PETROBRAS	TECHNICAL SPECIFICATION	Nr: I-ET-3010.00-1359-940-P4X-001
	CLIENT:	SHEET: 1 of 22
	JOB :	
	AREA:	
SRGE	TITLE: OFFSHORE LOADING EQUIPMENT DESIGN REQUIREMENTS	INTERNAL
		ESUP

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INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL ISSUE
A	GENERAL REVISION
A1	REVISED ACCORDING TO THE CONSISTENCY ANALYSIS
B	REVISED TO BE IN LINE WITH I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS – REVISION U
B1	REVISED ACCORDING TO GR IOM SEAP-1/SEAP-2 FASE 3. ITEM 6.2.5.1 UPDATED.
C	REVISION IN ORDER TO COMPLY WITH BOT MODALITY.

	REV. 0	REV. A	REV. A1	REV. B	REV. B1	REV. C	REV.D	REV. E	REV. F
DATE	APR-06/22	MAY-19/22	JUN-21/22	JUL-12/22	SEP-01/22	JUL-11/24			
PROJECT	ESUP	ESUP	ESUP	ESUP	ESUP	ESUP			
EXECUTION	CXZ0	CXZ0	CXZ0	CXZ0	CXZ0	T3P7			
CHECK	U3Y0	U3Y0	U3Y0	T3P7	T3P7	CXZ0			
APPROVAL	UPDM	UPDM	UPDM	UPDM	UPDM	CJI8			

TABLE OF CONTENTS PAGE

1. INTRODUCTION

1.1. OBJECTIVE

The purpose of this technical specification is to describe the minimum requirements for the design, manufacturing, assembly, supply, installation, commissioning and tests of the Offloading System equipment in conformance with relevant regulations and GENERAL TECHNICAL DESCRIPTION documentation.

The offloading system comprises the mooring hawsers, the hose strings, the equipment for hawser and hose handling and all other equipment required to export the stabilized crude oil from the FPSO ("the Unit") to a tandem moored Shuttle Tanker or to a different offloading alternative approved by BUYER.

1.2. DEFINITIONS

SELLER: It is defined as the responsible for project, assembly, construction, fabrication, testing and furnishing of the Offloading Equipment.

For other definitions refer to GENERAL TECHNICAL DESCRIPTION mentioned on item 3.

1.3. ABBREVIATIONS

CS……Classification Society

FAT……Factory Acceptance Tests

FPSO……Floating Production Storage and Offloading Unit

HPU……Hydraulic Powe Unit

NSV……North Sea Valve (Outboard Hose Termination Piece)

SOS……Supervisory and Operation System

ST……Shuttle Tanker

2. NORMATIVE REFERENCES

2.1. INTERNATIONAL CODES, RECOMMENDED PRACTICES AND STANDARDS

The equipment shall be designed and manufactured in accordance with the codes and standards declared on GENERAL TECHNICAL DESCRIPTION and on I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

- Classification Society defined for the Hull scope.
- NBR 13715-2 Guidelines

2.2. BRAZILIAN CODES AND STANDARDS

- Brazilian codes and standards declared on GENERAL TECHNICAL DESCRIPTION.

2.3. CLASS APPROVAL AND CERTIFICATION

The Offloading equipment shall be designed, manufactured and tested according to the design reference documents, normative requirements and in accordance with the latest editions of Classification Society Rules, Regulations and Standards.

3. REFERENCE DOCUMENTS

[1] GENERAL TECHNICAL DESCRIPTION

[2] METOCEAN DATA

[3] I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

4. DESIGN REQUIREMENTS

4.1. GENERAL

4.1.1. Offloading Equipment shall be designed for a design life defined on item 1.2. of GENERAL TECHNICAL DESCRIPTION in a corrosive offshore environment without the need for replacement of any major component due to wear, corrosion, fatigue, or material failure.

4.1.2. The minimum volume of crude oil available in the cargo tanks to be offloaded is according to item 1.2 of GENERAL TECHNICAL DESCRIPTION.

4.1.3. All elements of the Offloading equipment and components shall be field proven design and well within the manufacturer's actual experience and the OCIMF guidelines, where applicable. In addition, the system shall be designed according to the rules and regulations of the Unit's Classification Society.

