PETROBRAS	TECHNICAL SPECIFICATION	N	I-ET-3000.00-1519-291-PAZ-004
	CLIENT:		SHEET 1 de 14
	PROGRAM:		-
	AREA: SUB		
SUB/ES/DCT	TITLE: GENERAL FUNCTIONAL REQUIREMENTS		I

INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL
A	Requirements for repair kit adjusted in Section 1 Requirements for pressure in the offshore leak test adjusted in Section 1 Adjustments on differential pressure effects in Section 2.1 (see I-ET-3000.00-1519-291-PAZ-005) Added leak test requirements for end fitting ports to Section 2.2 Added Section 2.3 with flooding detection requirements Added minimum flowrate requirements to vent systems in Section 6.1.5 Adjustments to flange/connector test requirements in Section 6.1.9 New end fitting dimension requirements in Section 6.1.10 Added minimum installation and retrieval speed to Section 6.1.13 New buoyancy module design water depth standardization in Section 6.1.16 New requirement for bright colors in outer sheaths in Section 6.2 Adjustment in the pre-comissioning requirements in Section 6.3.2 General update on the maintenance requirements in Section 6.3.3
B	General revision Revision of Section 1 with new requirements for bend stiffener fixing devices New flooding detection chamber dimensions in Section 2.3 New requirements in 6.1.3 Corrosion Protection New requirements in 6.1.9 Connectors New requirements in 6.1.10.7 Handling and Installation Devices New requirements in 6.1.11.1 Riser Integrity Monitoring System, annulus classes New requirements in 6.1.12 Shipping, Storage and Handling on wet storage New requirements in 6.1.15 Flexible Pipe External Protection for corrosion protection

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G
DATE	18/12/2019	01/11/2021	31/07/2023					
PROJECT	SUB/ES/DCT	SUB/ES/DCT	SUB/ES/DCT					
EXECUTION	Walter (UQ9R)	Walter (UQ9R)	Walter (UQ9R)					
CHECK	Eder (CSN8)	Eder (CSN8) Gasparetto (BEJH)	Eder (CSN8) Gasparetto (BEJH)					
APPROVAL	Lancelotti (CXAX)	Lancelotti (CXAX)	Lancelotti (CXAX)					

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This Technical Specification is part of I-ET-3000.00-1519-291-PAZ-001 – Flexible Pipe Technical Specification. Please refer to the Flexible Pipe Technical Specification for instructions, definitions and abbreviations.

1. General

For any given contract, throughout its execution, the manufacturer shall maintain the same flexible pipe structure characteristics. This also includes the design of the associated end fittings, ancillary components, and accessories. Exceptions to this are acceptable if qualification testing or field experience shows that the structures might not be suitable or if changes are accepted by the purchaser.

The manufacturer shall propose a single design of flexible pipe structure for each required flexible pipe technical specification. Risers may be divided into sections according to the rules defined in the purchasing documentation. The proposal of more than one structure for each required specification or for each riser section may be accepted if duly justified.

Whenever a contract or process is started, the proposed structures within it shall be given a unique alpha-numerical identification code. Once a structure is proposed and its code is given, no more revisions on the structure build-up are accepted (e.g. changes in dimensions or materials). Any changes in the structure shall result in a new unique alpha-numerical identification code. The same rule applies from the moment a structure is proposed and on, including different contracts.

Structure code shall be revised and alpha-numerical identification code shall be maintained when structure build-up is unchanged but revisions in the design methodology or manufacturing process lead to updated parameters.

The total required flexible pipe section length always refers to the distance between external faces of flanges at the extremities of each section. Flexible pipe section length shall be maximized by the manufacturer. Flexible pipe section length shall be defined in a way to avoid having connections at the touch down zone and to avoid having a connection at the PLSV table during installation, subsea equipment connection and operation.

End fittings, accessories and optical sensors, cables and connectors for riser/jumper monitoring shall be supplied already installed in the flexible pipes. Exceptions may be accepted if duly justified.

Buoyancy modules, anchoring collars, buoy clamps, dead weight clamps, bend stiffener stoppers and anti-abrasive protection elements, shall be supplied separately and will be assembled late during installation phase. Whenever specific procedures or specific tools are required for assembly of these items, they shall also be included in the supply.

