

GENERAL SPECIFICATION

STRUCTURAL

GS EP STR 004

Riser/Umbilical Pulling Rig, Pulling and Mooring Winches

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1. Scope

1.1 Scope

This general specification applies to:

All pulling systems rigs (pulling as windlass, chain jacks, winches..., positioning and travelling systems, supporting structures and attached lifting tackles) installed on floating units (FPSO, FSO, FPU, Deepwater CALM BUOY used for mooring, subsea riser and umbilical installation).

The following are excluded:

- Devices used for other underwater installations
- Devices used for manned submarine/diving equipment handling operations
- Special drilling devices.

The boundary between riser/umbilical pulling system (including its support/gantry) and the floating unit shall be defined in a Project Particular Document (Interface identification and battery limits/SCR interface or Umbilical interface with floating unit)

The specification will apply to the field starting usually at the boundary between Riser/Umbilical pulling system and floating unit is set at the first horizontal weld connection or bolted joint above the floating unit hull/deck when the pulling system has a fixed location and at the skidding beams or rolling tracks when the pulling system is mobile.

The purpose of this specification is not to impose any specific technique, but to fix the obligations that any system shall fulfil.

One major obligation is the safety of the system associated with a clear and proved method of performing the works.

1.2 Definitions and field of application

The system in general is for **lifting** action. Even in the water as soon as the load is subject to gravity forces it shall be considered as a **lifting device**.

If the load is partly supported during one period, and then submitted to gravity force during a second period, the system shall be considered also as a lifting device.

If the load is only pulled on a surface which is supporting it, or if the gravity force is hold by some other mechanism or device, the system may be considered as a pulling device. But the holding mechanism or holding device shall be analysed separately, and considered as a lifting device.

Rated line pull (RP): The Rated line pull (RP) of a winch is the maximum rope tension in kN, that the winch can haul at the relevant layer in normal service condition, when the drum rotates at its maximum service speed. For Jacks Rated line pull shall be read as SWL.

Terms between "pulling" and "lifting" may get confused and the following definitions shall be considered:

Pulling rig: It comprises two main devices: Pulling rig base and Pulling rig system.

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Pulling rig base: Movable or fixed steel structure(s) to support the pulling rig system, and which is positioned in cantilever position or on deck to hold lifting forces and transfer them to the vessel structure. Structures include platforms and access.

Pulling rig system: Lifting device which includes winches, motorisation, safety devices, hydraulics or electrical equipments, and all auxiliary mechanical devices such as sheaves, stoppers, etc.

SWL: The safe working load (SWL) of the appliance is defined as the maximum load which may be lifted by the appliance.

Note: This specification does not intend to cover all cases that can be encountered in the different Projects and shall be used as a basis in conjunction with the Project Particular Specification (PPS).

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published at the effective date of this document.

As a minimum the supplied equipment shall be designed, manufactured, tested and delivered in accordance with the Regulations, Codes, Standards, Client Specifications, Project Specifications and other documents which will be listed in the document "Package Specification" and here below documents.

All Company General Specifications, technical Specifications and Documents, Particular Data sheets and relevant Drawings shall be transmitted to Supplier except Codes, standards & Regulations.

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated in the Contract, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of the Contract. References to superseded standards that may occur on technical documents will not over-write this clause.

National regulations are not listed in this document due to their high specificity and variability.

However, where national regulations exist, their provisions and those of the standards and codes to which they refer shall apply to the works done in the Country, and supplementing or amending the provisions of this document.

Reference	Title
ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
ASME BPVC Section VIII Div 1	ASME Boiler and Pressure Vessel Code (BPVC), Section VIII- Rules for Construction of Pressure Vessels - Division 1

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Reference	Title
ASTM B633	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM F1941M	Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric
BV NR 595	Classification of Offshore Handling Systems
Directive 94/9/EC	Directive 94/9/EC of the European Parliament and the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres
DNVGL-ST-0378	Standard for offshore and platform lifting appliances
EN 10204	Metallic products - Types of inspection documents
EN 13586	Cranes - Access
EN 14399 (Parts 1; 3)	High-strength structural bolting assemblies for preloading - Parts 1; 3
ISO 7731	Ergonomics - Danger signals for public and work areas - Auditory danger signals
ISO 4042	Fasteners. Electroplated coatings
ISO 4413	Hydraulic fluid power - General rules and safety requirements for systems and their components
ISO 9001	Quality management systems - Requirements

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Order of Precedence is as follow:

- Applicable rules of the country in which the system will be operated
- Class rules
- Company particular specs and data sheets
- Company GS
- International standards
- Other recognised codes.

