



**OFFSHORE  
DESIGN  
SECTION  
MUMBAI  
REGION**


**GENERAL  
SPECIFICATION  
FOR  
MATERIALS,  
FABRICATION AND  
INSTALLATION OF  
STRUCTURE**


|                     |            |
|---------------------|------------|
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| Rev. No.            | 11         |
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# **GENERAL SPECIFICATION FOR MATERIAL, FABRICATION AND INSTALLATION OF STRUCTURE**

| Prepared /<br>Revised By | Reviewed<br>By | Approved By | Total No. of<br>Pages | Date       | Rev. No. |
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### 1. MATERIAL

#### 1.0.1 Scope & General

This specification defines the minimum requirements for the manufacture and supply of structural materials for uses in the fabrication of the Platform.

If a deviation from these specifications or a substitution of material is sought, the Contractor shall submit written request to Company along with necessary supporting documents including test results, manufacturer's certificate etc., and allowing reasonable time for evaluation without disruption of the construction schedule. It shall be the Contractor's responsibility to satisfy the Company that the proposed deviation or substitution will in no way be detrimental to the quality of the works intended in the bid package. The Company may ask for additional information & testing/retesting which the Company may consider necessary, which the Contractor shall carry out at no extra time and cost to the Company.

#### 1.0.2 CODES AND STANDARDS

##### 1.0.2.1 Mandatory Indian Statutory requirement.

This document has been prepared to the International standards detailed hereunder. The Contractor shall ensure that the work is executed in accordance with all mandatory Indian Statutory and regulatory requirements.

##### 1.0.2.2 Codes and Standards & Regulations

The requirements of the latest published versions of the following listed Codes, Recommended Practices, Specifications and standards shall be complied by the Contractor.


##### 1.0.2.3 American Society of Mechanical Engineers (ASME)

| Sr.no. | Code no.      | Description                                 |
|--------|---------------|---|
| 1      | ASME B1.1     | United Screw Threads (UN & UNR Thread Form) |
| 2      | ASME B18.2.2  | Square and Hex Nuts                         |
| 3      | ASME B18.21.1 | Lock Washers                                |
| 4      | ASME A112.6.3 | Specification for floor and trench drains   |
| 5      | ASME A112.6.4 | Roof/Deck & Balcony drain                   |

##### 1.0.2.4 American Petroleum Institute (API)

| Sr.no. | Code no.  | Description  |
|--------|-----------|--|
| 1      | API RP 2A | Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working |

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|    |              |  |
|----|--------------|--|
|    |              | Stress Design  |
| 2  | API Spec 2B  | API Specification for Fabricated Structural Steel Pipe.  |
| 3  | API Spec 2H  | API Specification for Carbon Manganese Steel Plate for Offshore Platform Tubular Joints.   |
| 4  | 2MT1         | As Rolled carbon manganese Steel Plate with improved toughness for Offshore Structure.   |
| 5  | API RP 2X    | Recommended Practice for Ultrasonic examination and guidelines of offshore Structural fabrication and guidelines for qualification of Ultrasonic Technicians |
| 6  | API Spec 5L  | API Specification for Line Pipe  |
| 7  | API Spec 10A | Oil Well Cement Class - G  |
| 8  | ASTM 80      | Stainless Steel Chain  |
| 9  | API Spec 2F  | Specification for Mooring chain  |
| 10 | API RP 2FB   | Recommended Practice for the Design of Offshore facilities against Fire and blast Loading  |

#### 1.0.2.5 American Society for Testing and Materials (ASTM)

| Sr.no. | Code no.   | Description  |
|--------|------------|--|
| 1      | ASTM A 6   | General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling.                        |
| 2      | ASTM A36   | Structural Steel   |
| 3      | ASTM A 53  | Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.  |
| 4      | ASTM A106  | Seamless Carbon Steel Pipe for High Temperature Service  |
| 5      | ASTM A109  | Compressive Strength of Cement Grout.  |
| 6      | ASTM A123  | Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products  |
| 7      | ASTM A131  | Standard Specification for Structural Steel for Ships  |
| 8      | ASTM A153  | Zinc-Coating (Hot-Dip) on Iron and Steel Hardware  |
| 9      | ASTM A 182 | Stainless steel Flange, Fittings   |
| 10     | ASTM A 193 | Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.                                |
| 11     | ASTM A 194 | Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service.                          |
| 12     | ASTM A 240 | Stainless Steel plates   |
| 13     | ASTM A 276 | Stainless steel bars & Shapes  |
| 14     | ASTM A307  | Carbon Steel Bolts and Studs   |
| 15     | ASTM A312  | Stainless Steel Pipes  |
| 16     | ASTM A325  | High Strength Bolts for Structural Steel Joints  |
| 17     | ASTM A 370 | Mechanical Testing of Steel Products   |
| 18     | ASTM A490  | High Strength Steel Bolts for Structural Steel Joints  |
| 19     | ASTM A500  | Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes                            |
| 20     | ASTM A563  | Carbon and Alloy Steel Nuts  |
| 21     | ASTM A 572 | High - Strength Low-Alloy Columbium –Vanadium Steel of Structural Steel  |
| 22     | ASTM A 578 | Specification for Straight Beam Ultrasonic Examination of plain and Clad Steel Plates for Special Applications |
| 23     | ASTM A 633 | Specification for Normalized High Strength Low Alloy Structural  |

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|----|-------------|--|
|    |             | Steel Plate.   |
| 24 | ASTM A 653  | Specification for Galvanized steel sheet   |
| 25 | ASTM B 695  | Coatings of Zinc Mechanically Deposited on Iron and Steel.   |
| 26 | ASTM A 786  | Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates |
| 27 | ASTM C150   | Portland Cement.   |
| 28 | ASTM D 2000 | Classification System for Rubber Products in Automotive Applications   |
| 29 | ASTM F 436  | Hardness Steel Washers for Use with High Strength Bolts  |
| 30 | ASTM D 4894 | PTFE   |

#### 1.0.2.6 American Welding Society (AWS)

| Sr.no | Code no.  | Description   |
|-------|-----------|---|
| 1     | AWS D1.1  | Structural Welding Code – Steel                                       |
| 2     | AWS D1.3  | Structural Welding Code – steel Sheet                                 |
| 3     | AWS D1.6  | Structural Welding Code – Stainless steel                             |
| 4     | AWS A 2.4 | Standard Symbols For Welding, Brazing, And Nondestructive Examination |

#### 1.0.2.7 American Institute of Steel Construction (AISC)

| Sr.no. | Code no.                     | Description                                     |
|--------|------------------------------|---|
| 1      | AISC                         | Manual of Steel Construction                    |
| 2      | CAP 437<br>(Seventh Edition) | Standards for Offshore Helicopter Landing Areas |


#### 1.0.2.8 Indian Standards Institute (ISI)

| Sr.no. | Code no. | Description   |
|--------|----------|---|
| 1      | IS 2062  | Hot Rolled Medium and High Tensile Structural Steel - Specification             |
| 2      | IS 883   | Design of Structural Timber in Building - Code of Practice                      |
| 3      | IS 269   | Ordinary Portland Cement  |
| 4      | IS 3502  | Steel Chequered Plate – Specification   |
| 5      | IS 1786  | FE 415 – High Strength Deformed Steel Bars and Wires for Concrete reinforcement |
| 6      | IS 4457  | Specification for Ceramic Unglazed Vitreous Acid Resisting Tiles                |

#### 1.0.2.9 European Standard (EN-10025)

| Sr.no. | Code no.                 | Description  |
|--------|--------------------------|--|
| 1      | BS 8118                  | Structural use of aluminium – Parts 1 & 2                              |
| 2      | EN 755 Parts 1-9         | Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles    |
| 3      | EN ISO 3506<br>Parts 1-2 | Mechanical properties of corrosion-resistant stainless-steel fasteners |

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| 4   | EN 10025-3 | Hot rolled products of structural steels. Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels |   |                    |            |

1.0.2.10 NORSOK Standard

| Sr.no. | Code no. | Description                            |
|--------|----------|--|
| 1      | C-001    | Living Quarter Area                    |
| 2      | C-002    | Architectural components and Equipment |
| 3      | M-001    | Material Selection                     |

1.0.2.11 National Standard Plumbing code

1.0.2.12 DNV RP C204 Design against accidental Loads

1.1 STRUCTURAL STEEL

1.1.1 Delivery

Steel shall be delivered in accordance with the requirements of ASTM A6 and as specified in this document.

1.1.2 Condition of Material


Structural steel to be used shall be new, unused (not reconditioned) and free of defects. Steel plates and rolled shapes shall be free of rolling defects, burrs, rough spots and other surface imperfections. Surface finish for steel surfaces shall be such that only blasting and no grinding is required to achieve a surface acceptable for painting. Plate edges shall be even, smooth, and free of laminations. Edge shearing of plates of a thickness of 25 mm or larger shall not be permitted.

Except where requested by specific supplements, systematic Ultrasonic Testing (UT) of steel plates at fabrication time is not required. However, any delivered plate which fails to meet the maximum discontinuity requirements of AWS D1.1 Section 3.2.3 e.g. 4% rule with adjustments shall be replaced. These rules, written for edge discontinuities, shall apply to the body of the plate, since plates are generally used as rolled tubulars and must provide footprints (i.e. edges) to other tubular where small region outside footprints and edges in accordance with AWS D1.1.


1.1.3 Dimensional Tolerances

Dimensional tolerances of individual tubular sections 457 mm diameter and above shall be in accordance with API 2B. A maximum of 1.5% cold expansion shall be allowed. The use of electric resistance welded (ERW) or spiral welded pipe is prohibited. Only SAW or DSAW tubulars welded with a

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| <p>qualified procedure in accordance with AWS D1.1 or seamless pipe is acceptable for structural use. Hydrostatic testing of structural tubular is not required. Rolled tubulars shall not have more than one longitudinal seam.</p> <h3>1.1.4 Material Storage</h3> <p>All material, whether procured or fabricated, shall be stored above ground on pallets, timber cribbing or similar supports. The material shall be stored above the level of standing water and be kept free from dirt, grease, paint spray and other foreign matters.</p> <h3>1.1.5 Material Marking</h3> <p>All material shall be identified by marking <b>in accordance with codes &amp; standard</b> and heat numbers / <b>cast number / bloom number / product number</b> and will be in accordance with ASTM A6 where applicable. All identification markings shall be clearly visible and capable of remaining intact through the completion of fabrication. The material identification and traceability procedure shall be developed by the Contractor to identify each structural member / <b>component</b> with Heat Number /Cast Number / <b>bloom number / product number</b> to correlate the test certificates. This procedure shall be applicable from its receipt and storage through sub-assembly and final erection. Unidentified material shall not be acceptable in accordance with API RP 2A.</p> <h3>1.1.6 Inspection and Testing</h3> <h4>1.1.6.1 Mill Tests and Mill Certificates</h4> <p>All mandatory inspection and testing listed under the basic specification to which the steel is manufactured and all supplementary and additional requirements specified in these specifications for the concerned grade shall be documented to have been satisfied through mill tests and mill test certificates <b>both for Ladle &amp; Product</b>.</p> <p>One set of all relevant certificates and reports, clearly legible and in the English language shall he submitted by Contractor to Company. SI Units shall be used in all documentation. The mill certificates shall be signed by Manufacturer's Quality Assurance Representative and where specified by Company, an independent Third Party acceptable to Company to state compliance with this specification.</p> <p><b>In case of butt welded seam Tubular procured under API 5L / 2B, Mill Test Certificate of the Plate Material shall be obtained and submitted.</b></p> |  |   |  |                          |           |       |          |    |             |            |                     |  |
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#### 1.1.6.2 Contents

The mill certificates and reports shall include all relevant information including, but not restricted to the following:

##### a) Identification

Mill Location, Purchase Order and item Number, Date of manufacture, Method of Manufacture, steel making process, Mill Heat / Cast Numbers, bar or bloom number, plate number, supply condition, dimensions, specification and grade of steel (basic specification).

##### b) Composition

Ladle (Heat) analysis and product analysis **with** Carbon Equivalent. All elements used in the carbon equivalent formula shall be analyzed and reported. Elements which are not specified for any grade in the respective codes shall not be intentionally added without specific approval from Company prior to manufacture.

##### c) Mechanical Properties

- Tensile strength, Yield Stress, Ultimate strength and Percent elongation.
- Charpy V-notch tests results, (if required).
- Through thickness properties, (if required).
- Strain age test results, (if required).

##### d) Non-destructive test results, (if required).

##### e) Details of heat treatment, if performed.

##### f) Impact testing specimen size, orientation, impact values and test temperature.

##### g) Reports signifying meeting other specific/ supplementary requirements for the specification for the material.


##### h) Supplementary information relating to manufacturing process.

#### 1.1.6.3 Material Certification

Original Mill Test Certificate shall be made available to the Company **appointed Inspector** for verification **at the time of inspection**. Material with Mill Test Certificates, that do not satisfy the specified requirements herein shall

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be rejected and removed from the storage area. In case of butt welded **seam Tubular procured under API 5L / 2B, Mill Test Certificate of the Plate Material shall be obtained and submitted.**

**Copy of Original Mill Test Certificate duly signed by TPI/CA shall be submitted with material Traceability as As-Built Documentation.**

**1.1.6.4 Material Testing**

This section gives the minimum requirements of the materials supplied to this specification. Unless stated otherwise, all testing shall be performed in accordance with ASTM A6 "Standard Specification for General Requirements for Rolled Steel Plates, shapes, sheet piling and Bars for structural use" and ASTM A 370 "Mechanical Testing of steel products".

**1.1.7 Ex-Stock Steel**

Steel manufactured two years prior to the actual use shall not be accepted. However, in case of any immediate requirement of any small quantity, supply of ex-stock steel in good condition and free from rust and pitting may be offered for Company’s consideration. Such material shall be easily identifiable with respect to its Heat / Cast number, Manufacturer’s stamp, colour coding, Grade etc., as given in the mill test certificate. The mill test certificates of such material shall meet the required specification. The Contractor shall satisfy Company by means of additional tests as directed on the company’s inspection at no extra time and cost to the company.


**1.1.8 Steel Manufacturing Process**


Only product manufactured by the electric arc furnace or the basic oxygen processes is acceptable as structural steel. Bessemer process, rimmed or capped steels are not acceptable. Material for through thickness application shall be vacuum degassed or VAD or ladle refining process while molten. Rejected steels and unidentified steel are not acceptable. Specifically, rejected high strength steel (350 MPa) is not to be substituted for low strength steel (250 MPa).

**1.1.9 Class and Types of Structural Steel**

Steel material types define by shape and grade or strength designation consisting of the specified minimum yield strength in MPa. In the case where through thickness properties (TTP) are required for attachments and loads perpendicular to the plate surface, a suffix “Z” has been added. Chemical composition of steel shall be in accordance with the respective standards with

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| <p>supplementary requirements given in Sections 1.1.9.4 and supply conditions given in Section 1.1.9.5 hereunder.</p>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>1.1.9.1 Class of Material</b>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>Class A</b>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>Class A material are suitable for critical applications involving stress concentrations, high restraint, the possibility of plastic strain and lack of redundancy. Charpy impact test in accordance with the specified Standard is mandatory. Carbon equivalent shall be as per respective standard and specification.</p>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>Class B</b>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>Class B material are intended for less critical applications but still involve the possibility of plastic strain and therefore the need for impact testing. The material shall meet the Charpy requirements of the specified Standard and in addition. Carbon equivalent shall be as per respective standard and specification.</p>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>Class B material shall not exceed 63 mm. in thickness.</p>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>Class C</b>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>Class C materials are those, which have a history of successful applications in welded structures at service temperatures above 0° C, for which impact testing is not required. Applications are for primary and secondary members involving moderate forming, low restraint and modest stress concentrations. Structural redundancy should be provided by the design.</p> |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>1.1.9.2 Types of Structural Steel</b>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>The following is a guideline for the selection of steels for use in offshore structures. Contractor shall use steel type to suit fabrication methods, welding procedure etc., for each structural steel type as specified.</p>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>Grades of Steel are covered in this specification are: -</b>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>Grade 250:</b> Carbon Steel of Minimum yield strength 240-250 MPa (35-36 ksi).   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>Grade 350:</b> Intermediate Strength steel of Minimum yield Strength 340-360 Mpa (50-52 ksi).  |  |   |  |                          |           |       |          |    |             |            |                     |  |
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High strength steel, yield strength of steel exceeding 360 Mpa (52 ksi) shall not be used for offshore platform.

