



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS Z 3604 : 2002

(JLWA/JSA)

**Recommended practice
for inert gas shielded arc welding
of aluminium and aluminium alloys**

ICS 25.160.10; 77.120.10

Reference number : JIS Z 3604 : 2002 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Light Metal Welding and Construction Association (JLWA)/ the Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law. Consequently **JIS Z 3604 : 1993** is replaced with this Standard.

In this revision, the style and terms are amended according to **JIS Z 8301 : 2000** *Rules for the drafting and presentation of Japanese Industrial Standards* and **JIS Z 3001** *Welding terms* and further, the common items and the execution of welding are considered.

Date of Establishment: 1967-07-01

Date of Revision: 2002-03-20

Date of Public Notice in Official Gazette: 2002-03-20

Investigated by: Japanese Industrial Standards Committee
Standards Board
Technical Committee on Welding

JIS Z 3604:2002, First English edition published in 2002-10

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Printed in Japan

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Recommended practice for inert gas shielded arc welding of aluminium and aluminium alloys

1 Scope This Japanese Industrial Standard specifies the recommended practice for TIG welding and MIG welding of the aluminium and aluminium alloy (hereafter referred to as “aluminium”). Further, this Standard provides information necessary to **JIS Z 3400** *Quality requirements for welding—Fusion welding of metallic materials*.

2 Normative references The standards listed in Attached Table 1 contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) shall be applied.

3 Definitions For the purposes of this Standard, the definitions in **JIS Z 3001** apply, and the rest of the terms are as follows:

- a) **welding coordination personnel** A personnel controlling the execution of welding and shall be in accordance with **JIS Z 3410**.
- b) **welder** The welders who have passed the test of **JIS Z 3811** or have at least equivalent technique to that.

4 General items

4.1 Welding operation The welding shall be operated by welders under the appropriate guide and supervision by a welding coordination personnel.

4.2 Base metal

- a) **Classification of base metal** The base metals shall be in accordance with the materials specified in the following Japanese Industrial Standards or that based on them.

JIS H 4000, JIS H 4040, JIS H 4080, JIS H 4090, JIS H 4100, JIS H 4140, JIS H 4180, JIS H 5202 and JIS H 5302

- b) **Handling of base metal** The base metal shall be handled with care to avoid remarkable stains or damages.

4.3 Workshop The workshop shall have little trash, dust, metal powder and moisture, which are detrimental to the quality of weld, and shall be clean. The workshop shall also be provided with appropriate shelters against wind and rain.

4.4 Welding machine and accessory appliances The welding machine and accessory appliances shall be as follows.

- a) In both cases of TIG welding and MIG welding, the most suitable methods are required to be selected and the welding machine and necessary appliances suitable for each welding method are required to be selected.

- b) The welding power sources shall have a required current capacity and electrical characteristics suitable for the welding, and further, it shall be under a condition capable of adjusting the output smoothly.

The value of the welding current shall be indicated by the average value of the absolute values, as a rule.

- c) The welding torch shall have a required current-carrying capacity and durability, and be of excellent shielding characteristics, and it shall have a shape and size suitable for the working conditions. The electrode shall be fixed in the right position for the TIG welding and the welding wire (hereafter referred to as "wire") shall be capable of being supplied stably for the MIG welding.
- d) The accessory appliances such as wire feeder, control devices for shielding gas, etc. shall be so constructed that these appliances work normally.

4.5 Shielding gas The shielding gas to be used shall be argon gas, helium gas or their mixed gas corresponding to the welding method, plate thickness, welding position, etc.

The argon to be used shall be as specified in **JIS K 1105**.

4.6 Filler rod, wire and tungsten electrode The filler rod (hereafter referred to as "rod"), wire and tungsten electrode shall be as follows.

- a) The rod and wire shall be as specified in **JIS Z 3232** and **JIS Z 3263**, and they shall be able to produce a sound weld by taking into consideration the class of base metal, plate thickness and other required conditions.

The classes of rod and wire shall be selected in Table 1, but this selection may be changed as found necessary. The range of welding current for the wire diameter in MIG welding shall be as specified in Table 2.

