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Stainless steel covered electrodes

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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 3221** : 2003 is replaced with this Standard.

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Stainless steel covered electrodes

Introduction

This Japanese Industrial Standard has been prepared based on the second edition of **ISO 3581** published in 2003 with some modifications of the technical contents. **ISO 3581** is a combined standard of **EN 1600** 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 3581**) in the text, and those of **EN 1600** (system A in **ISO 3581**) in Annex JA.

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 JB.

1 Scope

This Standard specifies the stainless steel covered electrodes (hereafter referred to as “electrodes”) which generate the deposited metal of not less than 11 % of chromium (mass fraction) and not more than 37 % of nickel (mass fraction).

NOTE : The International Standard corresponding to this Standard is as follows.

ISO 3581:2003 *Welding consumables—Covered electrodes for manual metal arc welding of stainless and heat-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**.

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 0320 *Standard test methods for heat analysis of steel products*

JIS G 1201 *Iron and steel—General rules for analytical methods*

JIS G 3101 *Rolled steels for general structure*

JIS G 3106 *Rolled steels for welded structure*

JIS G 4304 *Hot-rolled stainless steel plates, sheet and strip*

JIS G 4305 *Cold-rolled stainless steel plate, sheet and strip*

JIS Z 2611 *General rules for photoelectric emission spectrochemical analysis of metal materials*

JIS Z 2615 *General rules for determination of carbon in metallic materials*

JIS Z 3001 *Welding terms*

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 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)

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in **JIS Z 3001** and the following apply.

3.1 test plate

base metal before the completion of welding used for the test (see **JIS Z 3111**)

3.2 test portion

that after welding from which the test specimen is taken (see **JIS Z 3111**)

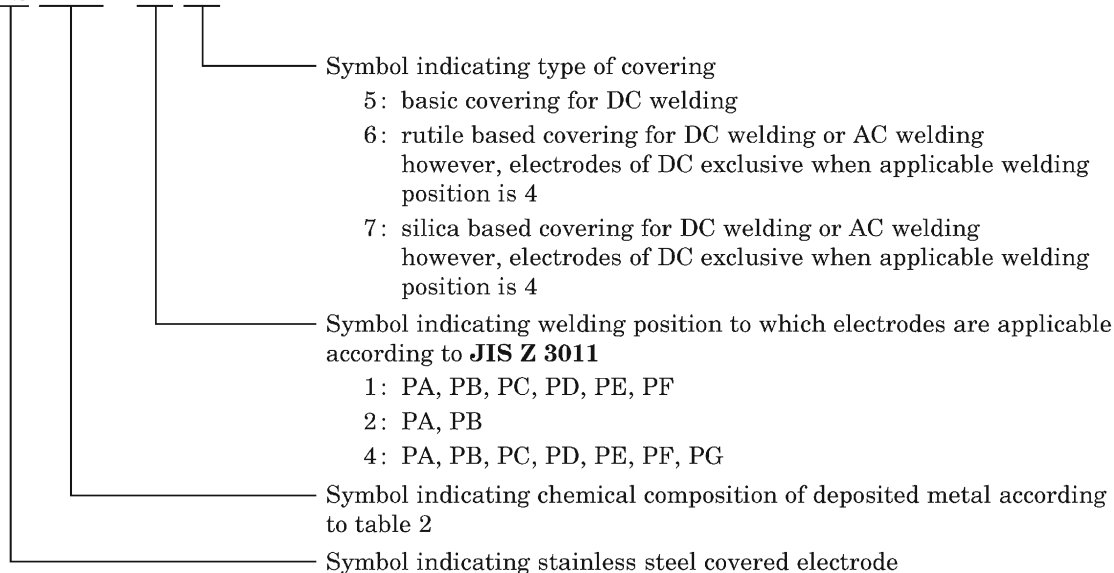
3.3 test specimen

that taken from the test portion and machined to the specified shape and dimension (see **JIS Z 3111**)

4 Classification

The electrodes shall be classified according to the chemical composition of deposited metal, applicable welding position and type of covering. The symbol indicating the classification of electrodes shall be as follows.

ES XXX – X1 X2



5 Quality

5.1 Dimensions and tolerances thereof of electrodes and product conditions

The dimensions and tolerances thereof of electrodes and product conditions shall be as follows.

- a) The dimensions and tolerances thereof of electrodes and product conditions shall conform to clause 4 and clause 5 of **JIS Z 3200**.
- b) The typical dimensions of electrodes shall be as given in table 1.
- c) Items other than **a)** and **b)** shall be subjected to the agreement between the parties concerned with delivery.

Table 1 Typical dimensions of electrodes

Unit: mm

Diameter	Length				
1.6	200	250			
2.0	200	250			
2.6		250	300	350	
3.2			300	350	400
4.0				350	400
5.0				350	400
6.0				350	400

5.2 Chemical composition of deposited metal

The chemical composition of deposited metal, when tested in accordance with the method in 6.2, shall conform to the specifications given in table 2.

