PETROBRAS	**DESCRIPTIVE MEMORANDUM**	Nr: **I-MD-3010.2Q-1200-960-P4X-001**	
	CLIENT: MARLIM LESTE E SUL		**SHEET:** 1 **of** 65
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SRGE	**TITLE:** **DESCRIPTIVE MEMORANDUM – HULL SYSTEMS**		INTERNAL
			ESUP

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1. INTRODUCTION

1.1. OBJECTIVE

This document describes the purpose, configuration, functionality and the minimum design requirements of the Hull Systems for the FPSO Revit-Marlim Sul / Marlim Leste high capacity conceptual design.

Hull systems conceptual design purpose, configuration, functionality and the minimum design requirements are based on the REFERENCE HULL 01 Basic design.

1.2. ABBREVIATON

- AIT – oil content analyzer indicator and transmitter
- CS – classification society
- ESD – emergency shut down.
- HPU – hydraulic power unit.
- PVSV – pressure / breather vacuum valves.
- SOS – Supervisory and Operational System.
- SOS-HMI – Human Machine Interface of SOS.

1.3. DEFINITIONS

1.3.1. All other definitions are found on I-ET-3010.00-1200-940-P4X-002 – GENERAL TECHNICAL TERMS.

1.3.2. OWNER: PETROBRAS.

1.4. RULES, REGULATIONS AND CERTIFICATION

1.4.1. Conceptual design of the Hull Systems considers the appliance of the engineering design Rules, Regulations, Standards, Conventions, including provisions of Classification Society, Flag Administration regulations and Brazilian Authorities requirements.

1.5. REFERENCE DOCUMENTS

1.5.1. The concept design is based on the PACX-AE documentation and the following documents.

a. ET-3500.00-9310-941-1HA-001 – BASE DE PROJETO PARA INSTALAÇÃO DE SUPERFÍCIE DO PROJETO DE REVITALIZAÇÃO DOS CAMPOS DE MARLIM SUL E MARLIM LESTE

b. I-DE-3010.2Q-1200-943-P4X-001 – PLANT OVERVIEW PROCESS PLANT OVERVIEW

1.6. GENERAL ASSUMPTIONS

1.6.1. UNIT CHARACTERISTICS

a. Barge shaped, double side Hull.

b. Minimum / Maximum trim as design requirements - naval architecture.

c. No Cargo Pump Room will be provided.

d. Three (3) tanks in the cargo area shall be dedicated for Topsides produced water settling.

e. One (1) tank in the cargo area shall be dedicated for off-spec oil storage.

f. Submerged centrifugal pumps shall be provided for each cargo, slop, settling, produced water and off-spec oil tanks.

g. Mooring type: Spread Mooring System (SMS).

h. “Self-commissioned Hull”: All Hull systems shall be commissioned only with the Hull or quay facilities not requiring the Topsides facilities.

- Note: This assumption is not applied to the interface systems between Hull and Topsides.

2. GENERAL REQUIREMENTS APPLICABLE TO HULL SYSTEMS

2.1. PACKAGER / MANUFACTURER’S RECOMMENDATIONS

2.1.1. All design and installation packager / manufacturer’s recommendations shall be followed. In case any conflict of this document and the Revit MLS/MLL FPSO Design documentation with any packager recommendation, OWNER shall be advised, and packager may be consulted accordingly.

2.2. PIPING AND ACCESSORIES

2.2.1. GENERAL

2.2.1.1. Piping, flanges, valves and accessories specification shall follow the PIPING SPECIFICATION FOR HULL to be issued during the Basic Design phase.

2.2.2. EXPANSION LOOPS / EXPANSION JOINTS

2.2.2.1. Expansion loops shall be used in all longitudinal headers. Unless that is infeasible, dresser type expansion joints can be used provided that restricted to water or liquid hydrocarbon systems for pressure classes up to 150#. The non-use of expansion loops shall be justified case by case and is subject to formal acceptance by PETROBRAS.

2.2.3. PIPING SUPPORT STANDARD

2.2.3.1. All Hull horizontal piping system on exposed decks, ballast tanks, cofferdams, void spaces, and other regions submitted to corrosive atmosphere shall be provided with PTFE pads or similar to avoid pipe wear due to supports friction. The pad standard shall be submitted for OWNER appraisal.

2.2.4. SPECTACLE FLANGES FOR TANKS ADMISSION

2.2.4.1. All Main Deck piping entering structural tanks such as cargo, slop, settling, off-spec oil, and produced water tanks, including the pipe stacks of cleaning machines and cargo pumps, and entering nonstructural tanks subject to internal inspections, shall be fitted with spectacle flanges aiming to provide a positive blocking on these lines for internal inspections. The spectacle flanges shall be installed the closest the possible of the tank's penetration pieces (between the blocking valve and the penetration piece).

- Note 1: In cases where it is possible to have liquids entering the tank by back flow through tank discharge lines, such lines shall also be provided with spectacle flanges positioned the closest the possible to penetration piece. Tank isolation only by means of double blocking valves is not acceptable for tank inspection.

- Note 2: The spectacle flanges shall be fabricated in stainless steel AISI 316 or similar.

- Note 3: Spectacle flanges shall not be applied to the Closed Vent System and Vent Purge header system. In this case, removable spool pieces shall be provided (for tank inspections safety procedures).

2.2.5. DROPLINES

2.2.5.1. The discharge end of the droplines shall be near the tank bottom (maximum height of 500 mm above the bottom plating) of the cargo, slop, settling, and off-pec oil. The droplines shall be installed as far as possible from suction pipes of these tanks.

2.2.6. MARINE PIPE RACK

2.2.6.1. A dedicated pipe-rack for the Hull Systems, marine pipe rack shall be installed on Main Deck with the purpose to house the hull systems headers.

2.2.7. GAS SEAL BY SIPHON

2.2.7.1. Gas seal siphon have the purpose to seal the gas in all situations that piping is routed from a classified area to a non-classified area and shall be installed always at the classified area as CS recommendation.

2.2.8. SEA CHESTS

2.2.8.1. Sea chests have the purpose to allow the suction of pumps which works with sea water. There shall be two (02) on Engine Room and other two (02) inside the aftermost cargo area ballast tanks.

3. HYDRAULIC SYSTEM FOR VALVE ACTUATION

3.1. PURPOSE

3.1.1. The purposes of this system are:

a. Actuation of the hydraulic driven valves of the Hull Systems.

b. Monitoring the status of the hydraulic actuated valves of the Hull Systems.

3.2. SYSTEM REQUIREMENTS

3.2.1. The following hydraulic system shall be supplied by a single packager:

a. Hydraulic power unit

b. Hydraulic oil filtering system

c. Hydraulic accumulators

d. Solenoid racks

e. Solenoid boxes

f. Local hydraulic actuation pumps

g. Hydraulic portable pumps

h. Valves position indication system

i. Hull systems hydraulic remotely actuation valves

j. Hydraulic oil feeding unit

3.2.2. HYDRAULIC POWER UNIT (HPU)

3.2.2.1. This system shall have a HPU to provide hydraulic power for the remotely controlled valves actuation through solenoid racks and boxes installed on Engine Room and Main Deck, respectively.

- Note: HPU shall be installed in Engine Room.

3.2.2.2. All valves remote actuation shall be performed by SOS-HMI.

3.2.3. SOLENOID VALVES RACKS AND BOXES

3.2.3.1. This system shall have Solenoid Racks and Boxes with the purpose to house the solenoid valves which are responsible to command the remotely actuated hydraulic valves installed aft the Engine Room fwd bulkhead.

- Note 1: Solenoid Racks shall be installed on Engine Room and control the valves aft the Engine Room fwd bulkhead.
- Note 2: Solenoid Boxes shall be installed on Main Deck and control the valves installed on Main Deck.

3.2.4. HYDRAULIC HEADERS

3.2.4.1. For the HPU communication with the hydraulic valves, Hydraulic headers have the purpose to distribute the hydraulic oil to feed the solenoid boxes on Main Deck through the high pressure lines and to receive the low pressure hydraulic oil return from the same boxes.

3.2.5. LOCAL HYDRAULIC ACTUATION PUMP

3.2.5.1. Local Hydraulic Actuation Pump have the same concept of cardan shafts and shall have the purpose to provide a manual actuation for valves (as shipside valves) installed on areas with restricted access for normal operation.

3.2.5.2. Local Hydraulic Actuation Pump shall not have any connection with the hydraulic headers, with their hydraulic circuit assembled from the Local Hydraulic Actuation Pump itself to the actuated valve.

- Note: however, the actuated valve can have connection with the solenoids boxes and racks.

3.2.6. VALVES POSITION INDICATION SYSTEM

3.2.6.1. Valves Position Indication System all remotely actuated hydraulic valves shall have the indication monitored on SOS, indicated on SOS-HMI, on the valves themselves and on the solenoid valves racks and boxes where they are connected.

3.2.6.2. Valves with nominal diameter lower than 50 mm shall have manual actuation, unless otherwise required in specific requirements of any system.

3.2.7. REMOTELY ACTUATED VALVES

3.2.7.1. Remotely actuated valves of the below systems, with diameter higher than 50 mm, shall not have any type of automatic interlocking command:

a. Loading system

b. Cargo system

c. Tanks Cleaning and Transference system

d. Ballast System

e. Slop Tanks discharge system (except for overboard discharge valve / slop return valve, which shall be interlocked with oil content sensor (AIT - TOG)).

- Note: automatic interlock command shall be understood as any command which change the valve position status without the operator interference. Remote commands by SOS-HMI are not considered automatic command.

3.2.7.2. The valves installed on Main Deck dedicated to the above mentioned systems shall have manual actuation, unless otherwise indicated in specific requirements of each system.

3.2.7.3. The following types of valves shall have hydraulic remote actuation through the Hull control system panel on SOS-HMI:

a. Sea chest intermediate valves and side shell / bottom.

b. Valves of continuous and frequent use.

c. Valves which the immediate actuation interfere on basic and safe operations of UNIT.

d. Valves located in places with restricted access as ballast tanks, void spaces, cofferdam, and balance lines.

- Note 1: Main Deck is not considered restricted area.
- Note 2: the above items shall be considered as a guide, specific requirements will be treated on the next chapters with the systems details and those thereafter requirements shall prevail.
- Note 3: hydraulic remotely actuation valves shall be herein understood as on / off valves activated by SOS-HMI, except otherwise mentioned.
- Note 4: all valves which does not have specific actuation on specific requirements of each system shall have manual actuation.

4. MARINE SYSTEMS

i. Marine Systems are the necessary systems to control the stability and longitudinal strength of the UNIT Hull, to keep a safe operation with the structural tanks, and other any functions to attend the operation performance of cargo, slop, settling, produced water, settling, off-spec oil, cofferdam, and ballast tanks on cargo area.

ii. The following Hull systems are considered Marine Systems:

- Loading system
- Cargo system
- Tank’s cleaning and transfer system
- Ballast system
- Slop tanks oily water mixture treatment and discharge
- Inert gas system
- Closed vent system.
- Tank degassing system
- Tank’s ullage, pressure, and temperature monitoring system
- Closed ullage system.
- Tanks manual sounding system.
- Tank venting system
- Tank level indication system
- Flooding monitoring system
- Draught, trim & heel indication system

- Gas sampling
- Oxygen Sampling System

4.1. LOADING SYSTEM

4.1.1. The purpose of this system is to load the cargo tanks with processed oil from the Topsides Process Plant and from the P-51 / P-56 loading header.

4.1.2. This system is composed by the fiscal metering skid, Process Plant loading header, P-51 / P-56 loading header and one loading dropline per tank.

4.1.3. Loading system shall have a contingency connection with the Transference system by means of a removable spool piece.

4.2. CARGO SYSTEM

4.2.1. PURPOSE

4.2.1.1. The main purpose of this system is to export the processed oil stored in the cargo tanks, through the Offloading Transfer Metering Skid to the fwd or aft Offloading stations and then to the shuttle tanker.

4.2.1.2. The secondary purposes are:

a. To feed cargo oil to the Transference Header for cargo transferring between cargo tanks.

b. To feed the Cleaning Machines Header to perform the crude oil washing (COW).

c. To collect the oily-water mixture from the cargo tanks during the sea water washing operations (SWW) and direct it to the slop tanks through the Cargo Pumps Header and Transference Header.

d. To deballast the cargo tanks in contingency cases.

e. To feed the Diesel Well Service System, for hydrate prevention, with cargo oil stored in the cargo tanks.