Riser mid-water intermediate connections shall be supplied with Intermediate bend stiffeners already assembled on the end fittings.

Riser top sections shall be supplied with the top bend stiffener fixed to the end fitting by means of a temporary device, which shall be removed or disassembled during the installation to allow the assembly of the pull-in kit. This device must be able to withstand the lifting loads from a horizontal to a vertical position, as well as the loads involved in passing the set through the PLSV launch tower during both the first and second end pull-in stages. The design shall consider the loads generated from all PLSVs informed in the project specific documentation. For every delivery, the manufacturer shall supply the consumables and all the materials

necessary to repair the pipe section. Required repair length is indicated in the project-specific documentation. The consumables and materials shall consider the possible replacement of all non-metallic layers above the tensile armor. The manufacturer shall pack all items of repair kit, according to I-ET-3000.00-1519-291-PAZ-010, identifying each specific flexible pipe structure and material.

All the flexible pipe structures that operate in the same flexible pipe system (i.e. well string) shall have the same value of the Maximum Differential Design Pressure.

The manufacturer shall design the flexible pipe and the flexible pipe system considering the offshore leak test and early offshore leak test (during the installation). Restrictions to the test pressure levels shall be previously approved by Petrobras. The test pressures shall be informed in the Design Basis and Operating Manual as a minimum.

The design of the ancillary components, accessories and end fittings shall consider that the flexible pipes may be laid in both directions and the limitations of the storage bases, installation vessels and associated equipment. Exceptions on this requirement shall be justified and submitted for approval within the Design Basis.

All accessories, ancillaries' components, equipment and devices to be installed with or in the flexible pipe system shall comply with the service life of the system.

The manufacturer shall have a valid Design Methodology Verification Report, the requirements from I-ET-3000.00-1519-291-PAZ-003 shall apply.

The manufacturer shall provide Petrobras with access to the IVA through joint meetings, whenever requested by Petrobras.

2. Overall Requirements

2.1. Flexible Pipe

The flexible pipes, including ancillary and accessories shall be capable of being shipped, handled, transported, stored, loaded, installed, connected, recovered and unloaded by means of the laying vessels, equipment and facilities specified herein and in the purchasing documentation.

The flexible pipe structure design shall comply with the maximum differential design pressure for the maximum and minimum specified design water depths and the maximum design pressure associated with each section.

Flexible pipe shall be delivered with a dry annulus.

2.2. End Fitting

The end fitting shall be designed to withstand the same loads as the flexible pipe considering the whole life cycle of the flexible pipe.

The end fitting designs shall allow the assembly of bending restrictors, anchoring collars or any other accessory or ancillary component required in the design.

The manufacturer shall standardize external dimensions of end fittings (groove depth and length), in order to facilitate handling of flexible pipes.

For flexible risers conveying hydrocarbons, the manufacturer shall carry out an analysis to evaluate the possible temperature reductions in the event of small leaks in the end fitting flanged connections and all end fitting components. The manufacturer shall then demonstrate that the selected materials are suitable for the temperatures. If necessary, changes to the end fitting design may be proposed.

If Spy Hole end fittings are used, even if the end fitting has water depth restrictions due to buckling, the external sealing systems shall be designed to withstand the design water depth.

2.3. Flooding Detection

Whenever required in the project-specific documentation, the manufacturer shall propose the option for all end fittings, except the top end fitting, for risers and flowlines, to allow for the visual or ultrasound inspection for annulus flooding detection.

For the ultrasound inspection facility, the design is an add-on similar to the Spy Hole End Fitting (as described in I-ET-3010.00-1500-960-PPC-014). This add-on shall create a sealed chamber which is an extension of the annulus to allow ultrasound inspection through its walls. The free area for inspection shall be equal or larger than 200 mm (axial direction) and a radial gap of 50 mm between wires and shell is recommended, no windows are required (see Figure 1). The hollow area shall have a thin plate 10 mm away from the outer shell to serve as target for the ultrasound readings (see Figure 2). The recommended thickness for the shell is 1”, however, the supplier shall evaluate if the design requires thicker walls to comply with installation, retrieval and operation of the pipes.

