RP 44-11

GUIDE TO THE SELECTION, ARRANGEMENT AND SPECIFICATION OF OFFSHORE PLATFORM DRAINAGE

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Document Title

GUIDE TO THE SELECTION, ARRANGEMENT AND SPECIFICATION OF OFFSHORE PLATFORM DRAINAGE

(Replaces BP Engineering Code of Practice CP 47)

APPLICABILITY

Regional Applicability: **International**

Business Applicability: **All Businesses**

SCOPE AND PURPOSE

This Recommended Practice gives guidelines for the selection, arrangement and specification of drainage systems within the topsides of offshore platforms. It includes recommendations for minimising drainage requirements in order to optimise platform weight and offshore drilling. While the principles herein are international in applicability, reference is made to certain British Standards that provide a standard that can be recommended.

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FOREWORD

Introducation to BP Group Recommended Practices and Specifications for Engineering

The Introductory volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Recommended Practice

This document represents the accumulated knowledge of BP in offshore drainage from a variety of projects. There are no comprehensive external documents addressing this specialised area, other documents being concerned with onshore systems. Provision of the required segregated drainage systems offshore has wide ranging safety and environmental implications which are addressed in this document to allow cost effective design to be achieved.

Application

Text in italics is Commentary. Commentary provides background information which supports the requirements of the Recommended Practice, and may discuss alternative options.

Contractors shall develop designs in accordance with the principles of this Recommended Practice. Designs will then be subject to general discussion and agreement with BP. For this reason, actions requiring approval or specification by BP are not individually identified in this document.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirement lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Principal Changes from Previous Edition

Safe and hazardous drainage systems are now totally independent.

Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSEs, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP Engineering or the Custodian. See Quarterly Status List for contacts.

1. INTRODUCTION

1.1 Scope

1.1.1 This Recommended Practice presents guidelines for the selection, arrangement and specification of drainage systems within the topsides of offshore platforms. Particular attention is given to the specific points that require consideration during conceptual design development - especially those concerned with safety. Recommendations for minimising drainage requirements in order to optimise platform weight and offshore hook-up are an integral part of the document.

See Appendix C1 for Commentary.

1.1.2 This document deals with the analysis of the drainage requirements on a fixed platform, and the selection of the appropriate system for the following:-

(a) Oil-free water drainage system.
(b) Oily water open drainage system.(Safe and Hazardous)
(c) Oily water closed drainage system.(Safe and Hazardous)
(d) Drilling areas drainage system.
(e) Firewater overflow drainage system.
(f) Chemical drainage system.
(g) Sanitary drainage system.

1.1.3 This document does not cover:-

The treatment and handling of produced (formation) water, and discharges arising from the use of oil-based muds.

All aspects of detailed design, although some important design points are included. It does not include manufacture, construction or commissioning.

Requirements specific to floating production platforms, but reference should be made to the guidelines of this document when developing drainage philosophies for such installations.

The collection and disposal of once-through seawater cooling water, although this may feature in the design of the platform effluent system.

2. OVERALL REQUIREMENTS

2.1 General

2.1.1 At an early stage of design, a drainage requirement study shall be carried out to identify every source of platform effluent, and the drainage systems that are required for their disposal.

Early evaluation will minimise conflict with platform structural requirements.

The study shall consider the routing of the platform effluent into one or more of the segregated systems covered in Sections 4 to 10 inclusive. Consistent with the requirements for safe design, the number of collection systems shall be kept to a minimum.

This Recommended Practice assumes segregation of the produced water system from the oil-free and oily water drainage systems.

2.1.2 Consideration should be given to the integration of drainage into the process facilities wherever possible.

If process conditions permit, this may allow savings in system extent and equipment duties. Any such integration shall take full account of the produced (formation) water treatment system.

For example by using the LP flare drum as the closed drain collection drum. The operational consequences of likely additional maintenance of the flare drum should be evaluated. Flare systems are pressurised and the possibility of back-flow into the drain system must be considered.

Segregation of the produced water system is due to:-

(a) Commingling being detrimental to the final effluent

(b) Risk of barium/strontium scale deposition.

(c) Requirement to prevent recycling of detergent which may adversely affect performance of the produced water package.

It is necessary to recognise the use of detergents as part of an ongoing good housekeeping policy. All effluent separators have limited performance when detergents are extensively used. Therefore, with such equipment, BP operational procedures should limit the use of detergents and make use of alternative cleaning procedures (e.g. high pressure water jets) or, if no alternative, 'fast break' detergents.

See Appendix C2.

2.2 Safety

The following general principles shall be applied to the design of all drainage systems:-

(a) Drainage systems shall be designed to prevent potential gas routes from one area to another through the drains.

Particular attention should be given to avoidance of flow from hazardous to non-hazardous areas and also between hazardous areas.

An explosion which resulted from gas flowing from a hazardous area to a non-hazardous area, and subsequently being ignited, occurred on Shell Cormorant Alpha platform on 3rd March 1983. Further details of this incident are given in document No. LL3/86 held by the Health, Safety and Environmental Services Division of BP Exploration.

(b) The design shall not permit pressures to build up inside drainage systems to the extent that flow of hazardous materials to non-hazardous areas could occur, e.g. because of blockage due to freezing.

Oily water open drains from hazardous and non-hazardous areas shall be led separately to the oil/water separation facility. (See Figure 4a and Figure 4b). Also, the closed drain drum discharge shall not be connected to an oily water separator associated with the oily water open drainage system.

(c) Hazardous and non-hazardous areas shall be separated as defined by the platform hazardous area drawings.

(d) Procedures shall be developed and regularly reviewed to avoid pressure surges in common drain systems.

For example, when blowing-down sight glasses or instrumentation. There may, in some circumstances, be a requirement for an intermediate pressure reduction stage, appropriately vented.

Attention to these basic points shall be given in order to prevent the known possibility of gas being blown back through a liquid seal in the oily water drainage system, and subsequently being ignited by welding operations or other potential sources of ignition.

2.3 Piping Specification

2.3.1 General

The specification for the pipework of drainage systems should be compatible with the associated piping system.

2.3.2 Open Drainage Systems

2.3.2.1 For open (vented-to-atmosphere) drainage systems, the requirements of the piping specification for the relevant service may be relaxed. Relaxation should also be considered for drainage systems normally closed (spaded) and only used when the process system is depressurised.

For example, to allow the use of socket welded fittings in sizes not greater than NPS 1 1/2 (DN 40) in place of butt-welded joints, and a possible reduction in testing.

2.3.2.2 Where appropriate, welded sleeve joints may be considered.

Welded sleeve joints may especially be considered for installation of spool pieces on offshore hook-up.

2.3.3 Closed Drainage Systems

2.3.3.1 The pressure rating of pipework and fittings on closed drainage systems (i.e. oily water closed drainage and chemical drainage systems) shall reflect the most severe upstream process temperature and pressure conditions which may be applied to the system if blockage or overloading occurs.

Appropriate pressure rating is particularly important where auto-refrigeration may cause ice or hydrate formation, or where waxy or viscous materials are being blown-down.

Trace heating and lagging may be required on some closed drainage pipework for such duties.

It should be noted that corrosion can take place under lagging if water ingress occurs, e.g. from washdown.

2.3.3.2 Drain sources of different pressure (class) rating shall not be manifolded together. Drain headers of each rating shall be routed directly and separately to the closed drain drum.

2.3.4 Sanitary Drainage Systems

Piping specification shall comply with BS 5572 or equivalent.

2.4 Catchment Areas

Catchment areas shall be related to the process equipment which they surround. All areas must drain freely and away from other equipment. (see also 3.1).

Due allowance must be made for out-of-true alignment. High points should be under equipment where possible.

2.5 Drainage Gulleys

2.5.1 Drainage channels recessed into the deck should be made as short as possible in hazardous areas, to minimise risk of spread of fire due to flammable liquids and vapours in the channels.

2.5.2 Gulleys shall be designed to slope towards the outlet, such that they do not remain permanently liquid-filled. Use of weirs in gulleys generally should be avoided. Deck gulleys should be covered with grating.

Unobstructed drainage will facilitate ease of cleaning, and reduce the risk of fire spreading in the event of a minor hydrocarbon spill.

The grating should not present a trip hazard. The effect of partial blockage of the grating by debris such as rags or lagging should be considered.

2.5.3 The normally-used gulley outlet (i.e. not the firewater overflow gulley outlet) shall be fitted with a readily removable large-mesh strainer.

2.6 Collection System Maintenance

2.6.1 All loop seals should be fully roddable or flanged to permit removal in the event of a blockage.

2.6.2 All drainage pipe runs shall be fully roddable.

The number and location of rodding-out points and removable flanged fittings shall be determined during detailed design, taking account of the rodding out procedure to be adopted and the ease of access. To facilitate access, swept rodding eyes may be brought through decks.

2.6.3 Access to rodding points shall be considered in detail during design development. Branch connections to headers should be of the 'swept T' type to facilitate rodding operations.

Particular consideration should be given to access to rodding points located on the underside of the platform lowest deck. An aim in design shall be to avoid running piping below the lowest deck. Following the guidelines in this Recommended Practice should enable such pipework (and possible associated heat tracing) to be minimised. The use of catch pots and pumps (fixed or portable) should be considered if necessary and in preference to under-deck piping.

2.6.4 Spade isolation shall be provided to enable facilities to be isolated where required during construction/commissioning, and for maintenance without complete shut down of the platform. The required number and location of spade isolation points shall be determined during detailed design. Spades shall be located in accessible and prominent positions.

2.6.5 Isolation spade points shall be provided with a valve on each side of the spade, except where the spade is next to a vessel isolation valve, in which case, a downstream valve only will be sufficient. If more than one production train is being provided, then the drains shall each be provided with spade isolation to allow one train to be maintained without shutdown of the process. There should be provision for separate draining connections on isolated sections of line, where breaking of flanged joints is not a practicable method of draining. These connections will allow purging prior to removal or reinstatement of a spade.

The provision of drain connections will be influenced by the particular application. e.g., the nature of the fluid and the hold-up volume and location of the isolated line section. Thus, sections of small bore lines having a hold-up capacity of a few litres and whose contents would not represent a direct hazard to personnel or nearby operational equipment, would not require drain connections.

2.6.6 The valves selected for isolation duty in drainage collection headers shall be full-bore to facilitate rodding, and to allow liquids and silt to be freely discharged. Where possible lightweight valve designs should be adopted.

2.7 Outfall Locations

All drainage outfalls shall be positioned so that platform pump intakes (particularly those feeding the potable water plant) are at maximum distance and across normal tidal current direction. Outfalls would typically be at different depth from any water intake.

All overflows via deck plates shall be arranged to have discharge overboard away from equipment, personnel, escape routes and lifeboats on lower decks.

3. GENERAL DESIGN REQUIREMENTS

3.1 Topsides Structural Design Considerations

3.1.1 At an early stage, structural design shall take account of:-

(a) Falls in Deck Areas

Deck areas should be sloped towards gulleys (or external edge if shedding oil-free water overboard although this method should be avoided if possible) at a net gradient (allowing for possible out-of-level alignment after installation) of not less than 1:80. Falls and gulley locations should be arranged so that water is not shed from one side of the deck right across to the other side. Attention should be paid to possible implications of a sloping deck on the design of the supporting structure. Due regard shall be given to deck plate settling under load and the stiffening action due to the use of box section gulleys.

(b) Penetrations through Structural Steel Members

In order to facilitate drain line falls, to avoid interference with other systems and for ease of maintenance, gravity drainage systems should be kept as close to the underside of the platform decks as possible. In the case of the platform bottom deck drainage, platform underside piping should be avoided (see 2.6.3). These aims may often be achieved only if the structural steel members supporting the decks are appropriately designed for drainage line penetrations.

(c) Location of Closed Drain Drum

Structural design may be required to make space allowance between main deck beams for mounting a closed drain drum half below the lower deck (see also 3.2).

(d) The weight loading caused by temporary accumulation of firewater during deluge.

3.2 Gravity Flow Requirements

3.2.1 Drainage systems should be designed to operate, wherever practicable, by gravity with a minimum net fall of 1:100. Where pumps are required, pumps with low turbulent energy dissipation should be used, and the resultant emulsification of oil in water accounted for in downstream separation facilities design.

Pumping should be avoided wherever possible, especially on the oil/water drainage systems where the resultant emulsification of the oil in the water will impair the performance of downstream separation facilities.

