

Engineering

Technical Standard

TS 0420 - Welding Requirements (Metals)

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Only the current revision of this Standard should be used which is available for download from the SA Water website.

Documents Superseded by this Standard

The following documents are superseded by TS 0420 Version 4.0

- TS 0420 Version 3.0

Significant/Major Changes Incorporated in This Edition

This is a major revision to TS 0420. The document has been extensively updated and aligned to changes to Australia and International Standards as well as feedback received from users of the previous version.

Given the breadth of changes made, users of this document are strongly advised to re-familiarise themselves with the requirements of this latest revision.



Document Controls

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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 fit for purpose.

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

This Technical Standard also provides detail of the application of relevant Australian and/or International Standards, which are note in tables below the heading of each applicable section. Further guidance as to the respective requirements can be obtained from these sources directly.

1.1 Purpose

The purpose of this standard is to detail minimum requirements to ensure that fabricated infrastructure covered by the scope of this standard are constructed and maintained to consistent standards and attain the required asset design life.

1.2 Glossary

The following glossary items are used in this document:

Term	Description
API	American Petroleum Institute
ASTM	American Society for Testing Materials
BMS	Business Management System
CE	Carbon Equivalent
CSR	Compliance Statement Report
DPI	Dye Penetrant Inspection
FCAW-GS	Flux Cored Arc Welding Gas-shielded
FCAW-SS	Flux Cored Arc Welding Self-Shielding
FSBW	Full Strength Butt Weld
GMAW	Gas Metal Arc Welding
GMAW-P	Gas Metal Arc Welding Pulsed
GTAW	Gas Tungsten Arc
HAZ	Heat Affected Zone
ITP	Inspection and Test Plan/s
IWE	International Welding Engineer
IWI-B	International Welding Inspector - Basic
IWI-S	International Welding Inspector - Standard
IWS	International Welding Specialist
IWT	International Welding Technologist
MDR	Manufacturers Data Report
MMAW	Manual Metal Arc Welding
MPI	Magnetic Particle Inspection
MSCACL	Mild Steel Calcium Aluminate Composition Lined

Term	Description
MSCL	Mild Steel Cement Lined
NATA	National Association of Testing Authorities
NCR	Non-compliance Report(s)
NDT/NDE	Non-Destructive Testing / Examination
PAUT	Phased Array Ultrasonic Testing
PWPS	Preliminary Welding Procedure Specification
R _a	Average Surface Roughness
RFEE	Request for Engineering Engagement
RT	Radiographic Testing (X-ray or Gamma)
SA Water	South Australian Water Corporation
SAW	Submerged Arc Welding
SDS	Safety Data Sheet
SMAW	Shielded Metal Arc Welding
TG	SA Water Technical Guideline
TS	SA Water Technical Standard
UT	Ultrasonic Testing
WPQR	Welding Procedure Qualification Record
WPS	Welding Procedure Specification: is a Qualified Weld Procedure which has been developed, tested and approved
WQMS	Welding Quality Management System
WQTR	Welder Qualification Test Record

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. Unless otherwise specified, the latest edition of Standards and Codes shall be used.

Number	Title
AS 1171	Non-destructive testing - Magnetic Particle Testing of Ferromagnetic Products, Components and Structures
AS 1579	Arc-Welded Steel Pipes and Fittings for Water And Wastewater
AS 1594	Hot-Rolled Steel Flat Products
AS 1665	Welding of Aluminium Structures
AS 1796	Certification of Welders and Welding Supervisors
AS 2062	Non-Destructive Testing - Penetrant Testing of Products and Components
AS 2177	Non-Destructive Testing - Radiography of Welded Butt Joints in Metal
AS 2207	Non-Destructive Testing - Ultrasonic Testing of Fusion Welded Joints in Carbon and Low Alloy Steel
AS 3545	Welding Positions
AS 3978	Non-Destructive Testing - Visual Inspection of Metal Products and Components

Number	Title
AS 3992	Pressure Equipment – Welding and Brazing Qualification
AS 4037	Pressure Equipment – Examination and Testing
AS 4041	Pressure Piping
AS 4458	Pressure Equipment – Manufacture
AS 4855	Welding Consumables – Covered Electrodes for Manual Metal Arc Welding of Non-Alloy Fine Grain Steels
AS 4882	Shielding Gases for Welding
AS/NZS 14341	Welding Consumables - Wire Electrodes and Weld Deposits for GMAW of Non-Alloy and Fine Grained Steels
AS/NZS 1554.1	Structural Steel Welding
AS/NZS 1554.2	Stud Welding (Steel Studs to Steel)
AS/NZS 1554.3	Welding of Reinforcing Steel
AS/NZS 1554.4	Welding of High Strength Quenched & Tempered Steels
AS/NZS 1554.5	Welding of Steel Structures Subject to High Levels of Fatigue Loading
AS/NZS 1554.6	Welding of Stainless Steel for Structural Purposes
AS/NZS 1554.7	Welding of Sheet Steel Structures
AS/NZS 2214	Certification of Welding Supervisors – Structural Steel Welding
AS/NZS 2980	Qualification of Welders for Fusion Welding of Steels – Superseded by AS/NZS ISO 9606.1
AS/NZS 4854	Welding Consumables – Covered Electrodes for Manual Metal Arc Welding of Stainless and Heat Resistant Steels
AS/NZS 5131	Structural Steelwork Fabrication and Erection
AS/NZS ISO 14171	Welding Consumables - Solid Wire Electrodes, Tubular Cored Electrodes and Electrode/Flux Combinations for Submerged Arc Welding of Non-Alloy and Fine Grain Steels
AS/NZS ISO 14174	Welding Consumables - Fluxes for submerged arc welding and electroslag welding
AS/NZS ISO 14731	Welding Coordination
AS/NZS ISO 17632	Welding Consumables - Tubular Cored Electrodes for Gas Shielded and Non-Gas Shielded FCAW of Non-Alloy and Fine Grain Steels
AS/NZS ISO 17637	Non-destructive testing of welds - Visual testing of fusion-welded joints
AS/NZS ISO 3834	Quality Requirements for fusion welding of metallic materials
AS/NZS ISO 9001	Quality Management Systems
AS/NZS ISO 9606-1	Qualification testing of welders - Fusion welding - Part 1: Steels
NACE MR0103	Materials Resistant to Sulphide Stress Cracking in Corrosive Petroleum Refining Environments

1.3.2 SA Water Documents

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

Number	Title
TS 15	Protection of Steelwork In Submersible Environments
TS 16	Protection of Steelwork In Atmospheric Environments
TS 18	Protection of Steelwork In Buried Environments
TS 0230	Gate and Butterfly Valve Requirements
TS 0465	Mortar Repair Systems
TS 0730	Stainless Steel Durability, Fabrication and Erection
TS 0850	Liquid Chemical Dosing

1.4 Definitions

The following definitions are applicable to this document:

Term	Description
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.
Contractor	A person or firm that undertakes a contract to provide materials or labour to perform a service or complete a task.
Designer	A person whose profession, trade or business involves them in: <ul style="list-style-type: none"> Preparing sketches, plans, or drawings for a structure, including variations to a plan or changes to a structure. Making decisions for incorporation into a design that may affect the health or safety of persons who construct, use or carry out other activities in relation to the structure.
Fabrication	All activities required to produce and deliver a component. As relevant, this comprises procurement, preparation and assembly, welding, mechanical fastening, transportation, surface treatment, corrosion protection, inspection and documentation thereof.
Fabricator	The organization engaged by SA Water or Constructor to carry out welding/fabrication and or erection activities on/for SA Water infrastructure.
IIW	International Institute of Welding
Manufacturer	A person, group, or company that owns and operates a manufacturing facility that provides materials for use in SA Water infrastructure
Non-destructive Examination (NDE)	An inspection of a weld via visual means and / or other testing (RT, UT, MPI, DPI or PAUT) that does not destroy the sample.
Responsible Discipline Lead	The engineering discipline expert responsible for TS 0420 defined on page 3 (via SA Water's Representative).
SA Water's Representative	The SA Water representative with delegated authority under a Contract or engagement, including (as applicable): <ul style="list-style-type: none"> Superintendent's Representative (e.g., AS 4300 & AS 2124 etc.) SA Water Project Manager SA Water nominated contact person.
Specials	Fabricated section of pipe such as an elbow, tee, or modified line pipe. Manufactured via manual welding processes.

Term	Description
Subcontractor	The organization engaged by the Constructor to perform works on SA Water assets.
Supplier	A person, group or company that provides goods for use in SA Water infrastructure
Supplier declaration of conformity (SDoC)	A document issued by the supplier declaring that the products supplied comply with the requirements of the relevant Australian Standard and that the documentation required by the Standard is available for issue.
TDRF	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.
Terminology	<ul style="list-style-type: none"> 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 or not 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". Each word implying persons shall, where appropriate, also be construed as including corporations. "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. "Allow" shall mean that the cost of the item referred to is the responsibility of the Constructor. "Provide" shall mean "supply and install". "Submit" shall mean "submit to the SA Water Representative or their nominated delegate". Submissions, requests, proposals are to be provided at least 7 working days prior to work commencing or material ordering (unless noted otherwise). "Informative" shall mean "provided for information and guidance"
Visual Examination – VE (NDE)	A visual examination (also known as visual inspection) of the weld and defects including the use of visual aids and measuring devices to determine the weld quality has been achieved to conduct with respect to alignment, weld size, defect etc.
Visual Scanning	Determine all weld on the drawings are included and to detect gross defects.
Welder	Welder would commonly perform SMAW, MMAW, FCAW or GTAW
Welder Qualification Period	Demonstration that the Welder is within his Qualification Period for a particular Welding Procedure within a previous six-month period. Reference AS/NZS ISO 9606.1 Section 10, AS/NZS 1554.1, AS3992 & AS/NZS 2980.
Welding Coordinator	See Welding Supervisor
Welding Inspector	The Welding Inspector be qualified under the Certification Scheme for Welding Inspection Personnel also shall have training and experience in the fabrication and inspection of welded structures (further defined in Section 6.3 Welding Inspector).

Term	Description
Welding Operator	A welding operator is one who operates adaptive control, automatic, mechanized, or robotic welding equipment.
Welding Supervisor	All welding shall be supervised by Welder Supervisor qualified, employed by or contracted to the organization responsible for undertaking the welding work, Qualifications are defined in Section 6.2 Welding Supervisor.
Work	Means metal fabrication and repair work, involving welding, carried out by SA Water and Contractors or Sub Contractors to which this Technical Standard applies.

2 Scope

Reference Standard underpinning this Section	Relevant Sections/s
AS/NZS/ISO 3834.2	Section 5 - Sections 5.1, 5.2 & 5.3

This Technical Standard covers requirement of welding procedure specification preparation, qualification of welding procedures and personnel, workmanship and inspection requirements for welds related to the welding by Manual Metal Arc Welding (MMAW), Gas Metal Arc Welding (GMAW), Flux Cored Arc (FCAW), Gas Tungsten Arc (GTAW), Submerged Arc Welding (SAW).

Welding shall be carried out in accordance (in order of precedence) with the requirements of:

- 1) AS/NZS 5131 construction categories CC2 or CC3 for structural steelwork and requirements of ISO 3834.2 as specified on the design drawings.
- 2) TS 0420
- 3) Australian Standards including Safety Standards
- 4) Drawings/Specifications using appropriate plant and equipment.

Welding in this standard (TS 0420) covers the following categories of welding work:

- The manufacture of Spiral Welded Pipe; AS 1579 / AS/NZS 1554.1 SP
- Shop welding of "Specials" (fittings/bends/tapers etc); AS/NZS 4041 Class 2P or Class 3.
- Site welding of pipes, pipe fittings & flanges AS/NZS 4041 Class 2P or Class 3.
- Structural Steel Welding; AS/NZS 1554 Parts 1- 7
- Welding of Aluminium Structures; AS 1665.

Note: 'Wet welding' operations are excluded from the scope of this Technical Standard.

This Technical Standard does not remove the responsibility of any party to provide a safe workplace, systems, and methods in accordance with Work Health & Safety Regulations and local Occupational Health and Safety Regulations. Refer to WTIA Tech Note 7-04 Health & Safety in Welding, & WTIA Tech Note 22-03 Welding Electrical Safety.

2.1 Technical Dispensation

Departure from any requirement of this Technical Standard shall require the submission of Technical Dispensation Request Form (TDRF) for the review and approval (or otherwise) of SA Water Principal Engineer listed in Page 3, on a case-by-case basis.

The Designer shall not proceed to document/incorporate the non-conforming work before the Principal 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.

2.2 Structural Weld Design

In addition to undertaking structural design activities to address design actions, the structural welding requirements of this Technical Standard require a Designer to nominate a Construction Category in accordance with AS/NZS 5131 (which shall not be less than CC2).

Selection of Construction Category shall be based on a risk assessment, to ensure that the category selected (and the corresponding levels quality assurance and material traceability) are proportional to the risk, to deliver safe, value for money infrastructure outcomes for SA Water in accordance with TS 0420.

3 Acceptance Prior to Commencement of Work

Reference Standard underpinning this Section	Relevant Section/s
AS/NZS/ISO 3834.2	Section 7 - Sections 7.2 & 7.3
	Section 8 - Sections 8.2
	Section 14 - Sections 14.1, 14.2, 14.3 & 14.4

The Constructor shall submit the following documents to the SA Water Representative at contract award and as a minimum, at least ten (10) business days prior to the commencement work being fabricated in accordance with this Technical Standard. The submission, review and acceptance of these documents constitutes a **HOLD POINT** under this Standard (refer 4.7.1 and ITP Elements in Appendix A).

The process for initiating a review is via the Request for Engineering Engagement (RFEE) system where the SA Water Representative shall provide the documents and workorder for the project. The review process map is set out in Appendix C and is available on Engineering's BMS page [Engineering \(sharepoint.com\)](#).

The documents which shall be provided are:

- Inspection & Test Plan (ITP)
- The Qualified Welding Procedure Specification (WPS) intended for use on the work, including:
 - Weld Procedure Qualification Record, (WPQR)
 - Mechanical and non-destructive test results, (NATA endorsed),
 - Material certification,
 - Welding Consumable certification.
- Welder/Welder Operator Qualification Test Records (WQTR) are within the Welder Qualification Period
 - Inclusive of NDE/NDT results.
- Welding Supervisor qualifications
- Welding Inspector qualifications.

