

DEP SPECIFICATION

LAYOUT OF OFFSHORE FACILITIES

DEP 80.00.10.12-Gen.

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(DEP Circular 62/12 has been incorporated)

DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This new DEP specifies requirements and gives recommendations for the development and optimisation of layouts for all off-shore facilities. It covers the layout aspects of topsides on single supported structures, either for standalone integrated decks or platforms or for a single deck or platform that is part of multiple platform complexes.

The master planning considerations when locating multiple platform complexes are excluded from the scope of this DEP.

This DEP can be used for new facilities as well as for revamps or expansions of existing facilities.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual DEM 1 – Application of Technical Standards.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in offshore facilities related to oil and gas production and gas handling. Application in other facilities may also apply.

When DEPs are applied, a Management of Change (MOC) process should be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP 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, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

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

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

The **Principal** is the party that initiates the project and ultimately pays for it. 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 capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

1.3.2 General definitions

Facility	One single supported structure (can be a standalone integrated deck or standalone platform or a platform of a multi bridge linked platform complex)
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1.4 ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
SIMOPS	SIMultaneous OPerationS May include simultaneous operation & maintenance activities as well as simultaneous operation & constructions activities
TR	Temporary Refuge
HAC	Hazardous Area Classification
HSE	Health, Safety and Environment
HFE	Human Factors Engineering (or ergonomics); refers to the application of human physical and cognitive sciences in conjunction with engineering sciences to achieve optimal human and system performance

1.5 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (7).

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal <http://www.shell.com/standards> and on the main page of the DEPs DVD-ROM.

1.7 PROCESS SAFETY REQUIREMENTS

Derogations from these requirements have to be approved by the Delegated Technical Authority.

1.8 DUAL UNITS

**Amended per
Circular 62/12**

Dual units have been incorporated throughout this DEP.

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

2. LAYOUT STRATEGY

The main drivers for the development of an offshore facility layout are costs, lost production and safety.

The project shall develop and implement an overall layout strategy that addresses how and when the following elements will be delivered during the distinct stages of the project development cycle:

- topsides facility layout
- equipment arrangement

The layout strategy shall ensure that the above elements are optimized to achieve:

- Minimum cost by utilizing compact layouts with minimum hydrocarbon inventory and minimum required separation distances;
- Minimum lost production resulting from assets destroyed or damaged during a fire/explosion event;
- Safety risk levels for “on site” workforce are tolerable and ALARP;
- Safety and environmental risk levels for surrounding facilities and communities are tolerable and ALARP;

For offshore installations there is a need for layouts to be compact yet maintaining minimum required separation distances.

The layout strategy shall ensure that the resulting layouts are consistent with the defined Hazard Management Philosophies. Output from the deliverables of the defined Hazard Management Philosophies SHALL [PS] be incorporated into the layout development at each stage of the project.

Allowance for construction activities that will be executed in the foreseeable future shall be considered. This requires safe and unhindered access during construction activities and allowing for sufficient safety distances during SIMOPS.

3. LAYOUT DEVELOPMENT ACTIVITIES

3.1 OBJECTIVES OF LAYOUT DEVELOPMENT AND LAYOUT OPTIMISATION

The primary objective of layout development, as well as for layout optimization, is to ensure that the facility will be developed in such a way that all categories of risks (including HSE, technical, political, economic – cost & schedule, operational) in the facility are reduced to as low as reasonably practicable (ALARP) during all phases of its life, from construction to decommissioning.

Hazard management, inherent safety principles and good practices are key contributors to achieve this objective.

The application of Quantitative Risk Assessment (QRA) and the concept of Risk Tolerability Criteria in comparing alternative layout designs is considered valuable as part of the decision-making process. In addition to that it will help in demonstrating that the risk criteria have been achieved, and that the risks are indeed ALARP.

The layout development activity requires co-ordination between all engineering disciplines involved in the design, as well as construction, operations, maintenance and HSE staff. Systematic layout reviews involving these staff should be planned into the project schedule. Particular care should be taken when installation modifications are being considered.

At the early stages there could be a significant level of dimensional uncertainty, as equipment sizes have to be assumed. As a result a degree of iteration is inevitable as the layouts are developed. Sufficient space to accommodate increases in equipment sizes as the process design is finalised and vendor information becomes available should be provided.

3.2 PHASING OF LAYOUT DEVELOPMENT ACTIVITIES AND DELIVERABLES

Layout development activities to assure that the layout is ALARP will take place at various distinct stages during a project development cycle. Table 3.1 defines what should be delivered each project development phase.

