SA Water

Engineering

Technical Standard

TS 0230.2 - Requirements for Butterfly Valves

Version: 1.0.
Date: 24 October 2025.
Status: Final.
Document ID: SAWS-ENG-0230.2
Confidentiality: OFFICIAL

Government of South Australia

Issue and version number

Only the current version of the Technical Standard should be used. Earlier versions of this Technical Standard are superseded and must not be used.

This Technical Standard document is not controlled when printed or downloaded. Only online versions from the SA Water website may be used.

Copyright and intellectual property

Intellectual property

Where any material is extracted from this Technical Standard, which may occur only with express written consent of SA Water, that material must be attributed to SA Water as: © SA Water.

Technical Standards are only applicable for intended use

This Technical Standard may be used by only: SA Water staff, SA Water contractors and persons expressly authorised in writing by SA Water to do so.

This Technical Standard may be used only for application to progress activities associated with SA Water's statutory functions described particularly within the *Water Industry Act 2012* (SA), the *Water Industry Regulations 2012* (SA), and the *South Australian Water Corporation Act 1994* (SA). This Technical Standard may not be used for any other activity outside of the scope of the functions described in that legislation.

If you have access to this Technical Standard, and the Technical Standard is used by you or any other entity, for purposes or activity other than to progress SA Water's statutory functions, the Technical Standard may not be applicable to that other purpose or activity, in which you or that other entity intend to engage, and you could be misinterpreting the contents and you may not correctly apply the Technical Standard. This may result in loss or damage to you, the entity or to other parties, and must be avoided.

This Technical Standard has been prepared to address general and not particular circumstances. This Technical Standard is intended to be used in conjunction with designs and project instructions that are prepared in response to particular circumstances and toward particular objectives. Any user of this Technical Standard must ensure, by independent verification, that the application of the Technical Standard is suitable to any design for any particular project, and to ensure that the Technical Standard is in accordance with the latest relevant Australian standards, legislation, regulations and codes and also with any relevant and applicable policy.

SA Water does its best to provide accurate and up-to-date information in the Technical Standards we prepare, but you should use your own skill and judgement before you rely on it. SA Water does not guarantee or warrant the accuracy, completeness, or currency of the information provided. SA Water recommends that you ask for professional advice from your own advisors on any aspect of your own circumstances.

Liability disclaimer

This Technical Standard may be used by only: SA Water staff, SA Water contractors and persons expressly authorised in writing by SA Water to do so.

To the extent that the use of the Technical Standard constitutes you acquiring goods or services from SA Water, as a consumer within the meaning of the Australian Consumer Law set out in the *Competition and Consumer Act 2010* (Cth) sch 2, as amended or replaced from time to time, you may have certain rights and remedies (including:, consumer guarantee rights) that cannot be excluded, restricted or modified by agreement.

Nothing in this disclaimer operates to exclude, restrict or modify the application of any implied condition or warranty, provision, the exercise of any right or remedy, or the imposition of any liability under the Australian Consumer Law or any other statute, where to do so would contravene that statute or cause any term of this agreement to be void.

You acknowledge and agree that:

- Except for any non-excludable obligations, SA Water gives no warranty (express or implied) or guarantee that information, services and materials contained in this Technical Standard are accurate, complete, current, or fit for any use whatsoever.
- All such information, services and materials are provided "as is" and "as available" without warranty of any kind. This means, for instance, that you should not rely on the accuracy or completeness of any information displayed within this Technical Standard and its suitability for application to your particular circumstances, and furthermore it is your responsibility to contact an appropriate member of our staff if you have any questions about suitability of the Technical Standard to any particular circumstance, before your use of the Technical Standard.

To the maximum extent permitted by law and subject to any non-excludable obligations, SA Water excludes all liability for any loss or damage arising out of access to, use of, or reliance upon information, services and materials contained within this Technical Standard.

Documents superseded by this standard

The following documents are superseded by TS 0230.2:

a. TS 0230, Version 3.0

Significant/major changes incorporated in this edition

This is the first issue of this document.

Document controls

Version history

Version	Date	Author	Comments
1.0	24-10-2025	Julian Hamedi	Issued for use

Template: Technical Standard Version 8.2, 08 October 2025

Authors

Author Name	Author Role	Signature
Julian Hamedi	Principal Engineer Mechanical	6/11/2025 X Julian Hamedi Principal Engineer Mechanical Signed by: HA005811

Approvers

Approver Name	Approver Role	Signature
Matthew Davis	Manager Engineering Quality and Innovation	10/11/2025 X Matthew Davis Manager Engineering Quality and Innovation Signed by: DA003681
Sofia Chouli	Senior Manager Engineering	12/11/2025 X Sofia Chouli Senior Manager Engineering Signed by: CH005288

Reviewers

Name	Role	Version	Review Date
Josephine Premnath	Principal Engineer Hydraulic	0.1	10-10-2025
Mark Stephens	Engineering Specialist	0.1	10-10-2025

Contents

List of figures

List of tables

1 Introduction

SA Water is responsible for the construction and commissioning of an extensive amount of engineering infrastructure such that it is safe and functional.

This standard has been developed to assist in the design, maintenance, construction, and management of this infrastructure.

1.1 Purpose

The purpose of this standard is intended to be referenced in the technical specification, procurement, testing and delivery of butterfly valves (of all types and for all purposes) of all diameters. In the case of land development, and only for valves less than DN375, the application of this Technical Standard may be varied with reference to the scope and application of the SA Water Approved Products List TS 0503, provided the valves are used for isolation purposes only in gravity water reticulation systems.

Butterfly valves that are used for purposes other than isolation, for example, control, throttling or other hydraulic regulation, are subject to the requirements of this document and not the SA Water Approved Products List (regardless of their diameter or pressure rating).

1.2 Glossary

Terms and Abbreviations utilised in this Standard are included in the following sections. The definitions presented below are to be used when interpreting this Standard and actions undertaken in relation to this Standard. Where a conflict exists, clarification is to be sought from SA Water.

1.2.1 Terms and Definitions

The following is a list of Terms applicable to this document:

Term	Description
Accepted	Determined to be satisfactory by SA Water's Representative.
Actuation	One actuation is equal to the minimum of either the number of times the valve is fully closed (sealed) after opening, or fully opened from closed, or an accumulation of the percentage movements of a modulating valve up to the percentage required to fully stroke the valve from open to closed.
Allow	Means that the cost of the item referred to is the responsibility of the Constructor
Constructor	The organisation responsible for constructing and installing infrastructure for SA Water whether it be a third party under contract to SA Water or an in-house entity.
Contract	A set of documents supplied to Constructor as the basis for construction; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.
Contract Documents	A set of documents supplied to Constructor as the basis for construction; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.
Control valve	A valve that regulates process quantities such as flow, pressure, or level through varying its position, and hence flow, as part of normal operation. A control valve usually incorporates a means of automatically actuating the valve in response to process changes, but control valves may also be manually operated (e.g., a bypass valve).

Term	Description
Designer	The organisation responsible for designing infrastructure for SA Water whether it be a third party under contract to SA Water or a Constructor, or an in-house entity. A Designer is a person who effects design, produces designs or undertakes design activities as defined in the Work Health and Safety Act 2012 (SA).
Designer or constructor	The entities that undertake the design, specification, vendor negotiations, purchasing, construction installation or operational testing of the valves (can be either external or internal to SA Water).
Informative	Means "provided for information and guidance".
Inspection	Measuring, testing or examining of Works, materials or goods or services (includes raw materials, components and intermediate assemblies) for determining conformity with the Requirements.
Inspection and Test Plans (ITP)	The planned inspections and tests for individual work processes or activities.
Manufacturer	A person, group, or company that owns and operates a manufacturing facility that provides materials for use in SA Water infrastructure.
Must	Indicates a requirement that is to be adopted to comply with the Standard.
Person/s	Each word implying a person, or persons shall, where appropriate, also be construed as including corporations.
Provide	Means "supply and install".
Requirement	Need or expectation that is stated within the Contract.
Responsible Discipline Lead	The engineering discipline expert identified in the 'Approvers' table (via SA Water's Representative).
SA Water Representative	The SA Water representative with delegated authority under a Contract or engagement, including (as applicable): • Superintendent's Representative (e.g. AS 4300 and AS 2124 etc.) • SA Water Project Manager. SA Water nominated contact person.
Service Life	The actual period during which infrastructure (or its constituent components) satisfies the design performance requirements without unforeseen major repair or maintenance, when used for its intended purpose and under the expected conditions of use
Should	Indicates practices which are advised or recommended, but is not required
Supplier	A person, group or company that provides goods for use in SA Water infrastructure.
Technical Dispensation Request Form	This form is part of SA Water's Technical Dispensation Request Procedure which details the process by which those required to comply, or ensure compliance, with SA Water's technical requirements may seek dispensation from those requirements.
Vendor	The supplier (re-seller) or factory manufacturer of the valves (not always the same entity) – the information required of the vendor under this Technical Standard must be obtained from the supplier (re-seller) or factory manufacturer as "vendors" as required.
Work	Elements of a project which require design or construction.

1.2.2 Abbreviations

The following is a list of Abbreviations, Acronyms and Initialisms used in this document:

Abbreviation	Description
SA Water	South Australian Water Corporation
TDRF	Technical Dispensation Request Form
TS	SA Water Technical Standard
AS	Australian Standard
NZS	New Zealand Standard
ISO	International Organization for Standardization
FBE	Fusion Bonded Epoxy

1.2.3 Terminology

The following is a list of specific interpretations for Terminology used in this standard.

- Where an obligation is given and it is not stated who is to undertake these obligations, they are to be undertaken by the Constructor.
- Directions, instructions and the like, whether they include the expression "the Constructor shall" or equivalent, shall be directions to the Constructor, unless otherwise specifically stated.
- Where a submission, request, proposal is required and it is not stated who the recipient should be, it is to be provided to SA Water's Representative for review.
- Each word imparting the plural shall be construed as if the said word were preceded by the word "all".
- "Authorised", "approval", "approved", "selected", "directed" and similar words shall be construed as referring to the authorisation, approval, selection or direction of SA Water's Representative in writing.
- "Submit" mean "submit to the SA Water Representative or their nominated delegate".
- Unless noted otherwise, submissions, requests, proposals are to be provided at least 10 business days prior to work commencing or material ordering (unless noted otherwise).

1.3 References

1.3.1 Australian and international

The following table identifies Australian and International standards and other similar documents referenced in this document:

Reference	Title
AS 4795.1	Butterfly valves for waterworks purposes - Part 1: Wafer and lugged
AS 4795.2	Butterfly valves for waterworks purposes - Part 2: Double flanged
AS/NZS 4020	Testing of products for use in contact with drinking water
AS/NZS 4087	Metallic flanges for waterworks purposes
ASTM D395 - 16	Standard Test Methods for Rubber Property - Compression Set
ASTM D429 - 14	Standard Test Methods for Rubber Property - Adhesion to Rigid Substrates Test Method D Post Vulcanisation Bonding of Rubber to Metal
WSA 109	Industry standard for flange gaskets and O-rings

1.3.2 SA Water documents

The following table identifies the SA Water standards and other similar documents referenced in this document:

Reference	Title
DS 0200	Mechanical datasheets
TS 0101	Safety in design standard
TS 0105	Quality requirements
TS 0900	Pressure Testing of Pipelines
TS 147	Surge Mitigating Infrastructure
TS 15	Protection of Steelwork in Submersible Environments
TS 16	Protection of Steelwork in Atmospheric Environments
TS 18	Protection of Steelwork in Buried Environments

2 Scope

2.1 Scope and application of this Technical Standard

This Technical Standard must be applied in conjunction with all the requirements identified in the relevant Australian Standards for butterfly valves as listed in section 1.3.1. Valves supplied to SA Water must meet all the requirements in the Australian Standards listed in section 1.3.1. This Technical Standard is to be applied in addition to the requirements of the Australian Standards. In several areas, there is no overlap between the Australian Standards and this Technical Standard. In other areas, this Technical Standard provides direction if the Australian Standards contain options. But if a conflict between the requirements of this Technical Standard and those of the Australian Standards arises, then SA Water must be supplied with a written description of the details of the conflict by the designer or Constructor, and SA Water will provide a clarification within ten (10) working days of receiving the notification of the conflict from the designer or Constructor. No valve shall be procured if there is a potential conflict between the requirements of the Australian Standards and this Technical Standard.

