VIETSOVPETRO

DANH MỤC- СПЕЦИФИКАЦИЯ

Tên hàng hóa/Dịch vụ - На приобретение товаров/услуг: LQ Topside - Grating

Số ĐHXN - № заявки: DN.XNXL-0470/25-TTH

STT П/п	Mã Vật Tư Код МТР	Tên VTTB/dịch vụ (Việt/Nga hoặc Anh) Наименование МТР/услуг (вьетнам./русс. или англ.)	Đặc Tính Kỹ Thuật Технические характеристики	ĐVT Ед. Изм.	Số Lượng Кол-во
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
I. VẬT TƯ THIẾT BỊ					
1	00.037.022.00370	Grating 38x5/30x100 mm	Hot-Dip Galvanized Serrated Steel Grating 38x5/30x100 ASTM A36 1000x6000mm	pce	112,00
2	00.037.022.00591*	275W x 1219L Hot-Dip Galvanized Serrated Steel Stair Treads 38x5/30x100 with anti-slip nosing 275W x 1219L	ASTM A36	pce	274,00
3	00.037.022.00315	Grating clips to match with above serrated grating Grating clips to match with above serrated grating, SS316	Grating Clips: - 25x2 Thk Saddle Clip - Hex Head Bolt M8x75L c/w Nuts - Bottom Clip (All material shall be SS316L) Refer to Drawing: PQ-CPC0-STR DTL-MPC-00008-02_N01	set	2.204,00
4	00.037.022.00592*	Hot-Dip Galvanized Serrated Steel Bar 38x5	ASTM A36 6000mm	pce	5,00
5	00.037.022.00370	Grating 38x5/30x100 mm	Hot-Dip Galvanized Serrated Steel Grating 38x5/30x100 ASTM A36 1000x6000mm	pce	24,00
6	00.037.022.00591*	275W x 1219L Hot-Dip Galvanized Serrated Steel Stair Treads 38x5/30x100 with anti-slip nosing 275W x 1219L	ASTM A36	pce	58,00
7	00.037.022.00315	Grating clips to match with above serrated grating Grating clips to match with above serrated grating, SS316	Grating Clips: - 25x2 Thk Saddle Clip - Hex Head Bolt M8x75L c/w Nuts - Bottom Clip (All material shall be SS316L)	set	556,00

STT П/п	Mã Vật Tư Код МТР	Tên VTTB/dịch vụ (Việt/Nga hoặc Anh) Наименование МТР/услуг (вьетнам./русс. или англ.)	Đặc Tính Kỹ Thuật Технические характеристики	ĐVT Ед. Изм.	Số Lượng Кол-во
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
			Refer to Drawing: PQ-CPC0-STR DTL-MPC-00008-02_N01		
II. DỊCH VỤ					

(*) : New items

Руководитель предприятия/Отдела АУ Signed by: Phạm Thanh Bình
Date: 03/08/2025 11:11:21
Certified by: Vietsovpetro CA **Phạm Thanh Bình**

Thỏa thuận/ *Согласовано*:

Phó giám đốc Signed by: Lê Quốc Anh
Date: 03/08/2025 05:29:38
Certified by: Vietsovpetro CA **Lê Quốc Anh**

Ký tắt/Viza:

Trưởng PDA Signed by: Trần Nguyên Hưng
Date: 30/07/2025 17:31:20
Certified by: Vietsovpetro CA **Trần Nguyên Hưng**

Người thực hiện /Исполнитель:

Kỹ sư PDA Signed by: Phạm Vũ Thắng
Date: 29/07/2025 15:57:55
Certified by: Vietsovpetro CA **Phạm Vũ Thắng**

VIETSOVPETRO

VIETNAM BLOCK B GAS PROJECT

Agreed by
Deputy Director of OCD

Signed by: Lê Quốc Anh
Date: 25/07/2025 15:35:29
Certified by: Vietsovpetro CA

LE QUOC ANH

Approved by
Director of OCD

Signed by: Phạm Thanh Bình
Date: 25/07/2025 15:42:01
Certified by: Vietsovpetro CA

PHAM THANH BINH

TECHNICAL REQUIREMENT
PROVISION OF STEEL GRATING & STAIR TREADS FOR LIVING QUARTER – BLOCK B

DOC. NO : OCD-LQ-BLOCKB-TR-16

REV : 0

ISSUED FOR BID

TABLE OF CONTENTS

1. GENERAL

The purpose of this document is to provide the technical requirement together along with the datasheets and reference documents. It covers the minimum requirements for procurement, fabrication, painting, inspection, testing, and preparation for shipping, delivery of Steel Grating and Stair Treads package.

1.1. Definitions

Table 1 : Definitions

Acronym	Definitions
COMPANY	Shall mean Phu Quoc Petroleum Operating Company
CONTRACTOR	Shall mean The Consortium of McDermott Asia Pacific Sdn. Bhd. ("McDermott") and Petrovietnam Technical Services Corporation ("PTSC")
PTSC M&C	PTSC MECHANICAL & CONSTRUCTION LIMITED COMPANY, a company organized and existing under the Laws of Socialist Republic of Vietnam, having its head office at 31, 30/4 Street, Vung Tau City, Vietnam.
VSP/ PURCHASER	Vietsovpetro shall mean Sub-sub contractor that places the Purchase Order/ or Purchaser.
BIDDER	Means an individual or business entity that submits a bid

1.2. Document Reference

Table 2: Document Reference

No.	Doc No.	Document Title	Rev. No
1	PQ1-00-STR-SPC-TAP-00003	Specification for Design of Fixed Platform Structures	H02
2	PQ-CPC0-STR-SPC-MPC-00003-00	Specification For Structural Steel For Fixed Offshore Platform	N01
3	PQ1-00-QAC-SPC-TAP-00002	Specification For Control And Reporting Of Non- Conformances And Non-conforming Products	H01
4	PQ-GENR-QAC-SPC-PQC-00003-00	Quality Requirements Critical Levels 3 & 4	H01
5	PQ-GENR-QAC-SPC-PQC-00005-00	Traceability & Marking Requirements for Materials and Equipment	H01
6	PQ-GENR-ITM-SPC-PQC-00003-00	Document Numbering and Coding	H01

No.	Doc No.	Document Title	Rev. No
7	PQ-GENR-ITM-SPC-PQC-00002-00	Vital Document and Data Deliverables	H01
8	PQ1-00-MEC-SPC-TAP-00035	Specification Of Requirements For Positive Material Identification	H01
9	PQ1-00-TEC-SPC-TAP-00002	Units of Measurement	H01
10	PQ-GENR-CTC-EXH-PQC-00106-05	Contractor's Project Quality Management Program	H01
11	PQ-CPC0-STR-SPC-MPC-00002-00	Specification Of Fabrication Of Platform Structures For Fixed Offshore Platforms	N01
12	PQ-GENR-QAC-SPC-PQC-00004-00	Contractor and Subcontractor Quality Personnel Qualification	H01
13	PQ-CPC0-CRR-SPC-MPC-50001-00	Specification For Protective Coatings	L01

1.3. Reference Drawings

Table 3: Reference Drawings

No.	Doc No.	Document Title	Rev. No
1	PQ-CPC0-STR-DTL-MPC-00012-01	Jacket Topside Utility Module Bridge Typical Stair Details	N01
2	PQ-CPC0-STR-DTL-MPC-00008-02	Topside Utility Module Bridge Typical Flooring Sections And Details	N01

1.4. Acronyms and Abbreviations

Table 4: Acronyms and Abbreviations

Acronym	Acronym/ Abbreviation Description
ALARP	As Low As Reasonably Practical
AFC	Approved For Construction
CA	Contract Award
CAR	Corrective Action Request
CBE	Commercial Bid Evaluation
CPP	Central Production Platform
DSF	Design Safety Factor
ED	Effective Date
EEP	Engineered Equipment Procurement
EPCI	Engineering, Procurement, Construction and Installation

Acronym	Acronym/ Abbreviation Description
FAT	Factory Acceptance Test
FEED	Front End Engineering Design
HSES	Health, Safety, Environment and Security
HUC	Hook-Up and Commissioning
IFA	Issued for Approval
IMS	Integrated Management System
ITB	Invitation to Bid
LQ	Living Quarters
LQM	Living Quarter Module
LQP	Living Quarter Platform
LQU	Living Quarter Utility
MDR	Master Deliverables Register
MSDS	Material Safety Data Sheet
MTO	Material Take Off
OA	Operation Assurance
PEP	Project Execution Plan
PM	Project Manager
PMS	Project Master Schedule
PMT	Project Management Team
PTSC	PetroVietnam Technical Services Corporation
QA / QC	Quality Assurance / Quality Control
QMS	Quality Management System
RFSU	Ready for Start-Up
ROS	Required on Site
SCM	Supply Chain Management
SIMOPS	Simultaneous Operations
SME	Subject Matter Expert
TBE	Technical Bid Evaluation
VBGP	Vietnam Block B Gas Project
WBS	Work Breakdown Structure
WD	Water Depth
WHP	Wellhead Platform
Doc	Document
No	Number
Rev	Revision

2. ORDER OF PRECEDENCE

Should there be any conflict, discrepancy, inconsistency or ambiguity between any CONTRACT documents within the DESIGN DOSSIER, priority shall be given in the following order of precedence:

1. Convention followed by Vietnam (MARPOL, SOLAS)
2. Applicable Regulation of Vietnam.
3. COMPANY standards.
4. This Technical Requirement.
5. Project Technical Requirements (Project Drawings and Material Data Sheets, Project Specifications, etc.)
6. International Codes and Standards.

In case of conflict between standards, the most stringent requirements shall prevail. All regulations, codes and standards referred to shall apply in the latest official revision. If the COMPANY applies any changes in this specification or standards as described later herein, the VENDOR shall submit the effect on the supply, delivery date, cost implication or any other issue which may affect the purchase order in a written document. It is the VENDOR's responsibility to inform COMPANY through EPCI contractor of any deviations/conflicts for exceptions to the listed specifications codes & standards.

3. SCOPE OF SUPPLY

Table below covers the minimum Scope of Supply for the quotation. Bidder is requested to check in the "**BIDDER'S CONFIRMATION**" column in the table and attach the checked table to their technical proposal to confirm the coverage of their proposal.

Any exception shall be clearly and specifically stated in the Deviation List. Bidder is encouraged to add any items they think important for Purchaser's attention and further clarification. These shall include but not limited to the subsequent page:

Table 4: Scope of Supply

Item	No.	Qty	Description	Bidder's confirmation
1	**Common Scope of Supply**			
1.1	All Tags	1 lot	**Scope of Supply:** The Bidder must quote full items and enough quantity as per structural steel materials requisition listed in "**Appendix 2.1** of this TR". In general, the materials supplied by Bidder shall be in compliance with all the requirements set forth in the referenced documents in section 1.2, unless specified otherwise. Further than that, Bidder shall comply with the following requirements: - Material Condition: All materials shall be of new production. The sourcing of Material shall be met the requirement in "PQ-GENR-QAC-SPC-PQC-00003-00" **Ref. [1.2.4].** - BIDDER shall submit ITP/MPS (Inspection and Test Plan / Manufacturing Process Specification) for review along with the proposal (Not accept for sample ITP/MPS). *- The Goods must be brand new and manufactured after the signing of the Purchase Order.* *- The Goods must be free from any damage such as corrosion, deformation, bending, warping, cracking, fatigue, brittleness, pitting, scaling, or improper galvanizing and must also meet the following conditions:* *+ Goods must be brand new, properly galvanized in accordance with ASTM A123 and manufactured in 2025 or later.* - BIDDER shall mark-up one by one item into the "Bidder's Confirmation" column as per **Ref. [3].**	
1.2	All Tags	1 lot	Long term preservation and preparation for Shipment and Export packaging.	
1.3	All Tags	1 lot	Inspection and Testing as per **Appendix 8** of this TR	
2	**Guarantee and Warranty**			

Item	No.	Qty	Description	Bidder's confirmation
2.1	All Tags	1 lot	Guarantee and warranty complete for the package and supplied items. ** Goods is furnished with Warranty Certificate for the period of **12 months** from delivery of last portion of material.*	
3	**Marking, Inspection, Testing and Certification**			
3.1	All Tags	1 lot	All identification shall be in accordance with the Purchaser's details.	
3.2	All Tags	1 lot	- Inspection & Testing Requirements as per Section A.3 in **Appendix 1** of "Specification for Design of Fixed Platform Structures", **Ref. [1.2.1]** and in Section 6 of Datasheet in **Appendix 2** and **Appendix 8**. - Test Certificates as per EN 10204: 2004 Type 3.1	
4	**Delivery**			
4.1	All Tags	1 lot	Vietsovpetro Site, No.67, 30/4 Road, Thang Nhat Ward, Vung Tau City, S.R Viet Nam or Vietsovpetro Port, No.69, 30/4 Road, Thang Nhat Ward, Vung Tau City, S.R Viet Nam. ** Bidder has to follow Vietsovpetro's HSE policy when delivery goods to Vietsovpetro Site/Port*	
4.2	All Tags	1 lot	After issuing Letter of Award (LOA), the delivery time is required not later than **84 calendar days (or 12 weeks).**	
5	**Documentation**			
5.1	All Tags	1 lot	VDRS as per TR	
5.2	All Tags	1 lot	Final Documentation	

4. APPENDICES

Appendix 1: Reference Documents, Drawings (Refer to Section 1.2, 1.3)

Appendix 2: Summarized Technical Requirement

Appendix 3: QA Program Standard and Inspection Requirement

Appendix 4: Vendor Data Requisition Schedule (VDRS)

Appendix 5: Technical Query Form

Appendix 6: Template for Vendor Document

Appendix 7: Weight Quotation and Management.

Appendix 8: Quality, Inspection and Testing Requirements

Appendix 9: Material Origination and Special Conditions

APPENDIX 1

REFERENCE DOCUMENTS

APPENDIX 1

REFERENCE DOCUMENTS

PETROVIETNAM

PHU QUOC POC

Vietnam Block B Gas Project

Specification for Design of Fixed Platform Structures

				Christine Hew 2017.07.07 16:18:01 +08'00'		
H02	07 July 2017	Re-issued For Use	VMQ/NTH	WD	CHH	
H01	30 June 2017	Issued For Use	VMQ/NTH	WD	CHH	
F01	08 June 2017	Issued For Approval	VMQ/NTH	WD	CHH	
E01	22 May 2017	Issued For Review	VMQ	WD	CHH	
D01	19 May 2017	Issued For IDC	VMQ	WD	CHH	
REV	DATE	DESCRIPTION	ORIG	CHK	APPR	APPR BY COMPANY

PQPOC Document Control No.	Area Type	Area Identifier	Discipline	Doc. Type	Originator	Sequence No.	Revision
	PQ1	00	STR	SPC	TAP	00003	H02

Attachments		
Item No.	**Description**	**Document No.**
1	**Technical Requirements For Other Structural Materials**	**Appendix - 1**

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1 INTRODUCTION

1.1 Project Overview

Blocks B&48/95 and 52/97 are located in Southwestern Offshore Vietnam with sea water depth of about 77 meters. The distance from the Blocks B&48/95 and 52/97 to Ca Mau is about 250 kilometers and to O Mon Power Center, about 400 kilometers (Figure 1-1).

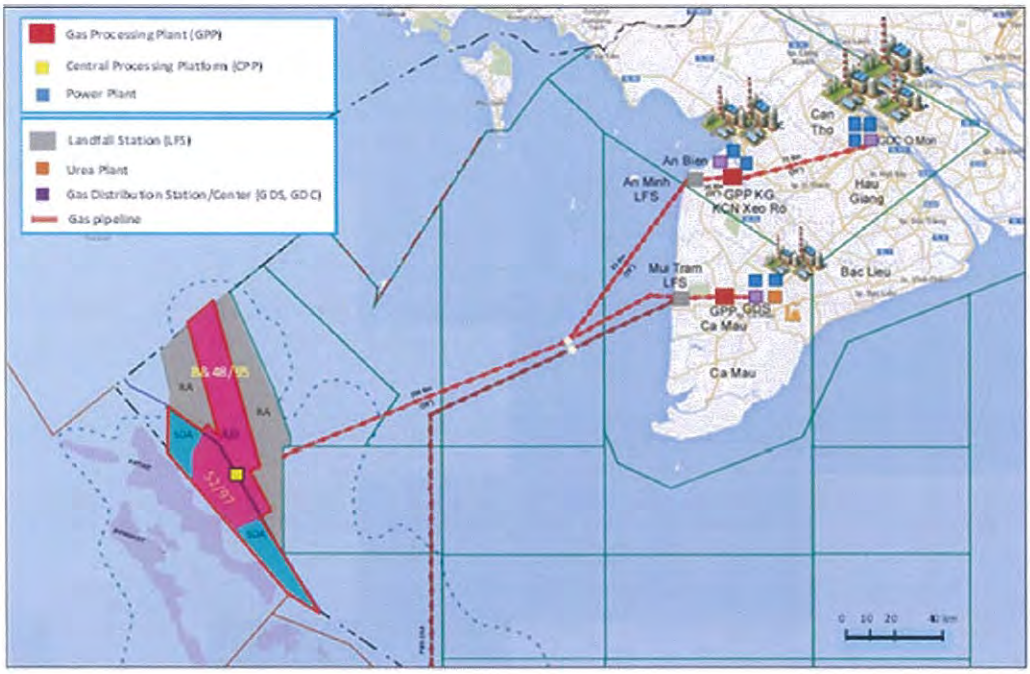

Figure 1-1 Location of Blocks B 48/95 and 52/97

The Vietnam Block B Gas Project facilities comprise:

- Central Processing Platform (CPP) with bridge linked flare structure;
- Living Quarters (LQ) Platform;
- Hub and Generic Wellhead Platforms;
- Trunk-lines and infield pipelines; and
- Floating Storage and Offloading (FSO) system for condensate storage and export.

These facilities will be installed and production and water injection wells drilled as needed to fulfill the contract gas sales requirements.

The asset will produce several thousand small reservoirs during field life. Consequently, there will be large variation in the gas composition values. The COMPANY plans to blend the producing

reservoirs to meet the sales gas specification. A significant percentage of inert gas (mainly CO_2) is expected, as well as traces of H_2S, Arsenic, and Mercury.

The initial facilities will consist of four Hub / Wellhead Platforms, Trunk Lines, a Central Processing Platform (CPP), a Living Quarter (LQ) Platform, Flare Platform, and an FSO. One Wellhead Platform will be bridge connected to the CPP. The three Hub Platforms act as gathering centers, receiving gas from other Wellhead Platforms, before routing the gas to the CPP.

All development wells are to be drilled and completed from remote Hubs or generic WHPs. The wells will be drilled by either jack-up or tender assisted rigs. The Wellhead / Hub Platforms will be designed to accommodate either type of rig. No permanent drilling facilities will be provided on the Wellhead / Hub Platforms.

Hub and generic Wellhead Platforms are designed with 20 wellslots. The produced fluid will be collected in the manifold at the Wellhead / Hub Platforms, then routed to the CPP via Trunk-lines / in-field gathering lines. Booster compressors will be installed on Wellhead / Hub Platforms to maintain production and maximize reserve recovery by connecting the compressor suction line to the low pressure wells with tubing head pressure 100-200 psig and routing the compressor discharge line to the production manifold which will the export well fluid to the infield pipeline. Hub platforms are designed to receive additional production via pipelines from connected WHPs and export via 20 inch trunk lines to the CPP. Generic WHPs export fluids via 16" infield pipelines to Hub Platforms. All remote WHPs in the initial development phase shall be of the Hub design.

At the CPP, all gas will be compressed and processed by dehydration, hydrocarbon dew-pointing and mercury removal to meet sales gas specification, then compressed and metered prior to export. Gas will be exported from the CPP to shore via a dedicated export pipeline to be developed and operated by PetroVietnam Gas. The facilities will be designed to deliver the DCQ of 490 MMscfd and Maximum Daily Contract Quantity (MDCQ) of 575 MMscfd, with additional WHPs installed, drilled and tied-in to the CPP to maintain the capacity for the agreed plateau duration.

Any produced water will be treated and disposed of via injection wells. Condensate will be stabilized and sent to the FSO for storage for later shipment. Electrical power will be generated by gas turbine generators for platform operations. Control for all offshore operations will take place at the Central Control Room (CCR) on the CPP. The manning requirement for the CPP and other facilities will accommodated in an LQ platform, bridge linked to the CPP.

The preliminary field layout for the First Gas is shown in Figure 1-2.

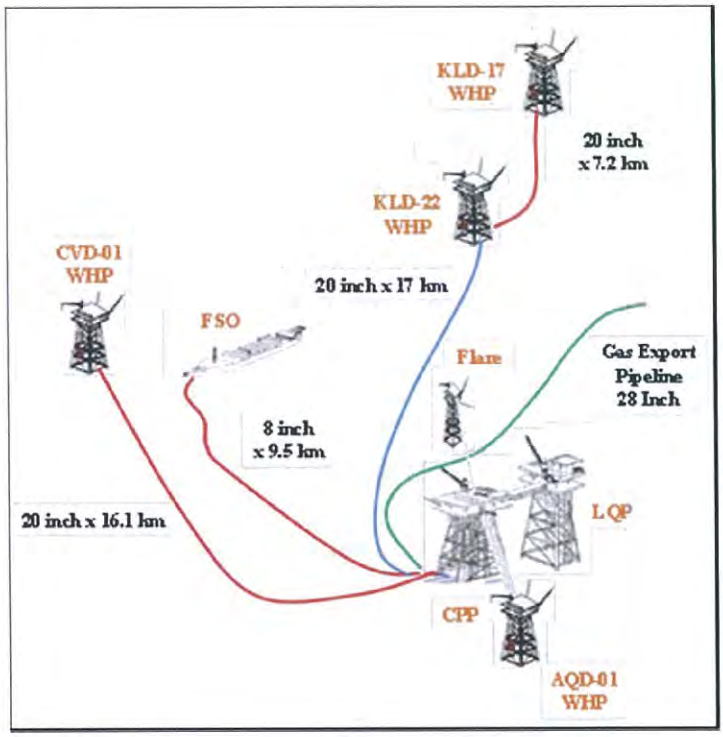

Figure 1-2 Preliminary field layout for First Gas

1.2 Acronyms and Abbreviation

3D	Three Dimensional
AISC	American Institute of Steel Construction
AFC	Approved for Construction
API	American Petroleum Institute
ASD	Allowable Stress Design
POB	Passenger On Board
CDR	Cumulative-Damage Ratio
COG	Center of Gravity
CPP	Central Production Platform
D/t	Outer Diameter-to-Wall Thickness
DAF	Dynamic Amplification Factor
DL	Dead Load
DNV	Det Norske Veritas
DOF	Degree of Freedom
Dwg	Drawing

EL	Elevation
FEA	Finite Element Analysis
FPS	Foot, Pound, Second
FOS	Factor of Safety
GML	Gravity, Metacentric, Longitudinal
GMT	Gravity, Metacentric, Transverse
GoT	Gulf of Thailand
HAZOP	Hazard and Operability
HSE	Health, Safety and Environment
HUB	Hub Platform
LAT	Lowest Astronomical Tide
LL	Live Load
LQ	Living Quarter
MLW	Mean Low Water
MWS	Marine Warranty Surveyor
ND	Noble Denton Group Ltd
RAO	Response Amplitude Operator
Ref.	Reference
Rev	Revision
ROV	Remotely Operated Vehicle
SCF	Stress Concentration Factor
SF	Safety Factor
TKY	Types of Tubular Joints
UDL	Uniform Distributed Load
UV	Ultraviolet
VIV	Vortex-Induced Vibration
WCR	Weight Control Report
WHP	Wellhead Platform
WSD	Working Stress Design

1.3 Definition

COMPANY	Phu Quoc Petroleum Operating Company (PQPOC)
CONSULTANT	The nominated engineering company
CONTRACTOR	The person, group or organization responsible for the construction of the platform.
PURCHASER	The person, group or organization who places purchase order on VENDOR.
VENDOR (or Supplier)	The person, group or organization responsible for the design, manufacture, testing and loadout/shipping, installing of the Equipment.
Sub-VENDOR	The person, group or organization who may be employed by the VENDOR to provide services for the design, manufacture, testing and loadout/shipping, installing of the Equipment or to provide materials, sub-components and sub-assemblies for incorporation in the Equipment packages.
Inspection and Test Plan (ITP)	A schedule of inspection and test activities identifying the stages at which VENDOR, COMPANY, third parties or independent inspectors are involved and additionally identifying the involved specifications, acceptance criteria and instructions that are relevant.
Third Party	An Independent 3rd Party Certifying Authority appointed by VENDOR approved by the COMPANY for certifying specific equipment/equipment packages fabricated at VENDOR's shop.
Inspector	COMPANY /PURCHASER appointed person, group or organization acting in behalf of the COMPANY /PURCHASER responsible for inspection and witness testing of equipment/equipment packages at VENDOR's shop.
Certifying Authority (CA)	Independent agency contracted by the COMPANY to provide Classification/Certification services to Phu Quoc POC Field Development Project's facilities from design review to construction & commissioning (start up) in accordance with CA Rules & Regulations, applicable Codes & Standards & Vietnamese Register (VR) Regulations.
May	Indicates possible course of action.
Shall	Indicates mandatory requirements
Should	Indicates preferred course of action.
Will	Indicates an intention of action.

1.4 Scope

This specification document provides guidance on the minimum requirements to be used for the structural analyses and design of fixed platform structures for Vietnam Block B Gas Project.

This specification shall be read in conjunction with the contract scope of work, other COMPANY specifications, and other relevant documentation to obtain a complete definition of scope of work and associated requirements.

2 CODES, STANDARDS, REGULATION AND REFERENCE

2.1 Codes and Standards

This specification shall be in accordance with the requirements of the latest edition of the following codes and standards:

American Petroleum Institute (API)	
RP 2A-WSD	Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms - Working Stress Design
RP 2A-LRFD	Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms - Load and Resistance Factor Design
RP 2L	Planning, Designing and Constructing Heliports for Fixed Offshore Platforms
Spec 2B	Specification for the Fabrication of Structural Steel Pipe
Spec 2C	Specification for Offshore Cranes
Bulletin 2U	Bulletin on Stability Design of Cylindrical Shells
Spec 10	Material Testing for Weld Cement
American Institute of Steel Construction (AISC)	
9th Edition	Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design
13th Edition	Steel Construction Manual
American Society for Testing Material (ASTM)	
ASTM C109/C109M Ed	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
American Welding Society (AWS)	
AWS D1.1	Structural Welding Code – Steel
American Concrete Institute (ACI)	
ACI 214-77	Recommended Practice for Evaluation of Strength Test Results
American Society for Testing and Materials (ASTM)	
A123	Standard Specification for Zinc (Hot- Dip Galvanized) Coatings on Iron and Steel Products
A153	Standard Specification for Zinc Coatings (Hot- Dip) on Iron and Steel Hardware

A320	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service
A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A490	Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
D429	Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates
D635	Standard Test Method for Rate of Burning and/ or Extent and Time of Burning of Plastics in a Horizontal Position
D695	Standard Test Method for Compressive Properties of Rigid Plastics
D945	Standard Test Methods for Rubber Properties in Compression or Shear (Mechanical Oscillograph)
D2240	Standard Test Methods for Rubber Property-Durometer Hardness
D2863	Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastic (Oxygen Index).
D2565	Standard Practice for Xenon-Arc Exposure of Plastic Intended for Outdoor Applications
E84	Standard Test Method for Surface Burning Characteristics of Building Materials
British Standards Institute (BSI)	
BS 5268-2	Structural use of timber (Part 2) Code of Practice for permissible stress design, material and workmanship
BS 5268-5	Code of Practice for the preservative treatment of structural timber
Det Norske Veritas (DNV)	
RP B401	Recommended Practice for Cathodic Protection Design
RP 5	Rules for the Design, Construction and Inspection of Offshore Structures
RP-C203	Fatigue Design of Offshore Steel Structures
RP-C205	Environmental Conditions and Environmental Loads
Rules for Planning and Execution of Marine Operations	
VMO	Standard for Insurance Warranty Surveys in Marine Operations
Noble Denton Group (NDI)	

0030/ND	General Guidelines for Marine Transportation
0028/ND	Guidelines for the Transportation and Installation of Steel Jackets
Civil Aviation Authority, London	
CAP 437	Offshore Helicopter Landing Areas – Guidance on Standards
Lloyd's Register	
Lloyd's Register of Shipping Recommended Parametric Stress Concentration Factors for Ring Stiffened Tubular Joints, Version 1.0, October 1989	
Structural use of timber (Part 2) Code of Practice for permissible stress design, material and workmanship	
Rules and regulations for the classification of fixed offshore installations	
Offshore Technology Conference (OTC)	
OTC004890	Recent Developments in the Design of Grouted Connections
McGraw-Hill Companies	
Timoshenko, Stephen P., and J. Gere. 1961. Theory of elastic stability (Engineering Society Monographs). New York: McGraw-Hill Companies	

CONTRACTOR/ VENDOR shall be responsible for ensuring compliance with all applicable Vietnamese codes, standards and regulations.

2.2 COMPANY General Specifications

The following COMPANY Specifications shall be applied to the subject work. In cases of conflict between COMPANY Specifications and any of the applicable codes, CONTRACTOR shall immediately submit the matter in writing to COMPANY who will provide a written clarification.

PQ1-00-ARC-SPC-TAP-00001	Specification for Design and Fabrication of Offshore Buildings
PQ1-00-ARC-SPC-TAP-00002	Specification for General Arrangement, Design and Installation of Living Quarters
PQ1-00-CRR-SPC-TAP-00001	Specification for Cathodic Protection Offshore Structures
PQ1-00-CRR-SPC-TAP-00002	Specification for Offshore Structures Sacrificial Anodes
PQ1-00-STR-SPC-TAP-00001	Specification for Loadout, Transportation and Installation
PQ1-00-STR-SPC-TAP-00004	Specification for Helidecks
PQ1-00-STR-SPC-TAP-00005	Specification for Disposal Caissons

PQ1-00-STR-SPC-TAP-00006	Specification for Structural Welding and Inspection for Fixed Platforms
VNM-GENR-STR-SPC-EDG-0000-00002	Structural Steel and Other Materials for Fixed Offshore Platforms
VNM-GENR-STR-SPC-EDG-0000-00005	Fabrication of Platform Structures for Fixed Offshore Platforms
VNM-HBGN-STR-BOD-EDG-0000-00001	Generic Hub Platform Structural Design Basis
VNM-VPP1-MEC-SPC-EDG-0000-00019	Specification for Protective Coatings
VNM-VPP1-STR-PHL-EDG-0000-00001	CPP Structural Design Basis

2.3 Order of Precedence

The following order of precedence shall govern:

- Applicable Regulation of Vietnam
- Purchase Order
- Project Drawings and Data sheets
- Project Specification
- International Codes and Standards

Should any conflict between the requirements defined in the reference documents not able to be resolved by the above order of precedence, CONTRACTOR shall bring the matter to COMPANY's attention in writing. Unless otherwise determined in writing by COMPANY, the most stringent requirement shall apply.

3 MATERIALS

The structural material types shall be designated on the structural drawings.

3.1 Structural Steel Materials

The structural steel materials shall conform to the requirements in the document VNM-GENR-STR-SPC-EDG-0000-00002, "Structural Steel and Other Materials for Fixed Offshore Platforms".

3.2 Other Structural Materials

Other structural materials such as timber, neoprene/ rubber liner, fiberglass grating, miscellaneous steel and grouting shall conform to the requirements in Appendix -1.

4 DESIGN PHILOSOPHY & GENERAL REQUIREMENTS

This section provides an overview of various requirements to be considered for the structural design of platform structures for Vietnam Block B Gas Project.

4.1 Design Philosophy

The design philosophy to be considered in the structural design of the platform are:

- To establish a structural design which fulfills the COMPANY requirements to conduct an efficient operation of production or drilling and support services (i.e. accommodation, compression, venting etc.) from the platform with full recognition of safety, economy, service life and environment.

- Global design of the structural system and design of individual components shall consider appropriate loadings for all phases of platform life. In-service conditions include extreme storm events, operating conditions, fatigue analysis, and other analyses as appropriate such as boat impact, dropped object, fire and blast, etc.

- To establish a structural design which caters for all conditions likely to be encountered during pre-service conditions (include construction/ fabrication, loadout, tow to site, launch (or lift), and upending of jacket, etc) and interim construction conditions (include lowering, docking, and mating of various jacket sections, pre-piled on-bottom stability, pile driving, and installation of the various deck sections or modules, etc).

- To demonstrate that all components of the structure have been adequately designed for design conditions and that all stresses, deformations, etc. are within allowable limits. Member sizes and components shall be selected on the basis of fitness, strength, stability, and economy.

- To develop a safe and optimized structural design of the platform, the following requirements shall be considered to apply:

  – The designed structures shall be achieved simplicity in configuration and ease of construction and installation. Principles for loadout, transportation, installation, lifting, launching or for any particular phase or condition, which has a major impact on certain component of the structures, shall be integrated in the design at the very beginning of the design phase.

  – Safety of the designed structures and facility shall be the top priority and shall not be compromised under any circumstances. All miscellaneous items such as walkways, ladders, stairs, boatlandings, etc., shall be designed and detailed to maximize their safe use.

- All appurtenances such as boatlandings, barge bumpers, riser guards, etc., can be damaged during operation. They should be designed for water depth adjustments and can be removed easily for replacement.

- If the jacket needs to be installed by launch method, then buoyancy shall be considered from the beginning of design, and the members shall be sized accordingly.

- To reduce local stress concentration; ring stiffeners used for joint strengthening at launch trusses shall have smooth transitions to the connecting members.

4.2 General requirements

The platform structural components and foundations shall be designed to ensure that they are adequate from the safety, strength, stability and serviceability requirements during all phases of pre-service and in-service conditions, as per API RP 2A and AISC. In addition, the foundations shall be designed with the necessary factors of safety in accordance with API RP 2A.

Certain components such as stiffened plate and shell elements may not be adequately covered by the above codes. For design of these components, the requirements of DnV or other internationally accepted codes shall be met.

4.2.1 Member Design

Member sizes and components shall be selected on the basis of fitness, strength, stability, and economy. Member stresses shall be checked at the ends of members and throughout their lengths in accordance with API RP 2A-WSD.

Reasonable attempts at sizing members shall be made to attain final unity checks in the range of 0.90 to 0.95 for primary members in the same member group and for the final AFC member configuration. Any unity check greater than 0.95 shall be considered for mitigation efforts on a case by case basis.

Slenderness Ratios

Slenderness ratios of structural members shall be calculated in accordance with API RP 2A. The slenderness ratios of all structural members shall be limited to a maximum as shown in below table, subject to fulfillment of vortex shedding design requirements.

Table 4.1: Maximum Member Slenderness Ratios

Member Description	Max. Member Slenderness Ratios	
	In compression	In tension
Primary braces	100	200
Secondary braces	120	240

For tension members with slenderness ratio over 120, caution must be exercised to ensure transportation and installation loads have been analyzed, vibration issues have been addressed, and load reversals into compression, if applicable, have been analyzed.

For braces and beams, the member length may be taken equal to the distance between the faces of the chords, or the actual connections.

D/t Ratios

Tubular members shall be sized to ensure that the minimum D/t ratio is 20. Maximum D/t ratios shall be in accordance with API RP 2A, with associated member capacity reductions to account for local buckling or subject to the provision of ring stiffeners.

Table 4.2: Diameter-to-Thickness Ratios

Member Description	D/t Ratio	
	Minimum	Maximum
Braces (510 mm – 20 inches diameter or less)	30	60
Braces (560 mm - 22 inches diameter or larger)	20	60**
Joint cans	20*	60
* Joint-can D/t ratios of less than 20 must be accepted in writing by COMPANY. ** In case of grouted Legs the maximum D/t restriction is not applicable for all pre-service analysis.		

For piles, the maximum D/t ratios shall be limited to 50.

Hydrostatic Design

Additionally, all members to be checked for hydrostatic head only considering full water depth.

For member with D/t ratios greater than 300 or a yield stress greater than 415 MPa (60 ksi), hydrostatic design shall be completed in accordance with API Bulletin 2U.

The hydro static pressure, as determined by the launch analysis, shall be used in member design.

The member unity checks shall include the axial force derived from launch analysis in the buckling equation.

In case of buoyancy tanks, design pressure shall be determined from the intact and damaged installation condition, and shall be assumed to be applied from outer side of the bulkhead for outermost bulkheads.

Minimum thickness

Minimum thickness of all primary tubular members shall not be less than 9.5mm and 12.7mm for braces and legs respectively, with additional provision for corrosion allowance in the splash zone.

Minimum web thickness/wall thickness for rolled shapes and tubulars for secondary members should be 6mm.

Conical transitions

Conical transitions shall be concentric and shall be designed in accordance with API RP 2A.

4.2.2 Joints

Tubular Joints

Tubular joints shall be designed in accordance with API RP 2A requirements. The joints shall be configured to provide the minimum gaps as shown on the drawings.

When detailing brace joint cans, if simple joint detailing is not practical, barrel joints shall be used with conical transitions back to nominal brace diameter to provide a minimum of 75 mm clear, between the toes of incoming bracing. For secondary braces, and with the acceptance of COMPANY, this clearance may be reduced to 50 mm.

Where overlap cannot be reasonably avoided, the minimum overlap shall be 150mm in line with API RP 2A 4.2.5.

Eccentricities of the brace centerlines greater than D/4 shall be appropriately modeled and accounted for in the design.

If an increased wall thickness in the chord at a joint is required, the thickened chord shall extend past the outside edge of the bracing a minimum of one quarter of the chord diameter or 300 mm, whichever is greater.

Joint cans that occur at the end of a chord member as a stub end shall extend past the edge of the bracing a minimum of one quarter of the chord diameter or 300 mm, whichever is greater.

The total length of all joint cans shall be detailed in even increments of 50 mm, unless directed otherwise by COMPANY at the request of the fabrication contractor.

The API requirement stating tubular-joint connections shall be designed for a minimum of 50 percent of the effective strength of the member shall apply to primary joints only. Secondary joints and minor joints will not be governed by this criterion.

Ring Stiffened Joints

Ring stiffened joints and node barrels shall be designed in accordance with API RP 2A. Closed form ring solutions shall be used to evaluate stresses and deformations.

4.3 Analyses Requirements

The platform structure shall be analyzed and designed for the following in-service and pre-service conditions. Analyses shall demonstrate that all components of the structure have been adequately designed for design conditions and that all stresses, deformations, etc. are within allowable limits.

4.3.1 Global Analyses

The platform structure and foundations shall be analyzed and designed for the following global in-service conditions:

- In-place Analysis (Storm and Operating Conditions) including pile design
- Dynamic Analysis (natural period calculation)
- Spectral Fatigue Analysis
- Boat Impact Analysis
- Push Over Analysis (if required)

Seismic activity is negligible in the GoT and need not be considered for design.

4.3.2 Jacket Structure

The jacket structure shall be analyzed for the following pre-services analyses as applicable:

- Loadout Analysis
- Transportation Analysis
- Launch (or Lift) Analysis
- Floatation and Upending Analyses
- On-bottom Stability
- Topsides to Jacket Mating Analyses (for platform installation by floatover method)

If the jacket needs to be installed by launching method, then buoyancy shall be considered from the beginning of design, and the members shall be sized accordingly. CONTRACTOR shall design to avoid use of external buoyancy tanks, if possible.

4.3.3 Pile Foundation

The pile foundations shall be analysed and designed for the following conditions:

- In-service conditions
- Handling, Transportation and Lifting
- Hammer/ Add-on Placement and Stick-up
- Pile Driving and Driving Fatigue

- Floatover installation (if applicable)

4.3.4 Topsides

The topsides structure shall be analyzed and designed for the following conditions as applicable:

- Loadout Analysis
- Transportation Analysis
- Floatover or Lift Analysis
- Blast Analysis
- Dropped Object Analysis

4.3.5 LQ and Other Buildings

The LQ and other building structures shall be analyzed and designed for the following conditions as applicable:

- In-service
- Loadout
- Transportation
- Yard Lift

4.3.6 Flare boom

The Flare boom structure shall be analyzed and designed for the following conditions as applicable:

- In-service
- Loadout
- Transportation
- Yard/offshore Lift
- Wind Spectral Fatigue, If applicable

4.3.7 Helideck

The Helideck structure shall be analyzed and designed for the following conditions as applicable:

- In-service (including helicopter emergency crash landing)

- Loadout
- Transportation
- Yard Lift

4.4 Design Criteria

4.4.1 General

The platform structural design shall conform to the design codes, standards and specifications referenced in Section 2 of this document and other project requirements. All structural components shall be designed to demonstrate adequacy to strength, stability, serviceability, safety and durability requirements as specified in this document, design basis and other referenced standards.

All members shall be checked at least at two ends and at mid-span, as a minimum. Members shall also be checked at sections where section property and material changes occur and at points of load application.

All tubular joints shall be detailed and checked for punching shear in accordance with API RP 2A. For ring stiffened joints, calculations shall prove adequacy of both ring and the joint.

Hybrid joints combined with beams/girders as used in deck trusses shall be designed in accordance with AISC guidelines. Web stiffeners or gusset plates shall be designed based on the design forces. Beam/ girder connections and associated welds shall be designed and detailed on the project drawings.

All welded and bolted joints shall be designed for strength and fatigue requirements as applicable. Accessibility and maintenance of the joints shall be given due consideration and inaccessible joints shall be sealed to minimize corrosion.

4.4.2 Allowable Stresses

All members and joints shall be designed in accordance with API RP 2A and AISC requirements, as applicable. The allowable stresses for different design conditions are given in Table 4.3 below, except where specific requirements are indicated in the analyses and design requirements in the earlier sections of this document.

Table 4.3: Allowable Stress Multiplier

Design Conditions	Allowable Stress Ratio
Global In-Service	
Extreme storm	1.33
Operating storm	1.00#

Design Conditions	Allowable Stress Ratio
Global Pre-Service	
Load out	1.00
Launch – Stillwater Condition	1.00
Launch – With Environmental	1.33
Transportation - Cargo	1.33
Transportation - Tie-downs	1.00
Lift	1.00
On-bottom stability - Stillwater condition	1.00
On-bottom stability – With Environmental	1.33
Pile installation - Combined axial and bending stress	1.00
Pile installation - Axial, bending, and driving stress	1.67
Local In-Service	
Boat impact - Boatlanding, barge bumper, riser guard	1.33
Wave slam - Jacket member	1.33
Transportation wave slam	1.33
Launch slam - Jacket member	1.33
Local Pre-Service	
Floatover – Mating loads	1.33
Blast (for compression braces & columns) Blast (for other members)	Min. Yield Min Yield x 1.2
Dropped Objects	Min Yield x 1.15
Push over analysis	Min Yield x 1.15
# An allowable stress ratio of 1.00 indicates no increase in allowable stresses.	

An increase in the allowable stresses for the interim construction phases shall be discussed and agreed upon by COMPANY and CONTRACTOR during the detailed design phase.

4.4.3 Allowable Deflections

Limiting deflections of primary and secondary structural members are tabulated below. Deflections of structural members supporting compressors, turbo generators and other rotating machinery shall be limited based on the equipment manufacturer's specifications.

Table 4.4: Allowable Deflections

Component	Loading	Allowable Limit
Truss Chords	Live Load	L/500
Primary Girders/ Beams	Live Load Dead Load + Live Load	L/360 L/240
Secondary Beams	Live Load Dead Load + Live Load	L/300 L/240
Cantilever Beams/Girders	Live Load Dead Load + Live Load	L/240 L/180
Walkway Supports	Dead Load + Live Load	L/200
Runway Beams	DL+SWL	L/500
Beams supporting rotating equipment subject to dynamic loads	-	L/500 to L/1000

In addition, grating panel deflections shall be limited to L/100 under uniform loads. The plating deflections shall be L/200.

4.4.4 Factors of Safety

The factors of safety in Table 4.5 shall be applied to the ultimate capacity of the soil for the design conditions if working stress design method is used.

Table 4.5: Soil Factors of Safety

Design Conditions	Factor of Safety
Pile Foundation	
Pile penetration - Extreme storm	1.50
Pile penetration - Operating storm	2.00
Shallow Foundation	
On-bottom stability- Stillwater*	2.00
On-bottom stability - Stillwater with wave*	1.50
* Factor of safety against sliding, overturning, and bearing capacity	

The factors of safety in Table 4.6 shall be applied to the collapse pressure of tubular members for the design conditions if working stress design method is used.

Table 4.6: Collapse Pressure of Tubular Members - Factors of Safety

Design Conditions	Factor of Safety
Tubular member hydrostatic collapse	
Extreme storm	1.50
Operating storm	2.00
Installation - Jacket launch and upending	2.00
Installation - Jacket laying on bottom*	1.25
Buoyancy tanks	2.00
* This is a case indicating failure of the jacket to float. If appropriate, CONTRACTOR may propose in writing a design depth other than "jacket laying on bottom" for review by COMPANY	

4.5 Corrosion Protection

4.5.1 Splash Zone

Splash zone generally refers to the area that is exposed to seawater and air at different times.

- The splash zone elevations depend on tide range, normal operating wave heights, and water depth uncertainty.
- CONTRACTOR shall use project-specific data provided by COMPANY for splash zone information and incorporate in the design basis.

All jacket primary structural members, such as legs, diagonal bracing, horizontal bracing, and risers shall be protected with splash zone coatings in accordance with VNM-VPP1-MEC-SPC-EDG-0000-00019, "Specification for Protective Coatings".

Items located within the splash zone excluded from this requirement include boatlandings, barge bumpers, riser supports, and temporary attachments such as buoyancy tanks, flood lines, and grout lines. All elevations shall be referenced to Chart Datum which is Lowest Astronomical Tide (LAT) (+ 0.0 m).

4.5.2 Coatings

All steel surfaces above the splash zone and items located in the splash zone that have been excluded from the splash zone coating such as boatlandings, barge bumpers, riser supports, and other temporary attachments shall be coated with a coating system consisting of a self-cured inorganic zinc primer, polyamide epoxy (high-build) intermediate coat, and aliphatic polyurethane top coat in accordance with VNM-VPP1-MEC-SPC-EDG-0000-00019, "Specification for Protective Coatings".

4.5.3 Cathodic Protection

Cathodic protection shall be provided for all jacket members, appurtenances, and conductors below LAT including the items coated in the splash zone.

Protection shall be by aluminum alloy sacrificial anodes. Design of the jacket cathodic-protection system shall be in accordance with PQ1-00-CRR-SPC-TAP-00001, "Specification for Cathodic Protection Offshore Structures" & PQ1-00-CRR-SPC-TAP-00002, "Specification for Offshore Structures Sacrificial Anodes".

The submerged zone shall include the jacket, boatlandings, riser guards, disposal sumps, caissons, conductors above the mudline, barge bumpers, and other permanently attached appurtenances.

The area of the top 6 m of the interior of an open skirt pile shall be considered in determining the surface area of the submerged zone.

The below-mudline zone shall include the jacket below mudline, piling below mudline, and conductors below mudline.

4.5.4 Corrosion Allowance

Jacket legs and joint cans, primary vertical and diagonal jacket braces, and caissons that are located in the splash zone shall be protected by a 6 mm thick corrosion allowance.

Horizontal members at the top of the jacket do not require corrosion allowance provided they are positioned above the splash zone.

Appurtenances such as boatlandings, barge bumpers, riser guards, etc., do not require a corrosion allowance. All steel surfaces above the splash zone and items located in the splash zone that have been excluded.

5 JACKET DESIGN REQUIREMENTS

5.1 Computer Structural Model

Jacket shall be sized, modeled, and analyzed in sufficient detail to ensure structural adequacy for all possible load cases in pre-service and in-service conditions.

A three-dimensional space frame computer model of the jacket structure of sufficient detail to accurately represent all effects contributing to loads, actions, stiffness, etc., of a structure and shall contain sufficient detail to accurately represent the weight, buoyancy, stability, stiffness and environmental force characteristics of the jacket structure.

5.1.1 Structural Model for In-service Analysis

An integrated 3D model of the jacket, deck and pile foundation representing the global stiffness of the platform shall be utilized for the in-service analyses. Conductors and other jacket appurtenances shall be included in the model for loading purposes and shall be excluded for global stiffness calculations. Corrosion allowance on the jacket primary members in the splash zone shall not be included for the stiffness calculations.

- For jacket in-service analysis, the deck shall be modelled in the computer model with sufficient detail so that it provides accurate stiffness, loads distribution and proper interaction with the jacket.
- The additional thickness for corrosion allowance of jacket members in the splash zone area shall not be used for in-service analyses (i.e. operating & storm, seismic, design event, etc.)
- If the eccentricity of a brace at a joint is more than D/4 or 300mm, the eccentricity of this brace shall be modelled. Accordingly, a separated joint shall be created on the jacket chord member along the line of the eccentricity with the brace/member connected to that new joint.
- All jacket primary structural members (such as joint cans, vertical braces, horizontal frames, launch trusses (if any), mudmat framing etc.) shall be included in the computer models. If necessary, a new joint along a member at wall-thickness transitions such as at the ends of thick-walled joint cans.
- The pile-leg connections shall be properly simulated in the computer model:
  - For non-grouted piles, the "wishbone" elements shall be used to separately model the piles and the legs in order to properly simulate the pile-leg contact at each jacket bracing level, and a fixed connection at the pile-leg shim connection at the top of the leg.
  - For grouted piles, the legs and piles shall be modeled as a composite section. The density of grouting shall be specified in the computer model for stiffness and weight calculation by the computer program.

- Conductors, risers, and caissons shall only be included in the computer model to represent the load acting from waves and currents during the in-service condition, and they shall not contribute stiffness to structural or foundation unless these members are framed such that they contribute to the structural and/or foundation stiffness.
  - The entrapped mass (including well casings and entrapped fluid) of these appurtenances (conductors, risers, and caissons) shall be appropriately modeled.
  - The member ends releases of these structural elements shall be appropriately modelled so that they can only transfer loads and do not contribute to the global stiffness of the platform.
- For jacket non-structural items such as boatlandings, riser guards, trunnions, clamps, top of jacket walkway, stairway from the top of jacket to sub-cellar deck, handrails and anodes, they shall be included solely to distribute load to the main members and shall be modeled as wave load areas and miscellaneous masses.
- Conductors shall be modeled such that they are not directly attached to the platform and they shall not contribute to the structural stiffness.
  - Soil at mudline elevation shall carry the conductors vertical loads. Lateral loads shall be transferred to the platform structure by bearing against the guides. "Wishbone" members with appropriate member releases shall be used to represent the lateral load transfer between conductors and its guides.
  - If the mudline framing of jacket structure is designed with conductor guides, all conductors shall be modeled (preferably as foundation piles) to take into account the proper additional global lateral resistance.
  - All horizontal levels with conductor guides shall be modeled with "wishbone" elements which are properly released at the ends to ensure that the conductors transfer lateral loads only, not axial loads.
  - A gap element may be used for conductors with a large annulus between the conductors and the guides.
- If conductors are used as foundation elements for global in-place analyses, a separate in-place analysis with no conductors modelled shall be run to assure correct pile design. The main reasons are:
  - To prevent under-sizing of piles foundations.
  - In some cases where soil is strong, the conductors may take out more lateral load at the mudline than they contribute to the structure.
  - Maximum pile lateral shear shall occur when no conductors are present.

- For members located in and below the splash zone, the drag and inertia effect of marine growths shall be modelled.
- Loads on jacket secondary members and appurtenances from dead loads and environmental loads shall be included in models.

5.1.2 Structural Model for Pre-service Analyses

The computer model of the jacket from in-service analyses shall be modified to suit the pre-service analyses.

Pre-service analyses models shall include any pre-installed sections of piling and/or appurtenances. All offshore installed appurtenances shall be excluded from the model. Any temporary structures, appurtenances and supports provided to installation operations and pre-installed in the yard prior to loadout shall be included in the computer model and/or loading.

The additional strength of the increased wall thickness for corrosion allowance may be used in the pre-service analyses.

5.1.3 Structural Model for Finite Element Analysis

The following is the guidelines for structural model of Finite Element Analysis (FEA):

- FEA model can be used to conduct the detailed component strength analyses and calculation of SCF for input to fatigue analyses.
- For thin-shell FEA, four-noded shell elements with full integration (four integration Gauss points) shall be used. Finite elements, similar to Shell 181 in ANSYS or S4 in ABAQUS, shall be used. For thick-shell FEA, an eight-noded solid brick element shall be used.
- In the high stress concentration areas, the element size/aspect ratio of the FEA mesh should be about t x t with a maximum of t x 2t, where t is plate thickness. A larger mesh size shall be acceptable farther away from high-stress areas.
- In the high-stress concentration areas, only rectangular elements should be used and triangular-shaped elements should be avoided.
- To insure accurate FEA results, the imposed displacement or load boundary conditions shall be located at sufficient distance from the high-stress region of interest.
- Von Mises stresses at both the top and bottom side of the shell element and at all element integration points shall be checked.
- High stresses in hot-spot locations (if any) shall be evaluated to consider for their reality conditions.
- Allowable stresses for detailed FEA shall be as follows:
  - 100-year Extreme Storm load condition: The maximum Von Mises stress (top or bottom and at any integration point) in hot-spot locations shall be less than 0.9 Fy.

– 1-year Operating load condition: The maximum Von Mises stress (top or bottom and at any integration point) away from hot-spot locations shall be less than 0.67 Fy.

5.1.4 Foundation Modelling

For the static in-place analysis, the platform shall be analyzed with the pile-soil foundation as an integral part of the structural system. The computer program shall be capable of performing iterative linear elastic analysis of the structure for the required load conditions, accounting for the non-linear pile/soil interaction, until the required level of compatibility and equilibrium tolerances at the structure/ soil interface joints are achieved. The pile foundation system shall be modelled as a combination of piles and the corresponding soil properties along the depth. The foundation model shall include the following pile/soil properties:

- P-Y curves, which define lateral resistance versus deflection at various soil depths.
- T-Z curves, which define pile skin friction versus axial displacement at various soil depths.
- Q-Z curves, which define axial point bearing resistance versus displacement at the pile tip.

All p-y and t-z curves shall be explicitly defined in the soil model and modified for scour.

For dynamic analyses, the pile foundation shall be represented by a set on equivalent pile stubs, based on the stiffness characteristics of the non-linear pile-soil system.

Jacket piles foundation for dynamic analysis (modal analysis) and fatigue analyses may be modeled as springs or with direct six-degree-of-freedom stiffness matrices.

The springs shall be checked for compatibility and convergence by comparison of the results with those from non-linear analysis resultants, to ensure that a sufficiently accurate representation of foundation stiffness for the analysis.

Sensitivity checks shall be performed by varying the stiffness of the springs and corresponding impact on the platform deflections and dynamic characteristics.

5.2 Design Loads

This section provides a general overview of various loadings to be considered for the structural design of platforms. Detailed calculations for the individual components of each loading case shall be included in the pertinent analyses and design documents.

5.2.1 Dead Load

The dead weight of the jacket includes jacket members plus all appurtenances such as J-tubes, risers, caissons, conductors, barge bumpers, boat-landing, mudmats, anodes, clamps, installation aids, etc. The contents inside the riser shall also be considered.

For dynamic analyses, the jacket legs, conductors, and riser masses shall be calculated based on make-up of the members. The entrapped fluid (if applicable) and added fluid masses for members submerged in water shall be included.

- For grouted jacket legs, grout, pile, and enclosed water inside the pile shall be considered.
- For conductors, all pipe strings, grout, and fluids inside the conductors shall be considered.

To consider the mill tolerance weight, a minimum of 2.5 percent weight contingency shall be added to the theoretical calculated steel weight.

5.2.2 Drilling Loads

For Hub Platform the drilling loads shall be established on the basis of the requirement of drilling (Jack-up or Tender Assist Rig, Hung Casings and Well Servicing) and other specified in the structural design basis.

Tender Assist Rig

- The loads from the drill rig during drilling (operating) and non-drilling (storm case) shall be considered.
  - Operating Case: 1-year Storm + 100% Hook Loads + Full Set Back loads + 100% miscellaneous drilling loads.
  - Extreme Storm Case: 100-year Storm + 50% Hook Load + Full Set Back loads + 100% miscellaneous drilling loads.
- Detail loads shall include skid beam reactions for each well location that include hook load and associated pipe rack loads and the module weights.
- Appropriate crane loads during drilling and operating condition shall be considered.
- Setback loads and pipe-rack loads shall be combined in a logical fashion to obtain the necessary worst cases sought for the design.

Jack-up Rig

When using the jack-up rig for drilling, there is no load to be put on the upper deck. The jack-up rig is standalone from the platform.

Hung Casings

Hung casings loads and Blow Out Preventer (BOP) weight shall be considered during drilling operations with Tender Assisted Rig or Jack-up Rig.

Well Servicing

Well servicing method applicable for platform design shall be discussed with drilling team during project execution. The upper deck beams shall be checked to accommodate the well service equipment. The adequacy of upper deck space shall be studied as well.

5.2.3 Production Loads

The production loads are defined as the combined dead weight/mass of topsides facilities include all equipment, cranes, pipings & valves, electrical, instrumentation, safety equipment and their supports, plus liquid loads within the equipment and pipes, plus stored commodities and consumables.

These shall represent all loads on the platform other than the structural weight of the deck and the drilling-rig weight.

5.2.4 Uniform Area Loads

Uniform area loads as specified in the structural design basis may be used for deck design, when actual equipment loads are not defined. A reduced percentage of area loading may be used for the design of truss girders, deck columns, jacket structures and pilings if accepted by COMPANY.

When actual equipment operating loads are available, these loads shall be combined with DL and associated open-area LL to check topsides beams.

For equipment placed directly on the deck plate without skids, the deck plate shall be strengthened using a beam underneath the deck plate unless it can be proved that the deck plate is adequate to support the bearing load.

5.2.5 Environmental Loading

Wave and Current Forces

Wave and current forces for in-service analyses shall be computed using the Morison equation and an appropriate wave theory as per API RP 2A. The currents shall be assumed acts simultaneously and co-linearly with the waves propagation unless stated otherwise on the project metocean report.

The wave-kinematic factors for the operating and extreme storm shall be in accordance with API RP 2A.

A wave kinematic factor of 1.0 shall be used for in-service spectral fatigue and installation analyses.

Hydrodynamic Coefficients

Hydrodynamic wave coefficients for use in Morison's equation for the inplace and fatigue analysis shall be determined in accordance with API RP 2A.

For the spectral fatigue analysis, the hydrodynamic wave coefficients shall be constant with no variation for wake effect.

Conductor Wave Shielding

For in-place analysis, the wave shielding factors that account for wave force reductions on closely spaced conductors shall be applied in accordance with API RP 2A.

For fatigue analysis, no benefit from the conductor wave shielding shall be applied.

Current Blockage Factors

Current blockage factors as a function of the number of platform legs and wave direction are given in Table 5.1. For other conditions, factors shall be computed using API RP 2A guidance.

Table 5.1: Current Blockage Factors

No. of Legs	Heading	Factor
3	All direction	0.90
4	End-on	0.80
4	Diagonal	0.85
4	Broadside	0.80
8	End-on	0.70
8	Diagonal	0.85
8	Broadside	0.80

For either freestanding conductors or braced caissons, the blockage factor shall be 1.0.

Wind Forces

Unless stated otherwise in the site-specific metocean report, the wind forces shall be assumed to act Omni-directionally, simultaneously, and co-linearly with the wave and current forces.

For substructure analysis, the one-minute sustained wind speed associated with the wave condition shall be used.

For global wind load acts on the deck, a shape factor of 1.0 shall be used for wind projected area.

For the flare boom design, the wind loads shall be determined by considering all members and pipes individually (i.e., without using projected area to calculate total wind force). The three-second gust wind shall be used to design the flare boom structures.

5.2.6 Load Contingencies

Appropriate contingency factors, based on the source, definition, status and the level of confidence of the load/weight estimates shall be used for the local and global designs. All loads shall include the appropriate contingencies defined in the latest weight control reports. Structural weights shall include contingencies to cover for mill and rolling tolerances, welds, coating and painting and any minor items not included in the basic loads.

Contingency factors shall not be used to cover design growth and future loads. These shall be considered as separate loads and included in the load combinations as appropriate.

5.3 Pile Design

5.3.1 Computer Model

Refer to Section 5.1.4.

5.3.2 Analyses

The pile-soil system shall be analyzed using a non-linear pile soil interaction analysis program. This analysis shall be carried out in conjunction with:

- Platform In-service analyses for extreme storm and operating cases
- Jacket analyses for deck floatover installation
- Platform In-service analyses with boat impact loads
- Platform In-service analyses for fatigue

5.3.3 Scour

A scour depth of 1.5 times the pile diameter or 1.5 m, whichever is less, shall be assumed for the in-service analysis if site-specific data are not available.

5.3.4 Underdrive/ Overdrive Allowance

The pile wall thickness make-up shall be designed to allow for the possibility of pile driving refusal before reaching/beyond the design penetration for piles having thickened sections at the mudline.

The pile sections near mudline shall be designed to accommodate possible underdrive/ overdrive requirements. A minimum allowance of 3.0 m and 6.0 m shall be provided for overdrive and underdrive, respectively.

5.3.5 Pile Drivability

A pile drivability analysis using a wave-equation program shall be performed in accordance with the recommendations made in the geotechnical reports. The main purposes of the analysis are to determine the required pile wall thickness and hammer requirements for both continuous and interrupted driving caused by the installation of add-on sections, the changing of hammers, the standby time during bad weather etc.

The assumed global hammer efficiency shall not exceed 70 percent and 90 percent for assessing drivability with steam and hydraulic hammers respectively without written verification of higher efficiencies from the hammer manufacturer.

Driven pile refusal criteria shall be in accordance with API RP 2A.

Dynamic pile stresses during driving shall be limited to 90 percent of the pile material yield stress.

The pile shall be checked with its tip both plugged and unplugged for a range of hammer sizes.

5.3.6 Pile Section Lengths

Main Piles

Pile section lengths design shall be in accordance with API RP 2A-WSD.

Pile stick-up lengths slenderness ratio (kl/r) shall be less than 200, with the effective length factor (k) of 2.1.

The pile makeup shall be arranged to avoid pile add-ons when the pile tip is at a soil layer where hard driving is expected (such as granular or cemented soils or rock).

Vertical Skirt Piles

Vertical skirt pile stick-up lengths slenderness ratio (kl/r) shall be less than 200, with the effective length factor (k) of 2.1.

The pile stick-up length (l) shall be equal to the fabricated pile length minus the self-penetration length and the length from mudline up to the last set of centralizers in the skirt pile sleeve.

The self-penetration of the pile shall be determined based on:

- The static ultimate soil resistance with end bearing not to exceed the skin friction between the soil plug and inside wall of the pile, using the remoulded shear strength to compute skin friction in clay soils.
- Consideration given to the buoyancy of the pile and the hammer weight.

Vertical skirt piles' stick-up length shall also be checked for the effects of current-induced VIV using DNV RP-C205.

- The lateral design load on the pile shall be determined based on the maximum of the following:
  - The combined maximum wave and current load during pile installation.
  - The lateral component of the gravity load resulting from the largest possible deviation from the true vertical of the pile due to the existing gap between the pile and pile sleeve, fabrication/installation tolerances, and pile deflection due to current and wave loads, or 2 percent of the total hammer weight applied at the hammer center of gravity, whichever is greatest.
- Pile stress checks shall be performed as follows:
  - Combined axial compression and bending using the static axial (fa) and bending (fb) stresses with no increase in allowable stresses.

- Combined static stress and driving stresses shall be governed by the more stringent of API RP 2A-WSD or (fa + fb + fd < Fy).

- Timoshenko, Theory of Elastic Stability, Section 2.12, and "Buckling of Bar under Distributed Axial Load" shall be used to check the axial component of pile stress due to pile self-weight.

- Pile stick-up length shall be checked for VIV during installation according to the latest edition of DNV RP-F105 with a maximum of 1 percent damping.

5.3.7 Pile – Jacket Connection

Piles shall be connected to top of jacket legs by welding segmented crown plates. The connection and the welds shall be designed to transfer the axial load, shear and moments from the jacket leg to the pile.

The design for connection of the skirt piles to the structure shall be designed in accordance with API RP 2A. A minimum grout characteristic strength of 10.34 N/mm^2 (after 2 hours) and 45 N/mm^2 (after 28 days) shall be assumed for the design of the grouted connection.

5.3.8 Pile Group Effects

Whenever the pile cluster is used at each of jacket leg, pile group effects (i.e. a reduction in lateral and axial capacity) shall be investigated for pile spacings less than four pile diameters.

5.3.9 Pile Soil Setup

The ultimate axial pile capacity due to soil setup shall be evaluated to account for time-dependent pile capacity at the time of loading for each of the foundation design conditions.

In cases where the jackets and decks are scheduled for installation in the same campaign, or early drilling works are planned, pile setup curves shall be developed and analyses to establish the minimum setup time before deck installation is performed.

5.4 In-place Analyses

In-place analyses of the platforms shall be performed for the static and dynamic loading due to the following design conditions:

- Storm conditions with environmental loads.
- Operating conditions with environmental loads.
- Still water conditions with no environmental loads.

The platform structure and appurtenances shall be designed for the maximum loads resulting from the combination of dead loads, operational loads, live loads and applicable environmental and accidental loads, as highlighted in Section 7.0.

In addition, any applicable amplification of loading due to the dynamic response of the structure shall be considered as appropriate in accordance with API RP 2A. The platform natural frequencies shall be determined from the modal analyses. If the fundamental period of the platform exceeds 3 seconds, the wave and current loads shall be increased by appropriate dynamic amplification factors (DAF). A detailed wave response analysis shall be performed to establish the DAF's for the in-place analyses and design.

Minimum and maximum water depths shall be used in conjunction with each of the above design conditions. In addition, topside loading conditions representing the minimum and maximum operating weights shall also be considered in the design load combinations

The platform shall be analyzed for a minimum of eight wave-and-wind-attack directions (at 45-degree intervals around the platform).

- Wave directionality (i.e., different wave heights from different directions) shall be taken into account in the analysis.
- For each wave approach direction, waves shall be stepped through the structure to determine the wave positions that cause maximum base shear and maximum overturning moment.

5.5 Dynamic Analyses (Platform Response)

A Dynamic Analysis shall be performed to determine the fundamental natural frequency of the structure at still water depth. The computer model shall simulate the mass and stiffness of the platform. Load combinations shall include the following:

- All Structural Jacket dead load and Topside operating loads.
- Buoyant and virtual loading (including water entrapped within jacket legs, piles casings, risers, etc.).
- Marine Growth.

The Platform DAF shall be determined from the Platform's natural period for, the extreme storm and operating wave conditions using the following equation which represents a simplified single degree of freedom.

$$DAF = 1/[(1-(Ts/Tw)^2)^2 + 4(c(Ts/Tw))^2]^{1/2}$$

Where Tw = Wave Period

Ts = Natural Period of Structure

c = Damping Ratio = 0.02

5.6 Fatigue Analysis

5.6.1 General

The fatigue damage due to in-place conditions over the design life of the platform shall be established by a dynamic spectral fatigue analysis.

The in-service fatigue design life-safety factors for joints shall be as shown in Table 5.2. Alternative life-safety factors for a site-specific application shall be subjected to COMPANY for approval.

Table 5.2: In-Service Fatigue Design Life-Safety Factors for Joints

Description	Minimum Fatigue Life-Safety Factors	Remarks
Secondary joints that are non-critical, accessible for inspection	2	Secondary joints at elevations from sea water surface down to a water depth of 60 m
Secondary joints that are non-critical, inaccessible or difficult for inspection	5	Secondary joints at a water depth greater than 60 m
Primary joints that are critical and accessible for inspection	5	Primary joints at elevations from sea water surface down to a water depth of 60 m, such as jacket leg joints, skirt pile joints, primary X-joints
Primary joints that are critical, inaccessible or difficult for inspection	10	Primary joints at a water depth greater than 60 m, such as joints to jacket leg joints, skirt pile joints, primary X-joints, or primary critical joints that are inaccessible

Prior to perform the analysis, CONTRACTOR shall prepare the brief of analysis methodology for COMPANY review and approval.

For dynamically sensitive structures, the in-service fatigue analysis shall also consider the history of the fatigue damage life during interim construction phases prior to complete installation of the structures.

The cumulative-damage ratios (CDRs) from in-service analysis shall be combined with the transportation CDRs to determine final combined damage ratios.

Minimum eight hot spot points around the circumference of each brace end shall be checked.

Fatigue design life of caisson attachments and conductor framing shall be checked.

Unless requested by COMPANY, the fatigue damage life check for the attachment of jacket appurtenances such as boatlandings, barge bumpers, and riser guards shall not be required.

5.6.2 Computer Model

The computer model shall be similar to the in-place analysis model with appropriate modifications required for the dynamic wave response and fatigue analysis.

- The conductor guide framing at the upper three jacket horizontal levels shall be modelled in detail to permit fatigue computer simulation at these areas.
- The foundation shall be represented by equivalent linear springs. Appropriate spring stiffness values shall be determined based on the center of damage wave.
- Corrosion allowance for the jacket primary members in the splash zone shall be half the values considered for the in-place analyses

5.6.3 Stress Concentration Factors

For simple tubular joints Efthymiou equation shall be used to generate SCFs. For cases where one or more Efthymiou parameters falls outside the range of Efthymiou equations. Maximum SCF values of the following is considered as recommended in section C5.3.2 of API RP 2A.

Ring stiffened joints, such as launch-leg joints, shall be determined using Lloyds register with a minimum SCF of 2.5.

Finite Element Methods may be considered for the derivation of more complex SCFs as required. For un-stiffened tubular joint connections, a minimum SCF value of 1.5 and 2.5 shall be used for axial and bending stresses on the chord and brace, respectively.

For the grouted legs or pile sleeves, the SCFs shall follow Lloyd's Register of Shipping requirement.

SCFs for conical transition: the SCF at each side of unstiffened tubular cone junctions will be as follows in accordance with UK Department of Energy guideline.

$$SCF = 1 + \frac{0.6t\sqrt{D_j(t+t_c)}}{t^2}\tan\alpha$$

$$SCF = 1 + \frac{0.6t\sqrt{D_j(t+t_c)}}{t_c^{\,2}}\tan\alpha$$

Where:

D_j = cylinder diameter at junction

t = tubular member wall thickness

t_c = cone thickness

α = slope angle of the cone

5.6.4 S-N Curves

The S-N curves for jacket tubular joints shall be in accordance with 'WJ' welded joint of API RP 2A. Other S-N curves such as DNV, HSE etc. shall be used only for the appurtenances joints.

The fatigue life for all tubular connections shall be calculated on the chord and the brace side of the connection based on API RP 2A WJ S-N curve, including the thickness correction factor on the allowable stress.

For connections not meeting the target life, chord and/ or braces shall be resized to ensure that the joints are adequate. Grinding/ Profiling requirements shall be kept to a minimum and such connections shall be checked against API RP 2A WJ S-N curve and its accompanying weld improvement techniques. Hammer peening is not permitted, except only for weld profiling for improvement of joint fatigue life.

The S-N curves for In-line connections shall be as per Table below:

Table 5.3: In-line Weld Connection Fatigue S-N Curve

Member	S-N Curve
Thickness transition – double side weld	E
Thickness transition – single side weld with permanent backing strip	F
Thickness transition – single side weld full penetration	F2
Conical Transition – double side weld	E
Conical Transition – single side weld with permanent backing strip	F
Conical Transition – single side weld full penetration	F2
Pile circumferential weld	E

5.6.5 Fatigue Design

Wave response analyses shall be performed for a series of wave height- period combinations to generate the transfer functions for static and dynamic base shears. Sufficient number of wave frequencies shall be chosen to represent the transfer function over the frequency range of interest.

The minimum frequency chosen shall ensure adequate definition of the response spectrum for storm seastate. The maximum frequency shall be chosen such that the area under the response spectra for frequencies greater than such value which is negligible.

Wave forces shall be computed for a minimum twenty five (25) frequencies per direction and the maximum spacing between adjacent frequencies shall be 0.05Hz. Frequencies shall be closely spaced in the region where the wave spectrum has its maximum energy.

A structural damping ratio of 2% shall be used for the wave response analyses for all modes.

The nominal stress ranges at each hot spot shall be determined from the response analysis by stepping the wave through the structure for at least ten (10) positions per wave.

Hot spot stress ranges at each of the eight (8) equally-spaced points around the circumference of each member end shall be calculated by using appropriate Stress Concentration Factor (SCF) for axial and bending stresses.

The transfer function ordinates shall then be computed for each member-end hot spot location by dividing the hot spot stress amplitude by the amplitude of the wave height under consideration.

5.7 Vessel Impact Analysis

The jacket shall be designed to withstand vessel impacts at the following locations:

- at the boatlandings and barge bumpers for the planned berthings by supply and crew boats
- at jacket members and riser guard systems for the uncontrolled vessel impacts

The CONTRACTOR shall develop relevant vessel impact load cases and analysis procedures based on the generic information specified within this specification together with project structural basis-of-design information. These shall be submitted in writing to COMPANY for acceptance.

The vessel impact analysis shall be performed based on a 3D computer model of platform, in which the primary framework in the impact zone shall be designed and configured to absorb energy during impact, and to control the consequences of damage after impact.

- Under operational impact case, the structure shall be able to absorb the impact energy without sustaining any damage and resulting stresses shall remain within the basic allowable stresses increased by one third.
- Under accidental impact case, the structure shall be designed to absorb the impact energy by elastic and plastic deformation of local members and elastic deformation of the overall platform. And to retain sufficient residual strength after impact to withstand the platform normal operating loads combined with 1-year environmental loads (post impact analysis).

All jacket legs except protected by bumper are defined as collision zones.

The platform shall be designed to resist operational and accidental impacts and to meet the API RP 2A post impact criteria in Sections 18.9.2 and C18.9.2c of the API RP 2A. Vessel impact energies shall be calculated by the CONTRACTOR based on the following:

- Vessel Mass = 1700 tonnes [to be confirmed in detailed design stage]
- Maximum permissible significant wave height for vessel operations near the platform (m) is 2.5m

- An impact velocity of 0.5 m/s and 1.25 m/s to be assumed for the operating and accidental impact load respectively.
- Added mass factor: Ca = 1.40 (for broadside collision)
  Ca = 1.10 (for bow/stern collision)
- Impact Zones are to be considered as:
  - Maximum Top Impact Elevation = HAT + Crest height + Vessel Freeboard
  - Maximum Bottom Impact Elevation = LAT – Maximum Vessel Draft/ 2

5.8 Loadout Analysis

The following loadout phases can be identified for a lift-off and a launch type jacket respectively.

Lift-off Jacket

- Moving the jacket on bogeys or SPMT, located underneath 4 appropriate jacket leg nodal points, to the end of the jetty and subsequently skidding it onto the barge, or
- Moving the jacket on skids located underneath 4 appropriate jacket leg nodal points, along skid beams to the end of the quay side and subsequently skidding it onto the barge.

Launch Jacket (Skidded Loadout):

- Moving the jacket on its launch beams along skid beams to the end of quay side,
- Moving the jacket along skid beams from the quay side onto the barge via the launch barge rocker beams.

The jacket shall be designed for stresses occurring during loadout in different load conditions:

- Loss of supports
- Differential support levels
- Jacking operations
- Static and Dynamic friction and break-out loads

The loadout analysis shall fully consider the method of loadout proposed by the fabricator, behavior of the foundation, and characteristics of the barge.

Maximum node reactions occurring on quay/ transportation barge and maximum cantilever conditions (for launch jacket) shall be determined.

The maximum allowable deflection of the barge supporting the jacket shall be determined for each stage of loadout.

The loadout should consider the compression-only elements at the loadout support points.

For the launch jacket loadout, the launch barge rocker arm and rocker arm restraints shall be explicitly modelled in the analysis.

5.9 Jacket Transportation

A three-dimensional computer model of the jacket and barge under tow shall be used to analyze the stresses in the jacket and barge.

- The jacket model shall include sufficient detail to evaluate the stress in all framing members and joints that experience transportation motion-induced loads.
- When a rigid barge model is not sufficient—generally for barges in excess of 91 m (300 feet) in length—the barge model shall contain sufficient detail to capture the overall flexibility characteristics of the vessel and to permit the distribution of hydrodynamic loads to model hogging and sagging effects.

The jacket-barge model shall use spacers and tie-downs to simulate actual connection conditions.

- Vertically oriented spacer members shall be attached at all hard points on the jacket launch runners to support and elevate the jacket to its proper height above the launch skidways.
- Vertically oriented members shall support a vertical load only.
- Tie-down members shall be modelled at each major horizontal elevation. The barge end of the tie-down members shall be attached to nearby barge joints using a series of statically determinate rigid links.
- The tie-down braces do not typically carry gravity loads in the static condition. A sequential structural solution shall be performed as follows:
  - The system without the tie-down braces shall be solved for the stillwater transportation case (loadout condition).
  - Then the system with the tie-down braces is solved for dynamic load cases, including the static wind-induced loads.
  - The still-water load case is then combined with other defined cases in the post processor. Therefore, the presence of the tie-downs is only active under the dynamic transportation loads.

The analysis of the jacket shall include all forces from the barge/cargo motion imposed during transportation, which includes but is not limited to the masses due to the following:

- Transport structural weight.
- Load contingency factors

- Weight of all pre-installed rigging and shipped-loose items

The jacket shall be designed to handle accelerations associated with the transportation barge motions. The criteria listed in Table 5.4 per Noble Denton Group 0030/NDI, "General Guidelines for Marine Transportations," can be used FEED design, before tow route specific data are available. However detailed design must be based on tow route specific criteria.

Table 5.4: Noble Denton Design Criteria for Transportation

Roll	20.0 degrees
Pitch	12.5 degrees
Heave	0.2g
Associated period	10.0 seconds

A minimum of eight headings shall be considered, including all combinations of beam seas, head seas, and quartering seas.

For the specified significant wave height, the mean spectral period shall be varied between the upper and lower bounds in order to find and analyze the maximum inertial forces acting on the jacket.

The extreme tow inertial forces shall represent the 1-in-1000 highest values (RMS x 3.72) of the motions using a spectral sea model.

Wind loads shall be included for the analyses. The design wind velocity shall be as specified in the tow route specific environmental data.

The lateral component of gravity due to roll caused by the design wave and wind shall be accounted for in the jacket stress analysis.

- Conservatively, the phase differences of the six components of inertial force may be neglected.
- Linear load combinations shall be formed for each wave direction to combine the extreme global force components using all possible signs.

The forces and stresses due to basic loads shall be combined suitably to reflect the following loading conditions to determine the most onerous load resultants for member and joint designs:

- Gravity loads ± Pitch ± Heave + Wind loads due to head seas
- Gravity loads ± Roll ± Heave + Wind loads due to beam seas
- Gravity loads ± Roll ± Pitch ± Heave + Wind loads due to quartering seas.

5.10 Jacket Lifted from Transportation Barges

Jackets lifted from transportation barges shall be designed as follows:

- A lift analysis shall be performed to determine stresses imposed on the jacket.
- A three-dimensional jacket structural model shall be used.
- Sling arrangement shall be modelled based on the basis of a statically determinate lift condition.
- A minimum sling angle of 60° to the horizontal shall be considered in the lifting analyses.
- Design shall include the effects of sling-length tolerances.
- No environmental loads will be considered for the lifting analyses.
- Lift points and sling configuration shall be modelled to provide suitable distribution of the load to the crane hook.

5.11 Launch Analysis

5.11.1 Launch Trajectory Analysis

- Barge-jacket behavior, jacket stability and seabed clearance during launching operations shall be simulated using appropriate jacket launching analysis software.
- The launch trajectory showing the movement of the jacket at various stages of launch shall be plotted. A time history description of the jacket and barge motion including displacement, velocity, accelerations as well as rocker arm reactions shall be reported. Mudline clearance between the jacket and the seabed shall be tabulated.
- The relative velocity of the jacket to the barge shall be ≥ 1.0 m/sec at the time of jacket tipping.
  - For the launch skidway system consists of greased timber on PTFE (Teflon) plates, a minimum coefficient of friction of 0.05 shall be used in the analysis.
  - For other skidway systems, the coefficient of friction shall be submitted (with appropriate documentation) for COMPANY approval.
- Steel mill, weld tolerance, load contingency and all pre-installed rigging shall be included in the launch weight.
- Reductions in the load contingency can be proposed by CONTRACTOR for COMPANY approval when the weight information is available during detail design phases.
- The basic design criteria for the launch trajectory analyses is summarized in Table 5.5.

Table 5.5: Launch Trajectory Design Criteria

Jacket dry weight variation	±5%
Transverse COG	±1% of average jacket width at nominal elevation of COG
Longitudinal COG	±1% of average jacket length at nominal elevation of COG
Vertical COG	±1% of average jacket height
Coefficient of static friction	±40% of estimated value
Coefficient of dynamic friction	±40% of estimated value
Hydrodynamic coefficients (Cd)	Cd = 0.65 to produce the deepest penetration of the jacket in the water Cd = 0.85 to produce the worst condition for jacket velocity at the time of jacket-barge separation

- The mudline clearance between the jacket and the seabed shall not be less than five (5) meters at any point along the jacket launch trajectory.
- For the intact condition, the jacket shall be designed such that minimum bottom clearance during launch shall be greater of 10 percent of the water depth at the launch site for Base case and 6.0 m for Worst case.
- All clearances shall be measured relative to the lowest astronomical tide (LAT).

5.11.2 Launch Stress Analysis

The structural analyses shall cover the following launch stages:

- Initial Stage - During the pre-launch stage, the jacket shall be on the barge skid beams, at an appropriate trim angle. The jacket shall be assumed to be supported at the launch truss hard points.
- Sliding Stage - Winch or jack force is then applied on the jacket until the jacket slides forward, having overcome the static friction.
- Tipping Stage - When the centre of gravity of the jacket lies directly above the axis of the rocker pin, the rocker arm begins to tilt via the action of the jacket weight and the jacket starts to tip.
- Separation Stage - In the separation stage, the jacket dives into the water and floats once the equilibrium position is reached.

5.11.3 Member Slam

- Member slam check on jacket members that enter the water within 10 degrees of horizontal shall be checked using the predicted velocities from the launch-trajectory analysis. The Cd factor shall be of 2.0.
- Dynamic amplification shall not be considered.

5.11.4 Hydrostatic Collapse

- A hydrostatic collapse check shall be carried out for all partially and non-flooded members in accordance with API RP 2A, with the maximum design dive depth determined from the launch trajectory.
- The minimum factor of safety for the hydrostatic collapse shall be 2.0.

5.12 Floatation and Upending Analysis

- Jacket flotation and upending analysis shall be performed to investigate behaviour of the jacket during floatation and upending sequences, obtain the required crane hook loads, verify the bottom clearance and obtain the flooding requirement at various stages from the free float position to the vertical position.
- The floatation and upending jacket weight shall include mill and weld tolerance, load contingency, and the weight of all pre-installed rigging and equipment installed after upending.
- Reductions in the load contingency can be proposed by CONTRACTOR for COMPANY approval when the design phase progresses.
- The basic design criteria for upending and flotation analyses is shown in Table 5.6.

Table 5.6: Flotation and Upending Design Criteria

Jacket dry weight variation	±5%
Transverse COG	±1% of average jacket width at nominal elevation of COG
Longitudinal COG	±1% of average jacket length at nominal elevation of COG
Vertical COG	±1% of average jacket height
Damaged condition	Multiple cases with one ballast compartment flooded in a main leg or buoyancy tank

- No variance in the center of buoyancy shall be considered.
- Sufficient combinations of the above basic parameters and damage conditions shall be analyzed to produce the worst-case flotation and upending scenario.
- For a hook-assisted upending, the following criteria shall be satisfied:

- Reserve buoyancy for intact condition: 12% of jacket weight.
- Reserve buoyancy for damaged conditions: 5% of jacket weight.
- A minimum bottom clearance of 5 m shall be maintained above the highest seafloor obstruction throughout the flotation and upending.
- After the jacket is in the vertical position, the minimum clearance above seafloor obstructions, such as wellheads or docking piles, may be reduced to 1.5 m.

- The jacket shall be designed such that, in the post-launch condition, the jacket shall float in a stable equilibrium position within 10 degrees of vertical for the worst-case intact and worst-case damaged conditions. The jacket should have "Acceptable Attitude for Subsequent Operation" as the jacket will be positioned using derrick barge, the rigging platform should be above water surface and thus making hook up rigging accessible to derrick barge.
- For self-upending jackets, its free-standing flotation condition shall satisfy the following criteria:
  - Minimum reserve buoyancy for intact condition: 5% of jacket weight.
  - The operation of upending and lowering can be done with one damaged compartment.
  - The structure shall be stable without the use of cranes with one compartment damaged.
  - The structure shall have a minimum of 1.0 percent excess buoyancy in case of accidental flooding of any two compartments. The jacket weight for excess buoyancy should include weight contingencies for self-weight and unmodeled jacket appurtenances.
  - Member hydrostatic collapse shall be checked when the jacket resting upright on the mudline.

5.13 On-Bottom Stability Analysis

Prior to commencement of piling, the jacket will be resting on its mudmat while being subjected to its dead weight, environmental forces and weights of piles(s) hung off the jacket. The on-bottom stability analysis shall be performed to assure the jacket at pre-piled condition has sufficient factor of safety as recommended by API RP 2A.

The mudmats sizes shall be designed to have enough safety factors against the bearing, sliding and overturning forces to avoid overstressing the seabed soils and causing the instability in jacket.

Bearing capacity:

The stability of jacket and mudmat system against bearing failure due to the imposed loading shall be investigated.

The ultimate bearing pressure shall be calculated in accordance with API RP 2A. The allowable soil capacities shall be based on the recommended values in the geotechnical investigation report and the proposed mudmat configuration. The required minimum factor of safety against bearing failure shall be 2.0 for jacket in still water condition and 1.5 for the jacket with installation environmental loads.

Overturning stability:

Jacket and mudmat system shall be checked for stability against overturning due to the eccentricity of the gravity as well as the installation wave loading. The required minimum factor of safety against overturning shall be 1.50.

Sliding stability:

The stability of jacket and mudmat system against sliding due to lateral forces from the during installation wave loads shall be investigated in accordance with API RP 2A. The required minimum factor of safety against sliding failure shall be 1.50.

5.14 Jacket Design for Deck Floatover Installation

The floatover concept utilizes the method of floating a transportation barge with the integrated deck over the installed jacket and ballasting down so that the deck weight is transferred from the barge to the jacket. The jacket-pile assembly shall be checked to ensure that adequate strength exists to resist the loads resulting from this mating process, both locally where barge and deck contacts occur and globally to transfer the docking loads to the foundation.

- For the mating analysis, the jacket computer model shall include the jacket (no corrosion allowance being considered) and all appurtenances installed at the time of floatover and all the piles installed and driven to the design penetration.
- The horizontal and vertical loads during mating shall be derived from the deck floatover installation analyses, for various stages of installation. The loads shall be applied at the top of LMU receptacle on each leg to simulate the impact at the deck leg/LMU interface and at the jacket walkway level to simulate the impact from the barge.
- The structural integrity of the sub-structure and piles shall be checked in accordance with API RP 2A, with a rational combination of lateral and vertical loads. A 1/3 increase in basic allowable stresses shall be used for member and joint checks.
- The floatover operation shall be designed for the following seastates:

Table 5.7: Mating Analysis Seastates

Wave Approach Direction from True North	Wave Direction Relative to Barge	Significant Wave Height (m)	Max Spectral Period Tp (sec)
45^0 , 225^0	Head & Stern	1.5	6.0
0^0 , 90^0, 180^0 , 270^0	Quartering	1.2	5.0
135^0 , 315^0	Beam	0.6	5.0

The seastate JONSWAP spectrum shall be used for floatover analysis. The mating loads are to include the maximum 1-year return period of 0.42m/s current and 10m/sec wind speed.

6 DECK DESIGN REQUIREMENTS

6.1 Computer Structural Modelling

Deck shall be sized, modeled, and analyzed in sufficient detail to ensure structural adequacy for all possible load cases in pre-service and in-service conditions during their lives.

A three-dimensional space frame computer model of the deck structure of sufficient detail to accurately represent the stiffness and load distribution in order to design individual members. The deck computer model shall consider the following:

- Primary truss and framing members and major beams.
- Deck plate may be modelled to incorporate in-plane shear restraint or to provide lateral bracing to beam flanges. If not explicitly modelled, plate stiffness shall be simulated by X-bracing.
- Grating shall not be considered to provide any stiffness.
- The flare/vent shall be included in the in-place model, otherwise coded in as reaction loads.
- Miscellaneous items such as stringers, ladders and others shall not be modelled but shall be coded in as loads.

For in-service loadings, if possible, decks shall be analyzed with a full jacket model.

- If, however, decks and/or modules are modelled and analysed separately from the jacket, total structural system performance shall be accounted for, including the effect of jacket stiffness on support conditions.
- As a minimum, the first bay of the jacket shall be included in the structural model.
- The topside in-place model shall be used as a basis and modified to suit the pre-service analyses. Modifications to the basic in-place model for these analyses are described in their respective design briefs and analysis reports.

6.2 Design Loads

6.2.1 Gravity Loads

The deck gravity loads shall be as per the latest weight control reports.

6.2.2 Operational Loads

The loads from the operation of the platform, which are variable in location and magnitude, include but are not limited to:

- Operational loads of the equipment, tanks and vessels and other machinery.

- Operating loads due to consumables, refills and stores.
- Crane operating loads with appropriate dynamic factors and lifting radius.
- Piping contents.
- Dynamic Loads from Equipment and Machinery.
- Well maintenance load.

The operating loads shall be based on the latest up to date information from the vendor data.

6.2.3 Live Loads

Live loads to account for personnel weight, maintenance loads, and temporary storage loads of equipment and supplies are to be considered on unoccupied deck areas. These loads can be simulated as uniformly distributed loads or concentrated loads depending on contact area or points.

6.2.4 Environmental Loads

Wave and Current Forces

- The deck shall be designed to account for the global effect of wave and current forces on the jacket.
- If it is possible, the jacket shall be included with the deck in the computer model so that the platform shall be analysed as an integral structure. This shall ensure the environmental effects are included in the deck design.

Wind Forces

- For the global analysis of the substructure, the wind forces shall be assumed to act Omni-directionally, simultaneously and co-linearly with the wave and current forces on the jacket. The one-minute sustained wind speed associated with the wave condition shall be used.
- The wind speed in 5-second gusts are appropriate for maximum quasi-static global actions on structures whose maximum horizontal dimension is less than 50 m; and 15-second gusts are appropriate for the maximum quasi-static global actions on larger structures.
- The projected area of the deck with a shape factor of 1.0 may be used for the global wind load on the deck.
- Wind loads on flare boom shall be determined rigorously; i.e., a projected area approximation shall not be used.
- The wind speed in 3-second gusts shall be used for the local design of deck appurtenances, such as flare booms, flare boom connections, firewalls, splash walls, equipment supports, and supporting deck beams.

6.2.5 Crane Operation Loads

- Crane operation loads shall consist of the static and dynamic crane loads and data provided by the crane manufacturer. The dynamic crane load cases shall be in accordance with API 2C and considered a range of boom directions to ensure all possible lifting scenarios are adequately checked.
- Crane loads shall be included in the operating load cases.
  - The crane shall be positioned at multiple headings with full capacity crane loads for each operating case.
  - Eight crane-load cases based on eight headings (0, 45, 90, 135, 180, 225, 270, 315 degrees) are recommended for each operating case.
  - During preliminary design a fewer number of load cases in final design could be used if it can be shown that only a few load cases control the design.

6.2.6 Bridge Reactions

If any, loads caused by the inter connecting platform bridges which include self-weight, equipment, piping, wind loads and friction forces shall be considered on bridge landings on Topside.

6.2.7 Flare Boom Reactions

If any, loads caused by the flare boom structure consisting of self-weight, piping, wind loads and thermal loads shall be considered on flare support points on Topside.

6.2.8 Other Loads

Any other temporary and permanent loading not explicitly covered herein, but might be reasonably expected occur during fabrication, installation or in-service conditions shall be investigated and included for local and/or global designs whichever appropriate, in view of nature, extent and duration.

6.2.9 Load Contingencies

Appropriate contingency factors, based on the source, definition, status and the level of confidence of the load/ weight estimates shall be used for the local and global designs.

Equipment, bulk and architectural loading shall include the appropriate contingencies defined in the latest weight control reports. Structural weights shall include contingencies to cover for mill and rolling tolerances, welds, coating and painting, and any minor items not included in the basic loads.

Contingency factors shall not be used to cover design changes and future loads. These shall be considered as separate loads and included in the load combinations as appropriate.

6.3 Deck In-service Analyses

The in-place analyses for deck structure can be performed in conjunction with the jacket in-place analyses. The analyses shall account for the dynamic response of the platform (if applicable) due to the wave loading and the associated inertial loads on the deck structure and equipment.

A minimum of eight wave and wind attack directions at 45 degree intervals around the platform shall be considered for analysis. Wave directionality (different wave heights from different directions) shall be considered in the analysis.

The loads on deck shall be included for deck in-place analysis, but not limited to are : dead loads, drilling rig loads, crane loads, area load, equipment loads (when available), and production live loads. The equipment loads shall include hydrotest case where the equipment is filled with water, but not all equipment shall be filled with water at the same time.

The deck shall be designed so that the drilling rig shall produce the maximum possible forces in the skid beams and supporting trusses.

Various loads conditions shall be considered to both maximize and minimize foundation loading.

6.4 Deck Loadout

The method of loadout, behavior of the foundation, and characteristics of the barge shall be fully considered and analyzed to ensure no structural member is overstressed.

In general, loadout activity should consider any possibility of events that can happen such as uneven level of trailer loadout path, sudden breakdown, loss of support contact with barge deck or quay unexpected pot hole, friction (for skidding method), loss of stability, etc.

The barge supporting the deck shall be checked for the maximum allowable deflection for each stage of loadout.

Four most critical deck support conditions shall be checked, as a minimum:

- All columns supported.
- Loss of support one column at a time - three-point supported.
- Maximum upward/downward displacement of unsupported columns of 25 mm.
- A horizontal jacking force on the two lead columns resisted by friction at all four columns.

Stability check is required for loadout using trailer.

6.5 Deck Transportation

6.5.1 General

The deck modules will be transported from the fabrication site to the field on cargo barges or heavy transportation vessels. Whilst being transported to the field, or awaiting installation, the structures will be exposed to inertial loads arising from wind and waves, which impose motions and accelerations on the combined structure/barge system. These accelerations act on the mass of the structure and equipment, to produce inertial and gravitational forces. The transportation analysis is to ensure the structure can resist the forces induced by the motions of the combined barge/structure system without exceeding the allowable stresses.

Transportation fatigue analysis shall be carried out in the detailed design stage.

6.5.2 Deck Transportation Modelling

The computer model shall be similar to the model used for loadout analysis. The pre-service vertical dead weight of the model will be taken by the same support points in the loadout design. The models will adopt pinned supports at the assumed sea-fastening locations for transfer of vertical and lateral loads. The model used for both procedures is essentially identical as only the loading is different. Longitudinal and transverse motion forces will be combined separately with the vertical motion.

A minimum of eight headings shall be considered, including combinations of beam, head and quartering seas. The lateral component of gravity due to roll and pitch caused by the design wave and wind will be accounted in the structural stress analysis.

6.5.3 Deck Transportation Loads

The flowing Basic Load groups shall be considered:

- Dead Load, including all pre-installed appurtenances, riggings and installation aids
- Inertial Loads
- Environmental Loads

The wind shall correspond to the 1-in-100 tow for the specific route planned.

The detailed description of load combination is shown in Section 5.9 above.

6.6 Deck Lifting Analysis

The deck structure shall be modelled as a 3D-space frame and performed lifting analysis in accordance with API RP 2A-WSD.

- The weight contingencies defined in the weight control report shall be included in the lifting model, and the weight of all pre-installed rigging and shipped-loose items.

- The final lifting analyses shall be performed to verify the integrity of structure at the completion of fabrication after the structures have been weighed or the final weight report issued.
- No environmental loads will be considered for the lifting analyses.

The padeyes shall be designed including sufficient reserve strength to allow for future weight growth, load distribution changes, and final selection of rigging and fabrication as possible. The padeyes of major deck/ module lifts shall be located so that they will be permanent, not requiring removal.

Single-Crane Lifts

CONTRACTOR shall prepare a lift analysis procedure and submit to COMPANY for approval before performing any lift. Otherwise, the following procedure shall be followed for a single-crane, four-point lift.

The structure shall be analyzed for two conditions:

- A 75 percent to 25 percent load distribution shall be assumed between diagonally opposite pairs of slings.
  - Sling reactions shall be multiplied by a factor of 1.35 for design of lifting eyes and connecting members.
  - If a spreader bar is used to prevents a load distribution of 75 percent to 25 percent, this condition shall not apply.
- A rigid-body lift analysis shall be performed to calculate the sling reactions, which properly accounts for the distribution of weight in the structure and for any hanging/skew angles.
  - A radial COG shift shall be considered to account for inaccuracy in the calculation of the COG.
  - A factor of 2.0 shall be used for design of lifting eyes and connecting members, and 1.35 for all other members.
  - Side loads on the padeyes and padears shall be calculated, taking into account the deck out of level, but the side load shall be less than 5 percent of the static sling load.

During lifting process, the deflection of the structures should be controlled in order to prevent damage to structure and coatings.

Dual-Crane Lifts

If the installation procedure proposed by CONTRACTOR is accepted by COMPANY, it shall be used in the lift analysis. Otherwise, the COMPANY and the CONTRACTOR shall agree upon a dual-crane lift procedure for use in the design.

6.7 Design Mating Analysis

The floatover concept utilizes the method of floating a transportation barge with the integrated deck over the installed jacket and ballasting down so that the deck weight is transferred from the barge to the jacket. The Deck and Deck Supporting Frame (DSF) assembly shall be checked to ensure that they are adequate from strength considerations to resist the loads resulting from this mating process, both locally where Deck leg – Jacket leg contacts occur and globally to transfer the docking loads to the overall structure.

For the mating analysis, the Deck - DSF computer model shall be similar to that used for the transportation analysis.

The loads during mating shall be derived from the deck floatover installation analyses. The analysis of the Deck and DSF shall consider all critical stages in the installation mating operation, as the deck loads are transferred from the loadout/transportation frame to the jacket leg-pile assembly.

The structural integrity of the Deck and DSF shall be checked in accordance with API RP 2A and AISC, with a rational combination of vertical loads and lateral loads at different stages of the operation. Members and joints shall be designed with basic allowable stresses.

6.8 LQ/ Building Design

Refer to specifications No. PQ1-00-ARC-SPC-TAP-00001, "Specification for Design and Fabrication of Buildings" & PQ1-00-ARC-SPC-TAP-00002, "Specification for General Arrangement, Design and Installation of Living Quarter".

6.9 Helideck Design

Refer to specification No. PQ1-00-STR-SPC-TAP-00004, "Specification for Helidecks".

6.10 Bridge Design

Bridges shall be also designed to sustain the its structural weight, commodities weight, and operating contents.