If needed, the tensile armor wires within the chamber region may be covered by the anti-buckling tapes or other holding devices, provided there is no contact between the wires and the internal surface of the chamber shell.

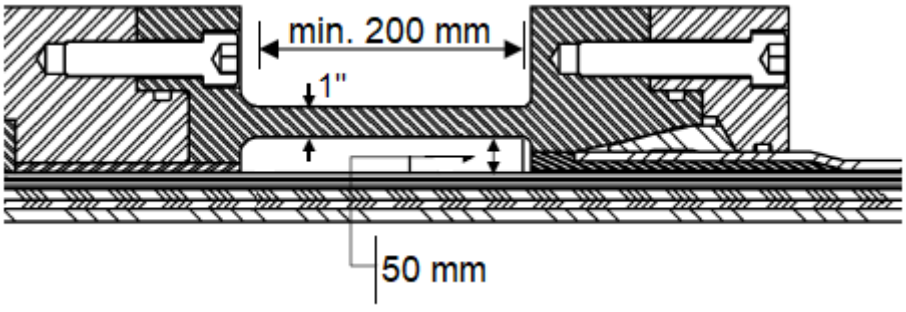

Figure 1 – Sample sketch of the add-on

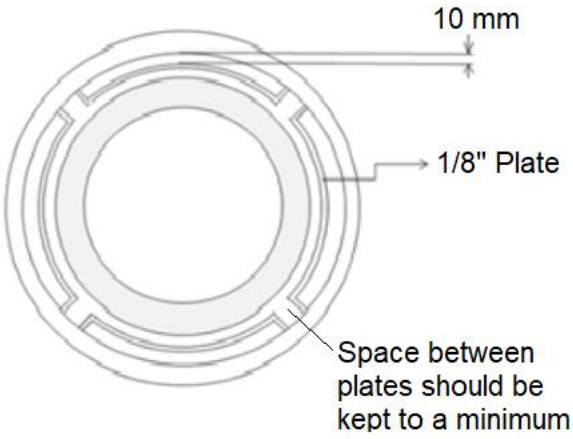

Figure 2 – Sample sketch of the add-on, in cut.

3. General Design Parameters

General Design Parameters will be provided in the project-specific purchasing documentation.

4. Internal Fluid Parameters

Internal Fluid Parameters will be provided in the project-specific purchasing documentation, including:

- Internal Pressure Definitions;
- Temperature Definitions;
- Fluid Density Definitions; and
- Fluid Composition.

The manufacturer shall present the results of calculations of permeated annulus gases as according to Annex V of I-ET-3000.00-1519-291-PAZ-008 – Documentation. The table shall be filled:

- For each well or set of wells under the same specified operating conditions;
- For each pipe function and diameter: production, gas lift, gas injection, gas export and oil export;
- For the top and bottom of each pipe application: top riser, intermediate riser, bottom riser, and dynamic jumper;
- For TDP and SAG/HOG zones, when applicable;
- For each flowline extremity.

5. External Environment

External Environment data will be provided in the contract and project-specific purchasing documentation.

6. System Requirements

6.1. Minimum System Requirements

6.1.1. General

6.1.2. Application Definition

6.1.3. Corrosion Protection

Any anodes weighting more than 20kg shall have lifting eyes for handling.

If the end-fitting has bending restrictors or other types of accessories attached to it, the anodes shall be designed to be attached to the opposite end-fitting of the same pipe section.

Anodes shall not have sharp edges to avoid damage to surrounding structures.

6.1.4. Thermal Insulation

Thermal Insulation requirements will be provided in the project-specific purchasing documentation.

The informed thermal exchange coefficient (TEC) of the flexible pipe provides the required grade of thermal insulation necessary for operation. The pipe TEC shall comply with the specified value for all operating conditions, including transients and flooded annulus scenarios.

For the purpose of providing better insulation capacity, pipe concept having a sealed intermediated sheath, creating a second sealed annulus space, is only accepted for smooth bore pipes.