2.2 Works not in scope

N/A

2.3 Technical dispensation

Departure from any requirement of this Technical Standard shall require the submission of a Technical Dispensation Request Form (TDRF) SAWT-ENG-0015 - Dispensation Request Procedure Template for the review and approval (or otherwise) of the SA Water Principal Engineer on a case-by-case basis.

The Designer shall not proceed to document/incorporate the non-conforming work before the Principal Engineer has approved the proposed action in writing via the Technical Dispensation Request Form (TDRF).

SA Water requires sufficient information to assess dispensation requests and their potential impact. The onus is therefore on the proponent to justify dispensation request submissions and provide suitable evidence to support them.

Design projects that are carried out without being appropriately sanctioned by SA Water shall be liable to rejection by SA Water and retrospective rectification by the Designer/Constructor.

2.4 Hazards

Hazards shall be identified and addressed in accordance with TS 0101.

3 Applications

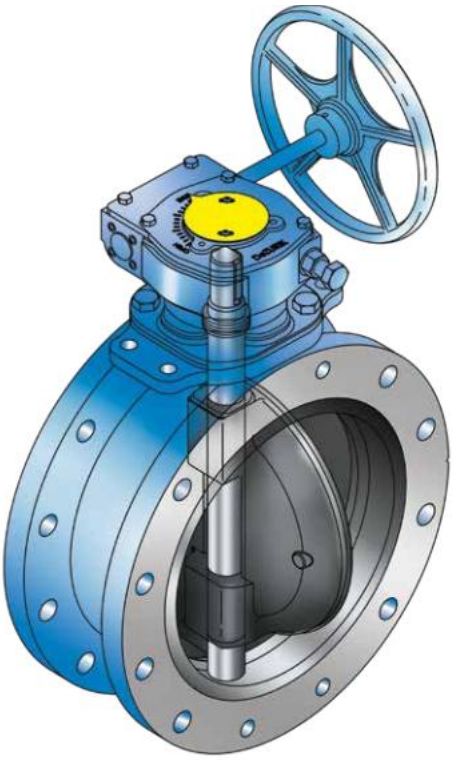

Figure 1: Typical concentric Butterfly valve

3.1 Concentric (single axis) butterfly valves

Concentric butterfly isolation valves may be used for potable, raw or recycled water installations for pressure classes up to and including PN16.

The specification of a vulcanised liner is required for valves that are actuated more than once per month. The frequency of actuation shall be determined by the Designer based on the functional requirements agreed with SA Water in the case of new valves including replacement of existing valves with a change in actuation frequency and based on existing operational data in the case of replacement of existing valves with no change in actuation frequency. The Designer must confirm in writing, using a valve datasheet (refer to DS 0200 Mechanical-Datasheets), the number of actuations and proposed functional operation for the concentric butterfly valve over its design life and acceptance of these requirements by the vendor, before it is procured.

The number of actuations required for maintenance work or operational purposes must be less than the maximum number of actuations nominated by the valve vendor over the design life referred to in section 4.1 (or greater if required by the requirements of a project brief or known operational circumstances).

3.2 Single offset butterfly valves

Single offset butterfly valves are configured such that the disc shaft is offset downstream of the valve seat plane, that is, an offset in the direction further into the valve body, to facilitate sealing contact around the circumference of the valve seal.

Single offset butterfly valves may be used for potable, raw or recycled water installations for pressure classes up to and including PN16.

The specification of a vulcanised liner for the seal-on body valves is required for valves that are actuated more than once per month. The Designer must confirm in writing, using a valve datasheet (refer to SA Water typical butterfly valve datasheet), the number of actuations and proposed functional operation for the single offset butterfly valve over its design life and acceptance of these requirements by the Vendor, before it is procured.

The number of actuations required for maintenance work or operational purposes must be less than the maximum number of actuations nominated by the valve vendor over the design life referred to in section 4.1(or greater if required by the requirements of a project brief or known operational circumstance).

3.3 Double offset butterfly valves

Double offset butterfly valves are configured such that the disc shaft is offset downstream of the valve seat plane and below the pipe and valve centreline such that interference is minimised on the opening and closing of the valve.

Double offset butterfly valves may be used for potable, raw or recycled water installations for pressure classes up to and including PN35.

Double offset butterfly isolation valves can be used where the valves are required for isolation or control, and the number of Actuations for maintenance work or operational purposes is less than the maximum number of Actuations nominated by the valve Vendor over the design life referred to in section 4.1(or greater if required by the requirements of a project brief or known operational circumstances). The Designer must confirm in writing, using a valve datasheet (refer to SA Water typical butterfly valve datasheet), the number of Actuations and proposed functional operation for the double offset butterfly valve over its design life, and acceptance of these requirements by the Vendor, before it is procured.

3.4 Triple offset butterfly valves

Triple offset butterfly valves may be used for potable, raw or recycled water installations for pressure classes up to and including PN35 and shall be submitted for approval by principal mechanical engineer.

Triple offset butterfly isolation valves can be used where the valves are required for isolation or control, and the number of actuations for maintenance work or operational purposes is less than the maximum number of actuations nominated by the valve vendor over the design life referred to in section 4.1 (or greater if required by the requirements of a project brief or known operational circumstance). The Designer must confirm in writing, using a valve datasheet (refer to SA Water typical butterfly valve datasheet), the number of Actuations and proposed functional operation for the triple offset butterfly valve over its design life, and acceptance of these requirements by the vendor, before it is procured.

SA Water generally does not use triple-offset butterfly valves.

4 Design requirements

The word design, as used in TS 0230.2, refers to the specification of the configuration, selection, and sizing of equipment to achieve required hydraulic and operational outcomes.

4.1 Design life

The minimum design life of a butterfly valve body, welded overlay seats, flanges and other cast components shall be in accordance with TS 0109.

The minimum service life of components that are expected to require periodic maintenance or replacement, as notified by the Designer or Constructor to SA Water, before the procurement of any valve shall be in accordance with TS 0109.

Any shorter design life identified for specific components must be communicated by the designer or Constructor to SA Water for endorsement by TDRF before any valve is procured. SA Water may require the Designer or Constructor to provide a detailed maintenance schedule with estimated present-day costs before any valve is endorsed.

The SA Water typical butterfly valve datasheet must be used by the Designer preparing the specifications to identify valve components for which the Vendor must provide information to assist in confirming the design life of the valve body, flanges, and other cast components as well as components which require periodic maintenance or replacement.

4.2 Selection of type of valve

Valve selection considerations include but are not limited to:

1. Type of water or wastewater:

   The type of valves the Designer can specify may be restricted depending on the type of water or raw water in which the valves must achieve full operational functionality over their design life without any more maintenance than identified by the valve vendor, in accordance with the requirements of this Technical Standard, prior to the procurement of the valves. The designer or valve Vendor must obtain information on the physical and chemical characteristics of the water or wastewater from SA Water as stipulated in this Technical Standard. It is the responsibility of the Designer to identify the correct type of valve for a particular application or to contractually transfer this responsibility to the valve Vendor.

2. Required design life:

   The minimum required design life for all valves is nominated under section 4.1 above. Yet the designer or Constructor must obtain written confirmation from SA Water that there are no particular operational or maintenance circumstances for a particular model or type of valve that require the valves the designer or Constructor is specifying or supplying to have a design life longer than the minimum periods identified in section 4.1. The outcome of this assessment may restrict the type of valves the Designer can specify that will meet the design life Requirements.

3. Operational requirements:

   The type of valves the Designer can specify may be restricted depending on the operational Requirements for the valves must fully perform over their design life without any more maintenance than identified by the valve vendor, in accordance with the requirements of this Technical Standard, prior to the procurement of the valves. The Designer, or valve vendor, must obtain information regarding the operational requirements for the valves from SA Water, including the criticality of the valve when it needs to be operated (and consequences if the valve fails to operate as required), and consider prior to the procurement of the valves. It is the responsibility of the Designer to identify the correct type of valve for operational requirements and criticality.

4. Maintenance requirements:

   The types of valves the Designer can specify may be restricted depending on the maintenance requirements for the valves to fully perform over their design life. The Designer must inform the valve vendor of all the requirements of this Technical Standard, including information regarding the operational requirements and the environment in which the valves must operate, to obtain information from the Vendor regarding the maintenance Requirements for the valves offered by the Vendor. The Designer is responsible for ensuring all operational and environmental information is transmitted to the Vendor and that the maintenance requirements for any valves offered are transmitted from the Vendor to SA Water prior to the procurement of any valves. The Designer in accordance with TS 0104 is responsible for ensuring that the valves procured do not have maintenance Requirements that are unacceptable to SA Water.

5. Safety requirements:

   The types of valves the Designer can specify must account for the following non-exhaustive list of considerations:

   a. The physical space required for the size of the valve nominated by the Vendor, including all connected elements, including any bypasses, and whether safe access can be achieved around the valve once installed in its intended location, for example, building, above ground, buried, or chamber.

   b. The method for installation and removal of the valve (whether during construction or later maintenance) and the weight of the valve, lifting methods (requirements for crane or other lifting device) and whether safe manoeuvring of the valve is always practical.

   c. The use of gearboxes to ensure that, in the case of manual actuation of the valve, excessive torque is not required (torque limits for manual actuation are specified in the SA Water typical butterfly valve datasheets.

   d. Requirements for single or double isolations using valves before work in spaces that may otherwise be inundated without the isolation are discussed in section 4.5.13 which relates to safe isolations.

   e. Safety in Design (SiD) and HAZOP workshops should be held, when the SA Water requirements for these workshops to be conducted are triggered under SA Water TS 0101, and the safety assessment of valves undertaken within these processes.

   f. Suitability of the valve for application, specifically throttling and flow control.

4.3 Materials selection

The Designer must confirm in writing, using a valve datasheet (refer to SA Water typical butterfly valve datasheets), the materials proposed for all valve components before the purchase of any valve. In many instances, a general arrangement drawing from the Vendor of the valve identifying each component and the material it is made of will be helpful, and the Designer must request this drawing from the Vendor and provide a copy to SA Water. The SA Water typical butterfly valve datasheets will, for some valve components (critical performance or wetted components), request minimum grades of materials be provided in any supplied valve. These SA Water nominated materials should not be varied in the supplied valves unless the Designer determines the technical reasons for the departure and specifically obtains from the Vendor a statement that the alternative materials offered will meet the design life and warranty Requirements of this Technical Standard. The Designer must ensure that the Vendor completes all responses, including material specification responses, required in the valve datasheet (returnable schedule), which forms part of the basis for entering the contract to purchase the valve.

If there are functional performance implications (including operational failure through to excessive maintenance of or replacement of components) associated with the choice of one component material instead of another, then the Designer must determine what these are and fully inform SA Water before any valve is purchased. Minimum material hardness and nobility separations for components in direct contact must be specified by the Designer and supplied by the vendor to avoid galling (due to mechanical contact) or dissimilar metal corrosion. Minimum hardness and nobility separations for components in close physical proximity where there is a risk of galling or dissimilar metal corrosion that will reduce the design life of the components must be identified by the Designer and supplied by the Vendor.

Stainless steel grade 431 shall not be used as a shaft material where chloride levels in the water exceed 500mg/L.

4.4 Pressure rating

4.4.1 Typical pressure ratings

The typical pressure ratings to be considered by the designer are PN10, PN16, PN21 and PN35 in accordance with the relevant Australian Standards for the valve, including AS 4795.1&2, AS/NZS 2638.1&2 Valves with alternative pressure ratings, for example, PN25 and PN40, are acceptable, provided the pressure rating is greater than the requirement for all possible design actions (loads, forces, and other conditions) and operational configurations.

Flange drilling patterns for valves with alternative pressure ratings may be at variance with flange dimensions given in AS/NZS 4087, and this must be considered when connecting pipework.

The Designer must consider the specific flange thickness of any valve offered by a vendor.

4.4.2 Minimum pressure rating

SA Water has established, for operational and maintenance purposes, a minimum pressure rating of PN16 for butterfly valves less than 375mm in diameter in SA Water’s pressurised water supply networks.

Lower pressure ratings may be specified if it is demonstrated that the lower pressure rating is sufficient for all possible design actions (loads, forces, and other conditions) and operational configurations (including urgent contingency system requirements) in the following applications.

Valves greater than 375mm in diameter in water systems (minimum allowable pressure rating is PN10).

