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| SRGE  | TITLE:                         | <b>METALLIC TANKS DESIGN FOR TOPSIDE</b> | INTERNAL                          |
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| 15/set/22 | FEB/21/19 | JUN/15/20   | SEP/15/22 | 08/dez/22 |        |        |        |        |        |
| DESIGN    | ESUP      | ESUP        | ESUP      | ESUP      |        |        |        |        |        |
| EXECUTION | PONTE     | DANISCHMIDT | HXG3      | HXG3      |        |        |        |        |        |
| CHECK     | ESTEVES   | ESTEVES     | CSM0      | CJX4      |        |        |        |        |        |
| APPROVAL  | JUVENTINO | GONZALEZ    | U32N      | U32N      |        |        |        |        |        |

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## SUMMARY

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**METALLIC TANKS DESIGN FOR TOPSIDE**

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# 1 OBJECTIVE

This specification covers the minimum requirements for design of metallic tanks, with maximum internal design pressure of 110 kPa, to be supplied to floating units. This technical specification does not include hull structural storage tanks.

# 2 NORMATIVE REFERENCES AND DESIGN SPECIFICATIONS

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

## 2.1 CLASSIFICATION SOCIETY

- 2.1.1 SELLER shall perform the work in accordance with the requirements of Classification Society.
- 2.1.2 SELLER is responsible for submitting to the Classification Society all documentation in compliance with stated Rules.
- 2.1.3 Classification Society rules may only be waived upon the formal approval from the Classification Society itself and from OWNER.

## 2.2 CODES AND STANDARDS

2.2.1 Table 1 shows the codes and standards referred within 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:

**Table 1: Codes and Standards**

|                       |  |
|-----------------------|--|
| AISC Manual           | - Steel Construction Manual  |
| 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 in Refineries Part 1&2 |
| 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   |
| 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             |

ISO 21457

- Materials selection and corrosion control for oil and gas production systems

### 2.3 GOVERNMENT REGULATION

**Table 2: Brazilian Regulatory Standard and Government Regulation**

|         |  |
|---------|--|
| NR-10   | - Brazilian Regulatory Standard – Safety in Electrical Facilities and Services                 |
| NR-17   | - Brazilian Regulatory Standard – Ergonomic  |
| NR-26   | - Brazilian Regulatory Standard – Safety Signing   |
| NR-37   | - Brazilian Regulatory Standard – Safety and Health in Petroleum Platforms                     |
| IBAMA   | - Brazilian IBAMA environmental regulations concerning the discharge of all types of effluents |
| INMETRO | - INMETRO Resolution nº 115, March 21 <sup>st</sup> 2022                                       |

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 DESIGN SPECIFICATIONS

**Table 3: Design Specifications**

|                               |   |
|-------------------------------|---|
| DR-ENGP-M-I-1.3               | - SAFETY ENGINEERING GUIDELINE                                    |
| DR-ENGP-I-1.15                | - COLOR CODING  |
| I-DE-3010.00-5140-700-P4X-003 | - GROUNDING INSTALLATION TYPICAL DETAILS                          |
| I-ET-3010.00-1200-200-P4X-115 | - REQUIREMENTS FOR PIPING FABRICATION, ASSEMBLY AND COMMISSIONING |
| I-ET-3010.00-1200-251-P4X-001 | - REQUIREMENTS FOR BOLTING MATERIALS                              |
| I-ET-3010.00-1200-431-P4X-001 | - THERMAL INSULATION FOR MARITIME INSTALLATIONS                   |
| I-ET-3000.00-1200-940-P4X-001 | - TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.                  |
| I-ET-3010.00-1200-940-P4X-002 | - GENERAL TECHNICAL TERMS   |
| I-ET-3010.00-1200-955-P4X-001 | - WELDING   |
| I-ET-3010.00-1200-956-P4X-002 | - GENERAL PAINTING  |
| I-ET-3010.00-1200-970-P4X-003 | - REQUIREMENTS FOR PERSONNEL QUALIFICATION AND CERTIFICATION      |
| I-ET-3010.00-1200-970-P4X-004 | - NON-DESTRUCTIVE TESTING REQUIREMENTS FOR                        |



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**METALLIC AND NON-METALLIC MATERIALS**

|                               |   |
|-------------------------------|---|
| I-ET-3010.00-1200-972-P4X-006 | - REQUIREMENTS FOR MANUFACTURING SURVEY INSPECTION        |
| I-ET-3010.00-1200-978-P4X-005 | - REQUIREMENTS FOR MATERIALS TRACEABILITY                 |
| I-ET-3010.00-5140-700-P4X-001 | - SPECIFICATIOPN FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS |
| I-ET-3010.00-5400-947-P4X-002 | - SAFETY SIGNALLING                                       |

Note: Specific Documents to be supplied by **OWNER**

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

**2.5 CONFLICTING REQUIREMENTS**

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

**3 DEFINITIONS AND ABBREVIATIONS**

**3.1 DEFINITIONS**

3.1.1 All terms and definitions are established in the latest revision of I-ET-3010.00-1200-940-P4X-002 - GENERAL TECHNICAL TERMS.

