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1. INTR	ODUCTION					
This Technical Description has been prepared having as a basis on Brazilian Labor Secretary Ordinance 1846 of July 1st, 2022, which modified Regulatory Standard Number 13 for Boilers, Pressure Vessels, Piping and tanks, and serves as a guide for the SELLER to comply with its requirements.						
This Technic applied into Minister Sta	This Technical Description also covers some other Regulatory Standard that are also, but not only, applied into the Unit Plant and facilities as a Guideline to help SELLER to comply with Brazilian Labor Minister Standards.					
This Technic	al Description contains mandatory te	echnical requirements.				
The requiren the scope of sub supplien document, th	nents herein listed are applicable to this Unit, including manufacturers, pa s, integrators, constructors, and all te ney are all referred to as being SELLI	all players performing such r ackagers, main contractor, sub echnical personnel involved. V ER.	elated activ contractors, Vithin the sc	ities within suppliers, ope of this		
2. REFERE						
	NICAL SPECIFICATIONS					
- Pl	ETROBRAS NI-1710 - Systems Codi	fication Standard				
- E D	Г-3010.1Ү-1200-91А-Р4Х-001 RE0 АТАВООКЅ	QUIREMENTS FOR O&M	1 MANUA	LS AND		
2.2 <b>BRAZ</b>	<b>ILIAN REGULATIONS</b>					
- N ar	R-12- SEGURANÇA NO TRABALHO Id Machinery Labor Safety)	D EM MÁQUINAS E EQUIPA	MENTOS (I	Equipment		
- N (B	R-13 – "Caldeiras, Vasos de Pressã oilers, Pressure Vessels, Piping and	13 – "Caldeiras, Vasos de Pressão, Tubulações e Tanques Metálicos Atmosféricos" ers, Pressure Vessels, Piping and Metal Storage Tanks)				
- N	R-15 - "Atividades e Operações Insal	ubres" (Unhealthy Activities a	nd Operatio	ns)		
- N H	२ 20 – "Segurança e Saúde no Trab ealth at Work with Flammable and Co	oalho com Inflamáveis e Com ombustible)	bustíveis" (S	Safety and		
- N	२-26 – "Sinalização de Segurança" (९	Safety Signs)				

 NR-37 – "Segurança e Saúde em Plataformas de Petróleo" (Safety and Health at Oil Marine Platform)

# 2.3 BRAZILIAN STANDARDS

ABNT – "Associação Brasileira de Normas Técnicas" (Brazilian Association of Technical Standards)

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- ABN vess	JT NBR 15417 - "Vasos de pressão sels - Safety inspection in service)	o - Inspeção de segurança o	em serviço" (Pressure				
- ABN Prin and	IT NBR ISO 3864-1 – "Símbolos grá cípios de design para sinais e marc Safety)	áficos — Cores e sinais de se ações de segurança" (Graph	∋gurança - Parte 1 e 2: nical symbols – Colors				
2.4 INTERNATIONAL STANDARDS							
ASME -	<b>ASME -</b> ASME BPVC Section VIII Division 1 and 2 - Rules for Construction of Pressure Vessels						
NFPA -	NFPA 30 - Flammable and Combus	stible Liquids Code					
API Sta	Indard						
- API Alte	510 - Pressure Vessel Inspection ration	Code: In-service Inspection	ı, Rating, Repair, and				
- API Pipi	570 - Piping Inspection Code: In-se ng	ervice Inspection, Rating, Re	pair, and Alteration of				
- Syst	tems						
- API	572 - Inspection Practices for Press	sure Vessels					
- API	574 - Inspection Practices for Piping	g System Components					
3. DEFINITIC	)NS						
ABN1 Stand	Γ – "Associação Brasileira de Norn lards).	nas Técnicas" (Brazilian As	sociation of Technical				
Auxil for co	iary systems of machinery packag oling, lubrication, or sealing purpose	<b>je</b> – set of equipment and aux es.	iliary devices intended				
<b>Brazi</b> de Me	lian National Institute of Metrolog etrologia, Qualidade e Tecnologia - I	<b>jy, Quality and Technology</b> INMETRO")	/ – ("Instituto Nacional				
Car S the opress	<b>beal Open/Close (or Lock-and-key</b> pen position to avoid closing the v sure relief device.	r) Device – device used to lo valves installed between pre	ock or "seal" a valve in ssure vessels and its				
CONI and A	FEA – "Conselho Federal de Engenh (gronomy).	naria e Agronomia" (Federal (	Council of Engineering				
CON and e	<b>FRACTOR / SELLER</b> – hired Comp execution of engineering services.	any which is responsible for	the supply of materials				

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**CORROSION RATE** – loss of thickness per unit of time, verified at a point or set of contro points.

**CRA** – Corrosion Resistant Alloys

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**CREA** – "Conselho Regional de Engenharia e Agronomia" (Regional Council of Engineering and Agronomy).

**DATABOOK** – a set of documents and records, provided by the SELLER, on paper, and in digital format. It contains records of all services, personnel, materials, and controls that occurred during the design, manufacture, assembly, inspection, and testing of equipment and piping systems.

**DEAD LEG** – piping components or regions that normally do not show significant flow. They are framed as dead zones: connections with blind flange, bypass systems ("by-passes") or control valves pipes with little use, sighs and drains of equipment and piping, connections for instrumentation, and auxiliary services, inlet connections of safety valves, etc.

**Definitive Installation Site** – Vessel or FPSO (Floating Production Storage and Offloading).

**Design Code** – a set of standards and rules establishing the requirements for design, construction, assembly, quality control during equipment manufacturing and inspection.

**Designer** – responsible to assure that the unit engineering design complies with the requirements of applicable codes and standards, technical specifications, Brazilian Regulations, and other contractual documents.

**NR-13 Dossier** – a set of documents and records regarding the equipment design, manufacturing, assembly, inspection, tests and maintenance that shall comply with Labour Brazilian Authority.

**EQUIPMENT INSPECTOR** – Professional with skills and training as specified in Annex B of Decree No. 537 of 2015 from INMETRO.

**EQUIPMENT RECORD** – Set of documents and records issued before the equipment starts operation to comply with regulatory norm NR-13, INMETRO Decrees 537, and 582 of 2015 and other requirements established by BUYER.

**Examination** – activity conducted by a Qualified Professional or qualified or certified technicians, as required by codes or standards, to assess whether certain products, processes, or services according to specified criteria. Examination shall be internal and/or external, as defined below:

- External examination: A visual inspection performed from outside the system, to assess external issues that could impact the system's ability to maintain pressure integrity. External inspections are also intended to evaluate conditions that compromise the coating integrity, insulation coverings, supporting structures, and attachments (e.g. stanchions, pipe supports, shoes, hangers, and small branch connections).
- Internal examination examination in the equipment internal surface and internal components, visually performed using the appropriate tests to assess their

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	structural integrity. In case of she the tubes bundle.	ell and tube heat exchang	er, it includes pull out
EXAN specif accura	<b>MINATION POINT, RECORDING PO</b> fic location on a system to obtain a rep ate corrosion rate along the equipmen	INT, MEASUREMENT PO beatable thickness measur ht life cycle.	<b>DINT, TEST POINT</b> – A ement to establishing an
FINAI install integr will be modu	L INSTALLATION SITE – Final instal ed, even though this module may ated to the FPSO on a later stage. It is transported to a different location) vis le is fully integrated.	llation on the module that still be transported to a s important to emphasize sual external inspection sh	piping and equipment is different location to be that in this case (module all be repeated after the
Final been	Interconnection of the Module – e welded and nondestructively inspecte	vent that occurs when all d.	module tie-in joints has
<b>Gradı</b> multip where requir	ual opening of safety valves – differ le safety valves provided in the design opening values above the MAWP ed for overpressure relief in different s	rentiated opening pressure gn code for equipment pr can be established, cor scenarios.	e calibration condition of otected by such valves, sidering the flow rates
<b>Hydro</b> equipi by the	<b>Ostatic Testing</b> – Pressure test with ment structural integrity and the rearrant design code.	incompressible fluid perfo angement of possible resic	ormed for evaluating the lual stresses as required
<b>Initial</b> definit	<b>Safety Inspection</b> – inspection petitive installation site and before it starts	erformed on new equipn s operating comprising:	nent, assembled at the
• E	xternal inspection: direct visual exami	ination and thickness mea	surement.
• Ir	nternal inspection: direct visual examir	nation.	
• apı	Non-destructive examinations and plicable.	integrity assessment	nethodologies, when
INSPI metho based	ECTION PLAN – A documented set of ods, and timing of specific inspection a l on defined/expected damage.	actions and strategies deta ctivities to determine the s	ailing the scope, extent, ystem condition usually
<b>Inspe</b> a con sched	<b>ection Reports</b> – formal record for res inclusive indication about equipment in luled inspection.	ults in inspections carried integrity and operational	out on equipment, with conditions till the next
<b>Intern</b> given intern	nal filling – materials inserted in pres service life, such as catalysts, filling, n al accessories are not considered to b	ssure vessels for specific polecular sieves, and activ pe internal filling.	ourposes and having a ated carbon. Trays and
<b>INSPI</b> contai	ECTION ISOMETRIC – drawing in ining at least the following inform	isometric perspective, n nation: Module, elevatio	ormally without scale, n, origin, destination,

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geog thickr	raphical orientation, flow direction, liness control points, and installation poir	ne identification, access nts for coupons and corro	sories and sion probes	equip	oment,
<b>INSP</b> requi	<b>ECTION OBJECTS</b> – All equipment rements described in this technical spe	and piping systems th cification.	nat are sub	ject 1	to the
Line which temp	<ul> <li>individual part section (individualized obeys a single specification of materia erature.</li> </ul>	<ol> <li>of a pipe located betwee ls, carried products, designation</li> </ol>	een two def gn pressure	ned p and c	ooints, design
LINE follow class test p	<b>LIST</b> – Also known as the piping datas ving information: identification (TAG), ification, operating and design pressure pressure, coating, pipe thickness, amon	heet. A document listing diameter, origin and de , operating and design te g others following BUYE	the lines co estination, fl emperature, R Standard	ntainii uid a hydro N-169	ng the nd its ostatic 92.
<b>Mach</b> syste	nine Package – set of equipment and de ms.	evices composed by the m	nachine and	its au	ixiliary
Manu	ufacturer – company responsible for bo	oilers, pressure vessels o	r piping con	struct	ion.
<b>Maxi</b> equip used	<b>mum Allowable Working Pressure</b> oment can be continuously subjected ac materials, the equipment dimensions a	(MAWP) – the highest cording to the design coc nd its operating parameter	pressure to le, the resisters ers.	o whi ance	ch an of the
Maxi categ opera	<b>mum operating pressure</b> – for framin pory, the maximum operating pressure is ates under normal process conditions, f	ng purposes and definitions the highest gauge pressones oreseen in design.	on for press sure that the	ure ve equi	essels pment
MEA differ	SUREMENT REGION (MR) – place wh ent spots, in which the corrosion rate a	ere the thickness of a pip nd remaining life time is c	be is measur letermined.	ed in	some
<b>Pipin</b> trans with b	<b>Ig</b> – set of lines, including their access portation of fluids between equipment fu poilers or pressure vessels.	sories, designed by spec rom the same unit of a co	ific codes, i mpany that	ntend is equ	ed for uipped
<b>PIPIN</b> lines MRs acces consi	<b>IG ACCESSORIES:</b> components used and between lines and equipment. For are curves, Ts, branch connections, ssories, such as flanges, valves, nippl dered for calculating the number of MR	in piping intended for intended	erconnectio essories for r reducers, among othe	ns be calcu etc. ers, a	tween ulating Other re not
<b>PIPIN</b> condi reliab	<b>IG INSPECTION:</b> a set of actions to itions, using techniques, procedures, a ble system operation within defined dea	to supervise and monition and methods that aim to dlines.	or the pipir guarantee	ng ph a saf	nysical e and
<b>Pipin</b> conta points	<b>ng isometric drawing –</b> drawing of aining the following information: geog s of origin and destination, location of w	piping, in isometric pers raphic orientation, flow o velds, drains, vents and o	spective wit direction, lir ther access	hout ne nu ories.	scale, ımber,
<b>Pipin</b> base	ng material specification - alphanume materials of the pipes and piping acces	ric code that defines the ssories.	pressure cla	ass ai	nd the