4.5 Hydraulic and operational conditions

4.5.1 General hydraulic data

The complete range of operating conditions for the valve(s), including urgent contingency system requirements, must be identified by the Designer and all hydraulic conditions identified in TS 0147, including:

1. Maximum flow (instantaneous and sustained/continuous).
2. Minimum flow (instantaneous and sustained/continuous).
3. Flow direction (one-way or two-way).
4. Maximum pressure (under static, steady state and surge conditions).
5. Minimum pressure (under static, steady state and surge conditions) and including negative pressure(s).
6. Maximum differential pressure and the direction of application of this pressure (instantaneous and sustained/continuous).

The Designer should confirm in writing, using a valve datasheet (refer to SA Water typical butterfly valve datasheets), the hydraulic conditions to which any valve is proposed to be subject and the acceptance of these conditions by the Vendor before it is procured.

The range of operating conditions for any bypass valve(s) associated with the main valve, including urgent contingency system requirements, must also be identified by the Designer.

4.5.2 Cavitation data

The cavitation index for the valve(s), including the main valve and any bypass valve, under the following hydraulic and operational circumstances, must be determined by the Designer.

The cavitation index must be determined for the main and bypass valves for the above hydraulic and operational circumstances, regardless of whether the valve is to be used for either isolation or control and is actuated (or not).

The Designer should confirm in writing, preferably using a valve datasheet (refer to SA Water typical butterfly valve datasheets), the calculated cavitation indices, and time of intended operation under each condition, and the acceptance of these conditions by the vendor (including confirmation by the vendor that design life Requirements will be met for the valve operating under the specified conditions), before any valve is procured.

4.5.3 Number and speed of actuations

An actuation is defined as either one full stroke of a valve from closed to fully open or fully open to closed.

The number and frequency of actuations required of a valve over its design life must be identified and included in a valve datasheet (refer to SA Water typical butterfly valve datasheets). The vendor must confirm that the valve offered can achieve the required number of Actuations before any valve is procured.

The Designer must seek historical operational data from SA Water for any actuated valve that is a replacement for an existing valve, and this data shall be interpreted and included in the datasheet provided to the vendor for a new replacement valve.

The speed of Actuation is the time taken for the valve to operate from closed to fully open or fully open to closed if the rate of operation of the actuator is linear; and the actuator rpm is constant.

If the rate of operation of the actuator is non-linear, as the valve is operated from closed to fully open or fully open to closed, then the pattern of speed variation shall be documented by the Designer and the purpose for varying the speed presented to SA Water before any valve or actuator is purchased.

4.5.4 Hydraulic control sensitivity and losses

The relationship between the degree open (or position), differential head (or pressure) across and flow (or discharge) through a valve must be considered by the Designer in the context of the functional (operational) requirements for the valve and the specification developed to ensure the functional requirements are met. SA Water's typical valve datasheets require that valve vendors provide curves showing the degree of openness, differential head across, and flow through valves. Curves showing the relationship between the Cv (or Kv) value plotted against the degree open for the valve may be provided by valve Vendors as part of satisfying the requirements under this curve the method of derivation of Cv (or Kv) values and their units must be provided by the valve Vendor to the Designer. These curves must be calibrated based on actual valve tests and not solely theoretically developed by the Vendor and should be requested by the Designer for all isolation or control valves to be procured.

Curves for control valves must be assessed by the Designer upon receipt from potential valve Vendors to determine whether the sensitivity of the valve at different degrees open, with different differential heads or flows through the valve, is appropriate for the functional Requirements and use the curves to make comparisons between different valves that are offered during the procurement process. The Designer must confirm that any valve to be procured meets the sensitivity Requirements determined by the Designer. Valves with more control sensitivity are preferred. The control valve curves shall be forwarded to SA Water for its records.

Curves for isolation valves should be assessed by the Designer upon receipt from potential valve Vendors to confirm functional requirements can be met. The isolation valve curves shall be forwarded to SA Water for its records.

The Designer or Vendor must use the curves supplied by the valve Vendors to confirm the hydraulic losses across the valves when operated to their various degrees of opening as either control or isolation valves. The Designer must confirm that the magnitude of loss across any valve will not prevent the operation of the system in which the valve is installed; for example, the loss will not exceed a magnitude at which minimum pressures or flows are not delivered in a system. Valves with the least hydraulic loss in the fully open position may be preferred, and this characteristic must be considered by the Designer in the context of other technical characteristics of the valves before a technical selection is finalised. For other hydraulic information, refer to TS 0147 surge mitigation standard.

4.5.5 Straight upstream and downstream pipe lengths

The Designer must provide valve Vendors with a complete description of the layout and functional requirements of a system (where available) in which new or replacement valves are proposed as part of the specification or datasheets issued for the purpose of procuring the valves. This description must ensure that the valve Vendor is able to assess whether the hydraulic or other conditions associated with the installation will be suitable for the valve that is proposed. The vendor must have enough information such that the minimum upstream and downstream straight pipe lengths of the valve that are required can be confirmed. The Designer is responsible for verifying the assessment undertaken by the valve vendor and ensuring that there are no hydraulic or other mechanisms that will invalidate the Vendor’s assessment.

Alternatively, the Designer must request the hydraulic or other conditions that are required for the vendor’s valves to meet the design life and functionality requirements of this Technical

Standard. The Designer must request this information using the specification or datasheets for the valves. The Designer is then responsible for ensuring the hydraulic or other conditions specified by the valve Vendors are satisfied and that the valve will not shorten the design life or impinge on the functionality of other physical elements, for example, pumps, other valves, pipes, or any other element forming part of the system.

4.5.6 Manual operation

The number of turns required to close a valve from fully open shall be based on gear ratio and is to be provided by the valve manufacturer.

Where a valve is fitted with a handwheel, the maximum rim pull force required to operate the valve under the worst conditions of differential head, unseating, or urgent flows shall not be greater than 350Nm.

Where a valve is fitted with a spindle cap for manual operation by a valve key, the maximum torque required to operate the valve under the worst conditions of differential head, unseating, or urgent flows shall not exceed 180Nm.

4.5.7 Time to open/close

The time to open or close any valve must be specifically determined by the Designer over the entire range of operational conditions under which the valve needs to function throughout its design life. In making this determination, the Designer must consider:

1. The hydraulic requirements of the system into which the valve is to be installed, including, but not limited to, surge minimisation and consistent with SA Water TS 147 surge mitigation standard.
2. The hydraulic, mechanical or any other requirements of the valve or associated gearbox or actuator (including timers for actuators) such that the equipment specified by the Designer and supplied by the Vendor can function over the required operating range throughout the design life (for the valve, gearbox, actuator or any other supplied equipment).

In the case of valves used for control, from pumps or otherwise, the Designer must consider the requirements of the pumps or equipment, other than the control valve, which interacts with the control valve to achieve the desired hydraulic action of the system during start-up, steady state operation or stopping. The Designer must ensure that the valve vendor is informed of the intended use of the valve as a control valve and provide specific information regarding the flows, differential pressures, opening duration, closing duration, upstream/downstream straight lengths and any other relevant information that is required to ensure the valve Vendor can specify a valve that will function operationally over the valve’s entire design life. The Designer must pass information regarding the technical details of the intended control valve back to the pump or other equipment Vendors (or SA Water Workshop maintenance group in the case of existing equipment) to ensure that all elements in the final operating system are compatible and will function operationally over each piece of equipment’s respective design life.

4.5.8 Gearboxes

Gearboxes shall be IP68 rated where directly buried and IP56 rated for other installation environments, where the Designer determines that an IP56 rating is sufficient to achieve the design life and functional operation requirements stipulated in this Technical Standard. The Designer shall determine the requirement for and specification of additional protective wrappings for gearboxes in all installation environments.

The gearbox shall be specified and supplied in accordance with the applicable sections within this Technical Standard, including those relating to design life, maintenance requirements, and safety, such as gearbox ratios to achieve permissible manual actuation torques.

Gearboxes fitted to butterfly valves must be selected based on maximum differential pressure equal to the pressure rating of the valve. The maximum differential pressure must be identified in the valve datasheet for the purposes of sizing the gearbox. Determination of the maximum differential pressure shall include consideration of the following:

1. The presence of a bypass valve, which allows pressure to be equalised when operating the valve under static conditions.
2. Any requirement to close the valve under dynamic conditions, for example, when isolating during a pipe failure.
3. The potential for network changes, future or temporary, that may increase the differential pressure.
4. Gearbox selection must also consider the actuation methods that are likely to be available. When a powered actuator readily available at some locations, in which case the torque capacity and output speed of the actuator is to be considered.
5. Gearbox end stops shall be capable of withstanding an input shaft torque of 350Nm.

4.5.9 Seat velocities, wear, and sealing

The range of hydraulic and other functional conditions, including the durations throughout a valve's design life through which the valve will be operated at less than fully open positions, must be identified by the Designer in the specification or datasheet for the valves. The Vendor must provide curves for any proposed valve showing the degree open, differential head across and flow through the valve (see section 4.5.4 of this Technical Standard). The Vendor must also provide specific information demonstrating the wear resistance of the seat of any valve that the vendor proposes in response to a specification or datasheet. The resistance that is required is against hydraulic erosion or mechanical wear of the metal, epoxy coating, rubber insert or any other valve seat component during the operation of the valve under any specified hydraulic condition or in any operating position for the durations identified in the specification. The required resistance must be sufficient for the operational requirements of the valve to be fulfilled over its entire design life. The Designer must confirm that the information provided by a valve Vendor confirms that the operational requirements of the valve will be fulfilled over its design life before any valve is procured.

The physical, for example, erosion potential and chemical characteristics of the relevant fluid in a system must be identified by the Designer in accordance with the requirements of this Technical Standard, and this information must be supplied to the valve Vendor so that it can be considered in determining the valve seat configuration that will ensure the operational requirements of the valve are fulfilled over its entire design life. The vendor must use the information provided by the Designer to confirm that the physical and chemical characteristics of the relevant fluid will not adversely affect the valve sealing. The vendor must recommend valve seat configurations that will continue to seal over the design life of the valve, considering the information provided by the Designer.

Misalignment between the internal diameter of a valve and the internal diameter of the connected pipework (whether coated, lined or otherwise) upstream or downstream of the valve is not preferred as such misalignment can significantly increase the erosion potential in the valve seat or for the connecting flanges, that is, both valve and pipe flanges. The Designer must identify alternative options for avoiding the misalignment, including the use of customised pipe spools if a valve cannot be selected with an internal diameter that matches the internal diameter of the connected pipework. If a misalignment is unavoidable, then the Designer is to inform the valve vendor of the misalignment and obtain confirmation from the valve vendor that the misalignment will not impinge on the operational functionality of the valve or reduce its design life, for example, the internal coating specification could be modified.

The Designer must ensure that the pipework connected to the valve is not damaged by any misalignment and inform SA Water of the reasons why a misalignment is unavoidable.

4.5.10 Thrust – through body and flanges or other end connections

Thermal stresses and displacements in a valve must be determined by the Designer and this information must be provided to the valve vendor to ensure that the valve is able to meet its required design life. Thermal stresses and displacements in the pipework connected to the valve must also be determined by the Designer, and the pipework must be able to withstand these stresses and displacements, in addition to all other load actions, over the design life of the pipework. Thermal stresses and displacements must be determined by the Designer using the range of conditions and temperatures identified in Table 1based on the following installation temperature ranges:

- Above ground installation temperature range: 12°C to 20°C.
- Below ground installation temperature range: 12°C to 28°C.

The use of flexible or dismantling joints to accommodate thermal expansion or contraction in the bypass pipework or the effect of thermal expansion or contraction in the pipework connected to the valve must be considered by the Designer. If flexible or dismantling joints are not specified by the Designer, then the reasons for this must be documented by the Designer.

Table 1: Installation temperatures

Valve and pipe location	Sun Expose	Full or empty	Variation from installation temperature[1]
Above ground	full or part sun	Empty	-5°C to +43°C
	total shade	Empty	0°C to +35°C
Below ground	not applicable	Empty or Full	-5°C to +30°C

4.5.11 Disc orientation

Horizontal disc shafts are preferred to avoid accumulated sediment and debris potentially affecting the valve sealing or operation. Vertical disc shafts are permissible if a horizontal arrangement cannot be achieved, provided a technical explanation for the need for the vertical orientation is provided by the Designer to SA Water.

