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(JCAA/JSA)

**Corrosion inhibitor for reinforcing
steel in concrete**

ICS 77.060; 91.100.30

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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 JAPAN CONCRETE ADMIXTURE ASSOCIATION (JCAA)/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 A 6205 : 1993** is replaced with this Standard.

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Corrosion inhibitor for reinforcing steel in concrete

1 Scope This Japanese Industrial Standard specifies the corrosion inhibitor for reinforcing steel in concrete (hereafter referred to as “corrosion inhibitor”) used as an admixture in concrete.

2 Normative references 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 A 0203** and the following definitions apply.

- a) **reference concrete** Concrete to be used for the reference when testing the quality of corrosion inhibitors, which does not use corrosion inhibitors.
- b) **test concrete** Concrete to be used under the test when testing the quality of corrosion inhibitors, which is made of the reference concrete using corrosion inhibitors.
- c) **percentage of corrosion prevention** An index which indicates a corrosion inhibitive effect of corrosion inhibitors, which refers to the percentage obtained by dividing the value obtained by subtracting the area of corrosion of reinforcing bars in the test concrete from the area of corrosion of reinforcing bars in the reference concrete by the area of corrosion of reinforcing bars in the reference concrete.

4 Quality

4.1 Performance The performance of corrosion inhibitors shall be subjected to the test in accordance with clause 5, and the test result shall conform to the requirements specified in Table 1. However, for the setting time and compressive strength of concrete, the test shall be performed with respect to the concrete of slump of 8 cm and 18 cm.

Table 1 Performance of corrosion inhibitors

Item		Specification	Test method
State of corrosion (visual observation)		Corrosions shall not be found.	In accordance with 5.1
Percentage of corrosion prevention %		95 min.	In accordance with 5.2
Difference of setting time of concrete min	Start	-60 to +60	In accordance with 5.3
	End	-60 to +60	
Compressive strength ratio of concrete %	Material age of 7 days	90 min.	
	Material age of 28 days	90 min.	

4.2 Chloride ion (Cl^-) content The chloride ion content, when it is subjected to the test in accordance with 5.4, shall be 0.02 kg/m³ or under.

4.3 Total alkali content The total alkali content, when it is subjected to the test in accordance with 5.5, shall be 0.02 kg/m³ or under.

5 Test method

5.1 State of corrosion (visual observation) The state of corrosion (visual observation) shall be as given in Annex 1.

5.2 Percentage of corrosion prevention The percentage of corrosion prevention shall be as given in Annex 2.

5.3 Test of concrete

5.3.1 Material of concrete Materials used for the test of concrete shall be as follows:

- a) **Cement** The ordinary portland cement specified in **JIS R 5210** shall be used for cement.
- b) **Aggregates** The aggregates shall be pure and strong, and durable, and shall not include dust, mud, organic impurities, chlorides, etc. enough to be detrimental. The coarse aggregates shall be crushed stones, and the fine aggregates shall be sands. The aggregates shall conform to the requirements for quality given in Table 2. For the grading of aggregates, large-size and small-size particles shall be mixed moderately, and the grading shall be within the range given in Table 3.

Table 2 Quality of aggregate

Type of aggregates	Density in oven-dry condition ⁽¹⁾ g/cm ³	Percentage of water absorption ⁽¹⁾ %	Particle shape judging solid content ⁽²⁾ %	Content of clay lumps ⁽³⁾ %	Amount passing through 0.075 mm sieve ⁽⁴⁾ %	Organic impurities ⁽⁵⁾	Stability (5 times) ⁽⁶⁾ %	Chlorides (as NaCl) ⁽⁷⁾ %	Alkali-silica reactivity ⁽⁸⁾
Coarse aggregates	2.5 min.	2.0 max.	57 min.	0.25 max.	1.0 max.	—	10 max.	—	Harmless
Fine aggregates	2.5 min.	3.0 max.	—	1.0 max.	2.0 max.	The colour is lighter than a standard colour solution or a colour sample.	8 max.	0.02 max.	Harmless

Notes (1) In accordance with **JIS A 1109** and **JIS A 1110**.

(2) In accordance with 5.8 of **JIS A 5005**.

(3) In accordance with **JIS A 1137**.

(4) In accordance with **JIS A 1103**.

(5) In accordance with **JIS A 1105**.

(6) In accordance with **JIS A 1122**.

- (7) In accordance with 5.5 of JIS A 5002. However, the amount of sample shall be 1 000 g.
- (8) In accordance with JIS A 1145 or JIS A 1146.

