SA Water

Engineering

Technical Standard

TS 0230.1 - Requirements for gate valves

Version: 1.0.
Date: 24 October 2025.
Status: Final.
Document ID: SAWS-ENG-0230.1
Confidentiality: OFFICIAL

Government of South Australia

Issue and version number

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Documents superseded by this standard

The following documents are superseded by TS 0230.1:

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

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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 to detail minimum requirements to ensure that assets covered by the scope of this standard are constructed and maintained to consistent standards and attain the required asset life.

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 (for example, a bypass valve).
Design	Refers to the specification of the configuration, selection, and sizing of equipment to achieve required hydraulic and operational outcomes.
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)*.

Term	Description
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 in order 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): a. Superintendent's Representative b. SA Water Project Manager. c. SA Water nominated contact person.
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
AS	Australian Standard
FBE	Fusion Bonded Epoxy
ISO	International Organization for Standardization
NZS	New Zealand Standard
SA Water	South Australian Water Corporation
TDRF	Technical Dispensation Request Form

Abbreviation	Description
TS	SA Water Technical Standard
WSA	Water Services Association

1.2.1 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 6401	Knife gate valves for waterworks purposes
AS/NZS 2638.1	Gate valves for waterworks purposes - Part 1: Metal seated
AS/NZS 2638.2	Gate valves for waterworks purposes - Part 2: Resilient seated
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
SAW-ENG-MAT-TEM-TSB-002	E&WS Gate Valve Refurbishment Specification
TS 0900	Pressure Testing of Pipelines
TS 0101	Safety in design standard
TS 0105	Quality requirements
TS 0109	Infrastructure Design
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 gate 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 a number of areas, there is no overlap between the Australian Standards and this Technical Standard. In other areas, this Technical Standard provides direction in the event that 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, and SA Water will provide a clarification within ten (10) working days of receiving the notification of the conflict from the Designer. No valve shall be procured if there is a potential conflict between the requirements of the Australian Standards and this Technical Standard.

2.2 Work not in scope

N/A

2.3 Technical dispensation

Departure from any requirement of this Technical Standard shall require the submission of Technical Dispensation Request Form (TDRF) SAWT-ENG-0015 - Dispensation Request Procedure Template.docx for the review and approval (or otherwise) of SA Water Principal Engineer listed in Page 5, on a case-by-case basis.

The Designer shall not proceed to document/incorporate the non-conforming work before SA Water Principal Mechanical Engineer has approved of 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 works 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 Hold points and witness points

3.1 Hold points

Please refer to TS 0105 for further detail on hold points.

3.2 Witness points

Please refer to TS 0105 for further detail on witness points.

3.3 Non-conformance

Please refer to TS 0105 for the requirements relating to non-conformance.

4 Valve applications

4.1 Gates and knife gate valves

Figure 1: Typical Gate valve

4.1.1 Resilient seated gate valves

Resilient seated gate valves may be used in water and wastewater systems for pressure classes up to and including PN16.

Resilient seated gate valves, used for either isolation or control, should only be provided with an actuator when the Designer has confirmed in writing, using a valve datasheet (refer to SA Water typical gate valve datasheet in DS 0200 the number of actuations and proposed functional operation for the resilient seated gate valve over its design life, and acceptance of these requirements by the Vendor, before it is procured.

4.1.2 Metal seated gate valves

Metal seated gate valves may be used in water and wastewater systems for pressure classes up to and including PN35.

Metal seated gate valves, used for isolation, can be provided with an actuator when the Designer has confirmed in writing, using a valve datasheet (refer to SA Water typical gate valve datasheet), the number of actuations and proposed functional operation for the metal seated gate valve over its design life, and acceptance of these requirements by the vendor, before it is procured.

4.1.3 Knife gate valves

Knife gate isolation valves can be used for water and wastewater installations where pressures are less than or equal to PN10 and must seal with less than 10m of differential pressure across the valve gate.

Knife gate valves should not be used where the valves are required for isolation and are actuated more than once per month for maintenance work.

Where the number of actuations required to achieve the operational duty of the valve exceeds once per month or the pressures are greater than PN10 knife gate valves with specific features to enable the performance specifications to be met can be used provided the vendor contractually commits to an extended five (5) year functional warranty for the valve from the date of the first operation of the valve after installation, that is, a warranty that covers the function of the valve under all operational circumstances communicated to the vendor by the Designer for the period of five (5) years.

Knife gate valves must not be used as control valves unless the Designer has obtained information from a valve vendor supporting the use of the valve as a control valve and the Designer makes a written submission recommending the use of a knife gate valve as a control valve to SA Water.

5 Design requirements

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

5.1 Design life

The minimum design life of a gate valve body (including 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.

The Designer must seek from the proposed valve Vendor information regarding the design life of all parts of the valve, and if there are departures from the design life identified in this section for specific components, then the shorter design life and maintenance or replacement period for the identified specific components shall be provided by the vendor to the Designer for assessment. Any shorter design life identified for specific components must be communicated by the Designer to SA Water for endorsement before any valve is procured. SA Water may require the Designer to provide a detailed maintenance schedule with estimated present- day costs before any valve is endorsed.

The SA Water typical gate valve datasheet (DS 0200) 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.

5.2 Selection of type of valve

Valve selection considerations include but are not limited to:

1. Type of water or wastewater:
2. Valve type selection depends on the water or wastewater characteristics.
3. Valves must function fully over their design life.
4. Maintenance must not exceed what the vendor specifies.
5. These conditions must be met before valve procurement.
6. All requirements must align with this Technical Standard.
7. The Designer, Constructor, 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. Gate valves may be required instead of a butterfly valve for raw water applications and may require a metal rather than resilient seat depending on the physical and chemical characteristics of the raw water. 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.
8. Required design life:

   The minimum required design life for all valves is nominated under section 5.1 of this standard.

9. Maintenance requirements:

   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, and then 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 or Constructor is responsible for ensuring that the valves procured shall have maintenance requirements that are acceptable to SA Water.