Note: Where documents and supporting information provided is insufficient, incomplete or incorrect, the RFEE will be returned. Only when updated and complete documents are received will the review commence, with 15 business days to be allowed for the response to be provided. Thus the acceptance should be requested as soon as possible, and well in advance of construction.

All correspondence, communication, and queries outside the RFEE system are to be directed to welding@sawater.com.au.

A letter of acceptance will be sent to the applicant to release the hold point for each project.

4 Quality Requirements

Reference Standards underpinning this Section	Relevant Section
AS/NZS/ISO 3834.2	Section 18
AS/NZS/ISO 3834.3	

4.1 Quality Assurance

Constructors and Fabricators shall provide sufficient information to enable SA Water's Representative to assess their suitability for the Works.

Quality Documentation, relative to this Technical Standard, shall be:

- Presented in English and legible in a Manufacturers Data Report (MDR) format.
- A standard SA Water MDR Index, or a SA Water approved equivalent.

Appendix D6 contains a sample MDR Index.

4.2 Quality Management System

Reference Standards underpinning this Section	Relevant Section
AS/NZS ISO 3834.2	Section 18
AZ/NZS ISO 9001	All

The Fabricator shall establish, file and maintain quality records that demonstrate implementation and use of a Quality Management System (QMS) certified in accordance with ISO 9001. Confirmation of this certification shall be provided to the SA Water Representative and constitutes a **HOLD POINT** under this Technical Standard.

The Fabricator shall also ensure that standards, systems, processes and qualifications used are appropriate for the material being fabricated, and that fabrication work undertaken complies with these requirements.

4.3 Quality Management System Audits.

Reference Standards underpinning this Section	Relevant Section
AS/NZS/ISO 3834.2	Section 6 & 18
AZ/NZS ISO 9001	Section 9.2

The Fabricator shall undertake internal audits of their QMS in accordance with the requirements of AS/NZS ISO 9001.

SA Water's Representative reserved the right to undertake additional audits of the Fabricator's QMS by way of review and verification of records or external inspection and testing.

4.4 Quality Plan

Reference Standards underpinning this Section	Relevant Section
AS/NZS/ISO 3834.2	Section 5 - Section 5.1
	Section 10 - Section 10.1
AS/NZS 5131	Section 4.5.2

The Fabricator shall, within 15 days of the Date of Acceptance of Tender, submit a draft Quality Plan (including details of the Fabricator's proposals for the management and control of quality for the Contract) for review by the SA Water Representative.

A finalised Quality Plan shall be provided within 15 days of receiving comments from SA Water's Representative.

4.5 Construction Category

Reference Standards underpinning this Section	Relevant Section
AS/NZS 5131	Section 4.7
	Section 5.2.3

In accordance with the requirements of AS/NZS 5131, the Designer shall assign a Construction Category or Categories to the structure described by the scope of work.

Guidance on the selection of the Construction Category can be found in Appendix C of AS/NZS 5131 and is based on the 'Importance Level' (IL), the 'Service Category' (SC) and the 'Fabrication Category' (FC).

The construction category shall be nominated in the construction specification and/or drawings. As a minimum, Construction Category CC2 shall apply.

4.5.1 Types of Traceability

This standard has adopted AS/NZS 5131 types of traceability. The three types of traceability are described as follows:

4.5.1.1 Lot

For lot traceability, the material for a lot of identically fabricated components (main members, purlin cleats, etc.) shall be traceable back to a set of parent material test certificates, but an individual test certificate cannot be assigned to an individual piece of material within that lot of components. Material identification shall be transferred when part material is returned to stock and before further being allocated to other jobs.

4.5.1.2 Piece-mark

For piece-mark traceability, the raw material or fabricated component shall be traceable to the parent material test certificates at all stages through fabrication to incorporation into the works on-site, for each piece-mark, of which there may be many individual pieces. Raw material including all plate and section bought or allocated from stock for the work shall be correlated to the test certificates and incoming inspection records. Material identification shall be transferred when part material is returned to stock and before further being allocated to other jobs.

4.5.1.3 Piece

For piece traceability, the raw material or fabricated component shall be traceable to the parent material test certificates at all stages through fabrication to incorporation into the works on-site, for each piece of steel. Raw material including all plate and section bought or allocated from stock for the work shall be correlated to the test certificates and incoming inspection records. Material identification shall be transferred when part material is returned to stock and before further being allocated to other jobs.

4.5.2 Construction Category's Traceability Levels

This standard has adopted AS/NZS 5131's traceability levels. Unless specified otherwise, the minimum acceptable level of traceability for SA Water works shall be CC2.

Note: A copy of the test certificates or supplier declaration of conformity (SDoC) with purchasing information shall be maintained, and a copy provided to the SA Water Representative for all purchased components for all categories.

Traceability is described as follows:

4.5.2.1 For CC2

Test certificates shall be provided for all steel material. Lot Traceability for main structural members, connections between main structural members and major plate components (for fabricated plate web girders and the like).

4.5.2.2 For CC3

Test certificates shall be provided for all steel material. Lot traceability for all items (including cleats, brackets and the like). Piece or piece mark traceability is required if so designated in the construction specification.

4.6 Work Identification and Traceability

<i>Reference Standards underpinning this Section</i>	<i>Relevant Section</i>
AS/NZS/ISO 3834.2	Section 17
AS/NZS 5131	Section 4.7

The Fabricator shall divide the works into lots for the purpose of:

- Positive identification and traceability of all work activities, measurements and tests
- Monitoring the quality of product
- Submission of work to SA Water's Representative under cover of a conformance report
- Rejection of work; and
- Application of dispensation provisions for below standard work.

The Fabricator is to define a system of lot numbering, practical for the Works, and which shall be logical, suit the specific application and be consistent with any specified computerised system.

All work and/or activities shall be able to be readily identified with the relevant lot.

The lot identification system, site records and sample numbering system shall allow test results to be positively identified with the lot they represent.

Weld numbers, if required above, shall be maintained by the Contractor, and shall be indicated on "As Built" Isometrics or weld maps.

All material (where unique identifier numbers are required) shall have identification numbers transferred to all cut lengths, to maintain traceability of all materials.

Refer to Appendix D2 and D3 for weld traceability.

4.7 Inspection and Test Plans

<i>Reference Standards underpinning this Section</i>	<i>Relevant Section</i>
AS/NZS/ISO 3834.2	Section 14
AS/NZS/ISO 3834.3	
AZ/NZS ISO 9001	Section 8

The Fabricator shall submit Inspection and Test Plans (ITPs) covering all materials supply, construction/installation, and testing/commissioning work elements of the Works in accordance with Section 3.

ITPs shall include, but are not limited to, the following information for each significant activity identified in the relevant process:

- 1) Description of the work activity/sequence of activities
- 2) Work item or work lot identification
- 3) Specification requirements/reference
- 4) Person responsible for activity (title)
- 5) Witness points, hold points and checklists
- 6) Inspection/test type and tolerances or other acceptance criteria
- 7) Identification of relevant test procedure and quality records
- 8) Details of test equipment to be used for specified tests
- 9) Sequence and frequency of Tests/inspections
- 10) Identification of records to be maintained of tests, inspections, and trials; and
- 11) Use of representative samples to demonstrate acceptable standards of workmanship for activities where subjective assessment of quality may be required, e.g., finishes.

ITPs will be reviewed and returned to the Fabricator and may be provided with nomination of specific witness points required by the SA Water Representative included.

Fabricators shall provide the SA Water Representative with one copy of each signed off ITP within 5 working days of completion of the activity to which the ITP relates.

- The number and status of all non-compliances identified in undertaking works shall be recorded in ITPs and attached to the completed ITP. ITPs shall not be considered complete until corrective actions are completed as agreed with the SA Water Representative (Refer to Appendix D1).

4.7.1 Hold Points

The minimum required Hold Points are detailed within Appendix A of this Technical Standard. Additional Hold Points are at the discretion of the SA Water Representative or the Constructor and/or Fabricator.

Hold points represent a critical stage of the work that requires release by the SA Water Representative before works can proceed further. The process for hold points release is provided below:

- a) For Hold Points associated with design or documentation submissions, these shall be submitted to the Representative for release within the nominated timeframes.

- b) For Hold Points associated with inspections, the Constructor and/or Fabricator shall submit a request for a Hold Point inspection when work is at such a stage and is ready for inspection. A minimum of 48 hours' notice shall be provided before the hold point is reached.
- ii) This request should also contain photographic evidence of the works that:
 - Consist of "jpg" files with a minimum size of 4 megapixels
 - Clearly denote where the image was taken
 - Are provided with a time and date stamp
 - iii) Submission of the photographic evidence may allow the hold point to be released without physical inspection having to occur, at the discretion of the SA Water Representative.
- c) If after the Hold Point inspection further work is required prior to proceeding, submit a request for re-inspection by the Representative prior to written approval being given.
- d) Subject to prior approval from the SA Water Representative (via a TDRF), the Constructor-nominated Quality Representative may be authorised to release the project-specific hold points. This is conditional on all records (including photographic evidence) being retained and furnished for later inspection. SA Water also reserves the right to undertake a random audit inspection of works being delivered.

4.7.2 Witness Points

The minimum required Witness Points are detailed within Appendix A of this Technical Standard. Additional Witness Points are at the discretion of the SA Water Representative or the Constructor and/or Fabricator.

Witness points represent a point at which compliance of the works with the drawings, QMS or ITP is to be verified.

The Constructor shall provide a minimum of 24 hours' notice to the SA Water Representative of a witness point being reached, with attendance by the SA Water Representative to be at their discretion.

4.8 Non-conformance

Reference Standards underpinning this Section	Relevant Section
AS/NZS/ISO 3834.2	Section 15
AZ/NZS ISO 9001	Section 10

The Constructor and Fabricator shall promptly advise the SA Water Representative and of any non-conformance, together with its location and proposals for corrective action where:

- a) There is potential for progress of the work to be seriously affected
- b) The proposed action to correct the non-conformance will result in work not complying with the requirements of the Technical Standard
- c) The time requirements of the Technical Standard have not been complied with
- d) The non-conformance may cause a health and safety hazard
- e) The non-conformance has resulted from a deficiency in the drawings or Technical Standard
- f) Material or serious environmental harm has occurred.

Each such notification shall include details of:

- o The action proposed for correction of the non-conformance, or the arrangements made for its disposition
- o The amendments to the quality system to mitigate recurrence of the non-conformance.

The Constructor and Fabricator shall not proceed to cover up or otherwise incorporate the non-conforming work before the SA Water Representative has approved of the proposed action in writing via a Technical Dispensation Request Form (TDRF).

Works that are carried out without being appropriately sanctioned by SA Water may be classed as defective work. Such work or material is liable to rejection by SA Water, who may require the defective work to be removed and replaced.

4.9 Materials Testing

Fabricators shall undertake independent laboratory testing as required by later sections of this Technical Standard.

Fabricators must demonstrate the following when procuring independent laboratory testing:

- a) Confirmation that the laboratory is adequately equipped, supervised, staffed and has the relevant previous experience
- b) Relevant certification (including NATA accreditation where required for each specific proposed test methods) are confirmed and sighted.
- c) That testing/inspection requests clearly indicate the testing required and traceability per Section 4.5.

SA Water reserves the right to collect samples and undertake any testing considered necessary to verify that the requirements of this Technical Standard are being adhered to.

4.10 Permits and Certificates

The Constructor and Fabricator shall obtain all necessary permits, certificates and approvals from SA Water and other relevant authorities as are required to carry out the Works. Copies of the approvals, permits etc. are to be supplied to the SA Water Representative upon receipt.

4.11 Site Records

Throughout the progress of the work, Fabricators shall ensure that:

- 1. Site supervisor/s have ready access to current standard (s) or other document (s) quoted or referred to in the Technical Standard for reference purposes.
- 2. A complete set of all up-to-date Drawings, Quality Documents and Specification(s), together with copies of all variations and additional drawings issued after the date of commencement are maintained.
- 3. Records are kept of any change to working drawings or shop drawings which may have been approved for construction purposes such that on completion of the works accurate "as constructed" information is available.

SA Water's Representative reserves the right to inspect daily records at any time during the works.

5 Welding Procedures

Reference Standards underpinning this Section	Relevant Section
AS/NZS/ISO 3834.2	Section 10
AS/NZS/ISO 3834.3	Section 10

All welding procedures used for SA Water infrastructure shall be qualified to the applicable project design standards and submitted for review per the process defined in Section 3. As a minimum, all welding procedures shall comply with the format requirements of AS/NZS ISO 3834.2 & 3.

Per Section 3, welding procedures are approved for specific projects/packages of work.

5.1 Welding Procedure Specifications (WPS)

Reference Standard underpinning this Section	Relevant Section
AS/NZS/ISO 3834.2	Section 10 - Sections 10.2 & 10.3

Fabricators performing welding for SA Water infrastructure, shall develop WPS' in accordance with the standards applicable to the material used in the work. The WPS's are to be reviewed and accepted by SA Water, in accordance with Sections 3 and 6.4.

5.2 Qualification of Pressure Piping Welding Procedures

Reference Standard underpinning this Section	Relevant Section
AS 3992:2020	Section 3
	Section 5 - Table 5.1

Each welding procedure that is intended to be used on SA Water infrastructure shall be suitably qualified in accordance with AS 3992, and this Technical Standard (refer Section 6.4)

Qualification is intended to demonstrate the suitability of the welding procedure for the material used in the work, specifically:

- The weld can be made without unacceptable imperfection (defects) in the weld deposit and heat affected zone (HAZ)
- The mechanical properties, such as strength, and if applicable fracture toughness and hardness, satisfy specified requirements
- The fabricating organisation and equipment is capable of successfully using the procedure.

Each welding procedure is only applicable within the limits of the essential variables in the Australian Standard which the procedure was qualified against.

The development of each welding procedure shall be recorded in detail, known as a Procedure Qualification Record (PQR) and shall contain all the major parameters / essential variables and at least the following information.

