

DEP SPECIFICATION

QUARTER-TURN ACTUATORS FOR ON/OFF VALVES

DEP 31.40.70.30-Gen.

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(DEP Circular 50/11 has been incorporated)

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for pneumatic actuators for quarter turn on/off valves and their accessories, for use in both General Service and Protective Applications.

This DEP covers the selection, Type Approval Testing, specification, requisitioning and procurement of these types of actuators and valve/actuator assemblies, referencing the current industry practices and international standards where applicable.

This DEP is intended for:

- The Principal's control and automation engineers who are involved in the selection and testing of actuators as well as in trouble-shooting, for both new and replacement quarter-turn actuators;
- Engineering consultants and system integrators (Contractors) who prepare requisitions and evaluate technical proposals on behalf of the Principal;
- Actuator and valve Manufacturers and Valve Automation Centres (Suppliers) which prepare technical quotations and calculations and provide support to sites.

This DEP does not cover electric actuators such as MOVs, or hydraulic actuators (which are covered in DEP 31.36.10.30-Gen.). In several places this DEP makes reference to Committee Draft ISO/CD TR 12490 (January 2009). Upon publication of this ISO Technical Report, the references should be checked and updated where required.

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 DEP of the same number dated December 1997; 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 Specific definitions

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.
Critical components	These include but are not limited to: • Pressure-containing components (i.e. cylinder barrel, piston rod, tie bolt/bar and springs), • Torque transmitting components, • Mechanically loaded parts. Refer to the detailed list in Appendix C.
Fail-safe actuator	An actuator which, upon loss of either electrical or pneumatic power or both, is automatically driven to a pre-determined safe position.
General Service Applications	Applications of an actuator on a valve with an on/off service not considered being HSSE Critical Equipment.
Instrumented Protective Functions	A (protective) function comprising one or more sensors, a Logic Solver and one or more Final Elements whose purpose is to prevent or mitigate hazardous situations and that have SIL 1, SIL 2, SIL 3 or SIL 4.
Maximum Operating Pressure (MOP)	The maximum pressure allowed in a device or system. The design pressure (DP) is 110 % of the MOP. With respect to this document, the MOP will be in reference to the maximum pressure allowed in the actuator.
Mechanically loaded parts	Parts that are designed to provide the generation and/or transmission of torque / thrust.
Pressure-containing parts	Parts whose failure to function as intended results 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 IPF SIL1 or higher • High rate emergency depressuring valves • Remote operated valves in pump or compressor suction • Process unit emergency sectionalisation valves

1.3.3 Specific abbreviations

AET	Air End Torque
ART	Air Running Torque
AST	Air Start Torque
ENP	Electroless Nickel Plating
GSA	General Service Application
IPF	Instrumented Protective Functions (see specific definitions)
MAST	Maximum Allowable Stem Torque
MOP	Maximum Operating Pressure
MST	Maximum Spring Torque
NDE	Non-Destructive Testing
NPT	National Pipe Thread
PA	Protective Application
PFD	Probability of Failure on Demand
PMI	Positive Material Identification
PST	Partial Stroke Testing
PTFE	Polytetrafluoroethylene (Dupont trade name Teflon)
RMS	Root Mean Square (of the material roughness in the context of this DEP)
SET	Spring End Torque
SF	Safety Factor
SIA	Secured Instrument Air
SIL	Safety Integrity Level
SRT	Spring Running Torque
VRST	Valve Re-Seat Torque
VRT	Valve Running Torque
VSCT	Valve Start to Close Torque
VSOT	Valve Start to Open Torque

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 (5).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated December 1997. The following are the main, non-editorial changes.

Content of the previous version that was background information, explanation, and guidance and therefore not required to be communicated to the Contractor, has been removed. This has been a major rewrite and it is impractical to summarise the changes here.

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.

1.7 DUAL UNITS

**Amended per
Circular 50/11**

Dual units have been incorporated throughout this DEP.

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. In some cases, size substitutions have been made in order to align with available products or methods customarily used in the US.

