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APPROVAL	JUVENTINO								

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## SUMMARY

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PRELIMINARY



## 1 SCOPE

This specification covers the minimum requirements for design of metallic tanks for topside to be supplied to **PETROBRAS** floating units.

## 2 NORMATIVE REFERENCES

Tanks design shall comply with the requirements of this specification, data sheets, rules, codes, standards and the project specifications as stated below and with those referred to herein.

### 2.1 CLASSIFICATION SOCIETY

2.1.1 MANUFACTURER shall perform the work in accordance with the requirements of Classification Society.

2.1.2 MANUFACTURER is responsible for submitting to the Classification Society all documentation in compliance with stated Rules.

### 2.2 CODES AND STANDARDS

2.2.1 The following codes and standards include provisions for this specification. The latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used, provided it can be shown that they meet or exceed the requirements of the standards referenced below:

AISC	- American Institute of Steel Construction
API Specification 12F	- Specification for Shop Welded Tanks for Storage of Production Liquids
API STD 2000	- Venting Atmospheric and Low-Pressure Storage Tanks
API STD 520	- Sizing, Selection, and Installation of Pressure-relieving Devices
API STD 650	- Welded Steel Tanks for Oil Storage
ASME B16.11	- Forged Steel Fittings, Socket-Welding and Threaded
ASME B16.47	- Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard
ASME B16.5	- Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard
ASME B31.3	- Process Piping
ASTM	- American Society for Testing and Materials
AWS D1.1	- Structural Welding Code
IEC 60092-502	- Electrical Installation in Ships – Tankers – Special Features
IEC 61892-6	- Mobile and Fixed Offshore Units – Electrical Installations – Installation
IEC 61892-7	- Mobile and Fixed Offshore Units – Electrical Installations – Hazardous Areas

### 2.3 GOVERNMENTAL REGULATION

NR-13	- Caldeiras, Vasos de Pressão, Tubulações e Tanques Metálicos de Armazenamento. (Boilers, Pressure Vessels, Piping and Storage Metallic Tanks)
NR 26	- Sinalização de Segurança (Safety Signaling - Brazilian Labor Ministry Rules)



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NR 30 – Anexo II - Plataformas e Instalações de Apoio (Platforms and Support Facilities/  
Brazilian Labor Ministry Rules)

\*Note: Government codes, regulations, ordinances or rules applicable to the equipment in Brazil shall prevail over the requirements of this specification, including reference codes and standards, only if more stringent.

## 2.4 REFERENCE DOCUMENTS

DR-ENGP-M-I-1.3	- SAFETY ENGINEERING
DR-ENGP-I-1.15	- COLOR CODING
I-DE-3010.00-5140-700-P4X-003	- GROUNDING INSTALLATION TYPICAL DETAILS
I-ET-3000.00-1200-940-P4X-001	- TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.
I-ET-3010.00-1200-251-P4X-001	- BOLT MATERIALS
I-ET-3010.00-1200-431-P4X-001	- THERMAL INSULATION FOR MARITIME INSTALLATIONS
I-ET-3010.00-1200-955-P4X-001	- WELDING
I-ET-3010.00-1200-956-P4X-002	- GENERAL PAINTING
I-ET-3010.00-5140-700-P4X-001	- SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS

### • Specific Documents to be supplied by **PETROBRAS**:

- METOCEAN DATA
- MOTION ANALYSIS
- PROCESS DATASHEET
- GENERAL ARRANGEMENT
- GENERAL AREA CLASSIFICATION
- MATERIAL SPECIFICATION FOR TANKS

## 2.5 CONFLICTING REQUIREMENTS

In all cases of conflict between this specification and applicable documents listed herein, the more stringent requirements shall prevail. In such cases, **MANUFACTURER** shall inform **PETROBRAS** of the conflict and seek clarification.

## 3 DEFINITIONS AND ABBREVIATIONS

### 3.1 DEFINITIONS

- 3.1.1 CAN: Can requirements are conditional and indicate a possibility open to the user of the standard.
- 3.1.2 [document supplied by **PETROBRAS**]: Project's document to be furnished by **PETROBRAS** to **MANUFACTURER**, this document contain information to be used during equipment design and fabrication.
- 3.1.3 MAY: May indicates a course of action that is permissible within the limits of the standard (a permission).
- 3.1.4 SHALL: Shall is an absolute requirement which must be followed strictly in order to conform with the standard.



