Shafer
valve operating systems

TECHNICAL SPECIFICATIONS
GAS HYDRAULIC VALVE ACTUATOR
FOR NATURAL GAS TRANSMISSION APPLICATIONS

Scope: The intent of this specification is to define the minimum requirements of valve actuators and their ancillary equipment.

Exceptions: Any exceptions to these minimum requirements shall be specifically stated in the vendors proposal.

1.0 ACTUATOR DESIGN

1.1 Valve actuators for ball or plug valves shall be of the rotary vane or rotary piston design.

1.2 Valve actuators shall have a 10 year warranty.

1.3 The basic design of the actuator shall provide torque directly to the valve stem with the fewest moving parts and without power absorbing reduction gearing.

1.4 The design life of the equipment offered should be a minimum of 50 years for the conditions as specified and the vendor shall supply a customer user list with his proposal showing the experience of the equipment offered.

1.5 The valve actuators will be of an automatic self purging design such that any air or gas pockets in the actuator will be eliminated.

1.6 The valve actuator and gas hydraulic tanks shall be complete with drain plugs in the lowest point to facilitate preventative maintenance procedures.

1.7 The rotary actuator shall be equipped with externally adjustable end of stroke stops which provide a minimum of 2 ½ degrees rotation adjustment at each end of travel. These stops shall be sufficient to absorb the maximum torque output of the actuator at the maximum rated pressure.

1.8 The actuator shall be of balanced torque design to insure that no side loading is imparted to the valve stem.

1.9 The actuator shall be equipped (if shown on the individual specification sheets) with independently adjustable flow control valves installed in the opening and closing hydraulic circuit to allow the actuator to stroke within the speed range as specified.

1.10 All actuators will have affixed with stainless steel screws, a permanent tag giving the manufacturers serial number, model number, maximum working pressure, purchase order number, and valve identification number.

2.0 ACTUATOR MOUNTING

2.1 The actuator shall be suited for direct mounting to the valve without changing the standard topworks of the valve and shall have the capability to be mounted or removed from the valve when the valve is in service.

2.2 It is the responsibility of the actuator vendor and valve vendor to cooperate in the exchange of mating dimensions and torque/thrust data for actuator sizing.

2.3 The actuator manufacturer shall supply all mounting hardware and accessories in order to successfully mate the actuator to the standard topworks of the valve. In the case of buried valves, the necessary elevated extensions will be the responsibility of the valve manufacturer. In the case of splined stem valves, they will be adapted to standard round keyed shafts by the valve manufacturer.

2.4 Preference will be given to the actuator design offering the most compact arrangement and those actuators designed to swallow the valve stem.

3.0 PRINCIPLE OF OPERATION

3.1 The actuator will be powered from the high pressure pipeline natural gas without the need for regulators or pressure reducers.

3.2 The actuator will be of the gas hydraulic principle wherein high pressure natural gas from the pipeline is directed by a directional control valve to a pair of gas-over-oil volume bottles wherein the gas pressurizes the hydraulic fluid and this pressurized hydraulic fluid is the actual working medium in the valve actuator.

3.3 The hydraulic fluid shall provide a corrosion resistant atmosphere for the internal workings of the actuator as well as an ideal medium for the buna nitrile seals thus greatly extending their service life and minimizing maintenance.

3.4 The hydraulic fluid is further required to provide a smooth transmission of power to the valve stem eliminating the jerky and erratic movement of straight pneumatic actuators and also allows the use of a hydraulic hand pump for manual override operation.

3.5 The recommended hydraulic fluids shall exhibit the following properties:

	For +20° to +120°	For -40° to +100°
API Gravity	31.1	32.8
Viscosity @ 210°F	45.2 SSU	42.9 SSU
Viscosity @ 100°F	115 SSU	74 SSU
Viscosity @ 0° F	1600 SSU	360 SSU
Pour Point	-50° F	-75° F
Viscosity Index	150	225
Flash Point	335° F	215° F
Fire Point	350° F	250° F
Base	Parrafin	Petroleum
Inhibitors	Rust/Foam/ Oxidation	Rust/Foam/ Oxidation
Color	Red/Brown No. 1	Pink/Red No. 16.5
Neutralization No.	107	.03

4.0 POWER SUPPLY

4.1 The actuator power supply will be high pressure natural gas taken directly from the pipeline at the valve being automated. Power gas will be taken from a double check valve connected to both sides of the valve so that the power supply pressure will always be equal to or greater than the valve differential pressure.

4.2 Pipeline operating design pressures must be within the range of 100 psi and 3,000 psi. The valve actuator shall use this pressure as its power source without the need for pressure regulation or reduction.

4.3 The ambient temperature range must be between -20° F and 250° F.

4.4 The test pressure of the actuator system shall be 1 ½ times the maximum pipeline operating design pressure.

5.0 ACTUATOR SIZING

5.1 The actuator should be sized to stroke the valve throughout the operating pressure range, but specifically shall provide a minimum of 1.25:1 safety factor over the valve torque requirement at the minimum pipeline operating design differential pressure while the actuator power pressure is also the minimum pipeline operating design pressure.

5.2 The valve torque requirement should include all additive factors for the application specified. Such additive factors would be those designated for cold temperature, time set, seat rotation, etc.

5.3 It is understood that the safety factor ratio of actuator torque output to valve torque requirement will increase as the pipeline operating pressure increases.

5.4 In his proposal, the actuator vendor shall specifically state the valve torque requirements, actuator torque output and the safety factors provided at both the minimum and maximum pipeline operating design pressures.

6.0 GAS HYDRAULIC TANK DESIGN

6.1 The gas hydraulic tanks are considered to be pressure vessels and will be designed, manufactured, and inspected in accordance with the requirements of ASME Code Section VIII unfired pressure vessels. Copies of mill material certificated showing physical and chemical properties of the materials used must be supplied along with complete U-1A forms, design calculations, and qualified weld procedures.

Materials of Construction shall be:

for -20° F Min.	for -50° F Min.
SA-53 or SA-106 SMLS	SA-333 SMLS

6.2 The gas hydraulic tanks will be of sufficient volume to stroke the actuator fully and shall be supplied with the initial fill of high grade hydraulic fluid.

6.3 The gas entry port of the gas hydraulic tanks shall be fitted with a diffuser to prevent the high pressure gas from foaming or churning the hydraulic fluid.

6.4 The hydraulic fluid exit port of the gas hydraulic tank shall be fitted with a riser so that sufficient sump volume in the tank exists preventing contaminants or condensation from entering the actuator cylinder.

6.5 All internal surfaces of the gas hydraulic tanks shall be thoroughly shot blast cleaned prior to construction to remove mill scale and rust.

7.0 SEALS

7.1 The seals in the hydraulic circuit shall be of Buna-N compound for ambient conditions of -20° F to +120° F and for cold temperature applications to -50° F, special low temp Buna compounds will be used.

7.2 Special elastomer compounds may be required in the pneumatic circuit in order to be compatible with power gas containing corrosive compounds or traces of synthetic base lubricants.

8.0 TUBING AND FITTINGS

8.1 All tubing and tubing fittings shall be 316 stainless steel. Fittings shall be 316 Stainless Steel Swagelok or equal. The use of thread sealing tape is prohibited in lieu of anaerobic pipe thread sealant.

8.2 All tubing shall be heavy wall and no tubing less than 1/4" OD shall be used. The use of 5/16" OD tubing is strictly prohibited.

9.0 MANUAL OVERRIDE

9.1 For rotary valve actuators where the required torque input to the valve stem is less than 4000 inch pounds, the actuator shall include a wrench square or post extension for manual override operation.

9.2 For rotary valve actuators where the required torque input to the valve stem is greater than 4000 inch pounds, a manual hydraulic hand pump shall be provided for manual override operation.

9.3 The hand pump shall be constructed of corrosion resistant materials and be of the positive displacement piston ram design.

9.4 The hand pump system shall be capable of producing the maximum rated working pressure of the actuator with reasonable force applied to the hand pump handle.

9.5 The hand pump must have a positive suction anti-cavitation feature such that rapid cycling of the pump handle is permitted.

9.6 The hand pump must be of the design such that in the event a remote or automatic signal is given to the actuator, the hand pump will automatically and immediately disengage allowing power operation of the valve. Further, this dead-man design shall prevent the inadvertent manual disarming of the valve control system in case the selector lever is left in either the open or closed position.

9.7 The hand pump shall be of the balanced ram design providing ultimate safety in preventing the ram from jumping up and causing bodily harm if the pump body becomes pressurized at any time. Mechanical lock downs are not considered sufficient in that the protection offered is not certain nor inherent in the design.

9.8 The hand pump shall have the capability of being pad locked to prevent unauthorized operation.

9.9 The hand pump shall incorporate a manual operated pressure relief button for relieving pressure and lowering pump ram after the pumping cycle is completed.

9.10 The pump ram shall be designed such that it is retracted into the pump body when not in use to prevent exposure to atmospheric conditions, inadvertent sandblasting, or painting operations.

9.11 The vendor shall state in his proposal the maximum pressure capability of the hand pump as well as the number of strokes of the handle required to stroke the actuator from open to closed or vice-versa.

10.0 CONTROLS (GENERAL)

10.1 The actuator shall be fitted with bi-directional control to open or close the valve.

10.2 This control valve must be of the zero leakage nylon poppet design. Spool type control valves are prohibited because of their tendency to leak and general unreliability.

10.3 The poppet control valve shall be designed of corrosion resistant materials and suitable for the intended service. Carbon steel material is not sufficient for long service life.

10.4 The poppet control valve shall be as compact as possible to withstand vibration as well as being of the self adjusting design to prevent frequent maintenance.

10.5 Power gas must be filtered to at least 140 microns on entering the control and pilot gas subsequently filtered to 25 microns.

10.6 These filter strainers must be stainless steel re-usable elements situated such that quick and easy removal and cleaning is achieved.

10.7 Power and exhaust poppets also must be readily accessible for quick change out in event of contamination.

10.8 Local manual operation of the poppet control valve shall be provided by means of a lockable handle. This local manual control must be of the dead-man design such that releases of the handle will cause the valve to stop.