The preferred sealing direction of a valve shall be identified and considered when determining the orientation of the valve.

4.5.12 Bypass pipework and valves

Bypass valves are gate valves and the Requirement for bypass pipework and valves around isolation valves greater than 375mm in diameter must be assessed by the Designer, and the determination made by the Designer, and the technical reasons for them, provided to SA Water for its records. The Designer must confirm that any valve without a bypass valve will

[1] Based on historical SA Water guidelines and earlier technical practice documents.

be fit for all required operational purposes in its technical documentation provided to SA Water.

One purpose of the bypass valve is to enable the differential pressure across the main isolation valve, that is, the isolation valve around which the bypass pipework and valve are provided, to be temporarily reduced to enable the main isolation valve to be seated or unseated without undue stress on the main isolation valve components or avoid excessive manual torque input (if manual operation is required). Another purpose of a bypass valve is to facilitate the controlled re-filling of a pipe section that has been drained or is otherwise empty between two closed isolation valves. Bypass pipework and valves may be integral to the main isolation valve or installed independently around the main isolation valve by a branched connection from a spool upstream to a spool downstream of the main isolation valve with the bypass valve located in the pipework formed by the branched connection.

The bypass valve shall be considered independent valve and meet the requirements of TS 0230.1 standard. The bypass valve shall be considered as a control valve. The bypass pipework and valve must be selected and sized by the Designer such that the pressure drop and flow in the bypass pipework and valve are not excessive and do not cause damage to line (if any), erosion or cavitation damage, to the bypass pipework and valve or the main isolation valve. The Designer may use one or two bypass valves per main isolation valve (two bypass valves would be configured in parallel bypass pipework). The maximum flow velocity through the bypass pipework and valves must be confirmed by the Designer and not exceed the limits for the pipework (and any lining) or the valves including seat velocity limits over the entire range of operating conditions. The Designer must obtain the flow velocity limits from the vendor through the bypass pipework and valves before procurement. The Designer must inform the vendor of the cumulative time over which the bypass pipework and valves will be operated during main isolation valve seating or unseating operations (and the cavitation index during these operations) over the design life of the equipment. The Designer may consult with SA Water to determine the typical time (based on re-fill rates or otherwise) and frequency of operation of a bypass valve and use this information to estimate the cumulative time over which the bypass pipework and valves will be operated. The design life of the bypass pipework and valves must match that of the main isolation valve. Lobster back bends are not preferred for bypass pipework.

cases (including non-actuated), the opening and closing sequence for the main isolation and bypass valves shall be as specified in Table 2 and Table 3:

Table 2: Opening sequence

Opening Sequence – main valve initially closed		
Step	**Action**	**Comment**
1	Open bypass valve (if closed)[2]	Maximum velocity through bypass pipework and valves
2	Open main isolation valve	Open main isolation valve
3	Close bypass valve	Can only be left open if hydraulic measures prevent

Table 3: Closing sequence

Opening Sequence – main valve initially open		
Step	**Action**	**Comment**
1	Open bypass valve	Can only be already open if hydraulic measures prevent cavitation or any other form of damage
2	Close main isolation valve	Close main isolation valve
3	Close bypass valve	Maximum velocity through bypass pipework and valves

[2] If there is a relatively high-pressure differential across the main valve when closed, then the bypass valve should be normally closed to avoid high-velocity flow (>4m/s) through the bypass valve. If there is a relatively low-pressure differential across the main valve when closed, and lower flow velocity occurs through the bypass valve (<4m/s), then the bypass valve should normally be open to assist with water circulation.

The bypass pipework and valves are also required for pipeline filling and draining operations. Hydraulic analysis of the pipeline system in which the isolation valve is to be installed must be conducted by the Designer to determine the full range of hydraulic conditions (including pressure drops and flows) under which the bypass pipework and valves are required to operate without damage. The cumulative time over which the bypass pipework and valves are required to operate for pipeline filling and draining and corresponding hydraulic conditions must be identified by the Designer such that the vendor supplying the pipework and valves can correctly identify the operating conditions under which the bypass pipework and valves will be required to operate over the design life of the bypass pipework and valves. The Designer may consult with SA Water to determine the typical time (based on re-fill rates or otherwise) and frequency of operation of a bypass valve and use this information to estimate the cumulative time over which the bypass pipework and valves will be operated.

Bypass pipework and valves are typically provided for control valves but may not be installed subject to the Designer providing a technical justification for not installing the bypass pipework and valves. Any technical justification for not installing bypass pipework and valves for control valves must be confirmed in writing, and the impact of this accepted by the Vendor for the main valve before any main valve is procured.

The bypass pipework incorporating the bypass valves shall include flexible or dismantling joints (or otherwise allow for movement and stress relief), as technically appropriate.

The amount of thermal expansion or contraction in the bypass and main valve pipework, allowing for movement at all flexible or dismantling joints, must be determined by the Designer and the pipework and joints designed and specified to avoid any thermal stresses on the bypass or main valves while pressure thrusts are still restrained.

The relevant temperature changes to be used by the Designer when determining thermal stresses and displacements are specified in Table 1 above.

4.5.13 Safety – Isolations (requirement for double isolation)

There are number of circumstances under which the requirements for double isolations using butterfly valves must be considered. These circumstances are described below, together with the approach to the risk assessment of the requirement for double isolation by Designer with operations, assets, engineering, and SA Water stakeholders.

4.5.13.1 Construction

When new or existing valves by Constructors is used to provide isolations for new projects delivered by the Constructor for new pipework, a risk assessment must be conducted by the Constructor that considers confirmed confined spaces or otherwise hazardous conditions and follow all applicable processes stipulated by Work Health and Safety or Safety in Design Legislation and Regulations.

If the new or existing valves are to be used for SA Water operation and maintenance in new or existing systems, then these valves must be assessed as stipulated under section 4.5.13.2 or 4.5.13.4 below.

4.5.13.2 Operation and maintenance of new valves in systems

When new valves installed in new or existing systems, where SA Water will take over the operation and maintenance of the completed project, a risk assessment must be conducted by the designer or Constructor using the SA Water Risk Assessment Process (as stipulated at the time by the SA Water Risk Group) with SA Water stakeholders involved from SA Water Assets, Operations and Engineering. This risk assessment must determine whether the requirement for the ongoing operation or maintenance of the system can be safely achieved by using double isolation valves to achieve effective isolation. The nature of the ongoing operation and maintenance activities must be fully described:

1. Working with reliance on valve isolation above ground with ready unrestricted escape route(s).

2. Working with reliance on valve isolation in a trench or pit excavation below ground with restricted escape route(s).
3. Working with reliance on valve isolation in an internal environment with restricted escape route(s).
4. Working inside a pipe downstream of an isolation valve with withdrawal from the pipe as the only escape route.
5. All other possible working arrangements with reliance on a valve isolation.

The risk assessment conducted by the Designer or Constructor must consider confirmed confined spaces or otherwise hazardous conditions and follow all applicable processes stipulated by Work Health and Safety or Safety in Design Legislation and Regulations.

The use of a butterfly valve does not mean double isolation, the closure of two valves (or a valve and another isolating device) in series, is automatically required for operations where the valve is used to isolate water from a work area. The specific mechanical configuration of the proposed butterfly valve must be obtained from the vendor by the Designer and analysed prior to the risk assessment. This is to ensure that there is no possible mechanism for a sudden failure of any component and the rapid and unexpected opening of the disc. Fitted locking mechanisms on the spindle/actuator can be specified to ensure no possible inadvertent operation of the valve or otherwise prevent unintended/uncontrolled opening of the valve.

4.5.13.3 Partial double isolation

The use of partial double isolations may be considered by Designer with risk assessment.

4.5.13.4 Operation and maintenance of existing valves in systems

In the case of existing valves installed in new or existing systems, for example, the use of an existing valve to facilitate isolations, all the requirements identified in section 4.5.13.2 with regard to the design, specification and risk assessment of new valves must be applied. The outcome from this risk assessment may require that other methods of isolation, or additional practical precautions, may be required to confirm a safe working environment can be established.

5 Specification requirements

5.1 General

5.1.1 Water quality parameters

The following physical and chemical water quality parameters must be identified in all specifications and datasheets by Designer. Sensitivity to particulate matter in the water or wastewater must be addressed by the valve vendor in the specification and datasheet for all valves.

Characteristics of the water or wastewater, including chemical composition and physical consistency (raw or treated water and raw or recycled wastewater):

1. Physical composition:
   a. Solids content (and size or grading of solids if applicable).
   b. Temperature range.
   c. Water density.
   d. Wastewater density.
   e. Rheology of wastewater (sludge or other similar fluids).
   f. Percentage of entrained air (if applicable).
2. Chemical composition:
   a. pH.
   b. Conductivity.
   c. Total Dissolved Solids.
   d. Chlorides.
   e. Free chlorine.
   f. Free gases.
   g. Other chemicals.

Valves must be able to achieve the design life specified in this standard when exposed to and operated in the chemical environment defined in the specification datasheet.

All valve components in contact with drinking water must comply with TS 0800 standard.

5.1.2 Configuration, dimensional and structural considerations

The valve configuration and other details listed below must be identified by the Designer in the specification and datasheet:

1. The Designer must identify the orientation of a valve to ensure, among other things, that the valve can be physically installed and removed for maintenance, that any gearbox can be fitted and operated, and that the preferred operating direction of a valve is achieved.
2. The Designer must confirm, with both the vendor and SA Water, whether a valve is to be buried or not. Dismantling joints must not be directly buried, and so in cases where a dismantling joint is specified with a valve by the Designer, the valve must be installed aboveground or in a chamber.

3. The environmental conditions in which the valve will be installed must be identified by the Designer to ensure that appropriate protective mechanisms are also specified for the valve and to ensure that installation environment information is provided to the valve vendor.
4. The Designer must confirm the minimum distance that is required between a valve and another equipment, i.e. flowmeter or pump, to avoid causing either a problem in the installation or operation of the valve or other equipment.
5. The Designer must confirm whether a valve will be installed in a chamber (above or below ground) and what the access arrangements are within this chamber. Any chamber and its method of entry/exit must comply with SA Water WHS requirements. The Designer must also specify whether any chamber is used to support gravity, thrust or any other type of load that would result in the failure of the valve either physical or operational.

5.1.3 Flanges

The valve flange thicknesses shall meet or exceed the requirements of AS 4087 flange standards. Depending on the structural characteristics of the materials comprising the valve body and flanges and the interaction of the forces throughout the valve body and flanges for all load cases including hydraulic, a Designer may request a valve vendor provide test records, structural calculations or Finite Element Analysis (FEA) to confirm the adequacy of the thickness of a valves flanges for structural strength, fatigue and deflection. The Designer must undertake an assessment of the technical risk of structural flexibility of a valve, including flanges, deflecting under pressure tests, bolt tightening during installation or under any other circumstances such that tests are failed, or deflection limits are exceeded.

A Designer can specify that a valve must have its flanges drilled to a pattern from AS 4087 standards. Any other pattern required technical dispensation TDRF from principal mechanical engineer.

Any Designer that is involved in the specification of valve flanges that are to be installed by an SA Water Workshop must contact the relevant SA Water Workshop and confirm the requirement for either raised or flat face (with O-ring or gasket) flanges.

The specification for uncoated flanges (raised or flat face) prepared by the Designer must include tolerances on the surface roughness of the flanges that are sufficient to enable sealing of the valve flanges with adjacent pipe spools upon installation in cases where gaskets or O-rings are used, with tightening torques in the ranges prescribed in WSA 109. The specification by the Designer must state that the valve flanges required surface finish shall comply in accordance with TS15, TS16, and TS18 technical material standards and design life Requirements identified in section 4.1 of this Technical Standard.

tightening torques shall be in the ranges prescribed in WSA 109.

Consideration may be given by the Designer to specifying valves without coatings on the flange faces but this specification must be provided to the valve vendor, including water or wastewater quality parameters and internal dimensions of mating flanges, so that the vendor can state whether the use of uncoated flange face will lead to corrosion of the flange faces, bolts or any other component within the valve before the prescribed design life from section 4.1 is achieved. This enquiry by the Designer with the valve Vendor must be made before the valve is procured.

