Specification

Engineering Standard M-SPE-STD-013 Chemical Dosing Piping

Document number: SPE-00355

Ver No.	Description	Document Owner		Document Approver		
		Position	Approval	Position	Approval	Approval Date
4	Amended	Principal Engineering Standards and Assurance	Refer to supporting Info in Rex	General Manager Engineering	Refer to supporting Info in Rex	16/06/2026
This Engineering Standard was endorsed by RPEQs on behalf of Seqwater.						

Version History

Rev	Date	Description	Author	SME	Owner	Approver
4	16/06/2026	Amended Version				
3	27/07/2023	Amended Version				
2	10/03/2020	Amended Version				
1	12/12/2018	Original Version				

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

Contents

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 works relating to the supply of new, upgrade or replacement of pipe work for chemical dosing processes.

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

This Standard Specification is applicable to all pipe work used for the expressed purpose of transferring and processing of chemical solutions between chemical delivery point, bulk chemical storage tank and to the point of dosing. Chemical dosing piping applications include, but are not limited to, Seqwater owned and/or leased treatment plants for water, trunk water main network, sewerage, or environmental release and all assets contained within Seqwater dosing facilities for potable, recycled and irrigation water where chemical dosing is utilised.

This Standard Specification applies to, but is not limited to the following chemicals:

- Aluminium Chlorohydrate (AHC)
- Aluminium Sulphate (Alum)
- Aqueous Ammonia
- Ammonium Sulfate (Liquid)
- Ascorbic Acid
- Calcium Hydroxide (Lime)
- Ferric Chloride
- Hydrochloric Acid
- Ozone
- Polyacrylamide
- PolyDADMAC
- Potassium Permanganate (Pot Perm)
- Powder Activated Carbon (PAC)
- Sodium Carbonate
- Sodium Fluoride
- Sodium Fluorosilicate
- Sodium Hydroxide (Caustic)
- Sodium Hypochlorite (Hypo)
- Sulphuric Acid

Where a chemical, not referenced in this specification, is used within a dosing application, the requirements of this Engineering Standard shall apply as far as practicable.

Suitable materials for Chlorine Gas are not included in the material tables due to its highly hazardous nature requiring very specific material selection requirements. Refer to Section 3.7 for further details for Chlorine Gas applications.

This Engineering Standard is not intended to cover pipe work for:

- bulk water
- raw water
- partially treated process water
- other pipe work not used for chemical dosing

Refer to the applicable standards, references, or P&ID documents for details.

2. Scope

This Standard Specification applies to all Seqwater workers, suppliers, contractors and consultants working for or on behalf of Seqwater unless otherwise stated. It applies to all new and 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, 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 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, 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. Technical Requirements

3.1. General

All piping will conform to the requirements of Engineering Standard M-SPE-STD-001- General Mechanical for general requirements related to mechanical assets.

All pressure piping shall be designed in accordance with AS 4041 - Pressure Piping, AS 1477 - PVC Pipes and Fittings for Pressure Applications, AS 2566 - Buried Flexible Pipelines, and AS 4130 - Polyethylene Pipes for Pressure Applications, with appropriate pressure ratings and suitable materials selected for the local conditions and fluids.

For additional requirements related to pipeline design and construction refer to WSA-01- Polyethylene Pipeline Code and WSA-03 - Water Supply Code of Australia where applicable.

All piping shall be fitted with a minimum number of joints that is practicable with suitable joints fitted in appropriate locations to aid dismantling the pipe work for replacement or maintenance. Attention to this requirement should be given to items such as valves, flow meters and pumps.

Pipe material must be selected to be fully compatible with the application to eliminate or reduce pipe degradation due to chemical contact or environmental exposure. Material selection shall include consideration of temperature and phase changes of the chemical in situ to the extent of the design basis of the installation. This may include but is not limited to temperature change due to heat of reaction, chemical freezing due to chemical phase change with ambient temperatures and / or off-gassing due to chemical reaction.

The need to use protective measures should be avoided, however where required to mitigate degradation from Sun/UV exposure, suitable protective measures shall be applied as per Section 3.9 of this specification.

Piping carrying any hazardous substances shall have the number of joints, flanges, fittings, and other potential leak points minimised, particularly for areas that are not able to be easily inspected or where pipes run above other equipment or personnel. Where joints and fittings are unavoidable, adequate room/enclosure ventilation (for gasses and vapours) and/or drip trays with suitable drainage (for liquids) shall be provided. Ventilation can be provided either by full area ventilation or locally (around joints) using extraction hoods. Refer to PRO-00008 – Hazardous Chemicals Procedure for a list of hazardous substances used at Seqwater for their use and classification.

All commonly used pipe, valves, fittings, gaskets and/or associated repair kits must be readily available in Queensland. Lead time for the delivery of replacement pipe to a nominated Seqwater site will be a maximum of three working days after receipt of order.

Specific Australian Standard requirements that cannot be reasonably met due to constraints associated with existing installations must be brought to the attention of the Seqwater Principal Engineer, Engineering Standards and Assurance (or their delegate) for written approval via a Deviation. Seqwater will require justification and assessment of risks associated with the Deviation.

External pockets or features on the associated pipe work or associated assets that facilitate moisture ponding must be eliminated.

3.2. Safety in Design

Seqwater's expectations relating to safety in design are outlined in Engineering Standard X-PRO-STD-009 – Engineering Design, Construction, Operation and Maintenance.

Where pipe work is being installed in a hazardous area, the pipe work must comply with the requirements of Engineering Standard M-SPE-STD-001 – General Mechanical, Section 6.2 Hazard Management, and PRO-00008 - Hazardous Chemicals Procedure.

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

The design process for specifying process pipe materials must include a chemical compatibility check to ensure that the specified material will have suitable long-term performance for the actual operating conditions, this will include thermostatically controlled heat tracing of pipes where the chemical has a high freezing point.

If identified as a credible risk for a specific site, design considerations for pipe work must include adequate controls for over pressurisation, leak detection and leak prevention. For key risks associated with chemical dosing, refer to documents Engineering Standards B-SPE-STD-009 – Liquid Chemical Storage and Dosing Standard, B-SPE-STD-011 – Polymer, PAC, Pot Perm and Soda Ash Systems, B-SPE-STD-012 – Lime Storage, Mixing and Dosing System, and B-SPE-STD-013 Fluoride Storage, Mixing and Dosing Systems.

