

# **PETRONAS TECHNICAL STANDARDS**

## **DESIGN AND ENGINEERING PRACTICE**

### **TECHNICAL SPECIFICATION**

## **CONSTRUCTION OF STRUCTURAL STEELWORK**

PTS 37.28.00.30  
AUGUST 2011



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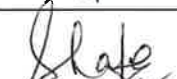
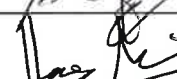
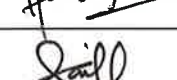
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|                                            |                                                                                                     |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------|
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| PTS No:                                    | PTS 37.28.00.30                                                                                     |
| PTS Title:                                 | Construction of Structural Steelwork                                                                |

This revision of PTS 37.28.00.30 – Construction of Structural Steelwork has been updated incorporating PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry codes and standards.

This PTS shall replace the existing PTS 20.104 (April 1989). The new title of this PTS shall be “PTS 37.28.00.30 Construction of Structural Steelwork”.

### Document Approval

|                       | Name                          | Designation                             | Date    | Signature                                                                             |
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### Revision History

| Date     | Version    | Description of Updates              | Author                                         |
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| Jan 2011 | Release 14 | Amendment to existing<br>guidelines | Ahmad Rizal A<br>Rahman/Ariff M Abdul<br>Wahid |

## PREFACE

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## 1.0 GENERAL

### 1.1 Scope

- a) This specification shall govern the material specifications, shop and field welding fabrication and inspection requirements of all structural steel for the Works, i.e.
  - i) Platform support structures (jackets, piles etc)
  - ii) The deck, whether constructed of plate girders, box girders or tubular frames, and all associated support structures in or on the deck, access and protection steelwork e.g stairways, walkways and handrails, and bridges
  - iii) Deck to substructure connection
  - iv) Structural steel in or on the substructure, such as J-tubes, subsea pipeline bridges, manifold jackets and supports for e.g. piping, process equipment, electrical equipment, instrumentation equipment, etc
  - v) Jetties
  - vi) Steel skirt to foundation (if any)
- b) The Contractor shall supply all steel, materials, labour, tools, equipment and services and perform or arrange all tests specified or necessary (unless specifically directed otherwise in the contract) to ensure that the requirements of this Specification are fulfilled and to ensure proper functioning of components.
- c) Where it is necessary for certain structural steel components to be installed offshore, compliance with all the requirements of this Specification shall also mean that such component shall be trial assembled onshore to ensure subsequent correct fit, whenever directed by the Company.
- d) The Contractor shall satisfy himself as to the details of the scope and requirements in the contract and shall be deemed to have included for the above stated and all that follows in this section of the Specification.
- e) This Specification covers the material selection and welding of structural steels with yield strengths of less than or equal to 52,000 psi as defined in the relevant material specification.

### 1.2 Performance Of Work

- a) The Contractor shall have in charge of the work, at all times, a thoroughly competent superintendent and a fully qualified welding engineer, who are experienced in this category of steelwork construction and its fabrication. The Contractor shall designate a competent representative with whom the company and/or its representative may communicate at all times.
- b) The Contractor shall employ only qualified craftsmen to perform all aspects of the work including testing. Any workman considered unsuitable by the Company shall be removed from the Works without delay and shall not be re-employed on the Works.
- c) The Company shall be advised at least two days before commencement of any work by the Contractor and his sub-contractors.
- d) The Contractor shall demonstrate to the Company that he is capable of producing work to the required standard, with particular respect to his sub-contractors he may wish to employ. This may be achieved by producing documented past and current types of work the Contractor/subcontractor has been engaged on.;

### 1.3 Errors And Omissions

The Contractor shall be responsible for all errors and omissions in the detailing, layout and fabrication of the Works. It is the obligation of the Contractor to check the Contract Documents including the Contract Drawings immediately upon award of the Contract and to notify the Company immediately of any errors or omissions discovered.

### 1.4 Referenced Documents

#### 1.4.1 Base Specifications

##### a) Materials

The EN 10225 and EN 10025 has been selected as the basis for materials. All materials shall meet the requirements of this Code and the requirements mentioned in this Specification Chapter 2.0.

