

DEP SPECIFICATION

DESIGN OF MULTIPLE-PIPE SLUG CATCHERS

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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 design of multiple-pipe slug catchers to be installed on land.

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 2016; 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 authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in designing multiple-pipe slug catchers, as part of pipeline systems related to oil and gas production and gas handling facilities. 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.

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

1.3.2 Specific definitions

Term	Definition
Bottle, primary	Pipe-type part of a multiple-pipe slug catcher for separation of the fluid and storage of the liquids, sloping down under small angle(s) from the lower end of the downcomer to the liquid outlet header (see Figure 2).
Bottle, secondary	Pipe-type part of a multiple-pipe slug catcher for storage of the liquids only, sloping up from the liquid outlet header, and ending at the gas risers (see Figure 2b).
Downcomer	Vertical or steeply sloping pipes of a multiple-pipe slug catcher between the inlet header and the primary bottles (see Figure 2).
Entrance length	The section of a primary bottle from the inlet to the gas risers.
Gas outlet header	Part of a multiple-pipe slug catcher on top of and connecting all risers for collection of the outgoing gas streams (see Figure 2).
Gas riser	Vertical pipe on top of a bottle, through which gas exits (see Figure 2).
Inlet header	Part of a multiple-pipe slug catcher in which the fluid is evenly distributed before entering the downcomers and in which fluid flow conditions are further improved for separation (see Figure 2). Also called distribution header.
Liquid outlet header	The lowest part of the multiple-pipe slug catcher, in which the liquid is collected for export. Also called liquid header.
Separator	Equipment for separating gas and liquids or various liquids of a mixed fluid.
Slug catcher, multiple-pipe type	Slug catcher, made of several parallel pipe bottles.
Slug catcher, parking-loop type	Slug catcher, where the separator is located apart from the storage part. The separator can be a vessel type and the storage part is made of pipeline material, which can be located away from the separator.
Slug catcher, vessel type	Slug catcher of limited dimensions and capacity, where separator and storage parts are combined within one or a combination of vessels.
Slug catcher	Part of a multiphase pipeline system for separation of the gas and liquid phases and for temporary storage of the liquids.
Splitter	Inlet of a multiple-pipe slug catcher in which the fluid stream is split up for even distribution over the inlet header (see Figure 2).

1.3.3 Symbols and abbreviations

1.3.3.1 Symbols

A	Cross-sectional area
C _w	Drag coefficient
d	Diameter of droplet, m (ft)
D	Diameter, m (ft)
H	Hold-up fraction
g	Gravity constant, m/s ² (ft/s ²)
L	Length, m (ft)
m	Number of risers per bottle
n	Number of bottles
V	Velocity, m/s (ft/s)
Vol	Volume, m ³ (ft ³)
Q	Gas flow rate, m ³ /s (gal/s)
Re	Reynolds number

Greek symbols

η	Dynamic viscosity, N.s/m ² (cP)
λ	Load factor, m/s (ft/s) or Volumetric fraction of liquid in two-phase flow
θ	Angle between bottle and horizontal plane
ρ	Density, kg/m ³ (lb/ft ³)

1.3.3.2 Subscripts

b	Bottle
buffer	Buffer
C	Constrictor
G	Gas
IH	Inlet header
int	Intercept
L	Liquid
goh	Gas outlet header
loh	Liquid outlet header
outlet	Outlet
pb	Primary bottle
pipeline	Pipeline
R1	First riser on a bottle (from inlet)
R2	Second riser on a bottle (from inlet)
riser	Riser
s	Settle
sb	Secondary bottle
SC	Slug catcher
SG	Superficial gas
SL	Superficial liquid