

Engineering Standard M-SPE-STD-014

Centrifugal Water Pumps

Document number: SPE-00505

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
1	Original Version	Principal Engineering Standards and Assurance	Refer to supporting Info in Rex	General Manager - Engineering Standards & Assurance	Refer to supporting Info in Rex	03/04/2024

This Engineering Standard was endorsed by an RPEQ on behalf of Seqwater.

Contents

Version History	3
1. Purpose	4
2. Scope	5
3. Technical Requirements	6
3.1. General.....	6
3.2. Design Life	6
3.3. Operating Conditions	7
3.4. Drinking Water Compatibility	7
3.5. Physical and Operating Requirements.....	7
3.5.1. General.....	7
3.5.2. Pump Sizing	8
3.5.3. Pressure Class.....	8
3.5.4. Coupling.....	9
3.5.5. Base Plate	9
3.5.6. Pump Seals	9
3.5.7. Bearings.....	10
3.5.8. Impellor.....	10
3.5.9. Shaft	10
3.5.10. Submersible Pumps	11
3.5.11. Pumps on Seqwater Network Pump Stations	11
3.6. Electrical and Control.....	11
3.7. VSD Operation	11
3.8. Protective Coatings.....	12
3.9. Markings	12
3.10. Existing Infrastructure.....	12
3.11. Installation	12
3.12. Maintenance.....	13
3.13. Commissioning.....	13
3.14. Documentation	14
4. Definitions & Abbreviations	14
5. Roles and Responsibilities	15
6. Reference and Related Materials	15
7. Changes from Previous Version	18

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	2 of 18

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.

Version History

Rev	Date	Description	Author	SME	Owner	Approver
1	03/04/2024	Original Version				

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

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	3 of 18

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 and safe so far as is reasonably practicable. Advice must be sought from Seqwater to clarify any ambiguities in relation to this document.

This Standard Specification provides the minimum requirements and recommendations for the design, supply and installation of new or refurbished centrifugal water pumps.

This document must be used in conjunction with the documents it references to assist in ensuring a fit for purpose asset. This Standard is not intended to be relied on solely for design, supply, and installation works; advice from specialist engineers and/or manufacturers may be required on a case-by-case basis.

This Standard Specification is applicable to centrifugal pumps used to move raw water and treated water, including bulk water transfer systems where boosting is required for distribution purposes as well as process and service water.

The centrifugal pumps covered by this specification include:

- Dry mount single stage horizontal pumps > 50 kW.
- Dry mount multistage horizontal pumps > 50 kW.
- Dry mount single stage vertical pumps > 50 kW.
- Dry mount multistage vertical pumps > 50 kW.
- Submersible single stage pumps > 20 kW
- Submersible multistage pumps > 20 kW
- All ISO pumps.

This specification is not applicable to pumps with lower power, other than those nominated above for each nominated pump type, however the requirements of this specification should be considered where applicable. Lower power pumps are considered more of a disposable commodity/off the shelf item with refurbishment costs exceeding the replacement cost of the pump.

The fluids pumped will vary depending on the application. Liquids will be water at various turbidity, solids content, chlorine content and from various points through the treatment process. Bulk / treated water will be of a quality and chemical content compliant with the requirements of the ADWG. Where pumping a different type of liquid is required, the requirements of this Standard Specification shall apply as far as applicable and practicable.

This Standard Specification is not intended to cover sump, slurry, sludge, chemical, gas, or non-centrifugal pump applications. For specific requirements related to chemical dosing pumps, refer to *M-SPE-STD-012, Chemical Dosing Pumps* and *M-SPE-STD-016, Progressive Cavity Pumps*. These specifications provide a comprehensive explanation of all requirements and supplementary information pertinent to the selection and application of these pumps.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	4 of 18

2. Scope

This Standard Specification applies to all Seqwater workers, as well as suppliers, contractors 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.

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 WSAA). Where no Australian Standard exists for a particular application, work must conform to the most current version of an industry accepted international standard.

