

Engineering Standard M-SPE-STD-001

General Mechanical

Document number: SPE-00367

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

Ver No.	Description	Document Owner		Document Approver		
		Position	Approval	Position	Approval	Approval Date
4	Amended Version	Principal Engineering Standards and Assurance	Refer to supporting Info in Rex	General Manager Engineering	Refer to supporting Info in Rex	16/06/2025
This Engineering Standard was endorsed by an RPEQ on behalf of Seqwater.						

Version History

Rev	Date	Description	Author	SME	Owner	Approver
4	16/06/2025	Amended Version				
3	23/06/2022	Amended Version				
2	21/3/2019	Amended Version				
1	17/7/2015	Initial Version				

(Refer Controlled Document in REX for Author, SME, Owner and Approver details)

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	2 of 47

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

Contents

1.	Purpose	5
2.	Scope	5
3.	General Mechanical Equipment Requirements	6
3.1.	Design & Equipment Selection	6
3.1.1.	Operating Conditions	6
3.1.2.	Potable Water Compatibility	7
3.1.3.	Design Life	8
3.1.4.	Quality	9
3.1.5.	General Design Consideration	9
3.1.6.	Design for Corrosion Control & Durability	12
3.1.7.	Design Loads	12
3.1.8.	Fatigue	13
3.1.9.	Design for Maximum Loads	13
3.1.10.	Allowance for Future Expansion	13
3.1.11.	Modification of Existing Equipment	14
3.1.12.	Decommissioning	14
3.1.13.	Unitised Equipment	14
3.2.	Hazard Management	15
3.2.1.	Risk Review	15
3.2.2.	Potentially Explosive Atmospheres	15
3.2.3.	Isolation	15
3.2.4.	Confined Space Access	16
3.2.5.	"Hot" Surface Personnel Protection	17
3.2.6.	Machinery Safety	17
3.2.7.	Equipotential Bonding	18
3.3.	General Mechanical Requirements	18
3.3.1.	Units of Measurement	18
3.3.2.	Limits of Fits	18
3.3.3.	Surface Finish	18
3.3.4.	Materials	18
3.3.5.	Fabrication	19
3.3.6.	Welding	19
3.3.7.	Protective Coatings	20
3.3.8.	Services Routing	21
3.3.9.	Vibration & Balancing	21
3.3.10.	Noise	22
3.3.11.	Labelling, Identification and Nameplates	23

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	3 of 47

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

3.4.	Component Mechanical Requirements	23
3.4.1.	Drive Modules	23
3.4.2.	Provisions for Handling Plant	24
3.4.3.	Flanges	24
3.4.4.	Gaskets	25
3.4.5.	Bolted Connections	25
3.4.6.	Masonry Anchors	26
3.4.7.	Packing and Grouting	27
3.4.8.	Base Frames	27
3.4.9.	Shafts and Pins	28
3.4.10.	Bearings and Housings	28
3.4.11.	Grease Lubrication and Seal Purging	28
3.4.12.	Gear Reducers	29
3.4.13.	Couplings	30
3.4.14.	Compressed Air Lines	30
3.4.15.	Special Tools	30
3.4.16.	Security Locks	30
3.5.	Mechanical Equipment	31
3.5.1.	General	31
3.5.2.	Pumps	31
3.5.3.	Blowers and Fans	31
3.5.4.	Valves	32
3.5.5.	Pressure Equipment	34
3.5.6.	Pipework	34
3.5.7.	Cranes, Hoists and Monorail Beams	34
4.	Execution	35
4.1.	Assembly & Testing	35
4.1.1.	Testing	35
4.1.2.	Pre-assembly and Delivery	35
4.1.3.	Installation and Commissioning	36
4.2.	Registration	36
4.3.	Submittals	37
5.	Definitions & Abbreviations	39
6.	Roles and Responsibilities	41
7.	References and Related Materials	41
8.	Changes from previous version	47

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	4 of 47

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

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 general mechanical equipment. It shall apply to all new mechanical assets, and as far as practicable, to all existing mechanical assets undergoing maintenance, replacement, refurbishment or expansion. Related ancillary equipment shall also comply with this Standard Specification. Example asset types include, but are not limited to, pumps, fans, pipework, valves and lifting equipment. In addition to asset specific requirements, this document contains requirements related to general mechanical works, equipment design, hazard management and equipment components.

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.

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.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	5 of 47

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 an *X-TMP-STD-022* Asset Standards Deviation Request Form 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 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 on the Waternet Engineering and Asset Standards page or using the REX Saved Search "Engineering Stds Controlled Documents by CD Owner".

3. General Mechanical Equipment Requirements

In addition to the requirements detailed within this Standard Specification it is generally expected that all equipment designed and supplied to Seqwater will meet the requirements laid out within all of the relevant codes produced by the Water Services Association of Australia (WSAA) and in particular *WSA 03 Water Supply Code of Australia* (as amended by *D-SPE-STD-001*).

All equipment supplied shall be selected from *X-LST-STD-001 Seqwater Preferred Equipment Register* where applicable.

Several WSAA codes and standards are referred to in this document as listed in Table 6 but are not necessarily all the codes and standards applicable for specific works.

3.1. Design & Equipment Selection

3.1.1. Operating Conditions

All mechanical works undertaken for Seqwater shall consider the following operating requirements, as applicable to each individual installation:

- The equipment shall be designed or selected to satisfy the specific operating and maintenance requirements and loadings for each duty
- Unless otherwise specified, mechanical equipment, associated foundations and support structure shall be designed to operate continuously, safely and reliably to meet the required availability under the conditions specified

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	6 of 47

- Mechanical equipment shall be designed or selected to operate as required within the nominated operating environment. Environmental conditions to be considered include, but are not limited to, ambient temperature, exposure to dust, heat, direct sunlight, rain, high wind and hose-down by process water. Note that the possibility of intermittent periods of more extreme exposure must be considered
- For the operating conditions and requirements refer to the relevant Equipment Specification/Datasheet, Project Specification, Scope of Works, or any other project specific documentation

3.1.2. Potable Water Compatibility

Materials in contact with water:

Any product in contact with drinking water or water that is to become drinking water shall be certified to comply with *AS/NZS 4020* by an accredited laboratory and have undergone re-evaluation testing within 3 months of the fifth anniversary of the certification decision. Overseas products that have certification to recognised standards, such as *ANSI/NSF 61* or *BS 6920*, or recognised approvals such as by WRAS (Water Regulations Advisory Scheme, UK), TZW (Technologie Zentrum Wasser, Germany), ACS (Attestation de Conformite Sanitaire, France), TGM (Technologisches Gewerbemuseum, Austria) etcetera may be considered subject to assessment by Seqwater water quality team via the standards deviation process.

Products that require testing include those in contact with drinking water or water that is to become drinking water at any stage of treatment and at any point in the transfer, storage, distribution and reticulation system from the WTP's raw water intake up to the point of customer connection. Products include those that are immersed in drinking water or water that is to become drinking water, frequently splashed, and where condensation may enter the above-mentioned water. Products used in upstream dams and catchments that are not in the immediate vicinity of a treatment plant intake, are considered not to be in contact with drinking water; but attention should still be given to avoid coatings that could leach products detrimental to the quality of the water and receiving environment (e.g. materials containing biocides/fungicides, lead etc.).

Attention shall be given to the ratio of surface area to volume at which products comply. The specific ratio of surface area to volume in the test certificate shall be equal to or greater than the actual structure ratio of the surface area to volume applicable in service and currency of relevant certifications must meet Seqwater's re-evaluation requirements at the time of installation. In addition, products must also be individually certified and subjected to an audited overall system of quality control (i.e. *ISO 9001*).

Conditions under which a product is to be used must also align with those specified on the technical data sheet and any relevant additional conditions listed on the *AS/NZS 4020* test report. Such conditions may include but are not limited to temperature, chemical and physical properties of the water, application thickness, and curing conditions including time. It is important to note that curing time can have a direct impact on a projects critical path and required shutdown windows.

Materials in contact with drinking water treatment chemicals:

Any product in contact with drinking water treatment chemicals, must be of a quality that will not leach inorganic or organic substances in quantities capable of producing deleterious or injurious effects on the health of those consuming the water from the WTP or that would otherwise render the water treated with that chemical unfit for public use. The products must also be subjected to an audited overall system of quality control (i.e. *ISO 9001*).

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	7 of 47

Lubricants that may incidentally come into contact with water:

Any lubricant that may incidentally come into contact with drinking water or water that is to become drinking water, must be H1 certified by an approved accreditation body such as NSF. H1 lubricants are intended for use in applications where there is only potential for incidental food (i.e. water) contact, such as anti-rust agents, or release agents on gaskets or seals of tank closures. Although this category implies the possibility of incidental food (i.e. water) contact, the amount used should be the minimum required to accomplish the desired technical effect and the user must also comply with any other limitations listed in the NSF Registration. The H1 lubricant must also be subjected to an audited overall system of quality control (i.e. ISO 9001) and have a current food allergen declaration that complies with the Australian New Zealand Food Standards Code.

Effective mitigations to prevent the spillage of H1 lubricants into water must also be fitted, and where practicable designed in a manner that allows sufficient holding capacity to accommodate the complete loss of lubricant from the asset that it is servicing (i.e. gearbox, hydraulic actuator, bearing oil bath etc.). In the case of spill trays, covers to minimise the ingress of rain or wash down water should be considered, whilst ensuring that they don't inhibit the ability to visually inspect these trays for spillage. Spill trays must also be designed so that they can be safely accessed for the routine removal of accumulated lubricant.

Heat transfer fluids that may incidentally come into contact with water:

Any heat transfer fluid that may incidentally come into contact with drinking water or water that is to become drinking water, must be HT1 certified by an approved accreditation body such as NSF. HT1 heat transfer fluids are intended for use in applications where there is the possibility of incidental food (i.e. water) contact, such as coolant used in the heat jacket of a submersible pump. Although this category implies the possibility of incidental food (i.e. water) contact, the amount used should be the minimum required to accomplish the desired technical effect and the user must also comply with any other limitations listed in the NSF Registration. The HT1 heat transfer fluid must also be subjected to an audited overall system of quality control (i.e. ISO 9001) and have a current food allergen declaration that complies with the Australian New Zealand Food Standards Code.

3.1.3. Design Life

The minimum mechanical design life of the assets should meet the Minimum Design Life as per Table 1, unless otherwise specified or approved by Seqwater.

Mechanical equipment may be assessed on an hours' run basis rather than a period of years if approved by Seqwater. It is understood that some equipment will require overhauls and maintenance in order to reach the desired asset life. Requirements for maintenance/overhaul must be submitted to Seqwater, usually completed through submission of the Installation, Operation & Maintenance Manual (IOMM).

If for any reason a proposed item of equipment cannot meet the specified design life, the contractor/vendor is to make this clear to Seqwater in writing, and a Deviation Request initiated through appropriate channels as per the process detailed in X-PRO-STD-008 for consideration by the Seqwater Engineering Standards and Assurance unit.

