

Centrifugal Pumps for Medium Services

Specification

This Standard replaces and cancels its previous revision.

The CONTEC - Authoring Subcommittee provides guidance on the interpretation of this Standard when questions arise regarding its contents. The Department of PETROBRAS that uses this Standard is responsible for adopting and applying the sections, subsections and enumerates thereof.

Technical Requirement: A provision established as the most adequate and which shall be used strictly in accordance with this Standard. If a decision is taken not to follow the requirement ("non-conformity" to this Standard) it shall be based on well-founded economic and management reasons, and be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by imperative nature.

Recommended Practice: A provision that may be adopted under the conditions of this Standard, but which admits (and draws attention to) the possibility of there being a more adequate alternative (not written in this Standard) to the particular application. The alternative adopted shall be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by verbs of a nonmandatory nature. It is indicated by the expression: **[Recommended Practice]**.

Copies of the registered "non-conformities" to this Standard that may contribute to the improvement thereof shall be submitted to the CONTEC - Authoring Subcommittee.

Proposed revisions to this Standard shall be submitted to the CONTEC - Authoring Subcommittee, indicating the alphanumeric identification and revision of the Standard, the section, subsection and enumerate to be revised, the proposed text, and technical/economic justification for revision. The proposals are evaluated during the work for alteration of this Standard.

"This Standard is exclusive property of Petróleo Brasileiro S. A. - PETROBRAS, internal application and PETROBRAS Subsidiaries and shall be used by its suppliers of goods and services under contracts or similar under the conditions established in Bidding, Contract, Agreement or similar.

The use of this Standard by other companies / organizations / government agencies and individuals is the sole responsibility of the users.."

CONTEC

Comissão de Normalização
Técnica

SC - 11

Machines

Introduction

PETROBRAS Technical Standards are prepared by Working Groups - WG (consisting specialized of Technical Collaborators from Company and its Subsidiaries), are commented by Company Units and its Subsidiaries, are approved by the Authoring Subcommittees - SCs (consisting of technicians from the same specialty, representing the various Company Units and its Subsidiaries), and ratified by the Executive Nucleus (consisting of representatives of the Company Units and its Subsidiaries). A PETROBRAS Technical Standard is subject to revision at any time by its Authoring Subcommittee and shall be reviewed every 5 years to be revalidated, revised or cancelled. PETROBRAS Technical Standards are prepared in accordance with PETROBRAS Technical Standard [N-1](#). For complete information about PETROBRAS Technical Standards see PETROBRAS Technical Standards Catalog.

Foreword

This Standard is the English version (issued in 10/2013) of PETROBRAS N-906 REV. D 10/2013. In case of doubt, the Portuguese version, which is the valid document for all intents and purposes, shall be used.

1 Scope

1.1 This Standard establishes minimum requirements for horizontal centrifugal pumps applied in chemical, petrochemical, and other medium-duty services, i. e., services not handling hazardous liquids (hazardous services) and not exceeding any of the conditions below:

- a) discharge pressure (gauge) of 1 900 kPa;
- b) suction pressure (gauge) of 500 kPa;
- c) pumping temperature of 150 °C for non-hydrocarbon and of 50 °C for hydrocarbon;
- d) rotative speed of 3 600 rpm;
- e) rated total head of 120 m;
- f) impeller diameter of 330 mm, overhung pumps.

NOTE Regardless of the conditions mentioned above, pumps for fire fighting and cooling tower services shall comply with this Standard.

1.2 Pumps shall comply with ASME [B73.1](#) or ISO [5199](#), according to purchaser definition, and meet the additional requirements and modifications described in this Standard.

NOTE Fire fighting pumps shall also comply with NFPA [20](#).

1.3 The end user is responsible to decide whether to apply this Standard, complementing it with specific technical requirements for each service.

1.4 This Standard applies to design starting from its issue date.

1.5 This Standard only contains Technical Requirements.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

PETROBRAS [N-2919](#) - Motores Elétricos Trifásicos de Indução ou Síncronos.

ANSI/HI [1.4](#) - Rotodynamic (Centrifugal) Pumps for Manuals Describing Installation, Operation and Maintenance;

ANSI/HI [9.6.4](#) - Rotodynamic Pumps for Vibration Measurements and Allowable Values;

ANSI/HI [14.6](#) - Rotodynamic Pumps for Hydraulic Performance Acceptance Tests;

API [682](#) - Pumps Shaft Sealing Systems for Centrifugal and Rotary Pumps;

ASME [B1.20.1](#) - Pipe Threads, General Purpose (Inch) Revision and Redesignation of ASME/ANSI B2.1-1968;

ASME [B16.1](#) - Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250;

ASME [B16.5](#) - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard;

ASME [B16.47](#) - Large Diameter Steel Flanges NPS 26 Through NPS 60 Metric/Inch Standard;

ASME [B73.1](#) - Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process;

ASTM [A216](#) - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service;

ASTM [A278](#) - Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F (350°C);

ASTM [A395](#) - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures;

ASTM [A487](#) - Standard Specification for Steel Castings Suitable for Pressure Service;

ASTM [A743](#) - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application;

ASTM [A890](#) - Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion- Resistant, Duplex (Austenitic/Ferritic) for General Application;

ASTM [A995](#) - Standard Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts;

ISO [5199](#) - Technical Specifications for Centrifugal Pumps - Class II;

NFPA [20](#) - Standard for the Installation of Stationary Pumps for Fire Protection;

NOTE For documents referred in this Standard and for which only the Portuguese version is available, the PETROBRAS department that uses this Standard should be consulted for any information required for the specific application.

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1

BB

between bearings, axially split, one stage double suction, foot mounted pump.

3.2

BEP

best efficiency point.

3.3

DN (Nominal Diameter)

designation usually followed by a number which represents the approximate size of the outer diameter of a pipe in millimeters.

3.4**hazardous service**

refers to the service where pumped liquid presents any of the characteristics below:

- a) H₂S (Hydrogen Sulphide) concentrations above 500 ppm (mass);
- b) hydrocarbons with hydrogen at a partial pressure above 700 kPa (abs);
- c) hydrocarbons at pumping temperatures above their auto-ignition temperatures;
- d) other toxic and lethal substances, which can result in death or permanent personal injury through inhalation, exposition, or contact, to be specified and defined in the proposal phase.

3.5**labyrinth "L" type**

shaft seal applied in bearing housing which design contemplate only one deflector that allows air circulation through the bearing housing.

