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1. PURPOSE

This Technical Specification establish the minimum functional requirements for Petrobras standard flexible pipe applications. With the information herein provided the manufacturer shall design and qualify flexible pipe structures, ancillary components, and accessories in order to supply these products.

Functional requirements not specifically required or not specified herein and that can affect the design, materials, manufacturing, and testing of the pipe shall be specified by the manufacturer and submitted to Petrobras approval.

The manufacturer shall inform any foreseen limitations for new pipe designs for water depth of 3100 m, high pressure pipes and pipes resistant to SCC-CO₂ failure mechanism regarding the applicable specifications presented in item 2, for instance, but not limited to, reels dimensions, PLSV characteristics, top and equipment interfaces and flanges specification. Manufacturer shall also provide results to evidence the limitation and propose feasible alternatives along with its validation results.


2. APPLICABLE SPECIFICATIONS – GENERAL

2.1. Normative References

Ref.	Designation	Title
[1]	API Specification 17J	Specification for Unbonded Flexible Pipe, Fourth Edition May 2014
[2]	API Recommended Practice 17B	Thermoplastic Composite Pipes, Fifth Edition May 2014
[3]	DNVGL-ST-F119	Flexible Pipe Certification Requirements
[4]	DNVGL-ST-C501	Composite Components

2.2. Petrobras Flexible Pipe Specifications

Ref.	Designation	Title	Ed.
[5]	I-ET-3000.00-1519-291-PAZ-001	Flexible Pipe Technical Specification	0
[6]	I-ET-3000.00-1519-291-PAZ-002	Flexible Pipe Qualification	0
[7]	I-ET-3000.00-1519-291-PAZ-003	Flexible Pipe Certification Requirements	0
[8]	I-ET-3000.00-1519-291-PAZ-004	General Functional Requirements	0
[9]	I-ET-3000.00-1519-291-PAZ-005	Design Requirements	0
[10]	I-ET-3000.00-1519-291-PAZ-006	Materials	0
[11]	I-ET-3000.00-1519-291-PAZ-007	Manufacturing Requirements	0
[12]	I-ET-3000.00-1519-291-PAZ-008	Documentation	0
[13]	I-ET-3000.00-1519-291-PAZ-009	FAT	0
[14]	I-ET-3000.00-1519-291-PAZ-010	Marking and Packaging	0
[15]	I-ET-3000.00-1519-291-PAZ-011	Testing Requirements	0

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Ref.	Designation	Title	Ed.
[16]	I-ET-3000.00-1519-291-PAZ-012	Field Test for Flexible Pipes	0
[17]	I-ET-3000.00-1519-291-PAZ-013	Requirements for Permeation Barrier Concept	0
[18]	I-ET-3000.00-1519-291-PAZ-014	Specification for Hybrid Composite Flexible Pipes	0
[19]	I-ET-3000.00-1519-291-PAZ-015	Specification for Thermoplastic Composite Pipes	0
[20]	I-ET-3000.00-1519-291-PAZ-016	Requirements for Flexible Pipes with Corrosion Resistant Armors	0

In addition to the I-ET-3000.00-1519-291-PAZ-004 R0 requirements, the end fitting shall be designed with a minimum of 3 vent ports. The minimum total flowrate for an end fitting, considering a 3 bar pressure differential, shall be 24 Nm³/h for pipes with nominal ID equal to or larger than 6" and 18 Nm³/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. All pipe sections shall be able to be subjected to a minimum installation speed of 360 m/h.

2.3. Technical Specification - Standard Flexible Pipe Applications

Ref.	Designation	Title	Ed.
[21]	ET-3000.00-1519-291-PZ9-001	Envoltórias de Aplicação de Dutos Flexíveis Padronizadas	0

2.4. Specifications for Structural Analysis

Ref.	Designation	Title	Ed.
[22]	I-ET-3010.00-1500-960-PZ9-001	Structural Analysis of Flexible Pipes	0

2.5. Specifications for Fatigue Analysis


Ref.	Designation	Title	Ed.
[23]	I-ET-3010.00-1500-960-PPC-002	Service Life – Fatigue Analysis (for risers designed for water of 1500m)	H
[24]	I-ET-3A26.00-1500-960-PPC-001	Flexible Risers and Umbilicals - Fatigue Analysis (for risers designed for water depth of 2300m and 3100m)	D