6.1.5. Gas Venting

Whenever vent valves are not used, the vent valve ports shall be sealed (and tested to assure the sealing) by means of appropriated plugs.

The top end fittings (interface with the FPU) may be supplied with plugs in the vent ports for the valves to be installed after installation. Water injection pipes may have vent valves only in the top end fitting, in the interface with the production unit. All other end fittings shall have at least two valves installed all the time.

Vent ports of the top end fittings (interface with the FPU) shall be localized into the end fitting connector but above of the hang-off support and allow easy connection with relief tube or tubes from relief head.

The end fitting shall be designed with a minimum of 3 functional vent ports. The minimum total flowrate through the vent ports for any end fitting, considering a pressure differential of up to 3 bar, shall be 24 Nm^3/h for pipes with nominal ID equal to or larger than 6” and 18 Nm^3/h for pipes with nominal ID smaller than 6”. The design of the pipe, end fitting and valves shall allow for any pipe section to be retrieved with an average speed higher than 360 m/h.

The use of burst discs not acceptable.

The manufacturer shall supply a gas venting system designed according to the project-specific documentation. The gas venting system shall comply with service life requirements of the flexible pipe. The manufacturer is also responsible for supplying the adapters for connection with the topside unit, along with the procedures for installation and commissioning of the system and annulus testing protocols. The manufacturer shall inform the pressure limit for integrity tests of the external plastic sheath with nitrogen injection.

If the pipe system contains a submerged or submersible top end fitting, a specific gas venting system may be required to provide access, from the topside, the annuli of the riser sections, for monitoring, venting, flushing or vacuum testing. The gas venting system shall be composed of a hose assembly, with valves, fittings and a collapse resistant hose. System details will be presented in project-specific documentation. Topsides venting system shall consider a backpressure of 1.0 barg unless otherwise specified in the project-specific documentation.

6.1.6. Pigging and Through Flowline (TFL) Requirements

6.1.7. Fire Resistance

6.1.8. Piggyback Lines

6.1.9. Connectors (Flanges)

All riser connectors of the same internal diameter shall have the same design, regardless of being or not the same structure. The same applies to the design of the flowline connectors.

The manufacturer shall abide to the requirements and recommendations concerning the selection of materials and design of connectors as found in API Specification 6A and API Specification 17D. The selected designs shall comply with the load cases and design requirements presented in I-ET-3000.00-1519-291-PAZ-005 – Design Requirements.

The design of the connectors and end fittings shall allow the use of hydraulic tensioners for fasteners tightening. The design or the end fittings and associated connectors shall not result in load limitations during handling, installation or operation. Special attention should be directed towards subsea vertical connections.

All connectors shall feature a pneumatic seal test device that allows the performance of a leak test from the outside, without the need of internal bore pressure. The design of the seal test device shall allow the test to be performed on board of the installation vessels, during the installation phase, or in the loading bases, considering a test pressure equal to 1.1 times the maximum design pressure. The preferred seal test connection port are: 9/16” Autoclave fitting type with a 1 1/8” 12 UNF thread or 3/8” NOM MP fitting type with a 9/16” 18 UNF thread. The test device design shall be submitted to Petrobras for approval.

6.1.10. Interface Definition

End fittings, Bend Stiffeners, Bend Restrictors, Buoyancy Modules and their clamps shall be designed with features for easy handling and lifting in the laying vessels, considering both vertical and horizontal laying spreads. If additional items or tools are needed for handling of these accessories, they shall be previously evaluated and approved by Petrobras.

6.1.10.1.End Fittings

End fittings and connectors shall be standardized for each pipe structure. Different end fitting designs between risers and flowlines may be accepted. For riser end fittings, the design shall allow connection to any type of FPU support specified, allow the mounting of intermediate bend stiffeners and anchoring collars. In addition, all riser connectors shall have the same design. Flowline end fittings shall also have the same design for a given structure. This design shall allow the connection of bend restrictors and anchoring collars.