Deviation from meeting the minimum requirements in this standard 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 or acceptance shall/must be sought, approval 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 assets. This includes modifications to the functional design of the asset including technical changes made which would extend an asset outside of its design operating envelope and/or approved operation and maintenance practices.

In the case that it is identified that a specific requirement within this Engineering Standard does not meet the requirements of project specific documents, other Seqwater Engineering Standards, or Australian Legislation, Standards, Codes or Guidelines, the conflict must be brought to the attention of the Seqwater Principal Engineering Standards and Assurance (or their delegate) via the Engineering Mailbox, and written agreement must be gained prior to application of the requirement.

Advice must be sought from the Seqwater Document Owner to clarify any ambiguities regarding this Engineering Standard.

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.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	5 of 18

3. Technical Requirements

3.1. General

Refer to the *M-SPE-STD-001* for general requirements related to mechanical assets.

The requirements of *WSA 03, Water Supply Code of Australia* and *D-SPE-STD-001 Water Supply Network Planning, Design and Construction, (Seqwater Supplementary Manual to WSA 03)* shall be applied wherever applicable. Brine and high salinity pumping applications shall be classified as highly corrosive for pump material selection according to the ISO standards.

WSA 130, ISO End Suction Centrifugal Pumps and *WSA 131, ISO End Suction Centrifugal Motor Pumps* requirements shall be met where applicable.

The pump selected must be specified by the Manufacturer as suitable for operation for the project specific application with the specified fluid and must have a proven record of reliable operation in that application. The specific application details include, but are not necessarily limited to, operational and maintenance requirements, disinfection with a 20 mg/L free chlorine solution, the operating environment and water quality. Where it is identified that a specific requirement within this Standard Specification would lead to installation of an unsuitable pump for the application, an alternative shall be identified and brought to the attention of Seqwater Principal Engineering Standards and Assurance for deviation approval.

All equipment shall be selected to ensure that chemical compatibility is appropriately met for systems before or after chemical dosing processes.

Any mandated or recommended Standards, Legislation, Regulation or Code requirements that cannot be met due to existing installations must be brought to the attention of Seqwater Principal Engineering Standards and Assurance.

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

Where pumps are being installed in a Classified Hazardous area, the relevant requirements of *E-SPE-STD-001* shall be met.

Unless otherwise specified, the pump shall be supplied with all required ancillary components for installation.

The equipment shall be designed to optimise reliability, minimise maintenance, spillage and contaminant release during service.

The pumps shall be designed such that safe fabrication, installation, testing, commissioning, operation and maintenance is ensured.

All machinery shall be furnished with all necessary safety guards in compliance with *AS4024* series and *M-SPE-STD-001*.

3.2. Design Life

The required design life for pumps based on operation is specified in *M-SPE-STD-001*. The *Pump Asset Class Plan* (ACP) further quantifies the design life requirements for various pump types. The design life has been adjusted for

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	6 of 18

the pump's typical application and the adherence to the ACP maintenance and refurbishment plan. The selection of all equipment must reflect the specified design life detailed in Table 1.

Table 1 – Design Life

Pump Type	Asset Class Plan Adjusted Effective Life (Years)		
	Raw Water	Dirty Process Water	Clear Process and Treated Water
Dry Mount Centrifugal	45	30	50
Submersible Centrifugal Single Stage	30	20	NA
Submersible Centrifugal Multi-Stage	10	NA	NA

3.3. Operating Conditions

The system and all components of the pump must be suitable for the design maximum flows, pressures, temperatures and other operating conditions, and all components, materials and coatings must have long term compatibility and suitability with the pumped fluid, as specified in the project specific documentation.

All components must be suitable for the external environment, including exposure to any potential liquid spills or chemical vapour. At a minimum, all components must be suitable for an outdoor industrial environment with ambient operating temperatures between -5°C and 50°C and relative humidity between 10% and 100%. More extreme environmental conditions may need to be assigned on a case-by-case basis.

Unless otherwise defined, the pump will be required to operate continuously at full duty, 24 hours per day, 7 days a week under the defined operating conditions.