The intent of the design lives listed is a general minimum life and it is understood that specific site conditions and project requirements may make these design lives unobtainable which is to be advised to Seqwater. It is assumed that the required specified maintenance and inspections are being performed in order to reach the specified life.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	8 of 47

Table 1 Asset Design Life

Assets	Minimum Design Life (years)
Protective coatings	Refer to M-SPE-STD-004
Flow Meters	15
General mechanical equipment	25
Cranes, hoists and winches	25
FRP/GRP/Plastic tanks (with UV protection)	20
Small Diameter Plastic Pipework (up to 100 NB) (non-chemical)	25
Large Diameter Plastic Pipework (non-chemical)	50
Plastic Pipework for Chemicals	Refer to M-SPE-STD-013
Large pumps (>500 kW)	50
Metalwork & Structural Steel	50
Platforms, Walkways, Stairways and Ladders (Metallic)	50
Platforms, Walkways, Stairways and Ladders (FRP)	20
Steel tanks	50
Concrete structures (incl. tanks/reservoirs)	80
Metal pipework and pipelines	80
Marine and submerged piping and structures	100
Valves	Refer M-SPE-STD-003

Note 1: It is understood that the life of a plastic tank will vary depending on chemical content, for further detail refer to Liquid Chemical Storage and Batching Asset Class Plan.

3.1.4. Quality

All products selected must be provided by a reputable and recognised manufacturer which has achieved proven compliance with the performance requirements.

All work undertaken shall be carried out to accepted standards and codes of good practice by competent, appropriately qualified personnel and to the satisfaction of Seqwater. Any work which does not conform to the requirements of the relevant documentation shall be rectified to the satisfaction of Seqwater's representative.

As part of project delivery, a comprehensive manufacturing data record (MDR) and operation & maintenance manual (OMM) are to be supplied that cover the delivered equipment. Refer to Section 4.3 for details.

Products and work undertaken should be compliant to *ISO9001*.

3.1.5. General Design Consideration

Any Seqwater provided requirements or Specifications that the Supplier believes:

- would not provide a fit for purpose system under the proposed conditions, or
- cannot be practically met for a specific application

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	9 of 47

shall be brought to the attention of Seqwater in writing.

In accordance with the Professional Engineers Act 2002 (Qld), any work deemed by the act to be providing a professional engineering service shall be performed by, or directly supervised by, an engineer registered with the Board of Professional Engineers of Queensland (RPEQ) in an engineering discipline appropriate to the work being undertaken. As proof of meeting this requirement, certified Engineering Statements shall be provided as outlined in Procedure X-PRO-STD-009, *Engineering Design, Construction, Operation and Maintenance* and the relevant project documentation and/or drawings shall be signed-off by a responsible RPEQ. Specific requirements for RPEQ certification of drawings are detailed in Procedure X-PRO-STD-007, *Drawing and Spatial Data Standards*.

Unless specifically instructed by Seqwater, the Supplier shall confirm all site dimensions required when designing and selecting equipment.

All mechanical systems and equipment design/selection shall meet the following requirements:

- Consider the whole of life requirements, including but not limited to, manufacture, installation, commissioning, operations, maintenance, and decommissioning
- Take into consideration the number, type and positioning of plant and equipment to achieve a fit for purpose installation
- Take into consideration impact on the operations and maintenance of the plant
- Avoid or minimise creation of confined spaces and/or the need to enter confined spaces
- Where equipment must be installed in a confined space the design shall allow for operation and regular maintenance tasks to be performed from outside the confined space area as much as reasonably practical
- Avoid or minimise working at heights
- Where working at heights cannot be avoided the design shall include davit mounts and fall arrest anchor points as appropriate
- Ensure the interface of any new mechanical equipment with existing equipment / systems is designed to be effective and efficient and allow for maintenance and ease of fault finding of the new and existing equipment
- Provide adequate hose down facilities for tanks, bunds, work bays, etc.
- Provide suitable quantity and distribution of isolatable drains, vents and connections to potable water to allow thorough cleaning, flushing and draining as a part of maintenance
- Where required to ensure water quality safety, RPZ valves shall be provided
- Allow for dismantling/re-installation, in particular, associated pipe work and services
- Allow for thermal movement in the equipment in normal operation without impacting performance or integrity
- Wherever practical, systems shall be optimised to use existing equipment for installation, operation and maintenance. E.g. lifting equipment, services etc.
- For equipment and parts >20 kg that will need to be removed, consideration must be given for access to appropriate mechanical handling aids (e.g. forklifts, lifting hoists, gantry crane)
- Ergonomic accessibility shall be provided to equipment where practicable
- Wherever possible, enable operational maintenance and cleaning to be carried out by the plant operators rather than specialised sub-contractors or trades personnel
- Where necessary, equipment shall be sufficiently secured against unauthorised operation or tampering

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	10 of 47

- Where practical, a design should minimise the required amount of site work (e.g. by use of modular skid arrangements)
- Adequate test and condition monitoring points should be added to equipment to assist in trouble shooting equipment faults
- Equipment and systems must be selected to avoid unacceptable environmental or process contamination. This may include elimination of contaminants from equipment or protection against contaminants (e.g. lubricants) leaking from the equipment

Factors to be considered in design, equipment selection and operations shall include, but not be limited to the following items:

- **Standardising:** using Australian and International Standards for all design, equipment and operations
- **Safety:** Provide a safe work environment for all personnel, including but not limited to, provision of suitable isolation from hazards (e.g. isolating points, guarding on moving/rotating equipment, chemical storage areas) as per relevant Seqwater requirements and Australian Standards
- **Cost:** Achieve the most cost-effective solution over the complete life cycle that satisfies the design life requirement.
- **Reliability:** The Supplier should provide documentation of the reliability claimed for each item of equipment in the specified operating environment. This should include the source and applicability of reliability data. Reliability data should include the mean time between failure (MTBF), where a failure is defined as a condition which will prevent the equipment performing its intended primary functions

Determination of the reliability data should consider:

- Seqwater service level obligations
- Equipment duty cycle
- Operating conditions
- Single points of failure and method(s) to avoid them
- **Availability:** The contractor shall insure that the system availability meets the requirements of the application
- **Redundancy:** Suitable levels of redundancy are to be incorporated into the plant to ensure continued operation, sufficient to meet required availability as specified, in the event of plant or equipment failure or maintenance down time
- **Maintainability and Operability:** Ensure that maintenance and operations personnel can effectively perform their respective work on/with the equipment
- **Accessibility:** Items to consider include:
 - The number of parts requiring removal in order to replace a given component shall be quantified
 - The general layout of all equipment shall ensure adequate accessibility during emergencies as well as regular operating and maintenance tasks to be performed including removal, and operations such as inspections, oil changes, etc. Consideration should also be made to be able to remove equipment with adjacent equipment operational (e.g. parallel pumps)
 - Platforms, walkways, stairways and ladders shall be as per Seqwater Standard Specification *M-SPE-STD-002*

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	11 of 47

- Provision of regular maintenance points at readily accessible locations (e.g. grease points, replaceable filters, filling points)
- For general maintenance access, the minimum clearance distance between any neighbouring equipment shall not be less than 600 mm. A minimum of 1000 mm clearance shall be maintained in evacuation routes
- Commonality: Where practical, mechanical design, equipment and components shall be standardised to reduce spares inventory and maximise equipment knowledge. This includes shaft sizes, bearings, sheaves, v-belts, pulley sizes, belt widths as well as the manufacturer, type, size and ratio of motors, speed reducers and hydraulic equipment
- Modularity: To reduce replacement time, where possible sub-assemblies are to be modularised to allow for quick removal and replacement
- Spare parts: Availability of spare parts throughout the life of the equipment. Where possible, components shall be selected from those that are readily available within Australia. Where spares cannot be shown to be readily available, the contractor shall supply critical spares
- Maintenance support: Minimise the need for external support equipment and personnel
- Simplicity: The simplest concept which provides the required outcome is preferred
- Sturdiness: Providing equipment which will stand up to the possible external forces

3.1.6. Design for Corrosion Control & Durability

Proper planning for and careful attention to corrosion protection at the design stage are essential to minimise corrosion and simplify future maintenance.

Material selection should consider corrosion and degradation of that material under the specific conditions experienced and shall be fit for purpose bearing in mind the design life of the equipment.

All design work must consider corrosion prevention by avoiding sharp edges, crevices, rough welds, corners, depression and pockets as well as incompatible material contact (e.g. materials exhibiting galvanic corrosion).

The detail design should as far as possible, avoid all features which would make it possible for water or foreign matter to accumulate, and therefore accelerate the failure of coatings. Where this is not possible, drainage holes should be provided. The structure should be designed to facilitate the application of maintenance coatings in the future.

Apply appropriate coatings to equipment, refer to the Section 3.3.7 of this document for protective coatings.

Surface edges should be eliminated wherever possible, as coating materials tend to run away from the edge. All sharp edges shall be removed, including all cutting and machining burrs and swarf.

Cathodic protection shall be considered for buried steel pipe and the internal surfaces of any coated steel tanks as well as any other submerged equipment/structure.

Where stainless steel is to be used as corrosion resistant material, minimum grade is to be 316.

3.1.7. Design Loads

Design loads for mechanical equipment shall be the most adverse combination of loading that is possible and shall include, but may not necessarily be limited to the following:

- Dead loads

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	12 of 47

- Live load
- Thermal loads
- Wind loads including cyclonic winds for equipment both full and empty
- Earthquake loads
- Pressure induced loads
- Loads applied by machine action (e.g., torque) – active forces and reactions
- Acceleration or deceleration (inertia) loading (e.g., braking forces)
- Impact loads
- Loading produced by expansion or contraction of materials of construction
- Loading produced by material spillage or abnormal operation
- Loading produced during the course of plant maintenance (e.g. resting equipment on platforms included in the package)
- Loading occurring during transport and construction
- Any loadings as prescribed within any relevant codes or standards

3.1.8. Fatigue

Equipment shall be designed for a fatigue life at least equal to the design life excepting items covered by maintenance schedule for replacement (e.g. bearings).

Design loads for fatigue failure analysis shall be determined from those loads applied to, or produced by, a machine whilst operating at its maximum rated capacity unless otherwise specified or approved by Seqwater.

3.1.9. Design for Maximum Loads

Equipment shall be designed to withstand the maximum loads reasonably expected during its design life, without the risk of equipment damage or risk of injury to personnel.

Where equipment is driven by a prime mover, e.g. an electric motor or reciprocating engine, it shall be designed to accommodate the maximum torque that the prime mover can produce.

Where equipment is driven by a hydraulic or pneumatic prime mover, it shall be designed to accommodate the maximum torque or force the prime mover can produce at the pressure relief valve setting, if Seqwater approves the setting to be lockable. If Seqwater does not approve the pressure relief valve setting to be lockable, the equipment shall be designed for the maximum torque or force the prime mover can produce at the maximum system pressure. Note that a 'lockable device' is a device that can be locked, with a key or other agreed security feature, and includes a setting that can only be changed after unlocking the device. Soft limits shall not be used as design limits.

3.1.10. Allowance for Future Expansion

When requested in a Specification, allowance shall be made in the design and layout of mechanical systems for future equipment installation, including:

- Space for additional equipment
- Plinths consistent with the installed equipment

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	13 of 47

- Routing for additional services consistent with installed equipment shall be included if impractical to install at a later date (e.g. cable conduit through concrete floor)
- Pipes that allow simple pipe extension to the additional equipment, minimising interruption to processes. This may require allowance for a stop valve and/or a blanking flange
- Where practicable, lifting equipment shall provide coverage for the area of future expansion when overhead lifting is provided on installed equipment

3.1.11. Modification of Existing Equipment

Any proposed modification of existing mechanical equipment shall include a condition assessment and capability/design assessment of all retained elements of the existing machine/system. This is to ensure that the retained elements will continue to operate within their design capabilities, following the proposed modification.