3.2.2 Pipes should be at such levels and gradients that liquids are not retained in any part of a drain system other than where designed to be so in the various traps.

3.2.3 Due account shall be taken of the likelihood of modules being out of level after construction and installation.

The minimum design falls suggested in this Recommended Practice shall be considered as net falls, i.e. the fall that will be achieved if the modules are installed with maximum out-of-level tolerance.

In the case of a fixed platform where a drain header requires a net fall of 1:100 and the estimated maximum tolerance of module out-of-level after fabrication and installation is 1/2 degree (i.e. 1:114), then the required slope of header relative to the module will be:-

$$\frac{1}{100} + \frac{1}{114} = \frac{1}{53} \text{ i.e. } 1:53$$

In some cases, the variation in the level of gravity drain lines is limited by the available vertical space under platform decks. Judicious arrangement of falling gravity drain lines towards centrally placed collection points will make the best use of the variation in levels permitted by such limitations.

See Appendix C3.

3.2.4 Where up-hill collection lines are unavoidable, there may be a need for gas pressure for blow-down of equipment and use of special operating procedures.

For cases where effluent sources will be at a low level, it may be appropriate to consider the following arrangements in order to avoid up-hill closed drain collection lines which normally are not acceptable:-

(a) Locate the closed drain drum in or below the lowest level module floor.

(b) Locate local closed drain catch pot(s) at appropriate points around the low-level modules, and feed the closed drain drum by means of low turbulent energy dissipation pumps (permanent or temporary).

(c) Locate the inlet nozzles of the closed drain drum at a lower level than the normal top mountings, but above the normal maximum operating level.

3.3 Hydraulic Design

3.3.1 General

Calculation of the hydraulic gradient within a drainage system shall be based on roughness factors appropriate to mature pipework. Consideration should be given to the use of hydraulic dampers on any large diameter lines to prevent flash flooding due to long vertical runs of pipe.

3.3.2 Open Drainage Systems

The hydraulic design of open (vented-to-atmosphere) drainage systems involves detailed consideration of the following:-

(a) Peak flows.

(b) Minimum flows/sediment transport capability.

(c) Degree of surcharge that can be tolerated.

(d) Hydraulic capacity and line sizing.

(e) Maintaining liquid levels in loop seals/seal pots.

(f) Provision of adequate vents.

3.3.2.1 Peak Flows

3.3.2.1.1 The drainage systems shall be designed for the greater of the following three flows:-

(a) Rain-water plus process effluent.
(b) Washdown water plus process effluent.
(c) Firewater plus associated process leakage.

The platform open drainage systems are required to carry process effluents, washdown water, rain-water and firewater. Note that in the case of deck areas drained into the oily water open drainage system, this peak flow will be met by the oily water open drainage system (see Section 5) and the firewater overflow drainage system (see Section 8).

3.3.2.1.2 The design rate of firewater drainage from a process area shall be the greater of:-

either The rate of firewater deluge water applied to the area.

or The rate of firewater applied to the area with the maximum number of fire hoses and fixed monitors in use.

Specific flow rates for deluge water depend upon local statutory regulations. For example, in the case of platform designs that follow UK Statutory Instruments 1978 No. 611 (The offshore installations (fire-fighting equipment) regulations 1978), the rate of firewater applied can be calculated on the basis of 12.2 litres per minute over each square metre of designated area (0.25 gallons/square foot/minute). There may be additional flows determined by the need to protect individual plant components, firewalls and structures.

Firewater flowrate employed should be the maximum output from all installed nozzles not just the design output of the deluge system.

The design rate of rain-water flow from open decks can be calculated from considering the design storm intensity on the exposed area. It will usually be very much less than that indicated above. Guidance regarding calculation methods, which include consideration of vertical surfaces, is given in BS 6367 and BP Group *RP 4-1*.

3.3.2.2 Minimum Flows/Sediment Transport Capability

3.3.2.2.1 Calculations shall be made to determine the minimum flow at which deposited solids are flushed out. This flow shall not exceed the hydraulic capacity of the drains.

Minimum flows arise when only process effluent is being discharged into the drainage system, or even if flow has completely stopped. In such cases, the flow velocities required for self cleansing (i.e. sediment transport) are seldom maintained. As part of routine platform operating procedures, BP may establish a planned programme for flushing open drainage systems. Flushing will also ensure that liquid levels in loop seals and in seal pots on the open drain systems are maintained.

BP Group RP 4-1 specifies a self cleansing velocity of 0.8 m/s, which shall be considered when calculating the required minimum flow.

3.3.2.2.2 The drilling system deck drains should be segregated from other platform drains.Water flush and/or rodding should be provided at potential sludge build-up points.The cement handling area deck drains shall be provided with a permanent flush facility.

Operational activities in the cement handling area can generate large amounts of solids which will probably settle in the drains and form solid plugs.

3.3.2.3 Surcharging of Gulleys

Surcharging of gulleys in open drainage shall be accommodated by provision of freeboard above the design flow rate level. This freeboard shall be not less than 100mm. For gulleys provided with firewater overflows (see also 8.2.1), the freeboard shall be between the design flow rate level and the lip of the overflow tundish.

3.3.2.4 Hydraulic Capacity and Line Sizing

3.3.2.4.1 Calculation of hydraulic capacity should be based on the Colebrook-White formula.

The hydraulic capacity of open drains depends on pipe size, allowances for entry, exit and fittings losses, gradient, condition, degree of surcharge that can be tolerated and the nature of liquid to be carried.

3.3.2.4.2 Drain lines should not be smaller than a certain minimum size, typically NPS 1 1/2 (DN 40).

Avoidance of small lines will reduce the risk of blockage with corrosion products or other debris such as lagging.

3.3.2.4.3 A hydraulic check on small-bore piping systems should be considered to ensure adequate flow capability, e.g. chemical drain lines.

3.3.2.4.4 Air entrainment, especially in downcomers, shall be assessed and action taken to avoid vibration.

Air entrainment can, in some circumstances, lead to unstable flow conditions and generate pipe vibration. Downcomers carrying large quantities of liquid (as in a firefighting situation) are the most susceptible. The problem occurs at Froude Numbers greater than about 0.35.

Froude No $= V_L \div \left[gd\,(*L - \frac{*G}{*L} \right]^{\frac{1}{2}}$

where	V_L	*= liquid superficial velocity*
	d	*= pipe internal diameter*
	g	*= acceleration due to gravity*
	$*_L$	*= liquid specific gravity*
	$*_G$	*= gas specific gravity*

(all units to be consistent to yield a dimensionless result)
Reference: 'Sizing Piping for Process Plants' L.L. Simpson, 'Chemical Engineering', June 17th ,1968, pp 203-205.

Three options are available to avoid the problem:-

(i) *Adequately support the pipework and tolerate the unstable flow,*

(ii) *Design to ensure operation at Froude Nos below 0.35*

(iii) *Provide drain entry boxes with integral vortex breakers such that the liquid depth will be sufficient to avoid entrainment. (There will be intermediate situations when flow rates will be low enough to give unstable conditions)*

3.3.2.5 Maintaining Liquid Levels in Loop Seals/Seal Pots

3.3.2.5.1 Piping design shall prevent the possibility of syphonic emptying of loop seals.

3.3.3 Closed Drainage Systems

The hydraulic design of closed drainage systems shall follow methods appropriate to flooded systems (i.e. lines fully liquid-filled). - see also 3.3.2.4.2

3.3.4 Sanitary Drainage Systems

The hydraulic design of the sanitary drainage system shall follow BS 5572 or equivalent.

3.4 Thermal Design

Drainage piping system design shall accommodate thermal expansion/contraction of lines, resulting from the temperature range of effluents.

3.5 Weight Minimisation

3.5.1 As open drainage piping systems are subject to negligible pressure, construction from lightweight material shall be considered in appropriate locations, e.g. thin wall carbon steel with adequate corrosion allowance (both inside and out) or GRP. Special consideration of support location may be necessary.

3.5.2 On small drain lines, e.g. instrument drain headers, compression fittings may be used where permitted by the piping specification (see 2.3).

3.6 Module Drainage Design and Hookup Minimisation

3.6.1 In order to minimise offshore hook-up time, drainage collection system pipework should be contained within the structure of the module and be included in the scope of the onshore fabricator. Access requirements and possible final out-of-alignment problems should be considered. See 3.2.3.

3.6.2 Drainage piping systems should preferably not be exposed below platform floors. Where this is not practicable, heat tracing should be considered, to avoid freezing (see also 3.7).

3.6.3 Where possible, pipework of each system should be combined to a common header within each module before passing to the next, to reduce the number of inter-module connections.

3.6.4 Consistent with operational convenience and efficiency, washroom and toilet facilities should be centralised within a minimum number of modules. Consideration should be given to providing both 'dirty' and 'clean' facilities within the accommodation module rather than providing separate facilities in adjacent modules.

3.7 Winterisation

Where applicable, drainage lines, loop seals, seal pots and headers shall be protected for winterisation in accordance with BP Group RP 44-2.

3.8 Helidecks

Helidecks shall be surrounded by gulleys discharging directly to sea in cases where fuel loading does not take place. Where fuel loading takes place the drains shall flow to the oily water open drainage collection system. Drains pipework shall be able to cope with burning fuel. See also 8.1.

3.9 Corrosion

3.9.1 The drains system design shall fully consider susceptibility to corrosion. Materials selected, fabrication procedures and layout shall be such as to ensure that corrosion damage remains within acceptable limits.

Offshore drainage systems may suffer corrosion damage from aerated seawater and water containing dissolved CO_2 or H_2S. Damage is usually severe in the transition zones between wet and dry regions which, for example, feature in loop seals, dip pipes, seal pots, pipework low points and where stagnant water can accumulate. Welding procedures and materials will influence the susceptibility to corrosion of the heat-affected-zones of the welds.

3.9.2 Corrosion monitoring procedures should be applied to those areas at most risk.

Refer to BP Group RP 6-1 for details of corrosion monitoring methods.

4. OIL-FREE WATER DRAINAGE

4.1 General

4.1.1 This system shall be provided to deal with oil-free water drainage, for example potable water overflows, run-off (including firewater) from module roofs and open deck areas, other than those liable to be contaminated by oil or chemicals.

4.1.2 Intermittent oil-free water flows (e.g. rain-water and firewater) from topsides deck areas should be discharged overboard. This may be achieved by either of the following methods:-

(a) Routing of run-off over the deck plates away from other plant areas and discharge overboard.

(b) Collection of water in headers connected to an outboard discharge point below the platform topsides.

Method (a) is preferred as the lower-cost solution.

Where Method (a) is not acceptable, a piped drainage system in accordance with Method (b) shall be provided, and have sufficient capacity to accommodate maximum firewater run-off. (See also Section 8)

4.1.3 Continuous oil-free water drainage flows shall be directed to a seawater outfall caisson, independently of the oil-free water drainage system.

4.2 Equipment Requirements

4.2.1 Gulleys

Oil-free water drainage gulleys should be provided as shown in Figure 3 . (See also Section 8.2.1)

4.2.2 Drainage Headers and Sub-Headers

Subject to module pressurisation requirements, the drainage headers and sub-headers should contain no loop seals or pockets, and should be designed to drain towards an outboard discharge point below the topsides bottom deck level.

4.2.3 Seals

Modules that are designed to be pressurised shall be provided with loop seals to prevent air losses. The depth of liquid required in these seals will depend upon the pressure level chosen for the module, and likely pressure surges e.g. doors opening and closing.

5. OILY WATER OPEN DRAINAGE

5.1 General

5.1.1 An open (i.e. vented-to-atmosphere) system shall be provided for the drainage of water contaminated by oil, such as may originate from the following sources:-

(a) Rain-water, washdown water and firewater from deck areas which are liable to be oil contaminated.

(b) Spillages and leaks from process equipment.

(c) Cooling water from water-cooled glands and bearings of equipment on hydrocarbon duty.

(d) Drainage from sample points, drain cocks, hydrocarbon overflows and equipment fittings.

(e) Water from transformer bays.

(f) Water from laboratory oil sinks.

Figure 4a and Figure 4b are schematic diagrams for typical oily water open drainage systems. Figure 4a is based on drainage caisson separation; Figure 4b is based on primary oil separation before the drainage caisson. These separation facilities are described in 5.2.

5.1.2 Oily water drainage from topsides deck areas should normally be collected in headers, and flow by gravity to the applicable oil/water separation facility (see 5.2.1 or 5.2.2).