3.3. Design Life

The minimum required design life for Chemical Dosing Piping is 15 years. The selection of piping must reflect this design life.

3.4. Operating Conditions

All pipe work must be suitable for the design maximum flows, pressures, temperatures, and other duty conditions.

All components must have long term compatibility and suitability with the specific dosing chemical specified in the project specific Scope of Works.

The pipe work will be sized to maintain a fluid velocity as per Engineering Standards B-SPE-STD-009 – Liquid Chemical Storage and Dosing Standard, B-SPE-STD-011 – Polymer, PAC, Pot Perm and Soda Ash System, B-SPE-STD-012 – Lime Storage, Mixing and Dosing System, and B-SPE-STD-013 –Fluoride Storage, Mixing and Dosing Systems for the respective chemicals.

All pipe work must be suitable for the external environment, including exposure to any potential liquid or gaseous chemical. At a minimum, all components must be capable of operating within an open environment with prolonged sun exposure, high UV levels, ambient operating temperatures of -5 to 50°C and relative humidity of 10 to 100% with a process fluid temperature of generally 5 – 32°C. More extreme environmental and fluid conditions may need to be assigned on a case-by-case basis.

A minimum of C3-Medium corrosivity category, as per AS 4312 – Atmospheric Corrosivity Zones in Australia, 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 Engineering Standard M-SPE-STD-004 – Protective Coatings, for various WTP classifications.

3.5. Drinking Water Compatibility

All chemical dosing pipework and associated components must conform to the potable water compatibility section of Engineering Standard M-SPE-STD-001 – General Mechanical.

3.6. Pressure Class

The pressure class of the pipe and associated fittings must have a minimum temperature derated pressure rating equivalent to, or higher than, the system design pressure considering all transient system pressures. The system includes all associated infrastructure such as network pipelines when dosing directly into the pipeline, pressure of systems used to flush lines, etc.

The design of non-metallic piping systems, pipe and associated valves and fittings must consider the temperature, vibration and installation pressure derating factors applied to the pipe material. For example, a designer may be considering the use of a Stubbe uPVC Pressure Relief Valve with a maximum operating pressure (MOP) of 10 Bar in a dosing system that doses into a network pipe with a PN10 system design pressure. Given the maximum fluid temperature of 32° C (per Section 3.4), applying the temperature derating factor at 32 deg from the Stubbe data sheet, the Stubbe valve MOP at 32 deg is 5.6 Bar and therefore the dosing system would be rated at 5.6 Bar in operation. As the system design pressure is 10 Bar this would not be acceptable. On the other hand, if the dosing system was dosing into an open tank with a dosing head pressure of less than 4 Bar, then this would be acceptable. The Pressure Relief Valve for this dosing system would also be set to the dosing system design pressure of approx. 4 Bar, not the derated uPVC pressure of 5.6 Bar.

Care must be taken when choosing to use schedule 80 PVC pipe and fittings. Schedule 80 PVC pipe does not have a pressure rating, but a maximum operating pressure for each pipe size and therefore the temperature derating is applied to the maximum operating pressure. Schedule 80 pipe fittings do not have any form of pressure rating. As a guide, the maximum operating pressure for a schedule 80 pipe fittings is 65% of the pipe size maximum operating pressure. The derating factors are then applied to this reduced operating pressure. AS 1477 – PVC Pipes and Fittings for Pressure Application and ISO pipe and fittings are all pressure rated and can be readily distinguished from Schedule 80 pipe and fittings by the PN rating marked on each.

It remains the responsibility of the system designer to ensure that all the piping systems are suitable for the systems design pressure and temperatures.

3.7. Process Chemicals – Acceptable Piping Materials

This section details the preferred materials for pipes, valves, and fittings for each process chemical.

Suitable materials for Chlorine Gas are not included in the material tables due to its highly hazardous nature requiring very specific material selection requirements. The requirements of AS 2927 – The Storage and Handling of Liquefied Chlorine Gas must be adhered to for Chlorine gas applications which references The Chlorine Institute - Pamphlet 6 Material, Fitting and Valve Selection Criteria and Pamphlet 95, Gaskets for Chlorine Service for materials suitable for Chlorine Gas applications.

It remains the responsibility of the system designer to ensure the material selections are appropriate and fit for purpose for the given chemical.

3.7.1. Pipe Materials

Table 1 Preferred Pipe Material based on Process Chemical

Process Chemical	Common Chemical Name	Typical Concentration	Pipe (In order of preference)	
			Non-Metallic	Metallic
Aluminium Chlorohydrate	ACH	50% w/w	UPVC, PE100	Hastelloy C
Aluminium Sulphate	Alum	47% w/w	UPVC, PE100	316SS
Aqueous Ammonia[9]	Ammonia	25% w/w	UPVC, PE100	316SS, 304SS, Hastelloy C
Ammonium Sulphate (Liquid)	Ammonia	40% w/w	PE100, CPVC, UPVC	316SS, 304SS, Hastelloy C
Ascorbic Acid	Ascorbic	5% w/w	UPVC, PE100	316SS, 304SS
Calcium Hydroxide	Lime	1500 mg/L (lime water) 2.5% w/v (Slurry)	UPVC, PE100	316SS, 304SS, Hastelloy C
Carbon Dioxide	CO_2	Gas	UPVC, PE100	304SS, 316SS, Hastelloy C
Citric Acid		50 % w/w	UPVC, PE100	316SS, Hastelloy C
Ferric Chloride		30 - 60 % w/w	UPVC, PE100	
Ozone		0.25% w/w	UPVC, PE100	316SS, Hastelloy C
Polyelectrolyte [2]	Poly, Polymer	0.25% w/v	UPVC, PE100	304SS, Hastelloy C, 316SS
Potassium Permanganate	Pot Perm	2.5 - 3.5 % w/w	UPVC, PE100	316SS, Hastelloy C
Powder Activated Carbon	PAC	1-2%	UPVC, PE100	316SS, Hastelloy C
Sodium Bisulfite	Bisulfite	34% w/w	UPVC, PE100	304SS, 316SS
Sodium Carbonate	Soda Ash	2% w/v	UPVC, PE100	316SS, 304SS, Hastelloy C
Sodium Fluoride	Fluoride	4% w/w	UPVC, PE100	Hastelloy C
Sodium Fluorosilicate	Fluoride	0.2% w/w	UPVC, PE100	Hastelloy C
Sodium Hydroxide (up to 50%) [1]	Caustic Soda	25, 32, 50 %	PE100, UPVC	304SS, 316SS, Hastelloy C
Sodium Hypochlorite	Hypo	10 - 11 % w/v	UPVC, PE100	Hastelloy C
Sulfuric Acid		70% w/w	CPVC, UPVC, PP < 50 ^{0}C	Hastelloy C, Alloy 20

