	TECHNICAL SPECIFICATION					Nº. I-ET-3010.00-1200-970-P4X-013				
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	PROJECT:							CC:		
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**COMPLIANCE WITH NR-13 AND SPIE
REQUIREMENTS**

INTERNAL

ESUP

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1 INTRODUCTION

This technical specification is intended to guide the SELLER to meet the technical requirements regarding NR-13 and SPIE equipment and piping.

This technical specification helps to define the scope of equipment and piping to which the NR-13 and SPIE requirements shall be applied.

The requirements consist of providing documents to demonstrate that the equipment and piping have been designed, manufactured, assembled, and inspected in accordance with recognized standards and codes, and carrying out the inspection after installation in the definitive location.

NOTE: Definitive installation location is the location on the Unit where the equipment or piping will operate. In FPSO, for equipment and piping installed in Modules, the definitive installation location only occurs after the Module's lifting and hook-up (according to item 37.22.6 of NR-37).


NR-13 is a regulatory standard issued by Brazilian Government. NR-13 is mandatory, the equipment and piping included in its scope must not be put into operation without meeting the NR-13 requirements.

SPIE (in English, Own Inspection Service of Equipment) is a certification to be obtained by BUYER. The requirements requested by this technical specification are necessary inputs to obtain the SPIE certification.

The SPIE equipment and piping set is the full scope of equipment and piping under control, including safety devices. The NR-13 equipment and piping is a smaller set that is also under the SPIE control.

This technical specification also considers the requirements of NR-37 regarding pressure vessels and piping. The NR-37 requirements prevail over the NR-13 requirements.

Details of SELLER's responsibilities regarding to NR-13, NR-37 and SPIE activities are presented in the Annex A of this technical specification.

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2 NORMATIVE REFERENCES

2.1 GOVERNMENT REGULATION

- Norma Regulamentadora nº. 13 – Caldeiras, Vasos de Pressão, Tubulações e Tanques Metálicos de Armazenamento (versão de 01/07/2022)*
Regulatory Standard No. 13 – Boilers, Pressure Vessels, Piping and Metallic Storage Tanks (version of July 01, 2022)
- Norma Regulamentadora nº. 37 – Segurança e Saúde em Plataformas de Petróleo (versão de 18/01/2022)*
Regulatory Standard No. 37 – Safety and Health in Oil Platforms (version of January 18, 2022)
- Portaria INMETRO n.º 537 de 21 de outubro de 2015 – Instrução Normativa para Serviços Próprios de Inspeção de Equipamentos*
INMETRO Ordinance No. 537 of October 21, 2015 – Normative Instruction for Own Inspection Services of Equipment

2.2 REFERENCE DOCUMENTS

- EXHIBIT IV – DIRECTIVES FOR CONSTRUCTION AND ASSEMBLY
- EXHIBIT VIII – DIRECTIVES FOR COMMISSIONING
- I-ET-3010.00-1200-540-P4X-001 – REQUIREMENTS FOR PRESSURE VESSELS DESIGN AND FABRICATION
- I-ET-3010.00-1200-451-P4X-001 – SHELL & TUBE HEAT EXCHANGER SPECIFICATION
- DR-ENGP-I-1.15 – COLOR CODING

3 LEGALLY QUALIFIED PROFESSIONAL

The equipment and piping covered by NR-13 and SPIE shall be inspected under the technical responsibility of the Legally Qualified Professional (LQP).

The Legally Qualified Professional shall be a Mechanical Engineer with valid registration at CONFEA/CREA (in english, Brazilian Federal Council of Engineering and Agronomy/Regional Council of Engineering and Agronomy).

The Legally Qualified Professional shall register the ART (in english, Technical Responsibility Annotation) at CONFEA/CREA regarding the inspection activities under his responsibility.

4 COMPLIANCE WITH NR-13

NR-13 requirements shall be applied to pressure vessels and piping according to item 13.2.1 of NR-13, with the following notes/interpretations:

a) *boilers with operating pressure greater than 60 kPa (0,61 kgf/cm²).*

- do not occur in FPSO (typically)

b) *pressure vessels whose product P.V is greater than 8 (eight), where P is the module of the maximum operating pressure in kPa and V is its internal volume in m³.*

- includes only the mettalic vessels
- includes only the vessels with internal diameter ≥ 150 mm
- includes, for vessels subject exclusively to the vacuum condition, only those with vacuum > 5 kPa
- includes, for the transportable vessels, only those permanently attached to the Unit's systems
- does not include the hydraulic accumulators, but includes the pulsation dampeners
- does not include plate heat exchangers (gasketed or brazed), but includes printed circuit heat exchangers
- does not include pressure vessels of machine auxiliary systems with function of cooling, lubricating, and sealing
- does not include filters supported by the piping (without self-support)
- for the P.V calculation, to consider the Design Pressure as "P"

c) *pressure vessels containing class A fluids, specified in item "a" of sub-item 13.5.1.1.1, regardless of the P.V product.*