3.6**labyrinth "U" type**

shaft seal applied in bearing housing which design contemplate two deflectors (internal and external) that obstruct air movement through the bearing housing.

3.7**Material Requisition (RM)**

document that aims to establish the scope of supply, technical requirements and additional instructions required to acquisition of materials, systems and equipment.

3.8**maximum discharge pressure**

maximum suction pressure plus the maximum differential pressure that the pump is able to develop (head at shutoff including all tolerances described in Table 3 of this Standard) when operating with the furnished impeller at the rated speed and maximum specified liquid relative density.

3.9**minimum continuous stable flow**

lowest flow at which the pump can operate continuously, defined by pump manufacturer on the data sheet. This flow is usually limited by recirculation, vibration, noise, shaft deflection or other parameter established by pump manufacturer.

3.10**normal point**

the most frequent operating point.

3.11**NPS (Nominal Pipe Size)**

designation usually followed by a number which represents the approximate size of the outer diameter of a pipe in inches.

3.12**OH**

overhung, single stage, foot mounted pump.

3.13**rated point**

operating point for which the pump is selected and its performance is guaranteed.

4 Design**4.1 Hydraulic Requirements****4.1.1 Hydraulic Requirements Applied To All Pumps**

4.1.1.1 Pumps shall have stable curves (continuous head rise to shutoff). Pumps with unstable curves shall be submitted to PETROBRAS previous approval.

4.1.1.2 In case of parallel operation, the shutoff head shall be at least 110 % of the head in rated point. The use of orifice plates shall be approved by PETROBRAS.

4.1.1.3 Pumps for parallel operation shall have equal shutoff head, considering the criteria established in Table 3 of this Standard.

4.1.1.4 The maximum pump discharge pressure (shutoff condition) shall not exceed design pressure for downstream piping and equipment.

4.1.1.5 The flow at BEP, for furnished impeller, shall be preferably between normal and rated flows.

4.1.1.6 At rated flow, the NPSH available shall exceed the NPSH required by at least 0,8 m and the NPSH ratio ($NPSH_a / NPSH_r$) shall be at least 1,15. Nevertheless, some services may require larger NPSH margins to be either specified on the data sheets or recommended by vendor.

NOTE For cooling tower services, the NPSH ratio ($NPSH_a / NPSH_r$) shall be at least 1,3 at rated flow.

4.1.2 Specific OH Pumps Hydraulic Requirements

4.1.2.1 The suction specific speed shall not exceed 12 000 when calculated in English units (or 233 in SI units).

4.1.2.2 For pumps with discharge nozzle greater than or equal to DN 100 (NPS 4), the rated flow point shall be between 70 % and 120 % of the flow at BEP.

NOTE For all other cases, the rated flow point shall be between the minimum continuous stable flow and 120 % of the flow at BEP.

4.1.2.3 The use of inductor shall be approved by PETROBRAS and if adopted shall be considered in suction specific speed.

4.1.3 Specific BB pumps hydraulic requirements

4.1.3.1 The suction specific speed shall not exceed 11 000 when calculated in English units (or 213 in SI units), except for cooling tower pumps in which the suction specific speed shall not exceed 9 000 when calculated in English units (or 175 in SI units).

4.1.3.2 The rated flow point shall be between 70 % and 120 % of the flow at BEP.

4.2 Mechanical Requirements

4.2.1 Mechanical Requirements Applied To All Pumps

4.2.1.1 Suction and discharge nozzles with diameter greater than or equal to DN 50 (NPS 2) shall be flanged according to ASME B16.1 for cast iron and ASME B16.5 or ASME B16.47 (Series A) for steel.

4.2.1.2 Suction and discharge nozzles with diameter less than DN 50 (NPS 2) and auxiliary connections can be threaded according to ASME B1.20.1 - NPT type, in services where the pumped liquid is water. Other services, only with PETROBRAS approval.

4.2.1.3 The use of welded impellers shall be approved by PETROBRAS.

4.2.1.4 Bilabial retainer for bearing housing sealing can only be used for shafts diameter up to 30 mm in sealing region. Above this limit, "U" type labyrinth shall be applied. "L" type labyrinth is not acceptable, except for BB type pumps.

4.2.1.5 For pumps with driver power greater than 30 kW, the thrust bearing shall be double row angular contact ball bearing type 3 000 series or duplex single row angular contact ball bearing type 7 000 series, back-to-back mounted.

4.2.1.6 Bearing cages of 3 000 series shall be metallic. Bearing cages of 7 000 series shall be brass or bronze.

4.2.1.7 Pumps shall be sealed with mechanical seal according to API 682, category 1, except in cases where the pumped liquid is water and the shaft has a diameter less than 40 mm in sealing region where can be applied a manufacturer's standard mechanical seal.

NOTE When packing is applicable, and the use is approved by PETROBRAS, it shall be carbon fiber type.

4.2.1.8 The coupling shall be stainless steel flexible element type for pumps with driver power greater than 5 kW.

4.2.1.9 The coupling guard shall be made of a carbon steel solid sheet and withstand 900 N load in any direction, in order to protect all rotating parts between driver and driven equipment, preventing unintentional personnel access.

NOTE 1 For shaft diameters equal to or larger than 40 mm in hub region, an opening shall be provided in order to allow coupling visual inspection without coupling guard removal (e.g. inspection window).

NOTE 2 Despite the design requirements described in 4.2.1.9 are acceptable, providing the coupling guard as Patent PETROBRAS is preferable.

4.2.2 Specific OH Pumps Mechanical Requirement

If the pump has closed impeller, at least the casing shall have wear ring.

4.2.3 Specific BB Pumps Mechanical Requirements

4.2.3.1 Hydrodynamic bearings shall be applied to shaft diameter greater than or equal to 80 mm in bearing region.

4.2.3.2 Pumps shall have casing and impeller wear rings.

4.3 Drivers

4.3.1 Electric motors shall have nameplate power ratings, excluding the service factor, at least equal to the percentages of power at pump rated conditions given in Table 1.

Table 1 - Power Ratings for Electric Motor Drives

Electric Motor (nameplate rating power)		Percentage of rated pump power
kW	hp	%
< 22	< 30	125
22 to 55	30 to 75	115
> 55	> 75	110

4.3.2 Unless otherwise specified by PETROBRAS, steam turbine drivers shall be sized to deliver continuously a minimum power of 110 % of the pump rated power at normal steam conditions.

4.3.3 Drivers for fire fighting pumps shall be sized according to NFPA 20.

4.4 Materials

4.4.1 Table 2 is a guide to material selection of the main pump parts. This table presents six (6) material classes to be applied considering the severity of the pumping service.