Where an oily water separator is used, as indicated in Figure 4b, this should be located at a low enough level to permit the gravity inflow of oily water effluent from the lowest deck.

Under abnormal conditions of firewater surge flow, oily water drainage will be diverted from the headers - see Section 8.

5.1.3 Oily water drainage from non-hazardous areas shall be collected in headers separate from those for hazardous areas. It is essential that flammable vapour leakage through oily water drains to non-hazardous areas be prevented. The oily water drain headers from non-hazardous areas shall be provided with a seal pot in addition to individual traps at inlet gulleys, etc.

5.1.4 Where bulk storage is to be provided for helifuel, lube oil and seal oil, the handling areas shall be provided with kerbs and valved connections to the oily water open drainage system; the valves normally being closed.

Valves to drain may be opened to dispose of uncontaminated rain-water. If minor contamination is present, adequate water flushing shall be available, and the area cleared via the drains.

5.2 Oil/Water Separation Facilities

5.2.1 Primary Oil Separation in the Drainage Caisson

5.2.1.1 This method of separation is indicated in Figure 1a and Figure 4a. Oily water drainage shall be discharged directly to the drainage caisson.

A treatment loop is provided to allow the upper liquid layers in the drainage caisson to be recycled by a drainage caisson pump, under manual control, through an external oil removal package, e.g. an oil water filter coalescer.

Sample points provided in the external pipework allow assessment of the degree of oil contamination present.

The recovered oil is passed under manual control directly to the process, e.g. to the main crude oil line downstream of the LP production separator outlet.

Note that the receiving process may be at a pressure which may present a risk of flow-reversal in some failure situations.

Water from the oil removal package is returned to the drainage caisson to a region near the sea outlet unless poor quality is demonstrated by sampling. In this case, the stream is diverted to the upper region of the caisson for further processing.

The oil removal package should be integrated with the drainage caisson pump. The feed to the package will be intermittent, and as most of the solids collected in the drainage system will have fallen out in the caisson, the necessity for pre-filters or other means of sludge/solids removal in the feed line to the oil removal package should be evaluated.

The feed to the oil removal package will be under manual control, unlike the feed to the oily water separator, and will be of known volume and pressure, thus permitting the selection of compact proprietary equipment.

5.2.2 Primary Oil Separation Upstream of Drainage Caisson

5.2.2.1 This method of separation is indicated in Figure 1b and Figure 4b. It shall be used for Gulf of Mexico applications and should also be considered if discharge consent conditions cannot be met by separation within the caisson alone.

Suspended oil is separated from water and collected in a separated oil compartment.

Separated oil is pumped under manual control directly to the process, e.g. to the main crude oil line downstream of the LP production separator outlet.

Note that the receiving process may be at a pressure which may present a risk of flow-reversal in some failure situations.
The water fraction is led over a weir arrangement in the oily water separator, and discharged to the drainage caisson.

A drainage caisson pump is provided as an additional facility, to allow any gross oil spillage into the drainage caisson to be returned to the closed drain drum. To check whether oil is present in the drainage caisson, the pump shall be arranged to recycle oil/water back to the caisson via a tundish. If a visual check of oil/water being collected by the tundish indicates the presence of a significant quantity of oil in the drainage caisson, then the pump discharge shall be arranged to be diverted to the closed drain drum. This operation should be supervised throughout to minimise the risk of pumping 100% seawater subsequent to removal of oil. This will avoid the addition of excessive quantities of water to the closed drain drum.

5.2.2.2 Oily water drainage shall be discharged into an oily water separator.

A bypass around the oily water separator is provided to allow maintenance, cleaning and inspection whilst the platform is on line.

5.3 Equipment Requirements

5.3.1 Drainage Collection

5.3.1.1 Piping from tundishes, equipment drip pans and drain gulleys shall incorporate loop seals. The seal depth shall be consistent with module pressurisation requirements but not less than 300 mm.

5.3.2 Drainage Headers and Sub-Headers

5.3.2.1 Other than at loop seals and seal pots, drainage headers and sub-headers shall contain no pockets, and shall drain towards the applicable oil/water separation facility (see 3.1 and 3.2).

5.3.2.2 Separate drainage headers shall be run from the hazardous and non-hazardous areas to the applicable oil/water separation facility, to avoid the possibility of backflow from the hazardous to non-hazardous areas.

5.3.3 Seal Pots

5.3.3.1 Where liquid seals are required on a drain header from a hazardous area, seal pots should be used in preference to piping loop seals.

5.3.3.2 The seal pots should have a seal depth at least twice the seal depth of the loop seals at drainage collection points. The seal depth shall not be less than 600 mm.

5.3.3.3 Modules that are designed to be pressurised will require a seal depth suited to the level of pressurisation for the module.

5.3.3.4 Seal pots shall be connected to suitable vents or vent headers so that trapped gas is safely vented and pressure fluctuations in one drainage system cannot adversely affect another.

5.3.3.5 Seal pots should be provided with liquid-sealed overflow lines which discharge to sea at a safe location.

5.3.3.6 Each seal pot shall be fitted with test cocks set at appropriate levels to allow the level of liquid seal in the pot to be proven.

5.3.3.7 The seal pot design and location should consider the need for routine seal level checking and cleaning.

5.3.3.8 Operating procedures should be developed which involve routine flushing, cleaning and inspection of seal pots.

5.3.4 Vents

5.3.4.1 Vents shall be provided in the oily water drainage system to maintain atmospheric pressure, and to release flammable vapours arising in the system. Lines shall drain back into the drainage system. Vents shall be in accordance with API RP 14C.

Failure to provide vents can result in drainage systems being vapour locked as a result of vapour pressure. Such vapour locking will restrict drains flows or possibly even result in the blow-out of liquid seals.

5.3.4.2 Vent outlets shall be diverted away from sources of ignition.

5.3.4.3 Flame arresters shall be fitted to vent outlets that discharge into areas where an intermittent source of ignition is possible.

5.3.4.4 Adequate access to flame arresters shall be provided.

5.3.4.5 Particular care shall be taken to ensure the safe location of vents on platforms handling sour hydrocarbons.

5.3.5 Oily Water Separator

5.3.5.1 The oily water separator shall remove all suspended oil particles of 50 microns and greater.

Note that the suspended oil content at the inlet to the separator is typically 0-2,000 mg/litre (normal), and 100,000 mg/litre (maximum).

5.3.5.2 Trash baskets shall be fitted at the inlet to the separator system.

Operational Procedures shall be developed to ensure routine inspection and cleaning of the trash baskets.

5.3.5.3 The inlet bay of plate-type separators shall be arranged to provide for preliminary oil separation, for deposition of solids in the form of sludge, and to contain anticipated oil spills.

Deposition may be in the form of sludge caused by the presence of oil emulsifiers, which may cause blockage of the plates.

In some instances the oil-spill quantity could be large, e.g. diesel oil tank overflow. If such a spillage cannot be routed to process or retained within a bund system, it may be appropriate to supplement the separator with an upstream open drains collection tank which should be mounted in the module floor, with all pumps and instruments top mounted.

5.3.5.4 Provision of filter screens between the separator inlet bay and the tilted plate section should be considered.

5.3.5.5 The separator shall incorporate a recovered oil compartment.

5.3.5.6 The separator shall be fitted with flushing facilities to facilitate the removal of sludge accumulations.

5.3.5.7 The separator shall have a permanent vent connection to the atmospheric vent header and the separator shall be continuously purged with nitrogen or fuel gas.

5.3.5.8 The separator shall be provided with a liquid-sealed overflow to the caisson to prevent gas backflow.

5.3.5.9 The separated oil pumps and separator instrumentation may be top mounted to allow the separator to be located at low level, i.e. within or below platform lowest deck level.

5.3.6 Separated Oil Pumps

5.3.6.1 The pumps shall take suction from the separated oil compartment in the oily water separator and discharge under level-switch control, typically to the main crude oil line, downstream of an LP production separator. Two sets of level switches shall be fitted to the separated oil compartment for this purpose.

Typically, two pumps should be installed, each capable of pumping 10% of the maximum normal liquid flow into the oily water separator. During normal operation, only one pump should be running, and shall be controlled using the lower set of level switches. However, if the drainage into the separated oil compartment exceeds the pump discharge rate, causing the level to rise, then the second pump shall be started automatically under control of the higher set of level switches. A selector switch shall be provided for selection of the leading pump.

5.3.6.2 Where practicable, the pumps should be located externally to the separator to facilitate maintenance and to minimise gas release or air ingress to the separator.

5.3.7 Drainage Caisson

5.3.7.1 The drainage caisson shall receive oily drainage directly or, alternatively, de-oiled water from an oily water separator (see Figure 4a and Figure 4b).

5.3.7.2 The water shall enter the caisson via downcomers which shall extend to be permanently submerged to provide a liquid seal and to minimise turbulence on entry. Consideration shall be given to the need for wave damping.

5.3.7.3 All incomers from non-hazardous areas shall discharge permanently below the caisson liquid level.

5.3.7.4 Minor, intermittent flows from hazardous areas may discharge above the caisson water level, provided the design prevents back-flow of gas.

Note that the drainage caisson also receives manually controlled discharge of water from the closed drain drum.

5.3.7.5 The drainage caisson shall extend well below LAT, and shall be located in accordance with 2.7.

The bottom of the caisson is typically at -50 m LAT in the Northern North Sea.

5.3.7.6 The holding volume of the drainage caisson should be proportioned to the largest vessel inventory.

A caisson having the typical internal diameter of 1.0 metre will provide only limited damping of any vertical wave motion. Therefore, the use of a low level orifice or slotted plate for damping should be considered if the platform is in an open-sea location.

Consideration should be given to providing integral plates or using a proprietary caisson design to improve oil/water separation. Access for cleaning and maintenance needs to be taken into account in such applications.

5.3.7.7 The caisson design should include a 150 mm mesh or bars across the exit, to prevent entry of divers.

5.3.7.8 The caisson gas space shall be continuously purged with nitrogen or fuel gas.

5.3.7.9 The caisson shall be provided with a vent connection to the atmospheric vent header.

5.3.7.10 The caisson should be designed to accommodate a drainage pump.

5.3.8 Drainage Caisson Pump

5.3.8.1 Design temperature of the pumped fluid shall be that of the ambient seawater and the setting height of the pump suction shall reflect tidal variations.

5.3.8.2 The pump and driver shall be designed for fully submerged operation.

5.3.8.3 Pump operation shall be manually initiated from a local control station.

5.3.8.4 Facilities shall be provided to enable the pump to be removed for maintenance.

5.3.8.5 Discharge pipework associated with the pump shall be fitted with a non-return valve to prevent back-flow to the caisson.

5.3.8.6 A manual sample point shall be provided on the pump discharge pipework. See also 5.3.9

5.3.8.7 Where the pump is used in conjunction with an oil removal package (see Figure 4a) the capacity of the pump should be sufficient to permit assessment of water quality through the depth of the drainage caisson.

Assuming, for example, the caisson diameter of 1.0 metre and extending 50 metre below LAT, a pump capacity of 20 m3/h would displace the volume of the caisson in about 2 hours, and be well within the capacity of the smallest oil removal package envisaged.

5.3.8.8 Where the pump is used in conjunction with an oily water separator (see Figure 4b) the following shall apply:-

(a) The pump suction should be located so as to minimise the induction of seawater, i.e. the pump will primarily perform the function of removing floating oil.

(b) The pumping capacity should typically be 5% of the normal maximum liquid flow from the oily water separator.

Assuming the caisson dimensions in 5.3.8.7 above, the pump capacity would be approximately 5 m3/h.

(c) The water content of the oil recovered by the pump should be taken as 0 to 10% (normal), and 100% (peak).

5.3.9 Treated Water Monitoring Equipment

To permit monitoring of the system, a manual sampling point shall be provided. Note that automatic sampling might be demanded in future. Other sampling points should be available in the drainage and separator systems, to the extent necessary to permit checks in equipment performance.

6. OILY WATER CLOSED DRAINAGE

6.1 General

6.1.1 A closed system (i.e. vented to flare, not to atmosphere) shall be provided for the drainage of potentially gaseous oil, or water which is normally heavily contaminated with oil from the following sources:-

(a) Production/utility equipment drain-down and sample points.

(b) Drain-down points on certain hydrocarbon liquid lines to facilitate maintenance, e.g. wellhead ligaments, production manifolds, etc.

