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(JWES/JSA)

**Solid wire electrodes, wires and
rods for gas-shielded arc welding
of molybdenum steel and chromium
molybdenum 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 3317:2007** is replaced with this Standard.

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Solid wire electrodes, wires and rods for gas-shielded arc welding of molybdenum steel and chromium molybdenum steel

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 21952** published in 2007 with some modifications of the technical contents. **ISO 21952** is a combined standard of **EN 12070** 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 21952** System B) in the text, and those corresponding to **EN 12070** (**ISO 21952** System A) in Annex A for information.

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

1 Scope

This Standard specifies the solid rods and solid wires (hereafter generically referred to as “filler metals”) used for TIG welding, and solid wires used for MAG welding and MIG welding of molybdenum steel and chromium molybdenum steel.

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows:

ISO 21952:2007 *Welding consumables—Wire electrodes, wires, rods and deposits for gas-shielded arc welding of creep-resisting steels—Classification* (MOD)

The symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

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 3103 *Carbon steel and molybdenum alloy steel plates for boilers and pressure vessels*

JIS G 4109 *Chromium-molybdenum alloy steel plates for boilers and pressure vessels*

JIS G 4110 *High strength chromium-molybdenum and chromium-molybdenum-vanadium alloy steel plates for pressure vessels under high-temperature service*

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 fusion welding and thermal cutting*

NOTE : Corresponding International Standard: ISO 14175 *Welding consumables—Gases and gas mixtures for fusion welding and allied processes* (MOD)

JIS Z 3423 *Procurement guidelines for welding consumables*

NOTE : Corresponding International Standard: ISO 14344 *Welding consumables—Procurement of filler materials and fluxes* (MOD)

3 Terms and definitions

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

3.1 solid rods

solid rods with homogenous cross-section used for TIG welding

3.2 solid wires

solid wires used for TIG welding

3.3 filler metals

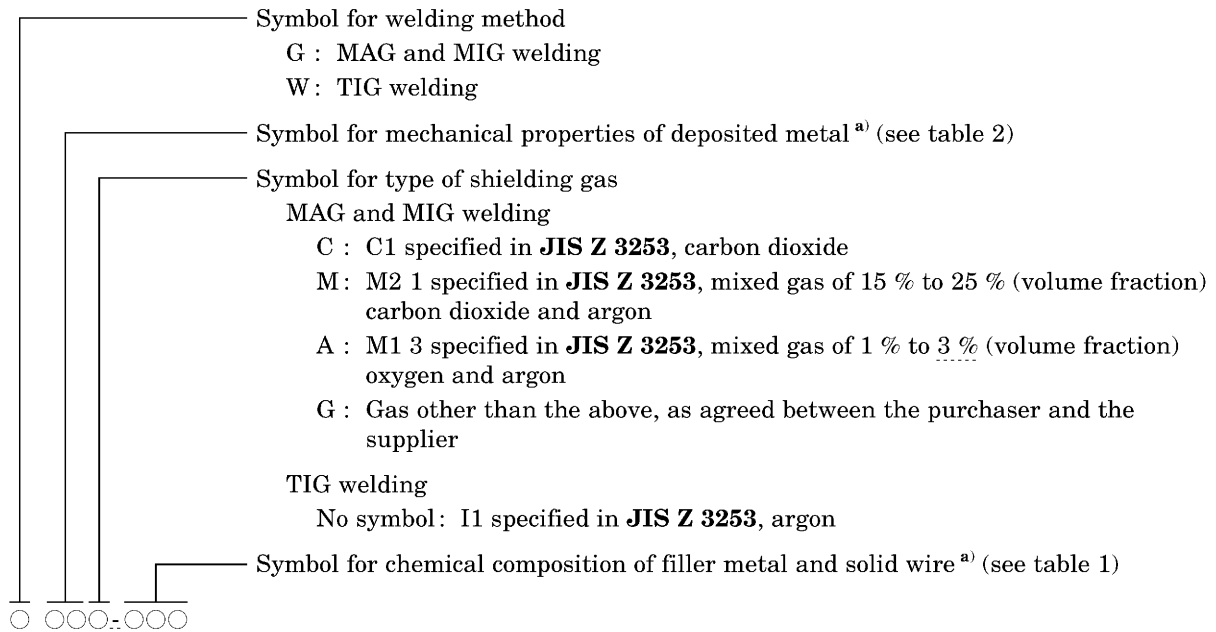
solid rods and solid wires used for TIG welding

3.4 solid wires

solid wires used for MAG welding and MIG welding

4 Classification and designation by symbols

The filler metals and solid wires are classified according to the welding method, mechanical properties of the deposited metal, the type of shielding gas and chemical composition, and designated by symbols as shown in figure 1.