- Welding Standard
 - e.g., AS 4041 Class 1
- A sketch of the joint design
- Material(s) grade - type on both sides of the joint
- Material thickness - all parts
- Method of material(s) preparation
- Welding process(s) to be used.
- Welding position – Flat, Horizontal, Vertical, Overhead
 - e.g., 1G 2G 3G 4G 5G 6G – 6GR 1F 2F 3F 4F 5F 6F
- Number and sequence of runs
- Current AC, DCEP, DCEN, voltage, amperage, travel speed
- Preheat and inter-pass temperature.
- Heat input (KJ/mm) for each weld pass
- Interim cleaning such as, brush, de-slag, grind, chip
- Classification and diameter of electrodes / wires
- Shielding gas(s) / gas mixtures / flow rates
- Surface and / or material treatment post welding heat treatment - i.e., pickled & passivated.
- Welders name & ID
- Supervisors Name & Cert No
- Direction of weld travel up, down, push, drag.
- Qualified material thickness range

Any Welding Procedure Specification shall be re-qualified when the essential variables on the welding procedures being used vary outside of the prescribed limits in the specified standard/code. The Welding Procedure Qualification records shall be submitted to SA Water's Representative for review and approval in accordance with Section 3.

Duplex Stainless steel WPS shall record a Ferrite count in accordance with NACE MR0103.

Typical Welding Procedure Specifications (WPS) & Weld Procedure Qualification Records (WPQR) information and templates can be found in the appendices of AS 3992.

5.3 Qualification of Structural Steel Welding Procedures

<i>Reference Standard underpinning this Section</i>	<i>Relevant Section</i>
AS/NZS 1554.1	Section 4

Each welding procedure that is intended to be used on SA Water infrastructure shall be suitably qualified in accordance with AS/NZS 1554.1, and this Technical Standard.

Welding Procedure Specifications (WPS) are required to undergo the same qualification requirements as those stated in Section 5.2 above, however the welding code to be qualified against shall be AS/NZS 1554.1

The qualification of welding procedures to AS/NZS 1554 shall account for the different types and grades of materials covered by AS/NZS 1554: Parts 1, 2, 3, 4, 5, 6, or 7.

5.4 Qualification of Aluminium Welding Procedures

<i>Reference Standard underpinning this Section</i>	<i>Relevant Section</i>
AS/NZS 1665	Section 4

Each welding procedure that is intended to be used on SA Water infrastructure shall be suitably qualified in accordance with AS/NZS 1665, and this Technical Standard.

Aluminium Welding Procedure Specifications (WPS) are required to undergo the same qualification requirements as those stated in Section 5.2 above, however the welding code to be qualified against shall be AS/NZS 1665.

5.5 Qualification of Spiral Welded Pipe Welding Procedures for Butt Welds

<i>Reference Standard underpinning this Section</i>	<i>Relevant Section</i>
AS/NZS 1554.1	Section 4

Each welding procedure that is intended to be used in the manufacture of spiral welded pipe for use in SA Water's network shall be qualified by the Pipe Supplier and in accordance with AS 1579, and this Technical Standard.

Welding Procedure Specifications (WPS) are required to undergo the same qualification requirements as those stated in Section 5.2 above, however the welding code to be qualified against shall be AS/NZS 1554.1 (SP).

6 Welding Personnel – Roles and Responsibilities

6.1 Welding Supervisor

Reference Standards underpinning this Section	Relevant Section
AS/NZS ISO 14731	Welding Coordination
AS/NZS/ISO 3834.2	Section 6
	Section 7.3

The Welding Supervisor is equivalent to the Welding Coordination Role specified in AS/NZS ISO 14731 and shall be responsible for:

- a) Overseeing the production welding process, including, but not limited to:
 - i. Witnessing the execution of production welding
 - ii. Ensuring all Welding Procedure Specifications being used have been approved by SA Water.
 - iii. Confirming that joint fit-up meets the required standards
 - iv. Ensuring pre-weld, in process weld and final welding inspections are completed
- b) Ensuring that only qualified welders are engaged on production work
- c) Preparing test requests for the specified Non-Destructive Testing (NDT) on each component and piece.
 - i. The work of each welder shall be properly represented in the NDT process.

The Welding Supervisor shall hold the appropriate Welding Qualification as described below (based on the type of fabrication being undertaken), and be approved by SA Water as described in Section 3:

- a) Pressure Equipment
 - o IWE, IWT or IWS or AS 1796 Certificate 10
- b) Structural
 - o IWE, IWT, IWS, AS 1796 Certificate 10 or AS/NZS 2214

Note: The use of other qualification/certification must be approved via a TDRF.

A qualified Welding Supervisor may delegate minor tasks to suitably qualified personnel. However, such delegation shall be marked in a Welding Coordination roles and responsibilities matrix **and must be approved** by SA Water via a TDRF. The nominated Welding Supervisor remains responsible for all welding supervision and inspection tasks on the project.

The Fabricator shall provide details of the Welding Supervisor's qualification(s), certification, and experience records to the SA Water Representative prior to the commencement of any welding, as provided in Section 3.

6.2 Welding Inspector

Reference Standards underpinning this Section	Relevant Section
AS/NZS 5131	Table 7.4
AS/NZS ISO 3834.2	Section 5
AS/NZS ISO 14731	Welding Coordination – Tasks and Responsibilities

The Welding Inspector shall be responsible for:

- Conducting a technical review in accordance with AS/NZS ISO 3834.2 or 3 Section 5. This review shall include all drawings, specifications, documentation, requirements for welding and weld planning.
- Inspecting the required percentages as provided in Appendix B across all items, joint types, welders and weld procedures.
- Validating that NDT results comply with the requirements of this Technical Standard.
- Providing a written report containing the results of the technical review, inspections and NDT (including, but not limited to, weld mapping, preparation/fit up inspections and final visual inspections) that is signed by the Welding Inspector showing the fabricated item meets the requirements of this Technical Standard.

The Welding Inspector shall hold the appropriate Welding Qualification as described below (consistent with the type/category of fabrication being undertaken), and the Fabricator shall provide details of the Inspector's qualification(s), certification, and experience records to SA Water's Representative as described in Section 3:

- Pressure Equipment
 - IWE, IWI-S, IWT or AS 1796 Certificate 10.
- Structural *(listed in order of seniority as defined in AS/NZS 5131 – Table 7.4)*
 - IWE, IWT, IWS-B (Basic), IWI-S, IWS, AS 1796 Certificate 10 or AS/NZS 2214 (Supervisor).

Note: The use of other qualification/certification must be approved via a TDRF.

6.2.1 Independent Welding Inspector

6.2.1.1 Use of Independent Welding Inspector

The use of a third party, independent welding inspector may be required under one of the following provisions:

- An increased testing and inspecting regime are nominated by SA Water (via the SA the Designer or the contract specification) per Section 7.1.
- The SA Water Representative nominates that an Independent Welding Inspector is to be used or
- Where a Fabricator has been listed in Appendix F.
 - Performance of weld inspections completed by these Fabricators have been identified by SA Water to be incorrect, inaccurate, inadequate/incomplete, or otherwise erroneous.

Fabricators will be notified via formal written notice (prior to Appendix F being updated) and provided with an opportunity to raise a corrective action under their quality management system. This corrective action must satisfactorily address shortcomings of internal inspection activities (and be validated as having done so) and correct the non-conforming work identified by SA Water.

Fabricators listed in Appendix F may continue to undertake work for SA Water infrastructure, subject to independent welding inspection being undertaken. Fabricators listed in Appendix F may apply to have their listing removed, subject to demonstrating systems have been implemented to address Section 6.2 of this Technical Standard.

SA Water's decision in listing a Fabricator in Appendix F is final, and not subject to appeal.

6.2.1.2 Requirements of Independent Welding Inspector

Where required by Section 6.2.1.1, an Independent Welding Inspector shall:

- a) Be engaged directly by the Constructor
- b) Be engaged to undertake the activities noted in Section 6.2
- c) Possess the required qualifications as detailed by Section 6.2
- d) Be independent of the Fabricator

It is not intended that the Inspector be present for the entire welding operation. Additional inspections should be conducted as required at the inspector's discretion to ensure they are confident the quality requirements are met.

Details of the Independent Welding Inspector shall be submitted to the SA Water Representative prior to their engagement, which represents a **WITNESS POINT** under this Standard.

6.3 Non-Destructive Testing Contractor.

<i>Reference Standard underpinning this Section</i>	<i>Relevant Section</i>
AS/NZS/ISO 3834.2	Section 6 Sub-Contracting
	Section 8 Inspection & Testing Personnel

The Non-destructive Testing (NDT) Contractor provides the following test/inspection services:

- Radiography Testing (RT)
- Ultrasonic Testing (UT)
- Magnetic Particle Inspection (MPI)
- Dye Penetrant Inspection (DPI).

NDT services shall be engaged by the Fabricator in accordance with the requirements of Section 6.5, with an example request form provided in Appendix D4.

Each NDT Technician shall have the appropriate qualifications and experience for the inspection technique and the NDT contractor Company shall be NATA accredited for the techniques.

A report of the results and subsequent test shall be provided to the Fabricator, and shall be provided to SA Water via the Welding Inspector's report (refer Section 6.2) and also upon request.

An Independent Welding Inspector (refer Section 6.2.1) and NDT Technician may be the same person, subject to satisfying the relevant qualification, experience and engagement requirements of this Technical Standard.

6.4 Weld Procedure Specification Development and Acceptance.

<i>Reference Standards underpinning this Section</i>	<i>Relevant Section</i>
AS/NZS/ISO 3834.2	Sections 10.2 & 10.3
AS/NZS 5131	Section 7.4.1

The compilation and acceptance of a Weld Procedure Specification (WPS) shall be undertaken by one of the following:

- Qualified Welding Supervisor (refer Section 6.)
- International Welding Specialist (IWS)
- International Welding Engineer (IWE)
- International Welding Technologist (IWT).

The witnessing or running of the weld procedure or welder qualification must be done by:

- Qualified Welding Supervisor (as stated in Section 6.2 above).

The compilation of a WPQR/WQR can be done by:

- Qualified Welding Supervisor as (stated in Section 6.2 above).
- IWI-C

The name and qualifications of the person producing the WPS document or running the testing shall be clearly stated in the WPQR or WQR.

6.5 Use of Subcontractors

Fabricators utilising subcontractors to undertake fabrication activities covered by this Standard remain responsible for ensuring compliance against the requirements of this Technical Standard. In engaging subcontractors (including those providing NDT services), it is expected that a Fabricator:

- Establishes a purchasing procedure that ensures the requirements of this Section are satisfied
- Establishes a system to maintain and document inspections (or other activities) sufficient to ensure that subcontracted work meets the specified requirements
- Provides the subcontractor with all necessary information to meet the requirements of this Standard for the scope of work being undertaken by the subcontractor.
- Obtain from the subcontractor all necessary records and documentation to ensure the requirements of this Standard can be met.

The subcontractor shall fully comply with the relevant requirements of this Standard for the scope of work undertaken and supply full documentation sufficient to meet the requirements of this Standard to the Fabricator for verification and inclusion in the MDR as required.

7 Inspection and Testing

Inspection and Testing shall be undertaken in accordance with the provisions of this Section, which are summarised in Appendix B.

SA Water reserves the right to attend, witness and audit all aspects of fabrication activity or documentation associated with any work to be used in SA Water infrastructure.

The frequency of Non-Destructive Examination (NDE) stated in Appendix B applies to each weld procedure/welding operator for each Fabricator. Representation of each operator against pipe diameters/wall thicknesses within the WPS limitations shall be obtained when applying the nominated percentages.

7.1 Inspection and Testing Regimes

Reflecting the varying levels of risk and criticality of SA Water's infrastructure, two inspection and testing requirements may be applied, with their details and application provided in Table 1.

Table 1 - Inspection and Testing Regimes

Inspection and Testing Regime	Requirements	Notes
Standard	Standard Inspection and Testing Requirements – Refer Appendix B	The minimum inspection and testing requirements of TS 0420 ¹ .
Increased	Increased Inspection and Testing Requirements – Refer Appendix B	Inspection and testing requirements where project risk and criticality are noted in the design and/or contract specification (by the Designer or SA Water Representative) as requiring elevated levels of quality assurance to ensure project outcomes are achieved.

Note: 1) Specialist welding categories (such as fabrication of pressure vessels or fatigue purpose welds) shall adopt the Increased Inspection and Testing regime by default.

7.2 Inspection & Test Plan (ITP)

Reference Standard underpinning this Section	Relevant Section
AS/NZS/ISO 3834.2	Section 14

The Fabricator shall:

- a) Provide an Inspection and Test Plan (ITP) for the specific welding work
 - o This is to be provided to the SA Water Representative, per the process outlined in Section 3
 - o A standard SA Water sheet shall be used (or an approved equivalent), and a sample ITP is provided in Appendix D1.
- b) Ensure that the ITP contains the necessary elements to ensure the completed welding work complies with the specified standards/codes and/or other specified requirements.
- c) Ensure that the ITP contains the necessary witness points for the SA Water Representative to audit the welding work so as it complies with the specified WPS and Standard requirements.

7.3 Testing of Welds for Rolled and Longitudinal Welded Pipe

All rolled and welded pipe (circumferential and longitudinal weld) greater than 114mm diameter and a pressure rating less than 6.8 MPa shall be manufactured to AS 1579.

Complete penetration butt welding shall be conducted with a minimum of one internal and one external pass unless otherwise approved by SA Water.

Pipes which are not hydrostatically tested shall be 100% non-destructively tested via radiograph (RT) or ultrasonic testing (UT) to AS/NZS 1554.1 Structural Purpose (SP).

7.4 Testing of Welds for Spiral Welded Pipe

All Spiral Welded Pipes shall be subject to factory hydrostatic strength tests in accordance with the requirements of Section 4 and Appendix F of AS 1579.