5.1.4 Vibration performance

The Designer must request vibration data from valve vendors for the most adverse conditions under which the valve will be operated. It is the responsibility of the Designer to identify the most adverse conditions under which a valve will be operated (either intermittently or continuously) and include this information in the specification and datasheet as a compliance condition that the valve vendor must address before any valve is procured. The Designer must confirm that under any operating condition, the valve proposed by the vendor will not suffer damage from vibration to any components in any way that will reduce the operational use or life of the valve. Vibration that leads to more frequent maintenance than identified at the time of procuring the valve is deemed a reduction in the operational use or life of the valve.

Valves must not move from positions set using either an actuator or manually, have bolts come loose, incur damage to seats or in any other way develop faults or defects due to vibration when operated within the range of operational conditions defined by the Designer in the specification and datasheet.

Designers or Constructor must ensure that connected pipework (including extent of fixing as well as the structural and hydraulic effects of bends or any other equipment), supports and any other elements that can affect the vibration meet the requirements stipulated by the valve vendors to achieve anticipated vibration levels.

5.1.5 Noise levels

If the valves to be procured are operated in a way that may result in problematic hydraulic noise levels in noise-sensitive environments, then the Designer shall request that the valve vendor provide the noise level information shown in the table below and identify the requested information in the specification and datasheet. Isolation valves are unlikely to be problematic in noise-sensitive environments, even if they are noisy, provided the frequency of their operation is deemed sufficiently infrequent. Control valves may be more problematic and may generate greater levels of noise more frequently in noise-sensitive environments. Designers or Constructors must contact SA Water to confirm whether a particular environment is noise-sensitive and what level of noise, or frequency of occurrence of noise, is considered problematic.

5.1.6 Coatings

Fusion bonded epoxy (FBE), ceramic, or other SA Water approved epoxy for internal coatings are required inside the body of cast iron, ductile iron, or steel body valves. All FBE coatings are to be in accordance with AS 4158.

In potable water applications, all coatings must be certified as AS/NZS 4020 compliant and suitable for contact with drinking water. FBE internal and external coatings must be applied with the requirements of SA Water TS 15, TS 16 or TS 18 including the required finished thickness of application. The valve vendor is to confirm compliance with the Requirements of TS 15, TS 16 or TS 18 before the award of any supply contract.

In raw water, wastewater or other applications, coatings may not need to be certified as AS/NZS 4020 compliant, provided there is no direct or indirect risk to human health. FBE, ceramic, or other epoxy internal coatings must be specified with explicit consideration of the physical and chemical characteristics of the fluid in contact with the internal surfaces within the valve. The Designer must ensure that the internal coating specified will achieve the minimum required design life as stipulated in section 4.1 above (or greater if required by the requirements of a project brief or known operational circumstances).

External coatings for valves vary considerably in terms of specification requirements depending on the physical and chemical characteristics of the location in which the valves are installed (internally, externally, aboveground, buried, or other). Refer to TS 15, TS 16 or TS 18 for further requirements.

Valves within internal buildings or external environments that are not aggressive shall comply with TS 16 and Ts 18 requirements. In internal or external environments that are aggressive, the coating specification should be adjusted by the Designer to achieve the minimum required design life as stipulated in section 4.1 above.

The Designer is responsible for determining whether wrapping is required to achieve the design life of the valves and ensuring compliance with TS18.

It is common for valve coatings to be damaged after leaving the vendor factory. The Designer shall obtain from the vendor the repair specification for the coating, including the type of material used, its method of application, its compliance with AS/NZS 4020 including relevant and current certificate of compliance with AS/NZS 4020, and the time to obtain the coating repair material. The valve is not to be procured before this information is obtained by the Designer, and it has been confirmed that the repair coating will be satisfactory, and its acquisition or application will not cause additional project costs or delays if damaged valve coatings need to be repaired. Spark testing of coating repairs is required.

5.1.7 Hydraulic requirements

There are several hydraulic Requirements or performance capabilities for valves that must be assessed by the Designer to ensure that the valve will operate as functionally required over its specified design life. For additional hydraulic requirements refer to SA Water TS 0147 standard:

1. The cavitation index of the valve installation must be determined by the Designer for all instantaneous, intermittent and continuous operating hydraulic conditions (refer to section 4.4.2) to confirm that the valve will not cavitate in a way or for a duration that is inconsistent with the Vendor's knowledge at the time the valve was procured or is likely to cause damage.
2. In case if mass production or special application valve is required, then the Designer must enquire with the vendor to determine whether any hydraulic testing or theoretical Computational Fluid Dynamics (CFD) analysis of the valve has been conducted by the vendor. If hydraulic testing or theoretical CFD analysis of the valve has been conducted, then the Designer must technically assess the valve before it is procured. Any hydraulic testing or theoretical CFD analysis of the valve obtained by the Designer must be provided to SA Water for records.
3. The method of resisting hydraulic forces (and force imbalances) within a valve shall be determined by the Designer to ensure that thrusts are appropriately transferred to the body of the valve.
4. The hydraulic curves for any isolation or control valve must be obtained from the vendor, and the relationships between the degree open, differential head across, and flow through a valve must be considered by the Designer.

5.1.8 Maintenance requirements

The maintenance requirements for a valve (including criteria identified in a datasheet or returnable schedule customised to suit specific application requirements by the Designer)shall be considered by SA Water Procurement as potential weighted criteria in any Request for Tender process or market approach document and the evaluation of these criteria shall be such that valves are not procured which cannot be efficiently or safely maintained by SA Water Operations and Maintenance (or its Constructor). The maintenance Requirements for a valve are to be explicitly obtained in writing from the Vendor by the Designer and provided to SA Water for assessment before any order for a valve is finalised.

In circumstances where valves are directly purchased on a project with a supporting specification from a Designer (including criteria identified in a datasheet or returnable schedule customised to suit specific application requirements by the Designer), the specification used shall refer to this Technical Standard and the information regarding maintenance that is to be provided to SA Water before any valve order is finalised. This section applies to valve purchases made by SA Water Workshops.

5.1.9 Electric actuators

Electric actuators for valves must be rated for continuous run time not less than consecutive close and open cycles, that is, two full strokes.

5.1.10 Torque-limiting devices

Torque-limiting devices shall not be specified for any valve unless there are special circumstances requiring their inclusion, and only after seeking approval from principal mechanical engineer.

5.2 Butterfly isolation and control valves (water only)

The minimum Requirements identified in AS 4795.1 or AS 4795.2, in all regards, shall apply if not exceeded or added to the following sections or specification datasheet.

The following parameters are to be specifically identified in the valve specifications, with items listed to be raised and closed out by valve vendors by the Designer before any valve is procured.

5.2.1 Configuration, dimensional and structural considerations

Wafer butterfly valves may only be used where:

1. The proposed installation is above ground.
2. The valve diameter is less than 100mm.
3. The system pressure is less than or equal to PN16 (unless explicitly guaranteed for a higher rating by a valve vendor).
4. The valve is not used for end of pipeline isolation.
5. Lugged butterfly valves must only be used where the proposed installation is above ground.
6. Flanged butterfly valves can be used where the proposed installation is above or below ground.
7. The system pressure is less than or equal to PN35.
8. Butterfly valves are not suitable for throttling (unless explicitly guaranteed by valve vendor).

Interference between any proposed wafer or lugged butterfly valve and the adjoining upstream and downstream pipework must be checked by the Designer before the procurement of wafer or lugged valves.

5.2.2 Body

The valve body must pass all tests from AS 4795.1 and AS 4795.2 and as otherwise stipulated in this Technical Standard.

The valve body must either be constructed from a material that will not corrode or be coated to prevent corrosion over the design life for the valve.

5.2.3 Body inserts or liners

Non-bonded EPDM liners may be considered by the Designer where the valves are required for either isolation or control, are actuated less than once per three months for maintenance work and are aboveground and accessible for periodic replacement of the non-bonded rubber liners.

For potable water systems, any insert or liner (or other internal rubber component) must comply with the requirements of TS 0800. The Designer must request the certificate of compliance with AS/NZS 4020 for the body insert material the valve Vendor is proposing to use, and the valve must not be procured until this certificate of compliance is provided by the Vendor. The material type and chemical characteristics of the body insert (including vulcanised liners) must be confirmed by the Designer before any valve is procured.

The Designer shall request a detailed Inspection Test Plan (ITP) for any vulcanised rubber liners where required under this Technical Standard. The ITP provided by the Vendor shall, among other things, explicitly include the pre-heating, application and curing times and temperatures used in the manufacturing process for the valve and the liner material.

The Designer must request the minimum adhesive bond strength and compression set (or memory) values required for the valve from any vendor with a vulcanised EPDM liner before any valve is procured. The Designer shall include in the specifications for the valve the requirement for a bond strength and compression set test piece or tab such that the strength of the adhesive bond between the vulcanised liner and valve body wall can be confirmed for each valve supplied by the Vendor.

SA Water recognises the following international standards for testing adhesive bond and compression sets:

- ASTM D429 - 14 Standard Test Methods for Rubber Property - Adhesion to Rigid Substrates Test Method D Post Vulcanisation Bonding of Rubber to Metal.
- ASTM D395 - 16 Standard Test Methods for Rubber Property - Compression Set.

The Adhesive bonding and compression set testing is to be conducted to the methods documented in the ASTM standards. Other testing methods or standards may be considered by submission of TDRF to principal mechanical engineer. The Designer will need to demonstrate the suitability of the alternate testing method(s) or standards to SA Water.

The Designer must confirm whether a valve vendor will utilise a third-party factory testing for the vulcanisation of a valve liner. If so, the Designer must obtain the third-party factory's Inspection and Test Plan (ITP) and all other manufacturing process details such that the information required under this section can be confirmed as appropriate by the Designer before any valve is procured.

5.2.4 Body seat ring

Stainless steel welded overlay seats for butterfly valves are not preferred when the valve bodies are cast or ductile iron because of the potential for carbon transfer during welding from the valve bodies to the welded overlay. The failure of butterfly valves due to the use of welded overlay seats and carbon transfer from the valve body has occurred in SA Water systems. If the options for the procurement of a butterfly valve are limited, or for other reasons, a valve with a welded overlay seat is required, then the Designer must obtain specific details of the materials and welding process proposed for valve seat and confirm that there will be no carbon transfer or other associated defect that reduces the design life of the valve. "Nickel buttering" layers are preferred in a valve when a welded overlay seat is required. Only specific stainless-steel compositions can be considered for welded overlay seats, and the composition proposed by a Vendor must be identified by the Designer and confirmed as appropriate for the valve's required design life. The Designer must submit detailed information from the valve vendor related to the welded overlay seat and valve body, including materials used and welding processes, to SA Water before the procurement of any butterfly valve with a cast or ductile iron body and welded overlay seat.

Welded overlay seats for butterfly valves may be used when the valve bodies are cast or fabricated steel because carbon transfer during welding from the valve bodies to or from the welded overlay can be controlled, and the overall design life of the valve is not affected. The Designer must submit detailed information from the valve vendor related to the welded overlay seat and valve body, including materials used and welding processes, to SA Water before the procurement of any butterfly valve with a cast or fabricated steel body and welded overlay seat.

Push-fit seat rings (including body seat or disc rings) can be used for butterfly valves provided the Designer confirms the method of installation and removal of the seat ring, any repair method, materials and that the required design life for the valve will be achieved. If pins are relied upon to hold a seat ring in place, then the Designer must obtain details of the pin material, the method of fixing, for example, interference fit, welding or heat deformation, from the Vendor and the Designer must determine whether there is any potential for dissimilar metal or crevice corrosion and a reduction in the required design life (of the valve or components within it). The specification of coatings for wetted valve components susceptible to any form of corrosion shall be considered by the Designer, and reasons for the non-specification of such coatings shall be provided to SA Water. Any coatings specified shall be in accordance with the requirements of this Technical Standard.

If a body seat ring welded overlay is incorporated in a valve in accordance with section 5.2.4 above, then the testing requirements identified in AS 4795.2 apply in addition to any other testing requirements identified by the Designer that are required to comply with section 5.2.4.

5.2.5 Disc and shaft connections

The valve disc must pass all tests from AS 4795.1 or AS 4795.2 and as otherwise stipulated in this Technical Standard.

The valve disc must either be constructed from a material that will not corrode or be coated (or encapsulated) to prevent corrosion over the design life for the valve.