A minimum of C3-Medium corrosivity category, as per AS 4312, will apply for all external surface protection requirements. A C4-high or C5-very high corrosivity category shall be assigned to equipment that will be installed in the specific locations requiring these categories as specified within *M-SPE-STD-004, Protective Coatings*.

3.4. Drinking Water Compatibility

All components of the pump that may come into contact with drinking water or subsequently enter the treatment process must comply with the Potable Water Compatibility requirements of *M-SPE-STD-001*.

3.5. Physical and Operating Requirements

3.5.1. General

The required maximum and minimum flow conditions shall be achievable on all pumps without the requirement to increase the pump or motor size.

Pump Net Positive Suction Head required (NPSHR) shall be a minimum of 1m less than the Net Positive Suction Head available (NPSHA).

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	7 of 18

All pumps will be direct coupled and should include features that provide dry and stalled running protection.

All pumps should be self-priming; however, the designer should include provisions for priming regardless of pump selection.

The pump housing must include a plugged vent and drain port positioned to effectively vent and drain the pump.

Suitable anti-seize coating, must be applied to all bolts required for disassembly of the pump.

The suction and discharge nozzles must include suitably sized bosses for pressure gauge or pressure sensor connections. The suction and discharge side bosses shall be drilled, tapped and plugged G1/2 ports. In line with the Seqwater Energy Efficiency Manuals and Guidelines, all pumps ≥ 500 kW shall, and pumps < 500 kW should, be installed with either thermodynamic efficiency monitoring per *ISO 5198* or differential pressure efficiency monitoring, dependant on the availability of a suitable flow meter for pressure efficiency determination.

Pumps shall be provided with two accelerometer mounting points, suitable to be drilled and tapped M8, on each of the pump's bearing housings, one in the vertical plane and the other in the horizontal plane for each bearing.

All pumps must be fitted with vibration resistant, platinum, three wire PT100 RTD's on each bearing housing. The RTD is to be inserted and secured into the bearing housing so the tip of the RTD is in contact with the bearing outer race. The RTD's must be manufactured to resist vibration such as a molten glass sealed wound coil RTD or similar.

Pumps ≥ 500 kW must have inbuilt catastrophic failure prevention. This is defined as mechanisms that will prevent operation if component temperature or vibration limits are exceeded. It is recommended that pumps between 250 – 500 kW also include catastrophic failure prevention.

The first lateral critical speed of the rotating elements of the pump shall be at least 20% above the maximum speed of the pump.

Rotating elements of the pump shall be individually dynamically balanced in accordance with *ISO 21940-11* to G6.3 balance tolerance grade. Then the assembled rotating elements of the pump shall be dynamically balanced in accordance with *ISO 21940-11* to G2.5 balance tolerance grade.

Commissioning vibration limits for new or refurbished pump sets shall comply with *ISO 10816-7* Zone A, Category II and Zone B, Category II in service.

3.5.2. Pump Sizing

The pump shall be suitably sized to achieve the required flow rate at the minimum, normal and maximum operational flow as specified within the project documentation. However, consideration must be given to effectively selecting equipment based on functionality and efficiency. The pump design duty points must be between 50% and 110% of the Best Efficiency Point (BEP) with the normal operational duty point between 85% and 110% of the pump BEP. Note that some pumps may have a more restricted safe operational region and those limits shall be applied as necessary.

3.5.3. Pressure Class

The pressure class of the pump shall be equivalent to or greater than the design rated pressure class of the associated infrastructure, whichever is greater. Suction flanges will have the same pressure rating as the discharge flanges.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	8 of 18

3.5.4. Coupling

Shaft couplings for direct drive equipment must be a radially, angularly, and longitudinally flexible couplings. The service factor for couplings must be greater than 1.5, based on maximum starting torque of the driver.

For drives 150kW and over, the couplings must be mounted to their respective shafts using 'locking assemblies'.

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

The pump and drive will be aligned so the coupling radial runout is < 0.2mm total indicator reading and an angular misalignment of < 0.2 degrees.