In case of different but not conflicting requirements, the most stringent shall be applied.

In case of conflicting requirements, Company and/or FPSO EPCC Contractor shall be advised for settlement of the conflict.

Company General Specifications must be complied with.

Reference	Title
GS EP COR 002	Corrosion control on production facilities: Field operations
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP COR 353	Design and application of passive fire protection coatings
GS EP ELE 031	Design of Earthing and Bonding Systems for Offshore Installations
GS EP ELE 079	Electrical Apparatus for Potentially Explosive Gas Atmospheres
GS EP INS 101	Instrumentation Design
GS EP SAF 222	Safety rules for turbines, Diesel engines, gas engines and process units in sheltered or enclosed areas
GS EP STR 100	Offshore steel structures - General
GS EP STR 101	Design of offshore jacket and subsea structures
GS EP STR 102	Design of offshore topside structure
GS EP STR 201	Materials for offshore steel structures
GS EP STR 301	Fabrication of offshore steel structures
GS EP STR 401	Loadout, seafastening, transportation and installation of offshore structures
GS EP STR 651	General principles for a F(P)SO design
GS EP STR 901	Design rules and construction standards for ancillary structures of offshore and onshore installations

3. General

3.1 Purpose

The purpose of this specification is to establish the necessary but not exhaustive general requirements and obligations for the:

- General engineering and methods
- Design and calculation
- Supply, manufacturing and preassembly works
- Painting
- Shop testing
- Final assembly and FAT including static and dynamic load testing
- Packing and ocean transportation

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- Final installation, site testing and commissioning
- Maintenance and spare parts

of the Riser/Umbilical pulling rig mounted on floating installations and all mooring and pulling winches.

Additional or variable requirements specific to each device shall be dealt with in the Project particular specification.

3.2 Main obligations regarding concept, design, construction and testing

The design shall be governed by all rules specific to a lifting device.

Some important parameters to take in account are summarized here after. They are valid for pulling rigs and pulling or mooring winches. Others obligations are described later in this specification and are completing the main ones.

The major points to fulfil are the following:

- Definition of a complete method statement regarding works including risk analysis prior any detail definition of pulling rig system. The result of this analysis integrating all parameters such as method of works, equipment involved, hydrodynamic conditions, friction forces, reaction given by others floating units, etc. shall support the technical requirements which are necessary for the pulling rig studies. A list of criteria and characteristics shall be established according to the result of methods, constraints and risks.
- Studies shall start after this complete definition, and may be revised according to new constraints during the development and calculation of the pulling rig system.
- Interfaces with existing or designed equipment and installation shall be studied, and checked prior any final design and calculation of the pulling rig. One major interface is the loading of the pulling rig on the vessel structure. The total load below the pulling rig base (i.e. the loads which are for example below the pads and applying on the rails or brackets) shall be distributed between all supporting points, without going over a maximum of 150% of the mean value on the most loaded point, even in the worst loaded condition (maximal braking condition).
- Maximal capacity and lifting height of the pulling rig system shall be justified by a detail calculation and detail drawings showing the method of works.
- Braking systems shall include 3 levels of braking, one service brake given by the motorisation, one parking brake to be use normally in a static mode and one emergency brake to be used at any time and mainly under dynamic conditions (refer to paragraph 5.3.7).
- Regeneration of energy when lowering with loads shall be taken in account by the system and the interface with the general network on the vessel shall be checked.
- Motorisation by hydraulic or electric drive shall allow having a correct speed regulation, with possibility of steps adjustment for speed increase or decrease. It shall be study to operate correctly even in no load condition and up to the maximal design load condition.