The transverse and longitudinal differential platform movement between the two platforms shall be included in bridge design.

The bridge shall be designed with a built-in camber so that it will remain level after installation when loaded.

Maximum relative deflection shall be checked based on a worst-case situation. The maximum deflection of the bridge due to bridge live load shall be limited to L/300, where L is the distance between bridge support points.

The bridge shall be designed with a hinged support at one end and a sliding support at the other end. The hinged and sliding ends shall include a stopper to prevent the bridge from coming out of the supports and sliding off the deck.

The sliding support shall be designed with guide restraints in the vertical and lateral directions. The sliding ends shall be designed so that they could accommodate the maximum relative displacements (combined x and y directions).

Bridge supports shall be designed for a 750 mm tolerance in all directions at final platform location, except when the bridge length is adjusted after measurement of actual distance between platforms.

6.11 Vent and Flare Boom Design

The vent/ flare boom structure is intended to be fabricated separately and integrated with the deck structure in the fabrication yard. The flare boom structure shall be analyzed and designed for the following conditions:

- In-service
  - In-place
  - Wind Dynamic Spectral Fatigue
  - Thermal Radiation
  - Vortex Shedding
- Fabrication and Installation
  - Lifting
  - Upending and Stabbing
  - Tow
  - Vortex Shedding (both in the yard and during tow)

The in-place analyses shall include dynamic effects of wind loading. A dynamic spectral fatigue analysis due to wind shall be performed using response spectrum method and the requirements outlined in API RP 2A.

Thermal stresses due to normal and high level flaring and the effects of temperature/radiant heat on steel properties shall be considered for the in-service analyses.

All tubular members shall be checked for susceptibility to vortex shedding in accordance with section 8.29.

Boom connection to the deck structure shall be designed for both in-service and installation conditions, including fatigue and the loads imposed during yard installation and transportation. The inertial forces due to barge motion during transportation and the associated impacts on strength and fatigue considerations shall be accounted for in the design.

An access way to the flare tip and a flare tip access platform shall be provided. A flare tip handling and removal system shall be provided for tip replacement.

The flare structure shall be painted with in accordance with the project specifications, with due consideration to the high temperatures. The finished colors shall be in accordance with the applicable visual marking required for helicopter operations and aviation safety.

Any heat shield requirement determined by Safety shall be included in the design.

7 JACKET APPURTENANCES DESIGN REQUIREMENTS

7.1 General

All appurtenances and their connections to the main structure shall be designed for strength and durability, in accordance with the requirements of API RP 2A, AISC or other referenced standards. The design of appurtenances shall be consistent with their intended usage, method of installation and proposed support arrangement.

The appurtenances shall be analyzed and designed using the approved structural analyses software and generally accepted engineering practices. Each appurtenance and its support arrangement shall be analyzed as a stand-alone structure, based on the pertinent local design forces and load conditions

7.2 T.O.J Walkways

Walkway design shall meet with the requirements in VNM-VPP1-MEC-SPC-EDG-0000-00022 "Specification for Safety in Design". Walkways in high-traffic areas and primary means of egress shall have a minimum clear width of 1.2 m.

- All walkways, stairways, and landings shall have a minimum clear width of 0.9 m and meet safety requirements.
- Platform stairway and associated landings and egress paths shall be designed to accommodate two men carrying an injured person on a stretcher from the boatlanding to the helideck.

Walkways, stairways, and landings shall be designed for a uniform live load of 5 kPa moving. In addition, stairs in the wave zone shall be checked for wave slam loads.

7.3 Caissons and Supports

Refer document No. PQ1-00-STR-SPC-TAP-00005, "Specification for Disposal Caissons".

7.4 J –Tubes

J-tubes and their support framings shall be designed to withstand wave loads and umbilical/ cable pulling forces, checked for vortex shedding, etc. The supports and connections shall be checked for all applicable loading conditions including fatigue.

J-tubes shall be preinstalled on the jacket and fitted with a "bell-mouths" at the bottom. J-tubes shall be connected to the jacket braces by welded stubs.

Mudline detailing at the entrance of the J-tube shall have gradual slope to minimize the incoming span.

Above every J-tube, a padeye shall be provided on the underside of the deck with a capacity equal to twice the estimated pulling force.

If a hatch opening is provided where the pipe can be pulled from the main deck, then padeyes shall not be required.

J-tubes and their support framings shall be designed to withstand wave loads and umbilical/ cable installation forces, checked for vortex shedding, etc. The supports and connections shall be checked for all applicable loading conditions including fatigue.

7.5 Riser Clamps

Riser clamps shall be designed to withstand all environmental and operating loadings including pipeline thermal expansion and surge.

Neoprene liner shall be included inside of riser clamps.

Riser clamps shall be designed so that clamps rigidly attached to risers are believed to exhibit a shorter fatigue life than clamps designed with larger annular gaps, which are somewhat more flexible.

7.6 Conductor Guides

Conductor guides shall be provided at horizontal framing levels on the jacket and deck. The conductor guides shall be assumed to provide lateral restraint only.

Sufficient clearances shall be provided between the guide and the conductor to accommodate the connector and connector installation requirements. This would require large clearances and excessive deflections and vortex shedding induced vibrations may develop.

All conductor guides shall include stabbing cones on the upper and lower side.

The conductor guides at the top of jacket level shall have no cavities so that water may be trapped.

Conductor guides and framing at the mudline elevation shall be included unless pre-drilled wells are present.

7.6.1 Design Conditions

The conductor guides shall be designed for all pertinent in-service and pre-service design conditions and associated loading.

The maximum lateral reactions due to in-service conditions shall be combined with loads due to direct wave loading on the guides and a vertical load equivalent to 10% of the maximum lateral load to account for the relative vertical movements between the conductor and the guide and friction.

In addition, loads from the interaction between the jacket and the conductors during wave loading due to jacket sway being restrained by the conductor acting as a pile shall be considered if applicable.

The fatigue damage for the conductor guides shall be calculated using a spectral fatigue analysis. The following locations shall be checked for adequate fatigue life:

- Connections between guide supports and bracing.
- Connections between guide "barrels" and adjacent steel.

Due to the difficulty involved with offshore inspection of conductor guides and adjacent supporting braces due to limited access, the target fatigue life shall be five times the design life of the platform.

7.6.2 Conductor Installation Loads

The design stabbing loads shall be finalized based on the installation method and length of the sections. The guides and supporting members shall be designed for appropriate vertical and lateral impact loads applied at any point around the rim of the guide cone.

7.7 Boatlanding

Boatlandings shall be designed for offshore installation and shall be removable. The structures shall be capable of absorbing vessel impact energy without leading to progressive collapse of the system. Boatlandings shall be replaceable with measures to prevent it from falling to seabed following accidental damage.

The boatlanding shall have two landing levels, to accommodate the tidal range and possible settlement and subsidence. An offshore adjustment of ±1.0 meter shall be provided to allow for water depth tolerances. The boatlanding shall be fully painted in accordance with applicable specification and the submerged parts provided with appropriate cathodic protection.

Jacket shall be designed with mooring bollards near each end of the boat landing for supply vessel mooring.

Swing ropes shall be provided to enable personnel movement between vessel and the boat landing.

The boatlanding shall be provided with rigid connections to the jacket legs that permit easy installation and replacement. Vessel impact energy under normal berthing conditions shall be fully taken by boatlanding. Boatlanding members shall remain elastic under normal berthing conditions.

7.7.1 Loading Conditions

The boatlanding shall be designed for the following loading conditions:

- Self-weight and operating/storm wave loads

- Self-weight + Area Live Loads for still water conditions
- Self-weight + Normal Boat berthing loads at still water conditions
- Self-weight + Applicable DAF for offshore lifting
- Self-weight + Accidental vessel impact loads at still water conditions

The boatlanding shall also be designed for accidental impact as per Section 5.7. The boatlanding shall be designed such that it does not collapse under accidental impact, and adequate clearance of at least 300mm to the jacket structure shall be demonstrated to ensure that no contact is made during energy absorption by plastic deformation of the boatlanding.

Vessel impact energy shall be calculated in accordance with API RP 2A, both for broadside and stern impacts. The energy absorbed due to vessel indentation shall be ignored.

7.7.2 Member and Joint Design

All boatlanding members, joints and connections shall be designed in accordance with API RP 2A and AISC requirements, with a one third increase to basic allowable stresses and a plastic analysis is applicable for accidental impact loads. Corrosion allowance specified in section 4.5 shall be considered only for the primary support members.

The jacket shall also be checked for the imposed loads and shall remain in the elastic range under all impact conditions.

7.8 Barge Bumpers

Barge bumpers shall be provided on all jacket legs as identified during FEED. In addition, a barge bumper with Eccentric Bumper Rings (EBR) only shall be provided on the boatlanding supports. The barge bumpers shall be designed for offshore installation and shall be removable to enable replacement in case of damage, with measures to prevent it from falling to seabed after accidental damage. Barge bumpers shall be fully painted and corrosion allowance shall be as per section 4.5.

The barge bumpers shall remain elastic under normal berthing conditions.

7.8.1 Loading Conditions

The barge bumper shall be designed for the following loading conditions:

- Self-weight and operating/storm wave loads
- Self-weight + boat impact loads (at 1/3 and mid-span)

Barge bumpers shall be designed for an impact load due to a vessel as per Section 5.7. Vessel impact energy shall be calculated in accordance with API RP 2A, both for broadside and stern impacts. The energy absorbed due to vessel indentation shall be ignored.

7.8.2 Member and Joint Design

All members, joints and connections shall be designed in accordance with API RP 2A and AISC requirements.

7.9 Riser Guard

Riser guards shall be designed to protect risers against boat impact loads which are typically characterized in terms of impact energy as specified in Section 5.7.

The platform shall be designed for riser guards for the future risers to prevent damage to these risers from accidental boat impacts. The riser guards and consequently the jackets shall be designed to resist operational and accidental vessel impacts. The riser guards shall be designed to the criteria in Section 7.8 of this specification. Emergency access ladders shall be incorporated into the riser guard.

7.10 Hydrostatic Collapse Rings

Design for hydrostatic loadings shall be in accordance with API RP 2A-WSD.

For the design of large-diameter members, out-of-roundness shall be considered in accordance with API Spec 2B.

The actual member length between the faces of the chords or between ring stiffeners may be used.

For the installation design conditions, all members shall be designed for the combined effects of tension or compression, plus bending, and hydrostatic pressure.

- For a given horizontal elevation, the most critical hydrostatic design pressure shall be used for all members at that elevation.
- The hydrostatic pressure, as determined by the launch analysis, shall be increased by 25 percent for use in member design, but in no case shall be less than 75 m design depth for all jacket sections

Jacket compartments shall be considered buoyant for the local member checks. Ballast and trim compartments shall be considered buoyant to account for failure of the flooding system.

Hydrostatic pressure checks shall be performed on all appurtenances.

The member unity checks shall include the axial capped end force in the buckling equation.

7.11 Vortex Shedding

All jacket members and appurtenances shall be checked for vortex shedding due to steady state currents from storm and operating cases using DNV RP-C205 and DNV RP-F105:

- Computed in-line and cross-flow hydrodynamic damping is a function of member modal response.
- For members in water, the maximum limiting total damping used to determine the member allowable span length shall not exceed 1 percent.

Members susceptibility to wind-induced vortex shedding shall be designed to withstand vortex-induced loading. Wind speed for the check shall reflect the design conditions in accordance with the following:

- The one-minute sustained wind speed of the 5-year storm shall be used for the site under consideration.
- The maximum limiting damping value shall not exceed 0.2 percent for members in air.
- Elevation and proximity to other elements of the structure shall be taken into account while calculating the wind speed.

Where possible, vortex induced oscillations shall be prevented; should this not be possible, checks shall be made to ensure that the maximum oscillation amplitude does not overstress the span under consideration, or cause unacceptable fatigue damage in combination with the wave-induced fatigue damage.

As required, vortex suppression devices may be used.

- Temporary suppression devices shall be designed for easy removal prior to platform installation.
- Permanent suppression devices shall be designed, fabricated, and inspected to meet long-term service requirements.

7.12 Wave Slam

All members and appurtenances in the wave zone shall be designed for wave slam forces during operation and transportation/ launch phases.

Member bending stresses induced by horizontal and vertical slam forces in combination with other global stresses shall be checked.

Calculation of slam loading shall exclude the current velocity components in wave kinematics.

For X-braces, members shall be assumed simply supported out of the plane of the framing. Member lengths may be reduced by setting offsets to the face of the jacket leg.

Morison's equation with a drag coefficient of 3.0 shall be used for wave slam calculation.

Member mid-span moments shall be factored to 2.0 and end moments factored to 1.5 in according with dynamic amplification.

7.13 Skirt Pile Guide

7.13.1 Battered Skirt Piles

The loads imposed during the installation of the piles shall be considered in the design of skirt pile framing for battered skirt piles.

Table 7.3 shows the criteria for the design of the skirt pile guide framing, as a minimum.

Table 7.3: Criteria for Design of Battered Skirt Pile Guide Framing

Top level	A vertical load equal to 1.1 times the weight of the heaviest string to be supported from this level, or 1.5 times the weight of the string that will initially pass this level, whichever is greater.
Second level	A vertical load equal to 1.5 times the weight of the string that will initially pass the second level.
Subsequent levels	A vertical load equal to 0.5 times the weight of the string that will initially pass these levels.

7.13.2 Vertical Skirt Piles

The loads imposed during the installation of the piles shall be considered in the design of skirt pile guides for a one-piece.

Table 7.4 shows the criteria for the design of the skirt pile guide framing, as a minimum.

Table 7.4: Criteria for Design of Vertical Skirt Pile Framing

Skirt pile guides	A lateral load equal to 0.2 times the weight of one skirt pile shall be supported by the skirt pile guide.
Skirt pile sleeve	A vertical load equal to 1.1 times the weight of one skirt pile shall be supported on the top of a skirt pile sleeve for the worst skirt pile location to assess the jacket stability and structural integrity of the jacket, including the skirt pile sleeve framing, jacket leg, and mudmats.

7.13.3 Grouted Connections

Grouted connections shall be designed in accordance with API RP 2A.

CONTRACTOR shall consider using the U.K. Department of Energy (DOE) Offshore Installations Guidance on Design and Construction for calculation of allowable bond stress for complex grouted connections as referenced in API RP 2A-WSD and/or API RP 2A-LRFD.

The DOE formulas shall be used in connection with recommendations presented in OTC paper No. 004890 for the grouted connection design.

7.14 Mudmats

The steel mudmats shall be provided by CONTRACTOR, other alternative could be considered if accepted by COMPANY.

Mudmats shall be designed such that they can be fabricated on the ground and then installed using a limited amount of welding.

CONTRACTOR shall consider the use of crimped or corrugated plate shapes instead of beam and plates if they are reducing cost.

If mudmat knee braces are designed to connect to primary jacket braces via doubler plates or joint cans, they shall be modeled in the in-place analysis.

Punching shear stress and ovalling checks shall be performed at locations where knee braces attached to the jacket legs by doubler plates.

A full stress analysis of the jacket structure using a jacket model that includes all mudmat framing and bearing loads from the soil shall be checked for CPP Platform by the following steps:

- The jacket is assumed to be supported at the center of each mudmat and the reactions at these supports shall be calculated with appropriate environmental loads and pile loads.
- The jacket is supported at the top and the reactions from first step are applied at the bottom acting vertically upwards.

7.15 Watertight Diaphragms and Leg Closure Plates

The jacket legs might be required to provide adequate buoyancy based on launching and upending considerations. In order to achieve this, watertight diaphragms are required for each leg and closure plates shall be provided at the top of each leg. The diaphragms shall be provided to control the flooding as required for upending or limit flooding in cases of damage to the leg during launching/upending or subsequent stages.

Watertight diaphragms shall be designed to resist out-of-plane pressure loading and, where appropriate, imposed in-plane loading. The design shall consider the different pressure heads developed during launching, upending and on-bottom conditions

7.16 Launch Cradle Design

The launch truss bottom chord at jacket mud line framing and the launch cradle assembly shall be designed for the loads from loadout, transportation, and all stages of launch.

The launch truss bottom chord nodes at jacket mud level framing shall be checked for crushing loads in addition to punching shear, for the loads derived from the pre-service analyses.

The launch cradle struts span between the jacket mud level framing and the launch runners. These struts shall be included as part of the structural analysis for loadout, transportation, launch, on-bottom and in-place conditions.

The launch runner beam/box section shall be designed for the maximum loads derived from the pre-service analyses. The launch runner shall be designed for a nominal vertical load of 1500kN/m along the entire length and for the maximum vertical reactions at the hard points.

Longitudinal and transverse loads due to break-out and dynamic friction and eccentricity of the pulling forces, environmental loads prior to installation of sea-fastening and barge motions during launch shall be included in the pertinent design condition.

All stiffeners shall be checked against bearing, bending, buckling and shear as appropriate.

The compressive stress applied to the timber shall be calculated as assuming a 45 degrees dispersion through the node. The timber shall also be checked for local crushing loads transferred from the beam webs and transverse stiffeners.

Brackets and tie rods shall be provided to retain the timbers on the launch box and to transfer lateral loads.

The brackets and tie bars shall be designed to transfer the lateral load from the jacket to the timber.

Launch Lugs and the connection to the launch runners shall be designed for the maximum break-out loads expected during loadout and launch.

7.17 Flooding and Grouting System

The flooding and grouting system shall be fully designed with two separate systems, i.e. primary and secondary ones, for backup purpose.

Flooding and grout lines shall be checked for transportation loads, launch loads and wave slam during jacket launching, where applicable.

The flooding and grout piping systems shall be checked for severe impact forces, if underwater hammers are used.

The flooding and grouting system shall be designed with minimum piping supports in the splash zone.

The flood and grout line supports shall be designed for easy removal of the lines down to elevation (−) 7.5 m, if no longer needed.

7.18 Installation Aids

CONTRACTOR shall design all installation aids required for platform installation. Installation aids in the splash zone shall be designed such that they can be removed without damaging the any jacket member and coating.

Miscellaneous aids for installation and maintenance shall be provided based on the project requirements. These include, but are not limited to:

- Jacking, winching, towing and positioning aids
- Temporary platforms, supports, walkways and ladders
- Temporary brackets for installation equipment/rigging attachments, tie-down and support
- Diver and ROV markings and aids
- Protection for caissons, valves, etc.

8 TOPSIDES MISCELLANEOUS DESIGN REQUIREMENTS

8.1 Design Considerations

This section provides the general requirements for the design and detailing of the deck structural components that are not explicitly included in the computer models for the primary structure design.

These components and their connections to the main structure shall be designed for strength, stability and serviceability in accordance with the requirements of API RP 2A, AISC and other referenced standards. The design shall be consistent with their intended usage and proposed support arrangement.

The secondary structural components shall be analyzed and designed using the approved structural analyses software and generally accepted engineering practices. Each component and its support arrangement shall be analyzed and designed based on the pertinent local design forces and load conditions.

The following sections describe the design criteria for typical deck structural components. Any other components required for the project shall be suitably designed with appropriate criteria approved by COMPANY.

8.2 Joint Design

8.2.1 Tubular joints

All deck tubular to tubular joints shall be designed in accordance with the requirements of API RP 2A.

8.2.2 Beam to beam joints

The design of plate girder to plate girder, plate girder to wide flange beams and wide flange beam to wide flange beams shall be in accordance with AISC. Stiffeners shall be provided where required to limit the bearing and buckling stresses at the joints as per AISC requirements.

8.2.3 Plate girder to deck leg joints

Plate girder to deck leg joints shall be designed based on the assumption that the forces in the beam flanges are resisted by the ring stiffeners/star plates provided at these joints.

The shear coefficient (Cv) shall be as specified by AISC, which shall comply with the requirements outlined in section F4 of AISC.

The rings shall be analyzed and designed for critical load cases using closed ring solutions.

8.2.4 Diagonal bracing to girder/beam joints

These joints comprise of diagonal members, tubulars or rolled sections, framing onto floor beams composed of plate girders or rolled sections.

For wide flange section braces framing on to girders/beams, stiffeners shall be provided where required to limit the bearing and buckling stresses at the joint as per AISC requirements. Bearing stresses shall be calculated considering the entire force transfer through the flanges of the brace member. Stiffeners shall be provided directly below the brace flanges.

Where tubular bracing frame onto beams, the loads shall be transferred onto the stiffeners by a series of bearing points where the tubular footprint passes over the beam web and stiffeners. The stress checks and the stiffener design shall be as per AISC requirements.

8.2.5 Horizontal Bracing to Girder/Beam Joints

Plan diagonals shall be connected to girders on the deck horizontal framing either by gusset plates or by direct welding to the web. The connections and the stiffeners shall be designed in accordance with AISC.

8.3 Secondary Beams

Deck secondary beams shall be designed for the minimum design loads specified in Section 5.2.4 and the applicable equipment and open area loads. The secondary beam spacing shall be finalized based on the loading and support requirements for the deck plates. The beam size and spacing in the lay down area shall be determined based on the design area loading and dropped object requirements.

8.4 Deck Plating

A smooth plate with a minimum thickness of 8 mm shall be used with non-skid paint on the top. The plating shall be designed for the minimum design live loads specified in Section 6.2. The plating thickness in the lay down area shall be determined based on the design area loading and dropped object requirements.

Seams in deck plating shall be continuously welded with full penetration butt welds. Deck plating shall be seal welded to the flanges of all supporting structural members.

8.5 Grating

Generally, well bay areas below main decks, access platforms and stair landings shall be grated. All grating shall be hot dip galvanized serrated bar steel grating or FRP grating.

8.6 Equipment Supports

The equipment support layout shall be based on the type of equipment, footprint and mounting arrangement.

Equipment supports shall be designed based on the most onerous loads during operation and testing. In addition, the supports shall be checked for the design transportation forces. Support of machinery shall account for both static and dynamic loads.

Equipment supports shall be designed for test, transportation and in-place conditions. Seismic and transportation accelerations at deck level shall be given to equipment/vessel vendors for the design of integral supports.

A minimum notional lateral load of 5% of equipment operating weight shall be considered acting laterally in each direction for operating load combinations described above.

Inertia loads during transportation shall be determined based upon the accelerations derived from relevant tow motion analysis.

Dynamic analysis shall be performed in equipment support designs for the following:

- All rotating machinery 150 Kw (200 HP) or over
- All Reciprocating machinery
- Vertical vessels/towers when h/d > 10 or when h > 15 m (where h = height of vessel, d = diameter of vessel)

8.7 Equipment Vibration

Rotating equipment support members and the deck structure in that area shall be checked for vibration response and possible resonance, using harmonic analyses.

Elements in the superstructure that support "major" mechanical equipment such as gas turbine generators & compressors shall be designed so that their natural frequency of vibration is either less than 70 percent or greater than 140 percent of any equipment operating or transient frequencies. The equipment vendor shall identify the applicable transient frequencies. For all other equipment other than the identified above as "major", the local checks of structural elements shall be performed based on the operating frequency limitations only.

The structural response of the framing shall meet the limits specified by equipment manufacturers and human sensitivity as per applicable standards.

For equipment with exciting frequencies between 1 to 40 Hz, the support structure natural frequencies shall be out of range by 0.5 to 2.0 times the forcing frequencies of any component of the equipment.

- The primary source of vibration in superstructures is harmonic unbalanced forces generated by rotating or reciprocating equipment. The final design shall be such that vibrations will be neither intolerable nor troublesome to personnel, and will not cause damage to the machine or structure.

- As a general rule, none of the natural frequencies of the structure should be within a band of the operating frequency of the supported machinery. The band to be avoided is from 1.414 above operating frequency to 0.707 below operating frequency. To find structural natural frequencies, a computer analysis will generally be required. All natural frequencies below 2 times the operating frequency for reciprocating equipment and below 1.5 times the operating frequency for rotating equipment shall be calculated.
- It shall be demonstrated that the amplitudes of the natural frequencies between 0.35 and 1.5 times the operating frequency are within the allowable values even assuming that -due to differences between the actual structure and the assumed model – resonance does occur. In this case, a reasonable amount of damping should be estimated.
- Resonant condition requires a detailed dynamic analysis. Once a modal analysis has been performed, the response analysis will indicate anticipated amplitudes of vibration, velocity, and acceleration, as well as magnitudes of forces in structural members. From the above information, the adequacy of the design can be evaluated, and, if necessary, modifications can be made.
- The maximum vibration amplitude of the equipment shall not exceed the lower of the following values:
  - The maximum allowable values stated by the manufacturer of the equipment.
  - The amplitude (single amplitude) which causes the effective velocity of vibration to exceed 2 mm/s at the location of the machine-bearing housings and 2.5 mm/s at any location of the structure.
  - 80 mm single amplitude.
- The depth of a steel beam supporting large open floor areas free of partitions or other sources of damping should not be less than 1/20 of the span to minimize perceptible transient vibration due to pedestrian traffic.

8.8 Stairs, Walkways and Landings

A uniform live load of 5 kPa moving shall be used for design of walkways, stairways, and landings.

All walkways, stairways, associated landings and egress paths shall have a minimum clear width of 0.9 m and meet safety requirements, such as accommodation of two men carrying an injured person on a stretcher from the boatlanding to the helideck.

Except for walkways in high-traffic areas and primary means of egress shall be designed with a minimum clear width of 1.2 m.

All stair treads shall be equipped with an abrasive steel nosing (non-slip) and fabricated from serrated bar grating and bolted to the stringers unless noted otherwise on the design drawings.

Handrails and Kick Plates

Handrails and kick plates shall be provided around the perimeter of each deck (except the helideck) and on both sides of stairways.

If containment of liquid is desired, the handrail kick plates shall be welded directly to the deck plate. The height of the kick plate shall be a minimum of 100 mm.

Handrails shall be fixed to deck except for the following areas which shall be provided with removable handrails:

- Around access hatches
- Along the rig approach side on Main Deck area
- Pig launcher/receiver access area
- Wellhead access areas
- Laydown area

Handrails and supports shall be designed to withstand a lateral or vertical concentrated load of 1.0 KN applied at any point on the handrails.

8.9 Drain Troughs and Curbing/ "Coaming"

Drain troughs shall be provided at suitable locations on all plated decks. The number, size and locations shall be determined during detailed engineering. Perimeter drains shall be provided at locations where curbing cannot be provided.

Plated deck areas shall be provided with a perimeter coaming to prevent spillage. Penetrations through the containment area shall be sealed with a 100mm high coaming bar. "Coaming" across access/ egress routes, if required, shall be bounded by a half segment of a 219 mm diameter pipe in lieu of a coaming bar.

8.10 Hatch Covers

Hatch covers and supporting structures shall be designed for self-weight and the design live load applicable for the area in which they are located.

Hatch covers shall be provided as per equipment layout drawings, to allow for the removal/maintenance of equipment. The hatch covers shall be suitably sized for the intended usage and adequately supported. The hatch covers shall be watertight and flush with surrounding deck plating/grating. Suitable lifting aids shall be provided to safely handle the hatch covers.

8.11 Ladders

Ladders with associated ladder cages and intermediate landings shall be designed in accordance with OSHA 3124-12R 2003, "Stairways and Ladders – A Guide to OSHA Rules" requirements and project standard drawings.

The ladder design load shall be determined by the usage of the ladder, but shall not be less than a single concentrated load of 1.35 KN.

Number and location of the ladders between the main deck and cellar deck, or between the cellar deck and top of the jacket, shall be based on HSE and HAZOP studies and requirements.

The ladder shall be located remote from other deck-to-jacket stairways.

8.12 Crane Pedestal

Crane pedestals and the supporting structure shall be designed in accordance with API RP 2A WSD and/or API RP 2C, as applicable, with due consideration to dynamic and fatigue loads. The pedestal shall also be checked for the motion induced forces during sea transportation.

The supporting structure is defined as the pedestal and all primary members directly attached to the pedestal.

If the crane pedestal is used for the storage of fluids, it shall also be designed for the design pressure plus the liquid head produced by the condition that the pedestal is filled with water. The liquid loads and the location of the access manhole shall be considered in the design of the pedestal.

Access platforms and associated ladders shall be provided for safe and easy access to the crane cab and for maintenance and inspection of the pedestal/crane connection.

8.13 Crane Boom Rest

Crane boom rests shall be designed for the maximum loads from the boom, including static loads due to self-weight of the boom and environmental loads. In addition, the boom rests shall be designed for an impact load equal to 1.25 times the static load from the boom, excluding environmental loads.

Lateral restraints for crane boom rests shall be designed based on 10% of the crane boom SWL applied transversely at the top of the boom rest.

Crane boom rests shall also be designed to withstand motion induced forces during sea transportation.

8.14 Access Platforms

Access platforms shall be provided wherever equipment is not accessible from grade, including to the top of vessels where flanges and nozzles are located. All access platforms shall be equipped with fixed ladders or stairs. The access platforms and the supports shall be designed for the minimum area loads specified in section 6.2.3 and environmental loads where applicable. The grating and hand rails shall be designed to be removable.

8.15 Pipe Support

Pipe support design shall include the checking of the critical pipe supports and floor beams on which these supports rest.

All major pipe supports shall be shown on the structural drawings.

Pipe support loads shall be based on the reactions from pipe stress analysis and the supports shall be designed for the most onerous combination of axial and lateral forces and associated moments.

8.16 Spreader Beams/Spreader Frames

Spreader beams/spreader frames required for installation of structures/appurtenances shall be sized based on the design lift loads with applicable dynamic factors and lifting arrangements.

8.17 Padeyes/Trunnions

All padeyes/trunnions required for installation and handling purposes shall be designed for the maximum lifting loads with applicable dynamic factors. Minimum factors shall be as required by API RP 2A.

8.18 Drip Pans

Drip pan plates and supports shall be designed for self-weight plus fluid loads for maximum hold-up condition.

8.19 Exhaust Stack

Exhaust stacks for the compressors and generator shall be designed.

8.20 Material Handling Appurtenances

Structural appurtenances necessary for material handling shall be provided in accordance with the project requirements for maintenance and handling. Appurtenances may include monorails, padeyes, pulling posts and deck latches. Deck floor plating checked and suitably reinforced along the proposed trolley routes.

8.21 Survival Craft Stations

Support structure for survival craft shall be designed to resist twice the maximum functional loads multiplied by an impact factor of 1.1 in combination with the walkway UDL of 5.0 kN/m^2.

8.22 Muster Areas

Muster areas of adequate size to accommodate the POB shall be provided as shown on the equipment layout and safety drawings. The muster areas are normally designed for UDL of 10.0 kN/m^2 for deck plate & stringers and 5.0 kN/m^2 for global design, unless noted by COMPANY.

8.23 Temporary Refuge

A temporary refuge shall be provided in accordance with the requirements of the safety studies. It will be located adjacent to the survival craft stations and may be incorporated into the living quarters.

8.24 Fire and Blast Rated Decks and Walls

The design blast overpressure and fire rating shall be established based on the requirements and recommendations from the safety studies document "Fire and Explosion Analysis".

Fire and blast rated walls and decks shall be designed in accordance with the requirements of VNM-VPP1-STR-PHL-EDG-00003-00 "Blast Design philosophy (CPP Topsides)". For the initial design blast overpressures contained within this document may be used, however the CONTRACTOR shall confirm these values during detailed design.

8.25 Dropped Object Protection

The location and extent of the dropped object protection required shall be established based on the QRA and material handling studies. All laydown areas, drilling areas and other identified deck locations are potential damage caused by dropped objects based on crane usage and objects lifted during drill-rig workover and platform production activities shall be designed for dropped object loads.

The object size, weight and height of the drop shall be established during detailed design stage. The design shall ensure that the impact energy is absorbed by the local plating, secondary and primary structures within the dropped object zone.

The impact energy shall be absorbed by elastic and plastic deformation of the affected region of the structure. Design procedures shall be established by CONTRACTOR and submitted to COMPANY review and approval.

8.26 Vortex Shedding

All deck members and appurtenances shall be checked for vortex shedding due to design steady state wind velocities from storm and operating cases in accordance with DNV RP C205.

Deck members and appurtenances shall also be checked for vortex shedding due to wind during fabrication and installation phases. Wind velocities for the check shall reflect the design conditions during these phases and shall be subject to COMPANY/ MWS review and approval.

Elevation and proximity to other elements of the structure shall be taken into account while calculating the wind velocities.

Where possible, vortex induced oscillations shall be prevented; should this not be possible, checks shall be made to ensure that the maximum oscillation amplitude does not overstress the span under consideration, or cause unacceptable fatigue damage in combination with the wave-induced fatigue damage.

9 DESIGN DOCUMENTATION

9.1 General

Detailed design documentation shall be provided for COMPANY review, approval and certification requirements. The documentation includes, but not limited to:

- Design basis
- Structural analyses and design reports
- Weight and COG. reports
- Detailed AFC drawings.

A master document register shall be submitted for COMPANY review and approval at the commencement of the project. All documentation shall be prepared in the approved project standard format and submitted in accordance with the project schedule.

9.2 Design Basis

The project structural design basis shall be updated and submitted to COMPANY review within 30 days of project award. The document shall be updated periodically to reflect the latest information, changes to design data and design developments.

9.3 Analyses and Design Reports

Detailed reports shall be prepared for all analyses and design work. The reports shall document the analyses and calculations performed to support the integrity of design for each design condition, including reference information, drawings and sketches. The report shall present a summary of the work performed, design criteria, assumptions, loads and load combinations, analyses methods, findings, results and conclusions, demonstrating the acceptability of the overall design. The reports shall include appropriate computer model information, including model plots showing joint and member numbers, geometry, code check parameters and member and joint unity check ratios. Detailed computer analyses models shall be presented in the form of hard copy of input files and summary output and also as electronic copy. All electronic files shall be systematically designated and cross-referenced in design reports/ calculation for easy traceability.

All design reports shall be prepared, checked and approved by competent personnel within CONTRACTOR's organization and in accordance with project quality requirements, prior to submission to the COMPANY.

The reports shall be updated to reflect COMPANY/Certification Authority/ MWS comments. Any revisions to weight/ COG. exceeding the tolerances considered for the analyses/ design and changes to the previously agreed design criteria shall also require updating of the analyses and design reports.

9.4 Weight and COG Reports

Detailed weight and COG reports shall be prepared and periodically updated in accordance with the requirements of COMPANY related specifications.

9.5 Detailed AFC Drawings

All detailed AFC structural drawings shall be prepared with sufficient details for fabrication of all items included in the design.

9.6 Final Documentation

The final design documentation shall be in accordance with the project requirements. The documentation shall detail all work performed to substantiate the design and shall include final design and analyses reports and associated computer model files, design briefs, calculations, results, plots and all necessary documentation required.

Soft copies of the computer models for all in-service analyses and major pre-service analyses shall be provided in the native format of the software. The files shall be properly indexed and shall include all input files, worksheets, macros, run files and detailed output files.

APPENDIX-1

TECHNICAL REQUIREMENTS FOR OTHER STRUCTURAL MATERIALS

A.1. Timber

A.1.1 Launch Runner and Boatlanding Fenders

The timber for the jacket launch runners, boatlanding fenders and crane boom rest shall be BS 5268-2 2002 strength class D70 hardwood.

The grade stresses shall be:

- Bending parallel to grain: 23 N/mm^2
- Tension parallel to grain: 13.8 N/mm^2
- Compression parallel to grain: 23.0 N/mm^2
- Compression perpendicular to grain: 6.0 N/mm^2
- Shear parallel to grain: 2.6 N/mm^2
- Mean Modulus of elasticity: 21000 N/mm^2
- Average Dry Density: 1080 kg/m^3

A.1.2 Sawn Timber

Dimensional Tolerances

Cut sizes of the structural timber shall be within the maximum dimension tolerances of ±6 mm and ±3 mm for length and width, respectively.

Straightness

All timber shall be reasonably straight with the sides showing not more than 3 mm deviation from a straight edge in any 1 metre and not more than 6 mm deviation in the entire length.

Taper

Timber shall be reasonably uniform section having width and thickness of the section within the above tolerances in its entire length.

Seasoning and Preservative Treatment

Launch runner timbers shall be subject to air or kiln seasoning to stabilize the moisture content to about 25 percent before treatment.

The timbers shall be treated with the preservatives by suitable cold pressure process and the treated timber shall be allowed to dry for 6 weeks after treatment.

Preservative shall be compatible and non-corrosive to bolt coating and materials.

All wood working including cutting to size, boring, etc. shall be completed prior to treatment. In case boring or re-working treated timber becomes absolutely necessary the bored hole or the re-worked surface shall be retreated with the same preservative using suitable treating apparatus.

Absorption of preservative in the treated timber shall be as per BS5268 part 5. Should the timber be refractory to treatment, incision of surfaces may be made to a depth of 12 to 20mm for proper penetration of preservative.

A.1.3 Delivery & Storage

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 as required by these requirements.

After delivery and prior to use, CONTRACTOR shall store all structural timbers 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 150 mm. The stacks shall be protected from hot dry winds or direct sun and rain and shall be accessible from all sides.

The stacks of timbers shall be appropriately marked so as to be readily identifiable and correlated with the purchase order, VENDOR's certificate or other inspection/ test certificates.

VENDOR shall supply documentation specifying the conditions required for delivery and storage.

A.1.4 Inspection & Testing

VENDOR's Certificate

Each lot of timber supplied for the works shall be accompanied by a certificate from the VENDOR giving the following particulars:

- name, trade mark or other means of identification of vendor;
- tag number identification of the lot which shall be correlated with the supplied timber;
- species of the timber;

- list of cut sizes and lengths supplied in the lot;
- details of seasoning carried out giving the method of seasoning and residual moisture content of timber along with test certificate;
- details of preservative treatment carried out giving method of treatment, preservative used, amount of absorption achieved, etc;
- mechanical test certificate giving results of all tests specified as below.

Tests

Mechanical tests shall be carried on small clear specimen to determine the following:

- Specific gravity.
- Modulus of elasticity in bending.
- Rupture stresses in bending, tension and shear along grains.
- Crushing strength in compression along and across grains.

The average of six test results for each item for every 3 cubic metre of part of timber of same species supplied in a lot shall form the basis of reporting.

Inspection

The VENDOR shall extend full co-operation and provide all facilities for such inspection prior to its use.

A.2. Neoprene/ Rubber Liner

A.2.1 Material

The black neoprene or vulcanized rubber liner shall be installed on riser clamps with optimum ozone resistance and mechanical properties for:

- Good abrasive and shear strength
- Good weathering resistance
- Extreme sea water resistance during 30-year immersion under constant shear stresses
- The sheeting shall have been tested to the following specifications: ASTM D395, ASTM D429, ASTM D945, ASTM D2240.
- The sheeting shall meet or exceed the following requirements.
    - Design Temperature = 82.2°C (180°F)

- Shore Durometer Hardness = 60-65A (ASTM D2240)
- Tensile Strength (minimum) = 13790 kPa (2000 psi)
- Elongation at Break (minimum) = 440 %
- Ozone Exposure Rating = no cracks (100 PPM 21°C (70°F) under 15% elongation for 100 hours)
- Outdoor Exposure Rating = no cracks after 6 months exposure
- Resilience (ASTM D945-55) = 55%
- Compression Set 70 hours = 45 at 100 ° C (212 °F) (ASTM D395-55)
- Abrasion Rating Using Akron Tester = excellent

Sheeting shall be bonded to the guides in accordance with the approved COMPANY method of application.

The full specification of the neoprene and adhesive intended to be supplied, including details of compounding for approval by COMPANY.

The neoprene shall be attached to the steel per the following:

- The neoprene will be bonded to the guides.
- The CONTRACTOR shall apply a neoprene lining to each guide as shown on the approved drawings.
- The inside diameter of the guide-plus-neoprene shown on the approved drawings may be achieved by grinding the neoprene surface if necessary.

A.2.2 Bond Specification

- Bond Strength = 13790 kPa (2000 psi)
- ASTM D429 Peel Test = 793 kPa (115 psi)
- Fully Cured Bond Retention = 100 % 6 months in Seawater

A.2.3 Inspection and Testing of Neoprene

- Mechanical tests shall be carried out on a cured sample of the rubber sheeting.
- Tests shall be carried out by the manufacturer in accordance with ASTM D429 Method E to demonstrate the adequacy of adhesion. Test results shall be provided to the COMPANY.

A.2.4 Protection

The neoprene surface and edges are protected from physical damage.

A.3. Fiberglass Grating

The application of fiberglass material in offshore structural shall be approved by COMPANY.

A.3.1 General

The phenolic grating shall be square mould with b-directional strength characteristics.

The grating shall be red in colour.

The grating penetration collars shall be from Polyurethane from Intrepid Industries or similar penetration collar system. These shall be of yellow in colour.

A.3.2 Strength/ Serviceability

Grating: Certified load rating and deflection characteristics shall be provided. As a minimum:

- The 25 mm grating shall be required to support a uniform load of 5 KN/m^2 for clear span of 800 mm.
- The 38 mm grating shall be required to support a uniform load of 10 KN/m^2 for clear span of 100 mm.
- The 50 mm grating shall be required to support a uniform load of 14 KN/m^2 for clear span of 120 mm.

A.3.3 Ultimate Flexural Strength

For grating the "maximum load" based on the ultimate strength of product shall be 3 times the sum of the specified live load.

The grating shall have flexural stiffness properties sufficient to limit deflection to 5mm assuming simple supports.

A.3.4 Impact Resistant

The grating when simply supported will take impact loadings of 1 KJ minimum with 90% retention of flexural stiffness and strength.

Impact Testing shall be in accordance with ASTM 695-79.

A.3.5 Anti-Slip Skid Resistant

The grating panel shall have an anti-slip surface.

A.3.6 Ultra Violet (UV) Resistance

Moulded grating and fibreglass components shall be manufactured with resins containing integral UV inhibitors.

The manufacture shall provide data demonstrating the UV resistance of the proposed FRP components, in accordance to ASTM D2565.

A polyurethane UV coating shall be applied to penetration collars.

A.3.7 Fire Performance Requirements

Flammability

FRP components proposed shall meet the requirements listed below as minimum.

Fire Resistance

All FRP grating and FRP components shall have low flame spread characteristics as determined by IMO Resolution A653 (16).

Smoke Test

FRP components shall gave low characteristics as determined by ASTM E84 with a smoke developed rating not to exceed 5.

A.3.8 Additional Requirements

Self-extinguishing

All FRP grating and RFP components shall be certified self-extinguishing by testing to ASTM D635 with burn rate less than 1 cm/minute linear horizontal rate once the flame source has been removed.

Flame Resistance

All FRP grating and FRP components shall be certified by testing to UL 94 as V0 class materials.

Combustion

All FRP grating and FRP components shall be certified to require over 50% oxygen to support candle like combustion by testing to ASTM D2863.

Heat Exposure

The grating shall be capable of maintaining structural integrity for operating temperatures up to 150°C minimum.

A.4. Miscellaneous Steel

A.4.1 Grating

Steel grating and stair treads shall be 38 mm by 5 mm or 25 mm by serrated bar grating with bearing bars at 30 mm on centers and crossbars at 100 mm on centers. Prefabricated stair treads may not be substituted without prior written approval by COMPANY.

Steel grating shall be heavy-duty galvanized (minimum 600 gr of zinc/sq. m. (or 85 µm thickness) of steel surface) in accordance with ASTM A123. Galvanizing shall be done after completion of all fabrication and welding. All mill coatings scale and paint shall be sandblasted from the surfaces of all items prior to galvanizing. All excess galvanizing shall be removed. Cold galvanizing repair and touch up on local areas due to modifications or penetrations is permissible with COMPANY approval. The final dry coating shall be at least 95% zinc.

Steel grating treads and the edge of landings at the top of stairs shall be fitted with a non-skid, cast abrasive nosing or approved equivalent.

Grating shall be fastened to structural members using grating stainless steel clips, or welded using approved WPS.

A.4.2 Threaded Fasteners

Bolts, studs, and nuts shall be heavy hexagon pattern.

Threads shall be Coarse Thread Series conforming to ASME B1.1.

Bolts, studs, nuts, and washers, 12.7mm and smaller shall be Type 316 stainless steel (ASTM A320, Grade B8M).

Bolts, studs, nuts, and washers larger than 12.7mm shall conform to ASTM A325 and shall be hot spun galvanized in accordance with ASTM A153.

Heat treated bolts shall comply with specification ASTM A490.

A.4.3 Manufactured Items

Manufactured items such as cleats, shackles, wire rope, clips, thimbles, turnbuckles, chain, tie wire, etc., shall be galvanized in accordance with VENDORs' standard.

A.5. Grouting Requirement

A.5.1 General

The CONTRACTOR shall be responsible for the development of all grouting procedures. Prior to commencing the offshore work, the CONTRACTOR shall submit fully developed grouting procedures to COMPANY for review and approval.

The CONTRACTOR shall be responsible for the supply of all grouting materials, equipment and personnel necessary to execute the grouting operations.

The CONTRACTOR shall list in his procedures all grouting equipment to be used in the grouting operations including the sources of grout materials.

A.5.2 Grout Mix Design

Design Strength

- Grout minimum density shall be 1.9 MT/m^3 (15.8 lb/US Gallon)
- Minimum 7 days grout strength shall be 24 N/mm^2
- Minimum 28 days grout strength shall be 45 N/mm^2

Grout Characteristics

The CONTRACTOR shall design the grout mix to comply with the following:

- Grout shall be of a High Sulphate Resistant, Low-Shrink and Low-Bleed type;
- Water/cement ratio of the mixed grout shall be not greater than 0.46 (by weight) unless confirmed otherwise by the design mix verification;
- Design mix shall specify a preferred in-situ density with a stated maximum and minimum range of acceptable densities;
- Thickening time for grout mix shall be at least 1.5 times the anticipated pumping time. In addition, the grout shall remain pumpable if pumping is stopped for up to 15 minutes during grouting operations;
- Limiting maximum design mix particle size to minimize segregation;
- Low heat of hydration characteristics to minimize cracking due to the placement of large grout volumes;
- Low shrinkage characteristics.

A.5.3 Grout Material Specification

The CONTRACTOR shall use the following grout materials for the annular grouting:

- Portland Cement – API Class High Sulphate Resistant Type Oilwell Cement manufactured to API Spec 10 – with or without accelerators for early strength as per CONTRACTOR's installation requirements;
- Mix Water - Clean sea water free from deleterious impurities;
- Admixtures - chloride free admixtures, non-corrosive to steel, may be used up to the manufacturers recommended addition rates. Such admixtures shall be subject to COMPANY review and approval.

A.5.4 Alternative Materials

The CONTRACTOR may specify other grout mix materials for the grouting to achieve the grout mix design requirements. These materials, however, shall only be approved for use if supported by acceptable laboratory, / technical and case history documentation.

A.5.5 Laboratory Test

General Requirements

The CONTRACTOR shall substantiate his grout mix design by extensive laboratory testing prior to commencing the offshore grouting operations. All tests shall be carried out at an approved certified testing laboratory.

The laboratory tests shall be performed with certified grout materials and clean sea water. The grouting materials shall be from the same source as those to be used for the offshore repair grouting. The mix water shall be kept at a constant temperature of 28^0C to simulate offshore conditions.

All strength tests shall be carried out in accordance with API Spec 10, Section 7. The 75 mm cube specimens shall be cured in a temperature controlled bath kept at a constant temperature of 28^0C.

The laboratory test results and reports for the design mix shall be forwarded to COMPANY for approval.

Specific Requirements

The CONTRACTOR shall perform in addition to the tests requested above:

- Pump ability tests shall be conducted for the grout slurry over a range of times up to the thickening time for the grout design mix;

- Grout thickening, initial and final setting times shall be determined and recorded for the grout design mix;
- Suitable adiabatic or semi-adiabatic tests shall be performed to determine the heat of hydration characteristics for each trial mix;
- Strength tests shall be conducted following final set, at 12 hours, 24 hours, 3 days, 7 days, 14 days and 28 days. A minimum of four cubes for each of these curing periods shall be taken excluding the 28-day period;
- A minimum of ten cubes shall be crushed at 28 days for each trial mix.
- For each mix, the mean and 28-day characteristic strength of the cubes shall be calculated in accordance with Lloyds Rules and Regulations for the Classification of Fixed Offshore Installations - Chapter 1 Section 6.6.6.
- All cubes shall be crushed at rate not exceeding 14 MPa/min.

A.5.6 Quality Assurance

The CONTRACTOR shall provide an experienced technician to supervise the offshore grouting operations and control the quality of grout. The technician shall also report on any conditions which could adversely affect the quality of grout and take grout samples as required by COMPANY.

A.5.7 Mixing and Pumping Procedure

The CONTRACTOR shall submit mixing and pumping procedures to COMPANY for approval prior to the commencement of grouting operations.

These procedures shall provide full details of the following:

- Responsibilities, control and communication during grouting operations;
- Grouting equipment specification;
- Method of grout mixing and pumping;
- Method of control of cement supply from 'P' tanks;
- Method of measuring mix materials to ensure mix complies with specification;
- Method of mix density measurement and calibration records/certificates;
- Method of chemical additive measurement and calibration records/certificates;
- Method of measurement of pumped volume and calibration records/certificates;

- Method of control and range of grout pump rates;
- Method of monitoring, recording and control of grout mixing and pumping;
- Contingency measures for equipment breakdown.

A.5.8 Grouting Materials

Cement shall be supplied offshore free from contamination or moisture damage. Test certificates for each batch of cement shall be supplied to COMPANY.

If blended cements are used, all blending shall be carried out at the cement manufacturer's factory. No cement blending operations will be permitted offshore.

Admixtures shall be supplied in suitable watertight containers complete with test certificates. Only admixtures previously approved by COMPANY shall be used.

COMPANY may request that random sampling and testing be carried out on the grouting materials stored offshore to check for compliance with the material codes.

Material certification and full traceability shall be provided for all grouting materials from the point of manufacture through to final placement at the offshore location.

A.5.9 Grout Mixing and Pumping

The CONTRACTOR shall supply suitable equipment to provide continuous monitoring and recording of grout slurry densities and flow rates. The density and flow rate real time data for each grouting operation shall be supplied to COMPANY.

Grout mixes falling out with the required minimum or maximum design mix density shall not be used.

The densities of the in situ annular grout shall be measured by nuclear densitometer. Grout shall be over-pumped until the required design density is achieved.

All grouting operations shall be monitored with the volumes of grout and pumping rates recorded. All grout monitoring equipment shall be calibrated prior to commencement of the pumping activities.

For all grouting operations, the maximum pump flow rate shall not exceed the recommended values determined from the infield pumping tests. At the commencement of pumping operations for the annular grouting, pumping shall initially be performed at a slower rate to avoid separation or 'splatter' of grout.

The CONTRACTOR shall provide a hard copy log for each grouting operation. The log shall contain as a minimum - densities, volumes and pumping rates and any other relevant information.

A.5.10 Grout Sampling and Testing Equipment

The CONTRACTOR shall provide a suitable portable laboratory offshore containing the following equipment to enable grout sampling and testing to be performed:

- calibrated cube crushing press
- 75 mm steel cube molds
- slurry density balances
- temperature controlled water bath
- nuclear densitometer
- calibrated water thermometers
- calipers

A.5.11 Sampling

During the grouting operations, sets of 75 mm cube specimens shall be taken. The grout shall be taken from the discharge line. Density measurements shall be recorded during the sampling of each set.

During placement, sets of cubes shall be taken at approximately 2.5 cubic metre intervals, or when instructed by COMPANY.

The above cube specimens shall be taken and tested in accordance with API Spec 10, Section 7. They shall be cured in a temperature controlled bath kept at a constant temperature of 28^0C. The bath temperature shall be recorded at 6 hour intervals.

All 3, 7, 14 and 28 days cube compressive strength tests shall be performed at an approved certified testing laboratory.

The mean strength of the cubes shall exceed the characteristic strength in accordance with Lloyds Register Rules and Regulations for Fixed Offshore Installation, Chapter 1/Section 6.6.6.

All cube compression test results as performed by the CONTRACTOR shall be supplied to COMPANY.

All test cubes shall be uniquely identified and traceable against final location of placed grout. The date, time taken and time of crushing shall also be recorded.

A.5.12 Equipment Calibration

General

All equipment used for testing and volumetric measurement purposes shall be properly calibrated prior to use.

Calibration records shall be submitted for COMPANY review prior to the commencement of grouting. Where practical, in-situ calibration tests should be performed offshore and shall be witnessed by COMPANY.

Densitometer

Prior to grouting operations commencing, the densitometers shall be calibrated in accordance with the manufacturer's procedures. During the trial mix offshore, the densitometers and the pressure balance shall be calibrated against each other as confirming the reliability of calibration procedures.

All results and measurements are to be duly documented and witnessed by COMPANY.

Pressure Balance

The pressure balance shall be checked for accuracy against a fluid of known specific gravity. The results of the calibration shall be duly documented and witnessed by COMPANY.

Mixing Units

During the mixing of the trial mix, the pumping rate, as indicated by the computer unit, shall be verified by timing the discharge of a known volume.

Cube Crushing Press

A properly calibrated cube crushing press shall be used for the determination of the grout compressive strength. A copy of the calibration certificate is to be available at the offshore worksite.

A.5.13 Material Traceability

API Class Cement

Full traceability records of all batches dispatched to the work site are to be kept. These records shall include material certificates, chemical analysis results, dispatch & transport dockets and quantities shipped. Transfer documents detailing vessel, name, date, tank number used shall be maintained.

Chemical Additives

Additives to improve pump-ability and anti-foaming characteristics of the grout slurry may be used as required by the relevant mix.

Full traceability records of all chemicals dispatched to the work site are to be kept. These records shall include material certificates, chemical analysis results, dispatch dockets and quantities shipped. Chemical data sheets are to be provided with all consignments of these chemicals.

Continuous records of injection rates for chemical additives shall be kept.

A.5.14 Storage

General

All storage locations shall be clean and free of residual cements which may contaminate the new batches. Storage locations shall be unambiguously marked and shall be dry and maybe subject to inspection by COMPANY.

Storage Aboard Installation Vessel

All cement storage aboard the installation vessel shall be located in 'P' tanks.

All onboard cements are to be removed from the 'P' tanks unless the cement is of the same type and supply source as will be used for the grouting operations. Acceptance of residual cements will only be approved if full documentation is available on the installation vessel and is at the discretion of COMPANY.

The CONTRACTOR shall prepare a detailed procedure for handling the cement which will be subject to the COMPANY's approval.

A.5.15 Documentation

The CONTRACTOR shall compile the following documentation packages for all supplied materials and the grouting operations as a whole and which shall form part of his MDR:

A.5.16 Material

- Cement material traceability records – refer Section A.5.13
- Chemical additives – if used – refer Section A.5.13

A.5.17 Measurement

Mixing and Pumping

The CONTRACTOR shall provide a detailed record of the mixing and pumping rates of his equipment during all grouting activities. These rates shall be recorded for every batch. The recording format will be subject to COMPANY's approval.

Grout Volumes

The CONTRACTOR shall provide a written procedure recording the volumes of grout pumped.

Calculations of volumes of grout to be pumped are to include theoretical volumes, / wastage/spillage and line/hose containment volumes. The CONTRACTOR shall allow for over-pumping to ensure full density of grout is placed during the initial pumping stages and also during the final topping up stages. All calculations and records for over-pumping allowances shall be fully recorded and documented.

Density Measurements

The densities of the grout shall be monitored and recorded both at the point of mixing and at the point of discharge. Densitometer reading to be continuously taken using the mixing unit densitometer.

In addition, random checks of the mixed grout shall be taken downstream of the / mixing unit using a pressure balance. A hard copy of all such checks is to be made.

All density measurements are to be taken and the results recorded on every batch of grout mixed.

Cube Samples

All cube samples are to be uniquely identified and a record of the following data maintained:

- Type of mix;
- Total volume pumped;
- Date and time of samples taken;
- Temperature of curing bath;
- Batch number;
- Density recorded for batch;
- Date and time of testing after appropriate curing period;
- Test results;

- Sketch of break profile.

Note: All tests crushing of cube samples shall be witnessed by COMPANY.

A.5.18 Daily Logs

The CONTRACTOR shall supply a daily log of all grout related matters throughout the period of the Work.

A.5.19 Mixing Pumping Records

The CONTRACTOR shall be responsible for the continuous monitoring and recording of the following parameters during all grouting operations:

- Date and time;
- Grout mix density;
- Grout in-situ density;
- Grout volume pumped;
- Grout pumping rate;
- Grout pump pressure;
- Volume of water used;
- Volume of cement used;
- Type and volume of chemical additive(s) used;
- Chemical additive concentration in mix water;
- Visual mix observations;
- Cement used from each P tank;
- Total chemical additive used.

Where electronic grouting records are maintained, these should be fully backed up by manual records. Simultaneous manual readings of the above parameters should be recorded at the regular intervals:

Suitable forms for recording the required information shall be developed by the CONTRACTOR and shall be submitted to COMPANY for approval prior to the commencement of grouting operations.

All records shall be signed by the Supervisor to be true and accurate recordings of the grouting operation.

A.5.20 Acceptance Criteria

For the overall grouting of the piles, the mean and 28-day characteristic strength of the cubes shall be calculated in accordance with Lloyds Rules and Regulations for the Classification of Fixed Offshore Installations - Chapter 1 Section 6.6.6. The mean strength shall be equal to or exceed 45 MPa.

A.5.21 Report

The CONTRACTOR shall provide a full report on all grouting operations at the completion of the grouting operations.

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PETROVIETNAM
PQPOC

PHU QUOC PETROLEUM OPERATING COMPANY

VIETNAM BLOCK B GAS PROJECT

PROVISION OF EPCI FOR CENTRAL PRODUCTION PLATFORM,
LIVING QUARTER PLATFORM AND FLARE TOWER

CONTRACT NO.: PQ-CTR-DEV-2022-005

DOCUMENT TITLE : SPECIFICATION FOR STRUCTURAL STEEL FOR FIXED OFFSHORE PLATFORM

PQPOC Approval	
Document return Code	**PQPOC Signature**
☐ Code 1 Reviewed and Accepted with no Comment ☒ Code 2 Reviewed/With Comment ☐ Code 3 Not Accepted/ Revise/Resubmit ☐ Code 4 Not Reviewed	Name : _____ Signature : _____ Date : _____

REV	DATE	DESCRIPTION	ORIG	CHK	APPR
N01	13-Jun-24	Issued for Use	PG	SP	JKH
L01	08-Feb-24	Issued for Approval	SP	SP	JKH
K01	22-Dec-23	Issued for Review	PG	SP	SS
J01	10-Nov-23	Issued for IDC	PG	SP	SS

PQPOC Document Control No.	Project Code	Area Code	Discipline Code	Document Type	Originator Code	Sequence Number	Sheet Number	Revision
	PQ	CPC0	STR	SPC	MPC	00003	00	N01

REVISION HISTORY

Rev. Date	Rev. No.	Detailed Description of Change	Ref. Section	Approved by
10-Nov-23	J01	Issued for IDC		
22-Dec-23	K01	Issued for Review		
08-Feb-24	L01	Issued for Approval COMPANY comments incorporated. This document has been updated from revision K01 of PQ-CPPT-STR-SPC-MPC-00003-00, due to changes in the document numbering structures. This revision shall supersede revision K01 of PQ-CPCO-STR-SPC-MPC-00003-00	As marked	
13-Jun-24	N01	Issued for Use COMPANY comments are incorporated	As marked	

TABLE OF CONTENTS

1 GENERAL

A Consortium of McDermott Asia Pacific Sdn. Bhd. (McDermott/MDR) and Petro Vietnam Technical Services (PTSC), hereafter referred to as CONTRACTOR has been awarded a Contract for Provision of Engineering, Procurement, Construction and Installation of Central Production Platform, Living Quarters Platform Flare Tower and Bridges by Phu Quoc Petroleum Operating Company (PQPOC), hereafter referred to as COMPANY.

This document contains Project's Specification for Structural Steel for Fixed Offshore Platform.

1.1 Purpose of The Document

This specification defines the minimum technical requirements for the manufacture and supply of structural steel materials. The material grade and categories are in section 5.0. The technical requirements are in section 6.0.

The SUPPLIER shall comply with the requirements of this specification unless otherwise instructed by the PURCHASER in writing.

1.2 Project Overview

Blocks B&48/95 and 52/97 are located offshore southwestern Vietnam in a water depth of about 77 meters. The distance from the Blocks B&48/95 and 52/97 to Ca Mau is about 250 kilometers and to O Mon Power Center, about 400 kilometers (Figure 1).

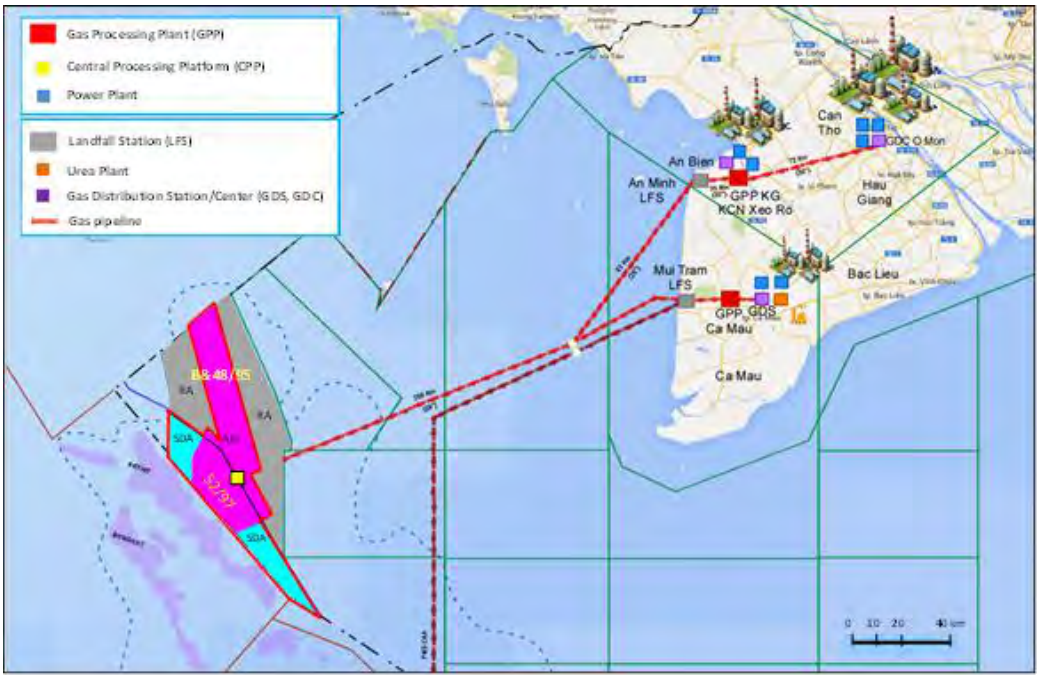

Figure 1 : Location of Block B 48/95 and 52/97

The Vietnam Block B Gas Project facilities comprise:

- Central Production Platform (“CPP”) with bridge linked flare structure.
- Living Quarters (“LQ”) Platform.
- Hub and Generic Wellhead Platforms (“WHP”).
- Trunk-lines and infield pipelines and
- Floating Storage and Offloading (FSO) system for condensate storage and export.

These facilities will be installed, and production and water injection wells drilled as needed to fulfil the contract gas sales requirements.

The asset will produce several thousand small reservoirs during field life. Consequently, there will be large variation in the gas composition values. The COMPANY plans to blend the producing reservoirs to meet the sales gas specification. A significant percentage of inert gas (mainly CO2) is expected, as well as traces of H2S, Arsenic, and Mercury.

The initial facilities will consist of four Hub / Wellhead Platforms, Trunk Lines, a Central Production Platform (CPP), a Living Quarter (LQ) Platform, Flare Platform, and an FSO. One Wellhead Platform will be bridge connected to the CPP. The three Hub Platforms act as gathering centers, receiving gas from other Wellhead Platforms, before routing the gas to the CPP.

All development wells are to be drilled and completed from remote Hubs or generic WHPs. The wells will be drilled by either jack-up or tender assisted rigs. The Wellhead / Hub Platforms will be designed to accommodate either type of rig. No permanent drilling facilities will be provided on the Wellhead / Hub Platforms.

Hub and generic Wellhead Platforms are designed with 20 wellslots. The produced fluid will be collected in the manifold at the Wellhead / Hub Platforms, then routed to the CPP via Trunk-lines / in-field gathering lines. Booster compressors will be installed on Wellhead / Hub Platforms to maintain production and maximize reserve recovery by connecting the compressor suction line to the low pressure wells with tubing head pressure 100-200 psig and routing the compressor discharge line to the production manifold which will the export well fluid to the infield pipeline. Hub platforms are designed to receive additional production via pipelines from connected WHPs and export via 20 inch trunk lines to the CPP. Generic WHPs export fluids via 16” infield pipelines to Hub Platforms. All remote WHPs in the initial development phase shall be of the Hub design.

At the CPP, all gas will be compressed and processed by dehydration, hydrocarbon dew-pointing and mercury removal to meet sales gas specification, then compressed and metered prior to export. Gas will be exported from the CPP to shore via a dedicated export pipeline to be developed and operated by PetroVietnam Gas. The facilities will be designed to deliver the DCQ of 490 MMscfd and Maximum Daily Contract Quantity (MDCQ) of 575 MMscfd, with additional WHPs installed, drilled and tied-in to the CPP to maintain the capacity for the agreed plateau duration.

Produced water will be treated and disposed of via injection wells. Condensate will be stabilized and sent to the FSO for storage and later shipment. Electrical power will be generated by gas turbine generators for platform operations. Control for all offshore operations will take place at the Central

Control Room (CCR) on the CPP. The manning requirement for the CPP and other facilities will be accommodated in an LQ platform, bridge linked to the CPP.

The preliminary field layout for the First Gas (Phase 1A) is shown in Figure 2.

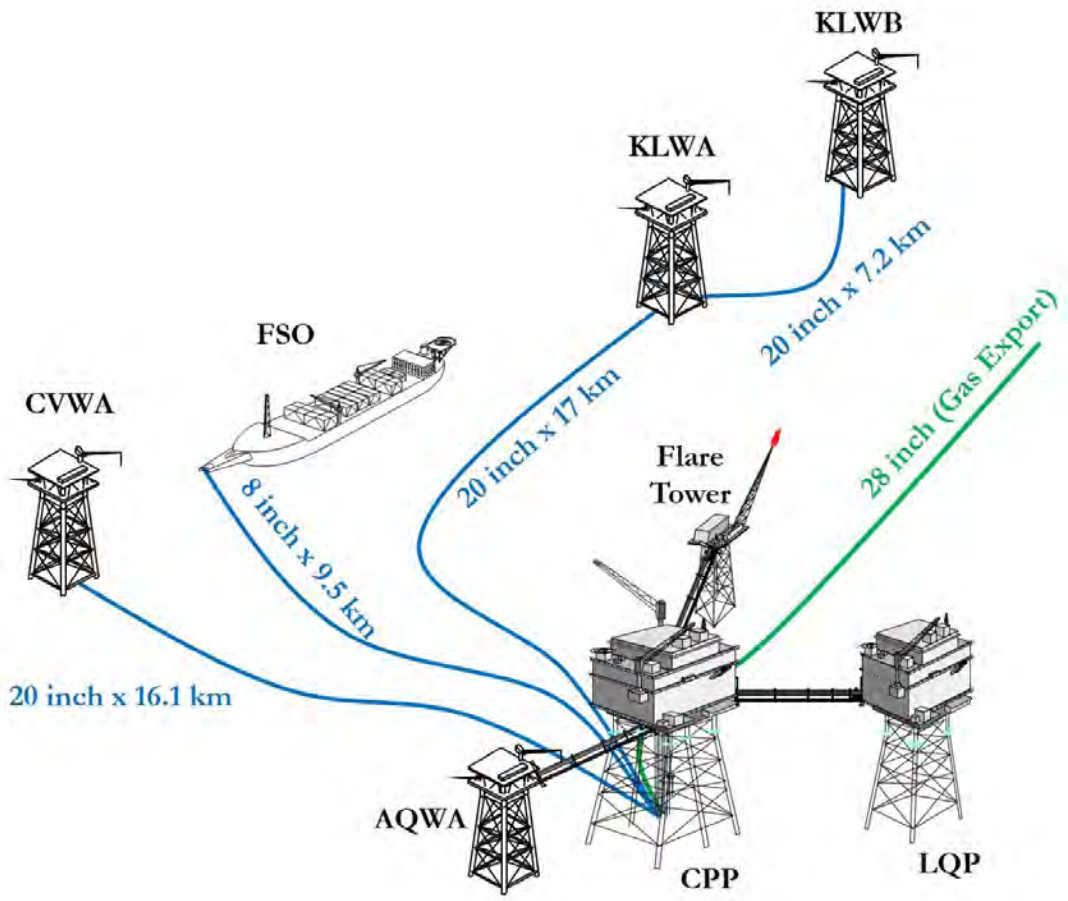

Figure 2: Preliminary field layout for First Gas (Phase 1A)

1.3 EPCI #1 Project Scope Summary

CONTRACTOR scope of the Work under the Contract shall consist of Management and Administration, Engineering, Procurement, Fabrication, including Onshore Pre-Commissioning, Sea fastening and Loadout, Transportation, Installation, Offshore Hook-Up and Commissioning works for the CPP, the LQ and Flare as detailed below:

- One CPP Jacket/piles/topsides
- One Flare Jacket/piles/flare
- One LQP Jacket/piles/LQUP topside
- Bridges connecting CPP to Flare, LQUP and Wellhead Platform AQWA
- One SSIV Skid and Umbilical (Excluding Transportation and Installation)

2 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

2.1 Definitions

Table 2-1 : Definitions

Definitions	Description
COMPANY	Shall mean Phu Quoc Petroleum Operating Company
CONTRACTOR (MPC)	Shall mean The Consortium of McDermott Asia Pacific Sdn. Bhd. ("McDermott") and PetroVietnam Technical Services Corporation ("PTSC")
WORK	Shall mean work or services being conducted by the CONTRACTOR including its SUBCONTRACTOR for delivery of Engineering, Procurement, Construction & Installation (EPCI) of CPP, LQ Platform and Flare Tower of Vietnam Block B Gas Project ("EPCI #1")
PURCHASER	Shall mean the CONTRACTOR issuing the purchase order
VENDOR / SUPPLIER	Shall mean the party awarded by CONTRACTOR for the supply of scope of work
SUBCONTRACTOR	Shall mean the party awarded by CONTRACTOR for the supply of scope of work in term of services
Independent Verification Service (IVS)	Shall mean the Independent Agency contracted by COMPANY to provide Verification/ Certification serviced to PQPOC Field Development Project's Facilities from design review to construction & commissioning (startup) in accordance with rule & Regulations, applicable Codes & Standards, and Vietnam Register (VR) Regulations.
Third Party	Shall mean certifying Authority appointed by VENDOR for certifying Specific equipment/equipment packages fabricated at VENDOR's scope.

2.2 Acronyms

Table 2-2 : Acronyms

Acronym	Description
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
BSI	British Standards Institute

Acronym	Description
CE	Carbon Equivalent
CTOD	Crack Tip Opening Displacement
EEMUA	Engineering Equipment & Materials Users Association
EPCI	Engineering, Procurement, Construction and Installation
FEED	Front End Engineering and Design
HSES	Health, Safety, Environment and Security
MTO	Material Take Off
MWS	Marine Warranty Surveyor
OD	Outside Diameter
PEP	Project Execution Plan
PQPOC	Phu Quoc Petroleum Operating Company
PTSC	Petrovietnam Technical Services Corporation
QA / QC	Quality Assurance / Quality Control
QMS	Quality Management System
TMCP	Thermo Mechanical Control Process
WPS	Weld Procedure Specification

2.3 Abbreviations

Table 2-3 : Abbreviations

Abbreviations	Description
Doc	Document
No	Number
Rev	Revision

2.4 Language

All documentation and communication shall be in the English language.

3 DOCUMENT REFERENCE

3.1 Project Specifications

The following Project / COMPANY specifications are also a part of this specification to the extent referenced herein.

This specification shall be read in conjunction with the following project specifications, either in full or as defined in this specification.

Table 3-1 : Project Specifications

No.	Doc. No	Document Title	Rev. No.
1)	PQ-CPC0-STR-SPC-MPC-00002-00	Specification of Fabrication of Platform Structures for Fixed Offshore Platforms	N01
2)	PQ-CPC0-QAC-SPC-MPC-00001-00	Quality Specification for Subcontractors and Suppliers	L01
3)	PQ-CPC0-CRR-SPC-MPC-50001-00	Specification for Protective Coatings	L01
4)	PQ-GENR-TEC-REG-PQC-00001-00	ITT-Addendum to Technical Documents	H01

3.2 Codes and Standards

The following listed Codes, Recommended Practices, Specifications and Standards are referenced as part of this specification. The latest revisions and amendments of these documents, as of the Contract document date, are applicable unless otherwise noted herein.

Table 3-2 : Codes and Standards

No.	Doc No.	Document Title	Year/Edition
1)	EEMUA 158	Construction Specifications for Fixed Offshore Platforms	3rd Edition, 2014
2)	API RP2A	Planning, Designing and Constructing Fixed Offshore Platforms, Working Stress Design	22nd Edition; Nov.2014, Reaffirmed Sep 2020
3)	API RP2Z	Recommended Practice for Preproduction Qualification for Steel Plates for Offshore Structures	4th Edition, September 2005
4)	API RP2X	Recommended Practice for Ultrasonic Examination of Offshore Structural Fabrication and Guidelines for Qualification of Ultrasonic Technicians	2004 Edition, April 2004

No.	Doc No.	Document Title	Year/Edition
5)	API Specification 2H	Carbon Manganese Steel Plate for Offshore Platform Tubular Joints	9th Edition, July 2006
6)	API Specification 2MT1	Specification for Carbon Manganese Steel Plate with Improved Toughness for Offshore Structures	2nd Edition, September 2001
7)	API Specification 2MT2	Rolled Shapes with Improved Notch Toughness	1st Edition, June 2022
8)	API Specification 2W	Specification for Steel Plate for Offshore Structures Produced by Thermo-Mechanical Control Processing Method	6th Edition, Jan 2019
9)	API Specification 2Y	Specification for Steel Plate, Quenched-and-Tempered for Offshore Structures	5th Edition, December 2006
10)	API Specification 5L	Specification for Line Pipe	46th Edition, April 2018
11)	API Specification 2B	Specification for the Fabrication of Structural Steel Pipe	6th Edition, March 2021
12)	ASTM A6/A6M	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling	2023 Edition, November 1, 2023
13)	ASTM A36/A36M	Standard Specification for Carbon Structural Steel	2019 Edition, July 1, 2019
14)	ASTM A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless	2022 Edition, July 1, 2022
15)	ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes	Revision 03A, September 10, 2003
16)	ASTM A106	Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service	Revision 02A, December 10, 2002
17)	ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products	2017 Edition, September 1, 2017
18)	ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware	2023 Edition, April 1, 2023
19)	ASTM A193/A193M	Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High-Pressure Service or Other Special Purpose Applications	2023 Edition, March 1, 2023

No.	Doc No.	Document Title	Year/Edition
20)	ASTM A194/A194M	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service, or Both	2023 Edition, May 1, 2023
21)	ASTM A307	Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod – 60000 PSI Tensile Strength	2021 Edition, February 15, 2021
22)	ASTM A320	Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service	Revision 22A, November 1, 2022
23)	ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products	2023 Edition, September 15, 2023
24)	ASTM F3125/F3125M	Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength	2023 Edition, November 1, 2023
25)	ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts	2023 Edition, December 1, 2023
26)	ASTM A572	Standard Specification for High Strength Low-Alloy Columbium- Vanadium Structural Steel	2021 Edition, May 15, 2021
27)	ASTM A709/A709M	Standard Specification for Structural Steel for Bridges	2021 Edition, November 1, 2021
28)	ASTM A992/A992M	Standard Specification for Structural Steel Shapes	2022 Edition, September 1, 2022
29)	ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus	2019 Edition, November 1, 2019
30)	ASTM F436	Standard Specification for Hardened Steel Washers	2019 Edition, December 1, 2019
31)	ASTM F3125	Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength	2023 Edition, November 1, 2023

No.	Doc No.	Document Title	Year/Edition
32)	ASME B1.1	Unified Inch Screw Threads (UN & UNR Thread Form)	2019 Edition, 2019
33)	ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts	2022 Edition, March 11, 2022
34)	ASME B18.21.1	Washers: Helical Spring-Lock, Tooth lock, and Plain Washers	9th Edition, 2016
35)	AWS D1.1	Structural Welding Code - Steel	Errata March 2000
36)	BS 7448-3	Fracture Mechanics Toughness Tests Part 1: Methods for Determination of KIC' critical CTOD and critical J values of Metallic Materials	2005 Edition, March 23, 2005
37)	BS EN 10204	Metallic products-Types of Inspection Documents	2004 Edition, 25 October 2004

4 ORDER OF PRECEDENCE

Where equal but conflicting requirements are specified, these shall be brought to the attention of the PURCHASER in writing. The order of precedence shall be:

1. Convention followed by Vietnam (MARPOL, SOLAS)
2. Applicable Regulation of Vietnam
3. Purchase Order/Service Order/Subcontract Agreement
4. Technical Requirements (Project Drawings and Data Sheets, Project Specifications, etc.)
5. International Codes and Standards

5 MATERIAL GRADES

Table 5-1 : Steel Grades and Types

Steel Type	General description	Typical uses	Material grade
I	PRIMARY HIGH STRENGTH WITH THROUGH THICKNESS PROPERTIES	JACKET AND DECK LEG CANS, BRACE JOINT CANS, CRANE PEDESTALS, LIFTING PADEYES AND MAIN CHECK PLATES, PLATE GIRDERS AND MAJOR BEAM INTERSECTIONS	API 2W, GR 50 SUPPLEMENTS SR1, SR3, SR4, SR5, SR6, SR9 API 2H, GR 50 SUPPLEMENTS S-1, S-3, S-4, S-5, S-8, S11 API 2Y, GR 50 SUPPLEMENTS S-1, S-3, S-4, S-5, S-8, S-11 (KT = -40°C + CTOD = -10°C)
I-X	PRIMARY HIGH STRENGTH WITH THROUGH THICKNESS PROPERTIES	JACKET AND DECK LEG CANS, BRACE JOINT CANS, CRANE PEDESTALS, LIFTING PADEYES AND MAIN CHECK PLATES, PLATE GIRDERS AND MAJOR BEAM INTERSECTIONS	API 2W, GR 60 SUPPLEMENTS SR1, SR3, SR4, SR5, SR6, SR9 API 2Y, GR 60 SUPPLEMENTS S-1, S-3, S-4, S-5, S-8, S-11 (KT = -40°C + CTOD = -10°C)
II	PRIMARY HIGH STRENGTH	PLATES, ROLLED TUBULARS SHAPES SEAMLESS TUBULARS Ø406 (16") & BELOW	API 2W, GR 50 SUPPLEMENTS SR6, SR9 API 2H, GR 50 SUPPLEMENTS S-8, S-11 API 2MT1, GR 50 SUPPLEMENTS S-8, S-11 (KT = -40°C + CTOD = -10°C) API 2MT2 CLASS A SUPPLEMENTS S-8, S-77 ASTM A709, GR 50T3 API 5L GR X-52 PSL 2 (KT = -40°C)
II-X	PRIMARY HIGH STRENGTH	PLATES, ROLLED TUBULARS	API 2W, GR 60 SUPPLEMENTS SR1, SR3, SR5, SR6, SR9 (KT = -40°C + CTOD = -10°C)

Steel Type	General description	Typical uses	Material grade
III	HIGH STRENGTH	PLATES, SHAPES SHAPES SEAMLESS TUBULARS Ø406 (16") & BELOW	ASTM A 572 GR 50 SUPPLEMENTS S-5, S-28, S-31 (CE≤0.43), KILLED, FINE GRAINED t>19 mm TO BE NORMALIZED (KT=-10°C) ASTM A992 (FINE GRAIN PRACTICE) API 2MT2 CLASS C API 5L GR X52 (PIPE, FINE GRAINED PRACTICE, PSL 1 FOR t≤13 mm, PSL 2 FOR t>13 mm)
IV	SECONDARY MILD STEEL	PLATES, SHAPES, ROLLED TUBULARS	ASTM A36
V	SECONDARY MILD STEEL	SEAMLESS TUBULARS Ø406 (16") & BELOW	API 5L GR B ASTM A53 GR B ASTM A106 GR B ASTM A500 GR B

KT indicates temperature at which Charpy V-notch impact testing in transverse direction is required.

- Types I, I-X, II and II-X shall exhibit minimum energy 30 Joules or as required by the material specification, whichever is higher.
- Types III, IV and V shall exhibit minimum energy 20 Joules or as required by the material specification, whichever is higher.

Rolled tubulars shall have a minimum D/t ratio of 20. The notch toughness test run at reduced temperature as specified in API RP 2A WSD, section 11.2.3 and Table 11.4; or test temperature as specified in this document, whichever is more stringent shall be complied.

CTOD indicates temperature at which CTOD testing is required. Type I, Type I-X, Type II and Type II-X require successful CTOD testing for material greater than or equal to 63.5mm thick, including any repair procedure.

6 REQUIREMENTS

6.1 General

All structural steel shall meet the requirements of ASTM A6/A6M and any additional requirements of the appropriate API or ASTM standard specified in Section 5 along with the relevant additional or specific test requirements as stated in this specification for each steel type. Prior to the commencement of production, the SUPPLIER shall provide a detailed summary of the process to be used for the production of all steel to this specification. As a minimum the following detailed information shall be submitted with the Tender:

a) Location and name of steel mill

b) Recent production data to support that the values proposed for ladle and product analysis are achievable

c) Steel manufacturing procedures

d) Segregation procedures for continuously cast steel

e) Control of sequential casting (for continuous casting)

f) Ingot or slab size including plate thickness ranges for each size

g) Details of Sulphur printing or alternative method of quality grading and frequency of checks for continuous casting

h) Rolling procedures

i) Dehydrogenation procedures

j) Normalization or alternative procedures

k) Recent production data to demonstrate that Charpy V-notch impact values specified herein are achievable

l) Information on the effect of extended times at stress relieving temperatures on tensile and Charpy V-notch impact properties

m) Details of the quality control procedures to be implemented during production which should clearly identify all inspection points

n) Details of proposed chemical analysis control

o) Weldability information including mechanical testing results (macro hardness, Charpy V-Notch, CTOD, cross weld tensile)

For fabricated sections and welded tubulars all Weld Procedure Specifications (WPS) shall be submitted to the PURCHASER for review and agreement prior to the commencement of the work. Requalification of welding procedures shall be required for fabrication of primary items unless otherwise agreed with the PURCHASER.

Welded tubulars and fabricated sections furnished to this specification shall comply with EEMUA 158.

All steel shall have a maximum carbon equivalent (CE) value as follows:

Type	Thickness	Max CE
I & II	up to 40mm	0.39
	40mm – 75mm	0.41
	> 75mm	0.43
IV & V	up to 40mm	0.39
III	up to 40mm	0.43
I-X & II-X	up to 40mm	0.42
	> 40mm	0.45

All steel shall be new and shall be free from defects impairing strength, durability or appearance and of the best commercial quality for the purpose specified.

Reject steel is not acceptable.

6.2 Fabricated Sections

Fabricated sections of Type I, Type I-X, Type-II, and Type II-X shall be in accordance with the requirements of EEMUA 158. These shall not be weld repaired.

6.3 Tubulars

6.3.1. Seamless Tubulars

Tubulars equal to and smaller than 406mm OD shall be seamless and manufactured in accordance with API 5L. For secondary mild steel tubulars, these shall be manufactured in accordance to ASTM A53, ASTM A106 or ASTM A500, whichever is applicable.

6.3.2. Welded Tubulars

Pipe larger than 406mm OD shall be fabricated per structural fabrication specification document no PQ-CPC0-STR-SPC-MPC-00002, using plate meeting the requirements of this specification. Longitudinal weld seams shall use appropriately qualified, and PURCHASER approved welding procedures.

Structural pipe shall be seamless or longitudinally submerged arc welded (SAW). All welding and weld procedure qualification shall be carried out in accordance with EEMUA 158.

Hydrostatic testing of structural pipe is not required.

Fabricated structural pipe shall not have more than one (1) longitudinal seam except where diameter precludes. Weld seam locations for large diameter pipe shall be subject to PURCHASER approval.

Pipe may be hot formed or cold formed. For the purposes of this specification, the definition of hot forming is when the material is deformed by line heating or external force while at a surface temperature greater than 425ºC.

When material is supplied through the TMCP route, heating shall not exceed 595ºC or any lower temperature advised by the SUPPLIER.

6.3.3. Cold Forming

1. If cold (≤200°C) forming strain exceeds 3%, a cold forming procedure qualification must receive written approval from the PURCHASER before forming proceeds.
2. The PURCHASER acceptance criteria for the procedure qualification requires the as-formed plate to satisfy all mechanical tests specified in API or ASTM specifications and any optional specifications contained herein.
3. Cold forming strain shall be calculated by the following formula:

$$E = \frac{t}{(OD-t)} \times 100$$

Where:

E	=	cold forming strain in percent
t	=	plate thickness
OD	=	outside diameter of member

6.3.4. Hot Forming

1. Prior to hot forming, the SUPPLIER shall submit to the PURCHASER for approval, a written hot forming procedure and written approval from the steel / welded tubular manufacturer of the procedure.
2. The PURCHASER acceptance criteria for the procedure requires the as formed plate to satisfy all mechanical tests specified in the relevant API and ASTM specifications and any optional or supplemental specifications contained herein.
3. Plate steel shall not be heated between the upper and lower critical temperatures and forming in the range between 250°C and 425°C shall not be done.
4. If the forming temperature exceeds 650°C for as rolled or normalized steels, or 595°C for TMCP steels, or falls within 25°C less than the tempering temperature for quenched and tempered steels mechanical property, tests shall be run to ensure that the mechanical properties of the steel conform to the relevant API or ASTM specifications. If the results are satisfactory, no further tests shall be required, unless the forming temperature is increased. Test results failing to meet the specification requirements shall be cause for rejection of the entire heat.

6.3.5. Jacket and Deck Node Cans

All primary nodes in the jackets and decks shall be minimum of Type I.

6.4 Storage

CONTRACTOR shall be responsible for the handling, storage, warehousing and protection of all materials.

Structural materials, whether plain or fabricated, shall be stored above ground, protected from the weather, on either flat surfaces or platform type skids or on other COMPANY approved supports.

Materials shall be kept free of dirt, grease, paint spray, or other foreign matter and shall be protected from corrosion. Protection of the structural steel during fabrication shall be capable to retain its physical configuration, strength and workability characteristics.

6.5 Chemical Composition

The acceptable limits of the chemical composition shall be revised to the following requirements:

Table 6-1 : Chemical Composition

Material grade	S	P	Al
Type III, Type IV, Type V	0.015 max	0.025 max	0.015/0.055
Type II, Type II-X	-	-	0.015/0.055
Type I, Type I-X	0.005 max	0.015 max	0.015/0.055

The maximum permissible nitrogen content for rolled sections and seamless tubular shall not exceed 0.010%.

6.6 Weldability

This clause applies to steel types I, I-X, II and II-X.

At the time of the Tender, the SUPPLIER shall submit weldability data of the material offered. In the absence of such data, the SUPPLIER shall advise his proposed methods and schedule for producing the required information.

This data shall include CTOD data for the offered steel plate that has been obtained in accordance with the requirements of API RP2Z.

6.7 Steel Plates and Rolled Shapes

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 an acceptable surface for painting.

Plate edges shall be even, smooth and free of laminations. Edge shearing of plates of 25mm (1") thickness or greater is not permitted.

6.8 Mechanical Testing

SUPPLIER shall provide historical testing data with their Tender documents to demonstrate that their steel is capable of meeting the requirements of this specification. Testing shall generally be in accordance with the requirements of the API or ASTM specification.

6.8.1. Tensile Testing

Tensile tests are required for all steel types.

6.8.2. Strain Aged Impact Testing

Strain aged impact testing is required for Types I, I-X, II and II-X steel in accordance with supplement SR6 of API 2W or S8 of API 2H and API 2Y, whichever is applicable.

6.8.3. Through Thickness Tensile Testing

Through thickness tensile testing shall be in accordance with supplement SR4 of API 2W or S4 of API 2H and API 2Y, whichever is applicable. The test samples shall represent the maximum thickness being produced.

6.8.4. CTOD Testing

Where required CTOD testing for weld procedure qualification shall be in accordance with Supplement SR9 of API 2W or S11 of API 2Y and EEMUA 158, with the recommended acceptance values met.

6.8.5. Hot Forming Procedure

The manufacturer shall supply the information indicated in clause 3.3 to confirm the suitability of the material for the hot forming.

6.9 Dimensional Tolerances

6.9.1. Plates and Structural Shapes

Tolerances for plates and structural shapes shall comply with ASTM A6.

6.9.2. Welded Tubulars

Tolerances for Type I, Type I-X, Type II and Type II-X welded tubulars shall be as per EEMUA 158.

6.9.3. Seamless Tubulars

Tolerances for seamless tubulars shall be as per API 5L. For secondary mild steel tubulars, these shall be manufactured in accordance to ASTM A53, ASTM A106 or ASTM A500, whichever is applicable.

7 INSPECTION AND TESTING

7.1 General

SUPPLIER shall perform inspection and tests as specified in this specification and/or referenced codes, standards and specifications.

Material certification and traceability shall be in accordance with EN 10204 as follows:

- Type 3.2. for Material Type I, I-X, II, II-X and III
- Type 3.1. for Material Type IV & V

Once certified, by an acceptable certification authority, copy of mill certificates covering the chemical, physical, Charpy V-notch properties and the heat treatment data (as applicable) of all steel shall be provided upon delivery of the material. All testing shall be done on the finished product, in accordance with the relevant specification.

Certified Mill Certificates shall include the following where applicable:

- Purchase order number and item number.
- Material size and Specification.
- Melting Practice.
- Mill heat numbers and control numbers.
- Ladle analysis and check chemical analysis, together with calculated Carbon equivalents.
- Heat treatment.
- Grain size.
- Tensile and Yield strengths and elongation.
- Impact testing specimen size, orientation, impact values and test temperature (when required).
- CTOD test report.
- Other information required by referenced specifications.
- Supplemental information relating to the manufacturing process.

Where welding has been performed, non destructive examination (NDE) certificates shall also be provided.

All steel surfaces shall be subject to 100 % visual inspection.

The material to be furnished under this specification shall be subject to the inspection requirements of the relevant referenced Specification.

PURCHASER shall be permitted access at all times to any part of the manufacturing process and shall reject any steel that does not comply with this Specification.

7.2 Internal Soundness

The internal soundness for all plates and sections shall be verified by ultrasonic testing in accordance with the requirements of the API RP2X or ASTM specification.

Plates and sections shall be sound and free from cold laps or other surface defects and from internal defects such as segregation, cracks and laminations.

7.3 Merchant Supply

If any secondary steel is supplied from a merchant's stock, the SUPPLIER shall be responsible for the following.

1. Supplying to the PURCHASER a copy of the original order requirements placed on the mill and the subsequent sales history of the product.
2. Supplying to the PURCHASER all documentation required by this specification including an original copy of the mill certificate or a copy verified by the certification authority.
3. Satisfying the PURCHASER by means of numbers or identification marks on the steel that such steel has been tested and complies with this specification.

7.4 Identification and Marking

Identification and markings on materials shall include the name of the producer, the steel type and grade, heat number, and the plate number. For identification and marking of materials ASTM A6 shall apply.

All steel shall be marked by die stamping and painting in accordance with the relevant specification. For painting, this shall comply to specification for protective coating, PQ-CPC0-CRR-SPC-MPC-50001-00.

It shall always be possible to match structural steel material by heat number with its certified mill test reports.

Additional paint marking of structural steel shall be as indicated below:

A) Fabricated Tubular:

1. Stencil marking shall be made on the inside surface of both ends of tubulars with white paint in black painted background in letters minimum of 35mm high.

Example:

PQPOC
P.O. NO.
ITEM NO.
MADE IN
API monogram

Year. Month
API-2B/2W-50Z
OD x WT
LENGTH xxxxx
HEAT NO./CAST NO./PLATE NO. x-xxxx
PCS NO. xxxxx (Pipe Identification No.).

2. A protective coating of clear varnish shall be applied only on the stenciled area.
3. One color band shall be made at both ends of outside surface as follows:

Type I	Red
Type I-X	Purple
Type II	Dark Blue
Type II-X	Light Blue
Type III	Yellow
Type IV	Black
Type V	Green

B) Seamless Tubulars

Marking

[ ]	Method	Longitudinal paint stencil
[ ]	Location	Paint stencil on the outside surface starting at a point between 460mm and 760mm from the end of the pipe
[*]	Marking items	Marking items shall be in accordance with API requirements mill's standard.

[ ] [Manufacturer's Name or Mark]
[ ] [Outside diameter], [Wall thickness],
[ ] [Grade], [Product Specification Level], i.e. "PSL 2"
[ ] [Process of manufacture] i.e., "S"
[ ] [Heat treatment]
[ ] [SR4]
[*] SR5B-4IJ-M20C
[*] [Unique Pipe No.]
[*] [Mill's work number]

Coating

[*] Mill's standard varnish shall not be coated on the surface of the pipe except marking portion.

C) Plate

Marking

Stencil Marking

Stencil marking shall meet the requirements of API 2W (including API monogram stencil marking).

Stencil markings shall be clearly visible, in dot letter, minimum height: 35mm x width: 23mm.

Die-Stamp Marking

Die-stamp shall be made at one end of the plate approximately 75 mm from any edges and including following items. Normal die-stamp is used.

- Mill brand
- Specification
- Heat No.
- Plate No.
- "Z" (if S-4 is required) or "LS Z" (if S-4 & S-5 are required)

D) Structural Shapes

Identification and Marking

Die stamping of Heat No.: No Die Stamping is applied.

Colour band shall be applied at each end of the plate by material Type as per section (A) above.

Shipping Label and Mill Label (shapes)

Shipping label or Mill label shall be attached on one end of web for each shape as per mill's standard.

Name of buyer
Name of manufacturer
Name of project
Material size and grade
P.O. Number / Item Number
Destination

Mill label shall be attached on one end of web for each shape as per Mill's standard.

7.5 Packing

Tubulars shall be packed as follows:

[*] Bundling

OD ≤ 182 mm	Bundled
OD ≥ 185 mm	Loose

[*] Bevel protection

Mill's standard bevel protector shall be provided for each pipe end.

Fabricated tubulars up to 1250mm diameter shall not be stacked more than three high and larger diameters shall not be stacked. All tubulars shall be securely stowed when being shipped so as not to cause damage during transport.

Structural shapes shall be packed "Bare in loose", but small size shapes shall be fastened with steel wire.

8 MISCELLANEOUS STEEL

8.1 Grating

Steel grating and stair treads shall be 38mm by 5mm or 25mm by serrated grating with bearing bars at 30mm on centres and crossbars at 100mm on centres. Prefabricated stair treads may not be substituted without prior written approval by COMPANY.

Steel grating shall be heavy-duty galvanized (minimum 0.705 kg/m^2 of zinc coat) in accordance to ASTM A123. Galvanizing shall be done after completion of all fabrication and welding. All mill coatings scale and paint shall be sandblasted from the surfaces of all items prior to galvanizing. All excess galvanizing shall be removed. Cold galvanizing repair and touch up on local areas due to modifications or penetrations is permissible with COMPANY approval. The final dry coating shall be at least 95% zinc.

Steel grating treads and the edge of landings at the top of stairs shall be fitting with a non-skid, cast abrasive nosing or approved equivalent.

Gratings shall be fastened to structural members using grating stainless-steel clips or welded using approved WPS.

8.2 Threaded Fasteners

All bolts, nuts and washers shall conform to project specification PQ1-00-STR-SPC-TAP-00003 ‘Specification for design of fixed offshore platforms’.

All bolts, studs and nuts shall be heavy hexagon pattern.

Threads shall be coarse thread series conforming to ASME B1.1.

Bolts, studs, and washers for 12.7mm and smaller shall be Type 316 stainless steel (ASTM A320/320M, Grade B8M).

Bolts, studs, and washers larger than 12.7mm shall conform to ASTM F3125/F3125M and shall be hot spun galvanized in accordance to ASTM A153/A153M.

Heat treated bolts shall comply with specification ASTM A490/A490M.

8.3 Manufactured Items

Manufactured items such as cleats, shackles, wire ropes, thimbles, turnbuckles, chains, tie wire, etc.. shall be galvanized in accordance with SUPPLIER’s standard.

9 QUALITY MANAGEMENT

Technical conformance shall be assured through the implementation of a quality management program meeting the requirements of Quality Specification for SUBCONTRACTORs and SUPPLIERs, PQ-CPC0-QAC-SPC-MPC-00001-00.

Vietnam Block B Gas Project

Specification for Control and Reporting of Non-conformances and Non-conforming Products

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H01	28 JUNE 2017	IFU	PB	GN	CHH	
F01	20 JUNE 2017	IFA	PB	GN	CHH	
E01	02 JUNE 2017	IFR	PB	GN	CHH	
D01	31 MAY 2017	IDC	PB	GN	CHH	
REV	**DATE**	**DESCRIPTION**	**ORIG**	**CHK**	**APPR**	**APPR BY COMPANY**

PQPOC Document Control No.	Area Type	Area Identifier	Discipline	Doc. Type	Originator	Sequence No.	Revision
	PQ1	00	QAC	SPC	TAP	00002	H01

Attachments		
Item No.	Description	Document No.

Table of Contents

1 INTRODUCTION

1.1 Project Overview

Blocks B&48/95 and 52/97 are located in Southwestern Offshore Vietnam with sea water depth of about 77 meters. The distance from the Blocks B&48/95 and 52/97 to Ca Mau is about 250 kilometers and to O Mon Power Center, about 400 kilometers (Figure 1-1).