4.4.2 For services which require materials other than shown in Table 2, these materials shall be specified by PETROBRAS on the data sheet, and the manufacturer shall comment the proposed material according to its experience.

4.4.3 If the materials are not specified on the data sheet, the manufacturer shall be responsible for the material selection.

4.4.4 The definition of materials is a mutual responsibility between PETROBRAS and manufacturer.

Table 2 - Construction Materials

Part	Material Classes					
	CLASS 1 Cast Iron - 12% Cr Steel	CLASS 2 Ductile Iron	CLASS 3 Carbon Steel	CLASS 4 12% Cr Steel	CLASS 5 ^(d) Austenitic Stainless Steel	CLASS 6 Duplex Stainless Steel
Casing	Cast Iron ASTM A278 Cl. 30	Ductile Iron ASTM A395	Carbon Steel ASTM A216 Gr. WCB	12% Cr Steel ASTM A487 Gr. CA6NM	Austenitic S.S.	Duplex S.S. ASTM A995 Gr. 1B or 3A
Impeller	12% Cr Steel ASTM A743 Gr. CA6NM	Ductile Iron ^(a) ASTM A395	Carbon Steel ^(a) ASTM A216 Gr. WCB	12% Cr Steel ASTM A743 Gr. CA6NM	Austenitic S.S.	Duplex S.S. ASTM A890 Gr. 1B or 3A
Wear Rings^(c)	12% Cr Steel Hardened	12% Cr Steel Hardened	12% Cr Steel Hardened	12% Cr Steel Hardened	Hard-faced ^(b) Austenitic S.S.	Hard-faced ^(b) Duplex S.S.
Shaft	4140 Alloy Steel	4140 Alloy Steel	4140 Alloy Steel	12% Cr Steel 410, 416 or 420	Austenitic S.S.	Duplex S.S. S31803
Shaft Sleeve	12% Cr Steel Hardened	12% Cr Steel Hardened	12% Cr Steel Hardened	12% Cr Steel Hardened	Hard-faced ^(b) Austenitic S.S.	Hard-faced ^(b) Duplex S.S.

(a) 12% Cr steel can be supplied to replace the specified material.

(b) The material and the hardening method shall be defined by manufacturer and described in the proposal. Alternative materials in place to surface hardening can be proposed, considering the type of pumping service.

(c) For hardenable materials with Brinell hardness lower than 400, stationary wear ring mating surface shall be harder than rotating wear ring mating surface. For impellers with no wear rings (integral wear surfaces), the impeller wear surface shall be harder than stationary wear ring mating surface.

(d) Austenitic stainless steel type 304, 304L, 316 or 316L to be specified by PETROBRAS on the data sheet. The manufacturer shall inform in the proposal the ASTM codes for considered construction.

NOTE 1 Casing and gland fasteners (bolting, studs, nuts etc.) shall be made as minimum in 4140 alloy steel. If it is in contact with the pumped liquid, they shall have the same metallurgy of the casing. Carbon steel is the minimum acceptable.

NOTE 2 Unless otherwise specified by PETROBRAS, for cooling tower services shall be specified CLASS 1.

NOTE 3 Welding or plugging repairs are not allowable in cast iron casings.

4.4.5 Pipes and components of sealing, drain and vent systems shall be made of material better than or equal to the casing material, concerning to mechanical properties and corrosion resistance. Carbon steel is the minimum acceptable.

4.5 Baseplate

4.5.1 Cast iron baseplates are not acceptable.

4.5.2 When grouting is specified, the baseplate design shall have appropriate holes for filling the entire cavity under the baseplate.

4.5.3 The baseplate shall be furnished with a tray or a leakage channel collector. The leakage shall be directed to a drain located at the front of the pump.

5 Nameplate

The pump nameplate shall contain, at least, the following information, in units consistent with the data sheet:

- a) tag number;
- b) pump size / type;
- c) manufacturer serial number;
- d) rated flow;
- e) rated head;
- f) casing hydrostatic test pressure;
- g) speed;
- h) maximum allowable working pressure (MAWP);
- i) temperature for MAWP.

6 Inspection and Testing

6.1 General Requirements

6.1.1 Reports of all tests performed at factory shall be included on the equipment databook.

6.1.2 Calibration certificates of equipment and instruments used in inspection and testing shall be available during these events.

6.1.3 Customer's representative shall have access to all manufacturer departments involved with inspection and testing.

6.2 Hydrostatic Test

6.2.1 The hydrostatic test is mandatory for all pumps.

6.2.2 The hydrostatic test shall be performed in accordance with ANSI/HI 14.6. Minimum test duration shall be 10 minutes.

6.2.3 During hydrostatic test, suction and discharge flanges, and drain and/or vent flanges shall be properly flanged and bolted. Fixation with clamps or any other clamping device are not acceptable.

6.2.4 After completion of hydrostatic test, casing and stuffing box shall be disassembled for internal and external visual inspection.

6.2.5 Thread sealant shall not be used in order to prevent leakage of threaded connections during hydrostatic test.

6.3 Performance Test

6.3.1 When specified the performance test, it shall be performed in accordance with ANSI/HI 14.6, observed the acceptance criteria described in Table 3 of this Standard.

NOTE When specified fire fighting pump, NFPA 20 performance test requirements shall also be met.

6.3.2 During performance test, the manufacturer shall record test data, including head, flow, power, and efficiency at a minimum of five points:

- a) shutoff;
- b) minimum continuous stable flow;
- c) midway between minimum and rated flow;
- d) rated flow;
- e) maximum flow.

NOTE 1 The record of these points shall be performed after the bearing temperature stabilization as per ANSI/HI 1.4 criteria.

NOTE 2 For fire fighting pumps, the maximum flow shall be 150 % of the nominal flow. For all other cases, the maximum flow shall be 120 % of BEP, except in low specific speed pumps, where the maximum flow shall be indicated in the proposal.

6.3.3 Unless otherwise agreed between customer and manufacturer, the performance test speed can vary from 80 % to 120 % of the pump rated speed. When specified mechanical run test, the test speed shall vary no more than 3 % of rated speed.

