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JIS Z 3312 : 2009

(JWES/JSA)

**Solid wires for MAG and MIG
welding of mild steel, high strength
steel and low temperature service
steel**

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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 Welding Engineering Society (JWES)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS Z 3312 : 2006** is replaced with this Standard. Also, **JIS Z 3325 : 2008** is withdrawn and replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

Solid wires for MAG and MIG welding of mild steel, high strength steel and low temperature service steel

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 14341** published in 2002 and the first edition of **ISO 16834** published in 2006 with some modifications of the technical contents. **ISO 14341** is a combined standard of **EN 440** and the standard used around the Pacific Rim, and **ISO 16834** is a combined standard of **EN 12534** and the standard used around the Pacific Rim. Either or both of the standards may be applied to the specific global markets. According to this, this Standard gives requirements corresponding to the standards used in Pacific Rim (**ISO 14341 System B** and **ISO 16834 System B**) in the text, those corresponding to **EN 440** and **EN 12534**, and **ISO 14341 System A** in Annex A and those corresponding to **ISO 16834 System A** in Annex B.

The portions given sidelines or dotted underlines are the matters in which the contents of the corresponding International Standards have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies the solid wires (hereafter referred to as “wire”) for MAG welding and MIG welding of mild steel, high strength steel whose tensile strength is between 490 MPa grade and 830 MPa grade and low temperature service steel.

NOTE : The International Standards corresponding to this Standard are as follows.

ISO 14341: 2002 *Welding consumables— Wire electrodes and deposits for gas shielded metal arc welding of non alloy and fine grain steels—Classification*

ISO 16834: 2006 *Welding consumables— Wire electrodes, wires, rods and deposits for gas-shielded arc welding of high strength steels— Classification* (Overall evaluation: MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS G 0203 *Glossary of terms used in iron and steel (Products and quality)*

JIS G 0320 *Standard test method for heat analysis of steel products*

JIS G 3101 *Rolled steels for general structure*

JIS G 3106 *Rolled steels for welded structure*

JIS G 3126 *Carbon steel plates for pressure vessels for low temperature service*

JIS G 3127 *Nickel steel plates for pressure vessels for low temperature services*

JIS G 3136 *Rolled steels for building structure*

JIS Z 3001-1 *Welding and allied processes—Vocabulary—Part 1: General*

JIS Z 3001-2 *Welding and allied processes—Vocabulary—Part 2: Welding processes*

JIS Z 3111 *Methods of tension and impact tests for deposited metal*

NOTE : Corresponding International Standard: ISO 15792-1 *Welding consumables—Test methods—Part 1: Test methods for all-weld metal test specimens in steel, nickel and nickel alloys* (MOD)

JIS Z 3200 *Welding consumables—Technical delivery conditions for welding filler materials—Type of product, dimensions, tolerances and markings*

NOTE : Corresponding International Standard: ISO 544 *Welding consumables—Technical delivery conditions for welding filler materials—Type of product, dimensions, tolerances and markings* (MOD)

JIS Z 3253 *Shielding gases for arc welding and plasma arc cutting*

NOTE : Corresponding International Standard: ISO 14175 *Welding consumables—Shielding gases for arc welding and cutting* (MOD)

JIS Z 3423 *Procurement guidelines for welding consumables*

NOTE : Corresponding International Standard: ISO 14344 *Welding and allied processes—Flux and gas shielded electrical welding processes—Procurement guidelines for consumables* (MOD)

3 Terms and definitions

For the purposes of this Standard, the definitions given in **JIS Z 3001-1**, **JIS Z 3001-2** and **JIS G 0203** shall apply.

4 Classification and symbol indication method

The classification and symbol indication method shall be either of the following.

- a) The type of wire shall be classified according to the tensile property of deposited metal, existence of post-weld heat treatment, impact test temperature of deposited metal, Charpy absorbed energy level of deposited metal, type of shield gas and chemical composition of wire, and shall be in accordance with figure 1. The combination of mechanical properties of deposited metal (tensile property and impact property) and the chemical composition of wire shall be in accordance with table 1.

