

DEP SPECIFICATION

ONSHORE PRODUCTION INSTALLATIONS - BASIC PROCESS SAFETY SYSTEMS

DEP 39.01.00.10-Gen.

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DESIGN AND ENGINEERING PRACTICE

DEM1



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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.

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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for basic process safety systems for onshore, upstream oil and gas production installations. It covers the controls necessary to prevent or mitigate the effects of undesirable events that pose a process safety threat to surface facilities.

The application of this DEP supports:

- a. ensuring consistency between facilities and structured risk controls;
- b. verifying safeguarding of the entire system through application of this DEP and the Hazard and Operability (HAZOP) process (DEP 80.00.00.15–Gen.);
- c. identifying safety systems that are needed and supplying an approved rationale where safeguards are not necessary; and
- d. providing a design standard that identifies required safeguards.

This DEP does not specify the required controls for the following types of upstream systems:

- Equipment containing light liquid hydrocarbons (i.e. butane or lighter); and
- Sour gas production or processing.

It does not apply to following types of upstream systems:

- Natural gas processing plants; and
- LNG facilities.

This DEP is modelled after API RP 14C (applicable to offshore production installations). It uses the same approach of identifying the common controls that may be necessary while clearly defining the reasons some controls would not be necessary. The Safety Analysis Checklists (SACs) are provided in the appendices of this DEP for each component type.

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 February 2015; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorized 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 upstream onshore oil and gas production, including associated gathering, separation, and compression systems. 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 authorized to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The capitalized term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Maximum Allowable Working Pressure (MAWP)	Maximum pressure allowed in a piece of equipment, e.g., vessel or pipe, within its design temperature range.
Natural Gas Processing Plant	Natural gas processing plant (gas plant) means any processing site engaged in the extraction of natural gas liquids from field gas, fractionation of mixed natural gas liquids to natural gas products, or both, classified as North American Industrial Classification System (NAICS) code 211112 (previously Standard Industrial Classification (SIC) code 1321).
Overpressure	Pressure increase over the set pressure of a pressure relief device during discharge and is usually expressed as a percentage of the set pressure.
Process Engineering Flow Scheme (PEFS)	Pictorial representation of a process or utility unit which shows all the equipment, including installed spares and the associated piping and piping components, instrumentation, heat tracing and insulation. NOTE: These are also known as Piping and Instrumentation Diagrams (P&ID).
Pipeline Pumps	Pumps transferring fluid to a regulated pipeline or to a facility operated by another entity.
Relief Pressure	Set pressure plus the overpressure. Also known as the relieving pressure.
Sour gas	Very toxic acute H ₂ S per DEP 01.00.01.30-Gen for human health / environment protection and DEP 30.10.02.11

Term	Definition
Shut-In Tubing/Casing Pressure (SITP/SICP)	Equilibrated pressure in the tubing/casing measured when the entire gas or oil outflow has been shut off.
Very toxic (substances)	Refer to DEP 01.00.01.30-Gen. for additional details concerning the definitions of "very toxic – acute," "very toxic – chronic," and "very toxic - environment."

1.3.3 Abbreviations

Term	Definition
ASH	Analyzer Safety High
BDV	Blow Down Valve
BSL	Burner Safety Low
EPRV	Emergency Pressure Relief or Safety Valve
ESD	Emergency Shutdown System
FSV	Flow Safety Valve
LNG	Liquefied Natural Gas
LSH	Level Safety High
LSL	Level Safety Low
NSL	Sand Probe (Erosion Probe)
OSH	Toxic Gas Detector
PRV	Pressure Relief Valve
PSBR	Process Safety Basic Requirements which is part of Design and Engineering Manual 2 Requirements
PSH	Pressure Safety High
PSL	Pressure Safety Low
PSV	Pressure Safety Valve
PVSV	Pressure-Vacuum Relief or Safety Valve
SAC	Safety Analysis Checklist
SAT	Safety Analysis Table
SDV	Shut Down Valve
SSV	Surface Safety Valve

Term	Definition
TA	Technical Authority, can be further described as level 0,1,2,3
TSE	Temperature Safety Element
TSH	Temperature Safety High
TSL	Temperature Safety Low
USH	Flame Detector (Ultraviolet/Infrared)

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 (13).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2015. The following are the main, non-editorial changes.