4.2.2. CONFIGURATION

4.2.2.1. Cargo system shall be composed by the following equipment:

a. Submerged cargo pumps with pipe stacks.

b. Portable cargo pumps

c. Hydraulic power units (HPU)

d. Auxiliary Hydraulic power units

e. Remote control valve assembly

4.2.3. The cargo system shall be dimensioned to allow the export of 1,000,000 barrels of oil in 24 hours. The cargo pumps header shall be installed on the Marine Pipe Rack and shall be dimensioned for the flow of six (6) cargo pumps operating simultaneously.

4.2.4. SUBMERGED CENTRIFUGAL CARGO PUMPS

4.2.4.1. Submerged centrifugal cargo pumps shall be installed one per cargo tank with pipe stacks and command on tank's top on Main Deck. These pumps have the purpose to perform the FPSO offloading operation to the shuttle tanker with six (06) cargo pumps operating simultaneously.

4.2.4.2. Two (02) Portable cargo pumps (2 X 100%) shall be supplied to be used in case of cargo pumps malfunction.

4.2.5. CARGO PUMPS HEADER

4.2.5.1. During the offloading operation, the submerged cargo pumps discharge shall be conducted to the Cargo Header and then to the offloading transfer metering skid, which has the purpose to measure the cargo oil quantity exported to the shuttle tanker.

4.2.5.2. For other purposes, Cargo Header shall have connection with:

a. the Transference Header for the cargo oil transference among the cargo tanks. This connection shall be performed by remotely actuated double blocking valves.

b. the slop pumps discharge for slop water to be exported to the shuttle tanker as part of the FPSO offloading operation.

c. the Butterworth pumps header for the cargo pumps header internal cleaning.

4.2.6. OFFLOADING TRANSFER METERING SKID

4.2.6.1. There shall be a single offloading transfer metering skid to be installed on Process Module M-04 with the purpose to measure the Offloading rating. This skid shall be installed with no by-pass and shall be connected with the offloading header by means of double blocking hydraulic remote actuated valves for both fwd and aft offloading stations.

4.2.6.2. Offloading Transfer Metering Skid shall have local and remote pressure indicators upstream and downstream the skid to evaluate the differential pressure.

4.2.7. OFFLOADING HEADER

4.2.7.1. Downstream the offloading transfer metering skid, the offloading header shall be installed on the Marine Pipe Rack with the purpose to conduct the cargo oil from the offloading transfer metering skid to both aft and fwd offloading stations.

4.2.7.2. Emergency Offloading stations shall be connected to the Offloading Header with double blocking manual valves (locked closed) and shall have a blind flange on its end. These offloading emergency connections shall be installed close to the fwd and aft Offloading stations and be provided with oil trays.

4.2.7.3. Offloading header shall have two (02) connections for the NSV hydrotest and for offloading internal cleaning operations, with sea water obtained from butterworth pumps header for both fwd and aft offloading stations. This connection shall be performed with two dissimilar check (non-return) valves.

4.2.7.4. For offloading system overpressure protection, offloading header shall have rupture discs (2 x 100%) connected to cargo tanks 7PS / 7SB through the transference header at offloading header aft part and to cargo tanks 1PS / 1SB at the forward part to destinate the relieved cargo oil. Those rupture discs shall have burst disc sensor indicator with alarm on SOS and be able to trip all cargo pumps at a further defined pressure set.

4.2.7.5. Offloading Header shall be fully welded, without flange connections, in the section located aft of the aft transversal oil coaming on Main Deck, with the purpose to mitigate the possible flange leakage near the Accommodations.

4.2.8. HYDRAULIC POWER UNITS

4.2.8.1. Submerged centrifugal cargo pumps and portable cargo pumps shall be driven by two (2 x 50%) dedicated hydraulic power units which have the purpose to provide hydraulic power and to control all submerged centrifugal pumps of the UNIT (cargo, slop, settling, produced water, off-spec oil, water ballast and butterworth pumps).

4.2.8.2. Hydraulic power units for centrifugal submerged pumps (2 x 50%) shall be 6,6 kV MV electric driven type supplied each one as a single skid to be installed on Engine Room.

a. Hydraulic power units for centrifugal submerged pumps shall be fresh water cooled type with their corresponding hydraulic power pumps and electric motors cooling circuits being all fresh water cooled type.

b. Hydraulic power units for centrifugal submerged pumps shall have Hull structural storage and drain tanks installed close to the HPU skid.

4.2.8.3. Hydraulic Power Units shall be designed to have a minimum capacity to run simultaneously the following centrifugal submerged pumps at their full capacity during the UNIT offloading operation:

a. 06 cargo pumps

b. 02 produced water booster pumps

c. 02 ballast pumps (fwd)

d. 02 off-spec pumps

e. 02 settling pumps

4.2.8.4. HPU shall have the power packs quantity per each HPU skid defined during the Basic Design.

4.2.9. HYDRAULIC POWER / CONTROL PIPING LINES

4.2.9.1. HPU and centrifugal submerged cargo area pumps discharge shall be interconnected by pressure / return hydraulic headers installed on Main Deck.

4.2.9.2. Centrifugal Submerged cargo area pumps shall be controlled by hydraulic pilot / control valves installed at the top of pumps interconnected with HPUs by hydraulic tubings.

4.2.10. LOCAL / REMOTE CONTROL PANELS

4.2.10.1. Remote control panel shall be installed at the CCR on the same console of SOS-HMI. This panel shall only display monitoring signals to the SOS-HMI.

4.2.11. DEEPWELL SUBMERGED CENTRIFUGALPUMPS OPTION

4.2.11.1. Electrical driven deepwell submerged centrifugal pumps shall be an alternative to the hydraulic driven submerged centrifugal pumps system. For this option, VSDs shall be provided to drive the pump’s motors.

4.3. TANKS CLEANING AND TRANSFERENCE SYSTEM

4.3.1. PURPOSE

4.3.1.1. The main purpose of this system is as below detailed:

a. Cargo, produced water, off-spec oil, and slop tanks cleaning with oil – Crude Oil Washing operation (COW).

b. Cargo, produced water, off-spec oil, and slop tanks cleaning with sea water – Sea Water Washing in closed circuit (SWW).

c. Cargo, produced water, off-spec oil, and slop tanks cleaning with sea water – Sea Water Washing in semi open circuit.

d. Oil transference between cargo and slop tanks.

4.3.1.2. Secondary purposes are:

a. Offloading Hose Reels internal cleaning.

b. Pressure test of Offloading equipment before offloading operations.

c. To receive oily water inventory from the Shuttle tanker to the Dirty / Clean Slop Tanks.

d. To feed the sea water distribution to drive the portable exhausters used for the cargo, slop, settling, produced water and oil off-spec tanks degasification.

e. To perform cargo tanks loading in event of Loading System out of service.

f. To conduct sea water from water ballast system to the cargo tanks in water ballast contingency operation.

g. To transfer oil-water mixtures on slop tanks through the Offloading stations to the shuttle tankers.

4.3.2. CONFIGURATION

4.3.2.1. The system PACKAGE has the following components and shall be supplied by the same PACKAGER:

a. Top Fixed Cleaning Machines with pipe stacks.

b. Bottom Fixed Cleaning Machines (where applicable).

c. Portable cleaning machines and respective components.

4.3.3. For the produced water tanks cleaning operations, the oil return in COW

operation or oil / water mixtures is SWW operations shall be performed by portable cargo pumps.

4.3.4. TOP AND BOTTOM FIXED TANKS CLEANING MACHINES

4.3.4.1. Top and bottom fixed tanks cleaning machines arrangement inside the cargo, slop, produced water, settling and off-spec oil tanks shall have their arrangement inside the tanks to be defined according to MARPOL requirements for shadow areas.

- Note: Top cleaning machines shall be programmable type.

4.3.5. CLEANING MACHINES HEADER

4.3.5.1. This system shall have a cleaning machines header with the purpose to distribute the oil / sea water to the fixed / bottom tank cleaning machines for the COW / SWW operations and shall be installed on marine pipe rack.

4.3.6. DIRTY / CLEAN SLOP TANKS

4.3.6.1. Two (02) slop tanks, one portside dirty slop and other starboard side clean slop tank shall be located at the aftermost cargo area.

4.3.6.2. Each of slop tanks shall be back up of the other slop tank and therefore shall fully perform the functions of both slop tanks considering the eventual repair and CS inspection activities on these tanks.

4.3.7. SLOP PUMPS

4.3.7.1. Slop tanks shall have one submerged centrifugal slop pump (2 x 100%) per tank to perform the following actions:

a. To feed sea water for the tank cleaning machines installed on cargo, slop, produced water, settling and off-spec oil tanks obtained from the SWW source slop tank in a closed circuit.

b. To export oil and oily water to the shuttle tankers by means of the offloading system.

c. To feed oily water to the Slop Treatment Unit for overboard discharge, as a backup for SLOP DISCHARGE PUMPS (requirements detailed on 4.5).

4.3.7.2. Slop Pumps shall be hydraulic submerged type with pipe stack and shall be supplied by the same packager of the cargo area submerged pumps package.

4.3.8. SLOP TANKS BALANCE LINE

4.3.8.1. Slop tanks shall have a balance line to communicate the dirty and clean slop tanks by gravity through the operation of double blocking valves with remotely actuation, being one of them with partial opening.

4.3.8.2. To avoid fluids contamination between cargo and slop tanks, balance line shall be fully welded since it crosses over a cargo tank to connect both slop tanks.

4.3.8.3. Balance line shall be painted with the same painting scheme as the Slop Tanks.

4.3.9. TRANSFERENCE HEADER

4.3.9.1. Cleaning and transference system shall have a Transference Header with the purpose to conduct the oil or water / oil mixtures from the cargo pumps header to the transference droplines.

a. This header shall act as back-up (contingency) to the loading header.

b. To allow the cargo tanks filling with ballast water.

c. To enable the slop tanks filling with sea water during SWW operations.

d. To enable the internal cleaning offloading hoses to slop tanks.

e. Return the oily water from shuttle tanker to slop tanks (offloading hose back flush operation).

4.3.9.2. Transference header shall be installed on Marine Pipe Rack. From the header branches there shall be installed one transference dropline by each cargo and slop tanks. For droplines requirements refer to 2.2.5.

4.3.10. BUTTERWORTH HEATER

4.3.10.1. For SWW operations a Butterworth heater (1 x 100%) shall be installed with the purpose to heat the sea water for the SWW open and closed circuit operations. The expected heating temperature is 40 degrees.

4.3.10.2. Butterworth heater shall be shell and tube type, installed with a by-pass of the Butterworth header and shall not be used for COW operations, only for SWW operations.

4.3.11. BUTTERWORTH PUMPS

4.3.11.1. Butterworth pumps (2 x 100%) shall be hydraulic / electric driven submerged centrifugal type, included on the submerged cargo pumps package and shall

have the following purposes:

a. To provide pressure test for the offloading equipment (North Sea valve) before each offloading operation.

b. To provide the internal cleaning of the offloading hoses.

c. To feed the cleaning machines of each slop tank with sea water in SWW semi-open circuit.

d. To distribute sea water to Main Deck, stern, bow for general service and portable exhauster.

e. To provide cargo pumps header internal cleaning operation.

4.3.12. BUTTERWORTH PUMPS HEADER

4.3.12.1. Butterworth pumps header shall be installed on Marine Pipe Rack and shall have multiple functions:

a. To be communicated with the offloading header upstream the Aft / Fwd offloading equipment, in such way to allow the hydrostatic tests and the internal cleaning of the offloading hoses.

b. To provide the sea water for driving the tanks degassing exhausters.

c. To provide general services on Main Deck, bow and stern area.

d. The internal cleaning of the cleaning machines header

e. To allow the SWW operations.

4.3.12.2. Butterworth System shall use the same sea chests as the Ballast System (Fwd), 2.2.8.

4.4. BALLAST SYSTEM (FWD)

4.4.1. PURPOSE

4.4.1.1. The main purpose of this system is to ballast and deballast the water from the ballast tanks installed ahead of the forward bulkhead of the Engine Room.

4.4.1.2. The secondary purpose is to perform the contingency ballast on cargo tanks.

4.4.1.3. System shall be designed to avoid accidental ballast operations by gravity.

4.4.2. BALLAST PUMPS

4.4.2.1. Two Ballast pumps (2 x 100%) shall be installed ahead of the Engine Room fwd bulkhead being one at the on water ballast tanks No 7 portside and other at water ballast tanks No 7 starboard side, as close as possible to the tank's bottom.

- Note 1: Ballast pumps (fwd) shall be hydraulic / electric driven submerged pumps type supplied by the submerged cargo pumps packager as detailed.
- Note 2: the use of self-priming units on Main Deck shall be evaluated.

4.4.2.2. Ballast pumps shall be each other connected to all fwd (cargo area) ballast tanks through a ballast ring with the suction from sea chests and the discharge through the Cofferdam to Main Deck with overboard on portside side shell.