**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
- CLASS - Classification Society
- HAZOP - Hazard and Operability Studies
- IEC - International Electrotechnical Commission
- IRC - Inspection Release Certificate
- NDT - Non-Destructive Test

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P&ID - Piping & Instrumentation Diagram

PHA - Preliminary Hazard Analysis

## 4 DESIGN REQUIREMENTS

### 4.1 GENERAL

4.1.1 SELLER shall be responsible to design and manufacture the equipment according to PROCESS DATASHEET [document supplied by OWNER]. SELLER is responsible for selecting a proper design code and submitting the calculation report for the OWNER's approval.

4.1.2 The minimum nominal thickness of the shell, roof, and bottom plates shall not be less than the values defined in API 12F.

### 4.2 OPERATION ENVIRONMENT

4.2.1 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 OWNER].

### 4.3 MOTION REQUIREMENTS

4.3.1 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 OWNER].

### 4.4 EQUIPMENT LOCATION

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

### 4.5 DESIGN LOADS

4.5.1 SELLER shall submit all calculations and mechanical datasheets to OWNER's approval.

4.5.2 In addition to the selected Design Code loads and the loads due to floating unit motion described in MOTION ANALYSIS [document supplied by OWNER], 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

4.6.1 SELLER shall design and fabricate the complete equipment for a minimum service life of 30 years, unless otherwise mentioned in a specific OWNER document.

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#### 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 OWNER].
- 4.7.3 Mandatory safety items, as established in DR-ENGP-M-I-1.3 - SAFETY ENGINEERING GUIDELINE, are to be considered complementary requirements, to the pertinent extent. In case of conflict with this document, OWNER shall be consulted.
- 4.7.4 HAZOP and PHA shall be according DR-ENGP-M-I-1.3 - SAFETY ENGINEERING GUIDELINE.
- 4.7.5 All safety signs and notices shall be in Portuguese language according to I-ET-3010.00-5400-947-P4X-002 - SAFETY SIGNALLING.

#### 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, including drain, venting, instrumentation, manhole, and process nozzles;
  - grounding and lifting lugs;
  - earthing boss;
  - internals;
  - all clips for piping, supports, thermal insulation etc., if required;
  - supports and/ or skids, when applicable;
  - Nameplate;
  - Ladders and access platforms;
  - Containment basin.
- 4.8.2 Tanks shall be provided with spectacle flanges at the main nozzles.
- 4.8.3 In case of storing flammable liquids, the tank vent connections 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, or by full penetration welds (set-in or set-on arrangement).
- 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 reinforced 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 supplied by OWNER].
- 4.10.2 The following items shall be applied when corrosion allowance is not specified:

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- 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 tanks manufactured with corrosion resistant alloys (CRA), or internally clad with CRA.

#### 4.11 TECHNICAL REQUIREMENTS

- 4.11.1 All tanks and their structural attachments shall be designed according to the selected design code, unless otherwise mentioned in a specific **OWNER**'s document. When rectangular tank is specified, the mechanical calculation shall be by AISC manual or equivalent standard.
- 4.11.2 Tanks with cylindrical cross section shall have conical bottom, with slop toward the center. Tanks with other than cylindrical cross section shall have sloped bottom. In both cases, the inclination shall be between 1:100 and 1:25.
- 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 API 12F, where applicable.
- 4.11.4 For roof design, self-weight, and a load of 981 N/m<sup>2</sup> (100 kgf/m<sup>2</sup>) shall be considered, unless otherwise specified.
- 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 centreline located at 3000 mm or higher above the floor.
- 4.11.7 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 CLASS rules.
- 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 - SPECIFICATIOPN FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS.

#### 4.13 TAGGING

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

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## 5 FABRICATION REQUIREMENTS

### 5.1 GENERAL

- 5.1.1 Unless otherwise stated, all inspections and tests shall be performed at the workshop of **SELLER** in the presence of **OWNER** representative and CLASS surveyor as applicable.
- 5.1.2 Inspections and tests are an integral part of the order which will not be considered complete until such inspections and tests have been carried out in full and recorded in an inspection report that shall be part of the data-book.
- 5.1.3 **OWNER** shall issue an Inspection Release Certificate (IRC) only after completion of all required inspections and tests and after the manufacturing data-books have been issued and approved.
- 5.1.4 Dimensional tolerances of equipment shall follow the limits stated in API 650.