Item	Description	Material
1-1	Insert	Plastic
2-1	Bolt	Stainless Steel A4-70
3-1	Stem Cap (Optional)	Ductile Iron
1-2	Bolt	Stainless Steel A4-70
2-2	Washer	Stainless Steel A4-70
3-2	Handwheel (Optional)	Ductile Iron
4	Bolt	Stainless Steel A4-70
5	Wiper Ring	NBR Rubber
6	Gland Flange	Ductile Iron
7	Seal Retainer	Copper alloy
8	O-Ring	NBR Rubber
9	Key	Stainless Steel A4-70
10	Thrust Washer	Stainless Steel
11	Thrust Collar	Copper alloy
12	Thrust Bearing	PTFE coated stainless Steel
13	Stem	Stainless Steel
14	O-Ring	NBR Rubber
15	O-Ring	NBR Rubber
16	Bonnet	Ductile Iron
17	Bolt	Stainless Steel A4-70
18	O-Cord	NBR Rubber
19	Back Seal	NBR Rubber
20	Wedge Nut	Copper alloy
21	Wedge	Ductile Iron
22	Face Ring	Copper alloy
23	Shoe (Optional)	Copper alloy
24	Bolt	Stainless Steel A4-70
25	Channel (Optional)	Copper alloy
26	Body	Ductile Iron
27	Seat Ring	Copper alloy
28-1	Blanking Plate (Optional)	Ductile Iron
28-2	Bypass Valve Kit (Optional)	/

Figure 2: Typical exploded view of a gate valve

(listed material are example only)

10. 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 bypasses, and whether safe access can be achieved around the valve once installed in its intended location, building (new or existing) 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 gate valve datasheets). The acceptable value in engineering standards AS 2368.1 to adopt a manual torque limit less than 350Nm, is to ensure safe and ergonomic operation.

    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 5.5.12 (which relates to safe isolations).

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

5.3 Materials selection

The Designer must confirm in writing, using a valve datasheet (refer to DS 0200 SA Water standard gate valve datasheet), 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. The SA Water typical gate valve datasheets will, for some valve components (critical performance or wetted component), request minimum grades of materials to 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. Any deviation from SA Water nominated materials shall be submitted for approval by TDRF. The Designer must ensure that the Vendor completes all responses, including material specification responses, required in the valve datasheet, which forms part of the basis for entering into 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.

5.4 Pressure rating

5.4.1 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 AS/NZS 2638.1,2. Valves with alternative pressure ratings of 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 including urgent contingency of system Requirements).

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.

5.4.2 Minimum pressure rating

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

SA Water has established, for operational and maintenance purposes, a minimum pressure rating of PN16 for all gate valves less than 200mm in diameter in SA Water's pressurised wastewater pumping mains.

Lower pressure ratings may be specified if it is demonstrated that the lower pressure rating is sufficient for all possible design conditions (loads, forces) and operational configurations.

1. Valves greater than 375mm in diameter in water systems (minimum allowable pressure rating is PN10).
2. Gate valves greater than 200mm in diameter in wastewater pumping mains (minimum allowable pressure rating is PN10).

5.5 Hydraulic and operational conditions

5.5.1 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, 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 completed DS 0200 gate valve datasheet, 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.

5.5.2 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:

1. Maximum instantaneous differential pressure across the valve (under any flow condition).
2. Maximum sustained/continuous differential pressure across the valve (under any flow condition).

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, control, or actuated.

The cavitation index shall be calculated using the following equation for each hydraulic and operational circumstance:

$$\sigma = \frac{P_d - P_v}{P_u - P_d}$$

Where:

σ cavitation index.

Pd downstream pressure.

Pv vapour pressure.

Pu upstream pressure.

Pressures must be used with the same units and relative to the same level datum.

The Designer should confirm in writing, preferably using a valve datasheet (refer to SA Water DS 0200 for standard gate valve datasheet), 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 prior to procurement.

5.5.3 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 DS 0200). The vendor must confirm that the valve offered can achieve the required number of actuations before any valve is procured.

In a situation that valve vendor requires valve configuration or specific component changes to achieve a total number of actuators over the valve's design life. The Designer must inform SA Water of the changes required to achieve the total number of actuations.

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; that is, 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 explained to SA Water before any valve or actuator is purchased and the non-linear rate of operation implemented. For detail on hydraulic requirements, refer to TS 147.

5.5.4 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 DS 0200 valve datasheet 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 valves to be procured.

Curves for isolation valves should be assessed by the Designer upon receipt from potential valve Vendors to confirm functional requirements can be met.

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; 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 further detail on hydraulic requirements, refer to TS 147.

5.5.5 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, pumps, other valves, pipes, or any other element forming part of the system.

5.5.6 Manual operation

The number of turns required to close a valve from fully open shall not exceed 500 unless the valve is fitted with an electric actuator or will be normally operated with a portable powered actuator.

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.

5.5.7 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 (consistent with SA Water TS 147 and any other design practice that will avoid damage to either the system into which the valve is installed or the valve itself).
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).

5.5.8 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 gate valves may be selected for a maximum differential pressure less than 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, 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.
5. Gearbox end stops shall be capable of withstanding an input shaft torque of 350Nm.

5.5.9 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. The Vendor must provide curves for any proposed valve showing the degree open, differential head across and flow through the valve (see section 5.5.4 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 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.

5.5.10 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 1 below.

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
		Full	-5°C to +31°C
	total shade	Empty	0°C to +35°C
		Full	0°C to +40°C
Below ground	not applicable	Empty or Full	-5°C to +30°C

5.5.11 Bypass pipework and valves – requirements for control sequence

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 to be provided to SA Water for its records. The Designer must confirm that any valve without a bypass valve will be fit for all required operational purposes in its technical repot 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.

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

Bypass valves must meet all requirements of the Technical Standard and are treated as control valves. Designers or Constructors must size bypass pipework and valves to avoid excessive pressure drop, erosion, or cavitation.

One or two bypass valves may be used per main isolation valve. Flow velocity through bypass systems must stay within safe limits and be confirmed with the vendor before procurement.

Designers must inform vendors of expected operational duration and cavitation conditions over the valve's design life. The design life of bypass components must match that of the main valve. Lobster back bends are discouraged in bypass pipework.