##### b) Welding

All welding, temporary or permanent, shall meet the requirements of the latest edition of AWS D1.1 "Structural Welding Code-Steel" as modified by this specification.

##### c) Inspection

All inspection requirements shall meet AWS D1. 1 and the codes mentioned therein describing the techniques and as modified in this Specification in Chapter 10.0. All other inspection requirement not addressed in AWS D 1.1 shall be referred to other recognized standards e.g. ISO 19902 as approved by the Company

#### 1.4.2 Standards, Rules And Codes

a) Unless otherwise specifically indicated, the following standards, rules and codes shall be the guides governing the works. These shall be considered complimentary to and providing further detailed requirements and recommendations to those stated in this Specification and shall be complied with. Where, however, the requirements of this Specification are in conflict with or expand the above requirements, this Specification shall prevail.

b) All the standards, rules and codes stated below are to be the latest editions at the commencement of the contract.

##### i) American Petroleum Institute (API)

|           |   |                                                                                        |
|-----------|---|----------------------------------------------------------------------------------------|
| API 5L    | - | Specification For Line Pipe.                                                           |
| API RP 2A | - | Recommended Practice For Planning, Designing And Constructing Fixed Offshore Platforms |
| API 2B    | - | Specification For Fabricated Structural Steel Pipe.                                    |
| API 2H    | - | Specification For Carbon Manganese Steel Plate For Offshore Platform Tubular Joints.   |

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

Code of Standard Practice For Steel Building And Bridges Specification For The Design, Fabrication And Erection of Structural Steel For Buildings.

##### iii) American Welding Society (AWS)

|           |   |                                                                  |
|-----------|---|------------------------------------------------------------------|
| AWS D.1.1 | - | Structural Welding Code-Steel                                    |
| AWS A.2.4 | - | Symbols For Welding And Non Destructive Testing                  |
| AWS A.3.0 | - | Welding Terms And Definitions                                    |
| AWS A.5.1 | - | Specification For Carbon Steel Covered Arc Welding Electrodes    |
| AWS A.5.5 | - | Specification For Low Alloy Steel Covered Arc Welding Electrodes |

- |            |   |                                                                           |
|------------|---|---------------------------------------------------------------------------|
| AWS A.5.12 | - | Specification Tungsten Arc Welding electrodes                             |
| AWS A.5.17 | - | Specification For Bare Carbon Steel Electrodes For Arc Welding Submerged  |
| AWS A.5.18 | - | Specification For Carbon Steel Filler Metals For Gas Shielded Arc Welding |
| AWS A.5.20 | - | Specification For Carbon Steel Electrodes For Flux Cored Arc Welding      |
- iv) American Society For Testing And Materials (ASTM)
- |          |   |                                                                                                                             |
|----------|---|-----------------------------------------------------------------------------------------------------------------------------|
| ASTM A6  | - | Specification For General Requirements For Delivery of Rolled Steel Plates, Shapes, Sheet Piles And Bars For Structural Use |
| ASTM A36 | - | Standard Test Methods and Definitions for Mechanical Testing of Steel Products                                              |
- v) Det Norske Veritas (DNV)
- |             |   |                                                  |
|-------------|---|--------------------------------------------------|
| DNV-OS-C201 | - | Structural Design of Offshore Units (WSD Method) |
| DNV-OS-C401 | - | Fabrication and Testing of Offshore Structures   |
- vi) European Norm (EN)
- |            |   |                                                                                                                           |
|------------|---|---------------------------------------------------------------------------------------------------------------------------|
| EN 10225   | - | Weldable structural steels for fixed offshore structures                                                                  |
| EN 10025   | - | Hot rolled products of structural steels                                                                                  |
| BS 4 Pt1   | - | Specification For Structural Steel Sections: Pt1 : Hot Rolled Sections                                                    |
| EN 10210-2 | - | Hot finish structural hollow sections of non-alloy and fine grain steels. Tolerances, dimensions and sectional properties |
| EN 1011-1  | - | Welding Recommendations for Welding of Metallic Materials. General Guidance for Arc Welding.                              |
| EN 1011-2  | - | Welding. Recommendations for Welding of Metallic Materials. Arc Welding of Ferrite Steels.                                |
| EN 60974   | - | Arc Welding Equipment.                                                                                                    |
| EN 462     | - | Non- destructive testing. Image quality of radiographs.                                                                   |
| EN 10204   | - | Metallic Products – Types of Inspection Documents                                                                         |
- vii) Engineering Equipment Material Association (EEMUA)
- |           |   |                                                                           |
|-----------|---|---------------------------------------------------------------------------|
| EEMUA 158 | - | Construction Specification for Fixed Offshore Structures in the North Sea |
|-----------|---|---------------------------------------------------------------------------|
- viii) International Institute of Welding (IIW)
- Collection of Reference Radiographs of Welds In Steel
- |           |   |                                                                                                                                            |
|-----------|---|--------------------------------------------------------------------------------------------------------------------------------------------|
| IIW-36-39 | - | Recommended Practice For The Radiographic 50mm Wall Thickness Inspection of Circumferential Fusion Welded Butt Joints In Steel Pipes Up To |
|-----------|---|--------------------------------------------------------------------------------------------------------------------------------------------|
- ix) International Standard (ISO)
- |           |   |                                                                  |
|-----------|---|------------------------------------------------------------------|
| ISO 19902 | - | Petroleum and Natural Gas Industries – Fixed Offshore Structures |
| ISO 10474 | - | Steel and Steel Product – Inspection Document                    |
- x) Japanese Industrial Standard (JIS)
- |                  |   |                                     |
|------------------|---|-------------------------------------|
| JIS G3106 SM41-B | - | Rolled Steels For Welded Structures |
|------------------|---|-------------------------------------|