Section/Clause	Change
General	For each section, changed heading title from "Description" to "General"
General	Deleted "recommended" from "recommended safety device"
Entire document	Added "vapour breakthrough" to instances of "gas blowby".
2	Added section 2.1 for definition of remote and unmanned site
Table 2.1	Changed Instrument Society of America to International Society of Automation
3.3	Rewording section for clarity. Reworded SHALL [PS] statement for clarity.
4.1	Minor text changes for clarification
Figure 4.1	Combined old Figures 4.1 and 4.2 for simplification Removed redundant safety components Added "cushion tees" to Note 1.
Figure 4.2	Removed redundant safety components
Section 4.4.2	Removed reference to FSV-2
Section 5	Eliminated section "Wellheads and Flowline Injection Lines"
Section 5	Changed section title from "Manifolds" to "Headers" and separate into two distinct equipment types: manifold and discharge header
5.4.1	Added statement of PSV being routed to a safe location and performing dispersion modelling if required
8.1	Eliminated "Ten basic rules in safe combustion"
Figures 8.1, 8.2, 8.3, 8.4	Addition of PSL on the pilot gas line
9.1	Added definition of "pipeline pump"

Section/Clause	Change
Figure 9.1	Eliminated SDV upstream of pump and TSE.
11.1	Reference to ISO 16812:2007 eliminated.
12	Added Combustor Section
Appendix A	Eliminated notes provided in the SDV SAC reference Eliminated second PSL Added SAC reference for PSL - External release hazards have been reviewed and adequate mitigation measures are in place. Added note to PSH - PSH to be located upstream of the spec break to detect credible high pressure scenarios caused by hydrates. Added SAC reference for PSH - Flow line segment has a maximum allowable working pressure greater than the maximum shut in pressure and is protected by a PSH on a downstream flow line segment. Modified SAC references for PSV. Deleted TSH in the SAC Table.
Appendix B	Changed FSV SAC reference to "no hazardous consequences have been identified associated with cross-flow between casing and tubing". Eliminated PSH SAC reference regarding well requiring artificial lift. Eliminated FSV-2.
Appendix C	Eliminated Wellhead and Flowline Injection Lines Safety Analysis Checklist. Eliminated Incoming Shut Down Valve in the Manifold SAC Table. Added the following SAC references for PSV - "Header is protected by a downstream PSV that cannot be isolated from the header" and "All input sources having a pressure greater than the inlet manifold MAWP are protected by an IPF set no higher than the inlet manifold MAWP".
Appendix D	Added the following SAC reference for Outlet Shutdown Valve - "FSV-2 installed, the fluid is not combustible or flammable and suitable isolation valve is present"
Appendix E	Added the following SAC reference for PSL: "External release hazards have been reviewed and adequate mitigation measures are in place". Eliminated LSH SAC Reference - "vessel is a small trap which is manually drained and is located in a normally dry system." Eliminated TSH in SAC Table. Reworded Liquid outlet SDV SAC references.

Section/Clause	Change
Appendix F	Added note to PVSV and EPRV: "PVSV and EPRV must be evaluated independently; PVSV must be able to handle maximum relief rates without taking credit from EPRV". Added SAC Reference to LSL: "The heating element is an indirect heater (e.g. glycol heater) and the maximum temperature from the indirect heater does not create a hazardous condition". Added note for blanket gas requirement: "blanket gas is required if the tank vapour space is connected to a combustor or flare".
Appendix G	Added SAC reference for fusible link - "fired heater is located at a Remote and Unmanned Site". Eliminated SAC reference for stack spark arrestor: "the fluid being heated is not flammable and the heater fuel is natural gas". Eliminated SAC reference for LSL-2: "alternate device(s) provide reliable detection of low level conditions, and the vessel section does not have an immersed heating element subject to excess temperature". Elimination of guarding / insulation in the SAC Table. Added SAC references to include the possibility of forced draft heaters.
Appendix H	Added SAC reference for fusible link - "fired heater is located at a Remote and Unmanned Site". Eliminated SAC reference for stack spark arrestor: "the fluid being heated is not flammable and the heater fuel is natural gas". Elimination of guarding / insulation in the SAC Table. Added SAC references to include the possibility of forced draft heaters.
Appendix I	Added SAC reference for fusible link - "fired heater is located at a Remote and Unmanned Site". Eliminated SAC reference for stack spark arrestor: "the fluid being heated is not flammable and the heater fuel is natural gas". Added SAC Reference for TSH-1: "Component is an indirect glycol/water heater in atmospheric service and is protected by an LSL". Added SAC Reference for LSH-1: "The process fluid being heated is not flammable." Elimination of guarding / insulation in the SAC Table. Added SAC references to include the possibility of forced draft heaters.
Appendix J	Added SAC reference for fusible link - "fired heater is located at a Remote and Unmanned Site". Eliminated SAC reference for stack spark arrestor: "the fluid being heated is not flammable and the heater fuel is natural gas". Added SAC reference for blanket gas: "the tank is located on a remote and unmanned site". Elimination of guarding / insulation in the SAC Table. Added SAC references to include the possibility of forced draft heaters.

