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भारतीय मानक

अपतट स्थित स्थिर इस्पात की संरचनाओं का संविचरण एवं संस्थापन के समय निरीक्षण – मार्गदर्शी सिद्धांत

Indian Standard

INSPECTION OF FIXED STEEL OFFSHORE STRUCTURES DURING FABRICATION AND INSTALLATION — GUIDELINES

UDC 622·242·422

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Offshore Installations Sectional Committee had been approved by the Civil Engineering Division Council.

Inspection and quality control is performed to ensure adherence to codes, specifications and to achieve a desired quality and service in the finished product. The most effective code of practice for inspection and quality control shall be the one which prevents the defects or deviations rather than identify them after they occure.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*).' The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

INSPECTION OF FIXED STEEL OFFSHORE STRUCTURES DURING FABRICATION AND INSTALLATION — GUIDELINES

1 SCOPE

1.1 This standard covers recommended procedures for the inspections of fixed offshore structures during fabrications and installation. It covers only the structural component and does not include equipment and equipment related systems on decks/modules.

1.2 This guideline is not limited to any specific procedure or method of fabrication or installation but is intended to be a general guide based on which detail procedures should be prepared.

1.3 This guideline does not stipulate any acceptance standard. These shall be as per governing specifications relevant to design criteria and related requirements mutually agreed.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
822 : 1970	Code of procedure for inspection of welds
1278 : 1972	Specification for filler rods and wires for gas welding (*second revision*)
5206 : 1983	Specification for covered electrodes for manual metal arc welding of stainless steel and other similar high alloy steel (*first revision*)
7280 : 1974	Specification for barewire electrodes for submerged arc welding of structural steels
7307 (Part 1) : 1974	Approval tests for welding procedures: Part 1 Fusion welding of steel

2.2 In specific situations, not covered by Indian standards, other relevant international standards may be used.

3 INSPECTION PERSONNEL

3.1 The personnel deployed for inspection shall have the necessary technical qualifications and experience with sound knowledge on inspection techniques and general areas of welding technology, fabrication methods, NDT and other test procedures.

4 QUALITY ASSURANCE

4.1 Every fabrication yard/contractor shall have an adequate quality assurance system modelled on standards meant for such system (such as IS 14000 Series) with defined procedures covering all aspects for tender/contract stage to final installation. This shall include detail quality control procedures and quality plans for bought-out materials/services, inhouse fabrication and installation at offshore. The system shall be suitably documented into a manual which shall be referred to as Quality Manual.

4.2 At the start of a particular contract the Quality Manual as modified for the contract under consideration shall be submitted for review by the purchaser and the inspection/certification organization appointed by them. Particular attention shall be paid to all procedures affecting Quality Plans shall be marked up to indicate the Hold/Witness/Review Points and the organization responsible for them (Purchase/Certification/Fabrication).

4.3 The yard/contractor thereafter shall effectively implement the Quality Plan on the contract work.

5 RESPONSIBILITY OF FABRICATOR/CONTRACTOR

5.1 Through an effective quality management system, the contractor shall ensure that the Quality Manual is strictly adhered to throughout purchase (of material and services), design, fabrication, transporatation (load-out) and installation work.

5.2 Due notice (the period and mode of which shall be mutually agreed at the start of

contract) shall be given by the contractor to organization responsible for inspection/witnessing/clearing the hold points.

5.3 Contractor shall ensure that Quality stages are properly recorded and endorsed for acceptance by authorized personnel.

5.4 Documentation indicating materials used (referring to quality and certification where appropriate) stage/type of inspection/testing and results thereof together with welding data (welding procedure and welder/operator identification) including record of approval by the concerned organization shall be maintained by the contractor. These shall be presented for verification and/or review by the organization responsible for inspection/certification and made available as each assembly (or sub-assembly) is completed unless otherwise mutually agreed.

6 ACCESSABILITY TO WORK

6.1 Inpection/Certification organization shall have free access to all fabrication installation work that is being carried out by the yard/contractor, sub-contact if any at all places and all times in order that they are satisfied that the required quality of workmanship is achieved during the fabrication/installation work.

7 STAGES OF INSPECTION

7.1 The yard contractor while preparing the Quality Plan shall lay down various stages of quality control and inspection hold points during fabrication and installation work in order to achieve the desired quality.

7.2 Identification of Material

All material before use on fabrication of structure shall be properly identified against mill certificates duly approved by the Inspection/Certifying Organization as complying with specified requirements. Mill Certificates or other relevant certificates wherever required shall be produced to identify the material.

7.2.1 All steel used for the primary structure as identified in the design, shall be certified at the mill by the Inspection/Certification Organization (or other appropriate organizations recognised for such work in addition to mill certification.

7.2.1.1 Steel for primary stucture shall also be subjected to supplementary requirements such as through thickness, strength, notch toughness, lamination check, etc as appropriate by design requirements, at the steel mill.