2.6. Specification for Riser Interference Analysis

Ref.	Designation	Title	Ed.
[25]	I-ET-3010.00-1519-274-PPC-001	Specification for Riser Interference Analysis	0

2.7. Bend Stiffener Requirements

Ref.	Designation	Title	Ed.
[26]	I-ET-3010.00-1500-960-PPC-011	General Bend Stiffener Requirements	G

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2.8. End Fitting Requirements

Ref.	Designation	Title	Ed.
[27]	I-ET-3000.00-1519-291-PZ9-002	General End Fitting Requirements	0
[28]	I-ET-3010.00-1500-960-PPC-014	Spyhole End Fitting	C

I-ET-3000.00-1519-291-PZ9-002 Rev. A supersedes the technical specification I-ET-3010.00-1500-960-PPC-013 Rev. E referenced in any document mentioned herein.

2.9. Specifications for High-Strength Steel Fasteners for Subsea Use

Ref.	Designation	Title	Ed.
[29]	ET-3000.00-1500-251-PEK-001	Fixadores em Aço Baixa Liga de Alta Resistência para Aplicação Submarina	0
[30]	ET-3000.00-1500-251-PEK-002	Rastreabilidade de Fixadores de Aço de Alta Resistência para Aplicação Submarina	0
[31]	-	Respostas da Petrobras aos Comentários dos Fornecedores de Duto Flexível Relativos à ET-3000.00-1500-251-PEK-001	-

2.10. Coating and Cathodic Protection


Ref.	Designation	Title	Ed.
[32]	I-ET-3000.00-1500-956-PZ9-001	Anticorrosive Coating for End Fitting and Connectors	0
[33]	I-ET-3000.00-1500-950-PMU-001	Revestimento de Níquel Químico com Tratamento Térmico de Interdifusão	E
[34]	ET-3000.00-1500-940-PZ9-001	Projeto de Proteção Catódica para Dutos Flexíveis e Umbilicais Submarinos	0

2.11. Specification for Subsea Equipment Loads Analysis

Ref.	Designation	Title	Ed.
[35]	ET-3010.00-1500-941-PLR-004	Análise de Cargas de Dutos em Equipamentos Submarinos	0
[36]	ET-3000.00-1500-940-PZ9-003	Procedimento para Análise de Esforços em Módulos de Conexão Horizontal - MCH	0

2.12. Specifications for Installation and Retrieval

Ref.	Designation	Title	Ed.
[37]	I-ET-3000.00-1500-942-PMU-001	Installation Methods	A
[38]	ET-3000.00-6600-941-PMU-001	Principais Características – Frota PLSV	AD
[39]	ET-3000.00-1500-290-PMU-004	Requisitos para Confecção de Curvas de Aperto de Dutos Flexíveis e Umbilicais	D

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Ref.	Designation	Title	Ed.
[40]	DOC No. 2778002-105-019	Pertinacia RAO Data (for risers and flowlines designed for water depth up to 1500m)	1
[41]	I-ET-3000.00-1500-941-PZ9-001	PLSV 550 TON - Technical Data and RAO Curves (for risers and flowlines designed for water depth deeper than 1500m)	0
[42]	ET-3000.00-1500-941-PMU-003	Padronização de Acessórios para Kit Pull-in	F

2.13. Specifications for Handling and Storage

Ref.	Designation	Title	Ed.
[43]	DE-3000.00-1500-140-PMU-007	Bobinas de Aço de Acondicionamento de Linhas Flexíveis a Serem Movimentadas pelas Bases de Dutos Flexíveis da ISBM; BAVIT e BANIT	B


The total weight of the reel set (reel, pipe, accessories, cradle, etc.) shall not exceed the handling load limit of currently Petrobras Bases, which is 300 tf.

2.14. Specifications for Pipe End Fitting Flanges

The manufacture shall consider the preliminary flange specification informed in the Table 1 for installation and operational analysis.