Note ^{a)} Combination of symbols for mechanical properties of deposited metal and symbols for chemical composition of filler metals and solid wires is shown in table 2.

Figure 1 Designation of type of filler metals and solid wires by symbols

5 Quality

5.1 Dimensions, dimensional tolerances and product conditions of filler metals and solid wires

Dimensions, dimensional tolerances and product conditions shall comply with **JIS Z 3200**.

5.2 Chemical composition of filler metals and solid wires

The chemical composition of the filler metal and solid wire, when tested by the chemical analysis described in **6.2**, shall comply with the requirements in table 1.

Table 1 Chemical composition of filler metals and solid wires

Unit: % (mass fraction)

Symbol for chemical composition of filler metal and solid wire	Chemical composition ^{a), b)}										
	C	Si	Mn	P	S	Ni	Cr	Mo	Cu ^{c)}	V	Other elements
1M3	0.12 max.	0.30 to 0.70	1.30 max.	0.025 max.	0.025 max.	0.20 max.	—	0.40 to 0.65	0.35 max.	—	—
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.	—	—
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.	—	Ti 0.02 to 0.30
CM	0.12 max.	0.10 to 0.40	0.20 to 1.00	0.025 max.	0.025 max.	—	0.40 to 0.90	0.40 to 0.65	0.40 max.	—	—
CMT	0.12 max.	0.30 to 0.90	1.00 to 1.80	0.025 max.	0.025 max.	—	0.30 to 0.70	0.40 to 0.65	0.40 max.	—	Ti 0.02 to 0.30
1CM	0.07 to 0.12	0.40 to 0.70	0.40 to 0.70	0.025 max.	0.025 max.	0.20 max.	1.20 to 1.50	0.40 to 0.65	0.35 max.	—	—
1CM1	0.12 max.	0.20 to 0.50	0.60 to 0.90	0.025 max.	0.025 max.	—	1.00 to 1.60	0.30 to 0.65	0.40 max.	—	—
1CM1J	0.05 to 0.15	0.10 to 0.40	0.70 to 1.00	0.025 max.	0.025 max.	—	1.00 to 1.60	0.30 to 0.65	0.40 max.	—	—
1CM2	0.05 to 0.15	0.15 to 0.40	1.60 to 2.00	0.025 max.	0.025 max.	—	1.00 to 1.60	0.40 to 0.65	0.40 max.	—	—
1CM3	0.12 max.	0.30 to 0.90	0.80 to 1.50	0.025 max.	0.025 max.	—	1.00 to 1.60	0.40 to 0.65	0.40 max.	—	—
1CML	0.05 max.	0.40 to 0.70	0.40 to 0.70	0.025 max.	0.025 max.	0.20 max.	1.20 to 1.50	0.40 to 0.65	0.35 max.	—	—
1CML1	0.05 max.	0.20 to 0.80	0.80 to 1.40	0.025 max.	0.025 max.	—	1.00 to 1.60	0.40 to 0.65	0.40 max.	—	—
1CMT	0.05 to 0.15	0.30 to 0.90	0.80 to 1.50	0.025 max.	0.025 max.	—	1.00 to 1.60	0.40 to 0.65	0.40 max.	—	Ti 0.02 to 0.30
1CMT1	0.12 max.	0.30 to 0.90	1.20 to 1.90	0.025 max.	0.025 max.	—	1.00 to 1.60	0.40 to 0.65	0.40 max.	—	Ti 0.02 to 0.30
2C1M	0.07 to 0.12	0.40 to 0.70	0.40 to 0.70	0.025 max.	0.025 max.	0.20 max.	2.30 to 2.70	0.90 to 1.20	0.35 max.	—	—
2C1M1	0.05 to 0.15	0.10 to 0.50	0.30 to 0.60	0.025 max.	0.025 max.	—	2.10 to 2.70	0.85 to 1.20	0.40 max.	—	—
2C1M2	0.05 to 0.15	0.60 max.	0.50 to 1.20	0.025 max.	0.025 max.	—	2.10 to 2.70	0.85 to 1.20	0.40 max.	—	—
2C1M3	0.12 max.	0.30 to 0.90	0.75 to 1.50	0.025 max.	0.025 max.	—	2.10 to 2.70	0.90 to 1.20	0.40 max.	—	—
2C1ML	0.05 max.	0.40 to 0.70	0.40 to 0.70	0.025 max.	0.025 max.	0.20 max.	2.30 to 2.70	0.90 to 1.20	0.35 max.	—	—
2C1ML1	0.05 max.	0.30 to 0.90	0.80 to 1.40	0.025 max.	0.025 max.	—	2.10 to 2.70	0.90 to 1.20	0.40 max.	—	—

Table 1 (continued)

Unit: % (mass fraction)

Symbol for chemical composition of filler metal and solid wire	Chemical composition ^{a), b)}										
	C	Si	Mn	P	S	Ni	Cr	Mo	Cu ^{c)}	V	Other elements
2C1MV	0.05 to 0.15	0.10 to 0.50	0.20 to 1.00	0.025 max.	0.025 max.	—	2.10 to 2.70	0.85 to 1.20	0.40 max.	0.15 to 0.50	—
2C1MV1	0.12 max.	0.10 to 0.70	0.80 to 1.60	0.025 max.	0.025 max.	—	2.10 to 2.70	0.90 to 1.20	0.40 max.	0.15 to 0.50	—
2C1MT	0.05 to 0.15	0.35 to 0.80	0.75 to 1.50	0.025 max.	0.025 max.	—	2.10 to 2.70	0.90 to 1.20	0.40 max.	—	Ti 0.02 to 0.30
2C1MT1	0.04 to 0.12	0.20 to 0.80	1.60 to 2.30	0.025 max.	0.025 max.	—	2.10 to 2.70	0.90 to 1.20	0.40 max.	—	Ti 0.02 to 0.30
2CMWV	0.12 max.	0.10 to 0.70	0.20 to 1.00	0.020 max.	0.010 max.	—	2.00 to 2.60	0.40 to 0.65	0.40 max.	0.10 to 0.50	Nb 0.01 to 0.08 W 1.00 to 2.00
2CMWV -Ni	0.12 max.	0.10 to 0.70	0.80 to 1.60	0.020 max.	0.010 max.	0.30 to 1.00	2.00 to 2.60	0.05 to 0.30	0.40 max.	0.10 to 0.50	Nb 0.01 to 0.08 W 1.00 to 2.00
3C1M	0.12 max.	0.10 to 0.70	0.50 to 1.20	0.025 max.	0.025 max.	—	2.75 to 3.75	0.90 to 1.20	0.40 max.	—	—
3C1MV	0.05 to 0.15	0.50 max.	0.20 to 1.00	0.025 max.	0.025 max.	—	2.75 to 3.75	0.90 to 1.20	0.40 max.	0.15 to 0.50	—
3C1MV1	0.12 max.	0.10 to 0.70	0.80 to 1.60	0.025 max.	0.025 max.	—	2.75 to 3.75	0.90 to 1.20	0.40 max.	0.15 to 0.50	—
5CM	0.10 max.	0.50 max.	0.40 to 0.70	0.025 max.	0.025 max.	0.60 max.	4.50 to 6.00	0.45 to 0.65	0.35 max.	—	—
9C1M	0.10 max.	0.50 max.	0.40 to 0.70	0.025 max.	0.025 max.	0.50 max.	8.00 to 10.50	0.80 to 1.20	0.35 max.	—	—
9C1MV	0.07 to 0.13	0.15 to 0.50	1.20 max.	0.010 max.	0.010 max.	0.80 max.	8.00 to 10.50	0.85 to 1.20	0.20 max.	0.15 to 0.30	Nb 0.02 to 0.10 Al 0.04 max. N 0.03 to 0.07 Mn+Ni 1.50 max.
9C1MV1	0.12 max.	0.50 max.	0.50 to 1.25	0.025 max.	0.025 max.	0.10 to 0.80	8.00 to 10.50	0.80 to 1.20	0.40 max.	0.10 to 0.35	Nb 0.01 to 0.12 N 0.01 to 0.05
9C1MV2	0.12 max.	0.10 to 0.60	1.20 to 1.90	0.025 max.	0.025 max.	0.20 to 1.00	8.00 to 10.50	0.80 to 1.20	0.40 max.	0.15 to 0.50	Nb 0.01 to 0.12 N 0.01 to 0.05
9C1MV2J	0.12 max.	0.10 to 0.60	1.20 to 1.90	0.025 max.	0.025 max.	0.20 to 1.00	8.00 to 10.50	0.80 to 1.20	0.40 max.	0.15 to 0.50	Nb 0.01 to 0.12 N 0.02 to 0.07
10CMV	0.05 to 0.15	0.10 to 0.70	0.20 to 1.00	0.025 max.	0.025 max.	0.30 to 1.00	9.00 to 11.50	0.40 to 0.65	0.40 max.	0.10 to 0.50	Nb 0.04 to 0.16 N 0.02 to 0.07
10CMWV -Co	0.12 max.	0.10 to 0.70	0.20 to 1.00	0.020 max.	0.020 max.	0.30 to 1.00	9.00 to 11.50	0.20 to 0.55	0.40 max.	0.10 to 0.50	Co 0.80 to 1.20 Nb 0.01 to 0.08 W 1.00 to 2.00 N 0.02 to 0.07