

Engineering Standard

M-SPE-STD-016

Progressive Cavity Pumps

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Contents

1	Purpose	4
2	Application of Engineering Standard	4
3	Definitions	5
4	Abbreviations	6
5	Reference Documents	7
6	Technical Requirements	8
6.1	General	8
6.2	Design Life	9
6.3	Design Reliability Target	9
6.4	Operating Conditions	9
6.5	Safety in Design	9
6.6	Drinking Water Compatibility	9
6.7	Physical and Operating Requirements	9
6.7.1	Mechanical Requirements	10
6.7.2	Electrical Requirements	10
6.8	Protective Coatings	11
6.9	Markings	11
7	Execution	11
8	Changes from Previous Version	11
9	Verification	11
10	Further Information	11

Table of Tables

Table 3-1 – Definitions	5
Table 4-1 – Abbreviations	6
Table 5-1 – Reference Seqwater Documentation	7
Table 5-2 – Reference External Standards, Specifications and Codes	7
Table 8-1 – Changes from previous Versions	11

Ver. no.	Doc No.	Doc Owner	Version Date	Doc Approver	
1	SPE-00506	Leah McInerney	24/06/2022	Manager Technical Support & Improvement	Page 3 of 12

1 Purpose

Seqwater Engineering Standards 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.

This Engineering Standard provides the minimum requirements and recommendations the supply of new, replacement or upgraded progressive cavity pumps. This document must be used in conjunction with the documents it references to assist in ensuring a fit for purpose asset.

This Engineering Standard is not intended to be relied upon solely for design, supply and installation works; advice from specialist engineers and/or Manufacturers may be required on a case-by-case basis.

This Engineering Standard is applicable to all progressive cavity pump applications within Seqwater. Progressive cavity pumps are typically used for the transfer and dosing of powder chemical solutions and sludges, particularly the transfer and dosing of shear sensitive fluids.

Progressive Cavity pumps can also be referred to as Helical Rotor, Progressing Cavity and Eccentric Screw pumps for which this Engineering Standard applies.

This Engineering Standard is not intended to cover:

- Rotary Lobe Pumps
- Bore Pumps
- Dosing Skids
- Supply and discharge tanks, pipes, valves, and nozzles.
- Bunding
- Electronic Control system/s
- Gauges, displays or instrumentation that is not specifically detailed within.
- Dosing system specific ancillary equipment that is not specifically detailed within.

Refer to the applicable standard, reference, or P&ID documents for these details.

This Engineering Standard forms the minimum requirements for the selection of preferred equipment for progressive cavity pumps for use within Seqwater infrastructure. The preferred equipment will be developed through one or more open market procurement processes with the resultant selection listed in *X-LST-STD-001 Seqwater Preferred Equipment List*.

Seqwater's Manager Commercial Services will approve the recommended preferred equipment that results from the open market procurement process.

2 Application of Engineering Standard

This Engineering Standard applies to all Seqwater employees, 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 Asset 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, at all times the designer remains responsible for ensuring infrastructure designed is fit for purpose and safe to construct, operate, maintain, and demolish. In doing so 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 WSA). Where no Australian Standard exists for a particular application, work must conform to the most current version of an industry accepted international standard.

Ver. no.	Doc No.	Doc Owner	Version Date	Doc Approver	
1	SPE-00506	Leah McInerney	24/06/2022	Manager Technical Support & Improvement	Page 4 of 12

Deviation from the 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*. This process includes completion of an Asset Standards Deviation Request Form and submission via the Seqwater Project Representative (for external parties) or via Seqwater's Engineering Mailbox (engineering@seqwater.com.au) (for internal parties).

Where noted in this Engineering Standard that Seqwater approval or acceptance shall/must be sought, approval or acceptance must be gained through the Seqwater Asset Standard Deviation process, as identified 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, another Seqwater Asset Standard 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 Seqwater to clarify any ambiguities regarding this Engineering Standard.

Seqwater undertakes regular updates of Asset Standards. Before utilising this Engineering Standard, the complete list of Seqwater Asset Standards should be reviewed, to ensure currency and applicability of standards applied to the works.

