

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

MANUAL

DRAIN SYSTEMS FOR OFFSHORE INSTALLATIONS

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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 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.

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, the Principal will expect 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 Principal or its technical advisor.

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1. INTRODUCTION

1.1 SCOPE

This new PTS specifies requirements and gives recommendations for the design of drain systems for offshore oil and gas production facilities. Though primarily intended for use during the design of new fixed platform facilities, the guidelines should also be followed for floating facilities, including FPSOs (Floating Production, Storage and Off-loading), and as far as is practical for the modification of existing facilities.

Drain systems on offshore facilities are an integral part of the platform's safety and operability aspects. Serious incidents have been caused by failings in drain systems design which therefore requires careful consideration. Drainage streams are produced from many sources in a facility and the guidance contained in this PTS covers the safe collection and disposal of streams from the following:

- process equipment and maintenance drains;
- rain, deluge and wash-down water from deck drains in process and utility areas;
- instrument drains.

This PTS does not cover the drainage of domestic waste water and sewage streams from accommodation and control room areas, or drainage from drilling units. These systems require special consideration and shall not be integrated with or connected to the facility's plant drain systems.

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 PETRONAS Group and to Contractors nominated by them.

This PTS is intended for use in offshore oil and gas production facilities but may also be applied to onshore facilities located in bodies of water, i.e. in lakes and swamps.

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

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 or maintenance of a facility. The Principal may undertake all or part of the duties of the Contractor.

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.

1.4 ABBREVIATIONS

CD	Closed Drain system
HVAC	Heating, Ventilation and Air Conditioning
OHD	Open Hazardous area Drains
ONHD	Open Non-Hazardous area Drains

1.5 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 [\(5\)](#).

2. DRAIN SYSTEMS PHILOSOPHY

2.1 PURPOSE AND FUNCTION OF PLATFORM DRAIN SYSTEMS

The purpose of the drain systems considered in this PTS is to collect and convey platform drainage streams to an appropriate disposal system in such a way as to protect personnel, plant and equipment, and to avoid environmental pollution. Note that the release of pollutants to the sea and hence the design features required of offshore drain systems are generally subject to the MARPOL convention, to which most countries are now signatories.

Drain systems provide the means of safely removing residual process and wash-down fluids from vessels, pipes, flooring and instruments, resulting either from operational activities or from preparation prior to carrying out maintenance work. The fluids are collected and transported to a recovery system or are disposed of in a safe and environmentally acceptable fashion. A fundamental safety consideration is that a drain system must not provide a route for migration of flammable liquids or vapours from one hazardous area to another, or to non-hazardous areas. Other factors affecting the safety and environmental acceptability of drain systems include:

- interconnections between drain systems;
- effect of blockages;
- accidental or deliberate misuse;
- preventing the spread of fires or flammable fluids;
- pollution of the sea;
- release of toxic materials to the atmosphere;
- incorrect material specifications;
- inability to be cleaned and maintained.

Drain streams shall therefore be segregated into specific systems, each designed for a particular type of stream, with no interconnection between the different systems. Existing drain systems should be modified to remove all interconnections. However, where this proves impractical, reduction to a single interconnection employing a dip-pipe seal in a drain caisson may be considered. In such cases, the dip-pipe shall be corrosion-resistant and the caisson vent be large enough to prevent the liquid seal being broken in the event of gas blow-by to the drain from the largest connected pressurised source. The system should be regularly tested to ensure the seal is maintained.

2.2 DRAIN SYSTEM CLASSIFICATION

The types of drain system found on typical offshore installations can be classified as follows:

2.2.1 Open non-hazardous area drain system

This system provides drainage from those areas of the facility which have been designated non-hazardous. These generally include storage vessel areas for utility materials such as diesel fuel and lubricating oils.

This type of drain system handles fluids collected from floors, drip pans and tundishes or funnels in non-hazardous areas and operates at atmospheric pressure. Open non-hazardous area drains shall be completely segregated from all other open or closed drain systems to eliminate the possibility of hydrocarbon vapour transmission through the drains from other areas to the non-hazardous area.

2.2.2 Open hazardous area drain system

This system provides drainage from those areas which are designated hazardous. These generally include all process areas and other locations in the facility where hydrocarbons are present in significant quantities.

Open hazardous drain systems handle fluids collected from plated decks, drip pans and tundishes or funnels in hazardous areas. Open drain systems shall only be used for draining residual hydrocarbon liquids from vessels and equipment when those vessels or equipment have been subjected to a maintenance preparation procedure ([see 3.4.1](#)).

2.2.3 Closed maintenance drain system

Process vessels may contain hydrocarbon fluids which, even after depressuring to atmospheric pressure, would release significant volumes of hazardous vapour if they were discharged via an open drain system. In these cases, a hard-piped connection to a collection header, routed to a dedicated drains vessel, shall be provided for the safe removal of generated vapour. This system is referred to as a closed drain and handles hazardous fluids from process vessels, keeping them away from atmospheric contact.

For new facilities, drain systems of this type should be avoided, if possible, since they require strict and verifiable adherence to rigorous operating procedures to avoid the occurrence of hazardous events. However, they should be used where the process involves toxic fluids such as those containing hydrogen sulphide.