1.1.9.3 Table: STEEL TYPE, SHAPE, APPLICATION, GRADE, SPECIFICATION & CLASS

| TYPE   | SHAPE           | APPLICATION   | GRADE | SPECIFICATION  | API CLASS |
|--------|-----------------|---|-------|--|-----------|
| 1-A    | Plate           | Plates for minor secondary steel in top side, deck plating, toe plates, etc. Building Wall, Building Floor and Roofing. Plates<br>*grating (from cellar Deck & upwards),  | 250   | ASTM-A 36 /<br>IS 2062:E250<br>Quality – B/C   | C         |
| 1-B    | Plate           | Plates for rolling tubular for secondary steelwork, Stiffeners. Plates for profiling for building module  | 250   | ASTM-A-36 /<br>IS 2062 E250<br>Quality - C   | C         |
| 1-C    | Rolled section  | Steel sections with a depth up to 300 mm and used as secondary members. (Including angles, channels, etc.).   | 250   | ASTM-A-36 /<br>IS 2062 E250<br>Quality – C   | C         |
| 1-D    | Tubular         | Seamless tubulars up to 406 mm (16") diameter for substructure braces, truss braces and chords for substructure and topside deck, bridge braces, *handrail & ladders (from cellar deck & upwards)   | 250   | API-5L-Grade-B/<br>ASTM-A-106<br>Grade B   | B/C       |
| 2-B    | Plates          | Non-through thickness applications less than 75 mm thick involving tubular above 406 mm diameter for primary steel throughout the structure, like Jacket legs/skirt sleeves, Deck truss, Deck legs other than joint cans, barge bumpers and helideck plating, plate girder, shim plates, bridge braces, Stiffeners, etc.                      | 350   | ASTM-A-131-DH36 /<br>EN 10025-S355 -J2G3/<br>EN 10025-S355-J2+N/<br>EN 10025-S355-K2+N | A         |
| 2-C    | Rolled Section  | For applications of Primary and major secondary steelwork where rolled sections are to be used with a depth above 300 mm  | 350   | ASTM-131-AH36 /<br>EN10025-S355-J0G2/<br>EN10025-S355-J2+AR/N                          | B         |
| 2-D    | Tubular         | seamless tubular up to 406 mm (16") diameter for use in substructure braces, truss braces and chords, energy absorbing tubulars in riser Protector, Boat-landing and Barge Bumpers, shock cells   | 350   | API-5L-Grade-X52N,<br>PSL-2  | B         |
| 2-Z    | Plates          | Typical through thickness applications ("Z") above 19 mm thickness involving primary items at critical design area like Tubular Can Joint Sections, Primary Member, Brace Node Sections, Installation Pad eyes, Crane pedestal, lifting eye and cheek plate, Pile in mudline region, diaphragm plate, beam web plate, beam flange plate, etc. | 350   | API-2H –50Z  | A         |
| 2-CON  | Tubular         | Conductor Pipes of all sizes (25mm minimum wall thickness) with single seam.  |       | API-5L, Grade X-52N,<br>PSL-2  | B         |
| 1-Arch | Stainless Steel | Exposed to weather – Doors & windows frames & shutters, handrail toe plate / kick plate, grating (in wave zone below Cellar deck).  |       | AISI 316/317<br>*316L/317L   |           |

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|  | plate                  |  |   | (See note-8)  |            |
| 2-Arch   | Galvanized steel sheet | Not exposed to weather-Doors, internal partition, bulkheads, false ceiling |   | ASTM A 653  |            |
| 3-Arch   | Stainless Steel tubes  | Handrails & ladders (in wave zone below cellar deck)                       |   | ASTM A 312<br>Gr. 316L/317<br>*316L/317L (See Note-8) |            |
| <b>Notes: -</b> <ol style="list-style-type: none"> <li>1. Specification supplements relate to the first code indicated in the above table under specification column only.</li> <li>2. Stiffeners, flange extension plates, ring stiffeners etc. shall be of the same grade as the element to which they are connected.</li> <li>3. For piles, mud line region is defined as the region over which the thickness is determined based on stress considerations and extends over the negative and positive bending moment regions and includes the under drive and overdrive allowances.</li> <li>4. All floor plating of Cellar deck, Main deck, etc. shall be of Chequered plates.</li> <li>5. Fabricated plate girder may be used only for the requirement sections having depth exceeds 900 mm and above. Welding of flange-web connection of plate girder shall be full penetration weld only.</li> <li>6. TMCP Steel material shall not be used for conductor (2-CON)</li> <li>7. All Stainless steel items wherever used shall be of SS316/ SS317.</li> <li>8. *All Stainless steel items wherever welding is required shall be of SS316L/ SS317L.</li> </ol> |                        |  |   |   |            |
| <b>1.1.9.4 Supplementary Requirements</b> <p>Material shall comply with the following supplementary requirements &amp; shall be reported in Mill Test Certificate:</p> <ol style="list-style-type: none"> <li>a. 1-A to 1-D Type of steel shall be killed steel.</li> <li>b. 2-B, 2-C, 2-D, 2-Z &amp; 2-CON Type of steel shall be killed and made according to fine grain practice.</li> <li>c. Steel material used for grating &amp; handrail shall have silicon content in the range of 0.15 &amp; 0.22% (for good galvanizing)</li> </ol>  |                        |  |   |   |            |
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d. Charpy V-Notch Impact test shall be conducted at (-) 20<sup>0</sup>C for Type 2-B steel material with minimum 34 Joules & 24 Joules in Longitudinal & Transverse direction respectively & at 0<sup>0</sup>C for 2-C and 2-D material with minimum single value 27 Joules.

e. Percentage elongation (200mm) shall be minimum 21% and 18% respectively for Grade 250 and Grade 350. The minimum percentage elongation shall be 2% more if report is made on gauge length of. 5.65 (So) <sup>½</sup>. The percentage elongation shall be (Lu-Lo) x 100 /Lo, where Lo= 5.65 x (So) <sup>½</sup>, so is the original cross sectional area of gauge length and Lu is the final length.

f. For Type 2-Z, the following shall be applicable:

i. All plates shall be **ultrasonically** examined in the final heat treatment condition for defects and discontinuities in accordance with ASTM A-578. Acceptance standard shall be Level-A (**S1** of API Spec 2H).

ii. Charpy V-Notch toughness impact test at (-) 40<sup>0</sup>C in Transverse direction with minimum single value 34 Joules and average energy value 41 Joules as per Supplementary requirement **S2** of API Spec. 2H.

iii. Individual plate testing as per **S-3** of API-2H.

iv. Through Thickness (Z direction) tensile testing shall be performed as per Supplementary requirement **S4** of API Spec. 2H.

v. The sulphur content of steel shall be as per clause 5.2 of Supplementary requirement **S 5** of Spec. API 2H.

g. If micro alloying elements Nb, V, Ti are used, their total shall not exceed 0.15 percent.

h. For Thermo-Mechanical Control Processing (TMCP) or equivalent steel please refer Section 1.1.9.5 (ii) hereunder.


i. Pitting Resistance Equivalent Number (PREN) value of stainless steel (1-Arch ) shall comply following:

- PREN=Cr +3.3 Mo + 16 N
- Minimum Mo content shall be 2.5%

1.1.9.5 Supply Condition

Material shall comply with the following supply conditions:

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i. Steel Grades 2-B and 2-Z shall be supplied in Normalized Condition. Steel **Type** 1-C and 2-C (Rolled Section of flange thickness over 25 mm) shall be supplied in Normalized condition. All other steel may be supplied in as rolled condition.

ii. If the manufacturer/supplier offers an alternative supply condition, e.g. Thermo-Mechanical Control Processing (TMCP) for steel plates

(2-B, 2-D & 2-Z) and structural steel shapes (2-C), shall meet the supply conditions as under:

a. Material grade above Grade 50 (50 Ksi – 345 MPa) shall not be used.

b. Conductor (2-CON) and Pile material shall not be used under this category.

c. Supplementary Requirement of Simulated Post-Weld Heat Treatment (S9) & Pre Production Qualification (S11) applicable to steel Type - 2B, 2C, 2D & 2Z.

d. Supplementary Requirement of S1, S3, S4, S5, Charpy V-Notch toughness test as per clause 1.1.9.3 above.

e. TMCP Steel material having Yield Strength exceeding 52 ksi shall not be used for offshore structure and shall not be accepted.

**1.1.10 Heat Treatment**

Elements subject to press or roll forming where the temperature of the steel is above 38 degree C and less than 427 degree C during forming operation shall be stress relieved by heating the element to a temperature between 590°C and 620°C and cooling after a specified time.

**1.1.11 Quality of finished Steel**


The finished steel shall be presented for inspection such that the surface can be readily inspected for defects. All surfaces shall be 100% visually inspected for defects. Repair of plates by welding by Manufacturer or supplier is not permitted.

**1.1.12 Material Substitution**


Alternative Specifications or property grades for certain material may be accepted with the prior approval of the Company, provided that it can be shown to be equivalent or superior to the specifications as per ASTM & API code listed in the table 1.1.9.3 and the required properties and appropriate supplements of the materials is complied with the material specified. When the

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| <p>proposed substitute material have variation in chemical and Mechanical properties from the listed codes, the contractor shall establish with reasoning the superiority/equivalent of the alternate material.</p>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>1.1.13 Steel Material Inspection</b>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>Steel Material shall be physically inspected by Company appointed inspector at Site of Works on arrival of Material with respect to Mill Test Certificate and accepted before put to use.</p>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>Mill Test Certificate along with material Traceability record shall be documented as As-Built Documentation/ record.</p>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>1.2 Material of Construction of Aluminum Helideck</b>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>Material for Helideck shall be Aluminum unless &amp; otherwise specified in the structural Design criteria for the designated Helicopter.</p>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>1.2.1 General</b>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>Aluminium Helideck shall be designed for the designated Helicopter as per the Structural Design Criteria and as well shall comply with CAP 437 Guideline. Helideck Purchase specification shall be generated supported with detail design of helideck.</p>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>The helideck beams and plating shall be made of extruded aluminium meeting the requirements of the following specification. The top pan cake aluminium structure shall be supported by the steel primary members of the helideck.</p>   |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>The top aluminium structure shall also cover the safety net, supports for solar panel, Cable tray, lights and drains ,threshold gratings at access points, Handrails, isolation sets at all interfaces with carbon steel, access gangways and stairs, Helicopter tie-down and helicopter landing net tensioning points.</p> |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>Design Calculation &amp; Analysis of Aluminum Helideck shall be certified by third party Certifying agency like DNV/BV. Helideck manufacturer shall obtain this certification, which along with drawing shall be part of Purchase specification.</p>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <b>1.2.2 Material Standards</b>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
| <p>The equipment shall be designed and tested in accordance with, but not limited to, the requirements of this specification and the latest editions of the following standards, codes, statutory regulations and other documents referenced therein:</p>  |  |   |  |                          |           |       |          |    |             |            |                     |  |
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BS 8118

Structural use of aluminium – Parts 1 & 2

EN 755 Parts 1-9

Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles.

EN ISO 3506 Parts 1-2

Mechanical properties of corrosion-resistant stainless-steel fasteners.

BS 4592

Specification for metal open bar grating

### 1.2.3 Material Grades

The materials and grades to be used to the helidecks are tabled below:

| PRODUCT                           | ALLOY     |
|-----------------------------------|-----------|
| Aluminium Extrusions (structural) | 6082 T6   |
| Aluminium Extrusions (planking)   | 6005A T6  |
| Aluminium Extrusions (other)      | 6063 T6   |
| Aluminium Sheet                   | 5083 H111 |
| Stainless Steel Fixings           | A4 – 80   |

#### 1.2.3.1 Alternative Grades

Alternative grades may be offered, however their use will be subject to the Company’s approval.


#### 1.2.3.2Stainless Steel Nuts & Bolts of Grade SS316 shall be used for bolted connections. Aluminum Helideck Bolted connections / Joints shall be sealed with suitable sealant to minimize possibility of Crevice Corrosion.

#### 1.2.3.3 Safety net panels shall be of Aluminum frames with Stainless Steel wire mesh.

### 1.2.4 Inspection

The aluminium helideck supplied to this specification shall be fully inspected and verified by an approved third party verification organization. The Supplier is required to provide all drawings supported with design calculations, details and descriptions to enable the company to obtain permission to use the helideck. All Mill Test Certificate of Aluminum material, Helideck Manufacturer’s QA & QC Records, Design document, Drawings and Material Inspection report shall be document as as-built documentation.

|                           |                    |                 |                |                          |
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1.2.4.1 Isolation

1.2.4.1.1Electrical Isolation

Electrical isolation between aluminum and steel structure shall be achieved by providing insulating material (hard neoprene or poly-acetyl made washers, bush & sleeves) to avoid galvanic corrosion.

1.2.4.1.2Earth Connections

The isolation achieved by § 1.2.4.1.1 requires that effective earthing of the aluminium is made through earth bosses. These will be welded to the aluminium support beams local to points of support on the steel substructure.

1.3 CEMENT

1.3.1 Cement Grades

Unless otherwise stated on the bid drawings all cement provided for construction, these platforms shall conform to one of the following.

Type A

Portland Cement as per ASTM C-150 Type I or IS-269

Type B

Oil well Cement as per API Specs-10A Class-G.

Cement supply to specifications equivalent to those listed above shall be considered as substitution and shall require written approval of the Company to this effect.


1.3.2

When a specific physical or chemical property of the grout or concrete is warranted which is not achievable by controlling the proportions of the normal constituents of the cement grout or concrete, additives to the cement grout or cement concrete may be allowed. The Contractor shall submit to Company his proposal for such additives giving details of the chemical composition of the proposed additives and the specific properties of the cement grout or cement concrete, Contractor proposed to achieve together with test results and other relevant details. The Company shall within a reasonable period review and convey to the Contractor its decision on such proposal. It shall be the Contractor’s responsibility to satisfy the Company that his proposal will satisfactorily meet the requirements of the works.

1.3.3 Usage Summary

Usage of different grades of cement shall be as given in Table 3.1.

|                           |                    |                 |                |                          |
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**TABLE - 3.1**

|   | CEMENT GRADE |         |
|---|--------------|---------|
|   | TYPE A       | TYPE B* |
| Grout in Jacket leg to Pile Annulus/ Skirt Sleeves to Pile Annulus /Grout Plug in Piles | -            | X       |
| Concrete in filling of structural members of riser guard vertical runners etc.          | X            | -       |

\*Non – shrinking property is essential.

### **1.3.4 General Requirements**

#### **1.3.4.1 Ex-Stock Cement**

Cement supplied ex-stock shall not be accepted without proper identification and without manufacturer's Test certificates.

Cement manufactured over six months prior to actual use shall not be used for construction of these works without written approval of Company. On written request by Contractor accompanied with results of satisfactory retesting of the cement as the Company may deem fit, Company shall at its sole discretion decide whether or not to allow use of such cement for its works.


In case of any doubt the Company may ask for independent testing of the cement to be used on Company's Works by a third party to be selected solely by the Company at the Contractor's cost. Non-compliance of any of these specifications shall be sufficient cause for rejection of the cement and in such case all costs of testing by a third party shall be borne by the Contractor and all such cement be removed from the work site by the Contractor


#### **1.3.4.2 Manufacturer's Test Certificate**

**1.3.4.2.1** The Contractor shall submit manufacturer's test certificates to the Company for all cements he intends to use for the works whether procured freshly or being supplied ex-stock. The Contractor shall indicate the manufacturer's name, trade mark or other means of identification, the batch number and date of manufacture and test results covering fineness, chemical composition and compressive strength at 1 day, 3 days and 28 days, initial and final setting time, shrinkage/expansion and soundness. All test shall be carried out as specified in 1.2.4.2.2 below.

**1.3.4.2.2** All tests for the cement shall be carried out as specified in ASTM C-109 using 50mm cube specimen.

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| <p>Shrinkage/expansion test shall be carried out as specified in ASTM designation C-807-87. "Restrained Expansive Cement Mortar" or by similar acceptable method.</p> <p><b>1.3.4.2.3</b> Identification of the cement intended to be used for the works shall be co-relatable with the identification on the manufacturer's test certificate.</p> <p><b>1.3.4.3 Special Requirements</b></p> <p>The following requirements shall apply unless specifically waived by the Company or otherwise specified herein or on bid drawings.</p> <p>For all cement used for the works where non-shrinking/expansive property is desired shall have acceptance criteria as below:</p> <p>Drying Shrinkage                      - 0.08 % at 28 days (as per ASTM C-596)</p> <p>Expansion                                      - 0.10% - 0.30% at 28 days.</p> <p><b>1.3.4.3.1</b>The total amount of chlorides calculated as free calcium chloride shall not exceed 0.3 percent by weight of cement.</p> <p><b>1.3.4.3.2</b> Compressive strength for Type-G HSR cement shall not be less than 2.1Mpa (300 psi) in 8 hours at 38°C.</p> <p><b>1.3.4.3.3</b>The grout shall be of non-shrinking expansive type having density 1920 kg/m<sup>3</sup> with compressive strength shall not be less than 70 Kg/cm<sup>2</sup> (1000 psi) in 24 hours and 281 Kg/cm<sup>2</sup> (4000 psi) in 28 days at 27±2°C</p> <p><b>1.4 Miscellaneous Steel Items</b></p> <p><b>1.4.1 Fasteners</b></p> <p>Unless shown otherwise in the Drawings, all fasteners shall conform to the following:</p> <p>a) Lag screws and bolts shall be machined with American Standard Regular Hexagonal Heads with American Standard Coarse Threads, Class-2.</p> <p>b) Nuts shall be American Standard Regular Hexagonal.</p> <p>c) Washers shall be standard round plate and/or machine lock unless shown otherwise on the drawings.</p> <p>d) All bolts for use in the submerged and splash zones and upto &amp; Including jacket walkway level shall be fluoro- polymer coated (XYLAN type) or equivalent as specified in table -1.4.1.1. Coating color for all bolts and nuts</p> |  |   |   |                          |       |          |    |             |            |                      |  |
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shall be "Red". All nuts & bolts shall be of ASTM A-193 Grade B7 and nuts of ASTM A-194, grade 2H.

- e) All bolts, nuts and washers above splash zone and fixed to external surfaces and internal surfaces exposed to natural ventilation, shall be of stainless steel ASTM A-193 Grade B8M and nuts of ASTM A-194, grade 8M.

**Table-1.4.1.1: Specification for PTFE/ Xylan Coating on nut & bolts**

| Technical requirement of PTFE/Xylan Coating on nut & bolts |                              |  |
|--|------------------------------|--|
| Sr. no.  | Properties                   | Test Requirement   |
| i  | Corrosion resistance         | salt spray test up to 3000 hours (nuts not frozen) (ASTM B117) |
| ii   | Adhesion                     | 5B (ASTM D3359)  |
| iii  | Pencil Hardness              | 5H-6H (ASTM D3363)   |
| iv   | Kinetic friction coefficient | 0.06-0.08  |
| v  | Elongation                   | 35%-50%  |
| vi   | Tensile strength             | 27.6 Mpa (4000 psi)  |
| vii  | Operating pressure           | upto 690Mpa (100,000 psi)                                      |
| viii   | Coating Thickness            | 25 µm to 40µm  |
| ix   | Impact                       | 18.43 Nm (160 in.lb) (ASTM D2794)                              |
| x  | Thread fit                   | Over tapping of nuts 0.25mm (0.010")                           |
| xi   | Dielectric strength          | 500 volts per 25 µm  |
| xii  | Operating temperature        | -100°C to +260°C   |


**Note:** PTFE /Xylan coating on fasteners will have a uniform thickness of 20 ± 5 Microns to 45± 5 microns thick.

In atmospheric zone for structural purposes the hardness and strength class shall not exceed to ISO 898 (all parts) class 10.9.

