

DEP SPECIFICATION

HUMAN FACTORS ENGINEERING - VALVES

DEP 30.00.60.13-Gen.

September 2011

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE



© 2011 Shell Group of companies

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, published or transmitted, in any form or by any means, without the prior written permission of the copyright owner or Shell Global Solutions International BV.

This document contains information that is classified as EAR99 and, as a consequence, can neither be exported nor re-exported to any country which is under an embargo of the U.S. government pursuant to Part 746 of the Export Administration Regulations (15 C.F.R. Parts 746) nor can be made available to any national of such country. In addition, the information in this document cannot be exported nor re-exported to an end-user or for an end-use that is prohibited by Part 744 of the Export Administration Regulations (15 C.F.R. Parts 744).

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of Shell Global Solutions International B.V. (Shell GSI) and, in some cases, of other Shell Companies.

These views are based on the experience acquired during involvement with the design, construction, operation and maintenance of processing units and facilities. Where deemed appropriate DEPs are based on, or reference international, regional, national and industry standards.

The objective is to set the recommended standard for good design and engineering practice to be applied by Shell companies in oil and gas production, oil refining, gas handling, gasification, chemical processing, or any other such facility, and thereby to help achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to Shell companies for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual Operating Units to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs, they shall be solely responsible for such use, including the quality of their work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will typically expect them to follow those design and engineering practices that will achieve at least the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal.

The right to obtain and to use DEPs is restricted, and is granted by Shell GSI (and in some cases by other Shell Companies) under a Service Agreement or a License Agreement. This right is granted primarily to Shell companies and other companies receiving technical advice and services from Shell GSI or another Shell Company. Consequently, three categories of users of DEPs can be distinguished:

- 1) Operating Units having a Service Agreement with Shell GSI or another Shell Company. The use of DEPs by these Operating Units is subject in all respects to the terms and conditions of the relevant Service Agreement.
- 2) Other parties who are authorised to use DEPs subject to appropriate contractual arrangements (whether as part of a Service Agreement or otherwise).
- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, Shell GSI disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any DEP, combination of DEPs or any part thereof, even if it is wholly or partly caused by negligence on the part of Shell GSI or other Shell Company. The benefit of this disclaimer shall inure in all respects to Shell GSI and/or any Shell Company, or companies affiliated to these companies, that may issue DEPs or advise or require the use of DEPs.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, DEPs shall not, without the prior written consent of Shell GSI, be disclosed by users to any company or person whomsoever and the DEPs shall be used exclusively for the purpose for which they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of Shell GSI. The copyright of DEPs vests in Shell Group of companies. Users shall arrange for DEPs to be held in safe custody and Shell GSI may at any time require information satisfactory to them in order to ascertain how users implement this requirement.

All administrative queries should be directed to the DEP Administrator in Shell GSI.

TABLE OF CONTENTS

1.	INTRODUCTION	4
1.1	SCOPE.....	4
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	4
1.3	DEFINITIONS	4
1.4	CROSS REFERENCES.....	5
1.5	SUMMARY OF MAIN CHANGES.....	5
1.6	COMMENTS ON THIS DEP	6
2	BACKGROUND AND GENERAL REQUIREMENTS	7
2.1	BACKGROUND	7
2.2	APPLICATION OF HFE PRINCIPLES IN DESIGN AND ENGINEERING	7
2.3	GENERAL HFE PRINCIPLES RELATING TO VALVE SELECTION AND LAYOUT.....	7
3	VALVE CRITICALITY ANALYSIS	8
3.1	VALVE CRITICALITY RATING.....	8
4	HFE DESIGN REQUIREMENTS FOR THE SELECTION, LOCATION AND ORIENTATION OF VALVE OPERATORS/ACTUATORS	10
4.1	VALVE CRITICALITY	10
4.2	VALVE OPERATOR/ACTUATOR	10
4.3	VALVE LOCATION	13
5.	REFERENCES	21

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for applying Human Factors Engineering (HFE) principles to the design and layout of valves for both onshore and offshore facilities and equipment. It includes the following:

- A procedure for analysing and then classifying the criticality of valves for a specific application;
- Guidance on selection of the appropriate type of valve operator/actuator;
- HFE design requirements for the location and orientation of manual valves.

