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(Reaffirmed 1997)

Indian Standard

CODE OF PRACTICE FOR CATHODIC PROTECTION OF STEEL STRUCTURES

PART IV GALVANIC PROTECTION OF DOCKGATES, CAISSONS, PIERS AND JETTIES

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Indian Standard

CODE OF PRACTICE FOR CATHODIC PROTECTION OF STEEL STRUCTURES

PART IV GALVANIC PROTECTION OF DOCKGATES, CAISSONS, PIERS AND JETTIES

0. FOREWORD

0.1 This Indian Standard (Part IV) was adopted by the Indian Standards Institution on 15 February 1979, after the draft finalized by the Corrosion Protection Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 The increasing activity of the navy and the mercantile shipping has led to the expansion of harbour installations like dockgates, caissons, piers, jetties, etc. Steel used in such structures are subjected to severe corrosive environment and requires protection to supplement the existing paint systems. With proper cathodic protection systems, such structures are expected to have much longer life.

0.3 The dockgates which open and close the entry to dry docks are usually made of steel and require cathodic protection only on external surfaces. Caissons are buoyant steel structures for closing the entrace of wet basins, dry docks and locks and are built with buoyancy chambers and ballast tanks containing water which may be adjusted for sinking or floating as required. The design of the cathodic protection sysem is, therefore, provided on the basis of: (a) internal area under cotmplete immersion, (b) external area, and (c) inter tidal area. Similarly jetties and piers which remain under sea or river water require cathodic protection.

0.4 This code is being issued in parts. The other parts of this code are as follows:

Part I General principles
Part II Underground pipelines
Part III Ship's hulls

1. SCOPE

1.1 This standard (Part IV) deals with the requirements of cathodic protection of dockgates, caissons, piers and jetties using galvanic type of anodes.

1.2 This standard should be read in conjunction with IS : 8062 (Part I)-1976* and IS : 8062 (Part III)-1977†.

2. CHOICE OF CATHODIC PROTECTION METHOD

2.1 Of the two methods, namely, the galvanic and the impressed current system, the galvanic method is preferable to the impressed current system for such structures. The caisson requires additional protection by galvanic anodes of the inside tanks/chambers.

3. APPLICATION OF GALVANIC ANODE SYSTEM

3.1 Anode Material — The galvanic anode material may be made of alloys based on magnesium, zinc or aluminium. The aluminium alloy anode is preferable to other types of anodes for cathodic protection in view of cost, indigenous availability and ease of fabrication. This may be used in various sizes and shapes depending on the requirement so as to deliver adequate protective current to the specific structure.

3.2 Design and Installation of Anodes

3.2.1 Galvanic anodes shall be provided with steel inserts suitable for welding or fitting by means of studs.

3.2.2 With weld-on type anodes, the projecting steel insert ends shall be welded to the structures to be protected cathodically.

3.2.3 For studs-on type anodes, studs shall be securely welded to the steel plates. Nuts are used to lock the anodes. Tack welding of the nut to the insert is desirable. The cavity around the stud and the nut should be filled with putty. The studs used should be made of mild steel.

3.2.4 Adequate safety precautions for hot-work shall be taken prior to welding of anodes or studs on such structures.

3.2.5 Protective coatings may preferably be applied to the structures only after fitting of anodes.

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*Code of practice for cathodic protection of steel structures: Part I General principles.
†Code of practice for cathodic protection of steel structures: Part III Ship's hulls.

3.2.6 *Protection of Anodes During Painting* — Anodes shall be suitably masked during painting of the structures and in no case, anode surface shall be painted. If any paint/coating material is found to adhere to the anode surface, it shall be cleaned by any suitable solvent or scraped off.

3.3 Mass of Anode Material

3.3.1 The mass of anode material required to cathodically protect a water-front structure from corrosion depends on: (a) current density required per unit area of wetted surface which shall take into account areas remaining permanently immersed and alternately/periodically immersed, (b) current capacity of the anode, and (c) period for which cathodic protection is necessary.