- Note 1: ballast ring shall be fiberglass material, only tanks penetrations shall be carbon steel.
- Note 2: two sea chests shall be installed on the water ballast tanks: one at portside and other at starboard side. For sea chests refer to 2.2.8.

4.4.2.3. It shall be possible to perform deballast operations using both ballast pumps at the same time.

4.4.2.4. Ballast pumps shall have local and remote (SOS-HMI) pressure indicators at their suction and discharge lines.

4.5. SLOP TANKS OILY WATER MIXTURE TREATMENT AND DISCHARGE

4.5.1. PURPOSE

4.5.1.1. The main purpose is to perform the slop tanks oily water treatment, discharge clean water to overboard and return dirty water to slop tanks, according to MARPOL requirements.

4.5.2. CONFIGURATION

4.5.2.1. This system has the following main components:

a. Slop Discharge Pumps, hydraulic / electrical submerged centrifugal type (2 x 100%),

b. Slop Tanks discharge lines,

c. Slop Treatment Unit, centrifugal type (2 x 100%),

d. Oil in water monitored side shell discharge.

e. AIT Analyzers.

f. Slop Tanks Oil Return Lines.

4.5.3. SLOP TREATMENT UNITS

4.5.3.1. The oily water treatment shall be performed by two (2 x 100%) slop treatment units' centrifugal type which shall be part of the Slop Treatment Unit package installed on Main Deck.

4.5.3.2. In normal operations the oily water is pumped from the Clean Slop Tank to be treated at the Slop Treatment Units. If the oil content is under the acceptable limit of 15 ppm as MARPOL requirements (measured by online TOG AIT), it can be discharged overboard. Otherwise (oil content is higher than MARPOL limit), the oily water shall be directed to the Dirty Slop Tank, same for the oil separated by Slop Treatment Units.

- Note: in contingency operations with one of the slop tanks under inspection or repair, the whole operation shall be totally performed by the remaining slop tank.

4.5.4. SLOP DISCHARGE PUMPS

4.5.4.1. Slop Discharge Pumps (2 x 100%) have the purpose to feed the Slop Treatment Unit for further discharge of the treated water with the oil content according to the MARPOL limit of 15 ppm.

4.5.4.2. Slop Discharge Pumps (2 x 100%) shall be installed each one on Dirty and Clean Slop Tanks. These pumps shall be hydraulic / electric driven submerged centrifugal type with pipe stacks and be part of the cargo area submerged pumps package.

4.5.4.3. Side shell discharge shall be installed on Main Deck and shall have an AIT analyzer installed on it. AIT analyzer shall be type approval by OWNER.

4.5.4.4. Slop Tanks Oil Return Lines shall be installed on Main Deck.

4.6. INERT GAS SYSTEM

4.6.1. PURPOSE

4.6.1.1. The main purpose of this system is to inject inert gas in the cargo, slop, settling, off-spec oil, and produced water tanks. This injection of inert gas has the following objectives:

a. To keep a safe atmosphere inside the tanks.

b. To keep a safe pressure inside the tanks.

c. To purge these tanks, during the degasification operations.

d. To be the backup system in case of failure of the Hydrocarbon Tank Blanketing System.

4.6.1.2. The secondary purpose of this system is:

a. To keep a safe atmosphere inside the tanks adjacent to cargo, slop, settling, produced water and off-spec oil tank, as ballast tanks and cofferdam in contingency operations.

4.6.2. CONFIGURATION

4.6.2.1. The following system components shall be supplied by the same supplier.

a. Inert gas generators, including blowers and scrubbers.

b. Deck water seal main and auxiliar

c. Retention valve of inert gas distribution and purge header

d. Pressure / vacuum breaker main and auxiliar

e. Remote and local control panel with selection key

f. Control valve and BDV of the system.

g. Fuel gas skid.

h. Diesel oil feed pumps.

4.6.2.2. This system shall be designed to comply with SOLAS chapter II-2.

4.6.3. INERT GAS GENERATORS

4.6.3.1. Inert gas generators (2 x 100%) have the purpose to produce inert gas from an automatic dual fuel mode (diesel oil / fuel gas) with adequate composition for the cargo area tanks inertizing.

a. The inert gas may be produced from the diesel oil or fuel gas burn, according to the operator selected mode the fuel type mode selection shall consider burning fuel gas as the main fuel and diesel oil as the secondary one.

b. The air supply for combustion chamber shall be provided by blowers with ambient air suctions located in a safe area free from other fans discharge. Blowers shall attend both IGGs.

c. the diesel oil feed pumps are responsible to supply diesel oil from the inert gas diesel oil tank to the Inert Gas generators burning chamber. Pumps requirements are detailed on item 9.2.

d. on fuel gas mode, process plant fuel gas control and supply are done by fuel gas ventilated cabinets which shall provide a safe supply atmosphere in a non-hazardous area compartment where IGG is installed.

e. the IGG scrubbers washing down, cleaning and cooling is performed by sea water pumps which have suction from Engine Room sea chests.

f. The produced inert gas shall be washed and cooled down before reach the header towards to the Hull cargo area structural tanks.

4.6.3.2. Inert gas generators shall be installed in a specific compartment on Forecastle in such way that its discharge does not impact the UNIT operation.

4.6.4. RETENTION VALVES

4.6.4.1. As SOLAS requirement, retention valves shall be installed on IGG purge and distribution headers downstream the Deck Water Seals as the first barrier for the gas return to the IGG compartment through the headers to the IGG compartment.

4.6.5. DECK WATER SEALS

4.6.5.1. Deck water seals are the second and definitive barrier against gas return to the IGG compartment, as required by SOLAS (Chapter II – 2), to avoid gas return from tanks with oil or oily water content. This device shall be water sealed type and shall have a compatible water column with the tanks pressure.

4.6.6. P/V BREAKERS

4.6.6.1. Pressure / Vacuum breakers (P/V Breakers) (Main) and (Auxiliar) shall be the last pressure barrier safety devices responsible to keep the inert gas system pressure under the allowable limits. The first pressure barrier is the PVSVs.

4.6.6.2. P/V Breakers shall have fresh water supplied by the Hydrophore Vessel and an inert gas / purge connection with the inert gas / purge distribution header with a manual block valve and a level gauge to ensure the reading of the design water level.

4.6.7. REMOTE / LOCAL PANELS

4.6.7.1. Inert gas generators remote control panel shall be installed on CCR as close as possible the Hull systems operators, while local control panel shall be installed close to the IGG skid. Remote control panel shall be independent on the SOS-HMI.

4.6.8. INERT GAS DISTRIBUTION HEADER

4.6.8.1. Inert gas distribution header shall be longitudinal and installed on Marine Pipe Rack with the purpose to distribute the inert gas to the cargo area tanks from the Inert gas generators.

4.6.9. PURGING HEADER

4.6.9.1. Inert gas purging header shall be longitudinal and installed on Marine Pipe Rack with the cargo area tanks purging operations purpose.

4.6.9.2. There shall be installed drain pots over the purging header length.

- Note: Inert gas purging header shall also be responsible for the tank's gas freeing.

4.6.10. INERT GAS VENTING SYSTEM

4.6.10.1. Inert gas generator shall have vent pipes to destinate excess of gas to a safe location according to the Gas dispersion analysis.

4.7. CLOSED VENT SYSTEM

4.7.1. PURPOSE

4.7.1.1. The main purpose of this system is to perform below functions in the cargo, slop, settling, produced water tanks and off-spec oil tanks:

a. To keep a safe atmosphere and pressure inside these tanks.

b. To conduct gas vented from these tanks to a safe location.

- Note: for purge discharge of these tanks another closed venting system with dedicated header and vent posts shall be installed.

4.7.2. VACUUM BREATHER / PRESSURE VALVES (PVSVs)

4.7.2.1. To ensure the cargo, slop, settling, produced water tanks and off-spec oil tanks

safe atmosphere and the system pressure under the allowable limits, Vacuum Breather / Pressure Valves (PVSVs) shall be installed on closed venting header branches dedicated to each of those tanks.

4.7.2.2. Vacuum Breather / Pressure Valves (PVSVs) shall have two independent sections: one for vacuum other for breather or pressure.

4.7.3. CLOSED VENTING HEADER

4.7.3.1. This system shall have a closed venting header to be installed on the Marine Pipe rack with the purpose to allow the cargo, slop, settling, produced water tanks and off-spec oil tanks pressure relief by venting through the header towards the dedicated Vent Posts during tanks normal operations.

4.7.4. PURGE VENTING HEADER

4.7.4.1. This system shall have a closed venting header to be installed on the Marine Pipe rack with the purpose to allow the cargo, slop, settling, produced water tanks and off-spec oil tanks pressure relief by venting through the header towards the dedicated Vent Posts during tanks purging operations.

4.7.5. VENT POSTS

4.7.5.1. Two (02) Vent Posts one portside and other starboard side shall be installed as close as possible of each side shell of UNIT to ensure a safe position for tanks gases venting during normal operation, mitigating the sensibilization of UNIT gas detectors.

4.7.5.2. Another two (02) Vent Posts one portside and other starboard side shall be installed as close as possible of each side shell of UNIT to ensure a safe position for tanks gases venting during purging operations, mitigating the sensibilization of UNIT gas detectors.

4.7.5.3. For both normal and purging operations, the selection between the two (02) vent posts shall be done remotely. The valves shall be interlocked. One vent post shall always be opened while the other shall be closed. Vent Posts shall be selected by the operator according to the wind intensity and direction.

4.7.5.4. Vent posts shall have a dedicated CO_2 firefighting (snuffing) systems and flame arrestors installed on them. System shall be able to receive inert gas injection from distribution header for Vent Post gases purging.

4.8. TANK DEGASSING SYSTEM

4.8.1. The purpose of this system is to provide the cargo, slop, settling, produced water,

and off-spec oil tanks degasification to allow personnel entrance for inspections and / or repair inside the tanks.

4.8.2. Main Deck openings have the purpose to provide the tanks degasification to allow personnel entrance for inspections and / or repair inside the tanks. The tank degassing is performed through the Main Deck openings for portable exhausters responsible for degasification of the tanks.

4.8.3. Portable Equipment for Tanks Degassing shall be installed on Main Deck attached to their suction ducts and shall be sea water driven type approved for zone 1 classified area.

4.8.4. Minimum of six (06) connection points for a group of three tanks shall be provided on Butterworth Pumps Header to ensure the simultaneous operation of two portable exhausters fans.

4.9. TANKS ULLAGE, PRESSURE AND TEMPERATURE MONITORING SYSTEM

4.9.1. GENERAL

4.9.1.1. The indication and alarms of ullage, pressure and temperature systems shall be provided on Remote Ullage, Pressure and Temperature Monitoring Panel and on SOS-HMI.

4.9.2. TANKS ULLAGE MONITORING SYSTEM

4.9.2.1. The objective of this system is to do the following functions:

a. Continuously monitor the level of the cargo, slop, off-spec oil, settling and produced water tanks, through ullage remote measurement of these tanks.

b. Provide the low-level alarm in these tanks.

c. Provide high, high-high and emergency alarms in these tanks.

d. Provide redundancy for high, high-high, and emergency alarms in these tanks.

e. To provide interface water / oil in each slop, produced water and off-spec oil tanks.

4.9.2.2. Besides the above-mentioned items, the system consists of the following main items:

a. To monitor continuously inside the atmospheric tanks.

b. To monitor continuously the flooding on specific compartments.

c. To do the continuous measurement of draft and to indicate the medium draft, trim, and heel of UNIT.

d. To make the loading simulation, with stability and longitudinal strength calculation.

4.9.3. TANKS PRESSURE MONITORING SYSTEM

4.9.3.1. The main purpose of this system is as the following:

a. To monitor the internal pressure of cargo, slop, produced water, settling and off-spec oil tank.

b. To activate the high-pressure alarm on those mentioned tanks.

c. To activate the low-pressure alarm on those mentioned tanks

4.9.4. TANKS TEMPERATURE MONITORING SYSTEM

4.9.4.1. The main purpose of this system is as the following:

a. To monitor the internal oil or water / oil mixture temperature of cargo, slop, produced water, settling and off-spec oil tank.

b. To activate the high temperature alarm on those mentioned tanks.

4.9.4.2. Three (03) sensors shall be installed on each cargo area tank for the temperature monitoring.

4.10. CLOSED ULLAGE SYSTEM

4.10.1. The purpose of this system is to allow different monitoring portable instruments to be inserted into cargo, slop, off-spec oil, settling, and produced water tanks without pressure drop of inert gas in these tanks.

4.10.2. This system shall be composed by penetration pieces on Main Deck, full passage valves, adaptor nozzles for instruments and cap protection against weather.