The coupling shall be dynamically balanced as an assembly in accordance with AS3709 to G6.3, or the same balance quality as the pump impellor if less than G6.3. The coupling components must be permanently marked to facilitate the as balanced component orientation when installed on the pump set.

Couplings shall be guarded in accordance with the Safety Guarding section of *M-SPE-STD-001* and include mesh panels for visual coupling inspection.

3.5.5. Base Plate

Where a base plate is included, the pump and motor shall be supplied with a common baseplate, fabricated from standard rolled steel sections and plate, which will be hot dipped galvanised according to AS 4680. The base plate will include four jacking screws per driver to facilitate driver alignment both laterally and longitudinally.

The common base plate should be located on concrete plinths and be held in place by hold down bolts and grouting in accordance with *M-SPE-STD-001*. Grouting influence must not factor into the design of the baseplate rigidity.

Four suitably rated lifting lugs must be provided on all baseplates, one at each corner. The lifting lugs must be of sufficient size to accept lifting hooks rated for the mass of the pump assembly or have a 40mm diameter centre hole minimum, whichever is greater. The dimensions of the base frame and position of the lifting lugs on the base frame must enable the pump assembly to be rigged and lifted in accordance with AS 3775 when fitted with a four-leg lifting chain with a 60 degree, minimum, included angle at the apex of the chains without the chains touching any part of the pump assembly.

The bottom of the baseplate must be in one plane to permit the use of a single level foundation.

The baseplate should have a raised lip and be either a drain-rim or drain-pan type, designed for complete drainage. The preferred method of drainage is a 25mm drain fitted in the raised lip at the pump.

Minimum two earthing lugs must be provided on all baseplates.

3.5.6. Pump Seals

Pumps seals shall be mechanical, mechanical cartridge or split case seals with the stuffing box specifically designed for the mechanical seal and not a retrofit gland seal design. The seal materials will be selected to give the maximum possible life for the given application.

Pumps, regardless of seal mechanism, should include provisions for leakage detection, either visual or instrumented.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	9 of 18

Mechanical seals must be a stationary pusher design with single or dual, bi-directional seals and hydraulically balanced when the sealing pressure exceeds 345 kPa. An air bleed/vent must be included on all vertical pumps and should be included on all pumps to ensure that there is no trapped air in the seal.

Seal chambers must be designed to restrict any solids contacting the seal faces and ensure that flushing liquid is directed to the seal faces with heat dissipation and liquid circulation maximised to effectively lubricate and cool the seals.

The seal flushing fluid can be service water, raw water, or a suitable commercially available closed flushing fluid system. Raw water must be pre-conditioned with a suitable strainer and/or cyclone to remove any solids that may be detrimental to the performance of the seal. The flushing fluid shall be supplied at a pressure 70 – 100 kPa above the seal chamber pressure and with the flow controlled to maintain the seal temperature at or below 80 °C. The seal manufacturer should be consulted for advice on the most appropriate seal flushing fluid pressure and flow for the application.

3.5.7. Bearings

The bearings will be designed in accordance with AS 2729 to accommodate maximum radial and axial loads under all operating conditions and a minimum L_{10} life of 60,000 hrs at the pump continuous operation duty point.

In general, for pump speeds less than 1800 RPM, bearings should be grease-lubricated, and oil lubricated for pump speeds greater than 1800 RPM. The bearing / pump manufacturers lubrication specification should be used to determine the type of lubrication included.

Where oil lubrication is included, the bearing housing must include a magnetic drain plug to minimise any metallic particles damaging the bearings and water in oil monitoring should be included with an alarm system to alert operation staff if water in the oil is detected.

All bearing housings must be sealed to prevent dust and water ingress into the bearing housing. Suitable labyrinth type, positive static seals, or lip seals with shaft wear sleeves must be fitted. LabTecta or MagTecta or alternate IP68 non-contact seals can be an option for all pumps but should be installed for damp or dusty environment applications, or installations prone to inundation such as pump wells and intake towers.

3.5.8. Impellor

Centrifugal pumps shall utilise hydraulically balanced impellers and include means of balancing axial thrust by providing balance holes, back vanes or such on the impeller or balancing drums.