The types of mechanical properties for deposited metal may be classified according to the existence of post-weld heat treatment. Moreover, the types of mechanical properties may be classified according to the combination of shield gases.

- b) The type of wire shall be classified according to the chemical composition of wire, type of shield gas and mechanical properties of deposited metal, and shall be in accordance with table 2.

The indication of symbols shall be as follows.

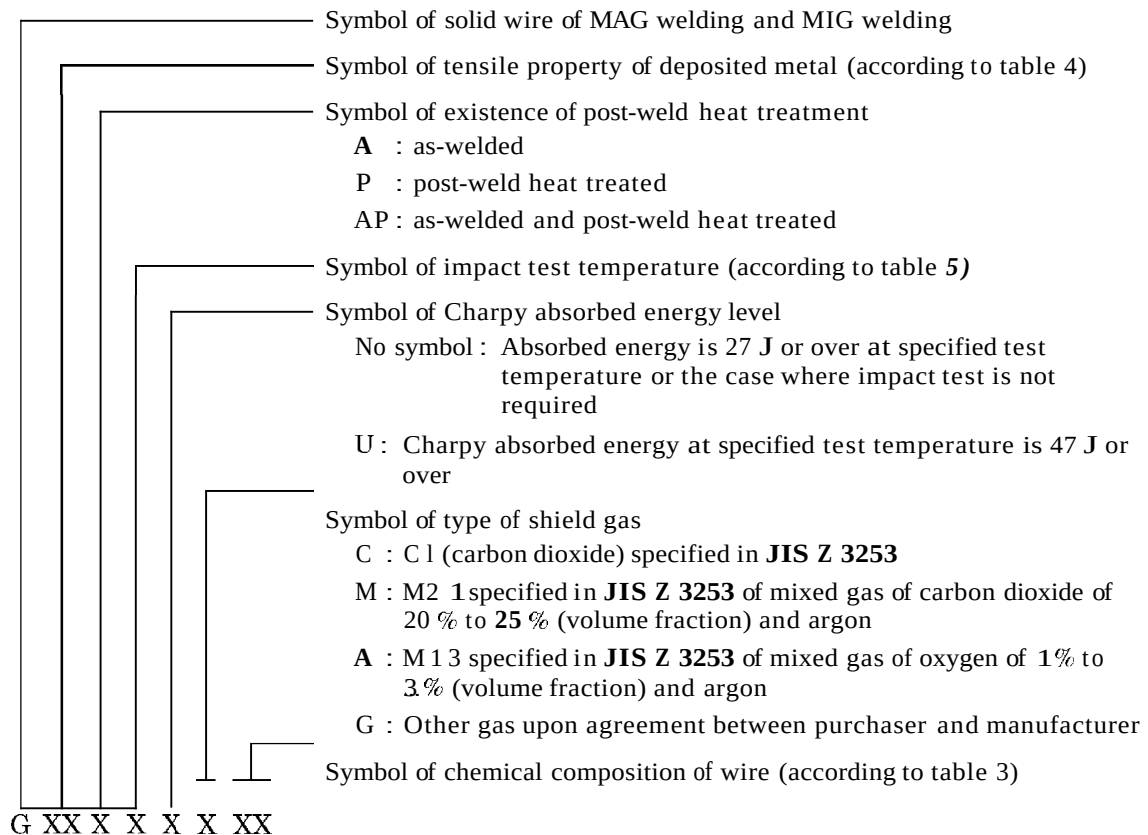
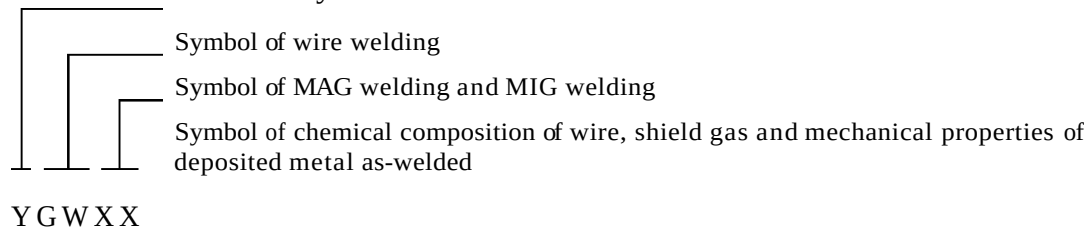