In submerged zone Low alloy steel fasteners used for structural purposes the hardness and strength class shall not exceed to ISO 898 (all parts) class 8.8 & shall be coarse threaded and Class 8.0 for nuts.

Bolts & Nuts shall be procured along the Mill Test Certificate containing Product Analysis for Chemical Composition, Mechanical Tests, etc. Ladle Analysis shall also be reported with Steel manufacturing process. Manufacturer shall inspect all Bolts & Nuts for surface cracks and certify that supplied bolts & nuts are free from defects. Test Certificate for PTFE Coating shall be provided. On arrival of Bolt at site, all Bolts & nuts shall be inspected by Company appointed Inspector with respect to Mill Test Certificates.

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#### 1.4.2 Grating (Electro forged grating):

##### 1.4.2.1 i) Grating from Cellar Deck and above Material

Serrated flats for gratings shall conform to ASTM A-36 or IS 2062, E250 Quality – B. Cross bars shall be high strength deformed bars conforming to IS 1786 Gr. Fe 415.

Welding of grating shall be electro-forged weld.

For gratings being fabricated by resistance welding/ electro forged welding, bearing member shall be minimum 30 mm X 5 mm serrated type spaced at 30 mm center to center also. Square twisted Steel cross bar having minimum 8mm (diagonal), spaced at 75 mm center to center. Crossed bars over bearing bar shall be fully pressed into the bearing bars, flush and cross bar projection should be less than 1.5 mm. All bearing bar to frame bars shall be completely seal welded. Each bearing member shall be serrated by punching out of plain bar tops in order to provide cut edges for increased grip. The serration depth shall not be less than 2.5 mm.

The spacing of serration shall 12.5mm. The gratings shall be manufactured in accordance with BS-4592 requirements.

Grating for Treads for staircase shall also be electro- forged grating.

End fixing plate 50mmx6mm shall be provided & seal welded along the two supported ends (perpendicular to bearing plates) of treads of staircase.

All grating panels and treads of staircase shall be seal/fillet welded all around/on both the sides with the structural members.

6mm thick chequered plate Nosing shall be provided in the grating for treads of staircase.

Gratings shall be galvanized as per Functional specification no. 2005 “Protective Coating”.


##### ii) Grating Below Cellar Deck Material

Material for grating shall be of stainless steel. Serrated flats for gratings shall conform to ASTM A-484-13a Grade SS 316L. Cross bars for gratings shall conform to ASTM A276 GRADE 316L.

Welding of grating shall be Resistance weld.

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For gratings being fabricated by resistance welding/ electro forged welding, bearing member shall be minimum 30 mm X 5 mm serrated type spreader at 30 mm center to center also. Square stainless Steel cross bar having minimum 8mm (diagonal), spaced at 75 mm center to center. Crossed bars over bearing bar shall be fully pressed into the bearing bars, flush and cross bar projection should be less than 1.5 mm. All bearing bar to frame bars shall be completely seal welded. Each bearing member shall be serrated by punching out of plain bar tops in order to provide cut edges for increased grip. The serration depth shall not be less than 2.5 mm. The spacing of serration shall not be less than 12.5 mm. The gratings shall be manufactured in accordance with BS-4592 requirements.

Material for grating shall be as per Table 1.1.9.3 of this spec.

End fixing plate 50mmx6mm shall be provided & seal welded along two sides (perpendicular to bearing plates) of treads of staircase.

All grating panels and treads of staircase shall be seal/fillet welded all around/on both the sides with the structural members.

Nosing shall be provided in the grating for treads of staircase. Grating for Treads for staircase shall be electro- forged grating.

Details of gratings indicated as per 1.3.2.1(i) & (ii) above are suitable for Span of Grating upto 750mm. An intermediate support shall be provided where the span of grating exceeds 750mm.

| Sr. No. | Components of grating   | Gratings                                      |   |
|---------|-------------------------|---|---|
|         |                         | Grating from Cellar Deck and above            | Grating Below Cellar Deck                     |
| 1       | Material Bearing bar    | ASTM A-36 or IS 2062, E250 Quality – B        | ASTM A312 GRADE 316L                          |
| 2       | Material for cross bar  | IS 1786 Gr. Fe 415.                           | ASTM A276                                     |
| 3       | Bearing Bar             | 30x5mm  | 30x5mm  |
| 4       | Cross bar               | Square twisted having minimum 8mm (diagonals) | Square twisted having minimum 8mm (diagonals) |
| 5       | Depth of of serrations  | Minimum 2.5 mm                                | Minimum 2.5 mm                                |
| 6       | Spacing of cross bar    | 75mm centre to centre                         | 75mm centre to centre                         |
| 7       | Maximum span of grating | 750mm   | 750mm   |


### 1.4.3 Hand Rail & ladders

#### 1.4.3.1 Hand Rail below Cellar Deck (Type – I)

Stainless Steel Hand rail & ladders shall be provided on all peripheries of platform from Boat landing to Cellar deck (bottom). It shall cover sides of Jacket Walkway, Stair sides, Stair landing, Sub-Cellar Deck sides, Boat Landing and Stair to Boat Landing.

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Hand rails shall have continuous weld all round joints. Removable type Or Offshore installed Hand rails shall be test fitted at yard prior to load out and shipped loose duly marked for offshore installation. Hand rail post interval shall not exceed 1.5 m (horizontal distance). Height of hand rail shall be 1.1 m. Handrail Type-I shall be designed to withstand extreme wave load. Wave slam check shall be carried out for Hand rails.

#### 1.4.3.2 Hand Rail on and above Cellar Deck (Type – II & III)

Hand rail shall be provided on all peripheries of platforms, Cellar & Main deck, modules, roofs, Lay down areas, landings & stair landings, stair sides, sides of walkway, access platforms sides, Solar Deck, etc. Hand Rail for Laydown Area shall be removable / re-fixable type.

Hand Rail shall be designed for 100 kg load applied at any point in horizontal & vertical & direction on top Rail & at handrail post. Hand rail post interval shall not exceed 1.5 m (horizontal distance) and height of hand rail shall be 1.1 m below the top rail. Two intermediate rails shall be provided in the handrail. Kick Plate/toe late shall be provided at the bottom level of Handrail with a gap of 10mm between floor plate and grating. Clear distance between two Handrail post shall be 50mm.

Steel Handrail and kick plate shall be galvanised and over coated as per spec.2005.


Drain hole shall be provided at the bottom of collar of removable type Handrail for drainage of water


Following types of Hand rails shall be used:


- TYPE – I - Hand rail below Cellar Deck (Wave Zone) - Fixed Type.
- TYPE – II - Hand rail on and above Cellar Deck - Fixed Type.
- TYPE – III - Hand rail on and above Cellar Deck - Removable Type.

#### 1.4.3.3 TABLE : Details of Handrails & Chains

| ITEM                      | MEMBER                             | INDIAN STANDARD | INTERNATIONAL STANDARD                                       | MATERIAL CONFORMING TO                     |
|---------------------------|------------------------------------|-----------------|--|--|
| HANDRAIL<br>TYPE – I      | *VERTICAL POST &<br>TOP HORIZONTAL | -               | 60.33 Φ X 5.54<br>(SCH 80S)<br>(please see note -1<br>below) | STAINLESS STEEL : ASTM A 312<br>GRADE 316L |
|                           | OTHER HORIZONTALS                  | -               | 48.26 Φ X 5.08<br>(SCH 80S)                                  | STAINLESS STEEL:ASTM A 312<br>GRADE 316L   |
|                           | KICK PLATE                         | -               | 100 X 6  | STAINLESS STEEL : ASTM A 240<br>GRADE 316L |
| HANDRAIL                  | VERTICAL POST AND                  | ---             | 60.33 Φ X 5.54   | ASTM A53 / API-5L GR.B                     |
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| TYPE – II   | TOP HORIZONTALS                       |  | (SCH 80)  |   |  |                        |
|   | OTHER HORIZONTALS                     | ---  | 48.3 Φ X 5.08<br>(SCH 80)                                   |   | ASTM A53 / API-5L GR.B                       |                        |
|   | KICK PLATE                            | 100 X 6  | 100 X 6   |   | ASTM A36 /IS 2062 : E250 Quality – B         |                        |
| HANDRAIL<br>TYPE – III<br>(Removable<br>Type)   | *VERTICAL POST AND<br>TOP HORIZONTALS | ---  | 60.33 Φ X 5.54<br>(SCH 80)<br>(please see note -1<br>below) |   | ASTM A53 / API-5L GR.B                       |                        |
|   | OTHER HORIZONTALS                     | ---  | 48.3 Φ X 5.08<br>(SCH 80)                                   |   | ASTM A53 / API-5L GR.B                       |                        |
|   | KICK PLATE                            | 100 X 6  | 100 X 6   |   | ASTM A36 /IS 2062 : E250 Quality – B         |                        |
|   | SOCKET, COLLAR                        | -----  | 73.0 Φ X 5.16<br>(SCH 40S)                                  |   | ASTM A53 / API-5L GR.B/<br>IS:1161/IS:1239 / |                        |
| SAFETY<br>CHAIN   | -----                                 | -----  | 6 MM DIA  |   | STAINLESS STEEL GRADE 316L                   |                        |
| <p>*Note -1: The size of vertical post &amp; top horizontal rail is minimum and indicative only. Size of vertical post &amp; top horizontal rail shall be calculated &amp; provided as per design calculations considering environmental and live loads during detailed engineering.</p>  |                                       |  |   |   |  |                        |
| <b>1.5 TIMBER</b>   |                                       |  |   |   |  |                        |
| <b>1.5.1 Usage</b>  |                                       |  |   |   |  |                        |
| <p>The specification for timber as per IS 883 shall govern the application of timber used in:</p>   |                                       |  |   |   |  |                        |
| <p>a) Launch Truss runners of jackets.</p>  |                                       |  |   |   |  |                        |
| <p>b) Mud mats</p>  |                                       |  |   |   |  |                        |
| <p>Timber to be used for each of the above application shall meet the strength, durability and dimensional requirements for the intended use. Contractor to indicate the grades of timber along with their properties and satisfy Company on their suitability for the proposed use.</p>  |                                       |  |   |   |  |                        |
| <b>1.5.2 Delivery &amp; Storage</b>   |                                       |  |   |   |  |                        |
| <p>All timbers supplied for the works shall be delivered at the fabrication site in sizes and lengths as required for the works and fully seasoned and treated with preservatives.</p>  |                                       |  |   |   |  |                        |
| <p>After delivery and prior to use all structural timbers shall be stored in such a manner as to prevent decay and renewed development of defects. Preferably timbers shall be piled into stacks upon well treated and even surfaced beams, sleepers or brick pillars so as to be above ground level by at least 15 cm. The</p> |                                       |  |   |   |  |                        |
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| <p>stacks shall be protected from hot dry winds or direct sun and rain and shall be accessible from all sides.</p> <p>The stacks of timbers shall be appropriately marked so as to be readily identifiable and co-relatable with the purchase order, vendor's certificate or other inspection/test certificates.</p> <p><b>1.5.3 Inspection &amp; Testing</b></p> <p>Inspection and testing of timber shall be carried out as per the grades of timber supplied as per the IS 883 requirement.</p> <p><b>1.6 RUBBER</b></p> <p><b>1.6.1 SCOPE</b></p> <p>Rubber products (Neoprene) shall conform the Requirements of ASTM D 2000.Rubber material for fenders shall conform to the Requirements indicated in Table- 1.5.1.1 &amp; Table -1.5.1.2.</p> <p>This specification describes the minimum requirements for procurement, manufacture, testing and supply of rubber products for use on offshore platforms as required either as permanent component or as temporary installation and as listed below:</p> <table><tr><td>1. Boat Landing</td><td>- Shear Fenders</td></tr><tr><td></td><td>- Rub Strips</td></tr><tr><td>2. *Barge Bumper</td><td>- Shock Cell with</td></tr><tr><td></td><td>Rotating Bumper Rings</td></tr><tr><td></td><td>(See Note-1 Below)</td></tr><tr><td>3. Jacket Leg -</td><td>Rub strips</td></tr><tr><td>4. Jacket Leg/Skirt Sleeves</td><td>- Diaphragm Closures</td></tr><tr><td>5. Jacket Leg/Skirt Sleeves</td><td>- Grout Seal/Packer</td></tr><tr><td>6. Piles</td><td>- Pile Closure</td></tr></table> <p><b>*Note-1:</b> A chain as per API 2F with corrosion allowance of 6mm shall be provided connecting jacket legs and shock cell to prevent the pull out of the shock cell. Size of chain and fixing arrangement shall be firmed up during detailed engineering.</p> |  |   |  |                          | 1. Boat Landing | - Shear Fenders |          | - Rub Strips | 2. *Barge Bumper | - Shock Cell with |                     | Rotating Bumper Rings |  | (See Note-1 Below) | 3. Jacket Leg - | Rub strips | 4. Jacket Leg/Skirt Sleeves | - Diaphragm Closures | 5. Jacket Leg/Skirt Sleeves | - Grout Seal/Packer | 6. Piles | - Pile Closure |
| 1. Boat Landing  | - Shear Fenders  |   |  |                          |                 |                 |          |              |                  |                   |                     |                       |  |                    |                 |            |                             |                      |                             |                     |          |                |
|  | - Rub Strips   |   |  |                          |                 |                 |          |              |                  |                   |                     |                       |  |                    |                 |            |                             |                      |                             |                     |          |                |
| 2. *Barge Bumper   | - Shock Cell with  |   |  |                          |                 |                 |          |              |                  |                   |                     |                       |  |                    |                 |            |                             |                      |                             |                     |          |                |
|  | Rotating Bumper Rings  |   |  |                          |                 |                 |          |              |                  |                   |                     |                       |  |                    |                 |            |                             |                      |                             |                     |          |                |
|  | (See Note-1 Below)   |   |  |                          |                 |                 |          |              |                  |                   |                     |                       |  |                    |                 |            |                             |                      |                             |                     |          |                |
| 3. Jacket Leg -  | Rub strips   |   |  |                          |                 |                 |          |              |                  |                   |                     |                       |  |                    |                 |            |                             |                      |                             |                     |          |                |
| 4. Jacket Leg/Skirt Sleeves  | - Diaphragm Closures   |   |  |                          |                 |                 |          |              |                  |                   |                     |                       |  |                    |                 |            |                             |                      |                             |                     |          |                |
| 5. Jacket Leg/Skirt Sleeves  | - Grout Seal/Packer  |   |  |                          |                 |                 |          |              |                  |                   |                     |                       |  |                    |                 |            |                             |                      |                             |                     |          |                |
| 6. Piles   | - Pile Closure   |   |  |                          |                 |                 |          |              |                  |                   |                     |                       |  |                    |                 |            |                             |                      |                             |                     |          |                |
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**Table 1.6.1.1: Requirement of rubber material (Molded Fenders)**

| Sr. no. | Property             | Testing Standard        | Condition                              | Requirement                                       |
|---------|----------------------|-------------------------|--|---|
| 1       | Tensile              | ASTM D412 Die C         | Original                               | 16.0 MPa (min.)                                   |
|         |                      |                         | Aged at 96 hours At 70° C              | 12.8 MPa (min.)                                   |
| 2       | Elongation at Break  | ASTM D412 Die C         | Original                               | 350%  |
|         |                      |                         | Aged at 96 hours At 70° C              | 280%  |
| 3       | Hardness             | ASTM D2240              | Original                               | 78°Shore A (Max.)                                 |
|         |                      |                         | Aged at 96 hours At 70° C              | Original +8° Shore A (Max.)                       |
| 4       | Compression set      | ASTM D395 Method B      | 22 hours at 70° C                      | 30 % ( Max.)                                      |
| 5       | Tear Resistance      | ASTM D624 Die B         | Original                               | 70 kN/mm (Min.)                                   |
| 6       | Ozone resistance     | ASTM D1149              | 50 pphm at 20% stain, 40° C, 100 hours | No cracks   |
| 7       | Sea water Resistance | ASTM D471               | 28days @ 95° C                         | Hardness±10% Shore A (Max.) Volume +10/-5% (max.) |
| 8       | Abrasion loss        | BS 903 A9 Method B      | 3000 Revolution                        | 1.5 cc (max.)                                     |
| 9       | Bond strength        | ASTM D395 Method B      | Rubber to steel                        | 7 N/mm (Min.)                                     |
| 10      | Dynamic Fatigue      | Method D430-95 Method B | 15000 cycles                           | Grade 0-2   |


**Table 1.6.1.2: Requirement of rubber material (Extruded & Wrapped Fenders)**

| Sr. no. | Property             | Testing Standard   | Condition                              | Requirement                                       |
|---------|----------------------|--------------------|--|---|
| 1       | Tensile              | ASTM D412 Die      | Original                               | 13.0 MPa (min.)                                   |
|         |                      |                    | Aged at 96 hours at 70° C              | 10.4 MPa (min.)                                   |
| 2       | Elongation at Break  | ASTM D412 Die      | Original                               | 280%  |
|         |                      |                    | Aged at 96 hours at 70° C              | 224%  |
| 3       | Hardness             | ASTM D2240         | Original                               | 78°Shore A (Max.)                                 |
|         |                      |                    | Aged at 96 hours at 70° C              | Original +8° Shore A (Max.)                       |
| 4       | Compression set      | ASTM D395 Method B | 22 hours @70° C                        | 30 % ( Max.)                                      |
| 5       | Tear Resistance      | ASTM D624 Die B    | Original                               | 60kN/mm (Min.)                                    |
| 6       | Ozone resistance     | ASTM D1149         | 50 pphm at 20% stain, 40° C, 100 hours | No cracks   |
| 7       | Sea water Resistance | ASTM D471          | 28days @95° C                          | Hardness ±10% Shore A (Max) Volume +10/-5% (max.) |
| 8       | Abrasion loss        | BS 903 A9 Method B | 3000 Revolution                        | 1.5 cc (max.)                                     |

## 1.6.2 SITE CONDITIONS

Rubber compounds for the rubber products shall be able to withstand the extreme marine environment indicated in the bid document.