3.1.5 MANUFACTURER: The supplier, vendor or Contractor. Company responsible for the fabrication of equipment and internal components.

### 3.2 ABBREVIATIONS

AISC	-	American Institute of Steel Construction
API	-	American Petroleum Institute
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing and Materials
AWS	-	American Welding Society
HAZOP	-	Hazard and Operability Studies
IEC	-	International Electrotechnical Commission
NDE:	-	Non-Destructive Examination
P&ID:	-	Piping & Instrumentation Diagram
PHA	-	Preliminary Hazard Analysis

## 4 DESIGN REQUIREMENTS

### 4.1 OPERATION ENVIROMENT

The equipment shall be suitable for the environment and range of ambient conditions, including, atmospheric pressure, relative humidity, rainfall, dry-bulb air temperature, characteristic monthly values and wind motions defined in latest revision of METOCEAN DATA specification [document supplied by **PETROBRAS**].

### 4.2 MOTION REQUIREMENTS

The necessary design data and information on motion requirements of the floating unit are given in the latest revision of MOTION ANALYSIS report [document supplied by **PETROBRAS**].

### 4.3 DESIGN CONDITONS

MANUFACTURER shall design the equipment according with the design conditions and dimensions as specified in the PROCESS DATASHEET [document supplied by **PETROBRAS**].

### 4.4 EQUIPMENT LOCATION

Equipment location is according to the floating unit GENERAL ARRANGEMENT drawing [document supplied by **PETROBRAS**].

### 4.5 DESIGN LOADS

MANUFACTURER shall submit all calculations and mechanical datasheets to **PETROBRAS** approval.

In addition to the Code described loads and loads due to floating unit motion described in MOTION ANALYSIS [document supplied by **PETROBRAS**], the following design loads shall be considered where relevant:

- Equipment transportation and erection loads;
- Nozzle loads;
- Wind loads;
- Weight loads;
- Thermal loads.



#### 4.6 DESIGN LIFETIME

MANUFACTURER shall design and fabricate the complete equipment for a minimum service life of 25 years, unless otherwise mentioned in a specific **PETROBRAS** document.

#### 4.7 SAFETY REQUIREMENTS

- 4.7.1 Maximum allowable pressure drop for pressure relief devices shall comply with API 520 requirements.
- 4.7.2 For area classification information see the GENERAL AREA CLASSIFICATION [document supplied by **PETROBRAS**].
- 4.7.3 HAZOP and PHA shall be according **DR-ENGP-M-I-1.3 – SAFETY GUIDELINE**.

#### 4.8 SCOPE OF SUPPLY

- 4.8.1 The scope of supply for the atmospheric tanks shall include, but not necessarily be limited to the following:
- dedicated nozzle connections;
  - grounding and lifting lugs;
  - earthing boss;
  - baffles;
  - manhole;
  - all clips for piping, supports, thermal insulation etc., if required;
  - supports and/ or skids, when applicable;
  - Nameplate.
- 4.8.2 Tanks shall be provided with figure-8 blank (spectacle flange) at the main nozzles.
- 4.8.3 Tanks shall be provided with vent connections according to the applicable API standards. In case of storing flammable liquids they shall have flame arrestors.

#### 4.9 NOZZLE AND FLANGES

- 4.9.1 Nozzle minimum thickness shall be Standard pipe (schedule STD).
- 4.9.2 Nozzles shall be attached to the tanks by full fillet welds, both inside and outside.
- 4.9.3 Flanges shall be either welding neck or slip-on, according to ASME B16.5 or ASME B16.47.
- 4.9.4 Roof manholes shall have reinforcing plate in accordance with API-650.
- 4.9.5 Davits shall be provided for tank manholes NPS 18" and higher.