Section/Clause	Change
Appendix K	Added SAC Reference for PSH (other pumps): "Downstream equipment to which the pump discharges is protected by a PSH". Added SAC Reference for PSL (other pumps): "pump is manually operated and continually attended". Added SAC Reference for PSL (other pumps): "external release hazards have been reviewed and adequate mitigation measures are in place". Eliminated SAC reference for PSV (other pumps): "pump has internal pressure relief capability". Added SAC Reference for FSV: "no credible backflow scenarios identified and documented in HAZOP".
Appendix L	Added SAC Reference for BDV: "compressor is not located in a building and risks associated with not automatically blowing down the compressor during an upset are acceptable". Added SAC Reference for SDV inlet: "SDVs located upstream within the facility limit that would isolate all flow to the compressor." Eliminated SAC Reference for SDV discharge: "FSV installed on rental equipment". Added SAC reference for SDV discharge: "Risks associated with backflow to the compressor during a release scenario have been reviewed and adequate mitigation measures in place". Added FSV to the SAC Table. Added SAC reference for OSH: "Toxic gas is not present".
Appendix M	Added SAC reference for PSL: "external release hazards have been reviewed and adequate mitigation measures are in place."
Appendix N	New Appendix

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. DEFINITIONS

2.1 REMOTE AND UNMANNED SITE DEFINITION

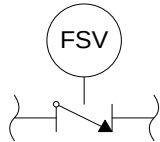
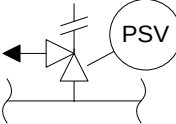
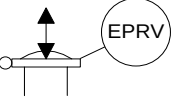
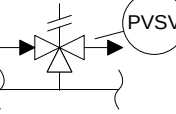
1. A site is defined as REMOTE when all of the following conditions are met:
 - a. Within a 450 meter (1,500 feet) radius of the site there is not;
 - o 10 or more occupied buildings (per DEP 80.00.10.11-GEN) or permanent campsites of any type, (e.g., residences, recreational vehicle parking spots);
 - o any hospitals;
 - o any multi-family dwellings;
 - o any churches;
 - o any schools;
 - o any sports parks;
 - o any places of business;
 - o any multi-lane roads, meaning two lanes or more in each direction.
 - b. There are no habitable buildings or public roads located such that, in the event of a release, public receptors would be exposed to hydrocarbons >20% Lower Flammability Limit (LFL) or very toxic - acute >50% Occupational Exposure Limit (OEL).
2. A site is defined as UNMANNED when the site does not have employees regularly assigned to work at the location on a daily shift basis.

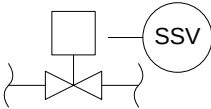
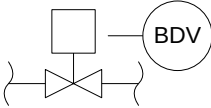
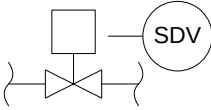
If the site is operated, maintained, or serviced by employees who visit the site only periodically to check its operation and to perform necessary operating or maintenance tasks, then this is not considered a regularly assigned shift basis.
3. A site is defined as REMOTE AND UNMANNED when the conditions in both (2.1, Item 1) and (2.1) above are met.

2.2 SAFETY DEVICE SYMBOLS AND IDENTIFICATION

1. Table 2.1 specifies the symbols and abbreviations used within this DEP.
 - a. The functional identification includes one first letter covering the measured or initiating variable and one or more succeeding letters covering the function of the device.
 - b. The term "safety" (S) applies to emergency protective elements, and is used as the second letter of sensing and self-acting devices.