Note:

1. Due to the high freezing temperature of Sodium Hydroxide, PE100 is the preferred pipe material.
2. Polyelectrolytes have many differing commercial forms which include, Poly DADMAC, Magnasol and Polyacrylamides. For the purpose of this specification, all pipe and fitting materials are consistent for all varieties.
3. Pipe fittings must be the same material as the pipe.
4. Operating temperature limits of < 50 ^{0}C apply to some pipe material/chemical combinations listed above, both non-metallic and metallic. The pipe material compatibility must be checked and confirmed with the manufacturer, including the specific operating environment prior to final material selection.
5. Pipe installations for chemicals with a high freezing point, such as Caustic and Sulfuric Acid, should be heat traced and insulated. All heat tracing applications must have suitable temperature controls to avoid over heating which may lead to stress cracking of the pipe work.
6. PP pipe is only suitable for low pressure applications, for example, suction or drainpipe work.
7. Where Non-metallic and/or metallic options are approved along with Hastelloy C, the non-metallic material or alternate metallic option should be used in preference to Hastelloy C to minimise installation and maintenance costs.
8. Double contained hosing with integral outer containment that manufacturer has indicated as compatible for the particular chemical in question, may be used even if material not listed in above table.
9. Process Chemical Aqueous Ammonia - High-Density Polyethylene (HDPE) may permeate ammonia gas, and the HDPE double containment system captures ammonia gas in the annular space between the dosing and containment lines. Therefore, the designer shall consider system suitability when designing a dual-contained system for aqueous ammonia around explosive atmosphere as well as ventilation of annular space in the containment lines.

3.7.2. Pipe Fitting Materials

Table 2 Preferred Fittings Material based on Process Chemical

Process Chemical	Common Chemical Name	Typical Concentration	Fittings	
			Non-metallic	Metallic
Aluminium Chlorohydrate	ACH	50% w/w	UPVC, PE100	Hastelloy C
Aluminium Sulphate	Alum	47% w/w	UPVC, PE100	316SS
Aqueous Ammonia	Ammonia	25% w/w	UPVC, PE100	316SS, 304SS, Hastelloy C
Ammonium Sulphate (Liquid)	Ammonia	40% w/w	PE100, CPVC, UPVC	316SS, 304SS, Hastelloy C
Ascorbic Acid	Ascorbic	5% w/w	PE100	316SS, 304SS
Calcium Hydroxide	Lime	1500 mg/L (lime water) 2.5% w/v (slurry)	UPVC, PE100	316SS, 304SS, Hastelloy C

Process Chemical	Common Chemical Name	Typical Concentration	Fittings	
			Non-metallic	Metallic
Carbon Dioxide	CO2	Gas	UPVC, PE100,	304SS, 316SS, Hastelloy C,
Citric Acid		50% w/w	UPVC, PE100	316SS, Hastelloy C
Ferric Chloride		30 – 60 % w/w	UPVC, PE100	
Ozone		0.25% w/w	UPVC, PE100	316SS, Hastelloy C
Polyelectrolyte	Poly, Polymer	0.25% w/v	UPVC, PE100	304SS, Hastelloy C, 316SS
Potassium Permanganate	Pot Perm	2.5 - 3.5 % w/w	UPVC, PE100	316SS, Hastelloy C
Powder Activated Carbon	PAC - slurry	1-2%	UPVC, PE100	316SS, Hastelloy C
Sodium Bisulfite	Bisulfite	34% w/w	UPVC, PE100	304SS, 316SS
Sodium Carbonate	Soda Ash	2% w/v	UPVC, PE100	316SS, 304SS, Hastelloy C
Sodium Fluoride	Fluoride	4% w/w	UPVC, PE100	Hastelloy C
Sodium Fluorosilicate	Fluoride	0.2% w/w	UPVC, PE100	Hastelloy C
Sodium Hydroxide	Caustic Soda	25, 32 - 50 %	UPVC, PE100	304SS, 316SS, Hastelloy C
Sodium Hypochlorite	Hypo	10 - 11 % w/v	UPVC, PE100	Hastelloy C
Sulfuric Acid		70% w/w	CPVC, UPVC, PP < 50 0C	Hastelloy C, Alloy 20

3.7.3. Valve Materials

Table 3 Preferred Dosing Valve Material based on Process Chemical

Process Chemical	Common Name	Typical Concen-tration	Valves					
			Non-metallic					Metallic
			Body	Seat/ Seal	Disc	O-ring	Other	
Aluminium Chlorohydrate	ACH	50% w/w	UPVC, PP, PVDF, PVC	PTFE, EPDM, FKM	UPVC, PP, PVDF	EPDM, Nitrile, Viton	Ceramic AL203, Glass,	Hastelloy C
Aluminium Sulphate	Alum	47% w/w	UPVC, PP, PVDF	PTFE, EPDM, FKM	UPVC, PP, PVDF	EPDM, Nitrile, Viton	Ceramic AL203, Glass,	316SS
Aqueous Ammonia	Ammonia	25% w/w	UPVC, PP, PVDF	PTFE, EPDM	UPVC, PP, PVDF	EPDM, Nitrile	Ceramic	316SS, 304SS,