#### 4.10 CORROSION ALLOWANCE

- 4.10.1 The minimum corrosion allowance to be used for tanks design is indicated in MATERIAL SPECIFICATION FOR TANKS document.
- 4.10.2 The following items shall be applied when corrosion allowance is not specified:
- For carbon-steel or low alloy steel parts, a minimum corrosion allowance of 1.5 mm shall be adopted and in case of water as process fluid, a minimum corrosion allowance of 3 mm shall be adopted.
  - It is not necessary to add corrosion allowance for stainless steel, welded metal overlay or clad tanks

#### 4.11 TECHNICAL REQUIREMENTS

- 4.11.1 All tanks and their structural attachments shall be designed according to API Specification 12F, unless otherwise mentioned in a specific **PETROBRAS** document. When rectangular tank is specified, the mechanical calculation shall be by AISC or equivalent standard.

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4.11.2 Tanks shall have conical or sloped bottom, with inclination between 1:100 and 1:25, and a draw roof at the center.

4.11.3 Supported conical roofs shall have inclination, from the center to the shell, of 1:16. When applicable, the maximum allowable inclination is 1:6. The deck type design shall comply with the requirements of item 5.12 of API 12F, where applicable.

4.11.4 For roof design, its self weight and a load of 981 N/m<sup>2</sup> (100 kgf/m<sup>2</sup>) shall be considered.

4.11.5 A level indicator and sounding guide pipe on the shell shall be foreseen.

4.11.6 Access means, such as ladders, platforms railings etc., shall be foreseen and provided for the following conditions:

- Vents and safety or relief valves;
- Instruments that need reading at the operation location or frequent inspection;
- Manholes with centerline located at 3000 mm or higher above the floor.

4.11.7 For reinforced hybrid tanks, minimum thickness shall be 2 mm for stainless steel.

4.11.8 The minimum bottom-plate thickness shall be 6.3 mm;

4.11.9 For cylindrical tanks with diameter up to 5 m, the minimum shell thickness shall be equal to the higher of the two following values:

a)  $t_{min1} = 4.75 \text{ mm};$

b)  $t_{min2} = 2.54 \text{ mm} + CA$

where:  $t_{min}$  = minimum thickness; CA = corrosion allowance

4.11.10 Feed pipes inside tanks shall be placed at the opposite end of suction pipes to avoid short circuit.

#### 4.12 GROUNDING INSTALLATION

4.12.1 Protection against static electricity shall comply with grounding requirements of IEC 61892-6 and Classification Society.

4.12.2 Additionally, for floating units, the requirements of IEC 60092-502 shall be complied with.

4.12.3 Grounding installation shall comply with the latest revision of **I-DE-3010.00-5140-700-P4X-003** – GROUNDING INSTALLATION TYPICAL DETAILS and **I-ET-3010.00-5140-700-P4X-001** – SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS.

#### 4.13 TAGGING

4.13.1 Tagging procedure for tanks shall be according latest revision of **I-ET-3000.00-1200-940-P4X-001** - TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.

### 5 FABRICATION REQUIREMENTS

Tanks and their structural attachments shall be fabricated in full compliance with section 7 of API 12F, where applicable.

#### 5.1 WELDING

All tanks shall be according the requirements described in the latest revision of **I-ET-3010.00-1200-955-P4X-001** – WELDING.

5.1.1 For welds between support and tank, pads shall be installed. For welds between tank and stiffening members, pad is necessary in case of stainless steel tanks with reinforcement of carbon steel.



## 5.2 NDE

5.2.1 Dye penetrant and visual inspection are mandatory in all welded joints.

## 6 MATERIALS

### 6.1 GENERAL

6.1.1 Tanks materials definition shall be according MATERIAL SPECIFICATION FOR TANKS [document supplied by **PETROBRAS**].

6.1.2 For steel tanks, all materials shall be according to Section 4 of API 650. The minimum grade of material specification for plates of carbon steel tanks shall be ASTM A 283 Gr. C.

6.1.3 Bolts and nuts materials shall be according **I-ET-3010.00-1200-251-P4X-001** - BOLT MATERIALS.

6.1.4 Thermal insulation for personal protection shall be applied on tanks with external temperature according to **I-ET-3010.00-1200-431-P4X-001** – THERMAL INSULATION FOR MARITIME INSTALLATIONS.