4.2. ENVIRONMENTAL CONDITIONS

4.2.1. The Unit shall be designed to operate normally with a Suezmax / Aframax sized shuttle tanker (up to 160,000 dwt), moored in tandem configuration. The design shall ensure that the Unit can withstand any range of draft conditions for the Unit itself and the shuttle tanker in tandem configuration and varying from only 3 (three) risers connected (production, gas-lift and umbilical control risers for one production well) to all risers connected.

4.2.2. Maximum offloading design conditions to be considered are:

- Winds – 1 (one)-year return period, 10-minute average wind speed, 10 m above sea level or 50 knots, whichever is the most stringent.

- Waves – The waves shall be considered as being aligned with the wind and limited up to: Hs = 5 m.

- Current – 1 (one)-year return period. Current shall be considered as propagating to in any direction, up to 45 degrees out of alignment with wind and waves incidence direction. The worst case shall be accounted for.

- The incidences directions to be considered range from 0° to 360°, with increments of 22.5º. The shuttle ship and Unit longitudinal alignment can be either bow-to-bow or bow-to-stern for offloading operations.

4.2.3. UNIT shall be ready to start any phase of the offloading operation (mooring, connection, transfer, disconnection) during the daylight or over the night without any restriction.

4.3. MOTIONS AND ACCELERATION

4.3.1. All offloading equipment shall be able to withstand with the UNIT subjected to the 100-year return period condition according to the environmental parameters specified on the METOCEAN DATA at any draft from fully loaded to the minimum loaded / ballasted condition.

4.3.2. For the Hull loading conditions details and the maximum designed operational trim and heel inclinations refer to GENERAL TECHNICAL DESCRIPTION

4.3.3. Offloading equipment shall be designed to withstand inertial forces during transportation from construction site to the final offshore location (transit condition).

4.3.4. SELLER shall calculate the motions and accelerations to estimate the expected maximum amplitudes and the maximum accelerations for offloading system equipment, structure and components.

4.4. OFFLOADING OPERATIONAL MODES AND SECTOR

4.4.1. For the Offloading operational modes and operational sector details, refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

4.5. OFFLOADING OPERATION TOTAL TIME AND FREQUENCY

4.5.1. For the Offloading operational total time and frequency details, refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

4.6. SHUTTLE TANKER DATA

4.6.1. For the shuttle tanker data refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

4.7. CRUDE OIL DATA

4.7.1. For crude oil data refer to the GENERAL TECHNICAL DESCRIPTION.

5. MOORING EQUIPMENT

5.1. SCOPE OF SUPPLY

5.1.1. Mooring system

- Mooring Hawser Winches
- Mooring Hawser Assembly
- Mooring Hawser Winches control consoles

5.2. GENERAL

5.2.1. The offloading mooring system shall be supplied and installed by SELLER comprising the Hawser Assembly, Mooring Hawser Winches and the related outfitting for each loading station, providing a complete arrangement with characteristics in accordance with these specifications.

5.2.2. On the FPSO side, the hawser / chafe chain shall be permanently attached to a holding point on the FPSO.

5.2.3. The load monitoring system shall be designed to allow a continuous hawser tension reading and recording in the CCR and also in the Offloading stations control panel.

- Note: Since the hawser tension data will be stored in a computer, SELLER shall provide the necessary hardware such as cables, connectors and panels. This data shall be made available to the BUYER onboard representatives on a regular basis.

5.2.4. The chafe chain for mooring system shall comply with NBR 13715-2 Guideline, specifically to prevent links not in compliance with this Guideline.

5.3. MOORING HAWSER ASSEMBLY

5.3.1. For the mooring hawser assembly links, ropes, thimbles, shackles and all corresponding accessories details, refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

5.4. MOORING HAWSER CHARACTERISTICS

5.4.1. For the mooring hawser material and minimum length requirements refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

5.5. MOORING HAWSER WINCHES

5.5.1. The Unit shall be equipped with a hydraulically driven winch at each offloading station to handle and store the mooring hawser.

