

DEP SPECIFICATION

DESIGN OF INJECTION POINTS, INJECTION SYSTEMS, AND CORROSIVE MIX POINTS FOR DOWNSTREAM PROCESSING APPLICATIONS

DEP 31.38.01.20-Gen.

February 2014

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP (applicable to process units in Downstream Manufacturing facilities) specifies requirements and gives recommendations for the design of injection points, injection systems, and corrosive mix points for new or modified facilities. It covers the general design of the types of injection points and corrosive mix points that are encountered in Downstream Manufacturing processes in refining, chemical, gasification, and other similar applications. Additionally, it covers the associated injection systems that are required in order to carry out these types of injections.

This DEP is limited to applications involving piping. Direct injection into equipment is not within the scope of this DEP; instead such injections are covered within DEPs specific to the applicable equipment. (e.g., DEP 31.22.05.12-Gen., DEP 31.27.00.25-Gen.).

Chemical injection systems for Upstream production facilities are addressed in DEP 31.01.10.10-Gen.

The following two DEPs have been written so that injection point design and injection system requirements for Upstream and Downstream applications are covered separately:

DEP 31.01.10.10-Gen.	Chemical injection systems for upstream production facilities
DEP 31.38.01.20-Gen.	Design of injection points, injection systems, and corrosive mix points for downstream processing applications

Additionally, the following DEP provides requirements for water injection in Downstream hydroprocessing units for corrosion control:

DEP 31.38.01.19-Gen.	Water injection in downstream hydroprocessing units for corrosion control
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The DEPs have been written so that general injection point requirements for a broad range of applications are included in this DEP and additional requirements concerning the specific application of water injection in hydroprocessing units for corrosion control are covered in DEP 31.38.01.19-Gen.

The following DEP specifies the requirements for the design and engineering of the steam injection facilities in thermal cracking units, for safeguarding their integrity and operation; therefore, this application is excluded from the scope of DEP 31.38.01.20-Gen:

DEP 10.02.51.11-Gen.	Steam injection systems for safeguarding thermal cracking units
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The following DEP specifies design requirements for corrosion prevention, control and surveillance for water injection systems associated with hydrocarbon recovery and disposal operations in upstream applications; therefore, this application is excluded from the scope of DEP 31.38.01.20-Gen:

DEP 31.01.10.11-Gen.	Corrosion prevention and control of water injection systems (EP)
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The following DEP specifies the design requirements of the surface facilities for waterflood projects where seawater is used as the water source, for both onshore and offshore application.; therefore, this application is excluded from the scope of DEP 31.38.01.20-Gen:

DEP 39.01.40.30-Gen.	Seawater Injection Facilities
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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 2013; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

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This DEP is intended for use in facilities related to oil refining, chemical processing, gasification, and other downstream manufacturing processes. 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

Term	Definition
Contacting	The degree to which intimate commingling of two streams within relatively small domains promotes rapid heat, mass, or momentum transport.
Cocurrent injection	An injection in which the injectant flow is introduced in the same direction as the flow of the receiving process stream.
Corrosive mix point	Any mix point in which the either the consequence of the mixing or the failure of the mixing to function as designed could result in accelerated degradation rates that may compromise process equipment integrity, including thermal fatigue and brittle fracture considerations. Corrosive mix points also include those where process conditions may result in short-duration, high-rate episodic degradation.

Term	Definition
Countercurrent injection	An injection in which the injectant flow is introduced in the opposite direction as the flow of the receiving process stream.
Crosscurrent injection	An injection in which the injectant flow is introduced in a direction perpendicular to the flow of the receiving process stream.
Injectant	A material that is being injected into a receiving process stream.
Injection point	A mix point in which relatively small quantities of materials are injected into process streams to control chemistry or other process variables. Examples of injection points are where process chemicals or water wash are introduced into process streams.
Injection system	The equipment, instrumentation, and infrastructure that is required in order to deliver the injectant to the injection point.
Mix point	Any point of potential or intentional contact within piping between two distinct process streams. Examples of mix points include compressor recycle tie-ins to the compressor suctions, the mixing of wet and dry hydrocarbon streams at branch connections, hydrogen mixing with hydrocarbon gas streams, and heat exchanger bypass tie-ins to the main header piping.
Mixing	The gross intermingling of the injectant with the receiving process stream.
Primary flow	Fully developed flow in a straight run of piping, after 5 to 10 pipe diameters downstream of a fitting for single phase flow. For multi-phase flow, the downstream distance will be greater.
Primary Zone	A minimum of 3 pipe diameters or 300 mm (12 in) upstream of the injection point nozzle (whichever is greater) or mix point tee and at least 10 pipe diameters or past the first change in flow direction downstream of the injection point / mix point (whichever is greater). For counter current injection points, the primary zone should be extended to a minimum of 2 m (6 ft) upstream of the injection point.
Receiving process stream	The stream that receives the injectant.
Quill	A tube, perforated pipe or similar element protruding some distance into a flowing process stream; a quill may or may not have a spray nozzle on the end.
Secondary Flow	The flow in the regions where fully developed flow is not established.
Secondary Zone	A minimum of 3 pipe diameters or 300 mm (12 in) upstream of the Primary Zone (whichever is greater) and 8 m (25 ft) or past the second flow directional change (whichever is greater) downstream of the Primary Zone.
Spray nozzle	Device for atomizing a liquid stream for dispersion into a gas or mixed phase stream. Nozzles may generate full cone or hollow cone sprays.
Static mixer	In-line, motionless mixing device which operates by splitting and recombining a stream multiple times in a short distance.
Wetting	An injection operation intended to cover or coat the surface of piping and/or downstream equipment.