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### 1.6.3 GENERAL REQUIREMENTS

Company requires that the offered products have had satisfactory past performance in offshore environments. For each product, a base specification/product trademark is furnished in the Technical requirement to evaluate the level of performance required. In case the Contractor wishes to propose an equivalent alternative product, approval for the same shall be obtained by him in writing from the Company after furnishing complete technical details and proven application record of the alternative offered, viz. technical properties, manufacturing process, exposure to marine environments, successful offshore use etc. The products so offered shall be supplied only from manufacturers with a proven track record of supplying identical or similar products. Only products and grades normally manufactured and listed in the manufacturers catalogues shall be supplied.

### 1.6.4 TECHNICAL REQUIREMENTS

This section details the various rubber products listed above along with their minimum general requirements. Specific requirements along with base specification/product trade mark for each product as given in Annexure-1. If Contractor proposes an alternate system design for any component, the specific requirements shall be suitably configured to meet the design criteria for that components.

#### 1.6.4.1 BOAT LANDING SYSTEM

The boat landing system is planned in such a way that it meets the requirements of the Design Criteria. The boat landing is designed to be mounted on shear fenders to absorb energy of impact. A set of low friction pads/strips are provided to act as rubbing surface against the boat.

##### 1.6.4.1.1 SHEAR FENDERS


The shear fender shall have solid rubber bonded between two parallel plates. The plates shall be bolted to the boat landing at one end and supporting member at the other end.

Testing shall be performed to 110 percent of design capacity and load deformation - energy relationship reported.

##### 1.6.4.1.2 BOAT LANDING RUBSTRIPS

The rub strips for boat landing shall be low friction type polyurethane minimum 150 mm width and 50 mm thickness bonded to back up plate/channel as shown in the relevant drawings.

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#### 1.6.4.2 BARGE BUMPER

The single boat landing plus barge bumper system mounted on a combination of shock cells and shear fenders can be provided. Individual barge bumpers may also be provided. The specification covers both the instances.

##### 1.6.4.2.1 Shock Cells

The shock cells shall consist of two concentrically placed steel tubes with a rubber annulus. The rubber material used in the shock cell shall be natural rubber based. Manufacturing process of shock cells shall be such that the rubber is slightly under a compressive strain rather than a tensile strain in the finished cell assembly at zero loading. The process of pouring and moulding the rubber in the annulus are not acceptable due to problem associated with shrinkage and cracking.

Steel Tubulars used for shock cells shall be designed for environmental loads and material of tubular shall conform to 2-D of table 1.1.9.3 of this specification.

The shock cells shall have a minimum overload capacity of 10% of the rated energy. Each shock cell shall be individually tested for both axial and lateral loading at least up to 110% of rated energy, and load-deformation-energy curves shall be developed for each.

Following information shall be supplied by the shock cell vendor with his quotation.


- i. The load/deformation/energy relationship of the shock cell.
- ii. The type and quality of rubber
- iii. The manufacturing process of the shock cell

##### 1.6.4.2.2 Rotating Bumper Rings

The function of the Rotating Rubber Rings is to transfer the lateral load to the shock cell absorbing part of the energy of impact. The rubber ring shall have a urethane facing. The rubber ring should be capable of rotating freely around the vertical pipe.

Testing shall be performed to 110% of the rated energy. The load deformation/energy characteristics of the Bumper Ring shall be obtained by testing the ring with an outer steel sleeve to simulate the actual conditions.

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#### 1.6.4.3 PLATFORM RUBSTRIPS

Platform substructure protective rub strips and rub strips on boat landing shall be an easily replaceable type so that if required, only damaged rubstrip need be replaced. They shall be manufactured by the extrusion process. There shall be no cracks or breaks in the body of the fenders. Necessary chambers must be provided to clear-up back ring.

Testing shall be performed to 110% of rated load and load-deformation energy relation reported.

#### 1.6.4.4 DIAPHRAGM CLOSURES (INSTALLATION AID)

Diaphragm closures, where required by Contractor as part of his installation engineering, shall be made of reinforced rubber and shall be tested to a pressure equal to 1.5 times hydrostatic pressure due to Water Depth plus 10M of seawater. In case the diaphragm is required to rest on / penetrate a sandy layer, the test pressure shall be 1.5 times (hydrostatic pressure due to Water Depth + Ultimate bearing capacity of Soil).

#### 1.6.4.5 GROUT SEAL/PACKER (INSTALLATION AID)

The grout seal packer shall be used to seal the annulus between the pile and Jacket leg (having Main Pile) / skirt pile sleeve during grouting operations. One of the following two types of seals/closures shall be used.

##### I. PASSIVE GROUT SEAL

It provides a seal with a loop under hoop tension, gripping the pile during driving/grouting.

##### II. INFLATABLE PACKER ASSEMBLY


It provides a seal by pneumatic/hydraulic inflation of a rubber torus. The inflatable packer shall be tested to a pressure of 40 bar against a pile mandrel.

#### 1.6.4.6 PILE CLOSURE PLATE (INSTALLATION AID)

The Pile Closure shall be provided if required by Contractor as part of his installation engineering. This closure shall be of easily removable type and shall not leave any protrusion of more than 25 mm after removal of the closure. This closure shall be tested to a pressure of 1.5 times the hydrostatic pressure at seabed computed at the installation site.

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### 1.6.5 DRAWINGS

- i. Contractor shall furnish drawings giving complete details and dimensions of the items for approval of Company at least 30 days prior to preparation of test piece, if so required. Drawing shall also include MTO along with various grade of material required for fabrication.
- ii. Approval of drawings shall not relieve the Contractor of his responsibility to provide the products in accordance with this specification.

### 1.6.6 QUALITY CONTROL

Contractor shall take every precaution to ensure and demonstrate, if required, adequate quality control of their products so as to provide products of uniform and required quality.

### 1.6.7 TESTING AND INSPECTION

#### 1.6.7.1 Testing

Testing shall be carried out on each item being supplied, for all the parameters specified in the technical requirements, and test reports shall be furnished to the Company. Company reserves the right of witnessing all tests and declining acceptance, if necessary, because of poor standards of manufacture and/or deficiency in meeting the technical particulars. The Contractor shall notify the Company 30 days in advance to enable Company or his authorized representative to witness the testing, if so required. The results shall be furnished to Company and approval obtained prior to shipment of the products.

In case of any doubt, the Company may ask for additional information, testing or retesting which the Company may feel necessary, which the Contractor shall carry out at no extra cost to Company and with no impact on the delivery project schedule.


#### 1.6.7.2 INSPECTION

All items intended to be installed in the works shall be subject to inspection by Company's inspectors. Contractor shall extend all facilities to the Company's inspector for such inspection at all reasonable times. Non-conformance to these specifications in the opinion of Company's Inspectors or as evident from the results of any additional tests or retesting shall be sufficient cause for rejection.

#### 1.6.7.3 MANUFACTURER'S CERTIFICATE

The Contractor shall submit to Company, Certificate by the manufacturer for each type of product giving the following details.

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a. Manufacturer's Name, Trade Mark or other means of identification.

b. Type and quantity of Rubber Products supplied.

c. Linear dimensions of each product noting deviations from the nominal dimensions.

d. Quality of rubber/Line call out no. used with test results for requirements outlined in **ASTM D-2000**.

e. Method of manufacture

f. Certified performance characteristic.

1.6.8 WARRANTY

Contractor shall have final and total responsibility for the satisfactory performance of all products to be supplied under this specification. Contractor shall warrant the equipment furnished by him and the performance of the said product in accordance with this specification and Spec. No. 1050, "General Specification Definition".


1.6.9 SPECIFIC REQUIREMENT

The specific requirements of the various rubber products for the system design given in the bid package along with Base Specification / Product trademarks are given below:-

1.6.9.1 Table: specific requirements of the rubber products

| Sr. No. | Product   | Minimum Design Load Carrying Capacity. (MT) | Minimum Energy Absorption (T.M) | Base Specification & Remarks     |
|---------|---|---|---------------------------------|----------------------------------|
| 1       | Shear Products.   | 50.0  | 12.5                            | Bridge Stone SC 500H, Grade Ro.  |
| 2       | Boat Landing Rubstrips  | -   | -                               | EPI Boat Landing Rubstrip.       |
| 3       | <b>Shock Cells</b>  |   |                                 |                                  |
|         | <b>Case A:</b> Barge Bumper designed as an individual unit.   |   |                                 | Regal SC 2036.<br>(508X904 Ø mm) |
|         | 1. Axial  | 150   | 20                              | Minimum Capacity.                |
|         |   | 100   | 12.5                            | Intermediate Capacity.           |
|         | 2. Lateral  | -   | 8.0                             |                                  |
|         | <b>Case B:</b> Barge Bumper designed as an integrated system. |   |                                 | Regal SC 1830.<br>(457X762Ø mm)  |
|         | 1. Axial  | 150.0                                       | 16.0                            | Minimum Capacity.                |
|         |   | 100.0                                       | 9.0                             | Intermediate Capacity.           |
|         | 2. Lateral  | -   | 5.5                             |                                  |
| 4       | Rotating Bumper Rings   | 136.0                                       | 4.2                             | Regal RBR 1931.20                |

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| 5   | Jacket<br>Rubstrips. | Leg  | 22.4 T/M | 2.3 T.M/M   | Bridge Stone SA 300H Grade R2. |   |  |           |       |          |    |             |            |                      |  |

1.7 Building Material and building products

1.7.1 Scope

The intent of this specification is to establish the minimum Requirement for operationally complete building to be provided on offshore well platform. Architectural component and equipment for the building module shall be as per Norsok C-002. The contractor adhere to this specification

1.7.2 GENERAL

1.7.2.1 GENERAL REQUIREMENTS.

1.7.2.1.1 Contractor shall fabricate a building on the platform to facilitate Switchgear Room, Telemetry Room, Battery Room & Generator Room and other necessary room as specified in the scope of work. Contractor is responsible for complete design including all structural framing.

1.7.2.1.2 Equipment, as specified elsewhere in bid package, shall be supplied and installed in the rooms of the building.

1.7.2.1.3 Contractor shall furnish other facilities and equipment, both inside and outside the building as required in these specifications.


1.7.2.1.4 All material, equipment, tools or supplies to be incorporated permanently into the building shall be new, sound, free from all defects and confirm to the size and /or capacity and quality specified. Contractor shall, when required, furnish satisfactory evidence as to the type and quality of materials, equipment, tools and supplies.


1.7.2.1.5 Contractor shall notify Company Representative of any aspect of this specification, which in the judgment of the Contractor should be changed to improve the buildings. However, the incorporation of these changes into this specification is subject to Company's approval.

1.7.2.2 BUILDING REQUIREMENT

The intent of this specification is to establish the minimum requirements for operationally complete building to be provided on Offshore Well Platform. Architectural components and Equipment for The items listed outline the general requirement for various buildings:

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| <p><b>1.7.2.2.1</b> The building shall be suitable for occupancy and general usage in a marine environment and suitable for environmental condition as indicated in the bid.</p> <p><b>1.7.2.2.2</b> The building shall be planned and design by Contractor with suitable wall, partition, interior partitions, interior and exterior doors with frames and windows etc.</p> <p><b>1.7.2.2.3</b> The building shall have framed openings in walls and roof for equipment, piping, cables exhaust etc. as required.</p> <p><b>1.7.2.2.4</b> The buildings shall be completely wired for lighting receptacles, switches and equipment.</p> <p><b>1.7.2.2.5</b> Piping and electrical connections shall be arranged such that field connections are minimized.</p> <p><b>1.7.2.2.6</b> The building shall be furnished completely operational prior to load-out.</p> <p><b>1.7.2.2.7</b> The area classification outside/inside the building shall be as per relevant specifications.</p> <p><b>1.7.3 STRUCTURAL SPECIFICATIONS</b></p> <p><b>1.7.3.1 MATERIAL</b></p> <p>Structural Steel shall be as per specification stated in table no. 1.1.9.3 of this specification.</p> <p><b>1.7.3.2 DESIGN</b></p> <p>The building shall be designed in accordance with Section.3.4, Structural Design Criteria.</p> <p><b>1.7.3.3 FABRICATION</b></p> <p>Fabrication of the Structure shall be in accordance with clause no 2.0 of this specification.</p> <p><b>1.7.3.4 COATING SYSTEM</b></p> <p>All exposed structural steel shall be coated in accordance with General Specification No. 2005, Protective Coatings. The Contractor shall keep adequate paint material for field touch-up after installation.</p> |  |   |   |                    |           |  |           |    |   |            |                      |   |            |            |
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1.7.4 ARCHITECTURAL SPECIFICATIONS (APPLICABLE FOR UNMANNED PLATFORM ONLY)

All Architectural items for unmanned platform shall be as per Functional Specification for Building Module Spec. 6011F of the bid document.

2. FABRICATION

2.1 SCOPE

These specifications provides for functional specification of fabrication of structures including few specific requirements/ guidelines.

2.2 GENERAL

The fabrication of platform including fit-up, welding, assembly, QA/QC pre-commissioning etc .shall be carried out as per provisions of API RP 2A, AWS D1.1 and AISC (American Institute of Steel Construction).

Contractor to furnish a detailed procedure for fabrication and assembly of structure for Company’s review which shall include following as a minimum.

1.

Material shall be physically Inspected by company appointed Inspector and accepted prior to start of fabrication.

2.

Steel Plates, Sections, pipes shall be transferred with heat numbers / cast number / bloom number / product number along with traceability mechanism. Traceability shall be physically inspected by company appointed Inspector.

3.

Procedure for fabrication and assembly.

4.

Procedure for fit-up and welding.

5.

Procedure for dimension control.

6.

Procedure for inspection and testing

7.

QA/QC plan.

8.

Procedure for Pre-commissioning.

9.

Procedure for post installation checks.


10.


Health Safety & Environment Manual.

11.

Procedure for Painting and galvanization

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| <p>12. Procedure for Post weld heat treatment</p> <p>13. Procedure for Defect repair and Distortion control</p> <p>14. Procedure for material traceability</p> <p>15. Procedure for material receipt, Inspection and storage.</p> <p>16. Weighing procedure</p> <p><b>2.3 SPECIFIC REQUIREMENT</b></p> <p>Following specific requirement shall be complied with:</p> <p><b>2.3.1 Manufacture of tubular for structural members</b></p> <p>Tubular of diameter greater than 406 mm shall be rolled, welded &amp; fabricated from plates in accordance with <b>API Spec. 2B &amp; API Spec. 5L</b>.</p> <p>The tubular shall be rolled in an <b>API</b> approved mill and shall carry the <b>API</b> monogram.</p> <p>The tubular shall be longitudinal seam welded by electric submerged arc process. Electric resistance welded or spiral welded pipes will not be accepted. Pipes shall have only one longitudinal seam weld. The welding and weld inspection shall be as per the Specification No.2009 and relevant Codes and Standards.</p> <p>The tubular shall meet the requirements of <b>API Spec. 2B</b> with the following exceptions:</p> <p><b>a.</b> The wall thickness and weight tolerances for tubular members shall be governed by the requirements of the code under which the plates are rolled.</p> <p><b>b.</b> For girth joints with offsets greater than 1.5 mm, the following shall apply:</p> <p><b>i.</b>When cans are of different thickness the higher thickness shall be ground smooth or machined to provide a 4: 1 taper transition.</p> <p><b>ii.</b>When cans are of same thickness, the offset shall be tapered to a slope of 4: 1 by deposit of additional weld metal and ground smooth.</p> <p>In no case shall the metal thickness be less than the nominal thickness of the thinner can. Maximum offset permissible shall be governed by Clause 3.7 of the <b>API Spec. 2B</b>.</p> <p><b>Note:</b> API Spec 5L / API Spec 2B Tubular shall be rolled &amp; manufactured under API license and shall carry the API monogram on the product. Mill Test</p> |  |   |   |                          |           |       |          |    |             |            |                      |  |
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Certificate of the Plate Material (Ladle & Product) shall be obtained and submitted along with pipe rolling Mill Test Certificate for inspection.

**2.3.2 Galvanizing.**

Following structural shall be galvanized as per General Specification No. 2005 “Protective coating”.

Gratings.

Handrails.

Stair Treads, Ladders and ladder cages.

Helideck Safety Net System.(For Steel Helideck)

Piping spools

Equipment supports

Miscellaneous hardware.

Galvanizing shall be done after completion of all cutting, drilling and punching operations and after welding but before final assembly in place.

Painting

All painting shall be done as per General Specification No. 2005 “Protective coating”.


Contractor shall mark levels suitably with paints to facilitate assessment of levels during and after upending and placement of sub-structure at location. Jacket and Pile shall be foot marked at 120° apart which should cover at least half the circumference. This is to facilitate the checking during the upending of the Jacket and pile driving. All under water clamps shall be painted with white paint.

