

PETRONAS TECHNICAL STANDARDS

MANUAL

DEOILING INDUSTRIAL WASTEWATER DESIGN & OPERATION OF CORRUGATED PLATE INTERCEPTOR (CPI)

PTS 10.05.10.30

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This revision of PTS **10.05.10.30 - Deoiling Industrial Wastewater Design & Operation of Corrugated Plate Interceptor (CPI) (October 2011, Revision 3)** 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 **10.05.10.30 (February 2009)** will be removed from PTS binder / e-repository from herein onwards.

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1. INTRODUCTION

1.1. SCOPE

This PTS outlines the minimum standards and requirements for the design, operation and maintenance of Corrugated Plate Interceptor (CPI).

This PTS shall supersede PTS 20.065; DEOILING INDUSTRIAL WASTEWATER DESIGN & OPERATION OF CORRUGATED PLATE INTERCEPTOR (CPI) (1981). This PTS also includes PETRONAS Lessons Learnt and PETRONAS Best Practice for the subject matter as stated above.

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 and, where applicable, in 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 as regards 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 object 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 the project, or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

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

The **Principal** is the party which initiates the project and ultimately pays for its design and construction. The Principal will typically specify the technical requirements. The Principal may also appoint an agent or consultant authorised to act for and on behalf of the Principal.

The word '**shall**' indicates a requirement. The English language equivalent or interchangeable term of 'shall' is '**must**'.

The word '**should**' indicates a recommendation.

The word '**may**' indicates a possible course of action

1.3.2. Specific definitions

Corrugated Plate Interceptor (CPI)

A device to separate suspended oil droplets from water phase based on differential density of oil and water. CPIs are equipped with parallel, corrugated plates

designed to assist in coagulation of oil droplets to improve oil/water separation.

Chemical Oxygen Demand (COD)

The standard method for indirect measurement of the amount of organic pollution in a sample of water, expressed in milligrams per liter (mg/L), which indicates the mass of oxygen consumed per liter of solution. The COD test procedure is based on the chemical decomposition of organic compounds using a strong oxidizing agent (e.g. potassium dichromate) in acidic conditions.

Biochemical Oxygen Demand (BOD)

The standard method for measurement of the amount of organic pollution that can be oxidized biologically in a sample of water, expressed in milligrams per liter (mg/L).

pH

A measure of the acidity or alkalinity of a solution.

American Petroleum Institute (API) Separator

A device to separate suspended oil droplets from water phase based on differential density of oil and water. However, unlike CPIs, API separators do not employ parallel plate packs and are subsequently larger than CPIs for a given degree of separation.

Oil and grease

A method for measurement (based on solvent extraction) of the amount of oily pollution in a sample of water, expressed in milligrams per liter (mg/L).

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 in this PTS are listed in Section 7.

1.5. SUMMARY OF CHANGES SINCE PREVIOUS EDITION

Section	Changes
General	General editorial changes were made throughout to correct grammatical errors and improve document flow.
General	Revised language style as per PTS requirements throughout document i.e. used "shall" for prescriptive statements and "should" for recommendations.
1	Updated the whole Section as per latest PTS subsections requirements. Included specific definitions.
2.2	Added specific regulations that may be relevant and guideline statement on following multiple regulations.
2.3	Deleted first paragraph.
2.3	Added characterisation study requirement for determining need of CPI and the criteria to select CPI as opposed to other technologies.
2.3	Added requirement on applicability of CPI in absence of characterisation study.
4	Added statement on CPI design requirements to be based on overall treatment requirement of the whole effluent treatment facility.
4.1	Added requirement that design basis shall be reviewed and endorsed by TP
4.1	Added Malaysian regulatory guidelines on effluent characterisation
4.1	Added statement on adoption of typical design values in absence of characterisation study.