4.10.3. There shall be provided closed ullage connections also to the aft ballast tanks for the purpose of analyzing the ballast water before discharging to overboard, whenever required.

4.11. TANKS MANUAL SOUNDING SYSTEM

4.11.1. The purpose of this system is to allow the manual sounding of ballast tanks, cofferdam, void spaces and any other tanks which are not constantly

pressurized with inert gas.

4.11.2. All structural tanks, void spaces and cofferdams shall have at least one sounding pipe and the sounding pipes shall have the lower end at the lowest point of the tank considering the UNIT Hull operational trim and the upper end installed on Main Deck.

- Note: the upper end of the Fore Peak Tank shall be installed on Forecastle or other compartment / area with easy access at the Hull bow area.

4.12. ATMOSPHERIC TANKS VENTING SYSTEM

4.12.1. The purpose of this system is:

a. To prevent pressurization and collapse of atmospheric structural tanks.

b. To enable the suction of fluids from inside of these tanks and prevent structural collapse due to vacuum inside such tanks.

4.12.2. The venting lines minimum height shall follow ICLL recommendations.

4.13. TANK LEVEL INDICATION SYSTEM

4.13.1. This system has the purpose to perform below functions in all ballast tanks (aft and fwd), diesel oil tanks, freshwater tanks, and other structural tanks in the Engine Room:

a. To continuously monitor the level inside the above tanks.

b. To provide low and high level alarm in the above tanks.

- Note: for the diesel oil storage and service tanks there shall be also the high-high and low-low level alarm.

4.13.2. Each atmospheric tank shall have at least one level sensor which shall be hydrostatic type. Any other sensor type shall be submitted for the OWNER formal approval.

4.13.3. Level sensors installed inside water ballast tanks adjacent to the cargo, slop, settling, produced water and off-spec oil tank shall be adequate to operate in hazardous areas classified as zone 0.

4.13.4. The indication of all level and alarms of this system shall be displayed on the remote ullage, pressure and temperature monitoring panel (on CCR) and on SOS-HMI.

4.14. FLOODING MONITORING SYSTEM

4.14.1. The purpose of this system is to alarm the presence of liquids in the Engine Room, Cofferdam, Forecastle, Inert gas system room, and void spaces to mitigate the risk of flooding in these compartments with a continued monitoring.

4.14.2. In Engine Room and Cofferdam two sensors shall be installed: one portside and other starboard side. Forecastle bilge wells and IGG Room shall have at least one sensor.

4.14.3. The alarms shall be audible and visual type with the indication provided on the Remote ullage, pressure and temperature monitoring panel on SOS-HMI.

4.15. DRAUGHT, TRIM & HEEL INDICATION SYSTEM

4.15.1. The purpose of this system is to indicate the draught, trim and heel of the UNIT Hull, remotely on CCR.

4.15.2. The system shall have six (6) sensors in the following locations: Forward Perpendicular at SB and PS; Midship at SB and PS and Aft Perpendicular at SB and PS.

4.16. GAS SAMPLING

4.16.1. The Gas Sampling System objective is to provide gas measurement and analysis for ballast tanks, cofferdam and void spaces adjacent to cargo, slop, settling, off-spec oil and/or produced water tanks.

4.16.2. The package is comprised of a central unit for collection and analysis of the atmosphere of the referred tanks for the hydrocarbon gas concentration. Additionally, the Gas Sampling Panel shall also analyze the tanks' atmosphere for H_2S (hydrogen sulfide) concentration.

4.16.3. The Gas Sampling System shall be connected to each water ballast tank, cofferdam and void spaces adjacent to cargo, slop, settling, off-spec oil or produced water tanks by means of tubings, being two of them provided for each of the compartments.

4.17. OXYGEN SAMPLING

4.17.1. Oxygen sampling system shall be installed on each cargo tank to allow the monitoring of the oxygen content inside the cargo tanks since these tanks will have inertization done by HC blanket system. Oxygen content shall be monitored to check if inside the allowable levels.

5. ENGINE ROOM SYSTEMS

5.1. GENERAL

5.1.1. Engine Room systems described on this chapter are Hull systems installed on Engine Room, consisting of various equipment and systems with multiples interfaces with Hull systems, topside and accommodation systems.

5.1.2. Engine Room is considered as a restricted accessed area, therefore, all valves with frequent operation shall have remote hydraulic actuation.

5.1.3. Engine Room systems comprises the following:

a. Engine Room Sea Water Cooling System.

b. Fresh Water Central Cooling System.

c. Inert Gas Sea Water Supply System.

d. Engine Room General Service and Ballast System.

e. Engine Room Bilge System.

f. Sewage System.

g. Marine Growing Prevention System (MGPS).

h. Engine Room Draining System

5.1.4. All connections between Engine Room systems and any other classified areas shall comply with the safety requirements of the Classification Society.

5.2. ENGINE ROOM SEA WATER COOLING SYSTEM

5.2.1. PURPOSE

5.2.1.1. The purpose of this system is to circulate sea water in the coolers of the Engine Room Fresh Water Central Cooling System in an open circuit type with a side shell discharge limited to 40º C (as IBAMA requirement).

5.2.2. CONFIGURATION

5.2.2.1. Engine Room Sea Water Cooling System is composed by sea water cooling pumps, sea / fresh water coolers, basket filters, sea chests for the sea water suction and the Marine growing prevention system (MGPS).

5.2.3. CROSSOVER

5.2.3.1. This system shall have a crossover piping responsible to connect both Engine Room sea chests with the purpose to feed all pumps which needs to have sea water suction.

5.2.4. SEA WATER COOLING PUMPS

5.2.4.1. System shall have sea water cooling pumps (3 x 50%) electrical driven centrifugal type to collect sea water from the Engine Room sea chests crossover and pump it to the Engine Room central fresh water coolers. These pumps shall have continuous operation with automatic standby and shall also be used for Engine Room emergency suction.

5.2.5. BASKET FILTERS

5.2.5.1. Basket filters (2 x 100%) shall be installed close to each Engine Room sea chests.

5.3. ENGINE ROOM CENTRAL FRESH WATER COOLING SYSTEM

5.3.1. PURPOSE

5.3.1.1. The purpose of this system is to provide fresh water cooling circulation in a closed circuit for all Hull systems consumers where it is applicable.

5.3.2. CONFIGURATION

5.3.2.1. System is composed by (4 x 33%) fresh water cooling system circulation pumps, (2 x 100%) fresh water coolers, a by-pass branch, a (1 x 100%) fresh water filter, an expansion tank for the system thermal expansion (1 x 100%) and a chemical injection tank / vessel (1 x 100%).

5.3.3. FRESH WATER COOLING PUMPS

5.3.3.1. Fresh water cooling pumps (4 x 33%) have the purpose to circulation the fresh water through the ER central fresh water coolers. These pumps shall be electrical driven centrifugal type and shall have continuous operations with automatic stand-by.

5.3.4. FRESH WATER CENTRAL COOLERS

5.3.4.1. Fresh water central coolers (2 x 100%) have the purpose to exchange the heating of the cooling water system to keep them under the designed temperature. A three-way valve shall be installed at the coolers discharge for flow / temperature control. Fresh water coolers shall be plate heat exchanger type with titanium alloy plates.

5.3.4.2. A fixed backwashing system with dedicated lines and valves shall be provided for the coolers seawater side backwashing of one cooler while the other is in operation.

5.3.5. BY-PASS BRANCH

5.3.5.1. A by-pass branch shall be installed at the coolers discharge and shall be communicated to the cooling pumps suction branch. A hydraulic remotely actuated valve shall be installed at the coolers discharge with an interlocking with a pressure transmitter installed at the cooling pumps discharge, to modulate the system pressure.

5.3.6. EXPANSION TANK

5.3.6.1. An expansion tank shall be provided for the system thermal expansion. This tank shall be installed in a minimum height enough to keep the system under the designed pressure. The expansion tank level shall be indicated on SOS-HMI with high / low alarms and shall have an interlocking with the fresh water feeding hydraulic actuated valve to open / close itself according to the necessary supply from the Hydrophore package.

5.3.6.2. Expansion tank shall have retention valves to avoid the contamination of the fresh water circuit through the connection with the Hydrophore Unit, since chemical products on the Expansion Tanks on normal operation are expected.

5.3.7. CHEMICAL TANK / VESSEL

5.3.7.1. A chemical tank / vessel shall be provided for periodical system chemical injection.

5.3.8. BASKET FILTER

5.3.8.1. A single basket filter (1 x 100%) 50 micra shall be installed at the ER fresh water coolers discharge and upstream the fresh water circulation pumps.

5.4. INERT GAS SEA WATER SYSTEM

5.4.1. PURPOSE

5.4.1.1. The purposes of this system are:

a. To feed the inert gas generators A/B with sea water for scrubbers refresh and washing through the Inert Gas Generator Sea Water Pump.

b. To feed the Deck Water Seals (Main and Auxiliary) with sea water through Inert Gas Seal Pump.

5.4.2. CONFIGURATION

5.4.2.1. This system shall be composed by:

a. Inert gas generators sea water pumps (2 x 100%)

b. Inert gas generators sea water header with a crossover for the pumps.

c. Inert gas generators seal pumps (2 x 100%)

d. Inert gas generators seal pumps dedicated headers.

5.4.3. CROSSOVER FOR SEA WATER SUCTION

5.4.3.1. Crossover for the Inert Gas Generator SW and Seal pumps sea water suction shall be the same as the sea water cooling system suction which shall be installed at the Engine Room bottom connected to both (PS/SB) sea chests.

5.4.4. INERT GAS GENERATORS SEA WATER PUMPS

5.4.4.1. Inert Gas Generators Sea Water Pumps shall be electrical driven centrifugal type, (2 x 100%) to be installed on the Engine Room to be solely dedicated to supply sea water to the Inert Gas Generators A and B. At least one Inert Gas Seal Pump shall be used for Topside Turbo Generators commissioning.

5.4.5. INERT GAS SEAL PUMPS

5.4.5.1. Inert Gas Seal Pumps shall be electrical driven centrifugal type (2 x 100%) and solely dedicated to supply sea water for Deck Water Seals (Main and Auxiliar). These pumps shall be installed on the Engine Room and shall be designed for continuous operation with automatic stand-by.

5.4.6. DECK WATER SEALING HEADERS

5.4.6.1. Deck sealing system shall have two (2 x 100%) dedicated headers with the only function to feed sea water to the Deck Water Seals (Main and Auxiliar). These headers shall be extended from Engine Room to the Deck Water seals over each side of the Marine Pipe Rack and shall be each other communicated through a crossover at the discharge of the inert gas seal pumps.

5.5. ENGINE ROOM BALLAST (AFT), BILGE AND GENERAL SERVICES SEA WATER SYSTEM

5.5.1. PURPOSE

5.5.1.1. The main purpose of this system is:

a. To ballast and de-ballast the water ballast tanks (PS/SB) aft of the Engine Room forward bulkhead.

b. To drain the bilge from the Engine Room (CS requirement).

5.5.2. CONFIGURATION

5.5.2.1. This system shall be composed by sea water suction crossover, general service / ballast pumps and side shell overboard lines.

5.5.3. CROSSOVER

5.5.3.1. Sea water suction crossover shall provide the communication from the Engine Room sea chests and the system pumps.

5.5.4. BALLAST (AFT), BLIGE AND GENERAL SERVICE PUMPS

5.5.4.1. Ballast (Aft), Blige And General Service Pumps (2 x 100%) shall be electrical driven centrifugal type and to be installed at the top of the Engine Room bottom. Each of the pumps shall be able to ballast / deballast each of the ER ballast tanks. A priming system with PCVs shall be provided to ensure the pumps suction pressure limits.

5.5.4.2. Ballast (Aft), Blige And General Service Pumps shall have suction from the sea water suction header and alternatively from the bilge wells aft (PS/SB) (Pump A), and Pump B only from bilge well aft (SB).

5.5.5. SIDE SHELL OVERBOARD

5.5.5.1. This system shall have an independent overboard discharge from the Engine Room to the sea water above the maximum draft.

5.6. ENGINE ROOM AUXILIARY, BILGE AND SLUDGE SYSTEM

5.6.1. PURPOSE

5.6.1.1. The purpose of this system is:

a. Engine Room bilge wells drainage.

b. Treated oily water discharge from Engine Room overboard to the sea.

c. Transference of oily water from the Engine Room to the slop tanks.

d. Suction and transference of sludge from the Engine Room to the slop tanks or discharge stations on the Main Deck.

e. Drainage of cofferdams and void spaces aft of the forward Engine Room bulkhead.

f. Emergency suction of Engine Room.

g. Engine Room direct aspiration.