### 6.2 COATING AND PAINTING

6.2.1 Carbon steel tanks designed for storage of produced water, sea water and chemical products at operating temperatures up to 150°C shall be integrally protected by internal coating.

6.2.2 Coating and painting requirements shall be according latest revision of **I-ET-3010.00-1200-956-P4X-002** – GENERAL PAINTING.

6.2.3 Equipment color shall be according latest revision of **DR-ENGP-I-1.15** – COLOR CODING.

## 7 NAMEPLATE

All tanks shall have a nameplate, in AISI 316 stainless steel with 3 mm minimum thickness, fastened with stainless steel bolts onto a visible and accessible location.

The nameplate model shown in **Figure 7.1** is a guideline on minimum data it must contain and their position. Letters and numbers shall have 3 mm minimum height

Nameplate NOTES:

**(note 1)** – “Identificação do Equipamento” = Equipment Identification (Tag Number): as mentioned on Process Data Sheet, P&ID and Equipment List.

**(note 2)** – “Serviço” = Equipment description (associated title at tag number): as per Process Data Sheet, P&ID and Equipment List.

**(note 3)** – “Norma de Projeto” = Design Code: as per Equipment Designer’s Data Sheet (Design Code and edition year).

**(note 4)** – “Temperatura de Projeto” = Design Temperature: as per Equipment Designer’s Data Sheet, in degrees Celsius [°C].

**(note 5)** – “Pressão de Projeto” = Design Pressure: as per Equipment Designer’s Data Sheet and P&ID in kilopascal [kPa].

**(note 6)** “Sobresspesura para corrosão” = Corrosion allowance value as per Equipment Designer’s Data Sheet, in millimetre [mm].





**(note 7)** – “Temperatura de Operação” = Operating Temperature: when applicable, according to Equipment Designer’s Data Sheet and P&ID, in degrees Celsius [°C].

**(note 8)** – “Pressão de Operação” = Operating Pressure: when applicable, according to Equipment Designer’s Data Sheet and P&ID, in kilopascal [kPa].

**(note 9)** – “Fluido” = Fluid: fluid name as per equipment designer data sheet.

**(note 10)** – “Densidade à Temperatura de Operação” = Fluid Specific Gravity at operation temperature.

**(note 11)** – “Comprimento” = Length: as per equipment designer’s data sheet, in millimeter.

**(note 12)** – “Largura” = Width: as per equipment designer’s data sheet, in millimeter.

**(note 13)** – “Altura” = Height: as per equipment designer’s data sheet, in millimeter

**(note 14)** – “Capacidade Efetiva” = Effective Capacity: as per equipment designer’s data sheet, in cubic meter.

**(note 15)** – “Peso Vazio” = Empty Weight: as per equipment designer’s data sheet, in millimeter, in Newton and kilogram force.

**(note 16)** – “Peso Cheio de Água” = Weight Full of Water: as per equipment designer’s data sheet, in millimeter, in Newton and kilogram force

**(note 17)** – “Peso em Operação” = Operating Weight: in kilogram force.

**(note 18)** – “Fabricante e Local de Fabricação” = Manufacturer and Manufacture Place: Manufacturer’s name, city and country.

**(note 19)** – “Montador” = Supplier: Supplier’s name of skid-mounted equipment.

**(note 20)** – “Número de Série do Fabricante” = Manufacturer Serial Number

**(note 21)** – “Ano de Fabricação” = Manufacture Year

**(note 22)** – Special service, e.g. “Serviço com Hidrogênio” (Service with Hydrogen) or “Serviço com H<sub>2</sub>S” (H<sub>2</sub>S service), if applicable.

**(note 23)** – Hydrostatic test water requirements (temperature and salt content), when applicable.

Example: “Teor de cloretos < 50 ppm” = chloride content < 50 ppm. Maximum chloride content permitted in the water shall be as defined in the design, but not greater than 50 ppm for equipment made of austenitic stainless steel or having an internal lining consisting of these materials.