In addition to the hydrostatic testing, non-destructive testing by Radiography (RT) or Ultrasonic (UT) methods in accordance with AS 1554.1 Category SP with acceptance standards as specified in AS 1554.1 shall be undertaken for:

- a) 100% of the welds for the first two (2) pipes of each pipe size
 - o In the event of a test failure, 100% of the next pipe length from the mill is required to undergo non-destructive testing until compliance is achieved
- b) After compliance against point a), 2 pipe random lengths taken from the production run shall each be tested radiographically at 8 randomly chosen locations on each pipe or ultrasonically for 10% of the total weld in 4 randomly chosen locations.
 - o In the event of a test failure, 100% RT or UT testing of the welds for a pipe length either side (upstream and downstream) of the initially tested pipe length shall occur.
- c) The Pipe Supplier shall provide test certificates, issued by a National Association of Testing Authorities (NATA) accredited laboratory, for both Destructive and Non-Destructive Testing (except hydro-static testing of pipe joints), as part of the MDR
- d) Material grade of Welded Pipe intended for supply to SA Water shall comply with the requirements of AS1579. Material certificates shall be provided for all pipe materials

Alternatively, if the supplier chooses not to undertake hydrostatic testing, then 100% of the welds shall be non-destructively tested in accordance with AS 1579 Section 4.1.1.(b).

Test reports shall be prepared in the format presented in this Technical Standard and provided to the SA Water's Representative.

SA Water reserves the right to attend, witness and audit manufacturing aspects of the production activity or documentation associated with production.

The testing detailed above is intended for each setup of runs for large pipe orders where production will span greater than one day such as a mains replacement. That is; 9 lengths or more of pipe or more than 100m.

7.4.1 Alternative Testing for Spiral Welded Pipe

This section is not intended to be an alternative for NDT requirements as outlined in Section 7.4 and shall not be applied as such. Alternative testing detailed below applies only to the supply of low volumes/individual lengths of MSCL and MSCACL pipe for the replacement of failed/damaged pipe. Alternative testing requirements are as follows:

- a) Spiral welded pipe that has been produced and tested per Section 7.4 above, as a batch run, requires no further testing needs, provided it can be demonstrated the available pipe(s) is (are) are from the batch run that the testing regime was applied to.

- b) Spiral welded pipe that has not undergone the testing requirements per Section 7.4 above, will require a minimum of eight (8) randomly selected areas requiring non-destructive testing by Radiography (RT) or 10% of the total weld in 4 randomly chosen locations by Ultrasonic (UT) methods in accordance with AS1554.1
 - a. Category SP requirements and acceptance standards shall be applied as specified in AS1554.1.
- c) For small quantities such as bursts or minor replacement eight (8) or less lengths of pipe (or less than 100m) from supplier stock.

7.5 Testing of Pressure Piping and Structural Steel

Testing regime of Pressure Piping and Structural welds shall be as per the following sections.

7.5.1 Testing of Pressure Piping Butt, Branch and Fillet Welds

The testing regime for the fabrication and welding work of new projects, including steel specials, stainless steel specials and field tie-in situations are based on AS 4041 Class 2P (Class 2A for stainless steel). Piping shall be examined in accordance with AS 4037 and as per AS 4041 Section 6.4. Details of the testing regime are summarised in Appendix B.

The testing regime defined in this Section also applies to the fabrication for and or within pump stations (defined as being between the first isolation valves outside of the pump station building; on both the upstream and downstream side of the pump).

7.5.2 Testing of Structural Welds

The testing regime for structural welds is presented in Appendix B and applies to fabrication and welding work in both workshops and all field situations (including additions, repairs, and modification).

7.6 Tying into Existing Piping

When cutting and tying into existing piping, the tie in location shall have the coating removed (noting that a check of the coating for asbestos may be required before doing so to manage associated hazards).

The surface shall be cleaned (by power tool or abrasive blasting), inspected and Ultrasonically Thickness tested (by a competent person) to ensure there is sufficient remaining wall thickness on the existing pipe to conduct the tie-in welding.

The wall thickness shall be locally tested at a minimum of eight (8) equally spaced points around the circumference, or a full circumferential scan. External pitting losses shall also be considered. If sufficient wall thickness is not able to be confirmed, an alternate location shall be identified and tested.

Inspection and Testing of planned tie ins shall be undertaken in accordance with requirements of Class 2P Steel, stated in Appendix B.

7.7 Testing Requirements for Emergency Field Repairs on Pressure Piping in Metropolitan Area and Pump Stations

The general testing requirements for Emergency Repairs in Metropolitan areas and within regional Pump Stations (between the first isolation valves outside of the pump station building; on both the upstream and downstream side of the pump) are to be the same testing regime as stated in section 7.5.1 above for welding of pressure piping in accordance with AS 4041 Class 2P.

7.8 Testing Requirements for Emergency Field Repairs on Pressure Piping in Regional Areas

The testing requirements for Emergency Repairs on pipework (outside of Pump Stations) are based on AS4041 Class 3 piping.

Where it is required to weld a patch plate (or collar and other repairs) onto piping, a Welding Procedure Specification (WPS) is required as well as the operator's being within their welder qualification period.

The suitability of all patch Welding Procedure Specification's (WPS's) is required to undergo the same qualification requirements as those stated in Section 5.2 above. Inspection and Testing requirements shall be as provided in Appendix B.

The patching plate is to have rounded corners and the weld profile of the deposited weld is to be smooth and free of defects (refer Figure 1).

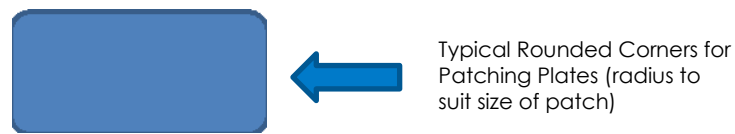


Figure 1 – Patching Plate

8 Quality Control Requirements

8.1 Preface

Reference Standards underpinning this Section	Relevant Section
AS/NZS/ISO 3834.2	Section 1
AS/NZS/ISO 3834.3	

This Standard requires the Fabricator and Constructor to demonstrate to SA Water that welders to be used on SA Water infrastructure are within their welder qualification period and approved to the welding procedure they are working to prior to the commencement of any welding.

This Standard requires all Welding Procedure Specifications (WPS) to be appropriately qualified and submitted to SA Water's Representative for review and approval ten (10) business days prior to the commencement of any welding per the process outlined in Section 3.

8.2 Fittings

All fittings shall be made from pipe manufactured in accordance with this Standard; or shall be fabricated from structural steel complying with AS 1594 or AS 3678. The Carbon Equivalent content (CE) shall not exceed 0.40.

The use of pipe manufactured in accordance with API Specification 5L shall be acceptable for branches only (e.g., offtakes, scour valves, air valves, etc.). Where such pipe is used, the CE of the material shall not exceed 0.40.

8.3 Welding Standards

For infrastructure intended for use by SA Water:

- The minimum acceptable construction category for SA Water works shall be CC2 in accordance with AS/NZS 5131
- The manufacture of Spiral Welded Pipe shall be in accordance with AS 1579 with the welding to AS/NZS 1554.1 SP
- The welding of pressure pipe shall be to AS 4041 Class 2P or 3
- The welding of structural steel shall be to AS /NZS 1554.1 SP
- The welding of stainless steel shall be to AS/NZS 1554.6 – Class 2 B II
- The welding of aluminium shall be to AS 1665 – Category B.
- The welding of reinforcement steel shall be AS/NZS 1554.3 (subject to prior approval via a TDRF)

Where there are changes to a welding standard and the previous revision of the standard has been superseded, each Weld Procedure Specification shall be reviewed by the Fabricator to ensure that all the essential variables and mechanical testing conducted to the previous standard meets the current standard, and that changes/updates are made to any documentation and welder qualifications per the Fabricator's QMS.

8.4 Edge Preparations

<i>Reference Standards underpinning this Section</i>	<i>Relevant Section</i>
AS 4458	Section 5 (Pressure)
AS/NZS 1554.1	Section 5.1 (Structural)
AS/NZS ISO 5131	Section 7.5.1.1

Surfaces and edges to be welded shall be uniform and free from fins, tears, cracks and other defects that would adversely affect the quality or strength of the weld. Surfaces to be welded and surfaces adjacent to a weld shall also be free from loose or thick scale, slag, rust, grease, paint and other foreign matter that could prevent proper welding or cause a defective weld.

For stainless steel edge preparations requirements refer to TS 0730.

8.5 Pressure Testing

Where the scope of fabrication work is covered by the scope of TS 0210, hydrostatic testing shall be undertaken and recorded in accordance with the requirements of TS 0210.

8.6 Additional Testing of Welds

Where there is a specific reason to question the quality, competency or capability of a welder/welding operator, the SA Water Representative may request additional NDT for any welding carried out on any SA Water infrastructure that the welder/welding operator in question has worked on.

Where such testing detects a non-conformance, the Fabricator shall raise a corrective action under their WQMS, and bear the cost of the repair and the additional cost of retesting the welds.

8.7 Welder Performance Monitoring

The Constructor and its Fabricator/s shall monitor the performance of welding operators working on SA Water infrastructure, and the Fabricator must maintain the re-validation records for each welder/welding operator (including those of any subcontractor engaged by the Fabricator to undertake work).

Where unsatisfactory welds are produced by a welder/welding operator, the Constructor and its Fabricator will notify the SA Water Representative as soon as the unsatisfactory welds are known (i.e., within two (2) days or before further works).

Should the percentage of unsatisfactory welds exceed 5% for any one operator, the SA Water Representative may request the welder/welding operator be removed from the work and offered training or re-qualification by the Constructor and its Fabricator/s.

The Welder/Welding operator should not be permitted to continue to work until such time/s as it can be demonstrated the Welder/Welding operator is able to achieve the requirements of the WPS which defects were recorded against. The welder/welding operator is required to restart their qualification process (i.e. requalify and test the next 5 welds of each weld procedure) after 5% defects have been recorded.

8.8 Welding and Material Traceability

The Constructor and/or its Sub-Contractor shall maintain Weld Traceability Records for all welding work carried out on current or future SA Water infrastructure.

Welding consumables shall be traceable to their batch certification and must comply with the requirements of AS/NZS 1554.1 Section 2.3 & AS 3992 Table 2.2

Standard SA Water weld mapping and weld traceability sheets shall be used (or an approved equivalent), and a sample Weld Map and Weld Traceability Sheet are shown in Appendix D.

The following shall be completed and maintained at the same level as production, throughout the fabrication process:

- c) Weld Mapping
- d) ITP shall be completed and maintained at the same level as production.
- e) Material identification and traceability
 - o To be maintained throughout the fabrication, installation and up to and including final inspection.

8.8.1 Pipe Requirements

Pipe identification (heat/unique number) shall be transferred to all cut lengths.

Each spool shall have the line number and spool number marked. If the spool is flanged, the marking shall be on the outer diameter of a flange.

Markings may be painted legibly on each pipe spool. However, the paint shall not cause corrosion of the material to which it is applied. Paint containing lead, zinc, copper, or tin shall not be used. Chloride free paint shall be used for austenitic, duplex, and super duplex stainless steel pipework.

9 Welding of Stainless Steel Materials Requirements

9.1 General

General cleanliness and the absence of contamination are important for attaining good weld quality. Oils or other hydrocarbons, dirt and other debris, strippable plastic film, and wax crayon marks shall be removed to avoid their decomposition and the risk of carbon pickup and weld surface contamination.

The weld shall be free from zinc, including that arising from galvanized products, and from copper and its alloys (care needs to be taken when copper backing bars are used; a groove should be provided in the bar immediately adjacent to the fusion area.)

It is important in stainless steel to reduce sites at which crevice corrosion may initiate. Welding deficiencies such as undercut, lack of penetration, weld spatter, slag, and arc strikes are all potential sites and shall thus be minimised to avoid corrosion. Arc strikes or arcing at loose connections also damage the passive layer, and possibly give rise to crevice corrosion, thereby ruining the appearance of a fabrication.

The shielding gas for MIG and TIG welding shall not contain carbon dioxide.

Where the weld appearance is important, the Designer shall specify the as-welded profile and surface condition required. This may influence the welding process selected or the post-weld treatment. Consideration shall also be given to the location of the weld and whether it is possible to apply the appropriate post-weld treatment.

9.2 Welding Consumables

Welding consumables shall comply with the requirements of AS/NZS 1554.6 and AS/NZS 3992.

Welding consumables shall be compatible with the parent metal and shall be classified and identified in accordance with the provisions of AS/NZS 1167.2 and/or AS/NZS 4854 to AS/NZS 4857 inclusive.

Welding Consumables shall be kept free from contaminants and stored according to the manufacturer's instructions. Any process that uses a flux (e.g., MMAW, FCAW, SAW) is susceptible to moisture pick-up from humid air, which can lead to porosity in the weld. Some processes such as GTAW (TIG) or laser welding may not use filler metals.

9.3 Structural Welding

Guidance for selecting the weld category for a given application can be found in Appendix B of AS 1554.6. Weld quality is specified by the category of the sub-surface weld, the class of the surface weld and the grade of the surface finish. A summary of these classifications can be found in Table 2. Each weld must be specified using these criteria by the Designer.

Where not specified, all structural welds shall be 2BII at a minimum. Pressure pipe welds in accordance with AS 4041 shall be completed as per Class 2P for pipe.

Table 2: Weld category requirements for stainless steel structures (AS1554.6)

Internal Category	Requirements
1	Structural and load bearing joints where weld is subject to moderate dynamic loading.
2	Structural integrity not paramount.
F	High levels of dynamic loading.
Surface Class	
A	Highest level of surface quality. Required for severe fatigue loading.
B	Required for most corrosion applications. Also suitable for decorative handrails.
C	Provided for non-critical surfaces where there is no contact with corrosive media.
Surface Finish Grade	
I	Polished, typically for decorative purposes.
II	Cleaned, provides best possible corrosion resistance for a welded joint. Removal of dark weld oxide and promotes formation of protective chromium oxide.
III	As welded. Provided for non-critical surfaces with no exposure to corrosive media.

9.4 Welding Distortion

Welding distortion is greater in austenitic stainless steel than in ferritic steel because of higher coefficients of thermal expansion and lower thermal conductivities. Heat input and interpass temperatures need to be controlled to minimize distortion and to avoid potential metallurgical problems.

Welding distortion shall be controlled by taking the following measures:

Designer Considerations

- Remove the necessity to weld wherever possible. This could be achieved through the specification of hot rolled sections, hollow sections or laser fused sections (laser fusing results in less distortion)
- Reduce the extent of welding
- Reduce the cross-section of welds. For instance, in thick sections, specify double V, U or double U preparations, in preference to single V preparations
- Use symmetrical joints
- Design to accommodate larger dimensional tolerances.