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Pipin repre relation the s accon and c	representation of the piping, process control, and instrumentation which shows the f relationships among the system components. The P&ID ties together the system de the system flow diagram, the electric control schematic, and the control logic di accomplishes this by showing all piping, equipment, principal instruments, instrume and control interlocks.						
Pipin set o with s	Ig system – an assembly of interco r sets of design conditions, or that h similar technical and process charac	onnected piping circuits that a have been grouped together for cteristics.	re subject to the same or inspection purposes				
PIPIN conce an ev	<b>VG SYSTEM INSPECTION CLAS</b> erning the effects on the safety of per ventual leak.	<b>SS:</b> the degree of importance of importance eople, installations, and the end	ce of piping systems nvironment, caused by				
<b>Porta</b> facilit	able receptacles - pressure vesse ies and cannot be classified as tran	els that can be moved within sportable.	a facility or between				
<b>N-17</b> Enge	<b>10-</b> BUYER Systems Codification S enharia)	Standard (Codificação de Doc	cumentos Técnicos de				
Nam in this	<b>eplate</b> - plate containing equipment s regulatory standard, fixed at a cor	t data in accordance with the spicuous place.	requirements set forth				
NPS of a c	("NOMINAL PIPE SIZE"): a dimen conduit pipe.	sionless term that designates	s the nominal diameter				
<b>OWN</b> Institu "Cert estat	I EQUIPMENT INSPECTION SER uto Nacional de Metrologia, Normali ification Bodies" accredited by it, wh blished in Decrees No. 537 and 582	<b>VICE (SPIE):</b> Certification g zação e Qualidade Industrial nich will verify the prior fulfillme of 2015 from INMETRO.	ranted directly by the (INMETRO) or through ant of the requirements				
<b>Pres</b> et the p	sure Indicator (PI/PIT): Device for iping system. Also included Pressu	measuring the pressure in the ressure in the re Indicator and Transmitter.	e pressure vessel or in				
Pres durin of a s Relie	<b>sure relief device -</b> A device actu g emergency or abnormal conditions specified design value, such as Pre f Valves, Pin Device, etc.	ated by inlet static pressure s to prevent a rise of internal fl ssure Safety Valve, Rupture	and designed to open luid pressure in excess Disk, and Buckling Pin				
<b>Pres</b> : Purch	sure Design Code: Recognized pl haser. Example ASME BPVC Section	ressure vessel standard spec on VIII, EN 13445, etc.	cified or agreed by the				

**Pressure Indicator (PI/PIT):** Device for measuring the pressure values in the pressure vessel or in the piping system. Also included Pressure Indicator and Transmitter.

**Pressure Relief Device** - A device actuated by inlet static pressure and designed to open during emergency or abnormal conditions to prevent a rise of internal fluid pressure in excess of a specified design value such as Pressure Safety Valve, Rupture Disk, Buckling Pin Relief Valves, Pin device, etc.

**Pressure Vessels** – Chamber designed in accordance with internationally recognized pressure vessels standards and codes, intended to safely withstand internal pressures that

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are different than atmospheric pressure, or subjected to external pressure, thus fulfilling their						

are different than atmospheric pressure, or subjected to external pressure, thus fulfilling their basic function in the process in which they are inserted. For this regulatory standard purposes, the following items are included:

- a) Pressure vessels, heat exchangers, evaporators, air-coolers, chillers of HVAC system, and the like;
- b) pressure vessels or parts subject to direct flame those are not within the scope of other Regulatory Standards (NRs), nor explicitly excluded from NR-13 scope;
- c) jacketed pressure vessels, including reboilers and reactors;
- d) autoclaves and boilers containing thermal fluid;
- e) compressed air pressure vessels supporting reciprocating compressors;
- f) pulsation dampeners in compressors and pumps.
- g) hydraulic accumulators

**Qualified Professional** - a person who is legally capable to exercise the engineering profession in the activities related to the construction design, operation and maintenance monitoring, inspection and inspection supervision for boilers, pressure vessels and piping, in accordance with the Brazilian professional regulations. CONFEA - Resolution Number 218 of June 29, 1973, as well as CONFEA normative decisions Number 029/88 and Number 045/92, establish the professional graduated in mechanical engineering as Qualified Professional in the following activities: mechanical design, manufacturing, installation, assembly, inspection, repair, maintenance activities. The Qualified Professional shall be an engineer designated by the manufacture or SELLER.

**RELEVANT PLAN (PL):** are the positions on the piping where thickness measurements are made.

**REMAINING LIFE (VR):** a period estimated through the corrosion rate and the current thickness, starting from the inspection date, that the system or piping would take to reach the minimum thickness required to operate reliably.

**Safety Records Book-** For Contractual purposes, the Safety Record Book shall record all inspections occurrences during the pre-commissioning phase of boilers and pressure vessels, and shall be registered by Qualified Professional. The Safety Record Book may be a set of sequential books.

The safety record book may be delivered a part as it covers various equipment.

**Serious and imminent risk** - any condition or work situation that may cause accident or work-related disease and severe injury to the worker physical integrity, according to NR-3.

**SPIE "Serviço Próprio de Inspeção de Equipamentos"** - Equipment Inspection Own Service is granted by Brazilian Authorities (INMETRO or IBP) to Brazilian operators companies. After BUYER is granted with SPIE certification, inspections interval are longer reducing shut down frequency. Buyer is the sole responsible to obtain SPIE Certification.

**System folder** - set of documents that shall be organized and maintained by the SELLER till final system delivery to BUYER.

**TECHNICAL RESPONSIBILITY NOTE (ART):** Document issued by the competent body institution in the Brazilian region (CONFEA/CREA) in which the engineer responsible for

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inspecting equipment and piping (Qualified Professional) has a registration and determines their technical responsibility.

TML - Thickness Monitoring Locations

**Transportable Receptacles** - receptacle designed and built to be transported pressurized in accordance with applicable standards and regulations of transportable receptacles. To be considered transportable container, the equipment shall be designed in accordance with the requirements addressed by specific rules of transportable equipment, such as ISO 9809, DOT-3A, DOT-3AA, etc.

**UT** - Ultrasonic examination

**Volume (V)** - means the internal net volume of the pressure vessel or chamber, including the nozzles down to the first connection or weld.

**VT**- Visual examination;

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#### 4. SCOPE OF CONTRACT

- 4.1 As per EXHIBIT I SCOPE OF SUPPLY, SELLER shall comply with all rules and regulations of all Regulatory Bodies Entities and Brazilians Authorities.
- 4.2 All information and documents required by Brazilian Authorities, Regulatory Entities, shall be issued, prepared, provided and delivered by SELLER to the BUYER.
- 4.3 SELLER shall provide all information, support, inspections, documents and reports to accomplish to all requirements to comply with NR-13 and support BUYER SPIE Certification.
- 4.4 SELLER is responsible to ensure that all suppliers and sub-suppliers will meet the items described in this Technical Specification, in NR-13, in INMETRO Decrees No 537 and 582, of 2015.

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#### GUIDELINES FOR INTEGRITY AND LABOR AUTHORITY STANDARD RULES COMPLIANCE

#### 5. COMPLIANCE WITH NR-13 - PRESSURE VESSELS (NR-13 Item 13.5)

#### 5.1 OBJECTIVE

This Technical Description has been prepared having as a basis on Brazilian Labor Secretary Ordinance 1846 of July 1st, 2022, which modified Regulatory Standard Number 13 for Boilers, Pressure Vessels and Piping, and serves as a guide for the SELLER to comply with its requirements.

Full compliance with NR-13 is mandatory.

The actions herein referred shall be performed by the SELLER, except where otherwise stated, for all pressure vessels being supplied within the scope of this project.

#### 5.2 GENERAL REQUIREMENTS

- 5.2.1 All pressurized containers shall be designed, manufactured, assembled, and inspected according to related codes and national or international standards, such as the ASME BPVC code. Equipment designed and built using pressure vessel standards are subject to the NR-13 requirements. They shall be thoroughly inspected and tested in the manufacturer's shop as required by the design code and any additional contractual requirements.
- 5.2.2 Pressure vessels shall be fully inspected and tested by the manufacturer in accordance with the design and construction code and other contractual requirements.
- 5.2.3 For the NR-13 compliance purposes, pressure vessels are chambers designed and built in compliance with recognized pressure vessel standard or code, such as: ASME BPVC Section VIII, BS PD 5500, AD Merkblätter, EN 13445, Pressure Equipment Directive 97/23 / EC, ASME BPVC Section X, ASME RTP-1, API STD 660, API STD 661, etc.
- 5.2.4 NR-13 requirements and the provisions of ITEM 5 of this Technical Specification shall be applied to the following equipment, as per NR-13 item 13.2.1:
  - a) Pressure vessels whose pressure x volume (P×V) product exceeds 8 (eight), where P is the maximum operating pressure in kPa, in module, and V their internal volume in m<sup>3</sup>;
  - b) Pressure vessels containing class A fluid (see <u>item 5.3</u>), regardless of its dimensions and PxV product;
  - c) Portable receptacles with a P×V product that exceeds 8 (eight), where P is the maximum operating pressure in kPa and V their internal volume in m<sup>3</sup>, or containing Class A fluid (see <u>item 5.3</u>).
  - d) Pressure vessels operating only subject to vacuum condition equal to or greater than 5 (five) kPa, regardless of the class of fluid contained.
- 5.2.5 SELLER is responsible for engineering detailing design and shall check in which NR-13 Item 13.2.1 or 13.2.2 the pressure vessels are subject to comply.

SELLER shall issue a list with all pressure vessels and General Equipment of the Unit, listing all variables used in the analysis (e.g. PxV product, PxV group, fluid type, fluid class), and also clearly defining if the equipment is subject to NR-13 Item 13.2.1 and consequently to NR-13 Item 5 requirements (Item 5 of this Technical Specification), or, if the pressure vessel is exempt to NR-13 Item 13.2.1, as per NR-13.2.2.

This complete list shall be fulfilled as per ANNEX V.

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SELLER Qualified Professional shall shock and validate this list, making any adjustments					

SELLER Qualified Professional shall check and validate this list, making any adjustments deemed necessary. This list shall be commented and approved by BUYER.