Table 2.1 Symbol Identification

SENSING AND SELF-ACTING DEVICE				
Variable	Safety Device Designation		Symbol	
	Common	International Society of Automation (ISA)	Single Device	Combination Device
Backflow	Check Valve	Flow Safety Valve		
Burner Flame	Burner Flame Detector	Burner Safety Low		
Level	High Level Sensor	Level Safety High		
	Low Level Sensor	Level Safety Low		
Pressure	High Pressure Sensor	Pressure Safety High		
	Low Pressure Sensor	Pressure Safety Low		
	Pressure Relief or Safety Valve	Pressure Safety Valve		
	Emergency Pressure Relief Vent	Pressure Safety Valve		
Pressure or Vacuum	Pressure-Vacuum Relief or Safety Valve	Pressure Safety Valve		
	Vent	None		

SENSING AND SELF-ACTING DEVICE				
Variable	Safety Device Designation		Symbol	
	Common	International Society of Automation (ISA)	Single Device	Combination Device
Temperature	High Temperature Sensor	Temperature Safety High		
	Low Temperature Sensor	Temperature Safety Low		
Flame	Flame or Stack spark arrestor	None		
Fire	Flame Detector (Ultraviolet/Infrared)			
	Heat Detector (Thermal)	Temperature Safety High		
	Fusible Material	Temperature Safety Element		
Combustible Gas Concentration	Combustible Gas Detector	Analyser Safety High		
Toxic Gas Concentration	Toxic Gas Detector			
Sand	Sand Probe (Erosion Probe)			
ACTUATED VALVES				
Service		Common Symbols		
Surface Safety Valve				
Blow Down Valve				
All Other Shut Down Valves				

Note: Since this DEP is modelled after API RP 14C, the symbols and nomenclature from that document have been retained.

3. GENERAL

3.1 BACKGROUND

This DEP should be applied during the development of the process engineering flow scheme (PEFS), which typically takes place in the DEFINE phase of a project

The purpose of a safety system is to protect personnel, the environment, and the facility from threats to safety caused by the production process. The purpose of a safety analysis is to identify undesirable events that might pose a threat to safety, and define reliable protective measures that will prevent such events or mitigate their effects if they occur. Potential threats to safety are identified through proven systems analysis techniques that have been adapted to the production process. Recommended protective measures are common industry practices proven through experience. The systems analysis and protective measures have been combined into a "safety analysis" for production installations.

The Safety Analysis Checklist (SAC) lists the recommended safety devices to protect each process component, if it were viewed as an individual unit with the worst probable input and output conditions. Individual SACs are provided in the appendices of this DEP.

Listed under each recommended device are certain acceptable conditions that eliminate the need for that particular device when the component is viewed in relation to other process components. This action can be justified because safety devices on other components will provide the same protection, or because in a specific configuration, the abnormal condition that the device detects will not lead to a threat to safety.

3.2 SAFETY ANALYSIS

1. For each process component, a safety analysis shall be completed to identify required protective measures:
 - a. requirements for each basic process component at surface producing operating facilities are specified in section (4) through section (12);
 - b. each component analysis includes the following;
 - i. a description of each process component;
 - ii. a typical drawing (PEFS) of each process component showing safety devices that shall be considered based on individual component analysis;
 - iii. a Safety Analysis Table (SAT) for each process component analysing the undesirable events that could affect the component;
 - iv. an outline of the safety device locations;
 - v. a reference to the appropriate appendices containing the SACs for each process component listing safety devices and showing conditions under which particular safety devices may be excluded.

3.3 APPLICATION OF THE SAFETY ANALYSIS CHECKLIST

1. for each process component within the facility, safety devices designed to protect the process component shall be identified:
 - a. the safety devices shall be selected from the choices specified in the SACs contained within this DEP ((APPENDIX A) through (APPENDIX N));
 - b. for each section of a SAC, one item shall be selected.
2. Except for the types excluded in this clause, the selected safety device or acceptable alternative identified in the SAC SHALL [PS] be incorporated into the design:
 - a. the following types are excluded;
 - i. FSV on the wellhead;
 - ii. stuffing box level switch on the beam pumped well;
 - iii. erosion probe (sand probe) on the wellhead;
 - iv. PSL (on the wellhead, pressure vessel, pump, heat exchanger).
3. If a process component is not covered by a SAC in this DEP, a SAC shall be developed and subject to approval by the discipline TA.
4. The safety devices should be incorporated into the design at the locations provided in this DEP.
5. The completed checklists and approved derogations shall be maintained as part of the facility/project record.