5.5.2. Mooring Hawser Winches shall have the following main functions:

- To storage the entire mooring hawser wire and ropes;
- Hawser spooling mechanism;
- Hawser load monitoring;

5.5.3. Mooring Hawser Winches design speed shall be as the following:

- Minimum launching speed.....0.6 m/s
- Minimum retrieval speed.....0.3 m/s

5.5.4. Mooring Hawser Winches shall have the minimum design requirements:

- Drum capacity to store one hawser assembly including the chafe chain and the messenger lines;
- Load monitoring system (load cell range 0 - 5000 kN);
- Fail Safe Brake System automatically activated in case of hydraulic system failure;
- Driving system: hydraulic driven with local (nearby the winch) control console;

5.5.5. The Mooring Hawser Winches shall be installed each one at the extreme Hull bow and stern in a clear area with no obstacles for the proper hawser operation to launch, retrieve and spool the mooring hawser assembly for the connection with the shuttle tanker.

- Note: the shuttle tanker operational area shall be verified according to the offloading operational sector for the shuttle tankers as indicated on I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

5.5.6. The Mooring Hawser Winches shall be all welded steel construction and assembled on a raised skid.

5.5.7. The winch drum shall be horizontal or vertical type. No other arrangement will be accepted. If the drum is a horizontal type, it shall be split in two parts, one for the hawser assembly and the other for the chafing chain. If the drum is a vertical type, the bottom plate of the drum shall have a suitable diameter to accommodate all metal components of the mooring hawser assembly.

5.5.8. Mooring Hawser Winches control system:

5.5.8.1. A local control console shall be installed adjacent to Mooring Hawser Winches of each offloading station with a clear view of the offloading operational sector. The control consoles shall be provided with the following functions:

- Mooring Hawser Winches control (reel-in, pay-out, spooling controls).
- HPU control (start, stop, emergency stop).
- Monitoring of the mooring hawser tension.

5.5.8.2. Local control console buttons shall not allow any release of the mooring system or hose string inadvertently. This specific button shall be provided with a transparent plastic cover or other similar alternative solution for this purpose.

5.5.8.3. To allow a smooth operation the hydraulic oil pressure supply line for the Mooring Hawser Winches shall be provided with a proportional directional control valve to allow a variable speed for the winches.

5.5.9. Mooring Hawser Winches safety issues

5.5.9.1. SELLER shall provide adequate lighting for the Mooring Hawser Winches safe operation on both bow and stern offloading stations covering local control consoles, deck work area, access, platforms, etc.

5.5.9.2. Retrieving the mooring hawser by the middle of the cable is not acceptable.

5.5.9.3. Chafe chain installation and disconnection: it must be designed to provide safe operation without exposing people near tensioned lifting accessories.

5.5.10. For the Mooring Hawser Winches maintenance considerations refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

6. OFFLOADING EQUIPMENT

6.1. SCOPE OF SUPPLY

6.1.1. SELLER shall supply the offloading equipment and components to perform the transference of stabilized crude oil from the FPSO cargo oil tanks to the tandem moored shuttle tanker with the herein minimum BUYER requirements, safety recommendations and normative rules, regulations and Class requirements.

6.1.2. Identical offloading equipment shall be supplied for the bow and stern (2x100%) offloading stations as the following:

6.1.2.1. Offloading System

- Hose Reels
- Offloading hose strings
- Spooling devices
- Hose Reel control cabins
- Hose messenger line winches
- Emergency stations for the offloading system

6.1.2.2. Hydraulic Power Units (HPUs)

- Hydraulic power units (HPUs)
- Offloading equipment / accessories interconnection with HPU.

6.1.2.3. Absolute, Relative Positioning Reference and Telemetry System

- Note: for this system refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS

6.1.3. Offloading Equipment shall be designed to fulfill the BUYER requirement for the FPSO offloading of the 1,000,000 barrels of crude oil to the shuttle tanker in no more than 24 (twenty-four) hours.