- xi) National Association of Corrosion Engineers (NACE)  
Std SP0176 - Corrosion Control of Submerged Areas of Permanently  
Installed Steel Offshore Structures Associated With  
Petroleum Production

## 1.5 Documentation

### 1.5.1 Prior To Fabrication

Prior to commencement of any part of the fabrication, the Contractor shall submit the following documentation for approval by the Company.

- a) Original Mill certificate or certified true copy by recognized third party approved by the Company for Contractor supplied materials.
- b) Fabrication procedures, welding sequence and erection sequence. This is to include the welding procedure specification to be applied, sequence of plates to be welded, and number and location of welders at each stage of assembly.
- c) Fabrication drawings including plate seam arrangement drawings, plate cutting drawings and weld details.
- d) Drawings and calculations of temporary works, inclusive of support points, jacking points and sling points, approved by a qualified engineer.
- e) List of proposed welding consumable and their areas of application including detailed control procedures for consumable handling, baking, storage and issue.
- f) Welding procedures, repair welding procedures with their supporting procedure qualification records and including weld maps.
- g) Certificates of welders, welding operators and tackers qualified in accordance with this Specification complete with list of welder identification numbers and photographs.
- h) Key plan showing an unambiguous member identification and weld marking scheme.
- i) Inspection procedures and detailed report sheets for non-destructive testing and inspection. This shall include separate sheets for Visual, Radiography, Ultrasonic, Dye Penetrant, Magnetic Particle, Painting and Coating.
- j) Identification and control procedures for materials.
- k) Procedures for control of tolerances during fabrication and procedure for distortion rectification.
- l) Detail procedures for welding equipment maintenance and calibration.
- m) Qualification certificates for all inspection personnel.
- n) Summary sheets for NDT test reports for each joint which are to be kept up to date as the work progresses.

### 1.5.2 During Fabrication

As the work progresses, the following shall be required:

- a) As built dimensional survey records which shall be updated continually.
- b) Where traceability is required, plans marked to relate certificate references for all materials to its final position in the structure.
- c) NDT test reports (original only) including radiographs and key plans marked showing final identification numbering, test report numbers and the results.

- d) Production mechanical test reports, post weld heat treatment charts, leak reports and all charts for all items tested.
- e) As built drawings and Specifications which shall show in detail the manner in which the facility was constructed and shall reflect all changes, additions, corrections or revisions made during the course of construction. The objective being to build up a full documented history of the Construction Work.