2. REQUIREMENTS FOR ALL APPLICATIONS

The requirements listed in this section form the basis for the specification of pneumatic actuators used in both General Service Applications and Protective Applications. Additional requirements that apply only to actuators used in Protective Applications are listed in (3.).

2.1 GENERAL

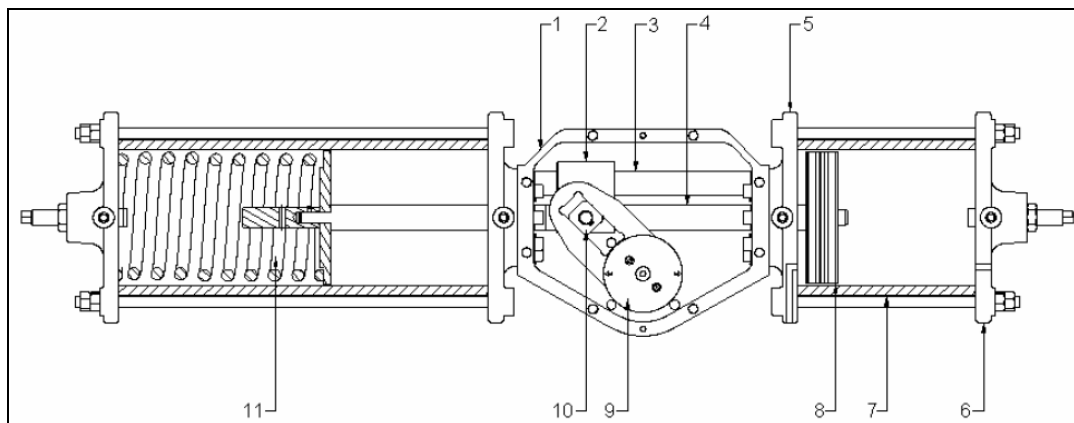
The requisition shall specify the tag number of the valve and the spring action of the actuator. It shall also clearly state whether the actuator is for a General Service or a Protective application.

2.1.1 Actuator mechanism and operating medium

Scotch-Yoke and Rack-and-Pinion are acceptable actuator mechanisms. The use of any other type of mechanism shall be subject to the approval of the Principal.

2.1.1.1 Scotch Yoke

The Scotch Yoke (Figure 1) is a mechanism for converting the linear motion of a slider/piston into rotational motion, or vice-versa. The design of the Scotch Yoke actuator can accommodate either air to open and air to close designs based upon the spring return configuration or a push or pull design. An example of Scotch Yoke mechanism is shown in Fig 1. The piston or other reciprocating part is directly coupled to a sliding yoke with a slot that engages a pin on the rotating part. Depending on the characteristics of the load the Scotch Yoke is symmetrical or canted.

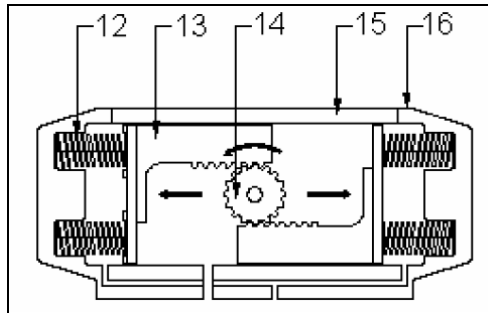


NOTE: This figure has been taken from ISO/CD TR 12490; for component item numbers refer to the list of critical components in Appendix C.

Figure 1 **Scotch Yoke Mechanism (shown in actuated position)**

2.1.1.2 Rack and pinion

A rack and pinion (Figure 2) is a pair of gears which convert linear motion into rotational motion. The circular pinion engages teeth on the rack (a flat bar).



NOTE: This figure has been taken from ISO/CD TR 12490; for component item numbers refer to the list of critical components in Appendix C.

Figure 2 Rack and Pinion Mechanism (shown in actuated position)

2.1.1.3 Operating medium

Unless otherwise specified in the requisition, the compressed air purity class for pneumatic actuators that have only a solenoid to control their position shall be ISO 8573-1:2010 Class 7 3 4 or better, i.e.:

- Solid particle Class 7, i.e. particle size $\leq 40 \mu\text{m}$ (1.6 mil), concentration $\leq 10 \text{ mg/m}^3$; ($\leq 6 \cdot 10^{-7} \text{ lb/ft}^3$)
- Humidity Class 3, i.e. pressure dew point $\leq -20^\circ\text{C}$ (-4°F);
- Oil Class 4, i.e. concentration total oil $\leq 5 \text{ mg/m}^3$ ($\leq 3 \cdot 10^{-7} \text{ lb/ft}^3$).