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- For pulling rig powered by hydraulic system with power pack and hydraulic motors, the installation shall incorporate all safety devices in case of hoses burst, lake of pressure, failure of pump, or in general term all failures or malfunction in the hydraulic system. The system shall be able to run safely even with one damage hydraulic motor. It shall be possible to replace any hydraulic motor at any time.
- For winch systems, the spooling of the steel rope on the drum shall be guarantee by a spooling mechanism and drum shall be as per LEBUS type or equivalent (refer to paragraph 5.3.8).
- For pulling rig installation powered electrically by the floating unit, electrical cable routing shall be studied not to interfere with other equipment. Racks for cable spooling shall be foreseen, and power cables shall be protected against any drop of heavy material.
- Pulling rig shall be designed to be as far as possible one unique package, compact and easy to handle in one block. Centre of gravity shall be balanced to get a horizontal position when hanged to the lifting points.
- Testing shall include static tests and dynamic tests. The dynamic tests shall be performed with load in hanged position (gravity force applying) or equivalent (having similar effect) and a vertical displacement equivalent to at least a 360° drum rotation.

3.3 Use of this specification

This specification is to be used in conjunction with **GS EP STR 651**, **GS EP STR 100** and **GS EP STR 102** and with the specifications indicated therein.

This specification shall be complied with by the pulling system Supplier together with information given on "Package Specification" and relevant attachments (i.e. equipment data sheet, and narrative specifications).

3.4 Description and Use of the equipment

The pulling rig shall include normally the following items (variable according to the technology use for the works and by the system):

- The riser/umbilical lifting device (hoist or winch)
- The Diesel Generator and Hydraulic Power Units required by the pulling system (for the winch and skidding system, and others to operate the pulling rig in an autonomous way), alternatively the motorisation can be 100% electric with the energy supply by the floating unit
- The skidding system or rolling system, if required, stoppers and anti up-lift device shall be included for any movable system
- Any auxiliary fitting necessary to the operation (and maintenance) of the pulling system (local handling, etc.)
- A maintenance davit (for inspection, maintenance and removal of components)
- A JIB crane to handle risers ESDV's and SDV's and piping spools if required

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- An operating and control cabin/stand and/or a portable operating and control panel
- All spreader bar(s) or fitting for the handling in one piece of the pulling ring with a heavy lift crane.

Riser pulling rig shall be used by approved installation contractor in accordance with contract requirement during first installation of the riser/umbilical. It shall either remain on the floating unit for installation/replacement of future risers/umbilicals or be withdrawn, stored onshore and re-installed when required.

This equipment is subject to hazardous area and shall support all accelerations from FPSO and environmental conditions foreseen during the FPSO life.

4. Definition of the installation

4.1 Requirements and general design data

4.1.1 The site, the zone in the site

The site is the geographical location of the installation on which the handling device in question is installed. It is defined in the basic data by:

- Its name
- Its location (latitude, longitude, distance from the coast)
- The jurisdiction having authority over it.

The zone in the site is the portion of the installation within the handling device operates; it is defined in the particular specification, within includes in particular:

- A descriptive text
- A drawing showing the location and characteristics of the device
- The classification based on the probability of the existence of an explosive gas/air mixture.

4.1.2 Hazardous area

All equipment must comply with the requirements of the specific hazardous area where they will be installed (hazardous are classification as specified on the Project particular specification and data sheets).

For any installation, ATEX European [Directive 94/9/EC](#) shall be followed.

Unless otherwise specified the complete equipment shall be suitable for installation in a hazardous area: Zone 2 Gas group II A Temperature class T3.

Specifically all instrumentation shall be certified for Hazardous area, Zone 2 Gas group IIA Temperature class T3, IP65.

4.1.3 Environmental conditions

As a general rule, the handling devices shall be designed for outdoor use in an offshore atmosphere and exposed marine environment (i.e. humid, salt laden and eventually corrosive

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and subject to equatorial rains). Attention of Supplier shall be drawn on tightness of all bearings that shall be protected from sea water and salt spray ingress.

Except for transfer operations, all handling devices must be useable with a maximum service wind of 25 m/sec.