Any proposed machine/system modification shall demonstrate its integration with:

- Current Seqwater operational strategies
- Current Seqwater maintenance strategies

and compliance with:

- Relevant codes and standards
- Seqwater's Standard Technical Specifications

A formal risk assessment shall be completed by relevant stake holders on the impact of the proposed modification, including details of any controls necessary to reduce the risks to as low as reasonably practicable.

When any equipment is modified, all relevant/affected drawings and documentation shall be submitted to Seqwater for review prior to being revised for reissue. All documentation of the modification, including the risk assessment, shall be provided to Seqwater.

All modification of existing equipment must follow procedures for Operate and Maintain Phase change approval as outlined in *X-PRO-STD-009, Engineering Design, Construction, Operation and Maintenance*, including all completed relevant Engineering Statement forms as specified.

3.1.12. Decommissioning

The design and installation of a mechanical system shall include provision for:

- Practical decommissioning and removal requirements
- Disposal of unsafe or environmentally hazardous materials
- Potential replacement with alternative equipment or re-use of that position

3.1.13. Unitised Equipment

Unitised equipment shall be skid mounted. The skid shall be designed for easy access to equipment while remaining compact and fitted with suitable lifting attachments.

All self-contained, unitised equipment and ancillary equipment shall be:

- Supplied complete with wiring and devices complete and installed. Wiring and conduit shall be brought to junction boxes, identified and terminated at the junction boxes
- Supplied complete with piping installed with minimum field connection and easy access for maintenance

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	14 of 47

3.2. Hazard Management

All equipment supplied or modified shall follow the Engineering Design, Construction, Operation and Maintenance procedure as laid out in *X-PRO-STD-009*, including a comprehensive safety in design review. All documentation shall be supplied as detailed in the procedure.

3.2.1. Risk Review

Risk Reviews shall be undertaken using the risk and hazard information provided by equipment suppliers including HAZOP & CHAZOP reviews.

Appropriate documentation shall be supplied with the equipment to ensure effective risk reviews can be undertaken.

Requirements for hazard studies (HAZOP & CHAZOP) are detailed in *X-PRO-STD-013*, Engineering Technical Hazard Study.

3.2.2. Potentially Explosive Atmospheres

The assessment, classification and treatment of hazardous zones shall be undertaken by the supplier or contractor as per the relevant standards.

Where possible, designs are to avoid or minimise hazardous areas (e.g. use of ventilation) and keep the installation of equipment within them to a minimum (e.g. install control panels etc outside hazardous zones).

Any equipment to be installed in a hazardous area shall be supplied with a hazardous area dossier to Australian Standards to cover electrical and instrument equipment (including motors).

The dossier shall contain current hazardous area certifications for the equipment. Only ANZEx or IECEx certification is accepted. All certificates shall be checked by an accredited Queensland Hazardous Area Auditor before submission with Vendor Data.

As per the Electrical Safety Act, 2002, the installed equipment in a hazardous area shall be independently audited by an accredited Queensland Hazardous Area Auditor.

In hazardous areas, all equipment shall be direct driven (e.g. V-belt drives are not acceptable).

For further details on hazardous area design and installation refer to Seqwater electrical design and construction specification *E-SPE-STD-001*.

3.2.3. Isolation

All system designs shall incorporate means to isolate sections of plant which may be required for:

- Isolating individual pieces of equipment to separate from operating equipment or plant
- Carrying out maintenance of regularly maintained items (e.g. strainers)
- Protection of personnel working in a particular area
- Avoiding cross contamination between different parts of the process stream
- Avoiding contact between incompatible chemicals
- Any other reasons as identified by HAZOP or similar process

Where frequent isolation is required (e.g. for maintenance testing of equipment) the isolation point shall be easily accessible and located within visual range of the specific piece of plant it controls.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	15 of 47

Isolation valves shall be provided on pipelines to isolate each line to major components prior to maintenance or removal. Position of the isolation points should be chosen to minimise major plant capacity loss and downtime.

Isolation points shall be padlockable.

For requirements around electrical isolation refer to *E-SPE-STD-001* Electrical Design and Construction.

Choice of isolation to be installed will depend on the function of the isolation and the level of risk this function represents with some examples and requirements given in the sections below.

It is known that in existing equipment there may not be the valves or removable spools available to perform certain levels of isolation. Therefore, before work is started, a risk assessment of the isolation should be completed to ensure the risk is acceptable for the task at hand. The intent of this section is mainly for application to new designs, or for retrofit to existing designs where it is deemed the risk is too great to perform the required task.

3.2.3.1. Single Valve Isolation

Single valve isolation consists of a single valve upstream of equipment to be isolated. A bleed valve (or scour valve) should be added downstream of valve to prove isolation. This shall be applied as the minimum class of isolation and can be used unless conditions require other classes of isolation as defined below.

3.2.3.2. Double Valve Isolation

Double valve isolation consists of two valves in series upstream of equipment being isolated. A bleed valve (or valves) should be installed either between the valves, or both between and downstream of the two block valves to prove isolation.

Note that the use of double body valves does not constitute a double valve isolation. Integral double block systems are acceptable.

Double valve isolation shall be used when:

- Piping systems contain substances defined as VHG or VHL as per AS 4343
- Where a risk assessment has identified a risk value requiring a higher class of isolation than single valve isolation

3.2.3.3. Positive Isolation

Positive isolation is achieved by physical separation in the pipeline through use of the following:

- Insertion or rotation of suitable spectacle blinds
- Insertion of suitable spades
- Removal of a pipe spool and fitting of blind flanges

Positive isolation shall be used for:

- Isolation between different process stages where sufficient risk has been identified
- Where a risk assessment has identified sufficient risk requiring a higher class of isolation than either single or double valve isolation

3.2.4. Confined Space Access

Confined Spaces shall be designed in accordance with AS 2865 – *Safe Working in a Confined Space*.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	16 of 47

Where required by the *Queensland Workplace Health and Safety Act* or Australian Standards, a minimum of two access ways shall be provided into a confined space.

Suitable anchor points shall be provided to ensure safe working conditions and to facilitate the rescue of an incapacitated personnel if required.

Hinged davit style access way covers shall be supplied which can be swung open and closed by one person.

Access way layouts shall be submitted to Seqwater for acceptance.

Access manway sizing shall be a minimum of 600 mm diameter for round shape, or 600 x 600 mm for square or rectangular shape. If the access way requires a ladder, then the opening shall be at least large enough to accommodate minimum ladder clearances as shown in AS 1657 and have retractable handgrip stanchions for safe access.

3.2.5. “Hot” Surface Personnel Protection

A “Hot” surface is any surface that may exceed 60°C under any operating condition.

Personnel protection to prevent contact with the “Hot” surface may be provided by any of the following:

- The surface is not accessible
- Internal insulation
- External insulation and cladding
- Barriers

The external surface temperature of cladding and barriers shall be below 55°C.

External insulation and cladding shall be removable for access to entry hatches. The cladding shall be suitable for outdoors weather protection. All joints shall be designed to shed water and ensure they are protected against any water ingress.

3.2.6. Machinery Safety

Safety devices including guards shall be designed and installed in accordance with *AS 4024 Safety of Machinery* and manufacturers requirements to protect workers against injury and must not be modified. A risk assessment in line with AS 4024 should also be completed where guards or shields are part of the installation.

Guards shall totally enclose all moving parts, including but not limited to gears, couplings, brake drums, shafts and collector rails (where these moving parts may be touched by hand from normal access platforms, stairs, etc.).

Guards shall be designed rigid, to withstand all reasonable loads which may be applied during operation, maintenance, transport and installation.

Mesh guards shall not be used in places where there is a possibility of people standing on it or where material can be placed upon it. Therefore, mesh guards should only be installed for use in the vertical plane, not horizontally.

The use of colour for the marking of physical hazards and the identification of certain equipment shall be as per AS 1318.

As far as practical, guarding should be easily removable where access is required for maintenance.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	17 of 47

3.2.7. Equipotential Bonding

Any electrically conductive structures (e.g. pipework, handrails, platforms, tanks, fences etc.) that could present a risk of electrical shock from any source shall be provided with equipotential bonding to the plant earthing system in accordance with AS/NZS 3000 – *Electrical Installations (Wiring Rules)*.

Any such structures without a clearly identified or designated earth attachment point shall have an earth boss welded to the frame to facilitate connection to the earthing system.

Refer to Seqwater standard E-SPE-STD-001 for full earthing requirements.

3.3. General Mechanical Requirements

3.3.1. Units of Measurement

All design documents and drawings shall be prepared using metric (SI) units.

All machine components, e.g. gears, shafts, bearings and pulleys, and all fasteners shall be metric. Soft imperial to metric conversions shall not be permitted.

3.3.2. Limits of Fits

Limits and fits shall be in accordance with ISO 286 – *ISO system limits and fits*.

3.3.3. Surface Finish

All machine surface finish designations shall be clearly noted on all workshop drawings in accordance with AS 1100.201.

Machining to a specific arithmetic mean deviation (Ra) value, also known as a centre-line average value (CLA), shall be verified against a roughness comparator in accordance with AS 2382.

3.3.4. Materials

Materials shall be selected to:

- Provide the required design life under the specified operating and environmental conditions
- Be corrosion resistant where practicable. Any non-corrosion resistant material used without protective coatings shall have an appropriate allowance applied to the thickness
- Materials in contact shall be compatible. The use of dissimilar metals leading to galvanic corrosion of contacting components shall be avoided where practicable. If unavoidable materials shall be isolated from each other.

The following materials are prohibited and must not be included in any components of the equipment supplied:

- Asbestos and materials containing asbestos
- Polychlorinated biphenyls (PCBs) and materials containing PCBs
- Any materials containing lead which may be ingested, inhaled or absorbed including lead in paints

Any equipment containing hazardous material shall be suitably identified with warning labels and signage.

All materials that could potentially come into contact with potable water must be compliant to AS 4020 as per Section 3.1.2.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	18 of 47

3.3.5. Fabrication

Fabricated items shall be designed and constructed to the latest version of the appropriate codes and standards, including but not necessarily limited to:

- AS 4100 - Steel structures
- AS 1664 - Aluminium structures
- AS 1657 - Fixed platforms, walkways, stairways and ladders - Design, construction and installation
- AS 3990 - Mechanical equipment – Steelwork

Metalwork shall be fitted accurately. Where appropriate, measurements shall be confirmed on site, prior to fabrication.

Welding shall be as per Section 3.3.6. Prior to installation, all materials stored at the fabrication plant, and all fabricated metalwork, shall be:

- Supported above the ground so as not to cause overstressing
- Properly protected from tarnishing or corrosion
- Kept free of dirt, oil, grease, and other foreign material

Materials that show signs of corrosion may be rejected.

Edges that are machined, cut or sheared shall be filed or ground to ensure they are smooth, free of burrs and devoid of sharp edges.

Stainless steel and carbon steel materials shall be stored separately and fabricated in such a way that the stainless steel cannot be contaminated by carbon steel particles.

Holes shall be accurately located and drilled or laser cut. Punching holes or oxy cutting is not permitted.

The finished dimensions shall be within the required tolerances.

3.3.6. Welding

All welding works and equipment shall conform to the appropriate codes and standards, including but not limited to:

- AS 1554 series - Structural steel welding
- AS 1665 - Welding of aluminium structures
- ASME B31.3 - Process Piping
- AS 4041 - Pressure Piping Code
- Welding codes stipulated in WSA 03

The class of weld selected shall be consistent with the equipment design requirements.