Drain down points include:-

(i) Production separators.
(ii) Scrubbers.
(iii) Crude oil pumps.
(iv) Level gauges.
(v) Condensate pumps.
(vi) Test separators.
(vii) Knock-out drums.
(viii) Compressor suction and blow-down drums.
(ix) Fuel oil tanks (including overflows).

(c) Drainage caisson pump discharge, when an oily water separator is used for primary separation (see 5.2.2).

6.1.2 Connection of the sources referred to in 6.1.1 (a) and 6.1.1 (b) to the oily water closed drainage system should be restricted to those where drain-down cannot be safely achieved by the following methods:-

(a) Using existing process routes.

(b) Connection of drain-down points via hoses to other equipment/hydrocarbon liquid lines capable of receipt of the drain-down liquid.

Temporary connections shall not remain in place after draining operations are completed. Hoses shall be kept specifically for the duty, be compatible with the fluids handled, be stored properly and be inspected and tested regularly.

(c) Connection of drain-down points, via hoses, to a portable slops drum (i.e. for small volumes of drain-down liquids). This system mainly applies to smaller platforms to avoid provision of oily water closed drains.

The use of portable pumps (hand operated, or powered) may be considered for the transfer of liquids by the methods of drain-down given in (a), (b) and (c).

6.1.3 The hazards associated with release of H2S from sour hydrocarbon liquids shall be given specific consideration.

6.1.4 The contents of the oily water closed drains system should be routed to fall by gravity, via oily water closed drain headers, to the closed drain drum (but see also 2.1.2).

Any layout which results in drain lines running 'uphill' in places, and thus requiring gas pressure to assist drain-down, should be avoided. This may be achieved by judicious location of the equipment, the closed drain drum and the interconnecting lines (see 3.1 and 3.2).

6.1.5 Closed drain lines for cold/dry service from NGL and condensate vessels shall be kept separate from any wet oil drainage lines, to avoid blockage by hydrate and ice. A pre-heater shall be provided for the closed drain drum for such service. Trace heating of the lines may also be required, with instrumentation to indicate blockages.

Consideration should be given to increasing the drain diameter towards the drum to allow for gas breakout as pressure is reduced.

6.1.6 Where large quantities of cold liquids are to be drained, consideration should be given to provision of a separate closed drain drum.

Provision for discharge of large quantities should be via process routes. If discharge to the closed drain system is unavoidable, the outlet connections to downstream drainage equipment (including possible separate direct routing to the caisson) and to the flare needs careful study. In particular, detailed procedures should be developed to ensure safe operation.

6.1.7 Valved flushing points shall be provided on closed drain lines on cold/dry service to permit methanol flushing when hydrate formations require clearing.

Particular care must be taken when methanol is being used, especially from temporary facilities as opposed to permanently installed injection points, because of sudden release of pressure or when the system is sour.

6.1.8 The water content of the liquid flow from the closed drain system into the closed drain drum should be taken as 0-10% (normal), and 100% (peak).

6.1.9 Depending on the anticipated duty for the closed drain drum a simple vessel only may be sufficient, with a pump sending all contents to an LP production separator. It may be necessary to achieve separation within the drum.

See Commentary notes on flow reversal in 5.2.1 and 5.2.2 above.

The requirement to achieve separation within the closed drain drum depends, for example, upon the amount of seawater returned to the drum from the drainage caisson (see 5.2 of the essential requirements of this document), and the need to avoid commingling seawater with any produced water in the crude oil system.

If separation in the drum is necessary it should be partitioned as follows:-

(a) A centre (receiving) section.
(b) A recovered oil section.
(c) A de-oiled water section.

6.1.10 For larger platforms, with a higher number of potential drain sources, a vessel suitable for primary oil separation should be provided.

6.1.11 Oil recovered from this primary oil separation vessel shall be pumped to the LP production separator and its water content should be taken as 0-1% (normal), and 10% (peak). In normal operation, the contents of the de-oiled water section shall be discharged, under manual control, to the drainage caisson (see 2.2 (b)).

See Commentary notes on flow reversal in 5.2.1 and 5.2.2 above.

6.1.12 Any flashed vapour from natural gas liquids or dissolved gases associated with drainage shall be free-vented directly to the LP flare header.

6.1.13 Those equipment drains which require observation during operation shall be discharged to the open drains via an open tundish rather than by connection to the closed drain system. Sour water drains shall not be included in this category. Procedures and equipment shall be arranged so as to minimise release of flammable and/or toxic vapours in such applications.

6.2 Equipment Requirements

6.2.1 General

6.2.1.1 The design of the drainage system shall accommodate the requirement, if necessary, to route small quantities of fluid from a vessel directly to the closed drainage system without first depressurising.

In some cases, where blowdown would lead to low temperatures, it may be appropriate to route the drains direct to the HP flare drum, which is often designed for low temperatures. The flare drum will then 'catch' any liquids (e.g. blowdown from the various compressor suction drums).

Normally, hydrocarbon systems will be depressurised to flare prior to discharge into the drainage system.

6.2.1.2 Backflow from6.2.3 Closed Drain Drum. (See also 2.1.2).

6.2.3.1 Sizing of the closed drain drum should be based on the following parameters:-

(a) The largest item of equipment likely to be drained to the closed drain drum.

(b) The contents of the inlet line with largest diameter.

(c) Likely overflows from storage tanks.

For very large vessels, there should be provision to reduce the inventory to a minimum using normal process outlets. The size of the drain drum can then be based on the lowest practical inventory of the vessel and piping. Consider supply operations and the likely overflow from storage tanks.

6.2.3.2 The requirement for electric heaters to maintain the temperature of the liquid in the drum shall be considered. Any such heaters shall operate under temperature switch control. An extra-high-temperature switch shall be provided to switch off the heaters in the event of overheating.

6.2.3.3 If the closed drain drum requires desanding facilities, the sparge shall be arranged so that the heating elements and bottom outlet nozzles as well as the vessel base are cleaned effectively.

6.2.3.4 An extra-high-liquid-level switch shall be provided in the centre section of the drum. Operation of this switch shall open an emergency dump valve discharging directly to the drainage caisson.

Operation of the extra-high-liquid-level switch shall cause an emergency dump valve to open, allowing the drum contents to discharge directly to the drainage caisson. It *should be noted that the high-level control should be designed to avoid the risk of liquid carry-over to the flare system.*

6.2.3.5 In the case of closed drain vessels with a de-oiled water section, an extra-low level switch shall be provided on the de-oiled water section of the drum. Operation of this switch shall cause a valve on the de-oiled water outlet line to close.

Note that for maintenance requiring complete emptying, the drum can be totally drained through a manhole by use of a portable pump.

6.2.3.6 The recovered oil pumps and closed drain drum instrumentation may be top mounted to allow the drum to be located at a low level, i.e. within or below platform lowest deck level.

6.2.4 Recovered Oil Pumps

6.2.4.1 Typically, two recovered oil pumps should be provided, each sized for 50% of the total design feed flow rate to the closed drain drum and suitable for the 'oil' properties.

Frequently the oil will be light condensate, i.e. with a high vapour pressure.

6.2.4.2 The pumps shall discharge, under level-switch control, typically to the main crude oil line upstream of an LP production separator.

The level switches should be arranged such that the pump-start frequency will not be greater than six times per hour. For partitioned drums, the pumps shall take suction from the recovered oil section.

6.2.4.3 Each recovered oil pump shall be fitted with high and low pressure switches on the discharge, in accordance with API RP 14C. Operation of these switches shall initiate shutdown of the pumps.

7. DRILLING AREAS DRAINAGE

7.1 This Section applies only to the use of water-based drilling muds.

Note that, as stated in 1.1.3, the use of oil-based muds is outside the scope of this Recommended Practice. These muds require specific provisions, i.e. total containment, or exemptions agreed with the regulating authority.

7.2 The drainage philosophy for the wellhead and drilling areas should be generally as shown on Figure 6. The drainage systems in this area should be as follows:-

(a) Segregated oil-free water drains for surface drainage from the mud handling area and drilling floor. These drains should discharge to sea via the shale chute.

(b) Oil-free water deck drains for surface drainage from the piperack area (see Section 4).

(c) Closed drains for drain-down of lubricators, flowlines and manifolds (see Section 6).

(d) Segregated oil-free water drains for surface drainage from the cement handling area. This drain should discharge direct to sea.

As it is susceptible to blockage, this segregated drain from the cement handling area shall be provided with a facility for permanent flushing. Also, the lines shall be made from flanged sections of appropriate lengths for easy dismantling.

7.3 An open oily water drainage system should not be necessary in this area. Disposal of lubricants, oil, sample point liquids, etc., can be more economically achieved by drumming.

7.4 The surface drainage of the well deck and the BOP/impact deck should be allowed to discharge direct to sea through the gaps between the BOP/impact deck plates and the open grating of the welldeck.

Note that the quantities of surface drainage flows on these decks will generally be limited by the collection system for deck drainage on the drilling floor above. This is because the drilling derrick/substructure shields these decks.

7.5 Gulleys should be provided under the BOP deck, to avoid leakage through gaps in the BOP/impact deck causing corrosion to equipment located beneath the BOP, e.g. corrosion under heat insulation on flowlines. Alternatively, the facilities under the BOP should be suitable for exposure to surface drainage from the deck above, or consideration may be given to the use of watertight hatches.

7.6 Rain-water collected by the drilling derrick/substructure should be directed overboard.

8. FIREWATER OVERFLOW DRAINAGE

8.1 General

8.1.1 Firewater overflow drainage shall be provided to fulfil four aims:-

(i) to minimise the surface area of a pool fire and thereby reduce the fire size,

(ii) during a fire, to dispose of unwanted oil to the sea or to a caisson as quickly and safely as possible,

(iii) to prevent the spread of a fire,

(iv) to minimise the size of the oily water drainage system.

Note that (i), (ii) and (iii) will only apply where a credible pool fire hazard exists. This excludes gas processing, high pressure condensate processing, high flash-point fuels remote from other hazards, and process sections containing less than 1 tonne of low flash-point liquids after stabilisation or polar solvents.

These aims may be achieved by either:-

(a) Routing of firewater run-off over the deck plates away from other plant areas, and discharge overboard. For environmental protection, local catchment trays may be necessary such as under pig trap doors.

This is particularly important when the lower decks are of the open type.

This method should be adopted on bottom decks and wellbays wherever possible, as the large flows associated with the use of firewater will result in the need for large diameter lines in a piped firewater overflow drainage collection system. If applied to other decks, overflow points at the edge of the platform shall be identified and the consequences of the carry-over of burning oil to lower decks assessed. This should consider the effect of wind, the location of escape routes and lifeboats as well as the proximity of hydrocarbon equipment and structures which could be affected by fire.

(b) Collection of firewater run-off in gulleys associated with the oily water open drainage system. The gulleys shall incorporate two offtakes; one at a low level leading to the oily water open drainage system, the other at a higher level leading to the firewater overflow drainage system. Where convenient, the individual firewater overflow drains should be piped directly overboard. Only if necessary should the firewater overflow drainage be collected in headers, the outlets of which shall discharge overboard. They should terminate at least 3.0 metre below the lowest equipment and, wherever practicable, not above access ways.

(c) Sub-dividing large, open process areas using gulleys, gratings or 'sleeping policemen'.

Segregation according to process section is desirable. e.g Separator area and MOL pump area. Catchment areas should be as small as reasonably practical and should not exceed 600m^2 where there are large liquid inventories.

These measures, plus solid floor edging at louvers shall be used to ensure that there is no overflow into other areas.

8.1.2 The sizing of the firewater overflow drainage system shall take no credit for the capacity of the oily water open drainage system.

The capacity of the system will be reduced if there are too many bends, dirt traps, etc. It may be improved by the inclusion of vortex breakers.

8.1.3 The hydraulic design of the firewater drainage system shall allow for the maximum output (not just the design output) of the firewater system plus that of any portable equipment that may also be used.

Where practicable, the design should be 110% of the maximum output so as to allow for cross flow from other areas and pooling. An allowance for supercharging may also be made (see 8.2.1).

8.2 Equipment Requirements

8.2.1 Gulleys

Firewater overflow drainage gulleys should be provided as shown in Figure 7 (see also 3.3.2.3). Where practicable, the design should ensure discharge of oil to the sea before the firewater.

8.2.2 Divisions

Upstands at louvered walls and 'sleeping policemen' should be 25 mm higher than that required for drainage control. Further allowance should be made for deck irregularities. When deciding on the position of a division, personnel movements and trip hazards shall be considered.