Fabricator Considerations

- Use efficient clamping jigs. If possible, the jig shall incorporate copper or aluminium bars to help conduct heat away from the weld area
- When efficient jiggling is not possible, use closely spaced tack welds laid in a balanced sequence
- Ensure that good fit up and alignment is obtained prior to welding
- Use the lowest heat input commensurate with the selected weld process, material and thickness
- Use balanced welding and appropriate sequences (e.g., backstepping and block sequences).

9.5 Weld Maps

The Fabricator shall provide a weld map outlining the welding undertaken in the fabrication of the stainless steel components. The weld map shall outline the following:

- WPS number used for the welding undertaken
- Welder's initials or welding number for each weld undertaken, and
- Welding supervisor's initials or welding number for each weld inspected.

The weld map shall be submitted to the Superintendent for approval after all welding has been completed. Refer to Appendix D3.

9.6 Post-Weld Treatment and Cleaning

Post-weld heat treatment of stainless steel welds shall not be undertaken outside a producing mill environment. In certain circumstances, a stress relief heat treatment may be required, however any heat treatment may involve risk and specialist advice should be sought.

Post-weld finishing is generally necessary, as below, especially if arc welding processes are involved.

All traces of heat tint shall be removed. It may be removed by pickling, electropolishing or glass bead blasting with the first 2 options being preferred.

Peening the surface of a weld is a beneficial post-weld treatment as it introduces compressive stresses into the surface, which improves fatigue and stress corrosion cracking resistance and aesthetic appearances. Peening shall not be used to justify a change in fatigue assessment.

The action of removing metal during substantial machining gives rise to stress relieving and hence distortion of the as-welded product. In cases where the distortion is such that dimensional tolerances cannot be achieved, a thermal stress relief may be required.

9.6.1 Grinding and Finishing

Grinding/sanding conducted to remove all weld defects, excessive reinforcement, weld spatter, sharp edges, arc strikes and gouges. When grinding, care must be taken, and all grinding shall comply with the requirements AS/NZS 1554.6 in paragraph 5.16.3 which are:

- Grinding shall not overheat the metal as heavy pressure or too rapid removal of metal may lead to heat tint.
- The area ground shall blend smoothly into the surrounding surface without abrupt changes in contour.
- The grinding shall not extend below the surface of the parent material by more than 0.5 mm for material less than 10 mm thick
- Grinding wheels shall be dedicated for stainless steel work only. Ceramic bonded sulphur-free grinding wheels are recommended. Where resin bonded grinding wheels are used, care should be taken to prevent smearing of resin on the material surface.
- Grinding shall mechanically polished surfaces to at least a 320 grit finish.

If the expected surface roughness of the stainless steel structure is less than 0.5 microns, then finishing is not required for reducing corrosion risk, however if a roughness profile of approximately 0.2 microns or less is required this process should occur.

9.6.2 Electropolishing

Electropolishing can be carried out manually or in a bath. The manual process offers a higher flexibility and can be carried out on site if needed. A mild electrolytic cleaning fluid is applied to the surface of the weld by using a conductive weld cleaning brush. Electric current (AC/DC) is employed so desired cleaning and passivation results are accomplished. In the bath process the stainless steel element is submersed in an acid bath (acetic acid/phosphoric acid). Often the size of the bath limits the volume of stainless steel that can be electropolished at any one time and requires that these structures be fabricated in small pieces.

9.6.3 Blasting

Blasting with non-metallic abrasive can be used to remove heat tint surface oxides and iron contamination from the stainless steel surface. Critically, the blasting medium must be completely free of iron contaminants otherwise these will become imbedded within the surface and decrease corrosion resistance.

Glass bead blasting may be used on surfaces that are too large to finish by traditional electropolishing to create a desired surface finish. Coarse, angular grit shall not be used as this would lead to a high surface roughness.

9.6.4 Pickling and Passivation of Stainless-Steel Welds

Oxide scales are formed on the surfaces of stainless steels during annealing, hot-forming and welding. Oxide scales deplete the chromium near the surface of the material which sensitises the material making it susceptible to corrosion. For butt welds, this scale (also referred to as heat tint) forms on both the external welded surface, and the internal welded surface. For external fillet welds it also occurs on the opposite side of the welded surface. For example, an external fillet weld to attach a lifting lug, bracket or puddle flange to a pipe will produce heat tint on the inside surface of the pipe. This will result in internal corrosion for a pipe conveying internal liquid and must be avoided.

Figure 2 below displays different levels of heat tint due to increasing amounts of oxygen contamination during welding. These oxygen concentrations vary between 10 ppm (Sample 1) to 25,000 ppm (Sample 10) and the discolouration is indicative of the amount of heat tint that occurs on the inside of a pipe when it is welded on the outside. This shows that descaling/pickling must occur on both sides of the weld to ensure corrosion resistance.

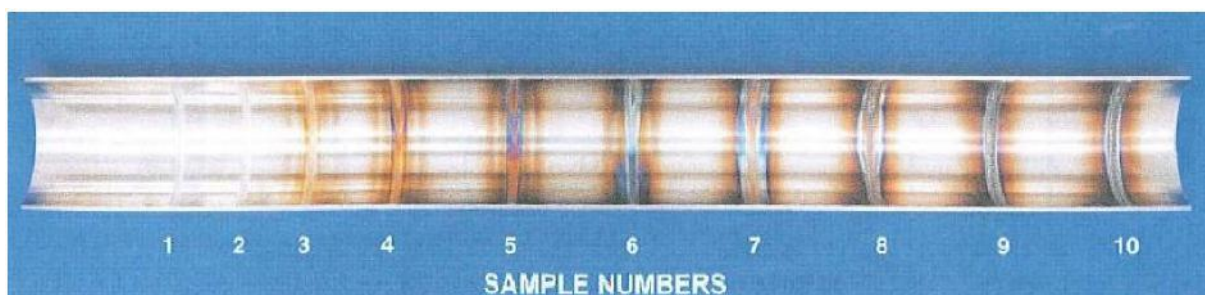


Figure 2 – Weld discolouration levels inside 316L stainless steel (AS 1554.6)

9.6.4.1 Post Weld Treatment of Heat Tint and Non-Compliant Weld Features of Stainless-Steel Welds

Pickling and passivation requirements for stainless steel welds are to be included in the Notes Sections of the WPS.

After this treatment, both the weld side and the reverse side must be free of any heat tint – except as indicated below for the inside of a pipe weld. The weld procedure must use the specified shielding gas and then pickle the weld capping bead and adjacent heat affected areas following the procedure in the following Pickling section. After chemical pickling, no heat tint should be visible.

Alternatively, the weld heat tint may be mechanically removed, and any weld crevices associated with the capping pass. If using abrasive belts, the final surface roughness must not exceed $0.5\mu\text{m } R_a$ – typically achieved with a final polish by 320 grit abrasive although a used 240 grit abrasive may also achieve this surface roughness. The abraded area should then be passivated with nitric acid paste unless pickled and therefore passivated as a by-product of treatment to the root weld.

If the root weld is the underside of a plate or interior of a vessel and the root weld is accessible after welding, then use the same procedure as used to clean and passivate the root weld bead and heat tinted surrounds as was used for the capping run and surrounds.

If the weld is in a pipe, then the interior must be purged with inert gas prior to welding until the monitored exit gas has less than 50ppm oxygen. If a sensitive oxygen meter is not available, then a gentle purge with inert gas for at least 10 times the interior volume is required with the vent location chosen to consider the purge gas density relative to air. This should provide a heat tint less than pale straw (Level 3 in Figure 2). Small additions of hydrogen in the purge gas may be used to reduce the severity of any heat tint in austenitic pipe welds. The lower the oxygen content, the fainter the colour and the better the corrosion resistance. Purging should continue until the metal temperature is below $\sim 250^\circ\text{C}$. If the internal heat tint exceeds pale straw, the interior must be pickled using pickling paste (for large diameter pipe) or by immersion in a pickling bath if interior access is not possible (where the pipe will not be Cement Mortar Lined).

9.6.4.2 Pickling to Remove Heat Tint and Passivate the Welded Area

Note prior to chemical treatments such as pickling or passivation all weld spatter / arc strikes / silica build-up and other surface defects shall be removed by stainless steel flap disc grit grade 240 or finer, power brushing & manual brushing using stainless steel wire brushes.

Also note that pickling gels/paste contain the highly dangerous chemical hydrofluoric acid. Before commencing pickling operations an SDS of the pickling gel shall be obtained and reviewed and a Job Safety Analysis be performed. Any instructions for safe use and disposal included in the SDS must be followed.

If heat tint inside a pipe is no more than pale straw (Level 3 in Figure 2), then provided the base material away from the weld has adequate corrosion resistance for the service, no further treatment is required. However, if the surface has been abraded during fabrication, an additional passivation treatment may be required.

ASTM A380 provides details of the pickling chemicals and a series of recommended combinations of concentration, time and temperature for pickling baths used off-site (Refer to Table 3). The conditions depend on the severity of the heat tint and the specific alloy (i.e., worse heat tint requires more pickling, and more corrosion resistant alloys requires pickling for longer or at higher temperatures). At the end of a pickling treatment, the corrosion resistance will be comparable to that of a 2B mill finish.

Over-pickling must be avoided and therefore continuous exposure times indicated in ASTM A380 shall be followed.

Table 3: Acid Pickling of Stainless Steel (ASTM A380, 2006)

Alloy	Condition	Code	Solution, Volume %	Temperature (°C)	Time (minutes)
200, 300, and 400 Series, precipitation-hardening, and maraging alloys (except free-machining alloys)	fully annealed only	A	H ₂ SO ₄ , 8–11 % Followed by treatment D or F (Table 4)	66–82	5–45
200 and 300 Series; 400 Series containing Cr 16% or more; precipitation-hardening alloys (except free-machining alloys)	fully annealed only	B	HNO ₃ , 15–25 % plus HF, 1–8 %	21–60	5–30
All free-machining alloys and 400 Series containing less than Cr 16 %	fully annealed only	C	HNO ₃ , 10–15 % plus HF, ½–1½%	21, up to 60 (with caution)	5–30
200 and 300 Series, 400 Series containing Cr 16 % or more, and precipitation-hardening alloys (except free-machining alloys).	fully annealed only	D ⁽¹⁾	HNO ₃ , 6–25 % plus HF, 1 /2 to 8%	21–60	As necessary
Free-machining alloys, maraging alloys, and 400 Series containing less than Cr 16 %.	fully annealed only	E ⁽¹⁾	HNO ₃ , 10 % plus HF, 1 /2 to 1 1 /2%	21, up to 60 (with caution)	1–2

Note

1. Acid pickling treatments code D and E are only for use after descaling or mechanical cleaning of scale or smut to produce a uniform white pickled finish.

Passivation is the process of increasing the chromium to iron ratio within the protective passive film as well as cleaning the surface of contaminants to accelerate the formation of the protective chromium oxide film under the correct conditions. This is often completed after pickling to restore the surface finish.

This process is a bath of nitric acid at the required concentration, time and temperature as described in ASTM A380 Table A2.1 Part II (recreated as Table 4, below. This table details the cleaning procedures for contamination and corrosion products formed during handling and fabrication. Passivation does not remove grease and oils from the surface, and as such appropriate cleaning must be completed prior to passivation.

9.6.4.3 Additional Passivation

If higher corrosion resistance is required than provided by the base material, then further passivation treatments using nitric acid are described in ASTM A967. This treatment will not change the appearance of the surface. Alternatively, the component can be electropolished in a factory bath. Both processes increase the chromium to iron ratio and therefore improve the corrosion resistance. Electropolishing also removes sharp edges and consequently increases the brightness of the surface.

Confirmation of successful pickling and consequent passivation shall be by visual inspection of both sides of all butt and fillet welds performed by a qualified welding supervisor or welding inspector to ensure removal of heat tint has been achieved. Site welds can be particularly problematic and careful consideration should be given to ensure that the inside and outside of site welds can be reached to allow inspection and pickling paste application.

Table 4: Cleaning Passivation with Nitric Acid (ASTM A380, 2006)

Alloys	Condition	Code	Solution, (Volume %)	Temperature (°C)	Time (minutes)
200, 300, 400, precipitation hardening, margining alloys containing 16% Cr or more. Exclude free machining alloys.	Annealed, cold-rolled, thermally hardened, work hardened with dull or nonreflective surfaces.	F	HNO ₃ 20-50%	49-71	10-30
				21-38	30-60
	Annealed, cold-rolled, thermally hardened, work hardened with bright machined or polished surface	G	HNO ₃ 20-50% Plus Na ₂ Cr ₂ O ₇ ·2H ₂ O 2-6 wt.%	49-69	10-30
				21-38	30-60
400, precipitation hardening, margining alloys containing 16% Cr or less, high carbon straight Cr alloys. Exclude free machining alloys.	Annealed or hardened with dull or nonreflective surfaces	H	HNO ₃ , 20-50 %	43-54	20-30
				21-38	60
	Annealed or hardened with bright machined or polished surfaces	I	HNO ₃ 20-25 % plus Na ₂ Cr ₂ O ₇ ·2H ₂ O, 2-6 wt.%	49-54	15-30
				21-38	30-60
200,300,400 Series free machining alloys	Annealed or hardened, with bright-machined or polished surfaces	J	HNO ₃ , 20-50 % plus Na ₂ Cr ₂ O ₇ ·2H ₂ O, 2-6 wt.%	21-49	25-40
		K	HNO ₃ , 1-2 % plus Na ₂ Cr ₂ O ₇ ·2H ₂ O, 1-5, wt.%	49-60	10
		L	HNO ₃ , 12 % plus CuSO ₄ ·5H ₂ O, 4 wt.%	49-60	10
Special free-machining 400 Series alloys with more than Mn 1.25% or more than S 0.40%	Annealed or hardened with bright-machined or polished surfaces	M	HNO ₃ , 40-60 % plus Na ₂ Cr ₂ O ₇ ·2H ₂ O, 2-6 wt.%	49-71	20-30

10 Additional Construction Considerations

In addition to the foregoing, the construction requirements of this Section are also to be complied with by both the Constructor and Fabricator.

10.1 Lifting Plans

To avoid overloading at pipe connections/joints (including gaskets) the Constructor (including any subcontractors) and the Fabricator shall have lifting plans developed and included in ITP's when handling pipe specials with valves. Lifting plans and ITPs are to be sent to the SA Water Representative for review and comment prior to the lifting of pipe specials with valves attached. These requirements represent a **HOLD POINT** under this Technical Standard.