4.3	<i>Added statement on sizing calculations to be used by Principal to do preliminary sizing and evaluation of proposals.</i>
4.3.2	<i>Changed retention time based on average flow to 2 hours.</i>
4.4	<i>Added statement that section intended as guideline only.</i>
4.5	<i>Added statement that the ancillaries shall be provided.</i>
4.5.7	<i>Added statement on CPI bay cover requirement unless justified by risk assessment</i>
4.5.7	<i>Deleted types of floating covers. Replaced with statement on requirement of floating covers to be heavy enough to withstand swelling and surging.</i>
4.7.1	<i>Added requirements for demulsification facility</i>
4.7.2	<i>Changed title to "Residual Waste". Added reference to Malaysian regulations.</i>
4.8	<i>Added statement on applicability of PTS to package separators</i>
4.9	<i>Changed language of the section on materials selection to indicate requirement (i.e. "shall")</i>
5	<i>Changed language for the section to indicate requirement (i.e. "shall")</i>
5	<i>Added statement on competent person requirements and related regulations</i>
5	<i>Added reference to Appendix.</i>
5.8	<i>Added plate pack recommended maintenance frequency</i>
6	<i>Added performance monitoring regulatory requirements</i>
6.1	<i>Added reference to Appendix</i>
6.2	<i>Changed title to "Performance Management Plan" and referred to Wastewater Management PTS 60.3302.</i>
6.3.1	<i>Added another potential cause: excursion of heavy rainfall</i>
6.3.1	<i>Added recommendation for CPI sizing calculations to be redone during investigation</i>
6.3.2	<i>Added another improvement approach</i>
7	<i>Added a reference section which lists all external references.</i>
Appendices	<i>Added Appendix 3: Density and Viscosity Chart</i>
Appendix 1	<i>Added reference of design calculations to API 421</i>

2. GENERAL

2.1. BACKGROUND

Hydrocarbon processing in PETRONAS Group that includes oil/water separation, gas processing, refining and petrochemical processing, generally produces wastewater streams. Typical pollutants in the wastewater streams of the plants are oil and grease, suspended solids, pH, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), while other less typical but may be present are aromatics, sulfide, ammonia and amine. Heavy metals may also be present depending on the characteristics of the oil or gas and pipeline conditions.

Oil and grease in the wastewater may be present in various forms - suspended (free phase oil and oil coated solids), emulsified, and dissolved. Coalescing and gravity type oil/water separator such as the Corrugated Plate Interceptor (CPI) as described in this manual is mainly used to remove oil in its suspended form. The device does not remove or treat emulsified and dissolved oil.

CPI devices are commonly found in many PETRONAS facilities. The separator is a simple device with long proven performance, but often its importance as the first line of defense in preventing damages and upsets to downstream wastewater treatment processes is overlooked. Several factors could potentially affect the safety, efficiency and proper management of the device, thus these factors shall be given careful consideration prior to any installations or modifications

2.2. OIL REMOVAL OBJECTIVES

The main objective of oil removal is to meet environmental regulations intended for protecting water quality and ensuring aquatic life and human health. For example, in Malaysia, any discharge of industrial effluent onto soil, inland waters and Malaysian waters are governed under the Environmental Quality (Industrial Effluent) Regulations 2009, which stipulate limits of 10 mg/L of oil and grease content for Standard B discharge areas and non detectable oil and grease content for Standard A discharge areas.

In other locations, the local/national/international regulations (such as US Environmental Protection Agency regulations, Australia's Environment Protection and Biodiversity Conservation Act 1999, International Maritime Organization's convention) will apply to the effluent discharge. Internal standards, such as the PETRONAS Procedures and Guidelines for Upstream Activities Revision 2 August 2008 (PPGUA) may also be applicable. In each case, careful consideration on the applicability of the standards and regulations for effluent discharge shall be made and the more stringent requirement shall always be followed.

In addition, oil shall also need to be removed for operational objectives and/or process related objectives such as:

- Prevention of upsets of downstream secondary wastewater treatment system such as hindrance of oxygen transfer in aerobic systems and interference of solids settling, and
- Prevention of damages and hazards caused by oil accumulation and fouling of instruments and equipment.

2.3. APPLICATION OF CPI

When determining the need for a new CPI or an upgrade of an existing CPI, a wastewater characterisation shall be conducted to ensure its effectiveness to meet the objectives of wastewater treatment. The wastewater characterisation shall be conducted to obtain the following information:

- Oil and grease content. If the oil and grease content is already below the specified limit, a separator is not required.
- Existence of free phase oil. If the oil exists in emulsified or dissolved form, other treatment processes shall be required such as a flotation device.
- Oil droplet size distribution. If the oil droplet size is not generally within 60 – 150 microns [API Publication 421], then CPI is not preferred and other separators may be required to remove the oil.

Figure 1 outlines the general flowchart for determination of the applicability of a CPI. In cases where characterisation is not possible or prohibitive, then it shall be assumed that a CPI is necessary unless otherwise justified by suitable reference with similar applications elsewhere and/or by careful consideration of any available process design information.

Figure 1: Flowchart for Determining Applicability of CPI