- Note: for the offloading operation time and frequency further requirements refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

6.1.4. Emergency offloading connections shall be installed in both offloading stations, as detail on item 6.11.

6.1.5. SELLER shall also provide all safety means for handling and maintaining the Offloading system, by supplying:

- Access platforms for safe inspections and maintenance, including the maintenance of the NSV;
- Safe protections for workers;
- Storage room for steel wire, ropes and NSV;
- Means of internal flushing the offloading hose string (according to internationally recognized procedures);
- Means of safely handling the emergency offloading hose and facilities to perform its pull-in / pull-out, by using proper equipment, such as winch and

lifting flange. It will not be accepted procedures where the operators are in an unsafe position near tensioned hose, hawser, wires or ropes;

- Means of safely handling messenger ropes and facilities to perform reel in or pay out, by using proper equipment, such as winch and shackles;
- Flanges for both offloading hoses (main and emergency) shall be of 20 inches class 300 type;
- It shall be possible to drain the offloading hose by the FPSO;
- It shall be possible to carry out inertization of the offloading hose;
- There shall be no interference in the route of the hose pull-in cables from puller and/or protrusions that can cause a damage in the offloading hose strings;
- The spooling device shall be positioned allowing free space in deck for other equipment. It shall also be free of edges or corners that could damage the offloading hose strings;
- The structure of the spooling device shall be designed to withstand the impact of the hose during offloading operation in bad weather conditions.

6.2. GENERAL

6.2.1. Controls to start, stop and manage speed of the Hose Reel shall be located in the control console cabin near by the Hose Reel, but keeping the operator in a safe place protected from the moving devices and whipping wires or ropes, and also sheltered from the weather conditions.

6.2.2. Offloading Equipment shall be dimensioned to withstand frequent start / stop / reel in / pay out loads, which are customary in an operation / inspection routine.

6.2.3. Offloading operations can occur even at night, thus, in both offloading stations it shall be provided good illumination in order to allow safe operations and also inspections of the hoses and mooring system at both day and night.

6.2.4. Sharp edges and corners on the internal and external structures (deck and hull) of the Offloading system are not allowed, including structures of the spooling device, in order to avoid damage on the hoses, cables and ropes.

6.2.5. Offloading system protection devices:

6.2.5.1. Offloading system shall have devices to mitigate the hydraulic transient as burst discs to destinate the cargo oil back to the cargo tanks on an

overpressure scenario. Alternative solutions other than burst discs shall be submitted to BUYER for appraisal.

- Note: Burst discs (or any alternative solution) shall be provided with a sensor indicator, to be triggered in case of disc rupture. In case of disc burst, a visual and sound alarm shall be initiated in the CCR. The offloading system shall stop offloading pumping automatically.

6.2.5.2. Regarding ESD (Emergency Shutdown) system, a shutdown valve shall be installed upstream to both offloading systems, bow and stern. This shutdown valve shall be of a single effect valve, fail closed type.

6.2.6. SELLER shall provide arrangements and facilities to allow proper internal cleaning of the offloading system (including the offloading hose string), which will be performed immediately after every offloading operation in a so called “backflushing operation”. For detail requirements refer to GENERAL TECHNICAL DESCRIPTION.

6.3. HOSE REEL

6.3.1. The Unit shall be equipped with a welded steel construction, hydraulically driven Hose Reel at each offloading station, bow and stern, designed to handle and to store the entire offloading hose string.

6.3.2. The maximum height of the Hose Reel drum in relation to the deck shall be 2.8 meters and the drum diameter shall be at least 8.0 meters.

6.3.3. The Hose Reel shall be designed to store the hose string in one layer, to avoid any damage to the hose cover and floating layers. Thus, it shall not contain sharp edges or any other part or structure that could damage the hose or hose’s cover.

6.3.4. The Hose Reel shall have the minimum capacity to store the whole offloading hose string, a spooling mechanism and a hose load monitoring.

6.3.5. The minimum launching or retrieving speed is 0.3 m/s, considering the worst environmental design condition as defined on item 4.2.

6.3.6. Hose Reel power and torque requirements:

6.3.6.1. The Hose Reels shall be capable of reeling in (recover) the offloading hose string full of seawater at the design speed and with the FPSO at the minimum operational draught. Additionally, the following remarks shall be considered:

- Note 1: the Hose Reel reeling in capacity shall consider the FPSO motions at the worst environmental design condition defined on item 4.2.