Figure 1 Classification and symbol indication method of wire [according to clause 4 a)]

Mechanical properties of deposited metal		Chemical composition of wire
Symbol of tensile property specified in table 4	Symbol of impact test temperature specified in table 5	Symbol of chemical composition of wire specified in table 3
43, 49, 55, 57	Y, 0, 2, 3, 4, 5, 6, 7, 8, 9, 10, Z	11, 12, 13, 14, 15, 16, 17, 18, 2, 3, 4, 6, 7, 1M3, 2M31, N1, N2, N3, N5, N7, N71, N9, 2M3, 3M1, 3M1T, 3M3T, 4M31, 4M3T, N1M2T, N2M1T, N2M2T, N2M3T, N2M4T, 0
<u>52^{a)}</u>	0	
<u>57J^{a)}</u>	1	
59, 62, 69, 76, 78, 83	Y, 0, 2, 3, 4, 5, 6	2M3, 3M1, 3M1T, 3M3T, 4M31, 4M3T, N1M2T, N2M1T, N2M2T, N2M3T, N2M4T, 3M3, 3M31, 4M3, C1M1T, N1M3, N2M3, N3C1M4T, N3M2, N4CM21T, N4CM22T, N4CM2T, N4M2, N4M3T, N4M4T, N5C1M3T, N5CM3T, N5M3, N5M3T, N6C1M4, N6C2M2T, N6C2M4, N6CM2T, N6CM3T, N7M4T, 0
<u>59J^{a)}</u>	1	
<u>78J^{a)}</u>	2	
Note ^{a)} 52, 57, 59J and 78J are applicable to the type of which the symbol of Charpy absorbed energy level is U.		

Table 2 Type of wire [according to clause 4 b)]

Type of wire	Symbol of chemical composition of wire ^{a)}	Shield gas	Mechanical properties of deposited metal ^{b)}				
			Tensile strength MPa	Proof stress ^{c)} MPa	Elongation %	Impact test temperature °C	Specified value of Charpy absorbed energy ^{d)} J
YGW11	11	C ^{e)}	490 to 670	400 min.	18min.	0	47 min.
YGW12	12			390 min.	18 min.	0	27 min.
YGW13	13					0	27 min.
YGW14	14		430 to 600	330 min.	20 min.	0	27 min.
YGW15	15	M ^{f)}	490 to 670	400 min.	18min.	− 20	47 min.
YGW16	16			390 min.	18 min.	− 20	27 min.
YGW17	17		430 to 600	330 min.	20 min.	− 20	27 min.
YGW18	J18	C ^{e)}	550 to 740	460 min.	17 min.	0	70 min.
YGW19	J19	M ^{f)}				0	47 min.
Notes ^{a)} The symbol of chemical composition of wire shall be in accordance with table 3. ^{b)} The test shall be carried out as-weld. ^{c)} When yielding occurs, it shall be the lower yield stress, and in other cases, it shall be 0.2 % proof stress. ^{d)} The number of impact test pieces shall be three, and the mean value thereof shall be evaluated. ^{e)} C : C1 (carbon dioxide) specified in JIS Z 3253 ^{f)} M : M2 1 specified in JIS Z 3253 of mixed gas of carbon dioxide of 20 % to 25 % (volume fraction) and argon							

5 Quality

5.1 Dimensions and tolerances of wire, and product condition

The dimensions and tolerances of wire, and product condition shall conform to the specification given in **JIS Z 3200**.