### 5.2 PERSONNEL QUALIFICATION AND CERTIFICATION

- 5.2.1 Personnel qualification and certification shall be in accordance with I-ET-3010.00-1200-970-P4X-003 - REQUIREMENTS FOR PERSONNEL QUALIFICATION AND CERTIFICATION.

### 5.3 QUALITY AND INSPECTION

- 5.3.1 **SELLER** shall provide documented schedules with the estimated completion dates. These schedules shall be issued by the same time the drawings are submitted for approval, as indicated in the agreed document schedule.
- 5.3.2 **OWNER** reserves the right to inspect all items at any time during fabrication to ensure that the materials and workmanship are in accordance with this specification and all applicable documentation.
- 5.3.3 **SELLER** is responsible for the overall compliance of the equipment when it comes to the CLASS requirements, including certificates, work examinations and tests, as well as final inspection activities and shipment.
- 5.3.4 The CLASS inspector shall have the right to request inspections or examinations to ensure that the equipment complies with the relevant CLASS requirements. If examination reveals any deficiencies, **SELLER** shall bear the full cost of repair or replacement when necessary. **OWNER** shall approve any repair work. The subsequent examination necessary to ensure the satisfactory manufacture of the equipment in question will be on behalf of the **SELLER**.
- 5.3.5 Except if approved by **OWNER** inspector, the equipment shall be presented for inspection in an unpainted state. **SELLER** shall provide notice to the inspector to witness the specified tests at least 2 (two) weeks in advance for Brazilian **MANUFACTURER** and 3 (three) weeks for foreign **MANUFACTURER**.
- 5.3.6 Manufacturing Survey Inspection shall be performed according to I-ET-3010.00-1200-972-P4X-006 - REQUIREMENTS FOR MANUFACTURING SURVEY INSPECTION.
- 5.3.7 Traceability of material shall comply with I-ET-3010.00-1200-978-P4X-005-REQUIREMENTS FOR MATERIALS TRACEABILITY.

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## 5.4 WELDING AND WELDING INSPECTION

- 5.4.1 All weldments shall be according to the requirements stated in I-ET-3010.00-1200-955-P4X-001 - WELDING.
- 5.4.2 Welding shall be carried out with procedures and welders qualified in accordance with Design Code and additional requirements stated in contractual technical specifications. Welding shall not be performed before qualified welding procedures specification have been approved.
- 5.4.3 Intermittent fillet welds are not permitted.
- 5.4.4 Welding inspection shall be according to the Design Code and additional requirements herein stated
- 5.4.5 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.

## 5.5 NDT

- 5.5.1 NDT shall be according to the Design Code and I-ET-3010.00-1200-970-P4X-004 - NON-DESTRUCTIVE TESTING REQUIREMENTS FOR METALLIC AND NON-METALLIC MATERIALS.
- 5.5.2 Final NDTs, for acceptance purposes shall be performed after completion of any post weld heat treatment (when applicable) and prior to paint application, hydrostatic testing, etc.
- 5.5.3 Dye penetrant and visual inspection are mandatory for 100% welded joints. Whenever possible, these tests shall be performed on both sides (internal/external) of the welded joints.

## 5.6 TESTING

- 5.6.1 Hydrostatic testing shall be carried out in the presence of OWNER inspectors.
- 5.6.2 Maximum chloride content permitted in the water shall be as defined in the design, but not greater than 50 ppm for equipment made of CRA or having an internal lining consisting of these materials.
- 5.6.3 Except for tanks fully constructed of materials suitable for low temperatures, the hydrostatic testing water temperature shall be greater than 15°C.
- 5.6.4 The equipment shall be drained and dried after hydrostatic testing.
- 5.6.5 Preservation to be applied shall follow the requirements of I-ET-3010.00-1200-200-P4X-115 - REQUIREMENTS FOR PIPING FABRICATION, ASSEMBLY AND COMMISSIONING.

## 6 MATERIALS

### 6.1 GENERAL

- 6.1.1 Tanks materials definition shall be according to MATERIAL SPECIFICATION FOR PROCESS PRESSURE VESSELS AND TANKS [document supplied by OWNER]. For tanks not therein listed the material selection shall be performed as predicted in ISO 21457.
- 6.1.2 For steel tanks, all materials shall be according to materials requirements of API 650.

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6.1.3 Bolts and nuts materials shall be according I-ET-3010.00-1200-251-P4X-001 - REQUIREMENTS FOR BOLTING 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 Coating and painting requirements shall be according to latest revision of I-ET-3010.00-1200-956-P4X-002 - GENERAL PAINTING

6.2.2 Carbon steel tanks designed for storage of produced water, sea water and chemical products at operating temperatures up to 200°C shall be integrally protected by internal coating.