Table 1 - Specifications for Pipe End Fitting Flanges

Envelope	Line application	ID	Pressure	Flange
E-1.01	Gas Lift / Service Line	4"	5.000 psi	API 4 1/16" API 17SS 5.000 PSI BX 155
E-1.02	Water Injection (RB or SB)	6"	5.000 psi	API 7 1/16" API 17SS 5.000 PSI BX 156
E-1.03	Water Injection (RB or SB)	8"	5.000 psi	API 9" API 17SS 5.000 PSI BX 157
E-1.04	Multi-Function	8"	5.000 psi	API 9" API 17SS 5.000 PSI BX 157
E-1.05	Production	6"	5.000 psi	API 7 1/16" API 17SS 5.000 PSI BX 156
E-1.06	Production	6"	5.000 psi	API 7 1/16" API 17SS 5.000 PSI BX 156
E-1.07	Production	6"	5.000 psi	API 7 1/16" API 17SS 5.000 PSI BX 156
E-1.08	Production	6"	5.000 psi	API 7 1/16" API 17SS 5.000 PSI BX 156
E-1.09	Production	6"	5.000 psi	API 7 1/16" API 17SS 5.000 PSI BX 156
E-1.10	Production	8"	5.000 psi	API 9" API 17SS 5.000 PSI BX 157
E-1.11	Multi-Function	9,13"	4.000 psi	API 11" API 17SS 5.000 PSI BX 158
E-1.12	Multi-Function	11,13"	4.000 psi	API 13 5/8" API 17SS 5.000 PSI BX 160
E-2.01	Gas Lift / Service Line	4"	6.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-2.01.1	Gas Lift / Service Line	4"	11.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-2.02	Multi-Function	6"	6.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-2.03	Water Injection (RB)	8"	6.000 psi	API 9" API 6BX 10.000 PSI BX 157
E-2.04	Water and Gas Injection (WAG)	6"	9.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156

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Envelope	Line application	ID	Pressure	Flange
E-2.04.1	Water and Gas Injection (WAG)	6"	9.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-2.04.2	Water and Gas Injection (WAG)	6"	13.000 psi	API 7 1/16" API 6BX 15.000 PSI BX 156
E-2.05	Water and Gas Injection (WAG)	8"	9.000 psi	API 9" API 6BX 10.000 PSI BX 157
E-2.06	Production	6"	6.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-2.06.1	Production	6"	11.000 psi	API 7 1/16" API 6BX 15.000 PSI BX 156
E-2.07	Production	6"	6.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-2.08	Multi-Function	8"	6.000 psi	API 9" API 6BX 10.000 PSI BX 157
E-2.08.1	Multi-Function	8"	11.000 psi	API 9" API 6BX 15.000 PSI BX 156
E-2.09	Production	8"	6.000 psi	API 9" API 6BX 10.000 PSI BX 157
E-2.10	Gas Export	9,13"	4.000 psi	API 11" API 17SS 5.000 PSI BX 158
E-3.01	Gas Lift / Service Line	4"	6.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-3.01.1	Gas Lift / Service Line	4"	6.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-3.02	Multi-Function	6"	6.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-3.03	Water Injection (RB)	8"	6.000 psi	API 9" API 6BX 10.000 PSI BX 157
E-3.04	Water and Gas Injection (WAG)	6"	9.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-3.04.1	Water and Gas Injection (WAG)	6"	9.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-3.05	Water and Gas Injection (WAG)	8"	9.000 psi	API 9" API 6BX 10.000 PSI BX 157
E-3.06	Production	6"	6.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-3.06.1	Production	6"	6.000 psi	API 7 1/16" API 6BX 10.000 PSI BX 156
E-3.07	Production	8"	6.000 psi	API 9" API 6BX 10.000 PSI BX 157
E-3.07.1	Production	8"	6.000 psi	API 9" API 6BX 10.000 PSI BX 157
E-3.09	Gas Export	9,13"	6.000 psi	API 11" API 17SS 5.000 PSI BX 158

2.15. Marking of Flexible Pipes


Ref.	Designation	Title	Ed.
[44]	I-ET-3000.00-6500-291-PMU-002	Marking of Flexible Pipes	H

2.16. Reference Floating Unit Data

For flexible pipe design the manufacture shall use the reference floating unit data according to the riser water depth application.

a) Riser Azimuth, Top Angle and Support Coordinates

The manufacturer shall consider the furthest supports from the vessel's midship, positioned at -55 m (afterward) and +80 m (forward) (for all units), 30 m (for [52] unit) and 31 m (for [53] and [54] units) from the center line, and 1,6 m above from base line (for all units). For oil and gas export lines (lines with internal diameter upper than 9in) the supports shall be positioned +/- 10 m from the vessel's

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midship. The platform azimuth shall be 190° heading from true north clockwise.

To convert x-coordinates from “from AP” to “from midship”, please adopt the following formulation:

$$x_{MS} = x_{AP} - L_{pp}/2, \quad L_{pp}: \text{length between perpendiculars}$$

The vessel's dimensions can be found in h).

The top angles can vary from 5 to 7,5 degrees for free hanging and from 6,5 to 9 degrees for lazy wave configurations.

For riser azimuth the manufacturer shall follow the instructions of section 4 of the I-ET-3010.00-1500-960-PZ9-001 Rev.0.

b) Support interfaces

The typical riser support used in the Petrobras' floating units is shown in Figure 1. For reference analysis the manufacture shall consider the use of an I-tube support and bell mouth, with the average distance between the lower and upper balcony of 27 m.

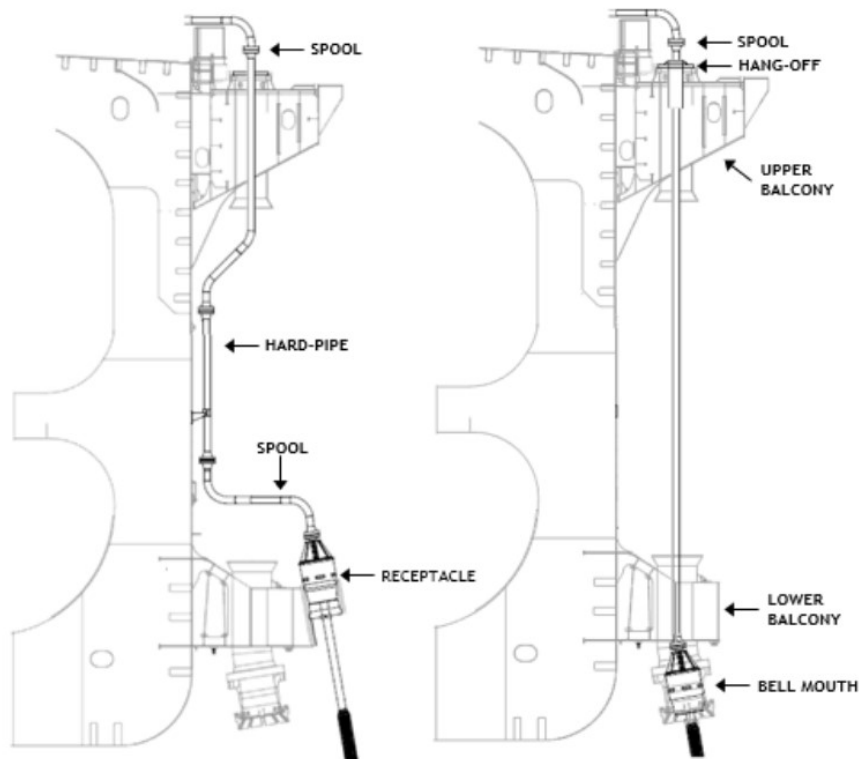



Figure 1 - Typical flexible riser support

The table below shown some examples of bell mouth and receptacle support.

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Ref.	Designation	Title	Ed.
[45]	I-LI-3010.00-1300-279-PPC-001	Part List - Bend Stiffener Lock System (BSN 900C)	H
[46]	I-LI-3010.00-1300-279-PPC-003	Part List - Bend Stiffener Lock System (BSN 900E)	C
[47]	I-DE-3000.00-1300-279-PPC-530	Multifunctional Bellmouth Assembly DN 48	E
[48]	I-DE-3000.00-1300-279-PPC-558	Multifunctional Bellmouth Dummy Cap DN48	C
[49]	PD14902	Mock-up for Receptacle Support	B


c) Riser Interface Loads

In order to define the riser top interface loads limits, for preliminary analysis purpose, the supplier shall comply with the loads imposed by the structures informed in the Table 2, considering the bend-stiffener data of Table 3 and the loading cases informed in [50]. For E-2.10 the manufacturer shall consider loads imposed by the riser configuration of **Erro! Fonte de referência não encontrada.** Loads limits for 3100 m water depth and high-pressure pipes (above 9000 psi) pipes are not defined yet, the reference loads shall be discussed with Petrobras during the pipe development by the manufacturer.

Ref.	Designation	Title	Ed.
[50]	I-ET-3010.00-1500-274-PLR-001	Riser Top Interface Loads Analysis	D
[51]	I-FD-3A36.05-1500-274-PLR-001	Riser Configuration Data	B

Table 2 - Reference flexible pipe data

Envelope	WD [m]	Section	L [m]	ID [mm]	OD [mm]	Internal Volume [l/m]	Dry Weight Empty [kgf/m]	Axial Stiffness [kN]	Bending Stiff. [kN.m ²]
E-1.01	1000	Top	250	101.6	186.8	8.84	60.77	1.57E+08	6.51
		Bottom	1500	101.6	186.77	8.84	61.06	1.61E+05	13.05
	1500	Top	200	101.6	192.46	8.84	68.09	3.27E+05	15.34
		Bottom	2000	101.6	186.77	8.84	61.06	1.61E+05	13.05
E-1.02	1000	Top	250	152.4	245.9	18.25	105.27	3.04E+08	38.43
		Bottom	1500	152.4	237.8	18.24	87.96	2.11E+08	33.21
	1500	Top	200	152.4	295.34	20.11	153.71	7.03E+05	58.54
		Interm.	1000	152.4	245.87	18.25	105.27	3.04E+05	38.43
	Bottom	1000	152.4	237.84	18.25	87.96	2.11E+05	33.21	
		1000	Top	250	203.2	309.4	32.44	154.32	4.14E+08
E-1.03	1000	Bottom	1500	203.2	303.0	32.44	131.24	2.81E+08	71.90
		Top	200	203.2	307.90	32.43	159.27	7.19E+05	85.18
	1500	Top	2000	203.2	310.70	32.43	146.71	6.19E+05	99.27
		Bottom	2000	203.2	319.9	34.73	164.96	7.92E+08	51.21
E-1.04	1000	Bottom	1500	203.2	334.5	34.73	171.02	4.47E+08	108.84
E-1.10		Top	250	152.4	302.5	19.68	195.32	1.61E+09	73.87
E-1.05	1000	Bottom	1500	152.4	276.7	19.99	135.07	4.77E+08	93.18
E-1.06		Top	200	152.4	300.54	20.11	164.58	7.19E+05	111.43
E-1.07	1500	Interm.	1000	152.4	294.52	20.11	154.60	6.19E+05	101.81
E-1.08		Bottom	1000	152.4	286.98	20.11	132.68	3.26E+05	97.28
E-1.09	1000	Top	250	231.9	411.9	44.94	342.9	3.12E+09	257.79
E-1.11		Bottom	1500	231.9	362.3	43.62	202.58	1.02E+09	200.21
	1500	Top	200	231.8	399.48	45.38	306.31	2.68E+06	196.34
Interm.		1000	231.8	357.08	45.38	194.72	8.90E+05	131.00	
Bottom	1000	231.8	366.00	45.38	199.69	5.11E+05	142.40		

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E-1.12	1000	Top	250	282.7	406.7	68.03	252.11	1.10E+06	103.73
		Bottom	1500	282.7	412.1	68.03	257.93	4.43E+05	106.73
E-2.01 E-3.01.1	2300	Top	400	101.6	232.10	8.84	114.62	1.00E+06	24.42
		Intern.	1200	101.6	189.94	8.84	69.31	5.19E+05	10.68
E-2.02	1000	Bottom	1400	101.6	185.94	8.84	62.64	2.52E+05	10.05
		Top	250	152.4	319.9	34.73	164.96	7.92E+08	51.21
	Bottom	1500	152.4	224.5	19.69	79.27	3.62E+08	8.77	
	Top	600	152.4	329,12	19,67	208,3	1,62E+06	156,00	
	Intern.	1200	152.4	322,14	19,67	163,92	1,07E+06	177,74	
	Bottom	1500	152.4	324,26	19,68	161,62	5,94E+05	185,03	
E-2.03	2300	Top	400	203.2	413.12	35,24	315.41	2.37E+06	326.92
		Intern.	1200	203.2	334.94	35,24	194.25	1.11E+06	100.53
		Bottom	1400	203.2	340.42	35,24	182.21	5.05E+05	146.53
E-2.04	2300	Top	400	152.40	19,68	347.32	282.59	2.14E+06	120.54
		Intern.	1200	152.40	19,68	287.50	177.93	8.01E+05	53.22
		Bottom	1400	152.40	19,99	296.34	180.93	5.60E+05	64.21
E-2.06 E-2.07	2300	Top	400	152.4	316.72	19,68	205.89	1,70E+06	124.18
		Intern.	1200	152.4	366.14	19,68	184.34	9,88E+05	199.78
		Bottom	1400	152.4	376.26	19,99	180.29	4,98E+05	150.58
E-2.08 E-2.09	2300	Top	400	203.2	404.92	35,24	330.88	2.57E+06	334.51
		Intern.	1200	203.2	360.54	35,67	236.71	1.36E+06	249.73
		Bottom	1400	203.2	392.66	35,67	310.05	1.34E+06	338.81

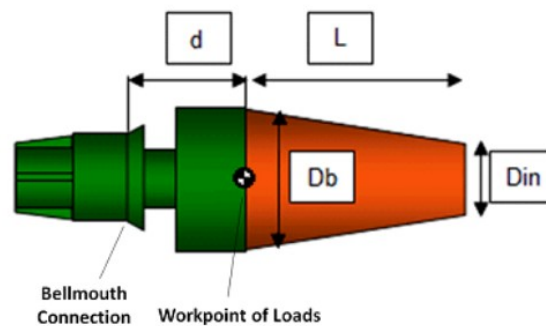



Figure 2 - Bend-stiffener dimensions

Table 3 - Reference bend-stiffener data

Envelop	WD [m]	Db [mm]	Din [mm]	L [m]	d [m]	E [MPa]
E-1.01	1000	661.5	194.8	1.7	1.2	103.4
E-1.05	1500	761.5	200.5	2.2	1.2	103.4
E-1.02	1000	811.5	253.9	2.1	1.5	103.4
	1500	1011.5	303.3	2.8	1.5	103.4
E-1.03	1000	1011.5	317.4	2.6	1.5	103.4
	1500	1150.0	320.0	2.50	1.5	103.4
E-1.04	1000	1061.5	327.9	2.7	1.5	77.0
E-1.08	1000	1011.5	310.5	2.6	1.5	77.0
E-1.09	1500	1111.5	308.5	3.2	1.5	103.4
E-1.11	1000	1061.5	372.0	2.5	1.5	77.0
E-1.12	1500	1311.5	407.5	3.10	1.5	77.0

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E-2.01	1500	1311.5	407.5	3.10	1.5	77.0
	2300	961.5	240.1	2.4	1.2	77.0
E-2.02	1000	861.5	232.5	2.3	1.5	77.0
E-2.02	2300	1261.5	421.1	2.8	1.5	77.0
E-2.03	2300	1261.5	421.1	2.8	1.5	77.0
E-2.04	2300	1161.5	365.9	2.7	1.5	77.0
E-2.06	2300	1181,5	354,5	2,7	1,5	77,0
E-2.07						
E-2.08	2300	1361.5	397.6	3.3	1.5	77.0
E-2.09						
E-2.10	2300	1211,5	416,5	2,7	1,5	77.0

d) Mooring Analysis - Offsets

For the preliminary analyses the manufacturer shall consider the offsets informed in the Table 4.

Table 4 - Reference offsets

Design Case	Mooring System	Offset Limit [% WD]	Error Position	Environmental Condition		
				Wave	Wind	Current
Operating Environment (Annual)	Intact	7.0	1,5% LDA + 7,5 m	1-year	1-year	1-year
Extreme Environment (Centenary)	Intact	9.0	1,5% LDA + 7,5 m	100-year	100-year	10-year
			1,5% LDA + 7,5 m	10-year	10-year	100-year
	One line broken	9.5	1,5% LDA + 7,5 m	100-year	100-year	10-year
			1,5% LDA + 7,5 m	10-year	10-year	100-year

Note: The Offset Limit values do not include positioning errors. For the riser analysis the values must be added.

e) Vessel Motion Analysis

For the preliminary analyses the manufacturer shall consider the RAO data informed bellow and the draft frequency indicated in the Table 5 and Table 6.