Bypass valves for main isolation valves may be actuated manually or automatically. In all 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	None
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	No velocity
3	Close bypass valve	Maximum velocity through bypass pipework and valves

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

[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

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.

5.5.12 Safety – isolations (requirement for double isolation)

There are number of circumstances under which the requirements for double isolations using valves must be considered. These circumstances are described below, together with the approach to the risk assessment of the requirement for double isolation:

5.5.12.1 Construction

In the case of the use of new or existing valves by constructors to provide isolations for new projects delivered by the constructor. 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 sections 5.5.12.2 or 5.5.12.3.

5.5.12.2 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 including the new valves, 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 personnel involved from SA Water Assets, SA Water Operations including Operations Partner where relevant and SA Water Engineering. This risk assessment must determine whether the requirement for the ongoing operation or maintenance of the system can be safely achieved by using a single isolation valve or whether more than one valve needs to be used to achieve effective isolation. The nature of the ongoing operation and maintenance activities must be fully described, including (but not limited to):

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 gate valve (for water or wastewater systems) does not automatically mean that a single isolation is satisfactory where the valve is used to isolate water or wastewater from a work area. Specific mechanical configuration of the proposed gate valve must be obtained from the vendor by the Designer and analysed from the door (wedge) through to shaft through to gearbox through to spindle/actuator, and through all other intermediate connections not listed, by the Designer (prior to the risk assessment) to ensure that there is no possible mechanism for a sudden failure of any component and the rapid and unexpected opening of the door (wedge). 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.

Knife gate valves must not be used as single or double isolations. Additional isolations (using other valves or methods) are required to achieve an effective isolation.

The use of partial double isolations may be considered, whereby two valves in series in a system are closed, but the pipework is only drained of water or wastewater downstream of the first isolation point. This form of isolation is implemented by first closing two valves in series in a system to isolate from one direction (a further two valves in series may need to be closed to isolate from the other direction). The section of pipe to be worked on between the valves is then drained, and the adjacent section of pipe is depressurised. Water or wastewater is retained in the section of pipe between the first and second isolations but is depressurised to a level matching the elevation difference between the first isolation valve and the highest level in the pipe between the first and second isolation valves. This reduces the potential for and impact of inundation of the work area protected by the first isolation while avoiding draining the pipe between the first and second isolations.

5.5.12.3 Operation and maintenance of existing valves in systems

Existing valves shall only be used to facilitate isolations if the meet all the requirements identified in 5.5.12.2. 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.

Any refurbished valve used in the network must be tested to ensure that the originally specified valve ratings have been reestablished, and that it meets the requirements of the proposed installation and this technical standard.

5.5.12.4 Maintenance and refurbishment of existing valves

For maintenance and refurbishment of legacy or E&WS valves, SA Water's maintenance and workshop teams have access to SAW-ENG-MAT-TEM-TSB-002 the E&WS Gate Valve Refurbishment Specification. Use of this specification by others is subject to express approval by the Principal Mechanical Engineer via a TDRF.

SAW-ENG-MAT-TEM-TSB-002 must not be used for modification of new valves. Modification or refurbishment of new valves must be supported by robust justification and submitted in writing via a TDRF for approval.

6 Specification requirements

6.1 General

6.1.1 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:
2. Valves must be able to achieve the design life specified in this standard when exposed to and operated in the physical environment defined in the specification datasheet.
    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).
3. Chemical composition:
4. 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.
    a. pH.
    b. Conductivity.
    c. Total Dissolved Solids.
    d. Chlorides.
    e. Free chlorine.
    f. Free gases.
    g. Other chemicals.

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

6.1.2 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 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 door, gate, or wedge is achieved. All the physical requirements listed in this section must be able to be conducted in accordance with SA Water WHS requirements.
2. The Designer must confirm whether a bypass around the valve is required (in accordance with section 5.5.12) and, if so, whether the bypass shall be integral or non-integral to the valve. The Designer must ensure the requirements of section 5.5.12 are met with respect to valve bypasses.

3. 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 above ground or in a chamber. Yet in cases where a valve capable of withstanding thrust and all other relevant forces exerted upon it over its design life is specified by the Designer, this valve may be directly buried with installation closing collars.
4. The environmental conditions in which the valve will be installed must be identified by the Designer or Constructor 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. Above-ground external and coastal, below-ground, aggressive groundwater and all other installation environments must be specified and acknowledged by the vendor before any valve is procured. All relevant SA Water Technical Standards and any other Australian Standards relevant to the coatings to be applied to valves above ground or below ground must be identified and followed by the Designer or Constructor or valve vendor.
5. The Designer must confirm the minimum distance that is required between a valve and other piece of equipment such as a flowmeter or pump, to avoid causing either a problem in the installation or operation of the valve or other equipment. The Designer may alter the type of valve specified if the minimum available distance between the valve and other equipment cannot be varied such that the operation of the valve is not compromised or to avoid increased maintenance requirements. A typical case might involve the selection of a full-bore gate valve rather than a butterfly valve to achieve minimum straight distances, in accordance with either the valve or pump Manufacturer requirements, on either side of a pump.
6. The Designer or Constructor 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 or Constructor must also specify whether any chamber is used to support gravity, thrust (pressure or thermal) or any other type of load that would result in the failure of the valve (either physical or operational) if the chamber did not exist. The Designer must confirm that all loads associated with the installation or operation of a valve in a chamber can be supported by the chamber (whether new or existing) and that the valve will not be detrimentally affected (in either a physical or operational sense).
7. The Designer or Constructor must confirm how debris (grit), can be cleaned or flushed from the seating area of the valve, a cleaning port.

6.1.3 Flanges

The valve flange thicknesses shall meet or exceed the requirements of AS/NZS 4087. For all flange requirements refer to SA Water TS 0200 standard.

The torques required to bolt a valve flange into adjoining pipe spools flange must be taken into consideration as one of the load cases for the valve flanges, and the Designer must specify the torques that will be applied in the installation of a valve in accordance with the tightening procedures described in TS 0200. The valve vendor must quantify the maximum deflection of the valve flange that will occur under all load cases (including the installation torques) with less than 2mm deflection of the flange from its unstressed condition.