**2.3.3 Marking of low-fatigue joint**

Marking of low fatigue life joints for future inspection shall be carried out as described in Design Criteria Structural. The marking panel of neoprene based cupronickel embedded sheets shall be at least 400 mm wide and shall have a length corresponding to number of letters in the marking. Each letter shall be located in the space of 200 mm x 200 mm size with a letter width of 40 mm. Lettering shall be with a medium suitable to withstand marine environment. A border of 100 mm shall be provided all round the lettering. Marking shall be provided in the form of a strip.

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### 2.3.4 Repair and remedial measures

Repair of defects and acceptability shall be as per **API RP-2A**. Welding repair, if any, shall be performed only after approval of the Company.

### 2.3.5 Connections

#### 2.3.5.1 Welded Connections

All structural welds shall be full penetration welds unless otherwise specifically shown in the drawing. Partial penetration welds are not permitted.

#### 2.3.5.2 Bolted Connections

As a general rule bolted connections shall not be used unless specifically indicated. Use of bolted connections for temporary works may be permitted by the Company’s representative at site at his sole discretion. Contractor shall submit detail procedure for bolting for approval of Company.

**All bolted connection shall be provided with protective caps with inhibited grease & sealed with suitable sealant to minimize possibility of crevice corrosion.**

### 2.3.6 Splices

a. Tubular member of the same diameter and wall thickness may be spliced by girth butt weld, as per provisions of API Spec. 2B with the following additions:

All joint cans length up to 3 M shall be rolled in one section. Joint cans with a length greater than 3 m must be made-up of sections limited to 1.5 m minimum length. In no case shall the girth weld/fall within 75 mm on either side of crown and saddle point.


b. Beam splices shall be as per API RP 2A with the following additions:

Splices for deck beams must be staggered i.e. the splices in any two adjacent beams shall not lie in a line perpendicular to the beam axis.

c. Joints in bar gratings and deck plate in the span direction shall occur only at points of structural support. All plating & end plates of gratings shall be continuously seal welded to supporting members.

d. Deck plating shall be welded in place using a low heat, short arc welding process. This requirement is to minimize potential warping of the deck plates and to obtain optimum levelness of the deck surface. Other low heat, time saving or automatic welding procedure may be considered but must be qualified.

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### 2.3.7 Stress relieving.

1. Rolled Tubular with outer diameter to thickness ratio less than 20 shall be stress relieved after manufacture.
2. Welded assemblies, where the thickness of one of the elements exceeds 65 mm, or where the thickness of weld exceeds 50 mm shall be stress relieved after assembly.
3. Any other element/assembly specifically noted in the drawings shall be stress relieved.

All stress relief shall be achieved by thermal methods by heating the element or assembly to a temperature between 590° C and 620°C. The use of furnaces is desirable for all stress relief operations. A detailed procedure shall be developed and Company's approval obtained prior to performing the operations.

### 2.3.8 Fabrication tolerances


Fabrication tolerances shall be as per API-RP-2A, AWS D.1, AISC, API 5L and API 2B wherever applicable. Fabrication tolerances for structural shapes fabricated from plates shall conform to the requirements of ASTM


A6. Contractor shall use his best efforts to provide a flat deck surface. All high or low spots that result during the installation of deck plating/grating and after installing skids and equipment shall be eliminated to reduce water holding valleys to a maximum of 3 mm.

### 2.3.9 Inspection And Testing For Structural Fabrication

- a. The Company shall inspect fabrication and assembly of structures stage wise and after final completion.
- b. The Company shall have the right to inspect the materials, fabrication and erection of all items concerned with the works without limitation.
- c. The Company shall have free access at all times to any part of Contractor's yard that concerns the work. When in the Company judgment, any working area or section should be inspected, the Contractor must thoroughly clean it of all excess and waste materials such as sand , slag, welding rods etc, and allow adequate time for proper inspection .
- d. The Company shall be informed at least ten days prior to starting of any work by Contractor or any sub-Contractor such as assembling or fabrication of any section, grit blasting, painting etc. The Company shall be informed before any repairs are made to the welds when defects are

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| <p>found and not after same defects have been rectified. Whenever any piece is to be assembled that will prevent inspection of the area, Company shall be informed, the area inspected and any defects rectified before proceeding with the assembly.</p> <p>e. The Company shall have the right to inspect at any time tools or equipments to be used in any part of the work and shall have the right to condemn any equipment or work which do not conform to the specification or the drawings. Defective work or work not conforming to the specifications or the drawing shall be re-done by the Contractor at his cost.</p> <p>f. Company shall approve all phases of the testing including leak repair or defects and replacement of materials and equipments found to be defective during testing and shall sign all Test Certificates, if testing is witnessed by the Company.</p> <p>g. The Company shall have the right to request any additional inspection to ensure that the Work conforms to the specifications, at no extra cot to the Company.</p> <p>h. The Contractor shall furnish, install and maintain in a safe operating condition all scaffolding, ladders, walk ways, adequate lighting etc. necessary for safe and thorough inspection by Company. The safety and condition of above scaffolding, ladders, lighting etc. must conform to OSHA &amp; local industrial safety codes for such operations.</p> <p>i. The Contractor must ensure that all valves and removable plugs on jacket legs are closed prior to load out and shall give written certification for the same.</p> <p>j. After the fabrication is completed, the jacket legs and skirt sleeves, pre-installed conductors and pile sections, launch truss chords and buoyancy tank, if any, shall be pressure tested for leaks through top and bottom closures. The applied pressure shall be 1.5 Kg/cm<sup>2</sup> minimum/as recommended by MWS/Installation Contractor and maintained for four hours. A soap test shall be conducted to detect any leakage between the rubber diaphragm and the flange and top closure plates and welds or any other joints. A nominal positive pressure shall be left in the jacket and skirt sleeve to ensure no leak condition before launching. All inflatable packers shall be pressure tested again at the yard to the test pressure specified.</p> <p>The manufacturer's test certificate shall be furnished to the Company.</p> |  |   |   |                          |       |          |    |             |            |                      |  |
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k. All grout and air lines for the jacket grouting system shall be cleaned by blowing clean air to ensure their operability. These shall be pressure tested at 40 Kg/cm<sup>2</sup> for one hour. The protective housing at the bottom of jacket for the inflate lines shall also be pressure tested to the above pressure.

### 2.3.10 Pre-commissioning checks


After the fabrication yard erection and hook-up has been completed, the Contractor shall start the pre-commissioning checks. It may not be possible to complete all the pre-commissioning checks in the fabrication yard. A detailed list of pre-commissioning checks required to be performed by the Contractor are specified in the bid documents. However, the Company desires that at least the following pre-commissioning checks/tests shall be completed in the fabrication yard.


Contractor to note that installation check as called out in the following list shall include the following

1. Name - plates and/ or certificates of equipment are correct and visible. Name plate of equipment shall be seal welded with the equipment.
2. Equipments are properly installed in accordance with drawings and foundations are proper.
3. All necessary supports are attached and are in acceptable condition.
4. All connections of equipment to piping, tubing and wiring, are made in accordance with drawings and specifications.
5. All low fatigue joints are properly marked.
6. List of out of tolerance reports.
7. All gratings & handrails and ladders, equipment supports, piping spools are welded and fixed to structural members as per drawing.
8. All welded joints are painted as per spec .2005
9. Stopper at the end of monorails
10. Safety net 1.5 m width all around helideck / 1.0 m width perimeter walkway below helideck
11. Providing chain connecting shock cell and jacket legs and shall be tight

a. **Lifting equipment (Cranes, Hoists etc.)**

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| <div>1. Installation check.</div> <div>2. Loads tests.</div> <div>3. Function check of alarm points in the control cab.</div> <div>b. <b>Decks, Building and Accessories.</b><div>1. Installation check.</div><div>2. Water flood check of flooring/Floor Drains and roof slope &amp; drainage arrangement against leaks and stagnation.</div><div>3. Adequate Floor drains are installed with removable type 3mm thick stainless steel removable sediment bucket with handle as per ASME A112.6.3 to prevent stagnation of water on the floor.</div></div>  |  |   |   |           |       |            |            |             |            |                      |  |
| <b>2.3.11 Weighing of decks/modules and other top sides facilities.</b> <p>The Contractor, prior to load out, shall accurately weight all Deck structures, topside modules &amp; buildings, and other topsides facilities etc. Contractor shall include in his proposal the basic details of the weighing procedure and equipments intended to be used. Detailed weighing procedures shall be developed and submitted for Company’s approval upon award of Contract. Load cells used shall have valid calibration Certificates.</p> <p>While weighing it shall be noted that the point of application of the load cells shall be in such a manner that based on the results of the weighing it shall be possible to devise the reactions at each support point as well as the center of gravity of the component being weighed.</p> <p><b>Contractor shall prepare a procedure for final weighing report for every lift containing.</b></p> <div><div>i. Weighing Results.</div><div>ii. Theoretical Prediction.</div><div>iii. Item schedule for all items which are yet to be installed prior to lifting, together with any items, which are to be removed i.e. rigging platform etc.</div></div> <p>Contractor shall assume full responsibility for all remedial measures required as a result of weight escalation beyond the weights budgeted for sea-transport, offshore lifting and final service operations. This responsibility shall include but not be limited to revision of the marine spread, strengthening and stiffening of the structures, off loading components in that lift etc.</p> |  |   |   |           |       |            |            |             |            |                      |  |
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### 3. INSTALLATION

#### 3.1 SCOPE

The specification assumes that piled steel jacket structures for the Platform Structure has been proposed by the Contractor and approved by the Company.

This specification described the minimum technical requirements for the engineering, marine and construction equipment spreads and operations required for the load out, transportation and installation of the Platform and facilities.

The Contractor shall assume entire responsibility for the successful load out, sea-fastening and transportation to site of all material, structures, components, equipment and other items necessary for installation and for satisfactorily completing all installations including hook-up and commissioning work, notwithstanding any review by the Company.

#### 3.2 QUALITY MANAGEMENT AND DOCUMENTATION

##### 3.2.1 Project Planning and Execution

Load out, transportation and installation operations shall be planned and executed in accordance with the requirements of the Contract and the DNV Rules for planning and Execution of Marine Operations. Release Note of Inspection agency, on behalf of Company, at fabrication yard shall be obtained and which shall be made available to Company at Offshore Installation site.

##### 3.2.2 Verification

The verification record control and retention system shall ensure documents relevant to obtaining Certifying Authority approvals are retained.


##### 3.2.3 Installation Engineering Manual

An Installation Engineering Manual shall be compiled, covering all aspects of the transportation and installation of the platform component structures, including mobilization of transportation and installation vessels spreads. The installation Manual shall contain detailed information on each stage of the operation, including contingency procedures and shall identify temporary works, equipment and personnel requirements.


The installation Manual shall include but not be limited to the following contents, as appropriate


a) General


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| <ul style="list-style-type: none"><li>• Organization charts for Load out site(s) and offshore site.</li><li>• Vessel utilization schedule</li><li>• Schedule for transportation and installation operations</li><li>• Offshore support base details.</li><li>• Mobilization and Demobilization activities.</li></ul>   |   |  |                      |                          |
| b) Vessel Data   |   |  |                      |                          |
| <ul style="list-style-type: none"><li>• Derrick Vessels</li><li>• Support Vessels</li><li>• Transportation vessels (Cargo barges and tow vessels or HLV)</li></ul>   |   |  |                      |                          |
| c) Load out  |   |  |                      |                          |
| <ul style="list-style-type: none"><li>• Load out site details and activities</li><li>• Planning for the load out phase</li><li>• Ballasting execution plans</li><li>• Barge strengthening or reinforcement (if required)</li><li>• Load distribution mats (if required)</li><li>• Sea fastenings</li></ul>   |   |  |                      |                          |
| d) Transportation  |   |  |                      |                          |
| <ul style="list-style-type: none"><li>• Pre-Sail away inspection checklists</li><li>• Towing/transit plans, towing arrangements, ballast arrangements, navigational aids, communications procedures, contingency procedures, etc.</li><li>• Tow/ transit routes, including any alternative and proposed safe refuges.</li><li>• Proposed dates for sail away, tow/transit, and installation.</li><li>• Weather forecasting and weather limits for sail away and tow/transit.</li><li>• Repair procedures during tow/transit and at completion of tow/transit</li></ul> |   |  |                      |                          |
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| <ul style="list-style-type: none"><li>• Post tow/transit inspection checklists.</li></ul> <p>e) Installation</p> <ul style="list-style-type: none"><li>• Offshore site Preparations</li><li>• Locations for existing subsea pipelines</li><li>• Location and orientation of existing jackets and other structures</li><li>• Installation equipment spread details</li><li>• Detailed installation procedures and checklists for structures, including tow/transportation vessel handling, derrick vessel anchor plans, survey, drilling and grouting procedures etc.</li><li>• Maximum sea states and weather conditions for weather installation operations</li><li>• Jacket launch/lift and up - ending, pile installation, jacket leveling procedures.</li><li>• Installing boat landing, barge bumpers, fitting and welding pump casing, sumps etc.</li><li>• Topside module installation procedures</li><li>• Removing temporary braces, lift trunnions, sea fastenings</li><li>• Installing all jackets to deck piping and utilities shown on drawings.</li><li>• Post – installation activities and inspection check lists.</li><li>• Platform hookup activities.</li></ul> <p>f) Contingency Plans</p> <ul style="list-style-type: none"><li>• Procedures for bad weather conditions</li><li>• Contingency procedures for piling operations, including storm ballast plan for the jacket if piling must be abandoned due to weather before storm safe.</li></ul> <p>g) Quality</p> <ul style="list-style-type: none"><li>• Site – specific Quality plan, including ITPs.</li></ul> |  |   |   |                          |           |       |          |    |             |            |                      |  |
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| <ul style="list-style-type: none"><li>• Qualified weld procedures and welder qualification records</li><li>• Installation activity proformas (pile driving records, grouting records etc.)</li></ul> <p>h) Health, Safety &amp; Environment</p> <ul style="list-style-type: none"><li>• Contractor HSE Plan, including JHA action sheets</li><li>• Emergency Response Plan for the offshore site.</li></ul> <p>i) Drawings and Calculations</p> <ul style="list-style-type: none"><li>• Installation Schematics</li><li>• Derrick vessels equipment layouts</li><li>• Cargo barge stability and ballasting calculations and details</li><li>• Temporary works layout</li><li>• Cargo barge or HLV layouts</li><li>• Anchor patterns and existing subsea pipeline locations</li><li>• Sea fastening and grillage layouts and details</li><li>• Jacket on-bottom weight and mud mat reaction pressures</li><li>• Weight and Centre of Gravity data for all installed items</li><li>• Relevant structure drawings</li></ul> <p><b>3.2.4 Certification</b></p> <p>Material Certificates shall be provided for all materials used for both temporary and permanent works, including at least for the following</p> <ul style="list-style-type: none"><li>• Temporary load bearing attachments</li><li>• Lift rigging</li><li>• Welding consumables</li><li>• Cement</li><li>• Coatings</li></ul> |  |   |   |                          |       |          |    |             |            |                      |  |
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### 3.2.5 Traceability

Traceability records shall be provided and maintained for –


- Steel Plate Material heat /cast numbers shall be Transfer to Primary & secondary Structural Members
- Welding consumable batch numbers
- Weld procedure numbers
- Welder identification numbers
- NDT reference
- Post weld heat treatment records
- Weld repairs


### 3.2.6 Manufactures Data Report

Documentation for welding to any part of a structure and all over as-built data shall be compiled into a MDR, which shall contain the following as a minimum, a appropriate –

- Approved welding procedures
- Welder qualification records
- Approved NDT procedures and NDT personnel qualification records
- Traceability records
- Plate Material test certificates
- Pipe Material (API 5I or API 2B) Rolling Mill Test Certificate as well Plate Material Mill Test Certificate.
- Welding consumable test certificates
- NDT records
- Post weld heat treatment records
- Dimensional control records
- Site preparation details

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| <ul style="list-style-type: none"><li>• Survey and inspection records</li><li>• Underwater inspection records (including video if available)</li><li>• Pile diving records</li><li>• Grouting records</li><li>• Hook-up activities quality records</li><li>• Engineering calculations and analysis results</li><li>• Technical manuals</li><li>• Basis of Design</li><li>• Barge Crane log shall be submitted for Jacket, Deck, Top Side Modules and Piles (single section pile). Same shall be the part of Manufacturing Data Book.</li></ul> |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.2.7 As-Built Report</b>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>The Offshore platform As-Built Report shall comprise the MDR and a summary of all work performed. Non-MDR documentation shall include but not limited to the following –</p>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <ul style="list-style-type: none"><li>• Daily Tow/Transit Reports</li><li>• Daily progress Reports from derrick vessels at the offshore site.</li><li>• Transportation and installation programme (actual versus planned)</li><li>• Record of mobilization activities</li><li>• Record of loadout site activities</li><li>• Vessel utilization schedule (actual)</li><li>• HSE Report</li><li>• Contract Variations</li></ul>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>In each section, manning levels, durations, problems, encountered, highlights and the like shall be included.</p>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
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### 3.3 HEALTH & SAFETY AND ENVIRONMENTAL MANAGEMENT

- i. All transportation and installation activities shall be planned and executed to minimize risk to personnel health and safety and to the environment, in compliance with the HSE Plan.

All statutory regulations at the load out site, along the tow/transit route and at the offshore site shall be complied with, including –

- a. SOLAS requirements
- b. IMO Convention on the international Regulations for Preventing Collisions at Sea (COLREG), 1972 and Amendments.
- c. IMO MARPOL 73/78 and Amendments (including The International Convention for the Prevention of Pollution from Ships).
- ii. Contractor shall submit the copies of following documents and latest/valid survey certificates in respect of all vessels proposed by the Contractor for transportation/installation/towing in compliance with General Condition of Contract.

Certificate of Registry, Certification of Classification, Certificate of Class, Cargo Ship Safety Construction Certificate, Cargo Ship Safety Equipment Certificate, Cargo Ship Safety Radio Certificate, Safety Management Certificate, International Oil Pollution Prevention Certificate, International Load Line Certificate, International Tonnage Certificate, DG Shipping License and Insurance Certificate.


