
**Arc welding and cutting —
Nonconsumable tungsten electrodes —
Classification**

*Soudage et coupage à l'arc — Électrodes non consommables en
tungstène — Classification*

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Foreword

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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 6848 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 6848:1984), which has been technically revised.

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Introduction

Tungsten electrodes are used in a variety of welding and allied processes, including tungsten inert gas welding, plasma arc welding and cutting, plasma spraying, and atomic hydrogen welding. In contrast to most other welding electrodes, tungsten electrodes are not intended to become part of the weld deposit. Nevertheless, the chemical composition of a tungsten electrode has an important effect on its range of usage in welding and allied processes. Therefore, tungsten electrodes are classified according to their chemical composition.

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 national standards bodies can be found at www.iso.org.

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Arc welding and cutting — Nonconsumable tungsten electrodes — Classification

1 Scope

This International Standard specifies requirements for classification of nonconsumable tungsten electrodes for inert gas shielded arc welding, and for plasma welding, cutting and thermal spraying.

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 31-0:1992, *Quantities and units — Part 0: General principles*

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3 Classification standards.iteh.ai

Classification of a tungsten electrode is based upon its chemical composition.

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4 Symbols and requirements

4.1 Symbol for the product/process

The symbol for gas shielded tungsten arc processes is the letter W.

4.2 Symbol for the chemical composition

The symbol for the chemical composition of the tungsten electrode is the chemical symbol for the principal oxide additive followed by digits indicating the nominal mass percent of the oxide additive multiplied by 10. If there is no additive, the symbol is the letter P. Table 1 lists the composition requirements for the various classifications. Compositions not listed in Table 1 shall be symbolized by the letters WG, followed by the chemical symbol and digits for the major oxide additive, according to the principle used for the other compositions given in Table 1.

5 Chemical analysis

Chemical analysis shall be performed on specimens of the electrode being classified. Any analytical technique may be used but, in cases of dispute, reference shall be made to established published methods.

6 Retests

If any test fails to meet the requirement, that test shall be repeated twice. The results of both retests shall meet the requirements. Specimens for retesting may be taken from the original test assembly or from a new test assembly. For chemical analysis, retests need only be for those specific elements that failed to meet their

test requirement. If the results of one or both retests fail to meet the requirement, the material under test shall be considered as not meeting the requirements of this specification for that classification.

In the event that, during preparation or after completion of any test, it is clearly determined that prescribed or proper procedures were not followed in preparing the weld test assembly or test specimen(s), or in conducting the tests, the test shall be considered invalid, without regard to whether the test was actually completed, or whether the test results met, or failed to meet, the requirement. That test shall be repeated, following proper prescribed procedures. In this case, the requirement for doubling the number of test specimens does not apply.

7 Marking

In accordance with Table 1, tungsten electrodes shall be marked on the basis of their chemical composition, with one colour ring near one end of the electrode. The width of the colour ring shall be at least 3 mm. Alternatively, tungsten electrodes may have their classification symbols marked on the surface of the electrode near at least one end of the electrode.

Table 1 — Chemical composition requirements for tungsten electrodes











Classification symbol	Chemical composition requirements				Colour code, RGB colour value and colour sample ^a
	Principal oxide	Oxide addition Mass percent	Impurities, mass percent	Tungsten, mass percent	
WP	None	N.A. ^b	0,5 max.	99,5 min.	Green #008000 
WCe 20	CeO ₂	1,8 to 2,2	0,5 max.	Balance	Grey #808080 
WLa 10	La ₂ O ₃	0,8 to 1,2	0,5 max.	Balance	Black #000000 
WLa 15	La ₂ O ₃	1,3 to 1,7	0,5 max.	Balance	Gold #FFD700 
WLa 20	La ₂ O ₃	1,8 to 2,2	0,5 max.	Balance	Blue #0000FF 
WTh 10	ThO ₂	0,8 to 1,2	0,5 max.	Balance	Yellow #FFFF00 
WTh 20	ThO ₂	1,7 to 2,2	0,5 max.	Balance	Red #FF0000 

Table 1 (continued)

Classification symbol	Chemical composition requirements				Colour code, RGB colour value and colour sample ^a
	Oxide addition		Impurities, mass percent	Tungsten, mass percent	
	Principal oxide	Mass percent			
WTh 30	ThO ₂	2,8 to 3,2	0,5 max.	Balance	Violet #EE82EE 
WZr 3	ZrO ₂	0,15 to 0,50	0,5 max.	Balance	Brown #A52A2A 
WZr 8	ZrO ₂	0,7 to 0,9	0,5 max.	Balance	White #FFFFFF 

^a RGB colour values and colour samples can be found at the following website:
<http://msdn.microsoft.com/library/default.asp?url=/workshop/author/dhtml/reference/colors/colors.asp>

^b N.A. = Not applicable.

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8 Standard sizes and tolerances (standards.iteh.ai)

8.1 Electrode diameters

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Standard electrode diameters and tolerances are given in Table 2. Other diameters and tolerances may be agreed between supplier and purchaser.

Table 2 — Standard electrode diameters and tolerances

Diameter mm	Tolerance mm
0,25	± 0,02
0,30	± 0,02
0,50	± 0,05
1,0	± 0,05
1,5	± 0,05
1,6	± 0,05
2,0	± 0,05
2,4	± 0,1
2,5	± 0,1
3,0	± 0,1
3,2	± 0,1
4,0	± 0,1
4,8	± 0,1
5,0	± 0,1
6,3	± 0,1
6,4	± 0,1
8,0	± 0,1
10,0	± 0,1

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8.2 Electrode lengths

Standard electrode lengths and tolerances are given in Table 3. Other lengths and tolerances may be as agreed between supplier and purchaser.

Table 3 — Standard electrode lengths and tolerances

Length mm	Tolerance mm
50	± 1,5
75	+ 2,5 - 1,0
150	+ 4 - 1
175	+ 6 - 1
300	+ 8 - 1
450	+ 8 - 1
600	+ 13 - 1

8.3 Electrode straightness

Electrodes shall not deviate from straight by more than 0,5 mm over any 100 mm of length or less.

9 Rounding-off procedure

For purposes of determining compliance with the requirements of this International Standard, the actual test values obtained shall be subjected to the rounding-off rules of ISO 31-0:1992, Annex B, Rule A. If the measured values are obtained by equipment calibrated in units other than those of this International Standard, the measured values shall be converted to the units of this International Standard before rounding off. If an average value is to be compared to the requirements of this International Standard, rounding-off shall be done only after calculating the average. In the case where the testing standard cited in the normative references of this International Standard contains instructions for rounding off that conflict with the instructions of this International Standard, the rounding-off requirements of the testing standard shall apply. The rounded-off results shall fulfill the requirements of the appropriate table for the classification under test.

10 Electrode quality

The electrode surface shall be free of impurities, undesirable films, foreign inclusions, slivers, cracks, scale and other defects. Electrodes shall be internally free of foreign inclusions or anything else that would adversely affect the operation of the electrode. Oxide additions shall be sufficiently uniformly distributed throughout the electrode so that the operation of the electrode is not adversely affected.

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11 Packaging

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11.1 Marking of packages

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The following information, as a minimum, shall be legibly marked so as to be visible from the outside of each package:

- a) the number of this International Standard, i.e., ISO 6848;
- b) electrode classification symbol in accordance with Table 1;
- c) electrode diameter;
- d) electrode length;
- e) net quantity of electrodes;
- f) supplier's name and trade designation;
- g) lot, control or heat number.

11.2 Packing

Tungsten electrodes shall be packed so that their surfaces are protected from all damage or staining when they are properly transported and stored.