- Note 2: for the offloading hose string load all the friction loads, and a 30 % allowance shall be added, to account for any difference in the weight of hoses. Also, to consider the NSV installed on them.

- Note 3: in addition, the hose reel shall be designed to recover the offloading hose string totally paid out and fully submerged. For this condition, a retrieval speed less than required on item 6.3.5 will be accepted.

- Note 4: the Hose Reel functional tests condition at the shipyard with the FPSO at the minimum quayside draft and with the offloading hose string installed fully loaded with sea water shall also be evaluated.

    - for this scenario the reel in speed may not be the same as the design speed.

    - this is a functional test scenario to be detailed on item 9.1.

6.3.7. Hose Reels drive system

6.3.7.1. The gearboxes are the hydraulic devices responsible for driving the offloading Hose Reel. Each hydraulic gearbox rate of operation will depend on the quantity of hydraulic gearboxes available for each Hose Reel. All gearboxes are intended to operate in parallel.

6.3.7.2. The offloading systems, bow and stern, shall be designed to operate in a condition with one of the gearboxes out of operation and at the design load and the specified speed.

6.3.8. Hose Reels control, locking mechanism and brake system

6.3.8.1. To avoid peak loads in the pinions and racks, a joystick control shall be installed at the offloading control console cabin. It shall be allowed to control start, stop and rotation speed, allowing a smooth movement of the Hose Reel. The pressure supply line shall be provided with proportional directional control valve to allow variable speed.

6.3.8.2. The locking device consists of a hydraulically operated pin or arm that engages on the locking holes mounted to the flange of the reel. In case of the hydraulic system failure, the pin or arm shall be manually operated. This locking device should be able to lock hose reel in at least twelve symmetrical positions. Sensors shall indicate to the reel operator if it has been locked or unlocked.

6.3.8.3. The Hose Reel drive units shall be supplied with an integrated hydraulically operated fail-safe brake. The gearboxes shall be able to withstand the Hose Reel stopped prior or after the actuation of the static brake.

6.3.8.4. In each Offloading system, bow and stern, it shall be installed a brake delay system in the parking brake line in order to be able to keep the pressure on

the parking brakes avoiding a “crash stop” on the Hose Reel, avoiding any issues due to inertial movements.

6.3.9. Hose Reels safety issues

6.3.9.1. The design of the Hose Reel and its auxiliary equipment shall allow inspection and maintenance without exposing people to tensioned accessories. Including hose string reel in and pay out operations.

6.3.9.2. SELLER shall provide adequate lighting for the Hose Reels safe operation on both bow and stern offloading stations covering local control consoles, deck work area, access, platforms, etc.

6.3.9.3. The size and angle of the goose neck and flange assembly must allow the connection of first of reel hose with a 1m long spool.

6.3.10. Hose Reels handling system

6.3.10.1. SELLER shall provide pull-in wire ropes to allow for offloading hose string removal and reinstallation whilst offshore. The pull-in wire ropes shall be permanently connected on the Hose Reel by means of pad-eyes. The pad-eye to connect the pull-in cables shall not offer a risk of damaging the hoses. Alternative solution shall be issued to BUYER for appraisal.

- Note: the padeyes and pull-in wire ropes arrangement and drawings shall be submitted to BUYER for appraisal.

6.3.10.2. There shall be an opening in the Hose Reel, over the gooseneck position, with pad eyes (SWL 15 t) installed on the internal structure of the reel, in order to assist during the hose string pull-in operation, with the connection of the hose first section with the Hose Reel load flange. Alternative solution shall be issued to BUYER for appraisal.

6.3.11. For emergency operation in case of failure of the Hose Reel drive units, the hose string shall be reeled on the Hose Reel drum by means of a redundant hydraulically driven mechanism. Start, speed control and stop of the emergency operation shall be done by a remote control, keeping the operator in a safe distance from the Hose Reel.