Impellers for pumps less than 50kW, except for single stage submersible pumps, shall be totally enclosed, and for pumps 50kW and greater shall be totally enclosed or semi-open.

Impellers must be securely locked to the pump shaft with suitable means of adjusting the impeller clearance for pumps > 50 kW.

3.5.9. Shaft

The pump shaft sleeve run out, as measured by a dial indicator immediately above the mechanical seal, shall be 0.05 mm total indicator reading (peak to peak) when turned by hand through 360°.

The first lateral critical shaft speed, when coupled to the driver, shall be a minimum of 120% of maximum operating speed.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	10 of 18

3.5.10. Submersible Pumps

All submersible pumps must be fitted with a lifting connection point. When installed in a pump well, they should be installed on a stool with a permanently connected lifting chain so the pump can be removed at ground level without the need to enter the pit.

Submersible dry mount pumps or installations where the submersible pump is only semi submerged for extended periods, must be supplied with a cooling system, including cooling jackets, with sufficient capacity to prevent any overheating during continuous duty operation.

Submersible pumps will be fitted with a minimum IP68 motor and include thermistor protection as a minimum thermal overload protection.

Submersible pumps shall incorporate a double mechanical seal arrangement with an oil filled central chamber. The seal on the volute side is to be supplied with hard faces, such as silicon carbide or tungsten carbide. The chamber must include instrumentation capable of sensing infiltration of water.

3.5.11. Pumps on Seqwater Network Pump Stations

Pumps on the Seqwater water grid shall be standard split case centrifugal pumps with a separate drive motor, housed above ground in a suitable pump station building. There shall be a minimum of one standby pump, equal to largest installed duty pump, with automatic changeover in the case of a failure.

3.6. Electrical and Control

Electrical and control works shall comply with the following Seqwater Standard Specifications:

- E-SPE-STD-001 Electrical Design and Construction
- I-SPE-STD-015 Instrumentation
- I-SPE-STD-013 Control System Design and Construction
- B-SPE-STD-003 Commissioning Requirements

Where a requirement under this Standard Specification conflicts with a requirement from a specification in the above list, the requirement within this Standard Specification shall apply.

The pump and its associated components must be grounded, as specified in *E-SPE-STD-001* and in accordance with regulations to protect personnel against electric shocks.

3.7. VSD Operation

The maximum and minimum specified pump duty points may be achieved by the inclusion of a variable speed controller as per *E-SPE-STD-010*, where applicable, but the pump must be designed and rated for continuous operation for the minimum and maximum proposed drive speeds.

If a VSD is used to achieve the specified pump duty points, then the requirements of 3.5.2 still apply.

When retrofitting a VSD to an existing pump system, a system analysis must be undertaken to determine the pumps safe operation region and apply control limits to ensure operation outside this region is not possible.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	11 of 18

3.8. Protective Coatings

All protective coatings shall comply with the requirements of *WSA 201, Selection and Application of Protective Coatings* and *M-SPE-STD-004 Protective Coatings*. Equipment shall generally be coated and tested to the appropriate original equipment manufacturers (OEM) high performance paint specification. The OEM paint specification is to be assessed for suitability for the specific application.

The specific product and application method shall be such that the coating will be suitable to achieve the design life without the need for re application. Refer to Section 3.3 for the expected operating environment, including minimum corrosivity category.

3.9. Markings

The pump shall be clearly and indelibly marked with the equipment serial number and all other standard information specified by the manufacturer. Where optional impellor sizes are offered, the name plate shall also include the impellor size.

Further Seqwater identification shall be attached meeting the requirements of both *X-PRO-STD-006, Equipment Numbering Convention* and *M-SPE-STD-001, General Mechanical*.

3.10. Existing Infrastructure

For new pumps installed and/or replaced within existing infrastructure, the requirements under this Standard Specification must be adhered to as far as practicable. It is important to note that modifying existing infrastructure to meet all requirements within this document may not be practicable. As such, the appropriateness of any deviation based on existing constraints must be submitted to Seqwater for approval for any departures from this Standard Specification.