Process Chemical	Common Name	Typical Concen-tration	Valves					
			Non-metallic					Metallic
			Body	Seat/ Seal	Disc	O-ring	Other	
								Hastelloy C
Ammonium Sulphate (Liquid)	Ammonia	40% w/w	PVDF, CPVC, PP	PTFE, EPDM	PVDF, CPVC, PP	EPDM, Nitrile, Viton	Ceramic	316SS, 304SS, Hastelloy C
Ascorbic Acid	Ascorbic	5% w/w	PVDF, PVC	PTFE, EPDM	PVDF	EPDM, Nitrile	Ceramic	316SS, 304SS
Calcium Hydroxide	Lime	1500 mg/L (lime water) 2.5% w/v (slurry)	UPVC, PP	PTFE, EPDM, FKM	UPVC, PP	EPDM, Nitrile, Viton	Ceramic, Glass,	316SS, 304SS, Hastelloy C
Carbon Dioxide	CO2	Gas	UPVC, PVC, PP	PTFE, FKM	UPVC, PP	Nitrile,	Ceramic, Glass,	304SS, 316SS
Citric Acid		50% w/w–	UPVC, PP, PVDF	PTFE, EPDM	UPVC, PP, PVDF	EPDM, Nitrile	Ceramic, Glass,	316SS, Hastelloy C
Ferric Chloride		30 – 60 % w/w	UPVC, PP, PVDF	PTFE, EPDM, FKM	UPVC, PP, PVDF	EPDM, Nitrile, Viton	Ceramic, Glass,	
Ozone		0.25% w/w	UPVC, PVDF	PTFE, FKM	UPVC, PVDF	Viton	Ceramic, Glass,	316SS
Polyelectrolyte	Poly, Polymer	0.25% w/v	PVDF	PTFE, EPDM, FKM	PVDF	EPDM, Viton	Ceramic, Glass,	304SS, Hastelloy C, 316SS
Potassium Permanganate	Pot Perm	2.5 - 3.5 % w/w	UPVC, PP, PVDF	PTFE, EPDM, FKM	UPVC, PP, PVDF	EPDM, Viton	Ceramic, Glass,	316SS, 304SS, Hastelloy C
Powder Activated Carbon	PAC	1-2%	UPVC, PP, PVDF	PTFE, EPDM, FKM	UPVC, PP, PVDF	EPDM	Ceramic, Glass,	316SS, Hastelloy C
Sodium Bisulfite	Bisulfite	34% w/w	UPVC, PP, PVDF	PTFE, EPDM, FKM	UPVC, PP, PVDF	EPDM, Viton, Nitrile	Ceramic, Glass,	304SS, 316SS
Sodium Carbonate	Soda Ash	2% w/v	PVDF, PP, UPVC	PTFE, EPDM, FKM	UPVC, PP, PVDF	EPDM, Viton, Nitrile	Ceramic, Glass,	316SS, 304SS, Hastelloy C
Sodium Fluoride	Fluoride	4% w/w	PVDF, PP, PVC	PTFE, EPDM, FKM	PVC, PP, PVDF	EPDM, Viton, Nitrile	Ceramic, Glass,	Hastelloy C
Sodium Fluorosilicate	Fluoride	0.2% w/w	PVDF, PP, PVC	PTFE, EPDM, FKM	PVDF, PP, PVC	Viton, FKM	Ceramic, Glass,	Hastelloy C

Process Chemical	Common Name	Typical Concen-tration	Valves					
			Non-metallic					Metallic
			Body	Seat/ Seal	Disc	O-ring	Other	
Sodium Hydroxide	Caustic Soda	25, 32 - 50 %	PVDF, PVC, PP	PTFE, EPDM, FKM	PVDF, PVC, PP	Viton, EPDM	Ceramic	304SS, 316SS, Hastelloy C
Sodium Hypochlorite	Hypo	10 - 11 % w/v	UPVC, PVDF	PTFE, FKM	UPVC, PVDF	Viton	Ceramic, Glass,	Hastelloy C
Sulfuric Acid		70% w/w	PVDF	PTFE, FKM	PVDF	Viton	Ceramic	Hastelloy C

Table 4 Typical non-metallic Valve Material combinations

Ball Valves			Butterfly Valves			Check Valves		
Body	Seat	Seal	Body	Disc	Seat	Seal	Body	Seal / Seat
UPVC, CPVC, PP, PVDF	PTFE backed EPDM or FKM	PTFE, EPDM, FKM	UPVC, CPVC, PP, PVDF	UPVC, CPVC, PP, PVDF	EPDM, FKM, NBR	EPDM, FKM, NBR	UPVC, CPVC, PP, PVDF	PTFE, EPDM, FKM

Table 5 Typical non-metallic Valve Material combinations, continued

Diaphragm Valves			Gate Valves		Pressure Control Valves		
Body	Diaphragm	Seals	Body	Seals	Body	Diaphragm	O-ring
UPVC, CPVC, PP, PVDF	EPDM & (EPDM or PVDF layered PTFE)	NBR, FKM	PVC	EPDM, FKM	UPVC, PP, PVDF	EPDM, PTFE.	EPDM, FKM

3.7.4. Gasket Material

Table 6 Preferred Gasket Material based on Process Chemical

Process Chemical	Common Chemical Name	Typical Concentration	Gaskets
Aluminium Chlorohydrate	ACH	50% w/w	EPDM, FKM, PTFE, NBR, Viton, CNAF, Hecker, Klingersil C-4430
Aluminium Sulphate	Alum	47% w/w	EPDM, FKM, PTFE, NBR, Klingersil C-4430
Aqueous Ammonia	Ammonia	25% w/w	EPDM, PTFE, NBR, Klingersil C-4430
Ammonium Sulphate (Liquid)	Ammonia	40% w/w	EPDM, FKM, PTFE, NBR
Ascorbic Acid	Ascorbic	5% w/w	EPDM, PTFE
Calcium Hydroxide	Lime	1500 mg/L (lime water) 2.5% w/v (slurry)	EPDM, FKM, PTFE, NBR, Klingersil C-4430
Carbon Dioxide	CO2	Gas	FKM, PTFE, NBR, Klingersil C-4430