### 3.4 LOADOUT

#### 3.4.1 General

The method of loadout may involve skidding, trolleying or lifting of structures. The structural integrity of the structures must be maintained during loadout. Detailed structural analysis for loadout or lift analysis for each loadout structure shall be undertaken to verify that structural member stresses do not exceed API and AISC basic allowable during any stage of the loadout. The loadout analyses shall include studies to determine the allowable differential deflections at the structures support point, which shall become the basis for deflections tolerances during loadout. If Contractor proposes any change in the parameters or procedures from those considered in the design, he shall carry out necessary engineering as detailed in Structural Design Criteria to ensure that his procedures are workable.

Structural strength of barge shall also be checked.

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### 3.4.2 Barge Ballasting and Structure Motions

The Loadout Supervisor shall have the authority to direct all barge ballasting and structure motions during loadout.

### 3.4.3 Loadout Systems

Contractor shall furnish to Company, at least 30 days prior to commencement of any load out operation, a load out procedure describing in detail the procedure, supported by calculation and analysis to ensure the compliance of design requirements, for the load out, including requirement of equipment and accessories. Contractor shall also furnish to Company the contingency pull back arrangement for retrieval of the structure during load out if the load out requires to be suspended due to some emergency reasons. Contractor shall also submit 30 days prior to commencement of load out, details of the shipment plan and final transportation analysis and sea-fastening design as described in design criteria.

The design or specification of all load out system components and temporary works items required for the operation, including, as appropriate the following–


- Winch systems
- Jacking systems
- Anchor points
- Onshore Skid beams
- Barge strengthening
- Cranes
- Transporters
- Lift points and lift rigging
- Barge mooring system

### 3.4.4 Cargo Barge

The adequacy of the cargo barge for stresses caused by load-out shall be verified, as will compatibility of dockside and barge arrangements for the proposed load out.

The ballasting procedure shall include pump discharge requirements and considerations of tidal variations during load out.

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### 3.4.5 Equipment

All equipment and accessories involved in the skidding/lifting/trolleying of the structures shall have the proper rating and are free of damage. Critical mechanical equipment, such as ballast pumps, shall have 100% backup system on standby.

### 3.4.6 Skid Beams

The procurement, fabrication and installation of any onshore runway beams/skids and bulkhead barge transition beams shall be suitable to loadout the structures onto the barge, as necessary.

### 3.4.7 Load-out plan

The Loadout Plan shall include barge ballasting requirements during loadout and a step-by-step schedule of the loadout. Allowances for actual tidal changes and current shall be included in the Loadout Plan.

### 3.4.8 Verification of lifts

Where loadout is executed by lifting, the padeyes, hook shackles slings, sling platforms or frames and the structural integrity of the lifted item shall be verified. The Contractor shall procure, fabricate and install all padeyes, slings and other aids necessary for lifting.

### 3.4.9 Weight Monitoring

The weight and center of gravity of the structures shall be accurately reported during construction and weight monitoring reports shall be submitted to the Company on a regular basis. The final weight control report and the results of the weighing operation shall also be submitted. Any weighing undertaken prior to loadout shall achieve accuracy better than ±2%. The center of gravity shall also be determined from these monitoring.

### 3.4.10 Cargo Manifest


An inventory list of all items to be loaded out shall be prepared by Contractor.

### 3.4.11 Post Loadout Inspections

After loadout onto cargo or launch barge is completed, if the component has been lifted, all critical joint intersections near the padeye/lifting points on the component shall be MPI/ dye-penetrant checked to ensure that no cracks have occurred during loadout. Any defects shall be repaired.

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### 3.5 GRILLAGE AND SEAFASTENING

#### 3.5.1 Design

All sea fastening and support grillage design shall be in accordance with the provisions specified in Structural Design Criteria Section 3.4 of Bid and of API RP 2A supported with following.

- a) Design calculations of the sea fastening and grillages.
- b) Drawings showing layouts and details of grillage and sea fastening.
- c) Details of any barge strengthening required for loadout or transportation.

#### 3.5.2 Grillage and Sea fastening Installation

Grillages and sea fastening shall be welded in accordance with relevant specification and shall be subject to 100% ultrasonic and magnetic particle inspection.

### 3.6 LOADOUT AND SEAFASTENING INSPECTION

The Contractor and MWS shall conduct pre and post load out tests and inspections.

#### 3.6.1 Pre Loadout Testing

Pre loadout testing of flood, buoyancy and vent systems of the jacket shall be executed in accordance with specification.

Prior and following loadout sea fastening, where possible, all vent and flood valves shall be checked several times by the Contractor to ensure easy operation. Any interference shall be eliminated. Vent and floods valves shall be left in the closed position and the valve handles shall be positively secured to the jacket.


#### 3.6.2 Post Loadout Inspection

All structures shall be visually checked after loadout to ensure no damage has occurred during loadout operations.

#### 3.6.3 Patch and Repair Damage

The Contractor shall patch and repair all damage to the structure and its protective coatings, which occur during loadout and sea fastening.

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### 3.6.4 Loadout Operation

An appropriate ballast system shall be provided and experienced personnel shall supervise the ballasting operation. The cargo barge shall be protected from excessive motions due to environmental loading or wave action from other vessels on the waterway during loadout. Following loadout, the cargo barge shall be ballasted to its design trim and draft for tow.

## 3.7 TRANSPORTATION

### 3.7.1 General

The cargo barge and tow vessel shall be classified for unrestricted ocean service and assigned loadline with a marine Classification Society. All statutory documents, including those listed in Section 3.3(ii) above, in support of sea worthiness of entire Marine spread shall be submitted to the company 30 days prior to the mobilization to the site. All vessels and equipment shall be maintained and operated in a safe and professional manner. A comprehensive stock of spares and consumables shall be carried at all times to support the independent day to day operation of the spread. Contractor shall appoint a Company approved Marine Warrantee Surveyor (MWS) at their expense who shall review the loadout and transportation analysis and sea fastening design and review and approve the sea fastening proposed by the Contractor. The marine surveyor's scope of approval shall include verifying the adequacy of the strength of the barge deck and framing to withstand the load due to load out, transportation of the cargo and sea fastening and launching of jacket.


The cargo barge and tow vessel shall be inspected and approved for the tow by the MWS prior to mobilizing to the fabrication site. The survey shall include all aspects of the vessel, manning suitability of accommodation on derrick / work barge etc. All certificates relating to the tow vessel and cargo barge, which are in accordance with the relevant statutory requirements, shall be carried onboard the tow vessel.

### 3.7.2 Cargo Barge Requirements

A dynamic motion analysis of the barge/cargo system shall be performed as per the Design criteria. The transportation barge shall have sufficient global and local strength for the loadout and transport of the cargo. Calculations shall be completed demonstrating that all barges and cargo comply with all allowable stress limits set forth by the AISC and API RP 2A codes, and the barge's classifying authority for all loading conditions encountered during loadout , transportation and launching, as applicable.

The cargo barge shall have sufficient positive and reserve buoyancy for all proposed operations. The barge shall have an acceptable stability and buoyancy

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and remain floating in an acceptable manner with any one submerged or partly submerged compartment flooded.

### 3.7.3 Tow Vessel Requirements

The tow vessel shall have a rated bollard pull at least equal to the design tow resistance of the transportation barge and its cargo. The tow forces shall be calculated by CONTRACTOR based on the anticipated environmental conditions along the tow route, vessel speed, requirements of API RP 2A and Design Criteria Structural Section 3.4. As a minimum, ambient sea conditions and the design storm/stall conditions should be considered. All towing resistance forces shall be assumed to be acting concurrently against the direction of the tow.

The tow vessel shall have latest Certificate of Rated Bollard pull issued by a reputed inspection authority.

### 3.7.4 Towing Arrangements

All components of the towing arrangement shall have acceptable factors of safety against the design tow resistance. The towing arrangement shall be inspected and approved by the MWS at the same time the tow vessel is inspected, prior to mobilization to the fabrication site.

## 3.8 LIFTING

### 3.8.1 Responsibilities


The Contractor assumes complete responsibility for all lifts of platform structures and appurtenances as required for installation. The responsibilities include, but shall not be limited to –

- Overall installation planning
- Detailed engineering and providing of all labour, supervision, materials and offshore installation equipment required to perform a safe and successful lift, in accordance with the design drawings and the Installation Procedure.
- The Installation Procedure shall include detailed descriptions of all operations and procedures.

### 3.8.2 Design

All calculations required to confirm the adequacy of all lifting operations shall be completed. Analysis shall include a review of re-analysis of the structure for the proposed lift conditions, design of padeyes and other lifting appurtenances and selection of all lifting hardware, rigging, slings etc. All components shall be designed so that eccentric loadings are minimized or eliminated. Final weight and

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center of gravity positions based on detailed weight take off and / or actual weighing shall be used in all design. Contractor shall provide following information 30 days prior to load-out/installation:

- De-rated capacity of barge crane and test record witnessed by a reputed inspection agency.
- NDT test records of all lifting equipment including lifting hooks.

### 3.8.3 Shackles

All shackles shall have valid manufacturer’s load test certificates. Used shackles which are free from any visual damage/deterioration and accompanied by load test certificates and satisfactory NDT reports can be used. Load in shackles and other fittings shall not exceed the manufacturer’s rated safe working load.

### 3.8.4 Slings

All slings shall have valid manufacturer’s breaking strength test certificates. Used slings, free from any kinks, fraying or other visual damage with a documented history of previous lifts, storage, load test and inspections are acceptable. Load in slings shall not exceed the manufacturer’s rated safe working load. Lifting slings shall be of sufficient lengths to ensure that the true angle of any sling with respected to the plane through the lifting points is not less than 60 degrees. All paired rigging elements (slings) for any one particular lift shall be of the same diameter and type. Over sized slings and slings having kinks, fraying, visual damage and deterioration shall not be used.

### 3.8.5 Protection of Equipment


All slings, spreader bars or other lifting apparatus, shall be arranged so to prevent damage to equipment and other components of the lifted item, during all phases of the lift. Adequate temporary bumpers and guides shall be provided to prevent damage during installation. Protection shall be given to both the item being installed and any previously installed items.

## 3.9 JACKET INSTALLATION

### 3.9.1 General

On arrival of Jacket at the site of Installation and before proceeding for Installation, Jacket shall be inspected by Company appointed Inspector and ensure no defect to the Structural Members. A report shall be generated and documented as as-built documentation. In case of defects are observed, repair work is to be taken up with approved procedure and completed before proceeding for installation.

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Installation Contractor shall also inspect all installation aids to ensure safe and smooth installation.

### 3.9.1.1 Drivability Analysis

The Contractor shall perform pile drivability and pile stick up analysis using the proposed hammer(s) and the geotechnical reports in compliance to Structural Design Criteria section 3.4 of bid document.

### 3.9.1.2 Survey Spread

The Contractor shall engage the services of a qualified Surveyor with the appropriate survey equipment to assist with the setting of jackets within the tolerances stated in this Specification.

### 3.9.1.3 ROV Spread / Divers

Contractor shall provide an ROV spread and divers on the derrick vessel capable of seabed inspection and assisting with retrieval of dropped items.

### 3.9.1.4 Anchor Handling

The Contractor shall be responsible for all anchor operations. The Contractor shall be responsible for adjusting anchor operation to avoid damage to existing platforms, pipelines, subsea well guards or any subsea facility. Subsea care shall be exercised near existing platforms and pipelines when running anchor or anchor lines from construction barges and boats. Before placing any anchors or anchor lines, the Contractor shall clearly define to the Company and shall obtain approval of the proposed location of the anchors or anchor lines.

### 3.9.2 Seabed Survey


Contractor is responsible for verifying the accuracy of all survey information. Any additional seabed survey performed by the Contractor prior to installation shall cover an area extending from the outline of the jacket on the sea bottom. The survey should accurately locate all existing platforms, pipelines, subsea well guards or any subsea facility. The extent of the area should encompass the extent of all activities, including the reach of all anchors.

### 3.9.3 Platform Location and Tolerances


#### 3.9.3.1 Jacket Location and Orientation

The jacket shall be set within 2.50 M of the required location. The bearing of the jacket shall be within two (2) degrees of the required location.


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| <p>The Location position &amp; Orientation check shall be witness by Company Inspector. Report shall be generated and documented as As-built Documentation.</p>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.9.3.1.1 Jacket Level</b>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>The final as-built level of the jacket shall be the within 1:140 of horizontal and the extreme opposite diagonal points in the jacket top level shall be within 25 minutes with the horizontal. If at any stage of jacket and pile installation the out-of-level exceeds the above tolerance, the Contractor shall bring the jacket back to within the level tolerance by lifting, de-ballasting or jacketing on the installed piles.</p> |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>The ballasting and pile installation sequence shall be such that on bottom jacket weight will not exceed a safe value determined in accordance with the results of an on bottom analysis documented in the installation Manual.</p>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>Jacket leveling activity shall be taken up during pile installation. The Location Level check shall be taken up and witness by Company Inspector. Report shall be generated and documented as As-built Documentation.</p>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.9.3.2 Jacket Elevation</b>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>The final jacket elevation shall be within (<math>\pm</math>) 750 mm of the design elevation. Following weld-out of the piles to the tops of the jacket legs, the tops of the Piles will be cut off to the required elevation. The final jacket elevation will also determine the elevation at which the boat landing is installed on the jacket.</p>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.9.4 Jacket Launch</b>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>If the Contractor proposes for jacket launching in their concept, the following responsibilities include, but shall not be limited to:</p>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.9.4.1 Vent and Flood Valves</b>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>Prior to jacket installation, the Contractor shall inspect and verify that all valves are closed and that all installation piping is intact.</p>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.9.4.2 Weather Window</b>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>Prior cutting sea fastening, the Contractor shall have a weather forecast sufficient to ensure it would be reasonably certain that no severe weather will occur before the jacket is secure on bottom. Installation will not be permitted unless the current sea state and its direction is less than the maximum safe values as determined by the installation analysis and included in the installation Manual.</p>                     |  |   |   |                          |           |       |          |    |             |            |                      |  |
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| <b>3.9.4.3 Sea fastening Removal</b> <p>All cuts on brace, used for sea fastening shall be made so that brace material remains on the launch cradle/jacket member, to avoid damage to any jacket member including launch cradle.. Tie-down braces on jacket members or lugs should be avoided. Where these are used they shall be removed so as to avoid cutting into any permanent structural member. To remove any stub from these areas or from painted areas tie-down brace member shall be cut and the protruding portion shall be grounded and surface shall be painted.</p> |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.4.4 Launch and Upending</b> <p>The jacket should be launched and upended at a predetermined launch site. A minimum bottom clearance should be determined by the Contractor for all phases of launch and upending operations in compliance with Design Criteria Structural, Section 3.4.</p> <p>In case of installation of jacket by launch/sliding method, Adequacy of Connection of Buoyancy tanks with jacket legs shall be checked for hydrostatic collapse during launching of jacket and dog plates shall be provided for safe launching of jacket.</p>                |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.5 Jacket Setting</b> <p>The jacket shall be set within tolerance given in Section 3.9.3. The Contractor shall maintain the specified location, orientation and level of jacket through completion of pile diving. The contractor shall report the as-built levels of jacket during the progress of the piling.</p>  |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.5.1</b> On successful placing of the jacket, on the seabed (on-bottom condition at the designated location), Contractor shall carryout Mud Mat survey to check absolute and differential settlements of jacket at mud line for the entire jacket. This survey shall be witness by Company Inspector and Report shall be generated and document with Video recorded data. This shall be part of As-built Documentation.  |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.5.2</b> On successful placing of the jacket, on the seabed (on-bottom condition at the designated location), Contractor may adopt suitable method of holding the jacket in place to prevent any possibility of jacket tilting, e.g. by securing it with barge by means of slings and/or winch ropes.  |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.5.3</b> Special care shall be taken so that there is no damage to the jacket during installation. Any damage to the jacket structure, to the protective coatings, or to the cathodic protection system etc. shall be repaired by the Contractor.  |  |   |   |           |       |            |            |             |            |                      |  |
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### 3.9.5.4

### 3.9.6 Pile Installation

On successful placing of the jacket on the seabed (on-bottom condition at the designated location), Contractor shall flood the jacket legs, buoyancy tank in compliance to the On-bottom Stability Analysis consideration. Flooding condition of Jacket Legs & Buoyancy Tank shall be checked, which shall be witnessed by Company Inspector. Report shall be generated and documented as part of As-built Documentation.

Removal of Buoyancy / Stability Tank shall be taken up only after securing jacket in position.

#### 3.9.6.1 Installation Procedure

The Pile installation procedure included in the installation manual shall include the following-


- The sequence of piles to be installed.
- Pile add-on details, if applicable.
- The effect of pile operation to on-bottom stability.
- Ballast / de-ballast required to maintain safe on-bottom stability
- Detail of pile handling, hammer handling, followers, ROV's etc.
- Derrick vessel crane reach and capacity values.
- Pile remedial procedure for pre-mature refusal of pile.
- Use of Front follower with hydraulic hammer for driving of vertical skirt pile using under water hammer

#### 3.9.6.2 Pile Driving

##### EQUIPMENT

Prior to commencement of pile driving hammers, boilers, compressors and valves shall be certified to be in good working order. Hammers shall be maintained and operated safely at all times.

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## **CUSHION BLOCK**

A cushion block shall be provided at the base of the hammer. Cushion block material shall be of a type compatible with the hammer and acceptable to the hammer manufacturer. Cushion material shall be of sufficient size to fill recess in anvil to full diameter, but not to exceed thickness recommended by manufacturer. The cushion material shall not be allowed to compress to the point that the cushioning effect is lost. Cushion performance criteria (i.e. maximum number of blows for a given cushion and hammer type) shall be recorded. Cushions shall be replaced in accordance with these criteria.