A Designer can specify that a valve must have its flanges drilled to a pattern that matches those from AS/NZS 4087 or can specify another pattern if required (i.e. PN25 or PN40 connecting pipework).

Gaskets, where used, must be specified by the Designer such that valve sealing can be achieved, for the test conditions stipulated in AS/NZS 2638.1 or AS/NZS 2638.2 and under this Technical Standard, with tightening torques in the ranges prescribed in TS 0200 (and WSA 109. Gaskets must comply with TS 0800 standard.

O-rings, where used, must be specified by the Designer such that valve sealing can be achieved. The test conditions are stipulated in AS/NZS 2638.1 or AS 2638.2 and under this Technical Standard, with tightening procedure and torque values as prescribed in WSA 109. O-rings must comply with TS 0800 standard.

6.1.4 Vibration performance

The Designer must request vibration data from valve vendors for the most adverse conditions under which the valve will be operated (this data may or may not be available and may be based on testing in factories with custom restraint conditions or field data for operational valves). It is the responsibility of the Designer to identify the most adverse conditions (hydraulic or otherwise) 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 constructors must ensure that connected pipework, supports and any other elements that can affect the vibration meet the requirements stipulated by the valve vendors to achieve anticipated vibration levels.

6.1.5 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 assess the location to confirm whether a particular environment is noise-sensitive and what level of noise, or frequency of occurrence of noise, is considered problematic.

The information provided by the valve vendors shall be used by the Designer to draw relative comparisons between the valves presented and to determine their suitability for a particular project. The Designer shall inform SA Water if valve Vendors are unable to provide the requested (or any) noise data.

6.1.6 Coatings

Fusion bonded epoxy (FBE) or ceramic (or other) epoxy 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 SA Water's technical standards TS 15, TS 16, and TS 18.

In drinking water applications, all coatings must be certified as AS/NZS 4020 compliant and suitable for contact with drinking water.

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 or

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 5.1.

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 (above ground, buried, or other). Refer to SA Water TS 16 standard for further requirements.

Valves that are buried must be supplied with a customised FBE specification. The Designer or Constructor is responsible for determining whether wrapping is required to achieve the design life of the valves and ensuring compliance with SA Water TS18 standard.

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), its design life (to match that of the factory applied coating) and the time to obtain the coating repair material (if not readily available in South Australia). The Designer shall confirm 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 recommended.

Internal coatings within valves must meet tolerances defined by SA Water TS 15 standard. All coatings to remain intact without cracked, abraded, eroded or removed or lost. Coatings to maintain valves integrity and prevent corrosion to meet their operational requirements over the design life for the valves. The integrity of the internal coatings is critical where the coatings act to protect internal wetted valve components from corrosion, and the Designer must ensure that the specification for the valves communicates with vendor and will achieve the design life required.

6.1.7 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, as follows:

1. The cavitation index of the valve installation must be determined by the Designer for all instantaneous, intermittent and continuous operating hydraulic conditions and to confirm that the valve will not cavitate.
2. If a 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. For detail hydraulic requirements refer to SA Water TS 147 standard.

6.1.8 Maintenance requirements

The maintenance requirements for a valve (including criteria identified in a datasheet or returnable schedule customized to suit specific application requirements by the Designer or Constructor) 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 or Constructor 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 customized 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 directly by SA Water and Workshops.

6.1.9 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.

6.1.10 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 SA Water.

6.1.11 Extension tubes

Extension tubes for actuators or position indicators shall be made of grade 316 stainless steel.

Where an extension tube is buried and bolted to a valve or gearbox without insulation at the bolted joint, the extension tube shall be wrapped in accordance with SA Water TS 16, and TS 18 standards.

Where an extension tube is buried and bolted to a valve or gearbox in a manner that isolates the extension tube from the valve or gearbox, the extension tube shall be unwrapped.

6.2 Gate isolation and control valves (water and wastewater)

The minimum requirements identified in AS/NZS 2638.1 or AS/NZS 2638.2, in all regards, shall apply if not exceeded or added to the following sections or specification datasheet.

6.2.1 Bonnet

The Designer shall specify whether a sealed (and pressure-rated) bonnet is required for a gate valve or not. Where a gate valve bonnet is required to be pressure-rated, the pressure rating shall be equal to the maximum structural pressure rating of the valve. The Designer shall specify a pressure-rated bonnet where a valve is buried in all cases.

6.2.2 Wedge/gate encapsulation

For drinking water systems, any wedge/gate encapsulation or other internal component must comply with the requirements of AS/NZS 4020. The Designer must request the certificate of compliance with AS/NZS 4020 for the wedge/gate encapsulation 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 wedge/gate encapsulation must be confirmed by the Designer before any valve is procured.

6.2.3 Stem (shaft), drive nut and seating

The Designer shall explicitly obtain from the Vendor, using a returnable datasheet or otherwise, the stem material type, diameter and end thread classification and confirm that the stem material type, diameter, and end thread classification will enable the valve to remain fully functional over the design life for the valve. The Designer must confirm that the stem will maintain its relative position within the valve body to all initial tolerances.

The Designer shall specify whether a rising or non-rising stem is required for a gate valve. The Designer must consider the available space for installation of the valve and any increased maintenance Requirements (or difficulties in achieving the required maintenance) in the case of either adopting a rising or non-rising stem. The use of a rising stem may, result in problematic access to the top of the stem but reduce the maintenance challenges that would otherwise arise if a non-rising stem were used.

The Designer shall explicitly obtain from the Vendor, using a returnable datasheet or otherwise, the drive nut material type and confirm what the functional life of the drive nut will be based on loading, actuation, or any other relevant parameters in this Technical Standard. The Designer shall confirm the Vendor-specified material for drive nut functional life is sufficient.

The Designer shall explicitly obtain from the Vendor, using a returnable datasheet or otherwise, the seating/unseating torque for the valve (under the operational condition that gives the maximum seating/unseating torque) and confirm the factor of safety for the stem 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.

6.2.4 Body inserts or liner

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 above ground and accessible for periodic replacement of the non-bonded rubber liners.