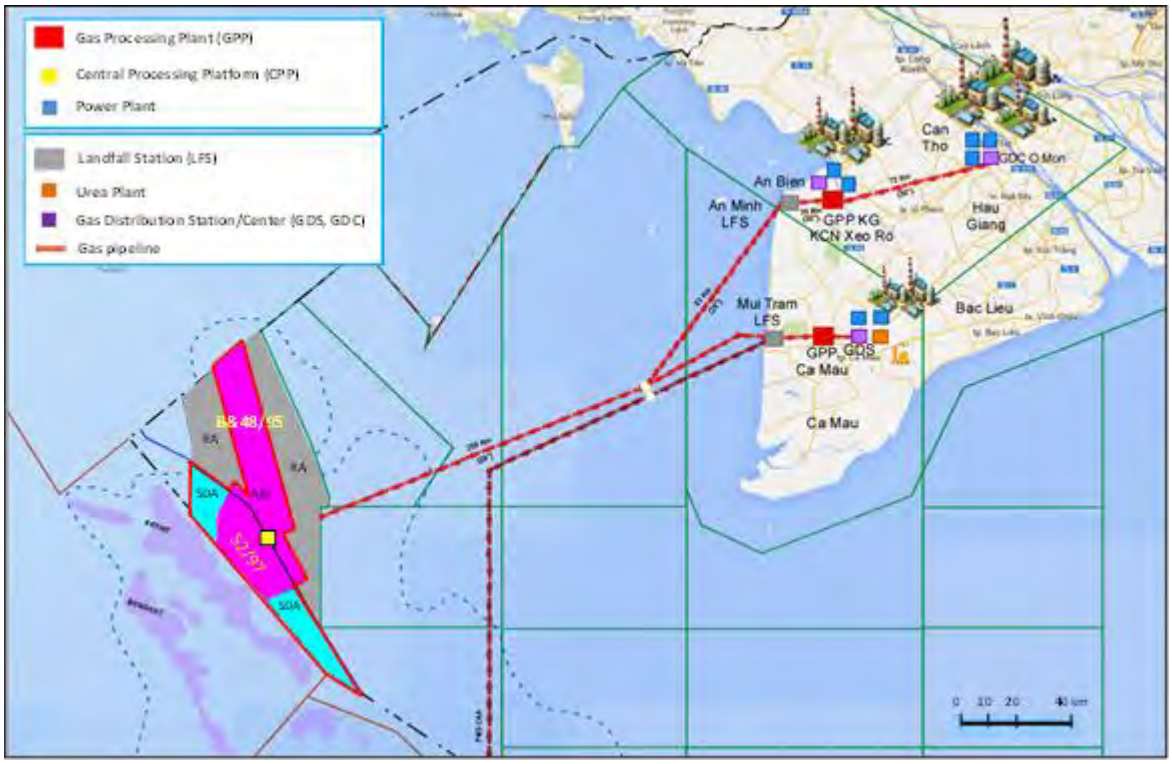


Figure 1-1 Location of Blocks B 48/95 and 52/97

The Vietnam Block B Gas Project facilities comprise:

- Central Processing Platform (CPP) with bridge linked flare structure;
- Living Quarters (LQ) Platform;
- Hub and Generic Wellhead Platforms;
- Trunk-lines and infield pipelines; and
- Floating Storage and Offloading (FSO) system for condensate storage and export.

These facilities will be installed and production and water injection wells drilled as needed to fulfill the contract gas sales requirements.

The asset will produce several thousand small reservoirs during field life. Consequently, there will be large variation in the gas composition values. The COMPANY plans to blend the producing reservoirs to meet the sales gas specification. A significant percentage of inert gas (mainly CO_2) is expected, as well as traces of H_2S, Arsenic, and Mercury.

The initial facilities will consist of four Hub / Wellhead Platforms, Trunk Lines, a Central Processing Platform (CPP), a Living Quarter (LQ) Platform, Flare Platform, and an FSO. One Wellhead Platform will be bridge connected to the CPP. The three Hub Platforms act as gathering centers, receiving gas from other Wellhead Platforms, before routing the gas to the CPP.

All development wells are to be drilled and completed from remote Hubs or generic WHPs. The wells will be drilled by either jack-up or tender assisted rigs. The Wellhead / Hub Platforms will be designed to accommodate either type of rig. No permanent drilling facilities will be provided on the Wellhead / Hub Platforms.

Hub and generic Wellhead Platforms are designed with 20 wellslots. The produced fluid will be collected in the manifold at the Wellhead / Hub Platforms, then routed to the CPP via Trunk-lines / in-field gathering lines. Booster compressors will be installed on Wellhead / Hub Platforms to maintain production and maximize reserve recovery by connecting the compressor suction line to the low pressure wells with tubing head pressure 100-200 psig and routing the compressor discharge line to the production manifold which will the export well fluid to the infield pipeline. Hub platforms are designed to receive additional production via pipelines from connected WHPs and export via 20 inch trunk lines to the CPP. Generic WHPs export fluids via 16” infield pipelines to Hub Platforms. All remote WHPs in the initial development phase shall be of the Hub design.

At the CPP, all gas will be compressed and processed by dehydration, hydrocarbon dew-pointing and mercury removal to meet sales gas specification, then compressed and metered prior to export. Gas will be exported from the CPP to shore via a dedicated export pipeline to be developed and operated by PetroVietnam Gas. The facilities will be designed to deliver the DCQ of 490 MMscfd and Maximum Daily Contract Quantity (MDCQ) of 575 MMscfd, with additional WHPs installed, drilled and tied-in to the CPP to maintain the capacity for the agreed plateau duration.

Any produced water will be treated and disposed of via injection wells. Condensate will be stabilized and sent to the FSO for storage for later shipment. Electrical power will be generated by gas turbine generators for platform operations. Control for all offshore operations will take place at the Central Control Room (CCR) on the CPP. The manning requirement for the CPP and other facilities will accommodated in an LQ platform, bridge linked to the CPP.

The preliminary field layout for the First Gas is shown in Figure 1-2.

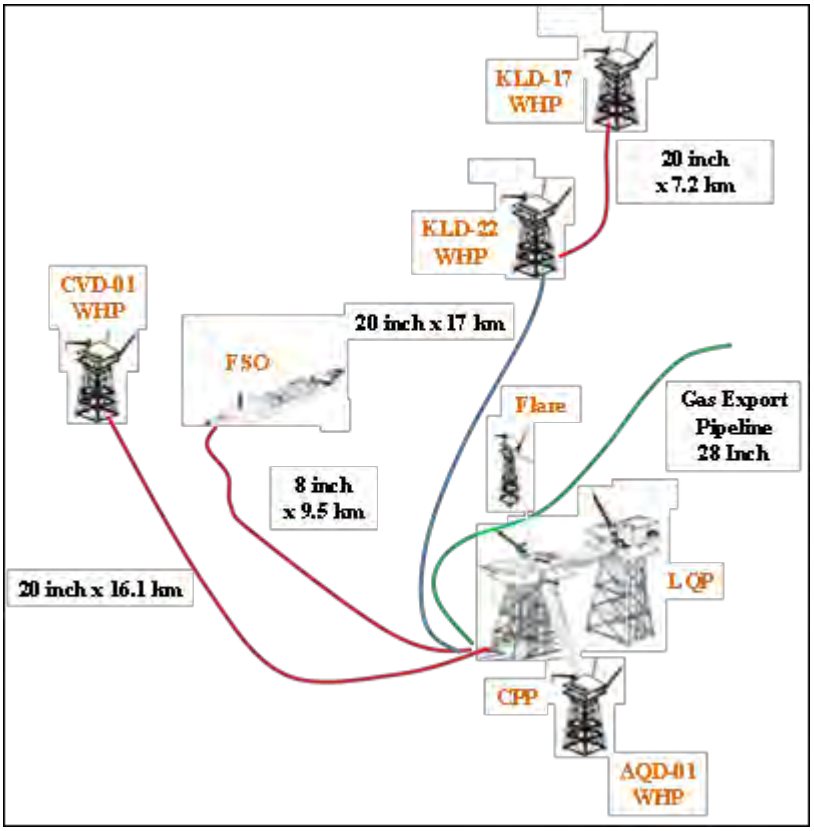


Figure 1-2 Preliminary field layout for First Gas

1.2 Acronyms and Abbreviation

QMS	Quality Management System
PMT	Project Management Team
PIM	Pre-Inspection Meeting
MOC	Management of Change
PQP	Project Quality Plan
MRB	Manfacturers Record Book (also referred here-in as Final record book)
WPS	Welding Procedure Specifications
PMI	Positive Material identification
NCR	Nonconformance Report

1.3 Definition

COMPANY	Phu Quoc Petroleum Operating Company (PQPOC)
CONSULTANT	The nominated engineering company
CONTRACTOR	The person, group or organization responsible for the construction of the platform.
PURCHASER	The person, group or organization who places purchase order on VENDOR.
VENDOR (or Supplier)	The person, group or organization responsible for the design, manufacture, testing and load-out/shipping, installing of the Equipment.
Sub-VENDOR (or Sub-supplier)	The person, group or organization who may be employed by the VENDOR to provide services for the design, manufacture, testing and load-out/shipping, installing of the Equipment or to provide materials, sub-components and sub-assemblies for incorporation in the Equipment packages.
Inspection and Test Plan (ITP)	A schedule of inspection and test activities identifying the stages at which VENDOR, COMPANY, third parties or independent inspectors are involved and additionally identifying the involved specifications, acceptance criteria and instructions that are relevant.
Third Party	An Independent 3rd Party Certifying Authority appointed by VENDOR approved by the COMPANY for certifying specific equipment/equipment packages fabricated at VENDOR's shop.
Inspector	COMPANY /PURCHASER appointed person, group or organization acting in behalf of the COMPANY /PURCHASER responsible for inspection and witness testing of equipment/equipment packages at VENDOR's shop.
Certifying Authority (CA)	Independent agency contracted by the COMPANY to provide Classification/Certification services to Phu QuocPOC Field Development Project's facilities from design review to construction & commissioning (start up) in accordance with CA Rules & Regulations, applicable Codes & Standards & Vietnamese Register (VR) Regulations.
May	Indicates possible course of action.
Shall	Indicates mandatory requirements
Should	Indicates preferred course of action.
Will	Indicates an intention of action.

1.4 Scope

This procedure shall provides requirements on the Handling, Control, Management and Close-out of non-conformances detected in the project for Phu Quoc Petroleum Operating Company (PQPOC), hereafter referred to as the COMPANY. This specification applies to all non-conformances detected towards process and/or products during the execution of any phase of the project.

This document defines the minimum requirements that shall be complied with by (a) CONTRACTOR, (b) Suppliers (and subcontractors) and (c) the entire chain of sub-suppliers – all tiers contracted to deliver (in parts or full) goods and services for the project.

NOTE: - In sections below, the requirements stated for CONTRACTOR shall also apply to Suppliers, Sub-suppliers, subcontractors contracted for the provisions indicated in clause 1.4.2 above.

2 CODES, STANDARDS, REGULATION AND REFERENCE

2.1 Codes and Standards

Sr. No.	Document Title	Document No.
1	Quality Management System – Requirements.	ISO 9001:2015
2	Quality Management System – Fundamentals and Vocabulary	ISO 9000:2015
3	Petroleum, petrochemical and natural gas industries — Sector-specific quality management systems — Requirements for product and service supply organizations.	ISO/TS 29001:2010
4	Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry	API SPEC Q1:2016

2.2 Company General Specifications

Sr. No.	Document Title	Document No.
1	Specification of Quality requirememnts for Subsea Equipment	PQ1-00-QAC-SPC-TAP-00001

2	Specification for Manufacturer Record Book	PQ1-00-QAC-SPC-TAP-00003

2.3 Order of Precedence

The following order of precedence shall govern:

- Applicable Regulation of Vietnam
- Purchase Order
- Project Drawings and Data Sheets
- Project Specifications
- International Codes and Standards

Should any conflict arise between the requirements defined in the reference documents, which cannot be resolved by the above order of precedence, CONTRACTOR shall bring the matter to COMPANY's attention in writing. Unless otherwise determined in writing by COMPANY, the most stringent requirement shall apply.

2.4 Technical Deviations and Exceptions

CONTRACTOR shall make every effort to achieve full compliancewith specified requirements. In case the CONTRACTOR (or Suppliers, Sub-suppliers, Subcontractors) have to request devation from specified requirements, the deviation must clearly be presented with the following contents, as a minimum -

a) Requirements – precisely indicate requirements in context.
b) Deviation – elaborate the deviation being requested.
c) Reason – why deviation to agreed requirements is being requested.
d) Mitigation - provide details of mitigation plan proposed to achieve compliance to specified requirements.
e) Attach supporting information for (a), (b), (c), (d) as above.

AII deviations shall be documented, reviewed and distributed in accordance with procedure. Deviations must be approved by COMPANY prior to commencement of any activity which deviates from specified requirements. Any costs incurred by CONTRACTOR to rectify unapproved deviations shall be to CONTRACTOR's account.

3 HANDLING AND MANAGEMENT OF NON-CONFORMANCES AND NON-CONFORMING PRODUCTS

3.1 General requirements

1) Definitions shall follow ISO 9000:2015.
2) Documentation of non-conformance, non-conforming products shall be in English or Bilingual (if local language is preferred) and shall clearly identify the non-conformance against the stated requirements.

3.2 Identification and control

1) CONTRACTOR shall document methods to identify and control the non-conforming products/process from unintended usage.
2) Non-conformances shall be documented in an suitable format (see section 6.1 below, sample format included in appendices). Upon detection, non-conforming products shall be clearly identified, segregated to prevent the unintended usage.
3) A documented criteria shall be adopted to outline the extent of investigation required to determine the cause of the nonconformity in order to eliminate both the nonconformity and the causal factors.

3.3 Correction

Measures shall be taken to correct the identified nonconformity. Personnel determining dispositions shall have the authority, technical knowledge, and resources necessary to define appropriate correction. Actions to rework, repair, replacement of non-conforming products shall be duly executed with the consent from COMPANY. Records shall be retained for compilation into MRB.

3.4 Corrective actions

In addition to correction, corrective actions shall be taken to eliminate the cause(s) of the nonconformity in order to avoid reoccurrence. Records shall be retained.
CONTRACTOR shall review nonconformities to identify and execute root-cause analysis, trends, or patterns requiring attention, and opportunities for improvement.

3.5 Concession

CONTRACTOR (and Supplier, sub-supplier, subcontractor) shall obtain a concession from COMPANY authorizing the use, release, or acceptance (as is) of product that does not conform to specified requirements. Provisions in section 2.4 above shall be applied and records shall be retained for compilation into MRB.

3.6 Verification and close-out

Corrected nonconformities shall be verified to originally specified requirements prior to acceptance and release for the next process/step of execution. Records shall be retained for

compilation into MRB. Personnel conducting verification and closeout of NCR shall have the authority, technical knowledge and resources necessary to ensure documented verification of conformity.

4 SUPPLIER, SUB-SUPPLIER, SUBCONTRACTOR NON-CONFORMANCES

Any non-conformance discovered by the Supplier or Sub-supplier or Subcontractor shall be promptly brought to the attention of CONTRACTOR. The NCR format shall contain as a minimum the information specified in this specification.
The Supplier or Subcontractor shall log and maintain their internal NCRs and a status summary of all NCRs will be included in the quality metric report to CONTRACTOR, which shall be further communicated to the COMPANY with the monthly reports. All NCRs shall be compiled and included in the Suppliers / Sub-suppliers / Subcontractors final as-built documentation for their respective scope of work and will include any relevant supplementary information used to facilitate closure.

5 FIELD-NONCONFORMITIES

Product related nonconformities detected after release (after issuance of IRC) or at site delivered during installation or during the use of the product post-delivery. Sufficient resources shall be mobilized to correct and reinstate the non-conforming product so as to avoid any delays. CONTRACTOR / Supplier / Sub-supplier shall ensure effective inspection, surveillance and quality control during product manufacturing so as to ensure no field-nonconformities.

6 DOCUMENTATION

6.1 Non-conformance reporting

1) The NCR format shall ensure that as a minimum the below detailed is adequately captured

   i. General Information e.g. purchase order reference, name of supplier / subcontractor / department and location, name of the equipment /services date of detection etc.
   ii. Reference to the governing document / section / clause / acceptance criteria as applicable which has not been met.
   iii. Identity of affected product or process.
   iv. Details with clear description of the detected non-conformance. Add photographs, drawings if required to substantiate the details.
   v. As a minimum, criticality of the non-conformance shall be measured against the schedule and associated risk, which shall be the basis for actions and turnaround durations.
   vi. Correction - actions to eliminate a detected nonconformity.

vii. Corrective action - actions to eliminate the cause of nonconformity and to prevent recurrence.
viii. Details of deviations, concessions obtained, if any.
ix. Reverification and close-out details. The reverication and close-out shall be authorized by CONTRACTOR's Quality personnel, prior to submission to COMPANY for approval.

6.2 Non-conformance status register

CONTRACTOR shall maintain an NCR register listing all project related nonconformities to track the NCR status. The same shall also be timely updated and submitted to COMPANY with the monthly reports.

7 APPENDICES

1) Template – Non-conformance report
2) Template – Non-conformance register

7.1 Template – Non-conformance report

Purchase Order / Subcontract Reference	To be filled by Issuer	**Issuer's Name**	To be filled by Issuer
Supplier / Subcontractor	To be filled by Issuer	**Recipient's Name**	To be filled by Issuer
Equipment / Service description	To be filled by Issuer	**Ref. No.**	To be filled by Issuer
Equipment / Service Criticality	To be filled by Issuer	**Location of Occurrence**	To be filled by Issuer
Activity	To be filled by Issuer	**NCR Criticality Rating**	To be filled by Issuer
Affected Product/ Material	To be filled by Issuer	**Date of Occurrence**	To be filled by Issuer

1. Reference Documents (with revision numbers, as applicable)
To be filled by Issuer

2. Description of the Non Conformity
To be filled by Issuer

Issued By: Name & Signature
Issue Date: DD-MMM-YY

3. Corrections, Corrective action(s) proposed by Project/Supplier/Subcontractor
To be filled by Recipient

☐ Accept as is / Deviation / Concession
☐ Repair as per agreed procedure
☐ Scrap & Replace

Proposed By: Name & Signature
Date: DD-MMM-YY

4. Root Cause Analysis (Causal factors)
To be filled by Recipient

5. Corrections
To be filled by Recipient

6. Corrective Action(s)
To be filled by Recipient

7. Verification of Correction, Corrective action(s)
To be filled by Issuer or his/her delegate

☐ Confirm & accepted
☐ Confirm & accepted Not conform & rejected

Verified By: Name & Signature
Date: DD-MMM-YY

8. CONTRACTOR's Decision
To be filled by Issuer' or his/her delegate

☐ Accepted with proposed dispositions
☐ Rejected

Remarks: To be filled by Issuer' or his/her delegate

Approved By: Name & Signature
Date: DD-MMM-YY

9. COMPANY's decision
To be filled by COMPANY Representative

☐ Accepted
☐ Rejected

Approved By: Name & Signature
Date: DD-MMM-YY

Others
Attach Supporting Document / Photographs – to substantiate details.

7.2 Template – Non-conformance register

S .No	NCR No:	Project No	Project / Audit Reference	NCR Issued To	NCR Issued Date	NCR Close Out Date	NCR Out-standing days	NC Description	Root Cause	NC close Out verification	
										By	Date

Vietnam Block B Gas Project

Quality Requirements Criticality Level 3 & 4

H01	28 November 2022		Issued for Use					
REV	**DATE**		**DESCRIPTION**			**ORIG**	**CHK**	**APPR**
PQPOC Document Control No.	**Project Code**	**Area Code**	**Discipline Code**	**Document Type**	**Originator Code**	**Sequence Number**	**Sheet Number**	**Revision**
	PQ	GENR	QAC	SPC	PQC	00003	00	H01

Revision History and Hold Record

Revision History

Date	Rev. No.	Detailed Description of Change	Ref. Section

Hold Record

Date	Rev. No.	Hold No.	Description / Reason for Hold	Ref. Section

Attachments

Item No.	Description	Document No.

Table of Contents

1 PURPOSE

This document defines certain minimum deliverables quality requirements in provision of personnel, equipment, material and services, hereafter referred to as "Work", "Material" and "Services".

2 SCOPE

The requirements identified herein are applicable to supply of materials and equipment designated as Criticality 3 or 4. These requirements apply in conjunction with criteria established in the Criticality Rating Program.

3 DEFINITION

Concession – An acceptance by CONTRACTOR and COMPANY of a deviation from specified requirements identified prior to or during fabrication/manufacture/erection.

Document Return Codes (DRC) – Refer to Exhibit F-2-B – Document Control & Exchange Specifications for specific Document handling requirements.

COMPANY will assign a Document Return Code (DRC) to each returned Document, signifying COMPANY's status of the Document. This code will be reflected in COMPANY's transmittal, and will be displayed on returned Documents which contain COMPANY comments. CONTRACTOR shall incorporate COMPANY's comments on any document with a DRC of 2 or 3 and submit the corrected documents consistent with the Contract requirements.

The Numbering and Coding Specification in Exhibit F-2-C details how a Document progresses through revisions based on COMPANY DRC.

COMPANY's comments or lack of comments on any document does not relieve CONTRACTOR of any obligation defined in the Contract.

Factory Acceptance Test (FAT) – Functionality and performance testing accomplished by Supplier under simulated operational conditions. Supplier FAT test procedures shall be submitted for review and must be approved a minimum of twenty-one (21) Days prior to the anticipated test commencement date.

Hold Point – A formally designated point in a manufacturing, assembly or other deliverables development process at which inspection or examination is required before further Work can be performed. Supplier shall provide purchaser a minimum of fourteen (14) Days written notice prior to reaching a Hold Point. Manufacturing, assembly or other deliverables development process activity shall not proceed past a Hold Point without written waiver from COMPANY.

Manufacturing – The process of making of goods and articles by hand or as facilitated by machinery, often on a large scale and with division of labor to final product form (i.e. plate, pipe, forgings, structural shapes, etc.).

Nonconformance – A deficiency in deliverables characteristic, documentation or procedure which renders the quality of an item, material, equipment or service unacceptable or indeterminate in conformance to specified requirements.

Origin – The physical location, facility and company at which any item of equipment or material is initially processed and offered as a product for use.

Purchase Order (PO) – A written contract which describes the terms and conditions, descriptions and specifications of a purchase of goods.

Quality Representative – CONTRACTOR or COMPANY representative responsible for evaluation of Supplier Work scope performance.

Review – Review denotes CONTRACTOR or COMPANY designee or their representative will review records of the activity in a timely manner.

Rework – The process of physically restoring a nonconformance to a condition such that an item complies with requirements.

Site Acceptance Test (SAT) – The purpose of the SAT is to inspect the system at Site to ensure a smooth startup and to confirm that the equipment/system meets its acceptance criteria and performance requirements. The SAT forms part of the overall validation testing of the equipment/system and involves either simulated or actual operating conditions.

Special Process – Any processes for production and service provision where the resulting output cannot be verified by subsequent monitoring or measurement. This includes any processes where deficiencies become apparent only after the product is in use or the service has been delivered (e.g. heat treatment, coating, welding, forging, etc.).

Supplier – The organization or person that provides a product. For the purpose of this document the terms Sub-supplier and Subcontractor have the same meaning as the term Supplier.

Verification Monitoring – Verification Monitoring encompasses ongoing review, surveillance, and other related activities focused on verification of compliance with accepted Supplier QC/ITP requirements.

Witness Point – A designated point during the execution of the PO requiring the Supplier to provide advanced written notice of the event. Supplier shall provide a minimum of fourteen (14) Days written notice prior to the witness point. Witness point participation is at option of COMPANY and CONTRACTOR.

4 GENERAL REQUIREMENTS

4.1 CONTRACTOR shall ensure efficient and effective communication of COMPANY requirements to Suppliers.

4.2 Supplier shall adapt and apply its Quality Management System (QMS) to the satisfaction of CONTRACTOR and COMPANY and demonstrate that the Work, Material, Equipment and Services supplied under the PO conform to specified requirements. Supplier QMS shall be developed and implemented in compliance with the following:

ISO 9000 Quality Management Systems – Fundamentals and Vocabulary

ISO 9001 Quality Management Systems – Requirements

ISO 9004 Quality Management Systems – Guidelines for Performance Improvement

ISO 10005 Quality Management Systems – Guidelines for Quality Plans

ISO/TS 29001 Petroleum, Petrochemical and Natural Gas Industries – Sector Specific Quality Management Systems – Requirements for Products and Service Supply Organizations

4.3 A copy of Supplier's current national or international registration document/code stamp, etc. shall be provided with the Supplier's bid for subsequent review by CONTRACTOR and COMPANY.

4.4 Supplier shall maintain a calibration and/or accuracy verification system for all inspection, measuring and test equipment used to determine compliance with product quality requirements.

Instrument calibration shall be verified by an independent externally certified body at a frequency consistent with instrument manufacturer specifications. Records shall be available and be traceable to a national or international standard.

4.5 Any changes within Supplier's Quality Management/and or Key Organization Management positions must be submitted in writing through Project Document Control channels for the attention of CONTRACTOR and COMPANY Project Quality Manager (PQM).

4.6 In practice implementation of Supplier QMS may be assessed by CONTRACTOR or COMPANY before start of Work.

4.7 CONTRACTOR and COMPANY may monitor application of Supplier QMS by means of CONTRACTOR Supplier Quality Management program including but not limited to:

- Ongoing Output Verifications
- Presence at "Hold", "Observation", "Surveillance" and "Witness Points"
- Processing of Non-Conformance Reports
- Periodic or Special Independent Quality Audits
- Review of Documents
- Additional Quality/Inspection and Tests Carried Out by CONTRACTOR, COMPANY or by CONTRACTOR or COMPANY appointed Third Parties

4.8 A Kick-Off/Pre-Fabrication Meeting may be held between Supplier, CONTRACTOR and COMPANY before Work starts in order to ensure that all PO requirements are understood and to ensure that the documents listed above have been submitted and are acceptable.

4.9 CONTRACTOR and COMPANY Quality Representatives shall be granted access to any and all parts of Supplier or Sub-Supplier plant(s) engaged in the manufacture or process of any contract or PO. Access shall include the ability to photograph COMPANY equipment, systems, system components, materials, etc. Supplier shall support CONTRACTOR and COMPANY requests for procedures, quality records, and all supporting documentation through provision of access to view and photocopy required to support verification of Work scope requirements.

4.10 Supplier shall ensure utilization of CONTRACTOR and COMPANY approved Sub-Suppliers. Supplier shall include a comprehensive list of approved Sub-suppliers in its bid package.

4.11 Supplier shall ensure Sub-supplier compliance with all PO Quality requirements. Supplier bid packages shall clearly and unambiguously identify how Supplier has verified Sub-supplier compliance with CONTRACTOR Project Supplier QMS and contract requirements, e.g. Evaluation, Audit, Historical data, national accreditation, etc.

4.12 CONTRACTOR and COMPANY will entertain Supplier requests to add Sub-suppliers not identified on CONTRACTOR and COMPANY Project Approved Vendor List (AVL) in accordance with the "Project Supplier Qualification Program" and other requirements in Exhibit F-3 – Procurement. Changes to an accepted Sub-Suppliers list shall not be initiated without the prior agreement of CONTRACTOR and COMPANY. All requests for the addition of Sub-Suppliers to the Project AVL shall be submitted in writing for COMPANY review at minimum forty-two (42) Days prior to the desired date for issue. No Sub-Suppliers shall be added or changed without the prior agreement of CONTRACTOR and COMPANY.

5 MATERIAL AND EQUIPMENT ORIGINATION

5.1 COMPANY requires the use of new materials that originate and are manufactured in one of the countries listed below. Use of materials that originate and are manufactured in one of the below listed countries does not require prior written approval: Exhibit F-3, Procurement

Argentina	Denmark	Netherlands	Switzerland
Australia	Finland	Spain	United Kingdom
Austria	France	Sweden	United States
Belgium	Germany	Norway	Venezuela
Brazil	Italy	South Africa	Vietnam
Canada	Japan	South Korea	Singapore

5.2 All material test reports must clearly state the Origin and Manufacturing location of the materials. Materials that cannot be clearly traced to their origin and point of manufacturing will not be accepted for use.

5.3 Supplier may request utilization of equipment or materials sourced from a country not identified on the list in 5.1. Such request shall be submitted to COMPANY in the form of a Deviation request.

5.4 Deviation request required information and intended use of unlisted foreign materials shall be provided within the original quotation.

5.5 Deviation requests will be evaluated on a case by case basis in consideration of intended use and project need. Written COMPANY approval of the deviation request must be received by CONTRACTOR and/or Supplier prior to the utilization of equipment or materials for which a deviation request is required.

5.6 CONTRACTOR and/or Supplier deviation requests must include the following information specific to sourcing of the subject equipment or Material:

5.6.1 Country of Origin

5.6.2 ASTM, ASME, API, BSI, DIN, JIS material designation, as applicable.

5.6.3 Material product form e.g. plate, pipe, forging, casting, structural shape, etc.

5.6.4 Intended use and location of service e.g. vessel shell/head, piping line class, pump case, primary or secondary support member, lifting lug, etc.

5.6.5 Design considerations of material, e.g. special loading, pressure/temperature, minimum design metal temperature, etc.

5.6.6 Special requirements applicable to materials, e.g. NACE, carbon equivalence, restricted chemistry, notch-toughness, heat treatment, HIC resistance, etc.

5.6.7 Legible copies of material test reports.

5.6.8 If available, prior project history of using materials from the subject source.

5.7 Deviation requests submitted and deviation request approvals must be included in applicable MRBs.

5.8 COMPANY or CONTRACTOR may require a QMS or other audit of manufacturing facilities associated with deviation requests prior to placement of a PO.

5.9 COMPANY or CONTRACTOR may require independent testing of equipment or materials associated with a deviation request. Independent testing may include: mechanical testing (tensile strength, elongation); chemical composition (wet chemical analysis), or any other supplemental testing required by the original equipment or material specification or by other Project requirements.

5.10 At COMPANY discretion, noncompliance with material origin requirements may result in further material testing at CONTRACTOR or Supplier expense or in return of the material at CONTRACTOR or Supplier expense.

5.11 Use of materials from unlisted sources prior to receiving COMPANY approval shall be subject to immediate incident investigation. Incident investigation must determine the origin and nature of deviation from procedure and system requirements. Incident corrective actions must be approved by COMPANY.

6 SUPPLIER QUALITY CONTROL/ITP (SUPPLIER QC/ITP) - CRITICALITY LEVEL 3)

6.1 CONTRACTOR shall ensure that Supplier Quality Control/Inspection and Test Plans (QC/ITP) comprehensively define, in one document, the quality activities for the intended scope of supply. At minimum, Supplier QC/ITPs shall include the design documentation and quality control requirements defined by the engineering requisition used in PO development, including any required specifications and drawings and all standards and codes referenced. Where CONTRACTOR and/or Supplier scope includes more than one distinct Work scope (e.g. supply and erection) or must address major Sub-suppliers of critical equipment, to achieve optimal clarity and convenience of review or reference, Supplier QC/ITPs shall be partitioned appropriately.

6.2 Supplier QC/ITPs shall include the following elements:

6.2.1 A list of the quality control inspection and test points presented sequentially, in the order they are to be performed.

6.2.2 For each quality control inspection and test point, reference to a document stating the acceptance criteria.

6.2.3 For each quality control inspection and test point, the "Verification Document" (i.e. the document to be checked or the one used to record the result of the inspection or test)

6.2.4 For each quality control inspection and test point of Supplier, CONTRACTOR or COMPANY action, an indication of Witness Point, Review, Hold Point, Verification Monitoring, FAT and/or SAT shall be annotated on the Supplier QC/ITP.

6.2.5 QC/ITP requirements detailed in this specification (e.g. applicable CONTRACTOR and COMPANY "Hold", "Witness", "Observation", "Review" "Verification Monitoring" points etc.).

6.3 Any equipment or item specific requirements listed elsewhere in this specification or incorporated into the PO.

6.4 Supplier QC/ ITP may be prepared in a Supplier developed format provided Supplier format clearly and unambiguously presents the minimum information requirements detailed in the QC/ITP provided below as Attachment 2.

6.5 Supplier QC/ITP and all documents included with, referred to, or incorporated by reference in Supplier QC/ITP shall be submitted for review and comment by CONTRACTOR and by COMPANY within fourteen (14) Days after the award of the PO. All CONTRACTOR and COMPANY comments shall be resolved before commencing Work.

6.6 Supplier QC/ITP and referenced documents shall be "ready for implementation" prior to commencement of design, material procurement, or fabrication.

6.7 Ready for implementation shall be defined as follows:

6.7.5 Supplier QC/ITP and all referenced documents have been developed, submitted and all comments have been resolved with CONTRACTOR and COMPANY DRC1 obtained.

6.7.6 Comments have been resolved on all other plans, processes, procedures and documents referenced and required to implement the plan.

6.7.7 Documents have been issued for use through a document control system acceptable to CONTRACTOR and COMPANY.

6.8 Supplier shall comply with the accepted Supplier QC/ITP. Any proposed changes to the accepted Supplier QC/ITP shall be incorporated into a revised version of the Supplier QC/ITP and resubmitted to CONTRACTOR and to COMPANY. Revised Supplier QC/ITP shall achieve COMPANY a minimum of DRC2 status shall be obtained prior to implementation. DRC1 shall be obtained before Final Acceptance.

7 RECORDING, INSPECTION AND TEST RESULTS – CRITICALITY LEVEL 3)

7.1 Inspection and test results shall be recorded on separate checklists, on certificates, or on other documents as defined under "Record Document" in the Supplier QC/ITP. Samples of such forms shall be presented to CONTRACTOR for review and acceptance prior to use based on compliance with approved Supplier PQMP and/or Supplier QC/ITP.

7.2 Supplier shall verify activities detailed in the Supplier QC/ITP are efficiently and effectively undertaken and shall maintain records of verification activities. Verification records shall be made available for review by CONTRACTOR and/or COMPANY and/or Authorized Inspection Agency/Authority.

8 PROCEDURES / WORK INSTRUCTION – CRITICALITY LEVEL 3

8.1 All activities which impact the quality of Work shall be defined in Supplier procedure or Work Instruction documents. Procedure and Work Instruction documents shall be submitted to CONTRACTOR and to COMPANY for review and acceptance before starting Work.

8.2 Supplier shall develop and include a definitive list of Sub-suppliers in Supplier QC/ITP. Supplier QC/ITPs and all other procedures relevant to planning for, executing, and verifying compliance with CONTRACTOR and COMPANY requirements are documented and implemented in accordance with PO deliverables Quality expectations.

8.3 Proposed procedures shall be submitted to CONTRACTOR and COMPANY to verify compliance with CONTRACTOR and/or COMPANY engineering standards/specifications.

8.4 Supplier documentation of Special Process shall include all process parameters, qualification records and controlling processes. In the specific case of welding, Supplier documentation shall include Weld Procedure Specifications (WPS), Weld Procedure Qualification Records (WPQR) and Welding Location Plan/List/Map.

8.5 Workplace documentation may take the form of a formal procedure or a Work Instruction. Supplier shall ensure availability of all relevant procedures, Work Instructions, etc. at Work locations. Procedures, Work Instructions, etc shall be clearly and unambiguously communicated in all workforce appropriate languages. Workplace documentation shall be available in English and in any workforce appropriate language.

8.6 Procedures/Work Instruction and other documentation requirements addressed in this section shall achieve a minimum of DRC2 status prior to commencing Work.

9 SUPPLIER DOCUMENT REQUIREMENTS LIST - CRITICALITY 3

9.1 CONTRACTOR shall ensure Suppliers are provided with a comprehensive, adapted for Work scope Supplier Document Requirements List (SDRL) within each PO. Each SDRL shall compel Supplier production of a comprehensive, adapted for Work scope, Document Register detailing Work scope document deliverables and due dates within fourteen (14) Days following PO award.

9.2 CONTRACTOR shall complete evaluation of Supplier submitted Document Registers for compliance with the SDRL within seven (7) Days following Document Register receipt. CONTRACTOR shall return evaluated Document Registers to Supplier using the DRC system described in Section 3.0 of this Attachment, incorporating any comments necessary to ensure clarity of expectations for SDRL compliance. Supplier shall incorporate comments and resubmit as appropriate. Supplier Document Register shall be updated at each subsequent submission or as required by the PO.

9.3 Documentation exchanges between CONTRACTOR and Supplier shall conform to COMPANY requirements for document control and exchange.

9.4 Supplier Quality documents submitted in support of process or procedure approval requests, e.g. WPSs, PQRs, weld procedures, etc. shall be transmitted in comprehensive and complete sets as opposed to multiple partial submittals. A minimum of DRC2 shall be obtained prior to commencement of manufacture. DRC1 shall be obtained before Final Acceptance.

9.5 Where supportive of more efficient and effective execution of responsibilities, and following initial review at CONTRACTOR or COMPANY office, COMPANY Quality Representative/Design Engineering Specialist may require process or procedural review evaluation to be completed at Supplier works. Supplier shall ensure availability of appropriate personnel to discuss, document and execute modification of documents sufficient to achieve ready for execution DRC status. Supplier failure to provide necessary support at the time of review will be classed as an aborted event with CONTRACTOR and or CONTRACTOR expenses held to Supplier account.

10 AUDIT/VERIFICATION

10.1 CONTRACTOR and COMPANY reserve the right to conduct a Supplier Quality Audit to verify Supplier QMS complies with relevant quality standards prior to PO award.

10.2 CONTRACTOR and COMPANY reserve the right to conduct ad-hoc verification oversight visits at any time after PO award.

10.3 Should Supplier QMS be found deficient during audits or verification visits, Supplier may be given the opportunity to carry out corrective action within a defined period of time. COMPANY and CONTRACTOR reserve the right to conduct additional ad-hoc oversight visits to verify Supplier compliance with corrective actions.

10.4 Additional process and deliverables quality verification visits may be employed by CONTRACTOR and COMPANY to monitor Supplier Quality Control.

11 DELIVERABLES QUALITY DEVIATION REQUESTS (CONCESSIONS)

11.1 Supplier may seek consideration of a change in PO specified deliverables quality requirements, a concession request, by formally applying to CONTRACTOR and COMPANY. Supplier concession application should be submitted utilizing the standard concession request form.

11.2 Concession requests will be considered by CONTRACTOR and COMPANY on the basis of business justification. Compliance with regulatory requirements is mandatory.

11.3 Neither CONTRACTOR nor COMPANY Quality Representative has authority to grant concessions. CONTRACTOR and/or COMPANY Quality Representative will not acknowledge acceptance of a deviation request unless a copy of the formal approved concession request is made available for review at the time of the facility visit.

Note: Concessions submitted late in the fabrication Work cycle will not necessarily be accepted. Concessions resulting in additional Work by CONTRACTOR and/or COMPANY and/or Authorized Inspection Agency/Authority will incur a back charge to the Supplier for man-hours expended in correcting documentation or Work already completed in detailed design or manufacture.

11.4 All concession requests shall be assigned a unique identifier. All affected documents shall be annotated with the unique identifier of the impacting concession request. Documents include but are not limited to drawings, specifications, procedures, and processes.

11.5 All accepted concession requests shall be included in the Manufacturing Record Book/Code Data Book..

12 UNAUTHORIZED DELIVERABLES DEVIATIONS (NONCONFORMANCE)

12.1 When a Nonconformance Report (NCR) is issued by Supplier, the NCR becomes the means by which the Nonconformance is identified and triggers the need for corrective action.

12.2 Nonconforming deliverables including but not limited to material, equipment or services shall be reviewed by Supplier in accordance with documented procedures. Supplier may propose one of the following standard strategies to CONTRACTOR and COMPANY as a means of nonconformance resolution:

12.2.1 Reworked (without repair) to meet the specified requirements

12.2.2 Repaired and reworked to meet the specified requirements

12.2.3 Accepted without Rework or Repair

12.2.4 Re-graded for Alternative Application

12.2.5 Scrapped

12.3 Repair, Acceptance or Re-grade nonconformance resolution strategies, together with relevant procedures, must be formally submitted to and accepted by CONTRACTOR or COMPANY Quality Representative.

12.4 In the event that CONTRACTOR and/or COMPANY and/or authorized Inspection Agency/Authority Representative identify a deviation from specification that is not subject to a Supplier NCR, CONTRACTOR and/or COMPANY and/or authorized Inspection Agency/Authority will raise a Corrective Action Request (CAR) on the Supplier. Supplier must, within twenty-four (24) hours, issue a response to CONTRACTOR and COMPANY indicating corrective action(s) undertaken or proposed to address the identified deliverables nonconformance event.

12.5 Material, equipment or services which do not conform to deliverables quality requirements shall not be utilized unless written authority is obtained through use of the concession request process (see Section 11.0, Deliverables Quality Deviation Requests (Concessions) above).

12.6 Supplier shall maintain a register of its NCRs together with their status. CONTRACTOR and/or COMPANY and/or authorized Inspection Agency/Authority Representative shall be granted access to Supplier NCR register during visits to Supplier facilities engaged in project deliverables production. CONTRACTOR and/or COMPANY reserve the right to request copies of NCRs for review of deviation detection, documentation and nonconformance disposition.

12.7 CARs may, at discretion of CONTRACTOR or COMPANY, necessitate additional COMPANY or CONTRATOR facility visits, additional Supplier Quality inspection, testing or other enhanced deliverables Quality management efforts. Supplier shall update Supplier QC/ITP to reflect CONTRACTOR or COMPANY mandated changes. Review and acceptance of Supplier QC/ITP in response to Supplier, COMPANY, or CONTRACTOR mandated changes shall be submitted for review and acceptance in accordance with paragraph 6.7 of this Attachment.

12.8 At the discretion of COMPANY or CONTRACTOR, a Supplier facility visit may be carried out by CONTRACTOR, COMPANY, or authorized Inspection Agency/Authority Representative to verify satisfactory compliance with authorized disposition on NCRs. Deliverables nonconformance is not considered resolved until authorized CONTRACTOR or COMPANY Quality Representative reviews the corrective action taken and signs the NCR.

12.9 Supplier shall ensure that its procedures provide for the identification and, where practical, segregation of all nonconforming material or equipment.

12.10 No material, equipment or other physical asset deliverables shall be dispatched until outstanding NCRs, CARs or Concession Requests, together with associated documentation, have been closed by all parties.

12.11 Supplier shall ensure agreed NCR and CAR disposition is carried out in a timely manner and that all supporting documentation is available for review. Accepted Concession Request disposition documentation must be a part of the FINAL documentation package.

13 MANUFACTURING RECORD BOOK AND DOCUMENTATION PACKAGES - CRITICALITY LEVEL 3

13.1 Supplier shall submit to CONTRACTOR or COMPANY within twenty-eight (28) Days of receipt of PO, a detailed description of the content of the Master Manufacturing Record Book (MRB) or as applicable, Code Data Book (CDB) in accordance with PO requirements. CONTRACTOR and COMPANY and/or authorized Inspection Agency/Authority Representative shall review the submission for acceptance. Any conflict must be resolved before start of Work. CONTRACTOR and/or COMPANY and/or authorized Inspection Agency/Authority Representative shall require the Master MRB or as applicable, the CDB, to be compiled in accordance with the accepted contents list. – Exhibit F-2.

13.2 POs shall indicate general certification requirements but shall also include specific reference to all specifications applicable to supply of the requested material or equipment. Any change in Work scope resulting from an amendment to a PO shall require re-submission by Supplier of the amended Master MRB contents List.

13.3 The Master MRB or as applicable, the CDB, shall contain those documents relevant to the current stage of manufacture including all certificates, inspection records and all other quality related documents.

13.4 Supplier shall ensure that the Master MRB or as applicable, the CDB, is compiled progressively during manufacture ensuring that, at release for shipment, the Master MRB or as applicable, the CDB, is complete.

13.5 All material test certificates within the Master MRB or as applicable, the CDB, shall be originals, where practical, or verified true copies. Distributor material test certificates are not acceptable unless accompanied by official copies of the original sub-tier Supplier, e.g. billet manufacturer, forge master, and related certificates. CONTRACTOR and/or COMPANY reserve the right to request verified true copies of originals.

13.6 Supplier shall ensure Master MRB or as applicable, the CDB, availability for review by Purchaser Quality Representative during Supplier facility visits. Supplier Master MRB or as applicable, the CDB, file shall include all quality related documents available for previous events. COMPANY or

CONTRACTOR Quality Representative shall sign, date and stamp each Master MRB or as applicable, the CDB, record found acceptable.

13.7 COMPANY or CONTRACTOR and/or authorized Inspection Agency/Authority Representative shall, at any intervention point where Master MRB or as applicable, the CDB, contents do not reflect the current stage of fabrication, issue a CAR.

13.8 Where photocopies of certificates or other Quality documents are furnished, document quality shall support legible reproduction. CONTRACTOR or COMPANY and/or Authorized Inspection Agency/Authority Representative are authorized to reject copies not considered of suitable quality.

13.9 Compliance with PO requirements and material specifications shall be supported by Supplier reviewed and approved Certification documents. A Supplier approval stamp, indicating Supplier review for consistency with PO requirements and material specifications shall be affixed to any certification document put forward as genuine and intended for inclusion in the Master MRB or as applicable, the CDB.

13.10 Supplier shall provide CONTRACTOR or COMPANY and/or Authorized Inspection Agency/Authority Representative access to any and all documents, records or other information put forward by Supplier as supportive of Supplier position of PO requirements and material specification satisfaction.

13.11 In consideration of authorization for release, Supplier shall provide CONTRACTOR or COMPANY and/or authorized Inspection Agency/Authority Representative with access to the Master MRB or as applicable, the CDB file. If required records are in place, the Release Note may be issued. For bulk materials, Master MRB or as applicable, the CDB review can be done on a shipment-by-shipment basis, prior to release of items. Supplier shall insert a copy of the Release Note into the Master MRB or as applicable, the CDB.

13.12 CONTRACTOR or Authorized Inspection Agency/Authority Representative shall ensure that all necessary certification and other required documents are included within the Master MRB or, as applicable, the CDB, before endorsing and issuing the Material Release Note. A Final Inspection Release Note will not be issued unless CONTRACTOR or COMPANY and, when applicable, the authorized Inspection Agency /Authority Representative, consider the Master MRB or as applicable, the CDB, complete and have endorsed it.

13.13 Acceptance by CONTRACTOR or COMPANY that the Master MRB or as applicable, the CDB, has been compiled in accordance with the PO shall be signified by CONTRACTOR or COMPANY and, when applicable, the authorized Inspection Agency/Authority Representative redline stamp on the index sheet of each volume. As in the case of pressure vessels, the National Board Number of the Inspector should be on the documents.

13.14 Immediately following issue of the Final Inspection Release Note, Supplier shall ensure that the Master MRB or as applicable, the CDB, is made up in accordance with the complete number of MRB or as applicable CDB copies required in the PO and that all copies are legible and complete.

13.15 Supplier shall ensure that Master MRB or as applicable, the CDB, is complete and ready for review at Supplier facility a minimum of seven (7) Days prior to release for shipment.

13.16 Where Supplier carries out deliverables quality inspection, Supplier shall produce and sign the relevant inspection report document. Where Sub-Supplier carries out the inspection, Sub-Supplier shall produce and sign the inspection report document. Supplier shall verify and countersign indicating Supplier acceptance of the Sub-Supplier inspection report document.

13.17 Quality documents shall only be signed by personnel authorized to verify the validity of information and technical content. A list of all authorized Supplier signatures, names, titles and initials shall be provided in Supplier PQMP and, as applicable to PO, QC/ITPs.

13.18 All documents shall be verified and signed by the Supplier before submission to CONTRACTOR or COMPANY or, when applicable, the Authorized Inspection Agency/Authority Representative.

13.19 Documentation prepared in conjunction with inspections and tests witnessed or verified by CONTRACTOR, COMPANY or authorized Inspection Agency/Authority Representative should be signed by the respective non-Supplier participants. The Supplier QC/ITP endorsed against the appropriate entry.

13.20 Supplier shall forward the Master MRB or as applicable, the CDB, to CONTRACTOR and/or COMPANY through use of a reliable express delivery courier service at the time of equipment or material shipment.

13.21 Master CDBs are required for all equipment designed and manufactured in accordance with national or international codes or as identified within each requisition.

13.22 Master Record Books or, as applicable, Code Data Books and any related documents shall be available and readily accessible to CONTACTOR and COMPANY at Supplier manufacturing works. Where original documents are prepared in a language other than English, English translations shall be prepared and made available to COMPANY and CONTRACTOR at no cost to COMPANY or CONTRACTOR.

13.23 English language versions of CDBs will serve as the principal code reference and code compliance verification documents.

13.24 English language versions of Code documents shall be readily accessible to COMPANY, CONTRACTOR and/or authorized Inspection Agency/Authority Representative prior to commencement of Work.

14 DOCUMENTATION PACKAGES - CRITICALITY LEVEL 4

14.1 All documentation in the package shall have been checked against the PO requirements and each certificate shall be stamped/signed and verified by the Supplier. A "CERTIFICATE OF CONFORMITY" shall be provided for all items/commodities.

14.2 For Criticality Level 4 PO's, material test certificates within the documentation packages shall be originals, where practical, or verified true copies. Supplier Stock material certificates without full traceability to the original chemical and mechanical data are unacceptable.

14.3 Where photocopies of certificates or other Quality documents are furnished, document quality shall support legible reproduction. CONTRACTOR or COMPANY and/or authorized Inspection Agency/Authority Representative are authorized to reject copies not considered of suitable quality.

15 RELEASE FOR SHIPMENT

15.1 For Criticality Level 3 POs and where specified for Criticality Level 4 POs, Supplier shall submit a Final Inspection Release Note System to PO designated Purchasing Representative within twenty-eight (28) Days following PO award. The Final Inspection Release Note System submittal shall include an example copy of a Release Note Form. A Supplier standard Release Note Form may be approved for use in lieu of the referenced COMPANY form if Supplier Release Note format contains minimum equivalent information.

NOTE: DRC1 status shall be obtained on all requirements before Final Acceptance will be given.

15.2 Shipment Final Inspection Release Note number shall be marked on the Supplier Delivery Note.

15.3 A copy of the Final Inspection Release Note and a copy of the Delivery Note/Packing List shall accompany each material and equipment shipment departing Supplier works.

15.4 A copy of the Final Inspection Release Note shall be submitted with the Supplier Invoice.

15.5 Shipment documentation shall be submitted to CONTRACTOR or COMPANY representative in accordance with PO provisions.

15.6 Shipment requires CONTRACTOR or COMPANY authorization as provided for in the PO.

APPENDIX 1 – REFERENCE DOCUMENTS

Document Name
Exhibit F-5 - CONTRACTOR's Project Quality Management Program
Exhibit F-5 Attachment A -Criticality Rating Program
Exhibit F-5 Attachment B – Supplier Mandatory Quality Specification (Criticality Level 1 and 2)
Exhibit F-5 Attachment D – Project Quality Personnel Qualification Specification
Exhibit F-3 - Procurement
Exhibit F-5 Attachment F - Traceability & Marking Requirements for Material & Equipment
Exhibit F-2 – Information Management
Exhibit F-2 Attachment A –Information Management Requirements Specification
Exhibit F-2 Attachment C – Numbering and Coding Specification
Exhibit F-2 Attachment B – Document Control and Exchange Specification
Attachment 1- hereto : Minimum Supplier, CONTRACTOR and COMPANY Activities Applied
Attachment 2 -hereto : Quality Control/Inspection and Test Plan
Attachment 3 -hereto : Concession Request Form
Attachment 4- hereto : Final Inspection Release Note

ATTACHMENTS

1. MINIMUM SUPPLIER, CONTRACTOR AND COMPANY ACTIVITIES APPLIED
2. TYPICAL QUALITY CONTROL/INSPECTION AND TEST PLAN
3. CONCESSION REQUEST
4. FINAL INSPECTION RELEASE NOTE

ATTACHMENT 1

SUPPLIER, CONTRACTOR AND COMPANY ACTIVITIES

THIS ITEM : [ITEM OR EQUIPMENT NAME] ON RFQ/OR PO NUMBER:
APPLY CRITICALITY LEVEL 3 LISTED BELOW ☐ APPLY CRITICALITY LEVEL 4 LISTED BELOW ☐

THIS MINIMUM LIST IN NO WAY IDENTIFIES ALL ACTIVITIES. IT SHOULD BE CONSIDERED SUBJECT TO MODIFICATION DURING THE COURSE OF DETAILED DESIGN, CRITICALITY RATING, SUPPLIER SELECTION, AND/OR AT OTHER POINTS PRIOR TO AND INCLUDING THE PRE-FABRICATION/KICK OFF MEETING. THE FINAL LIST WILL BE DEFINED IN THE (CONTRACTOR AND/OR COMPANY) QC/ITP.

"WITNESS" AND "HOLD" POINTS ARE DEFINED AS CRITICAL STEPS IN MANUFACTURING AND TESTING, WHEREBY SUPPLIER SHALL ADVISE *(CONTRACTOR AND/OR COMPANY) IN ACCORDANCE WITH SECTIONS 3.0, 4.7, AND 6.0.*

* = SAMPLED DOCUMENTS; ** = AS PER APPROVED/ACCEPTED SUPPLIER QC/ITP AND PO; H = "HOLD POINT"; W = "WITNESS POINT"; AR = "AS REQUIRED"; NA = "NOT APPLICABLE"; R ="REVIEW RECORDS"; VM = "VERIFICATION MONITORING".

	LEVEL 3			LEVEL 4		
DESCRIPTION	**SUPPLIER**	**CONTRACTOR**	**COMPANY**	**SUPPLIER**	**CONTRACTOR**	**COMPANY**
REVIEW OF ALL REQUESTED ENGINEERING, FABRICATION/QUALIFICATION AND QUALITY DOCUMENT SUBMITTAL REQUIREMENTS DEFINED WITHIN PO	**	H & R	R	**	R	R*
KICK-OFF/PRE-FABRICATION MEETING	AR	AR	AR	N/A	N/A	N/A
MATERIAL VERIFICATION	H & R	**	R	H & R	N/A	N/A
IN-PROCESS FABRICATION VERIFICATION	**	VM	**	**	N/A	N/A
DIMENSIONAL AND VISUAL PRIOR TO AND AFTER PWHT	**	VM	N/A	**	**	N/A
NDE	**	H & R	AR	**	** R	R
PROGRESSIVE REVIEW OF DOCUMENTATION	H & R	R	R	H	H	N/A
ASSEMBLY AND FIT UP INCLUDING INTERNAL INSTALLATION	**	VM	N/A	**	N/A	N/A
FAT OR TEST AS DEFINED WITHIN PO, APPROVED AND ACCEPTED PROCESSES AND PROCEDURES, DATA SHEETS ETC.	H & R	R	R	N/A	N/A	N/A
RELEASE FOR COATING/PAINTING	**	H	VM*	**	R	R
FINAL INSPECTION AND MANUFACTURING DATA REPORT REVIEW	H & R	VM	N/A	H	R	R
SHIPPING PREPARATION	H & R	VM	N/A	H	R	R
FINAL INSPECTION RELEASE NOTE	H & R	VM/R	R	H	VM/R	R
ON-SITE INSPECTION	**	**	**	**	H	H

ATTACHMENT 2 **QUALITY CONTROL/INSPECTION AND TEST PLAN**	Project Number: Reference: Project Name: Date:

Supplier QC/ITP Number: | Supplier / Subcontractor Name: | Supplier Contact Telephone No:
Po Or Contract Number: | Description: | E Mail Reference:
Equipment Description: | Tag / Item Number: | Location:

Item No	**Description Of Inspection/Test Activity**	**Test/Inspection / Requirement**	**Reference Document/Acceptance Criteria**	**Record Document**	**Type Of QA/QC And Inspection Responsibility**				**Remarks / Initials**
					SUPPLIER	EPC	Company	AIA	

Legend		
	H	Hold Point Work Shall Not Proceed Without Attendance Of The Designated Quality Representative (s).
	W	Witness Point Quality Representatives'/Inspectors Shall Be Given Prior Notice Of Witness Points - Work Proceeds If The Quality Representative/Inspector Issues a Waiver Notice And Does Not Attend.
	VM	Verification/Monitoring Observing Or Monitoring The Work, Inspection Or Test At A Frequency As Deemed Necessary By Quality Representative
	R	Review Suppliers Documentation Review Drawings, Procedures, Inspection Or Test Results Etc

Prepared By:		Reviewed By:		Accepted By:		COMPANY REVIEW	
Print Name	Date	Print Name	Date	Print Name	Date	Print Name	Date

ATTACHMENT 3
CONCESSION REQUEST
(FIRST OF TWO PAGES)

CONCESSION REQUEST NUMBER:

1. Buyer's Reference No.:
2. Buyer's Purchase Order No.:
3. Data/Requisition No.:
4. Supplier:
5. Discipline:
6. Tag/Item No.:
7. Date:
8. Supplier Reference No.:
9. Transmittal to COMPANY No.:

10. Description of Proposed Concession:

11. Reason for Concession Request:

12. Impact on Delivery Time:

13. Supplier Authorized Representative:

NAME (Print)	TITLE (Print)	SIGNATURE	DATE

14. Recommendation by Engineering/Quality/Projects: Amend Purchase Order: Yes ☐ No ☐

NAME(s) (Print)	TITLE(s) (Print)	SIGNATURE(s)	DATE
PROJECT (Print)	TITLE (Print)	SIGNATURE	DATE

15. Recommendation by COMPANY (if applicable):

NAME (Print)	TITLE (Print)	SIGNATURE	DATE

ATTACHMENT 3
INSTRUCTIONS FOR CONCESSION REQUEST COMPLETION
(SECOND OF TWO PAGES)

The following instructions are to be followed in order for a Concession Request to be considered:

Definition

Contractor is and/or COMPANY) as defined in the Contract.

On identification of the need for a Concession, the original form overleaf shall be completed and distributed as follows:

Contractor's Responsibility

Complete Sections 2, 3, 4, 6, 7, 8 with the details identified within the applicable Contract Number.

Section 3 must contain the correct Requisition Number; i.e. Indicated on the Engineering Requisition.

Section 4 must contain SubContractor's name.

Section 8 must contain the SubContractor's Reference Number, which must be a sequential number.

Complete Sections 10, 11, 12, 13 to clearly describe the Concession Request, to justify the request and to indicate any delivery impact.

Section 10 must contain a full description of the Concession Request making references to any Attachments as required. Full reference shall be made to; e.g., PO or requisition clauses, drawings, specifications, codes and guides Affected by the Concession Request.

Section 11 must provide a reason and justification for the Concession Request.

Section 12 must contain any impact on the delivery time.

Section 13 must contain the name of the SubContractor's representative responsible for the Concession Request and authorized to make decisions on the SubContractor's behalf with regard to the Concession Request.

Contractor must indicate on a separate sheet any cost impact to (CONTRACTOR and/or COMPANY) account due to deviation from contract if the Concession is approved.

Formally, submit the Concession Request to CONTRACTOR and/or COMPANY) Nominated Department, using the established communication channels.

In urgent cases the Concession Request may be faxed, followed by the submittal of the original by normal transmittal channels.

Non-Compliance to the above instructions may result in rejection of the Concession Request.

Upon approval of the Concession and completion of Sections 14 and 15 by CONTRACTOR and/or COMPANY), the Contractor shall carry out the disposition as defined by the (approved) Concession.

The Contractor shall ensure that the duly signed original of the Concession is included in the appropriate Quality Control Data Book/Dossier.

In addition, he shall indicate the Buyers Reference Number in Section 1 on the "As Constructed" drawings.

Finally, Contractor shall carry out an internal investigation into the cause of the Concession Request to ensure that further Concession Requests shall be avoided.

ATTACHMENT 4 - INSPECTION RELEASE NOTE

Client:
Supplier:
Project:

Purchase Order #:
Location:
Supplier Ref. #:

Item Tag #	Supplier S/O #	Description	Qty Ordered	Qty Released	Balance

Outstanding Work to Be Performed

This is a complete release. ☐ This is a partial release. ☐

Deviations To The Above: (Note Who Authorised The Deviation)	
Yes/No	**Order Status**
	Ncr's Outstanding On Item(S)
	Order Partially Complete. Other Release Notices To Follow.
	Conditional Release. (Approval Required From Client Prior To Shipment)
	Order Complete. File Closed.
	Passport/Data Dossier Complete And Submitted

Endorsement of this IRN confirms that, as far as can be verified by the Client Quality Representative, the items conform to the PO/Contract requirements and that the inspection requirements as specified in the Quality Control/Inspection and Test Plans for both Chevron and the Supplier have been completed and signed off as accepted by the appropriate\persons.

This release does not relieve the Supplier of any responsibility to ensure that the material or equipment meets all contractual requirements. Client Agency: Name: Position: Signature: Date:	Supplier: Name: Position: Signature: Date:

Vietnam Block B Gas Project

Traceability and Marking Requirements for Materials and Equipment

H01	28 November 2022		Issued for Use					
REV	**DATE**		**DESCRIPTION**			**ORIG**	**CHK**	**APPR**
PQPOC Document Control No.	**Project Code**	**Area Code**	**Discipline Code**	**Document Type**	**Originator Code**	**Sequence Number**	**Sheet Number**	**Revision**
	PQ	GENR	QAC	SPC	PQC	00005	00	H01

Revision History and Hold Record

Revision History

Date	Rev. No.	Detailed Description of Change	Ref. Section

Hold Record

Date	Rev. No.	Hold No.	Description / Reason for Hold	Ref. Section

Attachments

Item No.	Description	Document No.

Table of Contents

1 PURPOSE

1.1 To define the requirements and methods for the traceability and marking of equipment and Materials.

1.2 These requirements are intended to define those processes and functional responsibilities that contribute to effective quality control when assessed against selected marking and traceability criteria.

2 SCOPE

2.1 The Material marking and traceability requirements shall provide the convention and mechanics to proceed with the responsibilities for the traceability of Materials at manufacturing/ fabrication facilities and at Work Sites.

2.2 Materials and equipment associated with CONTRACTOR's Work, from receipt and entry into CONTRACTOR's, Subcontractor's or Supplier's Material management system, through Site issue, and return and disposal.

3 DEFINITION

Tagged Items	:	Equipment allocated a unique tag number or spool number i.e., tanks, vessels, rotating equipment, packaged units, fabricated pipe spools, control valves, relief valves and any other items listed in equipment list or instrument schedule.
Bulk Items	:	Piping Materials purchased in bulk by CONTRACTOR where individual items are not allocated a unique tag number e.g. plate, pipe, tube, valves, fittings, traps and strainers, other castings and forgings.
Material Specification	:	Material specification which defines chemical and mechanical properties of a particular Material form as specified in the Material requisition as found in the Project Specification and Technical Requirements (e.g. ASTM).
"In-Line" instruments	:	All instruments and components mounted in process lines or equipment. Typical examples: control valves / safety valves / turbine meters / orifice plates and flanges / thermowells / displacement type level instruments / etc.
"Off-Line" instruments	:	All instruments and components connected to process lines or equipment via small (maximum one inch (1") block valves. Typical examples: transmitters / pressure gauges / analyzer sampling systems / etc.

4 GUIDELINES

The language used for marking and within Material certificates shall be English.

Marking and Certificates in other languages are acceptable provided that they are accompanied by accredited English translation of the contents.

4.1 Material Traceability – The ability to trace an individual component back to the Material certificate that represents it and the ability to identify the installed location of components represented by a Material certificate through the use of a traceability reference maintained on the component, cross-referencing documentation or database, and the certificate.

4.2 For various systems consisting of numerous parts with possibly many different types and grades of Materials it is important that only the correct Materials are connected together in a system. For this to be achieved there must be auditable traceability of all components. There shall be a system in place that allows full traceability to an original Material certificate of every component part and this need is to be reviewed for every component.

4.3 Alloy Materials shall be verified prior to delivery to Site using a PMI process that makes an on the spot check analysis. (XRF Analyzer, Texas Nuclear, Metascope, Spectrotest etc., as applicable for the Material).

4.4 It shall be ensured that only the correct traceable and marked Materials are sent to the fabrication or construction Sites.

Example; piping Materials are, traditionally, supplied to Sites via a stockist or agent, who purchases all the Materials from numerous manufacturers. It is pertinent to require the stockist to perform the primary identification and traceability activities that are essential.

4.5 All goods purchased by, and received at the stockist, must be, tagged and checked against "Original Material Certificates" or "Verified True Copies" of originals, on receipt.

4.6 Once the basic receipt inspection activities are confirmed and any required PMI is performed, Materials shall be color coded as per relevant specifications to indicate the type and the fact that certification has been checked and the identity verified. Color coding shall be such that it shall remain visible up until the piping spool, or system or component is assembled, completed, and all Material details recorded on the relevant drawing, computer program or Material ISO.

4.7 All items including pipe and piping components, valves, flanges, fittings, "In-Line" instruments, "Off-Line" instruments, special items, etc., shall be supplied ready marked and tagged by the vendor with the purchase order number, item number/computer item code number and cast / heat numbering, in accordance with Contract requirements/Material specifications.

4.8 All items shall be inspected, including verification of Material certification and for correct marking upon receipt by CONTRACTOR. A system shall be established to ensure the fabricator/erector verifies the ready visibility and legibility of marking prior to acceptance from CONTRACTOR.

4.9 The cast/heat number, as marked by the manufacturer, provides traceability back to the relevant Material certification. Material certificates will be collated and stored by the Materials recipient at Site.

4.10 All items components shall be supplied color-coded for Material identification, as detailed in Project specifications. A color code shall be established for each different grade and type of Material; one most used common grade, such as plain, non-low temperature, carbon steel may be left self colored. CONTRACTOR shall identify the different Materials that are to be fabricated and establish a color coding system for COMPANY review and prior written approval.

4.11 CONTRACTOR shall establish a specification and system for Material usage that traces the identity of all component parts of a piping system, including the parts that are cut and part-used such as pipe, the tagged items such as valves and all "In-Line" instruments & "Off-Line" instruments.

4.12 The following sections are the minimum requirements for a traceability specification for the Contract.

5 MATERIAL MARKING

5.1 All equipment, pipe and piping components, including valves, flanges, fittings, special items etc. shall be supplied ready marked and tagged by the vendor with the Purchase Order number, item

number/computer item code number and cast/heat numbering in accordance with a color coding of piping components specification.

5.2 All items shall be inspected, including verification of Material certification and marking upon receipt at Site. CONTRACTOR shall verify the ready visibility and legibility of marking prior to acceptance for use.

5.3 While marking and developing the method of marking, CONTRACTOR shall follow the equipment / Material specification for specific marking requirement. In all other instances the following guidelines shall be implemented:

a. Marking shall be applied by engraving or stenciling on ferrous Materials with a thickness less than 5 mm, austenitic stainless steel below 10 mm, 9% Ni steels below 12 mm and all nonferrous Materials.

b. Stencil marking shall use a water-insoluble ink that does not contain substances which could harmfully affect the Material (such as metallic pigments, sulfur, zinc, sulfides, chlorides or inorganic halogens).

c. Heat exchanger tubes shall be marked by continuous stenciling over the entire tube length.

d. On ferrous Materials with a thickness of 5 mm and over, austenitic steels 10 mm and over, 9% Ni steels 12 mm and over, marking shall be applied by low-stress hard-die stamping on a painted background, unless otherwise reviewed and approved by COMPANY.

e. Low-stress stamps shall be round nosed with a radius of 0.25 mm minimum. Casting shall have the charge or heat number cast in the Material. The other required markings also to be cast-in, in an order of performance.

f. In case it is physically impossible to apply the required marking (e.g. small size) it would be accepted to apply the marking on a durable, securely affixed stainless steel tag or to codify the marking.

6 COLOR CODING

6.1 All pipe and piping components will be supplied color coded for Material identification, as detailed in the Contract's Material Specification for Color Coding or industry standards like ISO 9095:1990 Steel tubes - color coding for Material identification or ANSI Standard for Color Coding, that shall cover all grades of Materials

6.2 There should be no requirement to provide additional on-site color coding for Material identification. However, any inadequately marked Material received shall require corrective action involving verification of identity and re-establishment of required coloring.

7 TRACEABILITY REQUIREMENTS

7.1 It is a requirement that bulk Materials and fittings supplied by the Vendor can be traced back to a valid Material certificate, or similar document, to European Standard, BS/EN 10204 that specifies the different types of inspection documents supplied to the purchaser, in accordance with the requirements of the order, for the delivery of all metallic products, e.g. plates, sheets, bars, forgings, castings, whatever their method of production.

7.2 Traceability is required for any items, or batches of items, that are covered by a Material certificate, mill certificate, manufacturer's certificate, and Material test certificate, type approval certificate such as ABS, PTB, TUV, UL etc., or calibration certificate.

7.3 The method of traceability shall be via the Purchase Order number, item number/computer code number and cast/heat number referred to herein as the traceability reference, permanently marked on to bulk purchased piping, flanges, fittings and valves as defined on a marking matrix, and their installed locations recorded on installation quality inspection records.

7.4 All spectacle blinds, spade blinds and spacers shall be treated as flanges.

7.5 All welding consumable like wire, electrodes and fluxes shall be traceable to the manufacturer's certification and marking.

8 MATERIAL RECEIPT

8.1. At the time of receipt at fabrication facilities, or Site, all Materials shall be inspected against delivery/shipping list for correct marking, color coding and Material certification and acceptance witnessed by a COMPANY approved CONTRACTOR inspector.

8.2 Any Materials found to be non-compliant shall be duly identified and quarantined against correct certification, marking and color coding.

9 SEGREGATION

It is essential that strict segregation of Materials be maintained, both in the 'goods-in' receiving area, the warehouse, the fabrication workshops and the external fabrication areas. In addition, all Material types, be they pipes and fittings, or prefabricated spools, shall be segregated from each other in clearly identifiable storage locations and duly marked/tagged.

10 MATERIAL CONTROL/ISSUE

10.1 For Site fabrication and installation purposes, all pipe and piping components shall be controlled and issued by isometric, using a Material withdrawal request, from the Site warehouse to the piping fabrication personnel by Work package/Work order, component size and item identifying code number.

10.2 For off-site fabrication, all piping Materials will be issued directly to the fabrication personnel or Subcontractor ensuring traceability is similarly maintained. CONTRACTOR's or Subcontractor's system shall be reviewed and aligned with these requirements.

10.3 Work packages shall, as far as practical, comprise only one grade of Material. In addition, fabrication facilities, cutting, welding, grinding equipment including all welding consumables, cleaning Materials, wire brushes etc. shall either be dedicated to one Material type and specification, or only one type of Material shall be fabricated within the cutting / welding facility at a time. At any time, the type / specification of Material being fabricated shall be clearly identifiable by signs or labels.

10.4 Where a common facility is used for more than one type / grade of Material, signs / labels shall identify the Material being fabricated at any given time and a rigorous and complete cleaning and housekeeping shall be implemented when changing from fabrication of one Material specification to another. This shall ensure compatibility between the Material being fabricated and the associated welding consumables, grinding tools, wire brushes and fabrication facilities at all times.

10.5 Any Material, at any stage in fabrication, that cannot be positively identified as a specific grade / Material specification shall be segregated in a clearly identified quarantine area until such time as the Material can be positively/duly identified.

11 FABRICATION AND ERECTION TRACEABILITY

11.1 Traceability references shall be maintained throughout the fabrication and erection stages, through the transfer of the traceability reference when Material is cut. Where carbon steel pipe or plate is cut, heat numbers shall be transferred, utilizing low stress, round-nosed stamps, at the fabrication area or erection point.

11.2 Where stainless steel pipe is not continuously marked and is cut, the heat number shall be transferred utilizing paint (use a paint that does not contain substances which could harmfully affect the Material), at the fabrication area or erection point.

11.3 When components are installed, the location of each traceability reference marking shall be recorded on controlled documentation in accordance with a COMPANY accepted procedure for incorporation into the piping fabrication records.

11.4 Weld records shall be generated in computerized or equivalent system and this system will be the basis to collate all welding and adjacent Material traceability references to ensure 100% traceability, as required for the piping fabrication records.

11.5 Transfer of markings shall be verified and shall be done in presence of a COMPANY and / or an approved CONTRACTOR Inspector, for all manufacturing and fabrication Work.

11.6 When a component's Material reference is unknown, or has been transferred without verification, the component shall be quarantined and not used.

12 SURPLUS MATERIALS

12.1 Any off-Site fabricator shall return all surplus Materials, complete with specified traceability marking and relevant Material certification, to the main storage facilities at the Site.

12.2 On-Site fabrication and erection personnel shall return surplus Material, complete with specified traceability markings, to the main storage facilities at the Site.

13 AUDITS

13.1 CONTRACTOR shall have an audit schedule in place to verify and demonstrate the adequacy of the Material traceability system in use.

13.2 The audit results shall be recorded and maintained for further reviews, any deficiencies noted shall be immediately rectified.

14 POSITIVE MATERIAL IDENTIFICATION (PMI)

14.1 Alloy Materials shall require confirmatory per COMPANY Standard for PMI, prior to hydrostatic test, at a point that is nearest to the final assembly.

14.2 CONTRACTOR shall establish a procedure for performance of PMI which shall include random inspections and verifications, as well as 100% validation of Material critical systems. The detailed procedure shall meet Company Standard for PMI and shall require COMPANY review and prior written approval.

Vietnam Block B Gas Project

Document Numbering and Coding Specification

H01	08 February 2021		Issue for Use			TTL	BCAD, MSW	NTD
REV	**DATE**		**DESCRIPTION**			**ORIG**	**CHK**	**APPR**
PQPOC Document Control No.	**Project Code**	**Area Code**	**Discipline Code**	**Document Type**	**Originator Code**	**Sequence Number**	**Sheet Number**	**Revision**
	PQ	GENR	ITM	SPC	PQC	00003	00	H01

Revision History and Hold Record

Revision History

Date	Rev. No.	Detailed Description of Change	Ref. Section
08 Feb 2021	H01	This document is updated from PQ1-00-ITM-SPC-PQC-00003-00 Revision H03. Due to changes to the document numbering structures, this document shall therefore supersede PQ1-00-ITM-SPC-PQC-00003-00 Revision H03.	

Hold Record

Date	Rev. No.	Hold No.	Description / Reason for Hold	Ref. Section

Attachments

Item No.	Description	Document No.

Table of Contents

1. INTRODUCTION

Company will manage and control information consistently throughout VBGP life cycle. A core principle of this is the uniform and consistent numbering of all document whether generated by Company, Contractor, or 3rd parties.

The consistent and appropriate assignment of a document numbering structure and revision cycles to documents internally generated, or externally sent from external parties (Contractors, Sub contractors, Suppliers / Vendors, Sub suppliers / Sub vendors) is critical to an efficient and successful management of information for the project.

1.1 Abbreviations

Abbreviation	Description
AFC	Approved for Construction
AFD	Approved for Design
CPP	Central Processing Platform
DMS	Document Management System
EDMS	Electronic Document Management System
EPCI	Engineering Procurement Construction Installation
FEED	Front End Engineering Design
FSO	Floating Storage Off-loading
HVAC	Heating, Ventilating, Air Conditioning
IDC	Inter-Discipline Check
ITB	Invitation to Bid
LQ	Living Quarters
MDR	Master Document Register
PLEM	Pipeline End Manifold
RFI	Request for Information
SDRL	Supplier Data Requirements Listing
SSIV	Subsea Isolation Valve
VBGP	Vietnam Block B Gas Project

1.2 Definition

Term	Definition
Company	Phu Quoc Petroleum Operating Company (PQPOC)
Contractor	Provider of detailed engineering, procurement, construction, and installation of VBGP facilities.
Engineering Technical Documents	Formal information which includes text documents, database and drawings that communicate technical information defining the physical or functional requirements of the Project.

Term	Definition
Life Cycle State	The first character of the Revision code that defines the state of a document based on project phase and typical maturity levels, such as Approved for Construction or As built.
Official Correspondence	Formal communication between two or more parties to provide instructions or clarification on pertinent issues; for example, a letter between Company and Contractor.
Project Management Documents	Documents that communicate information regarding the status, administration, control, and management of the Project.
Revision	A code composed of a character that indicates document Life Cycle State (such as K for detailed design Company review) and a sequence number indicating the number of times a document has been issued at that Life Cycle State (K02 indicates the second issue for Company review during detailed design).
Sub contractor	Any party supplying services to the Contractor, which may in addition to the supply of services include the supply of goods and / or equipment.
Supplier / Vendor	Any party supplying equipment or materials to either Company or Contractor
Sub supplier / Sub vendor	Any party supplying equipment or materials to the Supplier or Vendor

1.3 Scope

This specification defines the numbering structure, revision coding, code lists and related instructions for the identification and numbering of the following documents for VBGP

- Engineering Technical Documents, and Project Management Documents
- Supplier / Vendor Documents
- Official Correspondences

1.4 General Requirements

1.4.1 Company Originated Document

All Company Development Department documents which meet (or will meet) the criteria of a 'controlled document' must have a document number assigned. It is highly recommended that the document owner requests this number from document control at the time of document creation.

1.4.2 Contractor and 3rd Party Originated Document

To ensure consistency over the Company document management system, all external parties with whom Company places a contract or purchase order with are required to assign Company document numbers and revision codes as defined in this specification to all documents, which are generated or modified by Contractor in the execution of the Work including those authored by Sub contractors and Suppliers / Vendors.

Contractor shall assign each document generated or acquired a unique Company document number.

Contractor shall maintain revision control of all documents through the application of the revision codes defined in Section 3.

Contractor may apply its own document number (or that of Sub contractors or Suppliers / Vendors) in addition to Company numbering, provided there is no negative impact to Company numbering system.

Contractor shall maintain a centralized DMS including EDMS and MDR as per Contract which contains all project documentation information.

1.5 Conventions

Company will apply the following convention in the presentation of the numbering structures of this specification:

A - Represents an Alphabetic character comprised of the letters A-Z (ABCDEFGHIJKLMNOPQRSTUVWXYZ)

N - Represents a Numeric character comprised of the numbers 0-9 (0123456789)

X - Represents either an Alphabetic or Numeric character

( ) - Characters shown in brackets are optional

2 DOCUMENT NUMBERING STRUCTURE

Company document numbering structure consists of a series of elements in a specific order for easy identification. These elements are separated by dashes (-). For the purpose of document number assignment, there are 3 classes of document numbering schemas as follows:

- Engineering Technical and Project Management Documents
- Supplier / Vendor Documents.
- Official Correspondence (A "to and from" paradigm; examples include letter, transmittal, RFI, interface request, etc.

2.1 Engineering Technical and Project Management Documents

The numbering structure of Engineering Technical and Project Management documents is depicted below (see Section **Error! Reference source not found.** for Supplier / Vendor Documents):

XX(XX)	-	XXXX	-	AAA	-	AAA	-	AAA(A)	-	NNNNN	-	NN
Project Code	*	Area Code	*	Discipline Code	*	Document Type	*	Originator Code	*	Sequence Number	*	Sheet Number

Where:

- Project Code (up to 4 alpha-numeric digits): indicates the project name code. A list of permissive *Project Codes* is defined in Section 4.1 (Project Codes).
- Area Code (4 alpha-numeric digits): the authors will select the most correctly defined area code, which would encompass the subject matter of their documents. A list of permissive *Area Codes* is defined in Section 4.2 (Area Codes).
- Discipline Code (3 alphabetic digits): the authors will select the discipline which is the most consistent to the content of their Engineering Technical or Project Management documents. A list of permissive *Discipline Codes* is defined in Section 4.3 (Discipline codes).
- Document Type (3 alphabetic digits): the document type code defines the specific kind of a document. This code may be used by one or more disciplines. A list of *Document Type* codes is defined in Section 4.4 (Document Type codes).
- Originator Code (up to 4 alphabetic digits): Originating company issues the document. A list of *Originator Codes* will be managed by Company and Contractor must seek Company approval of

any new codes prior to use. The current list of originator codes is defined in Section 4.5 (Originator / Recipient codes).

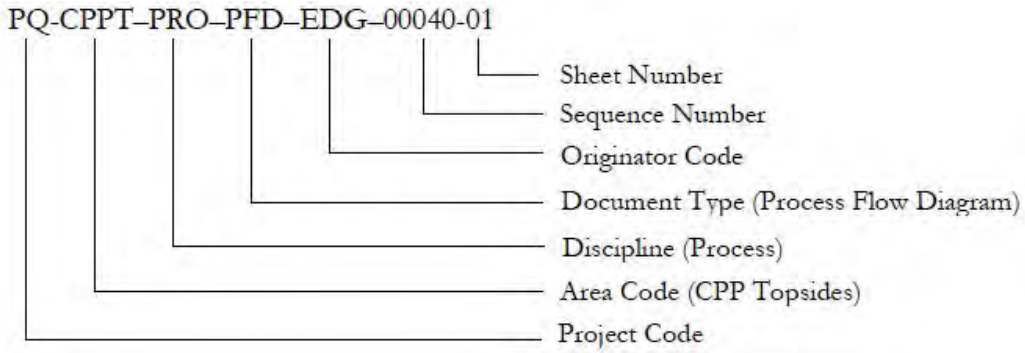
- Sequence Number (5 numeric digits): the sequence number is always unique for each combination of preceding codes, and it shall always start from 00001.
- Sheet Number (2 numeric digits): the two-digit sheet number is mandatory. It shall be only used to segregate multi-sheet drawings such as Loop Diagrams, Piping Isometrics, pipeline routes into uniquely identifiable sections that can be maintained independently. The sheet number will follow the sequence number and be separated with a dash (-). If sheet numbers are to be used the first one shall be '01'.

  Notes:

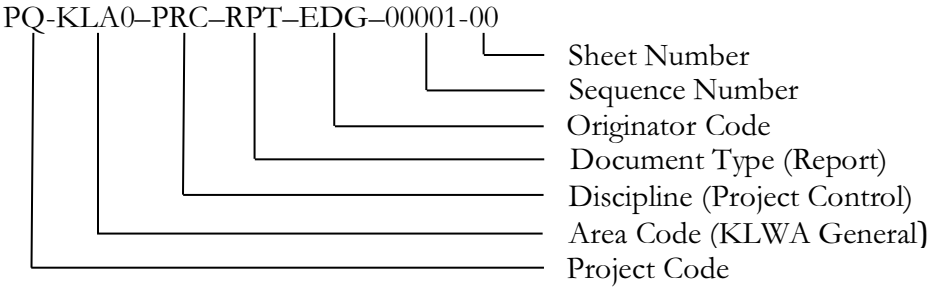
  - The sheet number shall be '00' for all multipage text documents and for drawings which are multi-sheet and treated as a single document which do not require revision control at the individual sheet level.
  - The sheet number shall be '01' for a single-sheet drawing.

Examples:

Process flow diagram of Process unit located on Central Processing Platform Topsides designed by EDG will be numbered as follows.

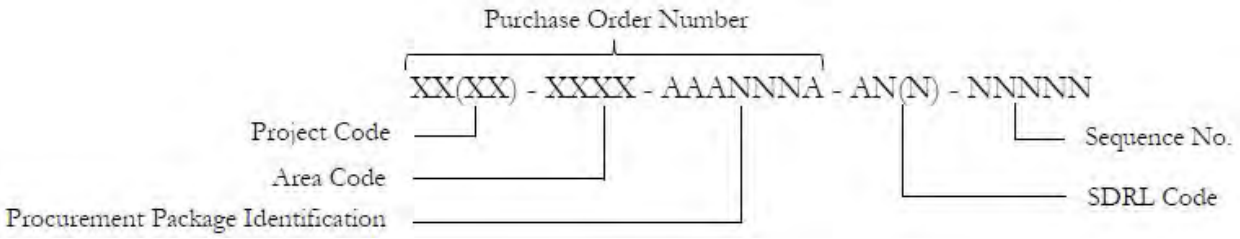


First report of Project Control discipline on Hub Platform KLWA provided by EDG will be numbered as follows.



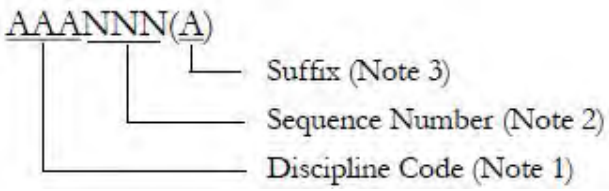
2.2 Supplier / Vendor Documents

Supplier / Vendor documents may include contracts and other agreements, quotes, specification documents, drawings, purchase order history, payment history, warranty document, etc. Supplier / Vendor documents shall be numbered as follows.



Where:

- Project Code, Area Code, and Sequence Number: See Section 2.1.
- SDRL Code: up to three alpha-numeric digits as specified in the Supplier / Vendor Data Requirements in the Material Requisition of the Purchase Order.
- Procurement Package Identification: will consist of three fields as follows.



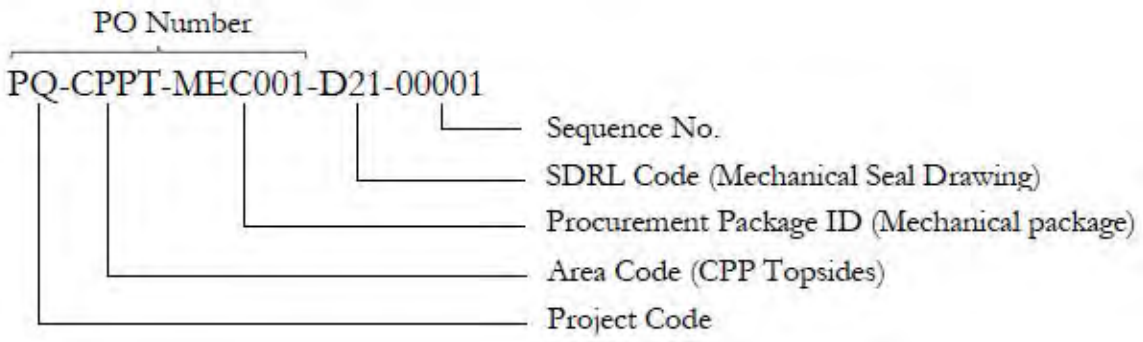
Notes:

1. Discipline Code: 3 alphabetic digits identifying the discipline of the engineering goup who will be in charge as the Package Engineer for a procurement package (e.g., if the procurement of a safety equipment package is assigned to the Mechanical group, the Discipline Code will be MEC) as per table below.

Code	Discipline
ARC	Architectural
ELE	Electrical
DRL	Drilling, Well Construction, and Completion
FGS	Fire and Gas Safety
HVC	HVAC
ICS	Instrumentation and Control System
MAR	Marine
MEC	Mechanical
PIP	Piping
PPL	Pipelines & Flowlines
STR	Structural
TEL	Telecommunication
Note: additional engineering disciplines (for Procurement Package Identification purpose) can be added subject to Company approval.	

2. Sequence Number: 3 numeric digits starting from 001.
3. Suffix (Optional): a single alphabetic digit allows the procurement package to be split as required.

Example:



2.3 Official Correspondence

Correspondences - documentation containing a 'to and from' paradigm e.g. (letter, transmittal, RFI, etc.) shall have the numbering format as follows.

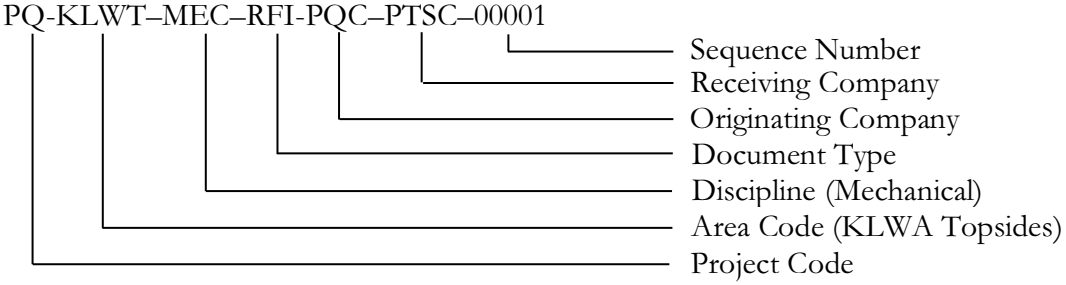
XX(XX)	-	XXXX	-	AAA	-	AAA	-	AAA(A)	-	AAA(A)	-	NNNNN
Project Code	*	Area Code	*	Discipline Code	*	Document Type	*	Originating Company	*	Receiving Company	*	Sequence Number

Where:

- Project Code, Area Code, Discipline Code, Document Type, and Sequence Number: See Section 2.1.
- Originating Company Code (up to 4 alphabetic digits): Originating company issues the document. A list of originating company codes is defined in Section 4.5 (Originator/Recipient codes).
- Receiving Company Code (up to 4 alphabetic digits): Company receives the document. A list of receiving company codes is defined in Section 4.5 (Originator/Recipient codes).
- For the purpose of simplicity, the Area Code, Discipline Code and Document Type of all transmittals shall always be classified as GENR, PMT and TRM respectively regardless of content.

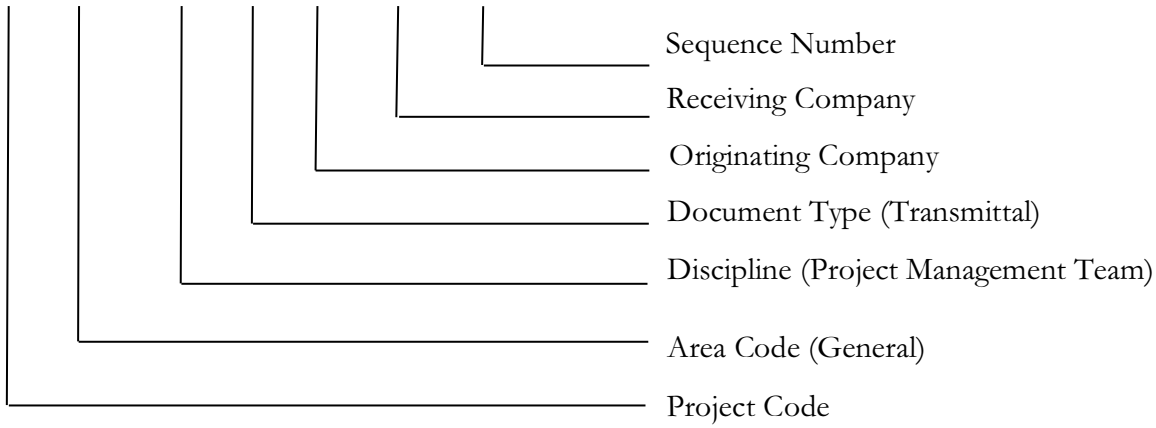
Example:

Company Request for Information (RFI) sent to PTSC for a mechanical equipment located on Hub Platform KLWA will be numbered as follows.



A transmittal from PTSC to Company will be numbered as follows:

PQ-GENR–PMT–TRM-PTSC–PQC–00001



3 REVISION CODING

Document revisions shall be alphanumeric, assembled from the Life Cycle State code and a sequential number incremented each time the document is issued within that given Life Cycle State.

Sequential Numbering – Example within a given Life Cycle State	
Life Cycle State Code - Alpha (A)	Sequential Number (NN)
K	01
K	02

Where:

- Life Cycle State Code (1 alpha digit): indicates the progress status of document life cycle state. A list of permissive *Life Cycle State Codes* for VBGP is listed and described in the table below:

Revision Code	Life Cycle State	Description
Pre-FEED Phase		
A	Pre-FEED Interdisciplinary Design Check/Office Check	Document is adequate for review
B	Pre-FEED Company Preview	Having been reviewed internally, Document must be fit for Company review
C	Pre-FEED Implementation/ Use	Document is adequate to be used by all parties until or unless it is revised and reissued. It incorporates the design or information available at the time of issue
FEED Phase		
D	FEED Interdisciplinary Design Check/Office Check	Document is adequate for review
E	FEED Company Preview	Having been reviewed internally, Document must

		be fit for Company review
F	FEED Preliminary Design	Contractor shall use this Revision code only after discussion with Company. This is used to define the state of documentation that will be included in the project Invitation to Tender (ITT) package which has not reached a state of 'for design' or 'for use'
G	FEED Design	Document is sufficient for affected disciplines to use it as the basis for continued design, having incorporated appropriate Company and interdisciplinary comments. Generally, restricted to drawings
H	Implementation/ Use	Document is adequate to be used by all parties until or unless it is revised and reissued. It incorporates the design or information available at the time of issue
Execution Phase		
H	Implementation / Use	Reserved for Company use during Execution Phase
J	Interdisciplinary Design Check/ Office Check	Document is adequate for interdisciplinary review
K	Design - Company Review	Having undergone IDC, document has matured to the point that it is fit for Company review
L	Design (AFD)	Document is sufficient for affected disciplines to use it as the basis for continued design, having incorporated appropriate Company and interdisciplinary comments.
M	Construction – Company Review	AFD document has matured to the point that it is fit for Company review as an Issued for Construction document.
N	Construction (AFC) for engineering documents or For Use for non-engineering	Document is sufficient for use by all parties including as the basis of fabrication until or unless it is revised and reissued. Document incorporates the design or information available at the time of issue.
P	As Supplied	The Supplier / Vendor document reflects the equipment, package, or item as it was at the time of shipment from the Supplier / Vendor / manufacturer's works. All Supplier / Vendor documents shall be issued by Contractor to Company in an as-supplied state 30 days before the package or item is shipped.
R	Redline Mark-up	Contractor mark-up of as supplied and AFC documents indicating changes made during

		construction, commissioning, etc.
Z	As Built	The document reflects the true state of the facility, equipment or item at the time of issue.
V	Void (Common)	Document will no longer be used on the project.

Below is an example revision code sequence for documents generated by the EPCI Contractor in fulfillment of their Work:

Acceptable Progress (External)			
Current Life Cycle State	**Current Review Return Code***	**Next Possible State**	**Notes**
K	3	K	At next 'K' revision
K	1,2,4	L01	Subject to Company comments inclusion
L	2,3	L	At next 'L' revision
L	1,4	M01	'M' only after Design is finalized
L	1,4	P	Supplier / Vendor documents 'as supplied'
M	3	M	At next 'M' revision
M	1,2,4	N01	Subject to Company comments inclusion
N	2,3	N	At next 'N' revision
N	1,4	N, R, Z	Depending on document type
P	1,2,3,4	R, Z	Depending on document type
R	2,3	R	At next 'R' revision
R	1,4	Z01	Where as-built required
Z	2,3	Z	At next 'Z' revision
Z	1, 4		End of lifecycle

*** Definition of 'Review Return Codes'**

Review Return Code	Name	Description
1	Reviewed with no Comment	Contractor may proceed with work (e.g., issue document for use, issue document for design, begin procurement and/or construction / fabrication depending on the current Life Cycle State of the document). Documents are to be resubmitted to Company at a higher appropriate Life Cycle State.
2	Reviewed with	Contractor may proceed with work (e.g., issue document for

	Comment	use, issue document for design, begin procurement and/or construction / fabrication depending on the current Life Cycle State of the document) after incorporating Company's comments. Documents shall be revised to reflect Company's comments and shall be resubmitted to Company at a higher appropriate Life Cycle State.
3	Not Accepted/ Revise & Resubmit	Contents of Contractor's document is fundamentally unacceptable. Document shall be modified and re-issued at the same 'alpha' revision with incremental numeric revision for Company review. Contractor shall not issue for use, issue for design, begin procurement and/or construction / fabrication until a return code of 1 or 2 is achieved.
4	Not Reviewed	Company has elected in its discretion not to review the document. The lack of Company review of any document does not relieve Contractor of any obligation defined in the Contract. Contractor may issue for use, issue for design, begin procurement and/or construction / fabrication. If documents are resubmitted to Company at a higher Life Cycle State Company may elect to comment on higher revision.

4

4 CODE LISTS

4.1 Project Codes

Project Code	Description
PQ	Vietnam Block B Gas Project
Note: Additional Project Codes can be added (by Company) as and when required.	

4.2 Area Codes

The list of permissible Area Codes are given in the table below:

Area Codes	Description
GENR	Project General
CPC0	CPP Complex (inclusive of CPP, LQ and Flare) - General
CPP0	CPP Platform - General
CPPB	CPP Bridges - General
CPB1	CPP - LQ Bridge
CPB2	CPP - AQWA Bridge
CPB3	CPP - Flare Bridge
CPPJ	CPP Jacket

CPPP	CPP Piles
CPPT	CPP Topsides
CPF0	CPP Flare Platform - General
CPFJ	CPP Flare Jacket
CPFP	CPP Flare Piles
CPFT	CPP Flare Topsides
CLQ0	Living Quarters Platform - General
CLQJ	Living Quarters Platform Jacket
CLQM	Living Quarters Module
CLQP	Living Quarters Platform Piles
CLQU	Living Quarters Utility Module/Deck
HWP0	Generic Hub and Wellhead Platform - General
HUB0	Generic Hub Platform - General
HUBJ	Generic Hub Platform Jacket
HUBP	Generic Hub Platform Piles
HUBT	Generic Hub Platform Topsides
WHP0	Generic Wellhead Platform - General
WHPJ	Generic Wellhead Platform Jacket
WHPP	Generic Wellhead Platform Piles
WHPT	Generic Wellhead Platform Topsides
AQA0	AQWA Wellhead Platform - General
AQAJ	AQWA Wellhead Platform Jacket
AQAP	AQWA Wellhead Platform Piles
AQAT	AQWA Wellhead Platform Topsides
AQB0	AQWB Platform - General
AQBJ	AQWB Platform Jacket
AQBP	AQWB Platform Piles

AQBT	AQWB Platform Topsides
CVA0	CVWA Hub Platform - General
CVAJ	CVWA Hub Platform Jacket
CVAP	CVWA Hub Platform Piles
CVAT	CVWA Hub Platform Topsides
CVB0	CVWB Platform - General
CVBJ	CVWB Platform Jacket
CVBP	CVWB Platform Piles
CVBT	CVWB Platform Topsides
KLA0	KLWA Hub Platform - General
KLAJ	KLWA Hub Platform Jacket
KLAP	KLWA Hub Platform Piles
KLAT	KLWA Hub Platform Topsides
KLB0	KLWB Hub Platform - General
KLBJ	KLWB Hub Platform Jacket
KLBP	KLWB Hub Platform Piles
KLBT	KLWB Hub Platform Topsides
KLC0	KLWC Platform - General
KLCJ	KLWC Platform Jacket
KLCP	KLWC Platform Piles
KLCT	KLWC Platform Topsides
FSO0	FSO - General
FSOA	FSO Accommodation and Superstructures
FSOH	FSO Hull
FSOM	FSO Mooring
FSOO	FSO Offloading
FSOR	FSO Riser
FSOT	FSO Turret

IP00	In-field Pipeline - General
IP01	In-field Pipeline from KLWB to KLWA
IP02	In-field Pipeline from KLWA to CPP
IP03	In-field Pipeline from CVWA to CPP
IPCX	Condensate Pipeline from CPP to PLEM
IPGX	Sales Gas Export Pipeline from CPP to SSIV
Note: Additional Area Codes can be added (by Company) as and when required.	