- same notes/interpretations as in item "b" above, but including any vessels subject exclusively to the vacuum condition

d) *mobile vessels with P.V greater than eight, where P is the module of the maximum operating pressure in kPa, or with class A fluids, specified in item "a" of sub-item 13.5.1.1.1.*

- mobile vessels are pressure vessels which can be moved (usually with no pressure) within a Unit or between Units and which cannot be classified as transportable
- if mobile vessels occur in FPSO, there will be very few, the same notes/interpretations as in item "b" above shall be followed

e) *piping containing class A or B fluids, according to items "a" and "b" of sub-item 13.5.1.1.1, connected to boilers or pressure vessels covered by this NR.*

- includes only the mettalic piping
- includes piping containing class A or B fluid not connected to pressure vessels
- includes piping (pipelines) designed in accordance with ASME B31.4 and ASME B31.8

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- does not include piping/tubing of instrumentation systems
- does not include hard pipes and risers

f) *metallic storage tanks, with external diameter greater than three meters, nominal capacity above twenty thousand liters, and containing class A or B fluids, according to items "a" and "b" of sub-item 13.5.1.1.1 of this NR.*

- do not occur in FPSO (typically)

NR-13 requirements are applicable, according to the rules above, to any type of pressure vessel, like drums, scrubbers, separators, shell and tube heat exchangers, printed circuit heat exchangers, towers, filters etc.

NR-13 requirements are applicable, according to the rules above, to the pressure vessels and piping supplied within units/skids, including units/skids of machines and naval equipment.

NR-13 requirements need not be applicable to pressure vessels of auxiliary machine systems with functions of cooling, lubrication, and sealing. For pressure vessels of auxiliary machine systems with other functions, NR-13 requirements are applicable according to the rules above.

NR-13 requirements are applicable, according to the rules above, to the pressure vessels originally transportable and permanently attached to any systems of the Unit. The following definitions shall be considered:

- Originally transportable pressure vessels: vessels designed and manufactured to be transported pressurized (with pressure), like cylinders.
- Permanently attached pressure vessels: pressure vessels not expected to be replaced during the operational life of the Unit, like the N₂ cylinders of nitrogen generation system. On the other hand, CO₂ cylinders of fire fighting systems shall not be consider permanently attached.

Filters design and manufactured according to piping component standards, such as ASME B16.34, shall not be considered as pressure vessel, shall be considered as piping component. Filters design and manufactured according to pressure vessel standards, such as ASME BPVC Sec. VIII, shall be also considered as piping component once they are supported by the piping (filters without legs, without self-support), even if P.V > 8 and internal diameter ≥ 150 mm.

NR-13 requirements are applicable, according to the rules above, to the pipelines designed and built according to ASME B31.4 and ASME B31.8. The pipelines shall be considered as piping. For the systems connected to the hard pipes and risers (production, injection, exportation), the boundary limit is the last SDV (or the first SDV, depending on the flow direction).

NR-13 requirements are applicable to piping containing fluid classes A and B, even if not connected to any NR-13 pressure vessel.

NR-13 requirements are applicable to tubing with function of piping. Tubing that are part of instrumentation lines are exempt from the NR-13 requirements.

NOTE: Instrumentation lines are those with function of connecting equipment/systems to their instruments (like pressure, temperature, level indicators and transmitters) or to operate the actuators (like valve actuators).

The fluid classification shall be as follows in Table 1:

Table 1 – Fluid Classification.

Fluid Class	Fluid Type
Class A	<ul style="list-style-type: none"> - Flammable fluids (liquid and gas) - Combustible fluids with temperature of 200 °C or above - Toxic fluids with tolerance limit of 20 ppm or lower - Hydrogen - Acetylene
Class B	<ul style="list-style-type: none"> - Combustible fluids with temperature lower than 200 °C - Toxic fluids with tolerance limit higher than 20 ppm
Class C	<ul style="list-style-type: none"> - Steam - Simple asphyxiating gases - Compressed air
Class D	<ul style="list-style-type: none"> - Other fluids not belonging to the above classes

NOTES:

- 1) Flammable fluid: liquid with flash point ≤ 60 °C.
- 2) Flammable gases: ignite with air at 20 °C and standard pressure of 101.3 kPa.
- 3) Combustible fluid: fluids with flash point > 60 °C and ≤ 93 °C.
- 4) Toxic fluids: fluids harmful to the health of workers, observing, regarding the tolerance limit, the provisions of NR-15.
- 5) In the case of mixture of fluids, for classification purposes the fluid presenting the highest risk to employees and facilities shall be considered, taking their toxicity, flammability, and concentration into account.

