International Standard

ISO 18276

Welding consumables — Tubular cored electrodes for gas-shielded and non-gas-shielded metal arc welding of high strength steels — Classification

Produits consommables pour le soudage — Fils-électrodes fourrés pour le soudage à l'arc avec ou sans gaz de protection des aciers à haute résistance — Classification

Third edition
2024-07

Reference number
ISO 18276:2024(en)

© ISO 2024



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **v**

Introduction ..... **vi**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **2**

4 Classification **2**
4.1 General 2
4.2 Classification systems 2
4.3 Compulsory and optional sections in classifications 3

5 Symbols and requirements **4**
5.1 Symbol for the product or process 4
5.2 Symbol for tensile properties of all-weld metal 4
5.3 Symbol for impact properties of all-weld metal 5
5.4 Symbol for chemical composition of all-weld metal 6
5.5 Symbol for type of electrode core – Classification by yield strength and 47 J impact energy – System A 10
5.6 Symbol for usability characteristics of the electrodes – Classification by tensile strength and 27 J impact energy – System B 10
5.7 Symbol for shielding gas 11
5.8 Symbol for welding position 11
5.9 Symbol for hydrogen content of deposited metal 11
5.10 Symbol for conditions of post-weld heat treatment 12
5.10.1 Classification by yield strength and 47 J impact energy – System A 12
5.10.2 Classification by tensile strength and 27 J impact energy – System B 12

6 Rounding procedure **12**

7 Mechanical tests **12**
7.1 General 12
7.2 Preheating and interpass temperatures 12
7.3 Pass sequence 13
7.4 Post-weld heat treatment (PWHT) condition 14
7.4.1 Classification by yield strength and 47 J impact energy – System A 14
7.4.2 Classification by tensile strength and 27 J impact energy – System B 14

8 Chemical analysis **14**

9 Retesting **14**

10 Technical delivery conditions **15**

11 Examples of designations **15**
11.1 General 15
11.2 Example 1 - Classification by yield strength and 47 J impact energy – System A 15
11.3 Example 2 - Classification by tensile strength and 27 J impact energy – System B 15
11.4 Example 3 – Classification by yield strength and 47 J impact energy - System A 16
11.5 Example 4 – Classification by tensile strength and 27 J impact energy – System B 17

Annex A (informative) **Classification systems** **19**

Annex B (informative) **Description of composition designations for electrodes in the classification system based upon tensile strength and average impact energy of 27 J – System B** **22**

Annex C (informative) **Description of types of electrode core in the classification system based upon yield strength and average impact energy of 47 J – System A** **23**

© ISO 2024 – All rights reserved

Annex D (informative) **Descriptions of types of usability characteristics in the classification system based upon tensile strength and average impact energy of 27 J – System B** **24**

Annex E (informative) **Notes on hydrogen content** **26**

Bibliography **27**

© ISO 2024 – 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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

For an explanation of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 18276:2017), which has been technically revised.

The main changes are as follows:

— document has been reformatted in single column format. Some clauses and subclauses have been merged or separated and some tables have been merged;

— dated normative references have been updated to the latest editions;

— Tables 3A and 3B have been revised and merged and is now Table 6;

— sub-clause 5.7 has been revised and is now 5.8;

— Clause 11 contains new designation examples.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

© ISO 2024 – All rights reserved

Introduction

This document proposes a classification system for tubular cored electrodes in terms of the tensile properties, impact properties, chemical composition of the all-weld metal, type of electrode core, shielding gas and welding position. The ratio of yield strength to tensile strength of the weld metal is generally higher than that of the parent metal. Note that matching weld metal yield strength to parent metal yield strength will not necessarily ensure that the weld metal tensile strength matches that of the parent metal. Where the application requires matching tensile strength, therefore, selection of the consumable should be made by reference to columns 3 and 7 of Table 3.

Note that the mechanical properties of all-weld metal test specimens used to classify tubular cored electrodes differ from those obtained with production joints because of differences in welding procedure, such as electrode size, width of weave, welding position and parent metal composition.

The classification in accordance with system A is mainly based on EN 12535. The classification in accordance with system B is mainly based upon standards used around the Pacific Rim.

© ISO 2024 – All rights reserved

Welding consumables — Tubular cored electrodes for gas-shielded and non-gas-shielded metal arc welding of high strength steels — Classification

1 Scope

This document specifies the requirements for classification of tubular cored electrodes with or without a gas shield for metal arc welding of high-strength steels in the as-welded condition or in the post-weld heat-treated condition with a minimum yield strength higher than 550 MPa or a minimum tensile strength higher than 590 MPa. One tubular cored electrode can be tested and classified with different shielding gases, if used with more than one.

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

— Subclauses and tables which carry the suffix "system A" are applicable only to tubular cored electrodes classified under the system based upon the yield strength and an average impact energy of 47 J of the all-weld metal given in this document.

— Subclauses and tables which carry the suffix "system B" are applicable only to tubular cored electrodes classified under the system based upon the tensile strength and an average impact energy of 27 J of the all-weld metal given in this document.

— Subclauses and tables which do not have either the suffix "system A" or the suffix "system B" are applicable to all tubular cored electrodes classified under this document.

It is recognized that the operating characteristics of tubular cored electrodes can be modified by the use of pulsed current but, for the purposes of this document, pulsed current is not used for determining the electrode classification.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 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 6947, *Welding and allied processes — Welding positions*

ISO 13916, *Welding — Measurement of preheating temperature, interpass temperature and preheat maintenance temperature*

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

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

© ISO 2024 – All rights reserved

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

ISO 80000-1:2022, *Quantities and units — Part 1: General*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Classification

4.1 General

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 under both systems. Then, either or both classification designations can be used for the product. Annex A gives figures that explain how the classification systems are structured. Annex B gives information on composition designations for electrodes in the classification system based upon tensile strength and average impact energy of 27 J.

The classification includes all-weld metal properties obtained with a tubular cored electrode and appropriate shielding gas combination as given in 4.2. With the exception of the symbol for welding position, the classification of gas-shielded tubular cored electrodes is based on an electrode size of 1,2 mm or, if this size is not manufactured, the next largest diameter manufactured and the classification of self-shielded tubular cored electrodes is based on a diameter of 2,4 mm or the largest diameter manufactured if less than 2,4 mm.

4.2 Classification systems

Each classification system, A and B, is split into nine parts as given in Table 1.

© ISO 2024 – All rights reserved