6.3.12. SELLER shall provide devices or mechanisms to allow adequate maintenance without crane assistance.

- All equipment shall be provided with suitable marine treatment.
- To ensure the hose reel will be operational and available when required it is essential that the design takes inspection and maintenance activities into consideration.

6.4. HOSE REEL SPOOLING DEVICE

6.4.1. The spooling device shall be hydraulically operated and assembled on the Hose Reel support structure. Spooling device shall assist in smooth spooling-on of the hose string onto the reel.

6.4.2. The main structure of hose spooling device shall not be positioned on a deck below the hose reel.

6.5. OFFLOADING HYDRAULIC POWER UNITS (HPU)

6.5.1. There shall be 2 (two) hydraulic power units (HPU), one at the bow offloading station and the other at the stern station.

- Note: HPU may be shared with other Unit's hydraulic systems.

6.5.2. Each HPU shall be electrical driven type assembled on a single skid, designed to be installed in a non-hazardous area and with a dedicated hydraulic oil reservoir, a minimum of two (2 x 100%) power pumps, circulation pumps, dedicated hydraulic accumulators and a single control panel with start / stop command and visual / audible alarms.

- Note: The hydraulic oil power pumps may have 3 x 50% configuration or more, always keeping at least one stand-by pump.

6.5.3. HPU shall be dimensioned for the following cases:

- Hose reel normal operation at the design power and speed range to fulfill the conditions detailed on item 4.2.
- Mooring Hawser Winches at the design power and speed range as detailed on item 5.5.
- Hose Reel, Mooring Hawser Winches and a Messenger Winch in a simultaneous and critical / contingency operational condition.
    - Note: for this scenario, all pumps including the stand-by pump may be used. In this case, the Hose Reel and winches operational speed shall not be necessarily the design speed for these equipment.

6.5.4. HPUs shall be fresh water cooled type with redundant heat exchangers.

6.5.5. HPU shall have an interlocking system for the hydraulic oil reservoir low level or admission valves closed with alarm and indication on the local control panel and CCR.

6.6. CONTROL CONSOLES

6.6.1. A main console installed in a control cabin shall provide manual controls comprising the following main functions for the Hose Reel:

- The rotation speed of the Hose Reel;
- The linear speed of the spooling device;
- Mooring Hawser Winches axial tension monitoring (*);
- Emergency shutdown switch (*);
- Locking device switch;
- Locking device position status (*).

(*) Functions or signals required in the CCR.

6.6.2. The control console cabin shall be located as near as safely possible to the Hose Reel in a platform providing a good and full visibility of the offloading hose strings reeling. It shall be possible to control, monitor and operate the Hose Reel by a single person located at the control cabin.

6.6.3. An emergency shutdown switch shall also be provided for installation near the spooling device.

6.6.4. Hose Reel local control consoles shall be installed inside a weatherproof cabin.

6.7. SPECIAL DEVICES AND MECHANISMS

6.7.1. Crude oil swivel shall have 20 in diameter, ANSI B16.5 class 300. To be mounted on the drive side of the Hose Reel.

6.7.2. Locking device: hydraulically operated pin or arm that engages locking holes mounted on the Hose Reel structure. No single hydraulic failure shall lead to stop operations in Hose Reel. In case of hydraulic system failure, the pin or arm shall be manually operated.

6.7.3. Inboard Hose Termination Piece (IHTP): Offloading System shall not have an IHTP. Connections for quick release the offloading hose from FPSO side (Hose Reel gooseneck) are not allowed. Emergency disconnections shall be provided at shuttle tanker side only by the means of hose NSV and shuttle tanker bow loading system.

6.8. OFFLOADING HOSE STRING

6.8.1. For the Offloading Hose Strings configuration, specification and details refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

6.9. OUTBOARD HOSE TERMINATION PIECE (NORTH SEA VALVE)

6.9.1. For the outboard hose termination piece, North Sea Valve (NSV), specification and details refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

6.9.2. With the Hose Reel in parking position, the NSV shall be positioned in a dedicated and retrievable oil collection tray and an adequate access platform shall be provided to contain spillage of NSV and also allow visual inspections.