3 Definitions

The following definitions (**Error! Not a valid bookmark self-reference.**) apply to this Engineering Standard

Table 3-1 – Definitions

Term	Definitions
Seqwater Approval / Acceptance	Written sign-off gained via the deviation process, as detailed in <i>X-PRO-STD-008 Asset Standards Management and Application</i> .
Contractor	An entity engaged by Seqwater to undertake work in accordance with an agreed contract and defined scope of work.
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).
Engineering Mailbox	Share Outlook Mailbox for correspondence with the Engineering teams within Seqwater (engineering@seqwater.com.au)

Term	Definitions
REX	Seqwater Electronic Document and Records Management System.
Shall / must	Indicates a mandatory requirement
Should	Indicates a recommendation
Pump, Pump's or Pumps	Refers to the singular and plural form of Progressive Cavity Pumps
Scope of Works	The scope of works document forms part of a project contract including supporting design documentation

4 Abbreviations

The following abbreviations apply to this Engineering Standard.

Table 4-1 – Abbreviations

Abbreviation	Description
AS	Australian Standard (published by Standards Australia)
DN	Nominal diameter
ESA	Engineering Standards and Assurance
MTBF	Mean Time Between Failure
PN	Nominal pressure
TSI	Technical Support and Improvement
WSAA	Water Services Association of Australia

5 Reference Documents

The documents listed in Table 5-1 and

Table 5-2, and the requirements therein, are relevant to this Engineering Standard. In their latest editions, these documents form a part of this Engineering Standard. Note that this is not an exhaustive list of documents relevant to the works.

Table 5-1 – Reference Seqwater Documentation

Asset Standard Document Number	Document Title	Waternet Reference
B-SPE-STD-003	Commissioning Requirements	SPE-00346
D-SPE-STD-001	Water Supply Network Planning Design and Construction (Seqwater Supplementary Manual to WSA Water Supply Code of Australia WSA 03:2011)	SPE-00395
E-SPE-STD-001	Electrical Design and Construction	SPE-00352
I-SPE-STD-015	Instrumentation	SPE-00353
E-SPE-STD-010	Low Voltage Variable Speed Drives and Soft Starters	SPE-00437
I-SPE-STD-013	Control System Design and Construction	SPE-00361
M-SPE-STD-001	General Mechanical	SPE-00367
M-SPE-STD-004	Protective Coatings	SPE-00348
M-SPE-STD-010	Liquid Chemical Dosing Skids	SPE-00435
M-SPE-STD-012	Liquid Chemical Dosing Pumps	SPE-00430
X-PRO-STD-001	Asset Standards Document Classification and Naming Structure	PRO-01873
X-PRO-STD-002	Engineering Drawing Numbers Procedure	PRO-01872
X-PRO-STD-004	Development and Review of Asset Standards	PRO-01874
X-PRO-STD-006	Equipment Numbering and Naming Convention	PRO-02190
X-PRO-STD-007	Drawing & Spatial Data Standards	PRO-02187
X-PRO-STD-008	Asset Standards Management & Application	PRO-02205
X-PRO-STD-009	Engineering Design, Construction, Operation and Maintenance	PRO-01617
X-TMP-STD-022	Asset Standards Deviation Request	TEM-00224

Table 5-2 – Reference External Standards, Specifications and Codes

Standard/Specification	Document Title
AS 1110	ISO metric hexagon bolts and screws
AS 1112	ISO metric hexagon nuts
AS 1237	Plain washers for metric bolts, screws and nuts for general purposes
AS 1318	Industrial safety colour code
AS 1319	Safety signs for the occupational environment
AS 1359.107	Rotating electrical machines - Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM Code)
AS 3000	Electrical Installations. (Wiring Rules)

Ver. no.	Doc No.	Doc Owner	Version Date	Doc Approver	
1	SPE-00506	Leah McInerney	24/06/2022	Manager Technical Support & Improvement	Page 7 of 12

Standard/Specification	Document Title
AS 4087	Metallic flanges for waterworks purposes
AS 4312	Atmospheric Corrosivity Zones in Australia
AS 60529	Degrees of protection provided by enclosures (IP Code)
E.P Act	Environment Protection Act (QLD)
WHS Act	Work Health and Safety Act
WSA 03	Water Supply Code of Australia
WSA 109	Industry standard for flanged gaskets and O-rings

6 Technical Requirements

6.1 General

Refer to *M-SPE-STD-001* for general requirements related to mechanical assets, *M-SPE-STD-010* and *M-SPE-STD-012* for specific dosing skid and dosing pump requirements.