The strength of all welded connections shall not be less than the strength of the parts being jointed.

All welding runs shall be continuous and free from cracks and undercuts. Intermittent welds, spot welds and stitch welding are not permitted. All weld spatter shall be removed.

All stainless steel welds shall be pickled and passivated in accordance with ASTM-A380 unless otherwise specified.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	19 of 47

All surfaces on welded fabrications shall be undistorted and free of weld scale after welding.

All welded components that require machining and those where dimensional stability is important, shall be stress relieved. Stress relieving shall be carried out before final machining.

All welds shall be fully inspected and tested in accordance with the relevant codes and standards; however, as a minimum the following non-destructive examination shall be undertaken:

- All welds to be 100% visual examination
- A minimum of 10% of all welds should be non-destructive tested (NDT) with an appropriate technique
- For all critical structural welds such as lifting lugs, lifting equipment, 100% NDT is required with an appropriate technique
- Appropriate techniques include, but are not limited to, ultrasonic, X-ray (radiographic) & magnetic particle. Specific codes may specify the NDT technique to be used in certain applications

Any rejected welds shall be reported to Seqwater immediately, who shall authorise the use of the Supplier's approved weld repair procedure as appropriate. The Supplier shall identify and record each weld by welder's name and number.

Care shall be taken in the use of welding wires for compatibility to the parent material(s). Ensure complete removal of all weld flux by wire brushing and, where necessary, washing with an appropriate solvent.

Weld spatter shall be carefully removed by blasting, chipping or grinding. Where resistance to corrosion is required, all rough welding shall be ground smooth.

All protective coatings and linings affected by welding operations shall be repaired and completed in accordance with specified and approved procedures on completion of welding. If the coating is applied by brush, brushing shall be towards an edge. When spraying, double coating of edges shall take place where possible. Refer to Seqwater protective coatings standard *M-SPE-STD-004* for further details.

All welding shall be carried out by skilled personnel appropriately qualified to *AS 1796*, *AS 2634*, *AS 2980* and all other relevant standards. Alternatively, welders shall be qualified by approved equivalent International Standard.

Where required by codes and standards, welders shall be qualified to the specific required approved weld procedures.

For internal welding performed by maintenance staff for non-critical application, requirements for NDT and welder qualifications may be relaxed. Determination of "non-critical" shall be by risk assessment and elements that must be considered include (but not limited to):

- Welder's experience
- Load to be supported
- Risks of failure (including potential impacts on elements being welded to)

In addition to above any equipment required by relevant standards to adhere to specific welding requirements shall not be considered "non-critical". Examples include pressure vessels (*AS 1210*), pressure piping (*AS 4041*), steel structures (*AS 4100*).

3.3.7. Protective Coatings

Protective coatings shall be in accordance with Standard Specification *M-SPE-STD-004 Protective Coatings*.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	20 of 47

3.3.8. Services Routing

Services shall be routed / installed in service corridors as per the Project Specification and SOW documents. The intent of service corridors is to provide safe, unobstructed access to services for operation and maintenance.

Above ground service corridors shall:

- Be on walls of structures or on a pipe rack or cable tray. Pipe rack and cable tray structures shall be designed to carry the weights and loads expected
- Be designed to allow clear access to all equipment for operation and maintenance
- Ensure walkways are unobstructed
- Be sized based on the quantity of services
- Be self-draining
- Be suitably protected from weather and vandalism
- Have electrical services installed at higher levels than fluids, wherever possible, and installed in separate trays
- Where practicable, have individual services installed in order of potential contamination, with cleanest at the top and most contaminated at the bottom
- Space services to allow maintenance access and comply with relevant standards
- Make allowance for future services as stated in the Project Specification or SOW documents

Below ground services shall:

- Only combine compatible services in the same trench considering minimum depth requirements
- Be installed in accessible service corridors
- Make allowance for future services as stated in the Project Specification or SOW documents
- Be suitably protected from water ingress

Where below ground services are mounted in a culvert, the culvert shall:

- Have services mounted on the walls, not on the floor
- Be rated for expected loads
- Have rated road crossing plates suitable for the area traffic, where required, installed to prevent movement by passing traffic

The Supplier may put forward alternative arrangements for installation of services in service corridors, but they shall meet the intent of the requirements above.

3.3.9. Vibration & Balancing

At a minimum, rotating components shall be balanced as per the following (as appropriate for the application):

- *ISO 19499 - Mechanical vibration – Balancing – Guidance on the use and application of balancing standards*
- *ISO 21940-2 - Mechanical vibration -- Rotor balancing -- Part 2: Vocabulary*
- *ISO 21940-11- Mechanical vibration -- Rotor balancing -- Part 11: Procedures and tolerances for rotors with rigid behaviour*

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	21 of 47

- *ISO 21940-12 - Mechanical vibration -- Rotor balancing -- Part 12: Procedures and tolerances for rotors with flexible behaviour*
- *ISO 14694 - Industrial fans – Specifications for balance quality and vibration levels*
- *ISO 21940-13 - Mechanical vibration -- Rotor balancing -- Part 13: Criteria and safeguards for the in-situ balancing of medium and large rotors*

For specific applications (e.g. high performance or high risk), the balancing quality required may be higher than the ISO guidelines.

The evaluation of machine vibration shall be as per the relevant part of *ISO 20816-1- Mechanical vibration - Measurement and evaluation of machine vibration - Part 1: General guidelines*. The standard shall dictate both the process of evaluation as well as the allowable vibration limits of installed equipment as appropriate.

All critical rotating equipment (see section 5 for critical equipment definition), or equipment specified by Seqwater shall:

- Include the collection of a vibration spectrum analysis or vibration "signature" prior to shipping
- Undergo vibration testing (spectrum analysis) once installed within the final location. Where possible, testing shall be undertaken both before and after connection to other operational equipment

Where specified by Seqwater or recommended by the Supplier (and agreed by Seqwater), permanent on-line vibration monitoring devices shall be provided.

The appropriate ISO standards related to human exposure to vibration and shock shall be applied.

Consideration should be made for vibration isolation of machinery under the following circumstances:

- Machines being installed next to equipment that cannot be exposed to high levels of vibration
- If vibration could cause issues to arise within attached structures (i.e. foundations and pipes etc.)
- If structure borne noise could cause sound levels above specified limits particularly in a habitable area (e.g. control room)

3.3.10. Noise

Acceptable maximum equipment sound pressure levels shall be based on consideration of the specific application. Items to include within the consideration process shall include but not be limited to:

- Relevant standards including workplace health and safety and specific equipment standards
- Local government requirements for noise at boundaries as well as noise conditions included in the environmental authority permit for the relevant operational site
- Distance to noise recipients and acceptable noise level at the location of recipients. E.g. residential recipient may require a significantly lower noise level at their location compared to an operational recipient
- Nature and timing of operational work undertaken near equipment
- Effect of barriers, such as buildings, walls etc
- Air and ground absorption
- Tonal characteristics

As an absolute maximum, under normal operating conditions no equipment shall cause a sound pressure level exceeding 82dB (A) measured at a distance of 1 metre from the noise source.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	22 of 47

Where noise requirements cannot be met, the Supplier shall indicate this and provide a noise attenuating enclosure or other sound insulating material to bring the sound pressure level down to an agreed acceptable level. Alternatively, exceptions may be agreed to by Seqwater assessed on a case by case basis.

Where required or nominated by Seqwater, noise generating equipment shall have their sound power and sound pressure levels tested during commissioning in accordance with the procedures contained in AS 1217.5, AS 1217.7 or equivalent. A test report shall be provided with the equipment in accordance with AS 1217.7. The measured sound frequency spectrum shall be included as part of the report.

Noise generated by equipment shall be within the nominated acceptable dB range throughout the full range of operating conditions.

3.3.11. Labelling, Identification and Nameplates

Labelling and nameplate details shall comply with all Standard, Code and Statutory requirements.

Requirements for labelling network assets are included in standard drawings *D-DWG-STD-003 & 004*.

As far as applicable, colour differentiation of potable and recycled water pipes shall be in accordance with Section 4.2 of WSA 03, subject to limitation on available product options and augmented by marking. All other pipework shall be coloured and/or labelled as per AS 1345- *Identification of the contents of pipes, conduits and ducts*. In addition to above ground pipes, buried pipes shall adhere to these requirements where possible, subject to limitation on available product options. Consideration and appropriate risk mitigation must be given to specific situations where application of both above mentioned standards could cause confusion in identifying contents of pipes (e.g. if a compressed air pipe is next to a potable water pipe, as both will be blue if in accordance with the above standards).

Each equipment item shall be clearly identified with a permanently attached label as per *X-PRO-STD-006*. Where components are to be separated for shipment, each separable component shall be provided with a clearly stamped temporary label to identify the component. The temporary label shall be made from a suitably durable material and shall be securely attached to each separate item.

All lifting points shall have load notice plates.

Signage

- Equipment signage shall be in accordance with AS 1319 – *Safety signs for the occupational environment*

Safety instructions shall be in English and shall be prominently located.

3.4. Component Mechanical Requirements

3.4.1. Drive Modules

Drive modules shall be integral with or supported from the driven equipment and shall incorporate the following major components (where applicable) on a common base frame:

- Motor
- Gearbox
- Torque reaction link
- Couplings
- Belt Drives

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	23 of 47

- Guards at the cooling fan and any couplings
- Brake (where specified)
- Dedicated lube system
- VSD (where specified as include on base frame)
- Flange mounted motors that eliminate the need to realign couplings are preferred

3.4.2. Provisions for Handling Plant

Removable equipment, e.g. gearboxes, pumps, base frames and chutes, with a mass greater than 20kg shall include permanent lifting points for lifting, slinging and handling during erection and maintenance.

Lifting points, including lifting lugs and eyebolts, shall comply with all statutory regulations and be marked with load limits where required.

The lifting points and the centre of gravity shall be shown on the drawings.

The weight of the items to be lifted shall be indicated on the manufacturers rating plate.

Lifting points shall be provided for crane loading/unloading with lifting capacity of each point clearly and indelibly marked. The design and fitment of all lifting points shall be in accordance with recognised and accredited standards

The Supplier shall design and supply spreader bars where these are required for lifting of equipment for maintenance. Spreader bars shall be equipped with all necessary attachments and shall have a centrally located device for attachment to an overhead crane as required.

Buildings in which lifting equipment is provided shall be of an adequate height to allow safe lifting above other items of equipment and onto vehicles as appropriate.

3.4.3. Flanges

Wherever practicable, all equipment and pipe flanges shall be in accordance with AS 4087. If an alternative flange type (of higher or equal rating) is the Manufacturer's standard for a given piece of equipment, and the flange type cannot practicably be changed to AS 4087, the alternative flange type may be used subject to Seqwater approval. Alternative flanges, if approved, shall be compatible with AS 4087 wherever possible.

In some applications the use of flanges in accordance with AS 2129 or AS 4331 may be required.

The flange standard and drilling pattern of existing flanges in brownfield installations shall be determined by the contractor. In order to meet the flange standard requirements above, existing flanges may need to be replaced. Matching new flanges to existing non-compliant flanges (i.e. do not meet standard requirements above) will require Seqwater approval. All flanges shall have an allowable operating pressure (AOP) equal to or greater than the specified pressure class.

The face type, PN rating and material shall be as specified in the Data Sheet.

Flange bolt holes are to be large enough after painting/coating to allow installation of insulation sleeves (approximately 0.8mm thick).

Where practical, bolt holes shall be internally coated prior to assembly, ensuring appropriate internal clearance is maintained.