4.3 Discipline Codes

Discipline Code	Meaning	Description
ADM	Administration/ Multifunction/ Multidiscipline	To be used in instances where the document in question covers multiple non-technical subjects and is unable to be assigned to another specific business discipline.
ARC	Architectural	The design of buildings including the contents, layout, and functionality.
ASR	Assurance	To be used for Project Assurance documents.
CAB	Commercial & Business	For use when referring to Commercial and Business documents.
CIV	Civil	To be used for civil works documents.
CMS	Commissioning Management	The planning, design, and management of activities necessary to prepare the facility for the introduction of production fluids.
CNS	Construction Management	Having to do with the actual actions necessary to construct the facility. Excludes activities necessary to define how components of the facility will be fabricated.
CRR	Corrosion and Surface Protection	The design, definition, application, and management of the application of preparatory processes, protective coatings and cathodic protection schemes to metals and other materials.
CTC	Contracting	Defines scopes of work, terms and conditions, exhibits and work orders. Negotiations with contractors, deviations and change orders. All matters related to the negotiation and execution of contracts related to the project.
DRL	Drilling, Well	Definition, design, and execution of

	Construction, and Completions	drilling, construction, and completions of wells.
ELE	Electrical	The generation, distribution and control of electric power including its transformation into mechanical energy.
FGS	Fire and Gas Safety	Related to the detection, alarming and control of fire and gas.
GEO	Geotechnical	The rock and soil studies related to the design of footings, piles, piers, and foundations.
HSE	Health Safety Environmental	Related to the execution of the project and operation of the facility in a safe and environmentally acceptable way.
HRS	Human Resources Services	Related to the definition, acquisition, and maintenance of needed human resources.
HVC	Heating/ Ventilating/ Air Conditioning	Equipment and other infrastructure for control, generation, and distribution of ventilation, heating, and air conditioning.
ICS	Instrumentation and Control System	Definition and design of the devices (including 'final control elements' such as automated valves), cabling and software required to automate the control functions of the facility.
INT	Interface	Related to interface activities.
ITM	Information Technology and Management	Related to the definition, acquisition and maintenance of information required for the execution of the project and continued operation of the facility. Also includes personal computing equipment and the business LAN, but excludes control system networks. Management, storage and tracking of all kinds of document related to the project.
LGL	Legal	
MAR	Marine	
MAW	Materials and Welding	Material science, material selection and welding.
MEC	Mechanical	Design and definition of mechanical equipment.
MNT	Maintenance	Defines the activities and planning required to maintain the facility's equipment and other infrastructure.
OPS	Operations	Related to the planning, scheduling and operations of the facility, training of

	Management	operations personnel.
PIP	Piping & Insulation	Design and definition of piping and associated insulation.
PMT	Project Management Team	
PPL	Pipelines & Flowlines	Design and definition of pipelines, including subsea assemblies/structures such as PLEM, SSIV.
PRC	Project Controls	Related to the scheduling, planning, and cost control of the project.
PRO	Process	Design and definition of the fundamental process of the facility, including mass and material balance, simulation, and calculation of process data for equipment.
PRV	Preservation	Preservation of equipment when not in service.
PSE	Process Safety	Design and definition relating to process safety engineering.
PUB	Public and Government Affaires	Press and government relations including control of information distributed to the press and other organizations.
PUR	Procurement	The negotiation and execution of purchase orders for materials and equipment required to construct and operate the facility.
QAC	Quality Assurance/ Quality Control/ Inspection	Ensures that design, materials, fabrication, and manufacturing activities are executed such that quality requirements established in either industry, Company, or Project standards are achieved.
RGL	Regulatory	Related to matters to which Company must comply with to be in regulatory compliance
RSK	Risk and Interface Management	**Interface management** – The management and definition of the physical and other boundaries between contract scopes of work to ensure safe, timely, accurate and conflict-free installation and use of equipment and materials at those boundaries. **Risk Management** – definition and mitigation of risks to the project's success.
SEC	Security	Having to do with the physical security of the facility, project team and/or construction or design sites of the project.

SRF	Subsurface	Geophysical & Geological (Earth Science) evaluation of reserves.
STR	Structural	Design and definition of structures through calculations, static and dynamic models, and drawings.
TEC	Technical Multifunction/ Multidiscipline	General technical documents that are related to all technical disciplines simultaneously.
TEL	Telecommunications	Design and definition of equipment and other infrastructure related to telecommunications, public address systems, and telephone systems.
TIN	Transportation and Installation	
Note: Additional Discipline Codes can be added subject to Company approval		

4.4 Document Type Codes

The document types shown below can be applicable to all Management, Business, and Technical disciplines.

Doc. Type Code	Meaning	Description
ACC	Accommodation	Accommodation document / drawing of a structure.
ADD	Addendum	Addendum.
ALN	Alignment Sheet / Diagram	Drawing of alignment Diagram.
ARF	Action Request Form	
ASY	Assembly Drawing	
ATL	Action Tracking List	List used to track Actions.
AUD	Audit	All types of Audit Documents.
BCA	Bid Circulation Advice	Company provided updates to ITB.
BEC	Bid Evaluation Criteria	Criteria upon which Bids / Proposals are evaluated.
BID	Bid	Bid for Tender/ Bid Tabs/ Approvals (ITB/ITT).
BLD	Building Diagram	A Building Diagram is a technical diagram of a platform/building that falls within the definition of architecture, to enable a building contractor to construct it.
BLK	Block Diagram	A Block Diagram is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that

		show the relationship of these blocks.
BOD	Basis of Design	Includes design basis, basis engineering design data, etc.
BOE	Basis of Estimate	The basis on which the Estimate is based.
BOM	Bill of Materials	
CAL	Calculation	Document providing information about data and basic conditions, and assumptions used for selection of appropriate system solutions, parts, material, schedule, or cost, as well as the way these data have been processed and evaluated.
CAR	Corrective Action Request	
CBE	Commercial Bid Evaluation Report	Report issued after completion of Commercial Bid evaluation which includes results of Commercial Bid evaluation.
CCR	Concession Request	Request for a concession against Contract requirements raised by Contractor / Supplier / Vendor.
CEF	Cause & Effect Diagram	Cause & Effect Diagram is shown in a simple form of matrix. The causes are listed in the left section while the effects are listed on the top section; both are described in form of tag number with their description and location in the equipment package or processing system.
CHA	Chart	Multiple types of document.
CLA	Clarifications	Clarification issued as part of Bid process.
CLM	Claim	Claim made against Contract.
COA	Contract/ Agreement	
COR	Change Order Request	This document is issued by Contractor.
CRT	Certificate	
CRV	Performance Curves	
CTL	Control Diagram	Diagram to describe the control of a process.
CXP	Commercial Exception	Commercial Exception taken to Bid process.
DAS	Data Sheet	
DID	Duct & Instrument Diagram	A Duct & Instrument Diagram shows the instrumental ducts in an equipment package/processing system.
DSP	Decision Support Package	Collation of information used in support of decision taken.
DTL	Detail Drawing	Sectional or exploded view drawing detailing main fabrication/ assembly information – design parameters, materials, wall thickness, lining,

		internal fittings, test details of major process and utility vessels and equipment.
DVR	Deviation Request	
ELV	Elevation Diagram	An Elevation Diagram gives an impression how one face (front, rear, side) of the platform will look from the outside.
ESA	Exceptional Situation Approval	Internal form generated by department to seek and obtain Board of Director and General Director approval related to exceptional circumstances.
EST	Estimate	A calculation or judgement of the value, number, quantity, or extent of something.
EXH	Exhibit	Exhibit for Bid process.
FAT	Factory Acceptance Test	A test conducted to determine if the requirements of a specification or contract are met.
FAX	Facsimile	The result of a system of transmitting and reproducing graphic matter by means of signals sent over telephone lines.
FOR	Forecast	A calculation or estimate of future events, especially a financial trend.
FRA	Framework	A basic structure underlying a system or concept.
FRM	Form	Document Form Template.
GAR	General Arrangement	A General Arrangement Diagram/Drawing presents the overall composition of an object such as a building/platform, which includes a number of different projections such as plans, section, and elevations.
GDL	Guideline	Document providing advice in following a course of action, policy, or procedure.
GND	Grounding	Drawing for Grouding.
HAZ	Hazardous Area	Drawing for Hazardous Area.
HMB	Heat and Mass Balance	Document including operating conditions, compositions, and key physical properties of major process streams on the Process Flow Diagram (PFD).
IID	Instrument Installation Details	An Instrument Installation/Hook-Up Detail diagram is a detailed drawing showing typical installation of instrument in a correct manner so that instrument operates properly.
IIS	Interface Information Sheet	
INC	Interconnection drawing	An Interconnection Drawing shows the interconnection between each device including

		instrument devices, junction box, panels, in order to provide a view of overall connection of system.
INV	Invoice/Payment Log	
IRF	Interface Request Form	All types of interface documents between multiple disciplines or multiple parties.
ISN	Inspection Notification	
ISO	Isometric Drawing	An Isometric Drawing is way of presenting designs/drawing in three dimensions; a 30 degree angle is applied to its sides.
ITB	Invitation to Bid	
ITC	Instruction to Contractor / Vendor / Tenderer	
ITP	Inspection of Test Plan	
ITR	Inspection Test Record	A written report of the equipment or material condition presented by a competent professional.
JBD	Job Description	A written summary of individual employees' responsibilities in performing their work.
LAY	Layout Drawing	A Layout Drawing is considered as location plan of equipment/instrument. This drawing shows the exact position of each instrument/equipment package with reference to plant layout.
LET	Letter	Issued for External Communication.
LIC	License – Authorization	An official permission or permit to do, use, or own something.
LGN	Drawing Legend	Drawing Legend(s) explain the symbols used for that discipline or set of drawings.
LGT	Lighting	Lighting design is a field within architecture, interior design and electrical engineering that is concerned with the design of lighting systems, including natural light, electric light, or both to serve human needs.
LLR	Lesson Learned	
LOA	Letter of Award	The letter as used to formally award a contract to the successful Bidder.
LOG	Logic Diagram	A Logic Diagram is a diagram of the logic used for representation purposes or to carry out certain types of reasoning.
LOI	Letter of Intent	The letter as used to notify the successful Bidder of the intent by Company to award it the respective contract.

LST	List/ Register/ Index	All types of lists including both business and technical such as equipment list, instrument index, lubrication list, motor list, piping list, specialty item list, line list, etc.
MAN	Manual	Documents providing general information on how to handle products, units, systems, plants, or installation. For example: operations manual, commissioning manual, service manual, installation, user manual, etc.
MAP	Map	
MDL	2D or 3D Model Review	2D or 3D representation engineering design.
MEM	Memo	Issued for Internal Communication.
MES	Method Statement	
MOC	Management of Change	
MOM	Minutes of Meeting	
MTO	Material Take Off	
MTS	Material Selection	Drawing for Material Selection.
NAV	Navigation Aids	Documents / drawings describing the navigation aids system that is an audial and visual system to warn ships for an obstruction at sea.
NCR	Non Conformance Report	A document depicting non-compliance with Contract / PO requirements.
NPL	Nameplate Drawing	Document depicting equipment nameplate.
ORG	Organization Chart	
PCD	Procedure	Procedures and guidelines, including processes.
PDG	Protection Diagram	A Protection Diagram describes the protection systems (electrical, pressure, temperature, etc.) for a plant, such as a chemical plant or oil refinery.
PEP	Project Execution Plan	The primary document that defines how the project will be undertaken.
PFD	Process Flow Diagram	A Process Flow Diagram is a diagram commonly used in chemical and process engineering to indicate the general flow of plant processes and equipment. This diagram displays the relationship between major equipment of a plant facility.
PHA	Process Hazard Analysis	
PHC	Pneumatic – Hydraulic Connection	Pneumatic – Hydraulic Connection drawings are single line drawings that use symbols and lines to illustrate the connection and equipment to be used in the pneumatic or hydraulic equipment.

PHL	Philosophy	Details the reasoning and assumption made in a design and required as reference documents for modification.
PHO	Photograph	
PIA	Proposal Internal Approval	Internal form generated by department to seek and obtain Board of Director and General Director approval of services.
PID	Piping & Instrument Diagram	A Piping & Instrument Diagram shows the piping and the process flow together with the installed equipment and instrumentation.
PLN	Plan	All types of plans including most DEP (Development and Execution Process) documents and roadmaps.
PLT	Location Plot Plan	A Location Plot Plan is an architecture, engineering and landscape architecture plan drawing which shows the buildings, equipment layout, and other constructions of an existing or proposed project at a defined scale.
PND	Panel Junction Termination Box Diagram	A Panel Junction Termination Box Diagram illustrates the connection of lines inside junction box.
POL	Policy	
POR	Purchase Order	The formal instrument used to order materials and equipment.
PQR	Welding Procedure Qualification Record	
PRP	Proposal	Technical and commercial proposals issued by Contractor to Company.
PRQ	Pre-Qualification	The process of prequalifying an entity.
PRS	Presentation	All types of presentation.
PSU	Piping Support Drawing	A Piping Support Drawing describes the designed element that transfers the load (weight of pipe and all the pipe fittings attached to pipe) from the pipe to the supporting structure.
PWR	Power Distribution Drawing	A Power Distribution Drawing illustrates the power distribution on each room/deck of the platform and to each electrical panel. This drawing provides an accurate depiction of the infrastructure, ensures efficiency and safety in power transmission, and can identify potential risks and issues.
QRY	Query	Query raised by Contractor during Bid process.
REC	Record	

REQ	Requisition	
RFI	Request for Information	
RFP	Request for Proposal	
RFQ	Request for Quotation	
RIA	Request for Internal Approval	Internal form generated by department to seek and obtain Board of Director and General Director approval for a specific service with known budget.
RID	Raw Input Data	Data files used in analysis tools.
RPT	Report	Used for documents providing summary findings of a business or technical nature including the results of observations, examinations, inspections, experience, etc.
RTA	Recommendation to Award	
SCH	Schedule	Used to store all types of project schedule documents. This includes overall roll-up management schedules; detailed technical discipline design, fabrication, and installation schedules; as well as plant maintenance T&I schedules, preventive maintenance schedules, etc.
SCM	Schematic Diagram	A Schematic Diagram is a representation of the element of a system using abstract, graphic symbols rather than realistic pictures.
SCT	Section Drawing	Drawing showing sectional aspects.
SDY	Study	
SFD	Safety Analysis Flow Diagram	Flow diagram pertaining to safety systems.
SGY	Strategy	
SHF	Shop Fabrication	Drawing for Shop Fabrication.
SID	Safety in Design	Mechanism to assure built in safety within design parameters.
SKT	Sketch	An outline drawing – not to be used for design or construction.
SLN	Single Line Diagram	A Single Line Diagram is circuit diagram where "one-line" is shown to represent three phase power system. In addition to showing the rating and size of electrical equipment and circuit conductors, a properly drawn one-line diagram will also show an electrically correct distribution of power with respect to current flow from power source to the downstream loads or panel boards.

SOR	Service order	The formal instrument used to order services.
SOW	Scope of Work	
SPC	Specification	
SQR	Site Query	Query raised from construction / fabrication sites.
STD	Standard/ Codes	International or national agreed rules published by standard organizations,and rules for a specific purpose which supplement existing international or national standards or provide guidelines when no standard is available.
SUR	Survey	
TBE	Technical Bid Evaluation Report	Report issued after completion of Technical Bid evaluation which includes results of Technical Bid evaluation.
TBU	Tender Bulletin	Document issued by tenderer providing update to / status of ITB.
TCR	Technical and Commercial Evaluation Report	The document is generated by Company upon completion of technical and commercial evaluation processes and includes evaluation summaries.
TEN	Technical Note	Engineering / Technical-related notes.
TOC	Table of Contents	Table of Contents for Bid process.
TOR	Terms of Reference	
TQY	Technical Query	Technical Query raised by Contractor / Supplier.
TMD	Termination Diagram	Termination Diagrams are used to help workmen to connect wires of electrical circuit. These diagrams are designed with expertise to demonstrate the connections among mechanisms and demonstrate how these are to be physically connected via cables.
TRM	Transmital	
TXP	Technical Exceptions	Technical Exceptions for Bid process.
UFD	Utility Flow Diagram	
VDD	Vital Document and Data	Collated set of information provided by Contractor at major Contract milestones.
VID	Video	
VIP	Value Improving Practice	A set of best practices to enhance project planning, delivery, and operation.
WAR	Warranty	Documents providing information about warranty matters such as a Certificate of Guarantee.

WDM	Weld Map	A Weld Map Drawing normally identifies a weld joint in a component and weld joint configuration.
WGR	Weight Report	
WHT	Whitepaper	A report giving information or proposals on an issue.
WKO	Work Order	
WPK	Work Pack	
WPQ	Welding Procedure Qualification Record	A typical completed document that shows the actual essential parameters used during welding of the test coupon as well as the test results.
WPS	Welding Procedure Specification	A formal document describing welding procedures which depicts the required welding parameters for specific materials/metals.
WRD	Wiring Diagram	A Wiring Diagram is a simplified conventional pictorial representation of an electrical circuit showing the components of the circuit as simplified shapes, and the power and signal connections between the devices.
WRI	Work Instruction	A document that sets out the process for a specific part of the Work.
Note: Additional Document Types can be added subject to Company approval.		

4.5

4.5 Originator / Recipient Codes

Originator / Recipient Code	Company Name
CHV	Chevron
EDG	EDG Engineering
FSL	Fugro Survey Ltd
PQC	Phu Quoc Petroleum Operating Company
PMC	PTSC Mechanical and Construction Limited Company
POS	PTSC Offshore Services
SMG	Somehsa Geoscience Pte Ltd
TAP	Technip Vietnam
TTC	TrueTech Company
VSP	Vietsovpetro
Note: Additional Originator / Recipient codes can be added subject to Company approval.	

EXHIBIT F-2-ATTACHMENT D
VITAL DOCUMENT & DATA DELIVERABLES

H01	28 November 2022		Issued for Bid					
E01	09 November 2022		Issued for Review					
REV	**DATE**		**DESCRIPTION**			**ORIG**	**CHK**	**APPR**
PQPOC Document Control No.	**Project Code**	**Area Code**	**Discipline Code**	**Document Type**	**Originator Code**	**Sequence Number**	**Sheet Number**	**Revision**
	PQ	GENR	ITM	SPC	PQC	00002	00	H01

TABLE OF CONTENTS

1. SCOPE

This Specification defines the Vital Documentation and Data (VDD) which shall be acquired or prepared by CONTRACTOR and submitted to COMPANY.

This specification forms the basis for the Handover Documentation and Data to Operations with respect to both content and organization.

The requirements and responsibilities referenced in this document, including access to CONTRACTOR systems, applications and personnel and the provision of information, documents and data shall be provided at no additional cost to COMPANY.

2. PURPOSE

This specification defines the requirements for the preparation of vital documentation and data (VDD), i.e. Documentation and Data that is:

- Essential for the continued operation the COMPANY
- Essential to ensure quality of required VDD Content and Format
- Important to the preservation of the COMPANY businesses as legal entities
- Needed to preserve and re-establish the contractual and/or financial position of the COMPANY in the case of loss recovery.
- Essential for the timely population of the COMPANY Information Management System throughout all Project Phases

The further purpose of this specification is to describe the detailed COMPANY requirements for the initialization and preparation, production, compilation and handling of vital documentation and data identified for handover to Operations.

Overall objectives of this specification are to:

- Identify roles and responsibilities
- Ensure that Documentation and Data which is vital to the Operations and Maintenance of the installation is identified, completed and prepared for handover to Operations.
- Ensure uniformity in content and format, thereby ensuring Quality
- Identify distribution requirements and availability in due time for the next user
- Define a uniform structure for handover to Operations
- Minimize preparation and handling cost
- Comply with regulatory requirements

2.1. Contract/VDD Deliverables Overview

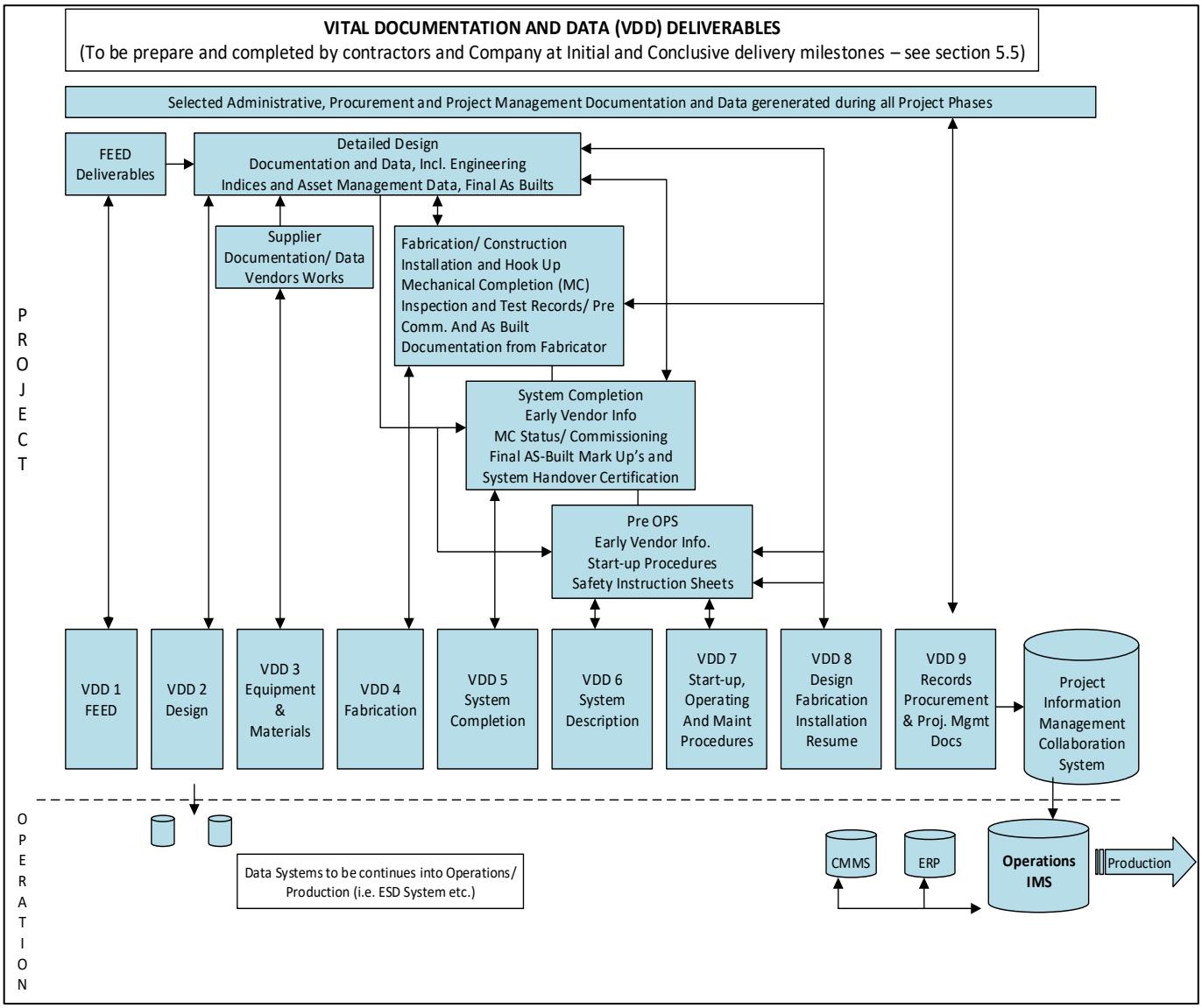


Figure 2.1 Contract/VDD Deliverables

3. DEFINITIONS AND ABBREVIATIONS

The following definitions apply to this document and as inferred herein. Definitions in the Terms and Conditions shall take precedence in the event of any conflict with the definitions listed below.

DEFINITIONS AND ABBREVIATIONS	
Term	**Definition**
As-Built	A Document life cycle state for which the Document's contents represent the actual facility at the time of its issue, formally incorporating any change, correction, or clarification necessary into a new revision of the original Document and clearly indicating the As-Built condition
As-Supplied	The vendor document reflects the equipment, package, or item as it was at the time of shipment from the vendor / manufacturer's works
CDM	Conclusive Delivery Milestones
PQPOC	Phu Quoc Petroleum Operating Company
CMMS	Computerized Maintenance Management System
Commissioning	Commissioning activities include the preparation for operation of any part or parts of the plant prior to start-up, e.g. tightness testing, drying of circuits, loading of molecular sieve, chemical cleaning, instrument complex function testing, software checks, final electrical checks, air freeing, equipment operational tests (e.g. nitrogen runs), etc.
Commodity	A commodity includes but is not limited to a fluid, electrical current or mechanical power, which is being handled, usually to generate product(s) meeting specific conditions
Component	A physical or software item that transforms, transfers, modifies the flow, changes a Property, or measures a Property of a Commodity. Examples include a tank stores Commodity inventory, a pump changes Commodity pressure, a Temperature Indicator (TI) senses and displays a Commodity temperature, an electric motor transforms electrical energy into mechanical energy and a gearbox transforms mechanical energy through a step-up or step-down in rotation speed.
Contract Object	The abbreviated title of the Contract, generally describing the scope of Work. Examples include 'Subsea Equipment', 'Topsides', 'Platform A', 'Pipeline', 'Wellpads and Flowlines', 'CPP' and 'FSO'
Database	A matrix of information in electronic format; databases generally consist of multiple tables of information including relationships between those tables

Data Warehouse	An object oriented database which not only contains information but records events regarding each change to that information. These systems are highly structured, very flexible and have the ability to hold many associations effectively.
DFI	Design, Fabrication and Installation
Document	A means of communicating a collection of related information. This includes electronic files containing the equivalent of paper documents such as specifications or drawings, an electronic model such as the 3D electronic model, or report of Database Information.
Document and Drafting Standard	Defined in Section 5.7
Document Requirement Schedule (DRS)	A list defining COMPANY's Document requirements, including required Document types, general content and formats. The DRS is used by CONTRACTOR as the basis for the development of the Project Document Schedule. For further definition of the DRS, see 'Management of Document Requirements' below.
FRB	Fabrication Record Book
IDM	Initial Delivery Milestones
IM	Information Management
Information	A collection of data or facts presented with appropriate context. For example, a number (200) by itself is not Information, while a number with a label and units is (discharge pressure 200 PSIG). Documents are also Information.
Large Facility Object	FPSO, production platform, loading buoy, tieback system, etc.
Mechanical Completion (MC)	When static inspection and testing of workmanship and materials proves and validates the equipment/system has been installed, tested, certified, and fully documented in accordance with the design, supporting specifications, and all other requirements
MRB	Manufacturing Record Book
PCS	Plant Completion System (WIN PCS™ or EQUIVALENT)
PDF	Adobe Portable Document Format
Pre-Commissioning	Part of Construction Completion, constitutes all non-operating activities such as adjustments, cold alignment checks, line cleaning, removing of free water from systems and equipment, oil flushing, loop-checks, reinstatement, etc. Pre- Commissioning is supported and signed-off by the Commissioning Team.
PMT	COMPANY Project Management Team

Project Document Schedule (PDS)	A list of all Documents for which CONTRACTOR is responsible throughout execution of the project. The list is a combination of all Documents supplied by COMPANY and those that are anticipated in the future to be generated by CONTRACTOR and CONTRACTOR'S Subcontractors, suppliers and vendors for the duration of the Work. For further definition of the PDS, see Document Control and Exchange Specification (PQ-GENR-ITM-SPC-PQC-00004-00).
Property	A characteristic quality of a Commodity. A property for a Commodity includes but is not limited to speed, power, pressure, temperature, flow, or inventory (stored amount or level).
RSPL	Recommended Spare Parts List
SDRL	Supplier Document Requirements List A list generated by CONTRACTOR to define the Documents required for a specific subcontract or purchase order. Each equipment type or subcontract shall have its own table of required documents. For further definition of the SDRL, see Document Control and Exchange Specification (PQ-GENR -ITM-SPC-PQC-00004-00).
SPIR	Spare Parts Interchangeability Record
Supplier	Any organization with which CONTRACTOR places a purchase order in the execution of the Work including manufacturers, vendors and suppliers, but excluding design, construction, installation, transportation, third party classification and commissioning contractors.

4. REFERENCES

Project Vital Documentation shall be prepared, completed and handed over in accordance with this procedure and in accordance with the following procedures and specifications.

DOCUMENT NUMBER	TITLE
PQ-GENR-ITM-SPC-PQC-00001-00	Information Management Requirements Specification
PQ-GENR-ITM-SPC-PQC-00003-00	Document Numbering and Coding Specification
PQ-GENR-ITM-SPC-PQC-00004-00	Document Control and Exchange Specification
PQ-GENR-ITM-SPC-PQC-00007-00	Document Requirements Schedule

5. REQUIRED VITAL DOCUMENTATION AND DATA

5.1. General

It is COMPANY policy to manage information consistently throughout the Project life cycle, from initial concept design through de-commissioning. The enactment of this principle is intended to help ensure efficient access to information during detail engineering, design, procurement, construction, fabrication, installation and ultimately through final handover to COMPANY. From the Contract Effective Date through Final Acceptance, CONTRACTOR contributes uniquely to the COMPANY's capability to implement this strategy.

Compliance with the requirements of this document will ensure uniformity in content and format and provide an effective handover into the COMPANY Information Management System.

5.2. Responsibilities

5.2.1 COMPANY

COMPANY's Project Organization is responsible for:

- Ownership, Management and Implementation of this Procedure.
- Oversight and quality assurance of CONTRACTOR's compliance with this specification.
- Pre-Handover and Quality Reviews of VDD Information in parallel with progress of the Permanent Works.
- Workshops and Guidance of the VDD Requirements.
- Receipt from CONTRACTOR, verification and timely Handover of the VDD Information from PMT to Operations.
- Prepare weekly and monthly status reporting on VDD Information completion by Contract. EPC CONTRACTOR to provide weekly and monthly input.

5.2.2 CONTRACTOR

CONTRACTOR is responsible for all VDD Information generated in the execution of the Contract Scope of Work including VDD Information generated by Subcontractors, Vendors and Suppliers. All such Information shall be in accordance with the COMPANY requirements in this specification and the Technical Requirements.

All VDD Information shall be submitted to COMPANY by CONTRACTOR, never directly from Supplier/Subcontractor to COMPANY.

CONTRACTOR shall work with its Subcontractors and Suppliers to identify and clarify the VDD Requirements, including weekly and monthly status reporting on completion of VDD Information.

5.3. Information Ownership

CONTRACTOR shall be responsible for all Information generated in execution of the Work including Information generated by CONTRACTOR and its Subcontractors, vendors and suppliers. All such Information shall be provided to COMPANY in accordance with this specification and the Technical Requirements.

COMPANY will assume ownership of the required VDD Information either upon completion of the Contract and/or at the appropriate Completion and Handover Milestones as set in this Procedure.

Transfer of responsibility and ownership for the VDD-Information will occur at handover from the PMT to Operations at the appropriate Completion and Handover Milestones.

5.4. Management of Document Requirements

The DRS (Document Requirements Schedule) is a list defining COMPANY Document requirements, including required Document types, formats, etc. The master DRS (PQ-GENR-ITM-SPC-PQC-00007-00) is a catalog of requirements from which each contract specific DRS is derived.

The DRS (either Contract DRS or the master) is not exhaustive, as requirements may be defined in the Contract that is not listed in the DRS at the time of contract award. CONTRACTOR shall provide all Documents required by the Contract.

Document requirements are managed per the procedure defined in PQ-GENR-ITM-SPC-PQC-00004-00 'Document Control and Exchange Specification'. The Contract DRS is issued under its own unique document number and referenced in the Document Control and Exchange Specification.

Each line item in the DRS defines a general category of Document for which CONTRACTOR shall submit Document(s) to COMPANY.

The DRS is a table containing the following columns:

COLUMN HEADING	Description
Disc. Code	The discipline (corresponding to the disciplines in PQ-GENR-ITM-SPC-PQC-00003-00, 'Document Numbering and Coding Specification') classification of the Document(s).
Item No.	The item number of the DRS requirement (unique within each discipline list). Note that DRS Code is the concatenation of Discipline Code and Item No.
Doc Type	A suggested Document Type (corresponding to the Doc Types in PQ-GENR-ITM-SPC-PQC-00003-00) classification of the Document(s).
VDD Number	The VDD number(s) in which the Document(s) will be placed.
Periodic Submission	Indicates whether the line item must be submitted periodically (for example, monthly)

FEED	Indicates whether the line item is required for FEED (Front End Engineering Design) scopes of work.
Regulatory	Indicates whether the line item is required to fulfill regulatory requirements (such as classification societies and government regulatory bodies
Integrity Critical	Indicates whether the line item is an Integrity Critical Document (Integrity critical documentation and data describe the facility layout, equipment, control and shut-down, process limitations and parameters, safety systems and escape routes)
EPC	Indicates whether the line item is required for EPC (Engineering, Procurement, Construction, Integration and / or Installation)
Document Name	A short name for the requirement, sometimes sufficient to define the requirement due to typical engineering practices.
Description	Where deemed beneficial, a more detailed description of the requirement may be included here.
As-Built required	Indicates whether the line item is to be issued As-Built
Format	Defines the format required. See Format Requirements below for additional detail.

5.5. Delivery and Handover Milestones

CONTRACTOR shall ensure that the milestone requirements as defined in this specification are met and any associated documents or data are submitted to COMPANY at or before the indicated timing. CONTRACTOR shall incorporate the milestones defined in the table below into CONTRACTOR schedule.

Initial Delivery Milestones (IDMs) are intended for CONTRACTOR to demonstrate to COMPANY the specific content, structure and format of the various VDDs.

Fulfillment of the Initial Delivery Milestones does not constitute fulfillment of any Conclusive Delivery Milestone (CDM). The Conclusive Delivery Milestones defined herein require CONTRACTOR to schedule and manage delivery of the VDDs to COMPANY.

DELIVERY AND HANDOVER MILESTONES			
Milestone	**Documentation and Data Description**	**Timing**	**Applicable to the Contract**
IDM 1	Sample text Document template and drawing border submitted to COMPANY for review and comment	7 days of the Effective Date	Yes
IDM 2	P&IDs and PFDs issued for COMPANY review	Three months after Effective Date	Yes
IDM 3	Submission of table of contents and outline of VDD 2 for COMPANY review and acceptance	30 days of Effective Date	Yes
IDM 4	CONTRACTOR's Information Management Plan Part I as defined in PQ-GENR-ITM-SPC-PQC-00001-00 (Information Management Requirements Specification)	30 days of Effective Date	Yes
IDM 5	Submission of Project Document Schedule (PDS) in a structure compliant with the DRS (PQ-GENR-ITM-SPC-PQC-00007-00)	30 days of Effective Date Note: The PDS shall be delivered bi-weekly during all project phases.	Yes
IDM 6	Submission of CONTRACTOR Document and Drafting Standard per Section 5.7 for COMPANY review and incorporation of COMPANY comments	30 days of Effective Date	Yes
IDM 7	Submission of Asset Register Development Plan (Information Management Plan Part II as defined in PQ-00-GENR-SPC-PQC-00001-00 'Information Management Requirements Specification')	60 days after Effective Date	Yes
IDM 8	Submission of CONTRACTOR's Information Management Plan Part III as defined in PQ-GENR-ITM-SPC-PQC-00001-00 'Information Management Requirements Specification')	90 days after Effective Date	Yes
IDM 9	Submission of table of contents and outline of VDD 6 for COMPANY review and acceptance	90 days after Effective Date	Yes
IDM 10	Definition of Transit Documents A list defining the content and organization of Documents and Data Required for Transit Phase	90 days prior to Transit Phase (Sail Away or other). One milestone shall be created, tracked and fulfilled for each Large Facility Object.	Yes
IDM 11	Submission of Transit Documents The final content of the 'Transit	At Mechanical Completion (MC) complete and/or one	Yes

	Documents' will be affected by the anticipated state and organization of the Large Facility Object at the time of transit.	month before Transit Phase of a Large Facility Object. One milestone shall be created, tracked and fulfilled for each Large Facility Object.	
IDM 12	Initial submission of the Asset Register Database in a structure compliant with Section 5.8 i.e. Engineering Indexes (Mechanical Equipment List, Line List, etc.)	Initial submission of the asset register shall be within 90 days of the Effective Date. Note: The asset register shall be submitted monthly throughout the project phases	Yes
IDM 13	Inspection Test Plan (ITP)	1 month after PO execution. One milestone shall be created, tracked and fulfilled for each purchase order.	Yes
IDM 14	RSPL (Recommended Spare Parts List for each Purchase Order (PO))	2 months after each PO award One milestone shall be created, tracked and fulfilled for each purchase order.	Yes
IDM 15	SPIR (Spare Parts Interchangeability Record)	Initial SPIR for each PO 4 months after PO Effective Date One milestone shall be created, tracked and fulfilled for each purchase order.	Yes
IDM 16	Factory Acceptance Test (FAT) Plan	3 Weeks prior to testing One milestone shall be created, tracked and fulfilled for each purchase order that requires FAT.	Yes
IDM 17	Vendor Information to accompany the Equipment or Materials to Site: Surveillance Completion Note Hazardous Area Certification as applicable Material Safety Datasheets Transport and Handling Procedure Installation Procedure Preservation and Lubrication Procedure Mechanical Completion Records (example; Hydrostatic and Pneumatic Test records) and Start Up and	With equipment delivery to Construction/Installation Site One milestone shall be created, tracked and fulfilled for each purchase order.	Yes

	Operations Procedures (part of VDD 3 Equipment Data Book) Spare Parts Lists and Maintenance Procedures (part of VDD 3 Equipment Data Book)		
IDM 18	Technical Data Book Detailed Index Submission A detailed index as defined in VDD 3 for each equipment package.	60 days prior to shipment of the equipment One milestone shall be created, tracked and fulfilled for each purchase order.	Yes
IDM 19	VDD 3 COMPANY receipt of electronic versions of As-Supplied Documents and submission (4 hard copies – 3 to COMPANY and 1 to organization responsible for system completions (MC/Commissioning) planning) of Design Data Book and Equipment Data Book of VDD 3 to CONTRACTOR with all Documents accurately reflecting the true physical state (As-Supplied) of the equipment at the time of shipment	Upon shipment of equipment	Yes
IDM 20	VDD 4 and 8 Index VDD 4 and 8 INDEX, defining the exact content of the VDD and listing section number per section 7.4.2, document number, revision and title of each document	1 month after start Fabrication/Construction	Yes
IDM 21	Index of Pressure Relieving Devices Initial Index listing all applicable Pressure Safety Valves, relief valves, rupture disks, Emergency Shutdown Valves, etc. and their certificate numbers per Section 6.5.2. This data shall be extracted from the Asset Register.	When all applicable devices have been purchased	Yes
IDM 22	Lifting Equipment Index Initial Index listing all applicable lifting equipment and their certificate numbers per Section 6.5.2. This data shall be extracted from the Asset Register.	When all applicable devices have been purchased	Yes
IDM 23	Regulatory Documentation Index A list of all Documents required by the applicable certifying/regulatory body. Examples include DNV, ABS, and Lloyds. This data shall be extracted from the PDS.	3 months of Effective Date	Yes

IDM 24	Submission of CONTRACTOR's Information Handover Plan (Information Management Plan Part IV as defined in PQ-GENR-ITM-SPC-PQC-00001-00 'Information Management Requirements Specification')	6 months prior to Mechanical Completion	Yes
IDM 25	Availability of draft VDD 5 for COMPANY review	As each system is Mechanically Complete	Yes
IDM 26	Submission of Operating Procedures for COMPANY review	2 months after first issue of AFC P&IDs	Yes
IDM 27	Submission of Maintenance Procedures for COMPANY review	2 months after first issue of AFC P&IDs	Yes
IDM 28	Submission of Operating Procedures with COMPANY comments incorporated	2 months before MC Complete	Yes
IDM 29	Submission of Maintenance Procedures with COMPANY comments incorporated	2 months before MC Complete	Yes
IDM 30	Submission of Detailed Indexes for VDD 2 and VDD 7 for COMPANY review	Prior to start of Hookup & Commissioning	Yes
IDM 31	Submission of draft set of Systems Description Dossier for COMPANY review and acceptance	1 month after Mechanical Completion	Yes
CDM 1	VDD 1	FEED Completion Certificate	No
CDM 2	As-Installed VDD 3 Markups CONTRACTOR shall submit electronic copies of all Documents (books 1 and 3) marked up to show the As-Installed condition of packaged equipment	When each package is installed, tested and ready for commissioning.	Yes
CDM 3	VDD 5	Per the Systems Completion Schedule a VDD 5 shall be submitted as each system or subsystem is commissioned. One milestone shall be created, tracked and fulfilled for each system or subsystem.	Yes
CDM 4	VDD 2	At Final Acceptance	Yes
CDM 5	VDD 3 books 1, 2 and 3	At Final Acceptance	Yes
CDM 6	VDD 4	At Final Acceptance	Yes
CDM 7	VDD 6	At Final Acceptance	Yes
CDM 8	VDD 7	At Final Acceptance	Yes
CDM 9	VDD 8	At Final Acceptance	Yes
CDM 10	VDD 9, as defined in Section 6.9. This VDD is compiled by COMPANY.	At Final Acceptance	No

5.6. Format Requirements

The DRS (PQ-GENR-ITM-SPC-PQC-00007-00) defines in general terms (native (N), image (I), database (DB), portable document format (D)) the formats in which CONTRACTOR shall provide electronic versions of Documents. Acceptable applications for each format type are listed in the following table:

File Type	Format Type	Required Software
2D CAD, including 2D Documents from the 3D model	N	AutoCAD (R14 or above).
Intelligent P&IDs	N	Intelligent P&ID system or COMPANY accepted equivalent.
Instrumentation	N	INtools®
Process Models and Simulations	N	As per COMPANY standards
3D CAD	N	Aveva's 3D design system or COMPANY accepted equivalent.
Text Documents	N	MS Word (XP or higher)
Spreadsheets	N	MS Excel (XP or higher)
Email	N	Rich Text Format
Schedules	N	Primavera (current version)
Organization Charts/diagrams	N	Visio (XP or higher)
Database	N / DB	COMPANY agreed data structure in MS Access, Oracle, XML, etc. Where Documents such as reports are required, these Documents shall also be provided in an electronic format that preserves appearance as a document (a *.PDF rendition of the report format, for instance). Scanned images of such Documents are not acceptable.
Image Files	I	TIFF (v6.0 or above), including OCR. Scanned images shall not be submitted without prior written acceptance by COMPANY.
Portable Document Format Files	D	PDF (Acrobat 7 or later). PDF files shall always be directly generated to PDF from the authoring application. Scanned documents which are converted to Adobe Acrobat format do not qualify as Portable Document Format files and shall be treated as image files for the purpose of format compliance.

COMPANY requires the following principles be followed by CONTRACTOR:

- CONTRACTOR shall submit all application related files associated with native format documents, such that COMPANY is able to subsequently use the native files in native applications.

- CONTRACTOR shall submit electronic documents to the COMPANY in accordance with Document Control and Exchange Specification (PQ-GENR-ITM-SPC-PQC-00004-00).

- CONTRACTOR shall ensure that all electronic Data submitted to COMPANY via any mechanism is virus free. CONTRACTOR shall demonstrate to COMPANY that

CONTRACTOR maintains a virus subscription service whereby the latest virus template files are updated on a continual basis, and that CONTRACTOR files are processed in a way which ensures virus free transmission.

- CONTRACTOR shall ensure that all native file formats are self-contained. Links to other files are not acceptable without prior written consent by COMPANY. This is necessary due to the fundamental requirement to number as stand alone documents.

- Files which are embedded via any technology (Open Database Connectivity ODBC, Object Linking and embedding OLE, etc) are not acceptable.

- Mechanical and Electrical Data sheets shall be generated and submitted in native format and in compliance with COMPANY's standard datasheets formats, which are provided electronically.

- CONTRACTOR shall provide all final VDD Information in electronic media as well as print form. CONTRACTOR shall provide Database Information (including VDD, book number (VDD 3 only), volume, section, subsection, etc.) defining each Document's position in each VDD using the specified Table of Contents for the original electronic and printed form of the VDD Information.

- Hard copy Documents which are scanned shall be of such quality that original clarity and quality will be maintained through generations of reproduction. Scans shall be a minimum of 300 DPI to a maximum of 600 DPI and in grayscale except where color is necessary to understand the content.

- Facsimiles of any kind are not acceptable as deliverables. In order to progress work, CONTRACTOR may submit to local COMPANY representatives, facsimiles of data while original or "certified" original copies of documents are obtained. CONTRACTOR is fully responsible for the provision of original quality versions of such documents to COMPANY. CONTRACTOR shall undertake whatever remedial action is required to fulfill this obligation up to and including CONTRACTOR recreation of the documents. This shall be performed only by exception and at the discretion of the COMPANY.

- Documents that require signature or are normally provided with seals of approval (examples including but not limited to: Classification Society and Regulatory Bodies) shall be provided in 3 formats: original hardcopy, image, and native format.

- CONTRACTOR shall ensure that all electronic Data submitted to COMPANY via any mechanism shall not be password protected.

- Revision numbers and dates shall be manual text not as field that is updated by the system date or other function.

5.7. Document and Drafting Standard

CONTRACTOR shall develop and submit to COMPANY for review within 30 days of the Effective Date (as part of the Information Management Plan) a Document and Drafting Standard to ensure that Document work meets or exceeds the COMPANY's minimum requirements with respect to Document legibility and standardization as defined herein. Any proposed deviation from COMPANY requirements shall be clearly indicated in the Document and Drafting Standard as submitted by CONTRACTOR to COMPANY for review.

CONTRACTOR shall ensure that all drawings and Documents prepared as part of its scope of work are in compliance with the Document and Drafting Standard, Document Control and Exchange Specification (PQ-GENR -ITM-SPC-PQC-00004-00) and the Document Numbering and Coding Specification (PQ-GENR-ITM-SPC-PQC-00003-00). Any modification to the Document and Drafting Standard shall be submitted to COMPANY for review and concurrence.

All references between Documents (for instance drawings which reference other drawings) shall indicate complete and unique COMPANY document number(s) at a minimum, though alternate document numbers may also be present.

5.7.1 Cover Pages, Title Blocks, Headers and Footers

All Documents shall include either a cover page (text documents only) or title block (drawings). Drawings shall not be submitted with cover sheets. CONTRACTOR shall submit a sample text Document template (cover page, header/footer, format, font, etc.) and drawing border to COMPANY for review and comment within 7 days of the Effective Date (IDM 1). All text Documents and drawings shall use the templates and borders as submitted and incorporating comments of COMPANY. The title block and text Document templates shall include the following information:

- Facility name
- Item name (where the Document pertains to a single item)
- Title
- Tag number (where the Document pertains to a single tagged item or package)
- Purchase order or agreement number
- CONTRACTOR / Subcontractor's unique drawing number
- A unique Document number assigned in accordance with COMPANY Document Numbering and Coding Specification (PQ-GENR-ITM-SPC-PQC-00003-00).
- Revision
- Issue Date
- Issue Status/Purpose
- Sheet Numbers to allow for multiple sheets

Titles should be short, unique and descriptive for the information contained within an individual document. A title should be a brief description that provides enough unique information that a User may ascertain the contents based on the title.

Capitalize words within text Document titles, including the short verb forms 'Is', 'Are', and 'Be'. Do not capitalize short words (internal articles, prepositions and conjunctions) within titles such as 'a', 'an', 'the', 'but', 'as', 'if', 'and', 'or', 'nor', regardless of their length.

Drawing titles shall be in all capital letters.

Abbreviations or symbols shall not be used in titles of Documents (examples; &, 1st, No.,

#, Attach, etc) except industry-wide acronyms that are best known by their abbreviation (example; P&ID; HAZOP).

All text documents shall contain the following information in the header and/or footer of each page: document number, title, revision, page x of y.

5.7.2 Abbreviations

Abbreviations shall be subject to COMPANY review and concurrence as part of the Document and Drafting Standard. Title blocks shall not contain abbreviations except in cases where lack of space precludes spelling out the entire word.

5.7.3 Document Issue Purposes

COMPANY has defined standard codes and issue purposes to ensure coordination and understanding between organizations participating in the project. Refer to the Document

Control and Exchange Specification (PQ-GENR-ITM-SPC-PQC-00004-00) for details.

5.7.4 Delays

If CONTRACTOR anticipates that the work schedule shall be delayed by "HOLD" markings on drawings or specifications, CONTRACTOR shall report such delay to COMPANY not less than 10 working days prior to the anticipated start of delay.

5.7.5 Drafting

- The drafting portion of the standard shall comply with the requirements of this specification and include a definition of acceptable:
- Materials, orientation, format, and size of drawings
- Lettering/fonts (size, alignment, orientation)
- Line types, weights, and colors by purpose and document type
- Layer utilization by discipline and document type
- Abbreviations
- General notes
- Borders and title blocks by document type
- Symbol libraries, by discipline and document type
- Scales
- Drafting practices defining layout, density and legibility guidelines

5.7.5.1 Drawing Generation

All drawings shall be developed using AutoCAD with the exception of those developed using the 3D design system, INtools®, or the Intelligent P&ID system.

CONTRACTOR shall extract drawings generated using these 'design systems' into AutoCAD format prior to electronic submission to COMPANY. All drawings extracted/converted to AutoCAD shall be an accurate reflection of the original document. CONTRACTOR is responsible to ensure conversions are accurate prior to any submission to COMPANY.

INtools® generated drawings (loop diagrams, interconnects, etc.) shall be generated by CONTRACTOR using AutoCAD. CONTRACTOR shall produce all necessary templates in AutoCAD to implement this requirement, and shall submit the templates to COMPANY for review and comment prior to use of the templates to generate deliverables.

Drawings submitted to COMPANY shall not include any drawing elements outside the border of the drawing, nor any cross reference files.

Sets of similar drawings (for example P&IDs or electrical one-lines) shall have as the first drawings in the set an index of drawings in the set listing full company document number, revision, and title.

Each electronic drawing submitted to COMPANY shall be self contained and shall not include electronic links to reference drawings or any other external file without prior approval of same by COMPANY Lead Document Controller.

Drawings shall be submitted with all appropriate layers and other settings such that the drawing may be opened and viewed with the correct appearance without additional user intervention.

CONTRACTOR shall produce hard copy drawings utilizing electrostatic plotters or printers (no waterbased ink-jet shall be used).

CONTRACTOR's engineering disciplines shall generate required area plans such as lighting plans, instrument location plans, pipe support location plans, cable tray plans, hazardous area plans, etc. using the 3D design system.

After a drawing has been released for issue, any corrections, changes and revisions shall be made by computer in the drawing's source application and shall require a new revision number. For example, a drawing generated from the 3D model which requires a change shall be changed in the 3D design system and a 'fresh' extract from the model executed to generate a new revision of the drawing. Drawings containing manual modifications of any kind are not acceptable for submission to COMPANY.

5.7.5.2 Sizes

Paper sizes and units shall be defined by the Project to be in accordance with the PQPOC standards and printing facilities. Standard Project agreed paper sizes to be used across the while project irrespective of local conditions and norms.

5.7.5.3 Orientation and Format

CONTRACTOR shall generate all key plans and detail plan drawings with a direction cruciform indicating forward, aft, port, and starboard. An onshore plant shall be oriented into facilities and vessels.

All CONTRACTOR's plan drawings for the project shall be oriented with port side toward the top of the sheet.

Sections and elevations, including those in details, shall be labeled to indicate the viewpoint, e.g., "Looking FWD", "Looking to Port", etc.

CONTRACTOR shall leave adequate clear space at the right side of the sheet above the title block/drawing number area for print stamping when required.

5.7.5.4 Detailing

CONTRACTOR shall give a careful consideration to the number of details needed, including adequate space for all details. CONTRACTOR shall use additional sheets where necessary to avoid congestion.

Unnecessary repetition shall be avoided.

Section cuts shall be lettered from left to right and shown in sequential order whenever possible.

The location of details shall be clearly indicated using a standard cross-reference numbering system.

The location of sections and elevations shall be clearly indicated using a standard cross reference lettering system.

Equipment details shall be drawn to scale when necessary for clarity or illustration purposes.

Details or dimensions not final at the time of issuing an Approval for Construction drawing shall be enclosed in clouding. The caption, "HOLD", shall be noted inside the clouded area.

5.7.5.5 Scales

CONTRACTOR shall use a civil engineers' metric units scale to produce the general layout drawings such as maps, plot plans, or any location or arrangement drawing.

CONTRACTOR shall use S.I. units for all dimensions of equipment layouts and drawings.

CONTRACTOR shall establish drawing scales and borders to permit the use of a 50% scale on drawings reduced from A1 to A3 sheet size.

CONTRACTOR shall produce drawings in scale that will show necessary design detail, depending on the actual sizes of equipment or structures to appear on the drawing. When details or sections drawn to different scales are included on the same drawing, the scale used for each shall be shown under the appropriate detail or section.

CONTRACTOR shall produce the overall structural plans using the same scale as their respective overall piping plans.

5.7.5.6 Dimensions

CONTRACTOR shall produce drawings that meet the following:

Arrowheads are distinct and uniform in size. Tick marks may be used in lieu of arrowheads where space is limited.

A sufficient number of dimensions are shown to minimize the need for scaling and to minimize the calculation of dimensions in the field.

Overall layout dimensions are shown on all equipment plans issued for construction. Dimensions symmetrical about a centerline shall not be repeated.

Dimensions are written to read from the bottom or from the right side of the drawing.

All dimensions shall be given in meters and millimeters as appropriate. Exceptions are pipe sizes and structural, architectural, and machine drafting dimensions.

Locations for all equipment, piping, structures, and buildings shall be defined by coordinates.

5.7.5.7 Lettering

CONTRACTOR shall place lettering to read from the bottom or from the right hand side of the drawing. Lettering for notes, dimensions, and bills of material shall be legible for all sheet sizes, including A1 size reduced to A3 size.

5.7.5.8 Symbols

A unique legend of symbols shall be assigned for each engineering discipline. Any additions to the issued standard must be submitted to COMPANY for comment prior to the use of the symbols on any deliverable.

5.7.5.9 General Notes

Notes shall be sequenced and worded exactly alike on all drawings where the notes appear.

5.7.5.10 Reference Drawings

CONTRACTOR shall list reference drawings in the reference block at the lower left portion of the drawing.

Drawings referenced for special purpose such as to clarify details or denote additional requirements shall be called out in the immediate proximity of the related detail and in the reference block.

5.7.6 Design Drawing Development/Change Record

Details or dimensions not final at the time of issuing an Approval for Construction drawing shall be enclosed in clouding. The caption, "HOLD", shall be noted inside the clouded area.

5.7.7 As-Builts

CONTRACTOR shall develop and submit to COMPANY for review 6 months prior to the planned Mechanical Completion an Information Handover Plan (as Information Management Plan part IV, see PQ-GENR-ITM-SPC-PQC-00001-00 'Information Management Requirements Specification') which fulfills Contract requirements related to Document as-building and the handover of Documents to COMPANY. Any proposed deviation from COMPANY requirements shall be clearly indicated in the Information Handover Plan as submitted by CONTRACTOR to COMPANY for review.

COMPANY acceptance of any deviation from the as-building requirements of the Contract is strictly limited to official Management of Change (MOC) processes. COMPANY comment or lack of comment on CONTRACTOR's proposed Information Handover Plan shall not change the requirements of the Contract.

The Information Handover Plan shall further include:

- The method, defined in process diagrams, of collecting corrections and changes into the master markup set
- The method of periodic incorporation of corrections and changes into original documents and re-issue of the updated documents to company and site
- A manpower plan describing dedicated resources CONTRACTOR will employ throughout fabrication, integration, and commissioning to incorporate marks into all required As-Builts

5.7.8 CONTRACTOR Management of the As-Building Process

CONTRACTOR shall provide Project dedicated resources for the purpose of incorporating corrections and changes into Documents during construction, commissioning, and startup phases of the Contract. The resources shall be sufficient to incorporate changes, ensure that changes are accurately incorporated, and issue the documents to COMPANY.

CONTRACTOR shall track in the PDS for each document:

- Which Documents are required to be As-Built
- Which Documents have pending changes or corrections resulting from construction or commissioning efforts

CONTRACTOR shall maintain a master markup library for all Documents subject to as- built requirements. The library shall be at the construction / integration site, shall be climate controlled and have controlled access at all times. The master markup library shall be accessible by COMPANY for audit and review purposes.

CONTRACTOR shall sign and retain the hard copy of all As-Built Documents and transmit the equivalent electronic file to COMPANY in accordance with the dates in the PDS.

5.7.9 As-Built Submission Timing

CONTRACTOR shall, as part of its management of the PDS, maintain the expected As- Built issue date for each Document. These dates shall meet the As-Built timing requirements of the Contract and must be assigned within 3 months of the Effective Date. CONTRACTOR shall plan as-building activities to ensure the earliest possible submission of each As-Built Document.

As-Built Documents shall be transmitted to COMPANY by the time specified in the PDS. COMPANY will evaluate the submitted documents and respond to CONTRACTOR within 15 working days, informing CONTRACTOR whether COMPANY accepts the Documents as As-Built.

Documents which are distinct to a particular Component or group of Components which are commissioned together shall have mark ups resulting from commissioning incorporated

immediately and the resulting corrected Document shall be issued to COMPANY and to the site. These Documents include but are not limited to:

- Loop diagrams
- Motor schematics
- Equipment and instrument data sheets
- Instrument junction box and marshalling panel wiring diagrams (when all loops utilizing the cabinet have been commissioned)

Documents which are frequently modified, critical to the commissioning effort and safe operation of the facility shall have mark ups resulting from commissioning incorporated on either a periodic (every two weeks) or event-driven (a system has been commissioned) basis, at COMPANY's discretion. These Document types include but are not limited to:

- Cause and Effect Diagrams
- Logic diagrams

CONTRACTOR shall, 30 days prior to Mechanical Completion (MC), replace all original markups in the master markup set with black and white copies. The original markups shall then be scanned and transmitted to COMPANY, and shall be used by CONTRACTOR to incorporate changes into the original Documents. Within 30 days after Mechanical Completion, CONTRACTOR shall issue to COMPANY all Documents subject to As-Built requirements to incorporate changes and / or corrections from the following sources:

- Quality assurance inspections
- Site receiving inspections
- MOCs, repair and non-conformances
- Interference and out-of-tolerance corrections
- Errors detected in MC process
- Material deviations

CONTRACTOR shall, upon first production, replace all original markups in the master markup set with black and white copies. The original markups shall then be scanned and transmitted to COMPANY, and shall be used by CONTRACTOR to incorporate changes into the original Documents. Within 30 days after first production, CONTRACTOR shall issue to COMPANY all Documents subject to as-built requirements to incorporate any changes and / or corrections regardless of source.

COMPANY may comment to non-compliant Documents and return to CONTRACTOR for revision. No milestone requiring As-Built documentation shall be complete until appropriate revisions are made and the fully compliant Documents are submitted to COMPANY.

When all Documents have been formally submitted As-Built, CONTRACTOR shall submit a notice of completed As-Built milestone. By submission of this notice CONTRACTOR attests

that all documentation currently in possession of COMPANY is a correct representation of As-Built. COMPANY will evaluate the state of As-Built within 15 working days of receipt of this notice and reply to CONTRACTOR.

5.7.10 As-Building Criteria

In order for a Document to qualify as As-Built, it must represent the actual facility at the time of its issue. This includes but is not limited to compliance with the items below:

- The Document shall represent vendor, manufacturer or supplier's component as- supplied and any aspect that may have been modified by CONTRACTOR or any of its Subcontractors.
- The Document shall represent the actual installed location of each Component or structural object within allowable tolerances.
- All dimensional non-conformances exceeding the specified tolerances.
- The Document shall represent the proper attribute information about items shown on or referenced by the document.
- The Document shall include the changes or modifications made for constructability, access, or operability during fabrication, commissioning, or handover to operations.
- The Document shall represent any changes that may represent a safety hazard to someone working on a system (e.g., changing electrical terminations for a motor lead in a junction box).
- The Document shall conform to the electronic format requirements. Manually updated paper copies are not acceptable.
- If the Document was generated by a system such as the 3D design system, Intelligent P&ID system, etc., the As-Built modifications shall be made in the authoring application, never to the extracted document even in native format.

Documents that represent significant changes from original concept shall reference the Management of Change number and HAZOP review that verifies the integrity of the design where applicable.

5.8. Asset Register Database/Data Acquisition Requirements

The Asset Register is a relational database composed of multiple tables which CONTRACTOR shall populate.

CONTRACTOR shall submit the Asset Register, incorporating up-to-date data, to COMPANY at least monthly, and shall provide it in As-Built condition as part of the handover process.

CONTRACTOR shall maintain all attributes in the tables for the duration of the Contract.

5.8.1 Contents of the Asset Register

The Asset Register shall be an accurate reflection of all Components in the facility and/or its design at all times. CONTRACTOR shall represent each Component in CONTRACTOR's scope of supply as a record in each applicable Asset Register table.

CONTRACTOR shall populate the Asset Register with appropriate records and attributes for each Component defined in the Work.

Units which consist of multiple Components (packaged units) shall be entered in the Asset Register. Each Component of such units shall have its own representative records and all applicable data (attributes and associations) shall be entered into the Asset Register by CONTRACTOR. A representative record shall also be created for the package itself. Asset Register data for these packaged units shall be entered beginning with the package unit vendor's issue of P&IDs 'for construction', and CONTRACTOR shall maintain the data thereafter as updated documentation is issued by the vendor.

Equipment which is part of a custom made installation for the facility, such as HVAC, control systems, shutdown systems, monitoring systems, telecommunications systems, network equipment, etc. are not considered by COMPANY to be packaged units.

5.8.2 Important Attributes Requiring Extended Definitions

Certain information required in for the Asset Register requires particular attention to ensure CONTRACTOR understanding of the information that is required.

Component Status

CONTRACTOR shall maintain the current status of each Component in the Asset Register. This attribute shall at a minimum indicate each Component as 'future', 'In Design', 'Procured', 'Delivered', 'Installed', 'Mechanically Complete', 'Commissioned', 'Started-up'. and 'Operating'. COMPANY and CONTRACTOR will agree the specific codes to be used to indicate status.

Document References

The table listings in section (detailed attributes) include a number of attributes in which CONTRACTOR is required to provide reference document numbers (such as data sheet or location plan) for items in the Asset Register. In certain instances, a single item in the Asset Register will have multiple references for a single type of document (piping line P&ID references for example). CONTRACTOR shall provide multiple-reference tag to document associations in the Tag-Document Associations register. The minimum requirements for references from tagged items to documents are included in section (detailed attributes). CONTRACTOR shall provide such additional references as are appropriate for the equipment within CONTRACTOR's scope of supply. In particular, any document or drawing generated as part of CONTRACTOR's scope of supply which references a tagged item (either graphically or in text) shall be included in the cross- reference table.

5.8.3 Population and Maintenance of the Asset Register

CONTRACTOR shall compose an Asset Register Development Plan defining the data sources (including that of vendors and subcontractors), data structures, data management and data quality assurance processes required for success in CONTRACTOR's development of Asset Register data. The plan shall be presented to and discussed with COMPANY in conjunction with a work process workshop (between 2 and 4 days duration) within 60 days of Contract date. The Asset Register Development Plan, incorporating input from COMPANY from the

workshop or other sources, shall be submitted for COMPANY review 30 days after the workshop.

CONTRACTOR may define the methods of data acquisition and management prior to submission to COMPANY, provided those methods fulfill all requirements otherwise defined in the Contract, including the requirement that data be maintained as an accurate reflection of the current design at any given time. COMPANY strongly prefers that as much of the required data as possible be extracted directly from CONTRACTOR design and related systems and merged by CONTRACTOR into the data submitted.

CONTRACTOR shall make Asset Register database entries as the existence of Components is identified through the design process. CONTRACTOR shall populate the attributes for the Components as the information becomes available to CONTRACTOR. Sub systems and Vendor provided Components shall be added as soon as items have been identified to CONTRACTOR. CONTRACTOR shall not delay population of the Asset Register but shall maintain it constantly as an accurate reflection of the facility.

CONTRACTOR's maintenance of the Asset Register, including capture of changes, additions and deletions, shall continue through all phases of the Work through Final Acceptance. Upon Final Acceptance of the Work, COMPANY will take ownership of the Register.

5.8.4 COMPANY Review of the Asset Register

CONTRACTOR shall submit the Asset Register to COMPANY monthly, beginning 60 days after Effective Date. These submissions shall be shown as milestones on the CONTRACTOR's schedule.

The database information submitted periodically (monthly) by CONTRACTOR in compliance with these requirements will be used by COMPANY in a number of ways including but not limited to the following:

- Analyze to confirm compliance with numbering and coding standards
- Use in Operations planning
- Determine data completeness and accuracy
- Analyze for potential spare parts requirements
- Use as base information for COMPANY project completions tracking
- Use as base information for the Computerized Maintenance Management System and other Operations systems.

COMPANY may from time to time issue reports to CONTRACTOR which indicate errors or omissions in the Asset Register which CONTRACTOR must then remediate. COMPANY comment or lack of comment shall not be considered acceptance or justification for any error or omission in the Asset Register.

5.8.5 Database Structure Overview

The minimum data required for each box in Figure 5.9.5 is listed in Appendix 1- Asset Register Tables.

It is important to note that the 'Common Data' table represented in the figure by the large rectangle is required to contain one record for each Component in the asset register. That table contains attributes which are common to many kinds of Components, such as P&ID reference and service description. The discipline specific tables such as Electrical and Mechanical are required to contain records specific to those disciplines.

The relationships displayed in the figure shall be implemented by CONTRACTOR through population of the required association attributes such as physical parent defined in section (table list section).

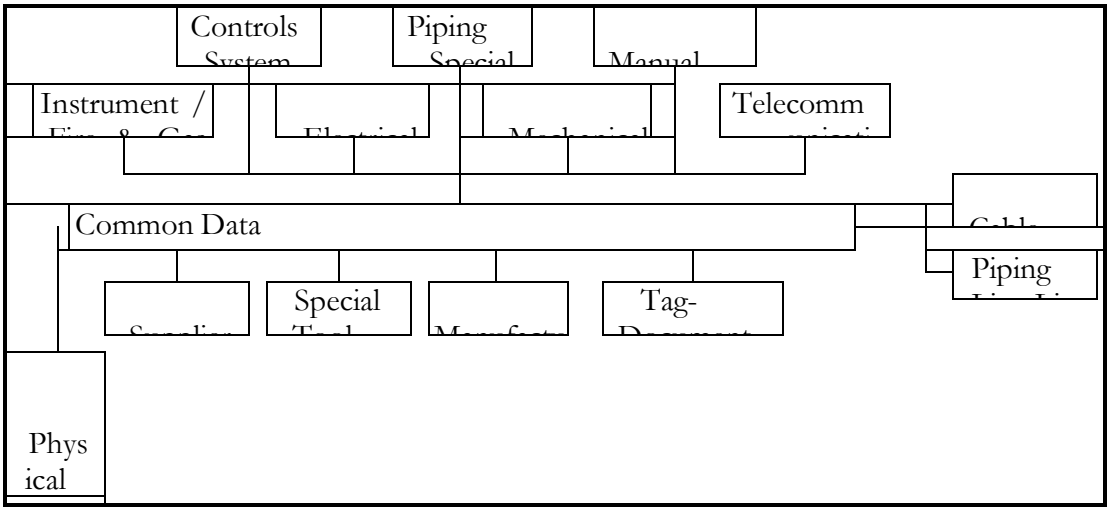


Figure 5.9.5 Database Structure Overview

5.8.6 Facility Hierarchy

CONTRACTOR shall associate each Component in the Asset Register to the facility hierarchy.

The attributes related to facility hierarchy are:

Location – the general location code of the physical region in which a Component is located, often referred to as 'area'. This code is defined in the numbering and coding standard (PQ-GENR-ITM-SPC-PQC-00003-00 Document Numbering and Coding Spec).

Sub location – a more specific set of physical regions, each contained within a location. This code is often but not always defined in the numbering and coding standard. Regardless of whether sub location is defined in the numbering and coding specification, CONTRACTOR shall provide a sub location to each Component in the Asset Register to facilitate navigation and the population of the CMMS.

System – the facility system of which a Component is part. Typical systems include for example flare gas and produced water. Systems are represented by a numeric code. CONTRACTOR shall provide only the numeric code in the system attribute.

Subsystem – often referred to as the startup subsystem, this is a further breakdown of system with boundaries set to facilitate commissioning and equipment isolation.

The facility hierarchy will present the structure and inter-relationships between the elements that define equipment physical locations (e.g., facility, area/location, etc) and functional

purpose (train, system, subsystem, etc.). The facility hierarchy will be issued by COMPANY upon commencement of detail engineering. A draft hierarchy for the Project is shown in Figure 5.9.6.

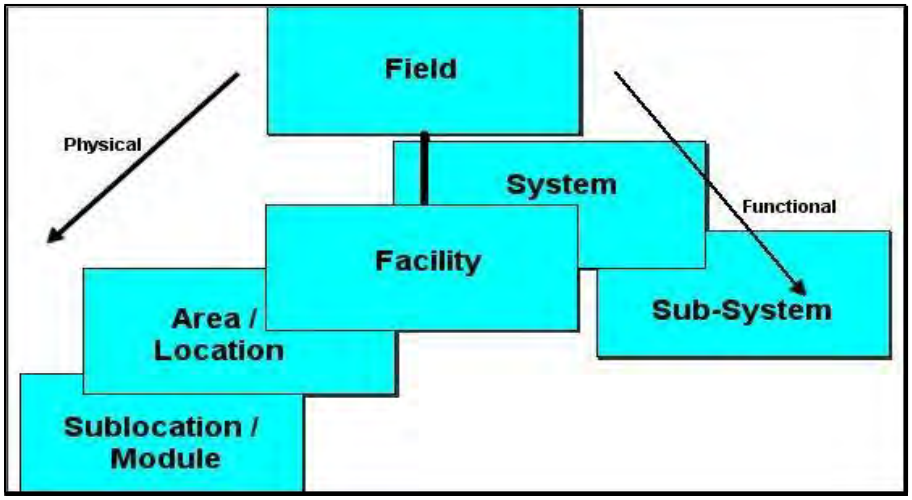


Figure 5.9.6 Draft Facility Hierarchy

5.8.7 Tag Hierarchy

The tag hierarchy describes the associations between tags, and is expressed in the form of parent/child relationships. It is possible to have multiple tag hierarchies based on a logical categorization such as discipline (e.g., maintenance, electrical, HVAC, etc.). Such multiple hierarchies provide additional benefits to users of information management systems by focusing on information areas that are most relevant to particular users (or disciplines).

CONTRACTOR shall assign items to disciplines, systems, locations, sub locations, and subsystems as appropriate for the item type.

CONTRACTOR data provided in compliance with this document shall include as a minimum, for each asset/item of equipment, a fully qualified reference to:

- The object to which the item is attached (the line a valve is in, for instance).
- The object to which the item provides a service (the pump whose discharge pressure the valve controls, for instance).

Additional associations between 'objects' are detailed in the data requirements tables in Appendix 1 - Asset Register Tables.

5.8.8 Data Quality Control and Assurance

The CONTRACTOR shall implement consistent quality assurance in its Asset Register population and data acquisition processes. For the purpose of this specification data quality consists of two categories, Quantitative and Qualitative. All Asset Register data for which CONTRACTOR is responsible shall meet the quality requirements defined in this section.

Quantitative Quality

Quantitative quality is the degree to which the Asset Register is a reflection of the existence of each Component in the design or Facility. Each Component in the design or facility without matching records in the Asset Register is considered to be a quantitative error. Likewise, each Asset Register record that does not exist in the facility or design is considered a quantitative error.

Database submissions shall be in compliance with technical documents with respect to the existence of items.

Qualitative

Qualitative quality is the degree to which the Asset Register's individual attribute fields applicable to the Component type in question are populated with data which is correct, complete and consistent with other similar Components in the Asset Register. Some specific aspects of Qualitative quality include:

- Each representative record in the Asset Register shall include data attributes equal to the requirements presented in Appendix 1 - Asset Register Tables. Some attributes are applicable to only certain types of Components.

- CONTRACTOR shall not include double or single quote characters in database information (",') except as required for line number identification.

- All unique identifiers (tag numbers, component tracking code, etc.) shall follow the numbering procedure as supplied by COMPANY wherever it can be applied. Such identifiers must be complete and unambiguous.

- Referential integrity shall be maintained such that all references, whether to another tag/line/cable number, a document, a system or discipline, shall be complete and unambiguous.

- Referential Integrity shall also be maintained such that references must be to items that exist in the appropriate portion of the database. In other words, for example, a document reference must be to a document present in the document register. References to items not present in the database will be considered incomplete.

- Units of measure shall be uniform such that a single text string shall be used for a single unit of measure. Units of measure shall comply with the Contract. For each attribute in the Asset Register which contains a measured value, CONTRACTOR is required to provide the units of measure in a separate but related attribute.

- For each Component, all applicable attributes defined in Appendix 1 - Asset Register Tables, shall be populated.

- All data sources in which a particular information item (an attribute, for instance) is submitted shall agree on the value of that information item. For example, the data in the Intelligent P&ID system shall agree with the data in the instrument index and Asset Register wherever they intersect.

COMPANY will audit CONTRACTOR data sources as required to ensure compliance with the Contract.

The COMPANY Information Manager will work with the CONTRACTOR's Information Manager to oversee the data validation process to ensure that data submitted at the required milestones is accurate, complete and appropriate as defined by the Contract.

5.8.9 Detailed Requirements

Database Submission Overview

The following diagram is provided as an overview of the flow of database information between CONTRACTOR and COMPANY. The diagram is not intended to show all database information systems or pathways. Rather, it is provided to clarify COMPANY's expectation for CONTRACTOR's compilation and submission of database information to COMPANY, and the primacy of key systems and information sources related to the referenced documents.

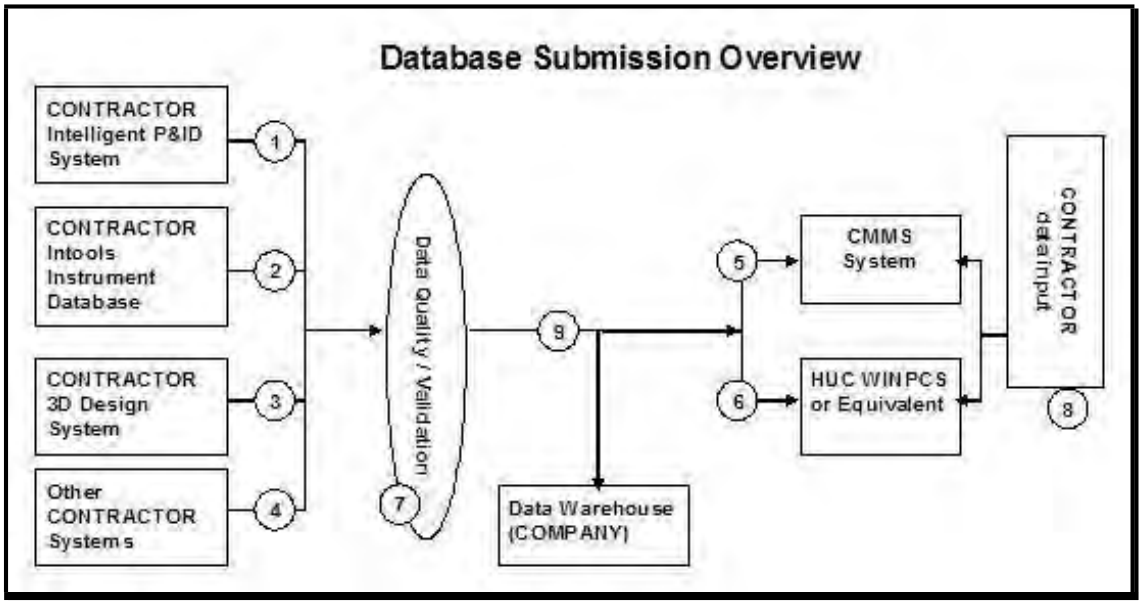


Figure 5.9.9 Database Submission Overview

In Figure 5.9.9, the flow of data is from the sources on the left to the right, ending with the use of the asset register to populate the CMMS. Each box on the left represents a system or systems (including manual processes, spreadsheets, and simple databases) that contain Component data required by this specification.

The numbered routes are described below. In each instance, the data exchange can be via data extraction from the originating system (format to be agreed with COMPANY), or more direct integration to a central system maintained by CONTRACTOR.

CONTRACTOR shall extract data from the intelligent P&ID system and submit the data to COMPANY upon request via official correspondence. While the actual request may include additional data contained in the intelligent P&ID system, CONTRACTOR shall provide:

- A list of all piping lines including the 'from' and 'to' Component for each and the P&IDs on which the line appears.

- A list of all major equipment containing tag number and the P&ID on which the Component appears

- A list of piping specialty items including the line number the specialty item is in and the P&ID on which the specialty item is displayed.

- A list of manual valves in all process lines, plus those in utility service which are 1" or larger, including the valve number, the line the valve is in, and the P&ID on which the valve is displayed.

- A list of all instruments including software tags, the line or equipment to which the instrument is connected and the P&ID on which the instrument is displayed.

All tagged item data from the Intelligent P&ID system shall be made available to COMPANY on request. As a minimum the identifying number (in accordance with the numbering system), system and subsystem will be present for each item which is visible when a P&ID is printed.

Instrument Data which complies with the data requirements defined in this document will be made available to COMPANY from INtools®. In cases where INtools® is used for generation of loop diagrams, a cable schedule and listing of all enclosures from the field instrument to the control system interface will also be provided from INtools®.

The 3D design system shall provide data related to the physical location of all tagged items. This data will be provided in the form of both tag/document listings in instances of arrangement drawings, isometrics, etc. and in the form of 3D coordinates. All data provided from the 3D system shall include complete and unique tag numbers for each object.

Other systems used by CONTRACTOR in the execution of the Work. This includes systems used for procurement, logistics, material management, engineering design and construction or fabrication control (example: Plant Completion System PCS). CONTRACTOR shall submit data from these systems when those systems contain data required by this specification. Proprietary or confidential data will be afforded protection as appropriate.

Data required by the CMMS such as hierarchy and tag listings shall be extracted from the Asset Register data submissions provided to COMPANY to ensure consistency of data across systems. Equipment and tagged item entries shall not be created directly in the CMMS system, only through this import process or an equivalent automated process. CONTRACTOR shall develop and employ processes which will ensure consistency between the CMMS and this data source from the outset.

Data required by the HUC management system such as tag listings and system associations shall be extracted from the same data submissions provided to COMPANY to ensure uniformity of data across systems. Equipment, tagged item, system and subsystem assignment information shall not be created directly in the HUC system. CONTRACTOR will develop and employ processes which will ensure consistency between the HUC system and this data source.

Data shall be quality assured by CONTRACTOR processes and systems.

Both the CMMS and commissioning management systems require data to be entered or loaded in addition to tag/equipment identification data that must be sourced from the Asset Register. CONTRACTOR retains full responsibility for the accuracy and completeness of the CMMS and commissioning management systems.

The data submitted in compliance with this specification shall be the same information used to populate the CMMS and HUC systems.

5.8.10 Specific Data Requirements (Tables)

Appendix 1 (Asset Register Tables) explicitly defines the minimum attributes CONTRACTOR shall populate for each table.

While the information in Appendix 1 is presented in tabular form, the actual structure of the database in which CONTRACTOR shall submit data will be different in that the database includes fields for units of measure. Unit of measure fields are included in the database for each attribute that requires a scientific measured value.

A database structure embodying these requirements will be provided by COMPANY within 14 days of the Effective Date.

In order to allow flexibility in execution while clearly stating intent, tabular listings are not included for the I/O list. Instead, COMPANY has defined the general content for further action in detail engineering.

6. DOSSIER REQUIREMENTS

6.1 General Requirements

Each VDD shall fulfill the requirements of this section.

A cover page containing the same information that is on the front cover and spine of the referenced volume shall be the leading page in each volume of the VDD.

A Table of Contents shall be included. The Table of Contents shall include main section headings, subsection headings and any appendices that are required. The volume number in which the section or subsection begins shall be indicated in the Table of Contents.

The VDD Table of Contents shall be placed in each volume of the applicable VDD (for example, the TOC for VDD 2 shall be included in each volume of VDD 2).

In any case where the Scope of Work in question has no applicable documents for a particular section or subsection, the VDD shall contain only a sheet clearly indicating NO CONTENT. NO CONTENT shall also be stated in the Table of Contents for the applicable section or subsection.

The outlines provided for each VDD define the general structure required by COMPANY for each VDD and /or its constituent 'books'. The line items or text describing the contents of each section are not exhaustive but are provided to allow CONTRACTOR to determine the Documents which need to be in each section. CONTRACTOR shall ensure that all Documents required by the Contract which are appropriate for each VDD or 'book' are appropriately placed in the defined structure.

Each VDD shall have a detailed index to enable easy location of any required document or information included within that VDD. The detailed index shall be generated in MS Excel (or database) format and shall include but not be limited to the following Classification and Metadata for each document:

a. VDD number and name

b. Data Book type (only applicable for VDD 3)

c. Section number and name

d. Sub-Section number and name

e. Volume (binder) number

f. COMPANY Document number

g. COMPANY DRS Code

h. Document's complete Title/Description

i. COMPANY Revision

j. CONTRACTOR document number (if applicable)

k. CONTRACTOR revision (if applicable)

l. Vendor Document number (if applicable)

m. Vendor Revision (if applicable)

n. Tag number for major Components

The first volume of each VDD shall include the entire detailed index for that VDD (for example VDD 2 volume 1 would include the detailed index for the entire VDD 2).

Each subsequent volume of a particular VDD shall contain the segment of the detailed index which that volume contains.

6.2 Submission (Process) Requirements

CONTRACTOR QA must review all Data books to ensure their correctness prior to submission to the COMPANY for Review. CONTRACTOR QA approval does not constitute approval by COMPANY and the Data books will still have to achieve return Code 1 from the COMPANY.

For the review of the Data books, a single copy of each complete data book shall be submitted to the COMPANY.

If a data book is incomplete when submitted, the CONTRACTOR shall include a front sheet that clearly states which documentation is incomplete or outstanding

All documents in the data book shall be the latest issue. Only documents that have been submitted to COMPANY for review and achieved either 'no comments' or 'with comments' (if all comments have been incorporated) return code may be included in the data books. The only exception shall be documents that were submitted to COMPANY for review but not returned by COMPANY.

Upon final acceptance, the CONTRACTOR will forward the number of copies required by the Contract within two weeks of the date of acceptance, with all outstanding documents completed/submitted.

If any drawings or documents are revised after the submission and final acceptance of the data book, the CONTRACTOR shall forward the revised drawings/documents together with the amended front sheet and indexes. CONTRACTOR shall update the data books to incorporate the updated information.

CONTRACTOR shall propose and submit for review and acceptance the Table of Contents for the Data Books six (6) weeks prior to compilation.

CONTRACTOR shall submit for COMPANY review and acceptance the detailed index of each VDD four (4) weeks prior to compilation.

6.3 Format Requirements

6.3.1 Electronic Copy Requirements

All dossiers shall be supplied in the following formats and quantities:

- Five (5) electronic sets on hard drives

Each VDD as described in this document shall be submitted on a separate hard drive. The contents of the electronic copy shall include

- All documents as per the agreed PDS
- Native file for each document including review and approval cycle initials
- PDF file for each document including authentic review and approval signatures
- Databases for deliverables as defined in this document
- Software used in the development and delivery of calculation, analyses, simulations etc
- 2D and 3D model files including RDB's, seed files, associated databases and review files.

6.3.2 Hard Copy Requirements

All dossiers shall be supplied in the following formats and quantities:

- Five (5) hardcopy sets, 4-hole **drilled**

All documents smaller than standard Contract letter size sheets shall be attached to standard size sheets. Documents larger than standard letter size sheets shall be folded to the Contract standard letter size with identification data visible on the bottom right hand side. Unless agreed otherwise by the COMPANY, all drawings shall be full-size. Ledger size drawings shall be fan folded to the standard letter size, with the title block visible in the lower right corner while folded. Documents larger than ledger size shall be folded to standard letter size with title block to the front, and inserted into pre-punched plastic sleeves. Insertion into plastic sleeves is not required for 11" x 17" and smaller drawings.

The hard copies shall be provided on Tyvek® or COMPANY accepted equivalent tear resistant and stain resistant construction for service in the workplace. The format shall not deteriorate through storage or through handling in the workplace and shall be resistant to liquid spills, humidity and deterioration through exposure to ultra-violet light.

All final documentation shall be first generation prints. All final documentation shall be loose leaf.

All documents, including photo reductions, shall be complete, legible, and suitable for photo copying or scanning. They shall not be disfigured during collation. The use of white correction fluids and colored markers to highlight, differentiate, etc., is not permitted. Alterations, additions, and deletions to documents shall not be permitted without a new revision being made, reviewed and accepted by the COMPANY.

Drawings printed on half scale (for example A1 size reduced to A3 size) shall be scaleable, e.g., full size drawing (A1) at scale of 1:33 1/3 would be acceptable at 1:66 2/3 when reduced to half scale (A3).

Any Document which is placed in a plastic sleeve shall be printed using a Blueline or Blackline process (xerographic processes using fused toner are not permitted) since the ink from the xerographic process will react chemically with the plastic and render the copy unreadable.

COMPANY may, at its sole discretion, reduce the requirements for hard copy data books in either quantity of copies or organizational requirements. Efforts on behalf of the CONTRACTOR in the management of electronic data will have a direct effect on this decision.

6.3.3 Binding/Front Page/Index

The CONTRACTOR shall carry out all binding in sturdy, white, plastic 4 "Post" binders or COMPANY approved equivalent, with a maximum thickness of 3 inches. Other binder dimensions shall match the paper size requirements of the Contract. The binders shall be of a flat back design, with top quality suede vinyl sealed over heavy gauge board. Acceptable manufacturer and model includes the latest Trojan® model. CONTRACTOR may submit equivalent for COMPANY approval.

A sturdy, tear-resistant divider shall precede each section and sub section with the section number and name pre-printed on each tab. The tabs shall extend beyond the page width by 1/2 inch and individual tabs shall be offset to allow for easy identification of the section number. Dividers shall be constructed of stain, moisture and UV resistant material.

7. VDD COMPLETE REQUIREMENTS

7.1 VDD 1 FEED

The purpose of VDD 1 is to provide a complete, well organized set of Information resulting from the FEED effort from design information through project management and costs. It is important to note that this VDD is compiled from Information generated or acquired by CONTRACTOR and by COMPANY.

COMPANY provided information such as pre-FEED studies, reports by third parties, COMPANY specifications, etc. shall be incorporated by CONTRACTOR into the appropriate sections of the VDD.

7.1.1 Covers and Spines

Shall show the following information:

COMPANY

Project Name Contract Object VDD 1 FEED

COMPANY Document Number Volume 1 of nn

CONTRACTOR's Name and Logo (Small) Contract Number

7.1.2 VDD 1 Outline

The following lists a typical VDD 1 outline:

Section 1 - Introduction

- Cover Page
- Table of Contents
- Detailed Indexes
- Options Technical Description

Section 2 - Design Information (separated by options where applicable)

- Studies and Simulations
- Option Selection Decision Support Package
- Specifications
- Calculations and Datasheets
- Technical Procedures
- Drawings

Section 3 – Vendor Technical Information (CONTRACTOR)

For all packaged equipment for which 'bid packages' were received from vendors, CONTRACTOR shall assemble design data as defined in VDD 3 Book 1 outline.

CONTRACTOR shall assemble a complete VDD 3 for any equipment or material which is procured and manufactured as part of its scope of work.

Section 4 - Project Management

- Cost and Schedule - The final versions of all Documents which define the cost and schedule expectations including but not limited to level 3 cost estimate, cash flow projections, level 1 and 2 schedules.
- Procurement - The final versions of all Documents generated or received which define the procurement activities undertaken during FEED. This shall include but not be limited to approved vendor list, procurement package detailed document indexes, requests for

quotation, vendor bid packages and bid tabulations.

- Contracting Strategy - A document describing how the Project is expected to be divided into separate contracts for execution.
- Correspondence - All correspondence, including letters, faxes and meeting minutes recording communication with partners or regulatory bodies.
- Expenditure Records - Shall contain sufficient records to show the expenditure of FEED costs, and the acceptance by partners of those expenditures. This shall include but not be limited to AFEs and cost reports.
- Plans and Procedures
- Project Reports - Shall include reports adequate to indicate the progress of the project over time. These reports shall include but not be limited to the monthly progress report, Peer Review reports and list of utilized lessons learned.

Section 5 - Invitation to Tender (ITT) Package (COMPANY except as noted)

- Detailed Index of Technical Documents (CONTRACTOR)
- Contract Exhibits
- Terms & Conditions
- Addendums

Section 6 - Bid Process (COMPANY only)

- Bid Prequalification
- Queries, Clarifications and Exceptions
- Technical Proposals
- Technical Evaluation
- Commercial Proposals
- Commercial Evaluation

7.2 VDD 2 DESIGN

VDD 2 shall provide a complete definition of the design of the Facility, as-built to the time of handover as required by the Contract. The Document Requirements Schedule (DRS) for the Contract indicates the Documents which are appropriate for inclusion in this VDD.

7.2.1 Covers and Spines

Shall show the following information:

COMPANY Name

Project Name Contract Object VDD 2 DESIGN

CONTRACTOR's/Subcontractors Log Engineering Discipline

COMPANY Document Number Volume 1 of nn

7.2.2 VDD 2 Outline

Section 1 - Introduction

1. Cover page
2. Table of Contents
3. Detailed Indexes
4. Contract Object Technical Description

Section 2 – Specifications

All specifications covering equipment or material used in the Work shall be included in this section.

Section 3 - Calculations and Data Sheets

All calculations and data sheets required by the Contract.

Section 4 - Design Studies/Briefs/Philosophies

All design studies, briefs, philosophies and similar documents used in the Work shall be included in this section.

Section 5 - Procedures

All procedures used in the Work shall be included in this section.

Section 6 - Drawings

Information provided in this section shall include a full set of all design drawings generated or acquired in the course of the Work.

Section 7 - Design Changes

All change definition Documents including but not limited to Management of Change forms, change control procedures, Design Deviation Requests and Notifications and engineering modifications shall be included in this section. All changes regardless of source shall be suitably indexed and referenced.

7.3 VDD 3 Equipment and Materials

COMPANY requires all Information required by the SDRL of each purchase order to be organized into three (3) separate types of information packaged in hard cover four (4) post binders. The three (3) types of data are as follows:

- **Type One - Design Data Book**
- **Type Two - Manufacturing Record Book**
- **Type Three - Equipment Data Book**

Data books for packaged equipment shall be compiled into separate sub-sections for each major Component (for example, Turbine and Generator for a turbine generator package), with sub-sub-sections where required to properly further organize the information.

CONTRACTOR shall assemble a complete VDD 3 for any equipment or material which is procured and manufactured as part of its scope of work.

Data books covering multiple equipment packages shall be compiled into separate sub- sections for each equipment package where the packages are not identical

Information shall be included for the overall equipment and for each major unit/component making up the equipment. Information shall include all sub-Vendor items with a list of all sub-Vendor names, addresses, telephone/fax numbers, order reference numbers, etc.

It is not acceptable to combine the three types of books. This is due to the different uses for the information included within the three types of books.

7.3.1 Covers and Spines

Shall show the following information

COMPANY Name

Project Name

Contract Object

VDD 3 Equipment and Materials Book Type (i.e. Design Data Book) Purchase Order Number Equipment Package Title

COMPANY Tag Number for Major Equipment System Number

Volume 1 of nn

Suppliers Name and (small) Logo COMPANY Document Number and Revision

7.3.2 Design Data Book

The Design Data book shall contain the detailed information developed during the design of the equipment or material specified within the Purchase Order. The Design Data Book shall

be submitted for the first time at IDM 19 (As-Supplied) and shall be submitted As-Built at Final Acceptance (CDM 5).

Design Data Book Outline

Section 1 - Introduction

1. Cover page
2. Table of Contents
3. Detailed Indexes
4. Equipment Technical Description
5. CONTRACTOR and major sub-VENDOR information (e.g., names, addresses, telephone/fax numbers, order reference numbers, etc.)

Section 2 – Specifications

All specifications covering equipment or material identified in the Purchase Order shall be included in this section.

Section 3 - Calculations and Data Sheets

All calculations and data sheets required by the DRS and covering the equipment or material identified in the Purchase Order shall be included in this section.

Section 4 - Design Studies/Briefs/Philosophies

All design studies, briefs, philosophies and similar documents covering the equipment or material identified in the Purchase Order shall be included in this section. This section shall also include all performance requirements for the equipment or material.

Section 5 - Selected Procedures

All procedures defined in the DRS and applicable to the Purchase Order as part of the CONTRACTOR scope of supply shall be included in this section.

Section 6 - Drawings

Information provided in this section shall include a full set of all design drawings for the equipment or materials.

Section 7 - Design Deviation Requests

All documented Design Deviation Requests, with all attachments, approved by the COMPANY shall be included in this section. Deviations are to be suitably indexed and referenced. If this section is not applicable, then a statement to that effect shall be included in this section.

7.3.3 Manufacturing Record Book

The Manufacturing Record Book (MRB) is intended to contain a collated set of manufacturing records and certification documents. This Manufacturing Record Book shall demonstrate the manufacturer's compliance to the specified requirements contained within the Purchase Order specification.

CONTRACTOR shall ensure that the Manufacturing Record Book includes all appropriate certification and quality records for all furnished equipment and/or materials.

The relevant types of documentation to be supplied at each stage of manufacture shall be indicated by the CONTRACTOR by means of the CONTRACTOR Quality Plan and the original COMPANY defined Quality specifications.

Original documentation shall be made available for all tests carried out on the equipment or materials supplied.

Test certificates and performance records shall be completed using the Vendor and sub-Vendor standard forms. Type of test and equipment/material tag number shall be clearly shown on each document.

Material Certification

'Material Certificate' shall mean a manufacturer's standard document, readily identifiable to and recording conformance of a piece or batch of material with a recognized code, standard or specification. All certified properties/test results on certificates shall be typed and/or printed.

Certification Markings

Vendor material and test certification shall be fully identifiable to the CONTRACTOR Purchase Order and to the item for which the certificate is supplied.

This identification shall include the manufacturer's numbers, (e.g. heat/cast numbers, batch numbers, work numbers, etc.). The certificate shall also be marked at the top of each page with:

- CONTRACTOR Purchase Order number Purchase Order item sequence number
- Component description (shaft, impeller, body forging, etc.) COMPANY equipment/instrument Tag Number
- The COMPANY will provide further guidance in specific instances, if requested by the CONTRACTOR.

Manufacturing Record Book Outline

Section 1 - Introduction

1. Table of Contents
2. Detailed Indexes
3. Equipment Technical Description
4. Vendor and major sub-VENDOR information (e.g., names, addresses, telephone/fax numbers, order reference numbers, etc.)

Section 2 - Description of Equipment

This section shall provide a summary of the duty and rating or size of equipment as appropriate. The description shall be followed by a parts list identifying all individual component items that comprise the equipment, including tag number, description, sub- CONTRACTOR (if applicable), and CONTRACTOR's part number/tag number as appropriate.

Section 3 - Surveillance Completion Notes

This section shall contain the CONTRACTOR Surveillance Completion Note or a notification of waived surveillance. Surveillance Completion Notes for sub-vendor components shall also be included in this section.

Section 4 - Test Certification

This section shall include test certification which records the tests on equipment required by the Purchase Order and associated specifications and standards which may include, but not be limited to:

- Performance Tests
- Functional Tests
- Alignment Checks
- Over-speed Tests
- Balancing Tests
- Impulse Voltage Tests
- Short Circuit Type Tests for Switchgear
- Load Tests
- Fire Tests
- Weighing Certificates
- Calibration Certificates for instruments and equipment supplied to fulfill the purchase order.
- Calibration Certificates for test equipment are not required.

Section 5 - Code Compliance Certificates

This section shall contain a certified copy of the Code Compliance or Type Approval certificates such as API, ASME or other recognized Approval Authorities.

Section 6 - Manufacturing Procedures

This section shall contain manufacturing procedures which have been followed during the manufacture of the equipment/packaged item. These may include but are not limited to:

- Fabrication Procedures
- Welding Procedure Specifications and Procedure Qualification Records
- N.D.E. Procedures
- Forming and Heat Treatment Procedures (including P.W.H.T.)
- Hydrostatic or Pneumatic Test Procedures
- Functional and Performance Test Procedures
- Surface Preparation and Painting Procedures

Section 7 - Production Weld Records

This section shall provide for the clear identification and subdivision of the weld production records into the following categories:

- Weld Identification Drawings
- Weld Record Sheets (recording per weld, the weld number, welder or welding operator identification, weld procedure, N.D.E. report numbers, post-weld heat treatment.)
- Weld Repair Records

Section 8 - Inspection, Test and N.D.E. Reports

This section shall provide for the clear identification and sub-division of the N.D.E. records into the following categories, as applicable:

- Radiographic Examination Reports
- Ultrasonic Examination Reports
- Magnetic Particle Inspection Reports
- Dye-Penetration Inspection Reports
- Visual Inspection Reports
- Hydrostatic or Pneumatic Test Reports indicating the limits of the test
- Painting Inspection Reports
- Insulation Inspection Reports
- Dimensional Reports

Section 9 - Material Test Certificates

This section shall contain material certificates and detailed indexes, and may include, but not be limited to:

- Chemical Analysis (Ladle and Product)
- Mechanical Test Results
- Material Heat Treatment Records

Section 10 - Hazardous Area Certificates

Hazardous Area Certificates and schedules shall be included within this section. When the scope does not include certified items a statement to that effect shall be made.

Section 11 - Other Testing/Certificates

7.3.4 Equipment Data Book

Equipment Information which encompasses all information required to operate, maintain, and repair the equipment.

The Equipment Data book (Operating, Maintenance and Start-Up Information) will be used initially during the installation, commissioning, and the development of the Operations and Maintenance procedures for the facility.

The basic information required in the Equipment Data Book is:

- To provide installation, start-up, operating and maintenance instructions for the equipment on the correct installation and its subsequent removal, replacement and re-commissioning.
- To provide clear and concise written instruction on the operational characteristics and functions of the equipment.
- To provide definitive maintenance requirements so that a Maintenance Schedule can be developed.

For a package, or a major item of equipment incorporating a number of sub-units, the Equipment Data Book shall be collated to give an overall system/equipment understanding, followed in order, by information on each sub-units and sub- CONTRACTOR items.

It is essential that the interfacing of parts/units is described. The equipment should be described in a logical order from the highest level (complete system or machine) down to sub-assembly, component or part level, consistent with the recommended repair policy. Where the Purchase Order covers equipment and items that will be installed by others, information on delivered items must be comprehensive.

Equipment Data Book Outline

Section 1 - Introduction

1. Table of Contents
2. Detailed Indexes
3. Equipment Technical Description

4. CONTRACTOR and major sub-vendor information (e.g., names, addresses, telephone/fax numbers, order reference numbers, etc.)

Section 2 - Erection and Installation Procedures

Section 3 - Pre-Commissioning and Commissioning Procedures

Section 4 - Operational Procedures

- Basis of System, Equipment or Plant Design Sub-Section
- System, Equipment, or Plant Description Sub-section
- Control, Alarm, and Shutdown Sub-Section
- Safety Devices Sub-Section
- Pre-start (Checkout) Procedures Sub-Section
- Initial Start Up Sub-Section
- Normal Operation and Start Up Sub-Section
- Routine Operator Activities Sub-Section
- Shutdown Modes Sub-Section
- Start Up After Shutdown Sub-Section
- Cause and Effect Diagrams and Matrices Sub-Section

Section 5 - Maintenance Data Sheets

Section 6 - Maintenance Procedures

- Planned Maintenance Routines (PMR) Sub-Section
- Major Intrusive Maintenance Sub-Section
- Isolation Activities Sub-Section

Section 7 - Spare Parts Listing

Section 8 - Lube Oil and Operating Fluid Schedule

Section 9 - Special Tools Listing

Section 10 - Corrosion Testing Procedures

Section 11 - Fault Finding/Correction Method

Section 12 – Change-out Time for Major Assemblies

Section 13 - Weight Reports

Section 14 - Vendor Training Materials (where training is given to operations/ maintenance personnel as part of the supply of the equipment).