## 1.6 Glossary

|                |   |                                                                                                                             |
|----------------|---|-----------------------------------------------------------------------------------------------------------------------------|
| Company        | - | Shall mean PETRONAS                                                                                                         |
| Contractor     | - | The party which entered into contract with the Company for the execution of activities as mentioned in a written agreement. |
| Sub-Contractor | - | The party which is engaged by the Contractor to perform work for Company                                                    |
| Shall          | - | The word "shall" is to be understood as mandatory to comply with the requirements of this specification.                    |
| Should         | - | The word "should" is to be understood as strongly recommended to comply with the requirements of this specification.        |

## 1.7 Abbreviations

|       |   |                                                       |
|-------|---|-------------------------------------------------------|
| API   | - | American Petroleum Institute                          |
| ASNT  | - | American Society For Non-destructive Testing          |
| ASTM  | - | American Society For Testing and Materials            |
| AWS   | - | American Welding Society                              |
| BS    | - | British Standard                                      |
| CSR   | - | Company Site Representative                           |
| CAR   | - | Company Authorised Representative                     |
| CSWIP | - | Certification Scheme For Welding Inspection Personnel |
| DPI   | - | Dye Penetrant Inspection                              |
| EEMUA | - | Engineering Equipment and Materials Users Association |
| FCAW  | - | Flux Cored Arc Welding                                |
| GTAW  | - | Gas Tungsten Arc Welding                              |
| GMAW  | - | Gas Metallic Arc Welding                              |
| ISO   | - | International Organization for Standardization        |
| JIS   | - | Japanese Industrial Standard                          |
| MSF   | - | Main Structural Frame                                 |
| NACE  | - | National Association of Corrosion Engineers           |
| NDT   | - | Non Destructive Testing                               |
| PQR   | - | Procedure Qualification Record                        |
| PWHT  | - | Post Weld Heat Treatment                              |
| RT    | - | Radiographic Testing                                  |
| SAW   | - | Submerged Arc Welding                                 |
| SMAW  | - | Shielded Metallic Arc Welding                         |
| UT    | - | Ultrasonic Testing                                    |
| WPS   | - | Welding Procedure Specification                       |

## 2.0 MATERIALS

### 2.1 General

- a) The purpose of this chapter is to specify the composition, properties, dimensions, tolerances, manufacturing process, handling, etc, of all materials which will be incorporated, both permanently and temporarily as either structural members or structural appurtenances, into the offshore platform.
- b) Company inspection personnel shall be permitted free access to the Manufacturer's works for the inspection of any process necessary for the manufacture of these materials.
- c) If a material not described in this chapter is required, it shall be brought to the attention of the Company which will decide which Specification shall apply.

#### 2.1.1 Transportation, Storage and Handling of Materials

- a) The Contractor shall ensure adequate protection to all steelwork during and loading and transportation activities by providing adequate timber bearers during transport.
- b) The Contractor shall provide nylon or similar lifting slings during handling or lifting operations; wire ropes or chain slings will not be permitted.
- c) The steelwork shall be stored above ground on pallets, timber blocks or other similar supports, be kept above the level of any standing water and be kept free from dirt, grease, paint sprays, etc. and shall be protected from harmful environments.
- d) Damage to any part of the steelwork either before, during or after erection shall immediately be brought to the notice of the Company.
- e) Particular care shall be taken in storage and handling of parts which have been metal sprayed, galvanized, painted, etc., and should the coating be damaged, it shall be restored by an approved method at the cost of the Contractor, and be compatible with the particular coating.

#### 2.1.2 Used Materials

Temporary bracing, erection aids, scaffoldings and materials and equipment for testing shall be furnished by the Contractor and shall be safe, serviceable and adequate, but need not be new.

#### 2.1.3 Classification of Structural Steels

For the purpose of this Specification, structural steel is classified by the following groups.