Handling of stainless steels shall be in accordance with TS 0730.

10.2 Purchase of Fabricated Products

For fabricated products purchased directly from a Supplier or Manufacturer which are to be used in SA Water infrastructure, the Constructor must:

- a) Obtain a Manufacturers Data Report (MDR)
- b) Have the MDR reviewed by a suitably experienced person (who is independent of the Supplier/Manufacturer) to confirm the product complies with TS 0420 and applicable Australian or International Standard(s). A Compliance Statement Report (CSR) shall be provided to SA Water
- c) Provide the SA Water Representative with the MDR and a compliance statement which confirms the product satisfies the requirements of TS 0420 and applicable Australian and/or International Standards. A copy of the test certificates or Supplier Declaration of Conformity (SDoC) shall be maintained with the purchasing information, and a copy provided to the SA Water Representative for all purchased components
 - o Where the compliance review identifies non-conformances, the Constructor shall either:
 - Source an alternative product which complies or
 - Have the Supplier or Manufacturer rectify the non-conformances, providing evidence and confirmation of this having been suitably completed in the compliance statement.

The requirements of Section 10.2 represent a **HOLD POINT** under this Technical Standard and must be released **before** the product is procured for use in SA Water's network.

Products listed in SA Water's Approved Products Technical Standards (TS 0502 to TS 0507) which are to be installed on non-critical infrastructure (refer TS 0109) are exempted from the requirements of this Section.

11 Approved Fabricators

An Approved Fabricator is exempted from the project by project submission requirements of Section 3 of this Technical Standard, but is still expected to comply with the other provisions of this Standard as applicable.

The process of becoming an Approved Fabricator occurs at SA Water's sole discretion, and requires a Fabricator to satisfy all of the following conditions:

- a) Demonstrates sustained compliance to Section 3 of this Technical Standard
- b) Completes a significant number of projects over a 12 month period
- c) The Fabricator has had no non-compliances and/or examples of uncontrolled welding operations occur on SA Water works within the 12 month period under consideration.
- d) The Fabricator's welding management system is confirmed by an SA Water audit to be compliant with the requirements of TS 0420
 - a. This requires any corrective actions identified by the audit to be resolved within 30 business days

SA Water's discretion to approve a Fabricator will consider matters including, but not limited to:

- Prevailing market conditions, including need, competition and availability of Fabricators
- The performance of existing Approved Fabricators
- Budget available to undertake an audit

Approved Fabricators are provided in Table 5 below.

Upon successfully becoming an Approved Fabricator, the following documentation will be provided by SA Water:

- An approval letter (a sample is provided in Appendix E)
 - a. This letter provides details of conditions and ongoing requirements an Approved Fabricator is expected to comply with, and consequences should this not occur.
- Hard copies of approved weld procedures
 - a. These can be identified by the presence of an SA Water approval stamp (shown in Figure 3 below) which contains a date and signature.

These documents shall be produced upon request and are to be included in MDR documentation as required by other sections of this Technical Standard, to support monitoring and quality assurance activities.

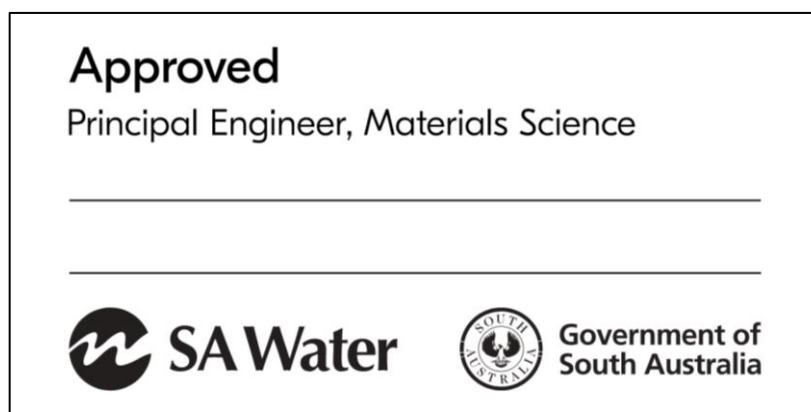


Figure 3 – SA Water Approval Stamp

Table 5: SA Water Approved Fabricators

Approved Fabricators (to SA Water TS 0420)
DMK Engineering
F Miller & Co.
JMA Engineering
Reimann Manufacturing

Given the conditions required to become an Approved Fabricator, TDRF's submitted to consider Fabricators other than those listed in Table 5 will be rejected.

Appendix A : Schedules of Hold/Witness Points & Identified Records

A1 Schedule of Hold Points and Witness Points

Section	Type	Description
3.0	Hold	Submission of documents for review prior to commencing work
4.2	Hold	AS/NZS ISO 9001 Certification
6.2.1.2	Witness	Independent Welding Inspector
7.0	Review	Welding inspection and NDT testing reports
8.8	Hold	Where unsatisfactory welds are produced by a welding operator, the Constructor and/or its Sub-Contractor will notify SA Water's Representative as soon as a discovery of unsatisfactory welds is made (i.e., within two (2) days or before further works)
10.1	Hold	Lifting Plan
10.2	Hold	Compliance Statement Report or SDoC and MDR when purchasing fabricated products.

A2 Schedule of Identified Records

Section	Description of Identified Record
3.0	Records submitted prior to commencement of work
4.0	Manufacturers Data Report (MDR)
4.4	Quality Plan
4.6	Completed ITPs
4.9	Permits (as applicable)
7.0	Welding Inspector Report - Visual inspection of completed welds
7.0	NDT Contractor - Non-Destructive testing report
8.6	Pressure test records
8.8	Welder Performance Monitoring
8.9	Weld traceability records
9.4	Weld Map

Appendix B : NDT & Inspection Requirements

Australian Standard	Section	Standard Inspection and Testing Requirements ^{1,2}	Structure Class	Weld Joint Type	Increased Examination Requirements	Increased NDT Requirements ^{1,3}
AS 4041	AS 4041 Table 1.5	Visual 100% MPI or DPI 10% RT or UT 10%	Class 2P steel	All³	-	-
AS 4041	AS 4037 Table 7.3 B	0% NDT ⁴	Class 2P steel	Fillet	Supervisor 100% scan Inspector 100% Visually Inspected	100% MPI first 5 welds 10% MPI remaining welds
	AS 4037 Table 7.3 B	5% RT T<10 RT 5% T>10 RT/UT + MPI 5% ⁴	Class 2P steel	Butt	Supervisor 100% scan Inspector 100% Visually Inspected	100% NDE (RT for <10mm and UT plus MPI for ≥10mm) for the first 5 welds 10% RT remaining welds
	AS 4037 Table 7.3 A	Visual 100% RT 10% (<10mm) RT/UT 10% + MPI (10-32mm)	Class 2P steel	Longitudinal Butt	Supervisor 100% scan Inspector 100% Visually Inspected	10% RT if <10mm or 10% UT if ≥10mm: Plus 10% MPI
	AS 4037 Table 7.3 C	5% RT T<10 RT 5% T>10 RT/UT + MPI 5% ⁴	Class 2P steel	Circumferential corner / Butt. Joint type C1	NA	NA
	AS 4037 Table 7.3 C	5% RT T<20mm MPI/DPI 0% T 20-32mm MPI/DPI 5% ⁴	Class 2P steel	Circumferential Butt and fillet. Joint type C2-5	NA	NA
	AS 4037 Table 7.3 D	Throat < 15mm MPI/DPI 0% Throat >15mm MPI/DPI 5%	Class 2P steel	Branch Joint Type D1-6	Supervisor 100% scan Inspector 100% Visually Inspected	100% MPI - branch / pipe ⁵ No NDE - pipe / branch / comp plate 100% MPI - branch / comp plate fillet
	AS 4041 Table 1.5	Visual 100% MPI or DPI 0% RT or UE 0%	Class 3	Section 7.8 - Emergency Repair Patch⁶ Regional (Outside Pump Stations)	NA	NA
AS 4041	AS 4037 Table 7.3 B	0% Note 22 - Shock 100% RT/UT +MPI/DPI	Class 2 piping Group K - 316	Fillet	Supervisor 100% scan Inspector 100% scan and 20% Visually Inspected	10% DPI
	AS 4037 Table 7.3 B	5% RT T<10 Rt 5% T>10 RT/UT + MPI 5% ⁴	Class 2 piping Group K - 316	Butt	Supervisor 100% scan Inspector 100% scan and 20% Visually Inspected	10% RT (10% DPI if there is RT test restrictions)
	AS 4037 Table 7.3 A	Visual 100% RT 10% (<10mm) RT/UT 10% + MT (10-32mm) ⁴	Class 2 piping Group K - 316	Longitudinal Butt	Supervisor 100% scan Inspector 100% scan and 20% Visually Inspected	10% RT
	AS 4037 Table 7.3 D	Visual 100% RT 10% (<10mm) RT/UT 10% + MPI (10-32mm) ⁴	Class 2 piping Group K - 316	Branch Joint Type D1-6	Supervisor 100% scan Inspector 100% scan and 20% Visually Inspected	100% DPI - branch / pipe ⁵ No NDE - pipe / branch / comp plate 100% DPI - branch / comp plate fillet

Australian Standard	Section	Standard Inspection and Testing Requirements ^{1,2}	Structure Class	Weld Joint Type	Increased Examination Requirements	Increased NDT Requirements ^{1,3}
AS 1554.1	AS 1554.1 Table 7.4	Visual Scanning 100% Visual examination 0 to 50% RT/UT 0 to 10%	Class SP Structural Steel	Fillet	Supervisor 100% scan Inspector scan and 50% Visually Inspected	10% MPI
	AS 1554.1 Table 7.4	Visual Scanning 100% Visual examination 0 to 50% MPI/DPI 0 to 10% RT/UT 0 to 10%	Class SP Structural Steel	Butt	Supervisor 100% scan Inspector scan and 50% Visually Inspected	10% RT if <10mm or 10% UT if ≥10mm (10% MPI if there is RT/UT test restrictions)
	AS 1554.1 Table 7.4	Visual Scanning 100% Visual examination 5 to 25% MPI/DPI 0 to 2% RT/UT Nil	Class GP	Fillet / Butt	Not covered in TS420	-
AS1554.6	AS1554.6 Table 7.4	Visual Scanning 100% Visual examination 10 to 50% RT/UT 0 to 10%	Class 2B Stainless steel	Fillet	Supervisor 100% scan Inspector 100% scan and 20% Visually Inspected	10% DPI
	AS1554.6 Table 7.4	Visual Scanning 100% Visual examination 10 to 50% DPI 0 to 5% RT 0%	Class 2B Stainless steel	Butt	Supervisor 100% scan Inspector 100% scan and 20% Visually Inspected	10% RT (10% DPI if there is RT test restrictions)
AS 1665	AS 1665 7.4 and 7.4 Table B1	CF1 - Cat B 2 to 5% RT or UT CF2 - Visual CF3 - Visual	Class B Aluminium	Fillet	Supervisor 100% scan Inspector 100% scan and 50% Visually Inspected	10% DPI
		CF1 - Cat B 2 to 5% RT or UT CF2 - Visual CF3 - Visual	Class B Aluminium	Butt	Supervisor 100% scan Inspector 100% scan and 50% Visually Inspected	10% RT or UT (10% DPI if there is RT test restrictions)
AS 1554.3	AS 1554.3 6.2	Type and extent to be specified	Reinforcing^{7,8}	Butt	Supervisor 100% scan Inspector 100% scan and 50% Visually Inspected	⁷ 100% MPI for the first 5 welds 10% MPI remaining welds
				Splice	Supervisor 100% scan Inspector 100% scan and 50% Visually Inspected	⁷ 100% MPI for the first 5 welds 10% MPI remaining welds

Notes:

1. Refer Section 7
2. Standard Inspection and Testing Regime is based on SA Water's interpretation and application of relevant Australian Standards to its infrastructure.
3. For tying into Existing Piping refer to Section 7.6 for additional requirements.
4. According to Note 22 of AS 4037 Table 7.3, for welds where the fluid is lethal or where the piping is subject to severe shock, welds shall be 100% RT/UT + MPI/DPI. Refer to TS 0850 for SA Water Chemical Dosing equipment.
5. NDE of the branch FSBW's shall occur prior to fitment of compensation plates, wrapper plates or crotch plates if specified in the design. Compensation plate fillet welds shall be 100% DPI inspected. No NDE -of the compensation plate butt weld is required.
6. Refer to Section 7.8 for patching plates details.
7. If a weld fails inspection the next 5 welds are to be tested as indicated for the first 5 welds.
8. TDRF is required for welding reinforcement per TS 0710.

Appendix C : Weld Review Process

The weld review process is mapped below to provide detail regarding the stages throughout, and what occurs in each stage. This is also represented diagrammatically in the flowchart below to highlight the interactions between the stages relative to the outcome.