3.11. Installation

The designer shall consider all relevant operating, safety and environmental conditions/requirements when specifying the pump and its installation.

The pump installation shall include a means of lifting and removal as well as all necessary infrastructure to facilitate pump isolation, drain down, and re-charge of the pipeline for future maintenance or replacement. Existing network infrastructure such as existing isolation valves, air valves, and scour valves may be utilised for this function, subject to acceptance by Seqwater. An inline dismantling joint, or other suitable means of dismantling, must be included in the installation to allow easy removal for maintenance.

If above or below ground access is required for operation and maintenance purposes, the installation must include permanent working platforms and access structures conforming to Seqwater Standard Specification *M-SPE-STD-002, Platforms, Walkways, Stairways and Ladders*, as well as relevant Seqwater standard drawings.

The pump installation shall be designed to withstand all potential stresses on the pump as a result of pipeline loads, including thrust and thermal expansion.

Flange connections must comply with *M-SPE-STD-001*. Industry standard flange sizing is preferred. DN225 piping shall not be used for new or replacement installations.

Flange gaskets must comply with *WSA 109*.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	12 of 18

The location of the installed pump must be safely and ergonomically accessible for maintenance without the need for any temporary access. Minimum clearance, in accordance with *M-SPE-STD-001*, must be maintained around the entire installation.

Where the pump is installed on a pipeline with cathodic protection, the pump installation must not adversely affect the effectiveness of the cathodic protection of the pipeline.

The installation design shall consider the manufacturer, supplier and Seqwater requirements with all aspects of the requirements met or exceeded. Items to consider, in addition to the above, include, but are not limited to, location of nearest pipe supports, pump orientation, allowable vibrations, vacuum avoidance, normally full pipes etc. Any conflict or deviation from these requirements will be identified and managed following consultation and approval from Seqwater Engineering Standards and Assurance.

3.12. Maintenance

Preventative maintenance activities will often be based on a calendar basis; however, it is acceptable for the manufacturer to supply a 'run hours' preventative maintenance schedule that could be adapted into calendar basis, if required, by the supplier and provided to Seqwater.

The pump must be designed for periodic refurbishment with all wear points and components readily replaceable. To aid disassembly, jack screws shall be provided at the parting face of the pump facing.

An operation and maintenance manual shall be supplied for all equipment.

All components and ancillary equipment shall be designed to withstand hot and humid conditions. These components should be suitable for wash down with hand-held pressurised hoses. If this is not the case, suitable measures shall be taken to identify and prevent incidental damage of equipment.

Equipment must be maintainable using standard tools. If special tools are required, they must be included with the supply of the pump and provided to Seqwater at commissioning.

Periodic monitoring of vibration levels within the equipment should be conducted every 6 months as outlined in the pumps asset class plan, with the vibration levels recorded in the maintenance records at each point with trend analysis conducted to monitor bearing condition and schedule replacement when required.

3.13. Commissioning

Operational tests, including hydrostatic test, pump efficiency, coupling alignment, bearing temperature, noise and vibration levels are mandatory for all pumps.

Hydrostatic testing of the system shall be conducted during commissioning, at a pressure not less than 1.5 times the maximum design pressure of the system and held for than 15 minutes without pressure loss.

Commissioning performance tests shall be conducted to *ISO 9906* Grade 2B minimum and pumps greater than 100 kW will be tested to Grade 1B with a minimum of 5 test points, including, zero flow, minimum flow, operating flow, maximum BEP flow at both minimum and maximum design head.

The pump and drive motor alignment must be confirmed prior to commissioning running of the pump.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	13 of 18

3.14. Documentation

All pumps must be supplied with the following as documentation:

- Datasheet showing all relevant parameters for the pump in question.
- Pump curves including Head vs Flow from shutoff head to highest flow, NPSHR, efficiency and absorbed power. If there are multiple impellor sizes available for the pump, curves for all impellor sizes must be supplied with the curve for the installed impellor highlighted and labelled with the actual impellor size.
- For VSD controlled pumps, pump curves must be superimposed for minimum speed, maximum speed and each 10 Hz increment between, including efficiency and power for each speed increment.
- Installation operation & maintenance manual.
- All test records associated with required testing.
- Any other appropriate data or test records specified in the scope of supply.