This DEP applies to new facilities and modifications to existing facilities; it is not intended to apply to existing facilities that are not being modified.

Accessibility requirements of instruments and their associated valves are addressed in DEP 30.00.60.20-Gen. and DEP 32.31.00.32-Gen.

This is a revision of the DEP of the same number dated April 2009; see (1.5) regarding the changes.

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 authorized 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 facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied for other similar facilities.

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 may 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 regard 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 word **should** indicates a recommendation.

1.3.2 Specific definitions

Term	Definition
ALARP	As Low As Reasonably Practicable. As defined in HSSE & SP CF Glossary - the point at which the cost (in time, money and effort) of further risk reduction is grossly disproportionate to the risk reduction achieved.
HSSE CF	Shell Group HSSE Control Framework
HEMP	Hazards and Effects Management Process
HFE Technical Authority	The individual assigned as Technical Authority for HFE on the project in compliance with Business Unit and Group standards.
Human Factors Engineering	A multidisciplinary science that focuses on the interaction between the human and the work system in order to design human-machine interactions that optimize human and system performance. [ISO 6385]
Critical Task Inventory	An inventory of human tasks, identified by application of DEP 30.00.60.19-Gen., that are considered to be critical to asset integrity or process safety.
Ops	Operations
ORM	Shell Group Opportunity Realisation Manual.

1.3.3 Abbreviations

Term	Definition
BDEP	Basic Design and Engineering Package
EPC	Engineering, Procurement and Construction
HFE	Human Factors Engineering
HSSE & SP	Health, Security, Safety, Environment and Social Performance
MAS	Marine Advisory System
MOV	Motor Operated Valve
ORM	Opportunity Realisation Manual
PEFS	Process Engineering Flow Scheme
P&ID	Piping and Instrumentation Diagram
RVO	Remote Valve Operator
TA	Technical Authority
VCA	Valve Criticality Analysis

1.4 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 (5).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated April 2009. In addition to separating the content in the previous version that was background and explanation into the companion Informative document, some minor editorial changes were made.

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 DUAL UNITS

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 BACKGROUND AND GENERAL REQUIREMENTS

2.1 BACKGROUND

This is one of a series of DEPs that support the implementation of Human Factors Engineering on projects. The design requirements (4) with regard to valve location and orientation are mainly applicable to manual valves. However, they also apply to motorised, mobile actuator or otherwise remotely operated valves which could need rapid or frequent manual intervention to override and manually operate them, or where visually checking their status forms part of an HSSE critical activity.

Accessibility requirements of instruments and their associated valves are addressed in DEP 30.00.60.20-Gen. and DEP 32.31.00.32-Gen.

2.2 APPLICATION OF HFE PRINCIPLES IN DESIGN AND ENGINEERING

HFE is the process of integrating human capabilities, limitations, requirements and expectations in the design of products, workplaces or work systems (plant/facility) resulting in the effective, efficient, safe and healthy functioning of human beings.

The aim is to improve the efficiency of operational and maintenance task performance, to protect operators from short or long-term health impairments, and to minimise the likelihood of human error contributing to process safety or loss of production.

2.3 GENERAL HFE PRINCIPLES RELATING TO VALVE SELECTION AND LAYOUT

Valves (including those on Vendor supplied skid-packaged units) shall be selected, located and labelled, based on a Valve Criticality Analysis (VCA) so that they can be identified, operated, maintained and inspected:

- with accessibility and visibility appropriate to their service;
- without exposing operators to risk of injury or exposure to hazards.

Selection of valves shall take adequate account of the ability of the expected workforce to apply and sustain the force needed to operate them. This shall include consideration of the physical size and strength, as well as gender of the workforce.

- In general, valves should be selected that have been designed in such a way as to facilitate ease of operation and maintenance. (For example, valve handles that incorporate knurling and other types of grip have been shown scientifically to support ease of operation.)

Actuated valves should be used where the frequency of operating them, the valve characteristics, and the layout or work environment around the valve are such that either:

- the human operators will be exposed to unacceptable risk of musculo-skeletal injury; or
- unavoidable constraints on accessibility could mean that operators have difficulty ensuring that valves in critical service are properly open or closed.