
**Welding consumables — Wire
electrodes, wires and rods for welding
of aluminium and aluminium alloys —
Classification**

*Produits consommables pour le soudage — Fils-électrodes, fils et
baguettes pour le soudage de l'aluminium et les alliages d'aluminium
— Classification*





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Foreword

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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).

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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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

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

This second edition cancels and replaces the first edition (ISO 18273:2004), 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, through your national standards body, a complete listing of which can be found at www.iso.org.

Introduction

For aluminium welding consumables, there is no unique relationship between the product form (solid wire or rod) and the welding process used (e.g. gas shielded metal arc welding, gas tungsten arc welding, plasma arc welding, or other welding processes). For this reason, the solid wires or rods can be classified on the basis of any of the above product forms and can be used as appropriate for more than one of the above processes.

Welding consumables — Wire electrodes, wires and rods for welding of aluminium and aluminium alloys — Classification

1 Scope

This International Standard specifies requirements for classification of solid wires and rods for fusion welding of aluminium and aluminium alloys. The classification of the solid wires and rods is based on their chemical composition.

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

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

3 Classification

The classification is divided into two parts.

- a) The first part indicates the product form being solid wires or rods (see [4.1](#)).
- b) The second part gives a numerical symbol indicating the chemical composition of the solid wire or rod (see [Table 1](#)).

The aluminium or aluminium alloy chemical composition limits specified are strictly identical to those registered to the Aluminium Association, Washington, DC 20006, U.S.A. for the corresponding alloys.

Table 1 — Symbol for the chemical composition of solid wires and rods

Alloy symbol		Chemical composition in % (m/m) ^a													
Numerical	Chemical	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ga, V	Ti	Zr	Al (min.)	Be	Other each	Other total
ALUMINIUM-LOW ALLOYED															
Al 1070	Al99,7	0,20	0,25	0,04	0,03	0,03	-	0,04	V 0,05	0,03	-	99,70	0,000 3	0,03	-
Al 1080A	Al99,8(A)	0,15	0,15	0,03	0,02	0,02	-	0,06	Ga 0,03	0,02	-	99,80	0,000 3	0,02	-
Al 1188	Al99,88	0,06	0,06	0,005	0,01	0,01	-	0,03	Ga 0,03 V 0,05	0,01	-	99,88	0,000 3	0,01	-
Al 1100	Al99,0Cu	Si + Fe 0,95		0,05 to 0,20	0,05	-	-	0,10	-	-	-	99,00	0,000 3	0,05	0,15
Al 1200	Al99,0	Si + Fe 1,00		0,05	0,05	-	-	0,10	-	0,05	-	99,00	0,000 3	0,05	0,15
Al 1450	Al99,5Ti	0,25	0,40	0,05	0,05	0,05	-	0,07	-	0,10 to 0,20	-	99,50	0,000 3	0,03	-
ALUMINIUM-COPPER															
Al 2319	AlCu6MnZrTi	0,20	0,30	5,8 to 6,8	0,20 to 0,40	0,02	-	0,10	V 0,05 to 0,15	0,10 to 0,20	0,10 to 0,25	Rem	0,0003	0,05	0,15
ALUMINIUM-MANGANESE															
Al 3103	AlMn1	0,50	0,7	0,10	0,9 to 1,5	0,30	0,10	0,20	-	Ti + Zr 0,10	-	Rem	0,0003	0,05	0,15
ALUMINIUM-SILICIUM															
Al 4009	AlSi5Cu1Mg	4,5 to 5,5	0,20	1,0 to 1,5	0,10	0,45 to 0,6	-	0,10	-	0,20	-	Rem	0,000 3	0,05	0,15
Al 4010	AlSi7Mg	6,5 to 7,5	0,20	0,20	0,10	0,30 to 0,45	-	0,10	-	0,20	-	Rem	0,000 3	0,05	0,15
Al 4011	AlSi7Mg0,5Ti	6,5 to 7,5	0,20	0,20	0,10	0,45 to 0,7	-	0,10	-	0,04 to 0,20	-	Rem	0,04 to 0,07	0,05	0,15
Al 4018	AlSi7Mg	6,5 to 7,5	0,20	0,05	0,10	0,50 to 0,8	-	0,10	-	0,20	-	Rem	0,000 3	0,05	0,15
Al 4020 ^d	AlSi3Mn1	2,5 to 3,5	0,20	0,03	0,8 to 1,2	0,01	0,01	-	-	0,005	0,01	Rem	0,000 3	0,02	0,10
Al 4043	AlSi5	4,5 to 6,0	0,8	0,30	0,05	0,05	-	0,10	-	0,20	-	Rem	0,000 3	0,05	0,15
^a Single values shown in the table are maximum values except for Al which are minimum values. ^b For Alloy Al 5754, the sum (Mn + Cr): 0,10 to 0,6. ^c Consumables for which the chemical composition is not listed in this table shall be symbolized similarly and prefixed by the letter Z. The chemical composition ranges are not specified and therefore it is possible that two electrodes with the same Z classification are not interchangeable. ^d For Alloy Al 4020, B (Max.) = 0,005 %.															