End fittings shall be designed with at least two support regions to be used during installation. The end fitting design shall allow for support from the top (right below the flange region A) through increased outer diameter and support from the lower part through a groove on the jacket (flange region B), as per Figure **3**. Dimension A shall be at least 20 mm and dimension B shall be at least 15 mm. Dimension B' shall be at least 80 mm. The final design shall be shown to be able to support the full load of the riser string during installation or operation.

The support region (right below the flange region, where "A" is) shall be designed for supporting both risers and flowlines during installation. For the top riser, the support region shall consider the requirements of the hang-off interface and shall be able to support the full load of the riser during operation.

The support region (groove on the jacket, where "B" is) should be used for connecting intermediate bend stiffener, bend restrictor, anchor collar, dead height collar or similar components. In these cases, the support region (right below the flange region) shall be used for supporting the line during installation phase.

For installation purposes, at least one support region shall always be free in every end fitting.

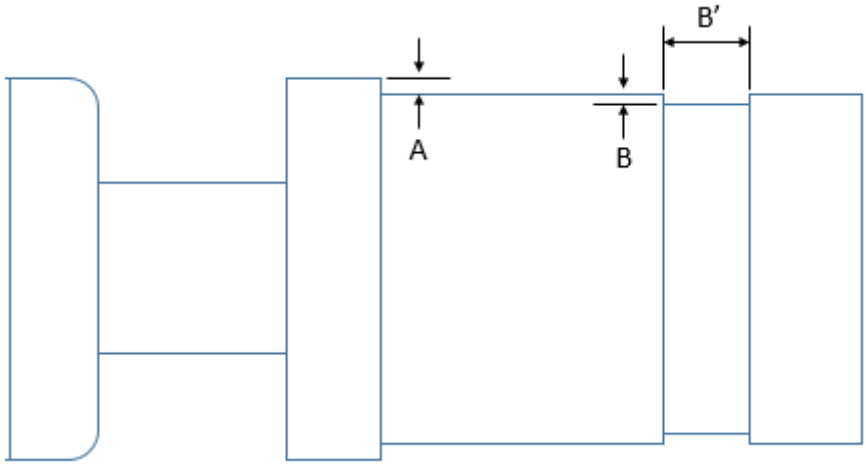

Figure 3 – End fitting support regions

6.1.10.2.Bend Stiffeners

The design of top bend stiffeners for the same type of structure shall be standardized for each floating production unit. The same design shall be suitable for use in the same structure in any riser position for that FPU. Different bend stiffener designs may be accepted if there are geometric or load restrictions. Whenever possible, the bend stiffener shall be designed to suit more than one structure in more than one FPU.

The design of the bend stiffener body should remain the same for a given structure. If necessary, due to differences in the interface components in the FPU, the parts related to the interface may be adapted for each different interface type and size.

When “castelo” or conical supports are specified, the manufacturer shall design and supply a bend stiffener adapter to separate the bend stiffener from the end fitting and minimize the bending effects in the top end fitting.

Top bend stiffeners shall always be supplied with a liner to avoid wear due to contact between bend stiffener metallic parts and the outer sheath of the flexible pipe. The bend stiffener liner shall be designed to comply with the pipe service life considering appropriate safety factors.

Top bend stiffeners shall be supplied with a bend stiffener cap for protection against handling impact during installation phase. The protection shall be designed in order to avoid damage on all regions of the cap, especially in the components responsible for the interface with the FPU.

In the same way, intermediate bend stiffeners shall be standardized. The intermediate bend stiffener design for each pipe structure shall be kept the same throughout multiple projects.

6.1.10.3.Hang-off

The hang-off structure shall be standardized for each I-tube top flange specification. The hang-off shall allow for multiple riser sizes to be connected to the same I-tube using the same hang-off components. Exceptions may be accepted if the manufacturer justifies the need for different hang-offs.

6.1.10.4.Bend Restrictors

Bend restrictors shall be standardized and range between 72° and 120°. The bend restrictor design for each pipe structure shall be kept the same throughout multiple projects. If duly justified, different angles may be acceptable.