For drinking water systems, any insert or liner (or other internal rubber component) must comply with the requirements of AS/NZS 4020. 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. The compression set of the test piece shall also be confirmed for each valve supplied by the vendor. The tests for adhesive bond and compression set for any valve supplied shall be undertaken in accordance with all applicable Australian or International Standards and may need to be independently witnessed if SA Water requests. The Designer must inform the valve Vendor of the right for SA Water, or its representative, to witness the adhesive bond and compression set tests and provide SA Water with sufficient notice to organise the witnessing of these tests.

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 will be considered (as required). The Designer will need to demonstrate the suitability of the alternate testing methods or standards to SA Water.

SA Water may request a destructive test of a vulcanised liner, that is, a liner pull-off test, to demonstrate adhesion and consistency between standardised testing (during batch manufacture as per ASTM Standards) and actual manufactured product (ready for client delivery). Results of this testing shall be made available to SA Water.

The Designer must confirm whether a valve vendor will utilise a third-party factory (separate from the vendor) 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.

6.2.5 Body seat ring

Enamelled surfaces on the inside of the valve cast or fabricated body can be used in lieu of seat rings. A specification confirming the type, method of application, thickness, AS/NZS 4020 compliance and design life of the enamel used shall be prepared by the designer and no valve shall be procured until these details are provided by the vendor to the Designer.

6.2.6 Seals and O-rings

Particular 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.

7 Testing

7.1 Factory testing

All factory tests, as stipulated in AS/NZS 2638.1, AS/NZS 2638.2, AS 4795.1, 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 and communicated to designer. Depending on the contractual arrangements for the supply of the valve(s), criticality, 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.

7.1.1 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 contracts 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, whether this standard is to be applied.

7.1.2 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 contracts 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).

The following non-exclusive list of considerations is to be considered in making the decision to witness the testing (or not):

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) body or components.
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.

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 engineer 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.

7.2 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, the dimensions and details of all valve elements, sections through the valve seat showing a method of construction/assembly. 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 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 before any valves are shipped from factories (or other points of origin).

7.2.1 Type and production tests

Type and production tests must be carried out as required and described in AS/NZS 2638.1, AS/NZS 2638.2, AS 4795.1 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.

7.2.2 Dimensional measurements

All dimensions of the valves must be measured and recorded and confirm with drawings, including flange dimensions.

7.2.3 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-to-closed-to-open position must be checked.

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

7.2.4 Materials certifications

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

7.2.5 Pressure tests

7.2.5.1 Metal seated gate valve

Type testing of metal seated gate 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 5.2) 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/NZS 2638.1. 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 metal seated gate 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 5.2) 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 metal seated gate valves must be conducted in accordance with AS/NZS 2638.1 and witnessed and recorded as follows (and in the order listed):

1. Body Strength: **WITNESS POINT**

   With reference to AS/NZS 2638.1, metal seated gate valves subject to production body strength pressure testing shall be arranged with blank flanges connected on both sides, the enclosed volume filled with water and the gate in the open position. Pressure testing must be conducted to 1.5 times the pressure rating for the valve, and this pressure is sustained for five (5) minutes (for all valve sizes) with no detectable leakage through the valve spindle or any other part of the valve body. There shall be no plastic (permanent) deformation or distortion of the valve body or components.

2. Sealing Tests: **WITNESS POINT**

   With reference to AS/NZS 2638.1, a blank flange must be fitted to one side of the valve only, and the gate must be closed 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 gate 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. Pressure testing must be conducted to 1.1 times the pressure rating for the valve, and this pressure is sustained for five (5) minutes (for all valve sizes) with preferably no leakage (this is to be confirmed visually and by reference to connected pressure gauges). If there is leakage, then the rate of leakage must not

exceed the limits set in AS/NZS 2638.1. The method of determining the rate of leakage must be requested from the vendor and confirmed as suitable by the Designer.

7.2.5.2 Resilient seated gate valves

Type testing of resilient seated gate valves is acceptable when the criticality of the valves has been assessed in accordance with this Technical Standard (including section 5.2) and the Designer or Constructor 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/NZS 2638.2. 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 pressure testing of all resilient seated gate valves must be conducted in accordance with AS/NZS 2638.2 and witnessed and recorded as follows (and in the order listed):

1. Body Strength: **WITNESS POINT**

   With reference to AS/NZS 2638.2, resilient seated gate valves subject to production body strength pressure testing shall be arranged with blank flanges connected on both sides, the enclosed volume filled with water, and the gate in the open position. Pressure testing must be conducted to 1.5 times the pressure rating for the valve, and this pressure is sustained for 5 minutes (for all valve sizes) with no detectable leakage through the valve spindle or any other part of the valve body. There shall be no plastic (permanent) deformation or distortion of the valve body or components.

2. Sealing Tests: **WITNESS POINT**

   With reference to AS/NZS 2638.2, a blank flange must be fitted to one side of the valve only, and the gate must be closed 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 gate 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. Pressure testing must be conducted to 1.1 times the pressure rating for the valve, and this pressure is sustained for five (5) minutes (for all valve sizes) with no leakage (this is to be confirmed visually and by reference to connected pressure gauges). No leakage is permitted during the test.

7.2.5.3 Pressure testing of refurbished valves

All refurbished valves regardless of size or pressure ratings shall be tested to the original pressure rating. Refer to TS 0900 for procedure.

7.2.5.4 Pressure testing of refurbished E&WS valves

All E&WS refurbished valves to be tested to the original pressure rating. Any deviation shall be submitted by dispensation request in accordance with TS 0104 standard to principal mechanical engineer for recommendation.

7.2.6 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 (if compliance with EPA limits is required, then designers, constructors or valve vendors must make contact with the SA Water to determine whether lower noise restrictions than stipulated by the EPA apply).

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 at 1m and sound power levels must be measured with the valve partially open and the hydraulic conditions which generate maximum noise established.

7.2.7 Other tests (including coating tests)

If internal or external coatings have been applied, then testing and then certification of the method of application, coverage, thickness, and holiday testing (spark testing) of the coating shall be provided to the Designer 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, external, or both coatings.

All coatings for gate valves shall be tested in accordance with AS/NZS 2638.1 and AS/NZS 2638.2 and certified including TS 15, TS 16, and TS 18 for buried valves.