##### (a) Primary Steels (TYPE I and TYPE II)

##### i) TYPE I STEEL : Primary Structural Steel – High strength

Primary structural steel-high strength is steel with yield strength of 355 MPa and over used in member and joints essential to the overall integrity of the structural and for other structural members of importance to the operational safety of the structure.

ii) TYPE II STEEL: Primary Structural Steel – High strength With Through Thickness Properties

Primary structural steel-high strength with through thickness properties is steel with yield strength of 355 MPa and over used in member essential to the overall integrity of the structural, where stress concentrations are high and where the stresses in the thickness direction may lead to lamellar tearing

(b) Secondary Steels (TYPE III)

i) TYPE III STEEL: Secondary Structural Steel – Mild Steel and High strength Steels

Secondary structural steel, is steel with yield strength 355 MPa and over used in members essential to the overall integrity of the structure and for the other structural members of importance to the operational safety of the structure.

ii) Type IV STEEL: Secondary Structural Steel -Mild Steels

Secondary structural steel is steel with yield strength between 275 MPa and 355 MPa used in members essential to the overall integrity of the structure and for the other structural members of importance to the operational safety of the structure.

(c) TYPE V STEEL : Tertiary Steels

Tertiary structural steel is steel with yield strength less than 275 MPa used in members not essential to the overall integrity of the structure.

| Type | Purpose   | Description            | Grade (MPa) | Reference        | Toughness class ( ISO 19902:2007) | AWS structural steel Group |
|------|-----------|------------------------|-------------|------------------|-----------------------------------|----------------------------|
| I    | Primary   | High strength          | ≥355        | EN 10225 group 2 | CV2                               | II                         |
| II   | Primary   | High strength with TTP | ≥355        | EN 10225 group 3 | CV2Z                              | II                         |
| III  | Secondary | High strength          | ≥355        | EN 10025         | CV1                               | II                         |
| IV   | Secondary | Mild Steel             | 275 - 355   | EN 10025         | CV1                               | I                          |
| V    | Tertiary  | Mild steel             | 235 - 275   | EN 10025         | NT                                | I                          |

## 2.2 Weldable Structural Steel And Steel Products

### 2.2.1 General Provisions

All structural steel for use in offshore structures shall meet the requirements of EN 10225 and EN 10025

#### a) Primary Steel (in Group 2 and 3 only)

| Form                       | Group | Grade                                                          | Toughness Class-ISO 19902:2007 | Notes |
|----------------------------|-------|----------------------------------------------------------------|--------------------------------|-------|
| Plate                      | 2     | S355G7 (+N and +M)<br>S420G1 (+Q and +M)<br>S460G1 (+Q and +M) | CV2                            | 1     |
|                            | 3     | S355G8 (+N and +M)<br>S420G2 (+Q and +M)<br>S460G2 (+Q and +M) | CV2Z/ZX<br>CV2Z/ZX<br>CV2Z/ZX  | 1     |
| Sections (Open)            | 2     | S355G11 (+N and +M)<br>S420G3 (+M)<br>S460G3 (+M)              | CV2<br>CV2<br>CV2              | 2     |
|                            | 3     | S355G12 (+N and +M)<br>S420G6 (+M)<br>S460G4 (+M)              | CV2Z<br>CV2Z<br>CV2Z           | 2     |
| Hollow Sections (Seamless) | 2     | S355G14 (+N and +Q)<br>S420G6 (+Q)<br>S460G6 (+Q)              | CV2<br>CV2<br>CV2              | 3     |
|                            | 3     | S355G15 (+N and +Q)                                            | CV2Z                           | 3     |
| Hollow Section (HFW)       | 2     | S355G13 (+N and +Q)<br>S420G5 (+Q)<br>S460G5 (+Q)              | CV2<br>CV2<br>CV2              | 4     |

#### NOTES:

1. Grades S355 G9 and G10 are equivalent to grades S355 G7 and G8 respectively, and may be substituted for them.
2. (a) Limited to 36 mm flanges thickness for primary applications  
(b) Steels in the as-rolled condition are not permitted.
3. Limited to 30 mm wall thickness for primary applications.
4. Limited to 20 mm wall thickness by EN 10225.
5. Group 2 & 3 grades substantially modified from EN 10113 Parts 1-3 and EN 10210-1 including qualities with enhanced through thickness ductility

#### b) Secondary Steel

Secondary plate and section shall conform to EN 10025-2 Grade S355 J2 + N, EN 10025-3. Grade 355N or EN 10025-4 Grade S355M with the following additional requirement.