- 5.2.6 Transportable vessels/containers connected with process plant or platform installations are within the scope of NR-13 regulation, according to NR-37, item 37.21.1.1.
- 5.2.7 Transportable container shall be designed, constructed, inspected and fixed in accordance with the requirements addressed by specific rules of transportable equipment, such as ISO 9809, DOT-3A, DOT-3AA etc.
- 5.2.8 The NR-13 requirements for pressure vessels are not applicable for pipeline or piping fittings. To be considered a pipeline, industrial piping or pipe fitting, the equipment shall be designed, constructed and inspected according to specific piping or pipeline standards, such as ASME B31.1, ASME B31.3, ASME B31.4, ASME B31.8, ASME B16.34, etc.
- 5.2.9 The Qualified Professional to accomplish and comply to this Technical Specification shall be an Engineer designated by the equipment manufacturer or SELLER. The Qualified Professional shall have professional registration in accordance with Brazilian regulations.
- 5.2.10 All pressure vessels equipment is subject to ITEM 5 of this Technical Specification, except the following, as per NR-13 Item 13.2.2, subject to ITEM 7 of this Technical Specification:
  - a) Transportable receptacles not connected with platform installations.
  - b) Equipment with maximum operating pressure equal to atmospheric pressure.
  - c) Pressure vessels that are integral parts of auxiliary systems packages machines, which are intended for cooling, lubrication, or sealing in these machines.
  - d) Tanks and receptacles for fluids storage not characterized as pressure vessels (designed by codes other than pressure vessels ones);
  - e) Pressure vessels with an inside diameter less than 150 mm (one hundred fifty millimeters) for Class B, C, and D fluids (see <u>item 5.3</u>);
  - f) Corrugated gasket plate heat exchangers.
  - g) Pressure vessels operating only subject to vacuum condition less than 5 (five) kPa, regardless of the contained fluid class.
  - h) Filters and strainers, without legs, saddles or skirt supported by piping.
  - Pressure vessels made of fiberglass reinforced plastics, containing Class A or B fluids, with internal volume greater than 160 liters and maximum internal operating pressure greater than 50 kPa;
- 5.2.11 The exceptions referred in <u>item 5.2.10</u> and pressure vessels with P × V less than 8 (eight) shall still be subject to the manufacturer's inspection, in accordance with design code or applicable standards.

# 5.3 CLASSIFICATION OF FLUIDS AND CATEGORY OF PRESSURE VESSELS

5.3.1 For the NR-13 application purposes, pressure vessels shall be classified by categories according to the class of fluid and the potential risk.

The regulatory requirements described in NR-15 and the definitions established by NFPA 30 shall be used as reference.

The contained fluids in pressure vessels shall be classified as described below:

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Class A						
Flamma	ble fluids (liquid and gas);					
Combustible fluids with a temperature of 200°C or above (two hundred degrees						
	Celsius); Toxic fluids with a tolorance limit of 20 (twenty) parts per million (ppm) or lower:					
Hvdroa	en:	1100001,				
Acetyle	ne.					
Class E	3					
Combus	stible fluids with a temperature lower than 200°C (two hundred d	egrees				
	, uids with a tolerance limit higher than 20 (twenty) parts per millio	n (nnm)				
		(pp:://				
Class C						
Steam,	simple asphyxiating gases or compressed air.					
Class D						
Other fl	uids not belonging to the above categories.					
Note	(Definitions according to NR-20):					
- Flan	nmable fluid: liquid with flash point <u>&lt;</u> 60º C.					
- Flan	nmable gases: ignite with air at 20º C and standard pressure of 1	01.3 kPa.				
- Com	bustible fluid: fluids with flash point > 60° C e $\leq$ 93° C					
5.3.2 In o em	case of fluid mixture, for classification purposes the fluid present ployees and facilities shall be considered, taking their toxic	ting the high ity, flamma	nest risk to bility, and			
cor	centration into account.		-			
5.3.3 Pre "P× volu	ssure vessels shall be classified in risk potential groups in accord V", where P is the maximum operating pressure, in module a ume in m3, as follows:	dance with tl nd in MPa a	ne product and "V" its			
Group	<u>0 1</u> - P×V ≥ 100					
Group	$\frac{1}{2} - P \times V < 100 \text{ and } P \times V \ge 30$					
Group	$53 - P \times V < 30$ and $P \times V \ge 2.5$ $4 - P \times V < 2.5$ and $P \times V \ge 1$					
Group	<u></u>					
5.3.4 The to r	e pressure vessels shall be classified by category in accordance v isk potential groups and the class of fluid.	vith <u>Table 1</u> ,	according			

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TITLE:

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Table 1 – Pressure Vessel Categories					
		Risk	Potential G	roup	
	1	2 PxV <	3 PxV <	4 PxV <	5
Fluid Class	P×V ≥	100	30	2.5	PxV < 1
	100	P×V≥	P×V≥	P×V≥1	
		30	2.5		
			Categories		
"A" - Flammable fluids - Combustible fluid with a temperature of 200°C or above - Toxic fluids with a tolerance limit below 20ppm - Hydrogen - Acetylene	I	I	II	III	111
<ul> <li>"B"</li> <li>Combustible fluid with a temperature lower than 200°C</li> <li>Toxic fluids with a tolerance limit above 20ppm</li> </ul>	I	II	111	IV	IV
"C" - Steam - Simple asphyxiating gases - Compressed air	I			IV	V
"D" - other fluids	II	III	IV	V	V

Notes:

a) Consider volume in m<sup>3</sup> and pressure in MPa;

b) Consider MPa corresponding to 10.197 kgf/cm<sup>2</sup>;

- 5.3.5 The designer responsible for the engineering detailing design shall check and approve the classification of fluid.
- The manufacturer shall categorize the pressure vessel based on the classification of fluids 5.3.6 and equipment maximum operating pressure.
- The fluids and pressure vessels classification shall be checked and approved by 5.3.7 SELLER's Qualified Professional.
- 5.3.8 Heat exchangers may have their category established in the following ways:
  - a) Considering the most critical category between the shell and the tube side (head cover/channel), or;
  - b) Considering the shell as a pressure vessel and the tube side (head cover/channel) as another pressure vessel.

Regardless of the categorization form, the shell and the tube side shall have pressure relief devices and pressure indicators.

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5.3.9 SELLER shall provide spreadsheets in an electronic file "Microsoft Excel" according to ANNEX III for all pressure vessels and General Equipment scope of Contract.

## 5.4 **IDENTIFICATION**

- 5.4.1 All pressure vessels shall have an indelible nameplate attached to their bodies in an easy access and conspicuous place according to the samples in <u>Annex I</u>. All information shall be written in Portuguese (Brazil) language, and with the units indicated in the International System (SI). The value of the hydrostatic test pressure indicated on the nameplate shall be the same as performed during the manufacturing phase.
- 5.4.2 In addition to the nameplate, the pressure vessel category shall be shown at a visible location along with its TAG (identification code). Digits and letters shall be as described in <u>Annex II</u>.
- 5.4.3 The pressure vessel TAG, category and nameplate locations shall be defined in a way it is not behind piping, ladders, platforms and other accessories after final location.

SELLER is responsible to check if the nameplates of pressure vessels supplied inside packages or skids are in accordance with this technical specification. If not, SELLER is responsible to replace the nameplates.

## 5.5 **PRESSURE VESSEL INSTALLATION**

- 5.5.1 The pressure vessel installation shall be designed so that all drains, vents, manholes, and level, pressure and temperature indicators, if any, are easily accessible. The accessories described in this item, which require the presence of the Operation, Maintenance or Inspection worker, shall allow easy and secure access by stairs, platforms and others in accordance with applicable regulations.
- 5.5.2 The installation design shall ensure that pressure vessels are equipped with the following items:
  - a) Safety relief valve or another pressure relief device with an opening pressure set to less than or equal to the MAWP, installed directly in the pressure vessel or in the system including it, considering the requirements of the design code for gradual openings and calibration tolerances;
  - b) Car seal open/close device, with warning signs, according to <u>ITEM 7.5.2</u>, to prevent the blocking of safety valve or other pressure relief devices, besides all LC/LO valves according to P&IDs designs.
  - c) Instrument indicating the operating pressure, directly installed in the pressure vessel or system containing it.
- 5.5.3 All NR-13 categorized equipment shall have pressure relief devices (pressure safety valve or rupture disk), whether installed directly on the equipment or on the system that contains the equipment.

*Note 1:* Devices such as pressure gauges, pressure reducing valves, pressure transmitters and pressure switches for alarm and trip are components in the monitoring hierarchy of system operating conditions and are not considered pressure relief device.

**Note 2:** The pressure relief devices are the devices for instantaneous mechanical relief in the internal pressure of pressure vessel which only uses the pressure itself as an energy source for actuation before the maximum allowable working pressure is exceeded.

**Note 3**: In the case of a control valve, self-operated valve or remote actuation, between the pressure relief devices and the equipment or system to be protected, it is considered capable of being closed, even if it is "fail-open" type. Therefore, there shall be a safety accessory of the valve upstream and downstream.

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- 5.5.4 The installation of the pressure vessels shall meet the following requirements:
  - a) provide at least 2 (two) wide exits, permanently unblocked and arranged in different directions.
  - b) provide an easy and safe access to the maintenance, operation and inspection.
  - c) provide illumination in accordance with contractual specifications.
  - d) has emergency illumination systems in accordance with contractual specifications.
- 5.5.5 The pressure indicators and pressure relief devices shall have an indelible stainless steel 304 nameplate with their identification (TAG Number). The TAG of these pressure indicators and relief devices shall be printed, or engraved, in a legible and indelible form. If wire used to fix the nameplate in the pressure indicator, the wire shall be at least Stainless Steel 316 0.7 mm diameter.
- 5.5.6 Pressure vessels operating in the vacuum condition shall have a vacuum relief valve installed directly in the pressure vessel or the system composing it. Other means preventing collapse by vacuum may be used. The following are some examples of other vacuum collapse prevention devices: vacuum reinforcements, sizing for the total vacuum condition, etc when clearly described in design, calculation memory and applicable manufacturing drawings.
- 5.5.7 The calibration seal installed in pressure relief devices shall be indelible. In case of fail, break or violation of calibration seal, a new calibration shall be applied.

#### 5.6 INSPECTIONS AND TESTS

- 5.6.1 Hydrostatic Test
  - 5.6.1.1 Pressure vessels shall be subject to hydrostatic test (or other pressure test approved by BUYER) during manufacturing phase and documented by a hydrostatic testing report signed by a Qualified Professional.
  - 5.6.1.2 The test pressure value shall be informed on its nameplate.
  - 5.6.1.3 In the absence of a documentary and accepted proof that test was performed during manufacturing phase, a new hydrostatic test shall be performed at the initial safety inspection.
  - 5.6.1.4 The hydrostatic test report to be valid and accepted shall contain: the signature, legible name and the professional counsel recording number of the Qualified Professional.
  - 5.6.1.5 This Qualified Professional shall be formally assigned and nominated by the pressure vessel's manufacturer or by SELLER.
  - 5.6.1.6 The instruments and monitoring devices for pressure vessels hydrotest shall be calibrated. The calibration certificate shall be issued in accordance with contractual technical requirements.
- 5.6.2 Initial Safety Inspection
  - 5.6.2.1 Pressure vessels subject to these requirements according to NR-13 Item 13.2.1 shall be submitted to an initial safety inspection, prior to startup, at the definitive installation site, and shall undergo <u>external</u> and <u>internal</u> examinations, with individual reports.
  - 5.6.2.2 Initial safety inspections for pressure vessels subject to this Technical Specification are SELLER responsibility.

