

SECTION - 3

ENCLOSURES TO THE SPECIFICATION (Customer's Specification)

1 Job specification for Bipolar Concrete Penetrating Corrosion Inhibiting Admixture




JOB SPECIFICATION
FOR
BIPOLAR CONCRETE PENETRATING
CORROSION INHIBITING ADMIXTURE
TO
PROTECT EMBEDDED STEEL
REINFORCEMENT IN CONCRETE

PROJECT : DAHEJ PETROCHEMICALS COMPLEX

OWNER : ONGC PETRO additions LTD.

PMC : ENGINEERS INDIA LTD.

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CONTENTS

- 1.0 SCOPE**
- 2.0 TERMINOLOGY**
- 3.0 SAMPLING**
- 4.0 PROPERTIES**
- 5.0 REQUIREMENTS**
- 6.0 SAFETY TO CONSTRUCTION MATERIAL**
- 7.0 SAFETY FOR FABRICATION**
- 8.0 WASTE WATER DISCHARGE**
- 9.0 PACKING**
- 10.0 MARKING**
- 11.0 INSPECTION**

1.0 SCOPE

- 1.1 This specification prescribes the requirements and test methods of physico – chemical characteristics including performance test for evaluating the efficiency of the product in the laboratory for protecting steel reinforcement embedded in concrete from corrosion.
- 1.2 This standard prescribes the requirements and methods of test for the material known as Bipolar Concrete Penetrating Corrosion Inhibiting Admixture (CPCIA). The CPCIA shall be concrete penetrating type which upon addition into the concrete matrix inhibits the corrosion process. It need not be in direct contact with the steel. Its vapours penetrate through fissures, honeycomb structure of concrete, pure water solution added in concrete and seals steel reinforcement at both anodic & cathodic sites, for inhibition. This is due to the bipolar mechanism property of the system. Non-concrete penetrating, nitrite & nitrate corrosion inhibitors are excluded from this scope. The product shall be suitable to protect embedded steel reinforcement bars used in concrete structures from corrosion.

2.0 TERMINOLOGY

- 2.1 For the purpose of this standard the definitions as given in latest versions of ASTM-G1, ASTM-G3, ASTM-G109, ASTM-C 1202, JIS-Z-1535, AASHTO T259, IS:101(Part1/sec.5)-89, IS:456-2000, IS:1202-97, IS:1448-67, IS:1786-85, IS:9103-99 etc. shall apply.
- 2.2 Rounding off, of observed values on different tests shall be in accordance with IS: 2-1960.

3.0 SAMPLING

- 3.1 The representative samples of the material shall be drawn by the purchaser or the Inspecting authority as per the table given below:

Scale of Sampling for CPCIA

No. of containers lot (N)	No. of containers to be selected for sampling (N)
Up to 50	1
51-100	2
101-200	3
201-300	3
301-500	4
501-800	5
801-above	6

4.0 PROPERTIES

- 4.1 The material shall comply with the requirements specified in Clause 5.0, Table-I and Table-II of this specification.
- 4.2 Unless otherwise specified, the following testing conditions shall apply.
- 4.2.1 All the tests shall be conducted at room temperature $27 \pm 2^\circ\text{C}$ and relative humidity at $65 \pm 5\%$ in a well ventilated chamber free from draught and dust.

5.0 REQUIREMENTS

- 5.1 The admixture shall be supplied in one pack.
- 5.2 There are two types of requirements that the material should meet in order to be considered for usage.
- 5.2.1 Properties which can be evaluated in short duration as laid down in Table –I. It can be performed at a laboratory or at sites with proper testing facilities.
- 5.2.2 Properties which can be evaluated by performing long duration tests as laid down in Table–II.
- 5.2.3 All the tests performed under Indian Tropical Conditions mentioned in Table-I & Table-II are mandatory requirement for the approval of product.
- 5.2.4 Approving authorities certificate for long term tests and Suppliers test certificate meeting the short term requirements may be accepted by the purchaser. However, short term tests may be cross checked with NABL accredited laboratory if desired.
- 5.3 The recommended dosage of CPCIA in concrete shall be preferably 1% (w/w of Cement) or as recommended by the manufacturer.
- 5.4 Tests specified in Table II shall be performed in triplicate.

TABLE –I

**REQUIREMENT OF BIPOLAR CONCRETE PENETRATING CORROSION INHIBITING
ADMIXTURE (Short Term Tests)**

Sr. No .	Characteristics	Requirements	Methods of Tests
1.	Appearance	Brownish Liquid free from any visible residual deposits	Visually
2.	Odour	Mild Ammonical Odour	By smell
3.	Skin irritation	No irritation	By applying on reverse of the palm for 05 minutes.
4.	pH i) As in supplied condition ii) 1% dilution ,w/w	i) 9.0-11.0 ii) 9.0-11.0	pH meter / Standard pH paper
5.	Specific Gravity at $27 \pm 2^\circ\text{C}$	1.04-1.06	IS 1448-1967

