INTERNATIONAL STANDARD

**ISO 14171**

Third edition
2016-07-01

# Welding consumables — Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non alloy and fine grain steels — Classification

*Produits consommables pour le soudage — Fils-électrodes pleins, fils-électrodes fourrés et couples fils-flux pour le soudage à l'arc sous flux des aciers non alliés et à grains fins — Classification*

Reference number
ISO 14171:2016(E)

© ISO 2016



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

# Contents

Page

**Foreword** ..... **iv**
**Introduction** ..... **v**
**1 Scope** ..... **1**
**2 Normative references** ..... **1**
**3 Classification** ..... **2**
**4 Symbols and requirements** ..... **3**
4.1 Symbol for the process ..... 3
4.2 Symbol for tensile properties ..... 3
4.2.1 Multi-run technique ..... 3
4.2.2 Two-run technique ..... 4
4.3 Symbol for the impact properties of all-weld metal or two-run welded joint ..... 5
4.4 Symbol for type of welding flux ..... 5
4.5 Symbol for the chemical composition ..... 5
4.5.1 Solid wire electrodes ..... 5
4.5.2 Tubular cored electrode/flux combinations ..... 6
4.6 Symbol for hydrogen content of deposited metal ..... 15
**5 Mechanical tests** ..... **15**
5.1 Multi-run technique ..... 15
5.2 Two-run technique ..... 17
**6 Chemical analysis** ..... **17**
**7 Rounding procedure** ..... **17**
**8 Retest** ..... **18**
**9 Technical delivery conditions** ..... **18**
**10 Examples of designation** ..... **18**

© ISO 2016 – All rights reserved

# 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html

The committee responsible for this document is ISO/TC 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables*.

This third edition cancels and replaces the second edition (ISO 14171:2010), which has been technically revised.

Requests for official interpretations 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.


© ISO 2016 – All rights reserved

# Introduction

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

This International Standard provides a classification system for the designation of solid wire electrodes in terms of their chemical composition, tubular cored electrodes in terms of the deposit composition obtained with a particular submerged arc flux and, where required, electrode/flux combinations in terms of the yield strength, tensile strength and elongation of the all-weld metal deposit. The ratio of yield to tensile strength of weld metal is generally higher than that of parent material. Users are to note that matching weld metal yield strength to parent material yield strength does not necessarily ensure that the weld metal tensile strength matches that of the parent material. Thus, where the application of the material requires matching tensile strengths, selection of the consumable is intended to be made by reference to column 3 of Table 1A or 1B, as appropriate.

Although combinations of electrodes and fluxes supplied by individual companies may have the same classification, the individual wire electrodes and fluxes from different companies are not interchangeable unless verified in accordance with this International Standard.

The mechanical properties of all-weld metal test specimens used to classify the electrode/flux combinations vary from those obtained in production joints because of differences in welding procedures such as electrode size and parent material composition.

© ISO 2016 – All rights reserved

# Welding consumables — Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non alloy and fine grain steels — Classification

## 1 Scope

This International Standard specifies the requirements for the classification of electrode/flux combinations and weld metal in the as-welded condition and in the post-weld heat-treated condition for submerged arc welding of non-alloy and fine grain steels with minimum yield strength of up to 500 MPa or a minimum tensile strength of up to 570 MPa. One flux can be classified with different solid wire electrodes and tubular cored electrodes. The solid wire electrode is also classified separately based on chemical composition.

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

a) Paragraphs and tables which carry the suffix letter "A" are applicable only to electrode/flux combinations and wire electrodes classified using the system based upon the yield strength and the average impact energy for weld metal of 47 J, in accordance with this International Standard.

b) Clauses and tables which carry the suffix letter "B" are applicable only to electrode/flux combinations and wire electrodes classified using the system based upon the tensile strength and the average impact energy for weld metal of 27 J, in accordance with this International Standard.

c) Clauses and tables which do not have either the suffix letter "A" or the suffix letter "B" are applicable to all electrode/flux combinations and wire electrodes classified in accordance with this International Standard.

Fluxes for the single-run and two-run techniques are classified on the basis of the two-run technique.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 3690, *Welding and allied processes — Determination of hydrogen content in arc weld metal*

ISO 6847, *Welding consumables — Deposition of a weld metal pad for chemical analysis*

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

ISO 14174, *Welding consumables — Fluxes for submerged arc welding and electroslag welding — Classification*

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

© ISO 2016 – All rights reserved

ISO 15792-1:2000, *Welding consumables — Test methods — Part 1: Test methods for all-weld metal test specimens in steel, nickel and nickel alloys*. Amended by ISO 15792-1:2000/Amd 1:2011

ISO 15792-2:2000, *Welding consumables — Test methods — Part 2: Preparation of single-run and two-run technique test specimens in steel*

ISO 80000-1:2009, *Quantities and units — Part 1: General*. Corrected by ISO 80000-1:2009/Cor 1:2011

## 3 Classification

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

A solid wire electrode shall be classified in accordance with its chemical composition as given in Table 4A or 4B.

An all-weld metal deposit from a tubular cored electrode shall be classified in accordance with the all-weld metal composition, as given in Table 5A or 5B, obtained with a particular flux.

When the solid wire electrode or tubular cored electrode is classified in combination with a flux for submerged arc welding, the classification shall be prefixed with a symbol in accordance with Clause 4, as appropriate.

The electrode/flux classification includes weld metal properties obtained with a manufacturer's specific electrode/flux combination as given below. A wire electrode may be separately classified with the symbol for its chemical composition in Table 4A or 4B.

### 3A Classification by yield strength and 47 J impact energy

The classification is divided into five mandatory parts and an optional sixth part.

1) The first part gives a symbol indicating the process to be identified.

2) The second part gives a symbol indicating the strength and elongation of all-weld metal for multi-run technique or the strength of the parent material used in classification for the two-run technique (see Table 1A or 2A).

3) The third part gives a symbol indicating the impact properties of all-weld metal or welded joint (see Table 3).

### 3B Classification by tensile strength and 27 J impact energy

The classification is divided into five mandatory parts and an optional sixth part.

1) The first part gives a symbol indicating the process to be identified.

2) The second part gives a symbol indicating the strength and elongation of all-weld metal in either the as-welded or post-weld heat-treated condition for a multi-run technique or the specified minimum tensile strength of the parent material or the weld metal used in classification for the two-run technique (see Table 1B or 2B).

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


© ISO 2016 – All rights reserved