Closed drain systems shall only be used for draining hydrocarbon liquids from process vessels when the vessels have been depressurised to atmospheric pressure under a maintenance preparation procedure ([see 3.4.1](#)).

2.2.4 Process drain system

This system is for the disposal of liquids discharged from equipment operating at high pressure, for example liquid streams from compressor scrubber (knockout) vessels. However, routine disposal of such liquids to a process drain system should be avoided wherever possible and compressor scrubber liquids should preferably be routed to a lower pressure part of the process.

2.2.5 Instrument drain system

Because process facilities have many widely dispersed instruments, it is generally not practical to provide a comprehensive open or closed drain system for instrument drainage. In most cases, particularly where the process does not involve toxic gases (e.g. H_2S), local venting and draining of an instrument is generally the most practical method in both open and closed platform modules. The drained liquids may be collected in a suitable container for disposal into an open hazardous area drain or may be piped to that drain, provided that the operator can observe the draining liquid when operating the instrument's drain valve.

Due attention shall be paid to the possible influence that an instrument drain may have on the hazardous classification of an area. Instrument drains which by their nature, location or frequency of use would affect the hazardous area classification should be avoided if possible; alternatively, such liquids can be hard-piped to a closed drain system.

2.2.6 Helideck drain system

Rainwater from a helideck should be collected and discharged overboard via a drain system equipped with a fire-trap. The design should take into account the drainage of spilt aviation fuel with the purpose of removing any spillage quickly from the vicinity of the aircraft.

2.2.7 Firewater and deluge drain systems

Where deluge systems or firewater monitors are installed for fire control, a direct overflow of firewater into the sea may be required to prevent excessive deck loading caused by back-up of water. Deluge water within modules shall be collected in open drain gullies and discharged directly overboard via downcomers, which may serve several drain outlets. Manifolding of the drains shall be such that upstream hazardous and non-hazardous area

segregation is maintained and the drain discharge shall be to a safe location. Seal legs will be required where the deluge drains originate in pressurised modules.

2.2.8 Living quarters drain system

A separate sewage/domestic water drain system is required to collect and dispose of waste water from accommodation and offices. Treatment should be in accordance with local regulations and to the MARPOL standards. Living quarters drain systems shall not be interconnected with any other drain system.

NOTE: Living quarters drains are not considered further in this PTS

2.2.9 Laboratory drain system

Laboratory drains are used for the disposal of hydrocarbon samples, chemicals and solvents. The normal disposal route would be to an open hazardous area drain via a water sealed drain pipe into an OHD gully outside the laboratory wall. Since the laboratory is itself a non-hazardous area, the drain shall not be hard-piped to the OHD to avoid the possibility of back-flow of flammable vapours.

Only hydrocarbon and water samples may be disposed of into the laboratory drain system. All other fluids shall be collected in drums for removal from the platform. If the only convenient drain is an open non-hazardous drain, then all fluids including hydrocarbons shall be collected in drums for off-platform disposal.

NOTE: Laboratory drains are not considered further in this PTS

2.2.10 Drilling module drain system

A mud drainage system is provided to collect and handle drilling mud/chemicals spillage from the rig floor and mud treatment areas. Because of the possibility of blockages, this system shall be totally segregated from other facility drain systems. The diameter of mud drainage lines shall not be less than DN 200; they shall be free of sharp bends and shall be equipped with adequate rodding facilities for clearing blockages.

NOTE: Drilling module drains are not considered further in this PTS

3. DRAIN SYSTEMS DESIGN GUIDELINES

3.1 SOURCES AND DESTINATION OF DRAIN SYSTEM FLUIDS

(Table 1) lists the most commonly encountered drain fluid sources, their expected contents, the type of drain system to which fluids would normally be routed and the probable classification of the area in which the source is located. The type of drain system that each source ties into shall be given careful consideration to avoid the introduction of additional hazards.

Table 1 Sources and destination of drain fluids

Drain fluid source	Expected Contents	Suitable Destination	Probable area classification
1. Drains on process equipment and lines containing hydrocarbons	Oil, condensate, some gas, produced water, sand, wash water	OHD (CD if toxic fluids)	Hazardous
2. Process drains from pressure vessels	Oil, condensate, some gas, produced water	LP process vessel or dedicated collection (flash) vessel	Hazardous
3. Drip-pans under process equipment	Oil, wash water	OHD	Hazardous
4. Drains from aviation fuel storage drip-pans/bunds	Aviation fuel, water	ONHD (OHD if located in hazardous area)	Non-hazardous
5. Drains/overflows on diesel fuel tanks/systems	Diesel fuel, wash water	ONHD or OHD (Note 1)	Non-hazardous or hazardous
6. Drains on compressor seal oil tanks	Oil/condensate, some gas	OHD (CD if toxic gas)	Hazardous
7. Drains on turbine and compressor lube oil tanks	Lubricating oil	ONHD or OHD (Note 1)	Non-hazardous or hazardous
8. Drip-pans under chemical storage tanks/vessels	Spilled chemicals, wash water, rain	ONHD or OHD (Note 1)	Non-hazardous or hazardous