8.2.3 Firewater Drainage Piping

8.2.3.1 Drainage piping should fall towards the discharge point (see 3.1 and 3.2).

8.2.3.2 Firewater drainage from safe areas shall be kept physically separate from that from hazardous areas.

8.2.3.3 Loop seals should be provided on firewater overflow drains from gulleys in hazardous areas and pressurised modules.

8.2.3.4 Subject to pressurisation requirements loop seals are not required below the lowest deck elevation. However, they may help in snuffing fires in the outflow.

8.2.3.5 Any form of impediment to the free flow of surface water to the drains should be avoided.

8.2.3.6 The possibility of the firewater drain freezing because of spillage of low temperature material during a fire should be considered.

8.2.4 Bunded Areas

Firewater shall be prevented from overflowing from bunded areas, such as around tanks containing flammable or hazardous materials, during deluge. The use of overflow outlets leading to the firewater drainage system or provision of low-level manual drains to the oily drains system should be considered.

8.2.5 Helidecks

Helidecks shall be provided with a gulley drain system which shall drain to a safe location (see 8.1.1 and 8.2.1).

9. CHEMICAL DRAINAGE

9.1 General

9.1.1 The preferred method of disposal of spilled chemicals is that they should be drummed for disposal ashore. Where this is not feasible, and for most low toxicity chemicals, they may be diluted into the seawater discharge line, and discharged through the seawater outfall caisson, in accordance with the design and equipment guidelines below.

9.1.2 Any hazardous chemical discharge into laboratory drains, shall be rendered non-hazardous, e.g. by manually flushing the drain immediately with a suitable neutralising solution.

9.1.3 At the commencement of design work, BP will provide a list of likely chemical stock items, their properties and approximate quantities involved.

This listing will also indicate:-

(a) Whether bulk storage is intended.

(b) The toxicity ratings and corrosivity of the various items.

(c) General hazard information, e.g. some chemicals are innocuous on their own but may react dangerously with others or with water. Chemical reactions may be highly exothermic or may release toxic of corrosive by-products.

9.1.4 All chemical storage and handling areas and their sub-divisions, shall be provided with kerbs and valved connections to chemical drains, the valves normally being closed.

The layout shall be such that any significant sized spill can be collected and drummed for disposal ashore. Valves to drain may be opened to dispose of uncontaminated rain-water. If minor contamination is present adequate water flushing shall be provided, and the area cleared via the chemical drain. Specific attention shall be given to ensure that the design of the containment is appropriate to the materials handled, and also to avoid risk to personnel, especially those working on lower platform levels.

9.1.5 Chemical drains should connect to seawater headers at points where the headers are free-draining to the seawater outfall caisson.

Connection of these drains to to free-draining headers will prevent the accumulation of chemicals should there be an interruption of seawater flow due to a platform shutdown.

9.1.6 A hydraulic check shall be made on chemical drain lines and seawater headers to ensure that there is adequate flow.

9.1.7 Removable injection quills should be provided wherever chemical drains are connected into the seawater headers.

A typical injection quill is shown on Figure 8. The quill design normally should incorporate electrical insulation between the dissimilar metals of the chemical drain piping and seawater header.

9.1.8 Reactions between chemicals shall be considered. Any necessary segregation shall be employed.

9.2 Equipment Requirements

9.2.1 Chemical Drainage Piping

9.2.1.1 Drainage piping should fall towards the discharge points. (see 3.1 and 3.2).

10. SANITARY DRAINAGE

10.1 General

10.1.1 A single sanitary drainage system shall be provided for domestic effluent, including drains from toilets, galley, internal floors, laundry, etc., and shall be designed in accordance with BS 5572. A typical schematic diagram for a sanitary drainage system is given in Figure 9.

10.1.2 BP may specify special requirements for drainage from medical suites.

10.1.3 Reference shall be made to BP Group RP 4-1 for guidance in the calculation of maximum discharge rates into the drainage system.

10.1.4 A macerator is sufficient for the sanitary drainage system prior to drainage disposal in a gravity outfall line, unless statutory requirements specify additional facilities, such as a bio-treatment unit. A bypass for cleaning purposes shall be provided.

10.2 Equipment Requirements

10.2.1 Sanitary Drainage Collection Piping

10.2.1.1 Drainage piping should fall towards the discharge point. The net slopes and line sizes shall be selected in accordance with BS 8301.

10.2.1.2 UPVC or other suitable pipe is acceptable where conditions permit.

There are situations where plastic pipework is not suitable, for example in external situations or where there is a risk of damage from local operations or equipment/material movements or in applications where high temperatures may be experienced.

10.2.2 Seals

In cases where drains emanate from pressurised areas, e.g. accommodation modules, seals should be provided to minimise leakage of air.

10.2.3 Sewage Outfall Line

The sewage outfall line shall be extended to be submerged continuously thereby preventing blow back due to wave action. Its location shall be in accordance with 2.7.

FIGURE 1A

SIMPLIFIED OVERALL DRAINAGE SYSTEM (DRAINAGE CAISSON SEPARATION PLUS OIL REMOVAL PACKAGE)

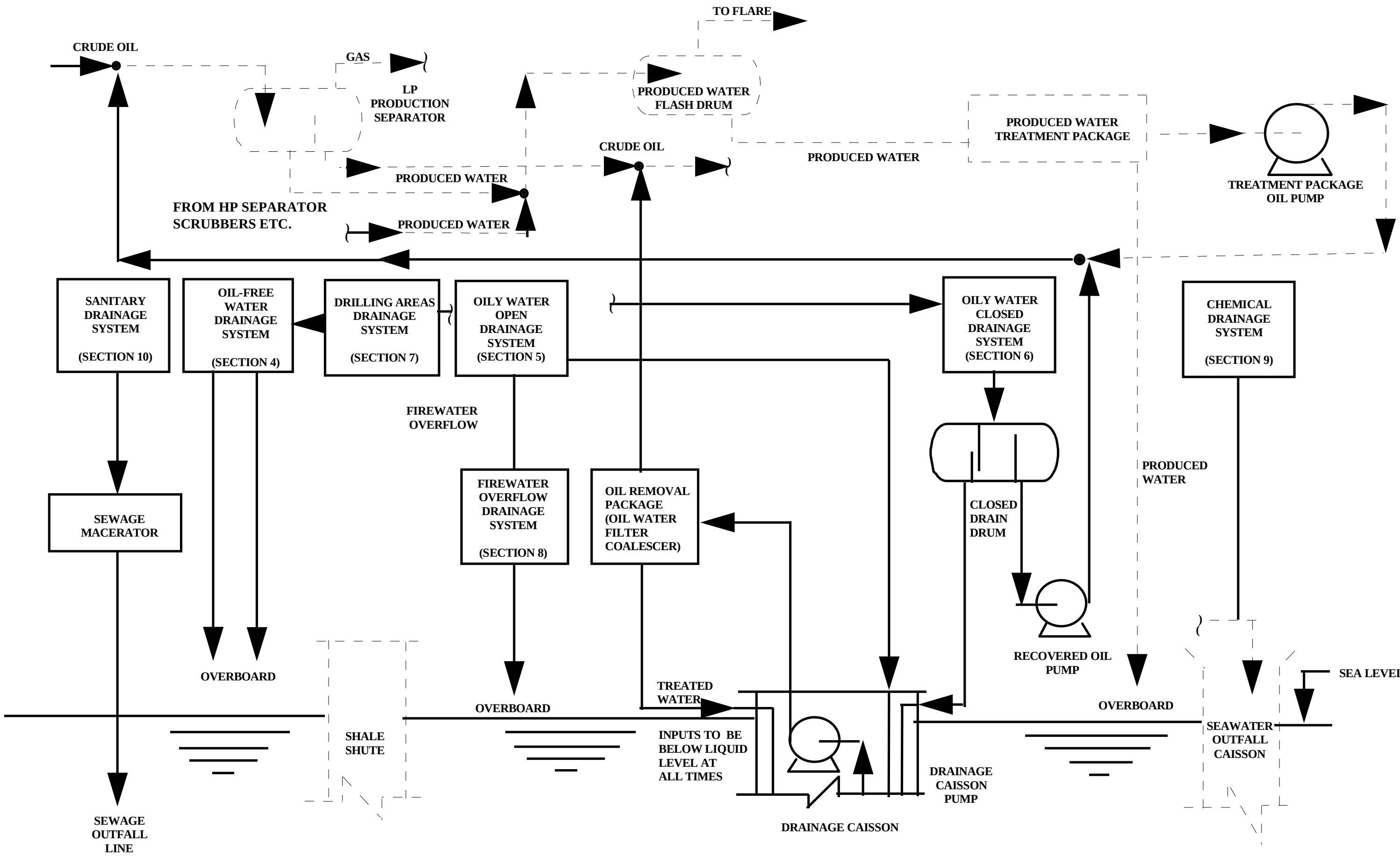
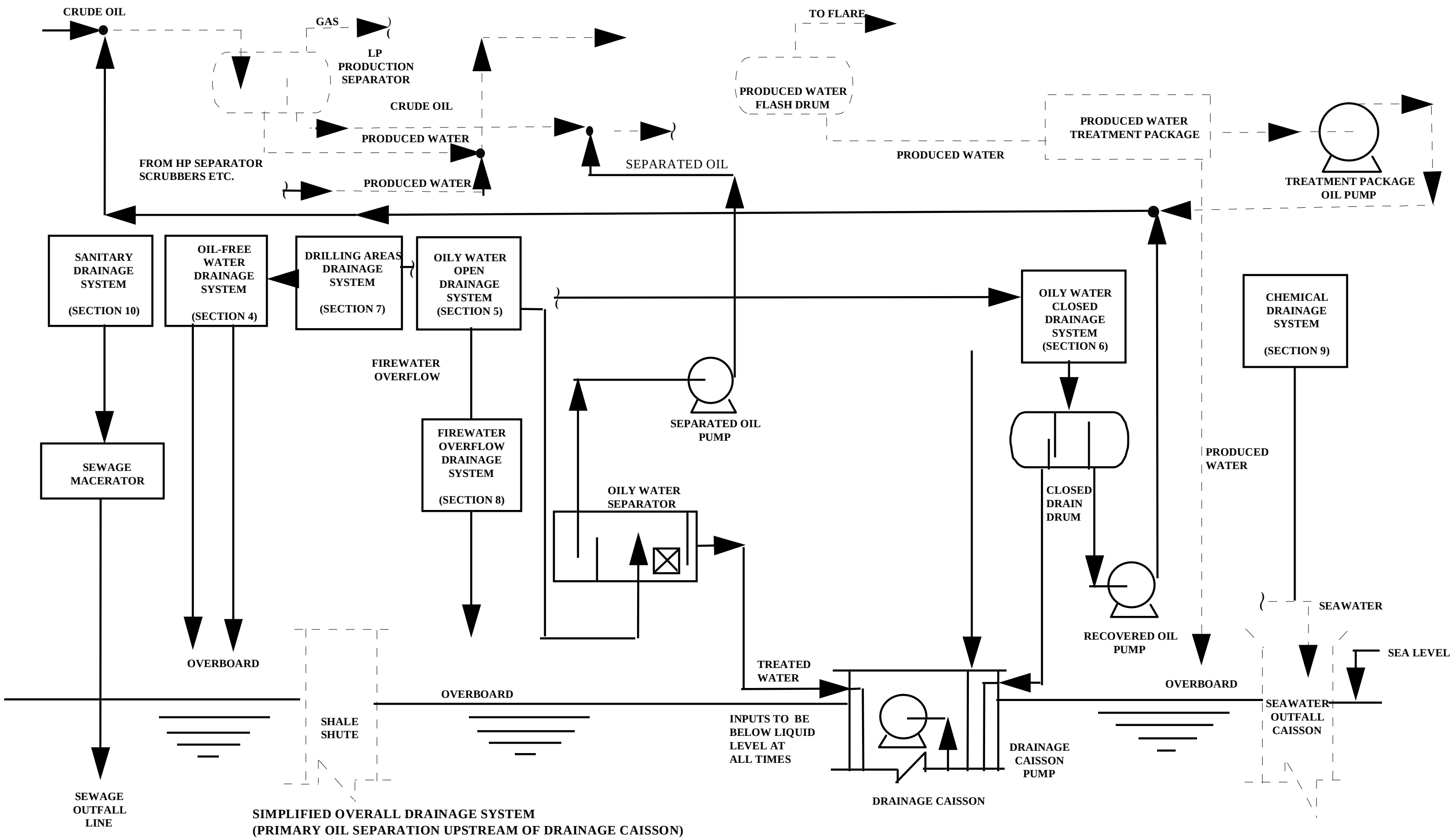