6.10. DETACHABLE HOSE BRIDLE

6.10.1. For the detachable hose bridle configuration, specification and details refer to I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

6.11. EMERGENCY OFFLOADING ASSEMBLY

6.11.1. One connection flange for each emergency station (bow and stern) shall be provided for emergency situations, which will be used to connect an Emergency Offloading hose string. The 1st hose section over the connection flange is a submersible hose without location collars. The 2nd and 3rd hose sections off the connection flange are submersible hoses with location collars and buoys or reinforced floating hoses. The remaining parts of the emergency hose string is similar to a regular 20” x 300# floating hose string.

6.11.2. BUYER shall supply the Emergency Hose String whenever it is required.

6.11.3. SELLER shall design and install only the standing part (piping, valves, controls) of the emergency offloading line (20”, ANSI 300# class).

6.11.4. SELLER shall provide all the necessary means and procedures at FPSO side to install the Emergency Hose String offshore (winches, sheaves, wire ropes, work platforms, slip way). On such procedures, special attention shall be given to safety of operators, which shall not be near or exposed to tensioned wires or ropes, or similar situations.

6.11.5. The bow/stern emergency connection platforms shall be located in a position that provides adequate clearance for the offshore hose string from hull structures. Structures around this area shall be as smooth as possible, without any kind of sharp edges in order not to damage the hose.

6.11.6. An oil spillage tray under the Emergency Offloading Assembly connection flange shall be provided, with means to convey residues to the Hull draining system.

- Note: for vertical connection the means for oil contention shall be submitted to BUYER for appraisal.

6.12. HOSE MESSENGER LINE WINCH

6.12.1. The UNIT shall be equipped with a hydraulically driven winch at each offloading station to launch, retrieve, spool and store the hose messenger line with pull in capacity of 20 t and minimum speed of 20 m/min.

6.12.2. The drum of messenger line winch shall be able to work with both synthetic ropes and steel wire cable. The dimensions of this drum must be compatible to contain up to 400 m of synthetic ropes of 96 mm diameter.

6.12.3. A 20 t SWL padeye shall be installed on deck, between hose messenger line winch and hose reel. This padeye shall be aligned to goose neck and be welded near messenger line winch structure base.

6.12.4. This winch shall have a minimum capacity to perform the offloading hose string pull-in / pull-out and must be aligned with the cargo flange of hose reel for this purpose. There should be no obstacles between winch and hose reel.

7. MANUFACTURING, SPARE PARTS AND TOOLS

7.1. WELDING (APPLICABLE CODES AND STANDARDS)

7.1.1. Workmanship, technique, qualification and inspection of all steelworks will be in accordance with AWS D.1.1.- "American Welding Society Structural Welding Code for Steel".

7.2. SPARE PARTS

7.2.1. All spare parts shall be according to the OCIMF guidelines. All spares have to be packed separately with clear identification and delivered in packing suitable for long-term storage.

7.3. SPECIAL TOOLS

7.3.1. SELLER shall supply all special tools required for installing, commissioning, operation and maintenance of all equipment specified herein.

8. ENGINEERING

8.1. GENERAL

8.1.1. SELLER shall submit the design of the offloading system to BUYER for approval. BUYER may request changes to the arrangements, equipment and redundancies proposed by CONTRACTOR to optimize the safety and availability of the system during its life cycle.

8.1.2. SELLER's scope of supply shall include a complete engineering package with the minimum following deliverables:

- certified drawings showing dimensions, weights, connections and further information necessary to facilitate the installation work.
- all necessary approvals or certificates, test sheets, instruction books and other documents required for proper operation and maintenance of the equipment during its lifetime.

8.2. TECHNICAL MANUAL

8.2.1. All instructions related to the operation, maintenance, inspection of the Offloading system should be detailed in a specific manual in order to ensure that they will be performed in a safe and suitable manner.