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

## 7 NAMEPLATE

### 7.1 GENERAL

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

7.1.2 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 and written in Portuguese language.

Nameplate NOTES:

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

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

**(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)** “Sobresspessura 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].

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**(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 millimetre.

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

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

**(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 kilogram force.

**(note 16)** – “Peso Cheio de Água” = Weight Full of Water: as per equipment designer’s data sheet, in 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 para a água do TH” = chloride content < 50 ppm for hydrostatic water.

“Temperatura da Água para TH > 15°C” = Hydrostatic Water Temperature > 15°C.

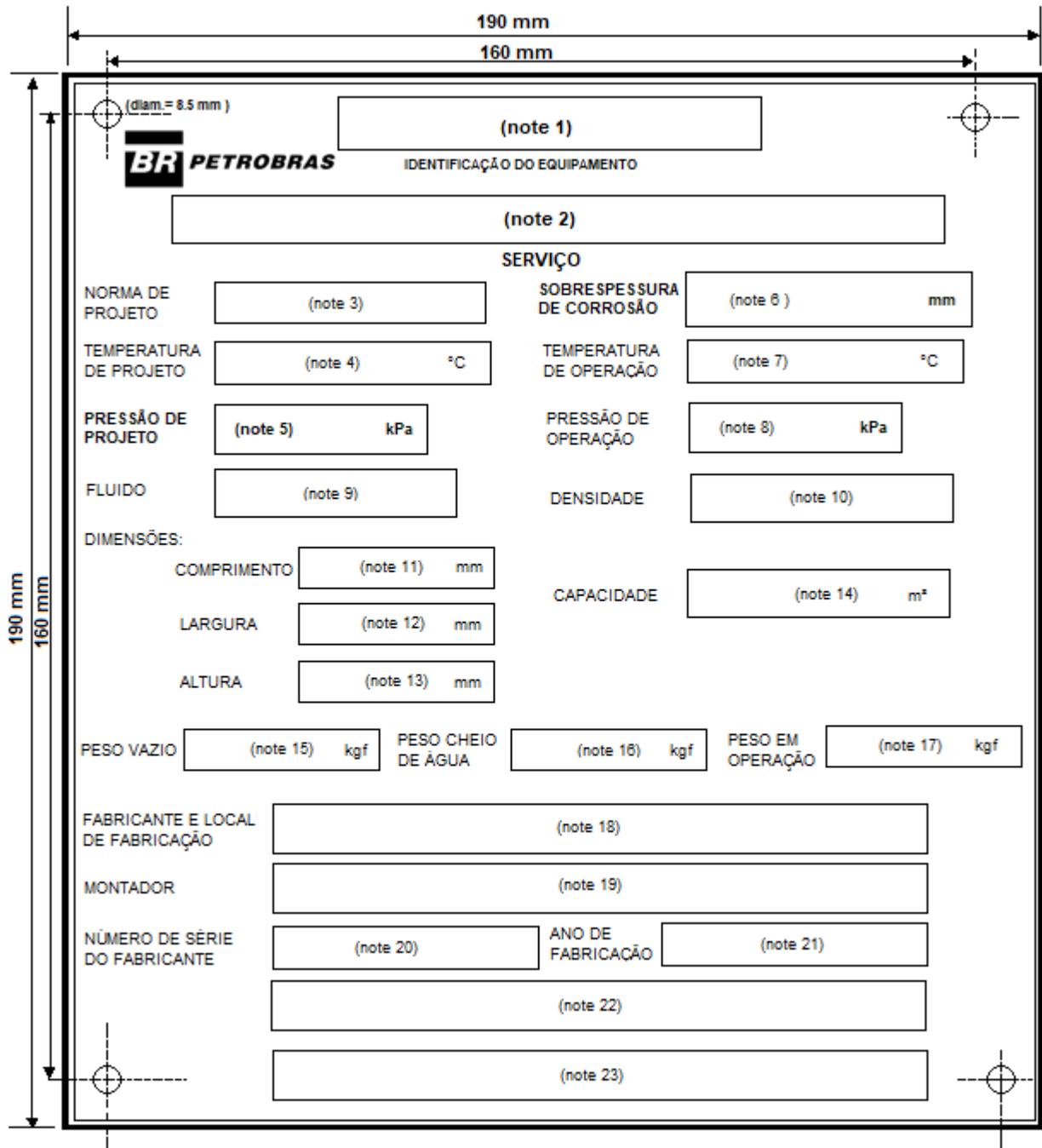


Figure 7.1 – Tank’s Nameplate (see NOTES for English translation)