FIGURE 1B
SIMPLIFIED OVERALL DRAINAGE SYSTEM
(PRIMARY OIL SEPARATION UPSTREAM OF DRAINAGE CAISSON)

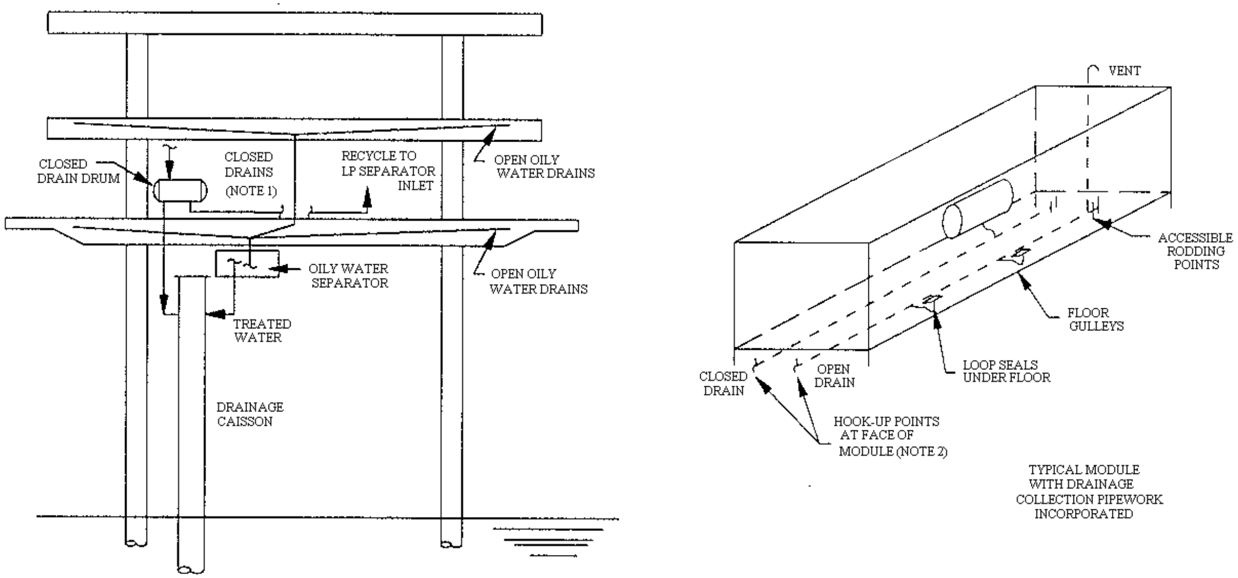


SIMPLIFIED OVERALL DRAINAGE SYSTEM
(PRIMARY OIL SEPARATION UPSTREAM OF DRAINAGE CAISSON)

FIGURE 2
TYPICAL TOPSIDES DRAINAGE ARRANGEMENT

NOTES :

1. CLOSED DRAIN COLLECTION SHOULD BE FROM DECK LEVELS ABOVE THE CLOSED DRAIN DRUM TO ALLOW GRAVITY FALL.
2. HOOK-UP POINTS SHOULD BE CENTRALLY PLACED ON THE MODULE LONG FACE IF THERE ARE HEIGHT CONSTRAINTS TO THE LEVEL VARIATION OF THE FALLING GRAVITY DRAIN LINES. (SEE 3.2 OF THIS RECOMMENDED PRACTICE)



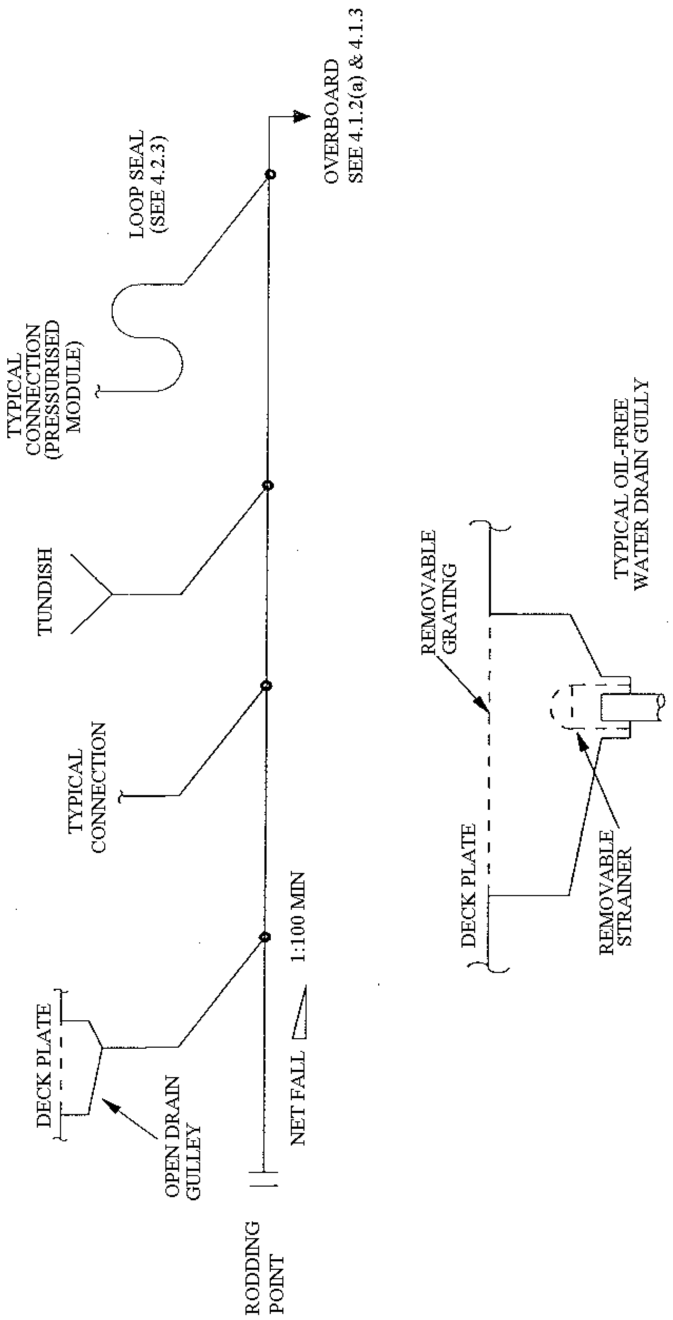
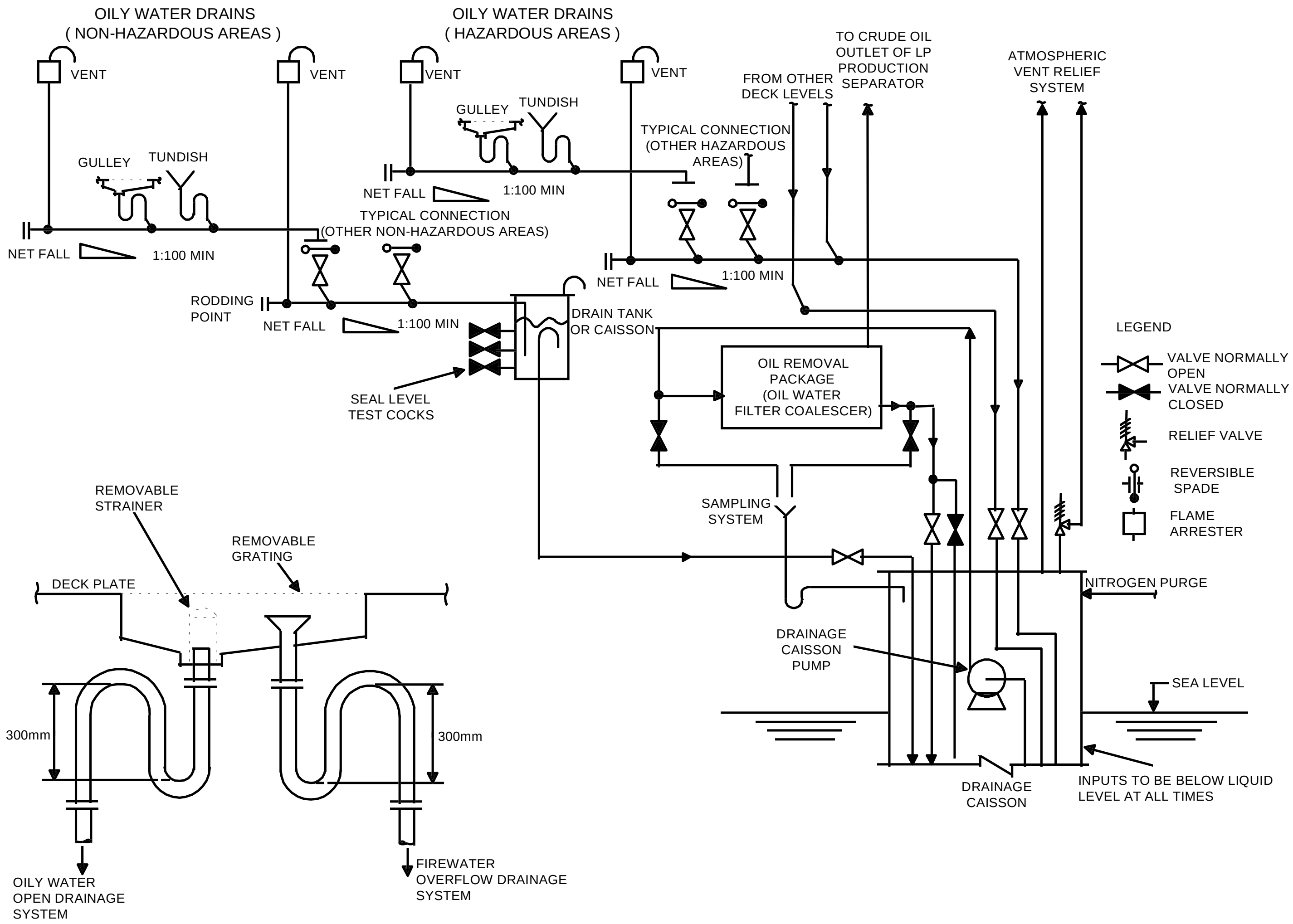


FIGURE 3

OIL-FREE WATER DRAINAGE SYSTEM SCHEMATIC

FIGURE 4A

OILY WATER OPEN DRAINAGE SYSTEM SCHEMATIC
(DRAINAGE CAISSON SEPARATION PLUS OIL REMOVAL PACKAGE)



TYPICAL OPEN DRAIN GULLEY
WITH FIREWATER OVERFLOW

FIGURE 4B

OILY WATER OPEN DRAINAGE SYSTEM SCHEMATIC
(PRIMARY OIL SEPARATION UPSTREAM OF DRAINAGE CAISSON)