Process Chemical	Common Chemical Name	Typical Concentration	Gaskets
Citric Acid		50% w/w	EPDM, PTFE, Klingersil C-4430
Ferric Chloride		30 – 60 % w/w	EPDM, FKM, PTFE
Ozone		0.25% w/w	FKM, PTFE
Polyelectrolyte	Poly, Polymer	0.25% w/v	EPDM, FKM, PTFE
Potassium Permanganate	Pot Perm	2.5 - 3.5 % w/w	EPDM, PTFE, Klingersil C-4430
Powder Activated Carbon	PAC	1-2%	EPDM, FKM, PTFE
Sodium Bisulfite	Bisulfite	34% w/w	EPDM, FKM, PTFE, NBR, Klingersil C-4430
Sodium Carbonate	Soda Ash	2% w/v	EPDM, FKM, PTFE, NBR, Klingersil C-4430
Sodium Fluoride	Fluoride	4% w/w	EPDM, FKM, PTFE, NBR
Sodium Fluorosilicate	Fluoride	0.2% w/w	EPDM, FKM, PTFE
Sodium Hydroxide	Caustic Soda	25, 32 - 50 %	PTFE, FKM
Sodium Hypochlorite	Hypo	10 - 11 % w/v	FKM, PTFE
Sulfuric Acid		70% w/w	FKM, PTFE

Notes:

1. Klingelsil C-4430 is a composite gasket sheet material that has AS 4020 - Testing of Products for Use in Contact with Drinking Water certification and is therefore usable for flange gaskets with the nominated process chemicals listed above.
2. Alternate Klinger and Hecker composite sheet gasket materials are available to suit most process chemical applications but none of the alternates have AS 4020 – Testing of Products for Use in Contact with Drinking Water or WSA 109 – WSAA Industry Standard for Flange Gaskets and O'Rings certification and therefore are not suitable for use.

3.8. Applicable Pipe and Pipe Fitting Standards

The final selection of material must be confirmed by the responsible designer as suitable for the application. Material selection shall include consideration of chemical compatibility, temperature, and phase changes of the chemical in situ to the extent of the design basis of the installation. This may include but is not limited to temperature change resulting from heat of reaction, chemical freezing due to chemical phase change with ambient temperatures and / or off-gassing due to chemical reaction.

In addition, the following table itemises both Australian and International standards relevant to each material type that the pipe and their associated fittings must conform with.

Table 7 Pipe Material Applicable Standards

Pipe Material	Applicable Standards
PE, PE100	AS 4129, AS 4130, AS 4131, ANSI C901-17, ASTM D2683
PEX	AS 2492, AS 2537
U-PVC, C-PVC	AS 1477, ASTM D1785 Schedule 80, ASTM D2467 Schedule 80
Hastelloy C	ASTM B575, UNS N06022
304, 316 Stainless Steel	ASTM A213/A213M Schedule 40, AS4041 Class 1

3.9. Installation

3.9.1. General

All non-metallic pipes shall be installed according to the manufacturer's specification. Consideration needs to be given to pipe expansion for all installations that will be subjected to normal ambient temperature variation. Long, straight pipe runs between 2 fixed points should be avoided. If this is not practical then a "U-bend" must be included in the pipe run to absorb expansion due to ambient temperature variation.

All pipe installations must conform to the requirements of Engineering Standard M-SPE-STD-001 - General Mechanical, AS 3500 – Plumbing and Drainage Standard, AS 2566.2 – Buried Flexible Pipelines Part 2: Installation for buried flexible pipework, and the specific requirements of AS 2032 – Installation of PVC Pipe Systems, AS 2033 – Installation of Polyethylene Pipe Systems and AS 4041 – Pressure Piping. These standards include requirements for minimum trench details, support type and hanger spacing.

Valves, piping and fittings should, where possible, be of the same OEM for a given dosing system and where possible supplied under the same contract in order to maintain commonality of the system components.

3.9.2. Above Ground Installations

Above ground installations must conform to the Standards listed in Section 3.9.1 above. Pipes must be adequately supported in such a way that the pipe does not sag in service. Supporting the pipe in a tray is the preferred installation method. If pipe hangers are being used, enough flexibility or slip must be built into the hangers to allow for pipe expansion. Hangers should have a protective sleeve between the pipe and hanger to prevent damage of the pipe. The hanger and tray material must be compatible with the chemical carried in the pipe. Non-metallic hangers and cable trays are the most suitable, with 316SS and Aluminium also acceptable, subject to chemical compatibility. Zinc plated/galvanised materials are acceptable when used in conjunction with a double contained hose system.

3.9.3. Below Ground Installations

Below ground installations must conform to the Standards listed in Section 3.9.1 above. Pipes must be installed in a suitably constructed trench of a depth suitable for the area of installation.

Where chemical pipes are installed in ducts or trenches, other services shall be given minimum clearances as specified for minimum clearances from Seqwater Water Mains as detailed in Engineering Standard D-SPE-STD-001 Water Supply Networks (Supplement to WSA03-2011) including:

- Telemetry
- Electrical
- Service / Potable Water

A risk assessment should assess the appropriateness of including different chemicals in the same duct, trench, pipe rack or similar.

Identification tape and metal trace should be placed along the full length of the pipe located 150mm above the pipe.

3.9.4. Additional Installation Specific Requirements

Installations of all pipe systems should avoid any vibration from external sources or pressure pulsations. If vibration and pressure pulsations cannot be avoided, the designer must derate the system accordingly and specify the system that will achieve the required design life, at a minimum, under these operating conditions.

PVC pipes should not be exposed to direct sunlight. If direct exposure cannot be avoided, then shielding shall be installed to protect the pipe. The preferred method of protection is to install the pipe in a covered support tray or an outer shield PVC pipe. If shielding cannot be achieved then coatings shall be applied as per requirement in AS 2032 – Installation of PVC Pipe System, for protection from UV radiation.

In areas where the ambient temperature falls below 0°C, PVC pipe installations must be protected from any form of impact. This can be achieved by installing the pipe;

- below ground in a trench with a minimum depth of 300mm
- in a suitable tray that will protect the pipe from all possible impact directions
- a protective sleeve or double containment system

Designers of caustic pipe installations should assess the risk of solution freezing on a case-by-case basis and include installation of heat tracing and insulation if necessary. 50% Caustic solution begins to freeze at approximately 14 °C. All heat tracing applications must have suitable temperature controls to avoid over heating as this may lead to stress cracking of the pipe work.