5.6.2. CONFIGURATION

5.6.2.1. This system is composed by: (2 x 100%) auxiliary pumps, a (1 x 100%) settling tank, (2 x 100%) bilge wells, an (1 x 100%) oily water separation (SAO), (1 x 100%) sludge tank, (1 x 100%) sludge pump and the Main Deck sludge discharge stations.

5.6.3. AUXILIARY BILGE PUMPS

5.6.3.1. Auxiliary bilge pumps (2x100%) have the purpose to collect the oily water from the Engine Room bilge wells, the Bilge water settling tank and from the Aft Void and discharge this oily water to the Dirty / Clean slop tanks.

5.6.3.2. These pumps shall be electrical driven reciprocating or monofuse type and shall be installed at the top of the Engine Room double bottom. Auxiliary bilge pumps shall also be backup for the Sludge Pump.

5.6.4. BILGE WELLS

5.6.4.1. Engine Room shall have a set of bilge wells to be installed at the top of the Engine Room bottom (PS/SB) at the lowest points with the purpose to collect oily water from Engine Room bottom. Bilge wells shall have the level high / low monitored with visual alarm on SOS-HMI.

5.6.5. EMERGENCY SUCTION

5.6.5.1. There shall be an emergency suction line on Engine Room for large flooding scenario. This line shall aspirate from the Engine Room bottom and with the suction directly connected to the large pump of this compartment, which is the Sea Water Cooling Pump, 5.2.4.

5.6.6. BILGE SETTLING TANK

5.6.6.1. A structural bilge water settling tank shall be installed on Engine Room to receive water / oil mixtures aft the Engine Room fwd bulkhead as below:

a. From Engine Room bilge wells.

b. From containment basins which could have water / oil mixture located aft Engine Room fwd bulkhead.

c. From Engine Room scuppers,

d. Oily water from diesel oil purifiers,

e. SAO return in case oil content is above 15 ppm.

5.6.6.2. Rose box filters shall be installed at the suction ends of the tanks.

5.6.7. OIL / WATER SEPARATOR UNIT (SAO)

5.6.7.1. An oil / water separator unit (SAO) shall be provided within a skid with the purpose to treat oily water and discharge to the sea water with a maximum oil content of 15 ppm, as the MARPOL requirement limits.

5.6.8. ENGINE ROOM SLUDGE SYSTEM

5.6.8.1. Engine Room sludge system have the purpose to collect mixtures of water / oil with high oil content which are produced on aft the Engine Room fwd bulkhead equipment.

5.6.8.2. Engine Room sludge system shall be composed by a sludge tank, a sludge pump, a sludge pump filter and the Main Deck Sludge Discharge Stations.

5.6.8.3. The Sludge Tank shall receive the water / oil mixture with high oil content from SAO, diesel oil purifiers and aft Engine Room fwd bulkhead equipment containment basins.

5.6.8.4. The sludge collected on sludge tank shall be pumped to the slop tanks or Main Deck discharge station with a single dedicated sludge pump (1x100%) alternative progress cavity type. Alternatively, Auxiliary Bilge Pumps 5.6.3 can be used for this purpose.

5.6.8.5. Two (2) Main Deck sludge discharge stations shall be provided with international shore connection for the sludge discharge to the supply boats. These stations shall be installed close to the fresh water / diesel oil filling stations.

5.7. BLACK AND GRAY WATER SYSTEM

5.7.1. PURPOSE

5.7.1.1. The purpose of this system is to collect, treat and discharge into the sea all the sanitary waste (gray water and black water) generated by the UNIT. No sewage flow, both gray and black waters, shall be discharged directly into the sea without treatment, even in situations of maintenance of the sanitary sewage treatment units.

5.7.1.2. To fulfill this requirement, two sanitary sewage units (2 x 100%) are being adopted. Each unit shall be able to meet 100% of the Installation's POB.

5.7.2. SEWAGE TREATMENT UNIT

5.7.2.1. Sewage treatment units shall be IMO type approved as per MPEC.227 (64) and the effluent discharge to the sea shall follow “CONAMA Resolução nº.430 (13/05/2011)” and “NOTA TÉCNICA CGPEG/DILIC/IBAMA Nº 01/11 – PROJETO DE CONTROLE DA POLUICAO – IBAMA”.

5.7.2.2. Sewage treatment units (2 x 100%) shall be biological type and able to attend the UNIT 100% POB. Sample points shall be installed at the grey and black waters influent admission and at the sewage treatment unit’s effluent discharge. STUs shall have a disinfection system for the discharged effluents.

5.7.3. GREY / BLACK WATERS COLLECTING PIPES

5.7.3.1. This system shall have grey and black waters collecting pipes able to destinate the flow to both sewage treatment units. The gray water pipes shall be completely segregated from the black water pipes.

5.7.3.2. Gray and Black waters systems shall be able to be treated by both sewage treatment units before being discharged overboard to the sea.

5.7.3.3. All the collection and drainage of the gray water shall be made by gravity, while black waters shall be made by vacuum system.

5.7.3.4. There shall be an equalization tank to allow the mixture of gray and black water upstream the Sewage Treatment Unit. The other purpose is to reduce the impact of the influents at the STU inlet.

5.7.4. SEWAGE DISCHARGE

5.7.4.1. The treated sewage from the sanitary sewage treatment units shall be discharged to the sea through two side shell discharges: one starboard side

and other portside and below the lowest draft of the UNIT. Each of those overboard discharges shall be able to attend both sewage treatment units.

5.7.4.2. A flowmeter shall be installed on each of the overboard discharges with the purpose to register and keep the discarded volumes historical on SOS.

5.7.5. SEWAGE SLUDGE REMOVAL

5.7.5.1. Sewage treatment units shall have a sludge connection to be transferred to drums (200 l) at the Laydown area for maintenance periods. It shall be provided a fixed pump and piping from sewage room to the laydown area for this purpose.

5.7.5.2. Sewage treatment units' desludging shall have a sludge compactor system to be added to the sludge removal system to generate a high density sludge for an easy removal. This sludge compactor system shall be specified during the Basic Design.

5.8. ANTI FOULING SYSTEM (MGPS)

5.8.1. This system aims to mitigate the risk of marine life formation and the corrosion inside the sea chests, sea water intake pipes, equipment, and accessories and shall be exclusively used for a dedicated Hull system sea water suction.

5.8.2. MGPS system shall be electrocatalytic type, without chemical products injection. For this purpose, this system shall have an electrolysis tank (2 x 100%) with anodes to generate copper ions to mitigate the marine life formation (as an anti-fouling system) and aluminum ions to inhibit the piping and accessories corrosion.

5.8.3. This system shall have a control panel to be installed on Engine Room with the purpose to control all system functions. This panel shall send monitoring signals to SOS and all parameters shall be seen on SOS-HMI.

5.9. SCUPPERS AND COAMING DRAINS IN ENGINE ROOM SYSTEM

5.9.1. PURPOSE

5.9.1.1. This system has the purpose the drainage by gravity of the Engine Room decks and shall comprise the following systems:

a. Dirty Oil Gravity Drainage System.

b. Oily Water Gravity Drainage System.

5.9.2. GENERAL REQUIREMENTS

5.9.2.1. Every compartment provided with a fire-fighting system by means of gases and with scuppers for drainage, including the scuppers of the containment basins, shall be fitted with shut-off valves for these scuppers, with external opening/closing actuation regarding to the protected compartment. The number of valves shall be minimized, and their position shall be monitored locally and, in the SOS-HMI.

5.9.3. DIRTY OIL GRAVITY DRAINAGE SYSTEM

5.9.3.1. Dirty Oil Gravity Drainage System have the purpose to collect:

a. dirty oil/sludge oil from the SAO,

b. dirty oil/sludge oil from diesel oil purifiers

c. the drainage of all the oil containment basins of the equipment installed aft of the Engine Room forward bulkhead except for the Aft Offloading equipment.

5.9.3.2. The drainage piping shall conduct the dirty oil or sludge directly to the Engine Room sludge tank only by gravity.

5.9.4. OILY WATER GRAVITY DRAINAGE SYSTEM

5.9.4.1. Oily water gravity drainage system has the purpose to make the drainage of oily water by gravity of the diesel oil tank containment basins, equipment containment basins, decks, and compartments in the aft of the Engine Room forward bulkhead that contain oily water to the Engine Room bilge water settling tank.

5.9.4.2. Oily Water collection headers under all levels of the Engine Room shall be provided to allow the drainage of the scuppers of all decks and compartments. The drainage piping shall conduct the oily water directly to the Engine Room bilge water settling tank by gravity only.

6. ACCOMMODATION AND MAIN DECK SYSTEMS

6.1. GENERAL

6.1.1. Accommodation and Main Deck systems are Hull systems which have not interface with Topsides, dedicated only to exposed decks on Hull side, bow and stern compartments and Accommodation. These systems can be detailed as below:

a. Main Deck fresh, sea water and compressed air distribution systems.

b. Hull draining systems: Main Deck, Aft (Poop) / Bow (Forecastle) decks, Cofferdam, Forecastle compartment, Upper Riser Balcony and Helideck.

c. Accommodation systems: cold / hot water distribution and black / grey water collection systems and external draining of Accommodation.

6.2. MAIN DECK FRESH, SEA WATER AND AIR DISTRIBUTION SYSTEM

6.2.1. MAIN DECK SEA WATER DISTRIBUTION SYSTEM

6.2.1.1. The purpose of this system is to supply sea water for

a. Portable exhausters for cargo, slop, settling, produced water and off-spec oil tanks.

b. Diving stations.

c. Main Deck general services.

6.2.1.2. Portable degasification exhausters of cargo, slop, settling, produced water and off-spec tanks shall be driven by the sea water supplied by the Butterworth pumps.

6.2.2. MAIN DECK FRESH WATER DISTRIBUTION SYSTEM

6.2.2.1. The purpose of this system is to supply fresh water to the:

a. diving stations

b. rescue boat station

c. general service for Main Deck

d. Pressure/Vacuum Breaker Main and Auxiliar (see 4.6.6).

e. fresh water consumers at the bow area.

6.2.2.2. Fresh water supply for the fresh water distribution header on Marine Pipe Rack on Main Deck shall be performed by the Hydrophore package located on Engine Room.

- Note: Fresh water distribution header on Main Deck shall have a connection with the Pressure / Vacuum Breaker Main and Auxiliar.

6.2.3. COMPRESSED AIR DISTRIBUTION SYSTEM ON MAIN DECK

6.2.3.1. The purpose of this system is to supply compressed air to:

a. Fixed or portable pneumatic pumps located ahead of the Engine Room fwd bulkhead, as on Cofferdam and Forecastle compartments.

b. Diving stations

c. Main Deck general service, poop deck and forecastle

d. Compressed air consumers at the bow area.

6.2.3.2. Compressed air supply for this system shall be performed by the instrument service air receivers (3 x 100%), located on Module 15-B with distribution header on Main Deck installed on Marine Pipe Rack.

6.3. HULL DRAINING SYSTEM

6.3.1. PURPOSE

6.3.1.1. The purpose of the Hull draining system is to provide draining for the:

a. Hull exposed areas: Main Deck, Poop deck, Forecastle deck.

b. Cofferdam.

c. Forecastle and compartments out of Engine Room and Accommodation module.

d. Helideck.

6.3.2. GENERAL

6.3.2.1. The draining by gravity over the Main Deck, Poop deck, Forecastle deck and all other Hull exposed areas plating down to the side shell and aft parts shall have free flow with no obstacles caused by equipment skid bases, supporting structures and / or any other accessory installed on Main Deck, Poop deck, Forecastle deck and all other Hull exposed areas.

6.3.3. SCUPPERS

6.3.3.1. All exposed areas shall have scuppers for the side shell discard of rain / sea water with no noticed mixed oil. These scuppers shall have rubber plugs on them.

6.3.3.2. Scuppers shall be placed on exposed areas in such way to allow the full flow of rain / sea water with no accummulation on the Hull exposed decks.

6.3.4. POOP AND FORECASTLE DECK DRAINING

6.3.4.1. On Poop and Forecastle Deck, coamings shall be provided specifically for the offloading stations, with draining provided by a surface valve and a fixed pneumatic discharge pump installed inside this area.

6.3.4.2. Offloading station flanges shall all be placed over this area and the NSV valves shall be recovered to the offloading stations containment basins area to avoid oil leakage to the sea.

6.3.5. MAIN DECK DRAINING

6.3.5.1. Main deck shall have internal coamings with the purpose to collect the Process Plant modules deluge and an external coaming to collect any water / oily water for the side shell.

6.3.5.2. Draining boxes shall be installed at the Hull side shell to collect the rain / sea water from over the Main Deck. These draining boxes shall have pumps (electric driven) installed inside to transfer the collected water to the hull draining header.