The maximum wave conditions under which transfer operations are allowed are those specified in the basic data; they may vary according to the loads; the “wave/load” relationship is to be specified in the particular specification. The other specifications to be taken into account are those specified in the basic data, namely:

- Design temperature (average of the coldest month minus 5°C) and corresponding humidity of the air
- The maximum temperature (average of the hottest month) and corresponding humidity of the air
- Ambient temperature
- The extreme wind with the device not in operation: the maximum wind to be expected in a 100-year period, lasting 3 seconds, acting in any direction
- Snow surcharge load (device not in operation)
- Ice surcharge load (device in operation and device not in operation)
- Floating support motions and accelerations.

4.1.3.1 Humidity

Electrical equipment shall be tropical zed. Heaters shall be added in electrical panel if necessary to avoid condensation.

4.1.3.2 Temperature

If the device is exposed to discharges of hot gases at a temperature higher than the maximum temperature specified above, it must be designed accordingly.

4.1.3.3 Worst-case wind

For equipment of which a storage area has been identified, this position may be assumed in the most unfavourable one. It shall however be assumed that this position must be reached with the extreme wind but with no load.

4.1.3.4 Snow surcharge load

Since the devices are mobile, it is assumed that snow does not build up when they are in use.

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4.1.3.5 Ice surcharge load

Two cases shall be considered:

- The surcharge load with the device in operation, i.e. the surcharge load such that the mechanisms and/or pivot points of the structural elements can operate
- The surcharge load with the device not in operation, i.e., the surcharge load prevents all movements by locking the mechanism and/or the pivot points of the structural elements.

4.1.4 Material obstacles

4.1.4.1 Definition

Material obstacles are all elements of the installation that may have an effect either on the setting of the device or on its shape (within limits acceptable for the technology of the device).

4.1.4.2 List of obstacles

This list is to be drawn up as soon as possible as the use of a handling device is planned; since the device and obstacle affect each other setting requirements, this list is to be drawn up in the order of arrival of the obstacles at the installation, so as to provide a permanent statement of the configuration of the environment at all times during the erection stage.

4.1.5 Regulation and safety requirements

4.1.5.1 Legislation

The country having authority over the installation is designated in the particular specification, as a basic data.

The pulling system must comply with the legislation of this country, and be such that it can be accepted in accordance with the conditions imposed or recommended by this legislation. If the country has no specific legislation or less stringent legislation than in Europe, it is European legislation that should be taken into account.

Any certificates of compliance with legislation required by the country having authority shall be supplied with the device.

4.1.5.2 Safety

The devices shall be equipped with all components necessary:

- For the safety of the personnel
- For the safety of equipment
- For operating safety

in accordance with the particular requirements stated in chapter 5.

If the legislation, which prevails over this document, imposes more stringent requirements, the constructive arrangements shall be altered accordingly.

The pulling system shall incorporate guards in accordance with [EN 13586](#), where reasonably practicable to protect personnel against hazards which cannot be eliminated by design. Where it

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is not practicable to fit guards around any hazard area, then clear, unambiguous and relevant warning notices should be posted at suitable positions on the equipment.

Means of access for operation and/or maintenance shall comply with [EN 13586](#).

4.1.5.3 Maximum allowable noise levels

Measurement to be taken:

- On idle and equipment controls in neutral position
- At full throttle with and without maximum rated loads
- In control cab or at control stand.

The noise pressure level at one meter of the machinery house or motor enclosure shall not exceed 80 dB(A).

When an operator cabin is provided, the maximum sound pressure level inside the cabin shall not exceed 70 dB(A), considering an exterior noise pressure of 95 dB(A) at 1 m of the cabin.

All necessary means to meet the requirements shall be provided by Supplier.

4.1.5.4 Vibrations

Supplier shall guarantee that operator within the cabin or at his operating stand position is not exposed to abnormal vibrations. If there are unacceptable levels of vibration at the location, remedial measures shall be proposed by Supplier and Contractor.

Due to potential high vibration levels on HPU, the scope of supply shall include the following:

- A dynamic analysis to establish the structural natural frequencies and confirm acceptable operating levels of vibration
- Vibrations measurements on Supplier test bench during full load test.

4.1.6 Classification of the device according to FEM rules and Design Life

Hoists, winches in light duty and not used for any transfers shall be dimensioned in accordance with the requirements of Section IX of the FEM rules. The pulling system shall be designed for the whole life of the Floating installation on which it will be mounted, i.e. a service life of 20 years of intermittent use.