The safety inspection shall be carried out under the responsibility of a Qualified

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Pr Ins	ofessional, and the report shall be spection Report.	issued in accordance with ite	m 5.7.6 Initial Safety		
5.6.2.3 S n	SELLER shall perform the Pressur nodule, before the module lifting and	re Vessel Initial <u>Internal</u> Safe d hook-up, as permitted by NI	ety Inspection on the R-37.		
5.6.2.3	.1 NOTE:				
As pla to Sa for	As per NR-37 Item 37.21.6.2, for equipment located in modules, Initial Safety Inspections planned and performed in advance into the module structure before its lifting and hook up to FPSO, the lifting/hook up shall take place no longer than one year from that vessel Safety inspection, otherwise the initial safety inspection shall be reassessed and reissued for close out, after module hook up to FPSO.				
Qu ma	Jalified Professional, the final hook aximum from that Inspection.	up of the module into the FP	SO may be two years		
Af Qu lift Af	ter module hook up to FPSO, an E ualified Professional in order to verify ing to FPSO. Resources and access ter equipment had been totally close t	External Inspection must be p y any damage has occurred in s shall be provided by SELLE sed, Initial Safety Inspection	performed by BUYER the equipment during R. Report can be closed		
5.6.2.4 T ii	The initial safety inspection end dat respections dates according to NR-1	te is referred to determine th 3 interval requirements.	e next periodic safety		
5.6.2.5 S c li	5.6.2.5 SELLER shall provide a Pressure Vessel Inspection Expiration Date Control in order to check earlier next External and Internal Inspections. An Excel file based on ANNEX V list shall be updated and provided.				
5.6.2.5	.1 This list shall be provided in regularity and commissioning phase.	ılar basis, every 2 months duri	ng pre-commissioning		
5.6.2.5	.2 The Inspection intervals to be FPSO unit without SPIE Certific	used for next safety inspection and the safety inspection (see NR-13 ITEM 13.5.4	ons shall consider the 4.5 a.).		
5.6.2.5	.3 If, at 4 (four) months before FPS Safety Inspection shall be per reissue the Pressure Vessel equipment is in original inspect internal salt water, impacts, exte	SO sail away from Integration S formed within the next two Initial Internal Safety Insp tion condition, maintained clc ernal damage were observed.	Site, the next foreseen years, SELLER shall ection Report, if the osed, no kind of wear,		
5.6.3 Ins wit	pection intervals to be used for ne hout SPIE certification, according to	xt safety inspections shall co NR-13 ITEM 13.5.4.5 a).	nsider the FPSO Unit		
5.6.4 Pro to dis	essure vessels which visual access physical impossibility shall be alte cretion of "Qualified Professional", I	to internal or external inspect rnatively subject to nondestr based on applicable standard	ion is not feasible due uctive examination at s and codes.		
5.6.4.1 T b	5.6.4.1 The use of non-destructive examinations, in lieu of internal or external examination, shall be approved by BUYER.				
5.6.5 Ini Th	tial Inspection Report shall attach ickness Measurement Record (Item	Inspection Photographic Rec 1 5.6.10)	ords (Item 5.6.6) and		
5.6.6 Ins	5.6.6 Inspection Photographic records				
Insp pres	pection Photographic records shall ssure vessels subject to this Technic	be included/attached in the I cal Specification.	nspection Reports for		
5.6.7 De an to	terioration, damage, or any non-co y reason exists, shall be observed ir OWNER. Additional inspection and v	nformance related to the equ the Inspection Report and pr work to correct the findings ma	uipment integrity, if for comptly communicated ay be needed and shall		

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be previously agreed with OWNER.

- 5.6.8 The criteria for external and internal visual examination shall meet the requirements of the ABNT NBR NM 315 and ABNT NBR NM 329 standards.
- 5.6.9 Non-Destructive Tests (END) or complementary tests, when applicable, shall be carried out in the event of changes or field repairs resulting from the result of the initial safety inspection.
- 5.6.10 Thickness Measurement
  - 5.6.10.1 All equipment in carbon steel, and subject to inspection shall be submitted to the thickness measurement test by ultrasound according to the items described in this technical specification and applicable technical standard.

For further requirements, see <u>ITEM 7.4.7</u> of this Technical Specification.

## 5.7 DOCUMENTATION

- 5.7.1 The following documentation is required by NR-13, and shall be prepared by SELLER as detailed in the following items:
  - a) Pressure Vessel NR-13 Dossier per equipment;
  - b) Safety Records book, as a set of sequential books that will cover all equipment;
  - c) Initial safety inspection report, per equipment;
  - d) Calibration certificate of safety accessories and instruments.
  - e) General Arrangement Drawing for pressure vessels with position of tag, fire & gas detection and lighting equipment (NR-37 Anexo F da DIM Declaração da Instalação Marítima)

All documents listed above in item 5.7.1 shall be delivered and archived in FPSO library along pre-commissioning and commissioning phase to BUYER Qualified Professional, for all equipment scope of Contract.

Maximum 1 (one) month before FPSO sail away to final location/Brazil all documentation shall be delivered.

#### 5.7.2 Pressure Vessel NR-13 Dossier

- 5.7.2.1 The pressure vessel NR-13 dossier is a set of documents that accomplish and comply with all NR-13 requirements, and shall contain at least the information listed below:
  - a) Information data sheet: category, risk group and class of fluid; Identification data such as TAG, service, manufacturer and year of manufacture; design and operating pressures and temperatures (minimum and maximum); test pressure (manufacturing and corroded and hot); MAWP, design code with year of edition and material specification; respective PSV or other safety device; associated pressure indicator.
     The Appex III is a reference of this Information Data Sheet

The <u>Annex III</u> is a reference of this Information Data Sheet

- b) Printed Calculation sheet for determining the MAWP and minimum thicknesses (contemplating all pressure vessel components);
- c) List of applied procedures during manufacturing: It shall be presented all procedures used during manufacturing and/or assembly, such as welding procedures specification (WPS), welding procedure qualification records (PQR), nondestructive testing (NDT) procedures, procedures for applicable heat treatments, if any, and procedures for

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	hydrostatic testing, and others. All these documents shall be recorded on the equipment data book;		
d)	Printed Drawing Documents: General Arrangement Drawing; assembly; body details (shell and covers); welding details; connections; appurtenances, supports of internal parts and pressure vessel supports; piping and instrumentation diagram(P&ID).		
e)	Pressure safety valves and other pressure relief devices data sheet, indicating the valve set point (opening pressure calibration) and the calibration records issued by the nanufacturer, as well as the pressure relief device certification. All relief and safety valves installed to protect equipment designed according to ASME BPVC Section VIII divisions 1 or 2, or other pressure vessel codes, shall have relief capacity certificates;		
f)	Pressure indicating instrument data sheet (pressure measurement units in the SI (kPa) with correspondence in metric system (kgf/cm <sup>2</sup> ).		
g)	Calibration certificate for pressure relief devices and pressure indicators.		
h)	Hydrostatic testing report performed at the shop.		
i)	All reports originated from fabrication/construction, such as NDE, painting and internal lining, heat treatment, and others.		
j)	Classification and categorization assessment worksheets of the pressure vessel to the NR-13.		
<ul> <li>NOTE 1: The equipment data sheet ("folha de dados"- FD) may replace the information data sheet indicated in item "a" provided that all the information contained in this item is indicated in the data sheet (FD).</li> <li>NOTE 2: With BUYER prior approval, the presentation of the calculation memory indicated in item "b" of this item may comprise a summary that indicates the values of MAWP and hydrostatic test pressure of each component and its minimum thicknesses. However, the complete mechanical calculation shall be presented in the manufacturer's "data-book".</li> <li>NOTE 3: With prior BUYER approval, the presentation of the procedures used in the manufacture indicated in item "c" of this item, may be through a list that indicates the numbering (codification / identification) of these procedures shall be presented in the manufacturer's "data-book".</li> <li>NOTE 4: All rupture disk shall be identified. The data sheets and fabrication certificates shall be traceable.</li> </ul>			
5.7.3 In equ rec ET DA	addition to the pressure vessel NR-13 Dossiers, the manufacturer shall issue the uipment data-book, according to applicable construction code and other technical quirements, as per EXHIBIT III - DIRECTIVES FOR ENGINEERING SERVICES and I3010.1Y-1200-91A-P4X-001 REQUIREMENTS FOR O&M MANUALS AND TABOOKS.		
5.7.4 <b>Sa</b>	fety Records Book		
5.7.4.1 lr c a	mmediately after the end of each equipment Initial Safety Inspection, its operational ondition shall be noted, in the Safety Record Book, stating the equipment was inspected and is able to start operation safely till next inspection.		
5.7.4.2 T s	The safety records book shall be composed by a book of numbered pages in which it hall be registered:		
a)	The date and occurrence of initial safety inspections, for each equipment;		

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b)	Physical and operational condition	of the pressure vessel;		
c)	Date of register , legible name, si Professional.	ignature and professional co	ouncil of the	Qualified
	The Safety Record Book shall be o Number sequence.	rganized per FPSO module/o	compartmer	it and TAG
5.7.5 Th and Pro	e issuance of the safety record bool d the physical and pressure vesse ofessional responsibility.	k and the annotation of the in els operating conditions is t	itial safety i he SELLEF	nspections { Qualified
5.7.6 <b>Ini</b>	tial Safety Inspection Report			
5.7.6.1 F	Pressure vessel Inspection reports s	hall be per pressure vessel.		
Se	everal pressure vessels in same insp	pection report are not valid ar	nd not accep	oted.
Ini the	tial safety inspection report shall be e contractual requirements.	issued in Portuguese langua	ige in accor	dance with
Th	e safety inspection report shall cont	tain, at least:		
	a) Pressure vessel identification;			
	c) Pressure vessel's service fluids	Indicate fluid class as defined	l in NR-13;	
	d) Type of pressure vessel;			
	f) Types of inspection carried out;			
	g) Description of the performed ins	pections and tests;	in the surrout	
	internal and external examination;	isis of the anomalies detected	in the press	sure vessei
	i) Results of inspection and interve	entions carried out;	novit inono	ation
	<ul> <li>k) Recommendations and necessa</li> </ul>	ary actions;	next inspec	Juon,
	I) Foreseen date for the next perio	dic inspection;	Qualified D	rofoccional
	and legible name and signature	of the Inspector(s) who has	s (have) att	ended the
	inspection;			
5.7.6.2 A	All pages of the report must contain t	be initials or signature of the	Qualified Pr	ofessional.
5.7.6.3 T	The conclusion must clearly inform th	ne equipment physical and or	erational co	onditions. It
s	shall be informed if the equipment is	able to safely operate until the	e next inspe	ction date.
5.7.6.4 li E o	nspection recommendations shall 3UYER approval. Anomalies, discon of the inspection.	not be included in the insp tinuities and pending shall be	solved befo	ort without ore the end
5.7.6.5 T ir	The hydrostatic test report performed nitial safety inspection report.	d at the shop shall be attached	d, or referer	iced, in the
5.7.6.6 T tı a c	The inspection report shall have an raceability between all documents the attachment, it shall reference it, and vector the following information:	interrelationship with its attant nat are part of the report, that vice versa. Initial safety inspe	achments, r is, if the rep ction reports	∩aintaining >ort has an s shall also
- Li	st of annexes, with a number (or let	ter) and title of attached docu	iments;	



- Numbered pages of the type (x of y), both for the report and for its annexes;

5.7.6.7 Reports with laconic information such as "new equipment, in perfect condition," will not be accepted instead of the correct description of the physical condition of the equipment. This shall indicate if there is any deterioration (corrosion, deformation, fracture, etc.), its intensity (mild, medium, severe), and the extent of the affected area (localized, dispersed, generalized). If there is a relevant deterioration, it shall be quantified and compared to the project condition.

#### 5.7.7 **Operation manual**

- 5.7.7.1 All category I or II pressure vessels shall have their own operations manual or operating instructions contained in the unit operation manual, in Portuguese language, with the following minimum content:
  - a) Startup and shutdown procedures.
  - b) Routine operational parameters and procedures.
  - c) Procedures for emergency situation.
  - d) General safety, health, and environment preservation procedures.
     See I-ET-3010.1Y-1200-91A-P4X-001 REQUIREMENTS FOR O&M MANUALS AND DATABOOKS
- 5.7.8 All documentation referenced in item 5.7 shall be organized and supplied by SELLER.

#### 5.8 NR-37 Compliance

5.8.1 Lifting and module interconnection shall be accompanied by a BUYER Qualified Professional.

After these operations, SELLER's Qualified Professional, accompanied by BUYER Qualified Professional, shall perform an external inspection in all pressure vessel in the module.