7.2.8 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 must request any certified CAD and other electronic format drawings from the Vendor and forward these drawings to SA Water.

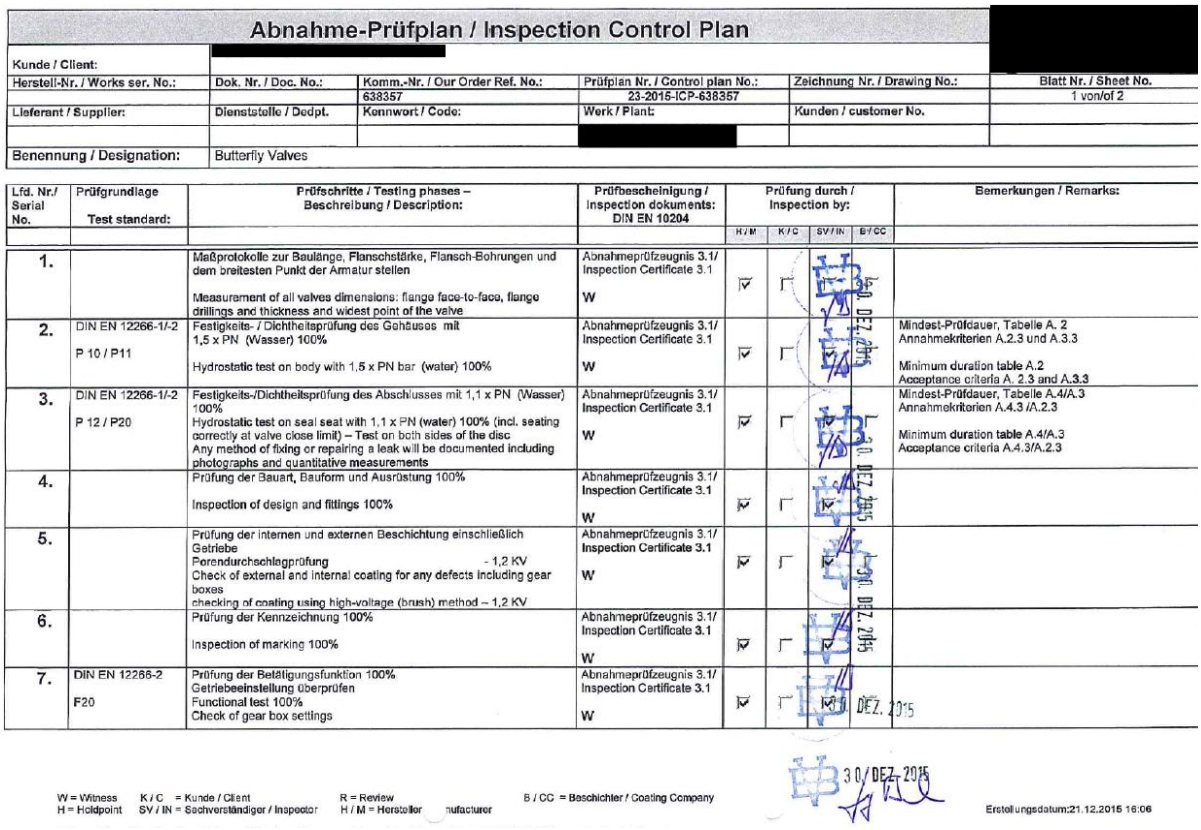
Any specific pipe, spool, or other device required to establish particular flow conditions approaching the suction side of a valve must be explicitly declared by valve Vendors, and certified dimensional engineering drawings of the pipe, spool, or other device must be provided before the valve procurement.

7.3 Pre-shipping documentation and delivery inspections and testing

7.3.1 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 and is defect-free at the time the valve is released for shipping from the factory.

An Inspection Test Plan (ITP) must be requested from the vendor by the Designer, 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, 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, and the Designer 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.



Abnahme-Prüfplan / Inspection Control Plan

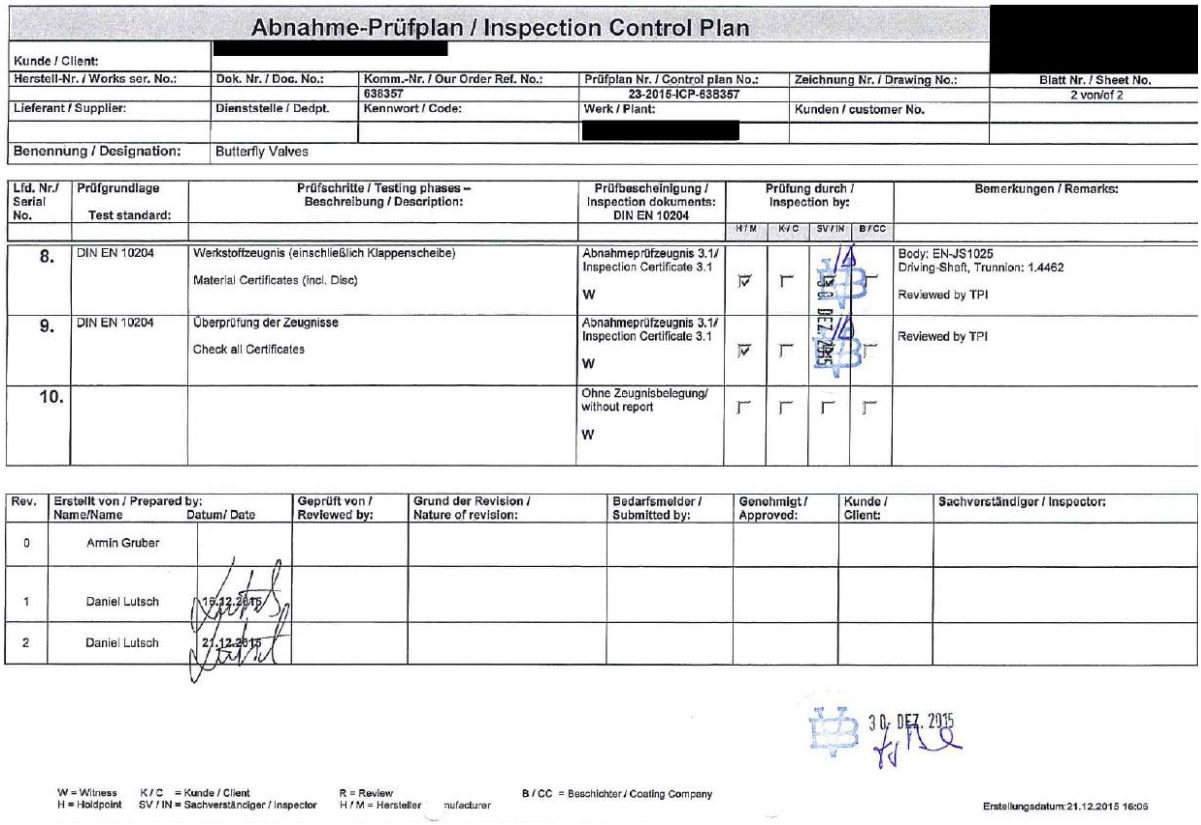
Kunde / Client: [redacted]					
Herstell-Nr. / Works ser. No.:	Dok. Nr. / Doc. No.:	Komm.-Nr. / Our Order Ref. No.: 638357	Prüfplan Nr. / Control plan No.: 23-2015-ICP-638357	Zeichnung Nr. / Drawing No.:	Blatt Nr. / Sheet No. 1 von/of 2
Lieferant / Supplier:	Dienststelle / Dedpt.	Kennwort / Code:	Werk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