1.3.3 Abbreviations

Term	Definition
DCS	distributed control system
G/G	injection of a gas into a gaseous receiving process stream.
G/L	injection of a gas into a liquid receiving process stream.
L/G	injection of a liquid into a gaseous receiving process stream.
L/L	injection of a liquid into a liquid receiving process stream.
P&ID	pipng and instrumentation diagram
PFD	process flow diagram
PFS	process flow scheme
PEFS	process engineering flow scheme
SME	Subject Matter Expert

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 (5).

1.5 SUMMARY OF MAIN CHANGES

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

Section/Clause	Change
General	This DEP is made DEM1 status with this revision.
Title	Added corrosive mix points to the title
1.1	Added corrosive mix points. Added additional DEP scope splits.
1.3.2	Added definitions for "Primary flow", "Primary Zone", "Secondary Flow", and "Secondary Zone"
1.3.3	Added abbreviations for DCS, PFD, P&ID, and DCS
2	Added corrosive mix points to the title of the section
2.1, Item 3	Original statement moved to Clause 4. Clause 3 replaced with new SHALL [PS] statement.
2.1, Item 4	Original statement moved to Clause 5 and updated to include Requisition/Data Sheet DEP 31.38.01.95-Gen. (USC units). Clause 4 replaced with previous Clause 3.
2.1, Item 5	Deleted original statement on basis of redundancy and replaced with previous Clause 4
2.1, Item 6	Reworded first sentence and changed to a SHALL [PS] statement
2.1, item 6	Added a figure, which due to its placement becomes Figure 1. All other existing figures were renumbered accordingly.
2.1, Item 7	Original item 7 deleted and all subsequent items renumbered accordingly
2.1, Item 8	Sentence changed to a SHALL [PS] statement

2.1, Clause 9	Reworded, and the first sentence changed to a SHALL [PS] statement
2.1, Item 10	New clause.
2.1, Item 11	New clause.
2.2 title	Title changed to "Process Assessment"
2.2.1.1, Item 1	Combined with 2.2.1.1 Item 2
2.2.1.1, Item 2	Original item combined with 2.2.1.1 Item 1. Subsequent clauses renumbered accordingly.
2.2.1.2, Item 1	Sentence changed to a SHALL [PS] statement
2.2.1.3, Item 1	Subclauses reworded and sentence changed to a SHALL [PS] statement
2.2.1.4, Item 1	Sentence changed to a SHALL [PS] statement
2.2.1.5, Item 1	Sentence changed to a SHALL [PS] statement and quantified temperature levels
2.2.2	Original Section 2.2.2 deleted and all subsequent sections were renumbered accordingly
2.2.3.3, Item 1	Linked to Section 2.2.1.5.
2.2.3.3, Item 2	Sentence changed to a SHALL [PS] statement
2.2.3.3, Item 3	Sentence changed to a SHALL [PS] statement
2.2.3.4, Item 1	Added item 1c
2.2.3.4, Item 2	First sentence changed to a SHALL [PS] statement
2.3.2.2	Reworded and rearranged subclauses.
2.3.3, Item 2	Split into two separate items, item 2 and item 3
2.3.5, Item 1	Sentence changed from "shall" to "should".
2.3.5, Item 1	Changed the diameter limit to reflect current accepted practices.
2.3.6	Reworded the clause
2.3.7	Added definition and illustration (Figure 8) of "secondary flow"
2.3.8.2.2, Item 1	Sentence changed to a SHALL [PS] statement
2.3.8.2.2, Item 2	Revised to reflect general acid and caustic injection into water-based receiving process streams.
2.3.8.2.2, Item 3	The original item 3 was incorporated into item 2. New item 3 added to reflect acid/caustic injection into non-miscible receiving process streams.
2.4.1, Item 2	Sentence changed to a SHALL [PS] statement
2.4.1, Item 3	Sentence changed from "should" to "shall". Added corrosive mix points.
2.4.2, Item 2	Second sentence changed to a SHALL [PS] statement
2.4.2, Item 3	First sentence changed to a SHALL [PS] statement
2.4.3, Item 1	First sentence changed to a SHALL [PS] statement
2.4.3, Item 2b	Sentence changed to a SHALL [PS] statement
2.4.3, Item 4	Deleted this item on the basis of redundancy

2.4.5, Item 1	First sentence changed to a SHALL [PS] statement
2.4.6, Item 3	First sentence changed to a SHALL [PS] statement
2.4.6, Item 4	Sentence changed to a SHALL [PS] statement
2.4.6, Item 5	First sentence changed to a SHALL [PS] statement
2.4.7, Item 2	Inserted new item as item 2 and renumbered all subsequent items accordingly
2.4.10, Item 1	First sentence changed to a SHALL [PS] statement. Quantified small bore sizes.
2.4.11, Item 3	Quantified the temperature limits
3.1, Item 2	Sentence changed to a SHALL [PS] statement. Added corrosive mix points
3.1, Item 3a	Added statement that PFS and PFD are identical
3.1, Item 3b	Added statement that PEFS and P&ID are identical
3.1, Item 4c	Updated to align with the definition of Primary Zone
3.1, Item 4d	Updated to align with the definition of Secondary Zone
3.1, Item 5	First sentence changed to a SHALL [PS] statement
3.3, Item 1	Sentence changed to a SHALL [PS] statement
3.3, Item 1g	Added item 1g to capture stagnant flow issues
3.4.2, Item 3	Added quantifiable limits
4.1, Item 1b	Added new item 1b and renumbered subsequent clauses accordingly. Second sentence is SHALL [PS] statement
4.1, Item 1e	Added further clarification
4.2, Item 1	First sentence changed to SHALL [PS] statements
4.2, Item 1	Added DEP references to second sentence.

1.6 COMMENTS ON THIS DEP

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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://www.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 .