The preferred method of connection between the valve disc and shaft is via disc shafts that geometrically interfere with the disc shaft housing, that is, the use of non-circular shaft sections and disc housings. The use of a keyed connection between the valve disc and shaft is satisfactory, provided the Designer confirms the minimum shear strength of the keyed connection where a maximum test or operational torque occurs or maximum pressure occurs on one side of the valve, and the other side is open to atmosphere.

1. Pinned connections between valve disc and shaft are not preferred, except in:
   a. High-performance valves using taper pins, and where the Designer confirms full compliance with the Technical Standard.
   b. The minimum shear strength of the pinned connection must be confirmed under:
   c. Maximum test or operational torque, or
   d. Maximum pressure on one side of the valve (with the other side open to atmosphere).
2. The must obtain specific details from the Vendor regarding the disc, shaft, and connecting pins.
3. It must be confirmed there will be no corrosion of the disc, shaft, or connecting pin.
4. No other defect will occur that could reduce the valve's design life.
5. Disc pin connections are unacceptable if:
   a. Dissimilar metals,
   b. Crevice corrosion, or
   c. Any other form of corrosion could compromise strength or functionality over the valve's design life.

6. If pins are used in combination with keyed connections, there must be no corrosion that reduces the initial (pre-installation) strength or functionality of either component.

5.2.6 Shaft

The Designer shall explicitly obtain from the vendor, using a returnable datasheet or otherwise, the shaft material type and diameter and confirm that the shaft material type and diameter will enable the valve to remain fully functional over the design life for the valve. The Designer must confirm that the shaft will maintain its relative position within the valve body to all initial (before installation) tolerances, such that internal disc seals and any external seals remain fully functional over the design life for the valve.

The Designer shall explicitly obtain from the vendor, using a returnable datasheet or otherwise, the seating/unseating torque, maximum opening torque and maximum closing torque for the valve (under the operational condition that gives the maximum seating/unseating torque) and confirm the factor of safety for the shaft strength during valve seating/unseating. The Designer must inform SA Water if there is more than a 10 per cent variation in the factors of safety for the different valve shafts during valve seating/unseating when valves that are being offered are technically assessed prior to the procurement of any valve.

5.2.7 Shaft bearings

Thrust bearings, if required, shall be specified to be able to resist all axial loads and radial loads.

Bearings shall be able to accommodate variations in shaft geometry with temperature.

The materials used in the bearings are to be identified by the valve Vendor.

The maintenance requirements for the bearing systems are to be identified by the vendor in the returned datasheets prior to the procurement of the valve.

5.2.8 Seals and O-rings

Specific operational or maintenance requirements for the seals must be identified by the valve vendor, including lubrication and access for maintenance Requirements, in the returned datasheets prior to valve procurement.

6 Testing

6.1 Factory testing

All factory tests, as stipulated in AS4795.1, AS 4795.2 and AS 6401, and as otherwise identified in this standard, must be requested of the valve Vendor via the specification and datasheet prepared by the Designer. Some tests are listed as optional or not mandatory in the Australian Standards, in which case the requirements of this Technical Standard must be followed, and SA Water is contacted to determine which testing is required if it is unclear. Required tests shall be identified in the specification and datasheet prepared by the Designer before the procurement of any valve. No valve shall be shipped from the factory until all required tests have been conducted, the results are communicated to SA Water, and SA Water has formally confirmed receipt of the test results. Depending on the contractual arrangements for the supply of the valve(s) and the terms of the specification and datasheet, SA Water may need to provide formal approval before any valves are shipped from the factory. Any such approval from SA Water will be based on independent third-party witnessing and certification of the valves if required in accordance with this standard.

6.1.1 Factory testing (unwitnessed)

Unwitnessed valve test results (factory test results), conducted in accordance with this standard, must be provided to SA Water in writing, and no valves must be shipped until SA Water has formally confirmed receipt of the test results for all water and wastewater valves with a diameter above 375mm. Formal confirmation of the receipt of the test results by SA Water under this section does not constitute approval or acceptance of the valves. Approval or acceptance of the valves will be governed by the terms of the contract(s) for the supply of the valves.

Unwitnessed valve test results may be required under contracts referring to Australian Standards or TS0503 SA Water approved product Standard for valves with a diameter less than or equal to 375mm. The requirements of this standard can be extended to valves with a diameter less than or equal to 375mm if the contract for the supply of the valves makes this standard applicable. All SA Water groups (including, but not limited to, SA Water Capital Delivery, Operations, Workshops, Assets and Procurement) involved in the delivery of valves with a diameter less than or equal to 375mm should explicitly confirm with the designer or Constructor, and SA Water Procurement, regardless of application of this standard.

6.1.2 Factory testing (witnessed)

Witnessed valve test results (factory test results), conducted in accordance with this standard, must be provided to SA Water in writing, and no valves must be shipped until SA Water has formally confirmed receipt of the test results for water and wastewater valves with a diameter above 375mm when the relevant contracts for the supply of the valves stipulate that witnessed testing is required. Formal confirmation of the receipt of the test results by SA Water under this section does not constitute approval or acceptance of the valves. Approval or acceptance of the valves will be governed by the terms of the contract(s) for the supply of the valves.

If SA Water stipulates, based on an assessment of the criteria identified below, that the relevant contracts for the supply of the valves shall include witnessed valve testing, then the Designer, or any other party purchasing the valves, shall include the requirement for witnessed valve testing in accordance with this Technical Standard in all subsequent contracts and the specification and datasheet for the valve(s).

Planning for witnessed tests must be coordinated through SA Water. The Constructor (or any other party purchasing the valve(s)) or valve vendor intending to test the valve(s) must provide thirty (30) working days of notice prior to factory testing so that arrangements can be made through SA Water for witnessing of the tests. Witnessing must be undertaken by SA Water or a suitably qualified third-party witness. SA Water determines whether a third-party witness is suitably qualified using its assessment criteria.

SA Water will assess the witnessed factory test results and approve or disapprove shipping within ten (10) working days.

6.2 Factory valve test requirements

The Designer must state in the valve specifications that detailed engineering drawings specific to the valve to be procured must be provided within two weeks of a contract for the supply of the valve being entered. These drawings must include, for example, among other things, the dimensions and details of all valve elements, sections through the valve seat showing a method of construction/assembly and shaft-to-disc connection details (for butterfly valves). The Designer must include, in the specification, requests for any other detailed engineering drawings considered relevant to confirming the information provided by the Vendor prior to procurement of the valve. The Designer must also include mechanisms in the specification for holding the delivery of any valve where the detailed drawings do not comply with the pre-procurement information provided by the Vendor or show details that mean the valve will not comply with the design life or operational and maintenance requirements of this Technical Standard.

The Designer or Constructor must state in the specification for the valves that Inspection Test Plans (ITPs), including the requirements identified in this Technical Standard, be prepared by the valve vendor and issued for review and approval by the Designer or Constructor before any valves are shipped from factories (or other points of origin).

6.2.1 Type and production tests

Type and production tests must be carried out as required and described in AS4795.1 and AS 4795.2 and as otherwise required or described in this Technical Standard. The results of the type testing must be requested, obtained, and confirmed as satisfactory by the Designer before any valve is procured.

6.2.2 Dimensional measurements

All dimensions of the valves must be measured and recorded, including overall length, width, height, internal diameter, and flange dimensions including pitch circle diameter, thickness, and number of bolts.

6.2.3 Visual checks

The position of all moving components must be checked with the valve in an open and closed position (including limit positions).

The free movement of all moving components from an open too closed to an open position must be checked.

Internal and external coatings must be checked for any visually detectable defects.

6.2.4 Materials certifications

Materials certificates for the valves, including the body, wedge or disc, seats, shafts, and all other components, must be provided.

6.2.5 Pressure tests

6.2.5.1 Wafer and lugged butterfly valves

Type testing of the wafer and lugged butterfly valves is acceptable when the pressure rating is less than or equal to PN16, and the criticality of the valves has been assessed in accordance with this Technical Standard (including section 4.2) and the Designer has confirmed with SA Water that the criticality is low and type testing of the valve type to be procured is sufficient.

Type testing must be conducted in accordance with AS 4795.1. The results of the type of pressure testing must be requested, obtained, and confirmed as satisfactory by the Designer before any valve is procured.

Production testing of the wafer and lugged butterfly valves is required when the pressure rating is greater than PN16 or the criticality of the valves has been assessed in accordance with this Technical Standard (including section 4.2) and the Designer has confirmed with SA Water that the criticality is sufficient to warrant production testing of the valve to be procured.

Production pressure testing of all wafer and lugged butterfly valves must be conducted in accordance with AS 4795.1, witnessed and recorded, and as described in section 6.2.5.2 below, except that "free-end" testing shall only be conducted for lugged butterfly valves. Sealing tests shall be conducted for wafer butterfly valves in accordance with AS 4795.1 such that the downstream disc face fully visible during the test (both valve flanges can be supported while still achieving a greater level of flange restraint than for a "free end" test).

6.2.5.2 Double-flanged butterfly valves

Type testing of double-flanged butterfly valves is acceptable when the pressure rating is less than or equal to PN16, and the criticality of the valves has been assessed in accordance with this Technical Standard and the Designer has confirmed with SA Water that the criticality is low and type testing of the valve type to be procured is sufficient.

Type testing must be conducted in accordance with AS 4795.2. The results of the type of pressure testing must be requested, obtained, and confirmed as satisfactory by the Designer before any valve is procured.

Production testing of double-flanged butterfly valves is required when the pressure rating is greater than PN16 or the criticality of the valves has been assessed in accordance with this Technical Standard (including section 4.2) and the Designer has confirmed with SA Water that the criticality is sufficient to warrant production testing of the valve to be procured.

Production pressure testing of all double-flanged butterfly valves must be conducted in accordance with AS 4795.2 and witnessed and recorded as follows (and in the order listed):

1. **Body Strength:**

   With reference to AS 4795.2, a blank flange can be fitted to both end flanges of a valve and the enclosed volume filled with water. Alternatively, a single blank flange can be fitted to one side of the valve and tested, and this process can be repeated for the other side of the valve. Pressure testing must be conducted to 1.5 times the pressure rating for the valve, and this pressure is sustained for ten (10) minutes for all valve sizes with no detectable leakage through the valve shaft seal or any other part of the valve body. There shall be no plastic (permanent) deformation or distortion of the valve body or components.

2. Disc Strength Test:

With reference to AS 4795.2, a blank flange must be fitted to one side of the valve, and the disc must be closed (to its mechanical limit stops), with the enclosed volume filled with water. Pressure testing must be conducted to 1.5 times the pressure rating for the valve, and this pressure is sustained for ten (10) minutes for all valve sizes with no plastic (permanent) deformation or distortion of the valve body or components. Seat leakage is permissible during this test but must be determined and forwarded to the Designer. For an eccentric valve that is required to seal bi-directionally, this test must be repeated on the other side of the valve.

3. Forward Sealing Test:

With reference to AS 4795.2, a blank flange must be fitted to one side of the valve only, and the disc must be closed (to its mechanical limit stops) with the enclosed volume filled with water. If a second flange has been fitted for a body strength test or any other reason, then this flange must be removed so that the disc is fully visible during the test. The valve must be supported and secured by the flange to which the blank has been applied, that is, the upstream flange, in accordance with the “free end” test requirements listed under AS 4795.2. Pressure testing must be conducted to 1.1 times the pressure rating for the valve in the preferred sealing direction, and this pressure must be sustained for ten (10) minutes (for all valve sizes) with no leakage (this is to be confirmed visually and by reference to connected pressure gauges).

4. Reverse Sealing Test:

For a valve that is required to seal bi-directionally, the requirements of the forward sealing test identified above must be applied with the blank flange fitted to the other side of the valve. With reference to AS 4795.2, pressure testing must be conducted to 1.1 times the pressure rating for the valve, in the non-preferred sealing direction and opposite to the direction for the forward sealing test, and this pressure sustained for ten (10) minutes (for all valve sizes) with no leakage (this is to be confirmed visually and by reference to connected pressure gauges).

6.2.6 Noise tests

Noise tests are required for control valves greater than 375mm in diameter where the valves are being installed in noise-sensitive installations such as where compliance with Environment Protection Agency (EPA) limits is required.

Noise levels should be measured on the upstream and downstream side of the control valve when installed in a factory hydraulic test rig with the valve partially open and at the differential pressure and flow conditions which generate maximum noise emissions. The sound pressure level (@ 1m) and sound power levels must be measured with the valve partially open and the hydraulic conditions which generate maximum noise established.