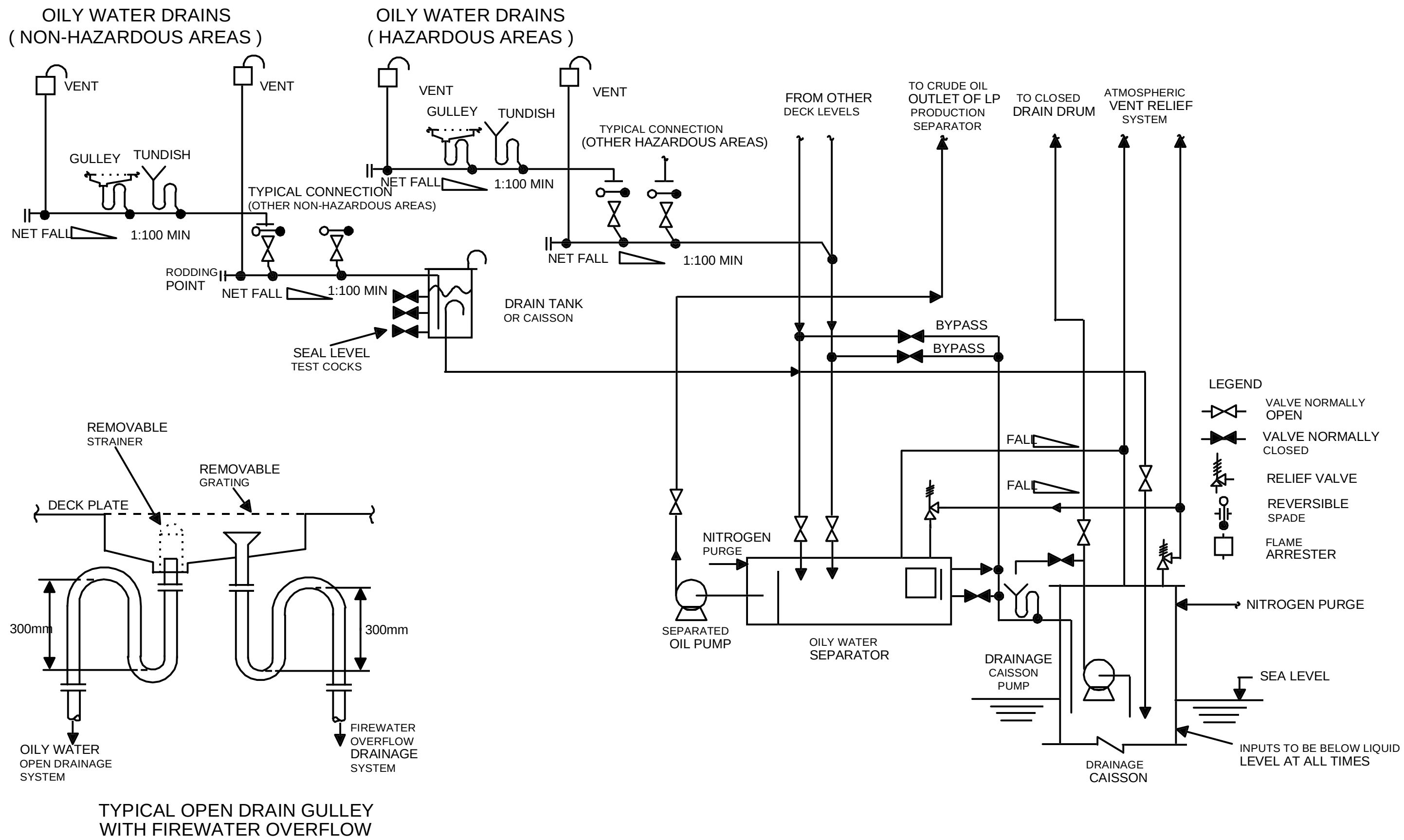


FIGURE 5

OILY WATER CLOSED DRAINAGE SYSTEM SCHEMATIC

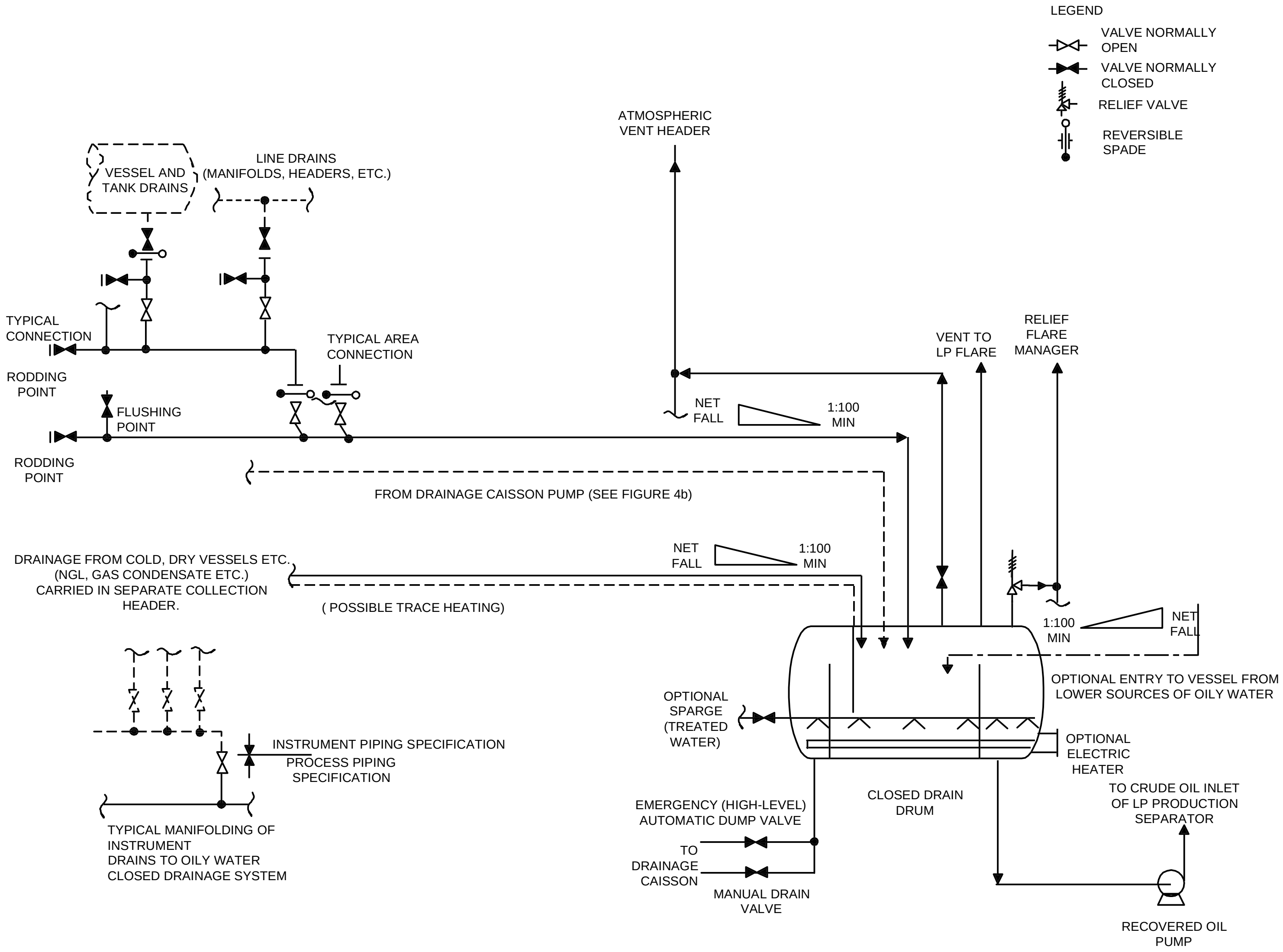
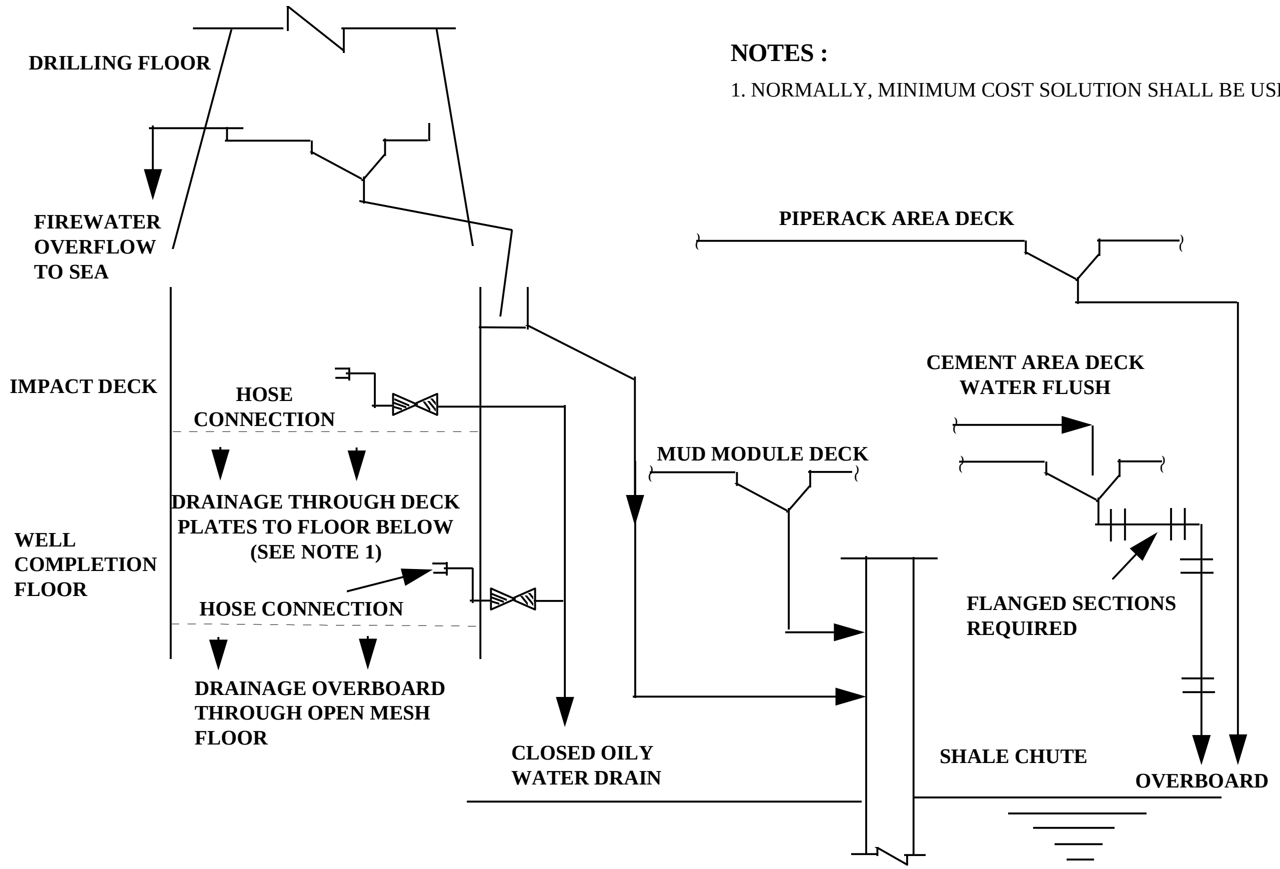


FIGURE 6

DRILLING AREAS DRAINAGE SYSTEM SCHEMATIC

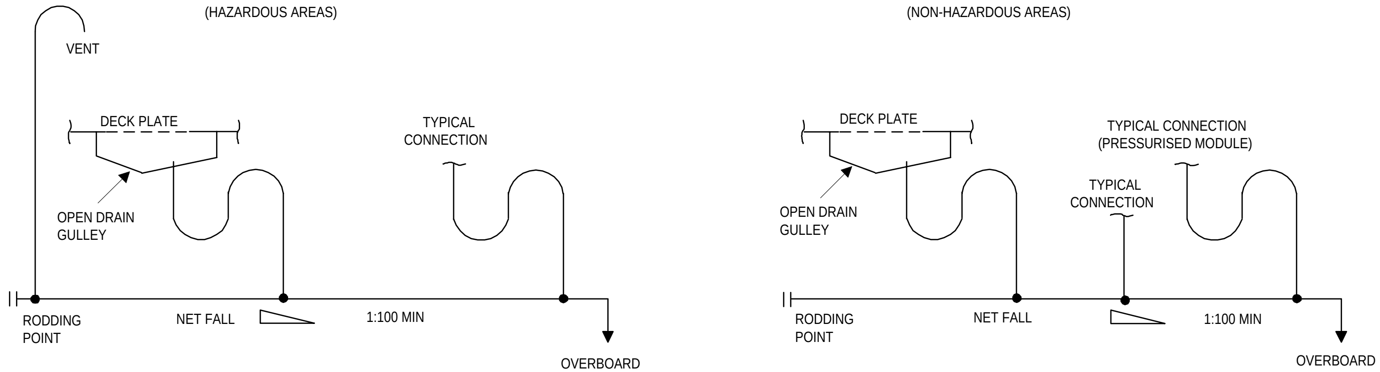


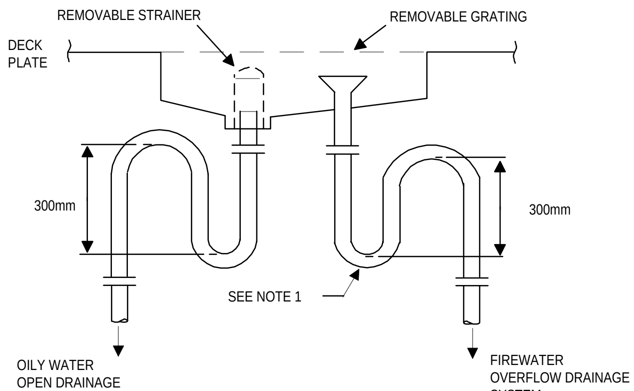
NOTES :