- 5.8.2 After interconnection of the modules, a leak test shall be done, according to criteria established in the contractual technical standards.
- 5.8.2.1 A leak test certificate shall be issued for each equipment and piping system/package.
- 5.8.3 A report shall be issued by SELLER's Qualified Professional stating the final date interconnection for each module.

#### 6. COMPLIANCE WITH NR-13 - PIPING (NR-13 Item 13.6)

#### 6.1. SCOPE

6.1.1. The actions indicated herein shall be performed by the SELLER, unless otherwise specified, for all industrial pipelines manufactured and / or supplied (including suppliers) included in scope of this Contract.

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6.1.2. This Technical Specification applies to <u>all piping containing A or B class fluids</u> as per <u>ITEM</u> <u>5.3.1</u> of This Technical Specification. (NR-13 ITEM 13.5.1.2).				
Note: NF	R-13 does not include additional design requirements and ass	sumes that	the piping	

Note: NR-13 does not include additional design requirements and assumes that the piping systems are designed and constructed in accordance with internationally recognized standards and codes.

### 6.2. **REQUIREMENTS**

- 6.2.1. The scope of NR-13 excludes instrumentation system pipes with a nominal diameter  $\leq$  12.7 mm (twelve point seven millimeters).
- 6.2.2. For the purposes of this technical description, piping is considered to be every line within the FPSO Unit, regardless of the design code (e.g. ASME B31.1, ASME B31.3, ASME B31.4, ASME B31.8, etc.).
- 6.2.3. The Qualified Professional shall be an engineer designated by the pipe system constructor or SELLER. The Qualified Professional shall have professional registration in accordance with Brazilian regulations.
- 6.2.4. For the classification of fluids SELLER shall refer to item 5.3.1 of this Technical Specification.
- 6.2.5. In order to comply with NR-13 requirements, the piping lines shall be listed according to fluid classification in 3 (three) piping lists provided by BUYER during Basic Design, for Hull, Safety and Process systems that shall be applied as standard and updated by SELLER during detailing design. These lists shall also be updated and incorporating all vendors packages piping list, as per N-1710 and I-ET-3010.1Y-1200-200-P4X-001/002.

#### **Basic Design Line System Lists**

Process Line Systems List- I-LI-3010.1Y-1200-940-P4X-001

Safety Line Systems List- I-LI-3010.1Y-5400-947-P4X-001

Hull Line List- I-LI-3010.1Y-1350-960-P4X-001

Note:

- 1- For piping system list reference, SELLER shall update and fulfill <u>ANNEX IV Piping</u> <u>System List model</u>.
- 2- Piping systems shall be defined and organized according to SOPs and SSOPs classification as per EXHIBIT VIII DIRECTIVES FOR COMMISSIONING.

# 6.3. Piping Design

- 6.3.1. Provision shall be made for pressure relief device in the design of piping or piping systems whenever required by applicable design code or identified by the hazard and operability study. This assessment shall be performed or validated by the SELLER in the detailed design phase.
- 6.3.2. The process, instrumentation design and HAZOP studies shall assess the necessity for pressure indicators ("PI" or "PIT") through the hazard and operability study or due to operational needs.
- 6.3.3. Calibration certificate for pressure relief devices and pressure indicators shall be issued in accordance with contractual requirements.

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6.3.4.	The pressure indicators and pressure their identification (TAG).	relief devices shall have an in	delible nameplate with
6.3.5.	All piping lines list issued and updated indicating:	d by SELLER shall contain co	lumns, per <u>ANNEX IV,</u>
	- SSOP- Operational System	, as per EXHIBIT VIII	DIRECTIVES FOR
	COMMISSIONING. - the classification of the fluid according to the fluid to the f	ording to ITEM 5.3.1 of This T	Technical Specification
	(NR-13 ITEM 13.5.2.1).		operation operation
	- Isometric Drawing Number.	in Dook / Engine Boom / Earo	acatla)
	- PI (pressure indicator) or PIT (pre- - the pressure relief safety device	essure indicator and transmitte	er) TAG number.
	All fields in <u>ANNEX IV</u> shall be fulfi	illed.	
6.3.6.	I-ET-3010.1Y-1200-200-P4X-001/002 incorporating all lines systems detailed	shall be complied durir d by SELLER and Vendors du	ng design, updated, uring Detailing Design.
6.3.7.	SELLER shall inform the maximum O	peration and Design pressure	s and temperatures.
6.3.8.	6.3.8. The lines shall be physically identified with TAG number according to contractua requirements and ABNT NBR ISO 3864-1 and ISO 3864-2.		
	The identification for each line shall be access.	e located in a visible place in	the pipe and with easy
6.3.9.	The lines shall be identified, painted a	nd marked according to DR-E	ENGP-I-1.15-R4.
6.4. IN	ISPECTIONS REQUIREMENTS		
6.4.1.	The initial safety inspection of the pip inspection procedures issued by requirements.	ing systems shall be perform SELLER and in accorda	ed in accordance with nce with contractual
6.4.2.	INITIAL SAFETY INSPECTION REPO	DRT	
6.4.2	.1 The Initial Safety Inspection Report Professional	t shall be issued and signed	by SELLER Qualified
6.4.2	2.2 The inspection report shall have ar traceability between all documents t attachment, it shall reference it, and	n interrelationship with its attand hat are part of the report, that vice versa.	achments, maintaining is, if the report has an
6.4.2	2.3 The Initial Safety Inspection Report	shall be issued per Piping Sys	stem (SSOP).
6.4.2	2.4 The initial safety inspection report sl	nall be issued in Portuguese l	anguage
6.4.2	.5 After initial safety inspection of each with numbered pages, containing at	piping system, an inspection least:	report shall be issued

- a) Piping system identification;
- b) Service fluid piping and their temperature and operating pressure.
- c) Inspection start and end dates;

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(	<li>Types of inspections carried out and description of the perfo tests;</li>	ormed inspections and
(	e) Photographic recording of anomalies detected during inspecti	ion.
f	<ul> <li>Results of inspection (thickness measurement) and conclusion integrity of the piping system until the next inspection;</li> </ul>	usive note about the
(	g) Foreseen date for the next inspection - See <u>Item 6.4.4</u> .	
ł	n) Legible name, signature and the professional council of the and legible name and signature of the Inspector who has atte	Qualified Professiona Inded the inspection.
6.4.2.6	6 All pages of the report must be signed by SELLER Qualified Profe	essional.
6.4.2.7	7 The conclusion of the Inspection Report must clearly inform the ph conditions of the piping system, and shall state that the piping sys safely until the date of the next safety inspection;	nysical and operationa stem is able to operate
6.4.2.8	3 No inspection recommendation or deviation shall be registered in without previous BUYER approval. Anomalies, discontinuities, r necessary actions, if exist, shall be accomplished before inspectio issue;	n the inspection report recommendations and on close out and report
6.4.2.9	Each piping system safety inspection close out shall occur af assembly, cleaning, after module hook up in FPSO and Integr activities have been carried out in the piping system, inc nondestructive and leak tests.	ter all manufacturing, ration Commissioning cluding all applicable
6.4.3.	The initial safety inspection report shall confirm and register:	
a) I	Report the initial inspection of all lines and piping that make up the	piping system;
b) / r	All piping components and the welds were evaluated (positive mate meet the applicable specifications;	erial identification) and
c) <sup>-</sup>	There is none deterioration or damage in the piping or its componer	nts;
d) [ ;	Manufacturing inspection and tests were carried out and approved a standard and technical specifications;	according to applicable
e) I	Flanged joints were properly assembled, tighten, the lines were thore valves and accessories were re-assembled after hydrostatic test, spring hangers were unlocked and all instruments were installed;	oughly cleaned, safety expansion joints and
f) I	Pressure relief devices and pressure indicator instruments are capperating condition;	alibrated and in good
g) <sup>-</sup>	The piping system is able to operate safely during the time set by th	ne report itself.
h) <sup>-</sup>	The lines were identified according to item 6.3.8 and 6.3.9.	
6.4.4.	The initial safety inspection as per NR-13 ITEM 13.6.2.1 shall operation start-up.	be performed before
-	The Initial Safety Inspection End date shall be used as a reference date of the next safety inspection.	ce for determining the
	SELLER shall provide a Piping Systems Inspection Expiration Da check earlier next inspections. An Excel file based on ANNEX IV list provided.	ate Control in order to t shall be updated and

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	This com	list shall be missioning	provided in regular phase.	basis, e	every 2 months durir	ng pre	-commi	ssionin	ig and
	The unit	Inspection without SPI	intervals to be used E Certification (see	l for nex NR-13 l	t safety inspections TEM 13.5.4.5 a.).	shall	conside	er the	FPSO
6.4.5.	Thic	kness Meas	surement						
	All sub star	piping syste mitted to th ndard and [	ems in carbon steel, ickness measureme <u>TEM 7.4.7</u> of this Te	, and su nt test b chnical	ubject to this Techn by ultrasound accord Specification.	ical S ling to	pecifica applica	tion sh ble tec	all be hnical
6.4.6. <i>i</i>	A pip the f	oing system	folder shall be prepa cuments:	ared for	each piping system	and sl	hall con	tain, at	least,
	a)	Initial safe	ty inspection report;						
	b)	Printed up	dated piping list that	t make ı	up the piping system	n, acco	ording to	o <mark>ANNI</mark>	<u>EX IV</u>
	c)	Data shee pressure i	ets and calibration of ndicators installed;	certificat	tes for all pressure	relief	device	s and	for all
	d)	Hydrostati	c testing report of lir	nes or sy	ystems.				
	e)	Leak testi	ng report of lines or	systems	, when applicable.				
6.5. NR	₹-37	Complianc	e						
6.5.1. l	Liftin Profe	ig and mo essional.	dule interconnectio	n shall	be accompanied	by a	a BUYE	R Qu	alified
After Profe	r the	se operation onal, shall p	ns, SELLER´s Quali erform an external i	fied Pro	fessional, accompa on in all pressure ve	nied b ssel in	y BUYE the mo	ER Qu odule.	alified
6.5.2.	After esta	r interconne blished in th	ection of the module te contractual techni	es, a le cal stan	ak test shall be de dards.	one, a	accordin	ig to c	riteria
6.5.2.	1 A I	eak test cer	tificate shall be issue	ed for ea	ach equipment and	piping	system	/packa	ige.
6.5.3. <i>i</i>	A re inter	port shall connection	be issued by SELI for each module.	_ER´s(	Qualified Professior	nal sta	ating th	e final	date
7 FOR EQ	λΛΙΒ	MENT AND	) PIPING <u>EXEMPT</u> I	FROM N	IR-13 ITEM 13.2.1				
7.1 INTRO	DUC	CTION							
NR-13 Certifi	3 AN icatio	NEX II ado on ("Serviço	dresses minimum re Próprio de Inspeção	equirem o de Equ	ents for Own Equipamentos "), that o	pment covers	t Inspec s as a w	tion S hole:	ervice
$\succ$	NR	₹-13 ITEM 1	3.2.1 (NOT EXEMP	T ITEM	S)				
		• COMP	LIANCE WITH NR-1	3 - PRE	ESSURE VESSELS	- NR-13	3 ITEM 13	.5	
		• COMP	LIANCE WITH NR-1	3 – PIP	ING — NR-13 ITEM 13.6	– Class	A or B flui	ds	
$\succ$	NR	R-13 ITEM	13.2.2 (EXEMPT I	TEMS)					

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	shown in <u>ANNEX VI</u> and des	cribed below.	
Buyer i	is the sole responsible to obtain SI	PIE Certification granted by	Brazilian Authorities.
7.2 EQUIPM	IENT AND PIPING EXEMPT FROM	NR-13 ITEM 13.2.1	
7.2.1 SI pij in: BI	ELLER shall comply to this Techni ping, exempt from NR-13 ITEM 13.2 spector, based on manufacturers RAZILIAN standards and codes:	ical Specification for the foll 2.1 requirements, to be inspe- recommendations and rela	owing equipment and ected by a responsible ited International and
- F n "	Pressure vessels with an internal dia nillimeters) containing classes B, C, a a" of NR-13;	ameter of less than 150 mm and D fluids, as specified in ite	(one hundred and fifty m 13.5.1.2, paragraph
- F p	Pressure vessels other those include pressure and volume less than 8 – P	d in NR13 (pressure vessels x V < 8);	with product operating
- N	Non-structural Tanks (metallics and r	non metallic)	
- E	Equipment belonging to auxiliary made	chine package systems;	
- E c	Equipment subject only to a vacuum contained fluid class	condition of less than 5 (five)	kPa, regardless of the
- (	Corrugated and gasketed plate heat	exchangers;	
- F	Pig launchers and receivers;		
- F	Flares		

- Safety and relief valves (PSVs);
- Piping systems <u>other those</u> specified in <u>Item 6.1.2</u> of this Technical Specification, except the following systems:
  - Sewage Waste
  - Gray Water
  - Sanitary Bilge
  - Distilled Water
  - Potable Water
  - Chilled Water

#### Notes

- 1- The exception list above is not part of BUYER inspection plan and shall not be part of SPIE Certification.
- 2- EXHIBIT VIII Directives for Commissioning remains applicable to the above exception piping systems and FVI and FVM are still applicable as pre-commissioning checking activities.
- 3- Piping systems shall be defined and organized according to SOPs and SSOPs classification as per EXHIBIT VIII DIRECTIVES FOR COMMISSIONING.