6.3.4 Visible leakage at mechanical seal is not accepted during performance and/or mechanical run test.

Table 3 - Acceptance Criteria for Performance Test

Test parameter	Acceptance criteria			
	1 kW < P ≤ 10 kW	10 kW < P < 500 kW	500 kW ≤ P < 1 MW	P ≥ 1 MW
Flow	± 10 %	± 8 %	± 5 %	± 5 %
Head	± 8 %	± 5 %	± 3 %	± 3 %
Power	$+ \sqrt{49 + [10(1 - 0,1P) + 7]^2}$ %	+ 8 %	+ 4 %	+ 4 %
Efficiency	Not applicable	Not applicable	Not applicable	- 0 %
P: Pump rated power.				
<p>NOTE 1 For pumps with rated power up to 1 kW, the acceptance criteria shall be agreed between manufacturer and PETROBRAS.</p> <p>NOTE 2 Grade 2, as defined in ANSI/HI 14.6 to measurement uncertainty, shall be considered for pumps.</p> <p>NOTE 3 For fire fighting pumps, the manufacturer shall also meet the acceptance criteria specified in items 6.2 and A.6.2 of NFPA 20.</p>				

6.4 Mechanical Run Test

6.4.1 When specified the mechanical run test, it shall be performed in accordance with ANSI/HI 14.6, after bearing temperature stabilization.

NOTE For diesel engine driven pumps, the mechanical run test shall be performed with the motor supplied.

6.4.2 The minimum test duration shall be 30 minutes.

6.4.3 The vibration measurement shall be performed only in the rated point, except for cooling tower pumps in which the vibration measurement shall be performed also in minimum continuous stable flow.

6.4.4 The acceptance criteria for vibration shall be according to ANSI/HI 9.6.4. For the minimum continuous stable flow, the vibration shall not exceed 30 % of the value established for the rated flow.

6.4.5 The acceptance criteria for temperature shall be as following:

- for pressurized systems, the oil outlet temperature shall be less than 70 °C and bearing metal temperature (if bearing-temperature sensors are supplied) less than 93 °C. During shop testing, the bearing oil temperature variation shall not exceed 28 °C;
- for ring-oiled, splash or flood systems, oil sump temperature shall be less than 82 °C. During shop testing, the bearing oil temperature variation shall not exceed 40 °C;
- for grease systems, the bearing housing temperature shall be less than 90 °C. For shielded bearings, the temperature shall be less than 50 °C.
- for oil mist systems, during shop testing bearing housing external surface temperature below 70 °C and outer ring / bearing metal temperatures shall not exceed 93 °C (if bearing-temperature sensors are supplied) and under the most adverse specified operating conditions, the bearing-oil housing temperature rise shall not exceed 35 °C above the ambient temperature.

NOTE Vendor shall consider the highest bearing housing temperature. It is acceptable that the bearing housing contact seal temperature be higher than the bearing housing temperature. In case of use of non contact seal (labyrinth) the temperature should be the same as bearing housing.

6.4.6 The noise measurement is for informative purposes only.

6.5 NPSH Test

6.5.1 When specified the NPSH test, it shall be performed in accordance with ANSI/HI [14.6](#).

6.5.2 During NPSH test, the manufacturer shall record test data for rated flow point.

NOTE The NPSH required at rated flow shall be between -2 % and 0 %

7 Preparation for Shipment

7.1 All items shall be properly packaged and protected against damage during transport. Each package shall be clearly identified with customer's name and address, equipment tag number, purchase order number and material requisition number. A packing list shall be sent with the package.

7.2 Parts susceptible to oxidation shall be protected by anti-corrosion agent.


7.3 All flanges shall be protected with steel blind flange with at least 5 mm thick, rubber gasket and fixed with at least four (4) bolts. All other connections shall be plugged or capped.

7.4 Unless otherwise specified by PETROBRAS, the equipment shall be conditioned for outdoor storage for a period of at least six (6) months.

8 Annexes


Annex A Centrifugal Pump Data Sheet

Annex B Vendor Drawing and Data Requirements


	DATA SHEET		Nº _____	REV. _____
	AREA: _____			SHEET 2 of 5
	TITLE: CENTRIFUGAL PUMP			


1	APPLICABLE TO	<input type="checkbox"/> PROPOSAL	<input type="checkbox"/> PURCHASE	<input type="checkbox"/> AS BUILT	
2	FOR	UNIT _____			
3	SITE	SERVICE _____			
4	MANUFACTURER	QUANTITY _____			
5	VENDOR	SERIAL Nº _____			
6	MODEL	DRIVER _____			
7	SIZE/TYPE	APPLIC. STANDARDS (<input type="checkbox"/> ASME B73.1 <input type="checkbox"/> ISO 5199) AND N-906D			