Where a credible risk of rodent damage to piping exists, all non-metallic pipes should be, at a minimum, shielded with an outer pipe for the exposed length of the pipe. Both ends of the shield pipe should be sealed with an application of expanding foam, such as SIKA Boom-AP to seal the inner pipe to the outer pipe. The shield pipe should also be fitted with a suitable drain fitting at the low point of the pipe, small enough to exclude rodents, and plumbed back to a suitable bund so any internal leakage can be detected. Full double containment of the pipe is also acceptable.

The following additional installation specific requirements shall be included as appropriate to the situation:

- A pressure relief valve, adjustable to a minimum pressure of 1.25 times the system design pressure, shall be included in all pressurised dosing lines to prevent system over pressurisation. The pressure relief valve should be installed as close as practicable to the pump outlet and the pressure relief valve outlet plumbed back to the source tank. Refer to the system P&ID drawing for details.
- Flushing points are required for all dosing lines for flushing and maintenance purposes.
- Gauge and test points are required for all dosing lines for the installation of gauges and to facilitate pressure testing of the pipe during installation and repairs.
- Drain points shall be installed at pipe low points to allow full pipe drainage to a secondary containment system or closed capture system for flushing and maintenance (excepting low points occurring where double contained hosing with integral outer containment is used).
- Dosing points shall have the joint covered with a spray guard where pressurised connections could leak and where operating personnel are frequently present.
- Suitable air vents shall be installed in systems where the chemical is prone to gassing. All air vents must incorporate splash guarding to contain any fluid when venting.
- Long radius bends and directional tees shall be used wherever available and practicable to avoid crystallisation build up and slurry system blockages.

- Piping design to avoid, or at least minimise to the greatest extent possible, any pipework dead legs where stagnation can occur.

3.10. Double Containment

3.10.1. Requirement for Un-Bunded Areas

In un-bunded areas, double containment must be provided for hazardous chemical lines, as it is the most practical method of reducing the risk of chemical leaks and preventing potential environmental release or personal injury in the event of a leak or rupture. This is particularly important when the chemical is under pressure.

Both buried and above-ground lines located outside of bunded areas must be considered high-risk, as any release from these systems could result in significant environmental harm. In such cases, leak-tight secondary containment is required, along with appropriate drainage to a designated capture point or bunded area.

All double containment systems must include provisions for leak detection – either via instrumentation or visual indicators, depending on the application. Drainage must be directed to a suitable capture point to ensure the safe management of any leaked material.

The design and selection of the double containment system must be carried out in consultation with key stakeholders, including representatives from engineering, operations, safety, and environmental teams, to ensure it is suitable for the specific application and site conditions.

If it is determined that the double containment requirements outlined above cannot be reasonably achieved due to site-specific constraints, or if the designer deems them impracticable based on the assessed risk of chemical leakage or safety hazards, a formal Deviation Request must be submitted to Seqwater's Principal Engineering Standards and Assurance. This request must follow the Asset Standard Deviation process outlined in Engineering Standard X-PRO-STD-008 Asset Standards Management and Application (PRO-02205) and be supported by a comprehensive risk assessment and a clearly justified alternative engineering solution which will mitigate the assessed risk of chemical leakage while meeting functional requirements and not compromise safety, lifecycle cost, or other enterprise risks.

3.10.2. Requirements for Bunded Areas

Within bunded areas, double containment for hazardous chemical lines is generally not required when an effective containment system is already in place to manage potential leaks.

However, double containment is still required in specific circumstances, including:

- Pipes on the pressurised side of pump systems located in trafficable areas, where pipe sleeving combined with appropriate drainage to a containment bund is acceptable.
- Pressurised overhead pipes in trafficable areas, which require full pipe sleeving and drainage to a suitable containment bund.

In addition, all dosing pump skids and distribution valve boards located within bunded areas must comply with the requirements set out in M-SPE-STD-010 Chemical Dosing Skids (SPE-00435).

3.11. Joining of Pipe and Fittings

Unless otherwise stated, all joints for pipes and associated fittings that are not required for dismantling shall have welded joints unless otherwise stated in this specification.

All flange joints must use suitably pressure rated, chemically compatible, full faced flanges, conforming with AS 4087 – Metallic Flanges for Waterworks Purposes or AS ISO 9624 – Polyethylene (PE) Pipes for Fluids Under Pressure – Mating Dimensions of Flange Adapters and Loose Backing Flanges for PE flanges. 316SS backing plates, bolts, nuts and washers shall be used on all non-metallic flanges. Flange gaskets shall be compliant with WSA 109.

3.11.1. Accepted joint welding method by material

U-PVC joints must be chemically welded according to with the manufacturer's specification and in accordance with AS 2032 – Installation of PVC Pipe Systems, utilising solvent cement and primer in accordance with AS 3879 – Solvent Cements and Priming Fluids for PVC (PVC-U and PVC-M) and ABS Pipes and Fittings. C-PVC joints must be chemically welded according to with the manufacturer's specification and in accordance with AS 2032, utilising solvent cement and primer in accordance with ASTM F493 – Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride, CPVC) Plastic Pipe and Fittings. Care must be taken to ensure that all pipe, flanges, and fitting joints are aligned, supported and movement limited to minimise any residual stress placed on the joints during the curing time as specified by the solvent cement manufacturer or a minimum of 24 hours if not specified otherwise. During curing time, trenches must not be back filled, nor should the pipe work be pressure tested or placed into service.

PE pipes, flanges and fittings must be heat fusion, or electro fusion welded per the manufacturer's specification and in accordance with AS 2033 – Installation of Polyethylene Pipe Systems, or ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, ASTM D1290 – Standard Test Method for Sediment in Water-Emulsion Polishes by Centrifuge and F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing.

All metallic pipes, flanges and fittings must have welded joints that comply with the manufacturer's specification. Welding must conform with the requirements of Engineering Standard M-SPE-STD-001 – General Mechanical, Section 6.3.6, Welding.

3.12. Pressure Testing and Commissioning

All new, upgraded, and repaired pressure pipework must be hydrostatic pressure tested as set out in the requirement of AS 2032 – Installation of PVC Pipe Systems for PVC pipes, AS 2033 – Installation of Polyethylene Pipe Systems for PE pipe, AS 2566.2 – Buried Flexible Pipelines Part 2: Installation for buried flexible pipework and AS 4041 – Pressure Piping for all other pipe work.

