

DEP SPECIFICATION

ALTERNATIVE PRESSURE RELIEF DESIGN FOR ASSESSMENT OF EXISTING FACILITIES

DEP 80.45.10.13-Gen.

February 2012

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE



© 2012 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 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 typically 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

PART I	INTRODUCTION AND GENERAL REQUIREMENTS.....	4
1.	INTRODUCTION	4
1.1	SCOPE.....	4
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	4
1.3	DEFINITIONS	5
1.4	CROSS REFERENCES.....	5
1.5	COMMENTS ON THIS DEP	5
1.6	DUAL UNITS.....	5
2.	GENERAL REQUIREMENTS	6
PART II	EXCEPTIONS TO DEP 80.45.10.11-GEN.	7
2.	DESIGN PHILOSOPHY.....	7
2.10	ROLE OF INSTRUMENTATION IN OVERPRESSURE PROTECTION.....	7
2.11	ROLE OF CHECK VALVES (NON RETURN VALVES) IN OVERPRESSURE PROTECTION	7
3.	DESIGN SCENARIOS.....	8
3.9	FIRE	8
3.10	THERMAL RELIEF/THERMAL EXPANSION RELIEF	9
4.	REMOTE CONTINGENCY SCENARIOS	10
4.2	HEAT EXCHANGER INTERNAL FAILURE	10
4.6	IMPROPER VALVE SEQUENCING.....	10
5.	SPECIFIC PROCESS EQUIPMENT GUIDANCE.....	11
5.2	FURNACES AND FIRED PROCESS HEATERS.....	11
5.3	HEAT EXCHANGER – DIFFERENTIAL PRESSURE DESIGN.....	12
5.4	ROTATING EQUIPMENT	12
6.	STORAGE TANKS.....	12
6.2	NORMAL VENTING.....	12
PART III	EXCEPTIONS TO DEP 80.36.00.30-GEN.	13
2.	RELIEF DEVICE SELECTION	13
2.3	SPECIFIC SELECTION CRITERIA	13
PART IV	EXCEPTIONS TO DEP 80.45.10.10-GEN.	14
2.	PRESSURE RELIEF DEVICES	14
2.1	RELIEF DEVICE LOCATION, INSTALLATION AND ARRANGEMENT	14
3.	FLARE AND VENT SYSTEMS	18
3.1	SELECTION OF DISPOSAL SYSTEMS	18
3.3	SIZING OF DOWNSTREAM PIPING SYSTEMS.....	18
3.4	LAYOUT OF DOWNSTREAM PIPING SYSTEMS.....	19
3.7	PIPING SYSTEM DESIGN	19
4.	KNOCKOUT DRUMS, WATER SEAL VESSELS AND LIQUID DISPOSAL FACILITIES.....	20
4.1	DESIGN OF KNOCKOUT (KO) DRUMS.....	20
5.	STRUCTURES FOR FLARE AND VENT STACKS AND LIQUID BURNERS	20
5.5	NOISE LIMITS	20
PART V.	EXCEPTIONS TO DEP 80.45.10.12-GEN.	21
2.	EMERGENCY DEPRESSURING SYSTEMS.....	21
2.2	DEPRESSURING DESIGN CRITERIA	21
2.3	APPLICATIONS FOR EMERGENCY DEPRESSURING.....	21
2.8	SECTIONALIZING OF PROCESS SYSTEMS.....	21
PART VI	REFERENCES	22

PART I INTRODUCTION AND GENERAL REQUIREMENTS**1. INTRODUCTION****1.1 SCOPE**

This new DEP provides alternatives for pressure relief system design that may be used in the assessment of existing facilities when modifications are made to the relief system as a part of project scope or plant changes.

(Part II) through (Part V) of this DEP are written in the form of amendments to the following DEPs which specify current requirements and recommendations for pressure relief system design:

Part	Referenced DEP	Title
II	DEP 80.45.10.11-Gen. (February 2012)	Overpressure and underpressure – Prevention and protection
III	DEP 80.36.00.30-Gen. (February 2012)	Relief devices – Selection, sizing and specification
IV	DEP 80.45.10.10-Gen. (February 2012)	Design of pressure relief, flare and vent systems
V	DEP 80.45.10.12-Gen. (February 2011)	Emergency depressuring and sectionalizing

The alternative requirements/exceptions specified in this DEP are applicable only to existing hardware. New hardware installed in existing facilities shall comply with the DEPs referenced above.