OPERATING CONDITION	PERFORMANCE																																																
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th></th> <th style="text-align: center;">RAT.</th> <th style="text-align: center;">NOR.</th> <th style="text-align: center;">MIN.</th> </tr> <tr> <td>10 CAPACITY m³/h</td> <td></td> <td></td> <td></td> </tr> <tr> <td>11 SUCTION PRESS. kgf/cm² g</td> <td></td> <td></td> <td></td> </tr> <tr> <td>12 DISCH. PRESS. kgf/cm² g</td> <td></td> <td></td> <td></td> </tr> <tr> <td>13 DIFF. PRESS. kgf/cm²</td> <td></td> <td></td> <td></td> </tr> <tr> <td>14 HEAD m</td> <td></td> <td colspan="2" style="text-align: center;">@ MINIMUM S.G.</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th></th> <th style="text-align: center;">RAT.</th> <th style="text-align: center;">NOR.</th> <th style="text-align: center;">MIN.</th> </tr> <tr> <td>16 AT DESIGNED CAPACITY</td> <td></td> <td></td> <td></td> </tr> <tr> <td>17 OPERATING TIME, H / Y</td> <td></td> <td></td> <td></td> </tr> <tr> <td>18 NPSH AVAILABLE m</td> <td></td> <td></td> <td></td> </tr> </table> <p>19 <input type="checkbox"/> PARALLEL OPERATION REQUIRED</p> <p>20 <input type="checkbox"/> SERIES OPERATION WITH ITEM NUMBER _____</p> <p>21 SERVICE <input type="checkbox"/> CONTINUOUS</p> <p>22 <input type="checkbox"/> INTERMITTENT (STARTS / DAY)</p> <p>23 CAPACITY CONTROL METHOD <input type="checkbox"/> CONTROL VALVE <input type="checkbox"/> ON-OFF</p> <p>24 <input type="checkbox"/> SPEED VARIATION <input type="checkbox"/> NONE <input type="checkbox"/> OTHER _____</p>		RAT.	NOR.	MIN.	10 CAPACITY m ³ /h				11 SUCTION PRESS. kgf/cm ² g				12 DISCH. PRESS. kgf/cm ² g				13 DIFF. PRESS. kgf/cm ²				14 HEAD m		@ MINIMUM S.G.			RAT.	NOR.	MIN.	16 AT DESIGNED CAPACITY				17 OPERATING TIME, H / Y				18 NPSH AVAILABLE m				<p>PROPOSAL CURVE Nº _____ <input type="checkbox"/> SPEED _____ rpm</p> <p>MEASURED AT CAPACITY</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th></th> <th style="text-align: center;">RAT.</th> <th style="text-align: center;">NOR.</th> <th style="text-align: center;">MIN.</th> </tr> <tr> <td><input type="checkbox"/> NPSH REQUIRED m</td> <td></td> <td></td> <td></td> </tr> </table> <p><input type="checkbox"/> TOTAL DIFF. HEAD @ RATED IMPELLER _____ m</p> <p><input type="checkbox"/> MAX. DIFF. HEAD @ RATED IMPELLER _____ m</p> <p><input type="checkbox"/> MINIMUM CONTINUOUS FLOW STABLE _____ m³/h</p> <p style="text-align: right;">THERMAL _____ m³/h</p> <p><input type="checkbox"/> ALLOWABLE OPER. REGION _____ TO _____ m³/h</p> <p><input type="checkbox"/> BEST EFFICIENCY POINT FOR RATED IMPELLER _____ m³/h</p> <p><input type="checkbox"/> SUCTION SPECIFIC SPEED _____</p> <p><input type="checkbox"/> IMPELLER DIAMETER, mm</p> <p style="text-align: center;">RAT. _____ MAX. _____ MIN. _____</p> <p><input type="checkbox"/> PUMP RATED POWER _____ kW</p> <p><input type="checkbox"/> PUMP EFFICIENCY _____ %</p> <p><input type="checkbox"/> MAXIMUM POWER @ RATED IMPELLER _____ kW</p> <p>ROTATION (VIEWED FROM COUPLING END)</p> <p><input type="checkbox"/> CLOCKWISE <input type="checkbox"/> COUNTER CLOCKWISE</p> <p>CASE PRESSURE RATING</p> <p><input type="checkbox"/> MAX. ALLOWABLE WORKING PRESSURE _____ kgf/cm² g</p> <p><input type="checkbox"/> HYDROSTATIC TEST PRESSURE _____ kgf/cm² g</p> <p>TRAIN SOUND LEVEL</p> <p><input type="checkbox"/> MAX. SOUND PRESS LEVEL (REQ./EST.) _____ / _____ dBA @ 1m</p> <p><input type="checkbox"/> MAX. SOUND POWER LEVEL (REQ./EST.) _____ / _____</p>		RAT.	NOR.	MIN.	<input type="checkbox"/> NPSH REQUIRED m			
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DESIGN CONDITIONS																																																	
26 UPSTREAM SYSTEM DESIGN TEMPERATURE _____ °C																																																	
27 UPSTREAM SYSTEM DESIGN PRESSURE _____ kgf/cm ² g																																																	
28 DOWNSTREAM SYSTEM DESIGN PRESSURE _____ kgf/cm ² g																																																	
LIQUID																																																	
30 LIQUID TYPE OR NAME _____																																																	
31 <input type="checkbox"/> HAZARDOUS <input type="checkbox"/> FLAMMABLE <input type="checkbox"/> TOXIC																																																	
32	MIN. NOR. MAX.																																																
33 PUMPING TEMP. °C																																																	
34 AT OPERATIONAL TEMP.:	MIN. NOR. MAX.																																																
35 SPECIFIC GRAVITY																																																	
36 VAPOR PRESS. kgf/cm ² a																																																	
37 VISCOSITY cP																																																	
38 SPECIFIC HEAT kcal/kg °C																																																	
39 INITIAL BOILING POINT _____ °C @ _____ kgf/cm ² a																																																	
40 <input type="checkbox"/> CHLORIDE CONCENTRATION _____ ppm																																																	
41 <input type="checkbox"/> H ₂ S CONCENTRATION _____ ppm																																																	
42 <input type="checkbox"/> CORROSION CAUSED BY _____																																																	
43 <input type="checkbox"/> EROSION CAUSED BY _____																																																	
44 <input type="checkbox"/> SOLIDS MAX. DIAMETER _____ µm																																																	
45 CONCENTRATION _____ ppm																																																	
DRIVER	MATERIAL																																																
48 <input type="checkbox"/> INDUCTION ELECTRIC MOTOR <input type="checkbox"/> STEAM TURBINE	MATERIAL CLASS CODE _____																																																
49 <input type="checkbox"/> OTHER _____	CASING _____																																																
50 <input type="checkbox"/> MANUFACTURER _____	COVER _____																																																
51 <input type="checkbox"/> DATA SHEET Nº _____	IMPELLER _____																																																
52 <input type="checkbox"/> FURNISHED BY _____	SHAFT _____																																																
53 <input type="checkbox"/> MOUNTED BY _____	SHAFT SLEEVE _____																																																
54 <input type="checkbox"/> POWER _____ kW <input type="checkbox"/> SPEED _____ rpm	CASING WEAR RING _____																																																
55	IMPELLER WEAR RING _____																																																
56	BEARING HOUSING _____																																																
57 REMARKS:																																																	
58																																																	
59																																																	
60																																																	