This section may include, but not be limited to:

- Objectives of Training Sub-Section
- Contents of Training Sub-Section
- Lesson Plans Sub-Section
- Training Modules Sub-Section

7.4 VDD 4 Fabrication

VDD 4 is a systematic compilation of Fabrication Documentation generated during fabrication, construction, manufacturing, installation, testing, reporting and certification required to demonstrate that construction, equipment, materials and fabricated systems and units are in compliance with the statutory regulations and specified requirements.

VDD 4 shall be compiled in tab-separated binders in parallel with progress of the permanent works and reflect the Final As-Built Status.

Each binder shall compiled by Discipline and then by section number. Each binder shall preferably contain one Discipline.

COMPANY shall be given access to perform Quality Reviews of the Documentation for progress and consistency according to the below Example and Guidelines for the completion of the Fabrication Records.

CONTRACTOR shall ensure that all changes that affect the VDD 4 and the quality Records during late phases of the Project (i.e. MC, Hook–Up, Pre-Commissioning and Commissioning, Start-Up) are documented and inserted into VDD 4.

VDD 4 shall be delivered to COMPANY at the Final Acceptance Milestone in scanned (TIFF or PDF) format.

7.4.1 Covers and Spines

Shall show the following information

COMPANY Name

Project Name Contract Object Module Title

VDD 4 Fabrication Discipline Name and Code Section Number (to/from) CONTRACTOR's Logo

COMPANY Document Number

7.4.2 VDD 4 Index and Section Coding Structure

VDD 4 Index and Section Coding Structure shall be implemented prior to start of the Fabrication Activities and CONTRACTOR shall at all times keep the file up to date.

- The Index is required to be produced in Excel spreadsheet format.
- The Draft VDD 4 Index shall be submitted to COMPANY for review and acceptance 1 month after start Fabrication/Construction.

FABRICATION RECORD BOOK TABLE OF CONTENTS		
Index Section Number	**Information Type**	**Description**
000	User Guide	User's Guide per the requirements defined in this specification
001	CONTRACTOR's As-Built	A listing of all drawings and documents at status As-Built
002	QA Manual	Contractors Quality Manual
003	QA Procedures	All Project Specific Quality Assurance Procedures
004	QC Procedures	All Project Specific Quality Control Procedures
005	Project Manual	A high level summary of how Contractor plan to execute his Scope Of Work for the Project and Contractors Organization
006	Material Integrity Reports	Multi discipline analyses i.e. to evaluate composite, performance, life, risk of failure of materials, structure and mechanical components
007	RFI Total File	A file of numbered Request for Information (RFI) Queries
008	Construction RFI Index	A file of RFIs related to Construction/ Fabrication
009	ITCs related to Construction	Supplementary Construction Work both including Change or Work not including Change
010	Non Conformance Request (NCR) with Index	Request forms describing items Not in compliance with Contract Requirements, Scope of Work, Regulations, Standards, Specifications and/or Technical Requirements
011	Corrective Action Request	Request forms describing Response and Proposed Solution(i.e. action to be taken) to a NCR

012	Index of Piping Special Items	A listing of All piping specialty items. The list shall contain the following: Item Tag #, Size, Rating, Connection Type, Description, Item location (drawing and line number), Equipment Number.
013	VDD 4 Detailed Index	A detailed List of Contents for VDD 4
014	Index of Materials used for Surface Protection including Fire, Corrosion and Heat Tracing, Pickling	Detailed list of Materials used
015	Regulatory Queries	Summary list of Queries to the Regulatory Body
016	Index of Fabrication Shop drawings with reference to Design Drawings	Listing of Fabrication Shop Drawings by Document Number (if required by the Contract)
017	Index of Pipe-laying and Tie In Drawings with reference to Design Drawings	Listing of Pipe-laying and Tie-In (Areas between Main Installation Areas) drawings by Document Numbers
018	Index of Pipe Support Drawings	Listing of Pipe Support Drawings by Document Number
019	Pipe Support Drawings	Total file of Pipe Support Drawings
020	Index of Spool Fabrication Drawings	Listing of Spool Fabrication Drawings by Document Number
021	Index of Design / Material / Fabrication Specifications	Listing of all Design and Fabrication Specifications specially produced for the developments project, Standard Project Specifications are included.
022	Isometrics	Piping shall be documented on Fabrication Isometric Drawings. The total file shall be submitted as well as Stress, Pressure Testing and Heat Tracing Isometrics
023	Welders Operations Certificates	Welders Operation Certificates and Qualification Records
024	NDE Operations Certificates and Index	Nondestructive Examination (NDE) Operations Certificates with Index
025	Welding Procedure Specifications (WPS)	Total File of all Welding Procedure Certificates
026	Welding Procedure Qualification Records	Total file of all Welding Procedure Qualification Records

027	Repair Procedures	All welding repair Procedures and related Specifications
028	Weld Summary List, Main Welds	The summary list of Main Welds
029	Weld Summary List, Non-Main Welds	The summary list of Non-Main Welds
030	Spot Sequence, Numbering and Marking System	Self explanatory
031	As-Laid Tally Sheets	Listing of tally sheets in As-Laid status
032	Material Identification	Material Identification System Procedure/Specification
033	Pipe Tracking Specification	Pipe Tracking Specification
034	Line – Pipe Reconciliation	Piping (Lines) Reconciliation Procedure
035	Material Certificates and Index	Total file of Material Certificates with Index
036	Material Receiving Reports	Total file of Material Receiving Reports
037	Signed statement by CONTRACTOR verifying correct usage of materials	Signed statement by Contractors Management Team verifying correct usage of materials
038	Assembly / Erection Procedures	Structural Assembly and Erection Procedures
039	Concrete Mattress Installation	Concrete Mattress Installation Procedures and Inspection Certification
040	Bitumen Mattress Installation	Bitumen Mattress Installation Procedures and Inspection Certification
041	Rock Dumping	Rock Dumping Procedures and Inspection Certification
042	Concrete Summary Report	Concrete Installation Procedures and Inspection Certification
043	Concrete Structures Production Test Reports	Concrete Production Status Reports (GBS)
044	Pressure Testing Reports	Pressure Testing Procedures and Test Certification (part of Mechanical Completion record files)
045	Daily Logs	Progress reporting on Surface Protection

046	Calibration and Test Reports	Instrumentation calibration records and test procedures (part of Mechanical Completion certification)
047	Anode Tally Sheets	Tally sheets describing the Anodes Systems
048	Visual Inspection and NDE Reports	Total file of Visual Inspection and Nondestructive Examination Reports
049	Ultrasonic Reports	Total file of Ultrasonic Reports
050	Radiographic Reports	Total file of Radiographic Reports
051	Magnetic Particle Reports	Total file of Magnetic Particle Reports
052	Dye Penetrate Reports	Total file of Dye Penetrate Reports
053	Photos and Videos of Submerged Structures and Components	For Risers, J-Tubes, Sub Sea Structures, Submerged Pipelines, Cables, Umbilicals, photo's and video's including identification of Main Components
054	Positive Material Identification Report	Total file of Positive Material Identification Reports
055	Dimension Control Reports	Total file of Final Dimensional Control Reports
056	Heat Treatment Reports	Total file of Heat Treatment Reports
057	Cable Routing Pulling Slips Report	Final Report of the Cable Routing/ Pulling Slip Status
058	As Trenched status Survey of Pipelines	As-Built (Installed) Inspection Reports and Survey Status Reports
059	As laid survey of Pipelines	As-Built (laid) Inspection Reports and Survey Status Reports
060	Pipe Line Crossing Surveys	Total file of Pipeline Crossings Survey Reports
061	As-Built Anode Drawings	Total file of As-Built Anodes Drawings
062	As-Built Shop Drawings	Total file of As-Built shop Drawings (If required by Contract)
063	Penetration Index	Detailed List of all penetrations, including but not limited to wall, deck, hull penetrations
064	Penetration Location Drawings of Internal and External Walls,	Total file of all Penetration Location Drawings
065	Door and Window Schedules	Door and Window register including number, location, materials and test certification
066	Raised Access Floor Installation Procedures and Drawings	Total file of all raised Access Floor Detailed Drawings, Installation Procedures and test certification
067	Carry Over work lists	Total Detailed Register of all Carry Over work
068	Ship Loose Items List	Total Index of all Shipped Loose Items
069	Preservation Master Plan	A detailed Plan describing Initial and Maintenance Preservation Scope, Method and Reporting
070	Weight Control Reports	All weight Control Reports

071	Load Out Manual	The aim of this manual is to provide an explanation of the purpose and function of the key items during Load Out.

7.4.2.1 Requirements for 'User Guide'

The User Guide shall provide a detailed overview of the Scope that is covered by the FRB.

The User Guide shall also provide clear Guidelines for how to achieve material traceability and weld traceability and how the associated documentation can be searched for and retrieved.

1. General
   1.1. Introduction
   1.2. Purpose
   1.3. Basis and assumptions
2. Description of organization of VDD 4
   2.1. Main outline and description of filing areas (plot plan)
   2.2. Listing of Documents per discipline with cross-reference to the actual volumes
   2.3. Index of Drawings containing As-Built Mark Up Information
3. Description of any deviation from COMPANY required structure for VDD 4
4. Examples explaining and demonstrating traceability to key documents such as:
   - Material Certificates
   - QC Reports
   - Non Conformance and Repair Reports
   - Hydrostatic Pressure Testing Reports

7.4.2.2 Weld Summary List

The Weld Summary List shall as a minimum have the following Field Information:

- Weld Number and welder's identification
- Visual Inspection and date welded
- System and Line Number (only for piping)
- Area Section
- Part Number

- Drawing Number
- Welders ID
- Welding Procedure Specification (WPS)
- Welding Procedure Qualification Records (WPQR)
- NDE Category, Extent of NDE
- NDE Results
  - Material Information
  - PWHT Report Number
  - Weld Repair Information and associated NDE Records
  - PMI Report Number
  - Type and extent of NDE including Technique reference
- Non Conformance report Number and relevant Site Query Number
- Inspection Results
- Number of performed repairs

7.5 VDD 5 Systems Completion

VDD 5 is intended to describe in detail the state of commissioning of the facility. CONTRACTOR shall maintain the required information constantly throughout the commissioning effort.

VDD 5 shall consist of one dossier for each system, plus one general dossier representing the facility overall. The dossiers shall be compiled in the structures defined in the outlines below. CONTRACTOR shall utilize subsections as required to appropriately organize information in the dossier.

7.5.1 Covers and Spine

Shall show the following information

Phu Quoc POC

Project Name

Contract Object

VDD 5 Systems Completion System #

Sub System #

Volume 1 of nn

CONTRACTOR's Name and Logo (Small) COMPANY Document Number and Revision

7.5.2 Outline of General Dossier

Section 1 - Introduction

1. Cover page
2. Table of Contents
3. Detailed Indexes
4. Subcontractor and major vendor information (e.g., names, addresses, telephone/fax numbers, order reference numbers, etc.)

Section 2 - Safety Precautions and Assessments

- Not applicable

Section 3 - System/Subsystem Limits

- System and Subsystem Breakdown List

Section 4 - Preservation and De-Preservation

- Master Preservation Plan

Section 5 - Mechanical Completion Status

- Not applicable

Section 6 - Vendor Support Requirements

- Vendor Callout Plan

Section 7 - Commissioning Procedures

- Master Commissioning Plan
- Index of System Specific Commissioning Scope and Procedures

Section 8 - Commissioning Status

- Not applicable

Section 9 - Materials Required for Commissioning and Start Up

- Spare Parts Lists

Section 10 - Design and Vendor Documents

- Index of all Documents corrected or modified as a result of Commissioning activities

Section 11 - Handover/Turnover Documentation

- Facility Completion Certificates per the Contract
- Index of System Completion Certificates per the Contract
- Final punch list (signed off by all Functional Management Teams) including Punch-list Status (By System and/or Area Completion).

Section 12 - Equipment Certificates

Indexes (per description below):

- Material handling Equipment
- Pressure Relieving and Shutdown Devices
- Other Equipment Certificates (third party)

7.5.3 System Dossier Outline

Section 1 - Introduction

5. Cover page
6. Table of Contents
7. Detailed Indexes
8. System and Sub System Description

Section 2 - Safety Precautions and Assessments

- Job Safety Analysis (JSA)
- Environmental Considerations
- Hazardous Materials
- System Specific Safety Procedures

Section 3 - System/Subsystem Limits

- Definition of Boundaries of this Commissioning System/Subsystems

Section 4 - Preservation and De-Preservation

- A conclusive status report showing the completion of all Preservation Programs / Procedures / Reports including Initial and Maintenance Preservation
- System specific preservation, sea-fastening and de-preservation plans

Section 5 - Mechanical Completion Status

- System Mechanical Completion Certificates

- A conclusive status report showing the completion of all Mechanical Completion Inspection and Test Records (MCITRs)

Section 6 - Vendor Support Requirements

- Vendor Support Plan and Schedule

Section 7 - Commissioning Procedures

- System Specific Commissioning Scope and Procedures

Section 8 - Commissioning Status

- A conclusive status report generated from the PCS showing the completion of all Commissioning Check Lists (CCLs)
- 'A' and 'B' punch lists
- System Commissioning Certificates
- Inspection Video/DVD index and Videos (Subsea and Other)

Section 9 - Materials Required for Commissioning and Start Up

- Special tools and test equipment
- Consumables
- Spare Parts Lists

Section 10 - Design and Vendor Documents

- Index of all Design Documents for the System (Document number, revision, title and a column indicating which Documents were changed/corrected as a result of Mechanical Completion or Commissioning) extracted from the Document Register
- Marked up vendor Documents
- Marked up CONTRACTOR Documents
- FAT & SAT Results and Records for major equipment
- All outstanding or incomplete Management of Change (MOC) Information (Queries / Corrective Action or NCRs) relevant to the System

Section 11 - Handover/Turnover Documentation

- System Completion Certificates per the Contract
- Final punch list (signed off by all Functional Management Teams) including Punch-list Status (By System and/or Area Completion).

Section 12 - Equipment Certificates

Indexes (per description below) and original certificates for:

- Material handling Equipment
- Pressure Relieving and Shutdown Devices
- Other Equipment Certificates (third party)

Equipment Certificate Indexes shall be extracted from the Asset Register. Each Component shall be represented by one row and shall include the following:

a) Tag Number

b) System & Sub System

c) Location

d) Sub Location

e) PO Number

f) Manufacturer

g) P&ID Reference (for Components displayed on P&IDs)

h) Layout Drawings Reference

i) Datasheet Reference

j) PO Number

k) P&ID Reference

l) Service Description

m) Certificate number (the COMPANY Document number of the certificate for the Component)

n) Certificate date (Cranes, Derrick or Material Handling Worksheet signed by certifying authority)

o) Calibration Certificate number (pressure relieving and shutdown devices only)

p) Calibration Date

7.6 VDD 6 System Description

VDD 6 is a high-level document describing all systems of the complete installation.

Typically an installation is divided into systems and areas. A system can belong to a specific area or be spread across many areas.

7.6.1 Covers and Spine

Shall show the following information

Phu Quoc POC

Project Name Contract Object

VDD 6 System Description System Numbers (to/from) Volume 1 of nn

CONTRACTOR's Name and Logo (Small) COMPANY Document Number and Revision

7.6.2 VDD 6 Outline

Each System shall include the following Sub-sections:

- Design Basis
- Function
- System Description
- System Control
- System Specific Considerations

Main Systems: (Example, shall include but not limited to)

- Utility Systems
- Process Systems
- Safety Systems (ESD, PSD)
- Fire and Gas Systems
- Instrument and Control Systems
- Electrical Systems
- Communication Systems
- Drilling Systems
- Marine Systems
- Subsea Systems
- Cargo Oil Systems
- General Systems [including Structure (i.e. Hull, Jacket, Workshops, Cranes, Mooring, Thrusters), Auxiliary and Temporary Systems (i.e. Temporary Power, etc.)
- Civil, Onshore

7.6.3 VDD 6 Preparation, Review and Delivery

VDD 6 shall be prepared in parallel with progress of the Detailed Design and shall be issued for review by COMPANY Engineering and Operations personnel on a continuous basis.

- CONTRACTOR shall submit a table of contents and outline of VDD 6 to COMPANY for review and acceptance at IDM 9.
- The draft set of VDD 6 shall be issued to COMPANY for review and acceptance 1 month after Mechanical Completion (Initial Delivery Milestone). The purpose of this early draft set occurring at Detailed Design Complete, occurs so that the Operations Team can start early preparation of Operating Systems, Strategies and Training.
- VDD 6 Final Issue is at Final Acceptance (Conclusive Delivery Milestone)

7.7 VDD 7 Start-up, Operating and Maintenance (SOM) Procedures

The Start-up, Operating and Maintenance Procedures shall be developed and issued for each type of Installation (e.g. FPSO, Production Platform, Drilling Rig, Subsea Installation etc.) comprising successive step-by-step procedures for bringing a dead installation to full operation.

The development of SOM Procedures shall ensure alignment with OE-MS, Operations Strategy, Reliability and Maintenance Strategy, Staffing & Contracting Strategy.

The SOM Procedures (Normal Production and Processing and Facility Operations) shall describe each system's mode of operation.

Typical content shall be:

- System Summary
- Functional Description
- Operation and control of data for equipment
- Process and emergency shutdown systems (PSD & ESD)
- Operation in emergency mode
- Equipment Data
- Safety Procedures
- Start-Up and Shut-down procedures, system and main equipment

CONTRACTOR shall provide an SOM Manual for each facility in CONTRACTOR's scope of supply.

CONTRACTOR shall prepare SOM Manuals which contain precise, equipment specific instructions and reference information adequate on their own for Operations to:

- Start up, operate and shutdown the systems, equipment or plant for which they are written in a safe and efficient manner.

- Provide a comprehensive reference when maintaining the systems, equipment or plant involved. This shall include routine maintenance, periodic maintenance, fault finding, major overhaul (where this can be achieved onboard) and spare parts.

- Convey the system, equipment or plant design intentions, (i.e., the basis of operation and maintenance documented during detail engineering).

Simple diagrams shall be supplied, with sufficient text to ensure the complete understanding of a particular event or operation. Drawings that are reproduced shall be electronically processed/scanned.

7.7.1 Covers and Spines

Shall show the following information

Phu Quoc POC Project Name Contract Object

VDD 7 SOM Procedures System Description and Number CONTRACTOR's Logo

COMPANY Document Number Volume 1 of nn

7.7.2 VDD 7 Typical Outline

Content of each SOM Manual shall include and be organized as follows:

1. TABLE OF CONTENTS
2. INTRODUCTION
3. DESIGN BASIS
    a. Production data
    b. Fluid properties
    c. Site characteristics and environmental data
    d. Facility design basis
    e. Index of Project specifications / standards
    f. List all contract specification and applicable code design deviations
    g. COMPANY safety practices guidelines
4. PROCESS TRAIN OVERVIEW
    a. Process and equipment overview
    b. Instrumentation and controls overview
5. DESCRIPTION OF FACILITIES
    a. Safety Systems

b. Communications

c. Floating/Fixed Systems and Storage Systems

d. Oil Production and Controls

e. Produced Water and Gas

f. Export, Relief and Drainage

g. Power

h. Utilities

i. Special Function Systems

j. Accommodations and Other Buildings

6. SPECIFICATIONS AND FACILITY DESCRIPTION

a. Purpose and Facility Description

b. System Components

c. Completed Data Sheets

7. SAFETY PROCEDURES

a. Facility Level

b. System Level

c. Major Equipment Level

8. OPERATING MODES

a. Normal Operation

b. Individual Equipment Bypass

c. Emergency Operating Mode

d. Alternative OPERATING MODES

9. PRE-START PROCEDURES

a. Mechanical and Utility Flow Diagram Check, for example:

i. Direction of Flow Through Check Valves

ii. Proper Connection of Tubing into Multi-port Pneumatic Relay Valves

iii. Verification of Car-Sealed Block Valves

iv. Verification of Relief Valve Settings

b. Electrical Checkout, for example:

i. Rotation of Electric Motors

ii. System Grounding

iii. Insulating Flanges

c. Mechanical Checkout, for example:

i. All Shipping Stops Removed from Machinery

ii. Pitch Settings for Fan Coolers

iii. Tightness of Foundation Bolts

iv. Packing and Plungers in Pumps

v. Equipment Lubrication

d. Safety Checkout, for example:

i. Location and Type of Fire Extinguishers

ii. Protective Masks and Clothing

e. Filling the System, for example:

i. Initial Charges of Chemicals

ii. Lubrication Oils

iii. Cooling Water

f. System Tune-up

10. INITIAL START-UP PROCEDURES

a. General

b. Start-up Sequence

c. Utility Systems - Initial Start-up

i. Potable / Utility water system

ii. Water maker

iii. Diesel fuel system

iv. Instrument and utility air system

v. Firewater system

vi. Sewage treatment system

vii. Drain system

viii. Cooling water system

ix. Fuel gas system

x. Produced water treatment system

xi. Chemical injection

d. Wellhead and Manifolds - Initial Start-up

e. Production System - Initial Start-up

i. Water filling of production vessels

ii. Water filling of process piping

iii. Air/Nitrogen purging procedure

f. Pipelines - Initial Start-up

i. Oil pipelines

ii. Gas pipelines

iii. Crude introduction

g. Temporary Well Clean-up Equipment - Initial Start-up

11. PLANT OPERATION PROCEDURES

a. Start-up Procedure

i. Reference list to initial start-up procedures

b. System Operating Requirements

c. Low Production

i. Low Oil Production

ii. Low Gas Production

iii. Low Water Production

d. High Production

i. High Oil Production

ii. High Gas Production

iii. High Water Production

e. System Safeties and Interlocks

12. SHUTDOWN PROCEDURES

    a. Component Shutdown

    b. Process Shutdown Sequence

    c. Emergency Shutdown Sequence

13. MAINTENANCE PROCEDURES

The maintenance procedures will be based on findings of the Reliability Centered Maintenance Analyses. For systems not covered under the RCM Analysis, the development of the Maintenance Procedures shall be based on the Original Equipment Manufacturer's Recommendations that are contained in the Equipment Manuals and from Best Practices from other Company Locations.

The Maintenance Procedures shall ensure that R&M technical consideration have been identified and adopted. The Maintenance Procedures shall be included but not limited to:

- Task Priority
- Spares Requirements
- 2 years Operational Spares
- Capital Spares (i.e. items that are not subject to deterioration by normal use, but the continuous operation of; where critical for continued and safe operation of the equipment or plant to meet overall annual efficiency levels, and safety and reliability goals.)
- Tool Requirements
- Job Safety Assessments
- Mean Time to Repair Estimate
- Personal Protective Equipment Requirements
- Resource Requirements

14. DRILLING

    a. Drilling Rig

    b. Completion Rig

    c. Facility Interface

    d. Simultaneous Operations

    e. Control and Safety Systems

    f. Facility Structural Allowances

    g. Communications

h. Special Requirements

15. ADDENDUM

a. Process Flow Diagrams

b. Piping and Instrument Flow Diagrams

c. Electrical Motor Load List

d. Electrical Power Load Tabulation

e. Safe Chart and Cause and Effect Matrix

f. Project Specifications

g. Overall Area Map

h. Cooling Water System Sketch

i. COMPANY Safety Code for Operation

j. Instrumentation Index

7.8 VDD 8 Design, Fabrication and Installation (DFI) Resume

The main objective of the Design, Fabrication and Installation (DFI) Resume is to provide Operations with a concentrated and precise summary containing the most relevant data extracted from the design, fabrication and installation phases with special focus on areas of high stress and use.

The document shall also serve as an aid in the consideration of measures to be taken if condition monitoring reveals that the installation is damaged or deviates from the acceptance criteria.

The DFI resume shall also enable an overall understanding of the structural behavior of the structures by providing basic information about the analyses performed.

Only a brief summary description of the work performed shall be included. Please note the subject and relevant documentation shall be referred to and not be included in this Document. CONTRACTOR shall refer to Section 7.8.2 for a detailed table of contents for the DFI Resume.

CONTRACTOR shall prepare and develop the resume in parallel with progress of the design, fabrication and installation of the Facility i.e.:

- The Design section of the resume shall be prepared in parallel with the development of the Design Documentation, as an integrated part of the design work.

- The Fabrication and Installation sections shall concentrate on non-conformances from design/fabrication criteria, specifications, etc. Further, areas should be highlighted where special attention in the operational phase is recommended due to e.g. difficult repairs, unexpected large loads or other unforeseen events.

- The resume shall reflect the As-Built status of the installation.

The DFI Resume shall contain information needed for:

- The planning of the in-service inspection and maintenance activities throughout the lifetime of the installation.
- Evaluation of the condition and functioning of the structure.

The DFI Resume shall therefore include a detailed description of the design, fabrication and installation of structures which include:

- Highly utilized areas, statically and in fatigue
- Structures for which structural integrity, functional integrity or fatigue life is sensitive to design assumptions or exact functioning of specific structural elements
- Prototype structures
- Structural elements subject to progressive collapse/non redundancy
- Structures where material selected is found to have (due to changing loads or other factors) lower safety factors
- Structures where corrosion protection is critical due to stress, strain, environmental conditions or materials used.
- Recommendation for what should be inspected and which methods may be used. (Planned replacement and repair shall be contained in separate operating and maintenance procedures in VDD 7.)

7.8.1 Covers and Spine

Shall show the following information

Phu Quoc POC Project Name Contract Object

VDD 8 DFI Resume Volume 1 of nn

CONTRACTOR's Name and Logo (Small) COMPANY Document Number

7.8.2 VDD 8 Outline

The structure and content of the DFI Resume shall be as follows:

1. Introduction
    a. General
    b. Objective
    c. User manual of DFI Resume
2. Description of the Facility

a. Main function of the Facility

Describe the overall facility (location, orientation, main elements)

b. Interfaces

c. Geometry, Weight & Centre of Gravity of the overall facility

d. Materials selection and Corrosion Protection

i. Material Grades

Description with key parameters of the different materials used and reasoning behind the selection of each material.

ii. Corrosion Protection

Description with key parameters of the protective systems, where the systems are used and the reasoning behind the selection of each system. Problem areas to be highlighted.

- Coating Systems
- Cathodes protection system
- Corrosion allowance

e. Structural Fire Rating / Fire Protection System general description

f. Identification System

Describe the system used to identify areas, members, welds etc. Describe the structural marking system

3. Design Resume

a. Civil / Structural and Marine Design Basis

i. Reference to Specifications, Codes, Standards and Regulations

ii. Design Philosophy

Describe the design philosophy guiding the choice of design methods and sequence

iii. Design Criteria and Loads

- Design Lifetime
- Air-gap
- Environmental conditions
- Drag and Inertia coefficients

- Geotechnical information incl. subsidence
- Marine Growth
- Ship Impact
- Dropped Objects
- Fire and Explosion
- Seismic Data
- Future Loads, Reserve Capacity

iv. Live Load Diagrams

To be illustrated by reference to separate drawings floor by floor

b. Static System

c. Design Conditions

d. Load Combinations

e. Analyses

Short Description of the analyses hierarchy and a brief description of each analyses:

- Purpose
- Model and Program System
- Loads
- Result

f. Governing Load Conditions / Structural Response

Give an explanation of how the structure responds to the governing load conditions and why these conditions are governing.

g. Design

Verification Model Tests

Load/ response monitoring. Description of monitoring programs / Time

Schedule / Results

Key results from third party verifications where significant differences from design documentation are observed

h. Non-conformances

Make reference to all cases of non-conformance in the design and the consequences of these should be highlighted

i. Integrity Critical Areas

i. Fatigue Life

Areas, members, welds with fatigue life less than 5 times the design life for accessible members shall be referred to. A verbal description shall also be given to assure exact and easy location.

ii. Static Utilization

Areas, members, welds with utilization ratio higher than 0.80 shall be referred to. The corresponding utilization ratio for the operational phase shall be given.

iii. Progressive Collapse

Elements causing progressive collapse on failure. All such elements to be listed with their maximum utilization ratio during operation.

iv. Sensitive areas / Structural elements

Items for which structural integrity, functional integrity or fatigue life is sensitive to design assumptions or the exact functioning of specific structural elements. E.g. sensitive to the assumed value of a coefficient of friction / assumed thickness of marine growth or e.g. the correct functioning of a bearing being governing for the fatigue lifetime.

v. Prototype Structures

Structures or parts of structures for which operational experience is missing or very limited. Give a description of the largest uncertainties in performance with respect to structural response and integrity.

j. Inspection

- Condition Monitoring Philosophy used in design.
- Overview of areas designed to be non-accessible
- Proposal of what should be inspected during the service life of the object based upon an evaluation, section by section, of the state of design.
- Describe access and methods available for the performance of this inspection.
- Problem Areas and areas with limited access to be highlighted.

4. Fabrication Resume

The information given in 4.2 – 4.8 shall concentrate on non-conformances from the design criteria, specifications, codes, standards and regulations.

Please note that the subject and relevant documentation shall be referred to only and not be included in this document

a. Weight and Center of Gravity As Built Values

b. Specifications, Regulations, Codes and Standards Refer to 3.1.1

c. Materials

Describe traceability of certificates.

d. Welding

Primary steel joints shall be given special attention

e. Tolerances (Interfaces)

As Built Values

f. Inspection and Non destructive Testing

g. Surface Protection

h. Fire Proofing

i. Identification System

Describe the Identification System used for Areas, Structural Parts, Welds, etc.

j. In Service Inspection

Items recommended for Inspection in the Operational Phase

k. Fabrication Documentation

Refer to the Document Number for the "As-Built" Fabrication Documentation Register

l. Fabrication Summary

Brief Summary Description of the Fabrication work performed. Give Fabrication and Assembly Sequence.

Fabrication Sites and Fabrication Periods. Unexpected loads and events during Fabrication.

5. Installation Resume

The information given in the 5.2 – 5.6 sections shall concentrate on non-conformances from the design criteria, specifications, codes, standards and regulations.

Please note the subject and relevant documentation shall be referred to and not be included in this Document.

a. Weight and Center of Gravity As Installed Values

b. Specifications, Regulations, Codes and Standards Refer to 3.1.1

c. Materials

d. Welding

e. Tolerances (Interfaces)

f. Surface Protection

g. Grouting

h. Identification System

Information about the identification system used

i. Installation Documentation

Refer to the document number for the "As Built" Installation Document Register

j. Transportation and Installation Summary

Brief summary description of the installation work performed, Installation and assembly sequence.

As installed information concerning location, orientation, penetration depth, scouring etc.

Unexpected events and loads during installation

Items recommended for inspection during the Operational Phase

k. Installation Activities

Typical activities could be, but not limited to:

- Pipe laying
- Towing
- Installation of Floating Accommodation Platforms or Vessels
- Riser Installation
- Installation of Articulated Loading Buoys
- Diving / ROV Support
- Welding
- Field Joint Coating

- Crossings
- Bridges
- Tie-Ins

l. Seabed / Ground Intervention Works

Typical intervention works could be, but not limited to:

- Trenching
- Backfill
- Rock dumping
- Dredging
- Types and Periods

m. Ready for Operations Activities

Give a short summary description of the RFO methods, activities, RFO Equipment, materials, chemicals used. Also refer to the Materials Safety Datasheets.

n. Non-conformances and Deviations

Give reference to all non - conformances and deviations during installation.

o. References

References to the relevant documentation shall be listed

7.9 VDD 9 Records, Procurement and Project Management Documentation (RPP) for Phu Quoc POC Operations

This VDD provides project management, procurement, and records (correspondence, minutes of meetings, etc) to Operations in an organized structure. A substantial portion (project management and records) of VDD 9 will be compiled from COMPANY information by COMPANY.

CONTRACTOR shall provide the content defined in this section to facilitate COMPANY final assembly of VDD 9. CONTRACTOR shall include the following Documents in its submission of VDD 9 for each purchase order CONTRACTOR places in the execution of the Work:

- Technical Evaluation Documentation
- Unpriced purchase orders
- Variations

7.9.1 Covers and Spine

Shall show the following information

Phu Quoc POC

Project Name Contract Object VDD 9 RPP

CONTRACTOR's Logo

COMPANY Document Number

7.9.2 VDD 9 Preparation, Review and Delivery

CONTRACTOR portions of VDD 9 shall be prepared in parallel with progress of the Detailed Design and shall be issued for review by COMPANY Engineering and Operations personnel on a continuous basis.

- CONTRACTOR shall submit a table of contents and outline of VDD 9 to COMPANY for review and acceptance 6 months prior to Mechanical Completion.
- The draft set of VDD 9 shall be issued to COMPANY for review and acceptance one month after Mechanical Completion.
- CONTRACTOR shall submit VDD 9 Final Issue is at Final Acceptance

APPENDIX 1 – ASSET REGISTER TABLES

This appendix defines the minimum attributes CONTRACTOR shall populate for each table of the Asset Register. CONTRACTOR shall populate all attributes in cases where CONTRACTOR scope includes detailed design, procurement, or construction.

Common Data Table

Each Component in the facility, whatever the source discipline (instrument, electrical, mechanical, piping, etc.), shall have an entry in this list. All discipline specific tables indicate additional information required for that type of equipment.

Exclusions: This table shall not include rows representing piping lines or cables, which are instead represented in the Piping Line List and Cable Schedule tables respectively.

Common Data Table		
Required Attribute	**Description**	**Requirement**
Tag Number	Project field identification number	Yes
Old Tag Number	If the object's tag number has changed, the previous tag number shall be recorded here. Each time the tag number is changed, the value in this field shall be updated to reflect only the immediately previous tag number.	Yes
Deleted Flag	If the object is deleted or otherwise voided, this field should indicate that status. The representative record should not be actually removed unless identifying number utilization requires it	Yes

Vendor Item	A yes / no attribute indicating whether an item is inside a vendor package (yes) or not (no).	Yes
Vendor Tag	Tag number used by vendor, if applicable	Yes
Service Description	Duty of item currently associated with equipment.	Yes
Equipment Classification	A short description of the equipment type of the item. CONTRACTOR and COMPANY shall jointly maintain a list of acceptable equipment classifications. Classifications may be coded, but will include such distinctions as 'centrifugal pump', 'fixed displacement pump' and 'globe control valve'.	Yes
Parent Tag	The tag number identifying the object to which this item provides a service. Examples include the compressor(s) served by a lube oil pump, the lube oil pump served by a pressure switch, etc.	Yes
Physical parent	The tag(s) (or appropriate other identifier such as a line number) of the object to which this item is physically attached	Yes
Location Plan	Document number of the physical location drawing showing the item	Yes
P&ID	Document number of the Piping and Instrument Diagram showing the item	Yes
Data Sheet	Document number of the data sheet for the item	Yes
Special Tools List	Document number of any applicable list of special tools required to service the item	Yes
Lifting Drawing	Document number of the drawing which describes how the equipment is to be lifted	Yes
Location	Area location, per Project facility hierarchy	Yes
Sub-Location	Per Project facility hierarchy	Yes
System	The facility system of which a Component is part. Typical systems include for example flare gas and produced water. Systems are represented by a numeric code. CONTRACTOR shall provide only the numeric code in the system attribute.	Yes
Subsystem	The subsystem of which this item is part. Typically, subsystem is related to isolation/HUC requirements.	Yes
Criticality Rating	Equipment criticality rating derived from the formal criticality assessment carried out by the project in conjunction with the operator. Multiple aspects of criticality (production criticality, safety criticality, corrosion criticality, etc.) must be accounted for.	Yes
Vendor	Company or source upon whom purchase order is placed	Yes
Vendor Model Number	The model number assigned by vendor, if applicable	Yes
Purchase Order Number	Number of PO placed on vendor	Yes

Manufacturer	Source or origin of the item currently associated with equipment	Yes
Manufacturer Model Number	Manufacturer's identifier for the item, which shall be sufficient in detail to procure the exact replacement for the item	Yes
Corrosion Group	CONTRACTOR shall define, as part of its responsibility in corrosion management	Yes
Recommended Spare Parts List	Document number of the manufacturer's recommended spare parts list for commissioning spares, 2 year operational spares for the item.	Yes
Equipment Parts List	Document number of the list of the parts and the quantities of each contained within / making up the item, e.g. a Bill of Materials (BOM)	Yes
Operation and Maintenance Manual	Document numbers for one or more documents (see list below) that describe the use (operations), maintenance, inspection, troubleshooting of the item • Equipment Manuals • Operating Procedures (start up, shut down, normal operation) • Preventive Maintenance Procedures • Standard Repair Procedures • Inspection Procedures • Inspection Check Sheets	Yes

Tag-Document Relationship Register Table

Tag-Document Relationship Register Table	
Tag-Document Relationship Required Attribute	**Requirement**
Tag Number	Yes
Document Number	Yes

Cable Schedule Table

Shall contain a single entry for each cable in the scope of work including power, control, signal and telecoms cables.

Exclusions: lighting, public address

Cable Schedule Table		
Required Attribute	**Description**	**Requirement**
Cable Number	Per the Project Component Identification Specification	Yes

Old Cable Number	If the object's tag number has changed, the previous tag number shall be recorded here. Each time the tag number is changed, the value in this field shall be updated to reflect only the immediately previous tag number	Yes
Deleted Flag	If the object is deleted or otherwise voided, this field should indicate that status. The representative record should not be actually removed unless identifying number utilization requires it	Yes
Cable specification	Usually an alphanumeric code defined in the cable specification which indicates the specific kind of cable to be used	Yes
Voltage	Rated voltage of the cable	Yes
Number of Cores	Number of conductor cores contained in the cable	Yes
Cross Sectional Area	Cross sectional area of cable	Yes
Estimated Length	Estimated cable length	Yes
Location		Yes
From Tag		Yes
From Location	The sub location from the facility hierarchy where the 'from tag' is located	Yes
From Gland		Yes
From Termination Drawing	Document number of the termination drawing for the 'from' end of the cable	Yes
To Tag		Yes
To Location	The sub location from the facility hierarchy where the 'to tag' is located	Yes
To Gland		Yes
To Termination Drawing	Document number of the termination drawing for the 'to' end of the cable. If multiple references of this type are needed, the tag-document relationship register should be used.	Yes
Intrinsically Safe Y/N - Classification		Yes
Type of signal carried		yes
System that cable is part of		Yes

Piping Line List Table

A list of all piping lines 1" and larger in CONTRACTOR's scope of supply. Tubing shall be included in this list only for hydraulic control systems.

Exclusions: tubing (except as noted), hoses

Piping Line List Table		
Required Attribute	**Description**	**Requirement**
Line Number	The complete line number as defined in the Project Component Identification Specification	Yes
Old Line Number		Yes
Deleted Flag		Yes
Size		Yes
Service		Yes
Line Specification	The piping specification code for the line	Yes
From	The tag or line number at the 'from' end of the line. This may be a line number, equipment tag number, etc.	Yes
To	The tag or line number at the 'to' end of the line. This may be a line number, equipment tag number, etc. and in some cases a descriptive text entry such as 'Generator building atmospheric vent'. CONTRACTOR shall carefully manage such entries such that they are meaningful and limited in quantity.	Yes
Sequence		Yes
System		Yes
Hydro Test Pressure	The hydrostatic test pressure for the line	Yes
Paint Requirement	The primary / most prevalent paint code required for the	Yes
P&ID Number	The P&ID document number that displays the line. Note that if the line is shown on multiple P&IDs, the tag-document relationship register should be used.	Yes
Isometric Drawing Numbers	The piping isometric for the line. Note that if the line requires multiple isometric drawings, the tag- document relationship register should be used.	Yes
Maximum Design Pressure		Yes
Normal Design Pressure		Yes
Maximum Design Temperature		Yes
Minimum Design Temperature		Yes

Maximum Operating Pressure		Yes
Minimum Operating Pressure		Yes
Maximum Operating Temperature		Yes
Minimum Operating Temperature		Yes
Normal Operating Pressure	A pressure at which the line is expected to operate normally	Yes
Insulation Thickness	The thickness of the insulation	Yes
Insulation Specification	Code that defines the type of material used to insulate the line (insulation type). These codes are typically defined in the piping specification.	Yes
Trace Heating	The type of heat treatment used on the line, and the minimum temperature to be maintained by the heat treatment	Yes
Schedule	ANSI pipe schedule number of the line	Yes
Material	Material of construction of the line	Yes
Test Medium	Testing medium for the line (e.g. air or water)	Yes
Normal Operating Temperature	A temperature at which line is expected to operate normally	Yes
MAWP	Maximum Allowable Working Pressure	Yes
MAWT	Maximum Allowable Working Temperature	Yes
Corrosion Allowance	Thickness added to the line to compensate for corrosion anticipated in the operational environment	Yes
NDE Testing	A Yes / No attribute indicating whether nondestructive testing of the line is required	Yes
Post Weld Heat Treatment	A Yes / No attribute indicating whether post weld head treatment was performed on the line	Yes

Control System I/O List Data

A list of inputs and outputs for each control system node is required. Because the exact structure of the list is dependent on the manufacturer of the control systems, the structure of this table will be defined jointly between COMPANY and CONTRACTOR during detailed design. The list shall be properly structured to indicate the exact physical I/O point to which each field device is connected.

All control systems in CONTRACTOR scope of supply shall be represented in the I/O list. These systems include but are not limited to process control systems, fire and gas systems, emergency shutdown systems, power management systems, condition monitoring systems and wellhead control systems.

CONTRACTOR shall make database information with respect to control systems and instrumentation available to COMPANY upon request.

The final list of fields shall be developed jointly between CONTRACTOR and COMPANY within 60 days of Effective Date.

Instrument Data

CONTRACTOR shall produce an instrument database and data sheets in INtools® format. CONTRACTOR shall provide the INtools® database data in native format for use in COMPANY INtools® system. Data for each tagged instrument item (including fire and gas items), whether it is a physical item or a software function used in control system configuration shall be included in the INtools® database.

Database information to be provided includes that which is found in either the standard INtools® data sheets for each type of instrument or, if a specification does not exist in INtools®, a CONTRACTOR-produced data sheet in INtools® containing all information necessary to specify the instrument. In all cases the data sheet information shall be comparable to corresponding ISA data sheet information for all instruments.

CONTRACTOR shall configure INtools® to include the attributes defined in this document for instrument Components (including applicable common attributes and all Instrument attributes). CONTRACTOR shall enter and maintain this data in INtools®. CONTRACTOR shall extract the required data from INtools® for submission in the Asset Register.

The queries used to extract this data from INtools® shall be provided to COMPANY upon request, upon issue of the associated data to COMPANY, and in As-Built condition at the conclusion of the project.

Exclusions: Software alarms, software special function devices, position indicator lamps.

Instrument Data Table		
Required Attribute	**Description**	**Deliverable**
Tag Number	Per the numbering system	Yes
Pressure Relieving Device	A Yes / No attribute indicating whether the tag is a pressure relieving device	Yes
Mechanical Connections	The type of connection associated with the instrument	Yes
Gasket Type	The type of gasket required for sealing the mechanical connections of the instrument	Yes
Calibrated Range	The range of measured variable the device is calibrated to measure	Yes
Span	The minimum and maximum measured variable settings for the instrument	Yes
Calibration Certificate	The calibration certificate number as issued by certifying authority	Yes
Calibration Date	Date the instrument was last calibrated	Yes
I/O Type	Analog input (AI), analog output (AO), digital input (DI), digital output (DO), software (S)	Yes

Digital Standard	Type and version number of the digital standard which applies to a digital instrument	Yes
Output Range	The output range for the instrument	Yes
SIL Level	Safety Integrity Level (1 to 4)	Yes
Relieving set point	Pressure at which a pressure relieving device (relief valve, rupture disk, etc.) operates	Yes
ANSI Leak Class	The leak class for control valves for sealing/shut-off requirements	Yes
Maximum Test Pressure (Valves)	The maximum test pressure to determine sealing/shut-off requirements	Yes
Bench Setting	An actuator bench setting is the instrument air pressure required, in the absence of service process pressure, to begin moving the stem and to fully stroke the actuator over its entire range. Bench settings are adjustments made to the actuator spring if the valve is out of service or "on the bench." These settings are applied by adjusting the spring compression to compensate for the process pressures that will act on the plug area.	Yes
Operating Time to Open	The time a control or Emergency Shutdown Valve takes to open	Yes
Operating Time to Close	The time a control or Emergency Shutdown Valve takes to close	Yes
Valve Travel	The total length of the valve stem travel	Yes
Valve Action on Failure	The final position of the control or Emergency Shutdown Valve on loss of input signal or actuator supply	Yes
Ingress Protection	Rating for protection against ingress of foreign bodies for safety and hazardous equipment	Yes
Hazardous Area	The certification, gas grouping and temperature rating for hazardous area equipment	Yes
Certifying Authority	The Certifying Authority for hazardous area equipment	Yes
Certifying Number	The number of certificate as issued by certifying authority	Yes
Certification Date	The certification test date	yes
Cause and Effect Diagram	The document number of the Instrumentation and Controls Cause and Effect chart or drawing	yes
Logic Diagram	Document number of the logic diagram containing this instrument	Yes
Loop Diagram	Document number of the loop diagram containing this instrument	Yes
Terminatio n Drawing	Document number of the termination drawing for the instrument	Yes
Installation Detail Drawing	Document number of the installation detail which applies to this instrument	Yes
Bursting Pressure	The design pressure at which a bursting disc will rupture	Yes

Cold Set Pressure	The pressure to which a pressure relief valve is set up on a test bed	yes
Design Setting	Design set point for pressure relief devices	Yes
Back Pressure	The normal process pressure condition into which a relief valve vents	Yes
Set Point High	The trip or alarm high setting (Fire and Gas only)	Yes
Set Point Low	The trip or alarm low setting (Fire and Gas only)	Yes
Detector Range	The designated coverage envelope for a detector (Fire and Gas only)	Yes
Detector Sensitivity	The sensitivity of a detector loop (Fire and Gas only)	Yes
Fire and Gas Control	Document number of the control schematic applying to the item	Yes
Voltage Rating	The highest voltage that may be continuously applied to the item by the power supply	Yes
Isolation Procedure	Document number of the E&I isolation procedure which applies to this instrument to allow repair, calibration, etc.	Yes

Telecommunications Data

Telecommunications Table		
Required Attribute	**Description**	**Deliverable**
Tag Number	Per the numbering system	Yes
Loop Type	The power supply source from yellow, red or post-red distribution boards	Yes
Loud Speaker Trip Settings	The loud speaker trip setting	Yes
Power Rating	The operating power of the unit	Yes
Voltage	The operating voltage of the unit	Yes
Frequency	The operating power frequency for the equipment	Yes
Licensed RF	The licensed operating frequency range of the unit	Yes
License Expiry Date	The license expiry date for radio equipment	Yes
Cable Type	The cable details (impedance, tolerance, etc) for specialized installations e.g., antenna and LAN	Yes
Power Supply Type	The type of power supply – UPS, 240 V, 110 V etc.	Yes
Hazardous Area	The certification, gas grouping and temperature rating for hazardous area equipment	Yes
Certifying Authority	The Certifying Authority for hazardous area equipment	Yes
Certificate Number	The number of certificate as issued by Certifying Authority	Yes
Installation Drawing	Document number of the installation detail that applies to equipment	Yes

Electrical Data

CONTRACTOR shall list each Component in the facility which requires an electrical connection including but not limited to motors, transformers, cabinets, junction boxes, control and lighting panels, marshalling panels and motor starters.

Exclusions: General receptacles, battery boxes, lighting fixtures, electrical control signals, terminal boxes, starter space heater

Electrical Data Table		
Required Attribute	**Description**	**Deliverable**
Tag Number	Per the numbering system	Yes
Overload Rating and	The type and setting of overload device for motors	Yes
Contactor Rating and Type	The type and setting for contactor	Yes
Lubrication Details	The lubrication requirement for rotating equipment and actuators	Yes
Bearing Details	The bearing type, size details for rotating equipment, drive and non-drive ends	Yes
Fuse Type/Rating	The fuse type and current rating for equipment	Yes
Actuator Detail	The type and size of a motor-operated valve actuator	Yes
Torque Setting	The torque setting for motor-operated actuators	Yes
Voltage Rating	The maximum and minimum voltage rating for equipment	Yes
kW Rating	The kW power rating for the equipment	Yes
kVA Rating	The voltage-ampere rating for the equipment	Yes
Phase	The phase for the equipment	Yes
Frequency	The operating frequency for the equipment	Yes
Speed	The normal operating rotational speed of the equipment	Yes
Amperes per Hour Rating	Capacity rating of a battery	Yes
Total Voltage	The total voltage for a battery	Yes
Full Load Current	The full load current for the equipment	Yes
Anti-Condensation	The type and make of heater	Yes
Weight Dry/Empty	The weight of an item when dry and empty	Yes
Transformer Ratios	The input/output ratio for a transformer	Yes
Frame Size	The class and frame size for motors	Yes
Switchgear Protection	The load protection level on the system equipment	Yes
Ingress Protection Rating	Rating for protection against ingress of foreign bodies for safety and hazardous equipment	Yes
Hazardous Area Classification	The certification, gas grouping and temperature rating for hazardous area equipment	Yes

Certifying Authority	The Certifying Authority for hazardous area equipment	Yes
Certificate Number	The number of certificate as issued by Certifying Authority	Yes
Block Diagram	Document number of the block diagram containing this equipment	Yes
Earthing Detail	Document number of the Grounding Detail drawing for this equipment	Yes
One Line Diagram	Document number of the One Line Diagram containing this equipment	Yes
Routing Drawing	Cable routing drawing showing this equipment	Yes
Layout Drawing	Document number of the layout drawing containing this equipment	Yes
Wiring Diagram	Wiring diagram for this equipment	Yes
Insulation Class	Class for the material used to insulate the item, for a motor, generator etc.	Yes
Performance Curve	Document numbers of performance curves which are applicable to the item, i.e. generators, motors, frequency drives, transformers	Yes
Schematic Diagram	Document number of a drawing illustrating the electrical item or electronic circuit with the components represented by their symbols	Yes

Mechanical Data

CONTRACTOR shall list each mechanical Component in the facility including but not limited to pressure vessels, tanks, winches, lifting equipment, pumps, compressors and heat exchangers.

Mechanical Data Table		
Required Attribute	**Description**	**Deliverable**
Tag Number	Per the numbering system	Yes
Lifting Equipment	A Yes / No attribute indicating whether the tag is for material handling equipment	Yes
Design Code	The industry standard to which the equipment complies	Yes
Normal Design Pressure	The pressure to which the equipment has been designed	Yes
MAWP	Maximum Allowable Working Pressure	Yes
Design Temperature	The temperature to which the equipment has been designed	Yes
Hydrostatic Test Pressure	The pressure to which the equipment is to be hydraulically tested	Yes
Shell Test Pressure	The pressure to which a heat exchanger shall be tested	Yes

Tube Test Pressure	The pressure to which a heat exchanger tube bundle shall be tested	Yes
Number of Tubes	Number of tubes for a tube type heat exchanger	Yes
SWL	The safe working load	Yes
Test Load	The load to be used in proof load testing an item	Yes
Test Requirements	Defines the description of test parameters for an item e.g., SWL x 1.5	Yes
Certification Requirements	The test or certifying authority for an item	Yes
Weight Dry / Empty	The weight of an item when dry and empty	Yes
Tube Bundle Weight	The weight of a heat exchanger tube bundle	Yes
Material	The physical composition of material for an item	Yes
Operating Pressure	The normal operating pressure for the equipment	Yes
Operating Temperature	The normal operating temperature for the equipment	Yes
Connection Size and Rating	The dimensions, type and pressure rating of mechanical connections	Yes
Gasket Type	The gasket details for mechanical connections	Yes
Speed	The normal operational rotational speed for equipment	Yes
Rotation	The direction of rotation as viewed from the non-drive or drive end (specify which)	Yes
Peak Load	The maximum working load/output power of the equipment	Yes
Capacity	The volume of fluid/medium held or capable of being moved in a given time	Yes
Number of Stages	The number of pressure stages in the equipment	Yes
Seal Details	The manufacturer, type and size of seal	Yes
Driver Type	The prime driver type (turbine, diesel engine, air motor, etc.)	Yes
Driver Tag	Tag number of prime driver, under which detailed driver attributes can be found	Yes
Coupling Detail	The manufacturer, type and size of the coupling	Yes
Certificate Number	The COMPANY Document number of certificate as issued by certifying authority	Yes
Certification Date	The certification test date	Yes
Element Detail	The manufacturer, type and size for filter elements	Yes
Well Control Equipment Certificate of Conformity Number	The certificate number for an item	yes

Well Control Equipment Certificate of Conformity Date	The issue and expiry dates for a certificate of conformity	Yes
Performance Curve	Document number of performance curves which are applicable to the item	Yes
General Arrangement Drawing	Document number of the piping general arrangement drawing that shows this item	Yes
Vessel Detail Drawing	Document number of the vessel detail drawing, if applicable	Yes
Vessel Design Calculation	Document number of the vessel design calculation, if applicable	Yes
Corrosion Allowance / Protection		
Elevation Drawings		Yes
Isometric Drawings		Yes
Size	Dimensions of the item	Yes
Specific Gravity	Specific gravity of the product stored in the tank/vessel	Yes
MAWT	Maximum Allowable Working Temperature (for fixed equipment only, i.e. exchangers, tanks, vessels)	Yes
Hazardous Area Classification	The certification, gas grouping, and temperature rating for hazardous area equipment per the specified classification system	Yes
NACE Requirement	Is equipment fabricated per NACE MR0175 requirements? Yes or No? (for Fixed Equipment only i.e. Exchangers, Tanks & vessels)	Yes
Post Weld Heat Treatment	A Yes / No attribute indicating whether post weld head treatment was done on the time (for fixed equipment only, i.e. exchangers, tanks, and vessels)	Yes
TEMA Class	Tubular Exchanger Manufacturer Association classification, for a heat exchangers	Yes
Insulation Type	Type material used to insulate the item (insulation type)	Yes
Insulation Thickness	Thickness of the insulation	Yes
Layout Drawing	Document number of the layout drawing containing this equipment	Yes
Cross Sectional Drawing	Document number of the cross sectional drawing for the Item	Yes
Process Flow Diagram	Document number of a diagram which shows the general flow of processes and equipment, displaying the process steps and relationships between the major equipment	Yes

Manual Valve Data

CONTRACTOR shall list each manual valve 1" and larger in the facility.

Manual Valve Data Table		
Required Attribute	**Description**	**Deliverable**
Tag Number	Per the numbering system	Yes
Valve Code	The valve type/specification number as detailed in the P&ID Legend. Valves which do not fit within this system shall be represented in the specialty items list.	Yes
Size	Valve connection and bore size	Yes
Unique Identifier	Sequence number Per the numbering system	Yes
Rating	Pressure rating for the device	Yes
Connection Type	The type of end connection for the valve. For example, RF Flange	Yes
Description	Description of the valve type, for example 'Knife Gate'	Yes
Comments		Yes
Valve Operator	Hydraulic, Pneumatic, Spring, etc.	Yes
Fire Safe	If the device is required to be fire safe, an appropriate entry should be made here.	Yes
NACE	If the device requires compliance with NACE an appropriate entry should be made here.	Yes
Cross Sectional	Document number of the cross sectional drawing for the Item	Yes
Valve Type	Type of Valve	Yes
Hazardous Area Classification	The certification, gas grouping, and temperature rating for hazardous area equipment per the specified classification system	Yes

Subsea Equipment Data

CONTRACTOR shall list each subsea Component in the facility including but not limited to Christmas trees, manifolds, subsea distribution units (SDUs), pipeline end termination (PLETs), risers, flowlines, jumpers, flying leads, umbilicals, control modules, power units, valves, sensors.

Subsea Data Table		
Required Attribute	**Description**	**Feed Deliverable**
Tag Number	Per the numbering system	Yes
Serial Number	The manufacturers unique number identifying the actual installed component	Yes

Nominal Size	Nominal size of risers, umbilicals, and valves.	Yes
Pressure Rating	Pressure rating of the process connection or body.	Yes
Material Class	Code per API 6A.	Yes
Temperature Class	Temperature rating code per API 6A.	Yes
Line Item Service Category	Service of the Line Item, e.g. Gas, Methanol, Oil export, Production test / Services, Water (injection, heating, etc.). Connectors (e.g. risers, flowlines, jumpers) only.	Yes
Line Item Material Category	Connectors (e.g. risers, flowlines, jumpers) only.	Yes
Length	A straight linear distance which is the face to face distance of cuboids circumscribing an object measured parallel to the longitudinal axis of an object. Connectors (e.g. risers, flowlines, jumpers) only.	Yes
Short Summary	Comment or short summary of component data (2000 characters maximum).	Yes
From	The tag number at the 'from' end of the line. This may be a line number, equipment tag number, etc. Connectors (e.g. risers, flowlines, jumpers) only.	Yes
To	The tag number at the 'to' end of the line. This may be a line number, equipment tag number, etc. Connectors (e.g. risers, flowlines, jumpers) only.	Yes

Piping Specialty Item Data

Items considered as "Specialty" shall include but are not limited to the following:

- Temporary Strainers and strainer baskets
- Y-Strainers
- Flange insulation kits
- Corrosion coupons
- Hose connections
- Injection quills
- Spectacle and pancake blinds
- Traps
- Automatic-drains
- Air release / vacuum breakers
- Eductors

- Duo-check, check valves
- Filters
- In-line mixers

Piping Specialty Item Data Table		
Required Attribute	**Description**	**Deliverable**
Tag Number	Per the numbering system	Yes
Line Number	The identifier of line in which a valve is located	Yes
Size	Valve connection and bore size	Yes
Rating	Pressure rating for the device	Yes
Connection Type	The type of end connection for the valve. For example, RF Flange	Yes
Description	Description of the specialty item type, for example 'Eductor'	Yes

Special Tool Catalog Data

The special tool catalog shall have an entry for each type of tool in CONTRACTOR's scope of supply. The content and structure of this table shall fulfill the objectives and intent of documents which define tool provision requirements.

Special Tool Catalog Data Table		
Required Attribute	**Description**	**Deliverable**
Manufacturer Name		Yes
Manufacturer Model Number		Yes
Vendor Name		Yes
Vendor Part Number		Yes
Description	Description of tool	Yes
Package Tag Number	The tag number of the package for which the special tool is provided	Yes

Supplier Data

This list shall contain entries for all equipment suppliers utilized by CONTRACTOR. Two

(2) entries shall be provided for each supplier; one (1) to show the in-country supplier / representative, and one (1) to show the Home Office of the supplier.

Supplier Data Table		
Required Attribute	**Description**	**Deliverable**
COMPANY Name		Yes
Contact Name		Yes
Contact E-mail Address		Yes
COMPANY Web Site URL		Yes
Support Phone	Manufacturer's phone number for support services	Yes
Phone Number	Supplier's phone number as it would be dialed from the Project facility	Yes
Delivery Address	Physical address for items shipped to supplier	Yes
Mailing Address	Address for correspondence	Yes
Fax Number		Yes

Manufacturer Data

Manufacturer Data Table		
Required Attribute	**Description**	**Deliverable**
COMPANY Name		Yes
Contact Name		Yes
Contact E-mail Address		Yes
COMPANY Web Site URL		Yes
Support Phone	Manufacturer's phone number for support services	Yes
Phone Number	Manufacturer's phone number as it would be dialed from the Project facility	Yes
Delivery Address	Physical address for items shipped to manufacturer	Yes
Mailing Address	Address for correspondence	Yes
Fax Number		Yes

PETROVIETNAM

PHU QUOC POC

Vietnam Block B Gas Project

Specification of Requirements for Positive Materials Identification

Christine Hew
2017.07.18
18:01:59 +08'00'

REV	DATE	DESCRIPTION	ORIG	CHK	APPR	APPR BY COMPANY
H01	17th JULY 17	Issued for Use	THH	KSI	CHH	
F01	21st JUN 17	Issued for Approval	THH	KSI	CHH	
E01	30th MAY 17	Issued for Review	THH	GP	CHH	
D01	17th MAY 17	Inter Discipline Check	THH	GP	CHH	

PQPOC Document Control No.	Area Type	Area Identifier	Discipline	Doc. Type	Originator	Sequence No.	Revision
	PQ1	00	MEC	SPC	TAP	00035	H01

Attachments		
Item No.	Description	Document No.
-	-	-

Table of Contents

1 INTRODUCTION

1.1 Project Overview

Blocks B&48/95 and 52/97 are located in Southwestern Offshore Vietnam with sea water depth of about 77 meters. The distance from the Blocks B&48/95 and 52/97 to Ca Mau is about 250 kilometers and to O Mon Power Center, about 400 kilometers (Figure 1-1).

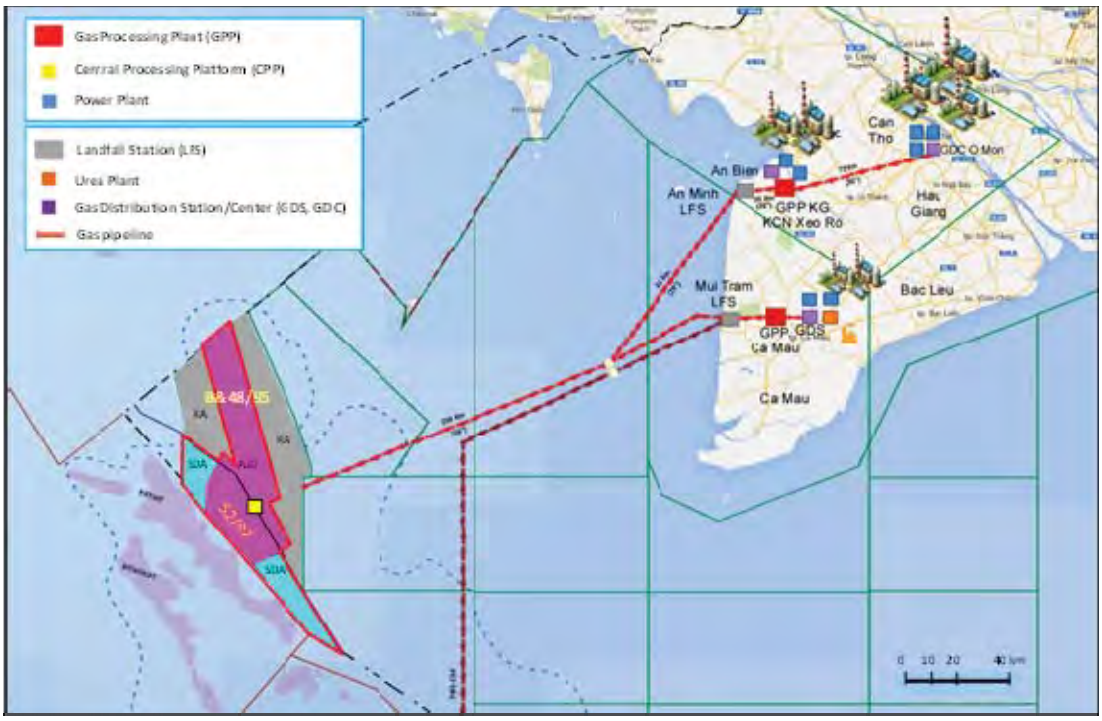


Figure 1-1 Location of Blocks B 48/95 and 52/97

The Vietnam Block B Gas Project facilities comprise:

- Central Processing Platform (CPP) with bridge linked flare structure;
- Living Quarters (LQ) Platform;
- Hub and Generic Wellhead Platforms;
- Trunk-lines and infield pipelines; and
- Floating Storage and Offloading (FSO) system for condensate storage and export.

These facilities will be installed and production and water injection wells drilled as needed to fulfill the contract gas sales requirements.

The asset will produce several thousand small reservoirs during field life. Consequently, there will be large variation in the gas composition values. The COMPANY plans to blend the producing reservoirs to meet the sales gas specification. A significant percentage of inert gas (mainly CO_2) is expected, as well as traces of H_2S, Arsenic, and Mercury.

The initial facilities will consist of four Hub / Wellhead Platforms, Trunk Lines, a Central Processing Platform (CPP), a Living Quarter (LQ) Platform, Flare Platform, and an FSO. One Wellhead Platform will be bridge connected to the CPP. The three Hub Platforms act as gathering centers, receiving gas from other Wellhead Platforms, before routing the gas to the CPP.

All development wells are to be drilled and completed from remote Hubs or generic WHPs. The wells will be drilled by either jack-up or tender assisted rigs. The Wellhead / Hub Platforms will be designed to accommodate either type of rig. No permanent drilling facilities will be provided on the Wellhead / Hub Platforms.

Hub and generic Wellhead Platforms are designed with 20 wellslots. The produced fluid will be collected in the manifold at the Wellhead / Hub Platforms, then routed to the CPP via Trunk-lines / in-field gathering lines. Booster compressors will be installed on Wellhead / Hub Platforms to maintain production and maximize reserve recovery by connecting the compressor suction line to the low pressure wells with tubing head pressure 100-200 psig and routing the compressor discharge line to the production manifold which will the export well fluid to the infield pipeline. Hub platforms are designed to receive additional production via pipelines from connected WHPs and export via 20 inch trunk lines to the CPP. Generic WHPs export fluids via 16” infield pipelines to Hub Platforms. All remote WHPs in the initial development phase shall be of the Hub design.

At the CPP, all gas will be compressed and processed by dehydration, hydrocarbon dew-pointing and mercury removal to meet sales gas specification, then compressed and metered prior to export. Gas will be exported from the CPP to shore via a dedicated export pipeline to be developed and operated by PetroVietnam Gas. The facilities will be designed to deliver the DCQ of 490 MMscfd and Maximum Daily Contract Quantity (MDCQ) of 575 MMscfd, with additional WHPs installed, drilled and tied-in to the CPP to maintain the capacity for the agreed plateau duration.

Any produced water will be treated and disposed of via injection wells. Condensate will be stabilized and sent to the FSO for storage for later shipment. Electrical power will be generated by gas turbine generators for platform operations. Control for all offshore operations will take place at the Central Control Room (CCR) on the CPP. The manning requirement for the CPP and other facilities will accommodated in an LQ platform, bridge linked to the CPP.

The preliminary field layout for the First Gas is shown in Figure 1-2.

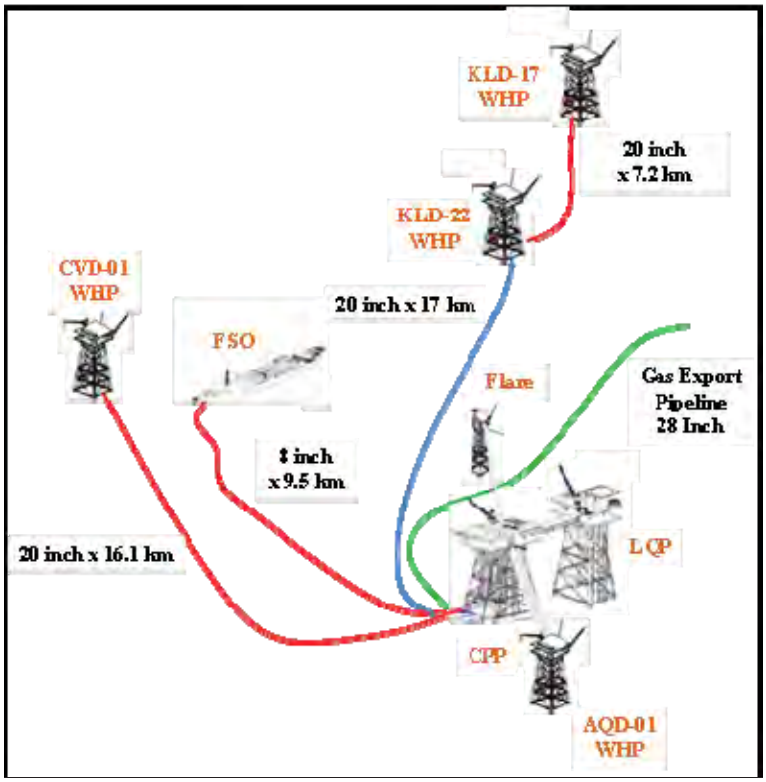


Figure 1-2 Preliminary field layout for First Gas

1.2 Acronyms and Abbreviation

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials

1.3 Definition

COMPANY	Phu Quoc Petroleum Operating Company (PQPOC)
CONSULTANT	The nominated engineering company
CONTRACTOR	The person, group or organization responsible for the construction of the platform.
PURCHASER	The person, group or organization who places purchase order on VENDOR.
VENDOR (or SUPPLIER)	The person, group or organization responsible for the design, manufacture, testing and load-out/shipping, installing of the Equipment.
Sub-VENDOR	The person, group or organization who may be employed by the VENDOR to provide services for the design, manufacture, testing and load-out/shipping, installing of the Equipment or to

	provide materials, sub-components and sub-assemblies for incorporation in the Equipment packages.
Inspection and Test Plan (ITP)	A schedule of inspection and test activities identifying the stages at which VENDOR, COMPANY, third parties or independent inspectors are involved and additionally identifying the involved specifications, acceptance criteria and instructions that are relevant.
Third Party	An Independent 3rd Party Certifying Authority appointed by VENDOR approved by the COMPANY for certifying specific equipment/equipment packages fabricated at VENDOR's shop.
Inspector	COMPANY /PURCHASER appointed person, group or organization acting in behalf of the COMPANY /PURCHASER responsible for inspection and witness testing of equipment/equipment packages at VENDOR's shop.
Certifying Authority (CA)	Independent agency contracted by the COMPANY to provide Classification/Certification services to Phu QuocPOC Field Development Project's facilities from design review to construction & commissioning (start up) in accordance with CA Rules & Regulations, applicable Codes & Standards & Vietnamese Register (VR) Regulations.
May	Indicates possible course of action.
Shall	Indicates mandatory requirements
Should	Indicates preferred course of action.
Will	Indicates an intention of action.
Inspection Lot	Group of components from the same heat or heat treatment batch from which a sample is drawn. For bolting, a lot is a group of the same components in term of alloy type and dimensions (diameter and length).
Representative Sampling	One or more pieces components selected at random from an Inspection Lot, which will be examined to determine the acceptability of the Inspection Lot.

1.4 Scope

The purpose of Positive Material Identification (PMI) is to ensure that specified materials are both supplied and installed in accordance with design requirements.

This specification defines the minimum requirements for PMI to be applied at the VENDOR/CONTRACTOR facilities, either shop or field location.

The PMI procedure and methods used shall ensure that the chemical composition of alloy materials are specified and that materials are properly analysed, results recorded, and marked to identify and confirm that the correct materials are used.

This specification does not apply to carbon steel materials, nor does it provide for analysis of carbon content in 'L' and 'H' grades of stainless steel, or nitrogen content in duplex grades stainless steel. Verification therefore of carbon and nitrogen contents by PMI is not required.

PMI examination of alloy materials and welds is independent of any certification, markings or colour coding. Where alloy materials are specified, only the correct alloy grades shall be used.

Note: Material Test Reports are a supplement to PMI and are not an acceptable substitute. Similarly, PMI shall not be considered as a substitute for Material Test Reports.

2 CODES, STANDARDS, REGULATION AND REFERENCE

2.1 Codes and Standards

In addition to the requirements of this specification and specification referenced therein, unless otherwise stated by COMPANY, the latest version of the codes and standards listed below shall apply. CONTRACTOR shall be responsible for ensuring compliance with these, and any other applicable code, standard, and Vietnamese Regulation.

ASME BPVC, Section II	Boiler and Pressure Vessels Code, Section II Materials
ASTM A 193	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications

2.2 COMPANY General Specifications

N/A

2.3 Order of Precedence

CONTRACTOR or SUPPLIER shall advice COMPANY of conflict between the specifications, data sheets and referenced codes and standards. In the event of any conflict, the most stringent requirements shall be applied. The order of precedence shall be:

- Applicable Regulation of Vietnam
- Purchase Order
- Project Drawings and Data Sheets
- Project Specification
- International Codes and Standards

2.4 Operation and Design Life

The CPP, LQ and AQD-01 Topside design life is 30 years.

The Hub platform topside design life is 25 years.

FSO design life is 20 years.

Generic WHP topside design life is 15 years.

3 GENERAL REQUIREMENTS

PMI shall be carried out in accordance with the requirements of this specification.

Materials listed in Section 4.2 shall be analysed to the extent necessary to confirm compliance to the requirements of purchase order.

Items require 100% PMI as per Section 4.2 shall be tested either after the completion of equipment fabrication (prior to PWHT, hydrostatic testing and coating) or on individual components prior to fabrication provided PMI results are properly recorded in a traceable manner (accessible weld surfaces shall be PMI tested after the fabrication).

Items require PMI on representative sampling may be tested upon receipt and PMI results shall be properly recorded.

4 POSITIVE MATERIAL IDENTIFICATION

Except where specified otherwise, PMI of a single spot on each component or weld is sufficient.

4.1 PMI Test Procedure

The PMI test procedure shall include the following:

- manufacturer and model of PMI analyzer;
- calibration procedure and frequency;
- qualification requirements of PMI test personnel;
- testing methodology;
- acceptance criteria;
- stamping and marking of PMI results;
- documentation requirements.

PMI shall be performed in accordance with a written procedure submitted to and approved by PURCHASER prior to any PMI work.

4.2 Extent of PMI

The following items shall be subjected to 100 percent PMI:

- pressure-containing components of pressure vessels, tanks, drums, heat exchangers, and welded pipe spools except for those items listed in Section 4.3 (this includes every segment of plate and pipe, flange, fitting, piping component, thermowell, and every accessible weld surface in the finished piece of equipment);
- pressure-containing machinery components such as casings for pumps, compressors, and process expander drivers including small pipe spools that are welded to the casing;
- pressure-containing instrument housings in alloy piping circuits that cannot be isolated from the process environment or housings with a design pressure above 62 barg (e.g., gauge glass housings, orifice meter tubes);
- each lot of alloy welding consumables prior to use in production welds as described in Section 5;
- external components of valves (body, bonnet, and any piping components and welds that are part of the valve pressure-containing envelope);
- expansion joints in process service (the bellows sections in every case; stub ends and other hard piping when other than carbon steel);
- pressure-containing tubing that cannot be isolated from the process environment (except as excluded in Section 4.3);
- fired heater tube assemblies and fired heater coils and this applies to both cast and wrought tube assemblies and coils;
- internal support rings, external stiffener rings, insulation support rings, internal components (support beams, distributor piping/flanges, etc.) that are welded to the shell of a pressure vessel or heat exchanger;
- dissimilar metal welds in pressure-containing components;
- any other components or materials specifically designated as requiring PMI in the purchase specification;

The following items require PMI on a representative sampling basis as a minimum, unless specifically exempted in the purchase specification or data sheets:

- alloy studs or bolting used for either flanged joints or for internal parts exposed to process conditions except as excluded in Section 4.3;
- refractory anchors and hexmesh;
- tower/column internals (trays, packing, demisters, splash plates, downcomers, weirs, etc.);
- tube to tubesheet welds in heat exchangers;
- fired heater and boiler internals (tube hangers and tube supports);

- tubes used in the fabrication of heat exchangers and boilers, provided that traceable Material Test Reports are available;
- furnace tube skin thermocouple attachment welds.

Basis of representative sampling is defined in Table 1.

Alloy liners, cladding, and corrosion resistant weld metal overlay shall be tested as listed below (at least one PMI test each) unless specified otherwise in the purchase order or its referenced fabrication specification:

- each individually cut section of clad plate (after removal from mother plate);
- butt welds used to splice alloy plates together prior to explosion bonding;
- individual weld overlayed components (shell rings, heads, nozzle necks, flanges, etc.);
- back-cladding welds (longitudinal, circumferential, nozzle attachment, etc.);
- weld repairs in cladding, weld overlay, or back-cladded seams.

4.3 Materials and Components Exempted PMI Testing

The following items are exempted from PMI unless specifically designated as requiring PMI in the purchase specification:

- internal machinery parts;
- electrical components;
- non-pressure containing welds that are not attached to the shell;
- alloy components where the alloy is installed for product purity considerations only;
- internal instrument parts;
- machinery lube oil piping;
- steam tracing, instrument air, and hydraulic tubing;
- A193 Grade B7 and B7M studs and bolting;
- stainless steel and alloy instrument tubing with an OD ≤ 19mm, when properly identified by the tubing manufacturer's stenciling;
- compression-type ferrules, fittings, and related components for use with OD ≤ 19mm and smaller tubing;
- internal valve parts;
- metallic insulation covering;
- carbon steel items.

5 WELDING CONSUMABLES

SUPPLIER shall maintain an established, documented process for the receipt, storage, distribution, and return of welding consumables.

When welding is conducted, one electrode or wire sample from each lot or package of alloy weld rod should be positively identified. The remainder of the lot should be compared to the sample to verify that the markings of the wires/electrodes are correct.

For weld rods have the alloying elements contained in the flux, PMI testing of undiluted weld "buttons" is a permissible alternative to PMI testing of an electrode or wire sample provided it is conducted immediately prior to welding or during the welding process.

Any alternative methods of welding consumables control shall be submitted to COMPANY for review and acceptance.

6 ACCEPTANCE AND REJECTION

Materials are accepted if the analysed concentration of alloy elements as determined by PMI examination is within the range specified in the relevant materials specification for base materials (e.g. ASME or ASTM) and weld metal (ASME Section II Part C).

Dissimilar metal welds shall be analysed for relevant elements and results shall be submitted for PURCHASER's review.

When PMI results are not in the acceptable range as per materials specification or purchase order, further chemical analysis shall be conducted by an independent testing laboratory. Materials acceptance or rejected shall be based on this test result.

Accepted materials shall be marked by low stress stamp or indelible ink / paint at or adjacent to PMI testing point on each component or weld.

Rejected material shall be identified by markings (red 'X' using indelible ink or paint) and segregated to prevent their re-use.

The SUPPLIER shall be responsible for replacing all rejected material with the correct specified material and performing PMI on this replacement material.

The SUPPLIER shall submit a non-conformance report to the COMPANY for the rejected material. The non-conformance report shall identify the root cause and include a plan for correction action.

When rejected material is not part of a Lot subject to 100% PMI, inspection frequency shall be increased as per Table 1 or as specified by PURCHASER on case-by-case basis.

7 EXAMINATION EQUIPMENT

The mothod used for PMI shall provide a quantitative determination of the critical alloy elements in accordance to Table 2, without interpretation by the PMI operator.

The following methods/instruments are acceptable:

- Innov-X Systems – InSpector
- Metorex – X-Met 820, X-Met 840, X-Met 880, X-Met 970, X-Met 2000, Arc-Met 930
- Niton Corporation – XLt 800 series, XLi 800 series, and prior models
- Spectro Analytical – Spectroport
- Texas Nuclear Corporation – TN 9277, TN 9266, Metallurgist Pro
- Arun Technologies – Metalscan 1625

Other PMI analyzers require PURCHASER acceptance prior to use.

All PMI instruments shall be calibrated in accordance with the instrument manufacturer's recommendation, at the start of each working shift as a minimum.

PMI shall be performed by qualified personnel. Personnel qualification shall be documented and made available for PURCHASER review when requested.

8 RECORD AND DOCUMENTATION

All PMI results shall be recorded on a PMI report form as per Table 3 and included as part of as-built documents. PMI record shall include as a minimum items in Table 2.

In addition to above, for fabricated equipment items (e.g. pressure vessels, heat exchangers), the report shall include a map / drawing identifying, by number, each component and weld tested.

Table 1: Requirements for Sample PMI

Number of Units in a Lot	Representative Sample
1-5	100% of all units
6-100	5% or 5 units, whichever greater
> 100	5% or 10 units, whichever greater

Notes:

1) If all units of the representative sample are acceptable, the inspection Lot shall be acceptable.
2) If any unit from the representative sample is found to be unacceptable, the remainder of the that Lot shall be examined 100%. The unacceptable unit(s) shall be replaced and the replacements examined 100%.
3) When a Lot is found to contain unacceptable unit, the next two Lots, of the same material product and from the same source, shall be examined 100%. If both Lots are acceptable, the sampling technique in Table 1 shall be resumed.
4) If any of the Lots examined in (3) above is found unacceptable, the remaining material product from the same source shall be examined 100%. Any unacceptable unit(s) shall be replaced and the replacements examined 100%.

Table 2: Elements to be Determined during PMI

Materials	Elements to be Determined	Standard Colour Code
1Cr-0.5Mo	Cr, Mo	Dotted Yellow Stripe
1.25Cr-0.5Mo	Cr, Mo	Solid Yellow Stripe
2.25Cr-1Mo	Cr, Mo	Solid Blue Stripe
5Cr-0.5Mo	Cr, Mo	Solid White Stripe
9Cr-1Mo	Cr, Mo	1 Solid Green & 1 Solid White Stripe
12Cr (Type 405/410S)	C, Cr	
12Cr (Type 410)	Cr	1 Solid Green & 1 Solid Red Stripe
17Cr (Type 430)	Cr	
304	Cr, Ni	Solid Black Stripe
304L	C, Cr, Ni	2 Solid Black Stripes
304H	C, Cr, Ni	3 Solid Black Stripes
309	Cr, Ni	
309L	C, Cr, Ni	
310	Cr, Ni	
316	Cr, Ni, Mo	Solid Gray Stripe
316L	C, Cr, Ni, Mo	2 Solid Gray Stripes
317	Cr, Ni, Mo	1 Solid Brown & 1 Solid White Stripe
317L	C, Cr, Ni, Mo	1 Solid Brown & 1 Solid Red Stripe
321	Cr, Ni, Ti	Solid Pink Stripe
347	Cr, Ni, Cb (Nb)	Solid Brown Stripe
Alloy 20Cb-3	Cr, Ni, Mo, Cb (Nb), Cu	1 Solid Black & 1 Solid Blue Stripe
Admiralty Brass	Zn	
Naval Brass	Zn	
Copper Nickel 90-10	Cu, Ni	
Copper Nickel 70-30	Cu, Ni	
Alloy 400	Cu, Ni	1 Solid Yellow & 1 Solid Black Stripe
Titanium Grade 2	Ti	
Titanium Grade 7	Ti, Mo, Ni	
Alloy 600	Ni, Cr	1 Solid Red Stripe
Alloy 625	Ni, Cr, Mo, Cb, Ti	
Alloy 800	Ni, Cr, Al, Ti	1 Solid Red & 1 Solid Blue Stripe
Alloy 800HT	Ni, Cr, Al, Ti	
Alloy 825	Ni, Cr, Mo, Cu, Ti	
Duplex stainless steel	C, Cr, Ni, Mo, N	
Alloy C-276	Ni, Cr, Mo, Fe, Ti	

List of materials is not exhaustive, and shall not be construed as limiting the alloy materials subject to PMI.

Table 3: Positive Material Identification Analysis Sample Form

SUPPLIER	Date
Location	Inspection Agency
Job Title	Operator
Job Number	Analyzer Make and Model
Drawing Number	Analyzer Serial Number
Purchase Order Number	Type of Source Used
Material Specification	Age of Source Used

Part No.	Standard Component	PMI Results						Accept / Reject
		Cr	Mo	Ni	C			

Inspector:

Date:

Place of Inspection:

PETROVIETNAM

PHU QUOC POC

Vietnam Block B Gas Project

Units of Measurement

				Digitally signed by Christine Hew Date: 2017.06.21 17:16:49 +08'00'		
H01	21/06/2017	Issued for Use	HKL	PVMD	CHH	
F01	22/05/2017	Issued for Approval	HKL	AC	CHH	
E01	10/05/2017	Issued for Review	HKL	AC	CHH	
D01	08/05/2017	Issued for IDC	HKL	AC	CHH	
REV	DATE	DESCRIPTION	ORIG	CHK	APPR	APPR BY COMPANY

PQPOC DOCUMENT CONTROL No.	Area Type	Area Identifier	Discipline	Doc. Type	Originator	Sequence No.	Revision
	PQ1	00	TEC	SPC	TAP	00002	H01

Attachments		
Item No.	**Description**	**Document No.**
-	-	-

Table of Contents

1 INTRODUCTION

1.1 Project Overview

Blocks B&48/95 and 52/97 are located in Southwestern Offshore Vietnam with sea water depth of about 77 meters. The distance from the Blocks B&48/95 and 52/97 to Ca Mau is about 250 kilometers and to O Mon Power Center, about 400 kilometers (Figure 1-1).

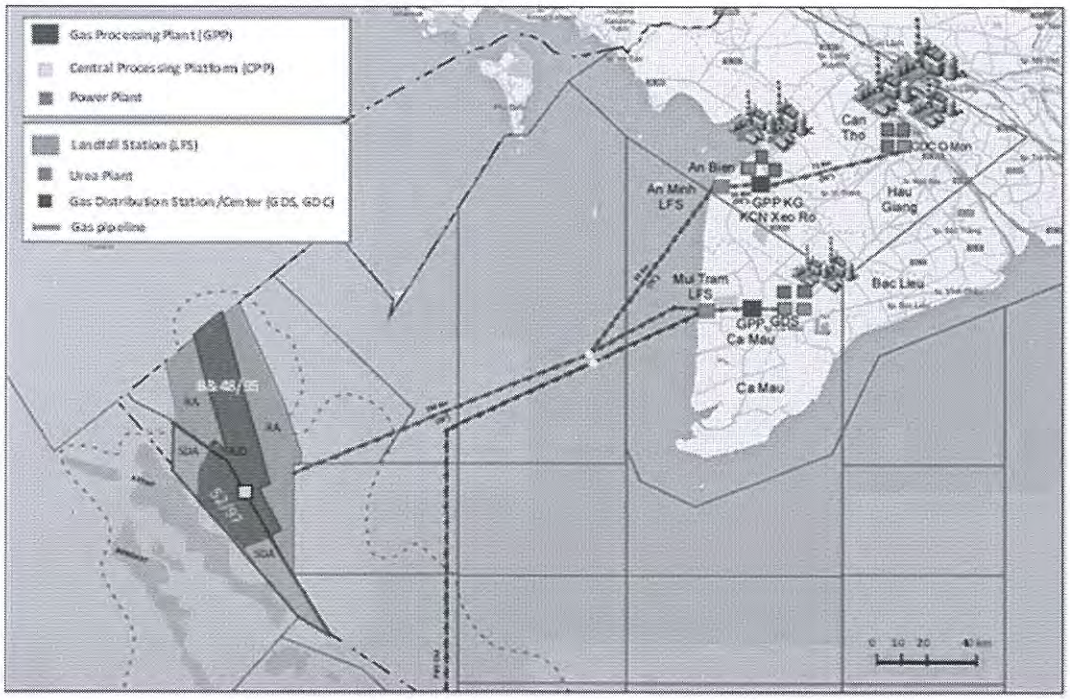


Figure 1-1 Location of Blocks B 48/95 and 52/97

The Vietnam Block B Gas Project facilities comprise:

- Central Processing Platform (CPP) with bridge linked flare structure;
- Living Quarters (LQ) Platform;
- Hub and Generic Wellhead Platforms;
- Trunk-lines and infield pipelines; and
- Floating Storage and Offloading (FSO) system for condensate storage and export.

These facilities will be installed and production and water injection wells drilled as needed to fulfill the contract gas sales requirements.

The asset will produce several thousand small reservoirs during field life. Consequently, there will be large variation in the gas composition values. The COMPANY plans to blend the producing reservoirs to meet the sales gas specification. A significant percentage of inert gas (mainly CO_2) is expected, as well as traces of H_2S, Arsenic, and Mercury.

The initial facilities will consist of four Hub / Wellhead Platforms, Trunk Lines, a Central Processing Platform (CPP), a Living Quarter (LQ) Platform, Flare Platform, and an FSO. One Wellhead Platform will be bridge connected to the CPP. The three Hub Platforms act as gathering centers, receiving gas from other Wellhead Platforms, before routing the gas to the CPP.

All development wells are to be drilled and completed from remote Hubs or generic WHPs. The wells will be drilled by either jack-up or tender assisted rigs. The Wellhead / Hub Platforms will be designed to accommodate either type of rig. No permanent drilling facilities will be provided on the Wellhead / Hub Platforms.

Hub and generic Wellhead Platforms are designed with 20 wellslots. The produced fluid will be collected in the manifold at the Wellhead / Hub Platforms, then routed to the CPP via Trunk-lines / in-field gathering lines. Booster compressors will be installed on Wellhead / Hub Platforms to maintain production and maximize reserve recovery by connecting the compressor suction line to the low pressure wells with tubing head pressure 100-200 psig and routing the compressor discharge line to the production manifold which will the export well fluid to the infield pipeline. Hub platforms are designed to receive additional production via pipelines from connected WHPs and export via 20 inch trunk lines to the CPP. Generic WHPs export fluids via 16" infield pipelines to Hub Platforms. All remote WHPs in the initial development phase shall be of the Hub design.

At the CPP, all gas will be compressed and processed by dehydration, hydrocarbon dew-pointing and mercury removal to meet sales gas specification, then compressed and metered prior to export. Gas will be exported from the CPP to shore via a dedicated export pipeline to be developed and operated by PetroVietnam Gas. The facilities will be designed to deliver the DCQ of 490 MMscfd and Maximum Daily Contract Quantity (MDCQ) of 575 MMscfd, with additional WHPs installed, drilled and tied-in to the CPP to maintain the capacity for the agreed plateau duration.

Any produced water will be treated and disposed of via injection wells. Condensate will be stabilized and sent to the FSO for storage for later shipment. Electrical power will be generated by gas turbine generators for platform operations. Control for all offshore operations will take place at the Central Control Room (CCR) on the CPP. The manning requirement for the CPP and other facilities will accommodated in an LQ platform, bridge linked to the CPP.

The preliminary field layout for the First Gas is shown in Figure 1-2.

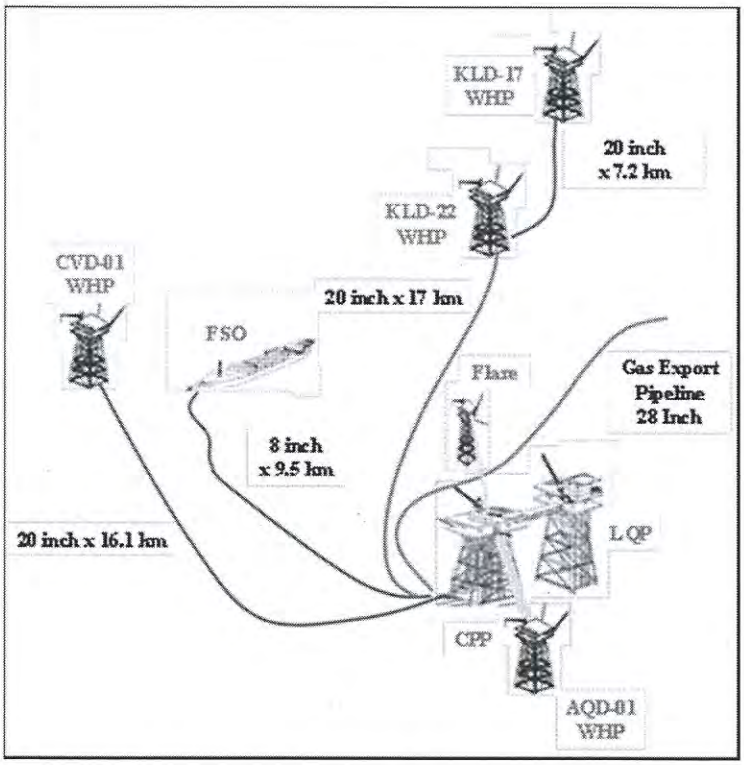


Figure 1-2 Preliminary field layout for First Gas

1.2 Definition

COMPANY	Phu Quoc Petroleum Operating Company (PQPOC)
CONSULTANT	The nominated engineering company
CONTRACTOR	The person, group or organization responsible for the construction of the platform.
PURCHASER	The person, group or organization who places purchase order on VENDOR.
VENDOR (or Supplier)	The person, group or organization responsible for the design, manufacture, testing and load-out/shipping, installing of the Equipment.
Sub-VENDOR	The person, group or organization who may be employed by the VENDOR to provide services for the design, manufacture, testing and load-out/shipping, installing of the Equipment or to provide materials, sub-components and sub-assemblies for incorporation in the Equipment packages.
Inspection and Test Plan (ITP)	A schedule of inspection and test activities identifying the stages at which VENDOR, COMPANY, third parties or independent inspectors are involved and additionally identifying the involved specifications, acceptance criteria and instructions that are relevant.
Third Party	An Independent 3rd Party Certifying Authority appointed by VENDOR approved by the COMPANY for certifying specific equipment/equipment packages fabricated at VENDOR's shop.
Inspector	COMPANY /PURCHASER appointed person, group or organization acting in behalf of the COMPANY /PURCHASER responsible for inspection and witness testing of equipment/equipment packages at VENDOR's shop.
Certifying Authority (CA)	Independent agency contracted by the COMPANY to provide Classification/Certification services to Phu Quoc POC Field Development Project's facilities from design review to construction & commissioning (start-up) in accordance with CA Rules & Regulations, applicable Codes & Standards & Vietnamese Register (VR) Regulations.
May	Indicates possible course of action.
Shall	Indicates mandatory requirements
Should	Indicates preferred course of action.
Will	Indicates an intention of action.

1.3 Objective

This document describes the Units of Measurement that shall be used for Vietnam Block B Gas Project (VBGP). The document covers both the high level summary at the facility level and detailed overview on the units of measurement at discipline level.

This specification shall be applicable for Central Processing Platform (CPP), bridge linked Living Quarters Platform (LQP), Floating Storage and Offloading (FSO) vessel, Bridge linked Hub (AQD-01), 3 nos. Hubs (CVD-01, KLD-17 & KLD-22), Flare Structure, associated bridges, in-field pipelines and all future Hubs/WHPs in Vietnam Block B Gas Project.

2 UNITS OF MEASUREMENT

2.1 High Level Summary

Table 2.1.1 below defines the Units of Measurement systems to be used on each facility for major disciplines.

DELIVERABLE / FACILITY	STRUCTURAL DRAWINGS & DOCUMENTS	PIPING DRAWINGS & DOCUMENTS	ELECTRICAL DRAWINGS & DOCUMENTS	PROCESS, MECHANICAL & INSTRUMENTATION DRAWINGS AND DOCUMENTS
CENTRAL PROCESSING PLATFORM, FLARE & ASSOCIATED BRIDGES	SI	LENGTH - SI SECTION - IMPERIAL	SI	SI & IMPERIAL (*)
LIVING QUARTERS PLATFORM	SI	LENGTH - SI SECTION - IMPERIAL	SI	SI & IMPERIAL (*)
WELLHEAD PLATFORM	SI	LENGTH - SI SECTION - IMPERIAL	SI	SI & IMPERIAL (*)
HUB/AQD-01	SI	LENGTH - SI SECTION - IMPERIAL	SI	SI & IMPERIAL (*)
FSO	SI	LENGTH - SI SECTION - IMPERIAL	SI	SI & IMPERIAL (*)

Table 2.1.1 Units of Measurement for Facilities and Disciplines

NOTES:

(*) Imperial units shall be used for design of Tubings, Fittings, Manifolds, process connection for instruments, control valves, on-off valves and manual valves.

Table 2.1.2 below specifies the Units of Measurements to be used on deliverables for infield pipelines.

DELIVERABLE / FACILITY	BASIS OF DESIGN & MISC. REPORTS	CALCULATIONS	DRAWINGS
INFIELD PIPELINE	SI	SI	LENGTH – SI SECTION - IMPERIAL

Table 2.1.2 Units of Measurement for Infield Pipeline

Please refer to appropriate section under Discipline Summary for details on the Units of Measurement required for each engineering disciplines.

Where Imperial unit is standard practice from vendor/manufacturer, both SI and Imperial units and with Imperial unit shown in bracket, shall be provided. This would be applicable to all contractor/subcontractor/vendor supplied documents. Any deviation from this requirement shall be subject to Company review and approval.

2.2 Discipline Summary

2.2.1 Process, Mechanical & Instrumentation

The process, mechanical and instrumentation parameters for all facilities under VBGP development shall use SI System as the Units of Measurement. Table 2.2.1 below details some of the units to be used on project drawings and documents for process, mechanical and instrumentation parameters.

Variables	Units	Acronym
Area	square meter	m^2
	square milimeter	mm^2
BS&W (Basic sediment and water)	% volume	% vol
Composition	% of mole, % of weight	Mol% or Wt%
Concentration	milligram per cubic meter	mg/m^3
	part per million (molar) by volume	ppm (V)
	part per million (molar) by weight	ppm (w)
Density	kilogram per cubic meter	kg/m^3
Dew Point	degree Celsius	^oC

Variables	Units	Acronym
Dimensions	millimeter, meter	mm, m
Elevation	meter	m
Energy	Megajoule	MJ
Enthalpy and Head (gas)	Kilo joule per kilogram	kJ/kg
Flow (Condenste/Liquid Volume)	cubic meter per hour	m^3/h
	barrel per day	bpd
	liter per minute	L/min
Flow (Gas Volume)	cubic meter per hour	m^3/h
	standard cubic meter per day	Sm^3/d
	(million std cubic feet per day)	(MMscfd)
Flow (Mass)	kilogram per hour	kg/h
Heat Transfer Coefficient	watt per square meter – per degree C	W/m^2-^oC
Heating Value	megajoule per cubic meter	MJ/m^3
	megajoule per kilogram	MJ/kg
Length	kilometer	km
	meter	m
	millimeter	mm
Level	meter or millimeter (or % of range)	m or mm or %
Liquid Head	meter	m
Mass / weight	kilogram	kg
	tonne	te
Moisture	part per million by volume	ppm(v)
Molar Flow	Kilogram mole per hour	kgmol/h
Oil in water	milligram per liter	mg/l
Power / Heat flow	kilowatt, Watt	kW, W
Pressure	bar absolute, millibar absolute	Bara, mbara
	bar gauge, millibar gauge	Barg, mbarg
	Vacuum	mmH20
	Pound force per square inch (for I/P positioner)	psi
Pressure (differential)	millibar	mbar

Variables	Units	Acronym
Quantity of Substance	kilogram-mole	kg mol
Residual Chlorine	milligram per liter	mg/l
Rotational Speed	Revolutions per minute	rpm
RVP (Reid vapor pressure)	Bar absolute	Bara
Sound Pressure	Decibel, A-weighted decibel	dB, dBA
Specific Heat	kilojoule per kilogram – per degree C	kJ/kg-^{o}C
Surface Tension	Dyne per centimeter	Dyne/cm
Temperature	degree Celsius	^{o}C
Thermal Conductivity	watt per metre – per deg. C	W/m-^{o}C
Volume (liquid)	cubic meter	m^3
	barrel	bbl
Volume (gas)	standard cubic meter	Sm^3
	million standard cubic feet	MMSCF
Volume Fraction (Gas)	mole percent	mol %
Volume Fraction (Liquid)	volume percent	vol %
Velocity (Flow)	meter per second	m/s
Velocity (Wind)	meter per second	m/s
Water Content	gram per million standard cubic feet	g/MMSCF
	milligram per standard cubic meter	mg/Sm^3
Viscosity (Dynamic)	centipoise	cP
Viscosity (Kinematic)	centistokes	cSt

Table 2.2.1 Units of Measurement for Process & Instrumentation

2.2.2 Electrical

The electrical parameters for all facilities under VBGP development shall use SI System as the Units of Measurement. Table 2.2.2 below details some of the units to be used on drawings and documents for electrical parameters.