6.3.5.3. Main Deck shall have a dedicated header (named as Hull draining header) to be installed on Marine Pipe Rack to receive the draining boxes pumps discharge and destinate it to the Slop Tanks. Hull drainage header shall also receive draining from the following systems / areas:

- Aft / Fwd offloading station drainage pneumatic pumps.
- Slop Vessel drainage operation.
- Cofferdam pneumatic drainage pumps.
- Forecastle pneumatic drainage pumps.
- Draining boxes pumps (as above mentioned).
- Portable drain pumps.
- Upper Riser Balcony drainage pumps.

6.3.6. COFFERDAM DRAINING

6.3.6.1. Cofferdam is a compartment necessary to segregated Hull classified and non-classified areas. It is void tank from where it is not expected to have fluids inside in normal operation. Therefore, in any event of the Cofferdam flooding, two (02) scenarios shall be considered for the appropriate compartment draining solution: high and low flooding volume.

a. For high flooding volume, a portable cargo pump shall be provided to be installed through a proper opening on Main Deck and with no obstacles to reach the cofferdam bottom.

b. For short flooding volume, two (02) diaphragm pneumatic pump type (2 x 100%) shall be provided. Those pumps shall be installed at the lowest part of Cofferdam bottom, one at the extreme portside and other one extreme starboard side. Rose box filters shall be installed at their suction ends.

6.3.7. FORECASTLE COMPARTMENT

6.3.7.1. Forecastle compartment has the purpose to house industrial rooms as Paint Shop, Paint Store, IGG room and others and shall be installed above Fore Peak Tanks top plate.

6.3.7.2. For the Forecastle compartment draining there shall be provided two (02) bilge wells installed at the compartment bottom to receive open drain from the above deck areas / compartments. Those areas shall conveniently destinate their draining lines through the Forecastle Compartment to the closest bilge well.

6.3.7.3. Positive closing valves shall be installed downstream the scupper draining lines.

6.3.7.4. Drain piping crossing Forward Peak Tanks shall be fully welded and applied with the same tank paint scheme to the piping external surface. Thickness shall be increased to schedule-160 and with spec B52H.

6.3.7.5. Two (02) fixed pneumatic diaphragm pumps (2 x 100%) shall be installed inside the Forecastle Compartment being the portside pump dedicated to the portside bilge well and the starboard pump dedicated to the starboard bilge well.

6.3.7.6. These pumps shall be driven by the Hull service air distribution system and an interlock shall be provided to start / stop the pumps according to the bilge well level signal.

6.3.8. UPPER RISER BALCONY DRAINING

6.3.8.1. Upper Riser Balcony Draining System shall have individual containment barriers (coamings) to be installed in Production, injection and service positions of production, production WAG, WAG loop wells hang-off and SDV flanges to collect oil from small leaks. All possible small liquid leaks from gas pipeline, production and injection SDVs flanges, located on the pull in area deck shall be contained by specific barriers (coamings).

6.3.8.2. Each containment basin shall have a scupper to be connected to a common

collector header (2 x 50%) which shall collect the draining of all containment basins of the upper riser balcony.

6.3.8.3. Two (02) collecting headers of the upper riser balcony containment basins shall be provided being each one having its discharge to a dedicated draining box (2 x 100%).

6.3.8.4. The two (02) draining boxes shall be installed on upper riser balcony with visual alarm for low and high level on SOS-HMI.

6.3.8.5. Two (02) fixed pneumatic pumps diaphragm type (2 x 100%) shall be provided for each draining box and shall be installed on upper riser balcony with the suction performed by foot valves. All pumps discharge shall be done to the Main Deck drainage header for further transference to slop tanks.

- Note: These pumps shall have remote operation by SOS-HMI and automatic stopping with draining boxes low level.

6.3.9. HELIDECK DRAINING

6.3.9.1. Helideck Draining System have the purpose to collect the rainwater, sea water and eventually the helicopter fuel leakage by dedicated lines, gutters and scuppers with AISI 316 (or similar) screens to avoid any impurities clogging.

6.3.9.2. Helideck draining discharge to the sea shall be external to Hull.

6.3.9.3. All requirements of Brazilian Regulation NORMAM 27 "*Registro de Helideques instalados em Embarcações e em Plataformas Marítimas*" shall be complied with.

6.4. ACCOMMODATION SYSTEMS

6.4.1. GENERAL

6.4.1.1. Accommodation systems consists of:

a. Accommodation fresh, hot and potable water distribution.

b. Accommodation black, gray and external draining water distribution.

6.4.1.2. For all Accommodation systems shall be provided facilities for inspection, maintenance and repair with inspection doors duly identified for valves access, dampers, toilets connections and where equipment and accessories are covered by insulation, but with the necessity of eventual maintenance.

6.4.2. FRESH WATER DISTRIBUTION SYSTEM

6.4.2.1. This system has the purpose to provide cold fresh water not treated (not for human consumption) for general service on external and internal areas of Accommodation module (toilets and laundry) and the Aft Deck.

6.4.2.2. The fresh water distribution system shall have a vertical header for fresh water distribution from the Engine Room to the uppermost level of Accommodation module. On each Accommodation deck one header branch shall be provided.

6.4.2.3. Fresh water connection point shall be provided over the header length for use on Accommodation module external areas, stern areas, and stores compartment.

6.4.3. POTABLE WATER DISTRIBUTION SYSTEM

6.4.3.1. The main purpose of this system is to provide treated water for human consumption for general use in Accommodation.

6.4.3.2. As water destinated to human consumption, UV sterilizing, mineralization and chlorination shall be applied. Human consumption shall be considered for Mess room, galley, toilets, eye washing and infirmary.

6.4.3.3. The potable water distribution system shall have a vertical header for potable water distribution from the Engine Room to the uppermost level of Accommodation. On each Accommodation deck, one header branch shall be provided.

6.4.4. HOT WATER DISTRIBUTION SYSTEM

6.4.4.1. The main purpose of this system is to provide hot water for human consumption and then UV sterilizing, mineralization and chlorination shall be provided.

6.4.4.2. The hot water distribution system shall be performed by an ascendent part of the hot water ring responsible for the distribution for all Accommodation decks while the descendent part shall be responsible for the collection.

6.4.5. ACCOMMODATION MODULE COLLECTING AND DRAINING SYSTEMS

6.4.5.1. The main purpose of this system is:

a. To collect gray water from the galley, laundry, toilets.

b. To collect gray water from infirmary.

c. To collect drainage from compartments provided with scuppers.

d. To collect condensate water from the internal side of the Accommodation bulkhead.

6.4.5.2. GRAY WATERS

a. Gray waters shall be totally segregated from the black waters and shall not pass through the inner part of the fresh water and distilled water tanks. For the galley, freezers room, provision room and any other compartment used for stocking of food and drinking, the piping union shall be done with sleeves totally welded or glued according to the piping material applied.

b. for steel piping the minimum schedule shall be sch 80 on those mentioned areas.

c. All collecting and draining of gray water shall be performed by gravity.

6.4.5.3. GREASE TRAP

a. A grease trap shall be installed at a lower level of galley and mess room with a location to be provided with facilities for inspection access and maintenance as hot and cold water points.

b. All effluents shall be treated before the discharge to the sea.

6.4.5.4. GRAY WATER HOLDING TANK

a. A structural gray water holding tank shall be provided for gray water retention. This tank shall be installed on Engine Room at a level to allow the receiving of all effluents by gravity. The effluents from this tank shall be treated before discard to the sea.

6.4.5.5. BLACK WATERS

a. Black waters shall be totally segregated from the grey waters and shall not pass through the inner part of the fresh water and distilled water tanks, neither through the galley, freezers room, provision room nor any other compartment used for stocking of food and drinking.

6.4.5.6. Accommodation Module External shall have a draining system composed by scuppers.

7. ACCOMMODATIONS AND TOPSIDES INTERFACE SYSTEMS WITH ENGINE ROOM

7.1. GENERAL

7.1.1. Accommodations and Topsides Interface Systems with Engine Room are as follows:

a. Engine Room Marine Diesel Oil System.

b. Engine Room Fresh Water System.

c. Engine Room Service Air System.

d. Engine Room Potable Water System

7.2. ENGINE ROOM MARINE DIESEL OIL SYSTEM

7.2.1. PURPOSE

7.2.1.1. The purpose of this system is to:

a. receive diesel oil from Platform Supply Vessels through diesel oil filling stations.

b. filter received diesel oil through diesel oil filters.

c. measure the received diesel oil.

d. store diesel oil.

e. export not purified diesel oil to diesel injection system in wells.

f. purify diesel oil.

g. export purified diesel oil to Engine Room and all UNIT consumers.

h. receive the diesel oil return from Topsides pressurized diesel ring (Topsides distribution network).

i. collect diesel oil overflow from diesel tanks located behind of forward Engine Room bulkhead.

7.2.2. PIPING SPECIFICATION

7.2.2.1. All piping lines with diesel oil spec which are installed on an exposed deck aft of Main Deck containment barrier shall be all welded, without flanges, to avoid the risk of diesel oil leakage close to Accommodation Module.

7.2.3. FILLING STATIONS

7.2.3.1. Diesel oil and fresh water filling stations (2x100%) shall be installed at the Hull risers opposite side at the two dedicated platforms at the Main Deck level nearby the aft and fwd supply boat operation area, respectively.

- Note: each of the filling stations shall have one (1) diesel oil hose reel and one (1) fresh water hose reel.

7.2.4. DIESEL OIL FILTERS

7.2.4.1. All received diesel oil from the filling station platform shall be filtered. Diesel oil filters (2 x 100%) shall be single basket automatic self-cleaning type and to be located upstream the diesel oil measurement system (flowmeter) attending both stations.

7.2.5. DIESEL OIL FLOWMETER

7.2.5.1. A diesel oil flowmeter shall be located immediately downstream of diesel oil filters and shall have an indication of instantaneous flow and total flow in SOS-HMI.

7.2.6. DIESEL OIL STORAGE TANKS

7.2.6.1. After the metering system, diesel oil shall be directed to the two (02) structural Diesel Oil Storage Tanks located aft of forward bulkhead of Engine Room. These tanks shall also receive the return of all diesel oil daily tanks installed aft the Engine Room fwd bulkhead.

7.2.6.2. Additional diesel oil service tanks shall be provided within a space between the Cofferdam and the Engine Room fwd bulkhead to attend the demand for well service as indicated on item 9.1 of “Bases de Projeto”.

7.2.7. DIESEL OIL WELL SERVICE SYSTEM PUMP

7.2.7.1. Three (03) Diesel Oil Well Service System Pump (3 x 33%) shall be installed preferably to collect the treated diesel oil from the diesel oil service tanks and to transfer this fluid to the Well Service Diesel Oil Buffer Vessel (Topside scope) an intermediary vessel responsible for the diesel oi / crude oil (stabilized) on the formation.

- Note 1: a duplex filter shall be installed downstream the pumps discharge.

7.2.8. DIESEL OIL CENTRIFUGAL PURIFIERS

7.2.8.1. There shall be preferentially three (03) Diesel oil centrifugal purifiers (3 x 50%) to receive the filtered and measured diesel oil from storage tanks and have the purpose to purify the diesel oil up to an OWNER defined standard.

a. Fresh water used for the centrifugal process shall be supplied by the hydrophore unit as item 7.3.8 and instrument air from the Hull service air system.

b. The sludge accumulated during the purifying process shall be discarded to a structural tank assembled on the purifiers skid. This sludge shall be transferred to the Hull sludge tank, item 5.6.8.

7.2.9. DIESEL OIL SERVICE TANKS

7.2.9.1. Two (02) Diesel Oil Service Tanks shall be installed aft Engine Room fwd bulkhead and shall receive the purified diesel oil from the diesel oil purifiers.

7.2.9.2. Additional diesel oil service tanks shall be provided within a space between the Cofferdam and the Engine Room fwd bulkhead to attend the demand for well service as indicated on item 9.1 of “Bases de Projeto”.

7.2.10. DIESEL OIL SERVICE PUMPS

7.2.10.1. Diesel Oil Service Pumps (2 x 100%) shall collect diesel oil from diesel oil service tanks and transfer to all Hull consumers and to Topside’s diesel ring.

7.2.10.2. A duplex filter shall be installed downstream the diesel oil service pumps to ensure that the diesel oil distributed to the UNIT consumers have been filtered.

7.2.10.3. Topside’s diesel distribution network can be used to supply Hull consumers depending on the location of these consumers on board. Whenever this occurs, connections shall be provided for diesel receiving in these equipment daily tanks to enable the commissioning of those equipment system even before the Topsides diesel oil network distribution is completed.