Component that may require change-out within this period shall be identified as such in the Maintenance Manual.

Environmental conditions stipulated in paragraph 4.1.3 prevail over overloads of the FEM rules.

In addition the winch and the HPU shall be designed for a minimum continuous service of 24 hours at full power. The number of cycles and associated loads shall be defined by detail mechanical handling study. Unless otherwise specified cycles of 240 min pay-in and 240 min pay-out for 24 hours shall be taken into account. Due consideration shall be especially paid to the forced draft air cooling system.

The winch shall be supplied with a protective cover that will protect it efficiently from sea spray, direct sun and other hazards that may affect its performance during the service life. This cover shall be quick and easy to remove and to install.

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Long term preservation/maintenance procedures shall be provided by the Supplier to ensure that the pulling system is capable of operation, when required, throughout its design life.

4.2 Definition of the handling operations to be performed

4.2.1 Functional overview

A Riser/Umbilical installation outline procedure and a functional summary shall be inserted in the Project particular specification.

4.2.2 Characteristics of the loads

The most significant loads shall be defined in the particular specification by the following characteristics:

- Mass
- Main dimensions
- Points of suspensions.

4.2.3 Movement of the loads

An erection cinematic diagram must be prepared for representative loads.

This cinematic diagram must show, in the most significant images, the simultaneous positions:

- Of the load
- Of the handling device, together with the cables and lifting ancillaries
- Of the control station
- Of obstacles to the load and the device
- Of obstacles to visibility of the load.

The most significant images must show, among other things:

- The transfer of the load to the pulling system
- The characteristic points of its routing (in the vicinity of obstacles, changes of the orientation of the load and the means used)
- The setting down of the load.

4.2.4 Characteristics of the movement of the device

The main characteristics of a movement are:

- The speed
- The acceleration
- The accuracy (minimum movement for one control pulse).

Due to the fact that this equipment is not used for loading and unloading supply vessels, there is no mandatory requirement on vertical speed, except the one which is resulting of the methods for performing works.

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The velocities shall be stipulated in the particular specification. The acceleration and accuracy are to be proposed in the Supplier's proposal.

4.2.5 Lifting ancillaries

The lifting ancillaries are the additional items of equipment that are placed between the tackle of the device and the loads, such as: socket, hook, spreader bar, slings, chains, shackles, etc.

As a general rule, these ancillaries are to be specified in the course of the handling study; a list should be drawn up giving their main characteristics and their assignments.

They shall satisfy the requirements of chapter 5.

4.3 Design of the handling system

Winches, sheaves and their foundations and associated mechanics (rope, bearings, motors...) shall be sized according to [BV NR 595](#) where OHS certification by Bureau Veritas is mandatory.

4.3.1 Choice, capabilities, characteristics

No device may be used outside the range of capabilities for which it has been designed; in case of doubt, the extreme utilization cases are to be specified in the particular specification.

The "hook" travel distances shall be specified in the particular specification.

Note: An additional socket (installation spare part) shall be provided and an extra length shall be taken into account in the "hook" travel distance in order to allow cutting and resocketing of the wire rope, if required, without being obliged to change the full length on the drum. Without defined value in the Particular Project Specifications, an extra length of 15% shall be used.

For all devices, it must be possible to move the maximum load that can be lifted over the entire vertical amplitude of the "hook" (pulling end termination).

4.3.2 Connection with the structures of the installation

The following loads and interfaces are to be specified by the Supplier for the various types of device.

4.3.2.1 Pulling rig

- Weight and COG, complete, without load, and dimensions (Weighing certificate to be provided in the empty and operating conditions)
- Static resultant of vertical loads in normal service
- Corresponding moments
- Static resultant of vertical charges with test surcharge load
- Corresponding moments
- Directions and amplitudes of horizontal forces others than those resulting from wind
- Corresponding moments
- Forces resulting from the maximum service wind

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- Corresponding moments
- Forces resulting from the extreme wind with the device not in operation
- Corresponding moments
- Other characteristics as necessary.