4. WELLHEADS AND FLOWLINES

4.1 GENERAL

Wellheads provide surface control (manual and automatic) and containment of well fluids and downhole access for well servicing. Flowlines transport hydrocarbons from the wellhead to the first downstream process component.

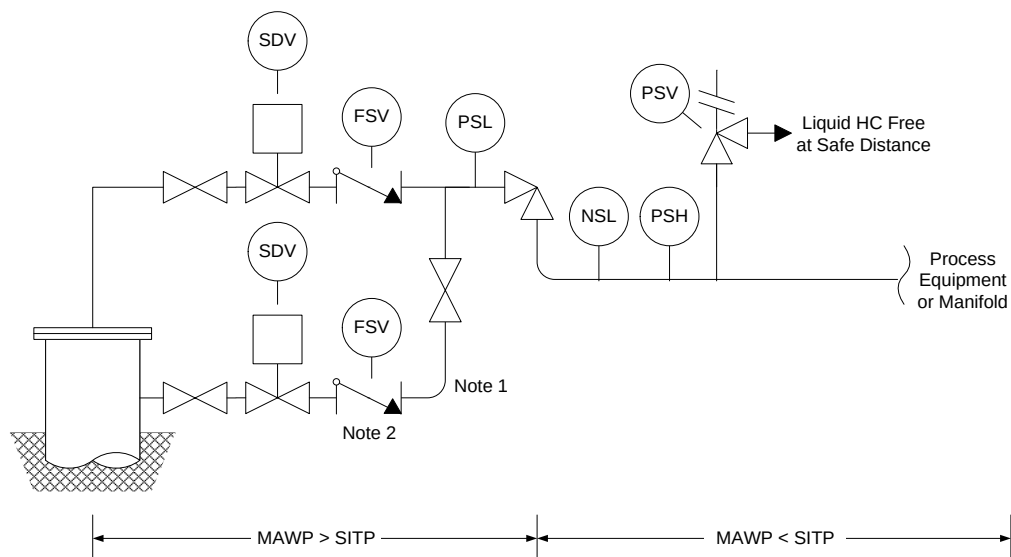
For analysis purposes and assignment of safety devices, flowlines are divided into flowline segments. A flowline segment is any portion of a flowline that has an assigned operating pressure different from other portions of the same flowline. These flowline segments can be classified as either initial (beginning at wellhead) or final (terminating at another process component) segment. Thus, a flowline that experiences a reduction in operating pressure due to some inline pressure reducing device, such as a choke, and has two different assigned operating pressures separated with specification breaks ("spec breaks"), will have an initial and final segment. A flowline that experiences no reduction in operating pressure due to a pressure reducing device will have only one segment (the initial and final flowline segments will be the same).

Safety devices for typical wellheads and flowlines and their location are shown in Figure 4.1 and Figure 4.2.

4.2 FIGURES

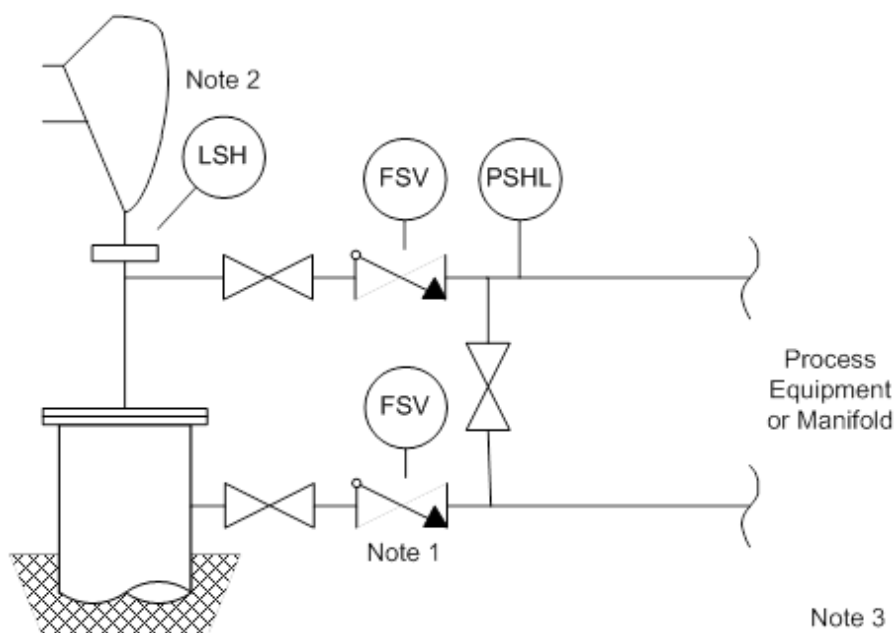
Legend:

- SITP – Shut In Tubing Pressure
- MAWP – Maximum Allowable Working Pressure

Figure 4.1 Safety devices – Flowing well

Notes: 1. Long radius elbows or cushion tees are recommended for bends on the flowlines for flowing wells per Materials.

2. FSV recommended to prevent cross circulation.

Figure 4.2 Safety devices – Beam pumped well

Notes: 1. FSV recommended to prevent cross circulation.

2. The stuffing box level switch is a secondary containment device that catches liquid from a seal leak and shuts down the pump jack when a level is detected.

3. The safety system remains the same whether gas is routed within a dedicated line or is mixed with liquid.

4.3 SAFETY ANALYSIS TABLE (SAT)

Table 4.1 SAT for flowline segment

Undesirable Event	Cause	Detectable Abnormal Condition at Component
Overpressure	- Blocked or restricted line - Choke plugged - Hydrate plug - Upstream flow control failure - Changing well conditions - Closed outlet valve	High Pressure
Loss of Containment	- Deterioration - Erosion - Corrosion - Impact damage - Vibration	Low Pressure
Erosion	Abrasives (sand, proppant, etc.)	Low Pressure
Over Temperature	- Operating temperature > Max Operating temperature - Well fluid higher than design - Well cooler abnormal operation	High Temperature
Stuffing Box Leak	Spill of liquid hydrocarbon	High Level

4.4 SAFETY DEVICE LOCATION

4.4.1 Pressure safety devices (PSH, PSL and PSV)

1. PSHs and PSLs shall be located to protect them from damage due to vibration, shock, and incidental damage:
 - a. the flowline PSH shall be located in the flowline such that if hydrates were to occur in a flowline section where the MAWP is less than the SITP of the well, the PSH would detect the pressure build-up;
 - b. the sensing point shall be located on top of a horizontal run or in a vertical run.
2. The PSV shall be located upstream of the first blocking device in the flowline segment and not be set higher than the rated working pressure of the segment:
 - a. if the PSV is not routed to a flare, the PSV outlet shall be located far enough from the wellhead to allow access to the master valves;
 - b. if the PSV is routed to atmosphere, refer to the requirements of DEP 80.45.10.10-Gen;
 - c. refer to Section 5.8.1 of Part IV of DEP 80.45.10.10-Gen. for the requirements for any PSV that could release liquid hydrocarbon above its flash point.

These requirements prevent the release of liquid hydrocarbons to the atmosphere, per PSBR 6.

4.4.2 Flow safety device (FSV)

1. FSVs shall be located downstream of the wellhead SDVs and upstream of where the tubing and casing production tie together.

4.4.3 Shutdown valve (SDV)

1. The SDV shall be located on the wellhead as the second valve in the flow stream from the wellbore.
2. The SDV shall be actuated by the flowline pressure sensors, emergency shutdown (ESD) system, fire loop system, erosion probe (sand probe), and sensors on downstream process components.

For cold climates where freezing of instrument gas is a concern, implementation of a hydraulic system may be necessary.

4.4.4 Sand probe (NSL)

1. An erosion probe, commonly referred to as a sand probe, shall be installed in the highest velocity area of the flowline, per the Materials and Integrity TA.

4.4.5 Temperature safety devices (TSH)

1. A TSH shall be installed in the flowline where the Maximum Operating Temperature (MOT) could exceed.
2. If a well cooler is installed to maintain flow temperature less than the MOT, a TSH shall be installed immediately downstream of the cooler.

4.5 SAFETY ANALYSIS CHECKLIST (SAC)

The SACs associated with wellheads and flowlines are at the following locations:

- a. (APPENDIX A) Flowing Well;
- b. (APPENDIX B) Beam Pumped Well.