6.2.7 Other tests (including coating tests)

If internal or external coatings have been applied, then testing and then certification of the method of application, coverage, and thickness (including spark testing) of the coating shall be provided to the designer or Constructor for approval (and written notification of the results must be provided to SA Water confirming compliance with all SA Water Materials Group standards). If the testing or certification does not comply with SA Water standards or Australian Standards, then SA Water may request third-party testing and certification of the internal or external coatings.

All internal wetted coatings, for double flanged butterfly valves subject to production testing, must be tested in accordance with AS 4795.2.

6.2.8 Certified Drawings

Certified dimensional engineering drawings of valves must be provided within four (4) weeks of entering a contract for the procurement of the equipment unless otherwise negotiated in the contract (if a longer period is negotiated by a Designer, Constructor, or valve Vendor then SA Water shall be notified of this in writing). The designer or Constructor must request any certified CAD or other electronic format drawings from the Vendor (if available) and forward these drawings to SA Water.

6.3 Pre-shipping documentation and delivery inspections and testing

6.3.1 Pre-shipping documentation (completed inspection test plan)

Unwitnessed or witnessed factory tests provide results or a certificate(s) demonstrating that the valve complies with the specification or datasheet prepared by the designer or Constructor and is defect-free at the time the valve is released for shipping from the factory.

An Inspection Test (or Control) Plan (ITP) must be requested from the vendor by the designer or Constructor, containing the factory test results or certificates in the specification or datasheets for the valve. The ITP must be specifically updated for each valve by the Designer or Constructor, in cooperation with valve vendors as required, and a copy must be provided to SA Water (for its records) ten (10) working days prior to any procurement contract for a valve being finalised. Once factory testing is completed and a valve is ready for shipping, the Vendor must forward the completed ITP to the Designer or Constructor, and the designer or Constructor must ensure that all requirements of the specification or datasheets for the valve have been complied with based on the information contained within the ITP. The valve(s) may then be shipped. Examples of Inspection Test plans listing typical items that may be included and confirmed before any valve is shipped, including factory test results and material certificates) are included in Figure 2 and Figure 3.

Abnahme-Prüfplan / Inspection Control Plan

[redacted]

Kunde / Client:	[redacted]				
Herstell-Nr. / Works ser. No.:	Dok. Nr. / Doc. No.:	Komm.-Nr. / Our Order Ref. No.: 638357	Prüfplan Nr. / Control plan No.: 23-2015-ICP-638357	Zeichnung Nr. / Drawing No.:	Blatt Nr. / Sheet No. 1 von/of 2
Lieferant / Supplier:	Dienststelle / Dedpt.	Kennwort / Code:	Werk / Plant: [redacted]	Kunden / customer No.	
Benennung / Designation:	Butterfly Valves				

Lfd. Nr./ Serial No.	Prüfgrundlage Test standard:	Prüfschritte / Testing phases – Beschreibung / Description:	Prüfbescheinigung / Inspection dokuments: DIN EN 10204	Prüfung durch / Inspection by: H/M	K/C	SV/IN	B/CC	Bemerkungen / Remarks:
1.		Maßprotokolle zur Baulänge, Flanschstärke, Flansch-Bohrungen und dem breitesten Punkt der Armatur stellen Measurement of all valves dimensions: flange face-to-face, flange drillings and thickness and widest point of the valve	Abnahmeprüfzeugnis 3.1/ Inspection Certificate 3.1 W	☑	☐	☑	☐	
2.	DIN EN 12266-1/-2 P 10 / P11	Festigkeits- / Dichtheitsprüfung des Gehäuses mit 1,5 x PN (Wasser) 100% Hydrostatic test on body with 1.5 x PN bar (water) 100%	Abnahmeprüfzeugnis 3.1/ Inspection Certificate 3.1 W	☑	☐	☑	☐	Mindest-Prüfdauer, Tabelle A. 2 Annahmekriterien A.2.3 und A.3.3 Minimum duration table A.2 Acceptance criteria A. 2.3 and A.3.3
3.	DIN EN 12266-1/-2 P 12 / P20	Festigkeits-/Dichtheitsprüfung des Abschlusses mit 1,1 x PN (Wasser) 100% Hydrostatic test on seal seat with 1.1 x PN (water) 100% (incl. seating correctly at valve close limit) – Test on both sides of the disc Any method of fixing or repairing a leak will be documented including photographs and quantitative measurements	Abnahmeprüfzeugnis 3.1/ Inspection Certificate 3.1 W	☑	☐	☑	☐	Mindest-Prüfdauer, Tabelle A.4/A.3 Annahmekriterien A.4.3 /A.2.3 Minimum duration table A.4/A.3 Acceptance criteria A.4.3/A.2.3
4.		Prüfung der Bauart, Bauform und Ausrüstung 100% Inspection of design and fittings 100%	Abnahmeprüfzeugnis 3.1/ Inspection Certificate 3.1 W	☑	☐	☑		
5.		Prüfung der internen und externen Beschichtung einschließlich Getriebe Porendurchschlagprüfung - 1,2 KV Check of external and internal coating for any defects including gear boxes checking of coating using high-voltage (brush) method – 1,2 KV	Abnahmeprüfzeugnis 3.1/ Inspection Certificate 3.1 W	☑	☐	☑		
6.		Prüfung der Kennzeichnung 100% Inspection of marking 100%	Abnahmeprüfzeugnis 3.1/ Inspection Certificate 3.1 W	☑	☐	☑		
7.	DIN EN 12266-2 F20	Prüfung der Betätigungsfunktion 100% Getriebeeinstellung überprüfen Functional test 100% Check of gear box settings	Abnahmeprüfzeugnis 3.1/ Inspection Certificate 3.1 W	☑	☐	☑		

30. DEZ. 2015

W = Witness K / C = Kunde / Client R = Review B / CC = Beschichter / Coating Company
H = Holdpoint SV / IN = Sachverständiger / Inspector H / M = Hersteller / Manufacturer

Erstellungsdatum:21.12.2015 16:06

Figure 2: Pre-shipping inspection test plan

Abnahme-Prüfplan / Inspection Control Plan

[redacted]

Kunde / Client:	[redacted]				
Herstell-Nr. / Works ser. No.:	Dok. Nr. / Doc. No.:	Komm.-Nr. / Our Order Ref. No.: 638357	Prüfplan Nr. / Control plan No.: 23-2015-ICP-638357	Zeichnung Nr. / Drawing No.:	Blatt Nr. / Sheet No. 2 von/of 2
Lieferant / Supplier:	Dienststelle / Dedpt.	Kennwort / Code:	Werk / Plant: [redacted]	Kunden / customer No.	
Benennung / Designation:	Butterfly Valves				

Lfd. Nr./ Serial No.	Prüfgrundlage Test standard:	Prüfschritte / Testing phases – Beschreibung / Description:	Prüfbescheinigung / Inspection dokuments: DIN EN 10204	Prüfung durch / Inspection by: H/M	K/C	SV/IN	B/CC	Bemerkungen / Remarks:
8.	DIN EN 10204	Werkstoffzeugnis (einschließlich Klappenscheibe) Material Certificates (incl. Disc)	Abnahmeprüfzeugnis 3.1/ Inspection Certificate 3.1 W	☑	☐	☑		Body: EN-JS1025 Driving-Shaft, Trunnion: 1.4462 Reviewed by TPI
9.	DIN EN 10204	Überprüfung der Zeugnisse Check all Certificates	Abnahmeprüfzeugnis 3.1/ Inspection Certificate 3.1 W	☑	☐	☑	☐	Reviewed by TPI
10.			Ohne Zeugnisbelegung/ without report W	☐	☐	☐	☐	

Rev.	Erstellt von / Prepared by: Name/Name	Datum/ Date	Geprüft von / Reviewed by:	Grund der Revision / Nature of revision:	Bedarfsmelder / Submitted by:	Genehmigt / Approved:	Kunde / Client:	Sachverständiger / Inspector:
0	Armin Gruber							
1	Daniel Lutsch	15.12.2015						
2	Daniel Lutsch	21.12.2015						

30. DEZ. 2015

W = Witness K / C = Kunde / Client R = Review B / CC = Beschichter / Coating Company
H = Holdpoint SV / IN = Sachverständiger / Inspector H / M = Hersteller / Manufacturer

Erstellungsdatum:21.12.2015 16:06

Figure 3: Pre-shipping inspection test plan

SA Water may require additional delivery testing to be undertaken after being added to the ITP in accordance with section 6.3.2.

6.3.2 Delivery inspections and testing

All valves must be physically inspected upon delivery by Constructors, SA Water Workshops or any other party taking receipt of the valves for defects including (but not limited to):

1. Valve labelling errors.
2. External or internal coating, such as paint or defects.
3. Dimensional errors.
4. Disc sealing errors – this could be due to inaccurately set mechanical stops, interference between the disc and body through seals, liners.
5. Excessive torque required to operate the valve.

Valve inspections must occur upon first receipt and acceptance of delivery of the valves. Constructors, SA Water Workshops, or any other party taking receipt of the valves must not do so unless subject to this inspection. A valve inspection check sheet (refer to the SA Water website for a template) shall be completed for all critical valves and all valves DN600 or larger. The completed inspection check sheet shall be included in the Manufacturer's Data Report (MDR) relevant to the installation of the valve.

If defects are confirmed for the as-delivered valves, then the vendor must be notified immediately and requested to rectify the defects in accordance with the terms of the contract(s) for the supply of the valves. SA Water Procurement may stipulate, based on an assessment of the criteria that delivered valves, which have already passed unwitnessed or witnessed factory tests, are to be re-tested in part or in full upon delivery to a designated point in Australia.

Re-testing of a valve upon delivery in Australia is required where the final gearbox or actuator is to be permanently installed. Any deviation from this standard shall be submitted through TDRF to principal mechanical engineer for approval.

6.4 Workshop testing for valve installations

This section is applicable to cases where a new valve (or existing valve being re-furbished and re-installed) is assembled with accompanying pipe spools or other attachments in a workshop prior to being transported to an installation site.

When a risk assessment confirms that workshop testing is required, buried valves used for isolation or control, whether actuated or not, which are not directly connected flange to flange into an existing system, must be assembled with upstream and downstream pipework spools in a testing workshop, in the final valve and pipework configuration to be buried after installation (via closing collars or otherwise), and subject to testing in accordance with this Technical Standard. All SA Water groups (including, but not limited to, SA Water Capital Delivery, Operations, Workshops, Assets and Procurement) involved in the delivery of valves must participate in the risk assessment of buried valves and determine whether workshop testing is required (or not). Constructors must inform themselves of any outcome from a risk assessment that has been undertaken by SA Water for a particular valve installation.

For valves used for isolation or control, whether actuated or not, which are not directly connected flange to flange into an existing system, the Designer or Constructor must obtain and provide information on each of the criteria identified below and provide this to SA Water to confirm whether workshop testing for valve installations is required after the delivery of a valve and preparations for its installation are complete:

1. Criticality of the valve when installed and operational.
2. Ease or difficulty of maintenance (and repair or removal) of the valve once installed and operational.
3. Required design life of the valve(s) (both components and body).
4. SA Water technical knowledge of issues with the type of valve(s), which can be managed by witnessed testing.
5. Changes in the technical configuration or manufacturing process for the valve(s) relative to the valve(s) of similar type already installed and operational in SA Water systems.
6. Specific SA Water testing results or performance history for the type of valve(s) to be purchased.

In the case of the direct installation of a valve (only), without any accompanying pipe spools or other attachments, this section is not applicable.

An Inspection Test Plan (ITP) must be prepared by the Designer or Constructor for workshops testing and certification of the valve and the assembly in which it is installed, for example, connected upstream and downstream pipe spools. The ITP must be specifically updated for each valve by the designer or Constructor, in cooperation with valve Vendors as required, and a copy must be provided to SA Water (for its records) ten (10) working days prior to the finalisation of fabrication details for the valve and its associated assembly. The ITP must ensure that sufficient factory tests are repeated, or other tests are conducted to ensure that all valves, pipework, or any other elements comprising the totality of the valve installation will be fully operationally functional over the design life of all elements. Examples of Inspection Test Plans listing typical items that may be included and confirmed as part of workshop testing before valve and associated assembly installation are included in Figure 4, Figure 5 and Figure 6.