Ref.	Designation	Title	Ed.
[52]	RAO data for risers designed to water depth of 1500 m	Generation ff Standard RAOs - Process plant weight of 20.000 t	-
[53]	RAO data for risers designed for water depth of 2300 m	Generation ff Standard RAOs - Process plant weight of 35.000 t	-
[54]	I-RL-3010.2B-1350-960-P4X-001 (RAO data for risers designed for water depth of 3100 m)	Reference RAO	A


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Table 5 - Draft Frequency for 1500 m and 2300 m Floating Reference RAO

Condition	Frequency
Full	17%
Int1	33%
Int2	33%
Ballast	17%

Table 6 - Draft Frequency for 3100 m Floating Reference RAO

Condition	Frequency
Min. Loaded (10.8 m)	7.5%
24P (13.2 m)	32,5%
47P (16.1 m)	38.0%
69P (19.0 m)	16.0%
Max. Loaded 100P (23.8 m)	6%

2.17. Top Annulus Venting System

Petrobras uses three venting systems described below. For a) and b) the manufacturer shall supply two vent valves and one free vent adaptor and for c) the manufacturer shall supply one vent valve and two free vent adaptors. All the interfaces shall be 3/8" NPT male.


- Automatic Control – This type of annulus monitoring and relief system integrates the pressure control and data acquisition into the FPU supervisory system, allowing alarms, historic trends, and a tighter control of the pressure within the annulus area.
- Manual Control – This type of annulus monitoring and relief system uses manometers and mechanical PSVs.
- Continuous Vented – The purpose of this system is to keep the annulus pressure as low as possible and is normally adopted for acid gas or sour service applications.

Gas venting systems for submerged top end fitting shall be supplied according to Section 6.1.5 of I-ET-3000.00-1519-291-PAZ-004

For reference riser analysis the manufacturer can consider the Continuous Vented system c.

2.18. Metocean Data

Ref.	Designation	Title	Ed.
[55]	I-ET-3000.00-1000-941-PPC-001	Metocean data (for risers and flowlines designed for water depth up to 1500m)	F
[56]	I-ET-3A26.00-1000-941-PPC-001	Metocean data (UO-BS) (for risers and flowlines designed for depths greater than 1500m)	F

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2.19. Riser Parameters

All riser designed for 1500 m water depth shall be in free hanging configuration. For risers designed for 2300 m water depth that cannot be installed in free hanging, the manufacturer shall use as reference the riser configurations presented in [57], [58] and [59] in order to design the pipe structures. The pipe envelope E-2.01, E-2.02 and E-2.03 shall be designed for free hanging configuration. For 3100 m pipe design, the manufacturer is free to propose the riser configuration but shall inform it to Petrobras using the template [66] in order to verify the compatibility with other risers' configurations (umbilical, flexible or rigid pipes).

Ref.	Designation	Title	Ed.
[57]	I-FD-3A52.01-1519-274-PLR-001	Preliminary Configurations Description for Infield Risers and Gas Export Riser of Berbigão	0
[58]	I-FD-3A26.06-1500-274-PZ9-001	Configurations Description for Flexible Risers and Umbilicals of Lula Norte	0
[59]	I-FD-3A36.04-1500-274-PLR-001	Preliminary Configurations Description for Infield Risers and Gas Export Riser of Buzios IV	0

2.20. Subsea Equipment


Ref.	Designation	Title	Ed.
[60]	-	Dados MCV ANM e Manifold.xlsx	-
[61]	-	Dados de ESDV, PLET e PLEM.xlsx (for gas export lines)	-

2.21. Soil Data

As reference soil data the manufacturer shall consider the soil data informed in Table 7.

Table 7 - Soil parameters

Soil Parameter Table	
Presence of Coral on Bottom	No
Bottom Inclination (°)	0,03 – 28
Soil description (clay, sand, etc.)	Mud (clay + silt)
Seabed scour/sand waves occurrence	No
Soil shear strength (kPa)	1,32 – 5,7
Lateral friction coefficient	1,07
Longitudinal friction coefficient	0,35 – 0,45

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2.22. Chemical Injection

Ref.	Designation	Title	Ed.
[62]	I-FD-3000.00-1260-291-PAZ-001	Chemical Injection (general data)	0
[63]	I-FD-3500.00-6500-291-PAZ-001	Chemical Injection in Flexible Pipes	0
[64]	I-ET-3000.00-1210-010-1DO-001	Fluids for Special Operations	

3. ADDITIONAL REQUIREMENTS

Pipes with Insulation Layers shall always have both an Outer Sheath and an External Protective Sheath. The Insulation Layer shall be positioned between the Outer Sheath and the External Protective Sheath. The design of the pipe shall account for the thermal effects of a continuously flooded Insulation Layer.

4. TEMPLATES

Ref.	Designation	Title	Ed.
[65]		- Modelo de Design Premise Rev.1.doc	-
[66]		- FlexibleRiserDataSheet2.2.zip	-