The requirements of *WSA 03, Water Supply Code of Australia* and *D-SPE-STD-001 Seqwater Supplementary Manual to WSA 03: 2011* shall be applied where applicable.

This Engineering Standard provides guidance on standard operating and physical requirements of progressive cavity pumps, and their constituent components. The progressive cavity pump shall be suitable for the intended application and have a proven record of reliable operation in that application. The specific application details include, but are not necessarily limited to, operational and maintenance requirements, operating environment, chemical and water quality.

In the case that it is identified that a specific requirement within this Engineering Standard would lead to installation of an unsuitable system for the application, an alternative shall be specified and a submission made to the Principal Engineering Standards and Assurance, or their delegate, via the Engineering Mailbox for consideration of a deviation approval.

The pump design shall be robust and practicable, having regard to all constraints. It shall be designed for a high degree of mechanical reliability, minimal maintenance, no leakage or spillage, and minimal containment release during servicing. External surfaces of the pump will be designed such that there are no external pockets that may facilitate moisture ponding.

The pumps shall be made from components commonly used for the application. Spare parts shall be readily available in Australia for those that may reasonably require replacement. Lead time for the delivery of spare parts to a nominated Seqwater site will be a maximum of three working days after receipt of order.

Unless otherwise specified in the project statement of works, transfer pumps will be fixed speed and sized according to meet the project requirements whereas dosing pumps will be variable speed pumps controlled via a variable speed drive conforming to *E-SPE-STD-010*. Where a variable speed drive (VSD) is included, the drive motor must be VSD compatible and equipped with a suitable auxiliary cooling fan with controller, and thermal protection.

Where the pump weight is greater than 20kg, permanent lifting attachments shall be included, and for pumps less than 20kg, lifting attachments should be included, in accordance with the *Provisions for Handling Plant* section of *M-SPE-STD-001*.

All components and ancillary equipment shall be designed to withstand washdown with a handheld, mains pressure water hose.

Ver. no.	Doc No.	Doc Owner	Version Date	Doc Approver	
1	SPE-00506	Leah McInerney	24/06/2022	Manager Technical Support & Improvement	Page 8 of 12

6.2 Design Life

The minimum design life of progressive cavity pumps shall be 10 years unless otherwise specified and approved by Seqwater Engineering Standards and Assurance. It is understood that the stator and rotor may require replacement to achieve the specified asset life, but all other components should only require the manufacturers specified preventative maintenance.

6.3 Design Reliability Target

Each pump should achieve a reliability and maintainability MTBF of 8750 hours resulting in an availability of 99.9% as a minimum. Care should be taken to include sufficient redundancy to avoid single points of failure for the system. There should be no hidden failures, especially for redundant elements in the design.

6.4 Operating Conditions

All components must be suitable for the design, minimum and maximum flow, pressure, temperature, duty cycle and other operating conditions. They must have long term compatibility and suitability with the specific pumped chemical specified in the project scope of works. All wetted parts shall be designed using corrosion and wear resistant materials suitable for the specific pumped chemical specified.

The pumps must be suitable for the ambient operating environment, including exposure to any potential liquid, powder, or gaseous chemical. At a minimum, all components must be capable of operating within an open roofed environment (no walls) with ambient operating temperatures of -5 to 50°C, relative humidity of 10 to 100% and a fluid temperature of 5 – 40 °C.

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 may be assigned on a case by case basis dependant on the installation location of the equipment. Refer to *M-SPE-STD-004* for individual plant assigned corrosivity categories.

The pump shall be capable of operating continuously at full continuous rated duty, 24 hours per day, 7 days a week under the defined operating conditions.

6.5 Safety in Design

Seqwater's expectations relating to safety in design are outlined in the Safety in Design section of *X-PRO-STD-009*.

All equipment must be designed to perform its intended duty safely and without being attended. Wherever practicable, identified health, safety and environmental risks, over the entire life cycle of the equipment, shall be fully mitigated ("designed out") during the design phase.

If it is an identified credible risk for a specific site, design considerations for the pump must include adequate controls for leak detection and prevention.

Where pumps are being installed in a Classified Hazardous area, the pump must comply with the requirements of the Hazardous Area Application section of *E-SPE-STD-001*, and the Hazard Management section of *M-SPE-STD-001*.

6.6 Drinking Water Compatibility

Progressive Cavity pumps must conform to the Potable Water Compatibility section of *M-SPE-STD-001*.