Table 1 Guideline for selecting rods and wires by combination of base metal

Base metal	AC4D	AC4C ADC12	A7003 A7N01	A6061 A6N01 A6063 A6101	A5086 A5083 A5056	A5154 A5254 A5454	A5052 A5652	A5005 A5N01	A2219	A2014 A2017	A3004	A1200	A1100 A3003 A3203	A1070 A1050 A1070
A1070	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A1050	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A1100	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A3003	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A3203	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A1200	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A3004	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A2014	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A2017	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A2219	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5005	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5N01	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5052	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5652	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5154	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5254	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5454	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5086	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5083	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A5056	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A6061	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A6N01	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A6063	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A6101	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A7003	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
A7N01	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
AC4C	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
ADC12	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
AC4D	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)
AC7A	(X)	(X)	(X)(X)	(X)	(X)	(X)(X)	(X)	(X)(X)	(X)	(X)	(X)	(X)(X)	(X)(X)	(X)(X)

- Notes (1) A1100 or A1200 may be used.
 (2) A5356, A5556 or A5183 may be used.
 (3) A5654 or A5554 may be used.
 (4) A4043 may be used according to its use.
 (5) A4047 may be used.
 (6) BA4145 may be used.
 (7) When no difference in tone shall be produced after anodization, A5356 should preferably be used.
 (8) The filler metal having the same composition as that of the base metal may be used.
 (9) A2319 may be used.

- Remarks 1 These combinations are applied to the general structure at ordinary and low temperature service. However, when the service temperature possibly exceeds 65 °C, A5356, A5183, A5556 and A5654 should be avoided.
 2 The symbols BY and XY to indicate rod and wire are omitted.
 3 The symbols indicating shapes of malleable materials for base metal are omitted. However, they are applicable to any shape.
 4 BA4145 is specified in JIS Z 3263, but it is often effective as the filler metal of 2000-series alloy.

**Table 2 Wire diameter and range of welding current (DC)
for MIG welding**

Unit : A

Wire diameter (mm)	0.6	0.8	1.0	1.2	1.4	1.6	2.0
Range of welding current	20 to 50	40 to 100	70 to 180	110 to 250	130 to 310	150 to 350	200 to 430
Wire diameter (mm)	2.4	2.8	3.2 ⁽¹⁰⁾	4.0 ⁽¹⁰⁾	4.8 ⁽¹⁰⁾	5.6 ⁽¹⁰⁾	6.4 ⁽¹⁰⁾
Range of welding current	250 to 500	300 to 580	350 to 650	400 to 750	450 to 850	500 to 950	600 min.

Note ⁽¹⁰⁾ These values are used for MIG welding by a large electric current.

- b) The rod and wire shall be stored so that they are free from dew condensation and dirt.
- c) The tungsten electrode specified in **JIS Z 3233** shall be used and the range of welding current to the diameter of electrode shall be as specified in Table 3.

**Table 3 Range of welding current (AC) to diameter
of tungsten electrode**

Unit : A

Diameter of electrode (mm)	Range of welding current	
	Pure tungsten	Thoria-tungsten, lanthanum oxide tungsten and cerium oxide tungsten
1.0	10 to 60	20 to 80
1.6	20 to 100	30 to 130
2.0	40 to 130	50 to 180
2.4	50 to 160	60 to 220
3.2	100 to 210	110 to 290
4.0	150 to 270	170 to 360
4.8	200 to 350	220 to 450
5.0	200 to 350	220 to 450
6.4	250 to 450	—

5 Preparation of welding

5.1 Groove and groove processing The groove and groove processing shall be as follows.

- a) The groove shall be determined by taking into consideration the shape of joints, thickness, welding method, welding position, number of layers, existence of backing and back chipping, restriction of work, quality to be required, etc.

The representative grooves for plates are shown in Table 4, those for pipes are shown in Table 5, and those for the large electric current MIG welding and electrode negative (hereafter referred to as "DCEN") TIG welding of plates are shown in Table 6.