Flange faces shall be appropriately protected against damage during transit and storage.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	24 of 47

Flanges shall be assembled as per procedures specified in *WSA 109* where practicable.

Raised face flanges shall not be bolted to Cast Iron flat face flanges due to the risk of flange failure.

All buried flanged joints shall have appropriate anti-seize paste applied to all threads. The assembled joint shall be wrapped with a suitable tape protection system to the manufactures recommendations.

Refer to section 3.4.4 and 3.4.5 for flange gaskets and bolted connection requirements.

3.4.4. Gaskets

Flange gaskets shall comply with, *AS 4087*, *AS 1646* and *WSA 109* as applicable.

Seals/gaskets shall be used between flanges.

Where possible, gaskets shall be readily available standard gaskets and able to be workshop fabricated from flat gasket stock as needed.

Pipes and fittings shall be in their correct position, alignment and grade before the joints are made, and no springing of joints shall be permitted.

Avoid proprietary gasket systems unless there is a particular reason it is required, which shall be documented in the design report if so. Gaskets should also be of standard thickness.

Gaskets shall be suitably rated for the specific connection torque, pressure requirements and chemical compatibility.

3.4.5. Bolted Connections

Screw threads shall be metric size, ISO coarse pitch, unless specific duty requires fine thread.

Where the equipment body and bolt/nut are dissimilar metals, and it is assessed that galvanic corrosion could cause an asset integrity issue during the specified design life, insulating washers and sleeves shall be provided per *WSA 201*.

Bolts and nuts shall be in accordance with *AS 1110*.

Bolts and studs are to be installed using appropriate lubricant or anti-seize compound. Particular attention is to be given to stainless steel fasteners to minimise occurrence of galling.

It is expected that all bolted connections will include compatible washers on both sides of the connection, unless there is a specific design reason identified to not include them.

Where practical, connections shall be through bolted.

Bolts shall be readily accessible considering the method of bolt tightening employed.

Bolt or stud length shall be the minimum standard bolt/stud length that ensures at least two full threads are showing past the nut. The maximum number of full threads past the nut shall not exceed 10.

All bolts used in the assembly of mechanical equipment, plate work and machine framing which may require disassembly for maintenance shall have an appropriate anti-seize compound used.

Adjusting screws and mechanisms shall have covers, to provide protection. The screws and mechanisms shall be accessible for inspection and adjustment. Adjusting screws shall have lock nuts or other means to positively lock the screw.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	25 of 47

On vibrating equipment and other joints subject to varying loads, a positive locking device shall be provided to prevent nuts coming loose.

Structural bolts shall be tensioned as per *AS 4100* as applicable.

Flange bolts shall be tensioned to values recommended in *WSA 109* with the associated assembly procedure.

Bolted connections on equipment shall be tensioned as per the manufacture's recommendations.

Insulating washers and sleeves shall be provided where required for electrical insulation, e.g. within systems with cathodic protection.

3.4.6. Masonry Anchors

Masonry anchors include both integrated mechanical anchors (i.e. integrated with reinforcing) and chemical anchors.

All anchors shall be:

- Stainless steel grade 316 where appropriate. The anchors shall be supplied with stainless steel grade 316 nuts and washers with appropriate anti-seize treatment
- Designed for any start up torques and/or operational loads in accordance with manufacturer's recommendations
- Installed at least 100mm or a minimum of 6 times the nominal bolt diameter (whichever is greater) from the edge of the concrete plinth or slab, unless certified by structural RPEQ
- Installed perpendicular to the concrete face

Integrated mechanical anchors shall be used if required by the OEM.

Integrated mechanical anchors should be used if the equipment has a drive power of less than 50kW but weighs more than 250kg or if the drive power is greater than 50kW.

Integrated mechanical anchors shall be:

- 'L' or 'J' shaped, or hook bolts, and secured to the reinforcing in the concrete
- Cast into the concrete plinth or slab in a removable foam, to permit minor re-alignment and then grouting during installation

Chemical anchors shall:

- Comply with OEM's installation requirements and guidelines for embedment (hole depth), hole diameter and edge distances
- Be positioned inside steel reinforcing
- Be inspected by a competent person after the drilling of the hole and prior to the insertion of the anchor for installations where the anchor is over 16mm diameter and/or hole depth requirement is greater than 150mm. Competent person in this case shall be someone assessed by the certifying structural engineer based on the person's experience and knowledge of anchor installations
- Be installed to ensure the anchor hole is sufficiently sealed against water ingress
- Not be installed before all concrete powder from drilling is removed

Ferrule type anchors shall not be used.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	26 of 47

Holes must not be drilled into pre/post tensioned concrete until the location of the reinforcing is known, e.g. though scanning, to avoid the risk of damaging the tensioned reinforcing. Locations of anchors must take this into consideration.

An assessment of existing concrete by a competent person must be undertaken to ensure all loads intended to be transmitted through the anchors can be safely supported.

3.4.7. Packing and Grouting

Each item of equipment shall be packed to provide alignment in accordance with the design in all planes.

Packing and shims should be:

- Stainless steel for thickness 3mm and less
- Machined steel for greater than 3mm
- Consisting of the minimum practical number of shims and packers

Equipment shall be grouted using an appropriate non-shrink epoxy-based grout. Grout shall be chamfered at 45° at all edges. Grout shall be applied in one session to avoid deformation of components. All excess grout shall be removed.

Where anchor bolts have pockets for adjustment and alignment, ensure that the pocket is filled with grout.

3.4.8. Base Frames

Machine and drive base frames shall be of rigid construction and may be of either fabricated (typically hot dipped galvanized steel) or cast construction. In corrosive areas, stainless steel or composites should be considered as alternate base frame materials.

Base frames shall be raised above surrounding ground level by a minimum of 100mm, particularly in banded areas to keep clear of any liquid build-up. Any concrete plinths shall be appropriate for the application and be signed off by an RPEQ.

Machine and drive base frames shall be stress relieved post welding and before final machining. No welding shall be undertaken after post weld stress relief or final machining.

Mounting surfaces on base frames shall be machined to maintain equipment location accuracy and tolerance.

Base frames shall be designed to prevent the retention of water, dust and other material.

Appropriate packing shall be applied between:

- Any equipment and its associated base frame
- The base frame and any supporting steel work
- The base frame and any concrete plinth

The space between the base frame and the concrete shall be fully grouted with the packing fully covered.

Jacking bolts to enable convenient alignment of the equipment in both the longitudinal and transverse directions shall be provided. Slotted holes shall be provided for hold down bolts. The slotted holes shall have sufficient adjustment to properly align the equipment.

The equipment and frame hold down bolts shall be sufficiently torqued in order to ensure acceptable frictional force between the equipment, frame and supporting structure.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	27 of 47

Lifting lugs shall be provided. The lugs shall be designed for lifting the fully assembled unit and shall be located such that the lifting slings do not contact equipment. The weight of assembled units shall be indicated on the manufacturers rating plate.

Design loads shall include the loads associated with lifting when a fully assembled unit is lifted by sling attached to the lifting lugs.

3.4.9. Shafts and Pins

Shafts shall be designed to the latest version of the appropriate codes, including but not limited to:

- AS 1403 - Design of rotating steel shafts
- AS 1442 - Carbon steels and carbon-manganese steels – Hot rolled bars and semifinished products
- AS 1443 - Carbon and carbon-manganese steel - Cold-finished bars
- AS 1444 - Wrought alloy steels - Standard, hardenability (H) series and hardened and tempered to designated mechanical properties
- AS 1448 - Carbon steels and carbon-manganese steels - Forgings (ruling section 300 mm maximum)

Drive shafts shall be provided with appropriate mechanisms for all torque transmitting connections.

Shafts shall be straight to within the tolerances specified in the applicable shaft material standards.

3.4.10. Bearings and Housings

The equipment manufacturer shall select bearings based on each specific application.

Where practicable, bearings, bearing seals and bearing housings shall be of standard types and sizes commercially available off the shelf.

Bearings shall be rated in accordance with AS 2729 Rolling bearings - Dynamic load ratings and rating life in conjunction with the maximum running radial load. L10 life shall be calculated at the maximum speed and radial loads resulting from rated motor power.

Bearings should, at a minimum, be water and dust-tight, and utilise self-aligning antifriction roller bearings of the multi-cylinder, spherical or tapered roller type as applicable to the particular duty.

The use of plain bearings shall be advised and approved by Seqwater.

Bearing housings shall be mounted on a flat surface that complies with the bearing housing manufacturer's requirements.

Bearing end caps should be used where possible.

Any expelled lubricant from bearings shall be captured for disposal and shall not be permitted to enter the associated process stream.

3.4.11. Grease Lubrication and Seal Purging

All grease lubrication fittings shall be standard nipple unless other type is required for specific application. Corrosion resistant material shall be used in aggressive environments. Each nipple shall be fitted with dust cap.

Grease lubrication piping shall be installed where necessary such that lubrication of components can be performed from a readily accessible area, without having to remove guarding.

Use of auto greasers and/or remote greasing points may be used for inaccessible or hazardous areas.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	28 of 47

Plastic tubing not rated for grease or oil shall not be used for grease lubrication piping.

All equipment shall be supplied with complete information on lubrication requirements including a list of approved product manufacturers. Lubricants shall be selected to suit the site conditions.

Equipment with multiple lubrication or purging points within reasonably close proximity (within 4m) to one another shall have their grease nipples mounted on a common bulkhead. The lubricated items must be conveniently seen or identified.

All grease nipple bulkheads shall include a hinged dust cover to protect the nipples.

3.4.12. Gear Reducers

Refer to *M-SPE-STD-003* for the reduction gearbox requirements for valves.

Gear reducers, unless otherwise specified, shall be fully enclosed, built, tested and rated to the latest ISO standard. They shall have cut tooth gears, rolling contact bearings and seals of appropriate design on shaft extension for the duty indicated.

Gear reducers may be of the helical parallel shaft, spiral bevel right angle or straight cut planetary type. Worm type reducers shall not be used, unless approved by Seqwater.

Separate motor and gear reducer type drives are preferred. Integral motor-reducers (motors of special mounting and/or an integral part of the reducer) are acceptable for certain low power applications, where they can eliminate the need for additional structures.

Magnetic drain plugs shall be provided to remove metal particles from the oil.

The gear reducer shall be designed to:

- Eliminate condensation of water vapour by use of desiccant or bellows type breathers, or
- Handle moisture accumulation by ensuring that water will move to the drain connection without entering bearings or being emulsified with the oil.

Any air-breathers shall include a removable fine mesh filter for cleaning and/or replacement. The filter shall be capable of retaining microscopic dust particles.

Minimum mechanical rating shall equal to or exceed the connected prime mover nameplate power multiplied by the appropriate service factor. Service factors shall be in accordance with latest ISO and Australian Standards but shall not be less than 1.5 times motor power. Service factors for applications where extreme repetitive shocks occur or where high-energy loads must be absorbed shall be not less than 2 times nominal motor power.

All enclosed gearing shall be protected in lubricant during shipment.

Lubricant level shall be always observable by use of sight glass or dip stick.

Gearing shall be designed for a service life of 100,000 hours at the design load unless otherwise specified.

Gear reducers on critical equipment or equipment types known for high failure rates shall include provision for monitoring vibration and lubricant temperature.