If a diagnostic positioner (see 2.5) or other pneumatic accessories are used, the compressed air purity class shall be ISO 8573-1:2010 Class 6 2 3, i.e.:

- Solid particle Class 6, i.e. particle size $\leq 5 \mu\text{m}$ (0.2 mil), concentration $\leq 5 \text{ mg/m}^3$ ($\leq 3 \cdot 10^{-7} \text{ lb/ft}^3$);
- Humidity Class 2, i.e. pressure dew point $\leq -40^\circ\text{C}$ (-40°F);
- Oil Class 3, i.e. concentration total oil $\leq 1 \text{ mg/m}^3$ ($\leq 6 \cdot 10^{-8} \text{ lb/ft}^3$)

In regions where the ambient temperature can frequently be as low as -10°C (14°F) or below, a tighter specification for humidity class and water class may be required.

The Contractor shall verify the air quality at the site where the actuator will be installed and state that in the requisition.

This DEP is based on the use of compressed air as a power source. The use of any other gas for actuation requires the approval of the Principal and this shall be stated in the requisition. The decision to use anything other than compressed air shall be based on a risk analysis.

If an alternative gas is approved it shall be clean, dry, oil free, not very toxic (as defined in DEP 01.00.01.30-Gen.) and non-corrosive. If anything other than compressed air is used the area around the actuator and solenoid-operated valve shall be ventilated so that personnel are not exposed to harmful levels of toxic gases. The exhaust from the solenoid-operated valve shall be oriented so that the release cannot affect personnel near the valve.

If other compressed gases are used, the Manufacturer shall specify the internal actuator parts and lubricants, which shall be compatible with that gas. Minimum compressed gas cleanliness shall be in accordance to ISO 8573-1:2010, Class 6 for particle size and Class 2 for dew point. In all cases, the compressed gas or pressurized fluids shall have a dew point at least 10°C (18°F) below the lowest ambient temperature or meet ISO 8573-1:2010, Class 2, whichever is lower.

Any electrical accessories supplied with the actuator assembly (e.g. solenoid) shall have the appropriate electrical approvals for the power gas used.

2.1.2 Actuator construction

The actuator shall be designed and fabricated such that the design life is appropriate for the service without damage to the actuator, plating, or seals. The associated testing of the actuator shall be appropriate for the actuator size, service, and application.

The actuator shall be designed and fabricated such that the in-service life is according to EN 15714-3 (2009) Table 1 for non-safeguarding applications. For process safeguarding applications, the minimum in-service life shall be ten times the values provided in EN 15714-3 (2009) Table 1. This shall be certified through the Type Approval Review.

For new actuator designs or where the vendor is unable to provide actuator operational history, the design life requirements shall be determined during the Type Approval Review.

It shall be demonstrated by calculation or testing that the actuator design fatigue life of all critical actuator components meets or exceeds the specified service life whilst experiencing the actuator maximum operating pressure (MOP) and operating at the maximum rated torque output.

Combinations of spring can and power cylinders shall not be used unless it is connected with a closed loop breathing configuration which protects against the actuator breathing in outside air which may contain moisture, salt, dust, or other contaminants that may impede proper operation of the actuator.

Where scotch-yoke actuators are specified, the power cylinder module and spring can module shall be bolted to the centre body. Tie bolts/bars shall not be used to attach the power cylinder to the centre body.

Paper/fibre gaskets, copper sealing washers or PTFE tape shall not be used as pressure seals.

The actuator shall not apply lateral loads to the valve stem in any orientation. The forces resulting from the actuator's weight and applied torque shall not be carried by the valve stem.