The alternative requirements/exceptions in this DEP are only a partial list of commonly found issues. It should not be interpreted that other deviations from the above referenced DEPs cannot be considered for existing facilities on a case-by-case basis.

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 authorisation 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 in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall 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 word **should** indicates a recommendation.

1.3.2 Specific definitions

Term	Definition
EGGS	Engineering Guides and General Specifications
MAWP	Maximum Allowable Working Pressure
PRV	Pressure Relief Valve
TERVs	Thermal Expansion Relief Valves

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 in this DEP are listed in (Part VI).

1.5 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.

1.6 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. GENERAL REQUIREMENTS

(Part II) through (Part V) of this DEP are written in the form of amendments and supplements to the following DEPs:

Part	Referenced DEP	Title
II	DEP 80.45.10.11-Gen. (February 2012)	Overpressure and Underpressure – Prevention and Protection
III	DEP 80.36.00.30-Gen. (February 2012)	Relief Devices – Selection, Sizing and Specification
IV	DEP 80.45.10.10-Gen. (February 2012)	Design of Pressure Relief, Flare and Vent Systems
V	DEP 80.45.10.12-Gen. (February 2011)	Emergency Depressuring and Sectionalizing

The requirements in this DEP shall apply when applying alternative rules for pressure relief system design when assessing existing facilities.

Unless shown as an exception in this DEP, all other requirements specified in the above referenced DEPs shall apply.

NOTE: The alternative requirements/exceptions in this DEP are only a partial list of commonly found issues. It should not be interpreted that other deviations from the above referenced DEPs cannot be considered for existing facilities on a case-by-case basis.

New hardware (equipment, instrumentation, piping, and piping tie-ins, etc.) for an existing area/unit shall comply with the above referenced DEPs. However, subject to an impact assessment in accordance with the Management of Change process that covers the facility, it is not an expectation that installation of new equipment triggers wholesale upgrades upstream and downstream of the new equipment.

A new asset shall be considered an existing asset once it has been commissioned.

This DEP shall be not be used to deviate from original specifications.

For ease of reference, the section numbering of the associated DEPs has been used in (Part II) through (Part V). In many cases, excerpts from the DEPs are included in this DEP (displayed with borders) so that the context of the exception/addition can be understood. The clauses in the associated DEPs which are not mentioned shall remain valid as written.

PART II EXCEPTIONS TO DEP 80.45.10.11-GEN.**2. DESIGN PHILOSOPHY****2.10 ROLE OF INSTRUMENTATION IN OVERPRESSURE PROTECTION****2.10.3 Instrumented Protective Functions (and other measures) to eliminate the relief device**

3.c If the scenario, without taking credit for mitigation measures as described above will result in pressures exceeding the corrected hydrotest pressure, then in addition, the risks shall be demonstrated to be ALARP using applicable HEMP methodology (e.g., perform LOPA if required).

Replace "the corrected hydrotest pressure" with:

50% accumulation

Add the following:

5. The requirements described in the above paragraphs (3 and 4) are not applicable to existing equipment that meets all of the criteria below:

- a. The equipment does not have a relief device for the scenario and the pressure resulting from that scenario exceeds the MAWP/design pressure (e.g., pump deadhead on an exchanger results in overpressure).
- b. The overpressure is self-limiting and does not exceed the allowable accumulation specified by Code or regulations (e.g., 16% for ASME Section VIII equipment, and typically 10% for other design code equipment).

NOTE: "self-limiting" pressure is the resulting pressure without taking any credit for instrumentation. For example, the deadhead pressure of a pump is a self-limiting pressure.

- c. There is sufficient instrumentation to alert operations of abnormal pressure conditions so that the equipment will not be operated above the MAWP/design pressure.
- d. The Principal approves the application.
- e. The application is documented preferably in the Safeguarding Memorandum.
- f. Where ASME Section VIII is applicable additional documentation may be required. If the overpressure is caused by closure of a manual valve (covered by ASME Section VIII Appendix M) then no additional documentation is needed. However, if the overpressure is caused by something else (e.g., closure of a control valve) then the documentation requirements in ASME Section VIII Section UG-140 shall be applied.

2.11 ROLE OF CHECK VALVES (NON RETURN VALVES) IN OVERPRESSURE PROTECTION**2.11.1 General**

5.c. Where there are dual Class 1 check valves, calculate the backflow assuming a check valve flow area of 10 % for new facilities.

Replace with:

Where there are dual Class 1 check valves, calculate the backflow assuming a check valve flow area of 1 % for existing facilities.