Gearboxes on vertical agitators shall not rely on output shaft seals to retain oil.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	29 of 47

3.4.13. Couplings

Shaft couplings for direct drive equipment (greater than 50kW) shall be of the heavy-duty flexible type. The service factor for couplings shall be no less than 1.5 (2.0 for fans and agitators), based on rated motor power.

Any flexible elements shall be removable from the coupling without requiring disassembly or removal of other drive components.

Couplings shall be mounted to their respective shafts using “locking assemblies” for drives up to and including 150kW.

Couplings shall be aligned to the minimum manufacturer’s specification prior to delivery of assembled equipment. In addition, correct alignment shall be confirmed following installation of all system components. Records of alignments are to be kept and submitted with the manufacturer’s records or commissioning documentation as applicable.

3.4.14. Compressed Air Lines

Brittle plastics, such as U-PVC, shall not be used for compressed air lines.

Generally compressed air distribution lines shall be stainless steel or copper tubing.

Where applicable, compressed air piping shall comply with *AS 4041 - Pressure Piping Code*. Compressed air lines shall be installed with fall, catch pots and drains, or automatic drains.

Compressed air shall be filtered, dehydrated and lubricated to the requirements for the individual application.

If required for a specific application, flexible air hose may be used for the air distribution lines. In this case, the use shall be approved by Seqwater and the piping shall be installed in a properly constructed piping route in accordance with relevant standards.

Appropriate polymeric or stainless-steel flexible hoses may be used (and should be considered) for the connection between the air distribution lines and the pneumatic equipment.

Vermin protection of compressed air piping shall be considered during design phase based on risk analysis (consequences of supply loss and personnel risk of air burst).

Polymeric tubing shall not be between the compressor and the primary receiver.

Stainless steel hoses shall be fabricated in accordance with relevant ISO standards.

All polymeric hoses shall be fabricated in accordance with *AS/NZS 2554 Class B*.

3.4.15. Special Tools

The Supplier shall supply any special tools that may be necessary to enable the dismantling, periodic maintenance or replacement of all parts to be carried out quickly.

Special tools shall be sufficiently labelled to allow identification of the tool and which piece of equipment it is required for.

3.4.16. Security Locks

The relevant branch of Seqwater Operations (e.g. Networks, Treatment Plant or Natural Assets) must be consulted on the required lock type and key combination for any security locks (e.g. door handle / lock, gate lock or padlocks). Any applicable Seqwater standard or procedure specifying locks shall be considered.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	30 of 47

3.5. Mechanical Equipment

This section provides general equipment requirements for some common mechanical assets.

3.5.1. General

Equipment shall be supplied in accordance with the Project Specification/Datasheet as well as any other applicable Seqwater Standard Specifications.

All equipment and included design features shall be specifically selected to be appropriate for the application.

All equipment provided shall comply with the relevant Australian and International Standards.

All equipment and material supplied shall be new.

3.5.2. Pumps

Centrifugal pumps shall be as per requirements in *M-SPE-STD-014*.

Chemical dosing pumps shall be as per requirements in *M-SPE-STD-012*.

Progressive cavity pumps shall be per requirements in *M-SPE-STD-016*.

3.5.3. Blowers and Fans

The wheel and shaft of fans shall be statically and dynamically balanced as a unit.

Fans shall be selected such that:

- The maximum safe operating speed of fans shall be at least 120% of the maximum speed at peak design flow conditions
- The first critical speed for all fans shall be at least 1.3 times the maximum design speed
- The duty point pressure is no more than 80% of the peak pressure developed
- A minimum of $\pm 20\%$ flow variation does not result in unstable fan operation

Motors shall be sized for 120% of the power required at the maximum operating point of the fan. If the supplier believes this will cause the motor to be oversized, this requirement may be waived with acceptance from Seqwater.

Blowers and fans shall include inlet and outlet silencers and other acoustic treatment if required to comply with noise level limitations.

Fan housings shall be of heavy-duty welded construction. All parts shall be sufficiently reinforced to limit vibration and noise resulting from imbalance or aerodynamic forces. All welding of fan casings shall be continuous fillet, and gas tight. No intermittent welding shall be permitted. Designs requiring field welding are not acceptable.

Expansion joints shall be provided at the inlet and outlet of the fan if required to provide vibration isolation from the connected ductwork.

Rotary lobe type blowers shall be equipped with vibration isolating mountings and flexible couplings on the inlet and outlet of the blower.

The fan housing shall be provided with a threaded drain connection of at least DN15 with a cap or plug in the bottom of the scroll.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	31 of 47

A cleanout inspection door shall be provided on the fan housing if the fan wheel diameter is 600 mm or larger. The door shall be gasketed and held in place with quick release latches. An interlock shall be included to prevent the fan starting when the door is open.

Fans shall be configured to provide ease of maintenance access to the motor and drive components. Fans and their drive assembly shall be skid mounted for shipment and installation. Access to facilitate impeller removal and/or inspection without disturbing inlet or outlet ductwork shall be provided in the fan housing. Housings and inlet boxes shall be provided with bolted and flanged split sections complete with lifting lugs for impeller and shaft removal without disturbing duct connections. The fan scroll support and bearing stand shall be of integral construction to ensure proper alignment.

Impellers and shafts shall be stress relieved.

Stress relieving shall be undertaken prior to final machining. Welding and stress relieving shall be in accordance with welding code/procedure and material specification used.

Shaft seals shall be replaceable from the outside of the casing without dismantling the fan housing or ductwork.

Wherever possible, bearings shall be located out of the gas stream and mounted independently from the fan housing so that they are changeable without major dismantling of the fan housing. Mounting areas for attachment of vibration monitoring transducers shall be provided on the bearing housings. The vibration transducers may be either fixed (tapped hole in flat surface) or temporary magnet mounted type.

Rotating element weights shall be shown on the general arrangement drawings of the fans.

Fan/blower motors requiring a datasheet for specification shall use the motor part of *M-TMP-STD-002* Pumps and Motors datasheet template.

Design for vent ducting must consider appropriate routing and intake/exhaust locations. Intake and exhaust locations must be sufficiently clear of each other to ensure exhausted air/fumes are not drawn into the intake.

3.5.4. Valves

Valves shall be supplied and installed as per requirements detailed in standard specification *M-SPE-STD-003*.

Valves not covered by *M-SPE-STD-003* shall be as follows:

- Electrically operated control valves designed for flow modulation; not including some valves covered in M-STD-SPE-003 shall be treated on a case by case basis through scope of works and project specifications
- Ball, diaphragm, plug and globe valves: Covered in section 3.5.4.1 below
- Reduced pressure zone (RPZ) valves: To be manufactured, installed and tested to AS 2845. Location of RPZ valves to be determined as required by legislation as well as identified by HAZOP study
- Penstocks: As described in section 3.5.4.2

3.5.4.1. Other Valves

For small-bore pipework there are a range of other valve types that may be used which include (but not limited to) the following:

- Ball valves
- Diaphragm valves
- Plug valves

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	32 of 47

- Globe valves

The use and quality of these valves shall be specified by the system designer who must consider at minimum:

- Valve intended use (e.g. isolation, flow control etc.)
- Expected equipment lifetime
- Operability
- Risk associated with failure

Generally, ball valves used for water works purposes shall be supplied as per WSA PS-274.

Preferred valve types and materials for chemical dosing service are covered in *M-SPE-STD-010* and *M-SPE-STD-013*, design requirements must still consider other conditions shown in this section.

Any valves intended to provide an isolation must have a dedicated locking point capable of receiving an isolation lock, to lock the valve in a closed position (as minimum), or both open and closed, as function dictates.

3.5.4.2. Penstocks

Penstocks shall be supplied generally in accordance with requirements of *BS 7775 - Penstocks for use in water and other liquid flow applications* specification. Additional requirements or differences shall be as follows in this section.

Where BS & EN standards are referenced, the use of the AS equivalent where possible shall be used or as referenced below.

Welding requirements shall be as per section 3.3.6.

Minimum material requirements for penstocks are detailed in Table 2.. All material selection shall be subject to suitability requirements based on the individual installation environment assessed by the penstock supplier. In particular, the suitability of stainless steels when exposed to various chloride concentrations. All materials will be subject to requirements in section 3.3.4.

Table 2 Minimum Penstock Materials Requirements

Component	Material	Standard	Grade
Frame	Stainless Steel	ASTM A240M	316L & Duplex 2205, 2507
Door	Stainless Steel	ASTM A240M	316L & Duplex 2205, 2507
Fasteners	Stainless Steel	ASTM A276	316 & Duplex 2205, 2507
Spindle	Stainless Steel	ASTM A276	316 & Duplex 2205, 2507
Drive Nut	Aluminium Bronze Manganese Bronze		
Actuator input shaft	Stainless Steel	ASTM A276	316
Anchor Bolts	As per section 3.4.6		
Spindle extension	Stainless Steel	ASTM A276	316

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	33 of 47

All equipment shall be factory assembled and tested prior to being shipped to site. Testing shall include leak testing to ensure leakage rates are within limits stipulated in section 5.2 of *BS 7775*.

All testing shall be documented, signed and submitted with the manufacturers data record.

Any actuators and gearboxes applied to penstocks shall comply to requirements stated in sections 6.18 (Gearboxes) and 6.19 (Actuators) in *M-SPE-STD-003- Valves for Water Applications*.

3.5.5. Pressure Equipment

Pressure equipment shall comply with the most recent versions of the following standards as appropriate:

- *AS 1200 - Pressure Equipment*
- *AS 1210 - Pressure Vessels*
- *AS 1170 - Structural design actions*
- *AS 3920.1 - Assurance of product quality – Pressure equipment manufacture*
- *AS 3990 - Mechanical equipment – Steelwork*
- *AS 3992 - Pressure Equipment – Welding and Brazing Qualifications*
- *AS 4037 - Pressure equipment – Examination and testing*
- *AS 4041 - Pressure piping*
- *AS 4343 - Pressure Equipment – Hazard Levels*
- *AS 4458 - Pressure equipment – Manufacture*
- Alternatively, equipment may be designed and manufactured using appropriate and recognised international standards. Use of non-Australian Standards shall be approved by Seqwater and is reliant on the provision that relevant Australian laws and legislation will be fully adhered to and that successful registration of the equipment will not be affected.

3.5.6. Pipework

For pipeline design and construction refer to *WSA 03: 2011* in conjunction with the Seqwater supplementary requirements to *WSA 03: 2011* in *D-SPE-STD-001* and *AS 3500*.

For chemical pipework requirements refer to *M-SPE-STD-013*.

3.5.7. Cranes, Hoists and Monorail Beams

Cranes, hoists and winches shall be designed, manufactured and tested in accordance with *AS 1418* and *AS 2550*.

Special attention shall be given throughout the design process to provide easy access to all components which require service or replacement. The crane shall be manufactured in accordance with other relevant Australian Standards and all Workplace, Health and Safety requirements.

The crane shall have sufficient hoist and hook travel to lift the equipment free of all possible obstructions and place it in the nominated service area or on a suitable truck in the loading area.

Operation of the crane or hoist shall be by radio control or cable connected pendant. As required, separate pushbuttons/switches shall be provided for:

- Emergency Stop Button

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	34 of 47

- Hoisting functions: raise and lower, high and low speeds
- Long travel: forward and reverse, high and low speeds
- Cross travel: forward and reverse, high and low speeds
- Slewing (rotation): clockwise and anticlockwise, high and low speeds
- Local isolator
- Other: as required for application

The Supplier shall confirm details and suitability of all support structures to the crane, hoist or monorail. The Supplier shall carryout any necessary condition assessments to existing structures in order to verify integrity.

