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**Covered electrodes for molybdenum steel
and chromium molybdenum steel**

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In the event of any doubts arising as to the contents,
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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 3223 : 2006 is replaced with this Standard.

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Covered electrodes for molybdenum steel and chromium molybdenum steel

Introduction

This Japanese Industrial Standard has been prepared based on the second edition of ISO 3580 published in 2004 with some modifications of the technical contents. ISO 3580 is a combined standard of EN 1599 and the standard used around the Pacific Rim, and either of them may be used in different global markets. According to this, this Standard gives requirements corresponding to the Pacific Rim (System B of ISO 3580) in the text, and those of EN 1599 (System A of ISO 3580) in Annex A.

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 covered electrodes used after the execution of the post weld heat treatment for the ferritic and martensitic creep-resisting molybdenum steel and chromium molybdenum steel of low alloy steel (hereafter referred to as "electrodes").

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

ISO 3580:2004 *Welding consumables—Covered electrodes for manual metal arc welding of creep-resisting steels—Classification (MOD)*

In addition, 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 0321 *Product analysis and its tolerance for wrought steel*

JIS G 3101 *Rolled steels for general structure*

JIS G 3106 *Rolled steels for welded 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 3011 *Welding position defined by means of angles of slope and rotation*

NOTE : Corresponding International Standard : ISO 6947 *Welds—Working positions—Definitions of angles of slope and rotation* (MOD)

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 3118 *Method for measurement of amount of hydrogen evolved from steel welds*

NOTE : Corresponding International Standard : ISO 3690 *Welding and allied processes—Determination of hydrogen content in ferritic steel arc weld metal* (MOD)

JIS Z 3181 *Method of fillet weld test for welding consumables*

NOTE : Corresponding International Standard : ISO 15792-3 *Welding consumables—Test methods—Part 3: Classification testing of positional capacity and root penetration of welding consumables in a fillet weld* (MOD)

JIS Z 3184 *Method of preparing deposited metal pad and samples for chemical analysis*

NOTE : Corresponding International Standard : ISO 6847 *Welding consumables—Deposition of a weld metal pad for chemical analysis* (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 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)

JIS Z 8401 *Guide to the rounding of numbers*

NOTE : Corresponding International Standard : ISO 31-0:1992 *Quantities and units—Part 0: General principles* (MOD)

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in JIS Z 3001-1 and JIS Z 3001-2 apply.

4 Classification and symbol indication method

The electrodes shall be classified according to the mechanical properties of deposited metal, type of coating flux and chemical composition of deposited metal as specified in figure 1. Also, the classification according to the hydrogen content in deposited metal may be added.

There are limitations for the combination of the mechanical properties of deposited metal, the type of coating flux and the chemical composition of deposited metal, and all available types are as specified in table 3.

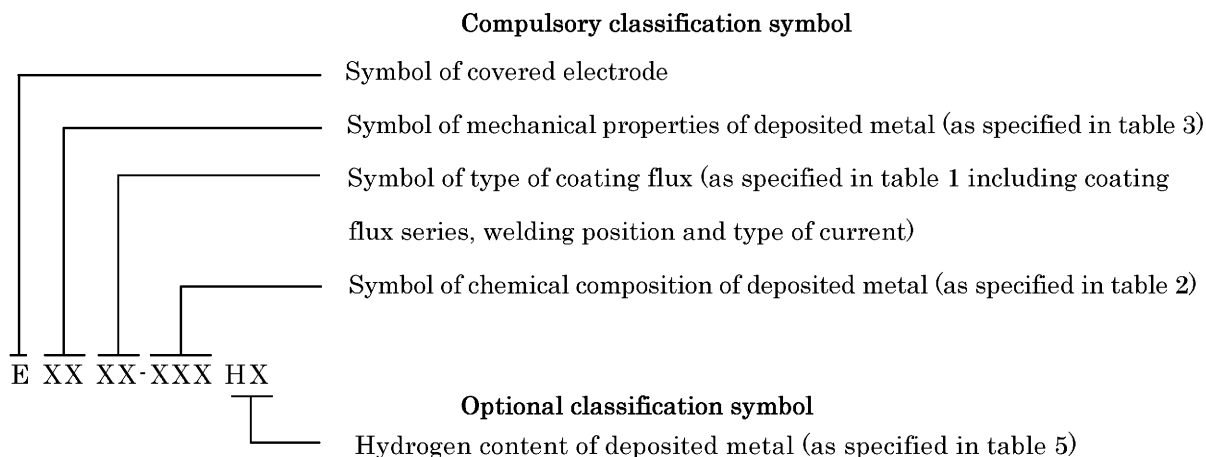


Figure 1 Symbol indication method for classification of electrode

Table 1 Type of coating flux

Symbol	Coating flux series	Welding position ^{a)}	Type of current ^{b)}
10 ^{c)}	High cellulose	All positions	DC (+)
11 ^{c)}	High cellulose	All positions	AC and/or DC (+)
13 ^{d)}	High titanium oxide	All positions ^{e)}	AC and/or DC (±)
15	Low hydrogen	All positions ^{e)}	DC (+)
16	Low hydrogen	All positions ^{e)}	AC and/or DC (+)
18	Iron-powder low hydrogen	All position except PG	AC and/or DC (+)
19 ^{c)}	Ilmenite	All positions ^{e)}	AC and/or DC (±)
20 ^{c)}	Iron oxide	PA and PB	AC and/or DC (–)
27 ^{c)}	Iron-powder iron oxide	PA and PB	AC and/or DC (–)

Notes ^{a)} The welding position shall be in accordance with JIS Z 3011. PA : flat, PB : horizontal vertical, PG : vertical downward

^{b)} The meaning of symbol used for type of current shall be as follows.