5.2 Chemical composition of wire

The chemical composition of wire shall conform to the specification given in table 3, when the chemical analysis test is carried out in accordance with the method of **6.2**.

Symbol of chemical composition of wire	Chemical composition ^{a), b)}											
	C	Si	Mn	P	S	Ni	Cr	Mo	Cu ^{e)}	Ti	Zr	Other compositions
11	0.02 to 0.15	0.55 to 1.10	1.40 to 1.90	0.030 max.	0.030 max.	—	—	—	0.50 max.	Ti + Zr : 0.02 to 0.30		—
12	0.02 to 0.15	0.50 to 1.00	1.25 to 2.00	0.030 max.	0.030 max.	—	—	—	0.50 max.	—	—	—
13	0.02 to 0.15	0.55 to 1.10	1.35 to 1.90	0.030 max.	0.030 max.	—	—	—	0.50 max.	Ti + Zr : 0.02 to 0.30		Al : 0.10 to 0.50
14	0.02 to 0.15	1.00 to 1.35	1.30 to 1.60	0.030 max.	0.030 max.	—	—	—	0.50 max.	—	—	—
15	0.02 to 0.15	0.40 to 1.00	1.00 to 1.60	0.030 max.	0.030 max.	—	—	—	0.50 max.	Ti + Zr : 0.02 to 0.15		—
16	0.02 to 0.15	0.40 to 1.00	0.90 to 1.60	0.030 max.	0.030 max.	—	—	—	0.50 max.	—	—	—
17	0.02 to 0.15	0.20 to 0.55	1.20 to 2.10	0.030 max.	0.030 max.	—	—	—	0.50 max.	—	—	—
18	0.02 to 0.15	0.50 to 1.10	1.60 to 2.40	0.030 max.	0.030 max.	—	—	—	0.50 max.	Ti + Zr : 0.02 to 0.30		—
J18 ^{d)}	0.15 max.	0.55 to 1.10	1.40 to 2.60	0.030 max.	0.030 max.	—	—	0.40 max.	0.50 max.	Ti + Zr : 0.30 max.		—
J19 ^{e)}	0.15 max.	0.40 to 1.00	1.40 to 2.00	0.030 max.	0.030 max.	—	—	0.40 max.	0.50 max.	Ti + Zr : 0.30 max.		—
2	0.07 max.	0.40 to 0.70	0.90 to 1.40	0.025 max.	0.030 max.	—	—	—	0.50 max.	0.05 to 0.15	0.02 to 0.12	Al : 0.05 to 0.15
3	0.06 to 0.15	0.45 to 0.75	0.90 to 1.40	0.025 max.	0.035 max.	—	—	—	0.50 max.	—	—	—
4	0.06 to 0.15	0.65 to 0.85	1.00 to 1.50	0.025 max.	0.035 max.	—	—	—	0.50 max.	—	—	—
6	0.06 to 0.15	0.80 to 1.15	1.40 to 1.85	0.025 max.	0.035 max.	—	—	—	0.50 max.	—	—	—
7	0.07 to 0.15	0.50 to 0.80	1.50 to 2.00	0.025 max.	0.035 max.	—	—	—	0.50 max.	—	—	—

Table 3 (continued)

Unit : % (mass fraction)