 PETROBRAS	DATA SHEET	Nº _____	REV. _____
	AREA: _____		SHEET 3 of 5
	TITLE: CENTRIFUGAL PUMP		

<div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">MECHANICAL DATA</div> <div> <div> <div>PUMP TYPE</div> <div> <input type="checkbox"/> OVERHUNG <input type="checkbox"/> BETWEEN BEARINGS </div> </div> <div> <div>CASING</div> <div> <input type="checkbox"/> RADIAL <input type="checkbox"/> AXIAL <input type="checkbox"/> SINGLE VOLUTE <input type="checkbox"/> DOUBLE VOLUTE <input type="checkbox"/> DIFFUSER </div> </div> <div> <div>IMPELLER</div> <div> <input type="checkbox"/> CLOSED <input type="checkbox"/> SEMI-OPEN <input type="checkbox"/> OPEN </div> </div> <div> <div>BEARINGS</div> <div> <input type="checkbox"/> BEARINGS MANUFACTURER _____ <input type="checkbox"/> RADIAL BEARING TYPE _____ Nº _____ <input type="checkbox"/> THRUST BEARING TYPE _____ Nº _____ <input type="checkbox"/> BEARING ISOLATORS _____ <input type="checkbox"/> SHAFT STIFFNESS RATIO (L³/D⁴) _____ </div> </div> <div> <div>LUBRICATION</div> <div> <input type="checkbox"/> OIL (FLOOD, RING ETC.) <input type="checkbox"/> GREASE <input type="checkbox"/> PURE OIL MIST <input type="checkbox"/> PURGE OIL MIST <input type="checkbox"/> FORCED <input type="checkbox"/> CONSTANT LEVEL OILER REQUIRED <input type="checkbox"/> HOUSING VENT REQUIRED <input type="checkbox"/> MAGNETIC DRAIN PLUG IN HOUSING REQUIRED <input type="checkbox"/> OIL COOLER REQUIRED <input type="checkbox"/> SEAL SPRAY GUARD REQUIRED <input type="checkbox"/> OIL VISCOSITY ISO GRADE _____ <input type="checkbox"/> OTHER _____ </div> </div> <div> <div>NOZZLE CONNECTIONS</div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <th style="width: 25%;">SIZE</th> <th style="width: 25%;">RATING</th> <th style="width: 25%;">FACING</th> <th style="width: 25%;">ORIENT.</th> </tr> <tr> <td>SUCTION</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DISCHARGE</td> <td></td> <td></td> <td></td> </tr> </table> <div> <input type="checkbox"/> AUX. CASE CONNECTION <input type="checkbox"/> DRAIN REQUIRED <input type="checkbox"/> SIZE _____ (mm) <input type="checkbox"/> THREADED <input type="checkbox"/> WELDED AND FLANGED </div> </div> </div> <div style="width: 50%; vertical-align: top;"> <div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">UTILITY CONDITIONS</div> <div> <div> <div>ELECTRICITY</div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <th style="width: 33%;">VOLTAGE</th> <th style="width: 33%;">PHASE Nº</th> <th style="width: 33%;">FREQ. (Hz)</th> </tr> <tr> <td>DRIVERS</td> <td></td> <td></td> </tr> <tr> <td>HEATING</td> <td></td> <td></td> </tr> </table> <div> SYSTEM VOLTAGE DIP <input type="checkbox"/> 20% <input type="checkbox"/> OTHER _____ STEAM MAX. PRESS. MAX. TEMP. MIN. PRESS. MIN. TEMP. </div> <div> <div>DRIVERS</div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table> <div>HEATING</div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table> </div> <div> <div>COOLING WATER</div> <div> SOURCE _____ SUPPLY TEMP. _____ °C MAX RETURN TEMP. _____ °C NORM. PRESS. _____ kgf/cm² g DESIGN PRESS. _____ kgf/cm² g MIN. RET. PRESS. _____ kgf/cm² g MAX ALLOW Δ P _____ kgf/cm² g CHLORIDE CONCENTRATION _____ mg/kg </div> </div> </div> <div style="text-align: center; border-bottom: 1px solid black; margin-top: 10px;">COUPLING AND COUPLING GUARD</div> <div> <div>COUPLING</div> <div> MANUFACTURER _____ TYPE _____ SIZE _____ MODEL _____ SPACER LENGTH _____ mm </div> <div> <div>COUPLING GUARD</div> <div> <input type="checkbox"/> SPEC. Nº _____ <input type="checkbox"/> MANUFACTURER'S STANDARD <input type="checkbox"/> BASEPLATE MOUNTED </div> </div> </div> <div style="text-align: center; border-bottom: 1px solid black; margin-top: 10px;">BASEPLATE</div> <div> <input type="checkbox"/> GROUDED <input type="checkbox"/> SPEC. Nº _____ <input type="checkbox"/> MANUFACTURER'S STANDARD <input type="checkbox"/> DIMENSIONS W = _____ mm L = _____ mm <input type="checkbox"/> CENTERLINE OF PUMP TO STILT BOTTOM _____ mm <input type="checkbox"/> MATERIAL _____ </div> </div> <div style="text-align: center; border-bottom: 1px solid black; margin-top: 10px;">INSPECTION AND TESTING</div> <div> <input type="checkbox"/> FINAL INSPECTION REQUIRED <input type="checkbox"/> DAYS NOTIFICATION REQUIRED _____ <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <th style="width: 30%;">TEST</th> <th style="width: 15%;">NON-WIT.</th> <th style="width: 15%;">WIT.</th> <th style="width: 15%;">CERT.</th> </tr> <tr> <td>HYDROSTATIC</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>PERFORMANCE</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>NPSH</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>VIBRATION</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>MECHANICAL RUNNING</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>OTHER _____</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table> <input type="checkbox"/> CASTING REPAIR PROCEDURE APPROVAL REQUIRED <div> <div>MATERIAL CERTIFICATION REQUIRED</div> <div> <input type="checkbox"/> CASING <input type="checkbox"/> COVER <input type="checkbox"/> IMPELLER <input type="checkbox"/> SHAFT <input type="checkbox"/> OTHER _____ </div> </div> <div> <div>INSPECTION REQUIRED FOR CONNECTION WELDS</div> <div> <input type="checkbox"/> MANUFACTURER'S STANDARD <input type="checkbox"/> VISUAL INSPECTION </div> </div> <div> <div>INSPEICION REQUIRED FOR CASTINGS</div> <div> <input type="checkbox"/> MANUFACTURER'S STANDARD <input type="checkbox"/> VISUAL INSPECTION <input type="checkbox"/> OTHER _____ _____ _____ _____ </div> </div> </div> <div style="width: 50%; vertical-align: top;"> <div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">PAINTING AND SHIPMENT PREPARATION</div> <div> <div> <div>PUMP</div> <div> <input type="checkbox"/> MANUFACTURER'S STD <input type="checkbox"/> MANUFACTURER'S STD <input type="checkbox"/> OTHER _____ <input type="checkbox"/> OTHER _____ </div> </div> <div> <div>SHIPMENT</div> <div> <input type="checkbox"/> DOMESTIC <input type="checkbox"/> EXPORT <input type="checkbox"/> EXPORT BOXING REQUIRED TOTAL WEIGHT _____ kgf <input type="checkbox"/> OUTDOOR STORAGE MORE THAN _____ MONTHS </div> </div> </div> <div style="text-align: center; border-bottom: 1px solid black; margin-top: 10px;">INSTRUMENTATION</div> <div> <input type="checkbox"/> ACCELEROMETER(S) _____ <input type="checkbox"/> VIBRATION PROBES <input type="checkbox"/> RADIAL _____ PER. BRG. <input type="checkbox"/> AXIAL _____ PER. BRG. <input type="checkbox"/> PROVISION FOR MOUNTING ONLY <input type="checkbox"/> FLAT SURFACE REQ'D <input type="checkbox"/> RADIAL BRG METAL TEMP. <input type="checkbox"/> THRUST BRG METAL TEMP <input type="checkbox"/> TEMP. GAUGES WITH THERMOWELLS <input type="checkbox"/> MONITORS AND CABLES SUPPLIED BY _____ </div> <div style="text-align: center; border-bottom: 1px solid black; margin-top: 10px;">WEIGHTS, kgf</div> <div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <td style="width: 50%;">PUMP</td> <td style="width: 50%;">BASEPLATE</td> </tr> <tr> <td>DRIVER</td> <td>TOTAL TRAIN</td> </tr> </table> </div> </div> </div> <div style="text-align: center; border-bottom: 1px solid black; margin-top: 10px;">REMARKS:</div> <div> <div>_____</div> <div>_____</div> <div>_____</div> <div>_____</div> <div>_____</div> <div>_____</div> </div>	SIZE	RATING	FACING	ORIENT.	SUCTION				DISCHARGE				VOLTAGE	PHASE Nº	FREQ. (Hz)	DRIVERS			HEATING											TEST	NON-WIT.	WIT.	CERT.	HYDROSTATIC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	PERFORMANCE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NPSH	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	VIBRATION	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MECHANICAL RUNNING	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OTHER _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	PUMP	BASEPLATE	DRIVER	TOTAL TRAIN
SIZE	RATING	FACING	ORIENT.																																																										
SUCTION																																																													
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MECHANICAL RUNNING	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																																																										
OTHER _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																																																										
PUMP	BASEPLATE																																																												
DRIVER	TOTAL TRAIN																																																												