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

Erstellungsdatum:21.12.2015 16:06

Figure 3: Pre-shipping inspection test plan



Abnahme-Prüfplan / Inspection Control Plan

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						

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

Erstellungsdatum:21.12.2015 16:06

Figure 4: 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 7.3.2.

7.3.2 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. Valve seating defects.
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 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 valve defects in accordance with the terms of the contract.

SA Water Procurement may stipulate, based on an assessment of the criteria identified below, 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:

a. Criticality of the valve when installed and operational.
b. Ease or difficulty of maintenance (and repair or removal) of the valve once installed and operational.
c. Required design life of the valve(s) (both components and body).
d. SA Water technical knowledge of issues with the type of valve(s), which can be managed by witnessed testing.
e. 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.
f. Specific SA Water testing results or performance history for the type of valve(s) to be purchased.

Any such stipulation will be expressed in the relevant contracts with Designers or constructors or directly with a SA Water Workshop prior to any supply contract with a vendor being entered, and the vendor will be notified of the intention to conduct post-delivery testing.

7.3.3 Re-Testing

The Designer must ensure the re-testing requirement is included in the valve specification or datasheets issued to Vendors prior to the procurement of any valve. Re-testing of a valve may be required for other reasons as stipulated in the relevant contract, specification or datasheet developed by the Designer and issued to the valve vendors prior to the procurement of any valve.

7.4 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.

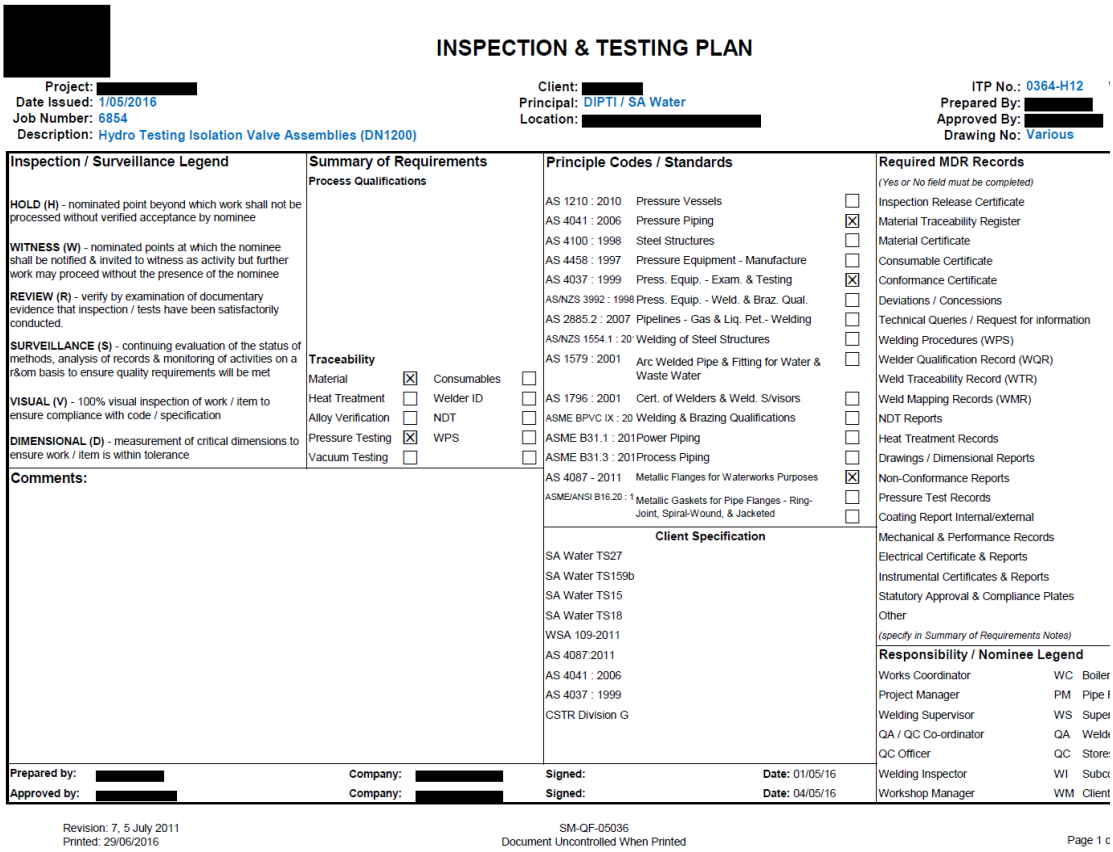
When a risk assessment confirms that workshop testing is required, buried valves used for isolation or control, whether actuated or not, which are not directly connected flange to flange into an existing system, must be assembled with upstream and downstream pipework spools in a testing workshop, in 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. 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 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, the following 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 with connected upstream and downstream pipe spools. The ITP must be specifically updated for each valve by the Designer or Constructor, in consultation 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. 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 5, Figure 6 and Figure 7.