4.1 NR-13 PRESSURE VESSELS

4.1.1 Pressure Vessel Categorization

Pressure vessels shall be classified into potential risk groups depending on their P.V product, according to Table 2:

Table 2 – Potential Risk of Pressure Vessels.

Risk Group	P.V Product
Group 1	P.V \geq 100
Group 2	P.V < 100 and P.V \geq 30
Group 3	P.V < 30 and P.V \geq 2.5
Group 4	P.V < 2.5 and P.V \geq 1
Group 5	P.V < 1

NOTES:

- 1) "P" is the Design Pressure in MPa, [in module].
- 2) "V" is the internal volume in m³.
- 3) Consider 1 MPa corresponding to 10.197 kgf/cm².

Based on Fluid Class and Potential Risk Group, the pressure vessels shall be classified into categories according to Table 3:

Table 3 – NR-13 Categories for Pressure Vessels.

	Risk Group 1	Risk Group 2	Risk Group 3	Risk Group 4	Risk Group 5
Fluid Class A	I	I	II	III	III
Fluid Class B	I	II	III	IV	IV
Fluid Class C	I	II	III	IV	V
Fluid Class D	II	III	IV	V	V

NOTE: The pressure vessels classification into categories shall be checked and approved by SELLER's Legally Qualified Professional.


Heat exchangers shall have their categories established considering the most critical category between the shell side and the tube side.

SELLER shall issue the NR-13 Equipment List, including all NR-13 pressure vessels of the Unit, according to the template of Annex B.

NOTE: The NR-13 Equipment List shall be submitted to BUYER for comments/validation.

SELLER shall issue, for each pressure vessel, the NR-13 Information Sheet according to the template of Annex C. This document shall be issued and signed by the Legally Qualified Professional.

All pressure vessels shall be represented and tagged in the P&IDs, including pressure vessels supplied within units/skids.

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4.1.2 Safety Device and Pressure Gauge

NR-13 pressure vessels must be equipped with safety valve or other safety device with set opening pressure equal to or less than the maximum allowed working pressure (MAWP), installed directly in the vessel or in the system that includes it, considering the design/construction code requirements regarding staggered openings and inspection and test tolerances.

NR-13 pressure vessels subjected to vacuum must be equipped with safety devices or other means provided for in the design (like to be design for full vacuum condition).

NR-13 pressure vessels designed for the two conditions (pressure and vacuum), shall be equipped with safety devices for both conditions.

The TAG(s) of the safety device(s) shall be informed in the NR-13 Equipment List, linking it to the pressure vessel.

NR-13 pressure vessels must be equipped with instrument(s) that indicates the operating pressure, installed directly in the vessel or in the system that contains it. The TAG(s) of the pressure gauge(s) shall be informed in the NR-13 Equipment List, linking it to the pressure vessel.


The safety devices shall be re-calibrated by SELLER, even if already calibrated by the manufacturer, as required by Exhibit VIII – Directives for Commissioning. Pressure gauges shall be re-calibrated if requested by Exhibit VIII – Directives for Commissioning.

For heat exchangers, safety device and pressure gauge shall be installed on each side, shell side and tube side.

4.1.3 Installation and Identification

Every NR-13 pressure vessel shall have affixed to your body, in a place of easy access and highly visible, a nameplate according to the templates presented in I-ET-3010.00-1200-540-P4X-001 – Requirements for Pressure Vessels Design and Fabrication or I-ET-3010.00-1200-451-P4X-001 – Shell & Tube Heat Exchanger Specification. All information shall be in Portuguese (Brazil) language.

NOTE: SELLER shall check if the nameplates of pressure vessels supplied within units/skids are in accordance with this technical specification. If not, SELLER is responsible to replace the nameplates.

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Every NR-13 pressure vessel shall have painted its NR-13 Category and its TAG according to the guidelines of Annex E. The NR-13 Category and TAG shall be painted in a visible place after installation and thermal insulation application, to enable quick view in emergencies, shall not be behind piping, ladders, platforms, and other accessories after final location.

Pressure vessel shall be installed so that all drains, vents, manholes and level, pressure, and temperature indicators, where applicable, are easily accessible.

The pressure vessel installation on its definitive location shall meet the following conditions:

- 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.

If the conditions regarding pressure vessel installation (access, exits, illumination) is not achieved, SELLER shall carry out safety study about the pressure vessel installation considering complementary security measures that allow for the mitigation of risks.

4.1.4 Inspections and Tests

Pressure vessels must be submitted to the hydrostatic test in their manufacturing phase. The test shall be validated, and the report signed, by a technical responsible.

NOTE: If the manufacturer does not have a technical responsible, the SELLER shall provide.

In the absence of satisfactory documentation regarding the hydrostatic test during the manufacturing stage, or when rastreability by TAG or serial number is not possible, the hydrostatic test shall be carried out after the pressure vessel installation at the definitive location under the responsibility of the Legally Qualified Professional.

