

PETRONAS TECHNICAL STANDARDS

MANUAL

PUMP – TYPE SELECTION AND BASIC DESIGN REQUIREMENTS

PTS 31.29.02.11

OCTOBER 2011



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PTS Title:	Pump – Type Selection and Basic Design Requirements

This revision of PTS **31.29.02.11 - Pump – Type Selection and Basic Design Requirements (October 2011)** has been updated to incorporate PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards. All updates in the document are highlighted in *italic* font.

The previous version of this PTS **31.29.02.11 (March 2008)** will be removed from PTS binder / e-repository from herein onwards.

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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 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 standardisation.

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.

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1. INTRODUCTION

1.1 SCOPE

This PTS provides the guidelines for the selection of the most suitable type of pump to be used in a particular application.

This PTS also specifies the basic design requirements of all types of pumps with the exception of the centrifugal submerged motor pumps for refrigerated product or pressurised storage service. The basic design requirements specified in this PTS shall be used as basis when writing the technical specifications for the procurement of the selected pump.

This PTS is intended for pumps in vital, essential, and non-essential services (see 1.3.2.11).

This PTS shall replace the PTS of the same number dated March 2008; In this PTS, US Customary (USC) units have been added in brackets.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by PETRONAS, the distribution of this PTS is confined to PETRONAS companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them.

This PTS is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities and, where applicable, 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 as regards 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 which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the objective of obtaining agreement to follow this PTS as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

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

The **Manufacturer/Supplier/Vendor** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

Selected Vendors are those Pump and or Seal Vendors who are invited to submit proposals.

Nominated Vendors are those Vendors who are given purchase orders to supply the Pumps and or Mechanical Seals and associated auxiliary systems.

The **Principal** is the party which 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, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

1.3.2.1 abrasive service

service in which there is an expected wear rate of 0.1 mm (0.004 in) or more per year, or where hard particles larger than 100 µm (0.004 in) exist in quantities exceeding 100 mg/kg (100 ppm).

1.3.2.2 alternative design pumps

pumps other than Heavy-duty pumps and Light-duty pumps

Examples:

- Specially engineered pumps such as slurry pumps, vortex pumps, and self-priming pumps
- Fire fighting pumps according to NFPA 20.

1.3.2.3 continuous operation

uninterrupted operation for a period of at least 24,000 h at the specified operating conditions.

1.3.2.4 hazardous service

service comprising the following categories, which shall be specified on the data/requisition sheets:

Category 1

- Liquids classified as "very toxic - acute" in PTS 01.00.01.30.
- Liquids containing ethylene oxide

Category 2

- Liquids classified as "very toxic - chronic" in PTS 01.00.01.30.
- Hydrocarbon liquids at an operating temperature above their auto-ignition temperature.

Category 3

- Hydrocarbon liquids with a seal chamber vapour pressure higher than 500 kPa (abs) [73 psia];
- Light hydrocarbon services (ISO 21049:2004, Clause 3.38).

1.3.2.5 heavy-duty pump

pump complying with ISO 13709, ISO 13710, API 675, API 676, API 681, API 685 and/or BS 4082-1 Code R

- NOTES:
1. API 610 is technically equivalent to ISO 13709.
 2. API 674 is technically equivalent to ISO 13710.

1.3.2.6 light-duty pump

Process pump built to a standard other than those listed under Heavy-duty pump, e.g. pumps complying with DIN, CHEM, ASME/ANSI, BS 4082-1 Code L.

1.3.2.7 intermittent operation

operation that is not classified as continuous operation.

Examples:

- Pumps started up and stopped automatically at intervals by process-operated controls;
- Pumps started up and stopped manually for batch transfer.

1.3.2.8 minimum continuous flow

The greater of minimum continuous stable flow as defined by the applicable industry standard and minimum continuous thermal flow.