- Ultrasonic examination for internal soundness shall be carried out [option 6 (Flat product) and Option 7 (open section) of EN 10025 -1]. Plate shall be inspected to EN 10150 Class S1/E2, sections to EN 103060 class 2.1 Plan D.
- The maximum carbon equivalent (EN 10025-1 clause 7.2.3) shall be 0.43

- Inspection certificates shall be in accordance with ISO 10474 type 2.1 or EN 10204 Type 3.1.

c) **Tertiary Steel**

Tertiary plate and sections less than 10mm plate/flange thickness shall be in accordance with EN 10025-2 Grade S235 JR or Grade S275 J). Inspection certificates shall be in accordance with ISO 10474 Type 2.1 or EN 10204 Type 3.1.

\* For through thickness properties, reference is made to PTS 37.19.10.30 Para 2.2

## 2.2.2 Alternative Specifications

The following material specifications are considered acceptable as an alternative to the grades specified in paragraph 2.2.1 above provided that

- the carbon content is always 0.23% maximum
- the maximum carbon equivalent (CE) is 0.45 (the applicable expression for C.E. is defined in EN 10225 Clause 8.2.3)
- all additional requirements defined in 2.2.1 are met.

Mild Steel

API 5L Grade B  
API 5L X42  
ASTM A36  
JIS G3106 SM41-B

High Strength Steel

JIS G3101 Class 4 SS55  
API 5L X52

## 2.2.3 Mechanical Properties

- The mechanical properties of the applicable specified material standard shall be met.
- Requirement for fracture toughness testing such as Charpy testing is made reference to PTS 37.19.10.30.
- Through thickness properties testing shall not be required for through thickness properties material of thickness 25.4mm and below.
- Should the Contractor require to purchase or supply the structural steel materials, Contractor shall comply with PTS 37.19.10.30

## 2.2.4 Certification Of Materials

### 2.2.4.1 General

The certification is used for the purpose of confirming the specified mechanical, chemical and physical properties of materials.

The following types of certificates are distinguished:-

- ISO 10474 Type 2.1 or EN 10204 Type 3.1

This certificate is applicable for Secondary steels.

Certificates in which manufacturer declare that the products comply with order requirement and material specifications. Material testing on the products carried out in accordance to products specification, official regulation and/or the order. The certificates and test result validated by the manufacturer's authorized inspection representative but must be independent of the manufacturing department.

b) ISO 10474 Type 3.1.C or EN 10204 Type 3.2

This certificate is applicable for Primary steels.

Certificates description is as Type 3.1 but validation of certificate and testing result must be made by manufacturer's authorized inspection representative and either the purchaser's authorized inspection representative

Or

the inspector designated by the official regulation. The test result must be made available to purchaser. All documents shall be stamped by appointed inspectors or on a separate certificate which refers to the mill certificates.

#### 2.2.4.2 Contents Of Certificates

a) All material certificates should specify the following :

- i) Identification
  - Product form
  - Mill location
  - The purchaser's order and item number where applicable
  - Method of steel manufacture
  - Heat or cast number and/or the product identification number
  - Dimensions
  - Designation of steel
- ii) Composition
  - Ladle analysis
  - Product analysis
  - CEV value
  - Pcm value where applicable
- iii) Heat treatment
  - Details of heat treatment stating nominal temperature, nominal soaking times and cooling method
- iv) Mechanical properties
  - Yield strength, tensile strength, elongation
  - Yield strength/tensile strength ratio where applicable
  - Charpy V-notch impact test results
  - Through –thickness properties
  - Strain Ageing
- v) Nominal or actual mass

## vi) Non-destructive test (NDT)

- Confirmation that NDT has been satisfactorily carried out is to be included in the inspection document

## b) In addition, the independent third party inspection certificates (ISO 10474 Type 3.1.C or EN 10204 Type 3.2) shall state :

- That identification of the material has been verified by the certification authority
- That all tests were witnessed by the independent third party inspection agency
- Agency or inspectors identification symbol
- Certificate number and date of issue

#### 2.2.5 Material Identification

Material marking of all Contractor supplied primary structural steel shall be white paint stenciled letters on black paint background. In addition, all materials shall be colour coded as per PTS 37.19.10.30.