7.2.2 Steel used for secondary structure shall be identified against mill certificates.

7.2.3 Records of steel used for primary and secondary structure shall be suitably maintained.

7.2.4 Sub- assemblies/fabricated components shall carry appropriate documentation including inspection certificates or release notes prior to acceptance.

7.3 Fabrication Sequence

7.3.1 Fabrication sequence procedures including mode of distribution of loads for heavy lifts and their transportation/installation, etc, shall be reviewed by the purchaser and Inspection/Certifying Organization to safequard against undue strain.

7.4 Welding

7.4.1 All welding performed for fabricating the structure shall be in accordance with requirements of 'Code of Practice for Structural Welding for Offshore Structures, Doc : CED 49 (5093) (*under preparation*)' to previously qualified welding procedures by qualified welders/welding operators and approved welding consumables.

7.4.2 Welding procedure specification, qualification record and test data shall be approved by the Inspection/Certification organisation prior to use for fabrication. Each such record shall have a unique identity.

7.4.3 *Welding Consumables*

All welding consumables used for procedure qualification and subsequently during fabrication should conform to the requirements of IS 1278 : 1972, IS 5206 : 1983 or IS 7280 : 1974.

7.4.4 *Welders and Welding Operators*

All the welders and welding operators assigned for welding to fabricate the structure shall have successfully passed the performance tests for type of welding to be employed and the procedures as applicable [*see* IS 7307 (Part 1) : 1974]. Each welder/welding operator shall be assigned a unique symbol which shall be used for identifying welding performed by a particular welder/operator.

7.5 Fit Ups

All fit ups and assemblies shall be examined for conformity with the approved drawings, specification and code requirements before proceeding with the welding work.

7.6 Dimensional and Alignment Check

7.6.1 Dimensional checks shall be carried out at various phases of fabrication as required and also alignment checks carried out as per the agreed plan for conformity with specification and drawing requirements. The alignment of riser clamps should be checked by a suitable means.

7.7 Weld Inspection

The completed welds shall be examined visually to identify defective/incomplete welds profile defects, unfused welds, surface cracks under cuts, surface porosity, damages to the parent metal etc as per IS 822 : 1970. Any non-destructive examination to be carried out on welds shall only be carried out after the weld has been visually accepted.

7.8 Non-Destructive Tests

7.8.1 The type and extent of NDT to be carried out shall be decided after considering criticality of the weld joint from design aspects, access and suitability of the mode to be deployed in consultation with the Inspection/ Certification Organisations.

NOTE — The type and extent of NDT can only be decided prior to award of contract if the design is finalized before the award of contract.

7.8.2 Procedures for various non-destructive tests shall conform to relevant specifications or other applicable codes and approved by the Inspection/ Certification Organizations.

7.8.3 All non-destructive tests operators shall be qualified as per relevant codes before deployment on the production work.

7.8.4 All non-destructive tests on the production work shall be carried out as per approved procedures and shall be witnessed/reviewed by the Inspection/Certification Organization as per agreed plans.

7.9 As Built Dimensions

7.9.1 Critical as built dimensions shall be measured on completion of fabrication in yard and recorded. These shall include, but not be limited to:

a) Jacket leg alignment,
b) Skirt piles alignment,
c) Jacket leg spacing,
d) Main deck leg spacing,
e) Helideck leg stabbing points,
f) Boat landing, and
g) Barge bumbers.

7.9.2 These dimensions shall be reviewed to ensure satisfactory installation offshore.

7.10 Cathodic Protection

7.10.1 Anodes shall be inspected at the manufacturer's works by the Inspection/Certifying organisation to ensure conformance to specification requirements.

7.10.2 The installation of anodes, including their location and attachment welds, shall be examined for conformance to approved drawings.

7.10.3 The continuity check shall be carried out on the anodes as well as on any cabling of the cathodic potential measuring system, if installed.

7.11 Testing

7.11.1 *Hydrostatic Test*

Grout lines or any other pressure pipe lines relevant for safe installation of the structure shall be hydrostatically tested for the duration and pressure as required by specification and drawings.

7.11.2 *Air Test*

All jacket legs top and bottom chords of launch truss (if any) are preinstalled coductors shall be air tested for the duration and pressure as required by the specification and drawings. If any buoyancys tanks are envisaged these also should be air tested for leakage.

7.12 Protective Coating

7.12.1 Surface preparation before application of any protective coating shall be checked for its profile and finish.

7.12.2 Application of protective coating shall be carried out as per the approved procedure and shall be checked for final dry film thichness and finish.

7.13 Load Out of Structure

Load out shall be carried out as per the approved procedure and witnessed by the Inspection/ Certification organization.

7.14 Tie Down of Structure on Barge

7.14.1 All materials including Saddles, Pipes, Sections, etc, shall be verified for conformance to approved drawings by the Inspection/Certification organisation.

7.14.2 All welding for the down of structure shall be checked visually for correct fillet sizes and non-destructive tests if stipulated shall be witnessed as per the approved specification and drawings.