10.9 The poppet control valve shall be of the 3-way design such that the actuator is pressurized only during the opening or closing stroke. At the end of the stroke, the control will be designed to neutralize and vent all power gas to atmosphere.

10.10 The exhaust port of the poppet control block shall be equipped with a soft seated check valve to exclude atmosphere from the gas hydraulic tanks thus preventing the formation of condensation in the system.

10.11 A stainless steel liquid filled pressure indicating gauge shall be included with the control in the power gas circuit.

10.12 In addition to local manual actuation, the poppet control valve shall be pilot actuated and capable of receiving and opening or closing pneumatic signal so that future addition of remote two-way electric, single-way pheumatic, etc. function can be achieved by the simple addition of the necessary components.

10.13 All poppet control valves mounted in exposed conditions will be complete with a hinged sheet steel control box. The hinges shall be stainless steel and the box must be suitable for padlocking to prevent unauthorized operation.

10.14 It is preferable that the manual hand pump and poppet control valve be mounted on the same side of the valve actuator package and where practical within the same control box.

10.15 All normally exposed sliding stems or plungers must be protected by flexible neoprene boots to prevent ice or paint build-up, corrosion, or inadvertent sandblasting.

10.16 All vents or breathers shall be pointed towards the ground to prevent ingress of moisture.

11.0 CONTROL FUNCTIONS (SPECIFIC)

11.1 A complete functional description of the valve actuator pilot control, such as manual, remote two-way electric, automatic emergency shutdown, automatic linebreak, high pressure or low pressure shut-off will be provided on the individual actuator specification sheets. Control functions offered are dependant upon project requirements.

12.0 POWER STORAGE TANK

12.1 Where specified, a power gas storage tank shall be included to provide sufficient reserve volume to stroke the valve under the specific conditions shown on the actuator specification sheets.

12.2 The formula for calculating the volume of the power storage tank is:

$$V = \frac{\sqrt{N \frac{PM}{PI}} \times \text{VOLUME of GAS for 1 STROKE}}{1 - \sqrt{N \frac{PM}{PI}}}$$

Where: N = Number of strokes of valve required.
PM = Minimum allowable pressure in tank at end of stroke to provide torque required to turn valve.
PI = Starting fill pressure of power storage tank.

The volume of gas for 1 stroke is the volume of the gas hydraulic tank being pressurized to cause the stroke of the actuator.

All pressures expressed psia.
All volumes expressed in cubic inches.
Solve for V = volume of power storage tank required.

12.3 The power gas storage tank shall be designed and constructed in accordance with the requirements of the ASME Code Section VIII for unfired pressure vessels. As required by code, an ASME approved factory sealed overpressure relief valve will be included with the tank.

12.4 In order to preserve the volume and pressure in the storage tank, a good quality soft seated bubble tight check valve must be included in the control power gas connection point.

12.5 At the bottom of the power gas storage tank must be a plugged blowdown valve in order to vent the tank for maintenance or disarming procedures.

13.0 ELECTRICAL REQUIREMENT

13.1 All electrical components must be explosion proof per the requirements of the National Electrical Code for Class I, Group D, Division I & II Hazardous Locations. All independent certification such as UL or CSA must be provided on request. Optional electrical certifications such as BASCEFA, CENNEVEC, SAA, etc. can be provided.

13.2 Solenoid valves, if required, will be Peter Paul high pressure or equal of good quality construction with molded continuous duty coils and stainless steel valve bodies. Maximum power consumption 14 Watts.

13.3 Limit switches, if required, will be Honeywell micro hermetically sealed SPDT switches rated 1 AMP @ 125 VAC or 10 AMP @ 28 VDC.

13.4 Limit switches shall be capable of being adjusted throughout the valve stroke.

13.5 Sufficient numbered screwed end terminals for all customer electrical connections shall be provided in an explosion proof enclosure.

13.6 Terminal screws shall be 316 stainless steel and all vendor supplied electricals shall be prewired to terminal end.

13.7 The common customer electrical connection will be 1 ½ inch NPS.

14.0 TESTING

14.1 The actuator package will be fully assembled and tested in the vendors facility prior to shipping.

14.2 Minimum factory testing shall include hydrostatic pressure testing, inspection for leakage, functional testing of sub-assemblies as well as the complete system function tests and adjustment of end of stroke trigger devices, limit switches, etc. Testing shall conform as close as is practical to actual field operating conditions.

15.0 DRAWINGS

15.1 Each valve operating system shipped shall include:

Assembly Drawings
Control Drawings
Schematic
Wiring Diagram
Maintenance & Installation Instructions

16.0 MAINTENANCE INFORMATION & SERVICES

16.1 Each actuator shipped shall include maintenance manuals showing step-by-step troubleshooting and repair procedures.

16.2 Maintenance services must be available to customers. Vendor shall maintain a service department capable of responding to service requirements in rapid fashion via phone or personal visit by a serviceman.

17.3 Repair kits and instructions must be available for all actuators in the field.