Ver. no.	Doc No.	Doc Owner	Version Date	Doc Approver	
1	SPE-00506	Leah McInerney	24/06/2022	Manager Technical Support & Improvement	Page 9 of 12

6.7 Physical and Operating Requirements

6.7.1 Mechanical Requirements

All progressive cavity pumps will have a fully sealed drive train to prevent any lubricating fluid entering the pump chamber and possible contamination of potable water. A single, flushed, mechanical seal (minimum) with the sealing materials specified to give the specified design life in the specified operating conditions is required.

The pump should be designed for ease of maintenance such that all moving components, pins, stator and rotor can be maintained in situ without the need to dismount the pump or disconnect adjoining pipe work.

The pump(s) must be supplied with fittings on the suction and discharge sides to enable connection with the applicable application's pipe work. The fittings must be suitable for the design, maximum flow, pressure, temperature, and other duty conditions. They must have long term compatibility and suitability with the specific pumped chemical specified in the project specific scope of works.

Flanges must be in accordance to AS 4087 and shall be full faced with suitable 316 Stainless Steel backing plates where required. Suitable gaskets, compliant with WSA 109, shall be supplied and used on all flange joints.

The pump(s) shall be installed with flooded suction supply. The pump's installed Net Positive Suction Head Required (NPSHR) shall be a minimum of one metre less than the Net Positive Suction Head Available (NPSHA).

Each pump will include a system to protect the pump in case of dry running or stator over-heating. In the event of dry running or over-heating, the system will shut the pump down and send an alarm to the operator via the sites control system.

Each pump must be capable of being flushed free of all chemical residue using only clean water (where appropriate) circulating through the pump. Flushing must be completed without the need to remove or dismantle any part of the pump or installed components.

The driving motor shall have sufficient power to drive the pump under all operating conditions and speeds, including starting under full load and after an extended stationary period. Drive components shall not fail under a stalled motor condition.

Progressive Cavity pumps, by design, are constant flow rate pumps, drive motor speed dependant and, due to this, flow control/restriction devices on the pump pressure side must not be fitted. The fitting of a flow control/restrictor will only increase the system pressure, to a possible system failure, and not modify the flow rate. For this reason, all pump installations must include a suitable, adjustable Pressure Relief Valve installed in the pressure side pipe work prior to any valves, offtakes, or other ancillary equipment. Pressure sustaining valves may be fitted after the relief valve if required for the application.

For dosing applications, the pump must be capable of achieving the project specific scope's dosing requirement with a maximum flow rate at least 10% greater than specified maximum flow and a dosing accuracy and repeatability of +/- 1.5% maximum over a 10:1 turndown range.

As a design guide to reduce pump maintenance, the pump should be sized to give a maximum fluid velocity within the pump of 2 m/sec and 6 Bar maximum pressure per pump stage.

6.7.2 Electrical Requirements

The equipment must comply with the requirements of AS 3000 and operate on a 230 V, single phase, or 400 V, 3 phase power supply. All electrical requirements must comply with the requirements of *E-SPE-STD-001 Electrical Design and Construction* and *I-SPE-STD-013 Control Systems Design and Construction*.

Ver. no.	Doc No.	Doc Owner	Version Date	Doc Approver	
1	SPE-00506	Leah McInerney	24/06/2022	Manager Technical Support & Improvement	Page 10 of 12

6.8 Protective Coatings

The protective coating shall comply with the requirements of *M-SPE-STD-004 Protective Coatings* and be suitable to achieve the design life (refer Section 0), without the need for re application. Refer to Section 6.4 for the expected operating environment, including minimum corrosivity category.

6.9 Markings

In addition to the manufacturers name plate, labelling in accordance with the Labelling and Nameplates section of *M-SPE-STD-001 General Mechanical Specification*, and *X-PRO-STD-006 Equipment Numbering and Naming Convention* shall be added by the contractor when the pump is installed.

7 Execution

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

8 Changes from Previous Version

This Engineering Standard 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 of this standard are summarised in Table 8-1 below.

Table 8-1 – Changes from previous Versions

Section Number	Change

9 Verification

Compliance with this document may be verified by internal audit.

10 Further Information

For further information please contact the owner of this document.

Ver. no.	Doc No.	Doc Owner	Version Date	Doc Approver	Page 11 of 12
1	SPE-00506	Leah McInerney	24/06/2022	Manager Technical Support & Improvement	

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