Calibrated pressure gauges (at least two) shall be used in the hydrostatic test. The calibration certificates shall be attached to the hydrostatic test report.

SELLER shall carry out, after the pressure vessel installation at definitive location and prior to start operation, the Initial Safety Inspection comprising internal and external examination.

NOTE: For pressure vessels with internal fillings (like catalyst), manufacturer shall not carry out the loading at the factory since the fillings must be removed for the internal examination after equipment installation.

The initial safety inspection shall be carried out under the responsibility of the Legally Qualified Professional.

NOTE: It is recommended to film (to make a movie) of the internal examination, especially if not witnessed by the BUYER.

Pressure vessels which do not allow visual access to internal or external examinations due to physical impossibility shall be alternatively subjected to other nondestructive examination at the discretion of the Legally Qualified Professional, based on applicable standards and codes.

NOTE: The use of non-destructive examinations, in lieu of internal or external examination, shall be previously approved by BUYER.

The recommendations resulting from the initial safety inspection must be implemented and any necessary repair shall be done. The pressure vessel shall be delivered with no pendings.


NOTE: SELLER shall notify BUYER to witness the initial safety inspections (witness point).

The initial safety inspection report shall be issued and signed by the Legally Qualified Professional for each NR-13 pressure vessel. The report shall include pictures. The template of Annex D shall be used.

The deadline date for the next safety inspection, based on the Table 4, shall be registered in the initial safety inspection report. The time counting starts from the end date of internal and external examinations.

Table 4 – Deadline for the next safety inspection.

Pressure Vessel Category	External Examination	Internal Examination
I	1 year	3 years
II	2 years	4 years
III	3 years	6 years
IV	4 years	8 years
V	5 years	10 years

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Thickness measurement shall be carried out in the pressure vessels made of carbon steel, without internal coating, in the regions (points) indicates in the Annex F.

4.1.5 Safety Record Book and Operation Manual

SELLER shall delivery a Safety Record Book, consisted by numbered pages. The same book may cover a various pressure vessel and may be delivered as a set of sequential books.

Immediately after the end of each initial safety inspection, the operational condition of the pressure vessel shall be registered in the Safety Record Book, stating that pressure vessel was inspected and is able to start operation safely till next inspection. In it shall be registered:

- a) The date and occurrence of initial safety inspections, for each pressure vessel.
- b) Physical and operational condition of the pressure vessel.
- c) Date of the annotation, legible name, and signature of the **Legally** Qualified Professional.

NOTE: SELLER shall agree with BUYER the standardized text to be written in the Safety Record Book.


SELLER shall issue, for all pressure vessels Categories I and II their own operations manual (or operating instructions contained in the operation manual of the Unit), 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.

4.1.6 Documentation

The following documentation listed below shall be provided by SELLER. The documents highlighted in bold are the documents requested by this technical specification. The other documents are common documents typically provided for any Project.

- 1) **NR-13 Equipment List** (according to Annex B).
- 2) **NR-13 Dossier** (individual, for each pressure vessel), containing:
 - a) **NR-13 Information Sheet** (signed by **LQP**).

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- b) P&ID (with the pressure vessel represented and tagged).
- c) Pressure Vessel Datasheet.
- d) Pressure Vessel Calculation Sheet (contemplating all components).
- e) General Arrangement, Components, and Nameplate Drawings.
- f) Bill of Materials (when not in the drawings).
- g) Procedures of manufacturing, assembly, and inspection (welding, heat treatment, non-destructive testing, hydrostatic testing, external painting, and internal coating).
- h) Report of hydrostatic test (signed by **technical responsible**).
- i) Safety Device Datasheet.
- j) Pressure Gauge Datasheet.
- k) Safety Device Calibration Certificate (**last one**).
- l) Pressure Gauge Calibration Certificate (**last one**).
- m) **Operation Manual** for Category I and II Pressure Vessels.
- n) **Initial Safety Inspection Report** (signed by **LQP**).
- o) **Thickness Measurement Report** (attached to initial safety inspection report).
- p) **Safety Study Report**, when the requirements regarding access, exits and illumination is not fully met.

3) **Alteration and Repair Design** (applicable only for repairs and modifications in the pressure vessels after the manufacturing phase).


4) **Safety Record Book.**

The documents of NR-13 Dossier shall clearly inform: the design code and its year of edition; the material specifications; the methodology for establishing the MAWP; the maximum operating pressure; the functional characteristics of the pressure vessel; and the year of manufacture of the pressure vessel.

SELLER is responsible to provide all the documents. Some of them are normally requested from manufacturers/suppliers of pressure vessels, safety devices, and pressure gauges. Any document not issued by manufacturers/suppliers (e.g. datasheets, calculation sheets, drawings etc.) shall be provided by SELLER.

