

DEP SPECIFICATION

RELIEF DEVICES – SELECTION, SIZING AND SPECIFICATION

DEP 80.36.00.30-Gen.

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DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the selection, sizing, and specification of relief devices.

This DEP does not cover pressure surge valves, these valves protect liquid filled lines from overpressures caused by water hammer.

Hydraulics and other requirements of the relief and flare system not covered in this DEP are covered in DEP 80.45.10.10-Gen. and DEP 80.45.10.11-Gen.

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

This is a revision of the DEP of the same number dated September 2013; 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 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 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 capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

For pressure relief valve (PRV) terminology and related terms, refer to API Std 520 and DEP 80.45.10.10-Gen.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (12).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated September 2013. The following are the main, non-editorial changes.

Section/Clause	Change
1.1	Moved 2 clauses into new Section 2 titled General Requirements
2 through 12	Renumbered all sections after Section 2.
3.1	Removed selection from MESC SPE 77/135 and added selection from API 526
3.1	Removed requirement for 300# rating
3.2.1	Removed location of threaded inlet bushing connection considerations in threaded PRVs
3.2.2	Added considerations for when threaded tubing connections on pilot operated relief valves may be used
3.3.1	Added when to use heat tracing in LNG
3.3.2	Added clarification on variable superimposed BP vs. built-up BP
3.3.3	Added clarification on using dispersion analysis for venting from a balanced PRV bonnet
3.3.3	Added when to use a balanced piston relief valve
3.3.4, item 5	Added more information on why to use modulating pilots
3.3.4, item 7	Added pulse operating pressure issue considerations for pilot operated PRV
3.3.8	Added when to use a flow check valve, pressure gauge, and pressure alarm
3.3.13	Added section on Lube-oil relief systems
4.2.1	Added information on how to model a relief valve, in terms of isenthalpic and isentropic flash
4.2.2	Added information on when to assume ideal gas
4.2.3	Added preference for type of trim and manufacturer confirmation for compatibility
4.2.6	Added caution for using Manufacturer's coefficients
6.1	Added fire scenario as a potential event for soft goods
6.3.1	Removed gauge pressure qualification
6.3.2	Removed incorrect wording for the scenario for exceeding allowable accumulation

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swwww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (Other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

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.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. GENERAL REQUIREMENTS

1. The selection, sizing, and specification of relief devices shall be in accordance with the following standards, as clarified, amended or supplemented by this DEP:
 - a. ASME Section 1; ASME Sect. IV; ASME Sect. VIII, Divisions 1 or 2;
 - b. API Standard 520, Part I and Recommended Practice 520, Part II;
 - c. ISO 23251;
API Standard 521, 5th edition is identical to ISO 23251:2006
 - d. API Standard 526;
 - e. API Standard 527;
 - f. ISO 28300.
API Standard 2000, 6th edition is identical to ISO 28300:2008.
 - g. ISO 4126
 - h. Pressure Equipment Directive (97/23/EC)
2. Refer to DEP 80.45.10.10-Gen. and DEP 80.45.10.11-Gen. to determine the hydraulics and other requirements of the relief and flare system.

3. RELIEF DEVICE SELECTION

3.1 GENERAL CRITERIA

1. Flanged direct acting spring loaded pressure relief valves (PRVs) shall be selected from the standard sizes listed in API Std 526, unless otherwise approved by the Principal.
2. Outlet flange ratings for PRVs that relieve to a flare system or atmosphere shall be in accordance with API Std 526.
3. For PRVs that relieve to a pressurised system, the outlet flange shall be selected according to the maximum back pressure and temperature to which it is subjected.
4. Material selection for PRV and Terv components shall be compatible with the associated piping class material selection.
5. The minimum inlet flange rating shall be equivalent to the flange rating of the protected equipment.
6. The minimum outlet flange rating shall be class 150, unless the specific project/facility has specified a higher minimum rating across the site.

3.2 MECHANICAL DESIGN

3.2.1 Inlet and outlet connection

1. The inlet and outlet connections including flange face finish shall be consistent with the pipe specifications for the systems to which they connect.

3.2.2 Threaded connections

1. Limitations to threaded connections shall conform to DEP 31.38.01.11-Gen. Where threaded inlet connections are allowed per this DEP, they shall not have threaded inlet bushing connections that can unscrew from the body during installation.

2. The pilot operated relief valve tubing connections are allowed to be threaded, provided the following conditions are met:
 - a. A thread sealant/lubricant shall be used on the pipe threads of all connections to ensure the threads are vapour tight.

Some examples of products include "Loctite PST 567" and Jet-Lube TFW with temperature limits up to 200 °C (400 °F) and 260 °C (500 °F), respectively.
 - b. If the temperature exceeds 260 °C (500 °F), a high temperature nickel-based lubricant, such as Nickel-EZE, shall be used.
 - c. PTFE Tape and thread lubricants containing molybdenum disulfide shall not be used.

3.2.3 Pressure relief device design temperature

1. The design temperature SHALL [PS] be determined by the inlet and outlet temperatures that result from extreme operating and relieving conditions.
2. The temperature reduction resulting from possible internal valve leakage (e.g., flashing of liquid) shall be included in the determination of the design temperature.

For the definition of design conditions reference is made to DEP 01.00.01.30-Gen.

Elevated temperature arising from an external fire is not a basis for the design temperature or material selection.

3. To determine the minimum temperature at the throat of the relief device, an isentropic flash calculation to the choking pressure should be carried out.

3.3 SPECIFIC SELECTION CRITERIA

3.3.1 General

1. PRVs shall normally be of the spring-loaded type. For special applications, pilot-operated PRVs, buckling pin valves, and where permitted by local regulations, assisted PRVs may be employed.
2. Capacities established and guaranteed by the relief device Manufacturer for the applicable service conditions shall be used for selecting the relief device.
3. Relief valves in dry service, specifically LNG, that contain any liquids created by the Joule-Thompson effect will evaporate. Relief valves in wet gas service, however, shall have heat tracing to prevent water condensation and accumulation from freezing.

3.3.2 Conventional spring-loaded pressure relief valves

1. If the built-up back pressure plus the variable superimposed back pressure does not exceed the allowable overpressure, PRVs shall be conventional safety relief valves unless considerations other than back pressure justify the use of a different type of relief device.
2. Variable superimposed back pressure is considered as part of the built-up back pressure since it should not be included in the cold differential test pressure (CDTP) of the relief valve.
3. Constant superimposed back pressure should be included into the CDTP and is therefore not included in allowable overpressure considerations.
4. The set pressure and CDTP may require adjustment for this backpressure (see API Std 520 Part 1, Paragraph 5.3.2). Conventional spring-loaded PRVs connected to a closed discharge system shall always have a closed bonnet.