

DEP SPECIFICATION

EQUIPMENT IN LPG INSTALLATIONS

DEP 30.06.10.11-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 main equipments (pumps, compressors, strainers, valves, flexible loading arms, quality measuring instruments and odorizing facilities) available for use in LPG installations. LPG includes commercial propane, commercial butane and mixtures thereof.

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 January 2010; 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 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 Abbreviations

Term	Definition
ESD	Emergency Shut Down
LPG	Liquefied Petroleum Gas

NPSH _A	Net Positive Suction Head (Available)
PTFE	Polytetrafluoroethylene
THT	Tetrahydrothiophene
QMI	Quality Measuring Instruments
RVP	Reid Vapour Pressure

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 (10).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated January 2010. The following are the main, non-editorial changes.

Old section	New section	Change	DEP Part
8.2	2.2 – DEP RM	'Other odorising agents that satisfy national requirements' added	DEP RM
8.2	2.2 – DEP RM	'In Japan, two products known under their trade names of AL-741 and CP-380 are generally used' was deleted	DEP RM
Table 1	Table 1	The properties of AL-741 and CP-380 were removed	DEP RM
Table 2	Table 2	The injection rates of AL-741 and CP-380 were removed	DEP RM
		'SHALL PS' were critically reviewed after being ram scored and changes were carried out as needed	DEP SPECIFICATION

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.

2. PUMPS

2.1 GENERAL

Pumps shall be selected in accordance with DEP 31.29.02.11-Gen.

Considerations for pump type selection are e.g.:

- the power consumption;
- operating data (i.e. required flow rate and differential head);
- NPSH available of the pumping system;
- the required reliability of the overall installation.

2.2 PUMP SELECTION

Centrifugal pumps are the preferred type for LPG handling. However, certain conditions may prevail in which centrifugal pumps are not the optimum solution, in which case a positive displacement pump may be selected. For details, refer to DEP 31.29.02.11-Gen., DEP 31.29.02.30-Gen., DEP 31.29.06.30-Gen. and DEP 31.29.12.30-Gen.

2.3 NET POSITIVE SUCTION HEAD (NPSH)

An important consideration in the selection of the pump is the available NPSH margin (i.e. difference between NPSH available and NPSH required). NPSH margins SHALL [PS] meet the criteria of DEP 31.29.02.30-Gen.

2.4 DIFFERENTIAL HEAD

When calculating the differential head required, the following shall be taken into account:

- Pressure decrease in the supply vessel because of vaporisation of liquid to replace the product removed,
- Pressure increase in the receiving vessel, due to condensation of vapour as the liquid level rises.

NOTE: The pressure in the supply/receiving vessel is affected by the presence or absence of a vapour return line.

Figure 1 illustrates differential head and $NPSH_A$.