4.1.7 **Special Requirements for Shell and Tube Heat Exchangers**

For shell and tube heat exchangers, an internal examination shall be performed at the factory, before inserting the tube bundle into to the shell.

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NOTE 1: The internal examination at factory shall be well registered by photographic report.

NOTE 2: SELLER (SELLER's LQP) shall witness this inspection and shall notify BUYER (BUYER's LQP) to witness internal examination at manufacturer (witness point).

The hydrostatic test of the shell and tube heat exchangers shall be repeated after installation at definitive location (after all activities related to tube bundle insertion/removal, transport, lifting and installation) for checking the tube/tubesheet connection.

4.1.8 Special Requirements for Pressure Vessels Categories I and II

SELLER, by its Legally Qualified Professional, is responsible for carry out the Initial Safety Inspection of the pressure vessels Category I and II. This inspection activity must not be delegated to its subcontractors, like the subcontractors for Module's construction.

The initial safety inspection, comprising internal examination, external examination, and issuance of the report, must be carried out in the integration phase, with the Modules already interconnected to the Unit, not earlier than 12 months prior to the Unit leaves the shipyard (sail away).

The safety devices of this equipment must be recalibrated, not earlier than 12 months before the Unit leaves the shipyard (sail away), preferably not before the internal examination of the respective equipment.

The initial safety inspection report must be a single report comprising both internal and external examinations.

4.2 NR-13 PIPING


SELLER shall issue the NR-13 Piping List, covering all NR-13 piping of the Unit, according to the template of Annex B.

NOTE: The NR-13 Piping List shall be submitted to BUYER for comments/validation.

All piping shall be represented and tagged in the P&IDs, including piping supplied within units/skids.

4.2.1 Iso-Corrosion System

The piping shall be grouped in iso-corrosion systems based according to the guidelines presented in Annex G.

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For each piping iso-corrosion system shall be issued the marked-up P&ID identifying each line belonging to it.

NOTE: The grouping of the piping in iso-corrosion systems shall be submitted to BUYER for comments/validation.

SELLER shall issue, for each piping iso-corrosion system, the NR-13 Information Sheet according to the template of Annex C. This document shall be issued and signed by the **Legally** Qualified Professional.

SELLER shall issue, for each piping iso-corrosion system, the simplified isometric drawing for inspection purposes (iso-corrosion isometric drawing) based on examples presented in Annex H.

4.2.2 Safety Device and Pressure Gauge

When required by the design code or by the hazard and operability study (Hazop), NR-13 piping systems shall be equipped with safety device and pressure gauge.

The TAG of the safety device and pressure gauge shall be informed in the NR-13 Piping List, linking them to the piping system. If the pressure device and pressure gauge is not required for any piping system, it shall be clear stated in the NR-13 Piping List.

The safety devices shall be re-calibrated by SELLER, even if already calibrated by the manufacturer, as required by Exhibit VIII – Directives for Commissioning. **Pressure gauges shall be re-calibrated if requested by Exhibit VIII – Directives for Commissioning.**


4.2.3 Identification

The lines of the piping system shall be identified according to DR-ENGP-I-1.15 after installation. Piping with straight length less than 400 mm, typically within units/skids, need not be identified according to DR-ENGP-I-1.15. **However, an identification plate shall be attached to the lines.**

4.2.4 Inspection and Tests

Hydrostatic tests shall be performed prior to initial operation in accordance with the respective design code.

SELLER shall carry out, under the responsibility of the **Legally** Qualified Professional, the Initial Safety Inspection (external examination). The inspection close out shall be after the piping

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installation (after all manufacturing, assembly, cleaning, including all applicable nondestructive and leak tests) and prior to start operation.

NOTE: The Initial Safety Inspection shall be performed before installation of thermal insulation.

The recommendations resulting from the initial safety inspection must be implemented and any necessary repair shall be done. The piping system shall be delivered with no pendings.

NOTE: SELLER shall notify the BUYER to witness the initial safety inspections (**witness point**).

The initial safety inspection report shall be issued and signed by the **Legally** Qualified Professional for each NR-13 piping iso-corrosion system. The template of Annex D shall be used.


The deadline date for the next safety inspection shall be registered in the initial safety inspection report. The maximum period shall be based on Table 4, considering the period for the internal examination of the most critical pressure vessel connected to the piping system. In the case of piping systems not connected to any pressure vessel, the deadline shall be 5 years. The time counting starts from the date of issuance of the initial safety inspection report.

Thickness measurement shall be carried out in the piping made of carbon steel, without internal coating, in the regions (points) indicates in the Annex F.

4.2.5 Documentation

The following documentation listed below shall be provided by SELLER. The documents highlighted in bold are the documents requested by this technical specification. The other documents are common documents normally provided for any Project.