For valves equipped with hand wheels, unless otherwise specified the hand wheel shall comply with the following:

- Turn in a clockwise direction to close the valve
- Have a diameter that does not exceed 800 mm (32 in)
- Have spokes that do not extend beyond the perimeter
- Shall not have a turning force requirement greater than 360 N (80 lbf) for full valve travel

When the associated valve is an on/off valve (e.g. no control functions) in Protective Application, actuators SHALL [PS] not be fitted with hand wheels.

All joints between actuator components shall be metal-to-metal and "O" ring sealed against environmental ingress. Measures shall be taken to prevent movement of bolted joints subjected to lateral loads, e.g. by means of dowel pins. Fasteners shall be designed/installed in a manner to ensure bolt tightness is maintained under all operating conditions (e.g. temperature, vibration, etc.).

Actuators shall be supplied mounted on the valve complete with all accessories as a complete assembly to ensure single point responsibility. If the valve and the actuator are being purchased separately, the Purchaser shall specify which supplying party retains single point responsibility.

Only in the case where actuators are to be supplied for existing valves, may the actuator be purchased separately, making a designated party responsible for the correct torque calculations for the design of the mounting kit and the total assembly. A detailed specification of the valve shall be provided with the requisition to be used in conjunction

with that specification. The latter shall only be done if the relevant torque data of the existing valve can be made available to the designated responsible party, otherwise a new complete actuator/valve assembly shall be purchased. The designated responsible party shall be able to provide field support for integrating the actuator with the valve.

Bolting and tie bolts/bars shall be to ASTM A 193, grade B7, and nuts shall be to ASTM A 194, grade 2H, as a minimum.

If the actuator will be exposed to sour gas (e.g. the associated valve is specified for sour service) or the actuator power gas is considered sour then all bolting and nut materials shall comply with ISO 15156, NACE MR0103, or other appropriate standards as approved by the Principal.

The actuator internals shall be packed for life by the Manufacturer with suitable lubricants.

2.1.3 Materials of construction for General Purpose Applications

The chemical composition of critical components made of carbon steel parts subject to welding, including weld repairs and overlays, shall meet the following requirements unless otherwise agreed:

- Carbon content shall not exceed 0.25 % by mass.
- Carbon equivalent (CE) shall not exceed 0.42, when calculated by:

$$CE = \%C + \%Mn / 6$$

For actuators powered by sour process gas the following shall apply:

- Carbon content shall not exceed 0.23 % by mass.
- Carbon equivalent (CE) shall not exceed 0.43 using the following formula:

$$CE = \%C + \%Mn/6 + (\%Cr + \%Mo + \%V)/5 + (\%Ni + \%Cu)/15.$$

The carbon content of austenitic stainless steel pressure-containing parts subject to welding, including weld repairs shall not exceed 0,03 % by mass, except that for stabilized material a carbon content of up to 0,08 % by mass is permissible.

Apart from the above additional restrictions, the chemical composition of materials subject to welding, including weld repairs shall be in accordance with the relevant ASTM, CEN or ISO material specification.

For Scotch-Yoke type of actuators:

- The centre body shall be constructed of fabricated alloy steel, forged steel, or other material (e.g. ductile iron) as recommended by the manufacturer and with approval from the Principal.
- The yoke shall be constructed of cast steel, forged steel, fabricated forged steel, or another material (e.g. ductile iron) as recommended by the manufacturer and with the approval of the Principal.
- The yoke pin shall be high-grade steel capable of withstanding the stresses inherent in this design.
- The piston rod shall be constructed of fabricated alloy steel or forged steel.

For Rack-and-Pinion type of actuators:

- The gear rack shall be constructed of high yield strength ductile iron or other materials as recommended by the manufacturer (and with the approval of the Principal) as suitable for the service and required life.
- The pinion shall be of high grade steel, high yield strength ductile iron or other materials as recommended by the manufacturer (and with the approval of the Principal) as suitable for the service and required life.

All mounting kit hardware for marine services shall be Type 316 stainless steel.

2.2 ACTUATOR COMPONENTS

2.2.1 Spring can

2.2.1.1 Springs

No rubbing or buckling of the springs shall occur. Compression of the return springs shall be limited so that scragging or blocking of the spring coils does not occur.

