

DEP SPECIFICATION

SELECTION AND PROCUREMENT OF ACTUATORS FOR ON-OFF VALVES

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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 pneumatic, electric and hydraulic actuators for on-off valves and their accessories, for use in both General Service Applications and Protective Applications.

This DEP does not cover actuators installed on control valves, valves in subsea service and valves on distribution pipeline systems.

This DEP covers the selection, specification, requisitioning, procurement and Endurance Testing of actuators and integrated valve assemblies.

This DEP mainly deals with pneumatic actuators and some of the listed requirements might not apply to hydraulic or electric actuators. At the same time, not all relevant aspects of hydraulic and electric actuators have been included.

This DEP is intended for the following:

- Control and automation engineers that are involved in the selection and testing of actuators, as well as in trouble shooting, for both new and replacement actuators.
- Engineering consultants and system integrators (Contractors) who prepare requisitions and evaluate technical proposals on behalf of the Principal.
- Actuator and valve Manufacturers/Suppliers that prepare technical quotations and calculations and provide support to sites.

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

This DEP is a revision of the same number dated February 2018; 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 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.

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

1.3.2 Specific definitions

Term	Definition
Actuator	An electric, pneumatic or hydraulic powered device bolted or otherwise attached to the valve to apply torque or thrust for the opening and closing of a valve.
Fail safe	A property of a device that, in the event of failure or loss of signal or supply, responds in a pre-determined safe way.
General Service Applications	Applications of an actuator on a valve with an on/off service not considered being HSSE critical equipment.
HSSE Critical Equipment	Equipment whose failure could release a Hazard with a RAM red Risk (and yellow 5A and 5B Risks for Asset Integrity – Process Safety) or whose purpose is to prevent or limit the Consequences of the release of a Hazard with a RAM red Risk (and yellow 5A and 5B Risks for Asset Integrity – Process Safety).
Marine Environment	Oceans, seas, bays, estuaries, and other major water bodies including the land up to one kilometre of the mean high water mark.
Maximum Operating Pressure (MOP)	The maximum pressure allowed in a device or system. With respect to use of this definition relating to actuators, the MOP is the maximum pressure allowed in the power cylinder of the actuator which produces the torque/thrust for which the mounting kit has been designed and which also takes into account the mechanical strength of the housing and connecting rods.
Mechanically Loaded Parts	Parts that are designed to provide the generation and/or transmission of torque/thrust.
On-Off Valve	A valve that is not intended for throttling control in a partially-opened position. It is intended to be either fully open or fully closed.
Pressure-Containing Parts	Parts whose failure to function as intended could result in a release of contained fluid into the environment.
Protective Applications	Applications of an actuator on a valve which is HSSE Critical Equipment as defined in the HSSE Control Framework Glossary, such as final elements of an SIL1 SIF or higher.

1.3.3 Abbreviations

Term	Definition
GSA	General Service Application
MAST	Maximum Allowable Stem Torque
MAT	Maximum Air Torque
MOP	Maximum Operating Pressure
MST	Maximum Spring Torque
NDE	Non-destructive Examination (also known as NDT)
NPT	National Pipe Thread
PA	Protective Application
PST	Partial Stroke Test
SET	Spring End Torque
SIA	Secured Instrument Air
SIL	Safety Integrity Level
SIS	Safety Instrumented System
SRT	Spring Running Torque
SST	Spring Start Torque
VEOT	Valve End-to-Open Torque
VNBT	Valve Net Breakout Torque
VRST	Valve Re-Seat Torque
VRT	Valve Running Torque
VSCT	Valve Start-to-Close Torque

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 (10).

1.5 SUMMARY OF MAIN CHANGES

This is a revision of the DEP of the same number dated February 2018. This is an administrative update only to correct references to DEPs that have been involved in either a merge or a split.

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. REQUIREMENTS

2.1 ACTUATOR DESIGNATION AND CLASSIFICATION

2.1.1 Protective applications

1. For Protective Applications, the actuator and valve assembly, including the position control accessory (e.g., solenoid), SHALL [PS] meet the integrity requirement of the SIF or SIFs of which it forms a part, as defined in accordance with IEC 61511 (refer to DEP 32.80.10.10-Gen.).

Where used by more than one SIF, the most onerous integrity requirement applies.

2.1.2 Action on loss of supply energy

1. The action of the valve upon loss of supply energy shall be defined.

*The valve will be automatically driven to, or remain in, a predetermined position.
These positions can be as follows:*

- Fail open;
- Fail closed;
- Fail last (also known as stay-put).

2.1.3 Actuator designs

1. For Protective Applications, only designs that have passed the endurance test as described in (8) shall be used.

Refer to (Appendix A) for actuator typical drawings.

2.2 PNEUMATIC ACTUATORS

1. The operating medium for pneumatic actuators shall be compressed air.
2. For actuators that use a solenoid-operated valve to control their position, the compressed air supplied to the tie-in point of the actuator shall meet the purity classes ISO 8573-1:2010 Class 7 3 4 as follows:
 - a. Solid particle Class 7, i.e. particle size $\leq 40 \mu\text{m}$ (1.6 mils), concentration $\leq 10 \text{ mg/m}^3$;
 - b. Humidity Class 3, i.e., pressure dew point $\leq -20^\circ\text{C}$ (-4°F);
 - c. Oil Class 4, i.e., concentration total oil $\leq 5 \text{ mg/m}^3$.
3. For actuators also fitted with diagnostic positioner or other pneumatic accessories, the compressed air supplied to the tie-in point of the actuator shall meet the purity classes ISO 8573-1:2010 Class 6 2 3, as follows:
 - a. Solid particle Class 6, i.e. particle size $\leq 5 \mu\text{m}$ (0.2 mils), concentration $\leq 5 \text{ mg/m}^3$;
 - b. Humidity Class 2, i.e. pressure dew point $\leq -40^\circ\text{C}$ (-36°F);
 - c. Oil Class 3, i.e. concentration total oil $\leq 1 \text{ mg/m}^3$.
4. The Contractor shall specify the pneumatic supply pressure available at the point where the pneumatic supply line connects to the pneumatic system of the actuator in terms of the following:
 - a. Minimum available pressure to supply at the actuator;
 - b. Normal available pressure to supply the actuator;
 - c. Maximum available pressure to supply at the actuator.