

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

SEAWATER LIFT PUMPS

PTS 31.29.06.31

NOVEMBER 2010



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This PTS 31.29.06.31- Seawater Lift Pumps has been updated and has incorporated PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards. This PTS is still valid and with editorial changes only.

The previous version of this PTS 31.29.06.31 (November 2003) will be removed from PTS binder / e-repository from herein onwards.

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Document Approval

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PREFACE

PETRONAS Technical Standards (PTS) publications reflect the views, at the time of publication, of PETRONAS OPU/Divisions.

They are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PETRONAS' OPU/Divisions in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the owner.

The right to use PTS rests with three categories of users:

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1. INTRODUCTION

1.1 SCOPE

This new PTS specifies requirements and gives recommendations for seawater lift pumps for use on offshore production facilities.

This PTS may also be used for similar configuration pumps handling fluids other than water, e.g. diesel oil from leg storage.

This PTS covers both electro-submersible and line-shaft driven pumps.

This PTS shall be used in conjunction with data/requisition sheet PTS 31.29.02.93.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by PETRONAS, the distribution of this PTS is confined to companies forming part of or managed by PETRONAS, and to Contractors nominated by them.

This PTS is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities and supply/marketing installations. When PTSs are applied, a Management of Change (MOC) process should be implemented. This is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this PTS, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with respect to safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this PTS. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this PTS as closely as possible.

1.3 DEFINITIONS

1.3.1 General

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, installation, and commissioning or management of a project or operation of a facility. The Principal may sometimes undertake all or part of the duties of the Contractor.

The **Manufacturer** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant, authorised to act for the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.4 ABBREVIATIONS

BEP	Best Efficiency Point
CA	Certifying Authority
CLA	Centre Line Average
LAT	Lowest astronomical tide
NPSH	Net Positive Suction Head
NB	Nominal bore
E-SPIR	Electronic Spare Parts and Interchangeability Record

2. GENERAL REQUIREMENTS

2.1 CONFLICT

Any apparent conflict between the requirements of this PTS and any other relevant documents shall be brought to the Purchaser's attention. Unless otherwise agreed, the following descending order of precedence shall apply:

1. The Purchase Order.
2. The Pump Data Sheet.
3. This PTS.

3. DESIGN AND MANUFACTURING REQUIREMENTS

3.1 SCOPE

The pump Supplier shall have overall technical responsibility for the complete vertical seawater lift pump scope of supply, including design, manufacture and testing activities.

The seawater lift pump scope of supply shall include, but not be limited to, the following items:

- pump unit (bowl assembly)
- suction strainer
- non-return valve (submersible electric motor pumps only)
- rising main and line shaft (as applicable)
- discharge head
- electric motor or submersible electric motor with cable (as applicable)
- transportation container and cable handling system (submersible electric motor pumps)
- anti-marine fouling system for seawater service (if specified in the requisition)
- air vent valve/ vacuum breaker
- junction boxes, to include supports, for motor and anti-marine fouling system
- special tools (for dismantling/re-assembly)

The anti-marine fouling system shall be either the ion-release type or shall be by hypochlorite injection, as specified in the requisition.

The special tools shall be those necessary to dismantle/assemble the pump unit and remove/install the complete pump (with rising main).

3.2 PERFORMANCE

3.2.1 Characteristics

Pumps shall have a stable head/capacity curve rising continuously to shut-off. The head at shut-off for mixed flow impeller pumps shall be between 110% and 140% of the head at the rated capacity. Pumps for parallel operation shall have a similar percentage head rise to shut-off. Parallel operation shall be assumed whenever two or more identical pumps are ordered or enquired for at the same time, or when so stated in the requisition.

End-of-curve shall be at least 125% of the rated capacity or 85% head drop from the rated head.

Pumps shall have a non overloading power/capacity characteristic.

Pumps with constant speed drivers shall be capable of at least a 5% head increase at rated conditions by installing a new impeller or impellers.

The best efficiency point (BEP) should be close to the normal operating point, but in no case shall it be outside the range of between 80% and 105% of the rated flow.

When this PTS is used for pumps handling fluids more viscous than water, the performance shall be corrected in accordance with the Centrifugal Pump Section of the Hydraulics Institute Standards "Performance Correction Chart".

The reference point to be used for specifying the required delivery pressure shall be at the horizontal centre-line of the discharge flange at deck level and shall be referred to as the 'deck level reference point'. Given the pressure required at this point, and details of elevations, the Supplier shall estimate losses in the riser pipe and determine the total differential head required, assuming the pumped fluid is at the minimum operating level and

allowing for 'draw-down' in the caisson. For pumps taking suction from the sea the minimum operating level is the Lowest Astronomical Tide (LAT) level.

3.2.2 Immersion

For pumps in seawater service the impeller immersion depth shall be the greatest of the following:

1. Sufficient to ensure that the inlet to the first stage impeller is flooded at the LAT level and allowing for the 100-year wave trough depth. Unless otherwise specified the wave trough depth from LAT shall be assumed to be one third of the total wave height from trough to apex.
2. Sufficient to provide the NPSH required by the pump at duty point at LAT level with no wave trough allowance, plus 50% of the NPSH required by the pump at the inlet to the first stage impeller, or 3.0 m, whichever is the greater.
3. An immersion depth specified on the data/requisition sheet.

In calculating the immersion depth in accordance with 1 or 2 above, the following allowances shall be made:

- draw-down in the caisson;
- pressure drop around the anti-fouling device (if applicable);
- pressure drop through the suction strainer, assuming that the free area of the strainer has been reduced by 50% by fouling.

3.3 GENERAL DESIGN

3.3.1 Design criteria

The pump and motor unit shall be designed for 25,000 hours continuous operation, with 2,000 stops/starts between overhauls. In this context, continuous shall mean the capability to pump as specified for the period stated. The pump unit may shut down during the stated period for other operational reasons. It is anticipated that pumps will be removed for overhaul after each four-year operating period.

3.3.2 Pressure casings

The pressure casing shall be designed for the maximum pump discharge pressure generated at shut-off at the specified pumping temperature plus an allowance for head increases as required by para 3.2.1 above. In addition, a 3 mm corrosion allowance is to be added unless specifically agreed otherwise with the Principal depending on the material selection. The resulting design pressure shall apply to all parts of the bowl assembly, rising main and discharge head. The downstream discharge pipework and equipment should also be rated for this design pressure.

The stress used in the design for any given material shall not exceed the values given in Section VIII, division 1, of the ASME Boiler and Pressure Vessel Code for the material. For cast materials, the factor specified in the code shall be applied.

3.3.3 Connections

The following nominal sizes shall not be used for pump discharge or auxiliary connections: DN 32 (NPS 1¼), DN 65 (NPS 2½), DN 90 (NPS 3½), DN 125 (NPS 5).

Flanges shall conform to ASME B16.1, except as specified in 1, 2 and 3 below.

1. Ni-resist cast iron flanges and bronze flanges shall be flat-faced and shall be ASME B16.1 Class 250 minimum thickness for sizes 8 inches and smaller.
2. Flanges that are thicker and have a larger outside diameter than required by ASME are acceptable.
3. Flat-faced flanges with full raised face thickness on heads other than cast iron or bronze are not acceptable.