Variables	Units	Acronym
Power	Watt, Kilo Watt, Mega Watt	W, kW, MW
Electric Current	Ampere, milli Ampere	A, mA
Charge	Coulomb	C
Electric Potential	Volt, Volt AC, Volt DC	V, VAC, VDC
Resistance	ohm	Ω
Conductance	Siemens	S
Inductance	Henry	H
Capacitance	Farad	F
Electric Field Strength	Volt per meter	V/m
Electric Charge Density	Coulomb per cubic meter	C/m^3
Magnetic Field Strength	Ampere per meter	A/m
Magnetic flux	Weber	Wb
Magnetic Moment	Ampere square meter	Am^2
Magnetisation (Magnetic moment/unit volume)	Ampere per meter	A/m
Magnetic Pole Strength	Ampere meter	Am
Magneto Motive Force	Ampere - Turn	AT
Frequency	Hertz	Hz
Cable Size	square millimeter	mm^2
Distance/Length of Cable or Cable Tray	meter	m
Illuminance	Lux (Lumen per square meter)	lx

Table 2.2.2 Units of Measurement for Electrical

2.2.3 Structure

The Structural parameters for all facilities under VBGP development shall use SI System as the Units of Measurement. Table 2.2.3 below details some of the units to be used on drawings and documents for structural parameters.

Variables	Units	Acronym
Young's Modulus / Yield & Tensile Strength	Megapascal	MPa
Shear Modulus G	Megapascal	MPa
Coefficient of Expansion of		Steel m/m/°C
Density of Steel	kilogram per cubic meter	kg/m^3
Speed	meter per second	m/s
Force	kilo Newton	kN
Distance/Dimensions	millimeter, meter	mm, m
Energy	kilo Joule	kJ
Pressure	Megapascal	MPa
Acceleration	Meter per square second	m/s^2
Area	square meter	m^2
Temperature degree	Celcius	°C
Weight	kilogram, Metric Ton	kg, MT
Nominal Plate Thickness	millimeter	mm
Stress	Newton per square millimeter	N/mm^2

Table 2.2.3 Units of Measurement for Structural

NOTES:

- All dimensions and notes on Drawings shall be in SI units.
- Major overall dimensions shall be rounded to nearest integer with no decimal point. For example, length of 2177.67 mm shall be specified as 2178 mm on the drawings.
- All structural analysis, Drawings, Documents, Reports, Procedures, calculations etc. shall be done in SI units.

Plate Thickness:

- Plate thickness to be specified in SI Units based on rounded off conversion to integer in milimeter. For example, 10 mm, 12 mm etc. thickness.

Tubular Dimensions:

- The tubular dimension is to be specified in SI Units based on rounded off conversion to integer in milimeter for diameter greater than 20" and exact conversions from standard pipe sizes to one decimal point for diameter less than equal to 20". For example, tubular

24" x 0.5" thickness to be specified as 600 mm x 12 mm while tubular 12.75" x 0.625" thickness to be specified as 323.9 mm x 15.9 mm.

- Rolled Sections to be specified in SI units.

2.2.4 Piping

The Piping parameters for all facilities under VBGP development shall use dual Units of Measurement systems which included both SI and Imperial units. The parameters in Piping documents where the information is extracted from Process drawings and documents shall only use Imperial System of Measurement. Table 2.2.4 below details some of the units to be used on drawings and documents for Piping parameters.

Variables	Units
Piping Material Specification / Datasheets	Imperial
Equipment Layouts & General Arrangements	SI
Pipe Sizes / Valve Size / Tubing / Flange & Bolting	Imperial (Per Pipe class specification – API/ASME Standards)
PDMS Model	SI
Vessel Drawings	SI for dimensions Imperial unit for nozzles
Pipe Stress Analysis	Imperial for Pressure and Temperature SI for Dimensions, Stress and Load
Isometric Drawings	SI for Length, Imperial NPS (Nomonal Pipe Size)

Table 2.2.4 Units of Measurement for Piping

2.2.5 Units Conversion Rounding Tables

The table below is applicable to both Structure and Piping disciplines and shown for illustration purpose only, i.e. not intended to be all encompassing. Any other sizes not listed in the above table shall be converted accordingly and as specified in section 2.2.3.

Diameter (in)	Rounded Diameter (mm)
1.5	38.1
2.375	60.3
3.5	88.9
4.5	114.3
6.625	168.3
8.625	219.1
10.75	273.1
12.75	323.9
14	355.6
16	406.4
18	457.2
20	508.0
22	558.8
24	609.6
26	660.4
28	711.2
30	762.0
32	812.8
34	863.8
36	914.4
42	1066.8
48	1219.2
54	1371.6
60	1524.0
66	1676.4
72	1828.8
84	2133.6
90	2286.0

Thickness (in)	Rounded Thickness (mm)
0.2800	7.0
0.3750	9.5
0.4060	10.3
0.4375	11.1
0.5000	12.7
0.5625	14.3
0.6250	15.9
0.6875	17.5
0.7500	19.1
0.8125	20.6
0.8750	22.2
0.9375	23.8
1.0000	25.4
1.1250	28.6
1.2500	31.8
1.3750	34.9
1.5000	38.1
1.6250	41.3
1.7500	44.5
1.8750	47.6
2.0000	50.8
2.1250	54.0
2.2500	57.2
2.3750	60.3
2.5000	63.5
2.6250	66.7
2.7500	69.9
2.8750	73.0

Table 2.2.5 SI Units Conversion Rounding

2.2.6 Prefixes

The above units are the basic or derived units to be used. Prefixes can be used or altered where applicable. Only the prefixes listed below are valid for the project.

Prefix	Factor	Symbol
Tera-	10^{12}	T
Giga-	10^{9}	G
Mega-	10^{6}	M
Kilo-	10^{3}	k
Milli-	10^{-3}	m
Micro-	10^{-6}	μ
Nano-	10^{-9}	n

2.2.7 Definitions

Metric standard conditions are defined as follows:

	Pressure Bara	*Temp °C*
Metric standard conditions	1.01325	15

Metric standard conditions should normally be used.

Calorific values will be taken from GPA Standard 2145-93. "Table of Physical Constants of Paraffin Hydrocarbons and Other Components of Natural Gas".

MCDERMOTT

PTSC
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RECEIVED 07-03-2025 DOC. CONTROL

ISSUED 07 MAR 2025 FOR CONSTRUCTION

PETROVIETNAM
PQPOC

PHU QUOC PETROLEUM OPERATING COMPANY

VIETNAM BLOCK B GAS PROJECT

PROVISION OF EPCI FOR CENTRAL PRODUCTION PLATFORM,
LIVING QUARTER PLATFORM AND FLARE TOWER

CONTRACT NO.: PQ-CTR-DEV-2022-005

DOCUMENT TITLE : SPECIFICATION OF FABRICATION OF PLATFORM STRUCTURES FOR FIXED OFFSHORE PLATFORMS

PQPOC Approval	
Document return Code	**PQPOC Signature**
☐ Code 1 Reviewed and Accepted with no Comment ☒ Code 2 Reviewed/With Comment ☐ Code 3 Not Accepted/ Revise/Resubmit ☐ Code 4 Not Reviewed	Name : _____ Signature : _____ Date : _____

REV	DATE	DESCRIPTION	ORIG	CHK	APPR
N01	13-Jun-24	Issued for Use	PG	SP	JKH
L01	08-Feb-24	Issued for Approval	SP	SP	JKH
K01	18-Dec-23	Issued for Review	PG	SP	SS
J01	20-Nov-23	Issued for IDC	PG	SP	SS

PQPOC Document Control No.	Project Code	Area Code	Discipline Code	Document Type	Originator Code	Sequence Number	Sheet Number	Revision
	PQ	CPC0	STR	SPC	MPC	00002	00	N01

REVISION HISTORY

Rev. Date	Rev. No.	Detailed Description of Change	Ref. Section	Approved by
20-Nov-23	J01	Issued for IDC		SS
18-Dec-23	K01	Issued for Review		SS
08-Feb-24	L01	Issued for Approval COMPANY comments incorporated.	As marked	JKH
13-Jun-24	N01	Issued for Use COMPANY comments incorporated.	As marked	JKH

TABLE OF CONTENTS

1 GENERAL

A Consortium of McDermott Asia Pacific Sdn. Bhd. (McDermott) and Petro Vietnam Technical Services (PTSC), hereafter referred to as CONTRACTOR has been awarded a Contract for Provision of Engineering, Procurement, Construction and Installation of Central Production Platform, Living Quarters Platform Flare Tower and Bridges by Phu Quoc Petroleum Operating Company (PQPOC), hereafter referred to as COMPANY.

This document contains Project's Specification of Fabrication of Platform Structures for Fixed Offshore Platform.

1.1 Purpose of the Document

This specification covers the requirements for labour, equipment, materials, and all incidentals necessary for the fabrication, and welding of structural platforms and appurtenances as indicated on the drawings and other contract documents.

This specification covers the minimum technical requirements for the fabrication, welding and inspection of structural steelwork associated with COMPANY platforms.

Any exceptions to the requirements of this specification shall be submitted in writing for resolution by COMPANY.

1.1.1 Intent

CONTRACTOR shall comply with the requirements of this specification.

All fabrication, welding, inspection, construction issues and fabrication tolerances shall comply with the requirement of AWS D1.1 & API RP 2A with the exception of structural components involving primary high-strength steel Types I, I-X, II, and II-X which will be based on EEMUA 158 requirements.

1.2 Project Overview

Blocks B&48/95 and 52/97 are located offshore southwestern Vietnam in a water depth of about 77 meters. The distance from the Blocks B&48/95 and 52/97 to Ca Mau is about 250 kilometers and to O Mon Power Center, about 400 kilometers (Figure 1).

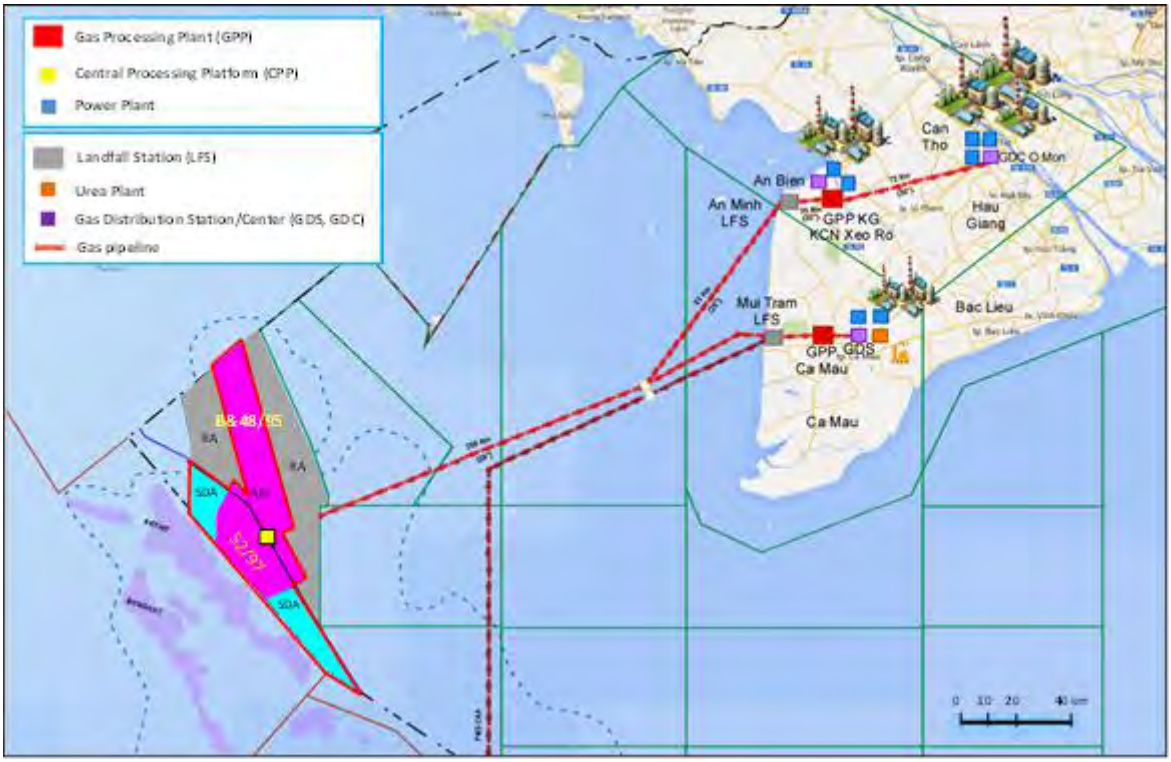

Figure 1 : Location of Block B 48/95 and 52/97

The Vietnam Block B Gas Project facilities comprise:

- Central Production Platform (“CPP”) with bridge linked flare structure;
- Living Quarters (“LQ”) Platform;
- Hub and Generic Wellhead Platforms (“WHP”);
- Trunk-lines and infield pipelines; and
- Floating Storage and Offloading (FSO) system for condensate storage and export.

These facilities will be installed and production and water injection wells drilled as needed to fulfil the contract gas sales requirements.

The asset will produce several thousand small reservoirs during field life. Consequently, there will be large variation in the gas composition values. The COMPANY plans to blend the producing reservoirs to meet the sales gas specification. A significant percentage of inert gas (mainly CO2) is expected, as well as traces of H2S, Arsenic, and Mercury.

The initial facilities will consist of four Hub / Wellhead Platforms, Trunk Lines, a Central Production Platform (CPP), a Living Quarter (LQ) Platform, Flare Platform, and an FSO. One Wellhead Platform

will be bridge connected to the CPP. The three Hub Platforms act as gathering centers, receiving gas from other Wellhead Platforms, before routing the gas to the CPP.

All development wells are to be drilled and completed from remote Hubs or generic WHPs. The wells will be drilled by either jack-up or tender assisted rigs. The Wellhead / Hub Platforms will be designed to accommodate either type of rig. No permanent drilling facilities will be provided on the Wellhead / Hub Platforms.

Hub and generic Wellhead Platforms are designed with 20 wellslots. The produced fluid will be collected in the manifold at the Wellhead / Hub Platforms, then routed to the CPP via Trunk-lines / in-field gathering lines. Booster compressors will be installed on Wellhead / Hub Platforms to maintain production and maximize reserve recovery by connecting the compressor suction line to the low pressure wells with tubing head pressure 100-200 psig and routing the compressor discharge line to the production manifold which will the export well fluid to the infield pipeline. Hub platforms are designed to receive additional production via pipelines from connected WHPs and export via 20 inch trunk lines to the CPP. Generic WHPs export fluids via 16" infield pipelines to Hub Platforms. All remote WHPs in the initial development phase shall be of the Hub design.

At the CPP, all gas will be compressed and processed by dehydration, hydrocarbon dew-pointing and mercury removal to meet sales gas specification, then compressed and metered prior to export. Gas will be exported from the CPP to shore via a dedicated export pipeline to be developed and operated by PetroVietnam Gas. The facilities will be designed to deliver the DCQ of 490 MMscfd and Maximum Daily Contract Quantity (MDCQ) of 575 MMscfd, with additional WHPs installed, drilled and tied-in to the CPP to maintain the capacity for the agreed plateau duration.

Produced water will be treated and disposed of via injection wells. Condensate will be stabilized and sent to the FSO for storage and later shipment. Electrical power will be generated by gas turbine generators for platform operations. Control for all offshore operations will take place at the Central Control Room (CCR) on the CPP. The manning requirement for the CPP and other facilities will be accommodated in an LQ platform, bridge linked to the CPP.

The preliminary field layout for the First Gas (Phase 1A) is shown in Figure 2.

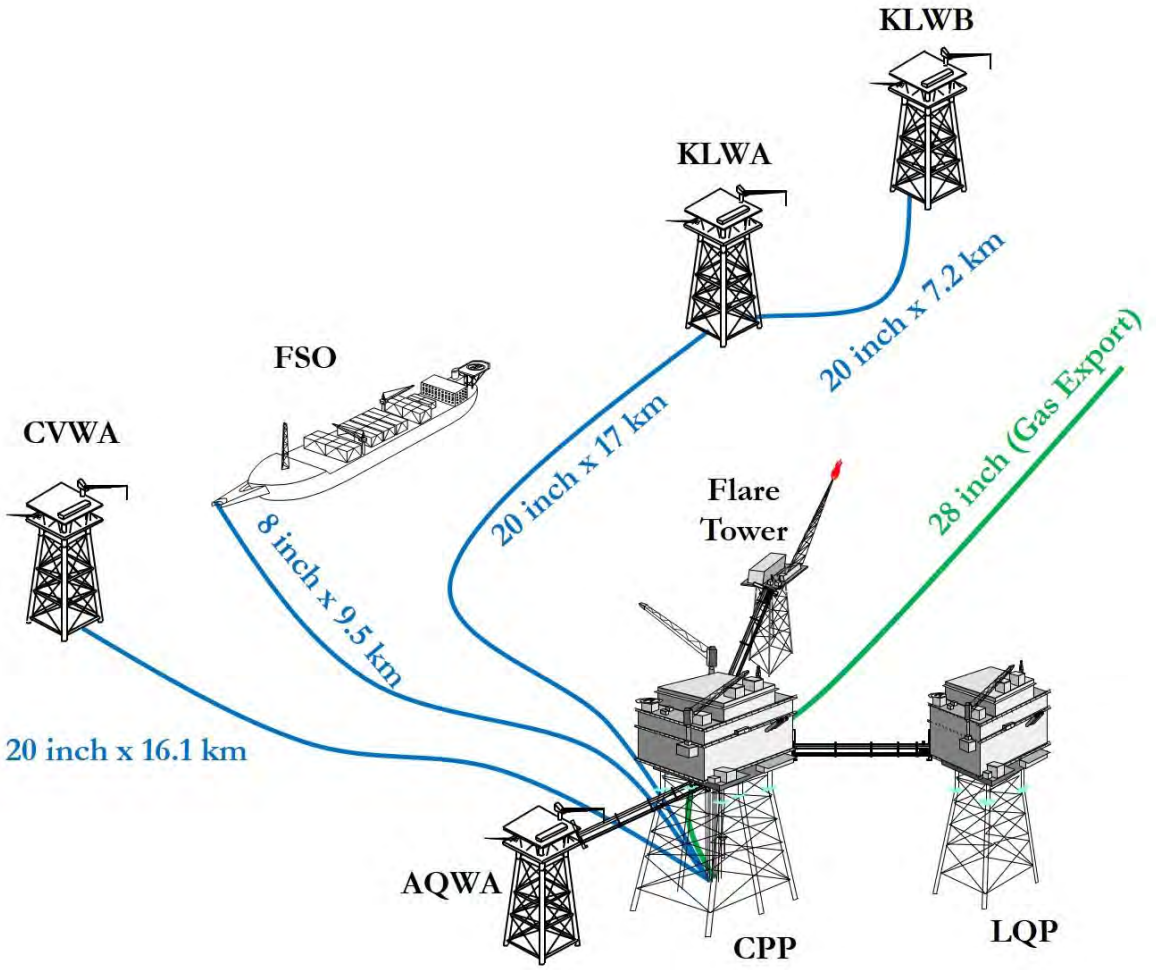

Figure 2: Preliminary field layout for First Gas (Phase 1A)

1.3 EPCI #1 Project Scope Summary

CONTRACTOR scope of the Work under the Contract shall consist of Management and Administration, Engineering, Procurement, Fabrication, including Onshore Pre-Commissioning, Sea fastening and Loadout, Transportation, Installation, Offshore Hook-Up and Commissioning works for the CPP, the LQ and Flare as detailed below:

- One CPP Jacket/piles/topsides
- One Flare Jacket/piles/flare
- One LQP Jacket/piles/LQUP topside
- Bridges connecting CPP to Flare, LQUP and Wellhead Platform AQWA
- One SSIV Skid and Umbilical (Excluding Transportation and Installation)

2 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

2.1 Definitions

Table 2-1 : Definitions

Definitions	Description
COMPANY	Shall mean Phu Quoc Petroleum Operating Company
CONTRACTOR (MPC)	Shall mean The Consortium of McDermott Asia Pacific Sdn. Bhd. (“McDermott”) and PetroVietnam Technical Services Corporation (“PTSC”)
WORK	Shall mean work or services being conducted by the CONTRACTOR including its Subcontractor for delivery of Engineering, Procurement, Construction & Installation (EPCI) of CPP, LQ Platform and Flare Tower of Vietnam Block B Gas Project (“EPCI #1”)
PURCHASER	Shall mean the CONTRACTOR issuing the purchase order
VENDOR / SUPPLIER	Shall mean the party awarded by CONTRACTOR for the supply of scope of work
SUBCONTRACTOR	Shall mean the party awarded by CONTRACTOR for the supply of scope of work in term of services
Independent Verification Service (IVS)	Shall mean the Independent Agency contracted by COMPANY to provide Verification/ Certification serviced to PQPOC Field Development Project’s Facilities from design review to construction & commissioning (startup) in accordance with rule & Regulations, applicable Codes & Standards, and Vietnam Register (VR) Regulations.
Third Party	Shall mean certifying Authority appointed by VENDOR for certifying specific equipment/equipment packages fabricated at VENDOR’s scope.

2.2 Acronyms

Table 2-2 : Acronyms

Acronym	Description
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
ASNT	American Society for Non-destructive Testing

Acronym	Description
BSI	British Standards Institute
CAR	Corrective Action Request
CE	Carbon Equivalent
CTOD	Crack tip opening displacement
ED	Effective Date
EEP	Engineered Equipment Procurement
EEMUA	Engineering Equipment & Materials Users Association
EMR	Electrostatic Membrane Reflector
EPCI	Engineering, Procurement, Construction and Installation
FAT	Factory Acceptance Test
FEED	Front End Engineering and Design
HAZ	Heat Affected Zone
HSES	Health, Safety, Environment and Security
IMS	Integrated Management System
MDR	Manufacturer's Data Record
MPI	Magnetic Particle Inspection
MTO	Material Take Off
MWS	Marine Warranty Surveyor
NDE	Non-Destructive Examination
OD	Outside Diameter
PCN	Personnel Certification in Non-destructive Testing
PEP	Project Execution Plan
PM	Project Manager
PMS	Project Master Schedule
PMT	Project Management Team
PQPOC	Phu Quoc Petroleum Operating Company

Acronym	Description
PQR	Procedure Qualification Report
PTSC	Petrovietnam Technical Services Corporation
PWHT	Post Weld Heat Treatment
QA / QC	Quality Assurance / Quality Control
QMS	Quality Management System
SIMOPS	Simultaneous Operations
TMCP	Thermo Mechanical Control Process
UTS	Ultimate Tensile Strength
WPS	Weld Procedure Specification

2.3 Abbreviations

Table 2-3 Abbreviations

Abbreviations	Description
Doc	Document
No	Number
Rev	Revision

2.4 Reference Drawings

The work shall conform to the Contract DRAWINGS.

2.5 Language

All documentation and communication shall be in the English language.

3 DOCUMENT REFERENCE

3.1 Project Specifications

The following Project / COMPANY specifications are also a part of this specification to the extent referenced herein.

In cases of conflict between Project specification, COMPANY specification and any other applicable codes, CONTRACTOR shall immediately submit the matter in writing to the COMPANY for clarification.

Table 3-1 : Project Specifications

No.	Doc. No.	Document Title	Rev. No.
1)	PQ-CPC0-STR-SPC-MPC-00003-00	Specification for Structural Steel for Fixed Offshore Platform	L01
2)	PQ-CPC0-STR-PCD-MPC-00001-00	Procedure for Weight Control	N01
3)	PQ-CPC0-CRR-SPC-MPC-50001-00	Specification for Protective Coatings	L01
4)	PQ1-00-STR-SPC-TAP-00006	Specification for Structural Welding and Inspection for Fixed Platforms	H01
5)	PQ1-00-TEC-SPC-TAP-00002	Units of Measurement	H01
6)	PQ1-00-STR-SPC-TAP-00003	Specification for Design of Fixed Platform Structures	H02
7)	PQ-GENR-QAC-SPC-PQC-00005	Traceability and Marking Requirements for Material and Equipment	H01
8)	PQ-GENR-TEC-REG-PQC-00001-00	ITT-Addendum to Technical Documents	H01

3.2 Codes And Standards

The latest edition of EEMUA 158, Construction Specification for Fixed Offshore Structures shall form part of this specification and all the requirements contained therein, if applicable as described in section 1.1.1, shall apply as the basic requirements of this specification and take precedence over other codes and standards.

The latest revisions of the Codes, Standards and Specifications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

Other international, national and local codes may be used for substitution upon the written approval of COMPANY.

Table 3-2 : Codes and Standards

No.	Doc. No.	Document Title	Year/Edition
1)	EEMUA 158	Construction Specifications for Fixed Offshore Platforms	3rd Edition, 2014
2)	API RP2A	Planning, Designing and Constructing Fixed Offshore Platforms, Working Stress Design	22nd Edition; Nov.2014, Reaffirmed Sep 2020
3)	API RP2Z	Recommended Practice for Preproduction Qualification for Steel Plates for Offshore Structures	4th Edition, September 2005
4)	API RP2X	Recommended Practice for Ultrasonic and Magnetic Examination of Offshore Structural Fabrication and Guidelines for Qualification of Technicians	2004 Edition, April 2004
5)	API Specification 2H	Specification for Carbon Manganese Steel Plate for Offshore Structures	9th Edition, July 2006
6)	API Specification 2MT1	Specification for Carbon Manganese Steel Plate with Improved Toughness for Offshore Structures	2nd Edition, September 2001
7)	API Specification 2MT2	Rolled Shapes with Improved Notch Toughness	1st Edition, June 2022
8)	API Specification 2W	Steel Plates Produced by Thermo-Mechanically Controlled Processing for Offshore Structures	6th Edition, Jan 2019
9)	API Specification 2Y	Specification for Steel Plate, Quenched-and-Tempered for Offshore Structures	5th Edition, December 2006
10)	API Specification 5L	Specification for Line Pipe	46th Edition, April 2018
11)	API Specification 2B	Specification for the Fabrication of Structural Steel Pipe	6th Edition, March 2021
12)	ASTM A6/A6M	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling	2023 Edition, November 1, 2023
13)	ASTM A36/A36M	Standard Specification for Carbon Structural Steel	2019 Edition, July 1, 2019
14)	ASTM A106	Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service	Revision 02A, December 10, 2002
15)	ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products	2017 Edition, September 1, 2017

No.	Doc. No.	Document Title	Year/Edition
16)	ASTM A193/A193M	Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High-Pressure Service or Other Special Purpose Applications	2023 Edition, March 1, 2023
17)	ASTM A194/A194M	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service, or Both	2023 Edition, May 1, 2023
18)	ASTM A307	Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod – 60000 PSI Tensile Strength	2021 Edition, February 15, 2021
19)	ASTM F3125	Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength	2023 Edition, November 1, 2023
20)	ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products	2023 Edition, September 15, 2023
21)	ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts	2023 Edition, December 1, 2023
22)	ASTM A572	Standard Specification for High Strength Low-Alloy Columbium-Vanadium Structural Steel	2021 Edition, May 15, 2021
23)	ASTM A709/A709M	Standard Specification for Structural Steel for Bridges	2021 Edition, November 1, 2021
24)	ASTM A992/A992M	Standard Specification for Structural Steel Shapes	2022 Edition, September 1, 2022
25)	ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus	2019 Edition, November 1, 2019
26)	ASTM F436	Standard Specification for Hardened Steel Washers	2019 Edition, December 1, 2019
27)	ASME B1.1	Unified Inch Screw Threads (UN & UNR Thread Form)	2019 Edition, 2019
28)	ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts	2022 Edition, March 11, 2022

No.	Doc. No.	Document Title	Year/Edition
29)	ASME B18.21.1	Washers: Helical Springlock, Tooth lock, and Plain Washers	9th Edition, 2016
30)	AISC 325	Manual of Steel Construction "Allowable Stress Design" Ninth Edition	16th Edition, 2023
31)	AISC ASD	Specification of Structural Steel Buildings, Allowable Stress Design and Plastic design, 1989	9th Edition, 1989
32)	AISC 303	Code of Standard Practice for Steel Buildings and Bridges	2022 Edition, 2022
33)	AWS D1.1	Structural Welding Code - Steel	Errata March 2022
34)	AWS A5.1/A5.1M	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding	14th Edition, 2012
35)	AWS A2.4	Standard Symbols for Welding and Non-destructive Testing	8th Edition, 2020
36)	BS 7448-3	Fracture Mechanics Toughness Tests Part 1: Methods for Determination of KIC' critical CTOD and critical J values of Metallic Materials	2005 Edition, March 23, 2005
37)	BS 7910	Guide to Methods for Assessing the Acceptability of Flaws in Metallic Structures	2019 Edition, December 31, 2019
38)	BS EN 10204	Metallic Products-Types of Inspection Documents	2004 Edition, 25 October 2004
39)	ISO 1461	Hot Dip Galvanized Coatings on Fabricated Iron and Steel Articles – Specifications and Test Methods	4th Edition, August 2022
40)	ISO3690	Determination of Hydrogen in Deposited Weld Metal Arising from the Use of Covered Electrodes for Welding Mild and Low Alloy Steels	4th Edition, July 2018
41)	IS0 9000	Quality System Series	4th Edition, September15, 2015
42)	ASNT-Recommended Practice No: SNT-TC-1A	Personnel Qualification and Certification in Non-Destructive Testing	2020 Edition, 2020

4 ORDER OF PRECEDENCE

4.1 Order of Precedence

Where equal but conflicting requirements are specified, these shall be brought to the attention of the purchaser in writing. The order of precedence shall be:

1. Convention followed by Vietnam (MARPOL, SOLAS)
2. Applicable Regulation of Vietnam
3. Purchase Order/Service Order/Subcontract Agreement
4. Technical Requirements (Project Drawings and Data Sheets, Project Specifications, etc.)
5. International Codes and Standards

5 GENERAL

5.1 Handling, Storage, Marking and Traceability

CONTRACTOR shall develop a detailed procedure defining the effective control of materials from receiving, handling, storage and preservation to issuance. This procedure shall be submitted to COMPANY for approval and shall be subjected to QA/QC audit to assess its effectiveness and implementation to project.

A material tracking procedure shall be prepared and implemented so that all items carry a permanent identification from arrival to final assembly. The system shall include material utilization forms. Marking shall be in accordance with marking shown on fabrication/shop drawings.

5.1.1 Handling and Storage

All materials and sub-assemblies delivered to the site shall be held in quarantine until the items have been identified against the relevant documentation. If any item has inadequate identification or unsatisfactory documentation, it shall be held in quarantine until adequate documentation is received. If no adequate documentation is received the COMPANY Representative reserves the right to test the material in question or reject the material outright. All costs for conducting these tests shall be for CONTRACTOR's account.

All materials shall be stored in conditions which will avoid damage and deterioration. Different materials and materials used for different contracts shall be segregated. Warehouse storage is preferred for all small painted or coated items and for portable sub-assemblies. All steel shall be handled in such a manner as not to cause excessive scratching or denting.

All imperfections shall be thoroughly inspected, and any deep cuts or serious abrasions shall be reported. Repair procedures shall be submitted to COMPANY for approval. No other grinding shall be permitted on base material to remove surface imperfections except as to prepare surfaces for welding.

Material shall be stored out of contact with the ground and above level of standing groundwater in such manner and location as will minimize contamination and deterioration. Materials of different type shall be stored separately and be clearly identified. A designated storage area shall be assigned for all materials specific for Block B Gas Project only.

Each type of structural steel shall be separately stockpiled. Structural pipes will be stacked a maximum of ten (10) pipes high for 100mm to 204mm diameter (4in to 8 in), and six (6) pipes high for pipes of 250mm (10 in.) diameter and larger. In any event tubulars shall not be stacked so high that they lose their roundness. Each row shall be separated by 150mm x 150mm (6" x 6") wooden beams.

5.1.2 Segregation of Materials

In the event that stainless steel or Corrosion Resistant Alloys (CRAs) are being fabricated, they shall be stored in a separate area, handled with dedicated equipment and fabricated in a separate area of the shop or the site such that it is not possible for hot fragments of carbon steel (grinding, weld spatter, etc.) to contaminate the area. All tools used for fabrication including wire brushes, chipping hammers and the like shall be marked with a colour code for each CRA material type and maintained in the segregated area for sole use in fabrication of the specific material in that area.

5.1.3 Marking

All items shall be marked for identification and traceability in accordance with this specification and the general requirements of specification for structural steel, PQ-CPC0-STR-SPC-MPC-00003-00.

Items marked to facilitate traceability shall retain the marking through manufacture and fabrication stages. Markings to be covered in final assembly and coating shall be first transferred to as built traceability quality records. The transfer of marking to traceability quality records may be subject to COMPANY Representative verification.

The markings shall be maintained through fabrication to allow visual observation, prior to sandblasting, to determine that the correct type of structural steel has been utilized in the fabrication. Items marked to permit identification only, shall maintain the marking throughout manufacturing stages until included in the final assembly.

The allocated joint numbers and piece numbers shall incorporate as a prefix the associated node and member numbers given on the CONTRACTOR's Shop Drawings. The same numbering systems shall be used on the CONTRACTOR's Working Sketches.

5.1.4 Traceability

As a minimum, items shall be marked, and a documented means established of:

- Locating the item in the final assembly (Traceability Record).
- Locating the quality records generated from inspection and testing of the item.

A material traceability record (MTR) containing all necessary information in tracing the materials against relevant documents such as mill certificates and test certificates shall be developed and made available for review by COMPANY upon request. The MTR shall contain information such as the material piece number/trace no., Heat number, quantity, etc. and this record shall form part of the MDR to be submitted to COMPANY as a document package upon completion of the project.

5.2 Weight and Centre of Gravity

The weight and centre of gravity (CoG) for every structure and component to be lift installed offshore shall be reliably determined (weighed) and recorded in accordance with Project weight control procedure, PQ-CPC0-STR-PCD-MPC-00001-00. Actual equipment and piping weights shall be

used for all weight and CoG calculations. Weights and CoGs shown on the DRAWINGS are based only on preliminary information. All structures (CPP Topsides, LQ Topsides, LQ Jacket, Bridges, Flare Deck & Jacket) except CPP jacket, which is under optional scope shall be weighed prior to loadout to demonstrate the weight and CoG are within that allowed as “Not to Exceed” weights given in the Weight Control reports.

5.3 Substitutions and Modifications

No substitution of materials or modification to detail shall be made without prior written approval of COMPANY.

In the event that any such substitutions or modifications be required, a request in writing to COMPANY stating the reason therefore shall be made and shall include copies of calculations certified by an engineer demonstrating the adequacy of the proposed substitution or modifications.

6 QUALITY ASSURANCE PROVISIONS

Quality Assurance provisions shall comply with the requirements of the Contract.

6.1 Quality Management System

CONTRACTOR shall be certified to ISO 9001 and shall comply with ISO 9001 requirements and the Quality Plan approved for the work.

6.2 Inspection and Test Plan

Inspection and testing activities shall be performed in accordance with the requirements of this specification and the approved inspection and test plan(s). The inspection and test plan(s) shall conform to contract quality assurance requirements and shall be submitted to COMPANY for approval.

6.3 Inspection and Test Procedures

Inspection and test procedures shall be prepared in accordance with the contract quality assurance requirements. The procedures shall be submitted for review and approval by COMPANY.

6.4 Quality Records

The quality documents required for the project shall be agreed upon with COMPANY. As such CONTRACTOR shall submit to COMPANY Representative for approval a list of Quality Document deliverables related to the construction of the structures prior to the commencement of fabrication. This list shall contain, but not be limited to, the following fabrication records:

- Welding Procedure Specifications (WPS) and the welding Procedure Qualification Records (WPQR)
- Welder and Welding Operator Qualification Package
- NDT Package (visual, RT, UT, MPI, etc)
- NDT Operator Qualification
- Welding Traceability Records
- Weld Maps
- PWHT Package (If performed)
- As-built construction drawings
- Material Traceability Records including relevant Mill certificates or test certificates
- Dimensional Reports

- Coating Reports
- And the like

The records shall be compiled and reviewed by CONTRACTOR following the completion of each inspection and test and submitted to COMPANY and IVS (when required) for review and acceptance.

An MDR containing the above mentioned documents shall be compiled progressively as inspection and testing progresses and will be subject to progressive review by COMPANY. A periodic QA verification audit shall be carried out by CONTRACTOR to assess status on documentation.

Quality records requiring traceability as detailed in this specification shall bear an identical marking to the item inspected or tested.

6.5 Radiograph Processing, Control and Testing

Processing of radiographic film shall be controlled in such a way as to ensure an archival storage life of at least 5 years.

Regular Thio tests in accordance with the manufacturer's recommendations shall be conducted by the CONTRACTOR, to verify the removal of those chemicals and film adversely affecting long term storage.

The radiographs shall be controlled and stored throughout the contract and shall be stored by CONTRACTOR for a further five years following Contract completion. The method of final disposal of radiographs shall be subject to agreement with the COMPANY.

7 MATERIALS

7.1 Weldable Structural Materials

Structural steel plates, rolled sections and tubulars shall be in accordance with Specification for structural steel PQ-CPC0-STR-SPC-MPC-00003-00. Definition of material types is also given in the above referenced specification. Material types for each location shall be as shown on the Design Drawings.

Material substitution from that shown on the Design drawings shall be reviewed and approved by the COMPANY.

7.2 Welding Consumables

All consumables shall be received with materials certification EN 10204 Type 3.1.

Welding consumables shall be batch tested and supplied with test certificates that report chemical composition of deposited weld metal, tensile test, and impact toughness data. For GMAW/GTAW wires, chemical composition of the heat is only required.

All welding consumables shall comply with the requirements of AWS standards.

SMAW electrodes shall be of the fully basic low hydrogen type.

Low hydrogen welding consumables shall be selected and completely dried to ensure that weld metal deposits shall contain no more than 5ml/100g of diffusible hydrogen content.

The use of EMR covered electrodes shall be subject to COMPANY review. To allow assessment of their suitability, a detailed handling procedure shall be required, which will include the maximum exposure time for the electrodes after the vacuum packing is broken.

Storage and handling procedures for welding consumables shall be in accordance with the recommendations of the welding consumables manufacturer. A detailed storage and handling procedure for welding consumables shall be compiled and submitted COMPANY for approval. Only the approved storage and handling procedure shall be used in production.

Prior to use, as a minimum, basic, low hydrogen, consumables shall be dried by baking. The baking temperature/time shall be that which is necessary to achieve a minimum diffusible hydrogen content of less than 5ml/100g of weld metal. Electrodes shall be transferred to holding ovens and heated quivers as necessary. Any electrodes remaining unused at the end of a shift shall be returned to the holding oven and re-dried before being re-issued. Returned electrodes must be suitably identified to distinguish them from virgin electrodes. No electrodes shall be re-dried more than once or as per manufacture's recommendation.

Different grades of electrodes shall be stored completely separated.

All welding consumables shall be clearly labelled with manufacturers name, product identity and batch number on every drum reel or tin. Each SMAW electrode shall have the brand name or other unique identification printed on the flux covering.

If the consumables are proposed for welding procedure which requires CTOD testing, the CONTRACTOR shall submit evidence of the consumable's ability to meet the test requirements. Submerged Arc Fluxes shall be of the fully basic type and shall not be used to make alloying additions to the weld metal.

SMAW electrodes shall be of the fully basic type.

7.3 Bolting Materials

Unless specified otherwise on the Drawings, bolts and nuts which form part of the final structure shall be high strength and shall be supplied as follows:

Description	Specification
Stud Bolts (Fully Threaded)	ASTM A193 B7
Heavy Hex Nuts	ASTM A194 2H
Mild Steel Bolts	ASTM A307 Grade A
High Strength Bolts	ASTM F3125
High Strength Nuts	ASTM A563
Washers	ASTM F436
Lock Washers	ASME B.18.22.1
Bolt and Nut Threads	ASME B1.1 (UNC) or ASME B.18.2.2

The above shall be supplied hot dipped spun galvanised in accordance with ISO 1461 or equivalent and with applicable materials/coatings test certification.

Bolting for temporary works shall use black bolts and nuts conforming to ASTM A307, Grade A.

All snug tightened bolts shall be supplied with locknuts.

8 FABRICATION

8.1 General

All fabrication shall be in accordance with API RP2A, AWS D1.1 for secondary steel fabrication and EEMUA 158 for high strength primary structural components. All fabrication shall conform to the design details indicated on the drawings. Workmanship and finish shall be equal to the best practice and quality in modern structural fabrication shops. Material shall be kept free from dirt, grease, and other foreign matter and shall be protected from corrosion.

In addition, the fabrication of 450 MPa yield strength structural steel shall comply as a minimum to the requirements of Appendix A of this specification.

Material shall be fabricated and assembled in the shop to the greatest extent possible.

When structures are fabricated or assembled in the open they shall be protected from the weather, especially those areas where welding is taking place, and supported on firm and level ground. There shall be no settlement of the ground during fabrication. Weekly Surveys shall be carried out to check that differential settlement is not occurring.

8.2 Fabrication/Shop Drawings

Fabrication/Shop Drawings shall include nesting drawings and plate cutting drawings. The longitudinal and circumferential weld arrangements for primary tubulars and node cans shall be in accordance with EEMUA 158. Drawings shall include unique identification for each item and weld. Drawings shall be provided for all temporary works including fabrication supports/aids, seafastening, grillage and installation aids.

8.3 Preparation of Materials and Structural Members

All plate and structural items shall be prepared to minimise wastage and rework.

Care shall be taken when flame cutting to avoid creating "drag lines" and damage to the material. All prepared surfaces shall be made notch free by grinding.

All tubular members shall be contour cut from templates or automatic gas cutting machine to fit members to which they connect. Ends shall be bevelled for full penetration welds.

8.4 Fitting and Assembly

Lifting of elements shall be made with nylon (or other soft material) straps. Wire rope slings shall not be used unless in conjunction with a shackle and a lug. Material shall be prepared to suit the dimensions shown on the DRAWINGS and no forcing or jamming of components shall be allowed.

The welding of assembly aids such as strong backs shall be kept to a minimum and in all cases shall be removed without damage to the structure, ground smooth and inspected. All such assembly aids shall be located a minimum of 100mm (4 inches) away from any structural welds.

Dimensional control shall be maintained at each stage of the work sequence to ensure that assembly tolerances are met.

8.5 Splices

Structural members may be spliced for economic use of material. Any splice shall develop the full strength and cross-section of the members joined. The locations of all splices in critical members are subject to the approval of COMPANY.

The term critical members include, but is not limited to, all jacket members and beams/girders with a depth of more than 530mm (21 inches). Splices shall be fabricated using full penetration welds and generally subject to the restrictions specified under AWS D1.1 structural code, API RP2A or EEMUA 158 whichever is applicable.

8.6 Fabrication Tolerances

Fabrication tolerances shall in general conform to API RP2A Section 14, and EEMUA 158. Generally, if conflict arises, the more stringent criteria shall apply.

The use of heat straightening, to bring or return structural members to the required tolerances, will require COMPANY approval prior to commencement on each occasion. A heat straightening procedure that will not impair the properties of the materials and of the welded joints will be subject to COMPANY approval. Rapid cooling of heated material by the application of water (quenching) will not be allowed.

At the completion of fabrication, deck plate surfaces shall be within 3mm (1/8in.) of a straight line from floor beam to floor beam or stiffeners. If necessary, heat straightening the deck plate may be considered to achieve this tolerance. The heat straightening procedure shall be submitted to COMPANY for review prior to commencement of straightening.

Special care and attention shall be paid to ensure that conductor guides are vertically aligned within a jacket structure prior to weld out of the conductor framing.

Every effort shall be made to ensure that the capping beams on the topsides are level along their entire length.

8.7 Connections

Connections shall be as shown on the DRAWINGS. Any connections not indicated shall be made to conform to the “AISC Steel Construction Manual” and indicated on the shop drawings.

Jacket tubular joints shall be detailed as shown in the DRAWINGS.

All details where two or more plates are in contact, other than sliding connections and pad-eye cheek plates, shall be seal welded to prevent moisture ingress.

8.8 Holes and Penetrations in Structural Material

Bolt holes shall be drilled at right angles to the surface of the metal and shall not be made or enlarged by burning. Other methods may be used with the written approval of COMPANY.

Holes for padeyes shall be drilled after cheek plates are welded in place. Other methods may be used with the written approval of COMPANY.

Penetrations (for piping etc.) through steel members shall normally be drilled, but where this is impractical penetrations may be flame cut and ground notch free. COMPANY Approval will be obtained prior to commencing of penetrations in this way.

8.9 Cope Holes

Cope holes for beam connections shall not exceed 50mm in diameter unless approved by COMPANY. They shall be cut and ground smooth. All cope holes shall be filled up with buttering weld after completing the weld or NDT in accordance with specifications.

8.10 Temporary Bracings and Supports

Scaffolding supports and facilities for supervision and inspection shall be erected in a safe and stable manner as necessary. Adequate temporary bracing shall be provided and left in place until such time as the structure is sufficiently far advanced for the bracing to no longer be required.

A qualified engineer shall design all temporary works. Design and calculations shall be submitted to COMPANY for review and approval before erection commences.

9 WELDS

9.1 General Requirements

All welding shall be carried out in accordance with the qualified welding procedures approved by COMPANY for each specific welding application. The qualification of welding procedures shall comply with AWS D1 .1 for secondary steel and EEMUA 158 for high strength primary steel.

Surfaces to be welded shall be visually examined and must be cleaned to bright metal for a distance of not less than 25mm from the edges of the weld grooves. All surfaces shall be free from oil, grease and other contaminants which would adversely affect the weld. All joints that are not prequalified in accordance with AWS D1.1 or EEMUA 158 as applicable shall be qualified before being used in production. A suitable joint detail shall be selected based on the thickness of the jointing base metals such that it will not cause lamellar tearing due to the shrinkage of the welds.

The size of structural fillet welds shall be as shown on the drawings but not less than 6mm leg length.

Partial penetration groove welds are not permitted, unless specifically called for on the drawings.

All tubular members and tubular connections shall have full penetration groove welds as detailed on the drawings or in accordance with prequalified tubular joints.

All seal welds will be in conformance with API RP 2A, Section 13, Paragraph 13.3.4.

Only qualified operators shall carry out welding, including tack welds. Tack welds shall be subjected to the same pre-heat and quality requirements as structural welds.

9.2 Welding Process

The following are the only pre-approved welding processes:

- SMAW, Shielded metal arc welding
- SAW, Submerged arc welding
- FCAW-G, Flux cored arc welding - gas shielded
- FCAW-S, Flux cored arc welding - self shielded
- GTAW, Gas tungsten arc welding

Gas metal arc welding with the short circuit transfer mode (GMAW-S) is normally not acceptable, however, the process may only be used with prior written approval by the responsible COMPANY representative and will only be approved for specific applications for a single project. GMAW is not acceptable as the primary welding process, but may be considered for root passes if completely removed or re-melted by subsequent welding methods. GMAW may be used for seal welding and for non- structural appurtenances with wall thicknesses 10mm (3/8") and less.

All weld areas shall be adequately protected from wind and moisture throughout welding. Maximum air velocity for welding processes shall be limited as follows:

- Shielded metal arc : 32 km/h
- Self-shielded flux core : 32 km/h
- Gas shielded processes : 8 km/h

9.3 Welding Procedure Qualification

9.3.1 Welding Procedure Specifications

Prior to commencing production welding detailed procedures shall be established for welding the various parts of the facilities as per connection details of the drawings and in accordance with the applicable requirement of AWS D1.1 for secondary steel and EEMUA 158 for high strength primary steel. Different welding procedures shall be developed for different material types, i.e. carbon steel, stainless steel, etc.

CONTRACTOR's existing qualified welding procedures may be submitted for consideration by COMPANY together with a list of any deviations between the testing requirement of this specification and those of the specification to which they were tested.

The following welding procedure specifications shall be submitted for review and approval by COMPANY prior to the start of production welding for each particular joint to be used. Only approved procedures shall be used.

a) Scope of application (materials and structural members to be welded).

b) Welding processes to be used in making a complete joint.

c) Steel type and thickness used for procedure qualification.

d) Sketch of joint showing edge preparation, fit-up and tolerances.

e) Thickness range qualified.

f) Welding position and welding vertical progression.

g) The brand name, classification manufacturer, and size of electrodes.

h) Shielding medium by name and type including rate of flow for gas shielding.

i) Sketch showing the estimated number beads and proposed welding sequence (actual values to be shown in the PQR).

j) The current type, polarity, amperage, voltage, welding speed, wire stick-out and heat input for each weld pass (actual values to be shown in the PQR).

k) Treatment of second side.

Each WPS shall contain all essential variables specified under AWS D1 .1 or EEMUA 158 as applicable.

For all new qualifications involving steel materials Type I, I-X, II, II-X, the PQR test coupon shall be subjected to NDE no earlier than 48 hours following completion of welding. If the PQR requires PWHT, the NDE shall take place after PWHT.

All testing required on the procedure qualification tests must be carried out by a testing laboratory approved by COMPANY.

The COMPANY Representative will require to witness and approve all welding procedure qualifications. Ten-day notice shall be given in writing to COMPANY prior to the commencement of welding procedure qualification.

9.3.2 Testing

a) Charpy V-notch

Charpy V-notch impact properties of the as deposited weld metal that will be used to weld jacket tubular joints shall be tested in accordance with EEMUA 158.

b) Crack Tip Opening Displacement Tests

Crack tip opening displacement (CTOD) testing is required on full penetration welds representing the maximum thickness of Type I, I-X, II and II-X materials that are to be welded by any single process or combination of processes.

The test welds and HAZ will be tested in the as welded condition by CTOD testing in accordance with EEMUA 158, Appendix A. Each set of CTOD tests shall comprise a minimum of three valid specimens.

For each CTOD test the least of the values of δc, δu or δm shall be greater than or equal to 0.25mm when tested at -10˚C unless specified otherwise on the drawings.

Separate tests are required to qualify single and double sided preparations, where both are appropriate to the work.

An all weld metal tensile test shall be extracted and tested from the weld used for the weld metal CTOD tests to provide the yield stress figure to be used in calculating CTOD.

All test plates shall be welded using heat inputs representative of the highest to be used in production welding.

The steel selected for performance of the test program shall have a minimum carbon equivalent not less than 0.02 of the maximum CE value to be used on the project.

Test plates shall be of dimension 1.5m x 0.35m minimum and weld preparation shall be such that the joint contains one square edge.

All CTOD test results together with CTOD record traces including all failures shall be reported and submitted to COMPANY.

9.4 Production Welding Control

All cut edges shall be visually examined for laminations, cracks, and other defects. Sharp edges shall be removed by grinding. Edge defects shall be repaired subject to COMPANY approval in each case. Prior to making repairs a repair method statement shall be submitted to COMPANY for approval.

CONTRACTOR shall develop and implement a weld monitoring system, subject to approval by COMPANY, covering production welds of steel materials. The weld monitoring system shall be approved before the start of any production welding. For each WPS used on primary structures, one welding production test is required to be done.

9.4.1 Control of Distortion and Shrinkage

All welds shall be deposited in a sequence that will minimize distortion and shrinkage.

Welding sequences and distortion control programs shall be developed before the start of welding on a member or structure in which shrinkage or distortion is likely to affect the adequacy of the member or structure.

9.4.2 Temporary Attachments

Temporary and assembly attachments shall be kept to a minimum and shall be welded in accordance with this specification. All welded attachments shall be subject to NDE (MPI) after removal to ascertain whether an arc strike on the parent metal has initiated any damage. In the event damage is found then a repair procedure shall be developed and implemented.

Temporary attachments shall be removed by cutting within 3mm of the structure and grinding smooth, under no circumstances should temporary attachments be removed by force (hammering etc).

Following removal, the area of the attachment weld shall be subjected to 100% magnetic particle inspection.

All arc strikes shall be removed by smooth profile grinding of the affected area which shall be subjected to 100% magnetic particle inspection on completion.

In cases where the arc strike has resulted in gauges of the parent metal greater than or equal to 3mm depth the gauge shall be repaired by buttering prior to profile grinding.

9.4.3 Arc-Air

Arc strikes outside the weld groove are not permitted. Arc strikes outside the weld groove shall be removed by grinding or removal of the affected material. After grinding the area shall be examined by magnetic particle inspection to ensure freedom from defects. All indications of cracking shall be subject to grinding and re-inspection with magnetic particle inspection.

Following the use of air-carbon arc cutting process all surfaces shall be thoroughly cleaned to remove traces of residual carbon and oxidation prior to the commencement of welding the affected area.

9.4.4 Weld Build-Up (Buttering)

Reinstatement of a weld preparation by overlaying of weld material and then grinding smooth may be made up to a maximum of 12mm to one or each side of the joint preparation providing the procedure has been qualified. The buttered edge shall have the weld preparation of the original edge. These welds shall be subject to the same quality requirement as the final welds.

9.4.5 Weld Interruption

Welding shall be continuous and maybe interrupted for a period to allow de-slagging, grinding or changing electrode. For welds where electrical resistance heater is maintained, an indefinite interruption will be permitted after completing the root and hot pass. For welds where preheating cannot be maintained, the indefinite interruption maybe permitted when the throat thickness of the completed weld is at least 15mm or 1/3t whichever is greater. However, at any case welds have been interrupted, the joints shall be preheated to the required preheating temperature prior to resuming welding.

9.4.6 Pre-heat and Interpass Temperature Requirements

Preheat and inter pass temperatures must be sufficient to prevent crack formation. The minimum preheat and interpass temperatures shall be in accordance with approved WPS.

In joints involving a combination of base metals, preheat shall be as specified for the higher strength steel being welded.

Preheating shall be performed in such a manner that the full thickness of the parts on which weld is being deposited are at or above the specific minimum temperature for a distance equal to the thickness of the part being welded, but not less than 75mm, both laterally and in advance of the welding. The preheat and interpass temperature shall be monitored and shall not exceed allowed temperature.

9.4.7 Post Weld and Stress Relief Heat Treatment

Post weld heat treatment (PWHT) will be required where the minimum throat thickness exceeds 63.5mm and where shown on the design drawings.

Where post weld heat treatment is required it shall be included in the weld procedure qualification test and stipulated on the Weld procedure specification (WPS).

If post weld heat treatment is required, welded assemblies shall be stress relieved by heat treating in accordance with EEMUA 158. A PWHT procedure, including repeat PWHT requirements following weld repairs shall be developed and submitted for Approval.

Full fracture mechanics tests on weld and heat affected zone (HAZ) and assessment using crack tip opening displacement (CTOD) methods may be used to obviate the requirement for PWHT if Approval in writing has been obtained from COMPANY. In the event that the fracture mechanics approach is used, engineering analysis will have to be provided.

9.5 Weld Profile Control

Weld profile control is performing of welding such that the overall weld shape gives a low stress concentration and the weld metal blends smoothly with the plate.

The intersection of two or more tubular members forms a connection with stress concentrations at and near the joining weld. Welds should achieve as full a joint penetration as applicable, and external weld profile should merge smoothly with the base metal on either side.

- Where controlled weld profiling is considered in the fatigue analysis by using the S-N curve as presented in Section 8.5 of API RP 2A-WSD, a capping layer shall be applied so that the as-welded surface merges smoothly with the adjoining base metal and approximates the concave profiles in the Figure 14.1 of API RP 2A-WSD.
- In addition to considering the weld quality provisions of section 6 and 9.12, deviations in the weld profile should be no deeper than 1 mm relative to a thin disk with a diameter equal to or greater than the brace thickness at the weld.
- For tubular joints requiring weld profile control, the weld toes on both the brace and chord side should receive 100 % MT for surface and near surface defects.
- For the fatigue-critical connections where the X curve is used, they shall be marked up and noted clearly on the structural design drawings.

9.6 Assembly

9.6.1 Fillet Welds

The parts to be joined by fillet welds shall be brought into as close contact as practicable. The separation between parts shall not normally exceed 1.5mm. However, a gap up to 5mm may be compensated for by increasing the leg of the fillet weld by the amount of the separation. All fillet welds shall be returned around the end of the connected parts.

Bearing stiffeners shall be a flush fit or full penetration weld used.

9.6.2 Run-Off Tabs

Runoff tabs shall be used to complete the butt weld at the edge of two adjoining plates. Run-off tabs shall be removed by cutting within 3mm of the structural material and then grinding smooth after welding and prior to any NDE.

9.6.3 Tack Welds

All tack welds to be incorporated into the completed weld shall be made by COMPANY approved welders in accordance with the qualified welding procedures.

Tack welds shall be subject to the same quality requirements as the final welds. If the tack welds are not intact or obstruct access to completing the root pass they shall be removed.

9.6.4 Alignment

No welding shall be done until as much of the structure as will be stiffened thereby has been properly aligned. All splice welds shall be aligned as carefully as possible with any mismatch being compensated for.

9.6.5 Galvanized Steel

Members joined by welding after they have been galvanized shall be protected from corrosion by spot treating with a system in accordance with the coating specification.

9.6.6 Peening

Peening is not permitted. The use of manual slag hammers, chisels and lightweight vibrating tools for removal of slag and spatter is not considered as peening and is permitted.

9.7 Weather Protection

Sufficient shielding to protect each welding site from rain and wind shall be provided.

9.8 Paint Removal

Any paint on surfaces adjacent to joints to be welded shall be thoroughly removed to expose clean steel within a minimum of 2 inches (50mm) of the joint. It may be necessary to clean further away from the joint to facilitate NDE.

9.9 Offshore Welding

Special care shall be taken in field welding offshore, such as the deck columns to piles and add-ons to piles and conductors. The following precautions shall be strictly observed.

a) Good scaffolding shall be provided to ensure the best possible working conditions for welders.

b) Complete shielding of the weld arc from wind, moisture or rain.

c) A sufficient number of welders shall work simultaneously and no stops shall be made before completion of the weld other than those necessary for changing electrodes and weld bead cleaning.

d) Field welds of piles shall be 100 percent visually and ultrasonically inspected immediately after weld completion. NDT shall not be carried out until the weld has cooled to no greater than 120 Celsius degrees.

e) The welds shall be 100% MT/UT tested in accordance with qualified elevated temperature MT (MPI) and UT procedures. Enforced cooling of pile-welds shall not start until the weld has reached 260 Celsius degrees. Cooling shall be in accordance with a COMPANY approved cooling procedure.

f) For all other welding of primary and/or retrained steel (e.g. crown shims, transition pieces). NDT shall be performed post 48 hours after welding completion, including repairs, unless approved otherwise by the COMPANY. Testing of secondary unrestrained steel may begin immediately after the welds have cooled to ambient temperature, as per AWS D.1.1. All welds must have been visually accepted before final NDT.

g) Unless noted otherwise in this specification, NDT requirements shall be assumed to be 100% MT and 100% UT for CJP welds and 100% MT on fillet welds.

h) Unless noted otherwise in this specification, NDT requirements shall be assumed to be 100% MT and 100% UT for CJP welds and 100% MT on fillet welds.

9.10 Welder and Welding Operator Qualification

A list of proposed welders and welding operators along with their relevant qualification records shall be submitted to COMPANY for approval. Any new qualification shall conform to the requirements of AWS D1.1 or EEMUA 158 as applicable. COMPANY representatives and Certifying Authority shall witness qualification of welders and welding operators. No unqualified personnel shall be accepted to perform the work.

Record of the test results and certificates of qualification of personnel, shall be maintained and available to COMPANY. Special skill is required for single side welding of complete joint penetration tubular welds without backing.

CONTRACTOR's existing qualified welders may be approved by COMPANY provided their qualifications have been witnessed and stamped by an Independent Verification party or Certifying Authority and all requirements specified under AWS D1.1 or EEMUA 158 as applicable have been met.

9.10.1 Welder Identification and Marking

Each qualified welder and welding operator shall be supplied with an identifying color crayon or chalk and number with which he shall mark the steel to identify his welds at intervals not more than 1 meter apart. All areas not clearly marked may be liable to rejection.

Each qualified welder shall be issued with and wear an identifying badge with the following minimum information:

- Photograph
- Name
- Identifying Number
- Positions Welder is Qualified for

9.10.2 List of Approved Welders

A list shall be maintained of all approved welders including name, procedures qualified for, date of qualification, and certificate expire date.

9.11 Welding Equipment

a) Condition of Equipment

Welding machines shall have adequate controls for making the current adjustments necessary for all welding requirements. Sufficient meters, portable or permanent, shall be provided to calibrate machines and to regulate voltage and amperage as needed. All welding machines shall be calibrated prior to commencement of fabrication and calibration certificates shall be available for audits. Certification shall be valid for 12 month periods, or as per manufacturers recommendation.

b) Grounding of Equipment

Grounding of welding machines shall be in accordance API RP 2A, with the following additional requirements:

- Each welding machine shall be individually grounded to the platform or portion of the platform being welded.
- No machine shall be grounded to floating equipment during welding on the structure.
- Earth cable shall at least be of equivalent capacity to the work cable.
- Ground clamps for tubulars shall be designed to prevent arcing.

9.12 Inspection Requirements

9.12.1 General

Inspection and NDE and acceptance criteria shall comply with the requirements of EEMUA 158 and the additional requirements of this specification. Each inspection or examination shall be carried out using a written procedure approved by COMPANY.

All inspectors shall be AWS QC1 or CSWIP certified (or acceptable equivalent) except specialty technicians (PT, MT, UT, and RT) who shall be qualified and certified according to the guidelines ASNT SNT-TC-1A or equivalent. COMPANY reserves the right to proficiency test, at no additional cost to COMPANY, any NDT operative working at any of the CONTRACTOR facilities, irrespective

of their current qualifications. The test shall comprise a practical demonstration of the NDT operative's abilities on a sample test piece together with the ability to record and report the work relative to the duties for which they are qualified.

Pipe and heavy-wall tubular members manufactured and tested in accordance with API specifications 5L and 2B shall be considered acceptable without further testing at the assembly site. Welds connecting such members shall be inspected in accordance with this specification.

Reports of all inspections shall be made available to the COMPANY Representative and Certifying Authority not more than 24 hours following completion of test.

NDE may be carried out prior to post weld heat treatment (PWHT), but for acceptance purposes shall be carried out following PWHT.

9.12.2 Extent of Inspection

The required NDE methods and the minimum extent of NDE and inspection shall comply with EEMUA 158 Table 3 or API RP2A Table 16.1, and additional requirements in Table 9.1 as follows.

Percentage of length of weld inspected in a given type of connection shall be in accordance to EEMUA 158. Depending on the results of NDE called for above, the percentage of welding inspection may be adjusted accordingly by COMPANY.

Table 9-1 : Examination Minimum Requirements Supplemental to API-RP 2A-WSD

LOCATION / TYPE OF WELD	EXTENT Note1	METHODNote2
Lamination Surveys (Location of Structural Plate)		
Joint CansNote 3	100%	UT
Padeyes	100%	UT
Plate to which padeyes or crane pedestals are attachedNote4	100%	UT
Fabricated Tubulars for Piling, Braces, Jacket Legs, Deck Legs, Stabbing guides	100%	RT or UT+MT
Tubular Connections		
Primary T, K, Y joints with brace diameter≥ 323.9 mm and wall thickness≥ 12.7 mmNote5	100%	UT+MT
Secondary T, K, Y joints	100%	MT
Miscellaneous	N/A	N/A
Plate Girder, Beam and Connections		
Primary full penetration welds	100%	RT or UT+MT
Secondary full penetration welds	10%	RT or UT

LOCATION / TYPE OF WELD	EXTENT Note1	METHOD Note2
Primary fillet welds	100%	MT
Secondary fillet welds	10%	MT
Padeyes Note9		
Full penetration	100%	UT+ MT
Fillet	100%	MT
Miscellaneous Fabrication		
Structural fillet	10%	MT
Arc strikes	100%	MT
Weld repairs Note6	100%	RT, UT or MT
Sea fastening	100%	UT+MT
Full penetration welds on launch legs, ring stiffeners, launch lugs, and skirt pile sleeves	100%	RT or UT+MT
Fillet welds on launch legs, launch lugs	100%	MT
Grout, flood, and inflation lines	10%	RT
Connections Made During Offshore Installation		
Pile/conductor field girth welds	100%	UT+MT
Pile-to-deck girth welds	10%	UT+MT
Jacket leg-to-deck girth welds Note7	100%	UT+MT
Pile-to-shim Welds Note 8	100%	MT

Notes:

1. Based on percent of total weld length. COMPANY to designate welds inspected to less than 100%.
2. All welds (structural and non-structural) and structural steel are subject to 100% Visual Test (VT) at all times. VT may include Penetrant Test (PT).
3. Projection of the brace onto the joint can plus an additional 150 mm radius around the circumference of the projection.
4. Projection of the padeye or pedestal plus an additional segment equal to 5 times the padeye thickness.
5. Although conventional techniques are generally limited to these dimensions, smaller members may require examination if they are designated primary welds.

6. NDE should be the same as the original inspection and performed by the same party.
7. For jackets with skirt piles.
8. Visual examination of each pass and Magnetic Testing (MT) upon completion of welding.
9. Primary structural padeyes utilized by CONTRACTOR during the construction phase shall be subject to the applicable 100% NDE both before and after use.

9.12.3 Visual Inspection

All welds shall have 100 percent visual inspection prior to any production welding to ensure good fit-up. When the fit-up meets all the requirements of this Specification, the joint shall be clearly marked for satisfactory fit-up, and initialled by the CONTRACTOR's welding inspector. Critical connections will be identified at the start of fabrication for which COMPANY inspection of fit-up will be required before commencement of welding. Visual inspection is also required at regular stages through the welding process to ensure correct interpass cleaning and that the welding procedure specification is adhered to. Minimum stages for inspection are upon completion of first pass and following any back gouging operation. Final visual inspection is required when the weld cap is complete.

All tubular brace ends to be welded to jacket node cans and all thicknesses in excess of 25 mm shall be subject to 100% UT after preparation, prior to fit up, to check for lamellar defects.

9.13 Corrections and Repairs

All weld repairs shall be carried out in accordance with COMPANY approved welding repair procedures. Weld repair procedures are required for all welding processes.

If ultrasonic or magnetic particle examination of weld appears to indicate any defect, then such weld shall be thoroughly re-examined by any means, including radiography, as directed by COMPANY.

Welds shall also be examined for inadequate penetration, incomplete fusion, burned through areas, slag inclusions, gas pockets, under cutting and improper weld geometry. If these or any other defects are discovered which, exceed the limits of this specification and referenced codes, then all such welds shall be repaired or replaced.

All welds shall present a uniform appearance and be without excessive undercut, inorder to pass the visual examination and magnetic particle test or liquid penetrant test.

All welds that shall be repaired or replaced that do not meet the requirements of the appropriate Codes and Standards and this specification.

Repaired welds (both as welded and PWHT) shall undergo 100% NDT along their full length in accordance with that for the original weld followed by repeat PWHT in the case of welds previously PWHT.

Normally, two (2) repairs will be permitted at same location. Repair after 2nd. repair will require approval from COMPANY.

When inspection indicates defects in a welded joint with CTOD or PWHT that requires repair, the repair shall be carried out in accordance with the applicable requirements of EEMUA 158 and the repair procedure which shall be qualified prior to performance of the repair.

Extent of cracks in welds or base metal shall be ascertained by use of NDE. The cause of cracking shall be established prior to removal and repair. The extent and cause of cracking shall be advised to COMPANY. All defects in weld deposits shall be repaired only with prior authorization of COMPANY.

Removal and repair of cracks in weld deposits or base metal shall be witnessed and Approved by COMPANY.

Removal of defective weld metal or portions of the base metal shall be done by machining, grinding, chipping and any other method, which produces a clean, uncontaminated surface for rewelding. Oxy-acetylene gouging will not be acceptable. All arc-air gouges shall be ground to remove residual carbon.

The defect and a minimum 50 mm of sound metal beyond each end of the defect shall be removed by grinding or arc-air gouging. Additional weld metal shall be deposited using an electrode preferably smaller than that used for making the original weld. The surface of the chord member in tubular intersection joint containing root crack or transverse crack shall be inspected by non-destructive methods to detect propagation into the base metal. The intersecting member shall be completely removed if, in the sole opinion of COMPANY, the surface of the chord cannot be properly inspected and repaired.

COMPANY shall have the right at any time to inspect the fabrication and erection of all items covered by this specification. Any welding defect, damage due to lift up, arc strikes or other weld features which COMPANY determine as deficient or detrimental to the integrity of the structures shall not be acceptable and shall be repaired by CONTRACTOR.

9.14 Site Access

COMPANY's personnel shall have free access at all times to any part of CONTRACTOR's, or his Sub-contractor's yard and facilities that are concerned with the works. COMPANY personnel shall be shown full cooperation, be given sufficient notice of inspections and be allowed sufficient time for all inspection and testing procedure to be properly executed.

10 ERECTION

10.1 General

The erection shall be in accordance with the provisions of the "AISC Specification for Structural Steel Buildings" and API RP2A. Splices and field connections shall be made as indicated. Welding will be permitted only where indicated or approved on the shop drawings. Errors in shop fabrication or deformation resulting from handling and transporting that prevent proper assembly and fitting of parts shall be reported to COMPANY and approval of method of correction obtained.

10.2 Padeyes

Padeye size and orientation will be dependent upon the weight and centre of gravity determined in accordance with Section 5.2 and also upon the installation procedure and rigging which shall be in accordance with Project Specifications. Certifying Authority inspection is required for padeyes, trunnions and similar components.

10.3 Offshore Installed Items

Where items are fabricated separately for installation offshore, special precautions shall be taken to ensure an exact fit between such items and the parent structure. Whenever practical such loose items shall be trial fitted in the yard to ensure exact alignment. All ship loose items shall be match marked prior to loadout and seafastening. All ship loose items shall be adequately packaged and/or secured for offshore transport, lifting and handling.

10.4 Bolting

Bolts shall be tightened in accordance with the turn of nut method as described in "AISC Steel Construction Manual" unless otherwise specified on the DRAWINGS.

10.5 Scaffolding

CONTRACTOR shall furnish, install and maintain in safe operating condition all scaffolding, ladder, walkway, adequate lighting, etc, necessary for safe and thorough erection and inspection. CONTRACTOR shall operate a Scaff tag system (or similar approved) to demonstrate that the scaffolding is safe at all times.

10.6 Equipment

COMPANY shall have the right to inspection at any time, tool or equipment to be used on the work, and have the right to condemn any equipment or work which does not conform to the contract document.

11 COATING

11.1 Painting

Painting shall be in accordance with Specification for Protective Coatings, PQ-CPC0-CRR-SPC-MPC-00001-00.

A well-defined coating procedure shall be developed and submitted by CONTRACTOR to COMPANY for approval prior to commencing coating activity. Each proposed coating system for each type of structure shall be included in the procedure in alignment with the Specification for Protective Coatings.

All jacket legs shall be marked with its grid identifier (A1, B3, etc) and with horizontal marks at 1.0m intervals from LAT up to EL. +5.0m. The markings shall be facing out from the jacket and should be clearly visible from an approaching vessel. The markings shall have a contrasting colour to the background coating of the jacket leg.

As per COMPANY's Addendum to Technical Documents, gratings, ladders, stairways, handrails, handrail sockets and miscellaneous structures shall be hot dipped galvanized conforming with ASTM A123 and applied in accordance with ASTM A385. Ladders, stairways, handrails, handrails sockets and miscellaneous structures shall be painted after galvanizing as per Specification for Protective Coatings, PQ-CPC0-CRR-SPC-MPC-00001-00.

11.2 Thermally Sprayed Aluminium

TSA, if required, shall be in accordance with Project specification.

11.3 Passive Fire Protection

PFP that is industry proved and fully certified by a classification society member may be used. PFP shall be in accordance with project specifications and applied in accordance with manufacturers recommendations.

12 LOAD-OUT

The methods to be employed for load-out and the requirement for these shall be established in consultation with COMPANY and will be subject to review and approval by COMPANY and a Marine Warranty Surveyor.

The Load-Out procedure developed by CONTRACTOR shall be submitted for COMPANY and MWS approval at least one month prior to loadout.

All necessary supports shall be designed as required to fabricate and load-out the structure. Supports shall be placed at locations on the structure that will not cause overstress of the structure.

13 APPENDICES

13.1 APPENDIX 1: ADDITIONAL REQUIREMENTS FOR FABRICATION OF 450MPA YIELD STRENGH STRUCTURAL STEEL

A1.0 Scope

This appendix specifies requirements for fabrication of 450 MPa yield strength structural steel in addition to the requirements specified in Structural Steel Fabrication Specification.

A1.1 Forming

Hot forming (forming carried out in the normalizing range) is not allowed. If required, a procedure for the hot forming of 450 grade steel shall be submitted for COMPANY approval.

A1.2 General

CONTRACTOR shall have or agree to employ a welding engineer with adequate experience in fabrication/welding of very high strength steel for the project duration. The welding engineer's resume shall require approval of the COMPANY Representative.

Welding Methods

Submerged Arc Welding

Restricted to Single Wire Technique and Heat Input Limitation of 3kJ/mm max. Basic flux with 1% Nickel and 0.5% Mo wire shall be used.

Shielded Metal Arc Welding

Heat input shall be limited to 3.5kJ/mm maximum. Low hydrogen electrodes shall be used. 2.5% Nickel steel electrodes are preferred to provide high notch toughness.

Other Welding Processes

Submerged Arc Welding and Shielded Metal Arc Welding are the only approved welding processes. Self-Shielded Flux Cored Arc (Inner shield) Welding (SSFCAW) and Gas Shielded Flux Cored Arc Welding (GSFCAW) are not acceptable due to under-match or low over-match margin of weld metal UTS and Yield Strength with the base metal. In addition, the requirement for Post Weld Treatment will further limit the applicability of these processes due to decrease in mechanical properties.

A1.2-1 Hydrogen Induced HAZ & Weld Metal Cracking

The susceptibility to Hydrogen cracking shall be reduced by careful control of welding consumables (by minimizing hydrogen levels) as per consumable manufacturers recommendations and use of adequate preheat as established in the welding procedures.

A1.2-2 Preheat & Interpass Temperature

Preheat requirements for 450 grade shall be similar to 355 grade but greater than BS-EN1011-1 requirements based on carbon equivalent and shall be established in the welding procedures. Maximum Interpass temperature for 450 grade steel shall be restricted to prevent degradation of mechanical properties in the HAZ especially for TMCP steels and to provide the necessary notch toughness in HAZ for Quenched and Tempered and TMCP steels.

A1.3 Transition Joints with Lower Grades

Transition joints of 450 grade steel with lower grades shall be welded with restrictions applicable to 450 grade material such as heat input and post weld heat treatment restrictions.

A1.4 Plate Girder Fabrication

Use of 450 grade steel for plate girder fabrication shall include a limitation of distortion control by welding sequence or by pre-forming and not by flame correction due to deterioration of mechanical properties at the flame corrected zones.

Vietnam Block B Gas Project

Contractor and Subcontractor Quality Personnel Qualification Requirements

H01	28 November 2022		Issued for Use					
REV	**DATE**		**DESCRIPTION**			**ORIG**	**CHK**	**APPR**
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Revision History and Hold Record

Revision History

Date	Rev. No.	Detailed Description of Change	Ref. Section

Hold Record

Date	Rev. No.	Hold No.	Description / Reason for Hold	Ref. Section

Attachments

Item No.	Description	Document No.

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1 PURPOSE

1.1. To establish the minimum requirements for deploying Quality Personnel, for a defined scope of Work / activity, in order to implement the Quality Management System (QMS) processes on a project(s).

1.2. These requirements are intended to define those competencies, qualifications, certifications and experiences that will contribute to effective quality assurance and quality control, when assessed against selected qualification criteria.

1.3. The requirements identified in this document should be interpreted as applicable to ALL Quality Management, Quality Assurance or Quality Control personnel engaged by CONTRACTOR or its Subcontractors.

2 SCOPE

This document applies to the quality personnel employed by CONTRACTOR and its Subcontractors to perform the Work described in the Contract and shall meet, as a minimum, the qualification and experience requirements, as detailed hereunder.

3 DEFINITION

Resource/Inspector: can be assigned to multiple function / inspection disciplines, provided Individual meets the minimum requirements as specified in this document for each of the discipline.

Final Authority: COMPANY shall be the final authority for determination of equivalency for all qualifications, certifications, or minimum number of years of experience as specified in this document upon successful completion of required examinations and/or interviews.

CONTRACTOR - As defined in the Contract Terms and Conditions.

4 RECOGNIZED CERTIFICATION SCHEMES

Most of the recognized international schemes are acceptable to COMPANY. Hereunder are some of the foremost COMPANY recognized certification bodies.

4.1 Certification Scheme for Welding and Inspection Personnel (CSWIP):

Independent Certification for which inspection personnel are required to be tested at an external independent test center. Such test centers are licensed by the central certifying body which has overall control of the certification scheme it operates.

4.2 Personnel Certification Scheme (PCN)

Independent Certification Scheme for the NDT Personnel (formerly CSWIP Phases)

4.3 American Society for Nondestructive Testing (ASNT) SNT-TC-1A

In house certification which means that the scheme of examining and certifying is controlled by CONTRACTOR/COMPANY procedure. This procedure is produced and operated by an independently qualified person who may be employed by CONTRACTOR/COMPANY or be an external consultant.

4.4 Qualification and Certification of Welding Inspectors (AWS CWI and CAWI)

The American Welding Society Scheme for qualification and certification of welding inspection personnel

4.5 Engineering Research Council (ERS) British Gas Corporation

Examination and review board of British Gas Corporation for NDT; Pipeline, Pipemil and Painting Inspection.

4.6 National Association of Corrosion Engineers(NACE) Coating Inspector Training and Certification Program

Three training levels (Level-I, II and Peer Review) are offered, each more demanding. Completion of Peer Review (earlier known as Level-III) culminates in candidates acquiring NACE approved Coating Inspector's status.

4.7 Institution of Corrosion (I. Corr) Paint Applicator Training and Certification (PATAC) Scheme

Principally a test program that recognizes and acceeds accreditation of Coating Application. Grades ranges from helper through blaster, brush applicator, spray applicator to paint supervisor.

4.8 The Lifting Equipment Engineers Association (LEEA) Certification Scheme

The object of the LEEA Scheme is to provide a register of technical personnel, employed by members of the Lifting Equipment Engineers Association recording their individual areas and categories of competence.

The LEEA has developed a range of courses covering key areas of interest like *General Lifting Gear, Manually Operated Lifting Machines, Power Operated Lifting Machines, Electric Overhead Travelling Cranes, Mobile Cranes, Derrick Cranes, Tower Cranes and Runways & Light Crane Structures* to the user of lifting equipment.

Upon completion of courses and exams, persons will be registered with LEEA and person will receive a LEEA TEAM card.

5 HEALTH & SAFETY

5.1 Personnel employed in quality assurance and/or quality control activities shall be trained and aware of the potential hazards associated with the employment of inspection, NDT equipment and coatings application. In addition they shall possess a certificate of attendance for COMPANY safety courses required.

5.2 Under water inspection/diver shall be fully aware of COMPANY diving safety requirements.

5.3 At least one person related to each quality control activity, shall be conversant with COMPANY health and safety matters associated with the relevant activity aspects.

6 SELECTION AND CERTIFICATION OF PERSONNEL

6.1. CONTRACTOR shall submit a preliminary Quality and Expediting Staffing Plan and resumes of key individuals to COMPANY for each identified quality and expediting position.

6.2. Selection of each individual shall be carried out by COMPANY Project Quality Manager based on the certifications and personal / telephonic interviews.

6.3. Once selected, no changes to the accepted personnel shall be allowed without written permission of COMPANY.

6.4. The Certificate shall include at least, the results of certification tests, the agency and person granting certification, the date of certification and its expiration date.

6.5. At COMPANY's option, NDT testing personnel may be required to be re-certified if any question arises about their ability at any time, whether it is at the beginning of a project or construction contract phase.

6.6. NDE personnel qualified to the ASNT system are accepted provided that such qualification has been conducted by an independent authority. The qualification documents of such independent authority including the written practice shall also be submitted.

6.7. Only original certificates shall be submitted for approval.

6.8. Underwater inspector / divers must satisfy COMPANY's diving requirements in addition to the requirements of Para 11.2 of this specification..

7 QUALIFICATION MINIMUM REQUIREMENTS

7.1. It is recognized that the effectiveness of Quality Management, Quality Control, Quality Assurance, Welding Inspection, Coating Application and Non-Destructive Testing (NDT) inspection depends upon the capabilities of the personnel who perform functions related to these activities.

7.2. It is important for CONTRACTOR to identify, select, propose and only deploy qualified, competent and experienced personnel with the minimum requirements stated in this or other Contract requirements.

8 ENGINEERING, PROCUREMENT & CONSTRUCTION PHASES

8.1. Project Quality Manager(PQM):

8.1.1. PQM shall have a university degree in engineering or equivalent with a minimum of twenty (20) years of direct experience in Quality Assurance system activities of which ten (10) years must be in managing quality systems relating to Contract Scope of Work (e.g.; oil, gas and petrochemical projects, infrastructure, communication)

8.1.2. Demonstrated knowledge of ISO 10005 and ISO 10006 and training in ISO 9001: Quality management systems international standard or equivalent will be desired.

8.1.3. PQM shall be able to exercise judgment against the criteria of the standards and shall be a certified ISO 9000 Quality Management Systems Auditor.

8.2. Quality System Auditors:

8.2.1. Shall minimum hold a Higher National Certificate in Mechanical Engineering or an approved equivalent with five (5) years of auditing experience, directly relating to auditing activities in the discipline the auditor is working in and in the Contract Scope of Work (e.g.; oil, gas and petrochemical projects, infrastructure, communication),

8.2.2. Auditors shall be qualified as stated in ISO 19011: Guidelines for quality and/or environmental management systems auditing and shall be competent in the discipline being audited, familiar with Quality System standards and be able to exercise judgment against the criteria of the standards.

8.2.3. Auditors must be able to communicate clearly in writing and orally.

8.2.4. Auditors shall have satisfactorily completed a training course and passed the course examination (e.g. ISO 9001).

8.2.5. Auditors shall have participated in a minimum of five (5) audits for a total of at least thirty (30) Days including documentation review, actual audit activities and audit reporting during the past three years..

9 ENGINEERING & PROCUREMENT PHASES

9.1. Supplier Quality Coordinator (SQC):

9.1.1. SQC shall have a bachelors/university degree in engineering, or equivalent and minimum eight (8) years inspection experience or

9.1.2. a high school diploma with ten (10) years inspection experience with a minimum of three (3) years directly relating to supervision of vendor inspection activities in Contract Scope of Work (e.g.; oil, gas and petrochemical projects, infrastructure, communication),

9.1.3. Shall have demonstrated knowledge of ISO 10005: Quality Management System-Guidelines for Quality Plans and ISO 9001.

9.2. Inspection Engineer

An Inspection Engineer must be qualified to at least one of the following requirements:

9.2.1. Hold a Mechanical Engineering degree or an approved equivalent and have at least six (6) years experience in inspection of engineering installation, of which at least three (3) years attributed to the oil and gas or petrochemical industry.

9.2.2. Hold a Higher National Certificate in Mechanical Engineering, or an approved equivalent and have at least ten (10) years experience in inspection of engineering installation, of which at least five (5) years in the oil and gas or petrochemical industry.

9.3. Vendor Inspectors:

9.3.1. As a minimum, Inspectors shall be a high school graduate or equivalent and shall carry a current certification as per international standards like AWS, CSWIP, ASNT, NACE, API, PCN in the discipline of his/her expertise.

9.3.2. Inspectors shall have minimum six (6) years of inspection experience in manufacturing plants, including minimum three (3) years of independent inspection experience in the specific commodity and processes to be inspected.

9.3.3. Inspectors shall be able to read, write and speak the English language in addition to the local language of the region/country of the activity.

9.3.4. Inspectors shall be fully conversant with applicable industry standards, specifications, and fabrication methods and shall perform a variety of inspection functions with minimal supervision as required to verify supplier compliance with the purchase order requirements.

9.3.5. Inspectors shall be able to read engineering drawings.

9.3.6. Inspectors shall have knowledge and understanding of ISO 9001: quality system requirements and implementation.

Additionally, every Inspector shall meet the following minimum requirements for each specific inspection discipline:

9.4. Welding and NDT:

9.4.1. Welding Inspector shall be certified as an American Welding Society CWI, CSWIP 3.1 Certified Welding Inspector, or approved equivalent.

9.4.2. Inspector shall have a demonstrated background and thorough knowledge of codes such as ANSI B 31.3, 31.4 and 31.8, ASME Section V and IX, API 620 and 650, AWS D1.1, required for the execution of the Work.

9.4.3. Where NDT forms part of the Work, and Inspector is required to review or ensure NDT programs and results:

☐ Inspector shall have been previously qualified and certified to a minimum ASNT Level II in the relevant method(s).

□ When performing, reviewing or ensuring NDT in Visual Testing, Magnetic Particle Testing, Penetrant Testing, Radiographic Testing or Ultrasonic Testing, Inspector shall be certified in the specific method(s).

□ When performing, reviewing or ensuring Radiographic Testing Film Interpretation (RTFI), Inspector shall be certified in RTFI.

9.5. Heat Treatment:

9.5.1. Inspector shall have direct knowledge of all aspects of heat treatment and with the types of equipment and monitoring devices (thermocouples, etc.) to be used for the Work, such as electrical resistance heating elements, induction coils, furnace, or gas fired heaters.

9.5.2. Inspector shall be able to verify the heat treatment parameters to approved heat treatment procedures.

9.5.3. If applicable, Inspector shall be thoroughly familiar with the heat treating requirements of ASME B31.3 and ASME Section VIII Division 1.

9.6. Mechanical:

Inspector shall demonstrate working knowledge of codes as required by the purchase order, such as ASME Sec I, V, VIII and IX, ANSI B31.3/4/8, NACE, and API 620/650 and AWS D1.1, and testing equipment including Positive Material Identification test equipment required for the inspection of mechanical commodities such as pipes, piping, fittings, valves, structural steel, and fasteners, etc.

9.7. Positive Materials Identification (PMI):

9.7.1. The Inspector(s) performing the PMI test should be knowledgeable about all aspects of operation of PMI test equipment, the PMI test method used and standards like API recommended practice 578.

9.7.2. Qualifications of the person performing the PMI test, including training and experience, shall be submitted for review and approval by COMPANY.

9.8. Coating:

9.8.1. Coating Inspector shall be certified as a National Association of Corrosion Engineers (NACE) Level II Certification, CSWIP Level II, or equivalent standard acceptable to COMPANY.

9.8.2. Inspector shall demonstrate a thorough working knowledge and proven ability of all phases and types of coating applications and methods and recognized industry standards.

9.9. HVAC System:

9.9.1. Inspector shall demonstrate a thorough working knowledge of codes such as the Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) codes Uniform Mechanical Code, NFPA 90A, ASHRAE Handbooks and/or equivalent standards.

9.10. Lifting Equipment/Crane:

9.10.1. Inspector shall demonstrate a thorough working knowledge of codes such as ANSI-A17.1 and 17.2, ANSI-B30.1 through B30.16, API 2C or equivalent standards.

9.10.2. Certification and training in LEEA Courses Part One – Courses 1 through 6.

9.11. Electrical:

9.11.1. Inspectors Certification to Construction Code Inspectors Certification Examinations (2A, 2B, and 2C) or Canadian certified electrical inspector program

9.11.2. Inspector shall demonstrate a thorough working knowledge of the National Electric Code/NFPA 70, IEC or equivalent standards.

9.11.3. Where, inspection of Cathodic Protection equipment is required, inspector must be able to demonstrate a thorough knowledge of applicable requirements of NACE or equivalent corrosion standards.

9.12. Instrumentation:

9.12.1. Inspector shall have five (5) years documented experience in the field of instrumentation and control systems.

9.12.2. Inspector shall be familiar with the international Industry Codes and Standards related to Intrinsically Safe Systems and Electrical Systems for Instrumentation such as; ISA RP12.6, ISA RP12.2.02, ISA TR12., ANSI MC96.1, IEEE 518, IEEE 1100, IEC 60529, NEMA ICS 6, NEMA 250, NEMA VE 1, NEMA VE 2, NFPA 70/NEC and UL 94.

9.12.3. As a minimum, Inspector shall be able to inspect complete loop checking, wiring continuity, color coding, and start-up.

9.12.4. When required, Inspector shall be able to evaluate FAT and demonstrate a thorough working knowledge of international codes and standards related to packaged units instrumentation such as, Distributed Control System (DCS), Supervisory Control and Data Acquisition (SCADA) Systems, Remote Terminal Unit (RTU), and Emergency Shutdown (ESD) systems.

9.13. Rotating Equipment:

Inspector shall have minimum five (5) years of hands-on inspection experience of rotating machineries such as pumps, compressors, generators, turbines, gears and motors, including attending and assessing FAT and reporting dynamic, vibration and/or high temperature problems.

10 CONSTRUCTION & PRE-COMMISSIONING PHASES

10.1 CONTRACTOR shall submit a preliminary Quality Staffing Plan and resumes of QA/QC individuals including the Personnel Certificate, the results of certification tests, the agency and person granting certification, the date of certification and its expiration date (refer to section 4 & 6 above) to COMPANY for review and approval before mobilization.

10.2 Site QA/QC Manager:

10.2.1 Shall have a university degree in engineering or equivalent and a total of fifteen (15) years QA/QC experience or a high school diploma with a total of eighteen (18) years field and shop QA/QC inspection experience.

10.2.2 As minimum, Manager shall have at least ten (10) years directly relating to field supervision of construction activities in Contract Scope of Work (e.g.; oil, gas and petrochemical projects, infrastructure, communication).

10.2.3 Shall have demonstrated knowledge of ISO 10005: Quality Management System-Guidelines for Quality Plans and certified as ISO 9001: quality management systems auditor, or equivalent quality verification.

10.3 QA/QC Supervisor:

10.3.1 Supervisor shall have a university degree or equivalent and a total of ten (10) years QA/QC/inspection experience or a high school diploma with a total of twelve (12) years inspection experience.

10.3.2 As minimum, Supervisor shall have five (5) years of directly relating to supervision of construction activities experience in Contract Scope of Work (e.g.; oil, gas and petrochemical projects, Infrastructure, communication).

10.4 Inspection Engineer

10.4.1 An Inspection Engineer shall be qualified to at least one of the following requirements:

10.4.2 Hold a Mechanical Engineering degree or an approved equivalent and have at least 7 (seven) years experience in inspection of engineering installation, of which at least five (5) years in the oil and gas or petrochemical industry.

10.4.3 Hold a Higher National Certificate in Mechanical Engineering or an approved equivalent and have at least ten (10) years experience in inspection of engineering installation, of which at least six (6) years in the oil and gas or petrochemical industry.

10.5 Quality Control Inspectors:

10.5.1 Inspector shall be minimum high school graduate or equivalent;

10.5.2 Shall be able to read, write and speak English Language in addition to the local language of the region/country of the activity.

10.5.3 Shall be fully conversant with applicable industry standards and specifications; and shall perform a variety of inspection functions with minimal supervision.

10.5.4 Should be able to read construction drawings, specifications, procedures and other documentation relevant.

10.5.5 Additionally, personnel employed by CONTRACTOR or its Subcontractors to perform the Quality Control Work described in this Contract shall meet, as a minimum, the following years of relevant experience:

Number of years of experience			
Inspector Title	**Overall**	**Inspection Specialty**	**Contract Scope of Work***
Senior Inspector	10	8	5
Inspector	8	5	3
Assistant Inspector (Nationals Only)	✓ High school with three (3) years working experience ✓ Technical college diploma with two (2) years working experience, or ✓ Bachelor Degree in Engineering (ME, EE, CE, etc)		

*e.g.; oil, gas and petrochemical projects, infrastructure, communication etc.

For specific disciplines the following additional requirements shall apply:

10.6 Welding:

10.6.1 Inspector shall be certified as an American Welding Society CWI, CSWIP 3.1 Certified Welding Inspector, or COMPANY approved equivalent.

10.6.2 Inspector shall have a demonstrated background and thorough knowledge of codes such as ANSI B 31.3, 31.4 and 31.8, ASME Section V and IX, API 620 and 650, AWS D1.1, EEMUA 158 required for execution of the Work.

10.6.3 Where NDT forms part of the Work, and Inspector is required to review or ensure NDT programs and results:

- Inspector shall have been previously qualified and certified to a minimum ASNT Level II or equivalent in the relevant method(s).
- When performing, reviewing or ensuring NDT in Visual Testing, Magnetic Particle Testing, Penetrant Testing, Radiographic Testing or Ultrasonic Testing, Inspector shall be certified in the specific method(s).
- When performing, reviewing or ensuring RTFI Inspector shall be certified in RTFI.

10.7 Nondestructive Testing (NDT) Personnel:

10.7.1 All CONTRACTOR and Subcontractor personnel located in Country responsible for performing NDT operations, or interpreting, reviewing, ensuring or auditing NDT operations shall meet COMPANY's requirement as listed in the Project's Engineering Specifications.

10.7.2 All CONTRACTOR and Subcontractor NDT and personnel shall hold current certification where outlined below attesting to their NDT qualifications:

- NDT Level III personnel: such personnel shall have been tested and certified by ASNT (or equivalent nationally recognized program as approved by COMPANY) in the required NDT method(s) specified in the Contract and shall be required to fulfill the full scope of a practicing Level III including, but not limited to: method application, interpretation of results, interpretation of codes and standards, preparation of procedures, and training of Level I and Level II personnel.
- NDT level II personnel have been tested and certified by ASNT or equivalent shall be approved to perform the works.
- Radiograph Film Interpreter: such personnel shall be certified by COMPANY in RTFI when performing, reviewing, ensuring or auditing RTFI.
- NDT Coordinator: individual with demonstrated knowledge in welding processes & NDT techniques.

10.8 Plant and Equipment:

10.8.1 Inspector shall demonstrate working knowledge of codes, as required by the scope of the Contract, such as ASME Sec I, V, VIII and IX, ANSI B31.3/4/8 and API 620/650 and AWS D1.1, required for the execution of the inspection Work.

10.8.2 As a minimum, Inspector shall have experience with:

a. Installation of equipment such as, pumps, motors, skids, valves, vessels, compressors, fired heaters, auxiliary equipment, packaged equipment in plant construction etc.
b. Piping systems and pipe line
c. Hot tap procedure
d. Vessels, tanks and spheres construction
e. Structural steel erection

f. Hot/cold Insulation

10.9 Heat Treatment:

10.9.1 Inspector shall have direct knowledge of all aspects of heat treatment and with the types of equipment and monitoring devices (thermocouples etc.) to be used for the Work, such as electrical resistance heating elements, induction coils, Furnace, or gas fired heaters.

10.9.2 Inspector shall be able to verify the heat treatment parameters to approved heat treatment procedures.

10.9.3 If applicable, Inspector shall be thoroughly familiar with the heat treating requirements of ASME B31.3 and ASME Section VIII Division 1.

10.10 Positive Materials Identification (PMI):

10.10.1 The Inspector(s) performing the PMI test should be knowledgeable about all aspects of operation of PMI test equipment, the PMI test method used and standards like API recommended practice 578.

10.10.2 Qualifications of the person performing the PMI test, including training and experience, shall be submitted for review and approval by COMPANY.

10.11 Civil:

10.11.1 Shall have an American Concrete Institute (ACI) certification, NICET Level II certification or an equivalent system acceptable to COMPANY.

10.11.2 Inspector shall demonstrate a thorough working knowledge of recognized building codes such as the Uniform Building Code (UBC) or equivalent standards.

10.11.3 As applicable for the Work, Inspector shall demonstrate thorough knowledge and proven ability in construction techniques with emphasis on soil mechanics, foundations, retaining walls, structural steel, masonry, building interiors, building finishes, roof systems, and asphalt.

10.12 Dimensional Control Surveyor

10.12.1 Dimensional Control Surveyor shall minimum have a Civil/Structural Engineering degree with minimum of 10 (ten) year's survey experience in the oil and gas industry.

10.12.2 Shall be proficient in latest surveying techniques, using modern surveying instruments and interpreting the results.

10.13 Batch Plant:

10.13.1 Inspector shall have direct experience in inspection of asphalt/concrete mix ingredients in accordance with the applicable ASTM, AASHTO or ACI procedures and guidelines.

10.13.2 Inspector shall be able to assess the plant Quality Control laboratory to determine that its equipment, procedures/techniques, sample recording and result reporting compliance with the applicable standards.

10.13.3 Inspector shall be able to evaluate batch plants capability and safety to meet COMPANY requirements.

10.13.4 Inspector shall review and perform full-scale plant trials to determine the required engineering properties.

10.14 Coating

10.14.1 Inspector shall demonstrate a thorough working knowledge and proven ability of all phases and types of critical coating applications and methods and recognized industry standards and critical coatings.

10.14.2 Coating Inspector shall be certified as a National Association of Corrosion Engineers (NACE) Level II Certification, CSWIP Level II, or equivalent standard acceptable to COMPANY.

10.14.3 Additionally, Inspector shall meet COMPANY qualification requirements for the Project's Engineering Standards.

10.15 Plumbing:

10.15.1 Inspector shall demonstrate a thorough knowledge of codes such as the Uniform Plumbing or equivalent standards.

10.15.2 Certification by associations such as International Code Council, International Association of Plumbing and Mechanical Officials, and National Fire Protection Association.

10.16 HVAC System:

10.16.1 Inspector shall demonstrate a thorough working knowledge of codes such as the Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) Codes, Uniform Mechanical Code, NFPA 90A, ASHRAE Handbooks and/or equivalent standards.

10.17 Lifting Equipment/Crane (Fixed, Overhead, Elevators):

10.17.1 Inspector shall demonstrate a thorough working knowledge of codes such as ANSI-A17.1 and 17.2, ANSI-B30.1 through B30.16, or equivalent standards.

10.17.2 Certification and training in LEEA Courses Part One – Six.

10.18 Electrical:

10.18.1 Inspector shall demonstrate a thorough working knowledge of the National Electric Code/NFPA 70, IEC or equivalent standards.

10.18.2 Inspector shall also have working knowledge of electrical installations including materials, methods, specifications, and hazardous location identification for oil and gas or petrochemical industries.

10.19 Communication:

10.19.1 Inspector shall demonstrate a thorough working knowledge of telecommunications in the field of outside plant installation as well as PDS (Premise Distribution System) installation.

10.19.2 Inspector shall be familiar with North American or International Telecommunications Standards; Building Industry Consulting Services International - Telecommunications Distribution Methods Manual (BICSI-TDMM); National Electrical Codes; and National Electrical Safety Codes, or their equivalents.

10.20 Instrumentation:

10.20.1 Inspector shall be familiar with the international industry codes and standards related to Intrinsically safe systems and electrical systems for instrumentation such as; ISA RP12.6, ISA

RP12.2.02, ISA TR12., ANSI MC96.1, IEEE 518, IEEE 1100, IEC 60529, NEMA ICS 6, NEMA 250, NEMA VE 1, NEMA VE 2, NFPA 70/NEC and UL 94.