Sr. No .	Characteristics	Requirements	Methods of Tests
6.	Viscosity of the material as in supplied condition, by Ford cup No 4, at $27 \pm 2^{\circ}\text{C}$	10 -20 sec.	IS: 101(Pt. 1/Sec.5)1989
7.	Accelerated Corrosion Test, for 21 hrs. i) Raw water without CPCIA ii) ii) Raw water with CPCIA	i) Excessive corrosion spots. ii) There shall not be more than 1-2 corrosion spots.	Modified accelerated corrosion test (Based on Japanese standard JIS Z 1535)

TABLE –II

REQUIREMENT OF BIPOLAR CONCRETE PENETRATING CORROSION INHIBITING
ADMIXTURE (Long Term Tests)

Sr. No .	Characteristics	Requirements	Methods of Tests
1.	Immersion test for 720 hrs. (Rebar weight loss method) i) With out CPCIA* ii) With 1% CPCIA*	i) 40.00 mpy, max. ii) 2.00 mpy, max.	Immersion Test (Rebar weight loss test)[as / ASTM G 1]
2.	Effect of Concrete admixture on compressive strength i) Wth out CPCIA* ii) With 1% CPCIA*	Concrete strength in sample with CPCIA* should be \geq concrete strength in sample without CPCIA*	Test for effect on compressive strength by addition of CPCIA [IS 9103-1999]
3.	Polarization test by Tafel polarization with 3.5% Sodium Chloride, for 20 days i) With out CPCIA* ii) With 1% CPCIA*	Rate of corrosion shall be i) 45 mpy, max. ii) 9 mpy, max.	Electrochemical polarization test conducted on steel rebars embedded in concrete [ASTM-G 3 and IS 9103-1999]
4.	Effect of CPCIA* on corrosion of embedded steel rebars exposed to chloride environments after 09 cycles (14 days wetting and 14 days drying) as per ASTM G109. i) With out CPCIA* ii) With 1% CPCIA*	Rate of corrosion shall be i) 25.00 Coulombs, max. ii) 0.50 Coulombs, max.	Long term corrosion test [ASTM G-109-2005]

Sr. No.	Characteristics	Requirements		Methods of Tests
5.	Chloride Migration profile properties of concrete with & without CPCIA i) Chloride % in concrete at 30 mm depth after 90 days. (For all types of cements e.g. OPC, PPC, PSC, SRC) ii) Ability to resist chloride ion penetration (RCPT) (For all types of cements e.g. OPC, PPC, PSC, SRC) a) Concrete grade M-30, Water cement ratio: 0.45 b) Concrete grade M-40, Water cement ratio: 0.40	With out CPCIA* Chloride % shall be 0.025%, max.	With 1% CPCIA* Nil Resistance to chloride ion penetration shall be 1650 Coulombs, max. 1000 Coulombs, max.	AASHTO T-259 i) Chloride ion penetration (Salt ponding test) [IS:456-2000] ii) Electrical indication of Concrete ability to resist Chloride Ion Penetration (Rapid Chloride Permeability test) [ASTM C-1202 1997]

Note

- 1 CPCIA* : Bipolar Concrete Penetrating Corrosion Inhibiting Admixture. The CPCIA shall be used as 1% w/w of cement or as recommended by the manufacturer for conducting the tests mentioned in Table-II except Immersion test for 720 hrs mentioned at S. No. 1 where it shall be used as 1% w/w of water or as recommended by the manufacturer.
- 2 Wherever required , rebars conforming to IS: 1786-1985 shall be used for testing purposes

6.0 SAFETY TO CONSTRUCTION MATERIAL

CPCIA should not degrade, or damage the construction materials.

- Concrete
- Aggregates
- Steel reinforcement
- Form work/Shuttering

7.0 SAFETY FOR FABRICATION

The CPCIA should not cause harm to personnel by mean of inhalation or skin

contact. All precautionary measures shall be intimated by the manufacturers clearly in writing along with instructions of usages. However final decision about adoption of such measures shall lie with the EIL or client and shall depend upon the conditions prevailing at the site.

8.0 WASTE WATER DISCHARGE

The waste discharge shall be in accordance with the laws of pollution control in force from time to time.

9.0 PACKING

The material shall be packed in suitable air tight polyethylene containers preferably of capacity 20 kg / 200kg or as agreed by purchaser and supplier.

10.0 MARKING

10.1 Each container shall be legibly and indelibly marked with the following:

- a) Name of the material
- b) Name of the manufacturer
- c) Volume / weight of material
- d) Specification number
- e) Batch No. or Lot No. in code or otherwise
- f) Month and year of manufacture

11.0 INSPECTION

11.1 At the time of initial approval of the product or firm, full testing as mentioned in clause 5.2.3, shall be carried out.

11.2 In case of acceptance testing, Inspecting Authority shall draw the sample as per clause 3.1, from the batch under consideration and the material shall be tested for the tests stipulated in Table-I.

11.2.1 Long duration tests need substantial amount of time. The testing facilities for these tests may not be available in each and every laboratory, therefore, Approving authority's certificate for long term tests as stipulated in Table-II & Supplier's test certificate/NABL accredited laboratory test certificate meeting the short term tests as stipulated in Table-I may be accepted by the Purchaser for the acceptance of the material. However if desired by the purchaser, long term tests may also be organized to be carried out at any IITs/NABL accredited laboratory.