		DATA SHEET		Nº	REV.	
		AREA:			SHEET	4 of 5
		TITLE:			CENTRIFUGAL PUMP	
1	MECHANICAL SEAL			BARRIER / BUFFER FLUSHING SYSTEM		
2	SUPPLIED BY <input type="checkbox"/> PUMP MANUFACTURER <input type="checkbox"/> PURCHASER MOUNTED BY <input type="checkbox"/> PUMP MANUFACTURER <input type="checkbox"/> PURCHASER <input type="checkbox"/> SEAL CLASSIFICATION CODE _____ <input type="checkbox"/> MANUFACTURER _____ <input type="checkbox"/> MODEL _____ SEAL TYPE <input type="checkbox"/> CARTRIDGE <input type="checkbox"/> COMPONENT SEAL DESIGN <input type="checkbox"/> SINGLE <input type="checkbox"/> DUAL <input type="checkbox"/> DRY GAS <input type="checkbox"/> PRESSURIZED <input type="checkbox"/> UNPRESSURIZED SEAL CHAMBER <input type="checkbox"/> TAPER BORE <input type="checkbox"/> CYLINDRICAL BORE SEAL CHAMBER SIZE <input type="checkbox"/> OVERSIZED <input type="checkbox"/> STANDARD <input type="checkbox"/> SLEEVE MATERIAL _____ <input type="checkbox"/> PUMPING RING REQUIRED _____ <input type="checkbox"/> THROAT BUSHING REQUIRED _____ MATERIAL _____			SECONDARY FLUSHING PLAN Nº _____ <input type="checkbox"/> BARRIER / BUFFER LIQUID _____ <input type="checkbox"/> TEMPERATURE (MIN. / MAX.) _____ / _____ °C <input type="checkbox"/> SPECIFIC GRAVITY _____ <input type="checkbox"/> SPECIFIC HEAT _____ kcal/kg °C <input type="checkbox"/> VAPOR PRESS. _____ kgf/cm² @ _____ °C <input type="checkbox"/> PRESS. REQ'D (MIN. / MAX.) _____ / _____ kgf/cm² <input type="checkbox"/> MAWP OF SECONDARY SEAL SYSTEM _____ kgf/cm² <input type="checkbox"/> TEMP. REQ'D (MIN. / MAX.) _____ / _____ °C SECONDARY SEAL FLUSH. PIPING <input type="checkbox"/> TUBING <input type="checkbox"/> PIPE MATERIAL <input type="checkbox"/> 316 SS <input type="checkbox"/> CARBON STEEL <input type="checkbox"/> OTHER _____ <input type="checkbox"/> PIPING / TUBING SIZE _____ mm PIPING ASSEMBLY <input type="checkbox"/> THREADED <input type="checkbox"/> UNIONS <input type="checkbox"/> FLANGED <input type="checkbox"/> TUBE TYPE FITTINGS <input type="checkbox"/> SOCKET WELDED		
19	SEAL GLAND			SEAL SYSTEM INSTRUMENTATION		
20	TAPS REQUIRED <input type="checkbox"/> QUENCH <input type="checkbox"/> FLUSHING <input type="checkbox"/> DRAIN <input type="checkbox"/> OTHER _____ <input type="checkbox"/> THROTTLE BUSHING MATERIALS _____			PRIMARY SEALS: GAUGES TRANSMITTERS FLOW <input type="checkbox"/> <input type="checkbox"/> TEMPERATURE <input type="checkbox"/> <input type="checkbox"/> PRESSURE <input type="checkbox"/> <input type="checkbox"/> SECONDARY SEALS: FLOW <input type="checkbox"/> <input type="checkbox"/> PRESSURE <input type="checkbox"/> <input type="checkbox"/> LEVEL <input type="checkbox"/> <input type="checkbox"/> OTHER _____ _____		
24	SEAL FLUSHING			COOLING OR HEATING PIPING PLANS		
25	PRIMARY FLUSHING PLAN Nº _____ <input type="checkbox"/> EXTERNAL FLUSHING LIQUID _____ <input type="checkbox"/> SUPPLY TEMPERATURE (MIN. / MAX.) _____ / _____ °C <input type="checkbox"/> SPECIFIC GRAVITY _____ <input type="checkbox"/> SPECIFIC HEAT _____ kcal/kg °C <input type="checkbox"/> VAPOR PRESSURE _____ kgf/cm² @ _____ °C <input type="checkbox"/> FLOW REQ'D (MIN. / MAX.) _____ / _____ m³/h <input type="checkbox"/> PRESS. REQ'D (MIN. / MAX.) _____ / _____ kgf/cm² <input type="checkbox"/> TEMP. REQ'D (MIN. / MAX.) _____ / _____ °C PRIMARY FLUSHING PIPING <input type="checkbox"/> TUBING <input type="checkbox"/> PIPE MATERIAL <input type="checkbox"/> 316 SS <input type="checkbox"/> CARBON STEEL <input type="checkbox"/> OTHER _____ <input type="checkbox"/> PIPING DIAMETER _____ mm PIPING ASSEMBLY <input type="checkbox"/> THREADED <input type="checkbox"/> UNIONS <input type="checkbox"/> FLANGED <input type="checkbox"/> TUBE TYPE FITTINGS <input type="checkbox"/> SOCKET WELDED			<input type="checkbox"/> PIPING PLAN Nº _____ <input type="checkbox"/> NAME OF FLUID _____ <input type="checkbox"/> INLET TEMPERATURE _____ °C <input type="checkbox"/> OUTLET TEMPERATURE _____ °C <input type="checkbox"/> RATED FLOW _____ m³/h <input type="checkbox"/> SUPPLY PRESSURE _____ kgf/cm² <input type="checkbox"/> MAX. ALLOWABLE Δ P _____ kgf/cm² <input type="checkbox"/> CARBON STEEL PIPE <input type="checkbox"/> SS TUBING <input type="checkbox"/> SIGHT FLOW INDICATOR <input type="checkbox"/> OUTLET SHUT-OFF VALVE		
43	REMARKS:					
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	CENTRIFUGAL PUMP			
NOTES				