1. NORMALLY, MINIMUM COST SOLUTION SHALL BE USED.

FIGURE 7

FIREWATER OVERFLOW DRAINAGE SYSTEM SCHEMATIC



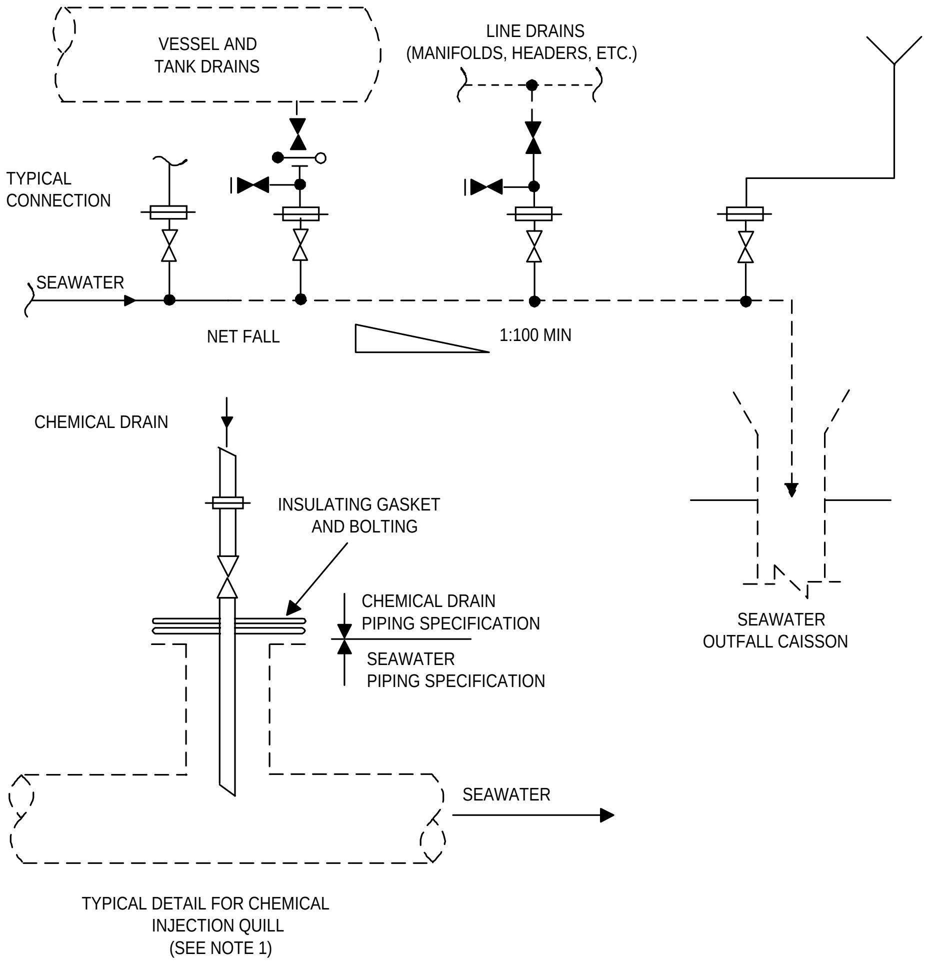


TYPICAL OPEN DRAIN GULLEY
WITH FIREWATER OVERFLOW

NOTES:

1. FIREWATER OVERFLOWS DO NOT REQUIRE LOOP SEALS IN NON-HAZARDOUS AREAS, UNLESS CONNECTED TO A HEADER.
2. FIREWATER OVERFLOWS DO NOT REQUIRE LOOP SEALS IN HAZARDOUS AREAS WHEN DISCHARGE IS DIRECT TO SEA (i.e. NO COLLECTION HEADER).

FIGURE 8
CHEMICAL DRAINAGE SYSTEM SCHEMATIC



NOTES

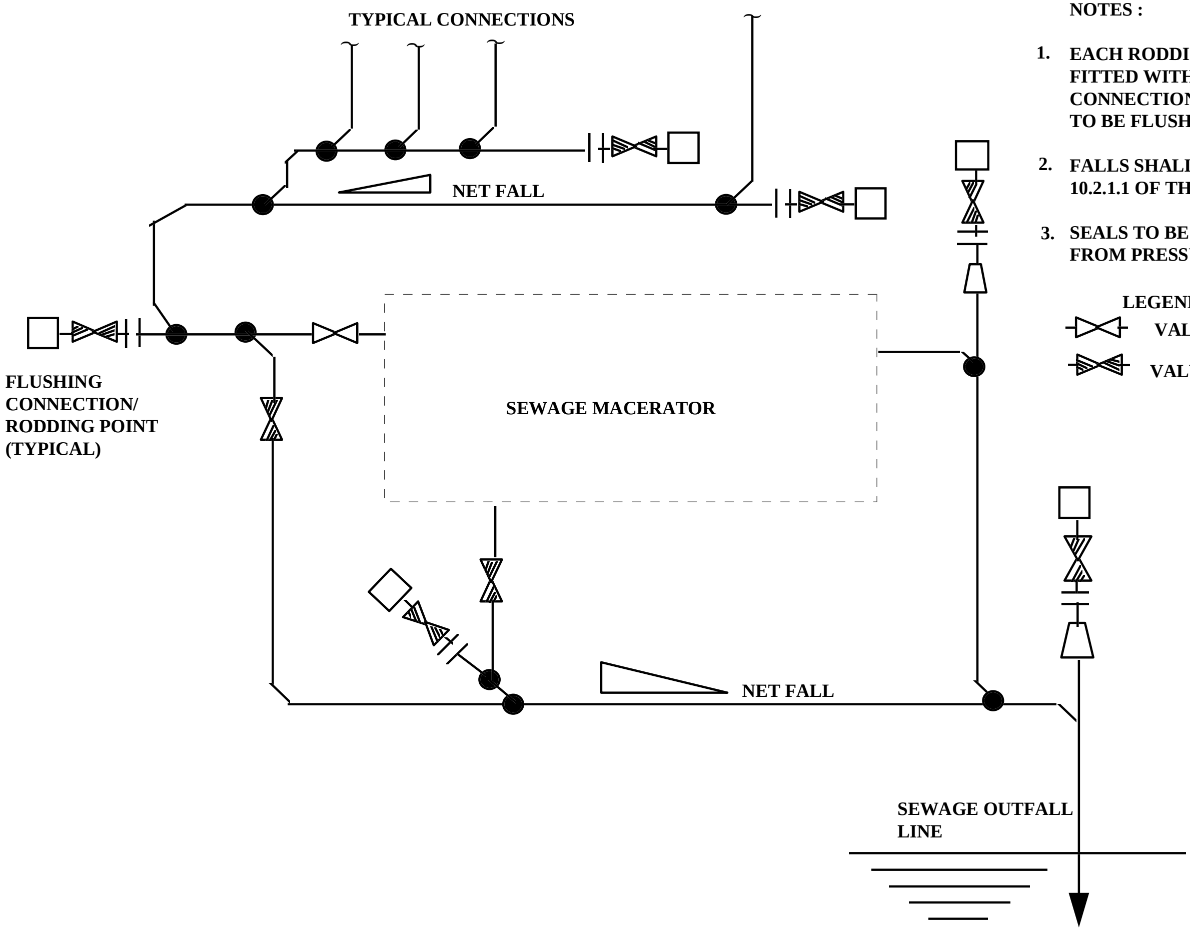
1. INJECTION QUILL REQUIRED TO DILUTE CHEMICALS IN SEAWATER STREAM.
2. HYDRAULIC CHECK SHOULD BE MADE ON CHEMICAL DRAIN LINE CONNECTIONS TO SEAWATER HEADER TO ENSURE HEAD IN SEAWATER HEADER ALLOWS FLOW IN CHEMICAL DRAINS TOWARDS HEADER.
3. ALL CHEMICAL DRAIN LINES SHOULD FALL TOWARDS INJECTION POINTS AT THE SEAWATER HEADER, NET FALL 1:100 MIN.

LEGEND

VALVE NORMALLY OPEN
VALVE NORMALLY CLOSED
REVERSIBLE SPADE
PIPING UNION

FIGURE 9

SANITARY DRAINAGE SYSTEM SCHEMATIC



NOTES :

1. EACH RODDING POINT SHALL BE FITTED WITH A STANDARD HOSE CONNECTION TO ENABLE LINES TO BE FLUSHED WITH SEA WATER.
2. FALLS SHALL BE IN ACCORDANCE WITH 10.2.1.1 OF THIS CODE OF PRACTICE
3. SEALS TO BE PROVIDED ON DRAINS FROM PRESSURISED AREAS, SEE 10.2.2.

LEGEND

VALVE NORMALLY OPEN

VALVE NORMALLY CLOSED

DEFINITIONS AND ABBREVIATIONS

Definitions

Standardised definitions may be found in the BP Group RPSEs Introductory volume.

Abbreviations

ANSI	American National Standards Institute
API	American Petroleum Institute
BOP	Blowout preventer
BS	British Standard
DN	Nominal diameter
GRP	Glass reinforced plastics
H2S	Hydrogen sulphide
LAT	Lowest astronomical tide
LP	Low pressure
HP	High pressure
NGL	Natural gas liquids
NPS	Nominal pipe size
UPVC	Unplasticized polyvinyl chloride

LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

BS 5572	Code of practice for sanitary pipework.
BS 6367	*Code of practice for drainage of roofs and paved areas.*
BS 8301	Code of practice for building drainage.
API RP 14C	Recommended practice for analysis, design, installation and testing of basic surface safety systems for offshore production platforms.
BP Group RP 4-1	Drainage systems (was BP CP 5)
BP Group RP 6-1	*Corrosion Monitoring* *(was BP CP 50)*
BP Group RP 44-2	Winterisation (was BP CP 24)
BP Group GS 142-6	Piping Specifications (was BP Std 170)
SI 611	*The offshore installations (firefighting equipment) regulations 1978*

SUPPLEMENTARY COMMENTARY

C1 Scope

This Commentary relates to clause 1.1.

At the commencement of conceptual design, BP will provide an indication of regulatory restrictions which are expected to apply to discharge from the platform. BP shall then be consulted with regard to the extent and type of waste water treatment facilities needed.

The design concepts described in this document satisfy the following consent conditions and exemption levels currently applied by the UK Department of Energy to drainage systems on offshore North Sea installations:

(a)Maximum oil content at point of discharge 100 mg/litre.

(b)The drainage system to contain, so far as practicable, all spills, discharges and leaks of oil and mixtures containing oil.

In other locations, particularly those close to shore or otherwise environmentally sensitive, other more stringent criteria may be applied. These may require additional treatment equipment. Reference shall be made in all cases to the appropriate regulating authority to confirm requirements before design work commences.

Different and usually more stringent consent conditions are also applied to discharges of produced water. Produced water is treated in separate systems and controlled by convention. It is not considered in this Recommended Practice.

It is a legal requirement in UK waters, and frequently elsewhere, that no oil is discharged to sea. However, for practical reasons, exemptions are given to offshore production installations.

In the case of a major incident requiring the prolonged use of firewater, containment of all spills may not be practicable. This is acknowledged in 5.1.2 of the essential requirements of this document by the reference to the use of a firewater overflow system which effectively bypasses the oily water drainage systems.

However, except in the case of a major spill, as distinct from normal contamination of decks and equipment, it is likely that the initial flow of firewater to the oil/water separation facility will clear a substantial proportion of contaminants from deck areas before firewater starts discharging to sea via the firewater overflow drainage system (see Section 8 of the essential requirements of this document).

C2 General

This Commentary relates to clause 2.1.2.

Figure 1a includes a system in which primary separation of oil and water from the oily water open drainage system takes place in the drainage caisson itself;. Figure 1b includes a system in which primary separation takes place in an oily water separator upstream of the drainage caisson. Local regulations will dictate which is the preferred system.

These diagrams are representative only, and serve to illustrate typical effluent systems for an integrated platform supporting production, drilling and quarters facilities. In some cases, some *sections would not be needed. For example, oily water may not be present on the quarters platform of a multi-platform complex.*

C3 Gravity Flow Requirements

This Commentary relates to clause 3.2.3.

Figure 2 shows typical locations of an oily water separator and closed drain drum on a platform topsides. These are placed centrally on the platform at levels which permit gravity flow from drainage points, and gravity flow to the oily water separator. Discharges of water from the oily water separator and the closed drain drum are routed separately to the drainage caisson.

These typical locations are appropriate for platforms on which the sources of effluent to the oily water closed drainage system are generally elevated above the inlet nozzle of the closed drain drum, which is located on the platform's lowest deck level.