Structural steel material shall be die stamped with the material number and heat number by the material manufacturer using low stress dot matrix type die stamps.

Materials in the Contractors yard shall be clearly identified with piece and item number painted on the steel.

#### 2.2.6 Bolts, Nuts And Washers

All bolts and nuts shall be the ISO metric thread series. Bolts shall be ASTM A193 Grade B7 and nuts shall be ASTM A194 Grade 2H.

Alternatively, bolts to ASTM A325 and A490, may obtained approval from the Company. Round washers shall conform to American Standard B27-2 Type B or equivalent, for use with ISO metric bolts. The diameter of the washer hole shall be 1.5 mm greater than the bolt size for bolts larger than 25 mm.

#### 2.2.7 Pile Packer And Pile Gripper Assemblies

Pile packer, pile gripper, zip-out closure and other structural assemblies shall be shown in the Drawings and shall be manufactured by a manufacturer approved by the Company. The assemblies shall be handled, installed and tested in strict accordance with the manufacturer's instruction. However, if the assemblies are done by another party apart from the manufacturer, the warranty shall cover for work done by parties authorized by the manufacturer.

#### 2.2.8 Gratings

##### 2.2.8.1 General

All materials shall be fabricated from galvanized tertiary steel (Type V) and will be painted for emergency escape routes.

Alternatively, ultra violet light resistant glass reinforced epoxy grating with fire retardants may be used after approval of the Company has been obtained.

#### 2.2.8.2 Open Steel Stair Treads and Floor Panel (See 8.9.3)

- a) Stair grating panel shall be of serrated pattern. Floor grating panel should be serrated pattern type. The cross bars of section 6 mm x 6 mm shall be twisted, load bearing bars and end plates shall be constructed as detailed in Table 2. The load bearing bars may be constructed from cold drawn flat bars or I-bars.
- b) On the rung of the steel ladders and stairs, anti-slip ladder rung covers of the industrial grade or equivalent as approved by the Company shall be installed.
- c) Clips used for grating shall be approved by Company.

#### 2.2.8.3 Galvanizing

All steel grating shall be hot dip galvanized with a minimum thickness according to BS 1461 or ASTM A-123. Where it is impossible to galvanize a complete unit which must be joined by welding after galvanizing, the welds shall be painted in accordance with PTS 30.48.00.31-P

#### 2.2.8.4 Installation

All galvanized gratings shall be installed after galvanizing to check the fit. At the discretion of the Company, the grating on any part of the structure may have to be removed prior to load out. In this case, the Contractor shall mark the grating prior to removal and prepare a placing drawing in accordance with Section 11 of this specification.

#### 2.2.9 Deck Plate

The use of chequer plates shall be avoided where possible and only be installed when indicated on the contract drawings. They shall be of the type where no slippery surfaces will be created due to standing water or oily products. For deck plates in a working area e.g. drill floors or walkways, heavy duty anti-slip surfaces shall be installed of the type "Safemate" or equivalent as approved by the Company. These anti-slip surfaces shall be bolted on.

#### 2.2.10 Timber

- a) Launch runner timber shall be a hardwood, "Selangan Batu" or equivalent, with an air dry density of approximately 960 kg/cu.m (60 lb/cu.ft). The required allowable compressive strength (parallel to the fibre) of the timber shall be 13 MPa (1.9 ksi) in accordance with ASTM 143-52.
- b) Timber for drilling decks shall be as a) above. Reference shall be made to PTS 34.19.60.30 (Impact Test on Derrick floor of Drilling Platform)

#### 2.2.11 Mudmat

- a) Timber for the mud mat shall be of a medium hardwood, "Keruing" or equivalent, with an air dry density of approximately 740 kg/cu.m (46 lb/cu.ft). The required allowable static bending strength of the timber shall be 11 MPa (1.6 ksi) determined in accordance with ASTM D143-52.

