Utilization of designations*. The designation according to standard ISO 14174:2002 for each flux exists in one variant. It shows only the main consumer characteristics of the flux itself. Such designations should be included in all information materials (on labels, in quality certificates, promotional products, technical documents) after the flux grade, for example, grade AN-60 (DSTU ISO 14174-S F MS 1 AC H10).

More often this designation is used by customers when approaching a manufacturer, or by manufacturers for promotion of a product.

Classification according to standard ISO 14171:2002 concerns only those fluxes, which are classified by standard ISO 14174:2004 to class 1, i.e. designed for welding of unalloyed and low-alloy steels. Therefore, the designations of other classes of the fluxes are given only according to standard ISO 14174:2004 (see Table 2, fluxes of AN-20S, AN-20P, AN-26S, AN-26P, AN-8 grades).

The quantity of designations of flux + wire combinations according to standard ISO 14171:2002 depends on the quantity of welding wires and steel grades, with which a flux was tested, and could achieve ten and a half or more.

*Meaning of codes*. Standards ISO 14171:2002 and ISO 14174:2004 contain a detailed description of codes, which are included in designations of fluxes or combinations of the latter with wires. Interpretation of the codes is given by an example of flux AN-60 (p. 47).

For domestic flux manufacturers, it is necessary to introduce the said designations of fluxes and their combinations with welding wires in the quality certificates and labels on packing, as well as in technical documents and promotion products. An example of designation to be used in advertisements and informational materials is given in Table 4.

It should be noted that Technical Commission ISO/TC44/SC3 prepares new editions of standards ISO 14171:2002 and ISO 14171:2004 by taking into account remarks of the customers, developers and manufacturers of welding fluxes. The updated standards will provide clear statements on the metallurgical characteristic, current load, methods for their determination and application in designations of fluxes. Publication of these standards is planned within the next years.


1. *GOST 9087–81E*: Fused welding fluxes. Specifications. Introd. 01.01.82.
2. *TU U 05416923.049–99*: Fused welding fluxes of grades AN-47, AN-348-A, AN-348V, ANTs-1A, AN-60, OSTs-45 and their modifications D, M, P. Valid from 04.04.2000.
3. *GOST R 52222*: Fused welding fluxes for automatic welding. Specifications. Approved 01.01.2005.
4. *ANSI/AWS A5.17–89*: Specification for carbon steel electrodes and fluxes for submerged arc welding. Approved 17.03.89.
5. *ANSI/AWS A5.23–90*: Specification for low alloy steel electrodes and fluxes for submerged arc welding. Approved 01.01.99.
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