8 Installation Offshore

8.1 The requirement stipulated in proceeding paragraphs shall be applicable for installation at offshore (para 4, 5, 6 generally and **7.1, 7.2, 7.3, 7.4, 7.5, 7.7** and **7.8** in particular).

8.2 Visual Examination

8.2.1 Structure on barge on arrival at site shall be visually examiner for apparent damages, if any that might have occurred during transportation.

8.2.2 *Pre-launching/Stabbin Inspection*

The structure shall be examined for readiness before prelaunching/stabbing operation.

8.3 Launching/Lifting/Setting Operations

8.3.1 The operation shall be witnessed by the Inspection/Certifying organizations to ensure that the same is carried out as per the approved procedure. Any unusual occurance or deviation from the approved procedure shall be carefully studied for any possible harmful effects and appropriate action taken.

8.3.2 Location and orientation of structure as set on the sea bed shall be checked to ensure conformity with coordinates and orientation stipulated.

8.3.3 *Welding Procedures*

For welding, procedure explained in **7.4.1** to **7.4.3** shall be followed.

8.3.4 *Fit Ups*

All fit ups and assemblies shall be examined for conformity with specification and code requirements before proceeding with the welding work.

8.3.5 *Alignment and Levelling*

All alignment and levelling shall be verified to meet the requisite tolerances.

8.3.6 *Weld Inspection*

The completed welds shall be examined visually for defective incomplete welds profile defects, unfused welds, surface cracks, under cuts, profile defects, surface porosity, damages to the parent metal etc.

8.3.7 *Non-Destructive Tests*

For non-destructive testing and checking procedure explained in **7.8** shall be followed.

8.4 Piling

8.4.1 Before starting of piling work mud mat survey shall be carried out and the diver report is to be reviewed to verify that the sea bed does not contain debris, troughs and hollows that could adversely affect the pilling operations.

8.4.2 Level markings, lengths and thickness of each section of the piles make-up shall be verified on barge against approved drawings, unless this has been veried on shore, by Inpection/Certifying organization and duly documented.

8.4.3 Piling operation shall be checked for conformity with the approved procedure, make ups and sectionalisation scheme. Records detailing hammer used (Power/Stroke) blows per metre, stoppages, time etc shall be made as each pile section is driven.

8.4.4 Tilt to the jacket during the piling operation shall be measures at suitable intervals and remedial measured taken to limit level within stipulated tolerances.

8.4.5 Each pile shall be driven to its design penetration without damage to the pile.

8.4.6 If any pile meet with refusal before achieving the design penetration, contractor shall propose plans to overcome the refusal or alternate methods of remedial measures. These shall meet design criteria and require approval by purchaser and Inspection/Certifying organization.

8.5 Grouting

8.5.1 Before commencing the grouting operation, flushing of grout lines shall be witnessed to ensure free passage for the grout. During the grouting operation usage of appropriate grouting equipment and the grouting procedure shall be checked and continuous grout flow shall be ensured until the annulus is filled.

8.5.2 During grouting operation sampling should be drawn from the batch and the density with the help of grout balance shall be measured to ensure the density of grout is as stipulated in the approved procedure.

8.5.3 *Testing of Grout*

Grout samples as per specification requirements shall be drawn and compression tests as called for are to be checked. Each sample shall be marked to indicate the annulus it pertains to.

9 POST INSTALLATION CHECKS

9.1 Levels at the top of the jacket should be recorded and compared with the designed/ stipulated levels. In case due to field conditions the level has changed significantly, necessary correction shall be made in the transition pieces.

9.2 Elevation of the main deck particularly where seatings of bridges or other connecting structures or pipelines are planned shall be established for interfacing and corrections.

9.3 Distances between adjoining structure which are planned to be interconnected shall be measured to establish, interfacing and correction.

9.4 Diver survey shall be carried out to ensure that all anodes, riser clamps etc; fixed earlier have not undergone any damage during installation.

9.5 Any debris laying on the structure or seabed shall be lifted to the surface and suitably dealt with.

9.6 All cables installed in the jacket for cathodic protection system shall be checked to ensure continuity.

10 DOCUMENTATION

10.1 Records of the following, duly approved by the Inspection/Certification organisation, shall be maintained.

10.1.1 As built drawings.

10.1.2 Materials used, as indicated in **7.2.3.**

10.1.3 Welding procedure qualification.

10.1.3.1 Welder/Welding Operator performance qualification.

10.1.3.2 Welding data (Procedure, welder/ operator, N. D. T. method and result) for all joints made in primary and secondary steel.

10.1.4 N. D. T. procedures employed.

10.1.4.1 N. D. T. operators qualifications records.

10.1.4.2 N. D. T. reports on welds inspected.

10.1.5 Piling records as indicated in **8.4.2** and **8.4.3.**

10.1.6 Grouting records.

10.1.6.1 Grout strength test results.

10.1.7 Post installation reports indicated in **9.4.**

10.2 Copies of or summarized records of the above, as mutually agreed, shall be furnished to the purchaser and Inspection/Certifying organisation.

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