## **HAMMER**

Designated Hammer and Refusal mitigation Hammers shall be deployed in compliance to Pile Drivability Analysis approved by Company. Driving activity shall only be taken up upon availability of workable hammers (Designated & Refusal mitigation)

## **PILE MONITORING & RE-STRIKE TEST DEVICE**

Contractor shall deploy Qualified Agency along with Pile Monitoring & Re-Strike Test Device in compliance to following Para.

### **3.9.6.3 HAMMER, PILE MONITORING AND RE-STRIKE TESTING**


Contractor will provide details of 'pile monitoring devices' proposed prior to installation of jacket and shall be included in installation procedure


#### **A. Hammer Monitoring**

The Hammer Monitoring shall include, but not be limited to the following: -

- Hammer monitoring shall be performed for all hammer operations. CONTRACTOR shall ensure that the hammer spread used complies with Drivability Analysis and also with the following requirement.
- CONTRACTOR shall provide person(s) who are fully competent and experienced in operating the hammers, to supervise and obtain all hammer monitoring data.
- In the event that Contractor's hammer fails to deliver sufficient energy or breaks down, Contractor shall complete the pile being driven with another appropriate hammer in the spread. Pile driving shall not commence on any pile without appropriate back up hammer.
- Standby of the construction and transportation spreads shall be at Contractor's cost if piling cannot commence or continue due to hammer inefficiency, malfunction or unavailability.
- Hammer monitoring and pile monitoring shall form part of a coherent and coordinated pile installation strategy. CONTRACTOR shall identify

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| <p>key personnel in this regard and define the communication channels to facilitate successful pile installation.</p> <p>f) Energy applied through Hammer shall be compared with the energy recorded through the Pile Monitoring to work-out the effectiveness of Hammer.</p> <p><b>B. Pile Monitoring and Re-strike Testing</b></p> <p>The Pile Monitoring re-strike Test shall include, but not be limited to the following: -</p> <p>i. CONTRACTOR shall provide pile monitoring services for the piles of each of the jacket structures. All the piles of each platform shall be monitored (the last two sections of each pile shall be instrumented for this purpose) unless specifically advised otherwise by the Company.</p> <p>ii. CONTRACTOR shall engage a <b><u>Specialist Geotechnical Engineering Consultant</u></b> for the work, approved by the Company, having relevant experience in pile monitoring, re-strike testing and interpretation. CONTRACTOR shall submit the prospectus of the said consultant firm, for approval of the Company, complete with details of previous experience and resume of the engineers who will be involved in the actual performance of the instrumentation; monitoring and interpretation.</p> <p>iii. CONTRACTOR shall determine, provide/supply and test all necessary equipment/accessories/ facilities that are required for Pile Monitoring and re-strike testing.</p> <p>iv. Contractor shall submit to the company details of pile monitoring and re-strike procedures which shall include but not be limited to:</p> <p>a) Details of Pile Monitoring Equipment Spread to be made available during pile installation with sufficient spare strain gauges, accelerometer, Pile Driving Analyser, required software for data interpretation e.g. CAPWAP including all necessary hardware and software.</p> <p>b) Details of proposed procedure for re-strike testing.</p> <p>c) Method of data analysis and interpretation.</p> <p>d) Operational aspects of installing instrumentation, data acquisition and removal of instrumentation.</p> <p>e) Calibration details of instrumentation and equipment.</p> |  |   |   |                          |       |          |    |             |            |                      |  |
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v. CONTRACTOR shall provide continuous pile monitoring services and shall make available during driving, in real time, the following information to COMPANY.

- a) Soil resistance to driving.
- b) Magnitude of maximum pile stresses during driving.
- c) Hammer blows per foot of penetration.
- d) Hammer stroke.
- e) Hammer blow rate.
- f) Hammer efficiency (defined as ram energy at impact as a ratio of hammer rated energy).
- g) System Efficiency (defined as energy actually transmitted to pile as a ratio of the hammer rated energy).

vi. CONTRACTOR shall provide the following information at the end of driving of each pile if pile meets acceptance criteria:

- a) Final blow count per foot of penetration for the last 05 (five) feet penetration.
- b) Hammer and system efficiency.
- c) Soil resistance to driving.

vii. If piles meet premature refusal, CONTRACTOR shall provide the following information immediately after pile driving:


- a) Final blow count per foot of penetration.
- b) Hammer and system efficiency.
- c) Soil resistance to driving.
- d) Recommendations on remedial action.


**viii. Criteria for Re-strike Testing**

The Re-strike Testing shall include, but not be limited to the following:


- a) Re-strike Test shall be carried out after a after a minimum 24- hour set-up period.
- b) Piles driven with target penetration, Re-strike Test shall be performed normally for two (02) piles (fitted with the re-strike test instrumentation). Two piles shall be selected from piles excluding pile driven last.
- c) Piles encountering refusal, re-strike test shall be performed on all of the refused piles.
- d) Pile re-strike length shall be minimum 0.5 m over the overdrive allowance.

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| <p>e) During actual re-strike Test period, Pile driving for other pile cannot be carried out. But during preparation of Re-strike Test, Pile driving for other pile is permitted.</p> <p>f) Cost on account of re-strike test shall be included in the project cost. Any additional re-strike test other than specified above shall be paid in terms of barge day rate charges only for the duration of re-strike test but not for the duration for preparation time for re-strike test.</p> <p><b>C. Responsibilities of the Specialist Geotechnical Engineering Consultant</b></p> <p>a) Consultant shall review hammer, pile and soil information as well as proposed installation procedure and drivability in co-relation to Soil Report.</p> <p>b) Consultant shall carry out the drilling and tapping instrumentation holes near the pile top of the sections of the piles to be monitored at the fabrication yard.</p> <p>c) Consultant shall install required gauges on the pile sections and shall observe lifting, upending and stabbing operations and advise the Contractor's personnel during the activities so as to avoid damage to the installed instrumentation.</p> <p>d) In case of damage to the instrumentation during these activities, the Consultant shall replace gages through use of steel man basket after the pile welding activity is completed.</p> <p>e) Consultant shall observe the pile driving and take all necessary steps in coordination with installation contractor to avoid damage to the installed instrumentation.</p> <p>f) All activities at the offshore site not covered above, but essential for successful data acquisition, monitoring, re-strike testing and interpretation.</p> <p><b>D. <u>Document Generation &amp; On-Board Report:</u></b></p> <p>As minimum following records &amp; On-board reports for Pile Driving related to Hammers and Pile Monitoring and Re-Strike Test shall be documented and issued to the Company Design Consultant with 24 hours of driving each pile:</p> <p>i. Blow count record for every feet of pile driving duly witnessed by Company appointed Inspector.</p> |  |   |   |            |            |             |    |             |            |                      |  |  |  |
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| <p>ii. Hydraulic Hammer computerized input data (like Date, time, identification of pile/pile segment, Hammer efficiency applied, Stroke length, Blows per minutes) &amp; output data (Oil Pressure, Blow counts, Soil Resistance, Energy applied, etc.) print out duly witnessed by Company appointed Inspector.</p> <p>iii. Details of stoppage of Pile Driving supported with valid reasons.</p> <p>iv. Submission of Pile Driving Analyser (PDA) Data File soft copy.</p> <p>v. Print outs from Pile Driving Analyser data duly signed by geotechnical consultant, contractor's representative and Company appointed Inspector.</p> <p>vi. Pile monitoring Records like Hammer Blows, Maximum Force, Maximum Energy, and Maximum Stress at gauge location.</p> <p>vii. Comparison of Energy recorded by Pile Analyzer Vs Energy applied by Hammer to establishing Hammer performances.</p> <p>Pile Driving Records after driving each segment of Pile data recorded daily vide point no. ii , iv, v, vi above shall be submitted to the Company within two hours (after completing the driving each segment of pile or re-strike activity) of driving through Documentation system (OPMAC), by Fax and Mail.</p> <p><b>E. Post Installation Pile Driving, Monitoring and Re-strike Test Report</b></p> <p>A post-installation pile monitoring report shall be submitted to COMPANY within thirty (30) days after completion of piling activity and shall include but not be limited to the following:</p> <p>a) Details of Scope of Work.</p> <p>b) Summary of hammer performances (complete with hammer numbers with traceability).</p> <p>c) Details of stoppages and their reasons.</p> <p>d) Pile stresses during driving.</p> <p>e) Computation of soil resistance to driving using CAPWAP software.</p> <p>f) Presentation of CAPWAP results – Soil dynamic parameters, Skin friction resistance distribution &amp; Max. Compressive &amp; tensile stresses.</p> <p>g) Comparison of predicted and measured/computed soil resistance to driving.</p> <p>h) Estimation of long term static pile capacity.</p> |  |   |   |                          |       |          |    |             |            |                      |  |
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#### 3.9.6.4 FIELD SPLICES OF PILES

Welding shall be according to Specification “Structural Welding and inspection for Offshore Platforms’. If the Contractor wishes to reduce the forty-eight (48) hours waiting period for flux core welding inspection, procedures which address the avoidance of hydrogen induced cracking shall be submitted to Company. Reduction in the waiting period shall only be allowed if approved in writing by Company.

Contractor shall 100 % ultrasonically inspect all field splices. Ultrasonic examination will follow the procedures and acceptance criteria of API RP 2X. Defect acceptance will be in accordance with level ‘C’ inspection. Each field butt weld in all piles shall be allowed to cool to a temperature below 120°F before ultrasonic examination or advancing of pile in any manner, either by diving or by free fall.

#### 3.9.6.5 DRIVING RECORDS


Company appointed Inspector shall physically witness the Energy application on the Driving Control Unit of the Hydraulic Hammer and record same on the report. The Contractor shall keep complete and accurate pile driving records on each pile driven and shall furnish a copy of these records to Company’s designated Office within two (2) hours after driving that pile duly witness by the Company appointed Inspector. All pile driving records shall be documented as part of As-built Documentation. In case of Pile Monitoring device is adopted, data obtained using same shall be document as as-built documentation.


These records shall include dates, times, drilling and / or jetting operations, shutdown and reasons for same and all other pertinent information including, but no limited to, the following-

- Platform & Pile identification
- Actual length of each pile section and cut-offs.
- Penetration of pile under its own weight.
- Blows per foot and penetrations during all pile driving with hammer identification.
- Date and Times of start and end of driving for all sections of all piles and time spent for add on piles on welding operations.
- Final penetrations of all piles.

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| <ul style="list-style-type: none"><li>• Driving Control Unit input Data &amp; Output data print shall be provided for Hydraulic Hammer.</li><li>• All time lost during bad weather and status of pile driving at that time including any interruptions.</li><li>• Steam pressure (if applicable).</li><li>• Hydraulic pressure (if applicable)</li><li>• Blows per minute and penetration.</li><li>• Stroke height.</li><li>• Cushion block data (total blows on cushion).</li><li>• Hammer used (make and model).</li><li>• All necessary data to determine the energy output oil either the steam of hydraulic hammer.</li><li>• Elevation of soil plug after driving each add-on and internal water surface after driving each pile.</li><li>• Pertinent data of a similar nature covering driving, drilling and grouting.</li><li>• Any unusual phenomena or occurrence during driving.</li></ul> |   |  |                      |                          |
| <p><b>3.9.6.6</b> The lead sections and subsequent add-ons of piles shall be installed as per the piling sequence developed during engineering. The jacket leg in which the rubber diaphragm is to be punctured shall be completely flooded before puncturing.</p>  |   |  |                      |                          |
| <p><b>3.9.6.7</b> Contractor shall take every precaution to prevent damage to grout seals during pile stabbing and driving. All lifting eyes, etc., shall be removed and the outside face of the pile ground smooth prior to driving the pile section.</p>  |   |  |                      |                          |
| <p><b>3.9.6.8</b> If the level of jacket is outside the specified tolerances, the leveling of the jacket shall be performed at the dog-off stage. The dog plates shall have a holding capacity of at least 1.5 times the jacking load applied for leveling. The dogs shall be retained in position in all main piles other than the pile being driven and shall be welded back after driving is completed.</p>  |   |  |                      |                          |
| <p><b>3.9.6.9</b> Jacket level measurements shall be taken at regular intervals during piping and reported to Company. Should any tilt take place during pile driving, it shall be corrected before further driving of the pile. No leveling operation shall be</p>   |   |  |                      |                          |
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carried out after any pile has reached design penetration, unless specifically approval by Company.

**3.9.6.10** The piles shall be sequentially driven to the design penetration, taking one pile at a time with minimum delay during welding of add-ons to avoid refusal due to soil set up.

**3.9.6.11** Skirt piles, if any, shall be installed after all main pile driving operations are completed.

**3.9.6.12** In case of platforms with only skirt piles and no main piles, specific procedures for leveling the jacket shall be developed by the Contractor.

**3.9.6.13 Refusal**

a. The refusal criteria for piles shall be as per API RP-2A unless specified otherwise.


b. In case of Pile met refusal, as per Bid Document Clause no. 5.6 of Volume -1, Contractor shall deploy higher capacity hammer (designated as **Refusal Mitigation Hammer**) as first remedial measure. Pile Drivability Analysis shall be carried out from the Design Stage of Engineering for the Refusal Mitigation Hammer as Plugged Pile and Soil partial Set up condition (considering clay soil develop full strength in 7 days' time) up to full depth of Pile.


c. If refusal takes place on account of soil set-up caused by delays due to malfunctioning, breakdowns of Contractor's equipment or any other cause attributable to the Contractor, it shall be the Contractor's responsibility to take measures to develop the required capacity of the pile without any effect on time and cost to the Company.


d. In case of refusal as specified in c) above, it shall be the Contractor's responsibility to employ other acceptable means of attaining the desired penetration, by driving the pile after removing the soil plug by jetting and or pile top drilling and putting back the equivalent soil plug with concrete layer at top after Pile Driving to the Design penetration. Company's approval of all pile remedial procedures shall be obtained prior to taking up such work.

A detailed investigation to ascertain the reasons for pile refusal shall be carried out by Contractor at no extra cost and time effect to Company. Detailed report of the findings shall be submitted to Company for review.

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| <b>3.9.6.14 Penetration</b> <p>Piles shall be driven to the design penetration by normal driving methods. The Contractor shall operate and maintain pile driving equipment in accordance with manufacturer's recommendations and accepted construction practices, the intent being to advance piles expeditiously to achieve design penetration. If required, pile cut-offs shall be made as detailed on the drawings.</p>              |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.7 Mechanical Pile Connectors</b> <p>If mechanical pile connectors are used, the Contractor shall be responsible for procurement of all specialty materials and pieces of equipment. Back-up/standby shall be required offshore for all essential equipments. All procedures shall be accordance with specifications of the manufacturer. The use of mechanical pile connectors shall be subject to approval by Company.</p>      |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.8 Jacket to Pile Connection</b> <p>Jacket to pile connections shall be made as specified in the design. Any adjustments necessary to correct discrepancies in jacket setting elevations, deck leg length etc. shall be taken up by means of either over / under lengths of legs or pile tops or by transition pieces, depending upon the design.</p> <p>Shim plates shall be used for connecting main piles with the jacket.</p> |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.9 Pile Cut-off Report</b> <p>The Contractor shall furnish to Company a pile and conductor cut-off report. This report shall include the exact length for the pile when stabbed, the cut-off measurement, the total length of pile actually driven and the total amount of cut-offs made.</p>   |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.10 Post Installation Inspection</b> <p>Following completion of the jacket installation, Contractor shall perform a visual underwater survey of the jacket, the seabed location at the pile locations, pile sleeves (if any), anodes etc. The report, shall record the inspection and any sustained damage, shall be provided to Company.</p>   |  |   |   |           |       |            |            |             |            |                      |  |
| <b>3.9.11 Post Piling Operations</b> <p>The following operations shall be carried out by the Contractor after completion of all piling.</p> <p>a) The substructure/jacket to pile shim connection in case of main pile, if any, shall be installed only after all pile driving including the skirt piles is completed.</p>  |  |   |   |           |       |            |            |             |            |                      |  |
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| <p>b) All installation aids such as temporary guider/ bumpers, grout line, vent line etc., skirt piles guides, including their supports up to and including elevation of (-) 25.00 M shall be removed. Buoyancy tanks, if provided, shall completely be removed.</p> <p>c) The contractor may use <b>front follower</b> to drive skirt piles &amp; to keep maximum length of pile upto 4.00 m above skirt sleeve during driving of skirt piles.</p> <p>d) Excess length beyond 3.0 meter above skirt sleeve shall be cut by the contractor. Under water cutting of excess length of pile shall be in the scope of the contractor with no extra time &amp; cost to the company.</p> <p>e) Soundings shall be taken to determine the level of the soil plug inside the pile. In case the soil plug has gone down appreciably and if it is found necessary as a result of engineering calculations, it shall be Contractor's responsibility to provide grout plug of adequate length, to develop full end bearing without any cost and time effect to the Company.</p> <p><b>3.9.12</b> Calibration certificate shall be obtained from the Manufacturer of the respective equipment. Original copy of Calibration certificate shall be submitted one month prior to mobilization for Installation for following Equipment:</p> <ul style="list-style-type: none"><li>i. Installation Barge Crane,</li><li>ii. Hammers for Pile &amp; Conductor driving,</li><li>iii. Drilling Equipment,</li><li>iv. Jetting Equipment, Grouting Equipment.</li><li>v. Internal Lifting Tool (ILT) for lifting of piles</li></ul> <p><b>3.10 Grouting:</b></p> <p>All grouting shall be done immediately after piling is completed. In cases where the piling &amp; grouting are not done immediately after placement of jacket on the seabed, the annulus between the pile and jacket leg shall be thoroughly cleaned by means of approved chemicals/procedure prior to commencement of grouting. Grouting</p> <p>Methodology from Bottom of Jacket or from top of Jacket shall be specified during detail Engineering and accordingly Drawing shall be developed:</p> <p><b>3.10.1 Grouting from Bottom of Jacket (applicable for Main Legs &amp; Skirt Legs):</b></p> <p>Methodology described below:</p> |  |   |   |                    |       |  |           |             |   |                      |    |   |            |            |
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### 3.10.1.1 Grout


The cement used for grout shall be as specified in General Specification No 6001F. The grout shall be of a non-shrinking expansive type with minimum compressive strength of 70 kg/cm<sup>2</sup> (1000 psi) at 8 hours and 281 kg/cm<sup>2</sup> (4000 psi) at 28 days at 27 ± 2 degrees C. A target grout density of 1920 kg/cu m (16 lbs/gallon) shall be maintained during placing of any grout. The Contractor shall furnish results of tests made on samples of cement taken at the time of shipment and certify that the applicable requirement of this specification have been met including the minimum compressive strength for 24 hours and 28 days. This test shall closely simulate, the field conditions, i.e. admixture contents, sea water maximum water content ratio etc. The laboratory test procedure shall be in accordance with ASTM 109. Contractor shall transport for the purpose of construction at site the same batch of cement and ingredients for which the tests are performed.