If multiple springs are used they shall be mounted in such a manner that a single spring failure shall not result in a complete actuator failure.

Spring can assembly shall be designed so that it is not possible under any circumstances to remove the spring can from the actuator centre body whilst the spring(s) is/are in the compressed condition.

The spring can shall be hermetically sealed to prevent ingress of air, sand or moisture.

Internal surfaces of a spring can shall be waxed or greased for life to prevent internal corrosion.

The spring(s) shall be treated with enamel painting or a wax coating to permanently resist atmospheric corrosion. Springs shall not be cadmium plated.

Springs shall be designed, manufactured and applied in accordance with a recognised standard such as EN 13906-1.

2.2.1.2 Tie bolts/bars on or in spring cans

Tie bolts/bars shall only be applied to retain the end caps/flanges on the spring can and/or the power cylinder; they shall not be mechanically loaded by other forces.

Internal tie bolts/bars shall receive the same anti-corrosion treatment as the internal surfaces of the power cylinder because they cannot be inspected after assembly.

Failure of one tie bolt/bar shall not cause the actuator to endanger personnel or interfere with the proper operation of the valve. If in-situ replacement of the failed bolt/bar is required, it shall be stated in the request for quotation and purchase order and the actuator shall be supplied with labelling indicating and in-situ service is the component is allowed.

2.2.2 Power cylinder

2.2.2.1 General

The power cylinder is considered to be a pressure vessel and shall be designed, fabricated and inspected in accordance with one of the following design codes, which shall be chosen by the Manufacturer:

- PD 5500, Construction category 2
- ASME Section VIII Division 1
- EN 13445, Testing Group 1

The power cylinder components shall be capable of withstanding the maximum operating pressure of the pneumatic supply system to which the actuator is connected. The maximum operating pressure of the pneumatic supply system shall be determined by the protected pressure (e.g. a mechanical component that prevents the pressure from exceeding a predetermined value).

Welding, including repair welding, of pressure containing parts and attachment welding to pressure containing parts shall be performed in accordance with procedures qualified to ISO 15607, ISO 15609, ISO 15614-1 or ASME Section IX. Welders and welding operators shall be qualified in accordance with ISO 9606-1, ASME Section IX or EN 287-1.

The actuator SHALL [PS] be protected against internal corrosion. This may be accomplished by one of the following methods:

- For Protective Applications, the application of Electroless Nickel Plating (ENP), in accordance with DEP 30.48.41.31-Gen.; Carbonising/nitrating, PTFE-type or similar coatings shall not be used for power cylinder linings or piston rod coating.
- The application of a coating, for General Service Applications.

Piston and piston rods shall be a mechanical wear resistant, non-corrosive, protected against abrasion, turned, ground and polished bar. This shall be verified and certified by the Principal's Type Approval Test. Piston rods shall be either electroless nickel plated or hard chromium plated over the entire bearing surface. Other plating methods may be proposed by the manufacturer, including supporting documentation indicating the plating is equal to or better than ENP, for approval by the Principal. Carbonising/nitrating surface treatment processes on internal parts such as piston rods, tie bolts/bars etc. shall not be used.

2.2.2.2 Coating (for General Service Applications)

The underlying surface material shall be treated to provide corrosion resistance. Carbonising/nitrating surface treatment processes may be used on internal parts such as the piston rods, tie bolts, etc. however this process shall not be used on the inside surfaces of power cylinders.

2.2.2.3 Coating (for Protective Applications)

All components of power cylinders and piston rods that come into rubbing contact with seals shall be non-heat-treated ENP to obtain protection against mechanical wear and abrasion (which also provides corrosion resistance). The ENP shall be finished to a smoothness of 4 µm (0.16 mil) RMS or better.

The application of ENP shall be in accordance with DEP 30.48.41.31-Gen. This shall be part of the Type Approval Review used by the Principal to qualify actuators for use on Protective Applications.

2.2.2.4 Seal materials

Dynamic seals in the power cylinder shall be Nitrile (e.g. Buna N), FKM (e.g. Viton-B), or 15 % Graphite PTFE (e.g. Teflon) – as appropriate for the service/application. If other material is used for the static seals, then they shall not be interchangeable with any dynamic seal.