Any pressure retaining equipment that is part of valves manifolds, e.g accumulators, or part of dynamic equipment package refered above shall be considered as within the scope of this technical specification.

Equipment belonging to vendors skid packages shall also be evaluated if they are within the

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N	IR-1:	3 Regula	ition scope	).							
F	or e quip	asier un ment Cla	derstandir assificatior	ng about Equ and SPIE E	iipment quipmen	and P It Certi	iping <u>Exemp</u> fication, see <u>/</u>	<u>t</u> fron ANNE	m NR-13 <u>EX VI.</u>	Item 2	13.2.1,
7.2.2	Spo add to r	ecifically dition to meet spe	for EQU the SELLE cific SPIE	IPMENT AN R's inspection requirements	D PIPIN on, the E s through	IG EX BUYER n a spe	EMPT FROM will perform ecialized inspe	√ NF com∣ ectior	R-13 ITE plementa n team.	M 13.2 ry insp	2.1, in pection
<b>7.3</b> REQ	UIR	EMENTS	FOR EQ	JIPMENT AN	id Pipin	IG <u>EX</u>	<u>EMPT</u> FROM	NR-	13 ITEM	13.2.1	
7.3.1	lt is <u>EX</u>	s SELLEI / <u>EMPT</u> fr	R's scope t om NR-13	to comply with ITEM 13.2.1	n the follo (NR-13	owing Item 1	items, for the 3.2.2) to be ir	EQU nspec	IPMENT cted:	AND P	PIPING
	- D	eliver th	e documer	ntation require	ed below	/:					
		<ul> <li>All d engii data OPE</li> </ul>	esign and neering da -book, acc RATION A	fabrication entropy fabrication entropy fabrication fabricatio fabrication fabrication fab	quipmen dor data- 1-3010.1 NANCE	t docu book ( Y.120 MANU	ments shall b or constructio 0-91A–P4X-0 JALS AND D/	oe ea: n dat 001 R ATAE	sy acces a-book, a EQUIREI 300KS;	s availa ınd ass MENT\$	able in sembly S FOR
		The	minimum o	documents th	at shall l	be ava	ilable is the fo	ollowi	ing:		
		a)	Mechanic	cal Data Shee	et.						
		b)	Mechanic	cal/Construct	on draw	ning.					
		c)	Hydrotes	t certificate, v	vhen app	olicable	э.				
		- Insp INSF	ection Re PECTION I	eports. (See REPORT)	e Item	7.4	GENERAL	RE	QUIREM	ENTS	FOR
	- Ic	dentify in	place all p	piping and eq	uipment	accord	ding to contra	ctual	requirem	ients.	
		•   :	NAMEPLA shall meet	TE of equipm the requirem	nent refe ents of t	rred in he des	ITEM 7.2 of t sign code.	this T	echnical	Specifi	ication
	- P	rovide d IV- Syst	ocument s ems Pipin	preadsheet i g List and An	n a "Mici nex V fo	rosoft l r all G	Excel" electro eneral Equipr	onic fi nent	ile accord List;	ling to	Annex
7.4 INSP	PECT		PORT								
7.4.1	The ITE	e pre-coi M 13.2.	mmissionir 1 applies to	ng inspection o all pressure	of EQUI -retainin	PMEN g equi	IT AND PIPIN pment, tanks	VG EX	XEMPT F piping in	<sup>-</sup> ROM the UN	NR-13 IIT.
	The	main ac	tivities rela	ted to the Pro	e-Comm	issioni	ng Inspection	is are	e:		
	a)	Verify thandling This installat comprise	the genera g, installat pection sh ion site or the internal	al equipment ion, erection all be perforr modules fabr and external	t conditi testing ned befo cation si thorougl	ons re , tightr ore equ ite, bef n visua	egarding its ness, commis uipment/syste ore lifting, acc al examinatior	fabric ssioni m ini cordir ı;	cation, tr ing, and itial start-i ng to NR-:	anspor preserv up, at it 37), an	tation, vation. ts final d shall



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- b) Measure the initial thickness for the different components and parts, so that the corrosion rates may be later properly referred and calculated along UNIT lifetime according to BUYER Inspection Plan.
- **7.4.2** The inspection of the equipment and piping referred in <u>item 7.2</u> shall be carried out by SELLER responsible inspector.

SELLER is responsible for making all items subject to inspection, examinations, tests, and verification of accessible equipment and piping systems. The inspection extension shall be defined and conditioned to BUYER agreement.

BUYER will perform complementary inspection to meet specific SPIE requirements.

7.4.3 Equipment and Piping Checking Report

For EQUIPMENT AND PIPING EXEMPT FROM NR-13 ITEM 13.2.1, SELLER shall present to BUYER, as per pre-commissioning inspection activities and purposes, the FVI and FVM for each tagged item stating the equipment or piping system had been inspected and accepted to operate safely. These checkings and records shall be performed at INSTALLATION SITE or modules fabrication site.

- 7.4.4 SELLER shall issue FVIs and FVMs, with Photographic records and reports (ITEM 7.4.5) and Thickness Measurement Report (ITEM 7.4.7.5) in order to BUYER proceed and obtain SPIE Certification.
- 7.4.5 Photographic records and reports

Inspection Photographic records shall be included/attached in the FVIs /FVMs for pressure vessels and tanks inspection.

The photographic report shall register the TAG equipment or piping system number subject to report in order to permit easy traceability between all documents and the FVI/FVM in which it shall be attached.

- 7.4.6 The criteria for external and internal visual examination shall meet the requirements of the ABNT NBR NM 315 and ABNT NBR NM 329 standards.
- 7.4.7 Thickness Measurement

All equipment and piping systems in carbon steel, and subject to this Technical Specification shall be submitted to thickness measurement test by ultrasound according to the items described in this technical specification and applicable technical standard.

7.4.7.1 Thickness Measurement Procedure

SELLER shall issue a thickness measurement procedure according to applicable international technical standards. This procedure shall be submitted to BUYER for approval.

7.4.7.2 Total Amount of thickness measurement points

The total amount of points to be measured should be sufficient to have control over the deterioration of all UNIT during its lifetime.

Recent BUYER UNITs had about five thousand (5.000) thickness measurement points that shall be considered and applied as a reference to attend to all Items of this Technical Specification.

7.4.7.3 Thickness Measurement Points Distribution Plan

SELLER shall present a TML - Thickness Measurement Points Distribution Plan to be commented and approved by BUYER during Detailing Design and prior to pre-commissioning final installation.

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The to a	quantity and location of the thickne	ess measurement points shal and the referred purpose in Ite	l be defined em <u>7.4.1 b</u> .	according
For <sup>-</sup> also	Thickness Measurement Points Dis be considered, as the following:	tribution Plan purpose, Intern	ational Stan	dards shall
- - -	ASME B31.3 - Process Piping API 570 - Piping Inspection Code: of Piping Systems API RP 574 - Inspection Practices API 579 - Fitness for Service	In-service Inspection, Rating, for Piping System Compone	Repair, anc nts	Alteration

Equipment and Piping Systems where expected higher corrosion rates shall have higher density location for Thickness Measurement Points Distribution Plan.

BUYER Qualified Professional shall participate, comment, and approve the Thickness Measurement Points Distribution Plan during Detailing Design.

SELLER shall also consider TABLE 2 Thickness Measurement Point Distribution Plan reference.

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		Tabl	e 2
	Thickne	ess Measurement	Point Distribution Plan reference.
ITEM	Equipment		Location
1	Vertical	Bottom head	bottom drain
2	Pressure Vessel ø ≤ 1m	Top head	center of head
3	2 - 111	Shell	Each shell plate, along the stair, 300 mm Upper Circumferential weld
4	Horizontal Pressure Vessel	Shell	Each shell plate in one point on each shell generatrix (lower and upper)
5	Ø S IIII	Heads	center of head
6	Vertical Pressure	Bottom head	Bottom, at a distance of 50 mm of the drain
7	ø > 1m	Top head	center of head
8		Shell	Each shell plate, along the stair, 300 mm Upper Circumferential weld
9	Hozizontal Pressure Vessel	Shell	Each shell plate in one point on each shell generatrix (lower and upper)
10	Ø > 111	Heads	center of head
11	Tanks		Tank bottom and side plate close to bottom
12		elbow	outside radius
13		upstream and downstream of valves	Horizontal sections: position 12 hours, 100 mm at upstream of valves Vertical sections: 100 mm at upstream of valves
14		Tees and branch conections	outside
15		Piping Reducer Eccentric	inclined section
16	Gases or vapors Piping	Piping Reducer concentric	12 o' clock , conic section
17		Dead point	Close to dead point
18		Boot	Shell boot vertical point
19		Injection points	6 o' clock position (300 mm) oppositive of the injection nozzle
20		Straight Section	Horizontal sections: position 12 hours, 1 point each 50 meters Vertical sections: 1 point each 50 meters
21		Elbow	outside
24		upstream and downstream of valves	Horizontal sections: position 6 o' clocks, 100 mm at upstream of valves Vertical sections: 100 mm of valves

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25		Tees and branch conections	outside			
26	Liquid Piping	Piping Reducer Eccentric	inclined section			
27		Piping Reducer concentric	6 o' clock , conic section			
28		Dead point	Close to dead point			
29		Boot	Shell boot vertical point			
30		Injection points	6 o' clock position (300 mm) oppo injection nozzle	ositive of the		
31		Straight Section	Horizontal sections: position 6 o' o each 50 meters Vertical sections: 1 point each 50	clock, 1 point meters		

#### 7.4.7.4 Identification and Protection

The measurement points on non-isolated lines shall be identified with tag number and protected with anticorrosive adhesive tape.

For insulated lines, a window port shall be provided in order to permit access to the thickness measurement point.

#### 7.4.7.5 Thickness Measurement Report

Thickness measurement (ME) reports shall be prepared and issued, including sketches in an editable digital file, with the location of the control points in the pipes and equipment.

In the case of equipment, also indicate in this sketch the location of the welds and connections.

The sketch shall reliably represent the equipment, that is, it shall clearly show all details and components (nozzles, boots, hull, changes in geometry, etc.).