Table 3.1

Phase	Deliverables				
	Overall field and facility layouts	Equipment arrangements	Implementation of studies of previous phase	Definition of studies in current phase	Layout development report 1)
Identify & Assess	Preliminary	Preliminary	-	X	X
Select	Conceptual	Conceptual	X	X	X
Define (FEED)	Ready for execution	Ready for execution	X	X	X
Execute	Approved for construction	Approved for construction	X	-	X 2)

- NOTES:
1. The layout development report should include all assumptions and considerations, along with decisions taken that impact the overall field and facility layout.
 2. Close out layout development report documenting how each action item from the Human Factor Review, Mechanical Handling Review and Layout Model Reviews was implemented as input to the facility start-up review activities

3.2.1 Identify & Assess Phase

The Identify & Assess phase closes with the feasibility of project concept options. As part of this phase schematic layouts shall be prepared for proposed developments so as to be able to assess the feasibility of the possible concepts. HSE shall be fully considered for the layout so as to select and optimize based on project hazard management principles.

The deliverables shall possess sufficient detail in order to check the feasibility of possible concepts.

3.2.2 Select Phase

Deliverables with sufficient detail are to be developed to support the required risk assessment, activity planning and costs estimating, and hence concept selection.

3.2.3 Define Phase

The layout development should focus on the progressive optimisation of field and installation layout drawings. The objectives of layout development are given in (3.1). Key considerations are constructability (cost, schedule, safety), technical integrity, maintainability and operability, all with due regard to safety. Appropriate risk assessment techniques should be followed.

Deliverables with sufficient detail shall to be developed to support the required level of project cost and schedule estimation.

3.2.4 Execute Phase

A fully detailed layout design for all process and utility systems forming part of the facility shall be produced. The layout shall be optimised for the working environment of facilities and equipment by addressing the various Human Factor considerations.

3.3 APPLICATION OF FACILITY LAYOUT METHODOLOGY

A documented method shall be used for optimising layout providing an auditable framework.

3.4 REVIEWS PER PROJECT PHASE

The reviews, e.g. by layout drawings and/or 3D-CAD model reviews shall use a structured and auditable assessment methodology, which ensures that the requirements of other disciplines have been incorporated in the design and to eliminate possible clashes and to ensure the design is fully ALARP. For 3D-CAD model reviews, reference is made to DEP 30.10.05.11-Gen.

4. GENERAL LAYOUT CONSIDERATIONS AND ORIENTATION

4.1 GENERAL

The objective of this Chapter is to explain the methodology of the development of a topside layout. Safety, economics, future expansion and the applicable codes and standards are the chief considerations for a layout that leads to 1) a safe and economic installation and flow of personnel and products and 2) an acceptable environment from the perspective of human comfort.

This Chapter explains the parameters and information required for general layout. The subsequent chapters provide more detailed requirements.

4.2 METHODOLOGY OF INSTALLATION CONFIGURATION

Conceptual layout studies shall (see 3.2) be conducted to both prove the feasibility of the proposed facility and to provide early facility data for economic and risk analysis studies.

The following steps should be taken:

1. Identification of the facilities required.
2. Selection of topsides type.
3. Preliminary layout of systems blocks with decreasing levels of hazard approaching the living quarters and with due regard to optimum process flow.
4. Identification of environmental factors, wind direction, prevailing currents, and operational factors, including helicopter and supply boat operations, and the constraints of maintenance/ construction on the layout.
5. Review layout options and resolve conflicts, hence optimise overall size, jacket and topside configuration and even out the structural loading, notably weight.
6. Analyse the hazard levels of facility layout options, modify to suit risk and consequence analysis, including the risk of explosion.

Following the initial estimate of the equipment sizes and room dimensions, alternative schemes may be considered for the facility configuration. The objective should be to identify the:

- most cost-effective, operable scheme which has the highest practicable separation between high and low risks, combined with prime safety access throughout;
- Minimum offshore hook-up and commissioning effort while accommodating constraints of lifting vessels etc.

4.3 SELECTION OF OVERALL TOPSIDES CONFIGURATIONS

Before proceeding with the facility layout the topsides type, i.e. integrated or Modular, should be chosen. This choice depends on:

- the flexibility in installation method, associated with whether the topsides is preferred to be installed as a single lift or piecemeal;
- the balance between onshore and offshore hook-up and commissioning;
- limiting the total weight through greater structural steel efficiency.

4.4 LAYOUT DESIGN CRITERIA

Installations with good layout are economic, safe and easy to operate and maintain. Good layout is a key factor in preventing escalations of fires and explosions and in minimising the effects of emergencies.

In developing the facility layout the following points shall be considered: