

Engineering Standard M-SPE-STD-003 Valves for Water Applications

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1. Purpose

This document is part of a suite of Seqwater Engineering Standards which are in alignment with the Seqwater Quality Management System. Their purpose is to provide a consistent approach to the development, modification, and management of Seqwater infrastructure that is fit for purpose, economic over the life of the asset, and meets Seqwaters Work Health and Safety obligations.

This Standard Specification provides the minimum requirements and recommendations for Seqwater works relating to the design, supply and installation of new, refurbished or modified valves (and ancillary equipment) for water applications. Ancillary equipment covered includes, but is not limited to, gearboxes and actuators.

This document must be used in conjunction with the documents it references to assist in ensuring fit for purpose infrastructure. This Standard Specification is not intended to be relied on solely for design, supply, and installation works; advice from specialist engineers and/or manufacturers may be required on a case-by-case basis. This Standard Specification is applicable to all water pipeline applications (unless otherwise noted herein). These applications include, but are not limited to, Network Pipelines, raw water, process water (partially treated), sludge, service water, irrigation water and recycled water.

This Standard Specification forms the minimum requirements for the selection of preferred equipment for valves and actuators for use within Seqwater assets. Preferred equipment was selected through one or more open market procurement processes with the resultant selection listed in [REG-01074](#) Engineering Standard X-LST-STD-001 - Seqwater Preferred Equipment Register. Seqwater's Manager Commercial Services approved the recommended preferred equipment that resulted from the open market procurement processes.

This Standard Specification applies to the following types of valves:

- Metal seated gate valves
- Resilient seated gate valves
- Knife gate valves
- Resilient seated butterfly valves (both seal on body and seal on disc)
- Non-return valves (swing check and tilting disc)
- Hydraulically operated automatic control valves
- Air valves

For valve types and applications not explicitly covered by this document (e.g. those in the below list), this Standard Specification should be applied as far as reasonable and appropriate to the valve and/or ancillary equipment, unless there is a more applicable Seqwater Standard Specification.

This Standard Specification is not intended to explicitly cover:

- Electrically operated control valves designed for flow modulation; however, modulation of some in-scope valve types (referenced above) is included,
- Ball, diaphragm, plug and globe valves,
- Penstocks,
- Reduced pressure zone (RPZ) valves,
- Plastic valves, including but not limited to those for chemical applications,

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- Valves which are smaller than the nominal size ranges covered by the relevant Australian Standard (as described within this document) for a particular valve type, or
- Valves for plumbing applications.

Refer to [SPE-00367](#) Engineering Standard M-SPE-STD-001 General Mechanical for requirements related to some of the valve types not covered by this document.

2. Scope

This Standard Specification applies to all Seqwater employees, contractors, suppliers and consultants working for or on behalf of Seqwater unless otherwise stated. It applies to all new assets and to all existing assets undergoing refurbishment or modification. It must be used in conjunction with other relevant Seqwater Engineering Standards and project specific documents to define the technical requirements for infrastructure design and construction.

Where single or discrete components of an existing non-compliant system are to be replaced, refurbished or modified, this standard should not automatically be applied to the entire system retrospectively, however consideration should be given, in consultation with relevant stakeholders, to the extent of the application of the standard outside of the components requiring replacement, refurbishment or modification, to ensure safe, economic, and fit for purpose infrastructure.

Seqwater Engineering Standards detail Seqwater's minimum requirements and recommendations to provide infrastructure that will be fit for purpose, and safe to operate and maintain. However, compliance with these requirements and recommendations does not remove, and cannot be relied on as meeting, the designer's overarching responsibility for ensuring infrastructure designed is fit for purpose and safe to construct, operate, maintain, and demolish. The designer must exercise appropriate due diligence to identify and manage hazards so far as is reasonably practicable.

Designers must also ensure compliance with relevant Australian Legislation, Standards, Codes and Guidelines (including those produced by Water Services Association of Australia). Where no Australian Standard exists for a particular application, work must conform to the most current version of an industry accepted international standard.

Deviation from meeting the minimum requirements in this Standard Specification requires written agreement from Seqwater as per the deviation process detailed in Procedure X-PRO-STD-008 Asset Standards Management and Application. That process includes completion of a [TEM-00224](#) Engineering Standard X-TMP-STD-022 Asset Standards Deviation Request Template and submission by the Seqwater Project Representative to the Seqwater Engineering Mailbox. Where noted in this Standard Specification that Seqwater approval, agreement, or acceptance shall/must be sought, such approval, agreement or acceptance must be gained through the Seqwater Asset Standard Deviation process, as outlined above.

Responsibility for ensuring compliance with Seqwater Engineering Standards lies with those engaged in the management and execution of design, construction, and modification of Seqwater infrastructure. This includes modifications to the functional design of the infrastructure including technical changes made which would extend an asset outside of its design operating envelope and/or approved operation and maintenance practices.

Any ambiguities or conflicts identified between specific requirements within this Standard and project documents, another Seqwater Engineering Standard or Australian Legislation, Standards, Codes or Guidelines, these must be

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brought to the attention of the Seqwater Document Owner, via the Engineering Mailbox, for clarification. Where it is proposed to proceed without meeting the requirements of this standard, agreement must be obtained via the Deviation Process, as outlined above.

Seqwater undertakes regular updates of its Engineering Standards. Before utilising this Engineering Standard the complete list of Seqwater Engineering Standards should be reviewed to ensure currency and applicability of standards to be applied to the works. These can be accessed from the Waternet Engineering Standards & Framework page.

3. Technical Requirements

3.1. General

Refer to [SPE-00367](#) Engineering Standard M-SPE-STD-001 General Mechanical for general requirements relating to mechanical assets.

The requirements of WSA 03-2011 Water Supply Code of Australia and [SPE-00395](#) Engineering Standard D-SPE-STD-001 Water Supply Network Planning, Design and Construction (*Seqwater Supplementary Manual to WSA 03-2011*) shall be applied wherever applicable.

Valves shall be suitable for the intended application and have a proven record of reliable operation in that application. The specific application details include, but are not necessarily limited to, operational and maintenance requirements, operating environment, and water quality. In the case that a specific requirement within this Standard Specification would lead to installation of an unsuitable valve, an alternative shall be identified and brought to the attention of Seqwater for approval.

Spare parts shall be readily available in Australia for components which may reasonably require replacement. Any specific requirement for maximum lead time of spares should be nominated in the specification or design.

Where materials are not nominated within this Standard Specification, the Contractor shall select valve materials best suited for the operating conditions and environment.

Valves which are larger than the nominal size ranges covered by the relevant Australian Standard shall still comply with that standard wherever possible. Specific Australian Standard requirements which cannot be met due to valve size shall be brought to the attention of Seqwater for approval.

Where a valve is installed on a pipeline with cathodic protection, the effectiveness and continuation of the cathodic protection shall be maintained as appropriate for that system.

There shall not be any external pockets on the valve body or associated equipment which facilitate moisture ponding.

Lifting attachments shall be provided in accordance with the relevant section of [SPE-00367](#) Engineering Standard M-SPE-STD-001 General Mechanical.

3.2. Design Life

The minimum design life of the assets shall be as per Table 1, unless otherwise specified or approved by Seqwater. It is acceptable that valves such as air valves, non-return valves and hydraulically operated automatic control valves may require periodic or scheduled maintenance to reach the required asset life.

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Table 1 – Asset Design Lives

Asset	Minimum Design Life
Gate Valve	Same as pipeline asset life – refer to M-SPE-STD-001
Butterfly Valve > DN150	50 years
Butterfly Valve ≤ DN150	25 years
Non-Return Valve	25 years
Hydraulically Operated Automatic Control Valve	25 years
Air Valve	Same as pipeline asset life – refer to M-SPE-STD-001
Gearbox	Same as associated valve
Electric Actuator	Refer to Section 3.19.3

3.3. Operating Conditions

All valves and ancillary components shall be suitable for the design and maximum (emergency) flows, pressures, forces, temperatures and other duty conditions. The valve pressure class shall be as specified within the Scope of Works or other project specific documentation.

Unless specified otherwise, isolating valves shall be bi-directional, i.e. capable of operation with flow in both directions and pressure on either side of the valve.

Valves, actuators and ancillary components shall be rated for continuous operation.

All valves and ancillary components shall be suitable for indoor, outdoor or buried use (as appropriate) and be suitably rated for the environmental conditions. Equipment installed outdoors (or not fully protected by a structure) shall be rated for operation in direct UV exposure and exposed to severe weather conditions. Some equipment may be required to be rated for operation in chemically aggressive atmospheres.

The minimum climactic condition rating shall be from -5°C to 45°C, with 100% relative humidity.

As specified for the particular application, valves shall be suitable for installation in the nominated physical orientation.

3.4. Safety in Design

Seqwater's expectations relating to safety in design are outlined in [PRO-01617](#) Engineering Standard X-PRO-STD-009 Engineering Design, Construction, Operation and Maintenance.

All equipment and installations must be designed to perform the intended duty safely and without being attended. Health and safety risks shall be mitigated as far as reasonably practicable. Wherever practicable, health and safety risks shall be fully mitigated ("designed out") during the design phase for both the construction and end use phases.

A full set of warning signs must be supplied on and around valve installations, giving warnings and instructions.

3.5. Potable Water Compatibility

All valves and ancillary components (as appropriate) shall have certified compliance with the requirements of AS 4020 as per *M-SPE-STD-001 General Mechanical* - Potable Water Compatibility section. Valve coatings considered

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in contact with potable water shall comply with the Potable Water Compatibility section in [SPE-00348](#) Engineering Standard M-SPE-STD-004 Protective Coatings.

3.6. Manual Operating Elements

3.6.1. General

The valve manual operating element is the interface where input force is provided by the operator. Manual operating elements include, but are not necessarily limited to, hand wheels, handles and removable keys.

Hand wheels or removable keys (as appropriate for the situation) are the preferred type of manual operating elements. Alternatives will be considered on a case by case basis. Lever operated quarter turn valves are only acceptable for valves $\leq$ DN100.

Hand wheel diameter shall not exceed 600 mm, unless otherwise approved by Seqwater.

A standard spindle cap shall be provided where manual actuation is via a removable key.

Manual operating elements shall be easily and safely accessible. Suitable access platforms shall be provided where necessary and comply with [SPE-00366](#) Engineering Standard M-SPE-STD-002 Fixed Platforms, Walkways, Stairways and Ladders.

Unless otherwise approved by Seqwater, manual operating elements shall be either horizontal or vertical, i.e. not angled.

The centreline of a manual operating element should be positioned above the ground or operating platform level (i.e. where the operator is standing) as follows:

- Between 900 mm and 1200 mm where the manual operating element is horizontal (i.e. attached to a vertical spindle), or
- Between 1000 mm and 1500 mm where the manual operating element is vertical (i.e. attached to a horizontal spindle).

If the above manual operating positioning requirements cannot be met, the proposed positioning will need to be assessed as safe by the Contractor and approved by Seqwater. For valves $\leq$ DN150, where operator access to the valve is readily and safely achievable, the above manual operating positioning need not apply.

Where valve operation is via a spindle cap below the operator access level, the spindle cap shall be located as follows:

- Below a platform: between 50 mm and 100 mm below the platform level
- Below ground: between 150 mm and 300 mm below the ground surface level

An adequate keyhole (with removable cover) shall be provided directly above the spindle cap.

For a manual operating element located adjacent to an operating platform, the horizontal distance from the edge of the operating platform to the centreline of the manual operating element shall not exceed 500mm.

3.6.2. Operator Input Force

Running Torque

Over the full asset life, the maximum operator manual input force (rim pull effort) to overcome the normal valve 'running' torque shall not exceed 160 N per hand (i.e. 320 N for a 2 handed operation) applied on the operating

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element. This shall be based on the specific worst-case operating conditions, with any associated bypass open. A gearbox may be required to achieve this requirement (refer to Section 3.18).

Seat and/or Un-Seat Torque

If practicable, the maximum operator manual input force to seat and/or un-seat ('crack') the valve should meet the same requirements as above for running torque. This may be achievable using a gearbox (refer to Section 3.18). Subject to Seqwater approval, it may be acceptable to use either multiple personnel or a non-standard manual operating element.

If the above is not practicable, a seat and/or un-seat input force above 160 N per hand may be allowed, subject to Seqwater approval.

To facilitate Seqwater approval for use of multiple operators, non-standard manual operating elements, or a force greater than 160 N per hand, the Contractor shall confirm that the valve seat and/or un-seat torque will be able to be safely achieved on site. In addition, the Contractor shall specify the maximum operator input force (and required torque) to seat and/or un-seat the valve and provide an assessment and methodology which details the intended method of safe operation over the full range of operator movement.

3.6.3. Direction of Closure

For all valves, the manual operating element direction of closure shall be anti-clockwise, unless otherwise approved by Seqwater.

Each permanent operating element or spindle cap shall be clearly and indelibly marked 'CLOSE' with an arrow to indicate the direction of closure.

3.7. Extension Spindles

A permanent extension spindle shall be provided where required to ensure valves are able to be safely operated or actuated from a readily accessible location. The spindle is to be attached to a suitably located permanent actuator, manual operating element, or spindle cap. Examples where an extension spindle would likely be required include valves in below ground level installations (buried or in a pit), submerged valves, or valves below operating platforms.

Extension spindles shall be a one piece (i.e. not made up of multiple sections) rigid shaft capable of transmitting the maximum design torque of the system.

Extension spindles for gate valves shall be in accordance with WSAA Product Specification WSA PS – 262 and AS2638.1 or AS2638.2 (as applicable).

Extension spindles for all other valves shall comply with WSAA Product Specification WSA PS – 269 and any relevant Australian Standard.

No welding of cast spindle components is permitted.

In buried valve installations, extension spindles shall be enclosed in a suitably sized and rated rigid PVC tube or shroud. Pooling of water within the shroud shall be mitigated.

Extension spindles shall be fitted with supporting brackets as required.

Spindle shrouding should be considered where there is potential for unintended contact of personnel with rotating spindles.

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In order to reduce maintenance and points of failure, the use of universal joints connecting spindles should be avoided.

3.8. Position Indicators

Valve installations where the person operating has little to no visibility on the valve position shall be fitted with a position indicator. Indicator examples include, but are not limited to, an integral indicator on the gearbox or actuator (if installed), or indication on or connected to the valve spindle. Mechanical indicators are preferred to ensure position indication during power loss. The indicator shall show when the valve is in the fully open, intermediate (continuous) and fully closed positions.

Valves that are not readily visible shall have a remote position indicator visible at the operating position. Examples include valves which are buried, submerged, or those fitted with extension spindles (e.g. in pits).

Position indicators shall be suitably protected and sealed against ingress of moisture and contaminants as appropriate to the operating and environmental conditions.

3.9. Flanges and Bolted Connections

Flanges, gaskets, and bolted connections shall be as per the relevant sections of [SPE-00367](#) Engineering Standard M-SPE-STD-001 General Mechanical unless otherwise stated within this Standard Specification.

All valves shall be double flanged where practicable.

Lugged valves are acceptable, if necessitated by the application. Examples of acceptable situations to install a lugged valve include replacing an existing lugged valve (where pipework modification is not practicable) or installing a new valve where length constraints cannot be reasonably overcome by other means.

Wafer type valves shall not be used for sizes > DN150. For valves ≤ DN150 it is preferred that wafer type valves are not used unless it is the most appropriate valve type for the application.

All internal and external fastener components (e.g. studs, bolts, nuts, washers) shall be 316 stainless steel class 70 (minimum) in accordance with AS 1110, unless this material and/or standard is not appropriate for the application. Higher class bolts (with an appropriately rated flange gasket) may be required for some applications. The bolted connections section of [SPE-00367](#) Engineering Standard M-SPE-STD-001 General Mechanical contains further information regarding the use of stainless steel fasteners.

3.10. Protective Coatings

Valve protective coatings shall be as specified within the relevant valve specific Australian Standards for the valve type, as suitable for the environment.

Ancillary component (gearbox, actuator etc.) protective coatings shall be the Manufacturer's specified high performance coating suitable for the environment.

Where the above statements in this section do not adequately define the protective coating requirements, refer to [SPE-00348](#) Engineering Standard M-SPE-STD-004 Protective Coatings.

3.11. Markings

Valves shall include body markings and name plates as specified within the relevant Australian Standards.

Each below ground valve shall have individual above ground indication / identification as follows:

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- A marker post and information plate as per Seqwater standard drawing D-DWG-STD-003.
- Where practicable, a stainless steel nameplate displaying the valve identification number (i.e. the same as shown on marker post information plate) should be provided at the valve operation point (above ground). The intention of this is to reduce the risk of incorrect valve operation.
 - Where valve operation is via a below ground spindle cap, this identification plate shall be installed on the concrete collar surrounding the spindle cap cover.
 - Where valve operation is via an above ground actuator, this identification plate shall be installed in a readily viewable location near the actuator.
 - Note that installation of a stainless steel nameplate is generally not suitable in regularly trafficked areas (due to plate wear).

3.12. Valve Installations

3.12.1. General

Valves shall be installed strictly in accordance with Manufacturer's instructions and this Standard Specification.

Installation of valves $\geq$ DN250 on non-horizontal sections of pipeline shall be avoided. Where a valve is to be installed on an existing section of inclined pipeline, it is generally preferred that a horizontal section of pipe be installed at the valve location. This has multiple advantages including, simplifying installation / replacement and removing the need to install universal joints. Installation of a valve on a non-horizontal section of pipe requires Seqwater approval. Where installation on non-horizontal pipelines is unavoidable and approved, options that do not include universal joints are preferable, for example installation of gearbox at an angle to the valve allowing for vertical extension spindle.

A number of Seqwater Standard Drawings are available to provide guidance related to standard valve and pit arrangements. The final design of the installation shall be based on the specific application. Relevant standard drawings include those identified in Table 2.

Table 2 – Relevant Standard Drawings

Drawing No.	Description
D-DWG-STD-00030	Butterfly Valve General Arrangement
D-DWG-STD-00031	Gate Valve General Arrangement
D-DWG-STD-00005	Scour Valve General Below Ground Arrangement
D-DWG-STD-00006	Air Valve Pit Typical Arrangement Details
D-DWG-STD-00018	Air Valve Installation General Arrangement

In addition the WSAA WAT-1300 series drawings shall be applied where appropriate.

Valves, gearboxes, actuators, operating elements and any other ancillary equipment shall be installed so that they are safely accessible for operation and maintenance. This includes provision of sufficient clearances. Clearance between equipment and structures must be a minimum of 600mm, or greater if required to safely perform maintenance tasks.

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Permanent access structures shall be provided where necessary for operation and maintenance. These shall be as per [SPE-00366](#) Engineering Standard M-SPE-STD-002 Fixed Platforms, Walkways, Stairways and Ladders, as well as relevant Seqwater standard drawings.

Where required to mitigate risk to personnel, guarding should be provided to isolate moving components.

Refer to Section 3.6.1 for requirements relating to the positioning of manual operating elements.

A dismantling joint or other approved means of disassembly shall be provided to allow valves to be removed. Consideration is to be given to safe and practical methods of removal during the design process. Subject to Seqwater approval, a means of dismantling may not be required for buried valves.

Sufficient isolation valves to facilitate maintenance shall be provided for valves used for modulating flow control, non-return valves, hydraulically operated automatic control valves, and any other valves nominated within the design. Note that isolation valves do not necessarily need to be installed directly adjacent to the maintained asset.

3.12.2. Below Ground Installations

Section 3.12.2 applies to valves installed on buried pipelines; noting that the valve itself may be located within a pit.

Only gate valves may be direct buried. All other below ground valves shall be installed within suitable pits.

Pits shall be permanently drained via a suitably sized drainage pipe (preferred) or sump pump.

Where a valve is to be installed within a pit, the need to enter a confined space shall be avoided as much as practicable. Installation of unnecessary items within confined spaces shall be avoided. Unless the pit is within a traffic corridor, items requiring regular maintenance access, such as an actuator, must be located above ground and be suitably protected by an enclosure as appropriate. Issues and risks related to personnel access, vehicle access, vandalism and security of any above ground equipment must be considered.

All valve pit cover slabs and access covers shall be trafficable (Class D – as defined in AS 3996) unless otherwise stated within the design and accepted by Seqwater. Preference will be given to covers that have a lower manual handling risk or are easily able to be handled by mechanical aids that retain a class D rating. Other classes of cover may be accepted on the basis that any vehicular access is excluded from the pit covers by means of:

- Inclusion of bollards around the pit
- Pit walls extending above ground level such that vehicles cannot gain access to pit covers
- Vehicular access to top of pit is physically not possible in normal circumstances (such as areas fenced off or within compounds that provide a barrier to access to vehicles).

For vertically orientated gate valves in pits, where the top slab is not readily removable, suitable clearance to safely undertake valve maintenance shall be allowed between the top of the gate valve and the underside of pit top slab. The minimum clearance shall be 500mm.

Wherever possible, valves shall not be installed such that maintenance or replacement requires disturbance to another asset or private driveway / access.

Where portable actuators are to be used to operate valves the above ground arrangement of the valve pit is to be considered such that access is available to trailers or vehicles nearby to the valve spindle access point where possible.

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3.12.3. Valve Bypasses

Where required, suitably sized bypass arrangements shall be provided to manage differential pressure and associated valve forces during valve operation. Provision and sizing of a bypass is dependent on the application and expected operating conditions.

As a general guide, it is expected that for Network Pipelines valve bypasses should be provided as follows:

- Pressure rating $\leq$ PN16 – bypass required for valves $\geq$ DN375
- Pressure rating $>$ PN16 – bypass required for valves $\geq$ DN300

For non-Network Pipeline valves, it is often the case that a bypass is not required due to low pressures.

Valves with integral bypasses shall not be used.

Where it is deemed operationally necessary to maintain operational flows during valve maintenance or replacement, a high capacity bypass line shall be provided. An example of where this may be required is a control valve which requires multiple overhauls (periods of downtime) over its life cycle.

3.13. Gate Valves

3.13.1. General Requirements

Gate valves shall only be used as isolation valves and shall be either fully open or fully closed during operation.

Gate valves for Network Pipelines shall have non-rising spindles.

Gate valves shall be installed with the spindle vertical, unless horizontal installation is required to provide a prudent and efficient installation. Horizontal installation must be explicitly justified as part of the design and approved by the valve manufacturer prior to purchase. Guide liners may be necessary to support the additional loadings resulting from horizontal installation.

3.13.2. Metal Seated

Metal seated gate valves shall be in accordance with AS 2638.1 and WSAA Product Specification WSA PS – 261.

3.13.3. Resilient Seated

Resilient seated gate valves shall be in accordance with AS 2638.2 and WSAA Product Specification WSA PS – 260.

The wetted sections of the valve body shall be fully covered by the resilient seat material, with no metal parts exposed to the medium.

The resilient seat shall be vulcanised to the valve body. Press fitted, glued, or mechanically retained seats are not acceptable.

3.13.4. Knife Gate

Knife gate valves shall be in accordance with AS 6401 and WSAA Product Specification WSA PS – 266.

Knife gate valves shall not be used within Network Pipelines. Knife gate valves are acceptable within water treatment plants and facilities, subject to suitability for the specific application, and based on design approval.

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3.14. Butterfly Valves

3.14.1. General

Section 3.14 applies to standard resilient seated butterfly valves which are intended to be used as isolation (i.e. during normal operation, the valve shall be either fully open or fully closed). Alternative requirements may apply to butterfly valves required for flow modulation, high velocity conditions or critical applications. Butterfly valves for these applications shall be specified on a case by case basis to ensure that the valve is suitable for the full range of operational conditions.

Resilient seated butterfly valves shall be in accordance with the appropriate part of AS 4795 and WSAA Product Specification WSA PS – 263.

Refer to Section 3.9 for information related to allowable valve body / connection type.

Resilient seated butterfly valves shall provide drip tight sealing from both sides when closed in operation.

Resilient seated butterfly valves shall be seal on disc for diameters $\geq$ DN600.

The valve shaft shall be positively locked to a one-piece disc. Splined connections are preferred. If pin connections are used, pins should be secured to the disc using an appropriate method, for example a retaining nut or tack weld (as appropriate).

Where required, valves shall be supplied with a suitability rated locking device which shall enable locking of the valve disc in either the open or closed position, to facilitate safe pipeline inspection or allow repair work to the gearbox or actuator when the pipeline is under pressure.

Butterfly valves shall be installed with the shaft in the horizontal position and the lower part of the disc opening in the direction of flow. Adequate clearance shall be provided between the butterfly valve disc and the adjacent pipes to allow full opening without clashing.

3.14.2. Seal on Disc

For valves $\geq$ DN750, the seal shall be readily replaceable on site without requiring the removal of the valve from the pipeline. The seal shall be of a low profile, resistant to high velocities and cavitation damage.

Seal on disc valves shall be double or triple eccentric.

The body seat ring shall not be press fitted or held in place by welding. Body seat rings which are bolted in or formed by weld deposition and machining are acceptable.

3.14.3. Seal in Body

Seal in body valves are not preferred, however may be accepted by Seqwater if required for a specific application. The contractor or supplier shall make a case as to why seal in body valves are required for consideration and approval of use by Seqwater via the deviation process.

If approved for use, seal in body valves shall be double or triple eccentric.

The resilient seal shall be mechanically restrained or vulcanised to the body. Press fitted or glued in resilient seals shall not be used.

3.14.4. Seal on Body

Seal on body valves shall have an aluminium bronze or stainless steel disc. The disc shall not be coated.

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The wetted sections of the valve body shall be fully covered by the resilient seal material, with no metal parts exposed to the medium.

The resilient seal shall be vulcanised to the valve body. Pressed fitted, glued or mechanically retained seals are not acceptable.

The valve seal shall extend over the flanges forming integral flange gaskets so that separate gaskets or O-rings are not required. The sealing surfaces of the valve shall bed on the metal face of the adjoining pipework flanges, not on the cement mortar lining. If the valve sealing surface does not bed on the adjoining metal face, the supplier shall provide grade 316 stainless steel (if appropriate) compensating rings and associated flange gaskets to provide an effective seal.

3.15. Non-Return Valves

This section applies to swing check and tilting disc non-return valves. This Standard Specification does not include requirements for high dynamic response check valves and/or damping devices which may be required for systems with significant transient pressure effects. High dynamic response check valves and damping devices shall be specified on a case by case basis.

Swing check and tilting disc non-return valves shall be in accordance with AS 4794 and WSAA Product Specification WSA PS – 264.

Where counterweight arms are required, the counterweight arm shall have an adjustable weight and be suitable for a hydraulic damper installation in the future if deemed necessary. A safety guard shall be provided on any non-return valve with a counterweight arm

Valves shall be installed with the shaft / hinge pins in the horizontal position.

Where specified, non-return valves installed on the discharge side of pumps shall be fitted with a limit switch ('no-flow' switch) or be suitable for installation of a limit switch in the future.

3.16. Hydraulically Operated Automatic Control Valves

Hydraulically operated automatic control valves shall be in accordance with AS 5081 and WSAA Product Specification WSA PS – 268.

Ancillary control components (such as regulators, solenoids, strainers, gauges etc.) shall be panel mounted, not within a confined space, to facilitate inspection and maintenance. A piping and instrumentation diagram shall be provided for the complete control valve assembly, providing settings and commentary on the functionality of each control component. A weatherproof version of this diagram shall be affixed adjacent to the panel.

Hydraulically operated automatic control valves shall be installed horizontally and upright, unless accepted otherwise by the Manufacturer and Seqwater.

3.17. Air Valves

Air valves shall be in accordance with AS 4956 and WSAA Product Specification WSA PS – 265.

Note that air valves compliant with the above documentation may not be suitable for use in applications with some non-treated water. In such a case, the air valve shall be selected for adequate performance taking into account the operating conditions and requirements.

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Air valve sizing and installation shall be in accordance with [SPE-00395](#) Engineering Standard D-SPE-STD-001 Water Supply Network Planning, Design and Construction (*Seqwater's Supplementary Manual to WSAA Water Supply Code of Australia: WSA 03-2011*).

Air-release valves shall vent accumulating air while a system is in service and under pressure.

To facilitate maintenance of the air valve, an isolating valve shall be provided between the pipeline and the air valve in accordance with the following:

- All isolators for air valves which are intended to be operated from above, such as those on buried pipelines, shall be hydrant type air valve isolators (i.e. screw down type isolation valves).
- All isolators for air valves which are not intended to be operated from above, such as those on aboveground pipelines, shall be specified as appropriate. It is expected that this will generally be a gate valve.
- Lever operated quarter turn valves shall not be used as air valve isolators.
- Stainless steel ball valves shall be used as isolators to air valves $\leq$ DN50 for above ground pipes.

3.18. Gearboxes

3.18.1. General

Gearboxes shall be supplied where required for the specific application. This includes where, without a gearbox, the maximum operator input force to overcome the normal valve running torque would not meet the requirements detailed in 3.6.2. Gearboxes shall be either part-turn or multi-turn, depending on the required rotation of the output shaft.

Gearboxes shall be totally enclosed and incorporate seals on the input and output shafts to prevent ingress of foreign matter and water. The enclosure rating shall be IP68 in accordance with AS 60529, suitable for a minimum immersion of 5 meters of water for 72 hours. Gearboxes shall be lubricated for life where required for the application.

Gearboxes must not be buried. Refer to Section 3.3 for operating condition information.

Gearboxes shall be sized to achieve the maximum output torque required (including a safety margin) over the full range of operating conditions.

Gearboxes shall be suitability robust and capable of withstanding the forces generated by the maximum input torque (including an appropriate safety factor). This shall include consideration of actuator stalling torque (in the event of torque or position limit device failure).

Where appropriate, gearboxes shall be self-locking in all positions.

The requirements within Section 3.3 shall be adhered to for any manual operating element attached to the gearbox.

Gearboxes for part-turn applications shall be fitted with a mechanical position indicator (dial and pointer), that can be clearly read from the operating position, to show the valve position between fully open and fully closed. The need and method for provision of visual position indication for multi-turn applications shall be assessed on a case by case basis.

Gearing shall have a single piece input shaft/worm or shaft/pinion, as applicable.

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Where applicable, a removable top entry stem nut with dual locking rings shall be provided to facilitate inspection and maintenance.

Where required, thrust bearings (integral to the gearbox) shall be included and should not need to be removed to replace the stem nut. Integral thrust bearings shall be provided for gearboxes which are intended to be operated via a permanent or portable motorised actuator.

Where required, gearboxes must be easily configurable to incorporate either Lost-Motion (hammer blow) or No-Lost-Motion (NLM) drive type as appropriate for the application.

Gearboxes must have a removable splined drive bush, to enable change of orientation to suit valve stem. The attachment arrangements shall match the standard ISO attachments, i.e. ISO 5210 for multi-turn and ISO 5211 for part-turn.

Where appropriate, gearboxes shall incorporate adjustable integral position end stops to limit valve travel.

Where required, there shall be input stops and/or a torque limiting device on the gearbox input shaft (i.e. actuator output shaft), independent of the gearbox. Any such device should be designed and set to protect the integral gearbox end stops. Inputs stops and torque limiting devices shall be fully enclosed (with the same IP rating as the gearbox), adjustable and set by Manufacturer to the nominated position or torque. The set position or torque shall be permanently marked on a stainless steel plate attached to the device. A torque limiting device, which provides protection throughout the valve stroke, should be considered for any buried valve.

Gearboxes shall include an engraved stainless steel nameplate, permanently attached using stainless steel fixings or adequate adhesive, suitably located on the gearbox so that it is clearly visible after installation. In addition to any requirements noted in the relevant valve standard (as specified in above sections), the following information shall be included:

- Manufacturer's name
- Model and serial number
- Year of manufacture
- Gear ratio
- Maximum allowable gearbox input torque.

3.18.2. Butterfly Valve Gearboxes

Gearboxes for resilient seated butterfly valves shall comply with AS 4795.

3.18.3. Gate Valve Gearboxes

Gearboxes for metal seated gate valves shall comply with AS 2638.1.

Gearboxes for resilient seated gate valves shall comply with AS 2638.2.

In accordance with WSA 03, gearing shall be provided for PN16 valves of size >DN500 and PN21, 25 and 35 valves of size ≥DN400. In some cases, gearing may be required for valves smaller than those noted above to meet the maximum input force requirements (set out in Section 3.6.2) or other requirements within this document.

Gearboxes shall be sized in accordance with Appendix D of AS 2638.1 or AS 2638.2, as appropriate, and be based on the specific operating conditions.

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For valves which are normally operated via a powered actuator, sizing of the gearbox will need to be completed in combination with sizing of the actuator, as outlined in Section 3.19.2.

For valves which are normally manually operated (i.e. no permanent powered actuator), the number of turns to operate the valve should be minimised without exceeding the maximum input force requirement to overcome normal valve running torque, as specified in Section 3.6.2. Table 3 provides guidance on the typical maximum number of turns to practically operate valves of various sizes. Note that for this type of installation, it is generally not practicable or recommended (due to excessive turns to operate) to size gearboxes for large gate valves to have a maximum input force of less than 160N per hand (on the standard operating element) to overcome seating and/or un-seating torque ('cracking' torque). In this case, as per Section 3.6.2, the seat and/or un-seat force, torque and methodology shall be subject to Seqwater approval.

Table 3 – Typical Maximum Number of Turns to Operate a Valve in a Reasonable Time

Valve Size	Maximum Number of Turns
DN600	120
DN750	140
DN900	170
DN1200	500

3.19. Actuators

3.19.1. General

Powered actuators shall be supplied where required or nominated for the specific application. It is recognised that the type of actuator used will be based on factors such as; valve / actuator environment, criticality and operational requirements, as well as availability of an energy source. Variations of actuator type include, but are not limited to, different energy sources (e.g. electric or pneumatic) and intrusive or non-intrusive types.

Section 3.19 is intended to cover the mandatory and recommended requirements for 'high-spec' non-intrusive type electric actuators (which include a display screen and local control facilities). Unless otherwise specified within the design documentation, and accepted by Seqwater, actuators shall be of this type. Where an alternative type of actuator is used, the requirements within Section 3.19 shall still apply where applicable and as far as practicable.

Actuators shall incorporate all mechanical, electrical and control components necessary for the application, housed within a suitability robust self-contained sealed enclosure. Components shall include all of those described within Section 3.19, unless otherwise accepted by Seqwater.

Actuators shall be suitability robust and capable of withstanding the forces generated by the maximum torque. This shall include consideration of actuator stalling torque (in the event of torque limit failure). The actuator and gearbox assembly shall be designed to seat, unseat and rigidly hold the valve in any position between fully open and fully closed (inclusive) under all operating conditions without creep or flutter.

Appropriate hazardous area certified (IECEx) actuators shall be provided, as required for the application.

Refer to Section 3.3 for operating condition information.

Where applicable, it is required that actuators be installed above ground as per Section 3.12.

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The device shall be non-intrusive. To maintain the integrity of the enclosure, calibration (including, setting of the torque levels, position/turn limits and general configuration etc.) shall be carried out without the removal of any actuator covers.

Actuators shall be capable of being rotated through increments of 90 degrees to suit valve / access orientation.

Actuators shall be positioned to allow sufficient maintenance access and be a minimum of 1000 mm above the ground or operating platform level.

Actuators shall include an engraved stainless steel nameplate, permanently attached using stainless steel fixings or adequate adhesive, suitably located on the actuator so that it is clearly visible after installation. In addition to any requirements specified in relevant standards, the following information shall be included:

- Manufacturer's name
- Model and series number
- Year of manufacture
- Motor kW rating, speed, voltage, no. of phases, max. current, power factor and insulation class
- Maximum operating output torque
- Output speed
- IP rating
- Hand wheel ratio.

Following a power loss scenario, when mains power is restored, the actuator must automatically return to fully functional operation i.e. there must not be a need for personnel to attend the actuator.

Where specified, an external backup power source shall be provided for the system to enable full monitoring or valve fail safe operation (e.g. fail closed) during a mains power loss scenario.

Where specified, diagnostic facilities / logging shall be included to accumulate, report and troubleshoot the actuator performance.

Any required commissioning tools shall be provided with the actuator and must meet the enclosure protection and other certification levels of the actuators. Commissioning tools shall not form an integral part of the actuator and must be removable for secure storage / authorised release. In addition, provision shall be made for the protection of configured actuator settings by a means independent of access to the commissioning tool.

Any separate auxiliary actuator control station mounted in the field shall meet the same requirements as the actuator, as applicable.

3.19.2. Actuator Rating and Sizing

The actuator shall be suitable for use with the nominal voltage, phase and frequency of the power supply. It is preferred that actuators operate on a 400V, 3-phase, 50 Hz power supply. However, 230V, single-phase, 50 Hz actuators may be used where 230V single-phase is the standard model (small actuators) and/or subject to practicable availability of 3-phase power at the site.

The actuator shall be sized and rated based on consideration of all relevant operational factors. Where provided, the gearbox (refer to Section 3.18) will need to be sized in combination with the actuator. Operational factors to consider include, but are not necessarily limited to:

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- The maximum output torque required over the full range of operating conditions (including a minimum 30% torque safety margin). Factors influencing torque required include, but are not limited to, seating, unseating and emergency flow forces at the relevant maximum differential pressure. The safety margin must be sufficient to provide the maximum output torque required with supply voltage 10% below nominal.
- The valve full stroke operating time / movement speed required (maximum and minimum).
- The intended maximum actuator operational duty. Minimum requirements are as follows:
 - The rated maximum number of starts per hour shall not be less than 20 for part-turn applications, 50 for multi-turn applications, and 1000 for automatic modulating actuators. If a shade cover is required to achieve the required duty, it shall be provided.
 - Unless otherwise approved by Seqwater, the actuator shall be rated for continuous operation for a minimum of three full valve cycles under normal operating conditions, i.e. continuous movement from 100% open to 0% open to 100% open (or visa verse).
 - Consideration of the manual operating element requirements in Section 3.19.7.

The maximum rated torque capacity of the actuator shall not be such that the torque transferred to the gear box and/or valve components would cause damage to these assets if limiting devices fail.

3.19.3. Design Life & Durability

Actuators for non-modulating duty shall be designed and selected to have a minimum design life of 10 years for the specified operating requirements. The minimum durability shall be 10,000 valve open-close-open cycles or 1,000,000 actuator output drive sleeve turns. Dependent on the application, durability requirements may need to be more than the above values to achieve the minimum 10 year design life.

Actuators for flow modulating duty shall be designed and selected to perform a minimum average of 1000 movements per day with a 10 year design life.

3.19.4. Operating Time

Table 4 provides guidance on the typical expected full stroke opening and closing times for non-modulating actuated valves of various sizes. Operational and valve specific requirements shall be considered when selecting operating times. Values in Table 4 are typical only, analysis may be required to determine minimum closure times to ensure transient pressures are managed.

Table 4 Typical Full Stroke Operating Times

Valve Size	Time for Open-to-Close / Close-to-Open (seconds)
≤ DN200	20 – 30
DN250 – DN400	60 – 90
DN450 – DN900	180 – 270
DN1000 – DN1200	300 – 450
> DN1200	500 – 750

3.19.5. Enclosure

Electric actuators (and any external attachments) shall be manufactured with an enclosure rating of IP68 in accordance with AS 60529, suitable for a minimum immersion of 5 meters of water for 72 hours.

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The enclosure shall be designed to prevent breathing and condensation.

The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the terminal cover is removed on site for cable connection. The ingress protection rating of the enclosure housing the motor and other internal electrical components shall not be compromised while the terminal cover is removed. The terminal compartment shall have the same ingress protection rating as that specified for the actuator.

The enclosure must allow for temporary site storage without the need for electrical supply connection.

All external fasteners shall be stainless steel, unless this material is not appropriate for the application.

3.19.6. Motor

The motor and integral reversing starter shall be an integral part of the actuator, designed specifically for valve actuator applications and the associated forces. The motor shall be a low inertia high torque design with suitable insulation and temperature rise class for the application. The motor shall include temperature sensing embedded within the motor windings, integrated into the control functionality, to prevent damage due to over-load.

The integral reversing starter shall be appropriately rated for the motor size and be suitable for the nominal minimum starts per hour (refer to Section 3.19.2). It should be mechanically and electrically interlocked to prevent simultaneous energising of the open and close coils. The integral reversing starter shall be modular so that it may be easily replaced in the field.

Electrical and mechanical disconnection of the motor and integral reversing starter shall be easily achieved using suitable cable connector(s) and shaft coupling. Motor and/or integral reversing starter removal should be possible without draining the lubricant from the actuator gear case.

Motor protection shall be provided as follows:

- Stall or over-torque – feedback from the torque measurement device shall de-energise motor within a nominal time period in the event of a stalled/jammed valve or over-torque.
- Over-temperature – feedback from the thermistor(s) will trip the motor. Auto-reset of the actuator should occur once temperature is below a nominal threshold.
- Single phasing – lost phase protection shall detect the issue and trip the motor.
- Over/under current or voltage – protection shall detect the issue and trip the motor.
- Direction – the phase rotation correction circuit shall ensure that the motor runs with the correct rotation for the required direction of valve travel irrespective of the connection sequence of the power supply.

3.19.7. Manual Operation

The requirements within Section 3.6 shall be adhered to for the actuator manual operating element, except where otherwise specified in this section.

Electric actuators shall be fitted with a hand wheel for emergency operation. It shall not rotate during electric operation. The hand wheel shall be engaged when the motor is declutched via a lever or similar means. Loss of power or non-mechanical failure of the actuator shall not prevent manual operation of the valve. Energising the motor shall automatically return the actuator to motor operation, without damage to the drive train, and the hand/auto selection lever shall not automatically move.

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Provision shall be made for the hand/auto selection lever to be lockable in either the hand operation or remote operation position.

If practicable, it is preferred that the maximum operator manual input force meets the requirements set out in Section 3.6.2. However, an operator input force of up to 200N per hand (i.e. 400N for a 2 handed operation) to overcome normal running torque is generally acceptable for this application. Seqwater approval to exceed this force shall be gained as per Section 3.6.2. The actuator hand wheel drive may need to include gearing, additional to the motor drive gearing, to suitably reduce the manual input force. Valve operation within a reasonable time must be considered.

3.19.8. Anti-condensation Heater

Where required, the motor shall include an automatic thermistor controlled self-regulating anti-condensation heater. This shall allow the motor and other components to withstand long period of idleness.

3.19.9. Power Transmission & Gearing

The power transmission shall be suitably robust to transfer the maximum rated loads and be completely bearing-supported (both radial and thrust bearings as required). All drive gearing and components must be of metal construction. Gearing shall be totally enclosed in a sealed gear case suitable for operation at any angle and be suitably lubricated.

As appropriate, lubrication shall be oil or grease, specifically designed for the application. Where possible, gearing shall be lubricated for life. Seals shall be provided at all shaft penetrations of the gear case to prevent leakage of lubricant. Lubricant shall be selected so that any leakage will not contaminate any exposed potable or process water (refer to Section 3.5) or the environment.

Where appropriate, drive gearing shall be self-locking to prevent the valve back-driving the actuator.

A Lost-Motion feature shall be incorporated where required.

3.19.10. Drive Interface

The actuator shall include a removable torque or thrust bushing (as appropriate) to mate with the valve or gearbox input spindle. The attachment arrangement shall match the standard ISO attachments, i.e. ISO 5210 for multi-turn and ISO 5211 for part-turn.

The drive bushing shall be easily detachable for machining to suit the valve stem or gearbox input shaft.

Thrust bearings shall be sealed for life.

3.19.11. Position Measurement, Accuracy & Limits

Absolute position measurement shall be incorporated within the actuator. The technology must include redundancy and be capable of reliably measuring position, even in the case of a single point fault. The system shall discern if failures require a warning only or require a warning plus automatic safe shutdown of the actuator.

The measurement device shall continuously measure valve position at all times, including during both motor or hand wheel operation, with or without mains power present, and without the reliance on an external battery. When mains power is restored following a power loss scenario, the actuator / valve position must be known and available to be transmitted. There must not be a need for personnel to attend the actuator to perform any restart calibration, even if the valve was manually operated during the mains power loss.

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The actuator must be capable of precise positioning. The minimum positioning accuracy of the actuator shall be as follows:

- For multi-turn applications, ± 7.5 degrees of output shaft position over 8000 output drive rotations.
- For part-turn applications, ± 0.1 degrees of output shaft position over 90 degree rotation.

Limits for position and/or number of turns shall be able to be set and modified as appropriate for the application. These limits shall be set to activate prior to any position limiting devices within the gearbox or on the actuator output shaft (i.e. end stops or inputs stops).

Position limit switches shall be incorporated within the actuator. Limit switches not forming an integral part of the actuator are not acceptable. Plastic limit switches are not acceptable.

Where required, there shall be independent mechanical protection on the actuator output shaft (i.e. gearbox or valve input shaft – as applicable) to limit valve travel. This protection could be in the form of input stops. Any inputs stops shall meet the requirements as described in Section 3.18.1.

3.19.12. Torque Measurement & Limits

Actuator output torque measurement shall be incorporated within the actuator. The motor shall be de-energized in the direction of travel if the torque limit is exceeded.

The torque limit for the actuator output shall be able to be set and modified as appropriate for the application. Initial setup shall be done by the Manufacturer based on the application requirements; however, the limit shall be adjustable on site. The torque limit shall be able to be set between 40% and 100% of the rated actuator output torque.

A function should be included to prevent torque trip during valve seating and/or un-seating by allowing for a temporarily increased torque limit. This boosted torque limit must still be within the rated actuator 100% output torque.

All actuator torque limits shall be set to activate prior to any independent torque limiting device(s) on the actuator output shaft.

Where required there shall be independent mechanical protection on the actuator output shaft (i.e. gearbox or valve input shaft – as applicable) to limit torque transmitted to the valve. This protection could be in the form of a torque limiting device. Any torque limiting device shall meet the requirements as described in Section 3.18.1. A torque limiting device, which provides protection throughout the valve stroke, should be considered for any buried valve.

3.19.13. Control Module

The control module should include the power and logic circuit boards, control transformer, integral reversing starter, local control interface, graphical interface, and LED indicators. These components shall be integral to the actuator.

The control module components shall suitably housed to prevent breathing and condensation.

The internal electrical supplies shall be protected against over current and short circuit faults and utilise appropriate isolation to minimise electromagnetic interference.

The control module should include an auto reversal delay, for the integral reversing starter, to inhibit high current surges caused by rapid motor reversals.

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A single point failure shall not result in erratic actuator movement. A dedicated circuit to prevent undesired valve operation in the event of an internal circuit fault or erratic command signal should be included.

Emergency shut-down (ESD) and DISABLE provision shall be included in each actuator. The inputs for ESD and DISABLE shall be configurable. The ESD signal shall override signals (as appropriate) and send the valve to its configured emergency position.

Normally closed or open contacts shall be nominated as appropriate for the application.

A configurable monitor relay shall be provided, which trips when the actuator is either in fault or unavailable. Monitor relay trip should occur during any one or more of the following conditions:

- Loss of mains power or backup power
- Loss of phase
- Motor thermostat tripped
- Torque sensor tripped
- Actuator internal fault
- LOCAL or STOP selected on actuator (only if relay is used to indicate availability)

There shall be local indication when the monitor relay is active.

3.19.14. Local Control Interface

The actuator shall incorporate local controls for OPEN, CLOSE and STOP, and have a LOCAL-STOP-REMOTE mode selector switch which is lockable in each position. The respective functions of the local mode selector switch shall be to select: LOCAL control only, STOP (no operation) and REMOTE control (with local stop only).

The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.

The OPEN and CLOSE switches should be configurable for either maintained or push-to-run (inching) control.

It should be possible to disable the local controls via authorised access protection (password / passcode). Provision shall be made to disable any provided Bluetooth communications or only allow a Bluetooth connection initiated by an Infra-Red command.

The local controls shall allow non-intrusive actuator configuration. Authorised access protection (password / passcode) must be provided for this function.

The local control interface shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

The control switches shall not penetrate the controls cover and shall be designed to electrically isolate the actuator's internal components from the external environment.

3.19.15. Local Display

An integral actuator graphical display shall be included, unless otherwise specified and accepted by Seqwater. This shall be a configurable display element able to show operational information, text indications of alarm / fault and configuration settings.

The local display shall include a numeric digital position indicator continuously displaying valve position as a percentage open (0-100%) in 0.1% increments. Where available, the valve fully open or fully closed, or partially

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open position should be indicated by symbols showing valve position in relation to the pipework to ensure that valve status is clearly interpreted.

With mains power connected, the display shall be backlit to enhance contrast at all ambient light levels and shall be legible from a distance of at least 2m.

There shall be indication included which allows for simple and quick identification of the valve status. In the case that this indication is provided via LEDs, the general approach is to use red, green, and yellow LEDs. For isolation valves, illumination should indicate valve fully open (red), fully closed (green) or moving/intermediate position (yellow). The Red and Green LEDs shall be reversible. The yellow LED should be fully programmable for blinker and fault indication.

Where required due to identified operational need or risk, there shall be provision for the digital display and LED operation to be maintained and updated (in a low power mode) during a mains power loss scenario.

Provision shall be made for the addition of an optional environmental cover to protect the display from high levels of UV radiation or abrasive materials.

The local display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

3.19.16. Remote Monitoring

Actuator and valve remote monitoring shall be provided by hardwired digital and analogue signals. These signals may be provided by the actuator, the valve itself or by the installation of additional equipment. The monitoring signals required vary depending on the application and combination of valve type and actuator used.

Valve Position Feedback

All valves are to provide positive position feedback to the control system.

Fixed position valves, such as AB valves require:

- A digital signal for each position (2+ Digitals)

Variable position and modulating type valves require:

- Valve Position (Analogue), and;
- Minimum Travel (Digital)
- Maximum Travel (Digital)

If the valve has an emergency safe position that is different to a normal operating position or minimum/maximum travel signal, an additional position feedback signal is required.

- Valve Safe Position (Digital)

Valve Torque Feedback

Where Torque feedback has been specified, the valve shall report:

- Torque (Analogue)

Additionally, If the valve is fitted with over torque protection:

- Over Torque Fault (digital)

Actuator Feedback

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For all actuators:

- Control power available (Digital)
- Operational energy available (Digital)
- Emergency Stop Healthy (Digital) – if fitted to the valve or used in the valve's control circuits

In addition, Motor actuated valves require:

- Valve or Actuator Fault (Digital)

Control Modes

If the valve is fitted with a local control interface, then the following additional digital signals are required:

- Local Control Selected (Digital)
- Remote Control Selected (Digital)

If the valve is fitted with a manual hand wheel, the valve should report Local Control Selected if the manual wheel has been engaged.

In addition, the valve should report if the valve is able to be operated remotely.

- Remote Control available (Digital)

Additional Feedback

Depending on the valve and actuator used (and application), additional behaviour reporting signals are required:

- Valve Moving (Digital – for motorised valves)
- Modulating (Digital – for valves performing a modulating function)
- Battery Low (Digital – for valves equipped with a battery backup)

Feedback Over Communications

Additional monitoring and feedback signals may be reported to the control system via a wired communication protocol, subject to the benefit justification of the additional signals and the availability of communications protocol on site. Protocol based signaling shall not replace the hardwired signals required for primary monitoring as described above.

3.19.17. Remote Control

Remote control of valves shall be provided via hardwired digital and analogue signals. The required signals depend on the application and combination of valve type and actuator.

Pulse Commands and Maintained commands

Actuators must support pulse and/or maintained command signals. If control is via pulse command; a pulse will initiate movement, and the valve will continue to move towards the commanded position until it receives a subsequent stop command. If control is via maintained command; the valve will move towards the commanded position for as long as the command is held.

Which type of command used depends on the interface supported by the actuator. Where both are supported, maintained commands are preferred.

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Controls

At a minimum the actuator must support the following interface:

- Reset (Digital) – to clear any faults/alarms
- Disable (Digital) – to inhibit valve operation.
- Activate Emergency Safe Position (Digital)

Depending on the valve type, further required commands differ as described below.

For fixed position valves, a digital signal is required per commandable position. Noting that neutral or spring return positions do not require a command signal. Hence:

- One signal per position. (1+ Digital)

Actuators that support binary, grey-code or similar command interfaces may use these to reduce the number of required signal wires.

For position valves, the preferred interface is an analogue position setpoint coupled with a run enable signal. Hence:

- Position Setpoint (Analogue)
- Run (Digital) – valve is allowed to move

In addition, the valve must support jog or inching commands:

- Open (Digital)
- Close (Digital)
- Stop (Digital – Used with pulse type commands)
- Hold (Digital – Used with maintained commands)

This interface can also be used if the actuator does not support a direct position setpoint command.

If the application requires torque and/or speed control, the actuator must support hardwired analogue setpoints.

- Torque Setpoint (Analogue)
- Speed Setpoint (Analogue)

Communications

Wired communications protocol may be used to allow the control system to remote update valve operational parameters provided that the valve supports selective parameter protection. That is, some parameters can be set as 'read-only' in the actuator configuration and cannot be changed via remote communications protocol.

The use of a communications protocol shall not replace the hardwired control signals described above.

3.20. Handover Documentation

Refer to the Submittals section of [SPE-00367](#) Engineering Standard M-SPE-STD-001 General Mechanical for general handover documentation requirements.

An Operation and Maintenance (O&M) Manual shall be supplied for all equipment. In addition to standard information included within the valve O&M Manual, it should include a recommended valve exercise schedule in order to minimise risk of failures, such as leaking and/or seizing, for valves which are static for extended periods.

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Asset details shall be submitted in accordance with [FRA-00011](#) X-FRA-STD-003 Asset Information Management Framework.

In addition to completing any general asset information documentation specified elsewhere, information shall be provided for all equipment by submitting technical datasheets.

Valves $\geq$ DN450 shall include signed factory acceptance certificates and shop drawings.

All actuators must be supplied with a signed factory acceptance certificate to verify performance and functions are as specified. In addition, the test certificate should record details of the specification, for example, gear ratios for both manual and automatic, drive closing direction, wiring diagram number.

Hazardous area certificates shall be provided where applicable.

Warranty certificates for all equipment shall be provided to Seqwater.

4. Definitions and Abbreviations

The following definitions and abbreviations (Table 5) apply to the Standard Specification

Table 5 Definitions and Abbreviations

Term	Definitions
AS	Australian Standard (published by Standards Australia)
Contractor	An entity engaged by Seqwater to undertake work in accordance with an agreed contract with a defined scope of work.
Design Life	The design life of equipment is the period of time during which the item is expected by its designers to provide the required functionality and availability, for the specific operating conditions
DN	Nominal diameter
Employees	Means persons employed directly by Seqwater in a permanent, temporary or casual capacity.
ESA	Engineering Standards & Assurance
Isolation Valve	A valve which, during normal operation, is either fully open or fully closed. Isolation valves are not used to control flow or pressure
Manufacturer / Supplier / Vendor / Original Equipment Manufacturer (OEM)	The entity that manufacturers or supplies equipment to meet the specifications of the Contractor.
Network Pipelines	Describes the pipelines making up the bulk potable water distribution network
Owner / Principal / Seqwater	The entity that engages the Contractor to undertake the work and takes custody of the outcome. The Owner may delegate responsibilities to other entities to act on its behalf (e.g. a consultant).
PN	Nominal pressure
REX	Seqwater Electronic Document and Records Management System.

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Term	Definitions
Scope of Works	The scope of works document forming part of the contract, including supporting design documentation
Seqwater Approval / Agreement / Acceptance	Written sign-off gained via the deviation process, as detailed in X-PRO-STD-008 Asset Standards Management and Application Procedure.
Seqwater Engineering Standard	Includes Standard Procedures and Standard Specifications and associated supporting documents such as Standard Drawings, Guidelines, Lists, Datasheets, Manuals, Registers, and Templates.
Seqwater Representative	The person empowered by Seqwater to administer the contract, or their nominated representative
shall / must	Indicates a mandatory requirement.
should	Indicates a recommendation.
This Standard Specification	Asset Standard M-SPE-STD-003
WSAA	Water Services Association of Australia

5. Roles and Responsibilities

Table 6 Roles and Responsibilities

Role	Responsibility
Leaders	In addition to the responsibilities of a worker, ensure compliance with this Standard Specification by those they lead.
Workers / Employees	Be aware of and comply with this Standard Specification
Principal Engineering Standards and Assurance	Responsible for implementation and management of this Standard. Accountable and responsible for receipt and management of drawings.
General Manager Engineering	Accountable for implementation and management of this Standard.
Seqwater Project Manager	Accountable and responsible for implementation of this Standard as a whole. Some works may be delegated as appropriate.

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6. References and Related Materials

The documents listed in Table 7 below, and the requirements therein, are relevant to this Standard Specification. In their latest editions, these documents form a part of this document. Note that this is not an exhaustive list of documents relevant to the works.

Seqwater undertakes regular updates of its Engineering Standards. Before utilising this document, the complete list of Seqwater Engineering Standards should be reviewed to ensure currency and applicability for the proposed works.

Table 7 References and Related Material

Description	Location
FRA-00011 Engineering Standard X-FRA-STD-003 Asset Information Management Framework	REX
PRO-01617 Engineering Standard X-PRO-STD-009 Engineering Design, Construction, Operation and Maintenance	REX
PRO-01872 Engineering Standard X-PRO-STD-002 Engineering Drawing Numbers Procedure	REX
PRO-01873 Engineering Standard X-PRO-STD-001 Asset Standards Document Classification and Naming Structure Procedure	REX
PRO-01874 Engineering Standard X-PRO-STD-004 Development and Review of Asset Standards Procedure	REX
PRO-02140 Engineering Standard X-PRO-STD-013 Engineering Technical Hazard Study Procedure	REX
PRO-02187 Engineering Standard X-PRO-STD-007 Drawing and Spatial Data Standards Procedure	REX
PRO-02190 X-PRO-STD-006 Equipment Numbering and Naming Convention Procedure	REX
PRO-02205 Engineering Standard X-PRO-STD-008 Asset Standards Management and Application Procedure	REX
PRO-02234 Management of Change (Technical) Procedure	REX
REG-01074 Engineering Standard X-LST-STD-001 Seqwater Preferred Equipment Register	REX
SPE-00348 Engineering Standard M-SPE-STD-004 Protective Coatings	REX
SPE-00366 Engineering Standard M-SPE-STD-002 Fixed Platforms, Walkways, Stairways and Ladders	REX
SPE-00367 Engineering Standard M-SPE-STD-001 General Mechanical	REX
SPE-00395 Engineering Standard D-SPE-STD-001 Water Supply Network Planning, Design and Construction (Seqwater Supplementary Manual to WSAA Water Supply Code of Australia WSA 03-2011)	REX

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Description	Location
FRA-00011 Engineering Standard X-FRA-STD-003 Asset Information Management Framework	REX
TEM-00224 Engineering Standard X-TMP-STD-022 Asset Standards Deviation Request Template	REX
D23/178912 D-DWG-STD-00030 Butterfly Valve General Arrangement Standard Drawing	REX & Waternet
D23/178914 D-DWG-STD-00031 Gate Valve General Arrangement Standard Drawing	REX & Waternet
686487 D-DWG-STD-00005 Scour Valve General Below Ground Arrangement Standard Drawing	REX & Waternet
686488 D-DWG-STD-00006 Air Valve Pit Typical Arrangement Details Standard Drawing	REX & Waternet
D17/90559 D-DWG-STD-00018 Air Valve Installation General Arrangement Standard Drawing	REX & Waternet
AS 1110 ISO metric hexagon bolts and screws – Product grades A and B Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 2638.1 Gate valves for waterworks purposes – Part 1: Metal seated Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 2638.2 Gate valves for waterworks purposes – Part 2: Resilient seated Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 3996 Access covers and grates Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 4020 Testing of products for use in contact with drinking water Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 4087 Metallic flanges for waterworks purposes Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 4794 Non-return valves for waterworks purposes – Swing check and tilting disc Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 4795.1 Butterfly valves for waterworks purposes – Wafer and lugged Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 4795.2 Butterfly valves for waterworks purposes Double flanged Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 4956 Air valves for water supply Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 5081 Hydraulically operated automatic control valves for waterworks purposes Australian and International Standards Web Service	Standards Australia Intertek Inform
AS 60529 Degrees of protection provided by enclosures (IP Code) Australian and International Standards Web Service	Standards Australia Intertek Inform

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Description	Location
FRA-00011 Engineering Standard X-FRA-STD-003 Asset Information Management Framework	REX
WSA 03 Water Supply Code of Australia	Water Services Association of Australia
WSA 109 Industry standard for flanged gaskets and O-rings	Water Services Association of Australia
WSA PS – 260 Gate valves, resilient seated for pressure applications – water supply and sewerage	Water Services Association of Australia
WSA PS – 261 Gate valves, metal seated for pressure applications – water supply and sewerage	Water Services Association of Australia
WSA PS – 262 Extension spindles for gate valves	Water Services Association of Australia
WSA PS – 263 Butterfly valves for pressure applications – water supply	Water Services Association of Australia
WSA PS – 264 Non-return (reflux) valves for pressure applications – water supply and sewerage	Water Services Association of Australia
WSA PS – 265 Air valves for pressure applications – water supply	Water Services Association of Australia
WSA PS – 268 Automatic control valves for pressure applications – water supply	Water Services Association of Australia
WSA PS – 269 Extension spindles for valves (other than gate valves)	Water Services Association of Australia
WAT-1300 series WSA 03 Standard Drawings – WAT-1300 Series – Installation Practices / Structures	Water Services Association of Australia

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7. Changes from previous version

This Standard Specification will be regularly reviewed in accordance with the requirements of the Seqwater Controlled Document Management Procedure. Reviews will include consideration of suggestions for alteration or improvement made in accordance with Seqwater Procedure X-PRO-STD-004 Development and Review of Asset Standards. Changes made from the previous version are summarised in Table 8 below.

Table 8 Changes from previous version

Section Number	Change
All	Document reformatted to meet current requirements and references updated. Minor typo's and wording changes completed throughout.
3.5	Added reference to potable water section in M-SPE-STD-004.
3.12.2	Further information added on trafficable pit cover requirements.
3.13.1	Gate valves mounted horizontally accepted if conditions are met.

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