	DATA SHEET		Nº		REV.	
	AREA:				SHEET 2 of 4	
	TITLE:					
VENDOR DRAWING AND DATA REQUIREMENTS						

THE DOCUMENTS STATED BELOW SHALL BE SUPPLIED IN ENGLISH OR BRAZILIAN PORTUGUESE

PROPOSAL: VENDOR SHALL FURNISH _____ HARD COPIE(S) OF DRAWINGS AND DATA INDICATED.

REVIEW: VENDOR SHALL FURNISH _____ HARD COPIE(S) AND AN ELETRONIC FILE OF DRAWINGS AND DATA INDICATED.

FINAL: VENDOR SHALL FURNISH _____ HARD COPIE(S) AND AN ELETRONIC FILE OF DRAWINGS AND DATA INDICATED.
VENDOR SHALL FURNISH _____ OPERATING AND MAINTENANCE MANUAL(S).

DISTRIBUTION RECORD

FINAL – RECEIVED FROM VENDOR _____


FINAL – DUE FROM VENDOR _____


REVIEW – RETURNED TO VENDOR _____

REVIEW – RECEIVED FROM VENDOR _____

REVIEW – DUE FROM VENDOR _____

CENTRIFUGAL PUMP									
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1. DRAWINGS AND DOCUMENTS INDEX						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2. LIST OF EXCEPTIONS TO THE SPECIFICATIONS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3. EQUIPMENT GENERAL DESCRIPTION AND CATALOGS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4. REFERENCE LIST						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5. PUMP TRAIN ARRANGEMENT DRAWING AND LIST OF CONNECTIONS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6. PUMP CERTIFIED DIMENSIONAL OUTLINE DRAWING AND LIST OF CONNECTIONS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7. PUMP CROSS-SECTIONAL DRAWING AND BILL OF MATERIALS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8. SHAFT SEAL CROSS-SECTIONAL DRAWING AND BILL OF MATERIALS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9. SHAFT COUPLING ASSEMBLY DRAWING AND BILL OF MATERIALS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10. PRIMARY AND AUXILIARY FLUSH PIPING SCHEMATICS AND BILL OF MATERIALS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.a. DETAILED DRAWING AND DATA SHEETS OF SEAL SYSTEM APPURTENANCES (RESERVOIR, HEAT EXCHANGERS ETC)						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11. COOLING OR HEATING SCHEMATIC AND BILL OF MATERIALS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.a. COOLER OR HEATER CROSS SECTIONAL DRAWING AND DATA SHEET						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	12. ELECTRICAL AND INSTRUMENTATION SCHEMATICS, WIRING DIAGRAMS, AND BILL OF MATERIALS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	13. ELECTRICAL AND INSTRUMENTATION ARRANGEMENT DRAWING AND LIST OF CONNECTIONS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	14. NAMEPLATE DRAWINGS (PUMP, DRIVER ETC)						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15. PERFORMANCE CURVES						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	16. VIBRATION ANALYSIS DATA						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	17. CERTIFIED HYDROSTATIC TEST DATA						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	18. MATERIAL CERTIFICATES						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	19. PROGRESS REPORTS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20. WELD PROCEDURES						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20.a. MAJOR WELD REPAIR DATA						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	21. PERFORMANCE TEST DATA AND REPORT						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	22. MECHANICAL RUNNING TEST DATA AND REPORT						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	23. OPTIONAL TEST DATA AND REPORT						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	24. INSPECTOR'S CHECKLIST						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	25. INSPECTION AND TESTING SCHEDULE AND SUMMARY						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	26. DATA SHEETS APPLICABLE TO PROPOSALS, PURCHASE AND AS-BUILT						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	27. NOISE DATA SHEETS						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	28. AS-BUILT CLEARANCES						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	29. INSTALLATION, OPERATION AND MAINTENANCE MANUALS						

			DATA SHEET		Nº		REV.						
			AREA:						SHEET 3 of 4				
			TITLE: VENDOR DRAWING AND DATA REQUIREMENTS										
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	30. SPARE PARTS RECOMMENDATIONS AND PRICE LIST					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	31. PRESERVATION, PACKAGING AND SHIPPING PROCEDURES					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	32. LIST OF INTERCHANGEABLE PARTS (SAME MODEL PUMP OR TYPE)					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	33. AUTOMATIC RECIRCULATION VALVE DATA SHEET, DIMENSIONAL AND SECTIONAL DRAWINGS AND BILL OF MATERIALS					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	34. EXPECTED AND GUARANTEED LEAKAGE RATES OF THE SEAL DURING TESTS AND NORMAL OPERATION					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	35. PAINTING SPECIFICATION					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	36. TECHNICAL DATA MANUAL (DATABOOK)					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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ELECTRIC MOTOR													
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1. DRAWINGS AND DATA REQUIRED IN PETROBRAS STANDARD N-2919 (WHERE APPLICABLE)					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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REMARKS:													

	DATA SHEET		Nº	REV.
	AREA:		SHEET 4 of 4	
	TITLE:			
	VENDOR DRAWING AND DATA REQUIREMENTS			
NOTES				
<div></div>				