3.3.2 Knowing the current capacity of the anode in terms of ampere year per unit mass, the total mass of anode which is necessary for such structures may be calculated for the immersed area for one year or its multiple till the lifting out of the structure for maintenance/repair. Normally, cathodic protection is required to be provided for a period of 3-4 years.

3.4 Number and Distribution of Anodes

3.4.1 The number of anodes depends upon the mass and dimension of individual anodes as well as ease of handling. The following factors also influence the number of anodes, namely: (a) quality and condition of paint coating, (b) area under full immersion, and (c) area subjected to intermittent immersion. Dilution of sea water by fresh water due to heavy rains, etc, may cause wide fluctuation in the requirement of current density.

3.4.2 The distribution of anodes depends upon the complexity of structure and efforts shall be made to position the anodes in such a way that all parts of the structure receives the required amount of average current density. Usually, a distance of 3-5 m between the anodes is considered adequate.

4. CURRENT DENSITY

4.1 The current density required to protect the wetted area of such structures is a variable quantity and may range between 10 mA and 50 mA per square metre of painted surface to be protected. This depends also upon the: (a) condition of the paint applied, (b) salinity of water, and (c) temperature. It should be recognized that a paint coating may deteriorate with time and the structure would be in need for greater amount of cathodic current progressively.

5. LOCATION OF ANODES

5.1 Anodes shall not be fitted in a chamber of a caisson (internal) at a height greater than $27/M$ metre, where M is the gross mass (kg) of the anode including inserts, the height being measured from the base of the particular chamber.

5.2 Location of anodes for external surfaces shall be selected in such a way that adequate protection is obtained over the whole surface.

6. RENEWAL OF ANODES

6.1 Galvanic anodes shall be replaced when wastage has occurred to the extent of about 70 percent of the total mass of the anode.

7. PROTECTIVE COATING SCHEDULE

7.1 The bitumen or bitumen based compositions may be used as a satisfactory protective coating system for static water front structures. The following compositions are recommended for this purpose:

a) *Bitumen Solution* — 3 coats conforming to IS : 158-1968*, or

b) *Hot Melting Bitumen Enamel* — 1 coat over a priming coat conforming to IS : 158-1968*.

7.2 Other heavy duty paint coatings may be used provided due attention is paid to the surface preparation.

8. STRUCTURE-TO-ELECTROLYTE POTENTIAL

8.1 When the external surfaces of the structures are satisfactorily protected, the structure/water potential shall remain within the range shown in Table 3 of IS : 8062 (Part I)-1976†.

9. PRECAUTIONARY MEASURES

9.1 Potential measurements should be made with reference electrodes located in water in close proximity to the structure to be protected, to minimize IR drops.

9.2 Steel coupons having similar composition to the structural materials may be placed with structure to determine the effectiveness of the

*Specification for ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, water and heat resisting for general purposes (*second revision*).

†Code of practice for cathodic protection of steel structures: Part I General principles.

corrosion preventive measures, specially for areas suspected of being comparatively inaccessible to cathodic protection.

9.3 The efficacy of some aluminium alloy anodes is adversely affected when covered with mud; attaching such anodes to structural members located at or below the mud-line should be avoided.

INDIAN STANDARDS

ON

CORROSION

IS:

3531-1968 Glossary of terms relating to corrosion of metals
3618-1966 Phosphate treatment of iron and steel for protection against corrosion
4180-1967 Code of practice for corrosion protection of light gauge steel sections used in building
4777-1968 Performance tests for protective schemes used in the protection of light gauge steel against corrosion
5555-1970 Code of procedure for conducting field studies on atmospheric corrosion of metals
6005-1970 Code of practice for phosphating of iron and steel
7808-1975 Code of procedure for conducting studies on underground corrosion of metals
8062 (Part I)-1976 Code of practice for cathodic protection of steel structures: Part II General principles
8062 (Part II)-1976 Code of practice for cathodic protection of steel structures: Part II Underground pipelines
8062 (Part III)-1977 Code of practice for cathodic protection of steel structures: Part III Ship's hulls
8221-1976 Code of practice for corrosion prevention of metal components in packages
8629 (Parts I to III)-1977 Code of practice for protection of iron and steel structures from atmospheric corrosion

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