- 1) Line List (datasheet).
- 2) ISO Drawing (with bill of materials).
- 3) **NR-13 Piping List** (according to Annex B, with the piping grouped by iso-corrosion system).
- 4) **NR-13 Dossier** (for each piping iso-corrosion system), containing:
 - a) **NR-13 Information Sheet** (signed by **LQP**).
 - b) P&ID (with all piping represented and tagged).
 - c) Piping Specs (material datasheet).
 - d) Calculation Sheet of non-standard piping components.
 - e) Report of hydrostatic test (**signed by technical responsible**).

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- f) Safety Device Datasheet.
- g) Pressure Gauge Datasheet.
- h) **P&ID marked by iso-corrosion system.**
- i) **Simplified ISO Drawing** for inspection purpose.
- j) Safety Device Calibration Certificate (last one).
- k) Pressure Gauge Calibration Certificate (last one).
- l) **Initial Safety Inspection Report** (signed by LQP).
- m) **Thickness Measurement Report** (attached to initial safety inspection report).

5 COMPLIANCE WITH NR-37

5.1 Initial Safety Inspection in the Modules (before lifting)

According to NR-37, the initial safety inspection of NR-13 pressure vessels (and piping) shall be carried out with them permanently connected to the process unit (Module) on the platform (FPSO), as established in the project. However, NR-37 also present provisions that allow to perform the initial safety inspection of NR-13 pressure vessels and piping after their installation in the Modules and before lifting and hook-up (that means before installation in the definitive location).

If the NR-13 initial safety inspection is carried out after the installation of the pressure vessels and piping in the modules, but before the lifting and hook-up of the module to the Unit, the following conditions shall be met:

- 1) The lifting and hook-up of modules shall be finished within 1 year after the NR-13 initial safety inspection of the pressure vessels and piping. The lifting operation must be witness by the BUYER's Legally Qualified Professional. A report about the lifting shall be issue and both Legally Qualified Professionals (SELLER and BUYER) shall sign it.
- 2) After lifting of the modules, shall be carried out an external inspection (general inspection) on each module including all NR-13 pressure vessels and piping. The general external inspection must be witness by the BUYER's Legally Qualified Professional. A report shall be issue and both Qualified Professinals (SELLER and BUYER) shall signed it.
- 3) After lifting and hook-up of the modules, shall be carried out leakage test on all NR-13 pressure vessels and piping.

The deadline for lifting and hook-up of the modules to the Unit may be extended from 1 year to 2 years if the BUYER's Legally Qualified Professional witnesses all the initial safety inspections. For

this, the initial safety inspection reports shall be signed by both **Legally** Qualified Professionals (SELLER and BUYER).

NOTE: The final date of the hook-up of each module shall be stated by documents.

If the lifting and hook-up of the modules to the Unit is completed after the maximum period allowed (1 or 2 years), the initial safety inspection must be repeated.

For NR-13 pressure vessels Category I and II, the initial safety inspection shall be carried out during integration phase (see item 4.1.8 of this technical specification).


6 COMPLIANCE WITH SPIE

All NR-13 pressure vessels and piping are also part of the set of equipment controlled by SPIE.

The documentation, inspections and records required by NR-13 are sufficient to meet SPIE requirements, this means that equipment that meets NR-13 requirements also meets SPIE requirements.

In addition to pressure vessels and piping covered by NR-13, the equipment listed below are also controlled by SPIE, and shall follow the SPIE requirements:

- Any pressure vessels (metallic) not included in NR-13, except the transportable ones.
 - includes vessels containing class class B, C, or D fluid with $P.V \leq 8$
 - includes vessels with internal diameter < 150 mm
 - includes vessels of machine auxiliary systems with function of cooling, lubricating, and sealing
 - does not include filters supported by piping (without self-support)
 - does not include transportable vessels (cilynders, extinguers etc.)
- Non-metallic pressure vessels.
- Plate heat exchangers (gasketed and brazed).
- Hydraulic accumulators.
- PIG launchers and receivers.
- Storage tanks (metallic and non-metallic), except structural tanks.
- Flare tips.
- Inert gas generator.

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- Heat exchange coils.
- Air Cooler of Fire Fighting System.
- Any metallic piping not included in NR-13 and any non-metallic piping, except:
 - Sewage Waste System
 - Gray Water System
 - Sanitary Bilge System
 - Potable Water System (when the piping runs inside the living quarter)
 - Chilled Water System (when the piping runs inside the living quarter)
- Safety devices, like PSV (pressure safety valve), BPRV (buckling pin relief valve), BPAV (angle style buckling pin valve), PVRV (pressure vacuum relief valve), rupture/bursting disc etc.
 - includes, for PVRV, only those installed in tanks controlled by the SPIE

The list above includes the equipment, piping and safety devices installed and supplied within any units/skids, including units/skids of machines and naval equipment.