Table 2 Chemical composition of deposited metal

Unit: % (mass fraction)

Symbol indicating chemical composition	Chemical composition ^{a)}										
	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N	Others
209	0.06 max.	1.00 max.	4.0 to 7.0	0.04 max.	0.03 max.	9.5 to 12.0	20.5 to 24.0	1.5 to 3.0	0.75 max.	0.10 to 0.30	V 0.10 to 0.30
219	0.06 max.	1.00 max.	8.0 to 10.0	0.04 max.	0.03 max.	5.5 to 7.0	19.0 to 21.5	0.75 max.	0.75 max.	0.10 to 0.30	—
240	0.06 max.	1.00 max.	10.5 to 13.5	0.04 max.	0.03 max.	4.0 to 6.0	17.0 to 19.0	0.75 max.	0.75 max.	0.10 to 0.30	—
307	0.04 to 0.14	1.00 max.	3.30 to 4.75	0.04 max.	0.03 max.	9.0 to 10.7	18.0 to 21.5	0.5 to 1.5	0.75 max.	—	—
308	0.08 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	9.0 to 11.0	18.0 to 21.0	0.75 max.	0.75 max.	—	—
308L	0.04 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	9.0 to 12.0	18.0 to 21.0	0.75 max.	0.75 max.	—	—
308H	0.04 to 0.08	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	9.0 to 11.0	18.0 to 21.0	0.75 max.	0.75 max.	—	—
308N2	0.10 max.	0.90 max.	1.00 to 4.00	0.040 max.	0.030 max.	7.0 to 11.0	20.0 to 25.0	—	—	0.12 to 0.30	—
308Mo	0.08 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	9.0 to 12.0	18.0 to 21.0	2.0 to 3.0	0.75 max.	—	—
308MoJ	0.08 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	9.0 to 12.0	18.0 to 21.0	2.0 to 3.0	0.75 max.	—	—
308LMo	0.04 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	9.0 to 12.0	18.0 to 21.0	2.0 to 3.0	0.75 max.	—	—
309	0.15 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	12.0 to 14.0	22.0 to 25.0	0.75 max.	0.75 max.	—	—
309L	0.04 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	12.0 to 14.0	22.0 to 25.0	0.75 max.	0.75 max.	—	—
309Mo	0.12 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	12.0 to 14.0	22.0 to 25.0	2.0 to 3.0	0.75 max.	—	—
309LMo	0.04 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	12.0 to 14.0	22.0 to 25.0	2.0 to 3.0	0.75 max.	—	—
309Nb	0.12 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	12.0 to 14.0	22.0 to 25.0	0.75 max.	0.75 max.	—	Nb 0.70 to 1.00
309LNb	0.04 max.	1.00 max.	0.5 to 2.5	0.040 max.	0.030 max.	12.0 to 14.0	22.0 to 25.0	0.75 max.	0.75 max.	—	Nb 0.70 to 1.00
310	0.08 to 0.20	0.75 max.	1.0 to 2.5	0.03 max.	0.03 max.	20.0 to 22.5	25.0 to 28.0	0.75 max.	0.75 max.	—	—
310H	0.35 to 0.45	0.75 max.	1.0 to 2.5	0.03 max.	0.03 max.	20.0 to 22.5	25.0 to 28.0	0.75 max.	0.75 max.	—	—

Table 2 (continued)

Unit: % (mass fraction)

Symbol indicating chemical composition	Chemical composition ^{a)}										
	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N	Others
310Mo	0.12 max.	0.75 max.	1.0 to 2.5	0.03 max.	0.03 max.	20.0 to 22.0	25.0 to 28.0	2.0 to 3.0	0.75 max.	—	—
310Nb	0.12 max.	0.75 max.	1.0 to 2.5	0.03 max.	0.03 max.	20.0 to 22.0	25.0 to 28.0	0.75 max.	0.75 max.	—	Nb 0.70 to 1.00
312	0.15 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	8.0 to 10.5	28.0 to 32.0	0.75 max.	0.75 max.	—	—
316	0.08 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	11.0 to 14.0	17.0 to 20.0	2.0 to 3.0	0.75 max.	—	—
316L	0.04 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	11.0 to 14.0	17.0 to 20.0	2.0 to 3.0	0.75 max.	—	—
316H	0.04 to 0.08	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	11.0 to 14.0	17.0 to 20.0	2.0 to 3.0	0.75 max.	—	—
316LCu	0.04 max.	1.00 max.	0.5 to 2.5	0.040 max.	0.030 max.	11.0 to 16.0	17.0 to 20.0	1.20 to 2.75	1.00 to 2.50	—	—
317	0.08 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	12.0 to 14.0	18.0 to 21.0	3.0 to 4.0	0.75 max.	—	—
317L	0.04 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	12.0 to 14.0	18.0 to 21.0	3.0 to 4.0	0.75 max.	—	—
318	0.08 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	11.0 to 14.0	17.0 to 20.0	2.0 to 3.0	0.75 max.	—	Nb 6 × C to 1.00
320	0.07 max.	0.60 max.	0.5 to 2.5	0.04 max.	0.03 max.	32.0 to 36.0	19.0 to 21.0	2.0 to 3.0	3.0 to 4.0	—	Nb 8 × C to 1.00
320LR	0.03 max.	0.30 max.	1.5 to 2.5	0.020 max.	0.015 max.	32.0 to 36.0	19.0 to 21.0	2.0 to 3.0	3.0 to 4.0	—	Nb 8 × C to 0.40
329J1	0.08 max.	0.90 max.	1.50 max.	0.040 max.	0.030 max.	6.0 to 8.0	23.0 to 28.0	1.00 to 3.00	—	—	—
329J4L	0.04 max.	1.0 max.	0.5 to 2.5	0.040 max.	0.030 max.	8.0 to 11.0	23.0 to 27.0	3.0 to 4.5	1.0 max.	0.08 to 0.30	W 2.5 max.
330	0.18 to 0.25	1.00 max.	1.0 to 2.5	0.04 max.	0.03 max.	33.0 to 37.0	14.0 to 17.0	0.75 max.	0.75 max.	—	—
330H	0.35 to 0.45	1.00 max.	1.0 to 2.5	0.04 max.	0.03 max.	33.0 to 37.0	14.0 to 17.0	0.75 max.	0.75 max.	—	—
347	0.08 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	9.0 to 11.0	18.0 to 21.0	0.75 max.	0.75 max.	—	Nb 8 × C to 1.00
347L	0.04 max.	1.00 max.	0.5 to 2.5	0.040 max.	0.030 max.	9.0 to 11.0	18.0 to 21.0	0.75 max.	0.75 max.	—	Nb 8 × C to 1.00