“Água > 15°C” = Water > 15°C. Except for tanks fully constructed of materials suitable for low temperatures, a cautionary note shall be included forbidding hydrostatic testing with water at a temperature > 15°C.

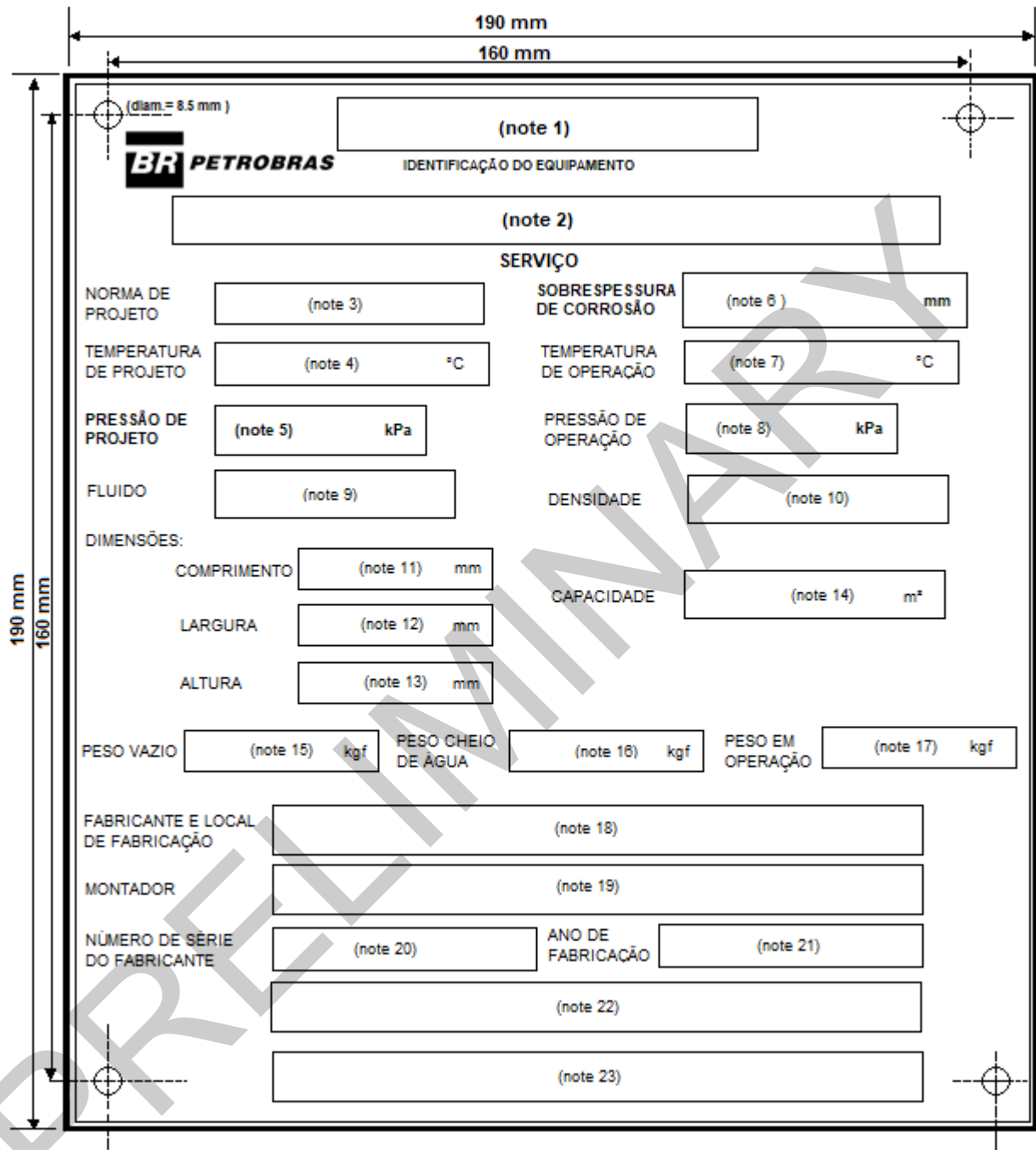


Figure 7.1 – Tank's Nameplate (see NOTES for English translation)