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
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	☒	Consumables	☐
Heat Treatment	☐	Welder ID	☐
Alloy Verification	☐	NDT	☐
Pressure Testing	☒	WPS	☐
Vacuum Testing	☐		

Comments:

Principle Codes / Standards

AS 1210 : 2010	Pressure Vessels	☐
AS 4041 : 2006	Pressure Piping	☒
AS 4100 : 1998	Steel Structures	☐
AS 4458 : 1997	Pressure Equipment - Manufacture	☐
AS 4037 : 1999	Press. Equip. - Exam. & Testing	☒
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	☒
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)

Inspection Release Certificate
Material Traceability Register
Material Certificate
Consumable Certificate
Conformance Certificate
Deviations / Concessions
Technical Queries / Request for information
Welding Procedures (WPS)
Welder Qualification Record (WQR)
Weld Traceability Record (WTR)
Weld Mapping Records (WMR)
NDT Reports
Heat Treatment Records
Drawings / Dimensional Reports
Non-Conformance Reports
Pressure Test Records
Coating Report Internal/external
Mechanical & Performance Records
Electrical Certificate & Reports
Instrumental Certificates & Reports
Statutory Approval & Compliance Plates
Other
(specify in Summary of Requirements Notes)

Responsibility / Nominee Legend

Works Coordinator	WC	Boiler
Project Manager	PM	Pipe f
Welding Supervisor	WS	Super
QA / QC Co-ordinator	QA	Weld
QC Officer	QC	Store
Welding Inspector	WI	Subco
Workshop Manager	WM	Client

Prepared by:	[redacted]	Company:	[redacted]
Approved by:	[redacted]	Company:	[redacted]

Signed: Date: 01/05/16
Signed: Date: 04/05/16

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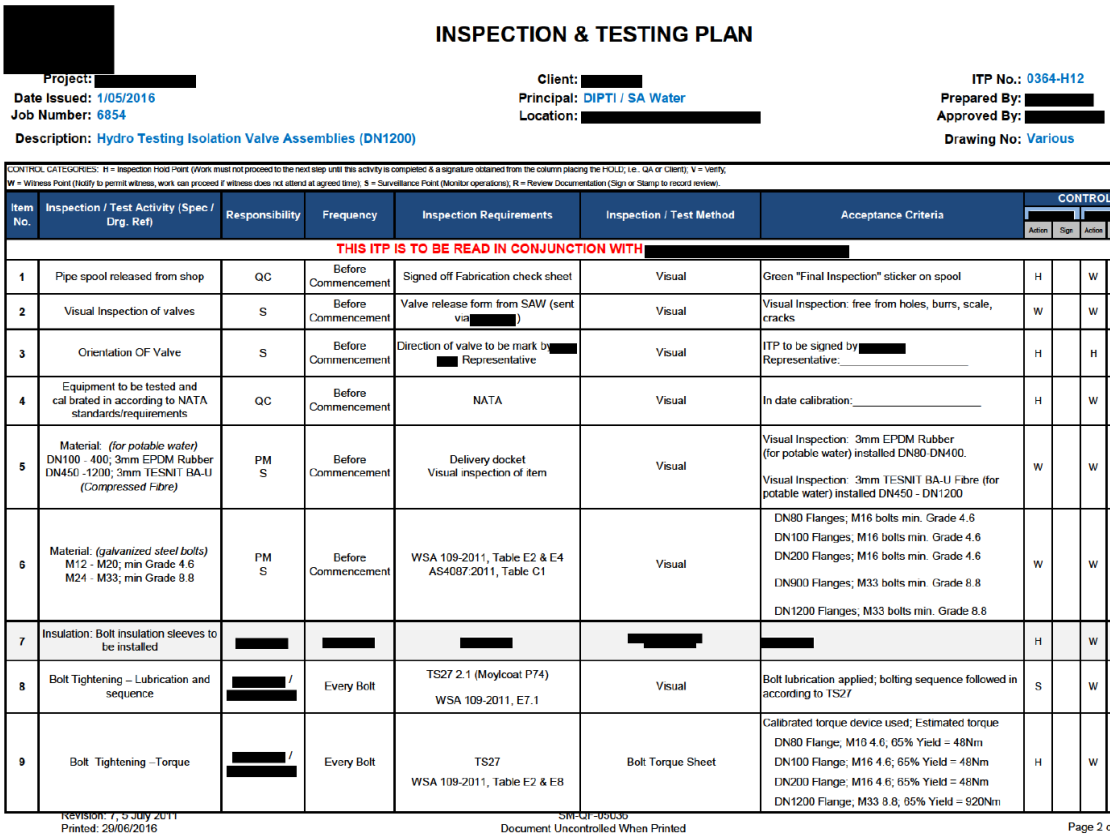
Figure 5: Workshop inspection test plan



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
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 [redacted] Action	Sign	CONTROL [redacted] Action
	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
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
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
4	Equipment to be tested and cal brated in according to NATA standards/requirements	QC	Before Commencement	NATA	Visual	In date calibration:_____	H		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
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
7	Insulation: Bolt insulation sleeves to be installed	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	H		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
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

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Figure 6: Workshop inspection test plan

[redacted]

INSPECTION & TESTING PLAN

Project: [redacted] **Client:** [redacted] **ITP No.:** 0364-H12 **Version:** 4
Date Issued: 1/05/2016 **Item No.:** [redacted] **Prepared By:** [redacted]
Job Number: 6854 **Approved By:** [redacted]
Description: Hydro Testing Isolation Valve Assemblies (DN1200) **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:** .....

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Figure 7: Workshop inspection test plan

A Schedules of hold points, witness points

Section	Type	Description
7.2.5.1	Witness	Metal seated gate valves Body Strength
7.2.5.1	Witness	Metal seated gate valves Sealing Tests
7.2.5.2	Witness	Resilient seated gate valves Body Strength
7.2.5.2	Witness	Resilient seated gate valves Sealing Tests