1.3.2.9 non-corrosive or mildly corrosive service

- Streams with no corrosive elements and with a service temperature not exceeding 400 °C (752 °F).
- Streams containing sulphur compounds and naphthenic acids with an acid value in excess of 500 mg/kg (500 ppm by mass) KOH, but with a service temperature not exceeding 230 °C (446 °F).
- Streams containing sulphur compounds and naphthenic acids with an acid value up to but not exceeding 500 mg/kg (500 ppm by mass) KOH, and with a service temperature not exceeding 330 °C (626 °F).
- De-aerated boiler feed water and condensate.
- Stripped sour water.
- Caustic soda at a service temperature not exceeding 50 °C (122 °F).
- Caustic soda with a concentration not exceeding 10 % by mass at a service temperature not exceeding 70 °C (158 °F).
- All concentrations of lean ADIP/DEA/MEA (Sulfinol) at a service temperature not exceeding 70 °C (158 °F).

NOTE: See also PTS 31.29.02.30., Appendix 1.

1.3.2.10 flashing hydrocarbon

liquid hydrocarbon with an absolute vapour pressure greater than 0,1 MPa (1 bar) (14,7 psi) at the pumping temperature, or a fluid that will readily boil at ambient conditions.

1.3.2.11 Centrifugal Pump Type Codes

OH1 – foot-mounted single-stage overhung pump
OH2 – centreline-mounted single-stage overhung pump
OH3 – vertical in-line single-stage overhung pumps
OH4 – rigidly-coupled vertical in-line single-stage overhung pumps
OH5 – close-coupled vertical in-line single-stage overhung pumps
OH6 – high-speed integral gear-driven single-stage overhung pumps
BB1 – axially-split one- and two-stage between-bearings pumps
BB2 – radially-split one- and two-stage between-bearings pumps
BB3 – axially-split multistage between-bearings pumps
BB4 – single-casing (ring-section) radially-split multistage between-bearings pumps
BB5 – double-casing radially-split multistage between-bearings pumps
VS1 – vertically-suspended, single-casing diffuser pumps
VS2 – vertically-suspended, single-casing volute pumps
VS3 – vertically-suspended, single-casing axial flow pumps
VS4 – vertically-suspended, single-casing volute line-shaft driven sump pumps
VS5 – vertically-suspended cantilever sump pumps
VS6 – double-casing diffuser vertically-suspended pumps
VS7 – double-casing volute vertically-suspended pumps

1.3.2.11 Service Category - Vital, Essential and Non-essential services

These terms are defined as follows:

	SAFETY EQUIPMENT		OTHER EQUIPMENT	
	SERVICE CATEGORY			
	VITAL	ESSENTIAL		NON-ESSENTIAL
Non-spared equipment		Spared equipment		
Definition	A service in which failure of equipment causes an unsafe condition , resulting in jeopardy to life and/or major damage (fire, explosion etc.).	A service in which failure of equipment renders a plant inoperable or reduces performance to a level unacceptable to the Principal.	A service in which failure of equipment renders a plant inoperable or reduces performance to a level unacceptable to the Principal.	All other services.
Selection Criteria	Equipment shall be adequately spared to ensure as near as practical 100 % availability of the service under all circumstances	A decision not to install spare equipment is based upon economic considerations and proven equipment availability. Non-spared equipment availability may be upgraded by means of additional Capex to match required plant availability.	Installed spare equipment is normally selected where potential losses due to equipment outage greatly outweigh equipment Capex. Sparing philosophy shall be economically evaluated and is typically 2x100 % or 3x50 %.	Economic evaluation required to justify spared equipment.
Driver Selection Criteria	Independent power sources shall be selected to ensure near 100 % service availability	Independent power sources may be selected, for start-up and utility availability reasons	Independent power sources may be selected, for start-up and utility availability reasons	
Examples	• Firewater pumps with diesel and motor drives; • Emergency shut-down (ESD) systems; • Emergency Instrument Air (EIA) compressor.	• Hydrocracker (HCU) feed pump; • HCU recycle compressor; • Cat. Cracker (FCCU) main air compressor; • Forced Draft (FD) and Induced Draft (ID) fans.	• Boiler Feed Water (BFW) pumps; • Fractionator bottom pumps; • Fresh gas compressors (HCU).	• Drinking water pumps; • Sewage pumps.

1.4 CROSS REFERENCES

Where cross-references to other parts of this PTS are made, the referenced section number is shown in brackets. Other documents referenced by this PTS are listed in Section 6.