The sketch shall use, as a reference, the overall drawing of the equipment issued by the manufacturer.

SELLER shall consider isometric drawing model presented below, in FIGURE 1 for piping thickness measurement points distribution plan.

The thickness report shall register the TAG equipment or piping system number subject to report in order to permit easy traceability between all documents and the FVI/FVM in which it shall be attached.



SELLER Qualified Professional and inspector team responsible for pre-commissioning inspections of equipment and piping systems shall attend this meeting.

7.5 COMPLEMENTARY REQUIREMENTS FOR ITEM 5, 6 AND 7 OF THIS TECHNICAL SPECIFICATION

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7.3.1 FN	ESSURE RELIEF DEVICES				
7.5.1.1 S H d ir	afety Valves, Relief Valves, Safety IIPPS systems, and any variations levices, as they are applied all ov ntegrity which they are connected.	✓ Relief Valves, Rupture Disc s, therefore, shall be conside er the Unit to protect the eq	s, Buckle-Pin Valves, red as pressure relief uipment and systems		
7.5.1.2 T o a	This requirement is applicable for al of this Contract applied for pressure and 7 of this Technical Specification	I PRESSURE RELIEF DEVIC vessel and pipings systems	ES provided in scope covered in ITEM 5, 6		
7.5.1.3 A c	In Inspection Plan for Pressure Rel contain at least the following:	ief Devices shall be issued by	/ SELLER, and it shall		
-	The detailed procedure for the ins	pection of the devices;			
-	Acceptance criteria for the inspect	ion, regarding the applicable	codes and standards;		
-	The detailed procedure for calibra	tion of the devices (where app	olicable);		
-	Acceptance criteria for the calibrat	tion, regarding the applicable	codes and standards;		
-	Methods for applying seals to the tampered with after installation);	device (that will guarantee th	at the device won't be		
7.5.1.4 T D v	he following instruments lists provid Design with all PSVs provided in s rendors.	led in Basic Design shall be up cope of this Contract, includ	odated during Detailing ng Vendors and sub-		
	I-LI-3010.1Y-1351-800-P4X-001 I-LI-3010.1Y-1200-800-P4X-001	INSTRUMENT LIST – HU INSTRUMENT LIST – TO	LL PSIDES		
7.5.1.5 S (i	ELLER shall issue and keep up to not including vendors packages) accord	date a list of all pressure rel ding to <u>Annex V</u> . All fields sha	ief devices of the Unit Il be fulfilled.		
7.5.1.6 A c C	II PRESSURE RELIEF DEVICES C ommissioning phase shall be issue comissionamento (Integration and C	Calibration Certificates issued d and available in FIC - Ferrar Commissioning Tool).	during final installation nenta de Integração &		
7.5.2 CA	R SEALS and WARNING PLATES	,			
SELLER describe	shall provide valves car seals and d below.	warning plates as per quanti	ties and specifications		
7.5.2.1 V d fi	Varning plate, in Portuguese langua levice and in valves handling flywhe gures (units in mm):	ge, will be attached to the valv eels according to the models	es car seal open/close shown in the following		
7.5.2.2 V	Varning Plates specification and qu	antities:			
Th inc	e warning plates shall be made of delibly engraved.	stainless steel (AISI 304) and	I have the information		

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- 1	Locked Opened Warning Plates – C	Quantity - 5.000 units				
			R3			
1		*				
	ATENC	ÃO				
	, <b>-</b>					
	DISPOSITIVO C	ONTRA	2 × Ø4			
	BLOQUEIO INAD	VERTIDO				
- 80,		se e construction de la construcción				
	CASO NECESSÁRI	O FECHAR				
	ESTA VÁLVULA, CO	ONTACTAR DA ÁDEA				
	U RESPONSAVEL	UA AREA				
↓ l		5				
*	120,0	*	0,5			
Thi	ickness: 0.5 mm					
	contest, 0.5 mill					



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Qualified Professional, shall perform an External Inspection in all equipment and piping subject to ITEM 7.2.1 installed into modules that had been lifted to hook-up to FPSO.

7.5.3.3 After interconnection of the modules, a leak test shall be done, according to the criteria established in the contractual technical standards.

- 7.5.3.3.1 A leak test report shall be issued for each equipment and piping system.
- 7.5.3.3.2 A report shall be issued by SELLER's Qualified Professional stating the final date interconnection for each module.

# 8 COMPLIANCE WITH NR-12

## 8.1 OBJECTIVE

This Technical Description has been prepared based on Brazilian Economy Ministry Ordinance 916 of July 30th, 2019, for machines and equipment and serves as a guide for SELLER to comply with its requirements. The full compliance with NR-12 is mandatory.

This Technical Description contains mandatory technical requirements.

The Brazilian Economy Ministry often issues technical notes clarifying items in NR-12. The user of this Technical Description shall consider these publications, since they reflect the understanding of the enforcement or regulatory bodies regarding the legal requirements established in this regulatory standard.

#### 8.2 SCOPE

- 8.2.1 All machines and equipment shall be designed, manufactured, assembled and inspected according to codes and Brazilian or international standards related thereto.
  - 8.2.1.1 NR-12 requirements are addition to design standards and shall be attended. It is the SELLER responsibility to comply with the requirements of NR-12.
- 8.2.2 SELLER shall attend the requirements of this technical specification for all equipment and machines under the NR-12 scope. The <u>ANNEX VII</u> shows a preliminary type of equipment list for NR-12 scope. SELLER shall issue the final list, in Portuguese, indicating all equipment under the NR-12 scope, according to <u>ANNEX VIII</u> Reference List for all machines and equipment of the unit that are within the scope of the NR-12.

#### 8.3 REQUIREMENTS

- 8.3.1 SELLER shall issue a record listing all machines and equipment of the unit that are within the scope of the NR-12, according to the model of <u>Annex VIII</u>.
- 8.3.1.1 SELLER shall issue a drawing with the localization of machines and equipment based on the list of <u>ANNEX VIII</u>, including ITEM number. This drawing must be in accordance with the model of <u>ANNEX IX</u>.
- 8.3.2 Color, size of letter, numbers and symbols indicated in machines or equipment shall comply with ABNT NBR ISO 3864-1 and ISO 3864-2.
- 8.3.3 Where machinery and equipment are installed, the circulation areas shall be properly demarcated and in accordance with official technical standards, including the item 5 of NBR ISO 12100 standard (Segurança de Maquinas– Princípios Gerais de Projeto –

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	Apre	ciação e Redução de Riscos.)				
8.3.4	Starti and i	ing and stopping devices for mac nstalled in such a way that:	chinery and equipment shall	be designe	d, sel	ected
	а	. they are not located in their da	nger zones;			
	b	. may be switched on or off in ar	n emergency by anyone othe	er than the o	perat	or;
	С	<ul> <li>prevent involuntary activation accidental manner;</li> </ul>	n or shutdown by the ope	rator or in	any	other
	d	. cannot be bypassed.				
8.3.5	The interf	start, stop, drive and control carace shall:	omponents that make up t	he machine	e ope	rating
	a.	enable the installation and ope	ration of the emergency stop	system; an	d	
	b.	operate at an extra low voltage mode of protection against e Technical Standards.	e up to 25 VAC or up to 60 electric shock, in accordanc	VDC, or ha e with curr	ve ar ent c	other official
8.3.6	Dang chara the p	nger zones of machinery and equipment shall be provided with safety systems aracterized by fixed guards, movable guards and interlocking safety devices to ensure protection of the health and physical integrity of workers.				
8.3.7	Powe equip devic	wer transmissions and their interconnected moving or accessible machinery and uipment components shall be fitted with fixed guards or movable with interlocking vices that prevent access from all sides.				
8.3.8	Fixed	d guards must be painted in acco	rd with NBR 7195 – Security	Colors.		
8.3.9	Mach partic work	nines and equipment that presen cles or substances shall have pr ers.	nt a risk of rupture of parts, protections that guarantee th	projection of e health an	f mate d safe	erials, ety of
8.3.9	.1 Spe	ecial attention shall be paid for so	me equipments and parts, bu	ut not only:		
	•	Pumps and compressors coupl	ing guards;			
	•	Workshop equipment				
		<ul> <li>grinding machines;</li> </ul>				
		<ul><li>workshop lathe;</li></ul>				
		<ul> <li>Milling cutter;</li> </ul>				
		<ul> <li>Drilling machine;</li> </ul>				
		<ul> <li>Automatic electric saw;</li> </ul>				
		<ul> <li>Hydraulic press;</li> </ul>				
	•	Equipment gears, pulley, v-belt	, impellers, protection guards	з;		
	•	Electric shocks protection and g	grounding;			
	•	Galley equipments, as food m machine, potato peeler and etc	nixer, blenders, slicers, fruit	juicer, dou	gh cy	linder
	•	Laundry equipments, as washir	ng and drying machines;			
Harza and e requir	ard ar eyes ir remer	nd ergonomic analyze, harzard zo njuries, correct color identification nts.	one and electric shock prote n, warning signaling are appli	ections to avections to avections to avections	/oid fi g to N	ngers NR-12

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- **8.3.10** Emergency shutdown devices (switch) shall be positioned in places easily accessible and viewable by operators at their workplaces and by others and kept permanently accessible.
- 8.3.11 Warning stickers to inform electrical voltage is required.
- 8.3.12 Hoses, piping and other pressurized components shall be located or protected in such a way that a rupture of these components and fluid leaks cannot cause work accidents.
- 8.3.13 Hoses used in pressurized systems shall have an indication of the maximum permissible working pressure specified by the manufacturer.
- 8.3.14 Workstation surfaces shall not have sharp corners, rough, sharp surfaces and sharpedged edges or burrs at the points of contact with segments of the operator's body, and fasteners such as nails, rivets and screws to do not add risks to the operation.
- 8.3.15 Fuel tank filler neck and other materials shall be located no more than 1.50 m (one meter and fifty centimeters) above the floor or than a support platform to perform the task.
  - 8.3.15.1 Machines and equipment with fuel tanks (or tanks with inflamable liquids) must have containment barriers to prevent leakage. Those barriers must be in accord with technical standards.
- 8.3.16 When any part of the equipment presents a risk of burns to workers, protective methods such as thermal insulating, barriers etc shall be used.
- 8.3.17 Machinery and equipment shall have safety alerts and safety signs, to warn workers and third parties about the risks to which they are exposed.
- 8.3.18 Safety signs shall:
  - a. be prominent on the machine or equipment;
  - b. be in an easily visible location;
  - c. be easy to understand.
- 8.3.19 Markings on machinery and equipment shall:
  - a. be written in the Portuguese language (Brazil); and
  - b. be readable.
- 8.3.20 The markings shall clearly indicate the risk and the part of the machine and equipment to which they refer.
- 8.3.21 Machinery and equipment shall have in a visible place the indelible information, containing at least:
  - a. Company name, CNPJ (if manufactured in Brazil) and address of the manufacturer or importer;
  - b. type, model and capacity information;
  - c. serial number or identification, and year of manufacture;
  - d. CREA manufacturer (if manufactured in Brazil) or importer registration number;
  - e. Weight.
- 8.3.22 Operation and maintenance manuals shall be written in Portuguese language (Brazil);
- 8.3.23 Machines and equipment used for hoist and transportation must be in accord with NR-37 standard, NR-12 standard and technical standards, in comply with the NR-37 item 37.20.1.
- 8.3.24 Machines end equipment for galley and cold storage chamber must be in accord with NR-12 and NR-37. The cold storage chamber must have horn and emergency shutdown button in its interior and allow opening internally.

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3 The model given in figure above seeks to guide the PACKAGER / MANUFACTURER as to the layout of the minimum data that shall obligatorily figure on the plate; in case necessary, at the discretion of the manufacturer, or as required in the vessel materials requisition, the plate may have other additional data

4 The plate shall be situated on the cover of the lower inspection cover of the vessel, or in another visible and easily accessible location. The localization of the identification plate shall be defined in the vessel manufacturing drawing.