7.2.11. ENGINE ROOM DIESEL OIL OVERFLOW TANK / PUMP

7.2.11.1. Engine Room Diesel Oil Overflow Tank receives all diesel oil overflow from all diesel oil tanks located aft of forward Engine Room bulkhead, including equipment daily tanks located in this area.

7.2.11.2. One (1 x 100%) diesel oil overflow pump shall be installed on Engine Room with suction from overflow tank and discharge into any of the diesel oil storage tanks.

7.2.12. QUICK CLOSING VALVES

7.2.12.1. Quick Closing valves fail latch type shall be provided in all suction branches

of the Diesel Oil storage, service and overflow tanks and in other diesel oil tanks and other types of oil as per SOLAS II-2.

7.2.12.2. Quick closing valves shall be provided with manual mechanical means of closure both locally and from a readily accessible and safe position outside of the compartment and not dependent on electric power.

7.3. ENGINE ROOM FRESH WATER SYSTEM

7.3.1. PURPOSE

7.3.1.1. The objectives of this system are to:

a. Receive fresh water from supply vessels through Filling Stations.

b. Measure the salt content of the water received from supply vessels.

c. Filter and measure fresh water received from supply vessels.

d. Receive fresh water (chlorinated distilled water) from Topsides.

e. Receive distilled water from Topsides.

f. Store fresh water.

g. Store distilled water.

h. Export fresh water from the Engine Room to Platform consumers.

i. Produce potable water (chlorinated, mineralized and UV-treated water) and export potable water from Engine Room to UNIT consumers.

j. Produce and export hot potable water to Accommodations.

k. Export distilled water from Engine Room to UNIT consumers.

7.3.2. CONFIGURATION

7.3.2.1. This system shall be composed by Filling stations, Fresh water filter and flowmeter, Fresh water storage tanks, Fresh water hydrophore unit, Potable water maker unit, UV sterilizer unit, Calorifier unit, Distilled water tanks and pumps and Desalination and chlorination units.

7.3.3. FILLING STATIONS

7.3.3.1. Filling Stations shall follow the general requirements as stated on item 7.2.3. Additionally, for each filling station fresh water hose reels skid one salinity sensor shall be provided and the salt content on fresh water shall be

continuously monitored by UNIT SOS and with a salinity alarm on SOS-HMI.

7.3.4. BASKET FILTER

7.3.4.1. All fresh water received from supply vessel on board shall be filtered. The single basket filter (1 x 100%) shall be located upstream the fresh water metering system and shall serve both filling stations.

7.3.5. FLOWMETER

7.3.5.1. A fresh water flowmeter shall be located immediately downstream of freshwater filter and shall have an instantaneous flow and total flow indication in SOS-HMI. A by-pass shall be provided for instrument maintenance purpose.

7.3.6. FRESH WATER STORAGE TANKS

7.3.6.1. Fresh Water Storage Tanks (2x100%) shall be located aft of the forward bulkhead of Engine Room for the purpose to store the received fresh water from the supply boats through the filling stations.

7.3.7. DISTILLED WATER STORAGE TANKS

7.3.7.1. Distilled Water Storage Tanks (2x100%) located aft of the Engine Room fwd bulkhead. These tanks shall receive distilled water from the distillation units installed on Topsides.

7.3.8. FRESH WATER HYDROPHORE UNIT

7.3.8.1. Fresh Water Hydrophore Unit (1 x 100%) have the purpose to suction the fresh water from the storage tanks and to distribute to the UNIT consumers as:

a. Main Deck fresh water distribution system.

b. Topsides consumers.

c. Expansion tank of the fresh water cooling system.

d. General services on Engine Room as workshops and decks.

e. Diesel oil purifiers

f. Aft area, Accommodation, shops and Lifeboats / rescue boat areas.

g. Eye washing.

h. Whichever points with necessary fresh / potable water.

- Note: Fresh water hydrophore unit (package) shall be supplied in a single skid composed by one (1 x 100%) hydrophore vessel, pumps (2 x 100%), control valves and control panel and shall be installed on Engine Room.

7.3.9. POTABLE WATER MAKERS AND UV STERILIZER UNITS

7.3.9.1. Potable Water Makers and UV Sterilizer Units have the purpose to produce potable water from the fresh water fraction destinated to human consumption.

7.3.9.2. Two identical (2 x 100%) potable water makers and UV sterilizers shall be supplied each one in single skid to be installed on Engine Room downstream the Hydrophore unit. UV sterilizers skids shall be installed downstream the potable water makers skids.

7.3.10. CALORIFIER UNITS

7.3.10.1. Calorifier Unit have the purpose to produce hot water for Accommodation module by means of heating the potable water produced by potable water makers and UV sterilizers.

7.3.10.2. Calorifier unit shall be supplied in a single skid with the following components all with 2 x 100% configuration:

a. accommodation hot fresh water circulation pumps,

b. control panels,

c. pressure vessels and

d. electrical heaters (INCONEL material) installed inside the pressure vessels.

7.3.11. DISTILLED WATER PUMPS

7.3.11.1. Distilled Water Pumps shall collect distilled water from distilled water storage tanks and route this water to the sulphate removal unit distilled water storage tank at Topsides. The line that route distilled water to Topsides can be installed on Marine Pipe Rack.

7.3.12. DESALINATION AND CHLORINATION UNITS

7.3.12.1. Desalination and Chlorination Units with distillation type and the chlorination unit shall be installed in Topsides. The fresh water and distilled water lines from Topsides to Engine Room Hull tanks can be installed on Marine Pipe Rack.

7.4. ENGINE ROOM SERVICE AIR SYSTEM

7.4.1. The purpose of this system is to supply compressed air to the UNIT.

7.4.2. The piping that forward compressed air from this system shall be arranged as follows:

a. To have a connection to Topsides.

b. To have a connection for the service air distribution header on Main Deck.

c. To have a connection for service air distribution lines to all consumers that are located aft of fwd Engine Room bulkhead.

- Note: Traps shall be provided at line low points.

8. MAIN DECK INTERFACE WITH TOPSIDES

8.1. GENERAL

8.1.1. The Topsides / Hull interface systems are the following but not limited to:

a. Topsides Seawater Lift for Cooling and Injection System.

b. Hypochlorite Injection System.

c. Produced Water Settling and Oil Recovery System.

d. Piping to/from off-spec oil tank.

e. Slop Tanks Oil Recovery System.

f. Topsides Open Drain Non-Classified Areas System.

g. Topsides Open Drain Classified Areas System.

h. Cargo oil injection for hydrate prevention.

i. Diesel oil well injection.

j. Diesel oil service system.

k. Topsides/Hull chemical injection points.

l. Topsides/Hull fresh, potable and distilled water systems.

m. Topsides/Hull Compressed air system.

8.2. TOPSIDES SEAWATER LIFT FOR COOLING AND INJECTION SYSTEM

8.2.1. This is an interface system between Topsides and Hull. The purposes of this system are:

a. Circulate seawater through freshwater generators (Topside’s scope).

b. Provide seawater for the Topsides Injection System, Topsides Cooling System, Hypochlorite Injection System, Topside’s service stations (Topside’s scope).

8.2.2. The components of this system located below the tie-in points are the following:

a. Seawater lift / emergency seawater lift pumps steel caissons.

b. Seawater lift / emergency seawater lift pumps discharge pipes located on Hull.

c. Seawater filters / Emergency seawater filters located on Hull.

d. Seawater overboard discharges from Topsides Cooling System and from Topsides Sulphate Removal Package.

8.2.3. The system shall be dimensioned by Topsides.

8.3. HYPOCHLORITE INJECTION SYSTEM

8.3.1. The purpose of this system is to inject hypochlorite in the steel caissons and in the Ballast System (Fwd) sea chests.

8.4. TOPSIDES / HULL OPEN DRAIN NON-CLASSIFIED AREAS SYSTEM

8.4.1. The purpose of this system is to conduct the oily water mixtures from the Topsides Open Drain Non-Classified Areas System to the Dirty and Clean Slop Tanks.

8.5. TOPSIDES / HULL OPEN DRAIN CLASSIFIED AREAS SYSTEM

8.5.1. The purpose of this system is to conduct to the Dirty and Clean Slop Tanks the oily water mixtures from the Topsides Open Drain Classified Areas System.

8.6. TOPSIDES CLOSED DRAIN SYSTEM

8.6.1. The purpose of this system is to collect the drain from the process vessels located at the Topsides and destinate to the slop tanks on Hull side.

8.6.2. The oil shall be stabilized and unpressurized.

8.7. FLARE DRAINING SYSTEM

8.7.1. The purpose of this system is the retention of liquid on the gas feeding lines to the high a low pressure flare to avoid the liquid burning.

8.7.2. This system shall not have connection with Hull structural tanks.

8.8. PRODUCED WATER SETTLING SYSTEM

8.8.1. The objective of this system is to perform produced water settling in three (3) dedicated Hull structural tanks (TQ-5331501A/C) located in Cargo Area,. The system shall execute the following functions:

a. To remove the settled produced water from the dedicated tanks and convey it to Process Plant Water Injection System.

b. To remove the oil layer from the upper part of the dedicated produced water tanks and to convey it to the Process Plant oil treatment system.

c. To store produced water from the Topsides produced water system in contingency operations.

8.8.2. PRODUCED WATER DRAIN LINES

8.8.2.1. Produced water drain lines shall be provided to connect the Process Plant equipment Gas Flotation Unit to each of structural produced water tank.

8.8.2.2. Produced water drain lines ends:

a. shall be installed as much as far from the produced water booster pumps suction to enable a more effective produced water settling process.

b. shall be installed in an enough height (to be defined by Process discipline during the Basic Design) to ensure the continuous immersion while the tank is in operation, but without revolving the sediments settled at the tanks bottom.

c. shall be in accordance with Class Society to mitigate the electricity formation inside the tanks.

8.8.2.3. Produced water drain lines shall have a connection point for the portable cargo pump discharge connection.

8.8.3. PRODUCED WATER TANKS

8.8.3.1. As I-DE-3010.2Q-1200-943-P4X-001 – PLANT OVERVIEW PROCESS PLANT OVERVIEW, three (03) structural tanks shall be installed in Cargo Area with the purpose to receive the produced water from the Process Plant.

8.8.4. BALANCE LINE

8.8.4.1. A balance line shall be installed to communicate both produced water tanks. This balance line shall be fully welded and shall cross a cargo tank to connect both produced water tanks within a minimum height.

8.8.4.2. Balance line material shall be duplex stainless steel or higher and shall be fully reversible to allow the water settling in whichever tank. Balance Line discharge shall be as far as possible from the produced water booster pumps suction.

8.8.5. PRODUCED WATER TANK BOOSTER PUMPS

8.8.5.1. Produced Water Tank Booster Pumps (B-5331501A/F – 6 x 25%) are continuous operation pumps dedicated to destinate produced water to the Process Plant Hydrocylcones (Solid Removal Hydrocyclone – CI-5331002A/B). These pumps shall be installed 02 (two) per Produced Water Tank (TQ-

5331501A/C) and shall be part of the Submerged Cargo Area Pumps package.

8.8.5.2. Produced Water Tank Booster Pumps (B-5331501A/F – 6 x 25%) shall be installed at a minimum height to be defined by Process discipline team on the Basic Design to avoid the suction of settled sediments. Access platforms shall be installed to allow for the pump's maintenance.

8.8.6. PRODUCED WATER TRANSFER PUMP

8.8.6.1. Produced Water Transfer Pumps (B-5331502A/F – 6 x 25%) are pumps dedicated to return the produced water to the Gas Flotation Unit (FL-5331001A/D) on the Process Plant. These pumps shall be installed 02 (two) per Produced Water Tank (TQ-5331501A/C) and shall be part of the Submerged Cargo Area Pumps package.

8.8.6.2. Produced Water Transfer Pumps (B-5331502A/F – 6 x 25%) shall be installed at a minimum height to be defined by Process discipline team on the Basic Design to avoid the suction of settled sediments. Access platforms shall be installed to allow for the pump's maintenance.

8.9. PRODUCED WATER TANK RECOVERY OIL SYSTEM

8.9.1. The purpose of this system is to remove supernatant oil from produced water decantation tanks and forward this oil for treatment in Process Plant.

8.9.2. This system is composed by:

a. Oil collector boxes

b. Oil recovery pumps

c. Return lines to Topsides.

d. Solids return.

8.9.3. COLLECTOR BOXES

8.9.3.1. A structural oil collecting box shall be installed in each Produced Water Tank (TQ-5331501A/C) with the base in an elevation higher than operational upper level of the referred produced water tanks.

- Note: oil collecting boxes shall have enough internal space to accommodate produced water tanks oil removal pumps and to allow interventions / maintenance to be carried out in these pumps.

