VALSTOM ENERGY

VALSTOM VALVE-ACTUATION SELECTION TECHNICAL NOTES

(Engineering Reference)

1. Purpose

This document provides general engineering guidance for the selection of valve actuators and actuation systems used in oil & gas, petrochemical, power, and industrial process applications. It supports actuator selection during project specification, system integration, and automation planning.

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2. Valve Actuation Overview

Valve actuation is used to operate valves remotely, automatically, or under controlled conditions. Actuators are selected based on valve type, operating torque or thrust, service conditions, and control requirements.

Actuation systems are typically classified as:

- Manual operators
- Pneumatic actuators
- Hydraulic actuators
- Electric actuators

The selected actuation method must ensure **safe, reliable, and repeatable valve operation** under all specified operating conditions.

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3. Manual Operators

3.1 Handwheel and Lever Operation

Manual operation is suitable for valves that:

- Are operated infrequently
- Have low operating torque
- Are easily accessible

Gear operators are used when manual torque exceeds acceptable ergonomic limits.

3.2 Gear Operators

Gearboxes are applied to:

- Large-size valves
- High-torque applications
- Multi-turn valves

They reduce operating effort and allow controlled valve movement.

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4. Pneumatic Actuators

4.1 General Characteristics

Pneumatic actuators are widely used due to:

- Simplicity
- Fast response
- Intrinsic safety in hazardous areas

They require a reliable compressed air supply.

4.2 Pneumatic Actuator Types

- **Piston actuators** – Quarter-turn operation for ball, butterfly, and plug valves
- **Diaphragm actuators** – Linear motion, commonly used with globe and control valves

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4.3 Fail-Safe Function

Pneumatic actuators can be designed for:

- Fail-open
- Fail-close
- Fail-in-last-position

- Fail-safe action is achieved using springs or accumulator systems.

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5. Hydraulic Actuators

5.1 General Characteristics

Hydraulic actuators are selected when:

- Very high torque or thrust is required
- Valve size or pressure is large
- Precise force control is needed

They are commonly used in:

- Pipeline valves
- Subsea and offshore applications
- Emergency shutdown systems

5.2 Hydraulic Power Sources

Hydraulic systems may use:

- Centralized hydraulic power units (HPU)
- Self-contained hydraulic actuators
- Accumulators for emergency operation

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6. Electric Actuators

6.1 General Characteristics

Electric actuators are suitable where:

- Electrical power is readily available
- Precise positioning is required
- Remote monitoring and control are needed

They are widely used in water, power, and industrial automation systems.

6.2 Operating Modes

- **On/Off duty** – Full open or full close
- **Modulating duty** – Continuous position control

Duty cycle and motor sizing must be considered during selection.

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7. Actuator Sizing Considerations

Actuator sizing must be based on:

- Maximum valve torque or thrust
- Differential pressure across the valve
- Seat friction and packing loads
- Safety factor as per project requirements

Sizing calculations should consider **worst-case operating conditions**, not nominal values.

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8. Accessories & Control Components

Actuated valves may include accessories such as:

- Solenoid valves
- Air filter regulators
- Positioners
- Limit switches
- Pressure switches
- Manual overrides

Accessories must be compatible with actuator type and control philosophy.

9. Environmental & Area Classification

Actuator selection shall consider:

- Hazardous area classification
- Ambient temperature range
- Corrosion and ingress protection
- Offshore or marine environment exposure

Electric actuators must comply with applicable explosion-proof or flameproof requirements where required.

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10. Integration & Automation Considerations

Actuated valves may be integrated into:

- Distributed Control Systems (DCS)
- Emergency Shutdown Systems (ESD)
- Safety Instrumented Systems (SIS)

Signal compatibility, response time, and fail-safe behavior must align with system requirements.

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11. Testing & Verification

Actuated valves are typically subjected to:

- Functional testing
- Stroke and travel verification
- Fail-safe testing
- Accessory calibration

Testing ensures reliable operation prior to commissioning.

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12. Conclusion

Proper actuator and actuation system selection is essential for safe and efficient valve operation. Final selection shall be based on valve characteristics, service conditions, control requirements, and applicable international standards.