Contractor shall provide adequate number of metal cube moulds of 10 cm size for preparing samples during grouting of subsequent compression tests. A minimum six samples per stage of grouting or pile shall be taken for testing. The Contractor shall also provide on barge a compression testing machine and shall conduct compression tests after 24 hours curing period of cube samples taken during grouting. The results of these tests shall be submitted to Company's representative immediately after completion of tests. A suitable tank shall be provided for storing and curing cubes prior to testing. The Contractor shall carry out the 28 days compression tests either on the barge or on a shore based compression testing machine and submit the results to the Company. If the test result does not satisfy the minimum compressive strength requirements, Contractor shall be responsible for making suitable rectification measures to ensure adequate load transfer to the pile.


### 3.10.1.2 Grouting Procedure

- a) Grouting operations shall start only after jacket to pile shim connections are completed.
- b) Prior to grouting, all grout lines and annulus of Pile – Leg/skirt leg shall be flushed with sea-water, at a rate of not over 950 liters per minute, to assure free passage of the grout and cleanliness of the annulus. Flushing shall be carried out from bottom most point and shall be continued till clear water comes out. A report shall be generated for this activity duly witnessed by company appointed inspector.


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| <p>c) Grout shall be mixed in a high speed mechanical or jet mixer and then passed through a strainer into pumping equipment, which is provided for recirculation. Grout shall be pumped into the annulus as soon as possible after mixing.</p> <p>d) Contractor shall mix and pump a volume of grout equal to one and one half times the theoretical volume of the annular space to be filled. A report shall be generated for this activity duly witness by company appointed inspector.</p> <p>e) In the event of blockage or an interruption of grouting, Company reserves the right to require Contractor to remove all grout from the annuli by flushing with water under pressure, and to have the grouting procedure repeated.</p> <p>f) Slurry density shall be monitored during grouting operations. If the Contractor proposes to use a continuous mixing process, an automatic density-meter recorder shall be used. If he proposes batch mixing the density of slurry of each batch shall be measured. A report shall be generated for this activity duly witness by company appointed inspector.</p> <p>If the measured slurry density is less than 1800 kg./cu.m. (15 lb/gal.), the grout shall be diverted on board into the disposal tank until the slurry density has returned to the specific value. A volume of grout equal to the volume diverted away shall be added to the volume of the slurry to be pumped in order to maintain the correct volume.</p> <p>g) The Contractor shall use inflatable or passive grout seals and grout the annuli if he proposes a single stage grouting system. The procedure shall be as follows:</p> <p>i) If water is used as the inflation medium, a pump capable of filling the inflate lines and pressurizing them upto 35 kg./cm and a manifold system with multiple pressure gauges for inflating and monitoring individual piling seals shall be used.</p> <p>ii) If air is used as the inflation medium, a separate cylinder with a pressure regulator and gauge for each piling seal shall be used. Cylinders shall be capable of inflation pressure as predetermined</p> |   |  |                      |                          |
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| <p>from the manufacturer's recommended air inflation chart for the particular seal, grout density, and water depth.</p> <p>iii) When water is used as the inflation medium, the inflation pressure (measured at surface) shall be as recommended by the grout seal manufacturer and shall be maintained within <math>\pm 10\%</math> variation throughout the grouting operation.</p> <p>iv) When air is used as the inflation medium, the inflation pressure (measured at surface) shall be as recommended by the grout seal manufacturer, and shall be maintained within <math>\pm 5\%</math> variation throughout the grouting operation.</p> <p>v) When water is used as the inflation medium, the inflate line shall be filled with water slowly at intervals to allow sufficient time for air inside the line to bleed back. Sufficient measures and precautions are to be taken to ensure that all air is bleed out from inside the inflate line before the line is fully pressurized.</p> <p>vi) After the grout seal is properly inflated and prior to grouting, the annulus and the grout line shall be flushed with sea-water at a rate of not over 950 liters per minute in order to ensure free passage of grout and to establish circulation.</p> <p>vii) After grouting is completed, the inflate pressure in the grout seals shall be maintained for a minimum period of 24 hours.</p> <p>viii) Contractor shall specify a back-up system he proposes to employ for completing the installation job in case of failure of the packers, inflation lines, or grout lines.</p> <p>h) The density of the returned grout at the top of the jacket shall be measured to have a minimum to have a minimum density of 1920 kg/cu m. The jacket pile annulus can be considered to be completely grouted only when this criterion is satisfied.</p> <p>Two openings one on the high side and the other on the low side shall be left open for purposes of monitoring return grout. The remaining seal plates shall be welded only after two hours of completion of grouting during which the grout level in the annulus shall be monitored and topped up by grout if required.</p> |   |  |                      |                          |
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i) If at any stage of grouting, any of the grout lines clog, the remainder of the annulus shall be filled using diver operated grout ports provided in the legs.

j) Care shall be taken, during and after the grouting to clear grout splatter, overflow and drippings from the structure.

k) Contractor is liable for any damage to grout lines and inflate lines, which occurs as a result of installation operation.

l) After completion of the entire grouting operation to the satisfaction of Company’s Representative, all flooding and grout lines and accessories including their supports shall be removed from top of jacket, upto a depth of (-) 25.00 m. A report shall be generated for this activity duly witness by company appointed inspector.

**3.10.2 Alternative Grouting Procedure: Grouting from top of Jacket (applicable for Main Legs only):**

In this method Grouting shall be taken up from top of jacket.

Grouting operations shall start only after jacket to pile shim connections are completed.


Grout packer shall be placed at the bottom end during fabrication stage.


Prior to grouting, all grout lines and annulus of Pile – Leg/skirt leg shall be flushed with sea-water, at a rate of not over 950 liters per minute, to assure free passage of the grout and cleanliness of the annulus. Flushing shall be carried out from bottom most point and shall be continued till clear water cones out. A report shall be generated for this activity duly witness by company appointed inspector.

The annulus shall be made free from water by repealing water by applying pressurizing air from top of Pile. Repealing water from annulus shall be ensured by observing air bubble coming out from the Jacket leg bottom (i.e gap between Pile & Jacket Leg Grout seal). In case, air bubble is not coming out, then emergency port located near mudline shall be opened to ensure repealing of water from annulus. A report shall be generated about repealing of water from annulus and duly witness by Company appointed Inspector and documented.

On completion of above stated activity, grouting methodology / procedure are similar as specified in Clause 3.10.1.

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| <p>In this method of Grouting, Mudline Horizontal Framing grouted Joints (Jacket leg &amp; pile) shall be designed as un-grouted Joint as in this procedure cleaning of contaminated annulus is not possible.</p>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.11 TOPSIDES INSTALLATION</b>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.11.1 General</b>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>This section will apply to the Topsides modules and any other installation other than work related to the jacket and piles.</p> <p>The Contractor shall field-adjust transition pieces connecting the deck legs to jacket and shall place the superstructure/deck within the tolerances specified. The Contractor shall remove any temporary deck structure, installation guides etc. (if any) already installed. Contractor shall take all necessary measures / precautions to avoid damage to the Topsides and jacket while removing the temporary deck.</p>      |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.11.2 Anchorage</b>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>Special care shall be exercised by the Contractor near existing platforms and pipelines when running anchor or anchor lines from construction barges and boats. Refer also to Section 3.9.1.4. Before placing any anchors or anchor lines, the Contractor shall clearly define to the Company Representative the proposed location of the anchors or anchor lines and obtain approval in advance prior to deployment at site.</p>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.11.3 Tolerances</b>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>The elevation of each deck and topside module shall be within 75 mm of the elevation specified on the construction drawings. The deck and topside module shall be leveled to a tolerance of 12 mm between any two extreme diagonal points.</p>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>3.12 ACCESSORIES</b>  |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <b>Navigational Aids</b>   |  |   |   |                          |           |       |          |    |             |            |                      |  |
| <p>The appropriate temporary navigational aids shall be placed on the structure at all times when construction equipment is not alongside the structure. The aids-to-navigational system and such additional aids to navigation as are required to meet applicable government regulations shall be provided, installed and maintained.</p> <p>The equipment shall be maintained in good operating condition until construction work under this contract is completed. The Contractor shall be responsible for losses or damage and shall replaced and maintain the</p> |  |   |   |                          |           |       |          |    |             |            |                      |  |
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navigational aids. Temporary navigation aids shall be put in place at the earliest possible time. At no time shall be Contractor leave any portion of the structure without operational warning devices after erection has begun. Permanent aids to navigation shall be left operating at completion of installation of the offshore facility.

### 3.13 REPAIRS AND CLEAN-UP

All damage to structural items during load out, sea fastening items during load out, sea fastening, transportation and installation shall be repaired to the original condition. All defective welds shall be repaired in accordance with relevant Specification.

All damage to the protective coatings which occur during load out and sea fastening shall be patched and repaired in accordance with Specification 2005 ‘General Specification for Protective Coatings’.

All installation appurtenances including flood lines, pile guides, trunnions, supports and scaffolding shall be removed upon completion of installation work. All cuts below water shall be made so that 10 mm of steel remains on the permanent member, to avoid damage to the jacket. Above water, cuts shall be made down to 6 mm and the remainder shall be ground smooth to remove any stub.

### 3.14 POLLUTION CONTRTOL


All operations shall be conducted in a manner that will prevent pollution. All applicable laws, ordinances, rules, regulations and lease or Contract provisions regarding pollution shall be obeyed.

No garbage, trash, waste or other pollutants shall be discharged or allowed to escape, except as allowed by regulating agencies having jurisdiction. At all times the equipment shall be kept orderly and unencumbered from or below deck rubbish or debris. Personnel shall be imparted guidance and training in pollution control and shall clean up any pollution occurring during the installation operations.

### 3.15 SAFETY

Contractor shall comply with safety instructions, which may be issued by Company or given by Company representative, during offshore work concerning essentially the work being done around oil or gas wells and pipelines. Contractor shall also comply with all local ordinances governing safety and it shall be Contractor’s responsibility to determine the content of these regulations.

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### 3.16 VETTING OF PRESERVICE ANALYSIS & INSTALLATION ENGINEERING:

Pile & Conductor Drivability Analysis shall be vetted by Installation Contractor & MWS and approved by Company. Vetting/ Approval of following Pre-Service analysis shall be obtained from MWS and Installation contractor prior to commencement of installation of jacket and pile:


| SL No | DESCRIPTION                             | Jacket | Deck | Module |
|-------|---|--------|------|--------|
| 1     | Load-out Analysis                       | Yes    | Yes  | Yes    |
| 2     | Sea-fastening & Transportation Analysis | Yes    | Yes  | Yes    |
| 3     | Launching Analysis                      | Yes    | No   | No     |
| 4     | Lifting Analysis                        | Yes    | Yes  | Yes    |
| 5     | Floatation & Upending Analysis          | Yes    | No   | No     |
| 6     | On-bottom Stability & Mudmat Analysis   | Yes    | No   | No     |


### 3.17 AS-BUILT DOCUMENTATION

#### A. As minimum following Structural Documents shall be documented:

- Contractor's Structural Design Consultant shall prepare the AS-Built Structural Drawings by incorporating all subsequent design changes approved by Company, marking actual Yield Strength of material in correlation to Material Traceability & Mill Test Certificate with Listing of Heat Numbers, Name of Mill, Mill TC Numbers, etc.
- During advance stage of Engineering SACS Model for All Analysis shall be documented.
- All AFC Drawings, All Structural Analysis and Design Calculations shall be documented.
- Post completion of work SACS Model Structural Analysis (Inplace, Fatigue & Earthquake) both for Jacket & Deck (top side) shall be updated with all design changes and load-data supported with final Weight control Report.
- All Structural Material Purchase Orders shall be documented.
- Structural Analysis Reports (all) and Design Calculations shall be documented.
- PS for Helideck (Aluminum) & handrails, rubber products, MGP, architectural items, gratings and handrails shall be documented
- Structural Steel Material Mill Test Certificates, Material Inspection & traceability Drawings with Reports/records, Dimension control report/Records, Cement Test Certificate, Grout Mix design Report, Grout cube Test Report, Paint Material inspection report with Manufacturer's test Certificate, Painting Records, Paint application Inspection Records, Weld Joint numbering Records with Welding Inspection Reports, fabrication related all procures upto loadout

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| <p>stages, etc., shall be documented as Fabrication /Construction Dossier.</p> <p>9. Weld joint numbering with Weld Inspection Report &amp; Record.</p> <p>10. Painting Material Inspection Report with Paint Manufacture's Test Certificate.</p> <p>11. Paint application &amp; Inspection activity Report with Inspect report.</p> <p>12. Load-Out activity shall be documented the form of Video for fabricated position to final position on Barge duly witness by ONGC appointed Inspector.</p> <p>13. Post Installation pile &amp; Conductor Driving records / Reports &amp; Pile monitoring record (as applicable) shall be documented daily immediately after driving of each segment of pile/Conductor.</p> <p>14. Pre-engineering Survey Report, Pre-construction Survey Report &amp; Post construction survey Reports, Installation barge activity log (during installation period), Installation related all procedures, Installation related Records like Inspection records, As-built video records of various installation stages (under water), As-built video survey of Jacket &amp; Mud-mat, Debris clearance survey report, etc. shall be documented as Installation Dossier.</p> <p>15. Activities specified elsewhere in the Bid Document but not specified above shall also be documented.</p> <p>16. All similar data shall be documented for PLEM, SSIV, Mooring Buoy, Bridge &amp; Top side Modules.</p> <p><b>B. As minimum following Architectural Documents shall be Documented:</b></p> <p>1. Contractor's Architectural Design Consultant shall prepare the AS-Built Architectural Drawings by incorporating all subsequent design changes approved by Company.</p> <p>2. As-Built Documentation for Architectural items shall be carried out similar to items specified for Structural items stated above.</p> <p>3. As-Built Documentation for Structural items shall be carried out for all Architectural Buildings as stated above.</p> <p><b>C. Fabrication / Construction Dossier as As-Built Documentation for structural Fabrication &amp; Installation Dossier shall be carried progressively during fabrication stage till installation so that As-Built documentation is complete with 60 days of Installation. Post completion of Work (Installation) As Built Drawings shall be prepared incorporation of Design changes and other activities specified which shall be approved by ONGC appointed Inspector. As-Built Documentation activity shall be the DCI Document having following parts as minimum requirement:</b></p> <p><b>Fabrication / Construction Dossier shall have following parts:</b></p> |  |   |   |                          |       |          |    |             |            |                      |  |
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|   | OFFSHORE<br>DESIGN<br>SECTION<br>MUMBAI<br>REGION | GENERAL<br>SPECIFICATION<br>FOR<br>MATERIALS,<br>FABRICATION AND<br>INSTALLATION OF<br>STRUCTURE | SPEC. No.           | 6001F                    |
|  |   |  | Rev. No.            | 11                       |
|  |   |  | Discipline:         | Structural               |
|  |   |  | PAGE :Page 77 of 77 |                          |
| <ul style="list-style-type: none"><li>▪ Pre-Engineering Survey reports, Pre-Installation Survey Report, As-Built Video Survey Reports. These documents shall be documented at the end of activity.</li><li>▪ Material Purchase Order. These documents shall be documented weekly and shall be submitted every Monday.</li><li>▪ Material Inspection Report along with Mill Test Certificate with acceptance of Material. These documents shall be documented weekly and shall be submitted every Monday.</li><li>▪ Material Traceability Report with respect to Mill TC. These documents shall be documented weekly and shall be submitted every Monday.</li><li>▪ Dimension Control checks. These documents shall be documented weekly and shall be submitted every Monday.</li><li>▪ Welding Inspection Reports &amp; Records. These documents shall be documented weekly and shall be submitted every Monday.</li><li>▪ Weighing report of jacket &amp; topside in the yard prior to load out.</li><li>▪ Painting material Inspection with Manufacturer’s test Certificate.</li><li>▪ Painting Inspection Report &amp; Record.</li><li>▪ Load-out activity shall be document as as-built video.</li></ul> <p><b>Installation Dossier shall have following Parts and document daily &amp; as specified elsewhere:</b></p> <ul style="list-style-type: none"><li>▪ Inspection of Item post Transportation and before Installation.</li><li>▪ Jacket Leveling &amp; Co-ordinate Report.</li><li>▪ Pile Driving Record &amp; Report</li><li>▪ Conductor Driving Record &amp; Report.</li><li>▪ Transition Piece Elevation &amp; dimension control Record.</li><li>▪ Deck Installation Report &amp; Record.</li><li>▪ Welding Inspection Report &amp; Record.</li><li>▪ Field Painting Record for application Priming Coat, mid coat &amp; Top Coats.</li></ul> <p style="text-align: center;">----- END -----</p> |   |  |                     |                          |
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