All hoists, where necessitated by the location, shall be suitable for continuous exposure to the weather and direct sunlight.

The rated capacity of equipment / safe working load shall be clearly identified on the equipment and signage.

Steel wire rope to be selected, operated and maintained in accordance with recommendations outlined in AS 2759.

Where required, cranes shall be fitted with data loggers to aid in Remaining Life Determination.

Weld testing shall include radiography testing (RT) or ultrasonic testing (UT) to 100% of all full penetration welds in load bearing members / functional components.

4. Execution

4.1. Assembly & Testing

4.1.1. Testing

All equipment (including auxiliary equipment) shall be shop assembled and tested prior to shipment. Testing shall be as per the relevant Australian Standards and industry best practice, and shall include all critical performance characteristics. All critical dimensions shall be verified, and all moving parts shall be tested prior to shipment. All components shall be examined and tested for defects.

Full testing documentation and results shall be provided to Seqwater.

Manual and automatic controls shall be tested to ensure safe operation in accordance with the specified functionality. Documentation detailing these test procedures and outcomes shall be provided to Seqwater.

Where specified or required by legislation, the owner, his representative and any authorities having jurisdiction over the equipment shall witness all tests.

4.1.2. Pre-assembly and Delivery

To reduce site installation costs and operational interruptions, site work shall be kept to a minimum. Sub-assemblies shall be shop-assembled and as large as transportation and erection facilities permit.

All fabrications shall be fully trail assembled before shipment to ensure satisfactory field erection. Prior to disassembly and shipping, all parts shall be match-marked to facilitate field erection.

All installation dimensions shall be verified and mating assemblies match-marked to facilitate field erection.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	35 of 47

Where practical, equipment shall be delivered to site ready for final connection, commissioning and operation.

Equipment shall be drained of water and completely dry internally and externally prior to packing. Cover plates shall be placed over inlet and outlet openings to prevent the ingress of foreign materials.

Equipment shall be adequately supported and braced to prevent damage during transport.

Shafts (e.g. motor and pump shafts) are to be securely locked to prevent brinelling of bearings during transport.

Equipment shall be fully crated so that truck tie down chains or other cargo cannot come into contact with it.

Electrical equipment susceptible to damage from moisture shall be packed with adequate desiccant to prevent deterioration.

After testing, the equipment shall be prepared for export shipment. Protective coatings shall be applied to ensure that the equipment is not damaged during shipment and storage on site.

Machine surfaces not normally painted, shall be coated with a suitable anti-corrosion compound to protect surfaces during shipment and outside storage at job site. The compound shall be such that it can be easily cleaned or removed with solvent.

4.1.3. Installation and Commissioning

The installation and commissioning of mechanical equipment shall comply with the OEM requirements and that of the relevant codes & standards.

Commissioning shall comply with the Seqwater Commissioning Requirements document *B-SPE-STD-003*.

The installer is required to provide the relevant Inspection & Test Plans (ITP) and Safe Work Method Statements (SWMS). ITPs and SWMSs provided shall cover all aspects of the installation requirements and the requirements of meeting the required standard of installation.

Unpacking, Assembly & Lifting:

- Determine the mass of largest component sub-assembly and total assembly prior to lifting. Check lifting equipment can meet the requirements at the necessary reach. Check points of contact of the lifting devices against ground or structure conditions. Assemblies shall be lifted onto foundations and secured using the designed fasteners
- The lifting of equipment shall be planned and documented by a competent engineer such that excessive loads are not applied to equipment fixing points
- Adequate space shall be allowed for lifting device, lay down and access during all lifting operations
- Provide isolation of materials to preserve the surface integrity of stainless steels and other alloys
- Provide soft covers on lifting equipment to avoid surface damage to thermoplastic and GRP materials

All equipment shall be tested at site for compliance with the specified criteria (noise, vibration, etc.)

4.2. Registration

Where required by State/Federal Regulations, equipment shall be registered with appropriate authorities.

Unless otherwise stated, it is expected that the supplier shall register the equipment on behalf of Seqwater.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	36 of 47

4.3. Submittals

Final submittal shall include all as-constructed drawings, datasheets, manuals, reports, calculations, models and any other documentation required to operate and maintain systems throughout their lifecycle.

All documentation shall be provided in plain concise English.

All documentation nominated within the Project SOW shall be provided.

All registration documentation shall be provided to Seqwater.

All drawings shall include RPEQ signoff as per requirements in *X-PRO-STD-007*.

Unless directed otherwise by Seqwater, drawings, documents and asset data shall comply with the following Seqwater Procedures and Templates:

- *X-PRO-STD-002* *Engineering Drawing Numbers Procedure*
- *X-PRO-STD-006* *Equipment Numbering and Naming Convention*
- *X-PRO-STD-007* *Drawing & Spatial Data Standards*
- *X-PRO-STD-010* *Asset Information Collection Procedure for Project Manager, Maintenance Provides, Contractors and Suppliers*

All submittals, including drawings and models, shall be provided to Seqwater in native format in addition to a readily assessable format. E.g. drawings shall be submitted as a CAD file and indexed/searchable PDF.

Manuals should be supplied as 2 hard copies and 1 soft copy compatible with the software specified in the Contract.

As a guide, the manuals for any new or modified equipment should contain, at a minimum:

1. Contents page
2. Description of work
 - 2.1. Scope of Work
 - 2.2. Functional Specification
 - 2.3. Photographs of completed work
3. Installed components and equipment
 - 3.1. Component/equipment list
 - 3.2. Specifications/performance curves
 - 3.3. Proposed spare parts
 - 3.4. Supplier (OEM) documentation & warranty
 - 3.5. As built drawings
 - 3.6. Electrical and PLC information
4. Operational Manual (refer below)
 - 4.1. Operational procedures
 - 4.2. Isolation procedures
5. Maintenance Manual (refer below)
 - 5.1. Maintenance requirements and schedules

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	37 of 47

- 5.2. Isolation procedures
- 5.3. Overhaul requirements and schedules
- 5.4. Spare parts list
- 5.5. Supplier
- 6. Commissioning Test/acceptance Criteria
 - 6.1. Test certificates
 - 6.2. Risk assessments
- 7. Training documentation
- 8. Statutory and Regulatory body information

Operation manuals shall describe the operation of the equipment, including:

- Safe operating instructions
- How to test that the equipment is performing to its stated functionality and capacity
- Shutdown procedures
- Isolation procedures
- Details of equipment make and model
- Serial number where applicable
- Pump operating curves

Maintenance manuals shall include:

- Safe maintenance instructions
- All OEM maintenance manuals. Material in any OEM manual that does not directly relate to the installed equipment is to be removed or shown in strikethrough
- Isolation procedures
- All maintenance schedules for the safe and reliable operation of the equipment throughout its design life, as recommended by the OEM
- Lubrication specifications and schedules, as applicable
- Contact details of OEM
- Contact details of supplier agents and/or parts suppliers
- List of warranty details
- Commissioning and re-commissioning procedure
- Detailed parts lists and associated drawings for all equipment
- Listing of serviceable and consumable items
- Special tools list

Any additional maintenance requirements as determined by the Supplier or recommended by an OEM.

The Manufacturing Data Record (MDR) shall include where relevant:

- Inspection & Test Plans (ITP's), initial and signed final

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	38 of 47

- Worker qualification records (e.g. welders' qualifications)
- Weld procedure specifications
- Weld Maps
- Materials certificates
- Required statutory documentation (e.g. design registration)
- Non-destructive testing (NDT) reports/results
- All signed and completed factory acceptance test (FAT), site acceptance test (SAT) and Inspection Test Report records
- Protective coatings test reports
- As built documents & drawings

5. Definitions & Abbreviations

Table 3 Definitions and Abbreviations

Term	Definitions
Contractor	An entity engaged by Seqwater to undertake work in accordance with an agreed contract with a defined scope of work.
Critical Equipment	For the purposes of this standard critical equipment shall be defined as being: Equipment that poses a high risk (as per Seqwater risk assessment) of causing injury to personnel if failed. Equipment that poses a high risk (as per Seqwater risk assessment) of supply interruption or impact on output quality.
Harmful Substances	Any materials defined as being VHG or VHL as per Table 3.1 in AS 4343
Manufacturer / Supplier / Vendor / Original Equipment Manufacturer (OEM)	The entity that manufacturers or supplies equipment to meet the specifications of the Contractor.
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).
REX	Seqwater Electronic Document and Records Management System.
Scope of Works (SOW)	Means the scope of works document forming part of the contract particulars 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.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	39 of 47

Term	Definitions
Shall / must	Indicates a mandatory requirement
Should	Indicates a recommendation.
Small-bore pipework	Pipework under 150 mm NB for the purposes of this specification
Water Pipelines	Pipelines for transfer of bulk water (potable), raw water, irrigation or recycled water. The majority of critical pipelines are outside of WTP limits; however large critical pipelines within WTPs shall be included within this category.

The following abbreviations (Table 4) apply to this Engineering Standard.

Table 4 – Abbreviations

Abbreviation	Description
AOP	Allowable Operating Pressure
AS	Australian Standard
ASME	American Society of Mechanical Engineers
BEP	Best Efficiency Point (for pumps)
HAZOP	Control System Hazard and Operability Study
FAT	Factory Acceptance Test
GFRP	Glass Fibre Reinforced Plastic
HAZOP	Hazard and Operability Study
IOMM	Installation, Operation and Maintenance
ISO	International Standards Organisation
MDR	Manufacturing Data Record
MTBF	Mean Time Between Failure
NATA	National Association of Testing Authorities, Australia
NDT	Non-Destructive Testing
OEM	Original Equipment Manufacturer
OMM	Operation & Maintenance Manual
SAT	Site Acceptance Test
RPEQ	Registered Professional Engineer of Queensland
SOW	Scope of Works
VHG	Very Hazardous Gas (ref: AS 4343)
VHL	Very Hazardous Liquid (ref: AS 4343)
WSAA	Water Services Association of Australia
WTP	Water Treatment Plant

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	40 of 47

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

6. Roles and Responsibilities

Table 5 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 – P6255	Responsible for implementation and management of this Standard. Accountable and responsible for receipt and management of drawings.
General Manager Engineering Standards & Assurance - P7990	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.