Symbol of chemical composition of wire	Chemical composition ^{a), b)}											
	C	Si	Mn	P	S	Ni	Cr	Mo	Cu ^{c)}	Ti	Zr	Other compositions
1M3	0.12 max.	0.30 to 0.70	1.30 max.	0.025 max.	0.025 max.	0.020		0.40 to 0.65	0.35 max.	—	—	—
2M3	0.12 max.	0.30 to 0.70	0.60 to 1.40	0.025 max.	0.025 max.	—	—	0.40 to 0.65	0.50 max.	—	—	—
2M31	0.12 max.	0.30 to 0.90	0.80 to 1.50	0.025 max.	0.025 max.	—	—	0.40 to 0.65	0.50 max.	—	—	—
3MI	0.05 to 0.15	0.40 to 1.00	1.40 to 2.10	0.025 max.	0.025 max.	—	—	0.10 to 0.45	0.50 max.	—	—	—
3M1T	0.12 max.	0.40 to 1.00	1.40 to 2.10	0.025 max.	0.025 max.	—	—	0.10 to 0.45	0.50 max.	0.02 to 0.30	—	—
3M3	0.12 max.	0.60 to 0.90	1.10 to 1.60	0.025 max.	0.025 max.	—	—	0.40 to 0.65	0.50 max.	—	—	—
3M31	0.12 max.	0.30 to 0.90	1.00 to 1.85	0.025 max.	0.025 max.	—	—	0.40 to 0.65	0.50 max.	—	—	—
3M3T	0.12 max.	0.40 to 1.00	1.00 to 1.80	0.025 max.	0.025 max.	—	—	0.40 to 0.65	0.50 max.	0.02 to 0.30	—	—
4M3	0.12 max.	0.30 max.	1.50 to 2.00	0.025 max.	0.025 max.	—	—	0.40 to 0.65	0.50 max.	—	—	—
4M3 1	0.07 to 0.12	0.50 to 0.80	1.60 to 2.10	0.025 max.	0.025 max.	—	—	0.40 to 0.60	0.50 max.	—	—	—
4M3T	0.12 max.	0.50 to 0.80	1.60 to 2.20	0.025 max.	0.025 max.			0.40 to 0.65	0.50 max.	0.02 to 0.30	—	—
N1	0.12 max.	0.20 to 0.50	1.25 max.	0.025 max.	0.025 max.	0.60 to		0.35 max.	0.35 max.	—	—	—
N2	0.12 max.	0.40 to 0.80	1.25 max.	0.025 max.	0.025 max.	0.80 to 1.10	0.15 max.	0.35 max.	0.35 max.	—	—	V : 0.05 max.
N3	0.12 max.	0.30 to 0.80	1.20 to 1.60	0.025 max.	0.025 max.	1.50 to 1.90	—	0.35 max.	0.35 max.	—	—	—
N5	0.12 max.	0.40 to 0.80	1.25 max.	0.025 max.	0.025 max.	2.00 to 2.75	—	—	0.35 max.	—	—	—
N7	0.12 max.	0.20 to 0.50	1.25 max.	0.025 max.	0.025 max.	3.00 to 3.75	—	0.35 max.	0.35 max.	—	—	—
N7 1	0.12 max.	0.40 to 0.80	1.25 max.	0.025 max.	0.025 max.	3.00 to 3.75	—	—	0.35 max.	—	—	—
N9	0.10 max.	0.50 max.	1.40 max.	0.025 max.	0.025 max.	4.00 to 4.75	—	0.35 max.	0.35 max.	—	—	—
N1M2T	0.12 max.	0.60 to 1.00	1.70 to 2.30	0.025 max.	0.025 max.	0.40 to 0.80	—	0.20 to 0.60	0.50 max.	0.20 to 0.30	—	—
N1M3	0.12 max.	0.20 to 0.80	1.00 to 1.80	0.025 max.	0.025 max.	0.30 to 0.90	—	0.40 to 0.65	0.50 max.	—	—	—

Table 3 (continued)

Unit: % (mass fraction)