6.1 Equipment

SELLER shall issue the SPIE Equipment List, including all SPIE controlled equipment of the Unit according to the template of in Annex B.

NOTE: The SPIE Equipment List shall be submitted to BUYER for comments/validation.

If the equipment is equipped with safety device, the TAG of the safety device shall be informed in the SPIE Equipment List, linking it to the equipment.

The equipment shall be represented and tagged in the P&IDs, including equipment inside units/skids.

Every SPIE equipment shall have a nameplate affixed to your body, in a place of easy access and highly visible.

Every SPIE equipment shall have painted its TAG according to the guidelines of Annex E.

SELLER shall carry out, after the equipment installation and prior to start operation, the Initial Inspection comprising internal (whenever possible) and external examination.

The initial inspection shall be carried out under the responsibility of the **Legally** Qualified Professional.

NOTE: It is recommended to film (to make a movie) of the internal examination, especially if not witnessed by the BUYER.

The recommendations resulting from the initial inspection must be implemented and any necessary repair shall be done. The pressure vessel shall be delivered with no pendings.


NOTE: SELLER shall notify the BUYER to witness the initial inspections (**witness point**).

The initial inspection report shall be issued and signed by the **Legally** Qualified Professional for each equipment. It shall be a single report for both the internal and external examinations and shall include pictures. The template of Annex D shall be used.

Thickness measurement shall be carried out in the equipment made of carbon steel and without internal coating in the regions (points) indicates in the Annex F.

The following documentation listed below shall be provided by SELLER. The documents highlighted in bold are the documents requested by this technical specification. The other documents are common documents normally provided for any Project.

- 1) **SPIE Equipment List** (according to Annex B).
- 2) P&ID (with the equipment represented and tagged).
- 3) Manufacturing Databook for each equipment containing:
 - a) Calculation Sheet.
 - b) Drawings.
 - c) Bill of Materials.
 - d) Reports of welding inspection, heat treatment, non-destructive testing, painting inspection, if applicable.
 - e) Reports of dimensional inspection.
 - f) Reports of hydrostatic test, if applicable.
- 4) **Initial Inspection Report** (signed by **LQP**).
- 5) **Thickness Measurement Report** (attached to initial inspection report).

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SELLER is responsible to provide all the documents even though the manufacturing databook are requested from manufacturers/suppliers of the equipment. Any document not issued by manufacturers/suppliers shall be provided by SELLER.

6.2 Piping

SELLER shall issue the SPIE Piping List according to the template of Annex B.

NOTE: The SPIE Piping List shall be submitted to BUYER for comments/validation.

All piping shall be represented and tagged in the P&IDs, including piping supplied within units/skids.

The piping shall be grouped in iso-corrosion systems based according to the guidelines presented in Annex G.

For each piping iso-corrosion system shall be issued the marked P&ID identifying each line belonging to it.

NOTE: The grouping of the piping in iso-corrosion systems shall be submitted to BUYER for comments/validation.

For each piping iso-corrosion system shall be issued the simplified isometric drawing for inspection purposes (iso-corrosion isometric drawing) based on examples presented on the Annex H.


The lines of the piping system shall be identified according to item 4.2.3 of this technical specification.

SELLER shall carry out, under the responsibility of the **Legally** Qualified Professional, the Initial Inspection (external examination). The inspection close out shall be after the piping installation and prior to start operation.

The recommendations resulting from the initial inspection must be implemented and any necessary repair shall be done. The piping system shall be delivered with no pendings.

NOTE: SELLER shall notify the BUYER to witness the initial inspections (**witness point**).

The intital inspection report shall be issued and signed by the **Legally** Qualified Professional for each piping iso-corrosion system. The template of Annex D shall be used.

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Thickness measurement shall be carried out in the piping made of carbon steel and without internal coating in the regions (points) indicates in the Annex F.

The following documentation listed below shall be provided by SELLER. The documents highlighted in bold are the documents requested by this technical specification. The other documents are common documents normally provided for any Project.

- 1) **SPIE Piping List** (according to Annex B, with the piping gruped by iso-corrosion system).
- 2) P&ID (with all piping represented and tagged).
- 3) **P&ID marked by iso-corrosion system.**
- 4) **Simplified ISO Drawing** for inspection purpose.
- 5) Manufacturing Databook of all piping containing:
 - a) Piping Specs (material datasheet).
 - b) Calculation Sheet of non-standard piping components.
 - c) ISO Drawing (with bill of materials).
 - d) Reports of welding, heat treatment and non-destructive testing.
 - e) Reports of hydrostatic test.
- 6) **Initial Safety Inspection Report** (signed by LQP).
- 7) **Thickness Measurement Report** (attached to initial inspection report).