Table 1 (continued)

Alloy symbol		Chemical composition in % (m/m) ^a													
Numerical	Chemical	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ga, V	Ti	Zr	Al (min.)	Be	Other each	Other total
Al 4043A	AlSi5(A)	4,5 to 6,0	0,6	0,30	0,15	0,20	-	0,10	-	0,15	-	Rem	0,000 3	0,05	0,15
Al 4046	AlSi10Mg	9,0 to 11,0	0,50	0,03	0,40	0,20 to 0,50	-	0,10	-	0,15	-	Rem	0,000 3	0,05	0,15
Al 4047	AlSi12	11,0 to 13,0	0,8	0,30	0,15	0,10	-	0,20	-	-	-	Rem	0,000 3	0,05	0,15
Al 4047A	AlSi12(A)	11,0 to 13,0	0,6	0,30	0,15	0,10	-	0,20	-	0,15	-	Rem	0,000 3	0,05	0,15
Al 4145	AlSi10Cu4	9,3 to 10,7	0,8	3,3 to 4,7	0,15	0,15	0,15	0,20	-	-	-	Rem	0,000 3	0,05	0,15
Al 4643	AlSi4Mg	3,6 to 4,6	0,8	0,10	0,05	0,10 to 0,30	-	0,10	-	0,15	-	Rem	0,000 3	0,05	0,15
Al 4943	AlSi5Mg	5,0 to 6,0	0,40	0,10	0,05	0,10 to 0,50	-	0,10	-	0,15	-	Rem	0,000 3	0,05	0,15
ALUMINIUM-MAGNESIUM															
Al 5249	AlMg2Mn0,8Zr	0,25	0,40	0,05	0,50 to 1,1	1,6 to 2,5	0,30	0,20	-	0,15	0,10 to 0,20	Rem	0,000 3	0,05	0,15
Al 5554	AlMg2,7Mn	0,25	0,40	0,10	0,50 to 1,0	2,4 to 3,0	0,05 to 0,20	0,25	-	0,05 to 0,20	-	Rem	0,000 3	0,05	0,15
Al 5654	AlMg3,5Ti(A)	Si + Fe 0,45	0,45	0,05	0,01	3,1 to 3,9	0,15 to 0,35	0,20	-	0,05 to 0,15	-	Rem	0,000 3	0,05	0,15
Al 5654A	AlMg3,5Ti	Si + Fe 0,45	0,45	0,05	0,01	3,1 to 3,9	0,15 to 0,35	0,20	-	0,05 to 0,15	-	Rem	0,000 5	0,05	0,15
Al 5754b	AlMg3	0,40	0,40	0,10	0,50	2,6 to 3,6	0,30	0,20	-	0,15	-	Rem	0,000 3	0,05	0,15
Al 5356	AlMg5Cr(A)	0,25	0,40	0,10	0,05 to 0,20	4,5 to 5,5	0,05 to 0,20	0,10	-	0,06 to 0,20	-	Rem	0,000 3	0,05	0,15
Al 5356A	AlMg5Cr	0,25	0,40	0,10	0,05 to 0,20	4,5 to 5,5	0,05 to 0,20	0,10	-	0,06 to 0,20	-	Rem	0,000 5	0,05	0,15

^a Single values shown in the table are maximum values except for Al which are minimum values.

^b For Alloy Al 5754, the sum (Mn + Cr): 0,10 to 0,6.

^c Consumables for which the chemical composition is not listed in this table shall be symbolized similarly and prefixed by the letter Z. The chemical composition ranges are not specified and therefore it is possible that two electrodes with the same Z classification are not interchangeable.

^d For Alloy Al 4020, B (Max.) = 0,005 %.

Table 1 (continued)