Symbol of chemical composition of wire	Chemical composition ^{a), b)}											
			Mn	P	S	Ni	Cr	Mo	Cu ^{e)}	Ti	Zr	Other compositions
N2M1T	0.12	0.30 to	1.10 to 1.90	0.025 max.	0.025 max.	0.80 to 1.60	—	0.10 to 0.45	0.50 max.	3.02 to 0.30	—	—
N2M2T	1.05 to	0.30 to	1.00 to 1.80	0.025 max.	0.025 max.	0.70 to 1.20	—	0.20 to 0.60	0.50 max.	3.02 to 0.30	—	—
N2M3	0.12 max.	0.30 max.	1.10 to 1.60	0.025 max.	0.025 max.	0.80 to 1.20	—	0.40 to 0.65	0.50 max.	—	—	—
N2M3T	0.05 to 0.15	0.30 to 0.90	1.40 to 2.10	0.025 max.	0.025 max.	0.70 to 1.20	—	0.40 to 0.65	0.50 max.	3.02 to 0.30	—	—
N2M4T	0.12 max.	0.50 to 1.00	1.70 to 2.30	0.025 max.	0.025 max.	0.80 to 1.30	—	0.55 to 0.85	0.50 max.	3.02 to 0.30	—	—
N3M2	0.08 max.	0.20 to 0.55	1.25 to 1.80	0.010 max.	0.010 max.	1.40 to 2.10	0.30 max.	0.25 to 0.55	0.25 max.	0.10 max.	0.10 max.	V: 0.05 max. Al: 0.10 max.
N4M2	0.09 max.	0.20 to 0.55	1.40 to 1.80	0.010 max.	0.010 max.	1.90 to 2.60	0.50 max.	0.25 to 0.55	0.25 max.	0.10 max.	0.10 max.	V: 0.04 max. Al: 0.10 max.
N4M3T	0.12 max.	0.45 to 0.90	1.40 to 1.90	0.025 max.	0.025 max.	1.50 to 2.10	—	0.40 to 0.65	0.50 max.	0.01 to 0.30	—	—
N4M4T	0.12 max.	0.40 to 0.90	1.60 to 2.10	0.025 max.	0.025 max.	1.90 to 2.50	—	0.40 to 0.90	0.50 max.	3.02 to 0.30	—	—
N5M3	0.10 max.	0.25 to 0.60	1.40 to 1.80	0.010 max.	0.010 max.	2.00 to 2.80	0.60 max.	0.30 to 0.65	0.25 max.	0.10 max.	0.10 max.	V: 0.03 max. Al: 0.10 max.
N5M3T	0.12 max.	0.40 to 0.90	1.40 to 2.00	0.025 max.	0.025 max.	2.40 to 3.10	—	0.40 to 0.70	0.50 max.	0.02 to 0.30	—	—
N7M4T	0.12 max.	0.30 to 0.70	1.30 to 1.70	0.025 max.	0.025 max.	3.20 to 3.80	0.30 max.	0.60 to 0.90	0.50 max.	0.02 to 0.30	—	—
C1M1T	0.02 to 0.15	0.50 to 0.90	1.10 to 1.60	0.025 max.	0.025 max.	—	3.30 to 0.60	0.10 to 0.45	0.40 max.	3.02 to 0.30	—	—
N3C1M4T	0.12 max.	0.35 to 0.75	1.25 to 1.70	0.025 max.	0.025 max.	1.30 to 1.80	3.30 to 0.60	0.50 to 0.75	0.50 max.	3.02 to 0.30	—	—
N4CM2T	0.12 max.	0.20 to 0.60	1.30 to 1.80	0.025 max.	0.025 max.	1.50 to 2.10	3.20 to 0.50	0.30 to 0.60	0.50 max.	3.02 to 0.30	—	—
N4CM21T	0.12 max.	0.20 to 0.70	1.10 to 1.70	0.025 max.	0.025 max.	1.80 to 2.30	3.05 to 0.35	0.25 to 0.60	0.50 max.	3.02 to 0.30	—	—
N4CM22T	0.12 max.	0.65 to 0.95	1.90 to 2.40	0.025 max.	0.025 max.	2.00 to 2.30	3.10 to 0.30	0.35 to 0.55	0.50 max.	3.02 to 0.30	—	—