10.20.2 As a minimum, Inspector shall be able to inspect complete loop checking, wiring continuity and color coding, start-up, and troubleshooting.

10.20.3 When required, Inspector shall be able to evaluate FAT and demonstrate a thorough working knowledge of international codes and standards related to packaged units instrumentation such as, DCS, SCADA Systems, RTU and ESD systems.

10.21 Cathodic Protection:

10.21.1 Shall be certified to minimum NACE CP-3 Cathodic Protection Technologist or equivalent certification acceptable to COMPANY.

10.21.2 Inspector shall have two (2) years documented experience in the field of cathodic protection for the required specific application.

10.21.3 Inspector shall be able to demonstrate a thorough working knowledge of international codes and standards related to inspecting Cathodic Protection System and its components, such as anode installation, cable installation, and positive and negative cable hookups to rectifier.

10.21.4 Inspector shall be able to interpret and assess cathodic protection design packages to ensure compliance with the contractual requirements.

11 OFFSHORE AND SUBSEA INSPECTION PERSONNEL

CONTRACTOR shall supply fully qualified and experienced personnel to undertake the services. Experience and qualifications shall be commensurate with the service being provided.

All personnel supplied under the services shall have experience in the field of subsea inspections of equipment such as valves, trees, tree block, chokes, tubing hangers, flow loop(s), manifold equipments, controls, umbilical's, flow-lines, risers, jacket structures and pipelines.

All personnel supplied under the services shall be fluent in written and verbal English in addition to the local language of the region/country of the activity.

All personnel shall be computer literate with adequate skills to produce electronic reports, spreadsheets and input to databases.

All personnel shall be familiar with related oil and gas industry codes and standards in general use, including all relevant CSWIP & NACE codes and standards.

All personnel shall demonstrate working knowledge of codes as required by the purchase order, such as API Specifications 17D, 17E, 17J, 17N, 6A, PSL 3, ISO 13628-1, ISO 13628-4, ISO 13628-6, ISO 13628-8, ISO 13628-9, NACE and testing equipment required for the inspection of subsea equipment.

Minimum qualifications and experience for key personnel are detailed below:

11.1 Subsea Inspection Engineer

11.1.1 Engineering/HNC/HND degree or equivalent. Minimum ten (10) years experience in the subsea inspection and testing of offshore oil and gas installations and facilities, pipelines, and marine facilities.

11.1.2 Good knowledge and experience of subsea inspection techniques and technology, including underwater NDT, ROVs, corrosion monitoring and diving operations.

11.1.3 Must be familiar with the relevant subsea inspection qualifications.

11.1.4 Must be able to write inspection scopes of Work and prepare subsea inspection report forms complete with structural sketches.

11.2 Underwater Inspector

11.2.1 3.1U Underwater Inspector

- Qualified in accordance with CSWIP 3.1U or an approved equivalent.
- Five (5) years experience (two (2) years related to the oil or petrochemical industry) in visual inspection of underwater structures, use of camera, both still film and CCTV, measurement of cathodic potentials and the use of ultrasonic digital thickness meters.

11.2.2 3.2U Underwater Inspector

- Qualified in accordance with CSWIP 3.2U or an approved equivalent.
- Five (5) years experience (two (2) years related to the oil and petrochemical industry) in the techniques included in the CSWIP 3.1U requirements. Additionally, be able to apply underwater magnetic particle inspection techniques and A-scan techniques using compression wave probes.

11.2.3 ROV Inspector

- The ROV Inspector is an above water member of the inspection team.
- Qualified in accordance with CSWIP 3.3U or an approved equivalent.
- Five (5) years experience (three (3) years related to the oil or petrochemical industry) in the techniques included in the CSWIP 3.1U requirements, recording and processing data, use of communication systems, have knowledge of QA relevancy to underwater inspection and of a remotely applied inspection system.
- Since remote visual inspection (RVI) requires good visual acuity, CONTRACTOR must provide evidence those procedures are in place to prequalify inspection personnel in remote visual inspection. This written practice shall include the following points:
- Vision qualification testing;
- Methods used to test personnel for competency;
- Documentation of the above points;
- The written practice shall be based on the types of equipment used.

11.2.3.1 ROV inspectors shall be able to perform specific calibrations, interpret test results and make final evaluations, including documentation preparation. Recommended requirements are:

- ROV inspectors shall have good visual acuity and color perception.
- As ROV reliability relies strongly on good vision, personnel shall have a minimum of 20/20 near visual acuity in both eyes (corrected or uncorrected).

- ROV personnel eyesight shall not suffer from astigmatism or poor depth perception.

11.2.3.2 ROV inspectors shall be screened for visual performance using a variety of tests including color/contrast discrimination using color plates such as Ishihara, a set of photographs with representative defects or practical tests on specimens that have representative VT indications.

11.2.3.3 The preferred method is performance demonstration on representative specimens.

11.2.4 Underwater Inspection Controller

- Qualified to CSWIP 3.4U or an approved equivalent.
- Five (5) years experience (three (3) years related to the oil or petrochemical industry) in all aspects of the 3.3U ROV in addition to the techniques included in 3.2U requirements. Also have knowledge of diving systems, capabilities and limitations of ROV's and an understanding of inspection planning and briefing.

12 AUDIT

12.1 CONTRACTOR shall have an audit schedule in place to verify and demonstrate the competency of deployed personnel on COMPANY projects and for shop inspections.

12.2 The competency audit results shall be recorded and maintained for further reviews, any deficiencies noted shall be immediately rectified.

12.3 CONTRACTOR's auditor shall have demonstrated knowledge of ISO 10005: Quality Management System-Guidelines for Quality Plans and certified as ISO 9001: quality management systems auditor, or equivalent quality verification.

13 COMPETANCY ASSESSMENT AND RECORDS

13.1. Inspectors shall be qualified in the discipline in which they are performing inspections. COMPANY reserves the right to remove individual inspectors.

13.2. CONTRACTOR shall have a competency review system in place, aligned with the above requirements, to verify and demonstrate the competency of deployed personnel.

13.3. The records of qualification, certification and training shall be maintained and made available for COMPANY review at all times.

13.4. All training records shall be maintained in a COMPANY acceptable format (see next page for sample format) for at least three (3) years or the duration of the project, whichever is the longer.

TRAINING RECORD

Training/Awareness program (name):

Group ☐ ***On-the-job*** ☐ **Self-study** ☐ **External** ☐ **From:** **To:**

Program description/objectives

Instructor/Supervisor

Participating trainee(s):

Reference documents/materials

Effectiveness verification (method and results)

I certify that above-listed personnel successfully completed training.

Name, title:

Date:

Name, title: **Date:**

COMMENTS

Checkboxes are symbols from the ***Wingdings*** *font. The unchecked box is character 168 and the checked box is character 254. To change form unchecked to checked box:*

- *Place the cursor directly in front of the box and double-click the mouse. This will bring up the* ***Symbol*** *dialog box (you can also open this dialog box by selecting* ***Symbol…*** *from the* ***Insert*** *menu),*
- *Make sure that the selected font is* ***Wingdings*** *(it should be),*
- *Type in the number* ***254*** *into the* ***Character code*** *field (or visually look for the checked box symbol and select it), and*
- *Click the Insert button and close the dialog box.*

To change form checked to unchecked box, do the same but use the character number 168 instead.

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PHU QUOC PETROLEUM OPERATING COMPANY

VIETNAM BLOCK B GAS PROJECT

PROVISION OF EPCI FOR CENTRAL PRODUCTION PLATFORM, LIVING QUARTER PLATFORM AND FLARE TOWER

CONTRACT NO.: PQ-CTR-DEV-2022-005

DOCUMENT TITLE : SPECIFICATION FOR PROTECTIVE COATINGS

PQPOC Approval	
Document return Code	**PQPOC Signature**
☐ Code 1 Reviewed and Accepted with no Comment ☐ Code 2 Reviewed/With Comment ☐ Code 3 Not Accepted/ Revise/Resubmit ☐ Code 4 Not Reviewed	Name : _____ Signature : _____ Date : _____

L01	31-May-24	Issued for Approval	NVK	NTN	TTT
K01	22-Apr-24	Issued for Review	NVK	NTN	TTT
J01	17-Apr-24	Issued for IDC	NVK	NTN	TTT
REV	**DATE**	**DESCRIPTION**	**ORIG**	**CHK**	**APPR**

PQPOC Document Control No.	Project Code	Area Code	Discipline Code	Document Type	Originator Code	Sequence Number	Sheet Number	Revision
	PQ	CPC0	CRR	SPC	MPC	50001	00	L01

REVISION HISTORY

Rev. Date	Rev. No.	Detailed Description of Change	Ref. Section	Approved by
17-Apr-24	J01	Issued for IDC		
22-Apr-24	K01	Issued for Review		
31-May-24	L01	Issued for Approval		

(COMPANY Comments incorporated. This document was issued with document number as PQ-CPPT-CRR-SPC-MPC-50001-00 in previous revision K01. The area code got changed as per latest EMDR. This revision shall supersede revision K01 of PQ-CPPT-CRR-SPC-MPC-50001-00)

HOLDS LIST

Rev. Date	Rev. No.	Hold. No.	Description / Reason for Hold	Ref. Section
31-May-24	L01	01	Subject COMPANY approval for TQ No. PQ-HWP0-CRR-TQY-PMC-00004-00, Add Coating Systems to The Protective Coating Specification	Appendix 1

TABLE OF CONTENTS

1 GENERAL

A Consortium of McDermott Asia Pacific Sdn. Bhd. (McDermott/MDR) and PetroVietnam Technical Services Corporation (PTSC), hereafter referred to as CONTRACTOR has been awarded a Letter of Limited Award for Provision of Engineering, Procurement, Construction and Installation of Central Production Platform, Living Quarters Platform, Flare Tower and Bridges by Phu Quoc Petroleum Operating Company (PQPOC), hereafter referred to as COMPANY.

1.1 Purpose of The Document

The purpose of this specification is to define the requirements of coating materials, surface preparation, application, testing and inspection of the protective coating system (both internal lining and external coating) to be applied for the CPP, the LQ and Flare as presented in Section 1.3.

The specification is applicable to the offshore structure steel, piping, valves, equipment and vendor package. In addition, the internal coating and lining system for equipment are covered in this specification.

Riser coating is not included in this specification. Coating for riser is specified in the document No. PQ-CPP0-PPL-SPC-MPC-00003-00 - Specification for Riser External Corrosion Coating.

The coating system in this specification is considered to meet the durability of Very High (VH) as defined in ISO 12944-1. All coating systems including the manufacturer standard coating shall be suitable for corrosivity category defined in ISO 12944-2 as follows.

- Exposed to external offshore environment, corrosivity category CX.
- Exposed to splash zone, corrosivity category CX and Im4.
- Exposed to immerged zone, corrosivity category Im4.

CONTRACTOR shall prepare and develop detail procedure, Inspection and Test Plan and Matrix then submit to COMPANY for review and approval prior to commencement of work..

1.2 Project Overview

Blocks B&48/95 and 52/97 are located offshore southwestern Vietnam in a water depth of about 77 meters. The distance from the Blocks B&48/95 and 52/97 to Ca Mau is about 250 kilometers and to O Mon Power Center, about 400 kilometers (Figure 1).

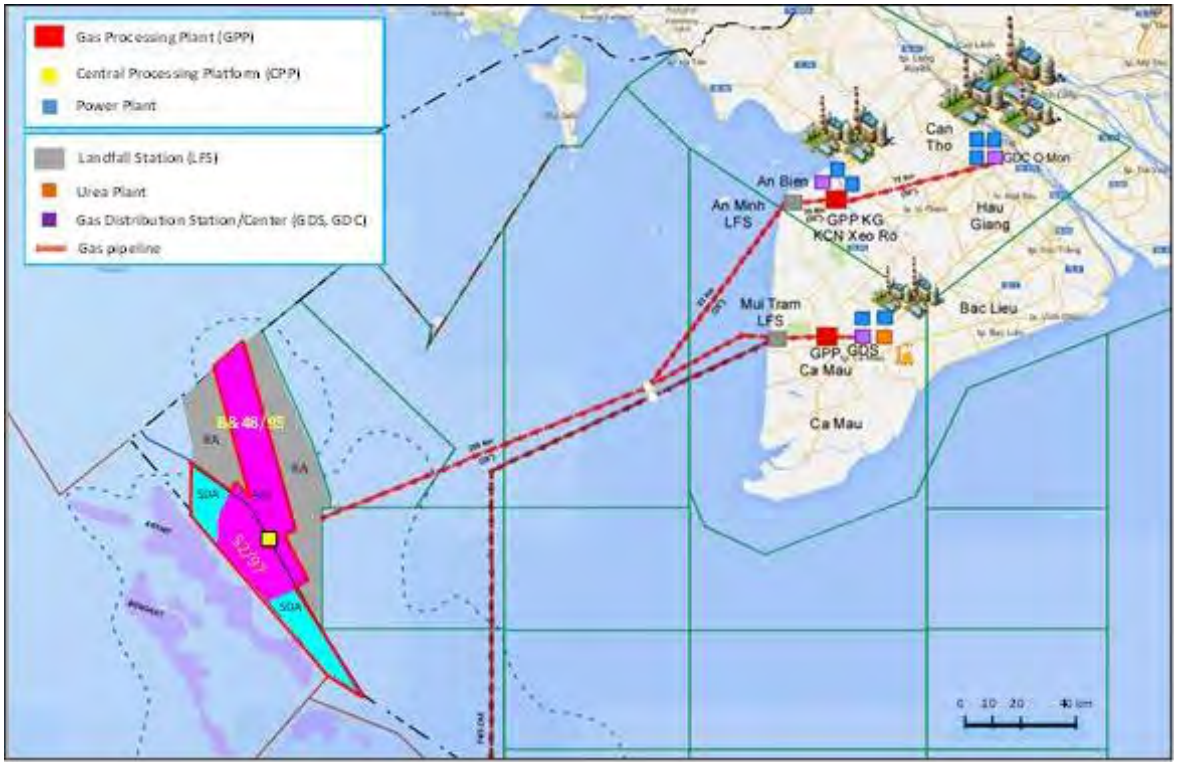


Figure 1 : Location of Block B 48/95 and 52/97

The Vietnam Block B Gas Project facilities comprise:

- Central Production Platform (“CPP”) with bridge linked flare structure;
- Living Quarters (“LQ”) Platform;
- Hub and Generic Wellhead Platforms (“WHP”);
- Trunk-lines and infield pipelines; and
- Floating Storage and Offloading (FSO) system for condensate storage and export.

These facilities will be installed and production and water injection wells drilled as needed to fulfil the contract gas sales requirements.

The asset will produce several thousand small reservoirs during field life. Consequently, there will be large variation in the gas composition values. The COMPANY plans to blend the producing reservoirs to meet the sales gas specification. A significant percentage of inert gas (mainly CO2) is expected, as well as traces of H2S, Arsenic, and Mercury.

The initial facilities will consist of four Hub / Wellhead Platforms, Trunk Lines, a Central Production Platform (CPP), a Living Quarter (LQ) Platform, Flare Platform, and an FSO. One Wellhead Platform will be bridge connected to the CPP. The three Hub Platforms act as gathering centers, receiving gas from other Wellhead Platforms, before routing the gas to the CPP.

All development wells are to be drilled and completed from remote Hubs or generic WHPs. The wells will be drilled by either jack-up or tender assisted rigs. The Wellhead / Hub Platforms will

be designed to accommodate either type of rig. No permanent drilling facilities will be provided on the Wellhead / Hub Platforms.

Hub and generic Wellhead Platforms are designed with 20 wellslots. The produced fluid will be collected in the manifold at the Wellhead / Hub Platforms, then routed to the CPP via Trunk-lines / in-field gathering lines. Booster compressors will be installed on Wellhead / Hub Platforms to maintain production and maximize reserve recovery by connecting the compressor suction line to the low-pressure wells with tubing head pressure 100-200 psig and routing the compressor discharge line to the production manifold which will the export well fluid to the infield pipeline. Hub platforms are designed toreceive additional production via pipelines from connectedWHPs and export via 20-inch trunk lines to the CPP. Generic WHPs export fluids via 16" infield pipelines to Hub Platforms. All remote WHPs in the initial development phase shall be ofthe Hub design.

At the CPP, all gas will be compressed and processed by dehydration, hydrocarbon dew-pointing and mercury removal to meet sales gas specification, then compressed and metered prior to export. Gas will be exported from the CPP to shore via a dedicated export pipeline to be developed and operated by PetroVietnam Gas. The facilities will be designed to deliverthe DCQ of 490 MMscfd and Maximum Daily Contract Quantity (MDCQ) of 575 MMscfd, with additional WHPs installed, drilled and tied-in to the CPP to maintain the capacity for the agreed plateau duration.

Produced water will be treated and disposed of via injection wells. Condensate will be stabilized and sent to the FSO for storage and later shipment. Electrical power will be generated by gas turbine generators for platform operations. Control for all offshore operations will take place at the Central Control Room (CCR) on the CPP. The manning requirement for the CPP and other facilities will be accommodated in an LQ platform, bridge linked to the CPP.

The preliminary field layout for the First Gas (Phase 1A) is shown in Figure 2.

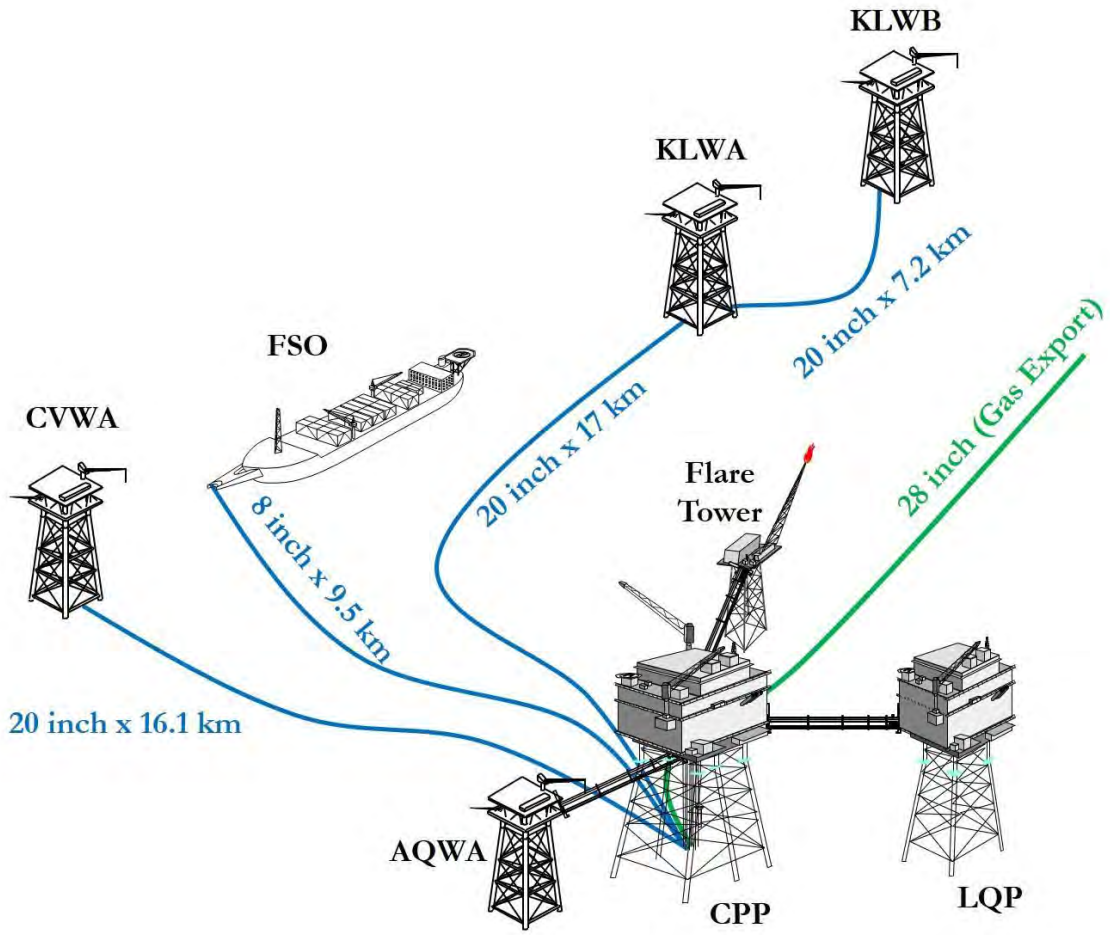


Figure 2 : Preliminary field layout for First Gas (Phase 1A)

1.3 EPCI #1 Project Scope Summary

CONTRACTOR scope of the Work under the Contract shall consist of Management and Administration, Engineering, Procurement, Fabrication, including Onshore Pre-Commissioning, Sea fastening and Loadout, Transportation, Installation, Offshore Hook-Up and Commissioning works for the CPP, the LQ and Flare as detailed below:

- One CPP Jacket/piles/topsides
- One Flare Jacket/piles/flare
- One LQP Jacket/piles/LQP topside
- Bridges connecting CPP to Flare, LQP and Wellhead Platform AQWA
- One SSIV Skid and Umbilical (Excluding Transportation and Installation)

2 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

2.1 Definitions

Table 2-1 Definitions

Definitions	Description
COMPANY	Shall mean Phu Quoc Petroleum Operating Company
CONTRACTOR (MPC)	Shall mean The Consortium of McDermott Asia Pacific Sdn. Bhd. ("McDermott") and PetroVietnam Technical Services Corporation ("PTSC")
WORK	Shall mean work or services being conducted by the CONTRACTOR including its Subcontractor for delivery of Engineering, Procurement, Construction & Installation (EPCI) of CPP, LQ Platform and Flare Tower of Vietnam Block B Gas Project ("EPCI #1")
PURCHASER	Shall mean the CONTRACTOR issuing the purchase order
VENDOR / SUPPLIER	Shall mean the party awarded by CONTRACTOR for the supply of scope of work
SUBCONTRACTOR	Shall mean the party awarded by CONTRACTOR for the supply of scope of work in term of services
Independent Verification Service (IVS)	Shall mean the Independent Agency contracted by COMPANY to provide Verification/ Certification serviced to PQPOC Field Development Project's Facilities from design review to construction & commissioning (startup) in accordance with rule & Regulations, applicable Codes & Standards, and Vietnam Register (VR) Regulations.
Third Party	Shall mean certifying Authority appointed by VENDOR for certifying specific equipment/equipment packages fabricated at VENDOR's scope.
Shall	Indicates required preferred course of action
Will	Indicates an intention of action

2.2 Acronyms

Table 2-2 Acronyms

Acronym	Description
ABS	Acrylonitrile Butadiene Styrene
ASTM	American Society for Testing and Materials
CuNi	Copper Nickel

Acronym	Description
CPT	Coating Procedure Testing
CPP	Central Production Platform
CRA	Corrosion Resistant Alloy
CS	Carbon Steel
DFT	Dry Film Thickness
DSS	Duplex Stainless Steel
EPCI	Engineering, Procurement, Construction and Installation
FEED	Front End Engineering Design
GRP	Glass Reinforced Plastic
ITP	Inspection & Testing Plan
ISO	International Organization for Standardization
MSDS	Material Safety Datasheet
NaCl	Sodium Chloride
NACE	National Association of Corrosion Engineers
NDFT	Nominal Dry Film Thickness
PFP	Passive Fire Protection
PLET	Pipeline-End Termination
PTFE	Polytetrafluorethylene
PVC	Polyvinyl Chloride
SS	Stainless Steel
SSPC	Society for Protective Coatings
TDS	Technical Datasheet
WFT	Wet Film Thickness
WHP	Wellhead Platform

2.3 Abbreviations

Table 2-3 Abbreviations

Abbreviations	Description
Doc	Document
No	Number
Rev	Revision

3 DOCUMENT REFERENCE

3.1 Project Specifications

Table 3-1 Project Specifications

No.	Doc. No.	Document Title	Rev. No.
1)	VNM-VPP-MEC-SPC-EDG-0000-00019-00-H01	FEED Design Update Specification for Protective Coating	Latest
2)	PQ-CPC0-CRR-RPT-MPC-00001-00	Material Selection Report	Latest
3)	PQ-CPC0-CNS-PCD-MPC-50015-00	Coating Procedure	Latest
4)	PQ-CPC0-QAC-ITP-MPC-50001-00	ITP for Surface Preparation and Coating	Latest
5)	PQ-CPC0-QAC-PCD-MPC-50003-00	Coating System Qualification Test Procedure	Latest
6)	PQ-CPC0-QAC-LST-MPC-50010-00	Project Coating and Painting Matrix	Latest
7)	PQ-CPP0-PPL-SPC-MPC-00003-00	Specification for Riser External Corrosion Coating	Latest
8)	PQ-GENR-CRR-TQY-MPC-50001-00	Propose to use zinc rich epoxy instead of inorganic zinc as primer coat for coating system BD-01	Latest
9)	PQ-HWP0-CRR-TQY-PMC-00004-00	Add Coating Systems to the Protective Coating Specification	Latest
10)	PQ-CPP0-CRR-TQY-MPC-00009-00	Coating Requirement for Bolting	Latest

3.2 Codes And Standards

Table 3-2 Codes and Standards

No.	Doc No.	Document Title	Year/ Edition
1.	ASTM A123	Standard Specification for Zinc (Hot Dip Galvanised) Coating on Iron and Steel Product	2017
2.	ASTM B117	Standard Practice for Operating Salt Spray Apparatus	2019
3.	ASTM D4285	Standard Test Method for "Indicating Oil or Water in Compressed Air	2018
4.	ASTM D4414	Standard Practice for Measurement of Wet Film	2020
5.	ASTM D4752	Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zink Rich Primers by Solvent Rub	2020
6.	ASTM D4940	Standard Test Method for Conductimetric Analysis of Water-Soluble Ionic Contamination of Blast Cleaning Abrasives	2020
7.	ASTM D7393	Standard Practice for Indicating Oil in Abrasives	2016
8.	ISO 2063-1	Thermal spraying - Zinc, aluminium and their alloys. Part 1: Design considerations and quality requirements for corrosion protection systems	2019

No.	Doc No.	Document Title	Year/ Edition
9.	ISO 2063-2	Thermal spraying - Zinc, aluminium and their alloys. Part 2: Execution of corrosion protection systems	2017
10.	ISO 2409	Paints and Varnishes – Cross-cut Test	2020
11.	ISO 8501-1	Preparation of Steel Substrates before Application of Paints and Related Products - Visual Assessment of Surface Cleanliness – Part 1: Rust Grades and Preparation Grades of Uncoated Steel Substrates and of Steel Substrates after Overall Removal of Previous Coatings	2007
12.	ISO 8501-3	Preparation of Steel Substrates before Application of Paints and Related Products - Tests for the Assessment of Surface Cleanliness - Part 3: Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure Sensitive Tape Method)	2006
13.	ISO 8502-3	Preparation of Steel Substrates before Application of Paints and Related Products – Tests for the Assessment of Surface Cleanliness – Part 3: Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure-Sensitive Tape Method)	2017
14.	ISO 8502-4	Preparation of Steel Substrates before Application of Paints and Related Products – Tests for the Assessment of Surface Cleanliness – Part 4: Guidance on the Estimation of the Probability of Condensation prior to Paint Application	2017
15.	ISO 8502-6	Preparation of Steel Substrates before Application of Paints and Related Products – Tests for the Assessment of Surface Cleanliness – Part 6: Extraction of Soluble Contaminants for Analysis	2020
16.	ISO 8502-9	Preparation of Steel Substrates before Application of Paints and Related Products – Tests for the Assessment of Surface Cleanliness – Part 9: Field Method for the Conductometric Determination of Water-Soluble Salts	2020
17.	ISO 8503-1	Preparation of Steel Substrates before Application of Paints and Related Products – Surface Roughness Characteristics of Blast-Cleaned Steel Substrates – Part 1: Specifications and Definitions for ISO Surface Profile Comparators for the Assessment of Abrasive Blast-Cleaned Surfaces	2012
18.	ISO 8503-2	Preparation of Steel Substrates before Application of Paints and Related Products – Surface Roughness Characteristics of Blast-Cleaned Steel Substrates – Part 2: Method for the Grading of Surface Profile of Abrasive Blast-Cleaned Steel – Comparator Procedure	2012
19.	ISO 8503-5,	Preparation of Steel Substrates before Application of Paints and Related Products - Surface Roughness Characteristics of Blast cleaned Steel Substrates -Part 5: Replica Tape Method for the Determination of the Surface Profile	2017
20.	ISO 12944 (all parts)	Paint and Varnishes – Corrosion Protection of Steel Structures by Protective Paint Systems	2017-2019
21.	ISO 14919	Thermal spraying - Wires, rods and cords for flame and arc spraying - Classification and technical supply conditions.	2015
22.	ISO 16276-1	Corrosion Protection of Steel Structures by Protective Paint Systems – Assessment of, and Acceptance Criteria for, the	2007

No.	Doc No.	Document Title	Year/ Edition
		Adhesion/Cohesion (fracture strength) of a Coating – Part 1: Pull-Off Testing	
23.	ISO 16276-2	Corrosion Protection of Steel Structures by Protective Paint Systems – Assessment of, and Acceptance Criteria for, the Adhesion / Cohesion (Fracture Strength) of a Coating – Part 2: Cross-cut Testing and X-cut Testing	2007
24.	ISO 19840	Paints and varnishes - Corrosion protection of steel structures by protective paint systems – Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces	2012
25.	ISO 29601	Paints and Varnishes – Corrosion Protection by Protective Paint Systems – Assessment of Porosity in a Dry Film	2011
26.	NACE SP0178	Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service	2007
27.	NACE No 12/AWS C2.23M/SSPC CS-23	Specification for the Application of Thermal Spray TSCs (Metallizing) of Aluminium, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel	2016
28.	NORSOK M-501	Surface preparation and protective coating	2022
29.	SSPC-SP 1	Solvent cleaning	2015
30.	SSPC-SP 16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals	2020
31.	UKCAA CAP 437	Standards for offshore helicopter landing areas	2003

3.3 Order Of Precedence

Where equal but conflicting requirements are specified, these shall be brought to the attention of the purchaser in writing. The order of precedence shall be:

1. Convention followed by Vietnam (MARPOL, SOLAS)
2. Applicable Regulation of Vietnam
3. Purchase Order/Service Order/Subcontract Agreement
4. Technical Requirements (Project Drawings and Data Sheets, Project Specifications, etc.)
5. International Codes and Standards

4 GENERAL REQUIREMEMTS

4.1 CONTRACTOR

CONTRACTOR shall have qualified personnel, procedures, knowledge and capability to produce quality surface preparation, coating application and inspection.

CONTRACTOR shall be evaluated by audit in accordance with project quality audit plan.

The CONTRACTOR shall furnish all labours, materials, and equipments to prepare properly the surface and to apply the protective coating in accordance with this specification.

4.2 Qualification Requirements

4.2.1 Pre-qualification material

The following coatings are required the pre-qualification tests for coating materials in accordance with NORSOK M-501, ISO 12944-5, ISO 19277 or equivalent.

- Coating system BD-01: all coating materials used for this system shall be pre-qualified.
- Coating systems BD-06, BD-10: Epoxy Glass Flake used for these systems shall be pre-qualified. Only topcoats already pre-qualified in the coating system BD-01shall be used.

The pre-qualification of materials shall be carried out by an independent laboratory certified to NS-EN ISO/IEC 17025.

4.2.2 Qualification of applicator

4.2.3. Qualification of coating operator

Blasters and Painters shall have relevant knowledge of health and safety hazard. They shall be qualified to tradesman level as blaster, painter, etc.

Blaster shall be competent and skilful with the following typical operations:

- Methods for surface preparation
- Blast-cleaning equipment set up.
- Abrasives used (type, size)
- Surface quality required (surface preparation grade, profile, etc.)

Painter shall be competent and skilful with the following typical operations:

- Painting equipment set up.
- Paint material used (generic type of paints, shelf life, mixing ratio, mixing method, thinner, percent thinning, pot life, thickness required).

4.2.4 Qualification of metal spray operators

Only thermal sprayers pass the practical test on test panels as described in the CONTRACTOR's Qualification Test Procedure are allowed to spray the TSA coating during the CPT and production.

4.2.3 Painting Inspector

Personnel carrying out inspection or verification shall be qualified in accordance with NACE/ AMPP/ SSPC/ FROSIO/ ICORR-Inspector level III, BGAS- Level. 1

Certified as inspector level II of NACE/MAPP/BGAS may carry out the inspection work under the supervision of an inspector level III.

4.2.4 Qualification of procedure

The coating procedures shall be qualified under realistic conditions likely to be present during coating application. This means the CPT shall be carried out under the same environmental conditions as the actual coating work. The qualification test procedure shall be submitted to the COMPANY for review and approval prior to the CPT.

5 SPECIFIC REQUIREMENTS

5.1 Coating Exclusion

In general, the following must not be primed or painted, either for indoor or outdoor installation, unless otherwise specified:

- Raised faces on flanges for valves, pipes and all equipments & packages. The machined raised surface shall be protected during blasting and painting. The protection applied to the raised faces shall be sufficiently robust to withstand abrasive blasting pressures. The remaining surface of the flanges and boltholes shall be abrasive blast cleaned and painted in accordance with the specified coating system.
- The contact surface of earthing bosses shall be masked after blast cleaning.
- Non-ferrous metal surfaces such as Titanium, marine grade Aluminium, Copper, Cu-Ni, Nickel bronze, Bronze, Chrome plate, Brass unless identification/colour coding is required.
- Non-metallic materials such as plastic, glass reinforced plastic (GRP) similar materials unless identification/ colour cording is required.
- Plastic pipe and fittings including Polyethylene, Polypropylene, Polyvinyl chloride, Acrylonitrile Butadiene Styrene.
- Cables and cable trays.
- Identification tags and nameplates. Surface preparation and coatings shall be continuous under identification tags and plates. Nameplate and tags shall be kept clean and legible.
- Threads of bolting and adjusting screws and studbolts for flanges.
- Surfaces that have permanent coatings already applied.
- Interior of tanks and vessels unless otherwise noted.
- Field weld margins. Areas to be field welded shall be masked after blasting to leave 50mm un-primed margin. Each layer of coating shall require a further 50 mm masked margin prior to over coating to facilitate final touch up of field welds.
- Pipe insulation jacketing cladding material.
- Surfaces below the splash zone unless otherwise noted.
- Stainless Steel (CRA) tubing.
- Stainless steel when used for non-process, non-pressurised applications such as instrument enclosure, junction box and control panel, electronic transmitter case/ housing.
- Uninsulated duplex stainless steel (22Cr DSS) used for processing, pressurized with operating lower than 100°C.
- Uninsulated super duplex stainless steel (25Cr DSS) used for processing, pressurized with operating lower than 110°C.
- Uninsulated stainless steel type 6Mo used for processing, pressurized with operating lower than 120°C.
- Cathodic protection anode.

- Greased and lubricated fitting.
- Expansion joint (if applicable).
- PTFE coated, electroplated and hard faced or other specially coated items.
- HDG grating.
- Rotating equipment coupling.
- Permanent sealed internal area.
- Insulated and uninsulated stainless steel heating/ventilation/air-conditioning ducts.

Welded stainless steel to carbon will be overcoat onto the stainless steel by at least 50mm.

5.2 Coating of Bolts for Topside Piping, Equipment (Pressurized Items)

Ferrous and ferrous-alloy bolting shall be purchased with coating as follows:

- For operating temperatures up to and including 230°C, bolts and nuts of following material:
  - Carbon Steel: 5 – 10µm of zinc nickel plating 20 - 25µm of PTFE / Fluorocarbon coat Total thickness shall be 25 – 35µm.
  - CRA: PTFE / Fluorocarbon coated with Americote or equivalent.
- For operating temperature over 230°C, all type of bolts threads shall be coated with a high temperature bolt coating material and an anti-seize thread compound.
  - Ceramic coating: 10 – 15µm of ceramic coating + 15 – 20µm of sealer / topcoat. Total thickness shall be 25 – 35µm.

The zinc nickel plating basecoat shall be 11% -15% nickel and 85% -89% zinc, thickness shall be 5-10 µm. The fluorocarbon topcoat with a minimum 25 µm thickness is intended to reduce torque-up friction.

Since there are various grades of bolting materials, fluorocarbon topcoat colour should differ in order to be able to identify various grades of materials. Fluorocarbon coating colour coding shall follow as indicated in Section 10.3.

The zinc nickel plating with fluorocarbon coating topcoat method used by the VENDOR shall have demonstrated/ passed at least 4500 hours in salt fog spray test as per ASTM B117.

The back of carbon steel flanges shall be primed, and sealer coated only prior to assembly. Following assembly, the remaining of the coating system shall be applied on the joint including the bolting.

5.3 Internal Coating and Lining

When a painting system is used for internal protection of equipment, it will be usually be associated with cathodic protection by sacrificial anode, unless otherwise specified (for example, sacrificial anodes are not recommended for potable/drinking water service). The chosen painting shall be compatible with cathodic protection.

Stainless steel vessel and storage tanks do not require internal coating, unless otherwise specified.

All surface areas to be coated shall be made fully accessible for the relevant coating application. All loose internals shall be taken out and corresponding mounting bolt shall be protected to allow simple reinstallation.

Tank, vessel, and other capacities shall not be closed before the completed solvent evaporation to ensure the full curing of the coating.

5.4 Equipment Manufacturer Standards

For standard production equipment or off-the shelf items including pumps, motor, gas turbines and compressor etc. coated with manufacture standard coating system, it shall be the manufacture responsible to ensure the coating system suitable for the anticipated service temperature and environment without breakdown and failure.

The manufacture standard coating system shall be suitable for corrosivity category as follows.

- Exposed to external offshore environment, corrosivity category CX.
- Exposed to internal room with HVAC, corrosivity category C2.
- Exposed to splash zone, corrosivity category CX and Im4.
- Exposed to immerged zone, corrosivity category Im4.

Vendors/suppliers shall propose their paint system that complies with the above corrosivity category for Company review and approval.

6 SURFACE PREPARATION

6.1 General Requirements

The surface preparation for each system shall comply with the requirements detailed in APPENDIX 1.

Steel material subject to surface preparation in new building phase shall not excess rust grade B according to ISO-8501-1.

Sharp edges and corners should be ground smooth to at least 3 mm radius before surface preparation and painting. Surface imperfections shall be minimum grade P2 according to ISO 8501-3.

All bolt holes including U-bolt holes in pipe supports shall be drilled and ground smooth before initiating blasting operations unless otherwise approved by COMPANY.

All welds shall be inspected and if necessary repaired prior to final blast cleaning of the area.

Where solvent cleaning is required prior to blast cleaning or power tool cleaning, it shall be done so in accordance with SSPC SP-1. Water soluble degreaser is preferred since solvent merely spread the oil or grease.

Prior to the blast cleaning and/or prior to any painting operation, the surface shall be free of any contamination and any excessive rust scale shall be removed.

Surface soluble salt level shall be determined in accordance with ISO 8502-6 and ISO 8502-9. The maximum content of soluble impurities of the blast cleaned surface shall not exceed a conductivity corresponding to a NaCI content of 20mg/m2 for all new construction/new build.

CONTRACTOR shall protect all equipment that is not to be painted or may be affected by the presence of abrasives or paint. Special attention shall be paid to avoid splashes of zinc paint on equipment made on austenitic stainless steels.

6.2 Abrasive Blasting

Abrasive blast cleaning is the preferred method of surface preparation except in hazardous areas where blast cleaning is not permitted.

Unless otherwise approved by COMPANY, surface to be coated shall be abrasive blasted as per requirement specified in the APPENDIX 1.

The surface profile and the anchor pattern for the surface to be coated shall be in accordance with this specification.

Blasting abrasive shall be dry, clean and free from contaminant that will be detrimental to the coating performance. The properties of abrasives for use in blast cleaning CS steels and SS steel shall meet the requirements of the relevant parts of ISO 11124 and ISO 11126 respectively.

Abrasive shall be non-ferrous and chloride free when used on stainless steel and non-ferrous surface.

Silica sand shall not be used due to the possibility of personnel health hazard from ingested silica dust.

Conductivity of all abrasive shall be less than 150.10^{-6} Siemen/cm as per ASTM D4940.

Prior to abrasive blasting, all parts of control valves, flanges, nametags, electrical fixtures or other delicate equipment and non-ferrous materials, that may be exposed to either blast or abrasive material, shall be properly protected from the blasting medium.

After blasting, the surface shall be blown down with compressed air for visual inspection. Any unsatisfactory areas shall be re-blasted.

Blast cleaning shall not be conducted when the relative humidity is greater than 85%. Metal temperature has to be >3ºC above dew point. Water, oil and contaminants shall be removed from blast cleaning pressure source prior to and as required during, blasting. Prior to blast cleaning, and only where necessary, oil, grease or other foreign contaminants shall be removed by water soluble degreaser.

In the event rusting occurs after completion of surface preparation, the surface shall be re-blasted and cleaned and potential chloride contamination removed.

Compressed air for abrasive blasting shall be clean, dry and oil free. Adequate operating moisture separator and traps shall be provided, and they shall be kept empties of water and oil. The presence of oil water shall be determined in accordance with ASTM D4285 at the beginning of the shift and every four hours subsequently.

On detection of contamination with oil or water, all activities requiring compressed air shall be suspended until system is cleaned and source of problem is rectified.

6.2.1 Carbon Steel and Low Alloy Steel Surface

Carbon steel to be coated shall be blast-cleaned in accordance with SSPC SP-10 or Sa 2½ as per ISO 8501-1 unless otherwise specified (See APPENDIX 1).

Blasting abrasive shall be dry, clean and of a type and size to give an angular anchor profile as specified in each coating system.

6.2.2 Stainless Steel and Non-Ferreous Surface

Stainless steel and non- ferrous substrates (if applicable) shall be segregated from carbon steel during surface preparation and application of primer.

Blast cleaning shall be carried by smooth sweep blasting as per SSPC-SP16 using the non-metallic abrasive.

Stainless steel and non-Ferreous surface requiring coatings shall be blast cleaned using non-metallic blasting abrasive such as Garnet or Aluminium Oxide.

Copper slag, steel shots and steel grits shall not be used.

6.2.3 Galvanised Surface

Galvanised surface to be painted shall be solvent cleaning in accordance with SSPC-SP1. Blast cleaning shall be carried out by light sweep blasting as per SSPC-SP16 using non-metallic abrasive.

6.2.4 Power Tool Cleaning

Power tool cleaning per SP-3 is allowed as surface preparation on a case-by-case basis with prior written approval by the COMPANY on small damaged areas as defined by the COMPANY. Mechanical Power Tooling shall be applied for the grade of cleanliness of St 3 as ISO 8501-1.

The power tool cleaning shall be carried out in accordance with the requirements defined in SSPC-SP11.

Stainless steel surface shall not be treated with carbon steel cleaning tools or any tool that used on carbon steel previously.

All repairs shall be feathered approximately 25 mm (1”) into the adjacent undamaged coating.

Power Tool Cleaning Procedure is included in the document No. PQ-CPC0-CNS-PCD-MPC-50015-00, Coating Procedure. The Applicator / CONTRACTOR shall submit the document for review and approval by the COMPANY.

6.2.5 Spot Blast Cleaning

Large repair shall be spot blasted with abrasive unless hand/ power tool cleaning is approved by COMPANY.

Spot blast cleaning shall utilize small straight bore blasting nozzle in surface preparation of weld area, localized coating damages exposing bare steel, local corrosion areas, etc.

Large bore venturi type blasting nozzle shall not be permitted in spot blast cleaning to prevent over blast damages to adjoining coatings.

6.2.6 Automatic Blast

The use of automatic blast equipment is acceptable when the specified anchor profile, degree of cleanliness, and cleanliness of abrasive can be achieved and maintained.

The operating mix of abrasive will contain enough sharp/angular grits to obtain a predominantly angular blast profile. Peened blast profile is not acceptable.

6.2.7 Housekeeping

After blast cleaning operations, spent grits shall be completely removed in the area of work. When air blowing is to be done to clean off spent grits, the area should be clear of non-painting personnel to prevent health risk and injury to other personnel in the work area.

7 COATING PROCEDURE

7.1 Material Coating System

7.1.1 Material Supplier

All coating materials or paints shall be obtained from approved manufacture by COMPANY using the general description for specific systems given in APPENDIX 1.

Paint system (i.e., primer, undercoat and finish coat) shall be from the same material manufacture to ensure compatibility.

The manufacturer shall be one of the following unless otherwise approved by COMPANY:

- International
- Carboline
- Hempel
- Jotun Paints
- Belzona
- Sherwin-Williams (Formerly Leigh's Paints)
- Oasis Ameron Company Ltd
- PV Paint

All coating materials or paints shall be approved by COMPANY prior to application after submission of technical data sheets and details of successful performance history.

7.1.2 Coating System

The coating systems and the required surface preparations are listed in APPENDIX 1.

7.1.3 Packing and Storage

All coating material or paints shall be furnished in unopened containers and shall be properly labelled as to their contents, date of manufacture and batch identification number. If coating materials require the addition of a catalyst, the pot life under application conditions shall be clearly stated on the label. This pot life shall not be exceeded.

All materials to be stored out of direct sunlight in ventilated areas and away from heat sources, in accordance with manufacturers recommendations.

7.1.4 Mixing

All components shall be thoroughly mixed by mechanical means. Mixing shall be done in containers free from grease, other paint and contaminants. Multi component coatings shall have the components accurately measured.

7.1.5 Thinning

No thinner shall be added unless necessary for proper application. Thinning shall not exceed limitation set by the manufacturer. Only manufacturer's specified thinner to be used.

7.1.6 Safety

Manufacturer's instructions including safety precautions are a part of this Specification. In case of conflict, the manufacturer's mandatory instructions shall govern.

7.2 General Coating Application

7.2.1 Environmental Conditions

No coating application shall be carried out under bad weather conditions that may cause unsatisfactory results. Adequate steps shall be taken to protect coated surfaces from the weather during the curing period. Coatings shall not be applied when the following conditions exist:

- Wet surfaces.
- Steel surface temperature is less than 3°C above the dew point.
- When relative humidity exceeds manufacturer recommendations or 85%, whichever is the lower (90% RH for inorganic zinc silicate).
- The weather is rainy, foggy, except under shelter, and subject to verification of the atmospheric condition.
- When ambient temperature is below 10°C; or when the surface temperature is high enough to cause blistering, porosity or other damaging effects to the coating.

All possible precautions shall be taken to eliminate dust before and during the painting process.

7.2.2 Pre-construction Primer

Pre-construction primer may be applied upon receipt of the steel plate and/or piping. This may take the form of a thin coat of inorganic zinc silicate (around 25µm) or the specified primer coating thickness.

If the pre-construction primer is a thin film zinc primer, then the surface shall be totally abrasive blasted to achieve the specified surface cleanliness and roughness profile prior to application of the specified coating system.

If the pre-construction primer is the specified primer applied over the specified surface preparation (i.e., cleanliness and roughness) at the specified thickness, then the primer shall be over coated by a tie-coat (type and thickness to be approved by the COMPANY), e.g., 25µm to 35µm zinc phosphate polyamide epoxy tie-coat, in order to minimize surface damage and prolong re-coat time.

Where pre-construction is the specified primer and sealer coat are applied on incoming materials and pre-fabricated steel items, the second coat under Coating System 1 shall be changed to epoxy sealer coat while maintaining the original system total thickness.

The selection of the tie-coat shall be such that:

- It is compatible with the primer and the specified build coat.
- It is a genuinely manufactured tie coat product tinted to oxide red with good hiding power when applied at 25µm to 35µm nominal dry film thickness.
- It does not impair the overall cohesive strength of the applied coating system.
- It can be coated by the specified build coats without the need for additional abrasive blasting (Note: It will require surface cleaning, e.g., washing with 10-30 MPa water jet, and dried prior to over coating to remove the zinc salts).

Shop primer is for temporary protection only. It shall be completely removed before the application of the final painting system. Surface preparation, grade of cleanliness and surface profile as specified in each coating system.

7.2.3 Primer Coating

All abrasive blasted surfaces must be prime coated with one complete application within 4 hours after blasting and before oxidation take place.

Oxidized surfaces shall be re-blast cleaned to the specified cleanliness and anchor profile prior to primer application.

Deck and skid surfaces shall be blasted and prime coated prior to installation of equipment. Where surface preparation is required after equipment installation, protective casings/boxes shall be installed on each equipment to prevent blasting grits ingress and contaminating the equipment.

After blast cleaning, a thorough clean-up of spent blasting grits and blasting residue shall be carried out to maintain a clean and safe working area.

The CONTRACTOR/Applicator shall ensure that the deck primer coat shall be maintained in good condition until the application of the subsequent coats.

All damage to deck primer coat shall be repaired prior to application of the subsequent coats.

Power tool cleaning after equipment installation is permitted on a case-by-case basis with prior written approval by the COMPANY.

If the second coat is not applied immediately after a zinc rich primer has cured, or if the primer is exposed to humid or outdoor conditions prior to application of the second coat, a tie-coat/sealer shall be applied on top of the primer immediately after the primer has cured to prevent oxidation of the zinc. This tie-coat/sealer shall either be of a thickness 30 to 50 µm or prequalified as a part of the coating system.

7.2.4 Dryness

Each coat shall be properly cured prior to the application of succeeding coats. The drying times specified by the manufacturer shall be always observed.

7.2.5 Recoating

The maximum and minimum re-coating interval specified by the paint manufacturer shall be observed before successive coats are applied. The only exception to this may be after the application of a mist coat where the recommended re-coat interval may be reduced in accordance with the paint manufacturer's recommendations.

Any thin spots or area missed in the application shall be re-coated and permitted to dry before the next coat is applied.

All areas such as external corners and edges, welds, bolts, nuts and interstices (excluding galvanised surfaces) shall receive a "stripe" coat prior to application of the specified coat (excluding the inorganic zinc silicate primer) to ensure these areas have at least the minimum specified film thickness as to ensure continuity of the coating. The "stripe" coat shall be allowed to become touch dry prior to coating with the specified coat.

When successive coats of the same product have been specified, alternate coats shall be tinted sufficiently to produce enough contrast to indicate complete coverage of the surface. When the paint is the colour of steel, or when the tinting of the final coat is not acceptable, the first coat to be applied shall be tinted. The tinting material shall be compatible with the material and not detrimental to its service life.

7.2.6 Coating Thickness

The minimum specified dry film thickness for each coat shall be applied. For low and rejected coating DFT, the coating system shall be repaired in accordance with this specification.

The CONTRACTOR/Applicator shall submit to the COMPANY the paint manufacturer maximum allowable thickness for each product per coat. Over thick applications shall be subject to re-blast and re-application. (Note, over thick applications can result in mud-cracking and other defects).

7.3 Spray Application

Spraying (air and airless) is the preferred method of application. Airless spray and conventional air spray shall be the methods for spray application.

Paint application shall be done according to the paint manufacturer's recommendations. Operators shall be skilled in the proper application technique for each coating.

Paint shall be applied in a uniform manner, with 50% overlap of the previous pass.

A cross pass technique spraying shall be utilized in thick coats.

For airless spray methods, the CONTRACTOR shall ensure that the pump ratio is correct for the paint product to be applied and a complete set of spray tips sizes/ spray widths shall be available to cover various spray application configurations andtypes of paint products to be spray applied.

For conventional air spray application method, the air caps, nozzles, needles and compressed air operating pressure shall be those recommended by the coating manufacturer for the paint product being sprayed.

The pressure pot shall be fitted with agitator, pressure gauges, and pressure regulator.

Adequate moisture traps shall be placed in the air supply line of the compressor.

7.4 Brush and Roller Application

Items which cannot be spray coated adequately shall be brush or roller coated, after obtaining COMPANY approval.

Brushes shall be of a suitable style and quality that will allow proper application of the coating material. Brushes shall be no wider than 150 mm.

Paint shall be worked into all corners and gaps. Runs shall be brushed out to eliminate air pockets, voids and solvent bubbles.

7.5 Repair of Paint Damage and Defects

Prior to application of any coat of material, all damage to previous coats shall be properly repaired. The areas of damaged coating shall be cleaned to the surface preparation required by the individual coating, the edges of the paint feathered, and appropriate coatings applied with quality and thickness not less than the original coating.

All coatings which are damaged by rust, shipment, handling, welding, cutting or by any other means shall be repaired by the VENDOR without due delay. Coating damaged during installation shall be repaired as soon as possible.

Equipment furnished with manufacturer's standard paint shall be touched up with a paint that is compatible with the paint system used by the various equipment suppliers.

Surface preparation and repair of damage coating shall be in accordance with the requirement of the specified coating system listed in APPENDIX 1.

Any defect shall be repaired before the application of further coats. Subject to the agreement of Company, and after determining the type and size of the defects, the following methods of repair shall be applied:

7.5.1 Repair of paint defects occurs during application.

Paint defects such as holiday, bubbling, pinholes, sags, orange peel shall be treated by sanding down, re-check and verify prior to re-application coat in accordance with document No. PQ-HWP0-QAC-LST-PMC-00001-00, Coating Matrix for Topside and PQ-HWP0-QAC-LST-PMC-

00002-00, Coating Matrix for Jacket & Pile. Before conducting the repair, any defects shall be subject to the agreement of the CPY as per the size and type of defect.

Especially mud cracking shall be re-blasted and recoated. Inorganic zinc silicate coat where areas repaired shall be applied using zinc rich epoxy primer in accordance with PQ-HWP0-QAC-LST-PMC-00001-00, Coating Matrix for Topside.

7.5.2 Repair for damaged coating expose substrate surface

All damaged, burnt coated shall be spot blast cleaned to achieve Sa 2½ according to ISO 8501-1 and the painting system shall be followed Painting Specification and Painting Matrix.

7.5.3 Repair of coating damage Un-expose substrate surface

The damaged and adjacent area shall be abraded and chamfered by disc sandpaper or sandpaper with the feathering area back to 50mm. Contaminants shall be blown off and wiped by dry rags or solvent according to SSPC-SP1 before paint application.

If the damage is in the first coat, the full coating system shall be reapplied.

If the damage is only in the intermediate and/or finish coat, the intermediate and/or finish coat shall be reapplied.

7.6 Galvanising

All galvanizing of structural steel shall conform to ASTM A-123 latest edition and be applied in accordance with ASTM A-385. The minimum zinc coat shall be 0.705 kg/m2.

Galvanized steel surfaces for indoor installation shall not be primed or painted unless otherwise noted in the applicable equipment specifications or for safety requirements.

Outdoor HDG structure items (i.e. Ladder, stairways, handrails, handrail sockets and their miscellaneous structure) shall be painted with coating system listed in APPENDIX 1 except for items in the Section 5.1.

Galvanizing damaged through fabrication, erection, assembly, handling, welding or other operations, shall be repaired, preferably with galvanized rods and heat or if this is impossible or impractical, by the proper surface treatment and application of a zinc-rich type of coating.

7.7 Thermally Sprayed Aluminium (TSA) Coating

TSA shall be applied in accordance with ISO 2063-1 and ISO 2063-2 or NACE No.12/AWS C2.23M/SSPC-CS 23.00.

Prior to TSA coating production, the CONTRACTOR shall submit a written application procedure for review and approval by the COMPANY. The procedure shall contain at least the following:

- Methodology of TSA application.

- Identification and set-up of the equipment for surface preparation and application.
- Operating parameters of the surface preparation, TSA and sealer coats application equipment to be used.
- Personal protective equipment to be used.
- Safety procedure.
- Product data sheets, MSDS.
- Records and certificates of qualified TSA applicators and supervisors.

The TSA coating procedure shall be qualified through a coating procedure test (CPT) in accordance with the document No. PQ-CPC0-QAC-PCD-MPC-50003-00Coating System Qualification Test Procedure. The CPT shall use test specimens consisting of a plate, shape and a pipe, each with a given minimum surface area of 1.0 m². The adhesion pull-off test shall be prepared and performed in accordance with ISO 4624.

A minimum of five adhesion measurements on the specimen shall be conducted and no single measurement shall be less than 9.0 MPa.

The metal spray operators shall be trained, qualified, and certified according to the TSA equipment manufacturer's procedures.

Aluminium alloy wire to be used for metal spraying shall be certified 99.5% Al according to ISO 14919 or its equivalent. Wire shall be free of kinks, visible oxide or other substances which could affect the application, adhesion, and quality of the TSA coating. The wire shall have proper identification and markings and shall be stored indoor in a dry environment.

The main method of TSA application shall be arc spray process. The flame spray process shall be subject to prior approval by the COMPANY. The CONTRACTOR shall ensure that the equipment and application methods are capable of achieving specified thickness, high productivity, and the deposited metallized coating shall be firmly adherent free of defects.

Boxing in of difficult to access areas shall be considered the primary means of overcoming surface blast cleaning and TSA gun access difficulties.

The TSA coating application shall be performed within 4 hours of surface preparation or before oxidation sets in. The surface preparation finish shall be in accordance to ISO 8501-1 Sa 3 white metal with angular surface profile between 75 and 125 microns at the time of application. The roughness of the surface profile shall be equivalent to ISO 8503-1 Coarse (G) verified by ISO Surface Profile Comparator while the amplitude of the surface profile shall be measured using dial micrometer and Testex Replica Tape.

The blasting abrasive shall be dry, clean and shall contain chloride contamination not more than 20mg/m² NaCl. Chloride test of the blasting abrasives shall be referenced to ISO 8502-6 and ISO 8502-9 or its equivalent standards. The blasting abrasives to be used shall be able to achieve the required angular surface profile and cleanliness. Shots and semi-round blasting abrasives are not permitted. Copper slag, silica sand and other type of blasting abrasives known to impart embedded fine particles shall not be used.

No surface preparation or application shall be permitted when the surface temperature is less than 3°C below the dew point and surrounding air relative humidity is above 85%.

The TSA coating shall be applied in multiple passes but not less than three passes to produce the required thickness and in order to avoid abrupt build-up of thickness that may result to abnormal internal film stresses.

Each pass shall overlap the previous pass with the angle of spray as close as possible to 90º to the surface being coated. The stand-off distance between the spray gun and the work shall be 150-200 mm or as specified by the TSA gun manufacturer.

The final surface of the unsealed TSA shall be smooth and free of lumps, coarse areas, loosely adherent particles, and voids.

Areas of insufficient thickness shall be rectified by further application of TSA within 2 hours of the initial application, and before the sealer coating application.

The TSA sealer shall be applied to the entire surface within 8 hours after the final thickness has been achieved.

Prior to sealer coat application, the TSA surface shall be cleaned of spray dust using hard bristle brush. Brushing technique shall be done in parallel stroke as this produces an even and nearly uniform texture and shade of the sealer coat appearance. High pressure dry air blowing shall follow to completely remove all dust contaminations on the TSA surface.

The sealer coat shall be applied until adsorption is visibly complete such that the metal pores are filled, and a film of the sealer coat begins to settle on the surface.

The second coat of the sealer shall be applied when the initial sealer is touch dry or at a later stage of the construction provided that the maximum recoating period is observed. When maximum recoating time is exceeded, the paint manufacturer shall be consulted to reactivate the initial sealer coat.

7.7.1 Repair /Reinstatement of TSA

Areas of visible damage to the TSA coating not exposing the steel surface shall have their remaining coating thickness checked. The affected areas shall be swept blast-cleaned using mini blast to remove oxides, contamination and provide keying for build-up to the required thickness.

Repair to damaged sealer coat shall require cleaning down of the surface with degreaser, water wash, and drying followed by sanding without removal of the sealer coat. The sealer coat shall then be applied according to the manufacturer's recommendations.

Areas of damage to TSA which expose the steel substrate shall be spot blast-cleaned to SSPC-SP5 near white with angular surface profile between 75 and 125 microns. Spot blast cleaning technique shall be able to chamfer the edge of the affected areas for smooth blending of the TSA coating. The TSA coating shall be applied beyond the prepared damages to blend with existing coating.

7.7.2 Inspection and Testing.

The CONTRACTOR shall prepare an inspection and test plan document No. PQ-CPC0-QAC-ITP-MPC-50001-00, ITP for Surface Preparation and Coatingfor review and approval by the COMPANY.

As a minimum, the inspection and test plan shall contain the frequency of each inspection or testing activity and its corresponding acceptance criteria referred to sections of this specification or applicable code and standard.

7.8 Treatment of Uncoated Surface of Stainless Steel and Duplex Stainless Steel

All surfaces of uncoated stainless steel and duplex stainless steel that have been contaminated with rust, dirt, oil, grease, paint marker, and other contaminants shall be treated with freshwater wash, de-greasing, pickling, and passivation.

Mechanical damage such as grind marks, scuffs, etc shall be removed with appropriate tools and treated with pickling / passivation solution. CONTRACTOR shall submit a pickling and passivation procedure for review and approval by the COMPANY.

The manufacture standard coating which is exposed to external marine environment shall be suitable for CX corrosivity environment.

The final colour shall be in compliance with project requirements specified in Section 10. The manufacturer shall submit the painting procedure for COMPANY’s approval.

8 INSPECTION AND TESTING

8.1 General

The work only be commented on when all coating and inspection procedures are approved by the COMPANY.

Detailed procedures of blasting and painting including the methods and equipment to be used and inspection test plan (ITP) and the frequency of their application and acceptance criteria shall be provided to COMPANY for approval.

The following inspection and testing activities shall be conducted by CONTRACTOR/ VENDOR and witnessed by COMPANY's representative and Paint Manufacturer.

Each coat shall be inspected prior to application of the next coat. Areas found to contain runs, overspray, roughness or signs of improper application shall be repaired or recoated in accordance with the manufacturer's recommendations.

The completed coating shall be inspected for runs, over spray and roughness and any areas found to show these or other signs of improper application shall be repaired or recoated in accordance with the manufacturer recommendation.

The details of inspection and testing requirements is given in Table 8-1.

8.2 Climate Condition

Relative humidity and air temperature shall be permanently checked (as a minimum before start of each shift and twice per shift). The substrate temperature shall also be tested in order to confirm that it is more than 3°C above the dew point. Relative Humidity shall be less than 85% (90% for inorganic zinc silicates).

Temperature and relative humidity shall be measured with a calibrated temperature gauge and a hygrometer. Readings shall be taken prior to commencement of blasting or painting and at regular intervals if there are changes in climatic conditions.

Instruments shall be recalibrated at intervals agreed with the COMPANY.

8.3 Surface Preparation Check and Anchor Profile Measurement

Surface profile shall be verified using replica tape such as Testex Coarse or Extra Coarse "Press O-Film" tape as required by the profile depth to be measured and Comparator may be used for reference. All used tapes shall be made available to the COMPANY, upon request, with an index where each tape was used. Tape samples and index shall form part of the final documentation package.

Blasting quality shall be visually verified by the use of SSPC-VIS-1 or ISO 8501-1 colour photograph standards.

8.4 Dry Film Thickness Measurement

Film thickness shall follow ISO-19840. The specified dry film thickness (DFT) shall be spot checked by means of a magnetic type of thickness gauge or comparable instrument. The DFT is obtained by taking five spot measurements, average of three readings, over 10m² (where possible). The average shall not be less than the specified value.

No single spot measurement in any $10m^2$ shall be less than 80% of the specified thickness. Measurement of DFT will not be conducted on machinery, pipes with nominal diameter less than 50mm and pipe supports where the geometrical surface limits practical inspection.

8.5 Wet Film Thickness Measurement

Wet film thickness shall be measured in accordance with ASTM D4414. Wet film thickness shall be measured and recorded during each individual coat application (except for Inorganic Zinc Silicate) by the wet film combs, such as Elcometer 112. The edge of the comb is placed into the wet film and then removed. The thickness of wet film is determined by examining the paint left on the teeth of the comb and the thickness scale marked on the front face of the comb or in accordance with ASTM D4414.

To calculate the desired wet film thickness from dry film thickness, the formula is:

$$WFT = \frac{DFT \times (100 + \%\ thinning)}{\%\ Solid}$$

Acceptance criteria: as per product data sheet in proportion with specified dry film thickness in accordance with document No. PQ-CPC0-QAC-LST-MPC-50010-00, Project Coating and Painting Matrix.

8.6 Curing Test (for Inorganic Zinc)

For application of inorganic zinc primer coating, spot curing test shall be performed in accordance with ASTM D4752 to ensure that hydrolysis is complete. The acceptance criteria for MEK test shall be level 4 to 5.

8.7 Visual Check and Inspection

The finished job shall not contain sags, runs, wrinkles, holidays, blisters, grittiness, dry spray, loss of gloss, fisheyes, orange peel, overspray, unmatched colours, mud-cracking, contaminants, bubbling, pinholes, or other application flaws.

8.8 Adhesion Test

Cross-cut test and X-cut test shall be performed in accordance with ISO 2409 and ISO 17276-2 respectively. The rating level shall be 0 to 2. The requirement to apply Cross-cut test and X-cut test is specified in each coating system in APPENDIX 1.

The cross-cut technique, and the use of pressure sensitive adhesive tapes to the cut surface shall be used on coated surfaces. Spot checks will be conducted as required by the COMPANY.

Pull of test of primer coat to the substrate and the inter-coat adhesion between subsequent coats shall be qualified in accordance with ISO 16276-1or ISO 4624, using equipment with an automatic centered pulling force. Two-component epoxy glue shall be utilized for this test method and carried out when coating system are fully cured in accordance with the manufacturer's recommendations. In the absence of manufacturer's recommendations, the coating shall be dried/cured for at least 10 days in well-ventilated conditions and at a substrate temperature in excess of 15°C and a relative humidity of less than 80 % prior to testing.

The “pull-off test requirement is specified for each coating system in APPENDIX 1.

8.9 Holiday Testing

Holiday testing shall be conducted in accordance with ISO 29601 or NACE SP0188 for coating system listed in Table 8-1.

100% of the surface shall be tested and in case of the presence of holidays, coating systems shall be repaired and re-tested.

Table 8-1. Inspection and Testing

Test Description	Method	Frequency	Acceptance Criteria
Activities Prior to surface preparation			
Visual Inspection of Substrate Preparation	ISO 8501-3 NACE SP0178 (Internal Coating)	100% of all surfaces	• Rounding of concerns, sharp edges to 3 mm radius minimum • Internal coating: Level C for filled weld tee join and lap weld according to NACE SP0178 • All surface free of oil and grease or other contaminant
Activities during surface preparation			
Environment Conditions	ISO 8502-4	Before start of each shift and twice per shift and when the ambient conditions are	Temperature of substrate at least 3°C above dew point. Maximum relative humidity of 85%

		obviously changing	
Conductivity of abrasive	ASTM D4940	Every shift and every batch	< 150 x 10^{-6} siemens/cm
Compressed air quality	ASTM D4285	Before start of each shift	No oil or water drops
Visual Examination of Pre-Cleaned Surface	Visual inspection for sharp edges, weld splatter, rust etc.	100% of all surfaces	No defects
Dust test	ISO 8502-3	Spot checks	Maximum quantity and size rating 2
Surface cleanliness after abrasive blast cleaning	8501-1	100% visual of all surfaces	As specified in each coating system
Surface cleanliness after Sweep blasting cleaning	SSPC-SP 16	100% visual of all surfaces	As specified in each coating system
Surface salt contaminant	ISO 8502-6 ISO 8502-9	Spot check	• Average conductivity corresponding to 20mg/m^2
Roughness Examination	ISO 8503-5	Each component or once per 10m^2	• In accordance with specified requirement in APPENDIX 1
Activities during coating application and after curing of coating			
Environment Condition	ISO 8502-4	Before start and twice per shift	• Temperature of the substrate is less than 3°C above the dew point. • The relative humidity is more than 85% RH (90% RH for inorganic zinc silicate). • The weather is rainy or foggy, except under shelter and subject to verification of the atmospheric.
Curing Testing (Inorganic Zinc)	ASTM D4752	Each component or once per 100m^2	Rating 4 to 5
Visual Inspection		100% surfaces	No defects (Detect surface defect such as "orange peel", cracking, bubbling, pinholes, runs and sags, fish-eyes, blistering, etc.) and contamination

Wet Film Thickness (WFT)	ASTM D4414	Spot Checks	According to each coat in the coating system.
Dry Film Thickness (DFT)	ISO 19840	Each coat as per ISO 19840	According to ISO 19840
Holiday detection (internal linings, coating systems used in splash zone, coating systems used in immersed zone, coating systems BD-04, BD-05, BD-06, BD-10)	ISO 29601/ NACE SP0188	100% surfaces	No holidays
Adhesion • DFT ≥ 200 µm • DFT < 200 µm	• ISO 16276-1 • ISO 16276-2	Spot Check	• Cross-cut test: rating 0 to 2 • Rating 0 to 2 • Minimum 5MPa for any measurement. • Minimum 7MPa (without sealer) for TSA coating.
Visual inspection of TSA coating		100% surface after each coat	No defects
Bend test (TSA coating)	ISO 5956-5 NACE 0.12/AWS C2.23M/SSPC CS-23)	Once per 100m^2 per shift per day	No visual appearance of cracks, lifting or sapling. Minor cracks that cannot be lifted from the substrate is acceptable.
Friction Test on Landing area	CAP 437	Continuous Friction Measuring Equipment	Table 3 of Chapter 3 of CAP 437.
Ferrous contamination (for SS surfaces)	Ferroxyl test ASTM A380	Spot Check	No surface pollution

9 COATING SYSTEM SELECTION

9.1 General

The coating system selection shall be based on following factors:

- Type of material
- Type of application
- Operating environment (Atmospheric, Splash zone, Submerged, Insulated etc.)
- Operating condition
- Project design requirements include design life, maintenance strategy and criticality of the item to be coated.

The coating system schedule for structure, piping, and equipment item provided in Table 9-1 and Table 9-2. The details of each coating system are provided in APPENDIX 1.

9.2 External Coating System

Table 9-1. External Coating System for Structure, Piping and Equipment Items

Surface to be painted	Operating Temperature, °C	Coating System	Remarks
Structure steel, support (piping, E&I, and equipment) - Atmospheric Zone (CX environment)			
CS – Uninsulated structure component	≤ 110	BD-01A	
CS – Insulated structure component	≤ 110	BD-01B	(Outdoor)
CS – Insulated structure component	≤ 110	BD-01C	(Indoor HVAC)
CS – Exhaust stack, flare stack and boom	≤ 595	BD-11	
CS – Crane Boom & Pedestal	≤ 110	BD-01A	
CS – Escape route, walkway, helideck, deck, floor, laydown deck	≤ 110	BD-07	
Galvanised ladder, cages and handrail	≤ 110	BD-08	
CS structure beneath cementitious fireproofing	--	--	The painting system shall be approved by PFP supplier. Refer to Project fireproofing specification.
Stainless steel support	≤ 110	BD-09A	
Stainless Steel structure and other equipment (not Piping, Valves, Tanks, Vessels) (if required).	≤ 110	BD-09B	
CS- Enclosures (Cabinets, Control Panel), Instrument and Electrical Equipment	≤ 110	BD-03	

Surface to be painted	Operating Temperature, °C	Coating System	Remarks
Structure Steel- Splash Zone (CX + Im4 environment)			
CS – Structure beam, members	≤ 50	BD-06	
CS – Caisson (External)	≤ 50	BD-06	
CS – Caisson (Internal)	≤ 60	BD-10	
Piping, Valves, Tanks, Vessels - Atmospheric Zone (CX environment)			
CS – Uninsulated	≤ 110	BD-02A	
	111 ≤ 200	BD-02B	
	201 - 500	BD-02C	
CS – Insulated	≤ 200	BD-02B	
	201 - 500	BD-02C	
SS316L – Uninsulated	≤ 110	BD-09B1	
	111 - 200	BD-09A	
	201 - 500	BD-09C	
22Cr DSS – Uninsulated	≤ 100	Not coating	
	101 - 110	BD-09B1	
	111 - 200	BD-09A	
	201 - 500	BD-09C	
25Cr DSS – Uninsulated	≤ 110	Not coating	
	111 - 200	BD-09A	
	201 - 500	BD-09C	
SS316L – Insulated.	≤ 200	BD-09A	
	201 - 500	BD-09C	
22Cr DSS – Insulated	≤ 200	BD-09A	
	201 - 500	BD-09C	
25Cr DSS – Insulated	≤ 200	BD-09A	
	201 - 500	BD-09C	
Galvanised CS	≤ 80	BD-08	
Fire-proofing surfaces	--	--	The painting system shall be approved by PFP supplier. Refer to Project fireproofing specification.
GRP	--	BD-12	Only for safety colour identification requirement. Additional colour pigment resin can be considered.
Copper and copper alloy	--	BD-13	Only for safety colour identification requirement

Surface to be painted	Operating Temperature, °C	Coating System	Remarks
Piping, Piping support, Valves – Splash Zone (CX +Im4 environment)			
CS	≤ 50	BD-06	
SS (22Cr DSS, 25Cr DSS) – Uninsulated	≤110	BD-09D	
CS subsea Equipment & Structure- Submerged Zone (Im4 environment)			
CS subsea components (PLEMS, protective frame, subsea valve and flange)	≤ 70	BD-10	
CS subsea components	≤ 120	BD-10A	

Notes:

1. Refer to APPENDIX 1 for the details of the coating system.
2. Do not paint galvanised steel except for Outdoor HDG structure items (i.e. Ladder, stairways, handrails, handrail sockets and their miscellaneous structure).
3. Do not paint GRP and CuNi unless drawings and/or purchase document indicate requirement.
4. Lines or equipment provided with metal guard for personnel protection shall be defined as uninsulated for the purpose of paint system selection.
5. Surfaces to be coated with an intumescent epoxy shall be primed, fireproofed, and top coated as recommended by the intumescent fireproofing manufacturer. TSA coating shall not be used under fireproofing.
6. The minimum temperature of the coating system shall be based on paint manufacture's recommendation.

9.3 Internal Tanks / Vessels Coating System

Table 9-2. Internal Coating System for Process Pressure Vessel and Storage Tank

Item	Service	Operating Temperature, °C		Coating System	Remarks
		Min.	Max.		
Process pressure Vessels	Hydrocarbon service	Note 1		BD-05A/B/C/D	
Storage Tanks	- Produced water, - Seawater, - Firewater, - Oily water, - Diesel	-20	+50	BD-04	

Notes:

1. The coating material shall appropriate for with internal vessels condition including pressure, temperature, fluid/vapour composition as specified in specific vessel documents.
2. Coating product recommended by the paint manufacturer intended for internal lining of vessel/tanks shall be reviewed and approved by COMPANY prior to purchase award for the vessel/tanks.
3. For tank/vessel with anode installation, internal lining shall be resistant to cathodic disbondment and compatible with sacrificial anode.

4. All application of internal coating shall be witness, inspected inclusive of providing technical expertise/ support to applicators by qualified internal coating manufacturer's representative.
5. All internal coating shall be provided with a minimum 5-year warranty.
6. Alternative coating system can be applied with COMPANY approval.

9.4 Coating Fastener (Non-Pressurized Items)

Table 9-3. Coating for Fastener (Non-Pressurized Items)

Location	Application	Corrosivity Category	Material grade	Coating
Jacket – Submerged area.	Structure	Im4	CS/LAS	HDG
			SS	Bare
Jacket – Splash zone.	Structure	CX & Im4	CS/LAS	HDG + BD-06 (1)
			SS	Bare
Jacket – Atmospheric zone.	Structure	CX	CS/LAS	HDG + BD-08 (1)
			SS	Bare
Topsides	Structure	CX	CS/LAS	HDG + BD-08 (1)
			SS	Bare
		Indoor with HVAC	CS/LAS	HDG
			SS	Bare
		Indoor no HVAC	CS/LAS	HDG
			SS	Bare
	Piping and Equipment	CX	CS/LAS	Coating according to Section 5.2
			SS	
		Indoor with HVAC	CS/LAS	
		Indoor no HVAC	CS/LAS	

Notes
(1) The paint system is applied after assembly on the exposed parts.
(2) HDG: Means hot-dip galvanized as per the requirements of ASTM A153.

10 COLOUR CODE REQUIREMENT

10.1 General Colour Code

The paint colour for all vessels, equipment, piping and structures shall be in accordance with this Specification as listed in Table 10-1, Table 10-2 and Table 10-3, unless otherwise noted in the individual Equipment Specifications.

All final colours shall be as follows:

Table 10-1 Equipment Colour Code Requirement

Colour	RAL Code	Equipment / Area
Silver (high temp)	Aluminum	Flare Structures (structural and piping)
Oxide Red	3009	Deck top surface
Signal Yellow	1003	All pipework except firewater (with colour bands) Jacket / deck structural steel All supports, skids, and baseplates (except firepump equipment) Handrails Walkways (outline on deck) Cranes Safety Equipment
Signal Red	3001	Firefighting equipment and piping for firewater equipment
Signal White	9003	Uninsulated vessel (Note 1), Exposed area of buildings (internal/ external)
Signal Green (non-skid)	6032	Walkways
Colours as per the Project drawings	-	Helideck
Signal Red	3001	Actuated valves, fail closed
Signal Green	6032	Actuated valves, fail open
Signal Yellow	1003	Actuated valves, fail last position
Pearl Grey	7048	Heat exchangers, pumps, compressors, instrument and electrical panels and equipment, and mechanical equipment packages. (Note 1)

Notes:

1. For high temperature service, Aluminium colour (9006) is acceptable.

10.2 Colour Banding for Piping

Piping will be identified according to the carried fluid as stipulated in the following colour coding list.

- The fluid identification colour shall be applied by means of a sprayed band 'X' mm wide around the pipe at a maximum of 6 meter intervals and on either side of each valve, fitting, wall penetration, deck penetration and any other place where the identification of the fluid is necessary.
- The flow direction shall be indicated with a black or white painted arrow depend on the band color.

Pipe NB	≤ 6"	Above 8"
X mm	150	250

Table 10-2 Piping Colour Code Requirement

Service	Designation	Colour	RAL colour reference number
Process Liquid	PL	Brown	8001
Process Gas	PG	Yellow-Ochre	1024
High Pressure Vent (Flare)	VH	Yellow-Ochre	1024
Low Pressure Vent (Flare)	FL	Yellow-Ochre	1024
Atmospheric vent	VA	Yellow-Ochre	1024
Fuel Gas	GF	Yellow-Ochre	1024
Instrument Gas	GI	Yellow-Ochre	1024
Utility Gas	GU	Yellow-Ochre	1024
Exhaust Gas (engines)	GE	N. A.	N. A.
Closed Drain	DC	Black	9005
Open Drain	DO	Black	9005
Produced/ Process Water	WP	Brown-Black	8001 / 9005
Utility Water	WU	Green	6024
Potable Water	WE	Green	6024
Hot Water	HW	Pink	3015
Sea Water	WS	Green	6024
Cooling Medium	WC	Green	6024
Hot Oil (heating medium)	T	Brown	8001
Fire Water	FW	Red	3000
Diesel Fuel	DF	Brown-Red	8001 / 3000

Service	Designation	Colour	RAL colour reference number
Instrument Air	AI	Light Blue	5012
Plant Air	AU	Light Blue	5012
Steam	SX	Silver-Grey	7001
Steam Condensate	SW	Dark Blue	5003
Glycol	GL	Brown-Blue	8001 / 5015
Nitrogen	IG	Light Blue-Green	5012 / 6024
Lube Oil	OL	Brown-Green	8001 / 6024
Chilled Water	PM	Green	6024
Hypochlorite	CC	Magenta	4010
Fire Fighting Chemical	CF	Red	3000
Corrosion Inhibitor	CI	Magenta	4010
Chemicals, Solvents, etc.	CP	Magenta	4010
Washdown Water	WD	Green	6024
Injection Water	WI	Green	6024
Treated Water	WT	Green	6024
Sewage	WW	Black/Green	9005 / 6024

10.3 Colour Code of Fluorocarbon Coating for Bolts and Nuts

Table 10-3 Bolt Colour Code Requirement

Colour	RAL Code	Bolt and Nuts Material
Blue	5003	ASTM A193 Grade B7/ ASTM A194 GR 2H
Red	3001	ASTM A193 Grade B7M/ ASTM A194 GR 2HM
Green	6024	ASTM A320 Grade L7/ ASTM A194 Grade 7
Black	9005	ASTM A320 Grade L7M/ ASTM A194 Grade 7M
Grey	7048	ASTM A193 GR B8M Cl.2/ ASTM A194 GR 8M
Silver	7001	ASTM A320 GR B8M Cl.2/ ASTM A194 GR 8M
Yellow	1003	UNS N09925 / Alloy 925
Note: For each color code of bolt, the Manufacturer color range can be applied with COMPANY approval.		

11 SAFETY, HEALTH AND ENVIRONMENT REQUIREMENT

The CONTRACTOR or VENDOR, as well as its/their Painting SUB-CONTRACTOR(s) shall be responsible for all aspects of safety and personal protection related to the painting work to be done.

Safe working is of the greatest importance particularly whilst working in confined spaces such as tanks and vessels.

All personnel shall be provided with approved personnel protection e.g., protective clothing, gloves, safety glasses, safety shoes, hard hats, goggles, respirators, earplugs, fresh-air-fed hood and any other necessary safety equipment. All safety equipment shall be maintained to a good working condition.

Adequate warning signs shall be prominently displayed at all access points to areas where abrasive blasting and painting is in progress.

Handling and disposal of hazardous waste resulting from the painting applicator's activities shall be in accordance with regulations and specific contract requirements. Moreover, the COMPANY's regulations on chemical management or banned materials shall also be strictly adhered to.

Paint products, solvents, diluents, etc. shall be stored in a closed dedicated room/container under controlled temperature.

Exposure of paint products, solvents, diluents to temperature equal or above their flash point, exposure to heat source, flame source, electrical arc or sparks, etc. shall be prohibited.

Material Safety Data Sheet of all coating products, solvent, diluents shall be available at their place of use and shall be included in VENDOR/CONTRACTOR Data Book.

These are minimum safety requirements that are applicable to both shop and field coating (including surface preparation).

- Fire and Explosion Prevention
- Smoking and/or the use of open flames shall be permitted only in designated safe areas.
- Solvents and coatings shall not be applied to surfaces warmer than 80°C.
- Mechanical (forced) ventilation shall be used in confined spaces whenever abrasive blasting, solvent cleaning, and/or coating application are in progress.
- Forced ventilation shall continue until the coating is fully cured.
- Natural ventilation (through opened manways, etc.) shall not be substituted for forced ventilation in confined spaces.
- Respirable air-fed hoods shall be worn by all personnel inside confined spaces whenever blast cleaning or spray coating is in progress.
- If alkaline catalysts (such as used in many epoxy coatings) come in contact with the skin, they shall be immediately washed off with water to avoid chemical burns. Follow the coating manufacturer's materials safety data sheet and other safety documents for washing off action.

- Adequate washing facilities shall be readily available so that coatings and solvents splashed on the body or in the eyes can be immediately removed.
- Technical Data Sheet (TDS) and Materials Safety Data Sheets (MSDS) for all coatings, solvents, cleaners and abrasives in use shall be readily available on-site.
- All paint and abrasive shall be free of heavy metals and carcinogenic substance such as lead, asbestos, cadmium, chromate and crystalline silica.

12 WARRANTY

The Work shall be covered by performance warranties in accordance with the following requirements unless noted otherwise:

- The maximum degree of rust shall be Ri3 according to ISO 4628-3
- The maximum degree of cracking, blistering, or flaking shall be 3S3 according to ISO 4628.

Guarantee Period shall follow the period time defined in the document “Terms and Conditions” of the Contract.

13 APPENDICES

13.1 APPENDIX 1: COATING SYSTEM

APPENDIX 1: COATING SYSTEMS

Coding for type of paint

Binders	Codes
Cold Spray Aluminium	CSA
Epoxy	EP
Glass flake Epoxy	EPGF
Novolac Epoxy	EPN
Phenolic Epoxy	EPPH
Rich Zinc epoxy	EPRZ
High Solid Epoxy	HSEP
High Temperature Silicone Aluminium	HTSiA
Inorganic Zinc	IOZ
Polyurethane	PU
Silicone Aluminium	SiA
Thermal Spray Aluminium Coating	TSA
Vinyl-ester	VY
Zinc Phosphate Epoxy Primer	ZPEP

System BD-01A. (Atmospheric Zone) - All uninsulated carbon steel exterior surface of structural operating temperature up to 110°C

BD-01A		
Operating temperature	**Corrosivity**	**Insulation**
Up to 110°C	CX	NO

Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness Medium: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPRZ	60	1	EPRZ	60
2	EP	120	2	EP	120
3	EP	120	3	EP	120
4	PU	60	4	PU	60
	Total NDFT:	360		Total NDFT:	360

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Pre-qualification: NORSOK M-501 or ISO 12944-9.
3. Zinc rich epoxy primer shall contain a minimum of 80% zinc dust by mass in the dry film. Zinc dust pigment shall comply with NS-EN ISO 3549 or ASTM D520.

System BD-01B. (Atmospheric Zone) - Outdoor structural steel surface under insulation

BD-01B		
Operating temperature	**Corrosivity**	**Insulation**
Up to 110°C	CX	YES

Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPRZ	60	1	EPRZ	60
2	EP	120	2	EP	120
3	EP	120	3	EP	120
4	-	-	4	-	-
	Total NDFT:	300		Total NDFT:	300

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Pre-qualification: NORSOK M-501 or ISO 12944-9.
3. Zinc rich epoxy primer shall contain a minimum of 80% zinc dust by mass in the dry film. Zinc dust pigment shall comply with NS-EN ISO 3549 or ASTM D520.

System BD-01C. (Indoor with HVAC control)
- structural steel surface under insulation
- Structural steel under underlayment (note 4)

BD-01C					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 110°C		C2		YES	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPRZ	60	1	EPRZ	60
2	EP	120	2	EP	120
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	180		Total NDFT:	180

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Zinc rich epoxy primer shall contain a minimum of 80% zinc dust by mass in the dry film. Zinc dust pigment shall comply with NS-EN ISO 3549 or ASTM D520.
3. A PU topcoat of 50 µm shall be added for area indoor (with HVAC control) un-insulated structural steel surface.
4. The painting system and over coating conditions shall be approved by underlayment supplier.

System BD-02A. (Atmospheric Zone) - All uninsulated carbon steel exterior surface of tank/ vessels, piping, valves, pumps, operating temperature up to 110°C
(HOLD 1)

BD-02A					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 110°C		CX		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPPH	150	1	EPPH	150
2	EPPH	150	2	EPPH	150
3	PU	60	3	PU	60
4	-	-	4	-	-
	Total NDFT:	360		Total NDFT:	360
Notes 1. Minimum Pull-off Test Requirement: 5 (MPa).					

System BD-02B. (Atmospheric Zone) - All insulated/uninsulated carbon steel exterior surface of vessels, piping, valves, pumps, operating temperature up to 200°C
(HOLD 1)

BD-02B					
Operating temperature		**Corrosivity**		**Insulation**	
From 111°C to 200°C		CX		YES / NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness Medium (G) (ISO 8503-1;2).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: Medium (G) (ISO 8503-1;2).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPPH	150	1	EPPH	150
2	EPPH	150	2	EPPH	150
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	300		Total NDFT:	300
Notes 1. Minimum Pull-off Test Requirement: 5 (MPa).					

System BD-02C. (Atmospheric Zone) - All uninsulated and insulated carbon steel exterior surface of vessels, piping, valves, pumps, structural, etc. operating temperature from 200°C to 500°C

BD-02C					
Operating temperature		**Corrosivity**		**Insulation**	
from 200°C to 500°C		CX		NO / YES	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	IOZ	75	1	IOZ	75
2	HTSiA	25	2	HTSiA	25
3	HTSiA	25	3	HTSiA	25
4	-	-	4	-	-
	Total NDFT:	125		Total NDFT:	125

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa) (test to be performed on the IOZ primer without the sealer).
2. Heat cured paint systems are not acceptable for coating system BD-02.
3. Only IOZ paint meets SSPC-Paint 20, Level 1 (at least 85% zinc by weight in the dry film) shall be used.

System BD-03. For inside/ outside of carbon steel surface of cabinets and control panels, instrument and electrical equipment

BD-03					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 110°C		CX		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EP	50	1	EP	50
2	HSEP	50	2	HSEP	50
3	PU	50	3	PU	50
4	-	-	4	-	-
	Total NDFT:	150		Total NDFT:	150

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).

System BD-04. (Internal Tanks) - For carbon steel interior surfaces of diesel storage tanks, washdown tanks and potable water tanks.

BD-04					
Operating temperature		**Corrosivity**		**Insulation**	
From -20°C to 50°C		Refer tank datasheet		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EP (Tank Primer)	125	1	EP (Tank Primer)	125
2	EP (Tank Coating)	125	2	EP (Tank Coating)	125
3	EP (Tank Coating)	125	3	EP (Tank Coating)	125
4	-	-	4	-	-
	Total NDFT:	375		Total NDFT:	375

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. System BD-04 shall require continuity holiday testing.
3. For potable water tanks, epoxy tank lining shall be approved by health authority for drinking purpose.
4. Coatings products recommended by the paint manufacturer for internal lining of pressure tanks etc. shall be reviewed and approved by the COMPANY prior to purchase award for the tanks.
5. Coating shall be compatible with cathodic protection if anode is installed.
6. The tanks shall be externally marked with black colour stating: INTERNALLY LINED, NO HOT WORK.

System BD-05A. (Internal Vessel) - Carbon steel interior surfaces of hydrocarbon pressure vessels with operating pressure ≤ 0.3 MPa

BD-05A					
Operating temperature		**Corrosivity**		**Insulation**	
From -20°C to +75°C		Refer vessel datasheet		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPPH/EPN/VY (vessel lining)	150	1	EPPH/EPN/VY (vessel lining)	150
2	EPPH/EPN/VY (vessel lining)	150	2	EPPH/EPN/VY (vessel lining)	150
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	300		Total NDFT:	300

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Pre-qualification: NORSOK M-501 (system 3D).
3. The internal coating/lining shall require continuity holiday testing.
4. Coating products recommended by the paint manufacturer intended for internal lining of vessels shall be reviewed and approved by the COMPANY prior to purchase award for the vessels.
5. All application of internal coatings shall be witnesses, inspected, inclusive of providing technical expertise / support to applicators by a qualified internal coating manufacturer's representative.
6. All internal coatings shall be provided with a minimum 5-year warranty.
7. Coating shall be compatible with cathodic protection if anode is installed.
8. The tanks shall be externally marked with black colour stating: INTERNALLY LINED, NO HOT WORK.

System BD-05B. (Internal Vessel) - Carbon steel interior surfaces of hydrocarbon pressure vessels with operating pressure from 0.3 MPa to 7 MPa

BD-05B		
Operating temperature	**Corrosivity**	**Insulation**
From -50°C to 80°C	Refer vessel datasheet	NO

Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPPH/EPN/VY (vessel lining)	150	1	EPPH/EPN/VY (vessel lining)	150
2	EPPH/EPN/VY (vessel lining)	150	2	EPPH/EPN/VY (vessel lining)	150
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	300		Total NDFT:	300

Notes

1. Minimum Pull-off Test Requirement: 10 (MPa).
2. Pre-qualification: NORSOK M-501 (system 3E).
3. The internal coating/lining shall require continuity holiday testing.
4. Coating products recommended by the paint manufacturer intended for internal lining of vessels shall be reviewed and approved by the COMPANY prior to purchase award for the vessels.
5. All application of internal coatings shall be witnesses, inspected, inclusive of providing technical expertise / support to applicators by a qualified internal coating manufacturer's representative.
6. All internal coatings shall be provided with a minimum 5-year warranty.
7. Coating shall be compatible with cathodic protection if anode is installed.
8. The tanks shall be externally marked with black colour stating: INTERNALLY LINED, NO HOT WORK.

System BD-05C. (Internal Vessel) - Carbon steel interior surfaces of hydrocarbon pressure vessels with operating pressure from ≤ 3.0 MPa

BD-05C					
Operating temperature		**Corrosivity**		**Insulation**	
From -20°C to +130°C		Refer vessel datasheet		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPPH/EPN/VY (vessel lining)	150	1	EPPH/EPN/VY (vessel lining)	150
2	EPPH/EPN/VY (vessel lining)	150	2	EPPH/EPN/VY (vessel lining)	150
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	300		Total NDFT:	300

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Pre-qualification: NORSOK M-501 (system 3F).
3. The internal coating/lining shall require continuity holiday testing.
4. Coating products recommended by the paint manufacturer intended for internal lining of vessels shall be reviewed and approved by the COMPANY prior to purchase award for the vessels.
5. All application of internal coatings shall be witnesses, inspected, inclusive of providing technical expertise / support to applicators by a qualified internal coating manufacturer's representative.
6. All internal coatings shall be provided with a minimum 5-year warranty.
7. Coating shall be compatible with cathodic protection if anode is installed.
8. The tanks shall be externally marked with black colour stating: INTERNALLY LINED, NO HOT WORK.

System BD-05D. (Internal Vessel) - Carbon steel interior surfaces of hydrocarbon pressure vessels with operating condition

- **3MPa < operating pressure < 7 MPa, 80°C < operating temperature**
- **7MPa < operating pressure, -50°C < operating temperature < 200°C**

BD-05D					
Operating temperature		**Corrosivity**		**Insulation**	
-		Refer vessel datasheet		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	Ceramic Epoxy or equivalent (note 3)	Note 1	1	Ceramic Epoxy or equivalent (note 3)	Note 1
2	-	-	2	-	-
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	Note 1		Total NDFT:	Note 1

Notes

1. The coating thickness is dependent upon service conditions and will be advised by the coating manufacturer.
2. Minimum Pull-off Test Requirement: 10 (MPa).
3. The internal coating/lining shall require continuity holiday testing.
4. Coating products recommended by the paint manufacturer intended for internal lining of vessels shall be reviewed and approved by the COMPANY prior to purchase award for the vessels.
5. All application of internal coatings shall be witnesses, inspected, inclusive of providing technical expertise / support to applicators by a qualified internal coating manufacturer's representative.
6. All internal coatings shall be provided with a minimum 5-year warranty.
7. Coating shall be compatible with cathodic protection if anode is installed.
8. The tanks shall be externally marked with black colour stating: INTERNALLY LINED, NO HOT WORK.

System BD-06. (Splash Zone) - For carbon steel exterior surfaces

BD-06					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 50°C		CX, Im4		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPGF	1000	1	EPGF	1000
2	EPGF	1000	2	EPGF	1000
3	PU	50	3	PU	50
4	-	-	4	-	-
	Total NDFT:	2050		Total NDFT:	2050

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Pre-qualification: NORSOK M-501 or ISO 12944-9.
3. Number of coats shall be as per the paint manufacturer's recommendation.
4. Coating shall be compatible with cathodic protection.

System BD-07. (Atmospheric Zone) - Carbon steel surfaces of helideck and deck plate, floor, walkway, escape route etc.

BD-07					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 110°C		CX		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	ZPEP	50	1	ZPEP	50
2	EP	250	2	EP	250
3	EP	250	3	EP	250
4	PU	50	4	PU	50
	Total NDFT:	600		Total NDFT:	600

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Pre-qualification: NORSOK M-501.
3. System BD-07 shall incorporate a non-sparking aggregate to provide a non-slip finish.
4. All deck surfaces shall be given non-skid treatment.
5. Power tool cleaning shall be on case by case basis with prior approval by the COMPANY.

System BD-08. (Atmospheric Zone) – Galvanised surfaces

BD-08		
Operating temperature	**Corrosivity**	**Insulation**
Up to 110°C	CX	NO

Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Solvent cleaning, fresh water washing and etch the galvanized surface with sweep blast cleaning in conformance with SSPC-SP-16. Roughness: Min 19 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	HSEP	125	1	EPRZ	65
2	PU	50	2	HSPU	125
3	-	-	3	PU	50
4	-	-	4	-	-
	Total NDFT:	175		Total NDFT:	230

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Galvanized gratings located on jacket walkway and boatlanding shall be coated with System BD-08 when specified in the drawing.
3. For Stainless steel the repair system shall be the same with coating system (HSEP + PU).

System BD-09A. (Atmospheric zone)

Insulated.

- **300 series stainless steel: exposed to temperature up to 200°C.**
- **22Cr DSS: exposed to temperature up to 200°C.**
- **25Cr DSS: exposed to temperature up to 200°C.**

Uninsulated.

- **300 series stainless steel: exposed to temperature from 111°C to 200°C.**
- **22Cr DSS: exposed to temperature from 111°C to 200°C.**
- **25Cr DSS: exposed to temperature from 111°C to 200°C.**

(HOLD 1)

BD-09A					
Operating temperature		**Corrosivity**		**Insulation**	
-		CX		YES/NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 37-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 37-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPPH	125	1	EPPH	125
2	EPPH	125	2	EPPH	125
3	(Note 2)	(Note 2)	3	(Note 2)	(Note 2)
4	-	-	4	-	-
	Total NDFT:	310		Total NDFT:	310

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. When perforated metal guards are used for personnel protection for piping and when apply for stainless steel support a layer 60 µm PU shall be added.

System BD-09B. (Atmospheric Zone) - Uninsulated stainless-steel structure and equipment (not vessels, piping and valves) (if required).

- **300 series stainless steel: up to 110°C**
- **22Cr DSS: up to 110°C**
- **25Cr DSS: up to 110°C**

(HOLD 1)

BD-09B					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 200°C		CX		YES	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 37-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 37-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	HSEP	125	1	HSEP	125
2	PU	60	2	PU	60
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	185		Total NDFT:	185

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).

System BD-09B1. (Atmospheric Zone) Uninsulated stainless-steel vessels, piping and valves

- **300 series stainless steel: up to 110°C**
- **22Cr DSS: from 100°C to 110°C**

BD-09B1					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 200°C		CX		YES	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 37-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 37-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPPH	125	1	EPPH	125
2	PU	60	2	PU	60
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	185		Total NDFT:	185
Notes 2. Minimum Pull-off Test Requirement: 5 (MPa).					

System BD-09C. (Atmospheric Zone) - Uninsulated/ Insulated 300 series stainless steel/ 22Cr DSS/ 25Cr DSS exposed to temperature from 201°C to 500 °C.

BD-09C					
Operating temperature		**Corrosivity**		**Insulation**	
201°C to 500°C		CX		NO / YES	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 37-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 37-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	CSA	125	1	CSA	125
2	CSA	125	2	CSA	125
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	250		Total NDFT:	250

Notes

1. Adhesion: Cross cut test (ISO 2409)-Rating 0 to 2 is acceptable. If the DFT exceeds 250 microns X-cut test shall be performed and shall be within level 0 to 2 (ISO 17276-2).
2. The Cold Spray Aluminium product recommended by the paint manufacturer shall be approved by the COMPANY prior to application after submission of the technical datasheets, performance test data, track record or case history.
3. Not applicable below Cellar Deck in splash zone.

System BD-09D. (Splash Zone) - Uninsulated duplex stainless steel up to 110ºC (in Splash Zone)

BD-09D					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 110°C		CX and Im4		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 50-85 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPGF	475	1	PGF	475
2	EPGF	475	2	PGF	475
3	PU	50	3	PU	50
4	-	-	4	-	-
	Total NDFT:	1000		Total NDFT:	1000

Notes

1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Coating shall be compatible with cathodic protection.