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IOTE 7: The minim 40-P4X-002 - REC IOTE 8: The hydro fest. IOTE 9: Show the opp) IOTE 10: The Max orrosion allowance IOTE 11: In this sp IOTE 12: In this sp IOTE 12: In this sp	num temperature of water for hydrostatic testing o QUIREMENTS FOR PRESSURE VESSELS FABF ostatic pressure test for a new vessel shall be deter equipment position and equipment point where the timum Allowable Working Pressure (MAWP) shall e, and the allowable stress value in the working te bace shall be written "SERVIÇO COM HIDROGÊI ble. bace shall be inscribed the requirements for the hy	of the equipment shall be determined ac RICATION ermined according to the ASME SECTION the hydrostatic pressure test is measured be determined using the nominal vesse emperature. NIO" (service with hydrogen) or "SERV ydrostatic test water.	cording to <b>I-ET-</b> DN VIII standard d.(e.g. vertical po el thicknesses, w IÇO COM H2S	<b>3010.00-1200</b> Hydrostatic osition/ at the ithout the '(service with
	HEAT EXCHAN	GER NAMEPLATE		
		180		•
		150		
		100	•	
- 150	Ø 8,5 Ø 8,5 EQUI DESIGN STANDARDS (See Note 5) DESIGN TEMPERATURE MIN, OPERATION TEMP, (See Note 6) DESIGN PRESSURE OVERTHICKNESS FOR CORROSION MAXIMUM ALLOWABLE WORK PRESSURE (See Note 7) LIMITED BY HYDROSTATIC TEST PRESSURE PERFORMED AT THE SHOP (See Note 8) TEST WATER STRESS RELIEF RADIOGRAPHY SERVICE WITH H2 SERVICE WITH H2 SERVICE WITH H2 DESIGN FOR DIFFERENTIAL PRESSURE MANUFACTURER AND LOCATION MANUFACTURER SERIAL NUMBER	IPMENT IDENTIFICATION (See Note 4)         SERVICE         SHELL SIDE       TUBE SIDE         "C         "C         "C         "C         "C         "C         "KPa         kgf/cm²         kPa         kgf/cm²         KPa         Kgf/cm²         KPa         KPa         Kgf/cm²         KPa         Kgf/cm²         KPa         KPa         KPa         KPa         Kgf/cm²         KPa         KPa         Kgf/cm²         Kgf/cm²         Kpa         Kgf/cm²         Kpa         Kgf/cm²         Kpa         Kgf/cm²         Kpa         Kpa         Kpa         Kpa         Kgf/cm² </th <th></th> <th></th>		

NOTE 1 The dimensions of the Figure are in mm.

NOTE 2 Units shall be filled in considering the international system and technical system.

NOTE 3 The language to be used for engraving all nameplate information shall be Portuguese.

NOTE 4 Inform pressure vessel identification

NOTE 5 The edition year of the standards adopted shall be indicated.

NOTE 6 When applicable

NOTE 7 The Maximum Allowable Working Pressure (MAWP) shall be determined for the corroded and hot vessel.

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NOTE 8 The Section VIII NOTE 9 Wh	e hydrostatic test pressure of the vessel, performed at the shop, shall be determined a or applicable standards renever the equipment is specified to operate with a special service, the type of servic	according to AS	ME BPV	/C:2010

NOTE 9 Whenever the equipment is specified to operate with a special service, the type of service, such as, for instance, "H2 Service", "H2S Service, and "Caustic Service", shall be described in this field.

NOTE 10 The characters shall be printed and follow the format according ABNT NBR 8402, with a minimum size of 3 mm

# NAMEPLATES - TRANSLATION (PORTUGUESE / ENGLISH)

identificação do equipamento	identification of equipment
norma de projeto	design standard
temperatura de projeto	design temperature
pressão de projeto	design pressure
pressão máxima de trabalho admissível	maximum allowable working pressure
limitada por	limited by
Casco	Shell
Tampo	head
peso vazio	empty weight
fabricante e local de fabricação	manufacturer and manufacturing site
Montador	Assembler
número de série do fabricante	manufacturer's serial number
Serviço	Service
sobreespessura para corrosão	corrosion allowance thickness
temperatura mínima de operação	minimum operating temperature
pressão de teste hidrostático de fábrica	hydrostatic test pressure - performed at the shop
pressão de teste hidrostático medida em	hydrostatic test pressure measured at
alívio de tensões	stress relief
Parcial	partial
Total	total
raio X	X-ray
Radiografia	radiography
peso cheio d'água	weight full of water
ano de fabricação	year built
serviço em hidrogênio	H <sub>2</sub> service
serviço com H <sub>2</sub> S	H <sub>2</sub> S service
projeto para pressão parcial	Design for partial pressure
pressão diferencial	differential pressure
sim	yes
não	no
ano de fabricação	year built

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# **ANNEX II - NUMERALS AND LETTERS FOR EQUIPMENT IDENTIFICATION**

# 1. TYPE AND SIZE

- 1.1 The type and size of numerals and letters standardized by this Standard are "Helvetic", "Petrobras Sans" or "Swiss 721 BT" fonts.
- 1.2 The letters and numbers that indicate the equipment TAG and category shall be arranged in the horizontal direction.

# 2. APPLICATION

2.1 It is recommended to use the criteria of ABNT NBR ISO 3864-1 and ISO 3864-2 to determine the color and size of letters and numbers that indicate the TAG and the category of equipment. Alternatively, it is acceptable to use the sizes listed in Table 1. Different sizes may be used by prior agreement with BUYER Qualified Professional.

Table 1 - Recommendations for height "H" of letters and numbers				
External equipment Diameter	Height "H"			
(mm)	(mm)			
D ≤ 300	25			
300 < D ≤ 1000	70			
1000 < D ≤ 2500	125			
2500< D ≤ 5000	220			
D > 5000	300			

2.2 The indication of TAG and category shall enable quick view in emergencies.

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ANNEX III - EQUIPMENT DATA SHEET									
	E] Petro	R BRAS	FOLHA DI	EDADOS	DOVAS	5	v-	XXYYZZ	
	LOCAL		DESCRIÇÃO			1	'AG	CAT	
	P-XX	FABRICANTE	NÚMER	o de Série	POSIÇ	O INSTALAÇÃO	) /	NO FABRICAÇÃO	
N	DESENHO		P&ID						
_			-					ı	
P	. V (m <sup>3</sup> . k	(Pa) =	CLASSIFI	CAÇÃO NR CLASSE	-13 GRU	JPO	CAT	EGORIA	
P	. V (m². M	APa) =							
			DADO	S DE PRO	JETO				
F	PRES	SÃO DE PROJETO	CÓDIGO E	E PROJETO/	ANO ED.		PMTA C	. <b>Q</b> .	
P	RESSÃO D	E TESTE DE FABRICAÇÃO	TEMP. DE PR	OJETO N	VOLUME	Kgilor	n2	kPag	
L L									
	PRESS	O DE OPERAÇÃO	DA DO: TEMPERATUR	S OPERACI	ONAIS		LUIDOS		
	Kglio	m <sup>2</sup> KPa SERVICO	0	-C	0	ASSE DO FLUID	O PARA CAT	EGORZACÃO	
			-						
			DISPOSITIN	O(S) DE SE	GURANCA				
	1	AG	biol contra	0,0, 02 00	o o nanya				
_			INDICADO	R(ES) DE I	PRESSÃO				
	1	AG							
PROFISSIONAL HABILITADO									
		NOME	CREA	MATRÍCULA		ASSI	NATURA		

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<b>2. HEAT E</b>	XCHANGER								
	_								
	BR					D VV	VV77	,	
	PETROBR	45				F-77	1122	,	
	FOLHA DE DADOS DO PERMUTADOR								
Г	PLATAFORMA		DESCRIÇÃO	1		TAG	CAT	1	
-	P-XX			·			-		
		FABRICANTE		NÚMERO DE	SÉRIE	AND FA	BRICAÇÃO		
N	PESENHO		P&ID					_	
		ci	ASSIFICA	ÇÃO NR-13				_	
-	P.V (m°.kPa) P.V (m°.MPa	= )=		CLASSE	GHUPO	CATEG	IOHIA	-	
_		D	ADOS DE	PROJETO				_	
	CÓDIO	30 DE PROJETO/ANO ED	L	TI	PO DE PERMU	ITADOR (TEMA)	)	<u> </u>	
	PRESSÃO I	DE PROJETO (kPag)	LADO (	ASCO	(*C)			-	
	PRESSÃO DE T	H - FABRICAÇÃO (kPag)		VOLUME (m?)		PMTA (K	Pag)	-	
-			14003						
	PRESSÃO I	DE PROJETO (kPag)	TEM	P. DE PROJETO	(°C)	PMTA (k	Pag)	1	
	PRESSÃO DE T	H - FABRICAÇÃO (kPag)		VOLUME (m?)					
L									
F		DA PRESSÃO DE OPERAÇÃO	ADOS OPE O (KPag) T	ERACIONAIS EMP. DE OPERA	CAO (°C)	FLUIDO	)	1	
F	LADO CASCO LADO TUBOS							-	
F		Dieboe	ITIVO(S)					-	
Г	TAG	LADO CASCO	11110(3)	DE SEGURA	TÇA			7	
F		100010000						4	
F	710	LADO CASCO	ADOR(ES	) DE PRESSĂ	0			7	
L	IAG	LADO TUBOS						]	
		PRO	FISSIONAL		0				
F		NOME	(	REA		ASSINATURA		9	
F					-			-	



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# NR-12 ANNEXES

#### ANNEX VII – PRELIMINARY LIST OF MACHINES AND EQUIPMENT TYPE UNDER NR-12 SCOPE

MACHINES AND EQUIPMENT					
Kitchen waste shredder	Rail car	Lathe			
Washer	Pump	Ship fender			
Dryer	Hydraulic power unit	Lifting winches			
Stove	Quick release hook	Nitrogen generation package			
Oven	Lifeboat	Flare ignition system			
Kneading machine	Lifeboat davit systems	Chemical injection package			
Industrial Slicer	Rescue boat	Measurement package			
Industrial Food mixer	Rescue boat davit systems	Monorail			
Cold room meat	Offloading station	Industrial vacuum cleaner			
Vegetable cold room	Offloading hose reel	Hydraulic jack			
Main cold room	Hawser reel	Hydraulic press			
Dairy cold room	Cranes	Ultrasonic-action cleaning tank			
Kitchen hood	Fans	Washing tank			
Kitchen fan	Electric hoist	Automatic sawing machine			
Turbines	Pneumatic hoist	Grinding machine			
Engines	Engine hoist (hydraulic)	Milling machine			
Powered generators	Seawater desalination unit	Inductive heater for bearings			
Powered generators package	Batteries for industrial power generation systems	Column-mounted drilling machine			
HVAC System	Overhead crane	Hydraulic hose crimping			
Evaporator	Fire damper	Portable hydrostatic test kit			
Trucks/trolleys	Pressurisation fan	Tirfor			
Emergency panel	Unit outdoor laboratory	Pneumatic oil drive pump			
	Ac unit indoor laboratory	Joint cutting machine			
Compressors	Air conditioning unit	Pneumatic grease drive pump			
Dampers	Air handling unit	Electric threading chaser			
	Hypochlorite generating unit	Portable hydraulic fluid filtration unit			
		Device for testing diesel engine injection nozzle			

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	ANNEX VIII – NR-12 Reference Lis	t for all machines and equipme	ent	
	Annex%20 %20I-ET-30	WIII%20- 10.2Q-12		