6.1.10.5.Anchoring Collars

The anchoring collars shall be supplied with two padeyes each one of them rated with a Safe Working Load (SWL) greater or equal to the maximum required tension, considering the utilization factors applicable to the end fitting components. Both padeyes shall be provided with electrical insulation relating to the shackles of the anchoring rigging. The shackles shall also be supplied according to the following ranges of maximum tension:

- ≤ 120t: bow shackles according to ABNT NBR 13545: 2012 Gr. 8S, CMT = 50t/55t (MBL = 250t);
- > 120t and ≤ 250t: bow shackles according to ABNT NBR 13545: 2012 Gr. 8S, CMT = 120t (MBL = 600t).

Note: ASME B30.26 and/or US Fed. Spec RR-C-271 IVA class 3, Grade B may be accepted when ABT NBR 13535 certification is not available.

If duly justified and accepted by Petrobras, different shackle capacity may be accepted.

6.1.10.6.Bend Stiffener Stopper

Risers on “I”-tubes shall be supplied with a bend stiffener stopper that shall be installed in distance of either 5.0m or 1.5 times the bend stiffener total length from bend stiffener bottom extremity after installed, whichever is the greatest.

6.1.10.7.Handling and Installation Devices

Handling blind flanges and pulling heads shall be supplied with a suitable port for hydrostatic test and corresponding plug. Blind flanges and pulling heads shall have a port for testing the BX ring sealing.

The pulling heads port shall be standardized as a 1” port and designed to avoid any direct projection of plugs in case of thread failure.

Eyehooks, padeyes and handling aids (anchoring points) shall be free of sharp edges to avoid damage to the hoisting equipment.

6.1.11. Inspection and Condition Monitoring

6.1.11.1.Riser Integrity Monitoring System

Whenever required in the project-specific documentation, the manufacturer shall design and supply the SpyHole end fitting for top risers. These end fittings shall be supplied with all optical sensors, fibers and connectors duly mounted and tested at the factory. The part of the connector to be connected to the FPU shall be supplied separately, in a box with the fibers protected.

If annulus is classified as Class 3 or 4, according to Table 1-1 of I-ET-3000.00-1519-291-PAZ-005, a flooding detection system is required in the end fitting, as per section 2.3. This requirement does not apply to the top connector interfacing with the FPU.

If annulus is classified as Class 4, according to Table 1-1 of I-ET-3000.00-1519-291-PAZ-005, a riser integrity monitoring system is mandatory.

6.1.11.2.Annulus Integrity Monitoring Systems

If an annulus integrity monitoring system is required, the manufacturer shall include the following in the scope:

- the procedures and the frequency for testing;
- the system requirements;
- evidence that the annulus integrity monitoring system is functional and that there is no significant additional risk of annulus flooding.

6.1.12. Shipping, Storage and Handling

Flexible pipe design shall consider at least 1 year of wet storage on the seabed, filled with untreated seawater and without corrosion inhibitor and with the extremities plugged. Specific

limitations shall be presented in the Design Basis and recommendations shall be presented in the Operating Manual.

6.1.13. Installation and Retrieval Requirements

The products shall be installable and recoverable with at least 3 laying vessels from the fleet listed in the project specific documentation.

The lengths of flexible pipe sections that connects to the subsea equipment shall be such that there is no interference between flexible pipe accessories and the tensioner or installation table of the installation vessel. For this purpose, the length of the flexible pipe section connected to the subsea equipment shall be either at least 50m shorter than the water depth (water depth minus 50m) or at least 250m longer than the water depth (water depth plus 250m). PLSV configurations are presented in ET-3000.00-6600-941-PMU-001.

The manufacturer shall have a procedure to repair the pipe outer sheath on board of the installation vessel, if it is damaged during the installation, operating, and retrieval phases.

All pipe sections shall be able to be subjected to a minimum average installation and retrieval speed of 360 m/h. Average speed shall be considered for over a flowline section or full riser length.

6.1.14. Exothermal Chemical Reaction Cleaning

6.1.15. Flexible Pipe External Protection

This section presents some requirements regarding protections added to the product and which are not normally produced in the same manufacturing line of the flexible pipe. Whenever required, the installation of anti-abrasive protection is indicated in the project specific documentation.

For protection of the surrounding risers against outer sheath abrasion between the bend stiffener stopper and their outer sheaths, the manufacturer shall supply sleeves for assembling in the stoppers.