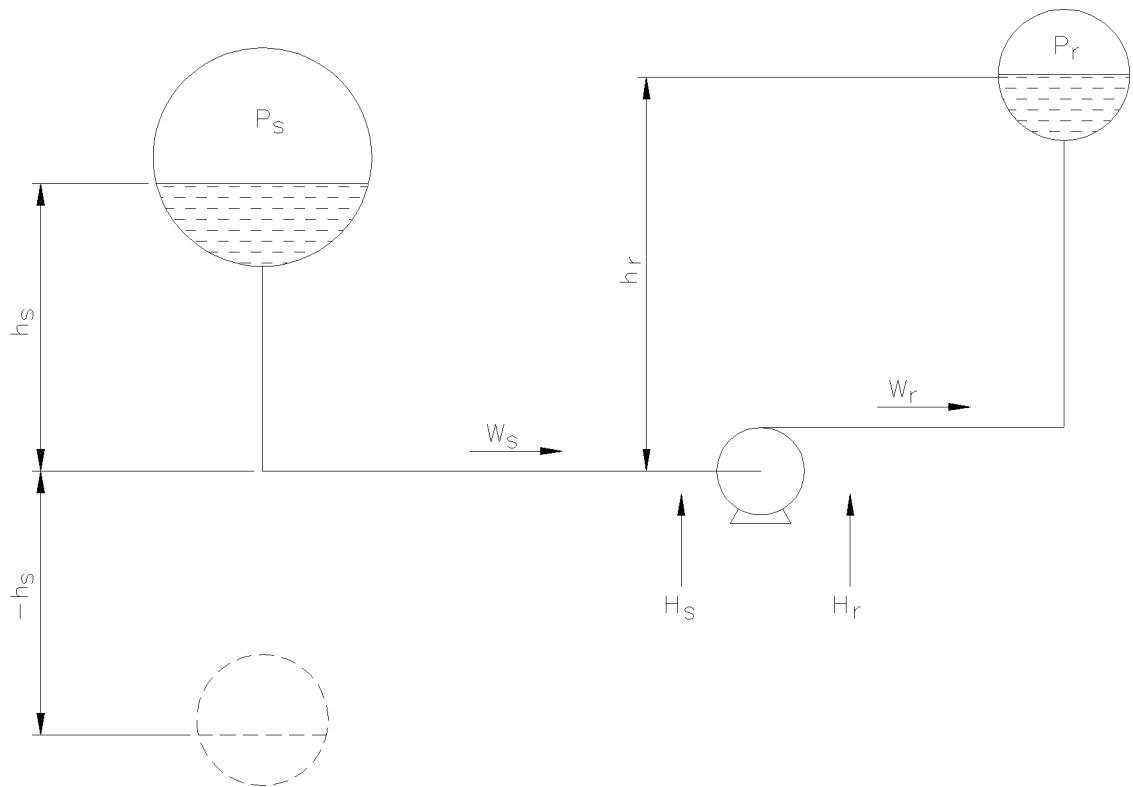


Figure 1 Diagrammatic illustration of differential head and NPSH_A

P _s	Pressure in supply vessel
h _s	Height of liquid level in supply vessel above/below pump centre in line (minimum)
w _s	Total head loss in suction line between supply vessel and pump
$H_s = P_s + h_s - w_s$	Total minimum suction head
P _r	Pressure in receiving vessel
h _r	Height of liquid level in receiving vessel above/below pump centre line (maximum)
w _r	Total head loss in discharge line between pump and receiving vessel
$H_r = P_r + h_r + w_r$	Total maximum discharge head
$H = H_r - H_s$	Differential head
H_s - product vapour pressure = Net Positive Suction Head available (NPSH _A) at the pump inlet.	

2.5 INSTALLATION REQUIREMENTS

2.5.1 General

Refer to DEP 31.29.00.10-Gen

Pumps SHALL [PS] be located as close as practicable to the supply vessel in accordance with DEP 30.06.10.12-Gen. Pumps shall be located so that in the event of leakage from mechanical seals, connections, etc., potential flame impingement on vessels and piping SHALL [PS] be prevented.

Pumps shall be located as close as possible to the supply vessel to:

- a) Minimise friction in the pump suction system, thereby having a positive effect on the $NPSH_A$;
- b) Minimise heat transfer into the suction piping system, e.g. from solar heat. Heat transfer can be reduced by, for example, painting the pipes in a light, heat-reflecting colour, fitting sun shades or applying insulation. If sun shades are used, they should not obstruct fire fighting. Insulation should also be effective in protecting piping against flame impingement.

2.5.2 Piping

Piping SHALL [PS] be in accordance with DEP 31.38.01.11-Gen., Section 4.2.

2.5.2.1 Suction lines

Suction lines shall be provided with suction strainers (see Section 4) to remove extraneous solid material. They shall slope continuously downward from vessel outlet to pump inlet and a straight length of pipe (as defined by the pump Manufacturer) shall be fitted immediately upstream of the pump suction flange.

2.5.2.2 Isolation valves

All pumps and strainers SHALL [PS] be provided with isolation valves to enable them to be taken out of service for maintenance.

2.5.2.3 Bypass lines/'No Flow' cut-off

If a pump is operated below its minimum continuous stable flow, or in a worst condition, against a closed discharge valve, the temperature of the liquid will rise, possibly causing vaporisation of the product and damage to the pump. To avoid this, a bypass line should be provided to return the liquid to the supply vessel.

For non-centrifugal pumps, the bypass lines shall be fitted with either a pressure differential valve, set to lift at, or just below, the pump's maximum working pressure, or with a low-flow controller.

For centrifugal pumps, the bypass line and valve shall be sized for the minimum continuous stable thermal flow as specified by the vendor.

For positive displacement pumps, the bypass system shall accommodate 100% of the pump's design flow rate.

For pumps with 'direct on-line' starting, overheating of the liquid shall be avoided by the provision of a 'no flow' switch in the discharge line. A suitable time delay before the switch operates should be included.

2.5.2.4 Discharge lines

Centrifugal pumps shall be fitted with a non-return valve close to the discharge flange to prevent 'back-flow' and consequent reverse rotation.

2.5.3 Vent valves

Pumps shall have a vent valve at the highest point and should also have one at the seal chamber, where applicable, for venting of accumulated vapour.

For vertical pumps, special venting arrangements shall be provided to allow for proper venting and priming of the pumps and mechanical seal chamber, to make sure that the pump is liquid full prior start-up.

In marketing depots/consumer installations small pumps need not have a provision for venting seals. Where venting is applied, the vented vapour should be returned back to the suction vessel.

Drain points on LPG pumps should be permanently blanked without valves.

2.5.4 Mechanical seals

Refer to DEP 31.29.02.30-Gen. and DEP 31.29.00.33-Gen.