Step	Step Description	Responsibility
1	Weld Information Collated Weld information supplied by the Contractor, for review as part of TS 0420 Section 3 (all documents must be submitted), to be collated by the SA Water Project Manager before submission. The SA Water Project Manager may delegate this step to others by agreement, and weld procedure review correspondence will be directed to them. However, overall responsibility remains with the Project Manager.	SA Water Project Manager
2	Weld Documentation submitted via Request for Engineering Engagement (RFEE) system The weld procedure review request is to be submitted via the RFEE system. Details of this form are provided below for reference. Weld procedure reviews will only to be actioned if received as a RFEE, and after steps 3 – 5 have been completed. Please note: <ul style="list-style-type: none"> a) Weld procedures will not proceed without a work order number being provided. b) Review timeframes specified in TS 0420 commence from the receipt of current and complete information. c) This review timeframe is reset when information is incomplete. d) The SA Water Project Manager may delegate this step to others by agreement, and weld procedure review correspondence will be directed to them. However, overall responsibility remains with the Project Manager. 	SA Water Project Manager
3	RFEE Assigned RFEE assigned to the SA Water Materials Engineer.	SA Water Manager Engineering Quality & Innovation
4	Submission Check The completeness of the submitted weld procedure review request is undertaken to ensure the applicant has supplied the documents required by TS 0420 Section 3. Where any document/s is/are not provided, the RFEE will be rejected (which will create an automated notification), with closing comments provided in the RFEE detailing the issues to be addressed.	SA Water Materials Engineer
5	Submission Review An initial review of the weld procedure request submission is undertaken to confirm (at a high level) that the documents provided meet the technical requirements of TS 0420 as detailed below: <ul style="list-style-type: none"> • The Weld Procedure Specifications (WPS) are provided. • The Welder Qualification Record (WQR): initial WQR (valid for 6 months) and continuity reports (extension available for up to 2 years). • Nominated Welding Supervisor qualifications. • Nominated Welding Inspector qualifications. • Inspection Test Plan (ITP) for the works to be undertaken. Where any document/s does not meet the requirements of TS 0420, the RFEE will be rejected (which will create an automated notification), with closing comments provided in the RFEE detailing the issues to be addressed.	SA Water Materials Engineer
6	Weld Procedure Specification (WPS) Acceptance Check A check of the WPS is conducted to determine if submitted documentation has been assessed and accepted previously. If a WPS has not been assessed and accepted previously, a detailed review is conducted.	SA Water Materials Engineer
7	Weld Procedure Specification Review Where a WPS has not been assessed and accepted previously, a detailed review of WPS is undertaken. This is required before other related documents can be reviewed.	SA Water Materials Engineer

Step	Step Description	Responsibility
8	Personnel and ITP Review A check of the ITP to ensure it has relevant hold points for the specific project, inspection steps and meets the Non-Destructive Testing (NDT) requirements of TS 0420. A check of Welder Qualification and Supervisor/Inspector to be used is also undertaken.	SA Water Materials Engineer
9 & 10	Response Prepared and Issued A response letter is prepared, detailing either acceptance or rejection of submitted documentation. Where documentation is rejected, feedback will be provided. Letter is issued to the SA Water Project Manager for distribution to the contractor and fabricator. RFEE also closed if compliant to TS 0420.	SA Water Materials Engineer
11	Fabricator Documents Updated Where any original submission is rejected, citing corrective actions, updated weld documentation will be required to address these.	SA Water Project Manager
12	Documents Resubmitted Updated weld documentation prepared in Step 11 is to be resubmitted for review via SA Water's welding email address at welding@sawater.com.au Please note: <ul style="list-style-type: none"> This review will commence upon receipt of <u>all documents</u> for which corrections have been identified in Step 11. The SA Water Project Manager may delegate this step as detailed in Step 2 	SA Water Project Manager

C1 : Request for Engineering Engagement Form

The RFEE form required for weld procedure reviews is provided below for reference, and is available on the Engineering RIVER intranet site at [Engineering - AquaNet \(sawater.sa.gov.au\)](http://Engineering - AquaNet (sawater.sa.gov.au)).

Request for Engineering Engagement

Is this request for capital work? *

Yes

Select 'No' if you are entering a request for -

Safety in Design, Technical Standards Dispensation Request, Technical Standards Recommendation for Improvement, Quality and Innovation

Engagement Types for Capital *

Weld Review

Capital Contract Type *

Framework Allocation *

Please Select

Required Documents for Weld Reviews *

- ☐ PQR ☐ NDT ☐ ITP ☐ WPS ☐ Material Certificate ☐ Weld Procedure Document
☐ Mechanical Test Results ☐ Weld Qualification Record ☐ Weld Supervisor Qualifications

Insight Output ID No. *

eg AXXXX - XXXX

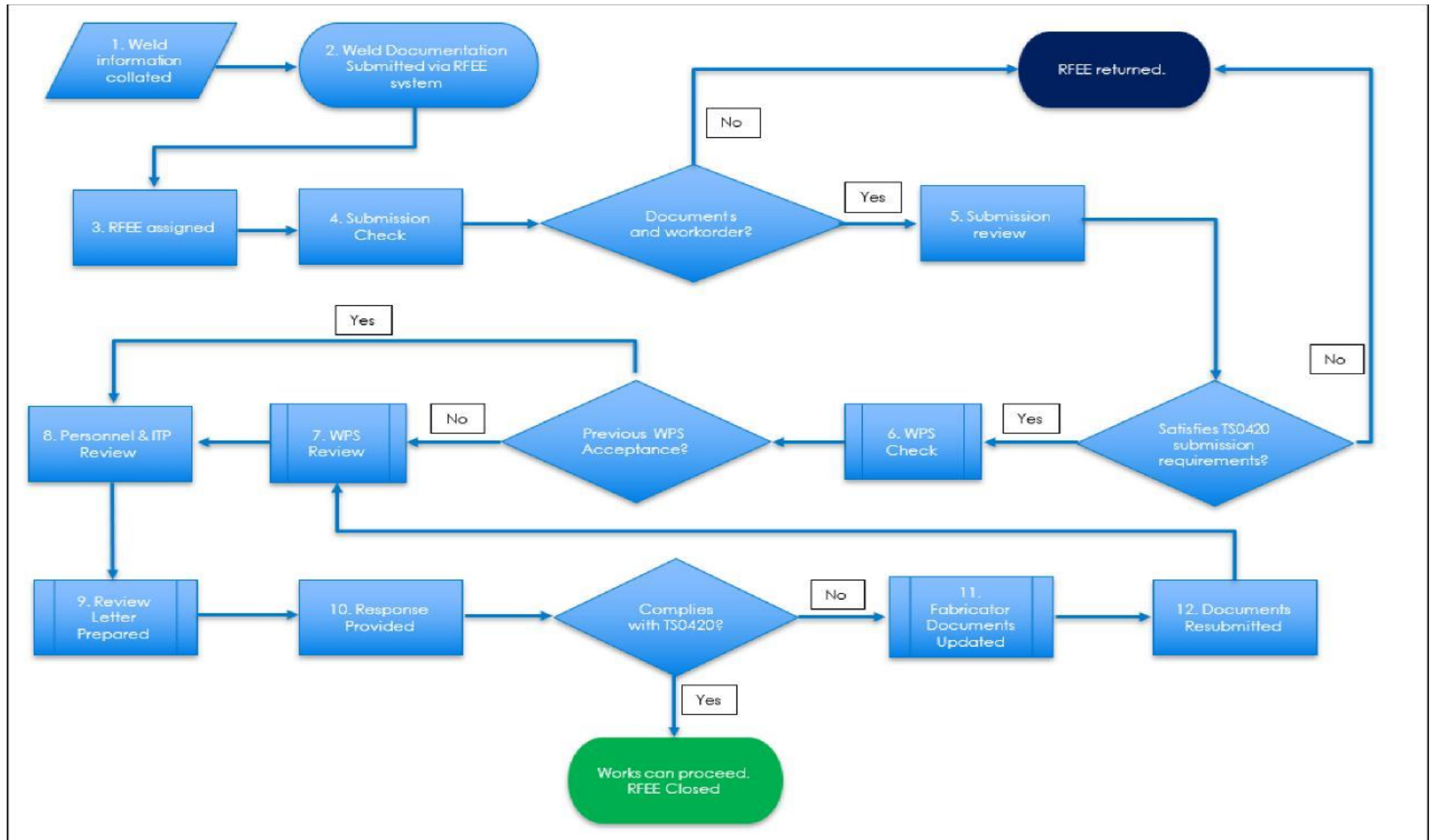
Title *

Max 50 Characters

Work Order Number *

for Solutions and non capital please use NA

C2 : Weld Review Process



Appendix D : Inspection Test Plans (ITPs) and Typical Forms

D1 : Inspection Test Plans

TS 0420 Welding Requirements (Metals) Inspection Test Plan						Doc ID:	Revision:			
Client: SA Water Contract No:						Prepared By:	Date:			
Project:						Reviewed By:	Date:			
Construction Process:						Approved By:	Date:			
Specifications:										
Structure/Component:										
Item	Inspection/Test Activity	Responsibility	Frequency	Inspection /Test Method	Acceptance Criteria	Record	Contractor	Subcontractor	SA Water	Sign & Date
1	Preliminaries									
1.1	Design verification, calculations and drawings	Constructor	Pre-Commencement	Issued for Construction drawings	Contract	Drawings	H			
1.2	Constructor to review all documentation of TS 0420	Constructor	Minimum 15 days prior to commencement	Review against TS 0420	In accordance with AS 4458 Section 4.4. Confirm acceptable as per all relevant documentation including: <ul style="list-style-type: none"> - Purchase Orders - Drawings 	Submission of SA Water	R	S		
1.3	Submission of ITP, welders, supervisors and inspectors for approval	Fabricator - Supervisor	Minimum 15 days prior to commencement	MDR	Documents submitted as per TS 0420 Sections 3 and 7	Document submissions	S		H	
1.4	Welding Procedures	Fabricator - Supervisor	Minimum 15 days prior to commencement	Document	As per TS 0420 in accordance with <ul style="list-style-type: none"> - AS 4041 Section 5 - AS/NZS 3992 Section 2 and 3 and - Detailed design drawings 	Welding procedure Specified and Procedure Qualification Records	R	S		
1.5	Qualified Welding Supervisor	Fabricator - Supervisor	Minimum 15 days prior to commencement	Certificates	TS 0420: Section 6.1	Qualification Certificates	R	S		

1.6	Welding Personnel qualified to procedures	Fabricator - Supervisor	Minimum 15 days prior to commencement	Certificates TS 0420: Section 6	TS 0420: Section 8.8 and in accordance with: - AS 4041: Section 5 - AS/NZS 3992: Section 2 and 3 - AS 4037: Table 8.2, 8.4 Class 2	Current Qualification records	R	S		
1.7	Welding Supervisor	Constructor	Pre-commencement	Verify	TS 0420: Section 6.1	Certificates	A	S		
1.8	Welding Inspector	Constructor	Pre-commencement	Verify	TS 0420: Section 6.2	Certificates	A			
1.9	Welding NDT Supervisor	Constructor	Pre-commencement	Verify	TS 0420: Section 6.3	NATA Certificates	A			
1.10	Approval submitted welding documentation	SA Water Representative	Pre-commencement	Review	Meets TS 0420 and welding codes minimum requirements	Approval Letter			A	
2	Preparation									
2.1	Materials certification and traceability	Welding Supervisor	All materials	Review	TS 0420	Materials certifications and records	W	T		
2.2	Equipment inspection to ensure good working order and consumables correct	Welding Supervisor	Each major item	Visual Inspection	Maintained in accordance with manufacturers recommendations and qualified welding procedures	Inspection and Test Plan	W	T		
2.3	Dimensional Inspection prior to cutting and forming	Welding Supervisor	All items	Visual Inspection AS 4458:1997 – Section 8	Drg. XXXX-XXXX	Inspection and Test Plan	W	T		
2.4	Inspection of joint fit up and joint preparation	Welding Supervisor	All items	Visual Inspection AS 4458:1997 – Section 8	In accordance with Approved WPS AS 4458: Section 8	Inspection and Test Plan	W	T		
3	Fabrication									
3.1	Weld traceability	Welding Supervisor	All items	Review /Visual	TS 0420: Section 8.9	Weld map and weld traceability records	M	S		
3.2	Visual scanning and inspection of welding during fabrication	Welding Supervisor	TS 0420: Section 7	Visual AS 3978:2003 AS 4037:1999 – Section 3.2	AS 4037 Table 8.4 – Class 2	Highlight all checked welds on drawings. Inspection Report / Documentation	M	T		

3.3	Dimensional inspection after fabrication	Welding Supervisor	100%	AS 4458:1997 – Section 21.2	In accordance with Contract, for construction drawings, any that are not as shown on the drawings are to be marked in red pen and identified as 'As Constructed'	Highlight all checked dimensions on drawings	W	T		
4	Post Fabrication									
4.1	Visual inspection of completed welds	Welding Inspector	100%	AS 3978:2003 AS 4037:1999 – Section 3.2	TS 0420: Section 7 AS 4037 Table 8.4 – Class 2	Formal Inspection Report	T	R	H	
4.2	Post weld cleaning of stainless-steel inspection	Welding Inspector	100% external and internal	Visual	TS 0420: Section 9	Formal Inspection Report	T	R	H	
4.3	Non-Destructive testing - Magnetic particle test	NDT Contractor	TS 0420: Section 7	AS 1171:1998 – EMY-AC	Magnetic Particle Test AS 4037 Table 8.4 – Class 2	NATA endorsed inspection report	T	R		
4.4	Non-Destructive testing.- Dye penetrant	NDT Contractor	TS 0420: Section 7	AS 2062:2017	Aluminium /Stainless steel fillets	NATA endorsed inspection report	T	R		
4.5	Non-Destructive testing - Radiographic	NDT Contractor	TS 0420: Section 7	AS 2177.1:1994 – XR2/S and XR2/DWS	Radiographic test butt welds in accordance with AS 4037 Table 8.2 – Class 2	NATA endorsed inspection report	T	R		
4.6	Non-Destructive testing - Ultrasonic	NDT Contractor	TS 0420: Section 7	AS 2207:2017	Ultrasonic test joint welds in accordance with AS 4037 Table 8.2 – Class 2	NATA endorsed inspection report	T	R		
4.7	Repairs from inspection and NDT	Welding Supervisor	100%	AS 4037:1999 – Section 9	AS 3788	All recorded documentation and Formal Report	S	W	R	
4.8	Pressure Testing	Constructor's Supervisor	100%	AS 4037:1999 – Section 17	In accordance with: <ul style="list-style-type: none"> AS 4037: Section 17 TS 0420: Section 8.6 and D5 	TS 0420 A6 Pressure Test Record	W	T	H	
4.9	Pre-delivery surface and edge preparation	Constructor's Supervisor	100%	AS 4458:1997 – Section 21.3	In accordance with Contract	Inspection and Test Plan	W	T		
4.10	Loading check before transport	Constructor's Supervisor	100%	AS 4458:1997 Section 21.3	In accordance with Contract	Inspection and Test Plan	W	T		
4.11	Final Inspection	Constructor	100%	Visual Check and Review	In accordance with Contract	Inspection and Test Plan	H	S		
4.12	Prepare Manufacturers Data Report (MDR)	Constructor's Supervisor	100%	TS 0420: Appendix D7	All procedures, drawings, results filed in accordance with Contract Clause	All recorded documentation and ITP	M	T		

4.13	Final Documentation Check	Constructor	100%	Review	In accordance with Contract	All recorded documentation and ITP	H	S		
4.14	Final Documentation Check	SA Water	100%	Review	TS 0420	MDR and ITP			H	

Final Inspection

The signature below verifies that this ITP has been completed in accordance with the XXXX Quality Systems, Procedures and verifies compliance with Specification.