Asset details shall be submitted in accordance with *X-PRO-STD-010 Asset Information Requirements*.

All approvals, supply, assembly, testing, submission, installation, and commissioning requirements shall be as *M-SPE-STD-001, General Mechanical* and *B-SPE-STD-003, Commissioning Requirements*.

4. Definitions & Abbreviations

Table 2 Definitions and Abbreviations

Term	Definitions
ADWG	Australian Drinking Water Guidelines
AS	Australian Standard and New Zealand Standard (AS/NZS)
Contractor	An entity engaged by Seqwater to undertake work in accordance with an agreed contract and defined scope of work.
DN	Nominal diameter
Employees	Means persons employed directly by Seqwater in a permanent, temporary, or casual capacity.
ESA	Engineering Standards and Assurance
ISO Pump	End suction centrifugal pumps that incorporate suction and discharge flanges up to and including DN200 and DN150 respectively, and conform the designation, nominal duty points and dimensions of ISO 2858.
Leader	Means any Level 1, 2, 3 and 4 Leader with responsibility for managing a functional area of the business, including people management responsibilities within their functional area.
Manufacturer / Supplier / Vendor / Original Equipment Manufacturer (OEM)	The entity that manufacturers or supplies equipment to meet the specifications of the Contractor.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	14 of 18

Term	Definitions
Owner / Principal / Seqwater	The entity that engages the Contractor to undertake the work and takes custody of the outcome. The Owner may delegate responsibilities to other entities to act on its behalf (e.g. a consultant).
PN	Nominal pressure
REX	Seqwater Electronic Document and Records Management System.
RPM	Revolutions Per Minute
RTD	Resistance Temperature Detector
SCADA	Supervisory control and data acquisition
Seqwater Approval / Acceptance	Written sign-off gained via the deviation process, as detailed in X-PRO-STD-008 Asset Standards Management and Application.
Shall / must	Indicates a mandatory requirement
Should	Indicates a recommendation
Standard Specification	Standard Specification M-SPE-STD-014, Centrifugal Water Pumps
VSD	Variable Speed Drive
Worker(s)	Includes all permanent, temporary, and casual employees of Seqwater, and: • vocational and work experience placements • volunteers • contractors and consultants employed by another entity but temporarily assigned to do work for or on behalf of Seqwater.
WSAA	Water Services Association of Australia

5. Roles and Responsibilities

Table 3 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.

6. Reference and Related Materials

The documents listed in Table 4 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.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	15 of 18

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.

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 4– References and Related Materials

Description	Location
AS ISO/ASME 14414 Pump system energy efficiency	Intertek Inform / Waternet
AS1110 ISO metric hexagon bolts and screws	Intertek Inform / Waternet
AS1112 ISO metric hexagon nuts	Intertek Inform / Waternet
AS1217 Acoustics- Determination of sound power levels of noise sources survey method	Intertek Inform / Waternet
AS1237 Plain washers for metric bolts, screws and nuts for general purposes	Intertek Inform / Waternet
AS1318 Industrial safety colour code	Intertek Inform / Waternet
AS1319 Safety signs for the occupational environment	Intertek Inform / Waternet
AS1345 Identification of contents of piping, conduits, and ducts	Intertek Inform / Waternet
AS1359.107 Rotating electrical machines - Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM Code)	Intertek Inform / Waternet
AS2129 Flanges for pipes, valves, and fittings	Intertek Inform / Waternet
AS3000 Electrical Installations. (Wiring Rules)	Intertek Inform / Waternet
AS3775 Chain slings for lifting purposes	Intertek Inform / Waternet
AS4020 Testing of products for use in contact with drinking water	Intertek Inform / Waternet
AS4024 Safety of Machinery (series)	Intertek Inform / Waternet
AS4087 Metallic flanges for waterworks purposes	Intertek Inform / Waternet
AS4312 Atmospheric Corrosivity Zones in Australia	Intertek Inform / Waternet
AS4680 Hot dip galvanised (zinc) coatings on fabricated ferrous articles	Intertek Inform / Waternet
AS60529 Degrees of protection provided by enclosures (IP Code)	Intertek Inform / Waternet
ASME B73 Specification for Centrifugal Pumps for Chemical Process	Intertek Inform / Waternet
<i>Environmental Protection Act 1994 (QLD)</i>	Queensland Legislation
ISO10816-7 Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts – Rotodynamic Pumps	Intertek Inform / Waternet
ISO21940-11 Mechanical Vibration – Rotor Balancing-Procedures and tolerances for rotors with rigid behaviour	Intertek Inform / Waternet
ISO2858 End Suction – Centrifugal Pumps	Intertek Inform / Waternet
ISO5198 Centrifugal, mixed flow and axial pumps code for hydraulic performance tests precision grade	Intertek Inform / Waternet

