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**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*



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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

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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.

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](http://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](http://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](http://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*.

This second edition cancels and replaces the first edition (ISO 18276:2005), which has been technically revised with the following changes:

- content has been aligned with ISO 17632:2015 and ISO 17634:2015;
- shielding gas designations have been updated;
- [Table 3B](#) has been extensively revised to align with existing Pacific Rim designations;
- new designations have been added to [Table 3B](#);
- the T4 designator has been deleted from [Table 4B](#);
- heat input ranges given in [Table 8B](#) have been modified to match current Pacific Rim values;
- fillet weld tests have been removed;
- an example using the Z designation has been added to [Clause 11A](#).

Requests for official interpretations of any aspect of this document 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](http://www.iso.org).

## 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 column 3 of [Table 1A](#) or [Table 1B](#).

Note that the mechanical properties of all-weld metal test specimens used to classify tubular cored electrodes will 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<sup>[1]</sup>. The classification in accordance with system B is mainly based upon standards used around the Pacific Rim.



# 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 letter “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 letter “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 letter “A” or the suffix letter “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 6947:2011, *Welding and allied processes — Welding positions*

ISO 13916, *Welding — Guidance on the 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 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

### 3 Terms and definitions

No terms and definitions are listed in this document.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### 4 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 under both systems. Then, either or both classification designations can be used for the product.

The classification includes all-weld metal properties obtained with a tubular cored electrode and appropriate shielding gas combination as given below. 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 larger 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.

#### 4.1A Classification by yield strength and 47 J impact energy

The classification designation is divided into nine parts:

- 1) the first part (T) indicates a tubular cored electrode;
- 2) the second part gives a symbol indicating the strength and elongation of the all-weld metal in the as-welded or post-weld heat-treated condition (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 chemical composition of the all-weld metal (see [Table 3A](#));
- 5) the fifth part gives a symbol indicating the type of electrode core (see [Table 4A](#));

#### 4.1B Classification by tensile strength and 27 J impact energy

The classification designation is divided into nine parts:

- 1) the first part (T) indicates a tubular cored electrode;
- 2) the second part gives a symbol indicating the strength and elongation of the all-weld metal in either the as-welded or the post-weld heat-treated condition (see [Table 1B](#));
- 3) the third part gives a symbol indicating the impact properties of the all-weld metal (see [Table 2](#)). The symbol “U”, added as an optional supplemental designator at or near the end of the complete tubular cored electrode designation, 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 usability characteristics of the electrode (see [Table 4B](#));
- 5) the fifth part gives a symbol indicating the welding position (see [Table 5B](#));