AC: Alternating current, DC (+) : Electrode positive, DC (–) : Electrode negative, DC (±) : Electrode positive and electrode negative

^{c)} The relevant coating flux shall only be applicable to the deposited metal of which the symbol of chemical composition is 1M3.

^{d)} The relevant coating flux shall only be applicable to E5513-1CM and E6213-2C1M.

^{e)} The application of PG is not essential but according to the specification by the manufacturer.

5 Quality

5.1 Dimensions, tolerances and product conditions of electrode

The dimensions, tolerances and product conditions of electrode shall conform to the requirements of JIS Z 3200.

5.2 Chemical composition of deposited metal

The chemical composition of deposited metal shall conform to the requirements specified in table 2, when the chemical analysis test is carried out in accordance with the method of 6.2.

Table 2 Chemical composition of deposited metal

Unit : % (mass fraction)

Symbol	Chemical composition ^{a) b) c)}								
	C	Si	Mn	P	S	Cr	Mo	V	Others
1M3	0.12 max.	0.80 max.	1.00 max.	0.030 max.	0.030 max.	—	0.40 to 0.65	—	—
CM	0.05 to 0.12	0.80 max.	0.90 max.	0.030 max.	0.030 max.	0.40 to 0.65	0.40 to 0.65	—	—
C1M	0.07 to 0.15	0.30 to 0.60	0.40 to 0.70	0.030 max.	0.030 max.	0.40 to 0.60	1.00 to 1.25	0.05 max.	—
1CM	0.05 to 0.12	0.80 max.	0.90 max.	0.030 max.	0.030 max.	1.00 to 1.50	0.40 to 0.65	—	—
1CML	0.05 max.	1.00 max.	0.90 max.	0.030 max.	0.030 max.	1.00 to 1.50	0.40 to 0.65	—	—
2C1M	0.05 to 0.12	1.00 max.	0.90 max.	0.030 max.	0.030 max.	2.00 to 2.50	0.90 to 1.20	—	—
2C1ML	0.05 max.	1.00 max.	0.90 max.	0.030 max.	0.030 max.	2.00 to 2.50	0.90 to 1.20	—	—
2CML	0.05 max.	1.00 max.	0.90 max.	0.030 max.	0.030 max.	1.75 to 2.25	0.40 to 0.65	—	—
<u>2CMWV</u>	<u>0.03 to 0.12</u>	<u>0.60 max.</u>	<u>0.40 to 1.50</u>	<u>0.030 max.</u>	<u>0.030 max.</u>	<u>2.00 to 2.60</u>	<u>0.05 to 0.30</u>	<u>0.15 to 0.30</u>	<u>Nb 0.010 to 0.050 W 1.00 to 2.00</u>
<u>2CMWV-Ni</u>	<u>0.03 to 0.13</u>	<u>0.30 to 0.90</u>	<u>0.40 to 1.50</u>	<u>0.030 max.</u>	<u>0.030 max.</u>	<u>1.90 to 2.60</u>	<u>0.20 max.</u>	<u>0.10 to 0.40</u>	<u>Nb 0.010 to 0.060 W 1.00 to 2.00 Ni 0.70 to 1.20</u>
2C1MV	0.05 to 0.15	0.60 max.	0.40 to 1.50	0.030 max.	0.030 max.	2.00 to 2.60	0.90 to 1.20	0.20 to 0.40	Nb 0.010 to 0.050
3C1MV	0.05 to 0.15	0.60 max.	0.40 to 1.50	0.030 max.	0.030 max.	2.60 to 3.40	0.90 to 1.20	0.20 to 0.40	Nb 0.010 to 0.050
5CM	0.05 to 0.10	0.90 max.	1.00 max.	0.030 max.	0.030 max.	4.0 to 6.0	0.45 to 0.65	—	Ni 0.40 max.
5CML	0.05 max.	0.90 max.	1.00 max.	0.030 max.	0.030 max.	4.0 to 6.0	0.45 to 0.65	—	Ni 0.40 max.
9C1M	0.05 to 0.10	0.90 max.	1.00 max.	0.030 max.	0.030 max.	8.0 to 10.5	0.85 to 1.20	—	Ni 0.40 max.
9C1ML	0.05 max.	0.90 max.	1.00 max.	0.030 max.	0.030 max.	8.0 to 10.5	0.85 to 1.20	—	Ni 0.40 max.
9C1MV	0.08 to 0.13	0.30 max.	<u>1.20 max.</u>	0.01 max.	0.01 max.	8.0 to 10.5	0.85 to 1.20	0.15 to 0.30	Ni <u>0.80 max.</u> <u>(Mn + Ni) 1.50 max.</u> Cu 0.25 max. Al 0.04 max. Nb 0.02 to 0.10 N 0.02 to 0.07