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	16 of 18

Description	Location
ISO9906 Rotodynamic Pumps – Hydraulic Acceptance Performance Tests - Grades 1, 2 and 3	Intertek Inform / Waternet
PLN-00432 Asset Lifecycle Planning - Pumps Asset Class Plan	REX
PRO-01617 X-PRO-STD-009 Engineering Design, Construction, Operation and Maintenance Procedure	REX & Waternet
PRO-01872 X-PRO-STD-002 Engineering Drawing Number	REX & Waternet
PRO-01874 X-PRO-STD-004 Development and Review of Asset Standards	REX & Waternet
PRO-02187 X-PRO-STD-007 Drawing & Spatial Data Standards	REX & Waternet
PRO-02190 X-PRO-STD-006 Equipment Numbering and Naming Convention	REX & Waternet
PRO-02205 X-PRO-STD-008 Asset Standards Management and Application	REX & Waternet
SPE-00346 B-SPE-STD-003 Commissioning Requirements	REX & Waternet
SPE-00348 M-SPE-STD-004 Protective Coatings	REX & Waternet
SPE-00352 E-SPE-STD-001 Electrical Design and Construction	REX & Waternet
SPE-00353 I-SPE-STD-015 Instrumentation	REX & Waternet
SPE-00361 I-SPE-STD-013 Control Systems Design and Construction	REX & Waternet
SPE-00366 M-SPE-STD-002 Fixed Platforms, Walkways, Stairways and Ladders	REX & Waternet
SPE-00367 M-SPE-STD-001 General Mechanical	REX & Waternet
SPE-00395 D-SPE-STD-001 Water Supply Network Planning, Design and Construction	REX & Waternet
SPE-00437 E-SPE-STD-010 Low Voltage Variable Speed Drives and Soft Starters	REX & Waternet
TEM-00220 M-TMP-STD-002 Pump & Motor Datasheet Template	REX & Waternet
TEM-00224 X-TMP-STD-022 Asset Standards Deviation Request Template	REX & Waternet
WHS Act Work Health and Safety Act	Queensland Legislation
WSA03-2011 Water Supply Code of Australia v3.2 January 2022 - Seqwater Copy - for Internal Use Only	REX & Waternet
WSA109 Industry standard for flanged gaskets and O-rings	Water Services Association of Australia
WSA130 ISO End Suction Centrifugal Pumps	Water Services Association of Australia
WSA131 ISO End Suction Centrifugal Motor Pumps	Water Services Association of Australia

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	17 of 18

Description	Location
WSA201 Selection and Application of Protective Coatings	Water Services Association of Australia

7. Changes from Previous Version

This *Standard Specification* will be regularly reviewed and updated, including the consideration of requested alterations, 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 5 below.

Table 5 Changes from Previous Revision

Section Number	Change
N/A	(New Standard)

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
1	SPE-00505	Principal Engineering Standards and Assurance	03/04/2024	General Manager - Engineering Standards & Assurance	18 of 18