Print Name:

Position:


Signature:

Date:

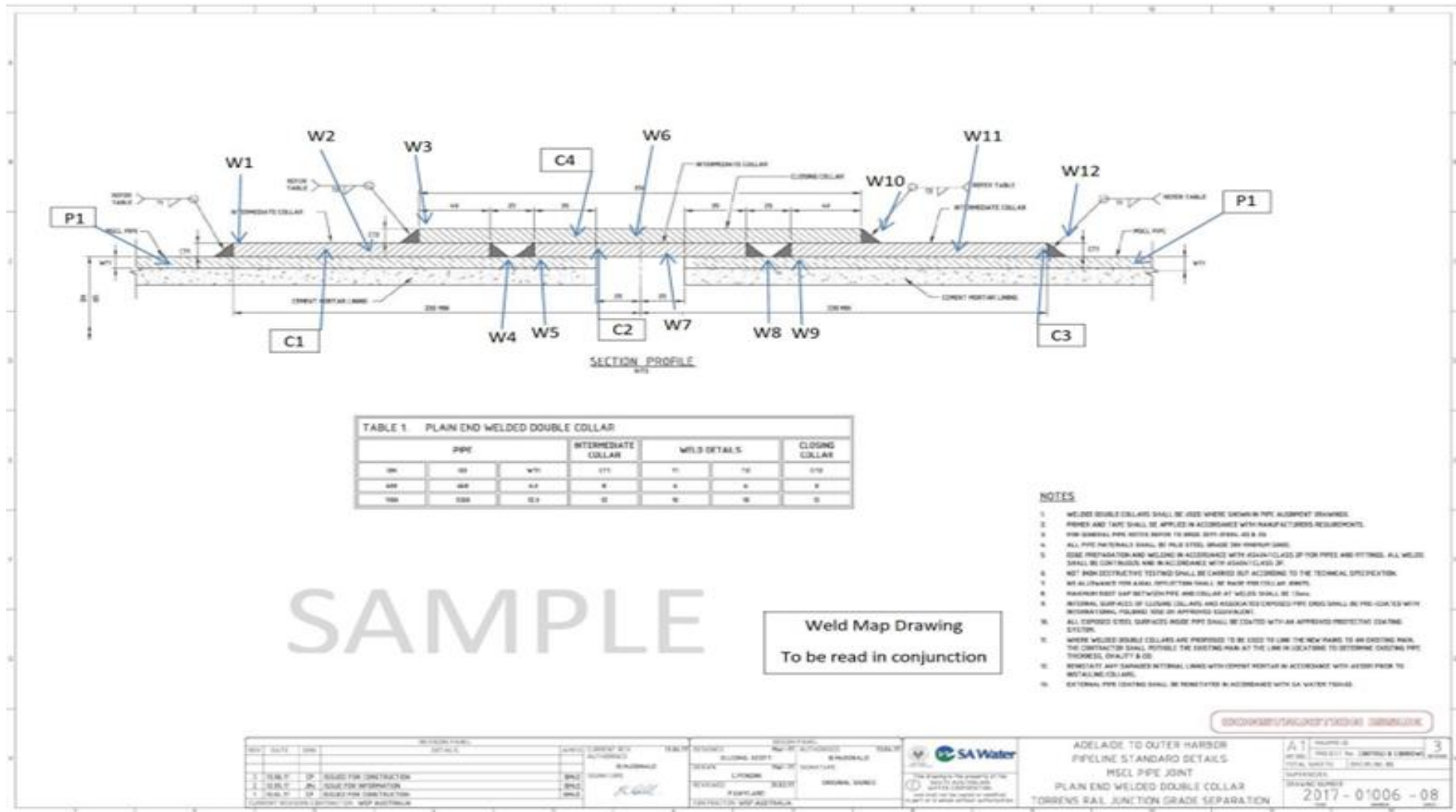
Notes:**Legend**

Abbreviation	Activity	Description		
H	Hold Point	Work shall not proceed past the HP until released by the SA Water's Representative	SAW	SA Water
W	Witness Point	An inspection which must be witnessed by the SA Water's Representative	Sub	Subcontractor
S	Send	Send documentation for review, verification or approval	Con	Constructor
M	Monitor	Monitor activity in an ongoing basis	Sup	Supervisor
R	Review	Review of product, procedures or documentation	QC	Quality Control
T	Test Point	Product compliance test to be undertaken and recorded/reported	Insp	Inspector
I	Inspect	Inspection to be done and recorded	3rd	Third Party Inspector
A	Approve		PE	Project Engineer


D2 : Weld Traceability Sheet

						WELD TRACEABILITY SHEET												
Project Details:																		
Drawing No. 2017-01006-08						Weld Traceability Sheet				Welding Service Provider			Inspector					
Spool no.	Material Type	Parts Identity	Dia	Thickness	WPS	WID	Weld No.	Weld Date	Joint Type	Weld Process	Consumable Certs Root/Cap	Supervisor Initials	NDE Report Number	NDE Method	C/DNC	Welding Inspector	Date	
600-P1	300 Grd	P1-C1	600	NA	SAW-01	SAW-003	W1	01.06.2017	Fillet	GMAW	201642236	KL	AIS16-1701	Vis and MPI	C			
600-P1	300 Grd	C1-C1	600	10mm	SAW-01	SAW-003	W2	01.06.2017	SVBW	GMAW	201642236	KL	AIS16-1702	UT	C			
600-P1	300 Grd	C1-C4	600	NA	SAW-01	SAW-003	W3	01.06.2017	Fillet	GMAW	201642236	KL	AIS16-1701	MPI	C			
600-P1	300 Grd	P1-C1	600	NA	SAW-01	SAW-003	W4	01.06.2017	Fillet	GMAW	201642236	KL	AIS16-1701	MPI	C			
600-P1	300 Grd	P1-C2	600	NA	SAW-01	SAW-003	W5	01.06.2017	Fillet	GMAW	201642236	KL	AIS16-1701	MPI	C			
600-P1-P2	300 Grd	C4-C4	600	10mm	SAW-01	SAW-003	W6	01.06.2017	SBBW	GMAW	201642236	KL	AIS16-1702	UT	C			
600-P1-P2	300 Grd	C2-C2	600	10mm	SAW-01	SAW-003	W7	01.06.2017	SBBW	GMAW	201642236	KL	AIS16-1702	UT	C			
600-P2	300 Grd	P2-C2	600	NA	SAW-01	SAW-003	W8	01.06.2017	Fillet	GMAW	201642236	KL	AIS16-1701	MPI	C			
600-P2	300 Grd	P2-C3	600	NA	SAW-01	SAW-003	W9	01.06.2017	Fillet	GMAW	201642236	KL	AIS16-1701	MPI	C			
600-P2	300 Grd	C3-C4	600	NA	SAW-01	SAW-003	W10	01.06.2017	Fillet	GMAW	201642236	KL	AIS16-1701	MPI	C			
600-P2	300 Grd	C3-C3	600	10mm	SAW-01	SAW-003	W11	01.06.2017	SBBW	GMAW	201642236	KL	AIS16-1702	UT	C			
6002P2	300 Grd	P2-C3	600	NA	SAW-01	SAW-003	W12	01.06.2017	Fillet	GMAW	201642236	KL	AIS16-1701	MPI	C			


D3 : Weld Map Sample Drawing




D4 : Non-Destructive Test Request Sample Form

										Non-Destructive Test Request (NDTR)	
ITP No. BC 1234										Page: 1 of 1	
Project Details										Item Details	
Project: Big Creek Pump Station Contract: XX										Test Date: 13/05/05 Test Location: Big Creek	
Drawing No	Weld No.	Welder ID	Welding Process(s)	OD Ø Tested and Wall Thickness (mm)	Material Type (AS/NZS 3678:1996)	DPI Required (Yes/No)	MPI Required (Yes/No)	R/T Required (Yes/No)	U/T Required (Yes/No)	Visual inspection	Other
XXXX-XXXX	FW001	SAWEPJB01	GMAW	356, 10	Carbon Steel - Grade 250	No	Yes	No	No	20%	
	FW002	SAWEPJB01	GMAW	356, 10	Carbon Steel - Grade 250	No	Yes	No	Yes		
	SW008	SAWEPJB01	GMAW	457, 10	Stainless Steel - Grade 316	No	No	Yes	No		
	SW0020	SAWEPJB01	GMAW	457, 10	Stainless Steel - Grade 316	Yes	No	Yes	No		
XXXX-XXXX	FW0012	SAWBWJS01	MMAW	610, 10	Carbon Steel - Grade 350	No	Yes	No	No		
	FW0030	SAWBWJS01	MMAW	610, 10	Carbon Steel - Grade 350	No	Yes	No	No		

D5 : Piping Fabrication Checklist Sample Form

		Piping Fabrication Checklist	
Page:		1 of 2	
Project		Contract no	
Item description			
Drawing no			
Standard		Class	
Inspection / Activity		Supervisor	
		SAW Representative	
1.0	Material complies with specified requirements		
2.0	Weld Procedures issued/approved		
3.0	Welder Qualification Records, issued/approved		
3.1	Pre-Welding Checks		
3.1.1	Dimensional Checks to drawings acceptable		
3.1.2	Weld Preparation acceptable		
3.1.3	Flanges Aligned and acceptable		
3.1.4	Consumable Verification		
3.2	Production Welding Checks		
3.2.1	Preheat Requirements		
3.2.2	Root Run Visual Check (Random)		
3.2.3	Hot pass Visual Check (Random)		
3.2.4	Capping Run(s) Visual Check		
3.2.5	WPS Parameter Check (Random) including Preheat Temp. as applicable		
3.2.6	100% Visual Inspection Completed & acceptable (see back of form)		
3.3	Post Welding Check		
3.3.1	Weld Visual (AS 1554-1 Table 2) Acceptable		
3.3.2	Weld Visual (AS 4037) Acceptable		
3.3.3	POST Weld Heat Treatment Acceptable (If applicable)		
4.0	Dimension Check to Drawing acceptable		
4.1	NDT completed & acceptable		
5.0	Identification/ Traceability		
5.1	Pipe Spool Identification acceptable		
6.0	Surface Treatment Requirements E.g., Passivation. Buffing / Polishing		
6.1	Surface Treatment acceptable (if applicable)		
7.0	Final Inspection Complete & acceptable		

		Piping Fabrication Checklist	
Page:			2 of 2
Weld Visual Inspection			
Weld no	Comments	Result	
		C/DNC	
		C/DNC	
		C/DNC	
		C/DNC	
		C/DNC	
		C/DNC	
		C/DNC	
		C/DNC	
		C/DNC	
		C/DNC	
		C/DNC	
Test Verification		SAW Representative	Contractor
Name			
Date			
Signature			
Reference			

D6 : Manufacturers Data Report (MDR) Sample Index

Manufacturers Data Report	
Project:	
Contract:	
Date:	
Contents	Page no.
Section A	
Inspection & Test Plan (ITP)	
Checksheets	
Section B	
As-Built Drawings (Weldmap)	
Section C	
Welding Procedures	
Section D	
Welding & NDT Record Sheet	
Section E	
Index of Enclosed NDT Reports	
Visual Inspection Report	
Non-Destructive Examination Reports	
Section F	
Pressure Test Reports	
Section G	
Protective Coating Reports	
Section H	
Miscellaneous	
Materials Certificates	
Welding Consumable Records	
Welder Qualification Records	
NDT % of Production Welds	
NDT % of Welders Production Welds	
Key: NR=Not Required	

Appendix E : Audit Outcome Letter (Sample)



Audit Outcome - SA Water Technical Standard (TS 0420) – Approved Fabricator

I am pleased to inform you that all corrective actions identified from SA Water's recent audit of your company's welding management system have been satisfactorily closed, and compliance to the requirements of SA Water's Technical Standard TS 0420 has been achieved.

With this successful audit outcome, coupled with over 12 months of successful weld reviews on SA Water projects, your company has now been listed as an Approved Fabricator in SA Water's Technical Standard TS 0420, which exempts your company from the 'Acceptance Prior to Commencement of Work' requirements provided in Section 3 of TS 0420.

The following conditions apply to this approval:

- 1) This approval is valid for **2 years** from the date of this letter.
 - a. Renewal of the Approved Fabricator listing is not automatic, and a written request shall be submitted to the Principal Engineer, Materials Science, at least 90 business days before the expiry of this approval.
- 2) Your company must remain active in delivering SA Water works.
 - a. The written request required in item 1a) shall provide details of works delivered for SA Water projects over the period for which this approval is applicable.
- 3) Certification of your Quality Management System to ISO 9001 shall be maintained
- 4) Compliance to TS 0420 must be maintained
 - a. This also includes maintaining compliance to the latest version of TS 0420, as well as applicable Australian/International Standards.
- 5) Documentation required by Section 3 of TS 0420 must continue to be supplied to the SA Water Representative for individual projects.
- 6) Approved welding procedures must be used.
 - a. These are attached and have been provided with an SA Water approval stamp.
 - b. Weld reviews that have been returned with comments are excluded, until they are updated and resubmitted for approval per Section 3 of TS 0420.

Where the conditions above are not satisfied, or where uncontrolled welding operations occur, SA Water reserves the right to revoke Approved Fabricator status at its sole discretion, which would re-instate the continuous review process of TS 0420 Section 3.

Examples of uncontrolled welding operations include, but are not limited to the following:

- ISO 9001 certification of your Quality Management System is no longer valid or has been suspended/cancelled.
- There is no active workshop welding supervisor controlling welding operations on a continuous basis.
- Weld failures, faults or defects are identified, attributed to poor workmanship or lack of supervision by the Approved Fabricator.
- Weld procedures not approved by SA Water are being used.
- The requirements of TS 0420 are not being routinely adhered to by the welding fabricator.

Thank you for participating in the audit process, and congratulations on becoming an Approved Fabricator for SA Water.

Appendix F : Fabricators Requiring Independent Inspection

Fabricators listed below shall be subject to independent inspection, per the requirements of Section 6.2.1 of this Technical Standard.

- None listed at this time.