Alloy symbol		Chemical composition in % (m/m) ^a													
Numerical	Chemical	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ga, V	Ti	Zr	Al (min.)	Be	Other each	Other total
Al 5556	AlMg5MnTi(A)	0,25	0,40	0,10	0,50 to 1,0	4,7 to 5,5	0,05 to 0,20	0,25	-	0,05 to 0,20	-	Rem	0,000 3	0,05	0,15
Al 5556C	AlMg5MnTi	0,25	0,40	0,10	0,50 to 1,0	4,7 to 5,5	0,05 to 0,20	0,25	-	0,05 to 0,20	-	Rem	0,000 5	0,05	0,15
Al 5556A	AlMg5Mn1(A)	0,25	0,40	0,10	0,6 to 1,0	5,0 to 5,5	0,05 to 0,20	0,20	-	0,05 to 0,20	-	Rem	0,000 3	0,05	0,15
Al 5556B	AlMg5Mn1	0,25	0,40	0,10	0,6 to 1,0	5,0 to 5,5	0,05 to 0,20	0,20	-	0,05 to 0,20	-	Rem	0,000 5	0,05	0,15
Al 5183	AlMg4,5Mn0,7(A)	0,40	0,40	0,10	0,50 to 1,0	4,3 to 5,2	0,05 to 0,25	0,25	-	0,15	-	Rem	0,000 3	0,05	0,15
Al 5183A	AlMg4,5Mn0,7	0,40	0,40	0,10	0,50 to 1,0	4,3 to 5,2	0,05 to 0,25	0,25	-	0,15	-	Rem	0,000 5	0,05	0,15
Al 5087	AlMg4,5MnZr(A)	0,25	0,40	0,05	0,7 to 1,1	4,5 to 5,2	0,05 to 0,25	0,25	-	0,15	0,10 to 0,20	Rem	0,000 3	0,05	0,15
Al 5187	AlMg4,5MnZr	0,25	0,40	0,05	0,7 to 1,1	4,5 to 5,2	0,05 to 0,25	0,25	-	0,15	0,10 to 0,20	Rem	0,000 5	0,05	0,15
Z ^c		Any other agreed composition													
<p>^a Single values shown in the table are maximum values except for Al which are minimum values.</p> <p>^b For Alloy Al 5754, the sum (Mn + Cr): 0,10 to 0,6.</p> <p>^c Consumables for which the chemical composition is not listed in this table shall be symbolized similarly and prefixed by the letter Z. The chemical composition ranges are not specified and therefore it is possible that two electrodes with the same Z classification are not interchangeable.</p> <p>^d For Alloy Al 4020, B (Max.) = 0,005 %.</p>															

4 Symbols and requirements

4.1 Symbols for the product form

The symbol for the solid wire and rod shall be S.

NOTE One product form can be used for more than one welding process.

4.2 Symbol for the chemical composition

The numerical symbol in [Table 1](#) indicates the chemical composition of a solid wire and rod determined under the conditions given in [Clause 6](#).

NOTE In addition, the chemical symbol can be used.

5 Mechanical properties of the weld metal

Mechanical properties of the weld metal are not part of the classification.

6 Chemical analysis

Chemical analysis shall be performed on samples of the product or the stock from which it is made. Any analytical technique can be used, but in case of dispute, reference shall be made to established published methods.

7 Rounding procedure

For the purposes of determining compliance with the requirements of this International Standard, the actual test values obtained shall be subject to ISO 80000-1:2009, B.3, Rule A. If the measured values are obtained by the 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. If an arithmetic average value is to be compared to the requirements of this International Standard, rounding shall be done only after calculating the arithmetic average. If a test method cited in [Clause 2](#) contains instructions for rounding that conflict with the instructions of this International Standard, the rounding requirements of the test method standard shall apply. The rounded results shall fulfil the requirements of the appropriate table for the classification under test.

8 Retest

If any test fails to meet the requirement, that test shall be repeated twice. The results of both retests shall meet the requirement. Specimens for the retest may be taken from the original test sample or from a new test sample. For chemical analysis, retest need be only 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 sample 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.

9 Technical delivery conditions

Technical delivery conditions shall meet the requirements of ISO 544 and ISO 14344.

10 Designation

The designation of solid wires and rods shall follow the principle given in the example below.

EXAMPLE 1 A solid wire (S) for gas shielded metal arc welding has a chemical composition within the limits for the alloy symbol Al 4043 (AlSi5) of [Table 1](#) is designated as

ISO 18273 – S Al 4043

or alternatively

ISO 18273 – S Al 4043 (AlSi5)

EXAMPLE 2 A solid rod (S) for tungsten arc welding has a chemical composition within the limits for the alloy symbol Al 4043 (AlSi5) of [Table 1](#) is designated as

ISO 18273 – S Al 4043

or alternatively

ISO 18273 – S Al 4043 (AlSi5)

where

ISO 18273 is the standard number;

S is the product form (see [4.1](#));

Al 4043 is the chemical composition of the welding consumable (see [Table 1](#));

AlSi5 is the optional chemical composition of the welding consumable (see [Table 1](#)).

EXAMPLE 3 A solid wire (S) for gas shielded metal arc welding has a chemical composition of Mg 4,3 %-5,1 %, Mn 0,7 %-1,1 %, Zr 0,15 %-0,25 %, and Al rem. for the alloy symbol Z of [Table 1](#) is designated as

ISO 18273 – S Al Z

or alternatively

ISO 18273 – S Al Z (Al Mg4,7Mn0,9Zr)

where

ISO 18273 is the standard number;

S is the product form (see [4.1](#));

Al Z the chemical composition is agreed between manufacturer and customer;

Al Mg4,7Mn0,9Zr indicates the chemical composition of the product.