Table 2 (concluded)

Unit: % (mass fraction)

Symbol indicating chemical composition	Chemical composition ^{a)}										
	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N	Others
349	0.13 max.	1.00 max.	0.5 to 2.5	0.04 max.	0.03 max.	8.0 to 10.0	18.0 to 21.0	0.35 to 0.65	0.75 max.	---	^{b)}
383	0.03 max.	0.90 max.	0.5 to 2.5	0.02 max.	0.02 max.	30.0 to 33.0	26.5 to 29.0	3.2 to 4.2	0.6 to 1.5	---	—
385	0.03 max.	0.90 max.	1.0 to 2.5	0.03 max.	0.02 max.	24.0 to 26.0	19.5 to 21.5	4.2 to 5.2	1.2 to 2.0	---	—
409Nb	0.12 max.	1.00 max.	1.00 max.	0.040 max.	0.030 max.	0.60 max.	11.0 to 14.0	0.75 max.	0.75 max.	---	Nb 0.50 to 1.50
410	0.12 max.	0.90 max.	1.0 max.	0.04 max.	0.03 max.	0.60 max.	11.0 to 14.0	0.75 max.	0.75 max.	---	—
410NiMo	0.06 max.	0.90 max.	1.0 max.	0.04 max.	0.03 max.	4.0 to 5.0	11.0 to 12.5	0.40 to 0.70	0.75 max.	—	—
430	0.10 max.	0.90 max.	1.0 max.	0.04 max.	0.03 max.	0.6 max.	15.0 to 18.0	0.75 max.	0.75 max.	---	—
430Nb	0.10 max.	1.00 max.	1.00 max.	0.040 max.	0.030 max.	0.60 max.	15.0 to 18.0	0.75 max.	0.75 max.	—	Nb 0.50 to 1.50
630	0.05 max.	0.75 max.	0.25 to 0.75	0.04 max.	0.03 max.	4.5 to 5.0	16.00 to 16.75	0.75 max.	3.25 to 4.00	—	Nb 0.15 to 0.30
16-8-2	0.10 max.	0.60 max.	0.5 to 2.5	0.03 max.	0.03 max.	7.5 to 9.5	14.5 to 16.5	1.0 to 2.0	0.75 max.	—	—
2209	0.04 max.	1.00 max.	0.5 to 2.0	0.04 max.	0.03 max.	7.5 to 10.5	21.5 to 23.5	2.5 to 3.5	0.75 max.	0.08 to 0.20	—
2553	0.06 max.	1.0 max.	0.5 to 1.5	0.04 max.	0.03 max.	6.5 to 8.5	24.0 to 27.0	2.9 to 3.9	1.5 to 2.5	0.10 to 0.25	—
2593	0.04 max.	1.0 max.	0.5 to 1.5	0.04 max.	0.03 max.	8.5 to 10.5	24.0 to 27.0	2.9 to 3.9	1.5 to 3.0	0.08 to 0.25	—
Notes ^{a)} When the presence of elements other than Fe not specified in this table is confirmed in the course of routine analysis, the total of these elements shall not exceed 0.50.											
^{b)} 0.75 to 1.20 for Nb, 0.15 or under for Ti, 0.1 to 0.30 for V and 1.25 to 1.75 for W.											

5.3 Mechanical properties of deposited metal

The tensile strength and elongation of deposited metal, when tested in accordance with the method in **6.3**, shall conform to the specifications given in table 3.