During pressurisation of the pipe safety precautions must be put in place that include, at a minimum, a safety barrier placed around the pipe work under test and all personnel, including those conducting the pressure test, must have the appropriate PPE and kept at a distance from the test pipe such that any failure will not cause personal harm. It is vital to note that failures can cause high speed projectiles and high-pressure chemicals that may cause serious injuries, and these risks must be appropriately mitigated. Familiarisation with the SDS of the fluid of system and a full SWMS must be completed prior to commencing any pressure testing.

Where a pipe is repaired, or the system is modified, hydrostatic testing may be conducted on the modified section only, between the closest isolation valves with a suitable point for pressure application. It must be noted that isolation valves can leak which could be undetectable and thus rendering the test as a failure.

The fluid used for pressure testing must be incompressible, inert and chemically compatible with the process fluid of the pipe work being tested. This is particularly important for strong acid and alkali system when severe

chemical reaction can occur with the addition of water, or other non-compatible liquids. Potable water is the preferred medium and can be used for all applications where the pipe work can be flushed of all process chemical prior to testing and completely drained and flushed of the test fluid prior to returning into service.

When pressure testing has been completed, the system must be drained of all test fluid. If there is no compatibility issue, then the test fluid can be drained into the systems containment bund, when provided, otherwise the test fluid must be captured in a suitable container and disposed of via a suitable trade waste service.

After pressure testing, and prior to the system being placed in service, the pipe work must be disinfected according to the applicable Seqwater disinfection procedure unless deemed not required for a specific application.

If there is no suitable fluid for pressure testing, then follow the alternate test methods stated in the applicable standards.

Double containment pipes (outer pipe) shall be low pressure hydrostatic tested, 2 bar minimum, to ensure a leak free installation. Double containment hosing that comes with integral outer containment, and installed new, only requires leak testing to confirm leak free end fittings installed post factory.

Compressed air or other compressible mediums must not be used for pressure testing.

3.13. Protective Coatings

All protective coatings shall conform to the requirements of Engineering Standard M-SPE-STD-004 - Protective Coatings.

The protective coating shall be suitable to achieve the design life as specified in Section 3.3 of this Standard, without the need for reapplication. Refer to Section 8.4 of Engineering Standard M-SPE-STD-004 - Protective Coatings for the operating environment, including minimum corrosivity category.

3.14. Markings

All pipe work shall be coloured and marked in accordance with Procedure X-PRO-STD-006 - Equipment Numbering and Naming Convention and AS 1345 - Identification of the Contents of Pipes, Conduits, and Ducts.

4. Definitions and Abbreviations

Table 8 Definitions and Abbreviations

Term	Definitions
Contractor	An entity engaged by Seqwater to undertake work in accordance with an agreed contract and defined scope of work.
Deviation	Written agreement from Seqwater as per the Deviations from Asset Standards process detailed in Procedure X-PRO-STD-008 Asset Standards Management and Application.
Manufacturer / Supplier / Vendor / Original Equipment Manufacturer (OEM)	The entity that manufacturers or supplies equipment to meet the specifications of the Contract.

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).
Pipe	Pipe work and all associated valves and fittings
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 / may	Indicates a recommendation
This Engineering Standard	Engineering Standard *M-SPE-STD-013, Chemical Dosing Piping*
Trafficable area	A designated walkway, access or egress area or anywhere that has frequent walking traffic or area that has a high chance of personnel attendance

The following abbreviations apply to this Engineering Standard.

Table 9 Abbreviations

Abbreviation	Description
AM	Asset Management
ANSI	American National Standards Institute
AS	Australian Standard and New Zealand Standard (AS/NZS)
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
C-PVC	Chlorinated Poly Vinyl Chloride
CSM	Chlorosulfonated Polyethylene, Hypalon
DN	Nominal diameter
EPDM	Ethylene Propylene Diene Monomer Rubber
ESA	Engineering Standards and Assurance
FKM	Fluro elastomer, FPM
FKKM	Perfluoro elastomer, Kalrez
FRP	Fiber Reinforced Plastic
NBR	Acrylonitrile Butadiene Rubber, Nitrile, Buna-N
OEM	Original Equipment Manufacturer
P&ID	Piping and Instrumentation Diagram

Abbreviation	Description
PE	Polyethylene
PE100	High Density Polyethylene Pipe
PEEK	Polyether Ether Ketone
PEX	Cross Linked Polyethylene, PE-X
PN	Nominal pressure
PP	Poly Propylene
PPSU	Polyphenylsulfone
PSU	Polysulfone
PTFE	Poly Tetra Fluro Ethylene, Teflon
PVDF	Polyvinylidene Fluoride, Kynar
PN	Nominal pressure
U-PVC	Un Plasticised Polyvinyl Chloride
SS	Stainless Steel
WSAA / WSA	Water Services Association of Australia

5. Roles and Responsibilities

Table 10 Roles and Responsibilities

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

6. Reference Documents

The documents listed in Table 11 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 11 Reference Documentation

Description	Location
PRO-00008 Corporate HSW - Hazardous Chemicals Procedure	REX & Waternet
PRO-01617 Engineering Standard X-PRO-STD-009 - Engineering Design, Construction, Operation and Maintenance Procedure	REX & Waternet
PRO-01872 Engineering Standard X-PRO-STD-002 - Engineering Drawing Number Procedure	REX & Waternet
PRO-02187 Engineering Standard X-PRO-STD-007 - Drawing & Spatial Data Standards Procedure	REX & Waternet
PRO-02190 Asset Information Standard X-PRO-STD-006 - Equipment Numbering and Naming Convention Procedure	REX & Waternet
PRO-02205 Engineering Standard X-PRO-STD-008 - Asset Standards Management and Application Procedure	REX & Waternet
SPE-00346 Engineering Standard B-SPE-STD-003 - Commissioning Requirements	REX & Waternet
SPE-00348 Engineering Standard M-SPE-STD-004 - Protective Coatings	REX & Waternet
SPE-00367 Engineering Standard M-SPE-STD-001 - General Mechanical	REX & Waternet
SPE-00395 Engineering Standard D-SPE-STD-001 Water Supply Networks (Supplement to WSA03-2011)	REX & Waternet
SPE-00445 Engineering Standard B-SPE-STD-009 - Liquid Chemical Storage and Dosing	REX & Waternet
SPE-00481 Engineering Standard B-SPE-STD-011 - Polymer, PAC, Pot Perm and Soda Ash Systems	REX & Waternet
SPE-00496 Engineering Standard B-SPE-STD-012 - Lime Storage, Mixing and Dosing System	REX & Waternet
SPE-00519 Engineering Standard B-SPE-STD-013 - Fluoride Storage, Mixing and Dosing Systems	REX & Waternet
ANSI C901-17 Polyethylene (PE) pressure pipe and tubing for water service Australian and International Standards Web Service	SAI Global
AS 1345 Identification of the contents of Pipes, conduits, and ducts Australian and International Standards Web Service	SAI Global