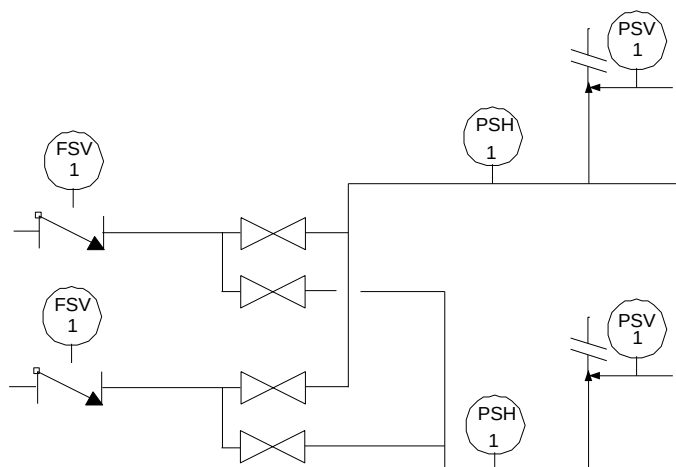
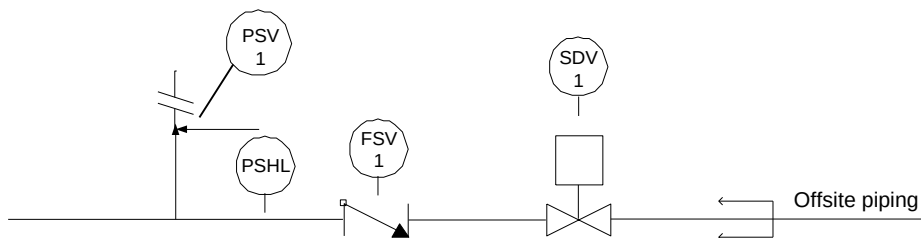
5. HEADERS**5.1 GENERAL**

Headers receive production from two or more flow streams and distribute production to the required process systems.

In this section the following terms are used for brevity:

<i>Manifold</i>	<i>Piping that combines or has the potential to combine feeds from multiple sources and directs them to processing equipment.</i>
<i>Discharge header</i>	<i>Piping fed from processing equipment into offsite piping.</i>

5.2 FIGURES

Figure 5.1 Safety devices – Manifolds**Figure 5.2 Safety devices – Discharge Header**

5.3 SAFETY ANALYSIS TABLE

Table 5.1 SAT for Manifolds

Undesirable Event	Cause	Detectable Abnormal Condition at Component
Overpressure	- Blocked or restricted line - Thermal expansion - Inflow exceeds outflow	High Pressure
Leak	- Deterioration - Erosion - Corrosion - Impact damage - Vibration	Low Pressure

5.4 SAFETY DEVICE LOCATION

5.4.1 Pressure safety devices (PSH, PSL and PSV)

1. PSHs and PSLs shall be located downstream of any facility input source and upstream of an outlet manifold's FSV.
2. If a PSV is required, it shall be located downstream of all input sources and installed so that it cannot be isolated from inlet sources:
 - a. refer to Section 5.8.1 of Part IV of DEP 80.45.10.10-Gen. for the requirements for any PSV that could release liquid hydrocarbon above its flash point;
These requirements prevent the release of liquid hydrocarbons to the atmosphere, per PSBR 6
 - b. if liquid hydrocarbon above its flash point can be released, refer to DEP 80.45.10.10 for design requirements of the vent system;
 - c. the outlet of the PSV vent shall be located in a safe location – dispersion modelling might be required.

5.4.2 Flow safety device (FSV)

1. The inlet manifold to a facility should have an FSV located immediately upstream of the process equipment.
2. The FSV on a departing outlet manifold should be located as far downstream as is practical, but upstream of a block valve.

Continued flow from offsite piping can prolong an abnormal situation within the facility by allowing additional hydrocarbon to enter a facility either from continued delivery or backflow.

5.4.3 Shutdown devices (SDV)

1. All SDVs shall be actuated by the facility's emergency shutdown (ESD) system:
 - a. manifold SDVs should be located as far away from process equipment as practical to maximize the separation distance from potential damage.
2. The SDV on an outlet manifold shall be actuated by the offsite piping's PSHs and PSLs and the facility's ESD system.

5.5 SAFETY ANALYSIS CHECKLIST (SAC)

The SACs associated with manifolds are at the following locations:

- a. (Appendix C) Manifolds;
- b. (Appendix D) Discharge Header.