[redacted]

INSPECTION & TESTING PLAN

Project: [redacted]
Date Issued: 1/05/2016
Job Number: 6854
Description: Hydro Testing Isolation Valve Assemblies (DN1200)

Client: [redacted]
Principal: DIPTI / SA Water
Location: [redacted]

ITP No.: 0364-H12 **Version:** 4
Prepared By: [redacted]
Approved By: [redacted]
Drawing No: Various

Inspection / Surveillance Legend

HOLD (H) - nominated point beyond which work shall not be processed without verified acceptance by nominee

WITNESS (W) - nominated points at which the nominee shall be notified & invited to witness as activity but further work may proceed without the presence of the nominee

REVIEW (R) - verify by examination of documentary evidence that inspection / tests have been satisfactorily conducted.

SURVEILLANCE (S) - continuing evaluation of the status of methods, analysis of records & monitoring of activities on a r&om basis to ensure quality requirements will be met

VISUAL (V) - 100% visual inspection of work / item to ensure compliance with code / specification

DIMENSIONAL (D) - measurement of critical dimensions to ensure work / item is within tolerance

Summary of Requirements

Process Qualifications

Traceability

Material	[x]	Consumables	[ ]
Heat Treatment	[ ]	Welder ID	[ ]
Alloy Verification	[ ]	NDT	[ ]
Pressure Testing	[x]	WPS	[ ]
Vacuum Testing	[ ]		[ ]

Comments:

Principle Codes / Standards

AS 1210 : 2010	Pressure Vessels	[ ]
AS 4041 : 2006	Pressure Piping	[x]
AS 4100 : 1998	Steel Structures	[ ]
AS 4458 : 1997	Pressure Equipment - Manufacture	[ ]
AS 4037 : 1999	Press. Equip. - Exam. & Testing	[x]
AS/NZS 3992 : 1998	Press. Equip. - Weld. & Braz. Qual.	[ ]
AS 2885.2 : 2007	Pipelines - Gas & Liq. Pet.- Welding	[ ]
AS/NZS 1554.1 : 20'	Welding of Steel Structures	[ ]
AS 1579 : 2001	Arc Welded Pipe & Fitting for Water & Waste Water	[ ]
AS 1796 : 2001	Cert. of Welders & Weld. S/visors	[ ]
ASME BPVC IX : 20	Welding & Brazing Qualifications	[ ]
ASME B31.1 : 201	Power Piping	[ ]
ASME B31.3 : 201	Process Piping	[ ]
AS 4087 - 2011	Metallic Flanges for Waterworks Purposes	[x]
ASME/ANSI B16.20 : 1	Metallic Gaskets for Pipe Flanges - Ring-Joint, Spiral-Wound, & Jacketed	[ ] [ ]

Client Specification

SA Water TS27
SA Water TS159b
SA Water TS15
SA Water TS18
WSA 109-2011
AS 4087:2011
AS 4041 : 2006
AS 4037 : 1999
CSTR Division G

Required MDR Records

(Yes or No field must be completed)	Yes	No
Inspection Release Certificate	[ ]	[x]
Material Traceability Register	[x]	[ ]
Material Certificate	[x]	[ ]
Consumable Certificate	[ ]	[x]
Conformance Certificate	[ ]	[x]
Deviations / Concessions	[ ]	[x]
Technical Queries / Request for information	[x]	[ ]
Welding Procedures (WPS)	[ ]	[x]
Welder Qualification Record (WQR)	[ ]	[x]
Weld Traceability Record (WTR)	[ ]	[x]
Weld Mapping Records (WMR)	[ ]	[x]
NDT Reports	[ ]	[x]
Heat Treatment Records	[ ]	[x]
Drawings / Dimensional Reports	[x]	[ ]
Non-Conformance Reports	[x]	[ ]
Pressure Test Records	[x]	[ ]
Coating Report Internal/external	[x]	[ ]
Mechanical & Performance Records	[ ]	[x]
Electrical Certificate & Reports	[ ]	[x]
Instrumental Certificates & Reports	[x]	[ ]
Statutory Approval & Compliance Plates	[ ]	[x]
Other	[ ]	[x]

(specify in Summary of Requirements Notes)

Responsibility / Nominee Legend

Works Coordinator	WC	Boilermaker	B
Project Manager	PM	Pipe Fitter	P
Welding Supervisor	WS	Supervisor	S
QA / QC Co-ordinator	QA	Welder	W
QC Officer	QC	Stores Rep	ST
Welding Inspector	WI	Subcontractor	SC
Workshop Manager	WM	Client	C

Prepared by: [redacted] **Company:** [redacted] **Signed:** **Date:** 01/05/16
Approved by: [redacted] **Company:** [redacted] **Signed:** **Date:** 04/05/16

Revision: 7, 5 July 2011
Printed: 29/06/2016
SM-QF-05036
Document Uncontrolled When Printed
Page 1 of 3

Figure 4: Workshop inspection test plan

[redacted]

INSPECTION & TESTING PLAN

Project: [redacted]
Date Issued: 1/05/2016
Job Number: 6854
Description: Hydro Testing Isolation Valve Assemblies (DN1200)

Client: [redacted]
Principal: DIPTI / SA Water
Location: [redacted]

ITP No.: 0364-H12 **Version:** 4
Prepared By: [redacted]
Approved By: [redacted]
Drawing No: Various

CONTROL CATEGORIES: H = Inspection Hold Point (Work must not proceed to the next step until this activity is completed & a signature obtained from the column placing the HOLD; i.e.. QA or Client); V = Verify;
W = Witness Point (Notify to permit witness, work can proceed if witness does not attend at agreed time); S = Surveillance Point (Monitor operations); R = Review Documentation (Sign or Stamp to record review).

Item No.	Inspection / Test Activity (Spec / Drg. Ref)	Responsibility	Frequency	Inspection Requirements	Inspection / Test Method	Acceptance Criteria	CONTROL POINT [redacted]		[redacted]		SAW	
							Action	Sign	Action	Sign	Action	Sign
THIS ITP IS TO BE READ IN CONJUNCTION WITH [redacted]												
1	Pipe spool released from shop	QC	Before Commencement	Signed off Fabrication check sheet	Visual	Green "Final Inspection" sticker on spool	H		W		W	
2	Visual Inspection of valves	S	Before Commencement	Valve release form from SAW (sent via [redacted])	Visual	Visual Inspection: free from holes, burrs, scale, cracks	W		W		W	
3	Orientation OF Valve	S	Before Commencement	Direction of valve to be mark by [redacted] Representative	Visual	ITP to be signed by [redacted] Representative:____________________	H		H		W	
4	Equipment to be tested and cal brated in according to NATA standards/requirements	QC	Before Commencement	NATA	Visual	In date calibration:____________________	H		W		W	
5	Material: *(for potable water)* DN100 - 400; 3mm EPDM Rubber DN450 -1200; 3mm TESNIT BA-U *(Compressed Fibre)*	PM S	Before Commencement	Delivery docket Visual inspection of item	Visual	Visual Inspection: 3mm EPDM Rubber (for potable water) installed DN80-DN400. Visual Inspection: 3mm TESNIT BA-U Fibre (for potable water) installed DN450 - DN1200	W		W		W	
6	Material: *(galvanized steel bolts)* M12 - M20; min Grade 4.6 M24 - M33; min Grade 8.8	PM S	Before Commencement	WSA 109-2011, Table E2 & E4 AS4087:2011, Table C1	Visual	DN80 Flanges; M16 bolts min. Grade 4.6 DN100 Flanges; M16 bolts min. Grade 4.6 DN200 Flanges; M16 bolts min. Grade 4.6 DN900 Flanges; M33 bolts min. Grade 8.8 DN1200 Flanges; M33 bolts min. Grade 8.8	W		W		W	
7	Insulation: Bolt insulation sleeves to be installed	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	H		W		W	
8	Bolt Tightening – Lubrication and sequence	[redacted] / [redacted]	Every Bolt	TS27 2.1 (Moylcoat P74) WSA 109-2011, E7.1	Visual	Bolt lubrication applied; bolting sequence followed in according to TS27	S		W		W	
9	Bolt Tightening –Torque	[redacted] / [redacted]	Every Bolt	TS27 WSA 109-2011, Table E2 & E8	Bolt Torque Sheet	Calibrated torque device used; Estimated torque DN80 Flange; M16 4.6; 65% Yield = 48Nm DN100 Flange; M16 4.6; 65% Yield = 48Nm DN200 Flange; M16 4.6; 65% Yield = 48Nm DN1200 Flange; M33 8.8; 65% Yield = 920Nm	H		W		W	

Revision: 7, 5 July 2011
Printed: 29/06/2016
SM-QF-05036
Document Uncontrolled When Printed
Page 2 of 3

Figure 5: Workshop inspection test plan

[redacted]

INSPECTION & TESTING PLAN

Project: [redacted]
Date Issued: 1/05/2016
Job Number: 6854
Description: Hydro Testing Isolation Valve Assemblies (DN1200)

Client: [redacted]
Item No.: [redacted]

ITP No.: 0364-H12 **Version:** 4
Prepared By: [redacted]
Approved By: [redacted]
Drawing No: Various

CONTROL CATEGORIES: H = Inspection Hold Point (Work must not proceed to the next step until this activity is completed & a signature obtained from the column placing the HOLD; i.e.. QA or Client); V = Verify; W = Witness Point (Notify to permit witness, work can proceed if witness does not attend at agreed time); S = Surveillance Point (Monitor operations); R = Review Documentation (Sign or Stamp to record review).

Item No.	Inspection / Test Activity (Spec / Drg. Ref)	Responsibility	Frequency	Inspection Requirements	Inspection / Test Method	Acceptance Criteria	CONTROL POINT					
							[redacted]		[redacted]		SAW	
							Action	Sign	Action	Sign	Action	Sign
10	Valves in open position	P	Before Hydro	N/A	Visual	No leakage or moisture	H		W		W	
11	Fill with water & leave for 24 hours	P	Before Hydro	N/A	Visual	N/A	W		W		W	
12	Valves in closed position, set gauges both ends	P	Before test	N/A	Visual	N/A	W		W		W	
13	By Pass Valve not to be installed for Sealing Test	P	Before Sealing Test	N/A	Visual	Blind flanges to be installed in place of By Pass valve	W		W		W	
14	**Sealing Test - 1760 kPa** test pressure for 10 minutes	P	Each test	AS 4795.2, Section 5.3.3 CSTR Part G, Section 12.2	Visual Inspection, no leaks. Pressure to be raised at 400kpa per 10min then target pressure.	0% leakage, moisture Use 2 x Calibrated gauges (0-4000kPa) Test record SM-QF-05098 completed and signed.	H		W		H	
15	Release test pressure	P	After test	N/A	Visual	Pressure < 100kPa	W		W		W	
16	**Sealing Test - 1760 kPa** test pressure for 10 minutes	P	Each test	AS 4795.2, Section 5.3.3 CSTR Part G, Section 12.2	Visual Inspection, no leaks. Pressure to be raised at 400kpa per 10min then target pressure.	0% leakage, moisture Use 2 x Calibrated gauges (0-4000kPa) Test record SM-QF-05098 completed and signed.	H		W		H	
17	Release test pressure	P	After test	N/A	Visual	Pressure < 100kPa	W		W		W	
18	By Pass Valve to be installed for Pressure Testing	P	Before Pressure Test	N/A	Visual	By Pass Valve Bolted lubrication applied; bolting sequence followed in according to TS27	S		W		W	
19	**Pressure Testing - 1600 kPa** test pressure for 30 minutes (client revised spec holding time)	P	Each test	AS 4041, Section 6.7 AS 4037, Section 17	Visual Inspection, no leaks or deformations. Pressure to be raised at 400kpa per 10min then target pressure.	0% leakage, moisture or deformations. Use 2 x Calibrated gauges (0-4000kPa) Test record SM-QF-05098 completed and signed.	H		W		H	
20	Release test pressure	P	After test	N/A	Visual	Pressure < 100kPa	W		W		W	

Signed by [redacted] **Representative:** .... **Date:** ....

Signed by Client Representative: .... **Date:** ....

Revision: 7, 5 July 2011
Printed: 20/06/2016
SM-QF-05036
Document Uncontrolled When Printed
Page 3 of 3

Figure 6: Workshop inspection test plan