8.2.2. The following information should be available in the Offloading system manuals:

a. Offloading System General Arrangement;

b. Installation Procedures;

c. As-built drawings of all steel construction parts and main hydraulic diagrams;

d. Technical specification, drawings and functional description of all parts;

e. Weight Control Report;

f. Detailed periodic maintenance instructions;

g. Detailed maintenance instructions for the operational situations;

h. Regular inspections, calibrations, tests (including pressure tests) and checks (including the related data sheets, tables and charts);

i. Check-lists and procedures for all the operational modes;

j. Instructions for emergency situations;

k. Procedures for replacement of the hawser and the hose string (full or sections);

l. Factory Acceptance Tests (FAT) for the main components;

m. Fabrication certificates, including the hose strings;

n. Tests/Inspections Report (Test Certificates, Visual inspections, Welding inspection, Non-destructive Testing).

o. Operational procedures for mooring, unmooring, emergency situations (hawser and hose string disconnection at the vessel) and offloading (including flushing the hose string).

- Note 1: the Operational Procedure shall be made according to the Offloading Guidelines issued by BUYER, which manages the Offloading Operations. If any operational modification occurs in the BUYER Guidelines during the lifetime of the Unit, it shall be included in the SELLER procedure.

p. Recommendations from the manufacturer where applicable.

9. INSPECTION AND TESTS

9.1. HOSE REEL TESTING

9.1.1. General

9.1.1.1. A load test and a set of functional tests as the rotation, speed and emergency tests shall be performed for each Hose Reel fully installed onboard.

9.1.1.2. Spooling devices and the emergency offloading stations shall also have their functional tests performed accordingly.

9.1.1.3. All tests shall be carried out with the offloading hose string stored on the Hose Reel and full of sea water, unless otherwise mentioned.

9.1.1.4. The offloading string hoses shall be inspected within a time defined on I-ET-3010.00-1359-960-PY5-001 – OFFSHORE LOADING SYSTEM REQUIREMENTS.

9.1.2. Rotation Test

9.1.2.1. A complete 360-degree rotation of the reel shall be made in both the clockwise and counter-clockwise direction and the torque required to start and turn the reel shall be recorded.

- Note: Joystick smooth controls will be evaluated at the same test.

9.1.3. Speed Test

9.1.3.1. A set of tests shall be performed to confirm the operational speeds.

9.1.4. Load Test

9.1.4.1. It shall be applied a static break to the hose heel and a capacity test of the drive unit shall be performed.

- Note: Load Test shall be performed with water bags or whichever other method with no offloading hose strings installed on the Hose Reel.

9.1.4.2. Gradually move the hose heel paying-out and reeling-in. The maximum torque shall be recorded.

9.1.5. Spooling Device Test

9.1.5.1. A set of tests shall be performed to confirm the functionality of the hose spooling device.

9.1.6. Emergency Test

9.1.6.1. The test shall be carried out considering the need to use the emergency devices to turn the Hose Reel, remotely installed and operated.

9.1.7. Emergency station

9.1.7.1. The test shall be performed to ensure the operability of this system.

9.2. MOORING HAWSER WINCHES TESTING

9.2.1. General

9.2.1.1. A set of functional (rotation and speed) tests and a loading test shall be performed for each Mooring Hawser Winches fully installed onboard.

9.2.1.2. All tests shall be carried out with the hawser stored on the Mooring Hawser Winches drum.

9.2.2. Rotation Test

9.2.2.1. A set of rotations of the winch drum shall be performed in both the clockwise and counterclockwise direction and the torque required to start and turn the drum shall be recorded.

9.2.3. Speed Test

9.2.3.1. A set of tests shall be performed to confirm the operational speeds.

9.2.4. Load Test

9.2.4.1. A capacity test of the drive unit shall be performed. The maximum torque shall be recorded.

- Note: Load Test shall be performed with water bags or whichever other method.

9.2.5. Spooling Device test

9.2.5.1. A set of tests shall be performed to confirm the functionality of the hawser spooling device.

9.3. PRESSURE TEST OF HOSES AND PIPING ON REEL

9.3.1. Offloading system, comprising the whole piping, swivel and hose string shall have the pressure test with 300 psi for a minimum of six (06) hours.

9.3.2. The offloading hose string shall be paid out and reeled in, according to OCIMF – Handling, Storage, Inspection and Testing Hose Reels.

9.3.3. During the test, a visual inspection shall be carried out in order to detect any leakages or deformations.