4.3.2.2 Pulling system/Winch

- Weight, complete, without load, and dimensions
- Directions and static amplitudes of normal and exceptional stress
- Corresponding moments on the base of the winch
- Dimensions of the base, arrangement, number and dimensions of attachment bolts.

4.3.2.3 Hook or end wire termination

- Weight, complete, without load, and dimensions.

4.3.2.4 Operating connections

If the devices are not self-powered, the particular specification should stipulate:

- The power source (electric, hydraulic, pneumatic)
- The characteristics of the source (voltage, frequency, pressure, flow rates)
- Its location with respect to the device
- The characteristics of the connections (cables, pipes, etc.)
- The characteristics and position of the point of connection of the links (junction box, disconnecting switch, joints or flanges for tubes, etc.)
- The allowable voltage drops or pressure drops in steady operation and at starting up in the connections supplied with the installation and in the connections supplied with the device; the Supplier must confirm the characteristics of the connections supplied with the device.

In the particular case of diesel hydraulic pulling system, if the diesel engine is placed on the installation, off the equipment, it is up to the Supplier to specify the dimensions and weight of the set and the characteristics of connections to the device and to the fuel supply (see paragraph 5.4).

4.3.3 Limits of supply

Scope of supply shall include all items, accessories, structural, electrical components, instrumentation and control devices necessary for safe and proper control and operation of equipment and necessary to reach required performances and guarantees.

The package shall be supplied in running order, fully assembled, pre-wired, pre-piped and interconnected with all its accessories mounted on skid frame structure with all necessary supports in the limits of the skid as far as practicable or otherwise specified. The hydraulic lines shall be delivered with a tight cap.

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In particular the scope of supply shall include mainly for the package the following equipments and materials listed here below. The following table is given for guidance and is not exhaustive, it shall be readapted to the technical solution retained for the pulling rig concept:

Item	Qty	Description	Base	Option
1		Riser/Umbilical Pulling Rig	X	
2		Diesel Generator and HPU	X	
3		Enclosed area over-pressured and ventilated for diesel HPU	X	
4		Active and passive fire fighting system for diesel HPU	X	
5		Diesel oil system and tank	X	
6		Exhaust gas system	X	
7		Jacking system for skidding or other translation system	X	
8		Jacking system for local positioning	X	
9		Hydraulic winch system, cables rigging	X	
10		Unit Control Panel (Pulpit)	X	
11		Engineering/Quality/Procurement documentation	X	
12		Spare parts for Pre-commissioning/Commissioning/Start up	X	
13		Special tools for erection and maintenance of the complete unit (if any)	X	
14		All the consumable for testing, pre-commissioning/commissioning and start-up including 10% addition (lubricant)	X	
15		Spare parts for 2-years operation	X	
16		Certified lifting beams and equipment (slings, shackles, etc.) to facilitate a single point lift of the supplied units and/or skids	X	
17		Maintenance davit for any inspection, maintenance or removal operation on the unit.	X	

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4.3.3.1 Structure

The Riser/Umbilical Pulling Rig is to be supplied complete.

Description	Base	Option
Structural steel (Main, Secondary and Supporting)	X	
Drip pans	X	
Stairs, platforms, handrails, ladders, safety cages and gratings as applicable	X	
Supports for Piping, Stairs, Platforms, handrails, ladders, safety cages, gratings cable trays, junction boxes, instruments, labels, tubing, lighting, fire & gas detectors, Fire fighting system and Insulation as applicable	X	
Earthing loop and permanent connection hardwired links (double) to FPSO earthing loop	X	

4.3.3.2 Piping

Description	Base	Option
Piping, if required, with associated Manual, Actuated, Control and Safety valves according to piping class between equipments inside unit till battery limits	X	

4.3.3.3 Instrumentation

The Pulling Rig shall be provided with its own unit control equipment logic system and alarm annunciation.

Description	Base	Option
Instrumentation according to specification	X	
Instrumentation Cable trays and fixing clamps within the unit	X	
Complete control & instrumentation tubing with clamps, compression fittings, associated valves and manifolds including labels	X	
Complete control & instrumentation cabling from instruments to junction boxes including cable glands & labels	X	
Sun shade for all instruments in direct contact with solar radiation	X	