External devices used to protect the end fittings against clashing shall be designed to avoid corrosion of the device itself and corrosion of the end fitting parts enclosed in it. The design of the external protective devices shall allow visual inspection of the connectors.

6.1.16. Buoyancy Modules

The buoyancy modules shall be designed to withstand water depths as per Table 1. This will allow for adjustments and changes in the overall riser configuration without the need for new buoyancy modules.

Table 1 – Buoyancy module design water depth

Design Water Depth of the Project	Buoyancy Module Design Water Depth
<1800m	Equal to the design water depth of the project
>=1800 and <2250m	1800m
>=2250m and <2500m	2000m
>=2500m	As per project-specific requirements

FAT Full scale hydrostatic tests, as per API Spec 17L1, shall be performed in at least 5% of the modules to be supplied in a batch. The minimum number of modules to be tested is 2 by batch. For the purpose of FAT testing of buoyancy modules, a batch is comprised of all modules from the same manufacturing run.

The full-scale hydrostatic test, as per API RP 17L2, shall be performed for a period of, at least, 168 hours for qualification purposes (of a new module design) and of, at least, 24 hours for FAT purposes.

6.2. Flowline and Riser Parameters

Risers and flowlines shall be designed to reduce the number of connections.

The Outer Sheath and External Protective Sheath shall be resistant to UV radiation, for long-term storage at non-protected area, onshore Brazil (storage duration of, at least, 4 years).

The most external layer of the pipe, Outer Sheath or External Protective Sheath should be manufactured in light/bright colors to allow better subsea visualization. Black or other dark colors may be accepted if justified.

The design of the pipe and end fitting shall allow for any sealed layer in the end fitting to be tested for leak tightness. The seals shall be tested up to the maximum design values (internal pressure, annulus pressure or external pressure) and applicable safety factors in the factory.

Riser configurations shall be optimized to reduce length, installation time and amount of buoyancy. Changes in the subsea layout require Petrobras approval. Changes in the riser supports, I-tubes or bellmouths require Petrobras approval.

The manufacturer shall carry out interference analysis between risers, between risers and the mooring system and between risers and the floating unit. The project specific data shall be considered for this analysis.

6.3. Servicing and After Delivery Requirements

6.3.1. Servicing

The manufacturer shall provide, at the purchaser’s request, support for servicing at any time during the specified pipe service life. Irrespectively of which party is the responsible for an eventual non-conformity.

The manufacturer shall maintain qualified personnel for promptly carrying out such activities in order to evaluate the pipe integrity for the remaining service life, considering the original

specification and the pipe history. If during any analysis, the manufacturer suggests a pipe down grade or rejection, the reasons shall be duly justified before the purchaser through comprehensive technical documentation. If required, the IVA shall certify the analysis provided by the manufacturer.

6.3.2. Commissioning of Flexible Pipes

All pipes shall be delivered with an empty bore (i.e. no water).

Gas Export lines shall be delivered inert. For this purpose, the manufacturer shall carry out the commissioning of flexible pipes in factory according to a procedure previously approved by Petrobras. This requirement may apply to other pipe functions if required in the project-specific documentation.

6.3.3. Maintenance

The products shall be designed to operate throughout the service life without the need for any maintenance that requires shut-down or pipe pull-out, unless some accidental condition occurs from events such as outer sheath damage and aerated water flooding of the annulus or pipe operation outside the specifications.

Repairs where annulus watertightness is required should be performed by the pipe manufacturer. For other types of repairs, the manufacturer shall provide repair instructions for outer sheath damage as required in I-ET-3000.00-1519-291-PAZ-008.

6.3.4. Inspection and Monitoring

The manufacturer shall provide a recommended in-service inspection program. The program shall include the criteria corresponding to each defect, possible consequences, and associated cause.

The manufacturer shall provide relevant information that allows the purchaser to carry out the as laid and in service monitoring/inspection of the products. For this purpose, the manufacturer shall consider its knowledge on the product design criteria, possible weak points, uncertainties of its design tools and performance of formerly supplied products to third parties.