- b) Fibre reinforced panels for the mudmat shall have the minimum allowable static bending strength of 11 MPa (1.6ksi) based on actual testing.
- c) Steel mudmat should have a minimum thickness should be of 8mm

### **3.0 WELDING**

#### **3.1 General**

- a) All welding, temporary or permanent, shall meet the requirements of the latest edition of AWS D1.1 "Structural Welding Code-Steel", as modified by this specification.
- b) All welding shall be carried out by qualified welders and welding operators using qualified welding procedures in accordance with this specification.

### **4.0 WELDING CONSUMABLE**

#### **4.1 Types Of Electrodes, Wires And Fluxes**

##### **4.1.1 General**

- a) The electrodes, wires and fluxes used in fabrication shall be selected to produce welds with mechanical properties equivalent to those required for the base metal or as specified by the Company. The trade names and classification of all welding consumable proposed shall be submitted for approval together with detail of testing of each batch by manufacturer.
- b) When steels of different strengths are joined, the tensile properties of the weld metal shall be matched to the lower strength steel.

##### **4.1.2 Covered Electrodes**

- a) All covered electrodes for welding of structural steels shall be low hydrogen electrodes. The hydrogen content shall not exceed 10 ml per 100 grams of deposited weld metal.
- b) Electrodes shall be selected from a list of approved types of electrodes, such a list to be submitted to the Company for approval prior to selection being made.
- c) Electrodes shall only be used under conditions, in positions, and using the welding parameters recommended by the manufacturer.

##### **4.1.3 Wire And Flux For Submerged Arc Welding**

Wire and flux shall be carefully selected and the flux shall be of the fully basic type. The storage and use of wire and flux shall be as recommended by the manufacturer. The flux supplier shall define the range of chemical composition of wire to be used for his particular flux. No low-alloy wires shall be accepted. The proposed wire and flux shall be submitted for approval by the Company.

#### 4.1.4 Wire For Gas Metal Arc Welding (GMAW)

The gas metal-arc process may only be used on mild steel in enclosed shop fabrication conditions, and provided that the filler wire selected is such that the welds produced have the same mechanical properties as the base metal.

#### 4.1.5 Wire For Flux Core Arc Welding (FCAW)

FCAW can be gas shielding or self shielding subject to Company approval.

### 4.2 **Conditions And Storage**

- a) Electrodes shall be supplied in hermetically sealed cartons and stored in a dry storage room where the minimum temperature is 20 Centigrade. All manual type electrodes shall be properly identifiable (see AWS A5.1 and 5.5) up to the time of usage, each electrode being distinguishable by color code marking. If colors are destroyed by baking, handling or other causes, the electrodes shall not be used. Batch numbers shall be recorded.
- b) Low hydrogen electrodes shall not be stored in heated cabinets containing electrodes of other types, such as rutile or organic type electrodes.
- c) Wire spools for automatic and semi-automatic processes shall be stored in cabinets with supplier wrapping not removed and remain clearly identifiable up to the time of usage. Unidentifiable wire shall not be used.
- d) Flux shall be supplied and stored in accordance with paragraph 4.1.3.
- e) Each batch of flux and wire shall be labeled with the information from the supply container. The labels with batch number shall be recorded for reference.
- f) All unidentifiable, damaged, wet, rusty or otherwise contaminated consumable shall be scrapped.
- g) A consumable handling, storage and issuing procedure shall be submitted to the Company for approval prior to the start of any fabrication.

### 4.3 **Heating And Baking Requirements**

- a) All low hydrogen electrodes shall be baked at 270 °C to 330 °C for one hour prior to use.
- b) On completion of baking, the electrodes shall be transferred to a holding oven at 150 °C. When later removed from the holding oven, the electrodes shall be transferred to heated quivers or containers at 75 °C and used within 8 hours.
- c) Electrodes not used within 8 hours or for some reason exposed to adverse atmospheric conditions shall be rebaked for one hour and then transferred to the holding oven for later use. Electrodes shall be rebaked only once.
- d) Flux for submerged arc welding shall be issued as required for immediate use. They shall be held in a heated silo at 70 °C.