7. References and Related Materials

The documents listed in Table 6 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 6 References and Related Material

Description	Location
686447 D-DWG-STD-003 Marker Post and Information Plates	REX & Waternet
686448 D-DWG-STD-004 Identification Plates	REX & Waternet
686487 D-DWG-STD-00005 Scour Valve General Below Ground Arrangement	REX & Waternet
686488 D-DWG-STD-00006 Air Vale Pit Typical Arrangement Details	REX & Waternet
686492 D-DWG-STD-00007 Water Quality Sample Point General Arrangement	REX & Waternet
D20/207903 D-DWG-STD-00026 Potable Water Tanker Delivery Connection Conceptual Arrangement	REX & Waternet
D21/201233 D-DWG-STD-00024 SS Ladder with Retractable Handgrip Stanchions General Arrangement and Assembly Details	REX & Waternet
D21/201234 D-DWG-STD-00025 FRP Ladder with Retractable Handgrip Stanchions General Arrangement and Assembly Details	REX & Waternet

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	41 of 47

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

Description	Location
D23/178910 D-DWG-STD-00029 Flowmeter Pit (DN600 and Larger) General Arrangement	REX & Waternet
D23/178912 D-DWG-STD-00030 Butterfly Valve Pit General Arrangement	REX & Waternet
D23/178914 D-DWG-STD-00031 Gate Valve Pit General Arrangement	REX & Waternet
D23/178916 D-DWG-STD-00032 Pigging Pit General Arrangement	REX & Waternet
D23/178918 D-DWG-STD-00033 Typical Pit Information	REX & Waternet
D23/178920 D-DWG-STD-00034 Pit Sump Pump Details	REX & Waternet
PRO-01617 X-PRO-STD-009 Engineering Design, Construction, Operation and Maintenance	REX
PRO-01872 X-PRO-STD-002 Engineering Drawing Number Procedure	REX
PRO-01873 X-PRO-STD-001 Asset Standards Documentation Classification and Naming Structure	REX
PRO-01874 X-PRO-STD-004 Development and Review of Asset Standards	REX
PRO-02140 X-PRO-STD-013 Engineering Technical Hazard Study	REX
PRO-02187 X-PRO-STD-007 Drawing and Spatial Data Standards	REX
PRO-02190 X-PRO-STD-006 Asset and Equipment Identifier Procedure	REX
PRO-02205 X-PRO-STD-008 Asset Standards Management and Application	REX
PRO-02234 X-PRO-STD-015 Management of Change – Technical	REX
REG-01074 X-LST-STD-001 Seqwater Preferred Equipment Register	REX
SPE-00323 M-SPE-STD-003 Valves for Water Applications	REX
SPE-00346 B-SPE-STD-003 Commissioning Requirements	REX
SPE-00348 M-SPE-STD-004 Protective Coatings	REX
SPE-00352 E-SPE-STD-001 Electrical Design & Construction	REX
SPE-00355 M-SPE-STD-013 Chemical Dosing Piping	REX
SPE-00366 M-SPE-STD-002 Fixed Platforms, Walkways, Stairways and Ladders	REX
SPE-00395 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
SPE-00430 M-SPE-STD-012 Chemical Dosing Pumps	REX
SPE-00435 M-SPE-STD-010 Chemical Dosing Skid	REX
SPE-00505 M-SPE-STD-014 Centrifugal Pumps	REX
SPE-00506 M-SPE-STD-016 Progressive Cavity Pumps	REX
TEM-00220 M-TMP-STD-002 Pump and Motor Datasheet Template	REX
TEM-00224 X-TMP-STD-022 Asset Standards Deviation Request	REX

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	42 of 47

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

Description	Location
AS 1100.201 Technical drawing – Mechanical engineering drawing Australian and International Standards Web Service	Intertek Inform
AS 1100.201 Technical drawing – Mechanical engineering drawing Australian and International Standards Web Service	Intertek Inform
AS 1170 Structural design actions Australian and International Standards Web Service	Intertek Inform
AS 1940 The storage and handling of flammable and combustible liquids Australian and International Standards Web Service	Intertek Inform
AS 1200 Pressure Equipment Australian and International Standards Web Service	Intertek Inform
AS 1210 Pressure Vessels Australian and International Standards Web Service	Intertek Inform
AS 1217.7 Acoustics – Determination of sound power levels of noise sources survey method Australian and International Standards Web Service	Intertek Inform
AS 1318 Industrial safety colour code Australian and International Standards Web Service	Intertek Inform
AS 1319 Safety signs for the occupational environment Australian and International Standards Web Service	Intertek Inform
AS 1345 Identification of the contents of piping, conduits and ducts. Australian and International Standards Web Service	Intertek Inform
AS1403 Design of rotating steel shafts Australian and International Standards Web Service	Intertek Inform
AS1418 Cranes, hoists and winches Vehicle loading cranes Australian and International Standards Web Service	Intertek Inform
AS 1442 Carbon steels and carbon-manganese steels – Hot rolled bars and semifinished products Australian and International Standards Web Service	Intertek Inform
AS 1443 Carbon and carbon-manganese steel - Cold-finished bars Australian and International Standards Web Service	Intertek Inform
AS 1444 Wrought alloy steels - Standard, hardenability (H) series and hardened and tempered to designated mechanical properties Australian and International Standards Web Service	Intertek Inform
AS 1448 Carbon steels and carbon-manganese steels - Forgings Australian and International Standards Web Service	Intertek Inform
AS 1554 Structural steel welding Australian and International Standards Web Service	Intertek Inform

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	43 of 47

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

Description	Location
AS 1646 Elastomeric seals for waterworks purposes Australian and International Standards Web Service	Intertek Inform
AS 1657 Fixed platforms, walkways, stairways and ladders – Design, construction and installation Australian and International Standards Web Service	Intertek Inform
AS 1664 Aluminium structures code Australian and International Standards Web Service	Intertek Inform
AS 1665 Welding of aluminium structures Australian and International Standards Web Service	Intertek Inform
AS 1796 Certification of welders and welding supervisors Australian and International Standards Web Service	Intertek Inform
AS 2129 Flanges for pipes, valves and fittings Australian and International Standards Web Service	Intertek Inform
AS 2382 Surface roughness comparison specimens (surface finish) Australian and International Standards Web Service	Intertek Inform
AS 2550 Cranes, hoists and winches – Safe use vehicle loading cranes Australian and International Standards Web Service	Intertek Inform
AS 2554 Hose and hose assemblies for air Australian and International Standards Web Service	Intertek Inform
AS 2634 Chemical plant equipment made from glass-fibre reinforced plastics (GFRP) Australian and International Standards Web Service	Intertek Inform
AS 2638 Gate valves for waterworks purposes Australian and International Standards Web Service	Intertek Inform
AS 2700 Colour standards for general purposes Australian and International Standards Web Service	Intertek Inform
AS 2729 Rolling bearings – Dynamic load ratings and rating life Australian and International Standards Web Service	Intertek Inform
AS 2759 Steel wire rope – Use, operation and maintenance Australian and International Standards Web Service	Intertek Inform
AS 2865 Confined spaces Australian and International Standards Web Service	Intertek Inform
AS 2980 Qualification of welders for fusion welding of steels Australian and International Standards Web Service	Intertek Inform
AS 3000 Wiring Rules Australian and International Standards Web Service	Intertek Inform

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	44 of 47

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

Description	Location
AS 3500.1 Plumbing and drainage Australian and International Standards Web Service	Intertek Inform
AS 3894.1 Site testing of protective coatings - Non-conductive coatings - Continuity testing - High voltage (brush) method Australian and International Standards Web Service	Intertek Inform
AS 3894.3 Site testing of protective coatings - Determination of dry film thickness Australian and International Standards Web Service	Intertek Inform
AS 3920.1 Assurance of product quality – Pressure equipment manufacture Australian and International Standards Web Service	Intertek Inform
AS 3990 Mechanical equipment – Steelwork Australian and International Standards Web Service	Intertek Inform
AS 3992 Pressure Equipment – Welding and Brazing Qualifications Australian and International Standards Web Service	Intertek Inform
AS 4020 Testing of products for use in contact with drinking water Australian and International Standards Web Service	Intertek Inform
AS 4024 Safety of Machinery Australian and International Standards Web Service	Intertek Inform
AS 4037 Pressure equipment – Examination and testing Australian and International Standards Web Service	Intertek Inform
AS 4041 Pressure piping Australian and International Standards Web Service	Intertek Inform
AS 4087 Metallic flanges for waterworks purposes Australian and International Standards Web Service	Intertek Inform
AS 4100 Steel structures Australian and International Standards Web Service	Intertek Inform
AS 4158 Thermal-bonded polymeric coatings on valves and fittings for water industry purposes Australian and International Standards Web Service	Intertek Inform
AS 4312 Atmospheric Corrosivity Zones in Australia Australian and International Standards Web Service	Intertek Inform
AS 4331 Metallic Flanges (Steel, Copper alloy & cast iron) Australian and International Standards Web Service	Intertek Inform
AS 4343 Pressure Equipment – Hazard Levels Australian and International Standards Web Service	Intertek Inform
AS 4458 Pressure equipment – Manufacture Australian and International Standards Web Service	Intertek Inform

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	45 of 47

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

Description	Location
AS 4680 Hot-dipped galvanised (zinc) coatings on fabricated ferrous articles Australian and International Standards Web Service	Intertek Inform
AS 4794 Non-return valves for waterworks purposes Australian and International Standards Web Service	Intertek Inform
AS 4795 Butterfly valves for waterworks purposes Australian and International Standards Web Service	Intertek Inform
AS 5612 Butterfly valves for general purposes Australian and International Standards Web Service	Intertek Inform
AS 6401 Knife gate valves for waterworks purposes Australian and International Standards Web Service	Intertek Inform
ASME B31.3 Process Piping Australian and International Standards Web Service	Intertek Inform
ISO 286 ISO code system for tolerances on linear sizes Australian and International Standards Web Service	Intertek Inform
ISO 21940-2 Mechanical vibration -- Rotor balancing -- Part 2: Vocabulary Australian and International Standards Web Service	Intertek Inform
ISO 21940-11 Mechanical vibration -- Rotor balancing -- Part 11: Procedures and tolerances for rotors with rigid behaviour Australian and International Standards Web Service	Intertek Inform
ISO 9001 Quality management systems Australian and International Standards Web Service	Intertek Inform
ISO 20816-1 Mechanical vibration -- Measurement and evaluation of machine vibration -- Part 1: General guidelines Australian and International Standards Web Service	Intertek Inform
ISO 21940-12 Mechanical vibration -- Rotor balancing -- Part 12: Procedures and tolerances for rotors with flexible behaviour Australian and International Standards Web Service	Intertek Inform
ISO 14694 Industrial fans – Specifications for balance quality and vibration levels Australian and International Standards Web Service	Intertek Inform
ISO 19499 Mechanical vibration – Balancing – Guidance on the use and application of balancing standards Australian and International Standards Web Service	Intertek Inform
ISO 21940-13 Mechanical vibration -- Rotor balancing -- Part 13: Criteria and safeguards for the in-situ balancing of medium and large rotors Australian and International Standards Web Service	Intertek Inform
WSA 03 Water Services Association of Australia Water Supply Code	Water Services Association of Australia

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	46 of 47

Description	Location
WSA 109 Industry Standard for Flange Gaskets & O-rings	Water Services Association of Australia
WSA 201 Manual for Selection & Application of Protective Coatings	Water Services Association of Australia

8. 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 7 below.

Table 7 Changes from previous version

Section Number	Change
All	Specification format updated to the latest version.
All	Minor wording changes for clarity
3	Added information and reference to Preferred Equipment Register
3.1.2.	Added compliance with Australian New Zealand Food Standards Code.
3.1.3.	Updated Table 1 Design Life, added paragraph about table and note below table.
3.2.3.2.	Removed sentence for double valves generally being considered for areas with confined space.
3.2.4.	Added that for access manways with a ladder, openings shall be as per ladder clearances as shown in AS 1657 and ladders shall have retractable handgrips.
3.3.6.	Order of some paragraphs changed to flow better.
3.3.11.	Added reference to X-PRO-STD-021. (Note: this reference was removed in an administrative correction as now obsolete.)
3.4.3.	Order of some paragraphs changed to flow better.
3.4.4.	Added use of proprietary gasket systems shall be documented in the design report.
3.4.5.	Removed bolts and nuts shall be 316 stainless.
3.4.6.	Added clarification for when integrated mechanical anchors should be used.
3.4.16	Added some more information on compressed airline installation requirements
7	Added more standard drawings and preferred equipment list to Table 6

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00367	Principal Engineering Standards and Assurance	16/06/2025	General Manager Engineering	47 of 47