6.3 Safety Devices

SELLER shall issue the Safety Devices List, including all safety devices of the Unit according to the template model presented in Annex B. The Safety Devices List shall also include those installed and supplied within any units/skids, including units/skids of machines and naval equipment.

NOTE: The Safety Devices List shall be submitted to BUYER for comments/validation.

All safety devices shall be supplied with datasheet and with calibration certificate (applicable for PSV) or batch approval certificate (applicable for BPRV, BPAV, rupture/bursting disc).

The safety devices (applicable to PSVs) shall be re-calibrated by SELLER, even if already calibrated by the manufacturer, as required by Exhibit VIII – Directives for Commissioning and item 4.1.8 of this technical specification.

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NOTE: The safety valves installed in the body of pumps and valves are exempted of the requirements of this technical specification. The PVRV installed in structural tanks and SDV are also exempted.

6.4 LO/LC Valves, Locking Devices (Car Seals) and Warning Plates

SELLER shall issue the LO/LC Valves List, including all LO/LC valves of the Unit according to the template of in Annex B.

The locking devices for LO valves associated to any safety devices of NR-13 pressure vessels or piping shall be assigned as DCBI in the LO/LC Valves List. It shall be possible and easy to segregate the LO valves with DCBIs in the LO/LC Valves List.

NOTE: DCBI is a regulatory denomination from NR-13 that means, in english, device against inadvertent blocking.

SELLER shall supply the locking devices and warning plates for LO/LC valves, as loose items, in the quantity established in the Contract, without the need to install them.

The specification for locking devices and warning plates shall be according to Annex I.






7 GENERAL NOTES

- The NR-13 Equipment List and the SPIE Equipment List shall be delivered unified into a single list according to Annex B.
- The NR-13 Piping List and the SPIE Piping List shall be delivered unified into a single list according to Annex B.
- Safety devices are those that are directly actuated by the variation of the internal pressure of the equipment, for example: PSV (pressure safety valve), BPRV (buckling pin relief valve), BPAV (angle style buckling pin valve), PVRV (pressure vacuum relief valve), rupture/bursting disc, etc. Does not include devices with indirect actuation, like BDV (blowdown valve).
- Calibration or re-calibration of safety devices are applicable to PSV and PVRV. The other safety devices (BPRV, BPAV, rupture/bursting disc) are supplied with batch approval certificate, and calibration or re-calibration are not applicable.
- The calibration validity period of safety devices of NR-13 pressure vessels is the same period of validity period of the internal examination of the NR-13 equipment protected by it (see Table 4). For example: the calibration of PSV attached to pressure vessel category I is

valid for 3 years, the calibration of PSV attached to pressure vessel category II is valid for 4 years. However, the maximum validity period for safety devices in general is 5 years.

- Pressure gauges accepted for NR-13 equipment and piping are those that allow local reading (not remote). For example: PI (pressure indicator) and PIT (pressure indicator and transmitter).
- The calibration validity period of pressure gauges of NR-13 pressure vessels and piping is 2 years.
- Alteration or Repair Design is a NR-13 requirement not applicable in the fabrication phase. After leaving the factory, if the equipment suffers any damage during transport and assembly, or any modification, it is necessary to issue an Alteration or Repair Design.
- The deadline date for the next internal and external examination to be informed in the initial inspection report of SPIE equipment and piping (not covered by NR-13) shall be requested to BUYER.
- Heat exchange coils shall be inspected and controlled together with the equipment. The only exception is the WHRU (waste heat recovery unit) coil, which is individually controlled.
- It is not necessary to provide calculation sheet for standardized piping components (pipes, flanges, elbows, tees etc.). Calculation sheet is required only for non-standard piping components.
- Instrument air manifolds or similar pneumatic vessels (generally designed according to ASME B31.3) shall not be considered as pressure vessel, shall be considered as piping component.
- The thickness measurement report shall include a sketch showing the measurement locations. In the equipment and piping, the thickness measurement locations shall be permanently marked/identified.

8 ANNEXES

- Annex A – NR-13/SPIE Responsibility Matrix 
- Annex B – Equipment, Piping, Safety Devices, LO&LC Valves Lists 
- Annex C – NR-13 Information Sheet 
- Annex D.1 – NR-13 Initial Safety Inspection Report for Equipment 
- Annex D.2 – NR-13 Initial Safety Inspection Report for Piping 

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- Annex D.3 – Initial Inspection Report for Equipment 
- Annex D.4 – Initial Inspection Report for Piping 
- Annex E – Equipment Identification 
- Annex F – Thickness Measurement Regions 
- Annex G – Piping Iso-Corrosion Systems 
- Annex H – Iso-Corrosion Isometric Drawing 
- Annex I – Locking Devices and Warning Plates 
- Annex J – Extras (templates for Thickness Measurement Report, PSV Calibration Report, Safety Record Book, Alteration and Repair Design Documentation and NR-13 Dossier)