System BD-10. (Internal caisson and submerged zone) - For internal caisson and carbon steel surfaces in subsea such as PLET, protection frame, manifolds, riser arches, subsea valves and flanges

BD-10					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 70°C		Im4		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EPGF	200	1	EPGF	200
2	EPGF	200	2	EPGF	200
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	400		Total NDFT:	400

Notes
1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Pre-qualification: NORSOK M-501 or ISO 12944-9.
3. Coating shall be compatible with cathodic protection.

System BD-10A. (Submerged zone) - Carbon steel surfaces with operating temperature up to 120°C

BD-10A					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 120°C		Im4		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 2½ (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EP	200	1	EP	200
2	EP	200	2	EP	200
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	400		Total NDFT:	400

Notes
1. Minimum Pull-off Test Requirement: 5 (MPa).
2. Pre-qualification: NORSOK M-501 or ISO 12944-9.
3. Coating shall be compatible with cathodic protection.

System BD-11. (Atmospheric Zone)

- **For surfaces of flare boom structure and its associated landings, platforms, piping and supports.**
- **Exterior surfaces of vessels, tanks, piping, and exhaust piping nominated in the drawing or documents to be coated with thermally sprayed aluminium.**

BD-11					
Operating temperature		**Corrosivity**		**Insulation**	
up to 595°C		CX		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).			Surface preparation: Grade of cleanliness: Sa 3 (ISO 8501-1). Roughness: 75-125 µm (ISO 8503-5).		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	TSA	200	1	TSA	200
2	SiA	25	2	SiA	25
3	SiA	25	3	SiA	25
4	-	-	4	-	-
	Total NDFT:	250		Total NDFT:	250

Notes

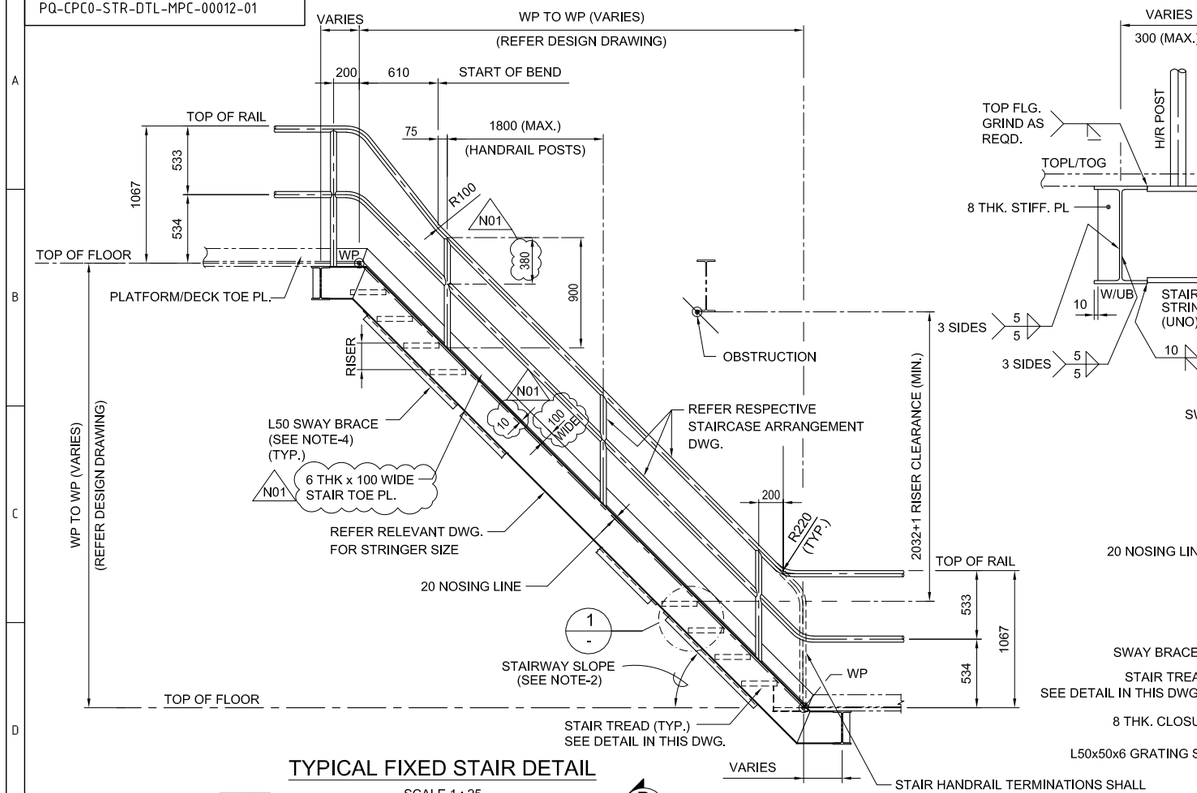
1. Minimum Pull-off Test Requirement: 9 (MPa) for CPT and 7(MPa) for production (test to be performed without the sealer).
2. TSA coating which is to be top coated with high build epoxy coating shall be sealed with one coat of a genuinely manufactured epoxy sealer coat guaranteed by the paint manufacturer as suitable for TSA surface and compatible with PFP coating or high build epoxy. The dry film thickness of the epoxy sealer coat shall be recommended by the paint manufacturer.
3. Surfaces of 316L stainless steel or duplex stainless shall be prepared using non-metallic angular blasting abrasives such as garnet or aluminium oxide with conductivity not exceeding 20mg/ml NaCl.

System BD-12. (Atmospheric Zone) - GRP/FRP surface requiring colour coding for identification purpose per Project requirement.

BD-12					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 110°C		CX		NO	
Coating system			***Repair system***		
Surface preparation: Grade of cleanliness: Wipe the surface with compatible tinner or wash with water using suitable detergent to remove any remain of mould. Lightly abrade areas to be coated prior applying the colour. Roughness: N/A.			Surface preparation: Grade of cleanliness: Wipe the surface with compatible tinner or wash with water using suitable detergent to remove any remain of mould. Lightly abrade areas to be coated prior applying the colour. Roughness: N/A.		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EP (surface tolerance)	50	1	EP (surface tolerance)	50
2	PU	50	2	PU	50
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	100		Total NDFT:	100
Notes 1. X-cut test (ISO 16276-2): Level 0-2.					

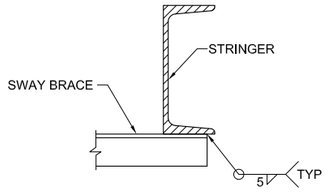
System BD-13. (Atmospheric Zone) - Copper and copper alloy surface requiring colour coding for identification purpose per Project requirement.

BD-13					
Operating temperature		**Corrosivity**		**Insulation**	
Up to 110°C		CX		NO	
Coating system			***Repair system***		
Surface preparation: Hand abrade with emery cold (#120-#160) to create a minimum profile. Roughness: N/A.			Surface preparation: Hand abrade with emery cold (#120-#160) to create a minimum profile. Roughness: N/A.		
Coat	**Generic Type**	**NDFT (µm)**	**Coat**	**Generic Type**	**NDFT (µm)**
1	EP (surface tolerance)	125	1	EP (surface tolerance)	125
2	PU	50	2	PU	50
3	-	-	3	-	-
4	-	-	4	-	-
	Total NDFT:	175		Total NDFT:	175
Notes 1. X-cut testing (ISO 16276-2): Level 0-2.					



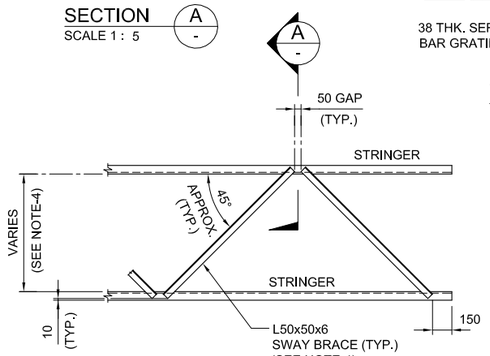
TYPICAL FIXED STAIR DETAIL

SCALE 1 : 25



SECTION A

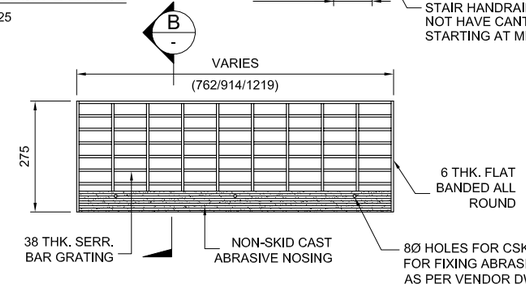
SCALE 1 : 5



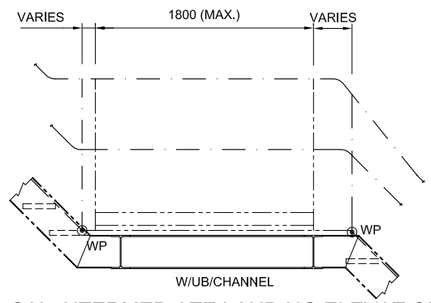
TYPICAL SWAY BRACE DETAIL

SCALE 1 : 25

ALL STRUCTURAL STEEL MEMBERS ARE TYPE-IV MATERIAL (UNO)

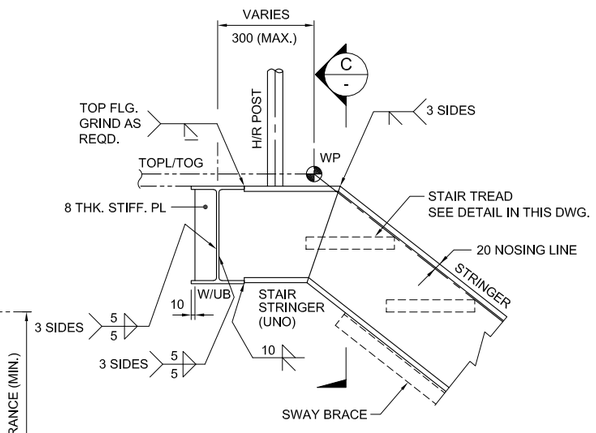


TYPICAL STAIR TREAD DETAIL

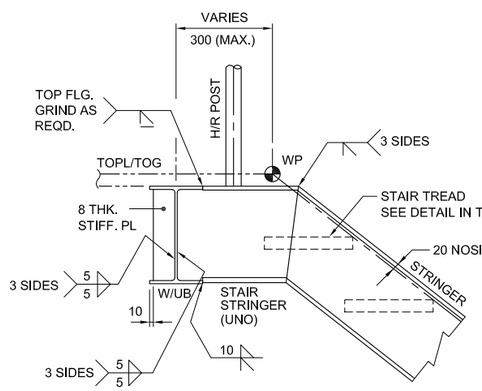


TYPICAL INTERMEDIATE LANDING ELEVATION

SCALE 1 : 25



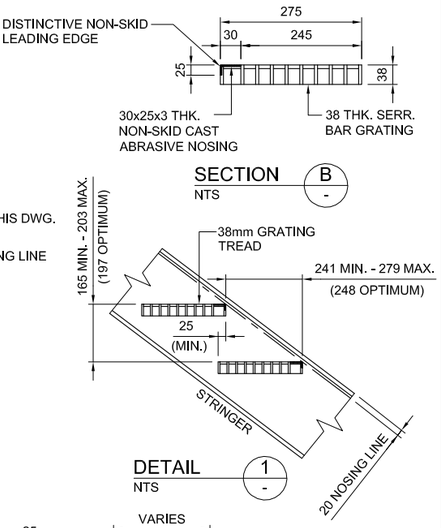
TYPE-1

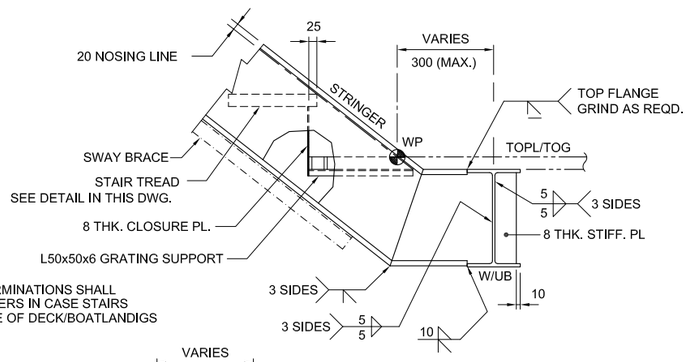


TYPE-2

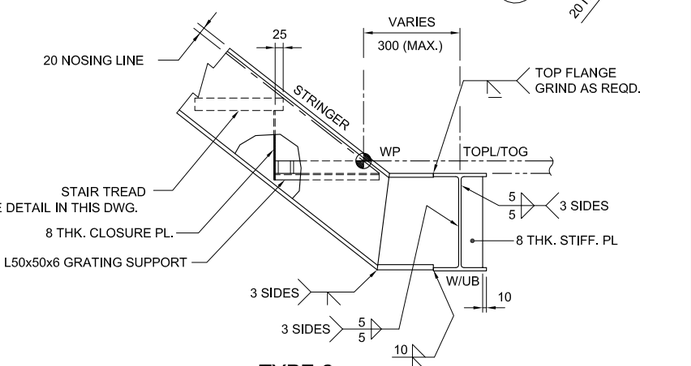
TOP STAIR CONNECTION DETAILS

SCALE 1 : 10





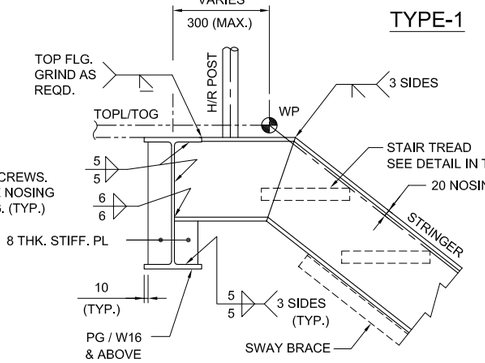
TYPE-1



TYPE-2

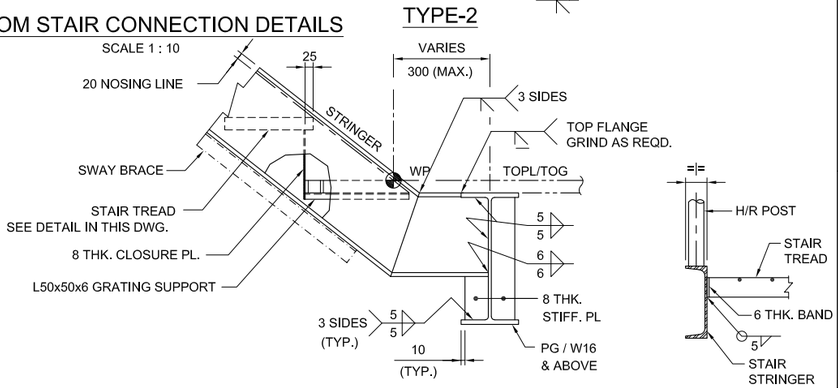
BOTTOM STAIR CONNECTION DETAILS

SCALE 1 : 10



TOP STAIR CONNECTION DETAILS

(CONNECTION WITH PG/W16 & ABOVE)



BOTTOM STAIR CONNECTION DETAILS

(CONNECTION WITH PG/W16 & ABOVE)

SECTION C

NTS

TABLE 1:

STRINGER SECTION	VERTICAL RISE
C12 x 30	3001 to 4200
C10 x 30	UP TO 3000

RECEIVED
25 APR 2025
DOC. CONTROL

ISSUED
25 APR 2025
FOR CONSTRUCTION

PQPOC Approval

Document return Code		PQPOC Signature
Code 1	Reviewed and Accepted with no Comment	Name :
X Code 2	Reviewed/with Comment	Signature :
Code 3	Not Accepted/Revise/Resubmit	Date :
Code 4	Not Reviewed	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS ARE IN METERS UNO.
2. THE SLOPE OF GENERAL ACCESS STAIRS TO BE BETWEEN 30° & 40° WITH AN OPTIMUM VALUE OF 38.29°.
3. MAXIMUM VERTICAL STAIR HEIGHT FOR SINGLE FLIGHT SHALL BE 4877mm OR 24 RISERS.
4. SWAY BRACING IS TO BE PROVIDED WHEN DIAGONAL DIMENSION OF WP TO WP EXCEEDS 4000mm. CALCULATE SWAY BRACING DIMENSIONS TO GIVE EQUAL NUMBER OF SPACINGS.
5. GRATING OR PLATE IS TO BE EXTENDED TO COVER THE TOP FLANGE OF THE TOP & BOTTOM SUPPORT.
6. MINIMUM HEAD ROOM CLEARANCE SHALL BE 2032+1 RISER.
7. PLATFORM HANDRAIL SHALL BE CONTINUOUS WITH STAIR HANDRAILS WITHOUT GAPS. TERMINATING STAIR HANDRAILS SHALL NOT HAVE CANTILEVERS.
8. TOE BOARDS SHALL BE PROVIDED BELOW THE FIRST TREAD AND UPTO END OF STAIR.

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	
PQ-CPC0-STR-DTL-MPC-00002-02	GENERAL NOTES (SHEET 2 OF 2)
PQ-CPC0-STR-DTL-MPC-00002-01	GENERAL NOTES (SHEET 1 OF 2)
PQ-CPC0-STR-LGN-MPC-00001-01	GENERAL DRAWING INDEX

NO.	DATE	DESCRIPTION	DRN.	CHKD.	ENG.	APPR.
REVISIONS						
N01	03-05-24	ISSUED FOR CONSTRUCTION	HJC	BNR	SP	JKH
L01	15-02-24	ISSUED FOR CONSTRUCTION	AM	BNR	SP	JKH
K01	19-01-24	ISSUED FOR REVIEW	HJC	BNR	SP	SS
J01	27-12-23	ISSUED FOR IDC	HJC	BNR	SP	SS

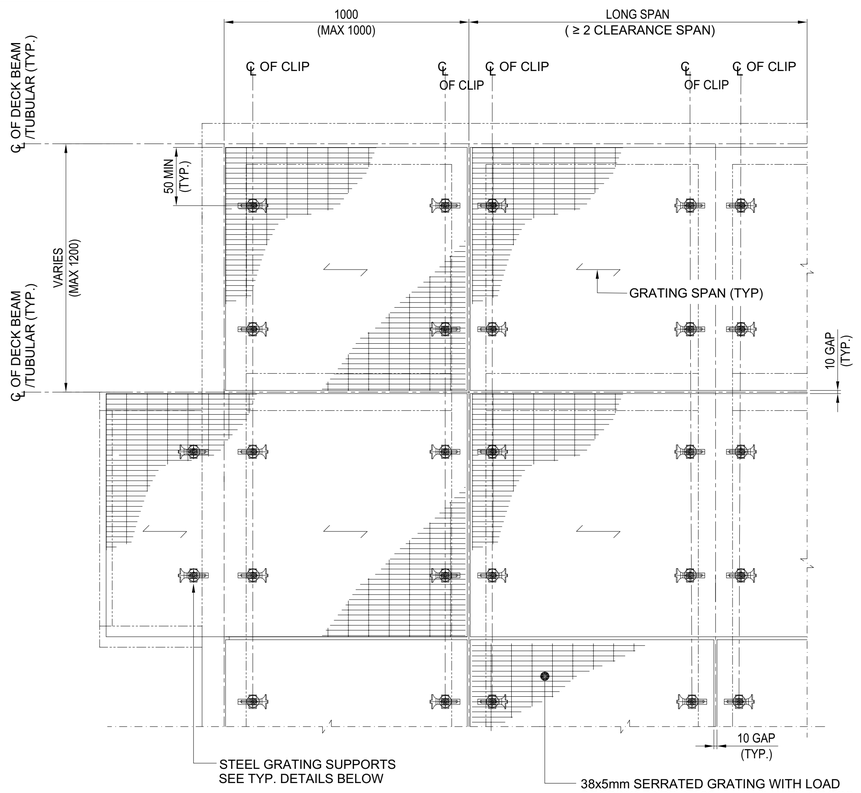
MANUAL CAD

MCDERMOTT | PTSC (A member of PETROVIETNAM) | PETROVIETNAM PQPOC — PHU QUOC PETROLEUM OPERATING COMPANY

VIETNAM BLOCK B GAS PROJECT
PROVISION OF EPCI FOR CENTRAL PRODUCTION PLATFORM, LIVING QUARTER PLATFORM AND FLARE TOWER JACKET / TOPSIDE / UTILITY MODULE / BRIDGE
TYPICAL STAIR DETAILS

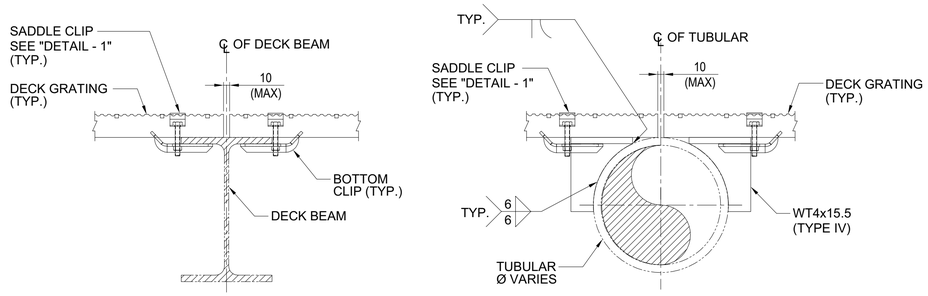
SCALE:	PQPOC DRAWING NUMBER:	REVISION:
NTS	PQ-CPC0-STR-DTL-MPC-00012-01	N01

PQ-CPC0-STR-DTL-MPC-00008-02



TYPICAL STEEL SERRATED GRATING ARRANGEMENT

(GRATING FIXED USING SADDLE CLIP)

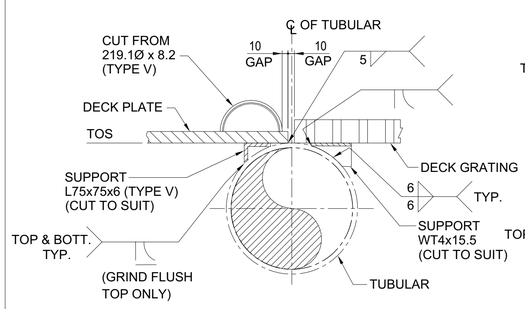


ON DECK BEAM

ON TUBULAR

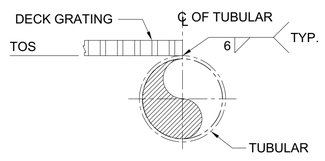
TYPICAL STEEL GRATING SUPPORT DETAILS

8. ALL STEEL GRATINGS SHALL BE OF 38x5mm SERRATED LOAD BEARING BARS AT 30mm c/c WITH CROSS BARS AT 100mm c/c. REFER TO X.1 & X.2 OF DRAWING NO. PQ-CPC0-STR-DTL-MPC-00002-01 FOR GALVANIZING AND COATING REQUIREMENTS.
9. ALL CUT EDGES OF GRATING SHALL BE PROVIDED WITH END BANDING WITH 38x5mm THICK LOAD BEARING BAR.
10. ALL OFFSHORE INSTALLED GRATINGS SHALL BE TRIAL FITTED AND TAGGED IN THE YARD FOR SHIPPED LOOSE AND OFFSHORE INSTALLATION.



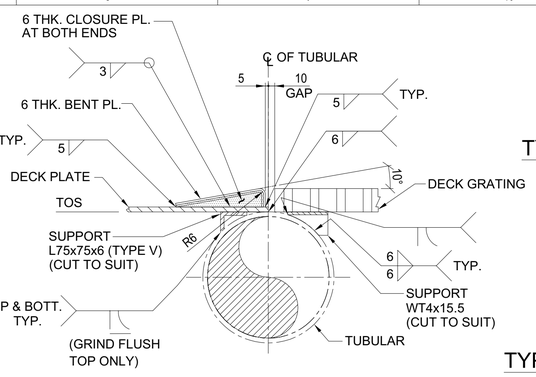
TYPICAL BUNDING-GRATING INTERSECTION

(GRATING FIXING BY CLIP)



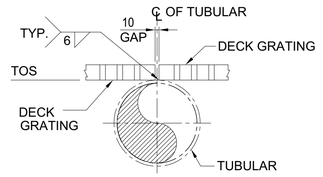
SECTION A

(GRATING FIXING BY WELDING)



TYPICAL TRANSITION DETAIL BETWEEN PLATING & GRATING

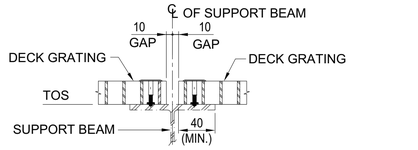
(NON BUNDED AREAS)
(GRATING FIXING BY CLIP)



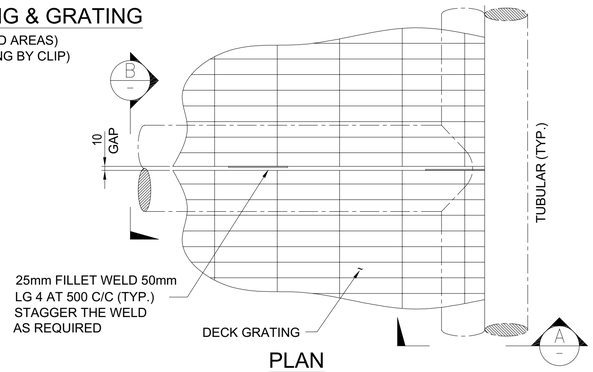
SECTION B

(GRATING FIXING BY WELDING)

TYPICAL GRATING FIXING WITH FASTENERS (CONTINUOUS GRATING PANEL)

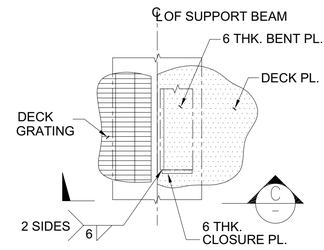


TYPICAL GRATING FIXING WITH FASTENERS (SEPARATE GRATING PANEL)

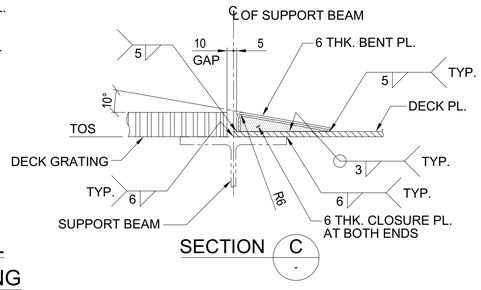


PLAN

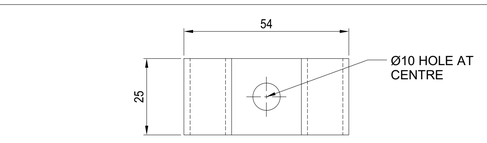
TYPICAL GRATING WELDED CONNECTION TO TUBULARS



TYPICAL TRANSITION DETAIL BETWEEN PLATING & GRATING

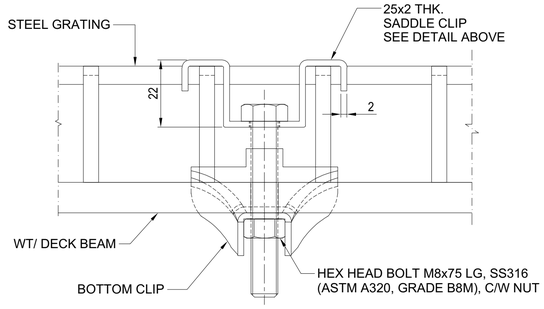


SECTION C



TOP SADDLE CLIP DETAIL

SCALE: NTS



DETAIL - 1

SCALE: NTS

THIS SHEET IS ADDED DURING IFC STAGE TO ACCOMMODATE ADDITIONAL DETAILS DEVELOPED AND ISSUED FOR IFC TO ALIGN WITH BASE DRAWING.

RECEIVED 25 APR 2025 DOC. CONTROL

ISSUED 25 APR 2025 FOR CONSTRUCTION

PQPOC Approval		
Document return Code		PQPOC Signature
☐ Code 1	Reviewed and Accepted with no Comment	Name :
☒ Code 2	Reviewed/with Comment	Signature :
☐ Code 3	Not Accepted/Revise/Resubmit	Date :
☐ Code 4	Not Reviewed	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS ARE IN METERS UNO.
2. ALL STRUCTURAL STEEL SHALL BE TYPE-IV, UNLESS NOTED OTHERWISE.
3. PLATE CUT TO SUIT TO REDUCE THE GAP & FILLER MATERIAL.
4. WHEREVER SPACE CONSTRAINT, THE GAP CAN BE ADJUSTED BY (±)5mm.
5. DECK PLATE SPLICE SHALL BE GROUND FLUSH IN LOCATIONS WHERE THE EQUIPMENT SKID IS PLACED ON TOP OF DECK PLATE, IN OTHER LOCATIONS IT SHALL BE GROUND SMOOTH.
6. THE GRATING CLIP DETAILS PROVIDED ARE INDICATIVE ONLY. THE ACTUAL LOCATION OF CLIP, SUPPORT SHALL BE ADJUSTED TO SUIT AT SITE.
7. L75x75x8 TYPE IV SHALL BE PROVIDED AS GRATING SUPPORTS WHEREVER REQUIRED BASED ON THE ACTUAL GRATING CUTTING PLAN AND SPANNING DIRECTION.

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	
PQ-CPC0-STR-DTL-MPC-00002-02	GENERAL NOTES (SHEET 2 OF 2)
PQ-CPC0-STR-DTL-MPC-00002-01	GENERAL NOTES (SHEET 1 OF 1)
PQ-CPC0-STR-LGN-MPC-00001-01	GENERAL DRAWING INDEX

NO.	DATE	DESCRIPTION	DRN.	CHKD.	ENG.	APPR.
REVISIONS						
N01	04-APR-25	ISSUED FOR CONSTRUCTION	XAR	BNR	SP	JKH

MANUAL CAD

MCDERMOTT | PTSC A member of PVMWORK | PETROVIETNAM PQPOC | PHU QUOC PETROLEUM OPERATING COMPANY

VIETNAM BLOCK B PROJECT
PROVISION OF EPCI FOR CENTRAL PRODUCTION PLATFORM, LIVING QUARTER PLATFORM AND FLARE TOWER TOPSIDE / UTILITY MODULE / BRIDGE
TYPICAL FLOORING SECTIONS AND DETAILS

SCALE:	PQPOC DRAWING NUMBER:	REVISION:
NTS	PQ-CPC0-STR-DTL-MPC-00008-02	N01

APPENDIX 2

SUMMARIZED TECHNICAL REQUIREMENT

Summarized Technical Requirement is a list of contents information taken from Project Specification, Datasheets, COMPANY Standard and other applicable documents in order to highlight and emphasize the critical and essential requirements of the Package to BIDDER, for the purpose of supporting BIDDER to submit a sufficient and correct proposal. This Summarized list shall not release BIDDER in any way from any of his obligations and liabilities under compliance of Project's requirement.

BIDDER shall respond to each requirement by confirming compliance. This requirement is mandatory and failure to comply may render Bidder technically disqualified.

If there is any conflict requirement between this List and other applicable documents, BIDDER shall raise to get clarification and agreement of PURCHASER. Otherwise, the most stringent requirement shall be applied

APPENDIX 2.1

MATERIAL TAKE OFF FOR STEEL GRATING AND STAIR TREADS

MTO FOR STEEL GRATING AND STAIR TREADS

No	Description	Material Grade	Type	Unit Wide (mm)	Unit length (mm)	Q-ty (nos)	Construction Allowance (%)	Final Q-ty (nos)	Unit weight (Kg/m2)	Total weight (Kg)	Remark
A. FOR LQM										**40,942.4**	
1	Hot-Dip Galvanized Serrated Steel Grating 38x5/30x100	ASTM A36	IV	1000	6000 (Span)	105	6%	**112**	53.60	36,019.2	
2	275W x 1219L Hot-Dip Galvanized Serrated Steel Stair Treads 38x5/30x100 with anti-slip nosing	ASTM A36	IV	275	1219	266	3%	**274**	53.60	4,923.2	
3	Grating Clips: - 25x2 Thk Saddle Clip - Hex Head Bolt M8x75L c/w Nuts - Bottom Clip (All material shall be SS316L)	SS316L				1836	20%	**2204**			Refer to Drawing: PQ-CPC0-STR-DTL-MPC-00008-02_N01
4	Hot-Dip Galvanized Serrated Steel Bar 38x5	ASTM A36	IV		6000	5		**5**			
B. FOR LQU										**8,760.5**	
5	Hot-Dip Galvanized Serrated Steel Grating 38x5/30x100	ASTM A36	IV	1000	6000 (Span)	22	6%	**24**	53.60	7,718.4	
6	275W x 1219L Hot-Dip Galvanized Serrated Steel Stair Treads 38x5/30x100 with anti-slip nosing	ASTM A36	IV	275	1219	56	3%	**58**	53.60	1,042.1	
7	Grating Clips: - 25x2 Thk Saddle Clip - Hex Head Bolt M8x75L c/w Nuts - Bottom Clip (All material shall be SS316L)	SS316L				463	20%	**556**			Refer to Drawing: PQ-CPC0-STR-DTL-MPC-00008-02_N01
	TOTAL									**49,703.0**	

APPENDIX 2.2

MATERIALS DATASHEET FOR STEEL GRATING & STAIR TREADS

MCDERMOTT PTSC A member of PETROVIETNAM	**Vietnam Block B Gas Project** **TECHNICAL REQUIREMENT FOR STEEL GRATING AND STAIR TREADS**	PETROVIETNAM PQPOC

APPENDIX 2.2 - DATA SHEET FOR STEEL GRATING AND STAIR TREADS

	Property		Specification	Bidder's Confirmation	Cost Impact (Yes/No)	Schedule Impact (Yes/No)
1	**Reference Documents**		1. PQ1-00-STR-SPC-TAP-00003_H02 Specification for Design of Fixed Platform Structures 2. PQ-CPC0-STR-SPC-MPC-00003-00_N01 Specification For Structural Steel For Fixed Offshore Platform 3. PQ1-00-QAC-SPC-TAP-00002_H01 Specification For Control And Reporting Of Non-Conformances And Non- conforming Products. 4. PQ-GENR-QAC-SPC-PQC-00003-00_H01 Quality Requirements Critical Levels 3 & 4 5. PQ-GENR-QAC-SPC-PQC-00005-00_H01 Traceability & Marking Requirements for Materials and Equipment 6. PQ-GENR-ITM-SPC-PQC-00003-00_H01 Document Numbering and Coding 7. PQ-GENR-ITM-SPC-PQC-00002-00_H01 Vital Document and Data Deliverables 8. PQ1-00-MEC-SPC-TAP-00035_H01 Specification Of Requirements For Positive Material Identification 9. PQ1-00-TEC-SPC-TAP-00002_H01 Units of Measurement 10. PQ-GENR-CTC-EXH-PQC-00106-05_H01 Contractor's Project Quality Management Program 11. PQ-CPC0-STR-SPC-MPC-00002-00_L01 Specification Of Fabrication Of Platform Structures For Fixed Offshore Platforms 12. PQ-GENR-QAC-SPC-PQC-00004-00_H01 Contractor and Subcontractor Quality Personnel Qualification 13. PQ-CPC0-CRR-SPC-MPC-50001-00_H01 Specification For Protective Coatings			
			Referenced Codes/ Standards/ Documents/ Specifications specified in above Specifications			
			Note: The purpose of this datasheet is providing key requirements of the STEEL GRATING AND STAIR TREADS. Bidder is requested to read and fully comply with all requirements stated in the given specifications. If any conflicts found between this datasheet and the referenced documents, Bidder shall bring to Purchaser for resolution. If Bidder has any deviations/ exceptions, Bidder is requested to fullfill in Form T5 in Bidding stage for further evaluation, otherwise Purchaser understands that Bidder fully comply with requirements specified in TR.			
2	**Quality Management System**		- Submit its own and its manufacturer ISO certificates to confirm that a Quality Management System was established according to ISO 9001:2015 standards. - The certificates shall be renewed if they are expired at the time of manufacturing.			
3	**Material Specification**	**Serrated Steel Grating**	ASTM A36 or similar. To be Hot Dip Galvanized by Bidder according to ASTM A123 (minimum 0.705 kg/m2 of Zinc coat) and be applied in accordance with ASTM A-385. Certified load rating and deflection characteristics shall be provided. As a minimum: - The 38 mm grating shall be required to support a uniform load of 10 KN/m2 for clear span of 1000 mm. - Grating to be checked with Concentrated Load 5 kN on an 0.3mx0.3m contact area, clear span 1000 mm. Bidder shall provide Catalogue of Grating to refer.			
		Stair Tread	ASTM A36 or similar. To be Hot Dip Galvanized by Bidder according to ASTM A123 (minimum 0.705 kg/m2 of Zinc coat) and be applied in accordance with ASTM A-385.			
		Grating Clip	SS316L.			
4	**Size**		- Serrated Steel Grating: To be provided with standard size 1000mm x 6000mm. - Stair Treads: As per MTO.			

APPENDIX 2.2 - DATA SHEET FOR STEEL GRATING AND STAIR TREADS

	Property	Specification	Bidder's Confirmation	Cost Impact (Yes/No)	Schedule Impact (Yes/No)
5	**Manufacturing Requirements**	- Selection of all components, materials, etc. suitable for the service and environmental conditions encountered and in accordance with Purchaser's specification. - Procurement and testing of individual items of the supplied items. - Bidder shall provide information on the country of origin and packaging location of the supplied STEEL GRATING AND STAIR TREADS. - The Bidder shall assume TOTAL responsibility for coordination between Sub-Bidders of all ancillary equipment and his own supply, and shall be solely responsible to the Purchaser for conformity with the Purchaser's specification. - STEEL GRATING AND STAIR TREADS shall be fabricated without sharp edges, burrs or spatter. No pin holes in welds are accepted. - Welding for Steel Grating shall be in accordance with PQ-CPC0-STR-SPC-MPC-00002-00_L01 Specification Of Fabrication Of Platform Structures For Fixed Offshore Platforms -All welds shall be continuous, intermittent welds shall not be accepted where relevant to prevent corrosion in-service.			
6	**Manufacturing Procedure Specifications (MPS)**	- Bidder shall develop a written Manufacturing Procedure Specifications (MPS) describing all stages of manufacture, testing and inspection and ITP, which shall be submitted to Purchaser/COMPANY for approval. - Bidder shall submit MPS for review along with the proposal for further evaluation (Not accept for sample MPS)			
7	**Inspection & Testing Requirement Plan (ITP) (Appendix 8)**	1. The Bidder shall submit ITP for Review and Approval, by Company and/or Third Party before commence the WORK. 2. CONTRACTOR/ EMPLOYER and/or Third Party shall be permitted to inspect the Bidder's facilities prior to placing an order.The successful Vendor shall agree to the CONTRACTOR's inspection throughout all phases of construction. 3. Inspection Notification for W an H point (as specified in ITP) to be sent to purchaser at least 14 days in advance. 4. Bidder to confirm compliance with the ITP as per Appendix 8 of this RFQ and submit mark up to Purchaser for review and evaluation. 5. All tools and equipments shall have a valid calibration certificate and labelled on it for identification.			
8	**Bidder Acceptability**	Bidder shall demostrate their ability to provide STEEL GRATING AND STAIR TREADS and miscellaneous items according to PQ1-00-STR-SPC-TAP-00003_H02 Specification for Design of Fixed Platform Structures and other related requirements.			
9	**Weight and Tolerances**	- Net Weight: As per details in Appendix 2.1 Material Take-Off - Gross Weight: As per details in Appendix 2.1 Material Take-Off			
10	**Certificates**	- Test certificate as per: EN 10204:2004 Type 3.1 - Galvanising certificate also to be provided by Bidder. - Certificate of Compliance to be provided by Bidder.			
11	**Bidder Data Requirement Schedule (VDRS) (refer to Appendix 4 of this RFQ)**	- Bidder shall submit mark-up VDRS along with the proposal for further evaluation. - All documents must be in English languages.			
12	**Store, Handling and Transportation**	The Bidder shall propose storage, handling and transportation procedures for PURCHASER and/or COMPANY approval.			

APPENDIX 2.2 - DATA SHEET FOR STEEL GRATING AND STAIR TREADS

	Property	Specification	Bidder's Confirmation	Cost Impact (Yes/No)	Schedule Impact (Yes/No)
13	**Material Origination**	All requirements for Material Origination shall be in accordance with section 5 of PQ-GENR-QAC-SPC-PQC-00003-00 Quality Requirements Criticality for Level 3 & 4. Purchaser requires the use of new materials that "Originate" and are "Manufactured" in one of the countries listed in the chart below. Use of Materials that Originate and are Manufactured in one of the below listed countries do not require prior written approval: Argentina, Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Norway, South Africa, South Korea, Switzerland, United Kingdom, United States, Venezuela, Vietnam, Singapore			
14	**Form T5- Master Deviation List**	Using form T5, Bidder to submit all technical deviations against TR including all reference documents to Purchaser for evaluation. Only deviations contained in this Form shall be considered. Bidder to comply and submit accordingly (if any).			

APPENDIX 3

QA PROGRAM STANDARD AND INSPECTION REQUIREMENT

Appendix 3 – QA Program Standard & Inspection Requirement

QUALITY SYSTEM STANDARD / INSPECTION REQUIREMENT SHEET	
Project:	**Subcontractor:**
Client:	**Vendor:**
Ref.:	**Service Supplier:**
Scope:	**Is Supplier's Quality system ISO 9001**

QUALITY MANAGEMENT SYSTEM STANDARD REQUIREMENTS

The Supplier's Quality System shall comply with the following Quality standard (or equivalent):

ISO 9001: 2015 ☒ {tick one box}
None ☐
Additional requirements for Accredited Certificate/Product Licence:
Note : The Quality System Standard applicable to consultancy services is ISO 9001.

COMPANY INSPECTION LEVEL REQUIREMENTS
(For Supplier's information. Relevant required services to be specified in the requisition)

Criticality 4 ☒ Visits on an exception basic only.

Criticality 3 ☐ Provide random quality representative visits and witness tests.

Criticality 2 ☐ Provide regular, quality representative visits.

Criticality 1 ☐ Provide full-time quality representative.
Note: Refer document number PQ-CPC0-TEC-RPT-MPC-50001 for result of criticality rating assessment.

Final documentation shall follow below specifications:

REVIEW AND APPROVAL

Discipline Lead	Quality Review	Project Manager	COMPANY Approval
Name : Date :	Name : Date :	Name : Date :	Name : Date :

APPENDIX 4

VENDOR DATA REQUISITION SCHEDULE (VDRS)

Appendix 4 - Vendor Data Requirement Schedule (VDRS)

MASTER VDRL ASSIGNMENT

C – Calculations
D – Drawings
E – Equipment Performance Data
G – General
M – Operations and Maintenance
R – Records and Certificates
DB – Data Books
DD – Design Data
FD – Fabrication Data
OM – Operating and Maintenance Manual
T – Types of Data Books P – Procedures

Milestone Abbreviation Used

Firm Order:	WAFO - Weeks After Firm Order
Production Start:	WPTP - Weeks Prior to Production
Test/Process:	WPTT - Weeks Prior to Test/Process
	WAT - Weeks After Test/Process
Delivery:	WPTD - Weeks Prior to Delivery
	WAD - Weeks After Delivery

Each category has an "alpha" code identifier and individual data items are numbered consecutively within each category. Recommended selections of required data submittals (i.e., "Q"—with quotation, "A"—approval, "C"—certified and "R"—record) for project use are provided below with the standard data codes and data descriptions/definitions.

Wherever "Q" denotes with ✓, 01 electronic copy of the data shall be furnished with proposal, along with the number of hardcopies required in package commercial dossier. Documents submitted for Approval "A" and Certified "C" shall be furnished with 01 electronic copy. Final certified drawings and the Manufacturer Data Book shall be furnished with 02 set prints (with at least 01 set bearing wet signatures) and 05 electronic copies.

DATA CODE	DATA DESCRIPTION/DEFINITION	RECOMENDED DATA SUBMITTALS (WEEKS) Q	A	C	R	REMARK
	C – CALCULATIONS					
C01	SEISMIC FORCE CALCULATIONS (TRANSPORTATION)					Include in T1
C02	PIPING ENGINEERING CALCULATIONS					Include in T1
C03	STRUCTURAL STEEL CALCULATIONS					Include in T1
C04	UNBALANCED FORCE CALCULATIONS					Include in T1
C05	SYSTEM HEAD LOSS CALCULATIONS					Include in T1
C06	ENGINEERING CALCULATIONS					Include in T1
C07	LATERAL CRITICAL SPEED CALCULATIONS					Include in T1
C08	TORSIONAL CRITICAL SPEED CALCULATIONS					Include in T1
C09	NOT IN USE					
C10	WIND LOAD CALCULATIONS					Include in T1
C11	CONVEYOR CEMA CALCULATIONS					Include in T1
C12	NON-CODE BIN, HOPPER, SILO DESIGN CALCULATIONS					Include in T1
C13	PROCESS SIZING / UTILITY CALCULATIONS					Include in T1
C14	HYDRAULIC CALCULATIONS / PSV SIZING CALCULATIONS					Include in T1
C15	BEARING LIFE CALCULATIONS					Include in T1
C16	ACOUSTIC ENCLOSURE VENTILATION SYSTEM CALCULATIONS					Include in T1
C17	COMBUSTION AIR SYSTEM PRESSURE DROP CALCULATIONS					Include in T1
C18	EXHAUST SYSTEM PRESSURE DROP CALCULATIONS					Include in T1
C19	EXHAUST DUCT CALCULATIONS					Include in T1
C20	HEAT EMISSION CALCULATIONS					Include in T1
C21	GENERATOR DESIGN CALCULATIONS					Include in T1
C22	HVAC LOAD CALCULATIONS					Include in T1
C23	ACOUSTIC VIBRATION CALCULATIONS					Include in T1

DATA CODE	DATA DESCRIPTION/DEFINITION	RECOMENDED DATA SUBMITTALS (WEEKS) Q	A	C	R	REMARK
C24	HVAC SYSTEMS COMPUTER GENERATED COOLING LOAD CALCULATIONS					Include in T1
C25	HVAC SYSTEMS NOISE CALCULATIONS					Include in T1
C26	HVAC SYSTEMS FAN TOTAL STATIC CALCULATIONS					Include in T1
C27	VENTILATION SYSTEMS DESIGN CALCULATIONS INCLUDING VENTILATION RATES USED					Include in T1
C28	ELECTRIC DUCT HEATERS SIZING CALCULATIONS					Include in T1
C29	INTAKE AND EXHAUST LOUVERS SIZING CALCULATIONS					Include in T1
C30	FLOW ELEMENT SIZING CALCULATION					Include in T1
C31	UTILITY CONSUMPTION CALCULATION					Include in T1
C32	HEAT DISSIPATION SUMMARY (FOR UCP)					Include in T1
C33	CONTROL VALVE CALCULATION (SIZING, NOISE ETC)					Include in T1
C34	PRESSURE RELIEF VALVE CALCULATION (SIZING, REACTION FORCE & NOISE)					Include in T1
C35	STRESS CALCULATION (FOR THERMOWELL, SAMPLE PROBE ETC)					Include in T1
C36	MECHANICAL CALCULATION					Include in T1
C37	LIFTING CALCULATION					Include in T1
C99	CALCULATIONS NOT SPECIFIED ABOVE, IF APPLICABLE					Include in T1
	D – DRAWINGS					
D01	OUTLINE DRAWINGS					Include in T1
D02	SHOP DETAIL DRAWINGS					Include in T1
D03	EQUIPMENT ARRANGEMENT DRAWINGS					Include in T1
D04	ASSEMBLY DRAWINGS(IF ANY)		✓			Include in T1
D05	EXPLODED VIEW DRAWINGS					Include in T1
D06	SUPPORT LOADING DIAGRAM / DATA					Include in T1
D07	ANCHOR BOLT LOCATION DRAWINGS, WELD DETAILS, SUPPORT G.A.					Include in T1
D08	GENERAL ARRANGEMENT DRAWINGS					Include in T1
D09	FLOOR PLAN DRAWINGS					Include in T1
D10	PROCESS FLOW DIAGRAMS INCLUDING MASS AND HEAT BALANCE					Include in T1
D11	NOT IN USE					
D12	ELECTRICAL / ELECTRONIC SCHEMATICS					Include in T1
D13	ONE-LINE ELECTRICAL DIAGRAM					Include in T1
D14	ELECTRICAL INTERCONNECTION DIAGRAM					Include in T1
D15	ELECTRICAL INTERNAL CONNECTION DIAGRAM					Include in T1
D16	ELECTRICAL SCHEMATICS AND WIRING DIAGRAMS					Include in T1
D17	PIPING SCHEMATICS AND ARRANGEMENT DRAWINGS					Include in T1
D18	DETAIL EQUIPMENT DRAWINGS					Include in T1
D19	HVAC SCHEMATIC AND FLOW DIAGRAM					Include in T1
D20	DETAIL VESSEL OR TANK FABRICATION DRAWINGS					Include in T1
D21	MECHANICAL SEAL DRAWING					Include in T1
D22	PIPING ISOMETRICS					Include in T1
D23	COUPLING DRAWING					Include in T1
D24	NOT IN USE					
D25	INPUT / OUTPUT NOZZLE SCHEDULES					Include in T1
D26	ELECTRONIC EQUIPMENT OUTLINE DRAWING					Include in T1
D27	ELECTRONIC CABLE DETAILS					Include in T1
D28	SYSTEM INTERCONNECTION DIAGRAM					Include in T1
D29	INSTRUMENT GA DRAWING					Include in T1
D30	AIR CONDITIONING SYSTEM POWER AND CONTROL WIRING SCHEMATICS					Include in T1
D31	POWER AND DUCT HEATERS WIRING SCHEMATICS					Include in T1
D32	AIR CONDITIONING SYSTEM CONTROL PANEL DETAILS					Include in T1
D33	HVAC SYSTEMS TYPICAL INSTALLATION DETAILS					Include in T1
D34	HVAC SYSTEMS DUCTWORK CONSTRUCTION DETAILS					Include in T1
D35	AIR FLOW DIAGRAM					Include in T1

DATA CODE	DATA DESCRIPTION/DEFINITION	RECOMENDED DATA SUBMITTALS (WEEKS) Q	A	C	R	REMARK
D36	INSTRUMENT SCHEMATIC & CONTROL DIAGRAM.					Include in T1
D37	DETAILED INTERCONNECTION WIRING DIAGRAM					Include in T1
D38	OVERALL PACKAGE TUBING BLOCK DIAGRAM					Include in T1
D39	OVERALL PACKAGE CABLING BLOCK DIAGRAM					Include in T1
D40	INSTRUMENT HOOKUP & INSTALLATION DRAWINGS					Include in T1
D41	UCP G.A. DRAWGING					Include in T1
D42	UCP FOOTPRINT SHOWING ALL BOLTING/INSTALLATION DETAILS					Include in T1
D43	UCP/CONTROL PANEL INTERNAL WIRING DIAGRAM.					Include in T1
D44	CONTROL & LOGIC DIAGRAM					Include in T1
D45	P & ID					Include in T1
D46	FIELD JUNCTION BOX WIRING DRAWINGS					Include in T1
D47	FIELD JUNCTION BOX G.A DRAWING					Include in T1
D48	LOCAL GAGE BOARD DRAWING					Include in T1
D49	CABLE TRAY & TUBING LAYOUT/ROUTING DRAWING					Include in T1
D50	LOGIC DIAGRAM / LOGIC FLOW CHART					Include in T1
D51	PIPE SUPPORT DRAWING					Include in T1
D61	AIR, FUEL, HYDRAULIC SCHEMATICS					Include in T1
D96	MISCELLANEOUS DRAWING					Include in T1
D97	CRANE CABIN LAYOUT AND GA DRAWING					Include in T1
D98	PEDESTAL ADAPTER DETAILS					Include in T1
D99	DRAWINGS NOT SPECIFIED ABOVE, IF APPLICABLE					Include in T1
	E – EQUIPMENT PERFORMANCE DATA					
E01	ELECTRICAL RELAY CHARACTERISTICS, RATINGS AND INSTRUCTIONS					Include in T3
E02	CURRENT, POTENTIAL AND POWER TRANSFORMER CURVES					Include in T3
E03	MOTOR PERFORMANCE CURVES					Include in T3
E04	ELECTRICAL FUSE / CIRCUIT BREAKER CHARACTERISTIC CURVES AND INSTRUCTIONS					Include in T3
E05	MOTOR HEATING AND SAFE LOCKED ROTOR TIME CURVES					Include in T3
E06	MOTOR CURVE FOR TORQUE AND CURRENT VS. SPEED					Include in T3
E07	EQUIPMENT PERFORMANCE CURVES AND DATA					Include in T3
E08	EQUIPMENT EMISSION DATA					Include in T3
E09	METER RUN REQUIREMENTS, FLOW TUBES AND VENTURI					Include in T3
E10	HOIST PERFORMANCE CHART					Include in T3
E99	EQUIPMENT PERFORMANCE DATA NOT SPECIFIED ABOVE, IF APPLICABLE					Include in T3
	G – GENERAL					
G01	VENDOR DATA SCHEDULE / VENDOR DATA REQUIREMENT LIST		✓			Include in T1
G02	FABRICATION / PRODUCTION SCHEDULE		✓			Include in T1
G03	ACKNOWLEDGEMENT OF PURCHASE ORDER					No Databook
G04	BILL OF INSTALLATION / ASSEMBLY MATERIALS		✓		✓	Include in T3
G05	UTILITY REQUIREMENTS					Include in T1
G06	EQUIPMENT WEIGHTS AND CENTER OF GRAVITY					Include in T3
G07	COMPLETED PROJECT DATA SHEETS					Include in T1
G08	COMPLETED VENDOR'S DATA SHEETS (INCLUDING WEIGHT AND NOISE D/S)					Include in T1
G09	CATALOG DATA					Include in T3
G10	VENTILATION REQUIREMENTS					Include in T1
G11	ALLOWABLE NOZZLE LOADS					Include in T1
G12	BOLT / FASTENER AND GASKET SCHEDULES					Include in T1
G13	ASSEMBLY / DISASSEMBLY SIZES AND WEIGHTS					Include in T3

DATA CODE	DATA DESCRIPTION/DEFINITION	RECOMENDED DATA SUBMITTALS (WEEKS) Q	A	C	R	REMARK
G14	ELECTRICAL EQUIPMENT / MOTOR COOLING REQUIREMENTS					Include in T1
G15	NOISE LEVEL DATA SHEETS					Include in T1
G16	SUB VENDOR DATA SHEETS / LITERATURE / MANUALS					Include in T1
G17	FOUNDATION STATIC AND DYNAMIC LOADS					Include in T1
G18	CABLE SCHEDULE					Include in T1
G19	NAMEPLATE DETAILS					Include in T1
G21	VENDOR EXPERIENCE LIST	✓				Include in T3
G22	PACKING LIST		✓		✓	2 WPTD
G23	INSPECTION AND RELEASE NOTES		✓	✓	✓	Include in T2
G30	EQUIPMENT SPECIFIC SOFTWARE DOCUMENT					Include in T1
G31	ISA INSTRUMENT DATA SHEET					Include in T1
G32	INSTRUMENT INDEX					Include in T1
G33	I/O LIST AND SCHEDULES					Include in T1
G34	CAUSE & EFFECT CHART					Include in T1
G35	CONTROL PHILOSOPHY/NARRATIVE FOR THE WHOLE PACKAGE					Include in T1
G36	SERIAL COMMUNICATION					Include in T1
G37	HMI GRAPHICS					Include in T1
G38	SET POINT LIST FOR ALARMS & TRIP SETTING					Include in T1
G39	FUNCTIONAL DESIGN SPECIFICATION					Include in T1
G40	FOUNDATION FIELDBUS SEGMENT DESIGN (IF FOUNDATION FIELDBUS APPLICABLE)					Include in T1
G41	SUB VENDOR/ SUPPLIER LIST					Include in T3
G42	MODBUS MAPPING LIST					Include in T1
G46	CRANE PEDESTAL REACTIONS					Include in T1
G98	CRANE LOAD CHARTS					Include in T1
G99	GENERAL INFORMATION NOT SPECIFIED ABOVE, IF SPECIFIED					Include in T1
	M – OPERATIONS AND MAINTENANCE DATA					
M01	OPERATING INSTRUCTIONS					Include in T3
M02	MAINTENANCE AND LUBRICATION RECOMMENDATIONS					Include in T3
M03	PRICED, RECOMMENDED SPARE PARTS FOR STARTUP / COMMISSIONING					Include in T3
M04	PRICED, RECOMMENDED SPARE PARTS FOR TWO (2) YEARS OPERATION					Include in T3
M05	MINIMUM SPECIFIED OPERATING SPARES					Include in T3
M06	SPECIFIED CAPITAL SPARES					Include in T3
M07	RECOMMENDED CONSUMABLES FOR TWO (2) YEARS					Include in T3
M08	SPECIAL MAINTENANCE TOOL REQUIREMENTS					Include in T3
M09	OPERATING FLUIDS AND MATERIALS (LUBRICATION SCHEDULE)					Include in T3
M10	SPARE PARTS LIST AND INTERCHANGEABLITY					Include in T3
M99	O&M DATA NOT SPECIFIED ABOVE, IF APPLICABLE					Include in T3
	P – PROCEDURES					
P01	QUALITY CONTROL PROCEDURES					Include in T2
P02	HYDROSTATIC OR PNEUMATIC TEST PROCEDURE					Include in T2
P03	NON-DESTRUCTIVE TEST PROCEDURES					Include in T2
P04	WELDING PROCEDURE FOR SHOP, FIELD AND REPAIR WELDS; WELDING PROCEDURE QUALIFICATION CERTIFICATE & RECORDS	✓	✓		✓	4 WAFO
P05	FACTORY / FIELD ACCEPTANCE TEST PROCEDURE					Include in T2
P06	ENVIRONMENTAL TEST PROCEDURES					Include in T2
P07	SURFACE PREPARATION AND PAINTING PROCEDURE		✓		✓	4 WAFO
P08	FIELD SUPPORT RECOMMENDATIONS					Include in T2

Vui lòng không sử dụng, sao chép, tiết lộ hoặc tái sản xuất tài liệu này cho bất kỳ mục đích nào khác ngoài mục đích được cung cấp. Tài liệu này là tài sản của PQPOC và không được sử dụng, tiết lộ hoặc tái sản xuất

DATA CODE	DATA DESCRIPTION/DEFINITION	RECOMENDED DATA SUBMITTALS (WEEKS) Q	A	C	R	REMARK
P09	SHIPPING, HANDLING AND STORAGE PROCEDURES		✓		✓	Include in T2
P10	INSTALLATION / ERECTION PROCEDURE					Include in T3
P11	CLEANING / PICKLING OF EXTERNAL PIPING SYSTEMS					Include in T2
P12	HEAT TREATMENT PROCEDURE					Include in T2
P13	QUALITY CONTROL INSPECTION AND TEST PLANS (ITP)	✓	✓		✓	Include in T2
P17	NOISE MEASUREMENT TEST PROCEDURE AND CALCULATIONS					Include in T2
P18	LUBRICATION OIL SYSTEM FLUSHING PROCEDURE					Include in T3
P19	DIMENSIONAL CHECK PROCEDURES		✓		✓	Include in T2
P21	MANUFACTURING PROCEDURE (MPS)	✓	✓		✓	Include in T2
P22	WEIGHT AND CENTER OF GRAVITY CONTROL					Include in T2
P23	NOT IN USE					
P24	INSTALLATION & COMMISSIONING PROCEDURE					Include in T3
P25	WELDING CONSUMABLE CONTROL PROCEDUE					Include in T2
P26	PERFORMANCE TEST PROCEDURE					Include in T2
P27	PMI PROCEDURE, AS APPLICABLE					Include in T2
P99	PROCEDURE NOT SPECIFIED ABOVE, IF APPLICABLE					Include in T2
	R – RECORDS AND CERTIFICATES					
R01	MECHANICAL COMPLETION CERTIFICATE					Include in T2
R02	CODE COMPLIANCE CERTIFICATE/ CERTIFICATE OF COMPLIANCE		✓	✓	✓	Include in T2
R03	OVERSPEED TEST RECORDS					Include in T2
R04	CORROSION TEST RECORDS					Include in T2
R05	ELECTRICAL EQUIPMENT HEAT RUN TEST RECORDS					Include in T2
R06	IMPULSE VOLTAGE TEST RECORD					Include in T2
R07	ELECTRICAL SHORT CIRCUIT TEST RECORD					Include in T2
R08	NAMEPLATE RUBBINGS OR PHOTOGRAPH					Include in T2
R09	HYDROSTATIC OR PNEUMATIC TEST CERTIFICATE					Include in T2
R10	SEISMIC TEST CERTIFICATE					Include in T2
R11	PERFORMANCE / ACCEPTANCE TEST REPORT					Include in T2
R12	NOISE LEVEL TEST REPORT					Include in T2
R13	INSTRUMENTED MECHANICAL RUN OR DYNAMIC TEST RECORDS					Include in T2
R14	CODE DATA REPORTS (ASME Forms U, UV, R…)					Include in T2
R15	VENDOR'S METAL ALLOY AND TEMPER CERTIFICATION					Include in T2
R16	MATERIAL SAFETY DATA SHEET					Include in T2
R17	RELIABILITY OR FAILURE RATE ANALYSIS					Include in T2
R18	CALIBRATION RESULTS REPORT		✓	✓	✓	2 WPTT
R19	WELDING ROD CHEMICAL ANALYSIS CERTIFICATE		✓	✓	✓	4 WAFO
R20	WELDER CODE QUALIFICATION CERTIFICATE	✓	✓	✓	✓	4 WAFO
R21	NOT IN USE					
R22	INSPECTOR'S QUALIFICATION CERTIFICATE FOR NONDESTRUCTIVE TESTING					Include in T2
R23	NOT IN USE					
R24	HEAT TREATMENT RECORDS					Include in T2
R25	DIMENSIONAL CHECK REPORT		✓	✓	✓	2 WAT
R26	SURFACE PREPARATION AND PAINTING REPORTS		✓	✓	✓	2 WAT
R27	MATERIAL TEST CERTIFICATES (MILL CERTIFICATES)		✓	✓	✓	Include in T2
R28	VIBRATION TEST REPORT					Include in T2
R29	LIFTING EQUIPMENT TEST CERTIFICATES					Include in T2
R30	POSITIVE MATERIAL IDENTIFICATION DATA		✓	✓		Include in T2
R32	NOT IN USE					
R33	NOT IN USE					
R35	NOT IN USE					
R36	NOT IN USE					
R37	NOT IN USE					

DATA CODE	DATA DESCRIPTION/DEFINITION	RECOMENDED DATA SUBMITTALS (WEEKS) Q	A	C	R	REMARK
R40	CHEMICAL COMPOSITION CERTIFICATE		✓	✓	✓	Include in T2
R41	SPECIFIED MINIMUM YIELD STRENGTH					Include in T2
R50	WELD MAP AND NDT MATRIX					Include in T2
R51	MOTOR TEST REPORT					Include in T2
R52	CERTIFICATE OF MATERIAL CONFORMANCE		✓	✓	✓	Include in T2
R53	SPECIFICATIONS COMPLIANCE STATEMENT OR LIST OF EXCEPTIONS	✓				Include in T2
R54	NOT IN USE					
R55	HARDNESS TEST RESULTS + NACE CERTIFICATION					Include in T2
R56	PROOF LOAD TEST RESULTS					Include in T2
R57	NOT IN USE					
R58	IN-PROCESS MATERIAL TEST RESULTS					Include in T2
R59	LIST OF MATERIALS FOR COMPONENTS					Include in T2
R60	NON-CONFORMITY REPORTS (AS GENERATED)		✓	✓	✓	Include in T2
R61	NOT IN USE					
R62	NOT IN USE					
R63	NON-DESTRUCTIVE INSPECTION RESULTS AND CALIBRATION RECORDS					Include in T2
R64	DESTRUCTIVE TEST RESULTS / CERTIFICATES (if applicable)					Include in T2
R65	TUBING PRESSURE / LEAK TEST RECORDS					Include in T2
R66	NOT IN USE					
R67	TYPE APPROVAL CERTIFICATE/TYPE TEST CERTIFICATE	✓	✓		✓	Include in T2
R68	WIRING MEGGER TEST RECORDS					Include in T2
R69	INSTRUMENT/CONTROL VALVE/PRESSURE RELIEF VALVE CALIBRATION REPORT (DRY/WET)					Include in T2
R70	WIRING-MEGGER&CONTINUITY TEST RECORDS					Include in T2
R71	LOOP TEST RECORDS					Include in T2
R72	FAT REPORT					Include in T2
R73	HAZARDOUS AREA CERTIFICATE					Include in T2
R74	DESIGN DEVIATION REQUEST/ TECHNICAL QUERY		✓			Include in T2
R75	BOLT TIGHTENING PROCEDURE					Include in T2
R76	CLEANING/ PICKLING PASSIVATION REPORTS					Include in T2
R77	WEIGHING RECORD					Include in T3
R78	FIRE SAFE/ FIRE TEST/ FIRE PROOF CERTIFICATE	✓	✓	✓		Include in T2
R79	ASSET DATA REQUIREMENTS DOCUMENT AND TAG DATA					Include in T2
R98	3RD PARTY STUDY REPORT					Include in T2
R99	RECORDS AND CERTIFICATES NOT SPECIFIED ABOVE, IF APPLICABLE		✓	✓	✓	2 WAT
	T – TYPES OF DATA BOOKS					
T01	TYPE ONE – DESIGN DATA BOOK					Include in T1
T02	TYPE TWO – MANUFACTURING RECORD BOOK			✓	✓	Include in T2
T03	TYPE THREE – EQUIPMENT DATA BOOK					Include in T3

APPENDIX 5

TECHNICAL QUERY FORM

Vendor's LOGO	VIETNAM BLOCK B GAS PROJECT PROVISION OF EPCI FOR CENTRAL PRODUCTION PLATFORM, LIVING QUARTER PLATFORM AND FLARE TOWER		
Document No :	**PQ-XXXX-MEC001-R74-YYYYY**	Rev. No :	0
Document Title :	Technical Query for GRATING (STEEL & FRP) AND STAIR TREADS	Page No :	1 of 2

Project Name: Vietnam Block B Gas Project Provision of EPCI for Central Production Platform, Living Quarter Platform and Flare Tower	**Document Number:** PQ-CPC0-STR-RFQ-MPC-50002-00
Contractor Name: McDermott and PTSC Consortium (MPC)	**Contract Code / PO Number:** PQ-CTR-DEV-2022-005
Subject Description: D/t Ratio for tubulars	**Date Issued:** DD-MMM-YYYY
Reference Document or Drawing Number: • PQ1-00-STR-SPC-TAP-00003 – Specification for Design of Fixed Offshore Platform Structures	**Response required by:** DD MMM YYYY

Issued By: Title:		Reviewed By: Title:	
Approved by : Title : Project Manager			

QUESTION / INQUIRY: (Note: Only one question per TQY)

BACKGROUND

Referring to D/t Ratios of tubular member in Section 4.2.1 of Company Specification (PQ1-00-STR-SPC-TAP-00003), it is mentioned as shown below.

The above table shows minimum D/t ratio for braces (510mm – 20 inches diameter or less) should be 30. However, FEED design used below tubulars which do not meet the above requirement.
508x19.1 – Used in Flare Bridge
457x15.9 – Used in CPP Deck and LQ Jacket
457x19.1 – Used in Flare Jacket / Topsides, CPP / LQ Boat landings and LQ Jacket
457x25.4 – LQ Jacket
500x20 – Used in VLQU Topsides
500x25 – CPP Deck and VLQU Topsides

CONTRACTOR PROPOSAL

As per API RP 2A, the minimum D/t ratio for all tubulars is 20. CONTRACTOR propose to use the D/t ratios same as mentioned in API RP 2A. CONTRACTOR request COMPANY to review and confirm.

Cost Impact: Yes [+] [-] No [ ]	**Schedule Impact:** Yes [+] [-] No [ ]

PTSC M&C's Response By: Title: PTSC M&C's Approval By: Title:	Date Responded: Dated Approved:

RESPONSE:

PQ POC's Response by: Title: PQ POC's Approval by: Title:	Date Responded: Dated Approved:
RESPONSE:	

APPENDIX 6

TEMPLATE FOR VENDOR DOCUMENT

MCDERMOTT

PTSC
A member of PETROVIETNAM

PETROVIETNAM
PQPOC

PHU QUOC PETROLEUM OPERATING COMPANY

VIETNAM BLOCK B GAS PROJECT

PROVISION OF EPCI FOR CENTRAL PRODUCTION PLATFORM, LIVING QUARTER PLATFORM AND FLARE TOWER

DOCUMENT TITLE

Approval by CONTRACTOR	
Document return Code	**CONTRACTOR Signature**
☐ Code 1 Reviewed and Accepted with no Comment ☐ Code 2 Reviewed/With Comment ☐ Code 3 Not Accepted/ Revise/Resubmit ☐ Code 4 Not Reviewed	Name : _____ Signature : _____ Date : _____

Vendor name:		Package name:			P.O No.:
Vendor doc ref: (Blank if N/A)		Tag No.: PIT-1201, PIT-1202, PIT-1204, PIT-1205			
K01	dd-Mmm-20YY	Issued for Review			
J01	dd-Mmm-20YY	Issued for IDC			
Rev	**Rev Date**	**Description**	**Issued by**	**Reviewed by**	**Approved by**

PQPOC Document Control No.	Project Code	Area Code	Package ID	SDRL Code	Sequence Number	Revision
	PQ	IP00	PPL001	D21	00001	K01

REVISION HISTORY

Rev. Date	Rev. No.	Detailed Description of Change	Ref. Section	Approved by
DD-MM-YY	J01	Issued for IDC		
DD-MM-YY	K01	Issued for Review		

HOLDS LIST

Rev. Date	Rev. No.	Hold. No.	Description / Reason for Hold	Ref. Section
DD-MM-YY	K01	1		

CONTENTS

LIST OF FIGURES

LIST OF TABLES

To update tables of contents/figures/tables, select the above table and press 'F9' key. Do not delete, or manually type in contents and lists – assign the relevant styles from the style gallery.

1 PURPOSE

The purpose of this document is to set forth…

2 SCOPE

This document addresses all equipment related to…

3 REFERENCES

Document No	Title

4 NOMENCLATURE

4.1 Acronym

Acronym	Description

4.2 Definitions

Term	Definition

5 HEADING 1

5.1 Heading 2

5.1.1 Heading 3

5.1.1.1 Heading 4

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- Bullet List
  - Bullet List 2

Number List

a. Number List 2

Table 5-1 Caption (Use 'References' Tab, 'Insert Caption', Select 'Table' (Place Table Caption Above Table)

Table Title Left	Table Title Centered	Table Title Centered	Table Title Centered
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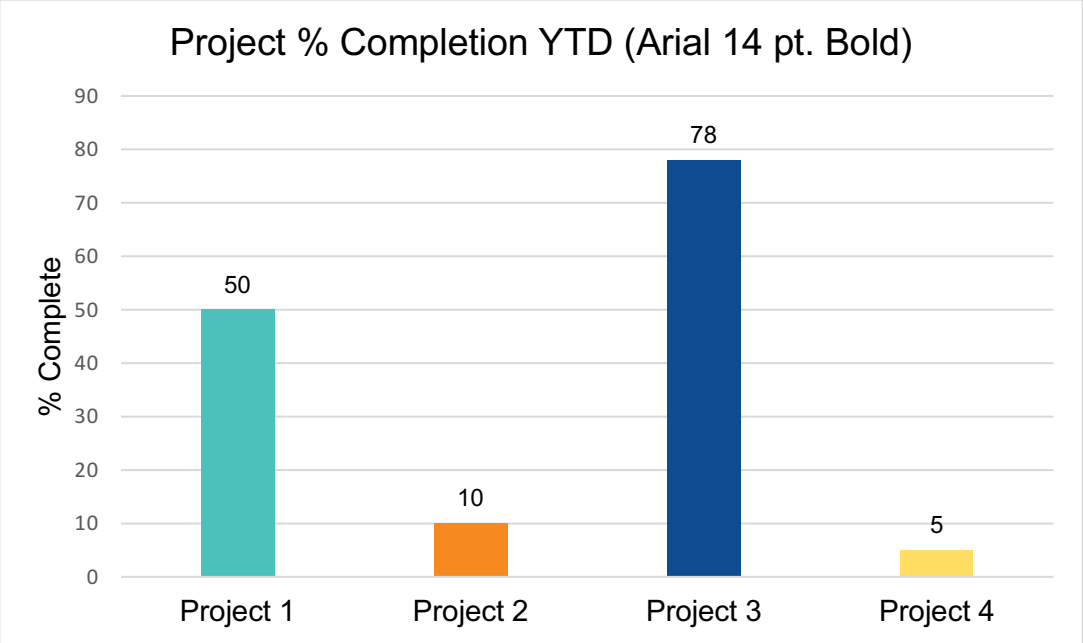

Figure 5-1 Caption (Use 'References' Tab, 'Insert Caption', Select 'Figure' (Place Figure Caption Below Picture/Graph)

APPENDIX 7

WEIGHT QUOTATION AND MANAGEMENT

Appendix 7 - Weight Quotation and Management

WEIGHT QUOTATION & MANAGEMENT

A) VENDOR TO QUOTE FOR PACKAGE WEIGHT IN ACCORDANCE WITH REQUIREMENTS IN Weight Control Procedure

B) PACKAGE WEIGHT MANAGEMENT SHALL BE IN COMPLIANCE WITH REQUIREMENTS IN Weight Control Procedure

LIST OF WEIGHT & DIMENSION

ITEM		DIMENSION IN M (L x W x H)	UNIT WEIGHT (MT)
No.	**DESCRIPTION**		

APPENDIX 8

QUALITY, INSPECTION AND TESTING REQUIREMENTS

APPENDIX 8 - Quality, Inspection and Testing Requirements

PTSC **QUALITY, INSPECTION AND TESTING REQUIREMENTS**	Rev. No.	00
	Date:	22Apr2024
Item Description:	REQ. No:	
GRATING (STEEL & FRP) AND STAIR TREADS	P.O. No.	
CRITICAL RATING: **INSPECTION LEVEL REQUIREMENTS: Criticality Level 4**		

SERIAL NO.	INSPECTION ITEM	INSPECTED BY			
		Vendor / Manufacturer	CONTRACTOR	IVS (*)	COMPANY (**)
1.	Quality Audit (When required)	D	W	By IVS	W
2.	Pre- Fabrication and/or Kick-off Meeting	-	-	-	-
3.	Documents and Procedures	D	R	By IVS	R
4.	Mill Test Certificates and Inspection Records	D	R	By IVS	R
5.	Incoming Material and Equipment Inspection	D	R	By IVS	R
6.	Welding Procedure Specification and Qualification (WPS/PQR)	D	R	By IVS	R
7.	Welder Qualification Testing and Certificates	D	R	By IVS	R
8.	Coating/Painting (include FJC) Qualification Testing	-	-	-	-
9.	Material Traceability Transfer	D	R	By IVS	R
10.	Shop and Field Assemblies include Fit-up	D	R	By IVS	R
11.	In-process of Production Welding	D	R	By IVS	R
12.	Visual Inspection before Hot-dip galvanizing	D	W/R	By IVS	R
13.	Non-Destructive Examinations	-	-	-	-
14.	PWHT (if any)	-	-	-	-
15.	In-process of Assemblies and final Dimension Inspection	D	R	By IVS	R
16.	Hydrostatic Pressure Test	-	-	-	-
17.	Hardness, PMI and Ferrite content Test	D	R	By IVS	R
18.	Pickling & Passivation	D	R	By IVS	R
19.	Substrate Surface preparation Cleanliness, Profile and Weather	D	R	By IVS	R
20.	In-process of Painting/Coating include WFT and DFT check	D	M	By IVS	R
21.	Final Painting/Coating inspection include Holiday Test	D	W/R	By IVS	R
22.	Production Test (If any)	-	-	-	-
23.	Stroke Test (Torque Test)	-	-	-	-
24.	Electrical Continuity Test	-	-	-	-
25.	Internal wiring Test Records	-	-	-	-
26.	Insulation Resistance Test	-	-	-	-

SERIAL NO.	INSPECTION ITEM	INSPECTED BY			
		Vendor / Manufacturer	CONTRACTOR	IVS (*)	COMPANY (**)
27.	Dielectric Strength Test	-	-	-	-
28.	Calibration Test	-	-	-	-
29.	Indication Accuracy Test	-	-	-	-
30.	Transmitter Accuracy Test	-	-	-	-
31.	Hazardous Area Certifications	-	-	-	-
32.	Cleanliness of tubing & Instruments	-	-	-	-
33.	Ex inspection before FAT	-	-	-	-
34.	Integrated Factory Acceptance Test (IFAT)	-	-	-	-
35.	Mechanical Running Test	-	-	-	-
36.	NPSH Test	-	-	-	-
37.	Complete Unit Test / String Test	-	-	-	-
38.	Local and Unit Control Panel Functional Test	-	-	-	-
39.	Design Verification Test	-	-	-	-
40.	Noise Test	-	-	-	-
41.	Vibration Test	-	-	-	-
42.	Performance Test	-	-	-	-
43.	Motor Performance test	-	-	-	-
44.	Compressor Performance Test	-	-	-	-
45.	Engine Performance Test	-	-	-	-
46.	System Leak Test (if any)	-	-	-	-
47.	Factory Acceptance Tests (FAT) & Completed Unit Test	-	-	-	-
48.	Weighing and C.O.G verification	-	-	-	-
49.	Site Acceptance Test (SAT)	-	-	-	-
50.	Nameplate / Tagging	D	R	By IVS	R
51.	Punchlist (if any)	D	R	By IVS	R
52.	As-Built Drawings	-	-	-	-
53.	Final Inspection & Inspection Release certificates	D	W/R	By IVS	R
54.	Shipping Inspection & Shipping Release Notice	D	R	By IVS	R
55.	Other tests as required by Code/Standard/Company Specification/ Requisition	AS PER ITP	AS PER ITP	By IVS	AS PER ITP

NOTE:

1. The inspection points as specified in this Inspection and Testing Requirements (ITR) shall be the minimum required. Purchaser has the right to request for additional inspection points where it is deemed required.

2. Inspection requests shall be made using the form provided by purchaser.

3. (*) IVS is appointed by the COMPANY, with inspection points to be updated upon receipt of the Vendor/Supplier's ITP.

4. (**) COMPANY's inspection points to be updated upon receipt of the Vendor/Supplier's ITP.

5. The inspection frequency shall be 100% and applied to all supplied products. Random inspection shall not be accepted.

- "Review" - R: Documents pertaining to the specific task or stage shall be transmitted to the verifying party for review, before pursuing the execution process.

- "Monitoring" - M: the verifying party attend the execution of the task, either continually or occasionally, as suitable.
- "Witness Point" - W: the verifying party shall be notified 14 days in advance of the relevant task or move to the relevant stage. The absence of a verifying authority does not suspend the continuation of the execution process.
- "Hold Point" - H: the verifying party shall be notified 14 days in advance of the relevant task or move to the relevant stage. The execution process is suspended (at a hold point) in the event of absence of the verifying authority.
- ” Document” -D: Performing the work and document provided.

APPENDIX 9

MATERIAL ORIGINATION AND SPECIAL CONDITIONS

Appendix 9 Material Origination and Special Conditions

Material Origination

"Origin" is defined as the smelting of the raw Materials into the steel billet.

"Manufacturing" is defined as the production of the steel billet into the final product form, i.e. steel plate, pipe, forgings, structural shapes, etc. All Material test reports must clearly state the "Origin" and "Manufacturing" location of the Materials. Materials that cannot be clearly traced to their origin and point of manufacturing will not be accepted for use.

COMPANY/CONTRACTOR require the use of new Materials that "Originate" and are "Manufactured" in one of the countries listed in the chart below. Use of Materials that Originate and are Manufactured in one of the below listed countries do not require prior written approval:

Argentina	Denmark	Netherlands	Sweden
Australia	Finland	Norway	Switzerland
Austria	France	Singapore	United Kingdom
Belgium	Germany	South Africa	United States
Brazil	Italy	South Korea	Venezuela
Canada	Japan	Spain	Vietnam

COMPANY/CONTRACTOR may at its discretion accept Materials from other sources provided the information required below is presented in writing to COMPANY/CONTRACTOR prior to the purchase of such Materials under the Contract. Information and intended use of Materials from origins other than as above shall be provided within the original quotation; however, it must be provided prior to actual purchase of the Material. Requests to use Materials from unlisted origins must be submitted in writing with the following information:

A. Country of origin;

B. ASTM, ASME, API, BSI, DIN, JIS Material designation, as applicable;

C. Material product form (plate, pipe, forging, casting, structural shape, etc.);

D. Actual Intended use or location (vessel shell/head, piping line class, pump case, primary or secondary support member, lifting lug, etc.);

E. Design considerations of Material (special loading, pressure/temperature, minimum design metal temperature, etc.);

F. Special requirements applicable to the Material (NACE, carbon equivalence, restricted chemistry,

notch-toughness, heat treatment, HIC resistance, etc.);

G. Legible copies of the Material test reports;

H. If available, prior project history of using Materials from that foreign source.

Additionally, quotations that include use of unlisted Materials must also include each specific Material source. Use of Materials from unlisted sources prior to receiving COMPANY/ CONTRACTOR approval will result in return of the Material at SUPPLIER/VENDOR's sole expense. Each submitted request will be evaluated on a case-by-case basis depending on the intended use of the Materials and Project requirements. At COMPANY/ CONTRACTOR's discretion, noncompliance with Material origin requirements may result in further Material testing at the SUPPLIER/VENDOR's expense.

Independent testing may include; mechanical testing (tensile strength, elongation), chemical composition (wet chemical analysis), and any other supplemental testing required by the original Material specification or Project requirements. SUPPLIER/VENDOR will be responsible for the cost of additional testing regardless of test results should COMPANY/CONTRACTOR elect to deny use of the Material.

Special Conditions

i. Spares And Service Support

SUPPLIER/VENDOR shall ensure that component parts of the Goods, or direct and useable equivalents thereof, will be available to COMPANY/CONTRACTOR for a period of at least twenty (20) years after delivery of the Goods, and likewise for after sales service support. SUPPLIER/VENDOR shall formally notify COMPANY/CONTRACTOR if the Goods or any parts thereof are to made obsolete, whenever such events may arise, with notice being provided at least twenty (24) months prior to any part of the Goods being discontinued. This requirement shall survive accordingly following the completion and close out of the Purchase Order.

ii. Engineering Codes And Standards

The codes and standards which apply to the Goods covered by the Purchase Order are listed in the Technical Requisition. Whereas these codes and standards may be updated prior to or after the Effective Date, SUPPLIER/VENDOR is obligated to promptly notify COMPANY/CONTRACTOR of the applicable revisions with a detailed explanation thereof and of the full implications of implementing each of the revisions. SUPPLIER/VENDOR shall not implement any revisions without the written approval of CONTRACTOR (as endorsed by COMPANY).

iii. Manufacturing Changes

SUPPLIER/VENDOR shall promptly notify COMPANY/CONTRACTOR of changes to the specifications or method of construction of Goods prior to any changes being implemented. SUPPLIER/VENDOR shall explain the reason and benefits of any such changes, all of which

will be subject to formal approval by COMPANY/CONTRACTOR. Any such changes implemented without the written approval of COMPANY/CONTRACTOR would be a material breach of the Purchase Order terms and conditions that would provide COMPANY/CONTRACTOR the right to exercise the remedies available under the Purchase Order, including termination.

iv. Patent Indemnity

SUPPLIER/VENDOR shall defend, protect, indemnify and hold harmless COMPANY/CONTRACTOR against claimed or actual infringement or contributory infringement of any patent, or infringement of any copyright or trademark, or misappropriation of any trade secret arising out of the Goods whether in progress or as provided by SUPPLIER/VENDOR under this Purchase Order.

In the event of any such claim, SUPPLIER/VENDOR shall immediately inform COMPANY/CONTRACTOR and shall take action to address or avoid the alleged or actual infringement, as agreed with COMPANY/CONTRACTOR, as may be undertaken via one of the following actions, or others, at its own expense to avoid future infringement:

a. Modify or replace any equipment that (i) SUPPLIER/VENDOR has furnished or utilized or that (ii) COMPANY/CONTRACTOR has built or any process that COMPANY/CONTRACTOR is using based on the Goods in order to avoid the patent infringement or trade secret violation. Such modification or replacement must be accomplished in a manner that is acceptable to COMPANY/CONTRACTOR and that does not detrimentally impact the performance of the affected Goods or the intended function thereof; and

b. Secure for the benefit of COMPANY/CONTRACTOR irrevocable and fully paid licenses for full unrestricted use of the Goods so to avoid any future infringement and without the need to modify or replace the Goods or any associated equipment or modify processes based on the full right of use. Such licenses must be obtained at no cost to COMPANY/CONTRACTOR and on terms acceptable to COMPANY/CONTRACTOR.

v. After sale service and customer support plan

SUPPLIER/VENDOR to confirm his plan for sales/ service/ support for his equipment in Vietnam that is detailed in Part 4 - Information to be submitted by SUPPLIER/VENDOR.

VIETSOVPETRO

VIETNAM BLOCK B GAS PROJECT

Agreed by
Deputy Director of OCD

Signed by: Lê Quốc Anh
Date: 25/07/2025 15:35:30
Certified by: Vietsovpetro CA

LE QUOC ANH

Approved by
Director of OCD

Signed by: Phạm Thanh Bình
Date: 25/07/2025 15:42:03
Certified by: Vietsovpetro CA

PHAM THANH BINH

TECHNICAL EVALUATION CRITERIA
PROVISION OF STEEL GRATING & STAIR TREADS FOR LIVING QUARTER – BLOCK B

DOC. NO : OCD-LQ-BLOCKB-TE-16

REV : 0

ISSUED FOR BID

Checked by:

Manager of PM Dept.	Signed by: Trần Nguyên Hưng Date: 25/07/2025 15:30:09 Certified by: Vietsovpetro CA	Tran Nguyen Hung
Manager of Design Dept.	Signed by: Trần Sỹ Thái Date: 25/07/2025 10:55:11 Certified by: Vietsovpetro CA	Tran Sy Thai
Project Manager	Signed by: Trương Thanh Tuyết Trường Date: 25/07/2025 11:52:00 Certified by: Vietsovpetro CA	Truong Thanh Tuyet Truong
Construction Manager	Signed by: Tạ Ngọc Hiếu Date: 25/07/2025 13:39:02 Certified by: Vietsovpetro CA	Ta Ngoc Hieu
Construction Engineering Manager	Signed by: Lê chí Thành Date: 25/07/2025 11:09:30 Certified by: Vietsovpetro CA	Le Chi Thanh

Prepared by:

Engineer of Design Dept.	Signed by: Trần Đăng Hải Date: 25/07/2025 10:42:30 Certified by: Vietsovpetro CA	Tran Dang Hai
Engineer of PM Dept.	Signed by: Nguyễn Văn Tài Date: 25/07/2025 10:50:39 Certified by: Vietsovpetro CA	Nguyen Van Tai

TABLE OF CONTENTS

1. PURPOSE OF THE DOCUMENT

This document is prepared to define the technical requirements and reference criteria to be used during the procurement process of Steel Grating and Stair Treads.

It describes the minimum acceptable requirements for material supply, fabrication, hot-dip galvanizing, inspection, testing, and preparation for shipment and delivery of the package.

These requirements shall serve as the basis for evaluating and comparing bidders' technical proposals submitted in response to the TR – Steel Grating & Stair Treads Package.

2. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

2.1. Definitions

Acronym	Definitions
COMPANY	Shall mean Phu Quoc Petroleum Operating Company
CONTRACTOR	Shall mean The Consortium of McDermott Asia Pacific Sdn. Bhd. ("McDermott") and Petrovietnam Technical Services Corporation ("PTSC")
PTSC M&C	PTSC MECHANICAL & CONSTRUCTION LIMITED COMPANY, a company organized and existing under the Laws of Socialist Republic of Vietnam, having its head office at 31, 30/4 Street, Vung Tau City, Vietnam.
VSP/ PURCHASER	VIETSOVPETRO shall mean Sub-sub contractor that places the Purchase Order/ or Purchaser.
BIDDER	Means an individual or business entity that submits a bid

2.2. Acronyms and Abbreviations

Acronym	Acronym/ Abbreviation Description
AFC	Approved For Construction
CBE	Commercial Bid Evaluation
CPP	Central Production Platform
EEP	Engineered Equipment Procurement
EPCI	Engineering, Procurement, Construction and Installation
FAT	Factory Acceptance Test
FEED	Front End Engineering Design
IFA	Issued for Approval
ITB	Invitation to Bid

Acronym	Acronym/ Abbreviation Description
LQ	Living Quarters
LQM	Living Quarter Module
LQP	Living Quarter Platform
LQU	Living Quarter Utility
MTO	Material Take Off
PTSC	PetroVietnam Technical Services Corporation
QA / QC	Quality Assurance / Quality Control
QMS	Quality Management System
ROS	Required on Site
TBE	Technical Bid Evaluation
VBGP	Vietnam Block B Gas Project
WHP	Wellhead Platform
UT	Ultrasonic Testing
MT or MPI	Magnetic Particle Testing
CTOD	Crack Tip Opening Displacement
TPI	Third Party Inspection
RFQ	Request for Quotation
CA	Certifying Authority
BA	Basic Certification
BCM	Bid Clarification Meeting
TBC	Technical Bid Clarification
TBE	Technical Bid Evaluation
TBEC	Technical Bid Evaluation Criteria
AVL	Approved Vendor List
Doc	Document
No	Number
Rev	Revision

3. DOCUMENT REFERENCE

Documents listed below shall make an integral part of this TEC. This TEC is composed of the documents listed hereunder:

No.	Doc No.	Document Title	Rev. No
Ref. [1]	PQ-CPC0-STR-SPC-MPC-00003-00	Specification for Structural Steel for Fixed Offshore Platform	N01

No.	Doc No.	Document Title	Rev. No
Ref. [2]	PQ-CPC0-STR-SPC-MPC-00002-00	Specification of Fabrication of Platform Structures for Fixed Offshore Platforms	N01
Ref. [3]	OCD-LQ-BLOCKB-TR-16	Technical Requirement Provision Of Steel Grating & Stair Treads for Living Quarter – Block B	0

4. ORDER OF PRECEDENCE

Should there be any conflict, discrepancy, inconsistency or ambiguity between any CONTRACT documents within the DESIGN DOSSIER, priority shall be given in the following order of precedence:

1. Convention followed by Vietnam (MARPOL, SOLAS)
2. Applicable Regulation of Vietnam.
3. COMPANY standards.
4. Technical Requirement.
5. Project Technical Requirements (Project Drawings and Material Data Sheets, Project Specifications, etc.)
6. International Codes and Standards.

5. TECHNICAL REVIEW AND EVALUATION CRITERIA

5.1. Evaluation Process

Bidder's technical proposal shall be technically evaluated based on compliance with the documents in Section 3 above.

5.2. Key Technical Point

Bidder is required to confirm to comply with the following requirement:

1. Material Certification.
2. Quality System Standard (ISO 9001:2015 Certificate).
3. Inspection & Testing Requirements.
4. Manufacturing Procedure Specifications.
5. Vendor Data Requirements List.
6. Experience Profile and Track Record
7. Scope of Supply
8. Technical Requirements

9. Delivery Time

6. CONCLUSION AND RECOMMENDATION

Based on the Technical Evaluation Criteria in **Appendix 1**, the technically acceptable bidder shall be recommended for the commercial evaluation phase.

7. APPENDICES

Appendix 1: Technical Bid Evaluation Criteria.

APPENDIX 1

TECHNICAL BID EVALUATION CRITERIA

TECHNICAL BID EVALUATION CRITERIA

No.	DESCRIPTION	PROJECT REQUIREMENTS	REFERENCE	Manufacturers/BIDDER:	
				BIDDER's Offer	Evaluation
I	**GENERAL**				
1	**Scope of Supply**				
1.1	Steel Grating c/w Grating Clips, Serrated Bar	BIDDER shall provide the following items	Ref. [1]		C/NC/NCA
1.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
2	**Manufacturer**				
2.1	Steel Grating c/w Grating Clips, Serrated Bar	BIDDER to provide	Ref. [1]		C/NC/NCA
2.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
3	**Material Origination**				
3.1	Steel Grating c/w Grating Clips, Serrated Bar	BIDDER to specify	Ref. [1]		C/NC/NCA
3.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
4	**Packaging Location**				
4.1	Steel Grating c/w Grating Clips, Serrated Bar	BIDDER to provide	Ref. [1]		C/NC/NCA
4.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
5	**Quality Management System**				
5.1	Steel Grating c/w Grating Clips, Serrated Bar	- Submit its own and its manufacturer ISO certificates to confirm that a Quality Management System was established according to ISO 9001:2015 standards. - The certificates shall be renewed if they are expired at the time of manufacturing.	Ref. [1]		C/NC/NCA
5.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
6	**Track Record and Experience**				
6.1	Steel Grating c/w Grating Clips, Serrated Bar	Suitable for offshore environmentals	Ref. [1]		C/NC/NCA
6.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
7	**Vendor Data Requirement**				
7.1	Steel Grating c/w Grating Clips, Serrated Bar	As per VDRS requirements	Ref. [1]		C/NC/NCA
7.2	Steel Stair Treads		Ref. [1]		C/NC/NCA

No.	DESCRIPTION	PROJECT REQUIREMENTS	REFERENCE	Manufacturers/BIDDER:	
				BIDDER's Offer	Evaluation
8	**Final Documentation**				
8.1	Steel Grating c/w Grating Clips, Serrated Bar	Bidder shall provide the final documentation to the purchaser as follows: 2 sets - 01 sets of original final documents (without hole drilled). - 01 sets of hardcopies (without hole drilled)	Ref. [1]		C/NC/NCA
8.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
9	**Manufacturing Procedure Specification (MPS)**				
9.1	Steel Grating c/w Grating Clips, Serrated Bar	- BIDDER shall develop a written MPS describing all stages of manufacture, testing and inspection which shall be submitted to PURCHASER for approval. The MPS shall include all works related to the product manufacture. - BIDDER shall submit MPS along with the proposal for evaluation.	Ref. [1]		C/NC/NCA
9.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
10	**Inspection & Testing Plan (ITP)**				
10.1	Steel Grating c/w Grating Clips, Serrated Bar	BIDDER shall submit ITP along with the proposal for evaluation	Ref. [1]		C/NC/NCA
10.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
11	**Certificates**				
11.1	Steel Grating c/w Grating Clips, Serrated Bar	The BIDDER shall submit to PURCHASER, certificate by the manufacturer for each type of product giving the following details: 1. Manufacturer's Name, Trademark or other means of identification 2. Type and quantity of FRP and steel products supplied 3. Linear dimensions of each product noting deviations from the nominal dimensions 4. Quality of FRP and steel used with test results for requirements 5. Method of manufacture 6. Certified performance characteristics All certificates shall comply with accepted international codes/standards and shall be in English language. All steel certificates shall comply to PQ-CPC0- STR-SPC-MPC-00003-00 Specification for Structural steel for Fixed Offshore Platforms.	Ref. [1]		C/NC/NCA
11.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
12	**Delivery Time**				
12.1	Steel Grating c/w Grating Clips, Serrated Bar	BIDDER to provide	Ref. [1]		C/NC/NCA
12.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
13	**Packing, Storing, Handling, Transport**				
13.1	Steel Grating c/w Grating Clips, Serrated Bar	Long term preservation and preparation for Shipment and Export packaging	Ref. [1]		C/NC/NCA
13.2	Steel Stair Treads		Ref. [1]		C/NC/NCA

No.	DESCRIPTION	PROJECT REQUIREMENTS	REFERENCE	Manufacturers/BIDDER:	
				BIDDER's Offer	Evaluation
14	**Quality Assurance and Quality Control**				
14.1	Steel Grating c/w Grating Clips, Serrated Bar	BIDDER to provide	Ref. [1]		C/NC/NCA
14.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
II	**TECHNICAL REQUIREMENTS**				
15	**Maximum Span, Loading and Deflection**				
15.1	Steel Grating	- The maximum span of Serrated Steel grating panel shall be 1000mm. - The Serrated Steel Grating shall withstand the uniform load of 10 KN/m2. - The Serrated Steel Grating shall withstand the Point Load 5 kN distributed on a 0.3mx0.3m. - The allowable deflection is L/100.	Ref. [1]		C/NC/NCA
15.2	Steel Stair Treads	- The maximum span of Steel stair tread shall be 1200mm. - The Serrated Steel Grating shall withstand the uniform load of 5 KN/m2. - The Serrated Steel Grating shall withstand the Point Load 5 kN distributed on a 0.3mx0.3m. - The allowable deflection is L/100.	Ref. [1]		C/NC/NCA
16	**Material Specification**				
16.1	Steel Grating, Serrated Bar	ASTM A36	Ref. [1]		C/NC/NCA
16.2	Steel Stair Treads	ASTM A36	Ref. [1]		C/NC/NCA
16.4	Grating Clips	Bolts, Nuts, Saddle Clip, Bottom Clip: SS316L	Ref. [1]		C/NC/NCA
17	**Testing**				
17.1	Steel Grating c/w Grating Clips, Serrated Bar	BIDDER is responsible for the systems provided by him and in full compliance with the project requirement	Ref. [1]		C/NC/NCA
17.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
18	**Corrosion Protection**				
18.1	Steel Grating c/w Grating Clips, Serrated Bar	All exposed steel elements shall be protected against corrosion in accordance with: + PQ1-00-STR-SPC-TAP-00003 Specification for Design of Fixed Platform Structures + PQ-CPC0-CRR-SPC-MPC-50001-00 Specification For Protective Coatings + PQ-CPC0-STR-SPC-MPC-00002-00 Specification Of Fabrication Of Platform Structures For Fixed Offshore Platforms			C/NC/NCA
18.2	Steel Stair Treads				C/NC/NCA
19	**Fabrication and Assembly**				
19.1	Steel Grating c/w Grating Clips, Serrated Bar	As specified in Technical Requirement	Ref. [1]		C/NC/NCA
19.2	Steel Stair Treads		Ref. [1]		C/NC/NCA

No.	DESCRIPTION	PROJECT REQUIREMENTS	REFERENCE	Manufacturers/BIDDER:	
				BIDDER's Offer	Evaluation
20	**Major Technical Deviation**				
20.1	Steel Grating c/w Grating Clips, Serrated Bar		Ref. [1]		C/NC/NCA
20.2	Steel Stair Treads		Ref. [1]		C/NC/NCA
EVALUATION RESULT				**TECHNICAL IS TECHNICALLY ACCEPTABLE / NOT ACCEPTABLE**	

References:
1. Doc. No.: OCD-LQ-BLOCKB-TR-16 Technical Requirement Provision Of Structural Steel Grating & Stair Treads for Living Quarter – Block B.
2. PQ-CPC0-STR-SPC-MPC-00002-00 Specification of Fabrication of Platform Structures for Fixed Offshore Platforms

Abrreviations:
1. C - Comply
2. NC - Not Complied
3. NCA - Not Complied but Acceptable
4. N /A - Not Applicable