Neoprene rubber shall not be used for dynamic or static seals.

For low ambient temperatures (< -10 °C (14 °F)), the Manufacturer/Supplier shall be responsible for the choice of the suitable seal material and approved by the Principal.

The Principal shall approve all dynamic and static seal materials used in the actuator if the pneumatic supply is a gas other than instrument air as specified in (2.1.1.3)

2.2.3 Centre body

The centre body cover shall be bolted and easily removable to allow for inspection of the internal linkages without disassembling the entire unit or removing the unit from the valve.

If the actuator has a cover as part of the centre body then the cover shall not form part of the structural integrity of the body if the actuator is to be serviced in-situ. There shall be a label, clearly visible on the cover, indicating that integrity and operation of the actuator may be compromised if the cover is removed without use of manufacturer's recommendations for support.

The requirement for in-situ service of the actuator shall be stated on the Request for Quotation and Purchase Order. The Vendor's/Manufacturer's response to the Request for Quotation and response to the Purchase Order shall clearly state if the cover (for the centre body) is part of the structural integrity of the actuator body preventing any in-situ servicing.

Bearings shall not contain aluminium and shall be protected from the environment.

Piston rod bushings shall be constructed from phosphor bronze, low friction polymer material or similar to ensure high performance during the service life. This shall be part of

the Type Approval Test. All metallic bearings shall be earthed to prevent build up of static electricity during operation.

If fitted on the valve without a mounting kit, the actuator shall be fitted with safety relief devices such as a rubber plug to ensure that in the event of leakage from the valve stem seals, excessive pressure cannot build up in normally unpressurised compartments.

The relief device shall be designed so that it cannot become inoperative as a result of external corrosion or blockage by paint. Similar arrangements shall be included to prevent leakage from the power cylinder from over-pressurising the adjoining actuator body or spring can module.

2.2.4 Mounting kit

The mounting kit, when applied, forms the mechanical interface/adaptor between the actuator and the valve and shall be specially designed for each particular combination. The actuator and valve shall be integrated using a mounting kit. Mechanical loads are transmitted through the mounting kit and this allows for some expansion and movement between the valve and actuator. Bolting alone shall not be considered sufficient to ensure no movement of the assembly.

The mounting kit consists of:

- a) An intermediate support (bracket, spool, adaptor);
- b) A coupling (drive adaptor, drive tube, drive shaft);
- c) Optional drive key(s) connecting the coupling to the valve shaft;
- d) A dowel pin fixing the intermediate support to the valve body or bonnet;
- e) Bolting.

The mounting kit design and manufacturing tolerance shall ensure the following:

- Parallelism of the intermediate support mounting faces;
- Concentricity of the pitch circle diameter of the bolting of the intermediate support;
- Alignment of the valve stem, coupling and the actuator drive.

The design basis for the mounting kit shall be either stress-based using the specified design code (see 2.2.2.1) or be based on satisfactory documented previous experience including validation testing.

The mounting kit shall be designed to transfer and react all of the loads from the actuator to the valve, including at least 1.1 times the maximum actuator torque output.

Bolting in mounting kits shall not be subjected to shear forces, unless otherwise agreed.

Incorrect angular orientation or improper assembly of actuator to valve shall be prevented, e.g. by means of a dowel pin or fitted bolt, to ensure the correct location of the actuator. To be able to identify the valve position without removing the actuator, the drive couplings shall be clearly marked to indicate the valve stem key location, so that the stem position can be known without having to remove the coupling.

If the mounting kit is a sealed compartment it shall be fitted with safety relief devices such as a rubber plug to ensure that, in the event of leakage from the valve stem seals, excessive pressure cannot build up in normally unpressurised compartments.

The mounting kit shall be designed to allow adjustment and re-packing of the valve stem packing with the actuator mounted on the valve, as applicable.

The attachment of actuators to valves shall be in accordance with ISO 5211, which describes:

- Flange dimensions necessary for the attachment intermediate supports;
- Driving component dimensions necessary to attach them to the driven components;