Table 3 Grading of aggregates [mass percentage of particles which pass through the sieves (%)]

Type of aggregates	Nominal size of sieve ⁽⁹⁾ mm									
	25	20	15	10	5	2.5	1.2	0.6	0.3	0.15
Coarse aggregates	100	90 to 100	55 to 75	25 to 45	0 to 5	0 to 2	—	—	—	—
Fine aggregates	—	—	—	—	100	85 to 100	60 to 80	30 to 50	15 to 25	2 to 10

Note ⁽⁹⁾ Each nominal size of sieves corresponds to nominal openings of mesh sieves specified in JIS Z 8801-1, 26.5 mm, 19.0 mm, 16.0 mm, 9.5 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 μ m, 300 μ m and 150 μ m.

- c) **Water** Water to be used for mixing shall be water from public water supply.

5.3.2 Proportion The proportion shall be specified so that the reference concrete conforms to a) to d) in the following. The test concrete shall be the same proportion as that of the reference concrete.

- a) **Unit mass of cement** The unit mass of cement shall be 300 kg/m³ for the concrete of slump of 8 cm, and 320 kg/m³ for the concrete of slump of 18 cm.
- b) **Unit quantity of water** The unit quantity of water shall be as follows:
- 1) The unit quantity of water of reference concrete shall be such a quantity that the slump at the time of mixing becomes 8 cm $\pm$ 1 cm or 18 cm $\pm$ 1 cm.
 - 2) The unit quantity of water of test concrete shall be the same quantity as that of reference concrete, including corrosion inhibitors.
- c) **Air content** The air content shall be as follows:
- 1) The air content of reference concrete shall be not more than 2.0 %.
 - 2) The air content of test concrete shall not exceed the value to which 1.0 % is added to the air content of reference concrete.
- d) **Percentage of fine aggregates** The percentage of fine aggregates of reference concrete shall be in the range from 40 % to 50 % and the value from which good workability is acquired, and the percentage of fine aggregates of test concrete shall be the same percentage as that of reference concrete.
- e) **Amount to be used of corrosion inhibitor** The amount of corrosion inhibitor to be used per 1 m³ of test concrete shall be the standard amount to be used designated by the manufacturer (hereafter referred to as "standard amount to be used").

5.3.3 Method of making concrete The method of making concrete shall be in accordance with JIS A 1138.

5.3.4 Mixing The mixing shall be as follows:

- a) **Mixer** The test of the mixer used for mixing shall be performed in accordance with **JIS A 1119**, and when mixing for 1.5 min in the case of a revolving-paddle mixer and for 3 min in the case of a gravity type mixer, the difference of density of mortar in the concrete shall be not more than 0.8 %, and the difference of amount of coarse aggregates per unit volume of concrete shall be not more than 5 %, and the mixer shall conform to the requirements for the mixing performance test.
- b) **Method of use of corrosion inhibitor** Mix the corrosion inhibitor into the mixing water beforehand, and then put it into the mixer.
- c) **Mixing time** After putting all materials into the mixer, mix the concrete for 1.5 min in the case of the revolving-paddle mixer and for 3 min in the case of the gravity type mixer.
- d) **Mixing volume** The mixing volume of one batch of reference concrete and test concrete shall be an equivalent amount with respect to each concrete.
- e) **Temperature at the end of mixing** The temperature at the end of mixing shall be $20\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.

5.3.5 Sample The sampling method shall be in accordance with **JIS A 1115**.

5.3.6 Test method of concrete The test method of concrete shall be as follows:

- a) **Slump** The test of slump shall be performed in accordance with **JIS A 1101**. The test shall be performed once, and the value at the result of test shall be regarded as the slump of the type of concrete.
- b) **Air content** The test of air content shall be performed in accordance with **JIS A 1128**. The test shall be performed once, and the value at the result of test shall be regarded as the air content of the type of concrete.
- c) **Setting time** The test of setting time shall be performed in accordance with **JIS A 1147**. The test shall be performed twice, and the average of test results shall be regarded as the setting time of the type of concrete.
- d) **Compressive strength** The test of compressive strength shall be performed in accordance with **JIS A 1108**. The specimen shall be cured in a room at a temperature of $20\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ without being dried until the formwork is removed, and after removing the formwork, it shall be cured in water or in a fog room at a temperature of $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ until the strength test is performed. The material age shall be 7 days and 28 days.

5.3.7 Calculation The calculation shall be performed as follows:

- a) **Difference of setting time of concrete** Calculate the difference of the start time or the end time of concrete according to the following formula from the start time and end time obtained in accordance with **5.3.6 c)**, respectively, and round off the result to the nearest integer.

$$T = T_t - T_e$$