Description	Location
AS 1477 PVC pipes and fittings for pressure applications Australian and International Standards Web Service	SAI Global
AS 2032 Installation of PVC pipe systems Australian and International Standards Web Service	SAI Global
AS 2033 Installation of PE pipe systems Australian and International Standards Web Service	SAI Global
AS 2129 Flanges for pipes, valves and fittings Australian and International Standards Web Service	SAI Global
AS 2566 Buried flexible pipelines Australian and International Standards Web Service	SAI Global
AS 2927 The storage and handling of Liquefied Chlorine Gas Australian and International Standards Web Service	SAI Global
AS 3500.1 Plumbing and drainage – water services Australian and International Standards Web Service	SAI Global
AS 3879 Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings Australian and International Standards Web Service	SAI Global
AS 4020 Testing of products for use in contact with drinking water Australian and International Standards Web Service	SAI Global
AS 4041 Pressure Piping Australian and International Standards Web Service	SAI Global
AS 4087 Metallic flanges for waterworks purposes Australian and International Standards Web Service	SAI Global
AS 4129 Fittings for Polyethylene pipes for pressure applications Australian and International Standards Web Service	SAI Global
AS 4130 Polyethylene pipes for pressure applications Australian and International Standards Web Service	SAI Global
AS 4131 Polyethylene compounds for pressure pipes and fittings Australian and International Standards Web Service	SAI Global
AS 4312 Atmospheric Corrosivity Zones in Australia Australian and International Standards Web Service	SAI Global
AS 4343 Pressure equipment – Hazard levels Australian and International Standards Web Service	SAI Global
AS ISO 9624 Polyethylene (PE) pipes for fluids under pressure - Mating dimensions of flange adapters and loose backing flanges Australian and International Standards Web Service	SAI Global

Description	Location
ASTM A213/A213M Engineering Standard for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes Australian and International Standards Web Service	SAI Global
ASTM B622 Specification for seamless nickel and nickel cobalt alloy pipe and tube Australian and International Standards Web Service	SAI Global
ASTM D1290 Engineering Standard and practice for electrofusion joining of polyolefin pipe and fittings Australian and International Standards Web Service	SAI Global
ASTM D1785 PVC plastic pipe – schedule 80 Australian and International Standards Web Service	SAI Global
ASTM D2467 PVC socket fittings – schedule 80 Australian and International Standards Web Service	SAI Global
ASTM D2683 Engineering Standard for socket type polyethylene fittings Australian and International Standards Web Service	SAI Global
ASTM D3261 Engineering Standard for butt heat fusion Australian and International Standards Web Service	SAI Global
ASTM F493 Engineering Standard for Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings Australian and International Standards Web Service	SAI Global
ASTM F1055 Engineering Standard for electrofusion type polyethylene fittings for OD controlled polyethylene pipe and tubing Australian and International Standards Web Service	SAI Global
WSA 01 Polyethylene Pipeline Code	WSAA
WSA 03 Water Supply Code of Australia	WSAA
WSA 109 Industry standard for flanged gaskets and O-rings	WSAA
Chemical Resistance Recommendations - Filtermat Belgium	Web
EN-B Chemical Compatibility Guide	Web
Cole Parmer Chemical Resistance	Web
VIN067 Chemical Resistance Guide	Web
Polysulfone chemical compatibility chart from ism	Web
IPEX Chemical Resistance Guide	Web
GF 1240 Vinyls catalogue	Web
IPX86 IPLEX-POLY16-BRO WEB Fittings	Web
VIN129 Polyethylene Pipe and Fittings Systems Plumbers Version	Web
PE 30Aug2013 W Fittings	Web

Description	Location
Dokumen tips klinger gasket catalogue	Web
Chlorine Gas Piping Pamphlet 6 Piping Systems for Dry Chlorine	REX
Chlorine Gas Gasket Selection Pamphlet 95 Gaskets for Chlorine service	REX

7. Changes from Previous Version

This Engineering Standard will be regularly reviewed and updated, including the consideration of requested alterations, in accordance with Engineering Standard X-PRO-STD-004 Development and Review of Asset Standards Procedure. Changes made from the previous version of this document are summarised in Table 12 below:

Table 12 Changes from Previous Version

Section Number	Change
General	Updated document references throughout
General	Minor spelling and grammar corrections
3.6	Removed PN16 minimum
3.7.1	Updated Table 1 – Added 316SS material to Sodium Hydroxide
3.7.1	Updated Table 1 Notes - Added item (9) on Ammonia gas with HDPE double containment
3.7.2	Updated Table 2 – Added 316SS material to Sodium Hydroxide
3.7.3	Updated Table 3 – Added 316SS material to Sodium Hydroxide
3.9.4	Dot point 1 confirmed valve outlet was pressure relief valve outlet and removed redundancy piping dot point which is covered in process engineering standards
3.10	Updated into two (2) sections, Section 3.10.1 Requirements for Un-Bunded Areas and Section 3.10.2 Requirements for Bunded Areas, for further clarity.
3.13	Updated section to include reference to protective coating standard Section 8.4 for design life and corrosive categories
4.0	Updated Table 9 spelling of PPSU “Polyphenylsulfone” and PSU “Polysulfone”