8.9.4. Produced water tanks oil recovery pumps, oil skimming pumps shall be part of submerged cargo area pumps package shall be installed inside the oil collecting

boxes in a bilge well provided to them.

8.9.5. PRODUCED WATER TANKS OIL SKIMMING PUMPS

8.9.5.1. Oil skimming pumps (B-5336502A/F – 6 x 25%) shall be installed two (02) per Produced Water Tanks (TQ-5331501A/C) inside the corresponding oil collector boxes with the purpose to transfer the recovered oil to the Slop Vessel at the Process Plant and shall be part of Submerged Cargo Area Pumps package.

8.10. PRODUCED WATER DISCHARGE SYSTEM

8.10.1. The purpose of this system is to enable the discharge of treated produced water into the sea and within CONAMA requirements.

8.11. OFF-SPEC OIL SETTLING SYSTEM

8.11.1. The objective of this system is to store off-spec oil that might be produced by process plant in to one (1 X 100%) dedicated structural tank (TQ-1223502) located in the cargo area.

8.11.2. Afterwards, the off-spec oil shall be pumped back to the Process Plant Slop Vessel by means of Off-spec oil pumps 2 x 100% (B-1223503A/B) to be re-processed. This system shall prevent the eventually produced off-spec oil to contaminate good spec oil stored in the cargo tanks.

8.12. SLOP TANKS OIL RECOVERY SYSTEM

8.12.1. The purpose of this system is to remove the layer of oil in the top of the oily water mixture inside both port and starboard slop tanks and to conduct the oil to the Process Plant Oil Treatment System by means of oil recovery pumps.

8.12.2. On each slop tanks, the oil recovery shall be performed by a centrifugal submerged pump (1 x 100%) called oil skimming pump to be installed inside the oil collector boxes. Slop Oil Skimming Pump shall be part of Submerged Cargo Area Pumps package.

8.12.3. Oil collector boxes have the purpose to collect the recovery oil from the upper layer of the oil / water mixture on the top of the slop tank and shall have enough space to house the oil skimming pump and allow the pump maintenance.

8.13. CARGO OIL INJECTION FOR HYDRATE PREVENTION

8.13.1. The main objective of this system is to transfer cargo oil from structural cargo tanks to the Topside well injection system, for hydrate prevention in flow lines.

8.13.2. The well injection system shall comprise both diesel injection and/or cargo oil injection, both systems consist of an interface of Hull and Topsides.

8.14. DIESEL OIL WELL INJECTION

8.14.1. The main objective of this system is to transfer diesel oil from the storage/service tanks to the Topside well injection system, to be injected in the Unit risers.

8.14.2. The well injection system shall comprise both diesel injection and/or cargo oil injection, both systems consist of an interface of Hull and Topsides.

8.14.3. For diesel oil well injection the quantity required is 7,178 m^3 from the diesel oil service tank (purified diesel oil).

8.15. DIESEL OIL SERVICE SYSTEM

8.15.1. The main objective is to receive, storage and transfer diesel oil to the Hull and Topsides consumers.

8.16. TOPSIDES/HULL CHEMICAL INJECTION POINTS.

8.16.1. The main objective of this system is to provide specific chemicals from Topsides to injection points in the Hull tanks and headers in the systems as below detailed:

a. Biostatic injection in both Slop Tanks.

b. Biocide injection in both Slop Tanks.

c. H_2S scavenger injection in the Hull Transference Header.

d. Oxygen Scavenger injection in the Off-spec oil Tank.

e. Biocide injection in the Off-spec oil Tank.

f. Biostatic injection in both Produced Water Tanks.

g. Biocide injection in both Produced Water Tanks.

8.17. TOPSIDES / HULL FRESH, POTABLE AND DISTILLED WATER SYSTEMS

8.17.1. The main objective of this system is to provide distilled or fresh water system generated in the Topsides to the Hull storage tanks, and from them to the Hull and Topsides consumers.

8.18. TOPSIDES / HULL COMPRESSED AIR SYSTEM

8.18.1. From the Topsides Service air header and Essential air header, there shall be two tie-in points for the compressed air distribution (service and essential air) on the Hull cargo area, forecastle, poop deck, Accommodations and Engine Room.

8.19. SUBMERGED CENTRIFUGAL CARGO AREA PUMPS PIPE STACK PURGING

8.19.1. The objective of this system is to allow the submerged cargo area pumps tightness testing and their pipe stacks purging.

8.19.2. The inert gas (N_2) distribution for submerged cargo area pumps header shall be installed on the Marine Pipe Rack and the (N_2) distribution header shall be connected to the Topsides Nitrogen distribution system.

8.20. HYDROCARBON BLANKET GAS SYSTEM

8.20.1. The purpose of this system is an alternative to the inert gas (conventional) generated from Inert Gas Generators.

8.20.2. The Hydrocarbon Blanket Gas System shall be able to maintain the cargo, slop, produced water and off-spec oil tanks with adequate pressure and oxygen content during the loading operation to the cargo tanks by the Process Plant, transfer operations of liquids between tanks and offloading operations. In addition, this system shall allow the recovery of VOC gases generated in the afore mentioned tanks, minimizing their discharge through the Facility's vent posts.

8.20.3. Detailed requirements for this system are found on I-DE-3010.2Q-1350-943-P4X-001_A – PROCESS FLOW DIAGRAM STRUCTURAL TANKS GAS RECOVERY SYSTEM.

8.20.4. STRUCTURAL TANKS GAS RECOVERY SYSTEM presents the simplified flowchart of the system.

8.21. OIL SEPARATION SYSTEM ON HULL TANKS – SETTLING TANKS

8.21.1. The purpose of this system is to enable the separation of the oil / water originated from the Process Plant by means of a settling system and to destinate the separated oil and water back to the Process Plant.

8.21.2. According to the I-DE-3010.2Q-1200-943-P4X-001 – PLANT OVERVIEW PROCESS PLANT OVERVIEW, three (3 x 50%) structural Settling Tanks, TQ-1223501A/C, shall be installed on Hull cargo area with the minimum requirements:

8.21.2.1. To have an Oil Settling Tank Transfer Pumps, B-1223501A/F (6 x 50%) submerged centrifugal type installed each one inside an oil caisson of the corresponding tank and with a capacity flow of 718 m^3/h. This pump is designed to ensure the oil transfer to the cargo tanks.

8.21.2.2. To have the Water Settling Tank Transfer Pumps B-1223502A/F (6 x 50%) submerged centrifugal type installed on a caisson inside the corresponding tank and with a capacity flow of 1040 m^3/h. This pump is designed to ensure the water transfer to the Produced Water Flash Drum (V-5331001A/B).

8.21.3. Settling tanks shall have the minimum requirements are detailed on 8.22.

8.22. PROCESS PLANT HULL INTERFACE TANKS

8.22.1. The following tanks have interface with Topsides / Hull:

a. Produced Water Tanks

b. Off-spec Oil Tank

c. Settling Tanks

d. Cargo Tanks (HC Blanket)

8.22.2. These Hull structural tanks which have interface with the Process Plant shall follow the minimum requirements for structural tanks as cargo hold tanks.

a. To be installed with no contiguous bulkheads to allow repair / inspection without stopping the Process Plant. A cofferdam shall be installed if necessary.

b. To be fully internally coated with a minimum temperature of 80 degrees. A cathodic protection with anodes shall also be provided.

c. Process Plant / Hull interface structural tanks ullage, pressure, temperature monitoring shall follow the item 4.9.

d. Inert gas shall be constantly supplied to them through the inert gas distribution system with the minimum requirements as on 4.6.8.

e. These tanks shall be integrated to the closed venting system with the minimum requirements as on 4.7.

9. HULL EQUIPMENT AUXILIARY SYSTEMS

9.1. GENERAL

9.1.1. Hull equipment auxiliary systems as the following:

a. Service diesel oil system for Inert Gas Generator

b. Lub oil system for Auxiliary and Emergency Generators

c. Diesel oil system for Auxiliary and Emergency Generators

d. Starting Air system for Auxiliary and Emergency Generators

e. Exhaust gas system

9.2. SERVICE DIESEL OIL SYSTEM FOR INERT GAS GENERATOR

9.2.1. PURPOSE

9.2.1.1. The purpose of this system is to supply diesel oil to Inert Gas Generators.

9.2.2. INERT GAS GENERATORS DIESEL DAILY TANK

9.2.2.1. The Inert Gas Diesel Daily Tank receives diesel oil from the Topside diesel oil distribution network. Since this tank receives diesel oil from the Topside diesel oil distribution network protection devices shall be provided to avoid tank overfill and overpressure.

9.2.2.2. This tank shall also be designed to receive diesel oil from the fwd overflow pump and the return from the diesel oil pumps for inert gas generators.

9.2.3. DIESEL OIL PUMP UNIT FOR INERT GAS GENERATORS

9.2.3.1. Diesel oil pump unit (2 x 100%) have the purpose to feed diesel oil to the Inert gas generators from the diesel daily tank. These pumps shall be included in the Inert Gas package and each pump shall attend both Inert gas generators.

9.2.4. FWD DIESEL OIL OVERFLOW TANK / PUMP

9.2.4.1. Fwd diesel oil overflow tank shall be located at the Forecastle and the objective is to receive the overflow diesel oil from the Inert Gas Generators Diesel Daily Tank (TQ-GG-5241501A/B-04).

9.2.4.2. Fwd diesel oil overflow pump shall be located on the Forecastle. This pump shall return the diesel oil collected from the fwd diesel oil overflow tank to the

Inert gas generators diesel daily tank.

9.3. LUB OIL SYSTEM FOR AUXILIARY AND EMERGENCY GENERATORS

9.3.1. The purpose of this system is to lubricate the auxiliary and emergency diesel generator sets.

9.4. DIESEL OIL SYSTEM FOR AUXILIARY AND EMERGENCY GENERATORS SET

9.4.1. The purpose of this system is to supply diesel oil to the auxiliary and emergency diesel generator sets.

9.4.2. Auxiliary and Emergency generator diesel daily tanks shall be filled by diesel oil service pumps. A double plate shall be installed to protect the tank structure against abrasion produced by the entering flow.

9.4.3. An overflow line shall be provided for both Auxiliary and Emergency generator diesel daily tanks to destinate the overflow to the aft diesel overflow tank.

9.4.4. There shall be draining lines on both Auxiliary and Emergency generator diesel daily tanks to destinate the tanks draining to the diesel oil storage tanks. Daily tanks shall also have drain outlet to the Engine Room bilge water settling tank.

9.5. STARTING AIR SYSTEM FOR AUXILIARY AND EMERGENCY GENERATORS SET

9.5.1. The purpose of this system is to be one of the ways to starting emergency and both auxiliary generators.

9.5.2. Auxiliary generators start-up air system shall be composed by an electric driven start-up air compressor unit (1 x 100%) and an air receiver vessel (1 x 100%).

9.5.3. Emergency generator start-up air system shall be composed by a diesel engine driven start-up air compressor unit (1 x 100%) and an air receiver vessel (1 x 100%).

9.5.4. Emergency generator start-up air system diesel engine shall be manually started and shall have a dedicated diesel oil tank with feeding done by the diesel oil service pumps. This tank shall have an overflow line to be destinated to the aft diesel overflow tank.

9.5.5. For both auxiliary generators and for the emergency generator the start-up air system shall be two stages and air cooled type.

9.6. EXHAUST GAS SYSTEM

9.6.1. The purpose of this system is to exhaust gases from internal combustion engines located in Hull.

10. SUBSEA INTERFACE SYSTEMS

10.1. SUBSEA INTERFACE SYSTEMS COMPRISE:

a. Riser Pull-in and Pull-out System.

b. Mooring System.

10.2. RISER PULL-IN AND PULL-OUT SYSTEM

10.2.1. The purpose of this system is the installation and uninstallation of flexible risers and umbilicals, detachable pulleys, rigid risers, to assist in the replacement of bell mouths during offshore operations, to assist in the replacement of rigid riser receptacles during offshore operations, to handle bell mouths, receptacles, parts / sections of hard pipes and diving stations.

10.3. MOORING SYSTEM

10.3.1. The main objective of the Mooring System is to perform the interface between Hull and seabed to maintain the platform positioning.

10.3.2. Mooring winches shall be linear type hydraulically operated from hydraulic power units installed one aft inside Engine Room and other fwd on bow compartments.

11. INTERFACE SYSTEM WITH SHUTTLE TANKER

11.1. OFFLOADING SYSTEM

11.1.1. All Offloading system components shall be supplied from the same packager.

11.1.2. UNIT shall have two (2 x 100%) Offloading systems hydraulic hose reel type, one installed at the UNIT bow and other on stern.

11.1.3. There shall be installed two emergency offloading stations one at the UNIT bow and other one at the stern as indicated on item 4.2.7.2.